North Bull Island Special Protection Area (Site Code 4006)

&

South Dublin Bay and River Tolka Estuary Special Protection Area (Site Code 4024)

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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 North Bull Island Special Protection Area, and South Dublin Bay and River Tolka Estuary 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 sites designated as North Bull Island SPA, and South Dublin Bay and River Tolka Estuary SPA, as well as introducing the concept of conservation objectives and their formulation.

Part Two provides site designation information for these two SPAs while Part Three presents their conservation objectives.

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

Part Five provides supporting information that 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 2011/12 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 2011/12 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 (referred to as a species that occurs in numbers of 'international importance');
- A migratory species that occurs at the site in numbers that exceed the all-Ireland 1% threshold (referred to as a species that occurs in numbers of '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 North Bull Island and South Dublin Bay and River Tolka Estuary Special Protection Areas

North Bull Island Special Protection Area, and South Dublin Bay and River Tolka Estuary Special Protection Area, are two designated SPAs located in Dublin Bay.

The site designated as **North Bull Island Special Protection Area** covers all of the inner part of north Dublin Bay, with the seaward boundary extending from the Bull Wall lighthouse across to Drumleck Point at Howth Head.

North Bull Island lies roughly parallel to the shore and is a low-lying sandy spit, about 4.85 km long and 0.70 km wide (McCorry & Ryle, 2009a). It is a relatively recent geomorphological feature having emerged as a result of the build up of sediment over the last 200 years following the construction of the South and North Bull walls during the 18th and 19th centuries. The North Bull Wall marks the southern boundary of the island and is connected to the mainland by a wooden bridge. The island is actively accreting (Ryle et al. 2009a). A sandy beach, Dollymount Strand, occurs on the seaward side of the island and intertidal mudflats occur on the inner (mainland side) fringed by saltmarsh. A causeway built in 1965 provides the main access to the island and divides the intertidal flats into two areas known as the North and South Bull lagoons. Both of these are covered completely by most tides and are drained by permanent channels; the southern lagoon fills and empties beneath Bull Bridge, while water in the northern lagoon is channelled in and out through Sutton Creek (Harris, 1977). These lagoons provide the main feeding grounds for the wintering waterfowl while the fringing saltmarsh provides the main roost site for wintering birds in Dublin Bay. Macroalgal mats of filamentous *Ulva* spp. (formerly *Enteromorpha* spp.)[1] are prevalent.

North Bull Island is one of the finest sand dune systems in Ireland and is internationally important in terms of conservation value (McCorry & Ryle, 2009a). It has several high quality examples of rare and threatened coastal habitats and a wealth of biodiversity, which includes several habitats and species listed in Annexes I and II of the EU Habitats Directive. As a consequence, North Bull Island is afforded several other nature conservation designations alongside its status as a Special Protection Area. It was designated as an official bird sanctuary under the Wild Bird Protection Act, 1931, the first bird sanctuary in Ireland (McCorry & Ryle, 2009a), and was established as a National Nature Reserve in 1988 (two parts covered by S.I. 231 and S. I. 232 of 1988). The site has been designated as part of a Special Area of Conservation (North Dublin Bay SAC - NPWS site code 000206). North Bull Island is also a Biogenetic Reserve (Council of Europe) and a UNESCO World Biosphere Reserve.

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

[1] Hayden et al. (2003), using genetic information, reassigned the genus *Enteromorpha* to the genus *Ulva.*

The **South Dublin Bay and River Tolka Estuary SPA** comprises a substantial part of Dublin Bay. It includes the expanse of intertidal habitat between the River Liffey and Dún Laoghaire plus the estuary of the River Tolka to the north of the River Liffey. A portion of the shallow marine waters of the bay is also included. The site also includes a small (*c.*4ha) brackish marsh called Booterstown Marsh.

In the south bay, the intertidal flats extend for almost 3 km at their widest. The sediments are predominantly well-aerated sands with Sandymount Strand dominating the narrower Merrion Strand further south. Sediments in the Tolka Estuary vary from soft muds with a high organic content in the inner estuary to exposed, well-aerated sands off the Bull Wall. Some bedrock shore occurs near Dún Laoghaire. The landward boundary is now almost entirely artificially embanked and bordered by road or railway.

A bed of Dwarf Eelgrass (*Zostera noltii*) occurs near Merrion Gates and is the largest known stand on the east coast. Green macroalgal mats occur at low densities. A sand bar has developed between Merrion Gates and Booterstown Railway Station. Sand bars are used as roosts by waders, gulls and terns as the tide floods and ebbs in the south bay. Embryonic dune, strandline vegetation and some marram dune also occur.

Booterstown Marsh lies approximately 3 miles south of Dublin City. The marsh is brackish in nature and developed during the 19th century after being separated from Merrion Strand by the building of an embankment which carries the Dublin/Wexford railway line. It is bounded to the west by the Dublin to Blackrock road. The marsh drains by a series of sluices and one main outflow (Williamstown Creek) to the south-east of the railway (DART) station. Primarily a brackish marsh, some fragmented saltmarsh occurs along its fringes. This is the only remaining area of saltmarsh in South Dublin Bay although this habitat would have fringed a large section of this area in the past (Dún Laoghaire-Rathdown County Council, 2009). Large parts of the marsh are unvegetated with bare intertidal mudflats. Salinity levels fluctuate on a regular basis due to the combination of freshwater inputs from two streams and tidal influence.

Also included in the SPA is an area of grassland at Poolbeg, north of Irishtown Nature Park.

Common Tern (*Sterna hirundo*) and Arctic Tern (*Sterna paradisaea*) breed in Dublin Docks on a man-made mooring structure known as the E.S.B. dolphin and this is also included within the designated area.

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

1.3 Introduction to Conservation Objectives

The overriding objective of the Habitats Directive is to ensure that the habitats and species covered achieve '*favourable conservation status'* and that their long-term survival is secured across their entire natural range within the EU (EU Commission, 2012). In its broadest sense, favourable conservation status means that an ecological feature is being maintained in a satisfactory condition, and that this status is likely to continue into the future. Definitions as per the EU Habitats Directive are given in Box 1.

Box 1

Favourable Conservation Status as defined by Articles 1 (e) and 1(i) of the Habitats Directive

The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when:

- *its natural range and areas it covers within that range are stable or increasing; and*
- *the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and*
- *the conservation status of its typical species is favourable'.*

The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:

- *the population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats; and*
- *the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and*
- *there is, and will probably continue to be, a sufficiently large habitat to maintain its populations*

Site-specific conservation objectives define the desired condition or range of conditions that a habitat or species should be in, in order for these selected features within the site to be judged as favourable. At site level, this state is termed 'favourable conservation condition.' Site conservation objectives also contribute to the achievement of the wider goal of biodiversity conservation at other geographic scales, and to the achievement of favourable conservation status at national level and across the Natura 2000 network[2].

Where relevant, conservation objectives are defined for attributes[3] relating to non-breeding[4] 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 North Bull Island Special Protection Area, and South Dublin Bay and River Tolka Estuary Special Protection Area).

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

[3] 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).

[4] Conservation objectives for breeding SCI species are in prep.

PART TWO – SITE DESIGNATION INFORMATION

2.1 Special Conservation Interests of North Bull Island Special Protection Area

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

The **Special Conservation Interests**[5] for North Bull Island SPA (Site Code 4006) are listed below and summarised in Table 2.1. This table also shows the importance of North Bull Island SPA for SCI species, relative to the importance of other sites within Ireland and within the Dublin region.

The Special Conservation Interest Species listed for North Bull Island SPA are as follows:-

1. During winter the site regularly supports 1% or more of the biogeographic population of Light-bellied Brent Geese (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,548 individuals.

2. During winter the site regularly supports 1% or more of the all-Ireland population of Shelduck (*Tadorna tadorna*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,259 individuals.

3. During winter the site regularly supports 1% or more of the all-Ireland population of Teal (*Anas crecca*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 953 individuals.

4. During winter the site regularly supports 1% or more of the all-Ireland population of Pintail (*Anas acuta*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 233 individuals.

5. During winter the site regularly supports 1% or more of the all-Ireland population of Shoveler (*Anas clypeata*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 141 individuals.

6. 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 1,784 individuals.

7. During winter the site regularly supports 1% or more of the all-Ireland population of Golden Plover (*Pluvialis apricaria*). The mean peak number of this Annex I species within the SPA during the baseline period (1995/96 – 1999/00) was 2,033 individuals.

8. During winter the site regularly supports 1% or more of the all-Ireland population of Grey Plover (*Pluvialis squatarola*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 517 individuals.

9. During winter the site regularly supports 1% or more of the all-Ireland population of Knot (*Calidris canutus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,837 individuals.

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

10. During winter the site regularly supports 1% or more of the all-Ireland population of Sanderling (*Calidris alba*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 141 individuals.

11. During winter the site regularly supports 1% or more of the all-Ireland population of Dunlin (*Calidris alpina*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 4,146 individuals.

12. During winter the site regularly supports 1% or more of the biogeographic population of Black-tailed Godwit (*Limosa limosa*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 367 individuals.

13. During winter the site regularly supports 1% or more of the biogeographic population of Bar-tailed Godwit (*Limosa lapponica*). The mean peak number of this Annex I species within the SPA during the baseline period (1995/96 – 1999/00) was 1,529 individuals.

14. During winter the site regularly supports 1% or more of the all-Ireland population of Curlew (*Numenius arquata*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 937 individuals.

15. 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 1,431 individuals.

16. During winter the site regularly supports 1% or more of the all-Ireland population of Turnstone (*Arenaria interpres*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 157 individuals.

17. The mean peak number of wintering Black-headed Gull (*Chroicocephalus ridibundus*) within the site during the baseline period (1995/96 – 1999/00) was 2,196 individuals. This number exceeds the selection threshold set for this species.

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

Table 2.1 Site Designation Summary: species listed for North Bull Island Special Protection Area, plus site importance at national and regional scales

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*		1,548	International importance	1	1
Shelduck *Tadorna tadorna*		1,259	All-Ireland Importance	2	1
Teal *Anas crecca*		953	All-Ireland Importance	7	1
Pintail *Anas acuta*		233	All-Ireland Importance	2	1
Shoveler *Anas clypeata*		141	All-Ireland Importance	8	1
Oystercatcher *Haematopus ostralegus*		1,784	All-Ireland Importance	2	1
Golden Plover *Pluvialis apricaria*	Y	2,033	All-Ireland Importance	26	2
Grey Plover *Pluvialis squatarola*		517	All-Ireland Importance	5	1
Knot *Calidris canutus*		2,837	All-Ireland Importance	2	1
Sanderling *Calidris alba*		141	All-Ireland Importance	9	3
Dunlin *Calidris alpina*		4,146	All-Ireland Importance	6	1
Black-tailed Godwit *Limosa limosa*		367	International importance	19	2
Bar-tailed Godwit *Limosa lapponica*	Y	1,529	International importance	3	1
Curlew *Numenius arquata*		937	All-Ireland Importance	11	1
Redshank *Tringa totanus*		1,431	All-Ireland Importance	4	1
Turnstone *Arenaria interpres*		157	All-Ireland Importance	9	1
Black-headed Gull *Chroicocephalus ridibundus*		2,196	All-Ireland Importance	8	2
Other conservation designations associated with the site[b]	**SAC**	**RAMSAR SITE**	**IMPORTANT BIRD AREA (IBA)**	**WILDFOWL SANCTUARY**	**OTHERS**
	SAC 0206	**Yes**	**Yes**	**Yes**	**Yes**

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

2.2 Special Conservation Interests of South Dublin Bay and River Tolka Estuary Special Protection Area

The **Special Conservation Interests**[6] for South Dublin Bay and River Tolka Estuary SPA (Site Code 4024) are listed below and summarised in Table 2.2. This table also shows the importance of South Dublin Bay and River Tolka SPA for SCI species, relative to the importance of other sites within Ireland and within the Dublin region.

The Special Conservation Interest Species listed for South Dublin Bay and River Tolka SPA are as follows:-

1. During winter the site regularly supports 1% or more of the biogeographic population of Light-bellied Brent Geese (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 525 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 1,263 individuals.

3. During winter the site regularly supports 1% or more of the all-Ireland population of Ringed Plover (*Charadrius hiaticula*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 161 individuals.

4. During winter the site regularly supports 1% or more of the all-Ireland population of Knot (*Calidris canutus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,151 individuals.

5. During winter the site regularly supports 1% or more of the all-Ireland population of Sanderling (*Calidris alba*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 349 individuals.

6. During winter the site regularly supports 1% or more of the all-Ireland population of Dunlin (*Calidris alpina*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,753 individuals.

7. During winter the site regularly supports 1% or more of the all-Ireland population of Bar-tailed Godwit (*Limosa lapponica*). The mean peak number of this Annex I species within the SPA during the baseline period (1995/96 – 1999/00) was 866 individuals.

8. 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 713 individuals.

9. The winter mean peak number of Black-headed Gull (*Chroicocephalus ridibundus*) within the site during the baseline period (1995/96 – 1999/00) was 3,040 individuals. This number exceeds the selection threshold set for this species.

10. During the breeding season this site supports a colony of Common Tern (*Sterna hirundo*) (52 pairs in 1995). This exceeds the All-Ireland 1% threshold for this Annex I species.

11. This site is selected as an important passage area for three migratory waterbird species based on significant concentrations recorded, as follows:

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

Common Tern (*Sterna hirundo*): 5,000 recorded in 1999.
Arctic Tern (*Sterna parasidea*): 20,000 recorded in 1996.
Roseate Tern (*Sterna dougalii*): 2,000 individuals recorded in 1999.

12. The wetland habitats contained within South Dublin Bay and River Tolka Estuary are identified of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore the wetland habitats are considered to be an additional Special Conservation Interest.

Table 2.2 Site Designation Summary: species listed for South Dublin Bay and River Tolka Estuary Special Protection Area, plus site importance at national and regional scales

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*		525	International Importance	12	5
Oystercatcher *Haematopus ostralegus*		1,263	All-Ireland Importance	10	4
Ringed Plover *Charadrius hiaticula*		161	All-Ireland Importance	13	3
Knot *Calidris canutus*		1,151	All-Ireland Importance	6	3
Sanderling *Calidris alba*		349	All-Ireland Importance	1	1
Dunlin *Calidris alpina*		2,753	All-Ireland Importance	10	2
Bar-tailed Godwit *Limosa lapponica*	Y	866	All-Ireland Importance	5	2
Redshank *Tringa totanus*		713	All-Ireland Importance	8	2
Black-headed Gull *Chroicocephalus ridibundus*		3,040	All-Ireland Importance	4	1
Roseate Tern *Sterna dougallii*	Y	2,000 (passage)	All-Ireland Importance	-	-
Common Tern *Sterna hirundo*	Y	52 pairs (breeding) 5,000 (passage)	All-Ireland Importance	-	-
Arctic Tern *Sterna paradisea*	Y	20,000 (passage)	All-Ireland Importance	-	-
Other conservation designations associated with the site[b]	**SAC**	**RAMSAR SITE**	**IMPORTANT BIRD AREA (IBA)**	**WILDFOWL SANCTUARY**	**OTHER**
	SAC 0210	**Yes**	**Yes**		

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

PART THREE – CONSERVATION OBJECTIVES FOR NORTH BULL ISLAND SPA AND SOUTH DUBLIN BAY AND RIVER TOLKA ESTUARY SPA

3.1 Conservation Objectives for the non-breeding Special Conservation Interests of North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA

The overarching Conservation Objective for North Bull Island Special Protection Area, and for South Dublin Bay and River Tolka Estuary 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 North Bull Island Special Protection Area, and for South Dublin Bay and River Tolka Estuary 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 North Bull Island SPA and South Dublin Bay and River Tolka Estuary 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.[7] Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis.[8]

- 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.[9]

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

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

- ❖ Disturbance: anthropogenic disturbance that occurs in or near the site and is either singular or cumulative in nature could result in the displacement of one or more of

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

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

[9] Waterbird distribution from the 2011/2012 waterbird survey programme is examined in Section 5.

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).

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

Objective 2: *To maintain the favourable conservation condition of the wetland habitat at North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA as a resource for the regularly-occurring migratory waterbirds that utilise these areas.*

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 **3,904 ha**, other than that occurring from natural patterns of variation.

This objective seeks to maintain the permanent extent of the wetland habitats that are contained within the boundary of these two SPAs, and which constitute an important resource for regularly-occurring migratory waterbirds (note that the total designated area also contains some non-wetland habitat).

North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA have a total combined area of **4,138** ha. Of this total area, **3,904** ha are considered to be wetland habitat and **234** ha are terrestrial habitat (the Bull Island sand dune system) with an additional **0.03** ha attributed to the artificial Tern Colony.

The wetland habitats can be categorised into three broad types: subtidal; intertidal and supratidal. Over time and though natural variation these subcomponents of the overall wetland complex may vary due to factors such as changing rates of sedimentation, erosion etc. Many waterbird species will use more than one of the habitat types for different reasons throughout the tidal cycle.

Subtidal areas refer to those areas contained within the SPA that lie below the mean low water mark and are predominantly covered by marine water. Tidal rivers, creeks and channels are included in this category. For North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA this broad category is estimated to be **2,238 ha**. Subtidal areas are continuously available for benthic and surface feeding ducks (e.g. Pintail, Shoveler) and piscivorous/other waterbirds. Various waterbirds roost in subtidal areas.

The intertidal area is defined, in this context, as the area contained between the mean high water mark and the mean low water mark. For North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA this is estimated to be **1,486 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[10] 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.

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

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 North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA this is estimated to be **180 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.

Table 3.1 Conservation Objectives for the waterbird Special Conservation Interests of North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA

Objective 1: *To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for North Bull Island SPA and South Dublin Bay and River Tolka Estuary 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 2011/12 waterbird survey programme is reviewed in Part Five of this document.
Objective 2: *To maintain the favourable conservation condition of the wetland habitat at North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA, as a resource for the regularly-occurring migratory waterbirds that utilise these areas.* *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 3,904 ha, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as 3,904 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 North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA

The sites designated as North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA are inextricably interlinked because several of the listed waterbird species use habitats within both of the designated sites and make regular movements between them. Non-breeding waterbirds have been counted regularly across the wider site known as 'Dublin Bay' as part of the Irish Wetland Bird Survey (I-WeBS) since the survey commenced in 1994/95. Two large count areas are used: (1) North Bull Island and (2) South Wall-West Pier Dún Laoghaire; these are further subdivided into count subsites. These subsites fit within the two SPA areas and their boundaries correspond closely, but not exactly, to the SPA boundaries. Count data for these subsites were used to inform the SPA designation process.

Table 4.1(a) and (b) present population[11] data for non-breeding SCI waterbirds of North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA). Annual maxima were identified and used to calculate the five-year mean peak for each species. The baseline period was 1995/96 – 1999/00 while the recent average relates to the five-year period 2006/07 – 2010/11.

I-WeBS counts take place across the core survey months of September to March inclusive; this period 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[12]. 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 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).

Tables 4.1 (a & b) highlight where the waterbird numbers shown surpass thresholds of International or all-Ireland importance. These thresholds are different for the baseline and recent time periods used; international thresholds are outlined in Wetlands International (2002) and Wetlands International (2012) while all-Ireland thresholds are presented within Crowe et al. (2008) and Crowe & Holt (2013) for the baseline and recent site data respectively.

Gulls are widely distributed during winter and are not monitored routinely during I-WeBS so standard methods of population estimation and threshold setting cannot be applied. Gull species are therefore not assigned 1% thresholds but rather a 'threshold of significance' is applied that relates to the known most important sites for the species in question (Crowe, 2005).[13]

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

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

[13] Current threshold of significance is 1,000 for Black-headed Gull (after Crowe, 2005).

Table 4.1 (a) Population data for non-breeding waterbird Special Conservation Interest Species of North Bull Island (data for North Bull Island I-WeBS count area)

Site Special Conservation Interests (SCIs)	Baseline Period[1] (1995/96 – 1999/00)	Recent Site Data[2] (2006/07 – 2010/11)
Light-bellied Brent Goose	1,548 (i)	3,443 (i)
Shelduck	1,259 (n)	913 (n)
Teal	953 (n)	921 (n)
Pintail	233 (n)	156 (n)
Shoveler	141 (n)	123 (n)
Oystercatcher	1,784 (n)	1,772 (n)
Golden Plover	2,033 (n)	1,094
Grey Plover	517 (n)	380 (n)
Knot	2,837 (n)	3,542 (n)
Sanderling	141 (n)	271 (n)
Dunlin	4,146 (n)	3,734 (n)
Black-tailed Godwit	367 (i)	873 (i)
Bar-tailed Godwit	1,529 (i)	1,627 (i)
Curlew	937 (n)	918 (n)
Redshank	1,431 (n)	2,356 (n)
Turnstone	157 (n)	238 (n)
Black-headed Gull	2,196 (n)	1,527 (n)

[1]Baseline data is the 5-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; international thresholds are outlined in Wetlands International (2002) and Wetlands International (2012), while all-Ireland thresholds are presented within Crowe et al. (2008) and Crowe & Holt (2013) for the baseline and recent site data respectively.

Table 4.1 (b) Population data for non-breeding waterbird Special Conservation Interest Species of South Dublin Bay and River Tolka Estuary SPA (data for South Wall-West Pier Dún Laoghaire I-WeBS count area)

Site Special Conservation Interests (SCIs)	Baseline Period[1] (1995/96 – 1999/00)	Recent Site Data[2] (2006/07 – 2010/11)
Light-bellied Brent Goose	525 (i)	854 (i)
Oystercatcher	1,263 (n)	1,965 (n)
Ringed Plover	161 (n)	345 (n)
Knot	1,151 (n)	1,934 (n)
Sanderling	349 (n)	466 (n)
Dunlin	2,753 (n)	3,383 (n)
Bar-tailed Godwit	866 (n)	446 (n)
Redshank	713 (n)	633 (n)
Black-headed Gull	3,040 (n)	2,023 (n)

[1]Baseline data is the 5-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).

4.2 Waterbird population trends – North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA

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

As noted in Section 4.1, the sites designated as North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA are inextricably interlinked because many of the listed waterbird species use both designated sites, making regular movements between them. I-WeBS data are therefore analysed and presented for the site 'Dublin Bay' as a whole (e.g. in Crowe, 2005; Boland & Crowe, 2012) and this practice is followed here.

Annual population indices were calculated for waterbird SCI species for the data period 1994/95 to 2010/11. Trends are given for the 'long-term' 14-year period (1995/96–2009/10)

and the recent ('short-term') five-year period (2004/05 – 2009/10) (Table 4.2). The values given represent the percentage change in index (population) values across the specified time period. Positive values equate to increases in population size while negative values reflect a decrease in population size.

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

Population indices were not calculated for Black-headed Gull because gulls are not monitored routinely during I-WeBS. A measure of population change was therefore calculated using the generic threshold method which compares population size at two time intervals based on five-year means (see Appendix 3 for methods).

Table 4.2 Site population trends for non-breeding waterbird Special Conservation Interest species of North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA

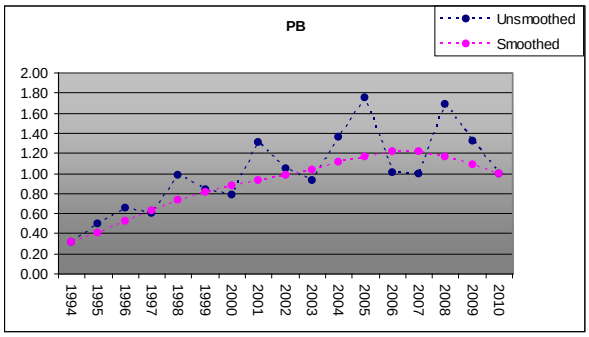
Site Special Conservation Interests (SCIs)*	Site Population Trend[1] 14 Yr	Site Population Trend[2] 5 Yr	Population change[3]
Light-bellied Brent Goose	+ 166	- 2	
Shelduck	- 1	- 7	
Teal	+ 28	+ 11	
Pintail	- 17	+ 40	
Shoveler	- 33	+ 6	
Oystercatcher	+ 78	- 18	
Ringed Plover	+ 14	- 28	
Golden Plover	- 49	+ 10	
Grey Plover	- 44	- 19	
Knot	+ 82	+ 25	
Sanderling	+ 45	- 41	
Dunlin	+ 20	+ 17	
Black-tailed Godwit	+ 325	- 9	
Bar-tailed Godwit	+ 27	+ 31	
Curlew	+ 4	- 26	
Redshank	+ 84	+ 11	
Turnstone	+ 206	+ 44	
Black-headed Gull	-	-	- 33

*species are listed jointly for the two SPA sites and in taxonomic order; [1]Site population trend analysis: 14 yr = 1995/96 – 2009/10; [2]Site population trend analysis: 5 yr = 2004/05 – 2009/10; [3]Site population change based on two five-year – means (1995/96 – 1999/00 and 2006/07 – 2010/11) using data from South Dublin Bay only.

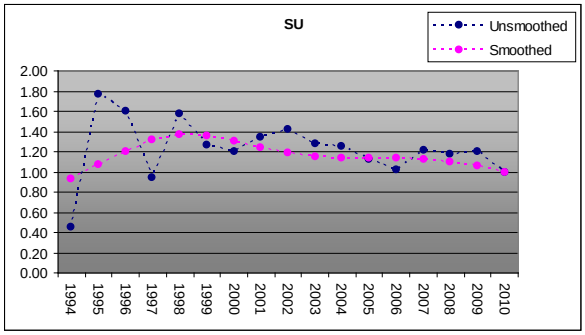
For selected species, explanatory notes are given below to aid the interpretation of trends. Smoothed and unsmoothed indices are shown graphically. Site trends are compared with national trends (Boland & Crowe, 2012[14]); all-Ireland trends (Crowe & Holt, 2013) and British trends (Holt et al. 2012). Graph headings use waterbird species codes and a list of these is provided in Appendix 4.

[14] National trends presented in Boland & Crowe (2012) update those shown previously in Crowe (2005).

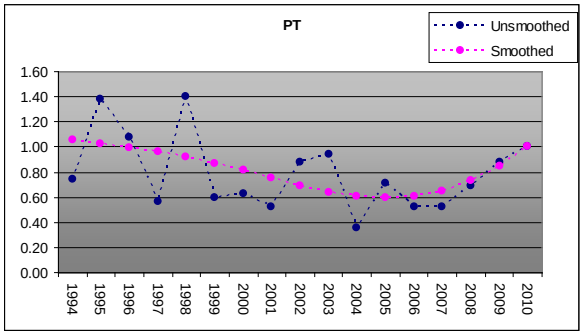
Light-bellied Brent Goose – the long-term trend is for increasing numbers at Dublin Bay although numbers in recent seasons have dropped slightly, hence the short-term trend for decline. Nationally, numbers increased at an annual rate of 5.1% over the period 1994/95 to 2008/09.



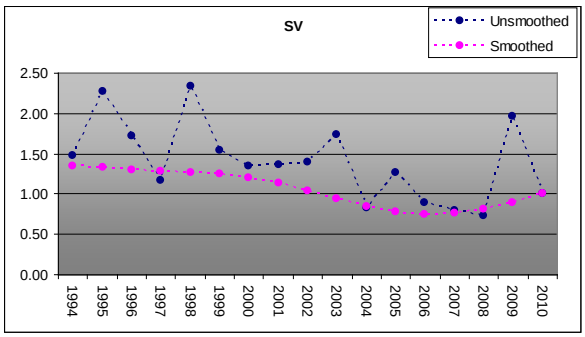
Shelduck – following an increase in numbers in the early seasons of I-WeBS, numbers have declined since the late 1990's. Nationally, numbers have shown a slight but steady decline since the mid 1990's, consistent with the trend observed in Britain. The all-Ireland trend is currently stable.



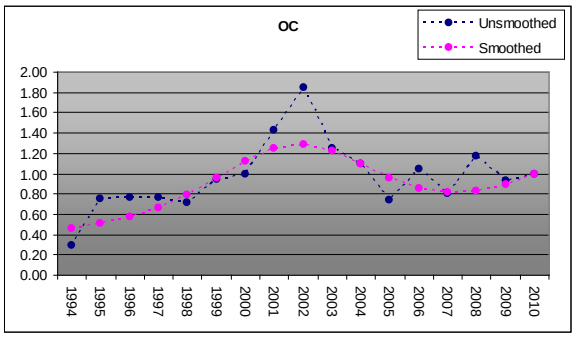
Pintail – the smoothed trend highlights a progressive decline in numbers at Dublin Bay since records began. However numbers have been climbing upwards since 2007/08, hence the short-term trend for increase. Nationally, numbers of Pintail declined during the late 1990's but subsequently recovered to former levels, while in Britain increasing numbers up to 2005/06 have been followed by a declining index.



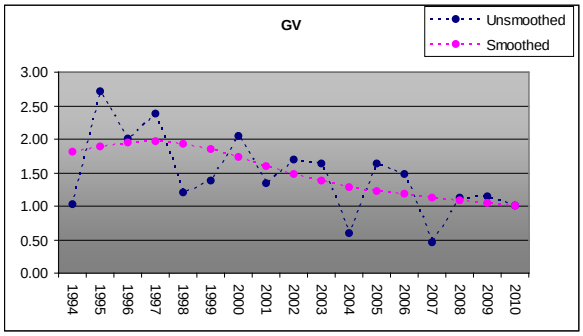
Shoveler – like Pintail, numbers of Shoveler at Dublin Bay progressively declined throughout I-WeBS although some increase in numbers has been recorded in recent seasons. Nationally numbers declined up to 2002/03 and have since increased to beyond previous levels.



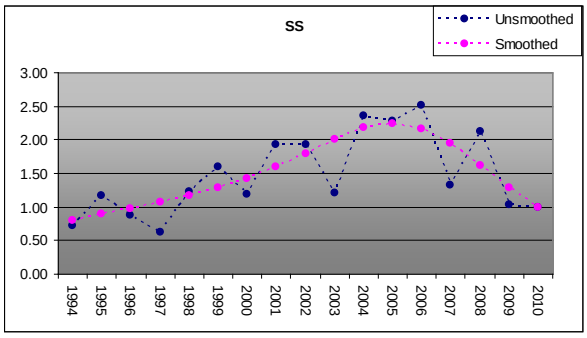
Oystercatcher – numbers increased to a site peak in 2002/03 but then dropped back to just above former levels. Nationally, numbers of Oystercatcher have shown an overall increase since 1994, and have been relatively stable since the early 2000's; a trend also observed at the all-Ireland scale.



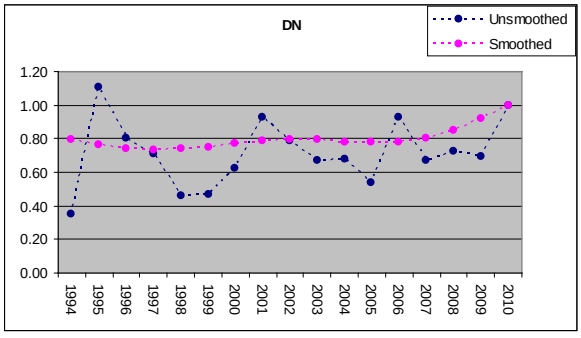
Grey Plover - numbers have progressively declined throughout I-WeBS although this decrease has levelled off in recent seasons. This trend mirrors that observed at national and all-Ireland level; Grey Plovers having declined at an annual rate of 4% since I-WeBS began, becoming stable in recent seasons. In Britain numbers now appear relatively stable after exhibiting a decline over the period mid 1990's to mid 2000's.



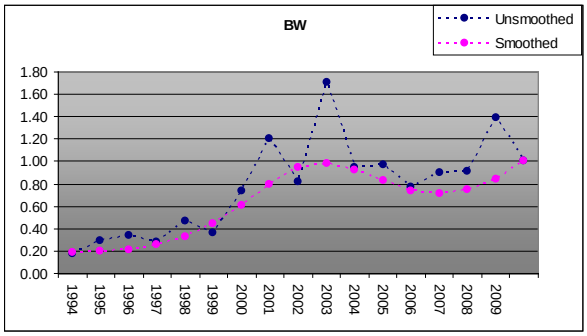
Sanderling – numbers steadily increased up to 2005/06 but have subsequently declined to be on a par with numbers recorded in the mid 1990's. The decline, since the mid 2000's has been quite steep. Nationally, numbers have increased throughout I-WeBS while in Britain the long-term trend is also for increasing numbers.



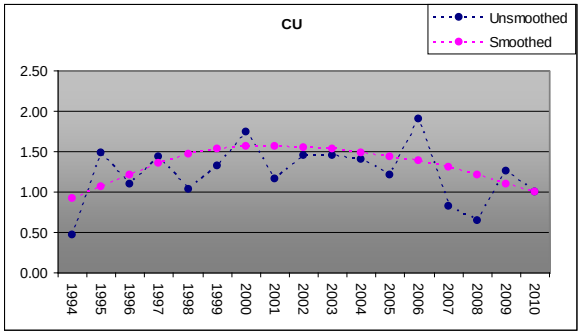
Dunlin– numbers across the long-term have remained relatively stable at Dublin Bay. This contrasts to a declining trend observed at national and all-Ireland level, and in Britain and in Northern Ireland.



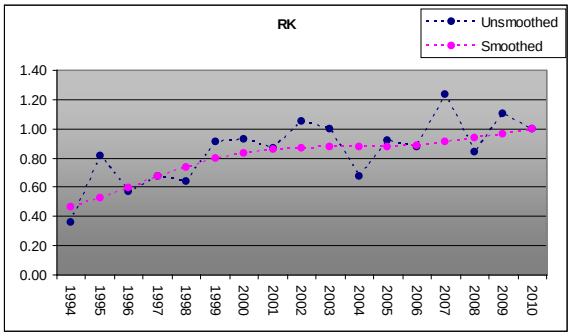
Black-tailed Godwit – this species has exhibited a long-term trend for increase at Dublin Bay. This is consistent with the national trend and that observed in the UK.



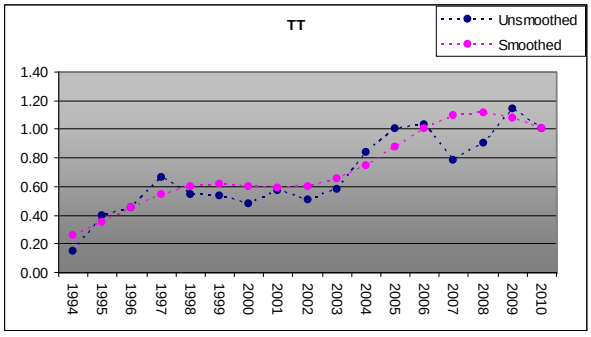
Curlew – numbers at Dublin Bay have been largely stable across the long-term, but have declined in recent seasons as highlighted by the short-term trend for decline. Nationally, numbers have declined throughout I-WeBS by an average *c.*3% per year. In Britain, numbers of Curlew increased from the 1970's until the start of the 2000's but have since shown a trend for steady decline.



Redshank – numbers have increased progressively at Dublin Bay since I-WeBS began. This is consistent with the national trend but the species is faring differently in Britain and Northern Ireland where a trend for decline has been evident over the past decade.



Turnstone – numbers have increased over the long-term, consistent with the national trend. This contrasts with Britain and Northern Ireland where a decline in numbers has been apparent since the mid 1980's.



4.3 North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA – site conservation condition of waterbird SCI species

Conservation condition of waterbird species is determined using the long-term site population trend and therefore relates to Conservation Objective 1 (population trend) only[15]. Conservation condition is assigned using the following criteria:

Favourable population = population is stable/increasing.

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

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

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

For Black-headed Gull, conservation condition has been assigned using % population change (See Section 4.2).

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 to the 18 waterbird species of Special Conservation Interest listed for North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA, and based on the long-term population trend for the site, it has been determined that (Table 4.3):-

1. 4 species are currently considered to be **Unfavourable** (Shoveler, Golden Plover, Grey Plover and Black-headed Gull);

2. 2 species are currently considered as **Intermediate Unfavourable** (Shelduck and Pintail);

3. 12 species are currently considered as **Favourable** (Light-bellied Brent Geese, Teal, Oystercatcher, Ringed Plover, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank and Turnstone);

Site conservation condition and population trends were also reviewed in light of species' all-Ireland and international trends (Table 4.3).

[15] Conservation condition in relation to Objective 1 (range, timing or intensity of use of areas by SCI species) has yet to be assigned.

Table 4.3 SCI species of North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA – Current Site Conservation Condition

Site Special Conservation Interests (SCIs)	BoCCI Category[a]	Site Population Trend[b]	Site Conservation Condition	Current all-Ireland Trend[c]	Current International Trend[d]
Light-bellied Brent Geese	Amber	+ 166	Favourable	Increasing	Increasing
Shelduck	Amber	- 1	Intermediate Unfavourable	Stable	Increasing
Teal	Amber	+ 28	Favourable	Stable	Increasing
Pintail	Red	- 17	Intermediate Unfavourable	Increasing	Increasing
Shoveler	Red	- 33	Unfavourable	Increasing	Increasing
Oystercatcher	Amber	+ 78	Favourable	Stable	Declining
Ringed Plover	Green	+ 14	Favourable	Stable	Fluctuating
Golden Plover	Red	- 49	Unfavourable	Declining	Declining
Grey Plover	Amber	- 44	Unfavourable	Declining	Declining?
Knot	Amber	+ 82	Favourable	Increasing	Fluctuating
Sanderling	Green	+ 45	Favourable	Increasing	Increasing?
Dunlin	Red	+ 20	Favourable	Declining	Stable
Black-tailed Godwit	Amber	+ 325	Favourable	Increasing	Increasing
Bar-tailed Godwit	Amber	+ 27	Favourable	Stable	Increasing
Curlew	Red	+ 4	Favourable	Declining	Declining
Redshank	Red	+ 84	Favourable	Stable	Stable/Increasing
Turnstone	Green	+ 206	Favourable	Increasing	Increasing?
Black-headed Gull	Red	-33	Unfavourable	n/c	n/c

[a]after Colhoun & Cummins, 2013; [b] Site population trend analysis; see Table 4.2; [c]all-Ireland trend:- where a species is deemed to be increasing or declining if the annual rate of change is equal to or greater than 1.2% (after Crowe & Holt, 2013); [d] current international trend after Wetlands International (2012).

Table 4.3 also shows the relationship between a species' long-term site trend and the current all-Ireland trend. The colour coding used represents the following cases:-

- Green – species whose populations are stable or increasing at both site level and all-Ireland level.
- Beige – species whose populations are declining at both site level and all-Ireland level. Therefore there is a potential for factors at a larger spatial scale to be influencing the observed trend at site level.
- Orange - species whose populations are exhibiting a 1 – 24.9% decline at site level but are stable or increasing at all-Ireland level.
- Pink - species whose populations are exhibiting a 25.0 – 49.9% decline at site level but are stable or increasing at all-Ireland l level.
- Red - species whose populations are exhibiting a decline of >50.0% at site level but are stable or increasing at all-Ireland l level.

The pink and red categories listed above highlight where populations are stable at all-Ireland 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 North Bull Island SPA and South Dublin Bay and River Tolka SPA.

Section 5.2 provides selected ecological summary information for non-breeding waterbirds of North Bull Island SPA and South Dublin Bay and River Tolka SPA. Section 5.3 presents results from the 2011/12 Waterbird Survey Programme. Finally, Section 5.4 provides summary information on the activities and events that occur in and around these sites that may either act upon the habitats within the site, or may interact with waterbirds using the site.

The information provided is intended to:-

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

Note however, that 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 September 2012 and updated in April 2014.

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

Waterbirds, defined as ‘‘*birds that are ecologically dependent on wetlands”* (Ramsar Convention, 1971), are a diverse group that includes divers, grebes, swans, geese and ducks, gulls, terns and wading birds. During the data period 1994/95 – 2010/11 the I-WeBS database shows a total of 64 waterbird species that have been recorded within the I-WeBS subsite North Bull Island, while a total of 64 species were recorded across South Wall-West Pier Dún Laoghaire. 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), *Ciconiiformes* (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[16] or species that use the site at certain times only (e.g. as a cold weather refuge).

A total of 31 and 26 waterbird species occurred on a regular basis within the two I-WeBS subsites[17] that correspond to North Bull Island SPA and South Dublin Bay and River Tolka

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

[17] I-WeBS subsites are called North Bull Island and South Wall-West Pier Dún Laoghaire.

SPA during the period 1994/95 – 2010/11.[18] After omitting species listed as SCIs for the two respective SPA sites; a further 14 and 18 species have occurred on a regular basis across these two areas. These are shown in Table 5.1a and Table 5.1b.

Table 5.1a Regularly-occurring non SCI waterbird species that occur at North Bull Island during the non-breeding season

Species	Baseline Data Period[1] (1995/96 – 1999/00)	Recent Site Average[2] (2006/07 – 2010/11)
Wigeon (*Anas penelope*)	801	1,039 (n)
Mallard (*Anas platyrhynchos*)	100	89
Goldeneye (*Bucephala clangula*)	14	9
Red-breasted Merganser (*Mergus serrator*)	26	32 (n)
Great Crested Grebe (*Podiceps cristatus*)	14	27
Cormorant (*Phalacrocorax carbo*)	25	74
Grey Heron (*Ardea cinerea*)	19	25 (n)
Ringed Plover (*Charadrius hiaticula*)	139	36
Lapwing (*Vanellus vanellus*)	72	73
Greenshank (*Tringa nebularia*)	16	34 (n)
Common Gull (*Larus canus*)	332	460
Lesser Black-backed Gull (*Larus fuscus*)	10	46
Herring Gull (*Larus argentatus*)	331	294
Great Black-backed Gull (*Larus marinus*)	51	163

[1] Baseline data is the 5-year mean peak for the period 1995/96 – 1999/00 (I-WeBS); [2]recent site data is the 5-year mean peak for the 5-year period 2006/07 – 2010/11 (I-WeBS). (n) denotes numbers of all-Ireland importance which differ for the baseline period (after Crowe et al. 2008) and recent time period (after Crowe & Holt, 2013).

Table 5.1b Regularly-occurring non SCI waterbird species of South Dublin Bay and River Tolka Estuary SPA that occur at South Wall-West Pier Dun Laoghaire during the non-breeding season

Species	Baseline Data Period[1] (1995/96 – 1999/00)	Recent Site Average[2] (2006/07 – 2010/11)
Shelduck (*Tadorna tadorna*)	19	23
Teal (*Anas crecca*)	20	62
Mallard (*Anas platyrhynchos*)	15	6
Red-breasted Merganser (*Mergus serrator*)	17	39 (n)
Red-throated Diver (*Gavia stellata*)	6	10
Great Crested Grebe (*Podiceps cristatus*)	21	194 (n)
Cormorant (*Phalacrocorax carbo*)	24	100
Grey Heron (*Ardea cinerea*)	9	16
Moorhen (*Gallinula chloropus*)	5	6
Grey Plover (*Pluvialis squatarola*)	45	6
Lapwing (*Vanellus vanellus*)	6	5
Snipe (*Gallinago gallinago*)	18	7
Curlew (Numenius arquata)	127	129
Greenshank (*Tringa nebularia*)	2	13
Turnstone (*Arenaria interpres)*	52	118 (n)
Common Gull (*Larus canus*)	330	228
Lesser Black-backed Gull (*Larus fuscus*)	348	67
Great Black-backed Gull (*Larus marinus*)	54	52

Grey shading denotes an Annex I species; [1] Baseline data is the 5-year mean peak for the period 1995/96 – 1999/00 (I-WeBS); [2]recent site data is the 5-year mean peak for the 5-year period 2006/07 – 2010/11 (I-WeBS). (n) denotes numbers of all-Ireland importance which differ for the baseline period (after Crowe et al. 2008) and recent time period (after Crowe & Holt, 2013).

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.

[18] Regular is defined as a species that has occurred in 14 out of the 17-year data period.

Table 5.2 provides selected ecological information for waterbird SCI species of North Bull Island SPA and South Dublin Bay and River Tolka SPA. Information is provided for the following categories[19]:-

- waterbird family (group);
- winter distribution – species distribution range during winter (based on the period 1996/97 – 2000/01 (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).

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

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

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

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

Table 5.2 Waterbirds – Ecological characteristics, requirements & specialities of SCI species

	Family (group)	Winter distribution[A]	Trophic Guild[B]	Food/Prey Requirements[C]	Principal supporting habitat within site[D]	Ability to utilise other/alternative habitats[E]	Site Fidelity[F]
Light-bellied Brent Goose *Branta bernicla hrota*	Anatidae (geese)	Localised	1, 5	Highly specialised	Intertidal mud and sand flats, *Zostera* beds	2	High
Shelduck *Tadorna tadorna*	Anatidae (shelducks)	Localised	1, 5	Wide	Intertidal mudflats, shallow subtidal	3	High
Teal *Anas crecca*	Anatidae (dabbling ducks)	Widespread	1	Wide	Intertidal mudflats, shallow subtidal	3	Weak
Pintail *Anas acuta*	Anatidae (dabbling ducks)	Localised	1	Wide	Sheltered & shallow subtidal	1	Weak
Shoveler *Anas clypeata*	Anatidae (diving ducks)	Intermediate	1	Wide	Sheltered & shallow subtidal	3	Moderate
Oystercatcher *Haematopus ostralegus*	Haematopodidae (wading birds)	Intermediate	4	Narrower	Intertidal mud and sand flats	2	High
Ringed Plover *Charadrius hiaticula*	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Golden Plover *Pluvialis apricaria*	Charadriidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate
Grey Plover *Pluvialis squatarola*	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Knot *Calidris canutus*	Scolopacidae (wading birds)	Localised	4	Narrower	Intertidal mud and sand flats	3	Moderate
Sanderling *Calidris alba*	Scolopacidae (wading birds)	Localised	4, 6	Wide	Intertidal sand flats	3	High
Dunlin *Calidris alpina*	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	3	High
Black-tailed Godwit *Limosa limosa*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	High
Bar-tailed Godwit *Limosa lapponica*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	Moderate
Curlew *Numenius arquata*	Scolopacidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	High
Redshank *Tringa totanus*	Scolopacidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	Moderate
Turnstone *Arenaria interpres*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	High
Black-headed Gull *Chroicocephalus ridibundus*	Lariidae (gulls)	n/c	1, 2, 4, 6, 7	Wide	Intertidal flats & sheltered & shallow subtidal	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 North Bull Island and South Dublin Bay and River Tolka Estuary. Note that this is the main habitat used when foraging with the exception of Golden Plover (roosting).
[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 2011/12 waterbird survey programme

5.3.1 Introduction

The 2011/12 waterbird survey programme was designed to investigate how waterbirds are distributed across coastal wetland sites during the low tide period. The surveys ran alongside and are complementary to the Irish Wetland Bird Survey (I-WeBS) which is a nationwide survey undertaken primarily on a rising tide or at high tide.

At North Bull Island SPA and South Dublin Bay and River Tolka SPA, a standard survey programme of four low tide counts (October, November & December 2011 and February 2012) and a high tide count (January 2012) were completed across the site.[20] Waterbirds were counted within a series of 20 count subsites (see map in Appendix 6) across a survey area hereafter called 'Dublin Bay.' Note that the count area used during this survey programme may be slightly different to the area designated as a SPA. In line with I-WeBS, count subsites included terrestrial grassland at Sean Moore Park (Subsite 0UL53; outside SPA boundary) and 0UL54 (inside SPA boundary), plus an area of interest due to a former planning proposal for the extension of Dublin Port (Subsite 0UL46).

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 five 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, two high tide roost surveys were completed on 25th November 2011 and 21st February 2012. These dates were chosen to reflect spring and neap tides respectively. During these surveys waterbird roost sites were located, species and numbers of waterbirds counted and the position of the roosts marked onto field maps. A dusk gull roost survey was undertaken on 21st February 2012 between the hours 16.20 and 18.20. This survey aimed to update previous surveys (e.g. Merne et al. 2009).

[20] Low tide surveys: 05/10/11, 04/11/11, 05/12/11 & 02/02/12 plus a high tide survey on 10/01/12.

5.3.2 Waterbird data, analyses and presentation

The aim of data analyses was to understand how waterbirds are distributed across the site of Dublin Bay during the autumn and winter months. By assessing patterns of waterbird distribution at low and high tide, together with examination of data on sediment and invertebrate distribution and abundance, we aimed to identify areas (subsites) within the site that are the most important for foraging and roosting on a species by species basis.

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

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

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

Subsite Rank Position - Categories

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

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

Waterbird count data for low tide surveys are also presented as species distribution maps ('dot density maps'). Dot-density maps show waterbird species distribution within intertidal or subtidal habitat[21] 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.

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

Notes on data interpretation and methodological limitations

Subsite rankings and dot-density maps relate to the distribution of waterbirds at subsite level as recorded within the survey area during the 2011/12 waterbird survey programme. Care must be taken in the interpretation of these data, and subsite rankings in isolation should not be used to infer a higher level of conservation importance to one area over another without a detailed examination of data and understanding of each species' ecology. For instance, while some species are known to be highly site-faithful, both at site level and within-site level (e.g. Dunlin), other species may range more widely across a site(s). While some species by their nature may aggregate in high numbers, others such as Greenshank or Grey Heron may not. It is also important to consider that distribution maps and data refer to a single season of low tide surveys. Although important patterns of distribution will emerge, these distributions should not be considered absolute; waterbirds by their nature are highly mobile and various factors including tide (e.g. spring/neap), temperature, direction of prevailing winds, changing prey densities/availabilities and degree of human activity across the site, could lead to patterns that may change in different months and years.

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.

Subsite 0UL46 was included in the survey programme count area due to it being subject to a former planning proposal for the extension of Dublin Port. It should be noted that this subsite contains largely subtidal habitat with a small proportion of intertidal habitat, but that at lowest astronomical tides up to one-third of the site may become exposed (*c.*6.9 ha). Given such characteristics, the standard methodology of the Waterbird Survey Programme is unlikely to have recorded waterbirds at the optimum time. Previous studies have shown this area can be used by good numbers of Oystercatcher, Curlew, Turnstone and Common Tern; with lower abundances of Great Crested Grebe, Light-bellied Brent Goose, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Redshank, Black-headed Gull, Common Gull, Herring Gull and Great Black-backed Gull (CWC, 2008).

5.3.3 Summary Results

A total of 45 waterbird species were recorded during the 2011/12 survey programme at Dublin Bay. Cummins and Crowe (2012) provide a summary of waterbird data collected. A map showing count subsites is provided in Appendix 6 of this report.

Note that in all cases where SCI species are listed, they are listed for the two SPAs combined, and in taxonomic order.

All SCI species were recorded within all counts undertaken with the exception of Pintail that was absent from the first (October) low tide survey, and Golden Plover that was not recorded during low tide surveys on 04/11/11 and 05/12/11. Table 5.4 shows peak numbers (whole site) for SCI species recorded during the low tide (LT) and high tide (HT) surveys.

Average percentage occupancy, defined as the average proportion of subsites in which a species occurred during low tide counts was lowest for Shoveler that occurred on average in

8% of subsites (Table 5.4). Golden Plover, recorded in two low tide surveys only, was recorded in one subsite only. Black-headed Gull (78%) and Oystercatcher (76%) were the most widespread species.

Average percentage area occupancy is defined as the average proportion of the whole site area that a species occurred in during low tide counts. This calculation included all subsites except the outer bay subtidal subsite 0UL52. Although this is a broad calculation across all habitat zones it presents some indication of the range of a species across the site as a whole.

The lowest average percentage area occupancy was recorded for Pintail and Shoveler (6%). Golden Plover was recorded in two low tide surveys and in one subsite only, representing 5% of the total count area.

Nine of the SCI species occurred, on average, across over 50% of the area surveyed; the most widespread species being Black-headed Gull, Curlew and Bar-tailed Godwit.

Table 5.4 Dublin Bay: 2011/2012 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	3,472 (i)	622 (i)	30 (19)	59 (51)
Shelduck	663 (n)	713 (n)	20 (4)	15 (4)
Teal	1,415 (n)	387 (n)	24 (5)	14 (5)
Pintail	176 (n)	171 (n)	10 (0)	6 (1)
Shoveler	100 (n)	13	8 (3)	6 (1)
Oystercatcher	1,997 (n)	2,255 (n)	76 (5)	97 (2)
Ringed Plover	118 (n)	47	14 (3)	24 (4)
Golden Plover	97	3	5	5
Grey Plover	173 (n)	432 (n)	34 (12)	47 (17)
Knot	5,694 (i)	901 (n)	36 (9)	43 (12)
Sanderling	357 (n)	182 (n)	21 (5)	54 (9)
Dunlin	3,636 (n)	2,487 (n)	46 (6)	72 (18)
Black-tailed Godwit	855 (i)	808 (i)	50 (4)	41 (4)
Bar-tailed Godwit	2,235 (i)	594 (n)	49 (8)	83 (7)
Curlew	674 (n)	917 (n)	63 (5)	89 (5)
Redshank	1,196 (n)	954 (n)	71 (3)	74 (15)
Turnstone	131 (n)	183 (n)	58 (6)	81 (10)
Black-headed Gull	2,933 (n*)	1,700 (n*)	78 (6)	97 (2)

(i) denotes numbers of international importance (1% thresholds: Wetlands International, 2012); (n) denotes numbers of all-Ireland importance (after Crowe & Holt, 2013); (n*) relates to threshold of significance applied by Crowe (2005).
[I] 4 low-tide counts undertaken on 05/10/11, 04/11/11, 05/12/11 & 02/02/12, [II] High-tide count undertaken on 10/01/12;
[III] Mean (± s.d.) averaged across low tide surveys with the exception of Pintail that was averaged across three low tide counts and Golden Plover that shows peak subsite occupancy.

Whole site species richness (total number of species) was relatively stable across low tide surveys and ranged from 34 to 37 species. 34 species were recorded during the high tide survey.

During low tide surveys, subsite species richness ranged from one species (0UL52, 0UL53, 0UL54) to an average 22 species (0U465) (Table 5.5). The majority of subsites (17) supported more species during low tide surveys as opposed to the high tide survey. 12

subsites supported on average, twelve or more species during low tide surveys. Five subsites supported an average 18 species or more (0U460, 0U462, 0U465, 0U466 and 0UL48).

Table 5.5 Subsite species richness

Subsite Code	Subsite Name	Mean (±S.D) LT Survey	No. species HT Survey	Peak Overall
0U460	Dún Laoghaire - Seapoint	18 (1.6)	11	20 (L)
0U461	Booterstown	8 (2.9)	9	10 (L)
0U462	Booterstown - Merrion Gates	18 (3.7)	19	21 (L)
0U464	South of Wooden Bridge	15 (3.2)	0	17 (L)
0U465	Wooden Bridge - Causeway	22 (0.6)	18	22 (L)
0U466	North of Causeway (to saltmarsh)	18 (1.0)	23	23 (H)
0U468	Dollymount Strand (incl. open water)	15 (1.3)	6	16 (L)
0U469	Sutton-Dinghy Club	12 (1.3)	5	13 (L)
0U472	East Pier to Forty Foot	9 (5.0)	9	14 (L)
0UL40	Sandymount Strand North	14 (2.0)	7	17 (L)
0UL41	Sandymount Strand South	9 (2.1)	8	12 (L)
0UL43	Fairview Park	15 (2.5)	7	18 (L)
0UL44	Clontarf Baths	16 (2.1)	9	18 (L)
0UL45	Dublin Port	5 (2.2)	0	7 (L)
0UL46	Dublin Port Extension	3 (2.9)	0	6 (L)
0UL47	Kilbarrack	17 (2.8)	15	19 (L)
0UL48	Sutton Strand South	18 (2.6)	20	21 (L)
0UL52	South Dublin Bay-Outer	1 (1.4)	0	3 (L)
0UL53	Sean Moore Park	1 (0.5)	2	2 (H)
0UL54	Ringsend-Irishtown Park	1 (0.6)	1	1 (H/L)

5.3.4 Waterbird distribution

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

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

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

Tables 5.6 (a–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. Waterbird distribution dot-density maps are provided in Appendix 7; summary roost data are presented in Appendix 8.

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

	0U460	0U461	0U462	0U464	0U465	0U466	0U468	0U469	0U472	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	0UL47	0UL48	0UL52	0UL53	0UL54
PB	L	L	L	M	V	M	L	H		H	V	V	M			H	V	L		L
SU					V	V							L			V	M			
T.		M			V	V							L			V	M			
PT					H	V										V				
SV					V	H														
OC	L	L	M	H	H	M	M	H	L	V	H	M	H	L		M	H		L	
RP			V							V	H					V	V			
GP					V															
GV			M	V	V	M	M	M		L		M	H			H	V			
KN	V	M	V	V	V	H		L		H	L		H			M	M			
SS	V		V	L			H			L	V									
DN	M		H	V	V	M	M	L		V	M	M				H	V			
BW	M	L	H		H	V		M		M	L	V	H			H	L			
BA	V		V	H	M	M	H	M		M	H	H				L	M			
CU	L		L	V	V	V	M	H	L	M	M	V	M			H	H			
RK	M	M	H	H	V	H	L	M	L	M	H	V	H			H	V			
TT	H		L	V	H	M	H	M	H	M		H	V			H	H			
BH	H	L	V	V	H	H	M	L	M	V	M	V	H	L	L	M	M			H

Table 5.6 (b) Dublin Bay and River Tolka Estuary Subsite assessment – ranked total numbers HT Survey (across all habitats)

	0U460	0U461	0U462	0U464	0U465	0U466	0U468	0U469	0U472	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	0UL47	0UL48	0UL52	0UL53	0UL54
PB	8		1		4	2		6				7				5	3			
SU					2	1							5			3	4			
T.		3	4		5	1										2	6			
PT						1										2				
SV					2	1														
OC	9	12	2		1	11		7	14	4	6		12			5	3		8	
RP			1			2														
GP																1	2			
GV			4		1											3	2			
KN			2		5	3					1					4	6			
SS			2				4			3	1									
DN			4		2	6				7	1					3	5			
BW		5	6		3	1										2	4			
BA			1		3	6				4	5						2			
CU			4		3	2					4						1			
RK		4	6		2	1		9	10	8	7					5	3			
TT	6		7		1	5	7	2	3	9			10				4			
BH	7	9	6		2	3	4	12	5	13	14	8	11			10	1		15	

Table 5.6 (c) Dublin Bay 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)

	0U460	0U461	0U462	0U464	0U465	0U466	0U468	0U469	0U472	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	0UL47	0UL48	0UL52	0UL53	0UL54
PB[I]	L	L	L	L	V	M	L	H		H	V	H	M			M	V			
PB[II]				M		M	M	V								V	V	L		
SU[I]					V	H							V			V	M			
SU[II]													H			V	V			
T.[I]		V			V	H										V	L			
T.[II]					V															
PT[II]						V														
SV[III]					V	V														
OC[I]	M	L	M	H	V	M	M	H	L	V	M	L	H	L		M	H			
RP[I]			V							V	H					V	H			
GP[I]					V															
GV[I]			M	V	V	M		M		L		M	H			H	V			
KN[I]	H	L	V	H	V	V		L		V	M		H			M	M			
SS[I]	V		V	L			H			L	V									
DN[I]	M		H	V	V	M	L	M		V	M	H				H	V			
BW[I]	H	M	H		V	V		M		M	L	V	H			H	M			
BA[I]	V		V	H	M	M	M	M		M	H	H				L	H			
CU[I]	L		M	V	H	M	M	H	L	H	M	V	M			H	V			
RK[I]	M	M	H	H	V	H	L	M	L	L	H	V	H			H	V			
TT[I]	H	L		V	H	M	M	M	M	M		H	V			H	H			
BH[I]	H	L	H	V	H	M	M	M		V	H	H	M			H	M			
BH[II]	M			V	H		M	M	V						H		V			

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

	0U460	0U461	0U462	0U464	0U465	0U466	0U468	0U469	0U472	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	0UL47	0UL48
PB		5			1	7		6		10	9	2	8			3	4
SU					1	3							4			2	5
OC		9		5	1	4		2		6			3	7		10	8
RP			1							5	3					4	2
GV			9	1	2	4		7		10		8	6			3	5
KN	9	5	6	3	1	7				4	10		2			8	
SS	2		1	5			4			6	3						
DN	6		10	2	1	8				7	9	5				4	3
BW	6	5	9	4	1			8				2	3			7	10
BA	1		2	4	10	8	9	6			5	3					7
CU			10	1	6	5		3			9	2	4			7	8
RK	9	1		8	3	2		10				4	6			5	7

Table 5.6 (e) Dublin Bay Subsite assessment – total numbers (roosting/other behaviour) during LT surveys (Intertidal[I], Subtidal[II]) (L Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods).
(Note that GP was not recorded, and no SCI species were recorded roosting/other in 0UL52, 0UL53 or 0UL54 so these subsites are omitted)

	0U460	0U461	0U462	0U464	0U465	0U466	0U468	0U469	0U472	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	0UL47	0UL48
PB[I]				M	V			L				V	M			H	H
PB[II]				V	M	H	V	M								V	L
SU[I]					V	V										V	H
SU[II]						H										V	H
T.[I]		M			V	V							L			V	
T.[II]					H	V										V	H
PT[I]					H	V											
PT[II]						H										V	
SV[I]					V												
OC[I]	L	M		M	V	V		L	L	V		H	M			H	H
RP[I]																	V
GV[I]				V	H	H	M										
KN[I]	V		V	V	H	H							M			L	H
SS[I]	V									V							
DN[I]	V			V	H		V					H					V
BW[I]	L					V	V		M			M	L			V	
BA[I]	V			V	H		V	H								M	
CU[I]	L		L	H	V	V	L	M				M	H				V
RK[I]	L	M	V	M	V	H			L			H	V			M	
TT[I]	V			V					V								V
BH[I]	M	L	V	M	H	H	H	L	H	M	L	V	H			M	M
BH[II]	M			M	H	V			H				H	L	H	L	M

Table 5.6 (f) Dublin Bay Subsite assessment – ranked total numbers (roosting/other behaviour) during HT survey (Intertidal[I], Subtidal[II] and supratidal[III])
(Note that PT, SV and GP were not recorded so are omitted from the table; subsites that held no roosting/other individuals are also omitted)

	0U460	0U461	0U462	0U464	0U465	0U466	0U468	0U469	0U472	0UL40	0UL43	0UL47	0UL48
PB[II]			1			2					4		3
SU[II]					3	1						2	
T.[II]		1										2	
OC[I]		6	2		1			4		3			5
RP[I]			1										
GV[I]			3		1								2
KN[I]						2							1
SS[I]										1			
DN[I]			1		2	4							3
BW[I]						1							
BA[I]			1			3							2
CU[III]					2	1							
RK[I]				4	1	2		6	5				3
TT[I]					1				2				
TT[III]						2		1					
BH[I]	6		3		5		2	8	4	7			1
BH[II]	9	6			1	3		8	5		4	7	2

5.3.5 On-going waterbird studies at Dublin Bay

In July 2013, BirdWatch Ireland with support from Dublin Port began a three-year programme of waterbird counts at Dublin Bay to further the investigations on how waterbirds are using the site for feeding and roosting (Tierney, 2013). A programme of catching and colour-ringing a selection of wader species began in February 2013. Marked birds will help elucidate how particular areas in the bay are used by birds, highlight variations throughout the non-breeding season, and provide information as to waterbird movements, especially those between Dublin Bay and other east coast estuaries.

Dublin Bay

Waterbird Survey Programme 2011/12

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Waterbird distribution - discussion notes

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

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

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

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

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

Numbers

Dublin Bay is the primary wintering site for Brent Geese in Ireland, with birds arriving from Strangford Lough which remains the main staging ground. The recent site mean peak (I-WeBS) is over 4,000 individuals (Boland & Crowe, 2012).

During the 2011/12 season, numbers of Brent Geese during low tide surveys rose from 115 in October 2011 to a peak of 3,472 the following month. Counts undertaken in November 2011 and February 2012, plus the high tide count of 622 on 10/01/12, exceeded the threshold of international importance.
Cooney (2012) noted that the first Brent to arrive at North Bull Island was in late August 2011, and numbers rose there to 560 by mid October although the main arrival of Brent Goose was during the period late October to early November.

Brent Geese were recorded in 16 subsites across the survey period. Peak numbers during low tide surveys were recorded within 0UL41 (Sandymount Strand South), 0U465 (Wooden Bridge – Causeway), 0UL48 (Sutton Strand South) and 0UL43 (Fairview Park) for the four low tide surveys respectively. The subsite peak count of 1,341 Brent Geese was recorded for 0U465 (Wooden Bridge – Causeway) on 04/11/11.

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) (composed of *Zostera noltii* and *Zostera marina*). Where this food source is absent or becomes depleted, the birds feed upon algae species, saltmarsh plants and may also undertake terrestrial grazing.

Brent Geese foraged intertidally across a total 14 subsites; the maximum number recorded in any one subsite was 640 (0U465: Wooden Bridge – Causeway, on 04/11/11).

0UL48 (Sutton Strand South) in the north of the site held peak numbers on 05/12/11 and 02/02/12 as well as peak numbers foraging intertidally (87) during the high tide survey. The intertidal community complex of this subsite is composed largely of 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). A mussel bed dominates the mid shore and mats of the green macroalgae *Ulva* spp. occur.

0UL41 (Sandymount Strand South) supported peak numbers (108) on 05/10/11, these birds foraging on the *Zostera noltii* bed that occurs close to Merrion Gates (NPWS, 2013). O'Briain (1991) studied the use of the *Zostera noltii* bed at Merrion Strand by Brent Geese during the ten-year period 1981 – 1991 and found this area to be the single most important feeding site for the geese after their arrival at Dublin Bay in October. Results of the low tide survey on 5th October 2011 suggest this to still be the case.

0U465 (Wooden Bridge – Causeway) supported peak numbers on 04/11/11. Three subsites supported individuals foraging intertidally during three or more low tide surveys: 0U469, 0UL47 and 0UL48. This subsite is also characterised by the intertidal community complex 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012).

The peak intertidal foraging density was 9 Light-bellied Brent Geese ha^{-1} recorded for 0U465 (Wooden Bridge – Causeway) on 04/11/11. The second highest density recorded was 5 Light-bellied Brent Geese ha^{-1} recorded for 0UL43 (Fairview Park) also on 04/11/11. The whole site average intertidal foraging density was 0.4 Light-bellied Brent Geese ha^{-1}.

Brent Geese were recorded foraging subtidally but in lower numbers than those that foraged intertidally. The maximum number recorded was 163 in 0U469 (Sutton - Dinghy Club) on 04/11/11.

Relatively few records were made of Brent Geese foraging terrestrially within the study area; just four individuals recorded foraging terrestrially within 0UL54 (Ringsend-Irishtown Park) on 04/11/11, and two individuals within 0U460 (Dún Laoghaire - Seapoint) during the high tide survey (adjacent to SPA boundary). However, terrestrial grazing in and around greater Dublin is a known phenomenon and was first recorded in 1991 (O'Briain & Healy, 1991). It has increased recently, likely as a result of the overall increasing numbers with a consequent earlier depletion of the favoured intertidal food sources (Benson, 2009b). Over 60 terrestrial feeding sites have been recorded (Benson, 2009a). Larkin (2012) studied foraging distribution at ten sites (examples include Sean Moore Park, Tolka Valley Park as well as Bull Island) and found no clear relationship between the location of feeding grounds and the distance to the species' main roost on Bull Island. Re-sightings of leg tags, unique to individual birds, and used by the Irish Brent Geese Research Group, demonstrated the temporal site fidelity of the geese feeding areas (Larkin, 2012). For further information on terrestrial foraging see Benson (2009a,b) and Larkin (2012).

Roosting Distribution

Brent Geese primarily feed by day and roost by night. Bull Island is their principal roosting site and they return here at dusk, from both intertidal and inland (terrestrial grassland) feeding areas (Benson 2009a).

Diurnal roosting/other behaviour during the low tide period was recorded within seven subsites (0U464, 0U465, 0U469, 0UL43, 0UL44, 0UL47 and 0UL48). Peak numbers, and the only subsites recording significant numbers, were 0U465 (peak number 111 geese) and 0UL43 (peak number 218 geese).

Subtidal roosting/other behaviour was recorded within nine subsites, but records were relatively irregular. 0UL47 (Kilbarrack) held the peak number recorded during any low tide survey (138 geese). Significant numbers were recorded for 0U462 (Booterstown - Merrion Gates) during the high tide survey (226 geese).

During the November 2011 roost survey (spring tide), diurnal roosting was recorded within four subsites: 0U462, 0U465, 0UL43 and 0UL44. With the exception of 0U462 (seven individuals) all intertidal and supratidal roosting/other behaviour was recorded for 0U465 (Wooden Bridge – Causeway). *c.*2 hours before high water, flocks of roosting/other individuals were recorded at various positions within the subsite, including

flocks of 240 and 190 roosting supratidally, plus 330 subtidally. A later count at 30 minutes before high tide recorded a single flock of 230 roosting as part of a large mixed-species roost in saltmarsh along inner Bull Island (NE of the subsite).

The February 2012 roost survey (neap tide), recorded far fewer roosting/other individuals because most were foraging. Roosting/other was recorded across a total eight subsites and with very few exceptions, most Brent Geese roosted/loafed subtidally, the largest flock comprising 27 individuals.

Shelduck *Tadorna tadorna* - Family (group): Anatidae (ducks)

Tadorna tadorna has five known populations which breed across temperate Eurasia. The northwest Europe population breeds and winters along coasts of Britain, Ireland, Scandinavia, the Baltic and continental Europe. Although a breeding species in Ireland, Shelducks undertake a moult migration each autumn. Large moult gatherings occur along traditionally used areas of the north German coast of the Wadden Sea although several sites in Britain have also become recognised as important moulting areas such as Bridgewater Bay (Severn Estuary), the Humber Estuary, the Wash, and the Firth of Forth. Following the moult, the ducks then migrate to wintering areas.

Numbers

Numbers of Shelduck rose from 94 in October 2011 to a site low tide peak of 663 in December 2011. All counts except that in October 2011 surpassed the threshold of all-Ireland importance. 713 Shelduck were counted during the high tide survey.

Shelduck were recorded in just five subsites overall (0U465, 0U466, 0UL44, 0UL47 and 0UL48). Two of these (0U465 and 0UL47) recorded Shelduck in all five surveys undertaken. 0U465, 0U466 and 0UL47 supported peak numbers during low tide surveys while 0U466 (North of Causeway (to saltmarsh)) supported peak numbers and the subsite peak count during the high tide survey (442 Shelduck).

Foraging Distribution

Shelducks can forage in a variety of ways from scything their bill through wet mud on exposed tidal flats, to dabbling and scything in shallow water and up-ending in deeper waters. They can therefore forage throughout the tidal cycle.

During low tide surveys Shelduck foraged intertidally across five subsites (0U465, 0U466, 0UL44, 0UL47 and 0UL48). Peak numbers were held by 0U465/0UL47 (shared), 0UL47, 0U465 and 0UL44 for the four low tide survey dates respectively; all of these subsites in the north of the count area (North Dublin Bay). The peak number recorded in any one subsite was 207 within 0U465 (Wooden Bridge – Causeway) on 05/12/11.

The dominant intertidal community complex of inner North Dublin Bay (inner/landward side of Bull Island) is 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). The gastropod mollusc *Peringia (Hydrobia) ulvae*, a favoured prey of Shelduck (Olney, 1965; Bryant & Leng, 1975; Viain et al. 2011) is common within this community complex.

The peak intertidal foraging density was 3 Shelduck ha^{-1} recorded for 0U465 (Wooden Bridge – Causeway) on 05/12/11. The second highest density recorded was 2 Shelduck ha^{-1} recorded for 0UL47 Kilbarrack on 04/11/11. The whole site average intertidal foraging density was 0.1 Shelduck ha^{-1}.

Subtidal foraging was relatively rare during low tide surveys with the exception of low numbers recorded on three occasions in 0UL48 (Sutton Strand South) (peak number of 19). During the high tide survey, 37 Shelduck foraged subtidally across three subsites, the highest number (17) in 0U465.

Supratidal foraging (saltmarsh) was recorded regularly within four subsites. 0U466 (North of Causeway (to saltmarsh)) supported 142 on 05/12/11 and 208 during the high tide survey (10/01/12). 0Ul47 (Kilbarrack) supported 245 foraging supratidally on 04/11/11.

Roosting Distribution

Intertidal roosting was recorded during low tide surveys, 0U465 (Wooden Bridge – Causeway) supporting individuals in all four low tide surveys and peak numbers (286) on 02/02/12. Good numbers also roosted within 0U466, 0UL47 and 0UL48. Subtidal roosting behaviour was rare during low tide surveys with the exception of 0UL47 (Kilbarrack) that supported birds in all surveys and a peak number of 63 during the high tide survey.

A total of 465 Shelduck roosted during the high tide survey; 0U466 (North of Causeway (to saltmarsh)) supported the peak number (222 individuals roosting subtidally). 0U465 (Wooden Bridge – Causeway) and 0UL47 (Kilbarrack) supported 77 and 46 individuals respectively, roosting supratidally in saltmarsh on the inner (landward) side of Bull Island.

During the November 2011 roost survey (spring tide), roosting was recorded within three subsites: 0U462, 0U465, and 0UL47. 0U465 (Wooden Bridge – Causeway) supported the most flocks with peak numbers of 105 roosting supratidally (saltmarsh along inner Bull Island) *c.*30 minutes before high water, plus a further 152 positioned subtidally. A single flock of 181 roosted supratidally (saltmarsh inner Bull Island) within 0UL47.

During the February 2012 roost survey (neap tide), Shelduck were recorded in roosting/other behaviour in 12 locations across three subsites (0U465, 0UL47 and 0UL48); all on the north side of Bull Island. Shelduck in 0UL47 were roosting/other subtidally. The largest single flock was of 53 individuals (saltmarsh) in 0UL48 and this subsite recorded individuals in the most number of locations (five).

Teal *Anas crecca* - Family (group): Anatidae (ducks)
Anas crecca has five breeding subspecies that occur across north and northwest Europe, Siberia and into Asia (Wetlands International, 2006). Teal are largely migratory, moving south of their breeding range during winter. Being highly responsive to cold spells they can show rapid and extensive movement during these periods. Teal breeding in Britain and Ireland are supplemented during winter by birds from a range extending from Iceland, through Scandinavia to northwest Siberia (Wernham et al. 2002).
Numbers
Whole site counts of Teal varied considerably, ranging from 177 recorded in November 2011 to a site peak count of 1,415 recorded on 02/02/12. 387 Teal were recorded during the high tide survey. Two low tide counts (December 2011 and February 2012) and the high tide count were above the threshold of all-Ireland importance. Teal were recorded in seven subsites overall (0U461, 0U462, 0U465, 0U466, 0UL44, 0UL47 and 0UL48), one of these (0U462) only recording this species during the high tide survey. Four subsites recorded the species in all five surveys (0U461, 0U465, 0U466, 0UL47). 0UL47 (Kilbarrack) supported peak numbers on 05/10/11 and 04/11/11, 0U466 (North of Causeway (to saltmarsh)) on 05/12/11 and 0U465 (Wooden Bridge – Causeway) on 02/02/12. The subsite peak count was 606 Teal, recorded for 0U465 (Wooden Bridge – Causeway) on 02/02/12. 0U466 (North of Causeway (to saltmarsh)) recorded the highest numbers during the high tide survey.
Foraging Distribution
Teal are omnivores and have a variety of foraging methods (e.g. dabbling and up-ending) within differing habitats and water depths. During the survey programme, a greater proportion of foraging Teal foraged intertidally. Four subsites supported foraging individuals on two or more survey occasions: 0U461, 0U465, 0U466 and 0UL47. Peak numbers were recorded within 0UL47 (Kilbarrack), 0U461 (Booterstown Reserve) and 0U465 (Wooden Bridge - Causeway) for the October, December and February surveys respectively (none recorded in November 2011). 0U465 (Wooden Bridge – Causeway) supported 253 foraging individuals on 02/02/12, and 0U466 (North of Causeway (to saltmarsh)) recorded 120 on this same date. Subtidally foraging Teal were recorded on two occasions in 0U465 (Wooden Bridge – Causeway). With the exception of Booterstown Reserve, Teal therefore foraged within North Dublin Bay subsites. This pattern of distribution is in agreement with previous notes on distribution that dabbling ducks tend to occur '*north and south of the Bull Island causeway'* (Crowe, 2005).
Roosting Distribution
Most Teal were recorded in roosting/other behaviour, the proportion ranging from 68% - 100% during low tide surveys. Intertidal roosting/other behaviour was recorded across five subsites: 0U461, 0U465, 0U466, 0UL44 and 0UL47. Peak numbers were recorded for 0UL47 (Kilbarrack) on 05/10/11 and 04/11/11, 0U466 (North of Causeway (to saltmarsh)) on 05/12/11 and 0U465 (Wooden Bridge – Causeway) on 02/02/12. 0U461 (Booterstown Reserve) supported good numbers (maximum 36) during the first two low tide surveys. Subtidal roosting/other behaviour was observed less frequently, the exception being the final low tide survey (02/02/12) when 356 Teal were recorded across three subsites, the majority within 0U466 (North of Causeway (to saltmarsh)). During the high tide survey a total of 51 Teal roosted subtidally, the majority (46) within 0U461 (Booterstown Reserve). A further 57 roosted supratidally, 40 within 0UL47 (Kilbarrack) and 17 within 0U465 (Wooden Bridge – Causeway). Teal were recorded roosting in three subsites during the November 2011 roost survey (spring tide) (0U465, 0UL44 and 0UL47). 0U465 held the majority of birds; the largest roost being of 60 individuals positioned in the NE corner of the subsite in saltmarsh (inner/landward side of Bull Island). 0UL47 recorded the largest roost during the February roost survey (neap tide) when 85 loafed subtidally in 0UL47. The flock extended into the adjacent subsite 0U466; 33 individuals counted in this subsite leading to a total flock size of 118 Teal, by far the largest aggregation recorded on the survey day.

Pintail *Anas acuta* - Family (group): Anatidae (ducks)

The Pintail has a Holarctic distribution breeding widely over northern temperate and arctic zones. Although there is a small population breeding within Ireland, the main numbers that winter in Ireland come from breeding grounds from Iceland eastwards through Fennoscandia to western Russia (Wernham et al. 2002). Although breeding within terrestrial wetlands, wintering takes places primarily within estuaries or coastal brackish lagoons. The species is unusual amongst dabbling ducks in being highly concentrated in winter. Greece, Spain, France and the UK hold the bulk of the European wintering population (EU, 2007).

Numbers

After being absent in the October 2011 low tide survey, numbers of Pintail rose to a low tide peak of 176 on 02/02/12. 171 were counted during the high tide survey. All counts surpassed the threshold of all-Ireland importance.

Pintail were recorded in three subsites overall: 0U465 (Wooden Bridge - Causeway), 0U466 (North of Causeway (to saltmarsh)) and 0UL47 (Kilbarrack), although 0U465 recorded only one individual on a single occasion. Both 0U466 and 0UL47 held peak numbers during surveys; the subsite peak count being 167 individuals recorded within 0U466 on both 05/12/11 and 10/01/12.

The recorded pattern of distribution is in agreement with previous notes on distribution, for example, that dabbling ducks tend to occur '*north and south of the Bull Island causeway'* (Crowe, 2005).

Foraging Distribution

0U466 (North of Causeway (to saltmarsh)) recorded low numbers (maximum 6) foraging subtidally on two low tide survey occasions, the peak number (103) during the high tide survey, plus a further 63 individuals foraging supratidally.

Pintail are omnivorous, and the winter diet is thought to be largely plant-based (BWPi, 2004) although supplemented by small invertebrates such as amphipod crustaceans and the gastropod mollusc *Peringia (Hydrobia) ulvae* (Olney 1965). Subsites on the inner (landward) side of Bull Island are characterised by the intertidal community complex 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). The gastropod mollusc *Peringia (Hydrobia) ulvae* is common within this community complex and macroalgal mats (*Ulva* spp.) are also commonly occurring.

Roosting Distribution

Pintail were recorded roosting intertidally within three subsites: 0U465, 0U466 and 0UL47. 0U466 (North of Causeway (to saltmarsh)) held individuals on three survey occasions with a maximum number of 82 on 05/12/11. 0UL47 (Kilbarrack) supported 32 individuals on 04/11/11 and four roosting supratidally during the high tide survey (10/01/12).

Roosting/other Pintail were recorded in 0U465 (Wooden Bridge - Causeway) during the November 2011 roost survey (spring tide). The largest flock was seven individuals, roosting in saltmarsh along the inner side of Bull Island. 0UL47 (Kilbarrack) supported two flocks of 28 and five individuals during the February 2012 roost survey (both subtidal).

Shoveler *Anas clypeata* - Family (group): Anatidae (dabbling ducks)

The Shoveler has a widespread breeding distribution across north America, Canada, north and eastern Europe, Siberia to central Asia (Wetlands International, 2006). The small numbers of Shoveler breeding in Ireland are largely sedentary or dispersive and are supplemented during winter by migratory birds from other locations within northwest and central Europe. The wintering population is relatively small (*c.*2500 individuals) (Crowe et al. 2008).

Numbers

Numbers of Shoveler rose from 30 in October 2011 to a low tide peak of 100 on 05/12/11. All low tide total site counts surpassed the threshold of all-Ireland importance. 13 individuals were recorded during the high tide count date (10/01/12).

Shovelers were recorded in just two subsites overall: 0U465 (Wooden Bridge - Causeway) and 0U466 (North of Causeway (to saltmarsh)). Peak counts in all low tide surveys were recorded by 0U465 whereas 0U466 held peak numbers (11) during the high tide survey.

Foraging Distribution

Shovelers are omnivorous, taking a range of items from planktonic crustaceans and small molluscs, to insects, larvae, plant material and seeds. A true dabbling duck, Shovelers feed by surface-feeding, swimming with head and neck immersed, up-ending, and less often, by shallow dives (BWPi, 2004).

Shovelers were recorded foraging intertidally within 0U465 (Wooden Bridge – Causeway) on 05/12/11 and 02/02/12. They foraged subtidally within 0U466 (North of Causeway (to saltmarsh)) on 04/11/11 and 02/02/12. 0U466 also held peak numbers foraging subtidally (11) during the high tide survey. The recorded pattern of distribution is in agreement with previous notes on distribution, that dabbling ducks tend to occur '*north and south of the Bull Island causeway'* (Crowe, 2005).

Roosting Distribution

Shovelers were recorded in roosting/other behaviour in 0U465 (Wooden Bridge – Causeway) during all four low tide surveys; the maximum number of 80 recorded on 04/11/11. No other roosting/other behaviour was recorded during the main survey programme.

Roosting/other Shoveler were recorded in 0U465 (Wooden Bridge - Causeway) during the November 2011 roost survey (spring tide). The maximum number recorded was 15 individuals and most roosted within saltmarsh off Bull Island (landward side). Shovelers were not recorded in roosting/other behaviour during the February 2012 roost survey.

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

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

Numbers

Whole site numbers peaked in October 2011 when 1,997 Oystercatchers were recorded, representing numbers of all-Ireland importance. 2,255 individuals were recorded during the high tide survey (10/01/12).

Oystercatchers were recorded in 18 subsites and nine subsites supported the species in all five surveys: 0U460, 0U462, 0U465, 0U469, 0UL40, 0UL41, 0UL44, 0UL47 and 0UL48. One subsite (0UL54 Ringsend-Irishtown Park) supported Oystercatchers during the high tide survey only. 0UL40 (Sandymount Strand North) supported peak numbers in all four low tide surveys.

Foraging Distribution

Oystercatchers are large wading birds that forage primarily on tidal flats although they can be found foraging along non-estuarine coastlines and may be seen foraging terrestrially for earthworms. On tidal flats their food consists of Cockles (*Cerastoderma edule*), Blue Mussels (*Mytilus edulis*) and to a lesser degree other bivalve molluscs such as *Macoma balthica*, *Scrobicularia plana* and *Mya arenaria* as well as larger polychaetes such as *Arenicola marina* and *Hediste diversicolor.* Cockles and Mussels are favoured prey items and '*universally important during winter'* (Zwarts et al. 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 morphology with regards choosing one or the other of these prey items, and their methods of handling them.

Oystercatchers were recorded foraging within 18 subsites overall and across intertidal, supratidal and terrestrial habitats. 0U465 (Wooden Bridge – Causeway) held peak numbers foraging intertidally on 05/10/11 (310 Oystercatchers) and numbers ranked as second or third highest in all other low tide surveys. The intertidal community complex of this subsite has been classified as 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). This intertidal community complex is recorded extensively throughout the site from Drumleck Point to Dollymount and a characterising species of this complex is the Cockle (*Cerastoderma edule*) that occurs in moderate abundances.

0UL48 (Sutton Strand South) was notable in supporting numbers ranked in the top five in all surveys. This subsite supports a large mussel bed along the mid shore (NPWS, 2012).

0UL40 (Sandymount Strand North) in South Dublin Bay supported peak numbers in three low tide surveys (November and December 2011, and February 2012) with numbers representing 32-43% of all foraging individuals. The intertidal community complex of this subsite has been classified as 'fine sands with *Angulus tenuis.'* The Cockle and the polychaete *Arenicola marina* are also associated with this community complex.

0U464 (South of Wooden Bridge) and 0U469 (Sutton - Dinghy Club) held good numbers in all surveys (ranked in the top six in all). These subsites are again classified as the intertidal community complex 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012).

The peak intertidal foraging density was 5 Oystercatchers ha^{-1} recorded for 0U465 (Wooden Bridge – Causeway) on 05/10/11. 0U464, 0U466, 0U469, 0UL40, 0UL44 all recorded peak densities of 2 Oystercatchers ha^{-1} or greater. The whole site average intertidal foraging density was 1.0 Oystercatcher ha^{-1}.

Terrestrial foraging was almost exclusively recorded during the high tide survey when 49 Oystercatchers foraged within 0UL53 (Sean Moore Park) and a further 26 foraged within 0UL54 (Ringsend-Irishtown Park).

Roosting Distribution

Relatively low numbers of Oystercatchers were recorded roosting/other during low tide surveys, apart from a few notable exceptions. 0U465 (Wooden Bridge – Causeway) supported roosting/other individuals in all low tide surveys, maximum number 76 on 04/11/11; 720 individuals roosted there during the high tide survey which was the subsite peak number of roosting individuals on that date. 350 Oystercatchers roosted within 0UL40 (Sandymount Strand North) on 05/10/11; this subsite supporting 179 individuals (ranked third) during the high tide survey.
0UL47 (Kilbarrack) supported low numbers in all four low tide surveys (maximum number 68 on 02/02/12). 0U462 (Booterstown - Merrion Gates) recorded no roosting individuals during low tide surveys but supported the second highest subsite count during the high tide survey (444 Oystercatchers).

711 Oystercatchers roosted supratidally during the high tide survey, the largest proportion (345) within 0UL48 (Sutton Strand South).

During the November 2011 roost survey (spring tide), Oystercatchers roosted across eight subsites: 0U460, 0U462, 0U465, 0U468, 0U469, 0U472, 0UL40 and 0UL48. 0U465 (Wooden Bridge – Causeway) supported the most flocks, the largest single (intertidal) roost in this subsite comprising 425 individuals. 0U462 in South Dublin Bay supported the largest single roost of 900 Oystercatchers that roosted on the seaward side of a sand dune in the north of this subsite. 0UL48 recorded a single roost of 665 Oystercatchers that roosted supratidally (saltmarsh) along the inner (landward) side of Bull Island.

Oystercatchers roosted at a similar group of subsites during the February 2012 roost survey (neap tide): 0U460, 0U462, 0U465, 0U469, 0U472, 0UL40, 0UL47 and 0UL48. Significant flocks were recorded at four of these: 625 individuals (0UL48), 406 (0U462), 220 (0U465) and 160 (0U460). The majority of roosts were in supratidal (saltmarsh) habitat.

Ringed Plover *Charadrius hiaticula* - Family (group): Charadriidae (wading birds)

The Ringed Plover breeds across Arctic and temperate zones from the east coast of Baffin Island, Greenland, across northern Europe and the Russian tundra to the coasts of the Bering Sea. Three subspecies are generally recognised of which the nominate subspecies, *C. h. hiaticula,* breeds in northern Europe (including Ireland) and winters in Europe and north-west Africa.

Numbers

Total site numbers of Ringed Plovers peaked at 118 individuals on 05/12/11. 47 Ringed Plover were recorded during the high tide survey. Only the December low tide count surpassed the threshold of all-Ireland importance.

Ringed Plovers were recorded in a total of six subsites throughout the survey programme (0U462, 0U466, 0UL40, 0UL41, 0UL47 and 0UL48). 0UL40 (Sandymount Strand North) was the only subsite to support the species during all four low tide surveys and held peak numbers on 04/11/11. Peak numbers were also held by 0U462 (05/10/11), 0UL48 (05/12/11) and 0UL47 (02/02/12). The subsite peak count of 58 Ringed Plover was recorded for 0U462 on 05/10/11 and for 0UL48 on 05/12/11.

Foraging Distribution

Ringed Plovers are 'visual foragers' searching the sediment surface for the visible signs of prey. Their diet is relatively broad and consists of small crustaceans, molluscs and polychaete worms, plus isopods, amphipods and insects (e.g. fly larvae).

All Ringed Plovers foraged intertidally and this wader was distributed across a total of six subsites throughout the survey programme; three within the north of the site (0U466, 0UL47 and 0UL48) and three within South Dublin Bay (0U462, 0UL40 and 0UL41).

The three most northerly subsites on the landward side of North Bull Island (0U466, 0UL47 and 0UL48) have sediments ranging from soft muds to fine sands. The most widespread benthic community type is 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). This intertidal community complex is recorded extensively throughout the site from Drumleck Point to Dollymount (NPWS, 2012) and characterising species of this complex include polychaetes *Scoloplos armiger*, *Tharyx* sp. and *Capitella* sp., the bivalve *Cerastoderma edule* and the amphipod *Corophium volutator*. The polychaete *Malacoceros fuliginosus* and the crustacean *Idotea baltica* are recorded in high abundances behind (inner/landward side) North Bull Island where the mudflats border the saltmarsh. The oligochaete *Tubificoides benedii* and the gastropod *Peringia (Hydrobia) ulvae* are also commonly recorded.

Where the sediment grades to finer sand the community 'fine sand with *Spio martinensis'* is found; particularly on the inner side of North Bull Island from Kilbarrack to Sutton. In general the fauna of this community complex occur in low abundances; the polychaete *Spio martinensis* being the most dominant species. The polychaete *Nephtys cirrosa*, the crustaceans *Bathyporeia guilliamsoniana*, *Corophium volutator* and *Praunus flexuosus* and the bivalves *Cerastoderma edule* and *Tellina tenuis* are also recorded as well as the oligochaete *Tubificoides benedii* and the gastropod *Peringia (Hydrobia) ulvae*.

The benthic community in South Dublin Bay is largely classified as 'fine sands with *Angulus tenuis*.' The distinguishing species of this community are the bivalve *Angulus tenuis* and the polychaetes *Scoloplos (Scoloplos) armiger, Pygospio elegans and Nephtys cirrosa* although they are not uniformly distributed across the site and are generally recorded in low abundances. Also recorded are the gastropod *Peringia (Hydrobia) ulvae*, the polychaetes *Sigalion mathildae*, *Capitella* sp. and *Paraspio decorata* and the bivalves *Cerastoderma edule* and *Angulus fabula*.

Peak numbers of Ringed Plover were recorded in 0U462 (Booterstown - Merrion Gates) on 05/10/11; 58 individuals foraging as one loose flock along with 63 Redshank and 29 Black-tailed Godwits in the south of the subsite (Booterstown). On 04/11/11 and 05/12/11, peak numbers were recorded in 0UL40 (Sandymount Strand North) (48 and 55 individuals respectively). The peak number of 12 individuals was recorded in 0UL47 (Kilbarrack) on 02/02/12. 0UL41 and 0UL48 held foraging individuals on one occasion only (40 and 46 individuals respectively). The benthic communities described above provide a range of prey items for Ringed Plover.
This wader foraged most regularly (all four low tide surveys) in 0UL40 (Sandymount Strand North).

The peak intertidal foraging density was 0.4 Ringed Plover ha^{-1} recorded for 0U462 (Booterstown - Merrion Gates) on 05/10/11. The whole site average intertidal foraging density was 0.1 Ringed Plover ha^{-1}.

Roosting Distribution

Only two records were made of Ringed Plovers in roosting/other behaviour during low tide surveys, both of these for 0UL48 (Sutton Strand South). 42 Ringed Plovers roosted within 0U462 (Booterstown - Merrion Gates) during the high tide survey.

Two flocks of roosting Ringed Plover were recorded during the November 2011 roost survey (spring tide), both in South Dublin Bay. 74 individuals roosted in 0U472 (supratidal (on breakwater)) and 50 roosted intertidally within 0UL40 (Sandymount Strand North).

One flock of 76 Ringed Plover were recorded during the February roost survey (neap tide) positioned intertidally within 0U462 (Booterstown - Merrion Gates).

Ringed Plovers are thought to be highly faithful to roost sites (e.g. Rehfisch et al. 2003).

Golden Plover *Pluvialis apricaria* - Family (group): Charadridae (wading birds)
The Eurasian Golden Plover is a Palearctic species, occurring mainly at higher latitudes of Western Europe to north-central Siberia and wintering south in Europe, north Africa and parts of Asia. Two subspecies are currently described. *P. a. altifrons* is the 'northern' form and breeds at high latitudes in Western Eurasia from Iceland and the Faeroes across northern Scandinavia to 125^{0}E in the north Siberia lowlands south of Taymyr (Delaney et al. 2009). The nominate *P. a apricaria* breeds at more southerly latitudes including Ireland and Britain and migrates south for winter. Golden Plovers that winter in Ireland are thought to be mostly Icelandic-breeding birds *P. a. altifrons* (Wernham et al. 2002).
Numbers
Golden Plovers were recorded in two low tide surveys only. Eight were counted during the October 2011 low tide survey and a total 97 were recorded on 02/02/12. Just three individuals were recorded during the high tide survey. All counts were below the threshold of all-Ireland importance. During low tide surveys this species was recorded exclusively in 0U465 (Wooden Bridge – Causeway).
Foraging Distribution
During winter, Golden Plovers feed primarily within agricultural grassland and arable land. Tidal flats are used more as a roosting/resting habitat and the birds tend to favour large, open tidal flats. As a consequence, Golden Plovers tend to be in large aggregations when observed upon tidal flats. Intertidal feeding is observed to a greater degree during cold weather periods when grassland feeding areas are frozen over. Although Golden Plovers eat a wide range of invertebrate species, relatively little is known about their intertidal feeding patterns (Gillings et al. 2006). Two observations of foraging individuals (intertidal) were made. Eight individuals foraged within 0U465 (Wooden Bridge – Causeway) on 05/10/11, and 97 foraged within the same subsite on 02/02/12.
Roosting Distribution
Three individuals roosted during the high tide survey, two within 0UL47 (Kilbarrack) and one within 0UL48 (Sutton Strand South). Golden Plover were not recorded roosting during either the November 2011 or February 2012 roost surveys.

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

The Grey Plover is generally considered a monotypic species and has a holarctic breeding distribution across the tundra of Eurasia and North America (Delaney et al. 2009). The species migrates from breeding areas to a very wide wintering range extending to the coastlines of Africa, south and east Asia, Australasia and South America (BWPi, 2004). In Ireland, Grey Plovers occur as both passage and wintering birds and are thought to originate from Russian breeding populations (Wernham et al. 2002).

Numbers

Whole-site counts of Grey Plover surpassed the threshold of all-Ireland importance in all except the November 2011 survey (51). The peak low tide count was 173 individuals (02/02/12) but the highest overall count was made during the high tide survey (432 individuals).

Grey Plovers were recorded in a total 11 subsites throughout the entire survey programme. Three subsites recorded the species during all four low tide surveys (0U464, 0U465 and 0UL48). Peak numbers during low tide surveys were held by 0U464 (South of Wooden Bridge) (05/10/11 & 02/02/12), 0U465 (Wooden Bridge – Causeway) (04/11/11), and 0UL48 (Sutton Strand South) (05/12/11). The subsite peak count was 132 individuals (0U464: South of Wooden Bridge on 02/02/12).

Foraging Distribution

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

Grey Plovers foraged in ten subsites overall (0U462, 0U464, 0U465, 0U466, 0U469, 0UL40, 0UL43, 0UL44, 0UL47 and 0UL49). Two subsites held individuals in all four low tide surveys: 0U465 (Wooden Bridge - Causeway) and 0UL48 (Sutton Strand South). The latter held peak numbers in the first three low tide surveys while 0U464 (South of Wooden Bridge) held peak numbers on 02/02/12; 106 individuals representing 75% of all recorded on that day. 0U465 (Wooden Bridge - Causeway) held joint peak numbers on 04/11/11.

The intertidal community complex of 0UL48 (Sutton Strand South), 0U465 (Wooden Bridge - Causeway) and a large proportion of 0U464 (South of Wooden Bridge) is dominated by the benthic community complex 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). This intertidal community complex is recorded extensively throughout the site from Drumleck Point to Dollymount. The polychaetes *Scoloplos armiger*, *Tharyx* sp. and *Capitella* sp., the bivalve *Cerastoderma edule* and the amphipod *Corophium volutator* occur in moderate abundances while *Tubificoides benedii* and the gastropod *Peringia (Hydrobia) ulvae* are also common. In 0UL48 (Sutton Strand South) however, Grey Plovers tended to occur in the mid-shore zone (south of the channel) and associated with a sandier substratum classified as 'fine sand with *Spio martinensis.'* The polychaete *Spio martinensis* is the most dominant species but the polychaete *Nephtys cirrosa*, the oligochaete *Tubificoides benedii*, the gastropod *Peringia (Hydrobia) ulvae*, crustaceans *Bathyporeia guilliamsoniana*, *Corophium volutator* and *Praunus flexuosus*, and the bivalves *Cerastoderma edule* and *Tellina tenuis* are also all recorded here.

The peak intertidal foraging density was 1.7 Grey Plover ha^{-1} recorded for 0U464 (South of Wooden Bridge) on 02/02/12. No other subsite recorded densities greater than one individual ha^{-1}. The whole site average intertidal foraging density was 0.05 Grey Plover ha^{-1}.

Roosting Distribution

During low tide surveys, relatively few Grey Plovers were recorded in roosting/other behaviour with the exception of 0U464 (South of Wooden Bridge) which recorded individuals during all four low tide surveys (maximum number 38). During the high tide survey a total of 224 Grey Plovers roosted intertidally, the majority (86%) in 0U465 (Wooden Bridge - Causeway). A further 208 individuals roosted supratidally, just over half within 0UL48 (Sutton Strand South) and smaller numbers within 0UL47 (91 individuals) and 0U465 (seven individuals).

Grey Plovers were recorded roosting in three subsites (0U462, 0U465 and 0U466) during the November 2011 roost survey (spring tide). 0U465 (Wooden Bridge - Causeway) supported the largest single flock (160 individuals) roosting supratidally some 80 minutes before high tide. A second visit later on recorded 80 individuals. 90 individuals roosted intertidally within 0U466 while 22 individuals roosted at two locations within 0U462 (intertidally). Of note were two subsites counted at roughly the same time (0U465 and 0U466) and *c*.30 minutes before high water that provided a count of 193 Grey Plovers which is greater than any low tide site total.

Grey Plovers were recorded roosting in three subsites (0U462, 0U465 and 0UL48) during the February 2012 roost survey (neap tide). The largest single roost was of 86 individuals (0UL48: Sutton Strand South). 0U465 (Wooden Bridge - Causeway) recorded two flocks of 59 and 20 individuals. Most roosts were positioned supratidally (saltmarsh).

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

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

Numbers

Whole-site numbers of Knot rose from 116 in October 2011 to a site peak count of 5,694 in December 2011, representing numbers of international importance. 901 Knot were recorded during the high tide survey (all-Ireland importance). Knot were recorded within 12 subsites overall and in all four low tide surveys in 0U462 (Booterstown - Merrion Gates), 0U465 (Wooden Bridge – Causeway) and 0U466 (North of Causeway (to saltmarsh)).
Peak numbers during low tide surveys were held by 0U460 (Dún Laoghaire - Seapoint), 0U462 (Booterstown - Merrion Gates), 0U465 (Wooden Bridge – Causeway) and 0U464 (South of Wooden Bridge) for the four low tide dates respectively. The subsite peak count was 2,795 (0U465: Wooden Bridge – Causeway on 05/12/11).

Foraging Distribution

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

Six subsites recorded foraging Knot in three or more low tide surveys: 0U460, 0U462, 0U465, 0U466, 0UL40 and 0UL48.

Peak numbers were held by 0U466 (North of Causeway (to saltmarsh) on 05/10/11, two flocks of 9 and 13 individuals foraging close to the channel. A peak count of 2,325 Knot was recorded in 0U465 (Wooden Bridge – Causeway) on 05/12/11, these birds were recorded in various places within the subsite and on both sides of the channel.
The intertidal community complex of 0U465 and 0U466 is classified as 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). This intertidal community complex is recorded extensively throughout the site from Drumleck Point to Dollymount (NPWS, 2012). The fauna of this community complex is distinguished by the polychaete *Pygospio elegans* and the crustacean *Crangon crangon*. The polychaetes, *Scoloplos armiger*, *Tharyx* sp. and *Capitella* sp., the bivalve *Cerastoderma edule* and the amphipod *Corophium volutator* occur in moderate abundances. The polychaete *Malacoceros fuliginosus* and the crustacean *Idotea baltica* are recorded in high abundances between Dollymount and North Bull Island where the mudflats border the saltmarsh. The oligochaete *Tubificoides benedii* and the gastropod *Peringia (Hydrobia) ulvae* are also common.

On 04/11/11 a peak number of 335 Knot foraged within 0UL40 (Sandymount Strand North). 0U462 (Booterstown - Merrion Gates) in South Dublin Bay held peak numbers (136) on 02/02/12. The benthic community in South Dublin Bay is largely classified as 'fine sands with *Angulus tenuis*.' The distinguishing species of this community are the bivalve *Angulus tenuis* and the polychaetes *Scoloplos (Scoloplos) armiger, Pygospio elegans and Nephtys cirrosa* although they are not uniformly distributed across the site and are generally recorded in low abundances. Also recorded are the gastropod *Peringia (Hydrobia) ulvae*, the polychaetes *Sigalion mathildae*, *Capitella* sp. and *Paraspio decorata* and the bivalves *Cerastoderma edule* and *Angulus fabula*.

The peak intertidal foraging density was 34 Knot ha^{-1} recorded for 0U465 (Wooden Bridge - Causeway) on 05/12/11. The second highest density recorded was 4 Knot ha^{-1} recorded for 0UL44 (Clontarf Baths) on 02/02/12. The whole site average intertidal foraging density was 1.0 Knot ha^{-1}.

Roosting Distribution

Good numbers of Knot were recorded roosting during most low tide surveys. The largest number (1,750) was held by 0U464 (South of Wooden Bridge) on 05/12/11, these birds roosting intertidally alongside the channel in the north of the subsite. The same subsite supported 900 roosting individuals on 02/02/12; 660 of which roosted intertidally as one flock in the north of the subsite.

0U462 (Booterstown - Merrion Gates) recorded a one-off count of 855 roosting individuals on 04/11/11. 0U460 (Dún Laoghaire – Seapoint) held individuals in three low tide surveys, the maximum number being 600 on 05/12/11. In contrast, only 35 individuals roosted intertidally during the high tide survey (95% of those counted in 0UL48), with 796 individuals on this day finding intertidal foraging options. A further 70 roosted supratidally during the high tide survey, 55 in 0UL47 (Kilbarrack).

The subsite 0U462 held the majority of roosting Knot during the November 2011 roost survey; a single roost held 1,500 individuals. Positioned on the seaward side of a sand dune in the north of the subsite, the large mixed species roost comprised Knot, Bar-tailed Godwit (1,400), Dunlin (1,100) and Oystercatcher (900). A further 330 Knot roosted intertidally within 0U462. 0U465 recorded roosting individuals in six different positions (maximum number 100).

The February 2012 neap tide roost survey recorded significantly fewer individuals roosting as foraging opportunities were available. Roosting was recorded in 0U465, 0U466 and 0U468. The maximum flock size was 120 individuals (0U465) that roosted supratidally.

Sanderling *Calidris alba* - Family (group): Scolopacidae (wading birds)

Sanderling are one of the most northerly of all Arctic-breeding waders with a circumpolar breeding range that includes Alaska, Northern Canada, Greenland and Svalbard. The species is a long-distance migrant with a wide wintering distribution that includes coastlines of much of the tropics and the Southern Hemisphere as well as northwest Europe. There is evidence for two subspecies, with the nominate form *C. a. alba* occurring on passage and during winter in Western Eurasia and Africa. It was thought that most Sanderling wintering in Ireland and Britain were of Siberian origin, but there is now thought to be considerable overlap in the wintering range of Siberian and Greenland-breeding populations (Delaney et al. 2009).

Numbers

Numbers of Sanderling peaked early (October 2011) when 357 individuals were recorded across the whole site, surpassing the threshold for all-Ireland importance. 182 were recorded during the high tide survey (10/01/12).

Sanderlings were recorded within six subsites overall: 0U460, 0U462, 0U464, 0U468, 0UL40 and 0UL41. 0U462 (Booterstown - Merrion Gates) held peak numbers on 05/10/11 and 02/02/12, 0UL41 (Sandymount Strand South) on 04/11/11, and 0U460 (Dún Laoghaire - Seapoint) on 05/12/11. The subsite peak count was 331 individuals (0U462: Booterstown - Merrion Gates on 05/10/11).

Foraging Distribution

Often foraging along the tide line where they rush in and out with the waves searching for small prey such as sandhoppers, Sanderlings are shorebirds characteristic of sandy shorelines, indeed significant proportions are found along non-estuarine coastlines (Crowe, 2005) or outer parts of estuaries (Musgrove et al. 2003). The species has a flexible foraging strategy however, with diet very much related to the local conditions at a site (Reneerkens et al. 2009).

Sanderlings were recorded foraging intertidally across six subsites (0U460, 0U462, 0U464, 0U468, 0UL40 and 0UL41). 0U462 (Booterstown - Merrion Gates) and 0U468 (Dollymount Strand (incl. open water)) held foraging individuals in all four low tide surveys.

Peak numbers were recorded for 0U462 (05/10/11 & 02/02/12), 0UL41 (04/11/11) and 0U460 (05/12/12), three adjoining subsites in South Dublin Bay. In 0U462 (Booterstown - Merrion Gates), Sanderlings were recorded foraging on the tide edge or on the mid to lower shore.

The benthic community in South Dublin Bay is largely classified as 'fine sands with *Angulus tenuis*' (NPWS, 2012). The distinguishing species of this community are the bivalve *Angulus tenuis* and the polychaetes *Scoloplos (Scoloplos) armiger, Pygospio elegans and Nephtys cirrosa* although they are not uniformly distributed across the site and are generally recorded in low abundances. Also recorded are the gastropod *Peringia (Hydrobia) ulvae*, the polychaetes *Sigalion mathildae*, *Capitella* sp. and *Paraspio decorata* and the bivalves *Cerastoderma edule* and *Angulus fabula*. The marine biotope '*Polychaete/ amphipod dominated fine sand shores* (LS.LSa.FiSa)' was assigned by MERC (2012).

0U468 (Dollymount Strand (incl. open water)) held good numbers in all low tide surveys, numbers ranked in the top three in all. The benthic community of this subsite is classified as 'fine sand with *Spio martinensis'* and this community extends from the intertidal into the shallow subtidal.

The peak intertidal foraging density was 2 Sanderlings ha^{-1} recorded for 0U462 (Booterstown - Merrion Gates) on 05/10/11. The only other subsite to record greater than one individual ha^{-1} was 0U460 (Dún Laoghaire - Seapoint). The whole site average intertidal foraging density was 0.2 Sanderling ha^{-1}.

Roosting Distribution

Sanderlings were rarely recorded roosting during the main survey programme and just 25 individuals roosted intertidally during the high tide survey (0UL40: Sandymount Strand North), a further 157 individuals finding foraging opportunities during this survey.

Sanderlings were not recorded during the November 2011 roost survey. The February 2012 neap tide roost survey recorded just 22 individuals roosting, a flock of 13 in 0U462 (intertidal) and nine in 0UL40 (supratidal), the latter roosting along with 45 Oystercatchers and 66 Black-headed Gulls along the northern boundary of the subsite.

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

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

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

Numbers

Numbers of Dunlin rose from 264 in October 2011 to a peak of 3,636 recorded on 05/12/11. All counts, except that on 05/10/11, represented numbers of all-Ireland importance. 2,487 Dunlin were recorded during the high tide survey (10/01/12).

Overall, Dunlin were recorded within 12 subsites (0U460, 0U462, 0U464, 0U465, 0U466, 0U468, 0U469, 0UL40, 0UL41, 0UL43, 0UL47 and 0UL48). Subsite use during low tide surveys ranged from eight subsites (05/10/11) to 11 subsites (05/12/11). Only four subsites held Dunlin in all four low tide surveys: 0U465 (Wooden Bridge - Causeway), 0UL40 (Sandymount Strand North), 0UL47 (Kilbarrack) and 0UL48 (Sutton Strand South). Peak numbers were recorded for 0UL48, 0UL40, 0U465 and 0U464 for the four low tide surveys respectively. The low tide subsite peak count of 1,032 Dunlin was recorded for 0U465 (Wooden Bridge – Causeway) on 05/12/11. 0UL41 (Sandymount Strand South) recorded peak numbers (670) during the high tide survey.

Foraging Distribution

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

The majority of Dunlin were recorded foraging during surveys. Peak numbers foraging intertidally were recorded for 0UL48 (Sutton Strand South), 0UL40 (Sandymount Strand North), 0U465 (Wooden Bridge - Causeway) and 0U464 (South of Wooden Bridge) for the four low tide surveys respectively. 0UL47 (Kilbarrack) supported good numbers in all low tide surveys e.g. 229 on 05/12/11. 670 Dunlin foraged intertidally within 0UL41 (Sandymount Strand South) during the high tide survey (10/01/12).

0UL48 (Sutton Strand South) and 0U465 (Wooden Bridge - Causeway) are situated on the inner/landward side of North Bull Island. The most widespread benthic community type of these subsites is 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). This intertidal community complex is recorded extensively throughout the site from Drumleck Point to Dollymount (NPWS, 2012) and characterising species of this complex include polychaetes *Scoloplos armiger*, *Tharyx* sp. and *Capitella* sp., the bivalve *Cerastoderma edule* and the amphipod *Corophium volutator*. The polychaete *Malacoceros fuliginosus* and the crustacean *Idotea baltica* are recorded in high abundances behind on the inner side of North Bull Island where the mudflats border the saltmarsh. The oligochaete *Tubificoides benedii* and the gastropod *Peringia (Hydrobia) ulvae* are also commonly recorded.

Where the sediment grades to finer sand, and particularly within 0UL48, the community 'fine sand with *Spio martinensis'* is found. The fauna of this community complex occur in low abundances; the polychaete *Spio martinensis* being the most dominant species. The polychaete *Nephtys cirrosa*, the crustaceans *Bathyporeia guilliamsoniana*, *Corophium volutator* and *Praunus flexuosus* and the bivalves *Cerastoderma edule* and *Tellina tenuis* are also recorded as well as the oligochaete *Tubificoides benedii* and the gastropod *Peringia (Hydrobia) ulvae*.

Dunlin were widespread throughout 0UL48 and 0U465 with no particular foraging patterns discernable from flock maps. Flock sizes ranged from just a few individuals to several hundred. A major flock of 968 Dunlin foraged along with 1,200 Knot in 0U465 on 05/12/11 to the east of the channel, yet others, sometimes as low a number as six, foraged as part of larger loose aggregations of mixed species.

The inner sections of 0U464 (South of Wooden Bridge) are classified as 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* while 'fine sand with *Spio martinensis'* is found along the south-eastern sections of this subsite. Dunlin were only recorded foraging in this subsite twice but in peak (633 individuals on 02/02/12) or good numbers (810 on 05/12/11) on both occasions and recorded in the inner section of the subsite; flocks often positioned close to the water channel.

0UL40 (Sandymount Strand North) and 0UL41 (Sandymount Strand South) were the only subsites in South Dublin Bay to support good numbers of Dunlin regularly; 0UL40 (Sandymount Strand North) holding peak numbers of foraging individuals on 04/11/11. This subsite is sandier by nature and is classified as 'fine sands with *Angulus tenuis*.' The distinguishing species of this community are the bivalve *Angulus tenuis* and the polychaetes *Scoloplos (Scoloplos) armiger, Pygospio elegans and Nephtys cirrosa* although they are not uniformly distributed across the site and are generally recorded in low abundances. Also recorded are the gastropod *Peringia (Hydrobia) ulvae*, the polychaetes *Sigalion mathildae*, *Capitella* sp. and *Paraspio decorata* and the bivalves *Cerastoderma edule* and *Angulus fabula*.

The peak intertidal foraging density was 15 Dunlin ha^{-1} recorded for 0U465 (Wooden Bridge – Causeway). 0U464 (South of Wooden Bridge) recorded a peak density of 13 Dunlin ha^{-1} while 0UL48 (Sutton Strand South) recorded a peak density of 8 Dunlin ha^{-1}. No other subsite recorded densities greater than five individuals ha^{-1}. The whole site average intertidal foraging density was 1 Dunlin ha^{-1}.

Roosting Distribution

Relatively few Dunlin were recorded in roosting/other behaviour during low tide surveys, a notable exception being 140 within 0U464 (South of Wooden Bridge) on 02/02/12. During the high tide survey 1,013 Dunlin roosted intertidally; 435 in 0U462 (Booterstown - Merrion Gates) and 405 in 0U465 (Wooden Bridge - Causeway) accounting for nearly all this total. A further 439 roosted supratidally within 0UL47 (Kilbarrack) plus 100 within 0UL48 (Sutton Strand South).

The November 2011 roost survey (spring tide) recorded Dunlin roosting across eight subsites: 0U460, 0U461, 0U462, 0U465, 0U466, 0U472, 0UL40 and 0UL47. The largest roost was recorded in 0U462 where 1,100 Dunlin roosted alongside Bar-tailed Godwit (1,400), Knot (1,500) and Oystercatcher (900) on the seaward side of a sand dune in the north of the subsite. A further 850 Dunlin roosted intertidally close by.

0U465 recorded roosting individuals in four different positions; a maximum flock size of 200. A flock of 400 Dunlin roosted intertidally alongside

50 Knot and 90 Grey Plover, just in front of saltmarsh in 0U466. 260 Dunlin roosted together with 50 Ringed Plover on the uncovered sand bar in 0UL40 *c.*2 hours before high water.

The February roost survey (neap tide) recorded Dunlin roosting in four subsites 0U462, 0U465, 0U466 and 0UL48. The largest number (555) roosted in saltmarsh on the inner side of Bull Island in 0UL48. A flock of 450 roosted intertidally within 0U462. 0U465 and 0U466 held smaller flocks.

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

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

Numbers

Numbers of Black-tailed Godwits peaked early with 855 recorded on 05/10/11 representing numbers of international importance. A total 808 Black-tailed Godwits were counted during the high tide survey.

Black-tailed Godwits were recorded in 12 subsites overall and six subsites recorded this wader in all four low tide surveys: 0U461, 0U462, 0U465, 0U466, 0UL44, and 0UL47. 0U466 (North of Causeway (to saltmarsh)) supported peak numbers during the first three low tide surveys and 0UL43 (Fairview Park) recorded peak numbers on 02/02/12. The subsite peak of 706 individuals was recorded within 0U466 on 05/10/11.

Foraging Distribution

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

Black-tailed Godwits foraged intertidally within 12 subsites: 0U460, 0U461, 0U462, 0U465, 0U466, 0U469, 0UL40, 0UL41, 0UL43, 0UL44, 0UL47 and 0UL48.

0U465 (Wooden Bridge – Causeway) recorded peak numbers (64) on 05/10/11; 0U466 (North of Causeway (to saltmarsh)) on 04/11/11 and 05/12/11 (maximum number 210), and 0UL43 (Fairview Park) held peak numbers on 02/02/12. The intertidal benthic community of these three subsites is classified as 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). The sediment of this community complex is largely that of fine sand; localised areas of muddier sediment occur to the north of the causeway linking North Bull Island to the mainland and at Kilbarrack. (i.e. subsites 0U465 and 0U466). Black-tailed Godwits therefore appear to preferentially use the muddier parts of the site. The characterising species of this community complex include polychaetes *Scoloplos armiger*, *Tharyx* sp., *Arenicola marina* and *Capitella* sp., the bivalve *Cerastoderma edule* and the amphipod *Corophium volutator*.

259 Black-tailed Godwits foraged intertidally within 0U466 (North of Causeway) during the high tide survey. 0U460 (Dún Laoghaire - Seapoint) was notable for supporting numbers ranked in the top three in all low tide surveys. Good numbers were supported regularly by 0U462 (Booterstown - Merrion Gates) (maximum number 47) and 0UL44 (Clontarf Baths) (maximum number 64).

The peak intertidal foraging density was 8 Black-tailed Godwits ha^{-1} recorded for 0U466 (North of Causeway (to saltmarsh)) on 04/11/11.
The whole site average intertidal foraging density was 0.2 Black-tailed Godwits ha^{-1}.

Roosting Distribution

Good numbers roosted intertidally within 0U466 (North of Causeway (to saltmarsh)) in all surveys, a maximum number of 650 recorded on 05/10/11. Smaller numbers also roosted regularly within 0U465 (Wooden Bridge – Causeway) (maximum number 81 on 02/02/12). 0UL47 (Kilbarrack) was notable for supporting 113 roosting intertidally on 02/02/12, almost no roosting individuals recorded there previously.

0U466 (North of Causeway (to saltmarsh)) recorded 282 intertidally roosting individuals during the high tide survey. A further 214 Black-tailed Godwits roosted supratidally across three subsites 0U465, 0UL47 and 0UL48; 0UL47 (Kilbarrack) supporting the largest number (100).

The November 2011 roost survey (spring tide) recorded Black-tailed Godwits roosting across four subsites: 0U461, 0U465, 0U466, and 0UL43. The largest roost was recorded in 0U466 (North of Causeway) where 180 godwits roosted intertidally in the south of the subsite. Further flocks of 50 and eight roosted supratidally (saltmarsh). A flock of 50 Black-tailed Godwits roosted intertidally within 0UL43 (Fairview park).

The February roost survey (neap tide) recorded Black-tailed Godwits roosting in three subsites 0U461, 0U465, and 0U466. The largest flock of 120 roosted in 0U466 (North of Causeway) and were in a relatively similar position to the flock of 180 recorded there in November 2011. Four other flock positions were recorded for this subsite. 0U465 (Wooden Bridge – Causeway) supported roosting individuals in four positions, the largest flock size was 55. 0U461 (Booterstown Marsh) supported one roost of 81 Black-tailed Godwits.

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

The Bar-tailed Godwit has a widespread breeding distribution across the sub-Arctic and low Arctic zones of the Palearctic and extending into western Alaska (Delaney et al. 2009). The taxonomy of the species is complex but five subspecies are generally recognised. The nominate subspecies *L. l. lapponica* breeds in northern Fennoscandia and Northern European Russia, east to the Kanin Peninsula, and winters mainly in Western Europe, including Ireland. The Wadden Sea is used by *L. l. lapponica* and other populations as a staging and moulting area in autumn and spring.

Numbers

Total site numbers of Bar-tailed Godwits ranged from 1,162 (05/12/11) to a peak of 2,235 on 02/02/12. Three low tide surveys (October, November and February) recorded numbers of international importance. 594 Bar-tailed Godwits were counted during the high tide survey.

Bar-tailed Godwits were recorded in a total of 12 subsites throughout the survey programme. Seven subsites supported this wader in all four low tide surveys: 0U460, 0U462, 0U464, 0U465, 0U468, 0UL40 and 0UL43.

0U462 (Booterstown - Merrion Gates) recorded peak numbers in October and November 2011 while 0U460 (Dún Laoghaire - Seapoint) recorded peak numbers in the latter two low tide surveys. The peak subsite count was 912 Bar-tailed Godwits (0U462 on 04/11/11).

Foraging Distribution

Bar-tailed Godwits are a wader species considered characteristic of coastal wetland sites dominated by sand. The birds forage by probing within intertidal sediment for invertebrate species, predominantly large polychaete worms such as *Arenicola marina* and *Nepthys* sp. The species is characteristic of sites with sandy substrates (e.g. Hill et al. 1993) and the birds often feed on the tide edge.

Bar-tailed Godwits were recorded foraging within 12 subsites overall but most regularly (all four low tide surveys) within six subsites: 0U460, 0U462, 0U464, 0U465, 0UL40 and 0UL43.

0U462 (Booterstown - Merrion Gates) recorded peak numbers in October and November 2011 and February 2012, the peak number recorded foraging was 912 (04/11/11), the godwits typically foraging on the mid to lower shore. The counts recorded in October and November 2011 accounted for over 70% of all foraging individuals recorded on those dates. This subsite in South Dublin Bay is characterised by a sandy substratum with a benthic community classified as 'fine sands with *Angulus tenuis*.' The distinguishing species of this community are the bivalve *Angulus tenuis* and the polychaetes *Scoloplos (Scoloplos) armiger, Pygospio elegans and Nephtys cirrosa* although they are not uniformly distributed across the site and are generally recorded in low abundances. Also recorded are the gastropod *Peringia (Hydrobia) ulvae*, the polychaetes *Sigalion mathildae*, *Capitella* sp. and *Paraspio decorata* and the bivalves *Cerastoderma edule* and *Angulus fabula*. The polychaete *Lanice conchilega* is commonly recorded to the north of Blackrock (subsites 0U460 and 0U462) and may form part of the Bar-tailed Godwit diet (Scheiffarth, 2001) while the polychaete *Arenicola marina* commonly occurs at Sandymount (0UL40).

0U460 (Dún Laoghaire – Seapoint) held peak numbers on 05/12/11 (608), representing 55% of total foraging.

The highest intertidal foraging density recorded for a single subsite was 11 Bar-tailed Godwits ha^{-1} (0U460 (Dún Laoghaire – Seapoint) on 05/12/11). 0U462 (Booterstown - Merrion Gates) recorded a peak density of 7 Bar-tailed Godwits ha^{-1}. The whole site mean feeding density (intertidal habitat) was 1.0 Bar-tailed Godwit ha^{-1}.

Roosting Distribution

Bar-tailed Godwits were recorded roosting intertidally within 0U464 (South of Wooden Bridge) with relative regularity, and 427 roosted there on 02/02/12. 0U460 (Dún Laoghaire - Seapoint) recorded 340 and 486 on 05/10/11 and 02/02/12 respectively. Thereafter records were of much lower numbers and with little regularity or pattern.

561 Bar-tailed Godwits roosted intertidally during the high tide survey, the majority (362) within 0U462 (Booterstown - Merrion Gates).

The November 2011 roost survey (spring tide) recorded Bar-tailed Godwits roosting across three subsites: 0U462, 0U466 and 0UL40.
0U466 and 0UL40 had peak numbers of one and three individuals respectively. The largest roost was recorded in 0U462 where 1,400 Bar-tailed Godwits roosted alongside Dunlin (1,100), Knot (1,500) and Oystercatcher (900) on the seaward side of a sand dune in the north of the subsite.

The February roost survey (neap tide) recorded Bar-tailed Godwits roosting in three subsites (0U462, 0U465, and 0UL48). 0U465 (Wooden Bridge – Causeway) recorded a roost of 950 individuals, positioned in saltmarsh on the inner (landward) side of Bull Island. A single flock of 650 roosted within 0U462. 0UL48 held a small number of individuals, a maximum flock size of eight.

Curlew *Numenius arquata* - Family (group): Scolopacidae (wading birds)

The Curlew has a widespread breeding range across temperate latitudes of the Palearctic region, occurring across Europe and Asia from Ireland in the west to northern China in the east (Delaney et al. 2009). The nominate subspecies breeds across Europe and winters in Europe. Ireland supports a small and declining population of breeding Curlew. Irish breeding Curlew are thought to make only short migrations, many resident during winter. Wintering numbers are enhanced by birds moving in from breeding grounds in Fennoscandia, the Baltic and northwest Russia (Delaney et al. 2009).

Numbers

Low tide counts of Curlew peaked in November 2011 when 674 were counted across the site. 917 were counted during the high tide survey. All surveys recorded numbers of all-Ireland importance.

Curlew had a widespread distribution across the site, occurring in 14 subsites overall. 11 subsites recorded this wader in all four low tide surveys: 0U462, 0U464, 0U465, 0U466, 0U468, 0U469, 0UL40, 0UL43, 0UL44, 0UL47 and 0UL48.
Peak counts were recorded for 0UL43 (Fairview Park), 0U466 (North of Causeway (to saltmarsh)), 0U465 (Wooden Bridge – Causeway) and 0U464 (South of Wooden Bridge) for the four low tide surveys respectively. The peak subsite count of 188 was recorded for 0U466 (North of Causeway (to saltmarsh)) on 04/11/11.

Foraging Distribution

Curlews are the largest wader to spend the non-breeding season within Ireland. Within intertidal areas they seek out larger prey items such as crabs, large worms and bivalves and their de-curved bill is ideally suited to extracting deep-living worms such as Lugworms (*Arenicola marina*). Curlews also feed amongst damp grasslands where they take terrestrial worms.

Curlew were recorded foraging intertidally across 14 subsites overall. 0UL43 (Fairview Park) held peak numbers (96) on 05/10/11 and good numbers in all other low tide surveys. 0U464 (South of Wooden Bridge) recorded peak numbers on 04/11/11 (90) and on 02/02/12 (129 individuals). 0UL48 (Sutton Strand South) supported peak numbers on 05/12/11. No peak count represented greater than 36% of the total numbers foraging across the site highlighting the widespread distribution of this species. Other subsites of note were 0U465 (Wooden Bridge - Causeway) and 0UL47 (Kilbarrack), supporting good numbers in all surveys and numbers regularly ranked in the top five subsites.

0UL43, 0U464, 0UL48, 0U465 and 0UL47 are all situated in North Dublin Bay where the most widespread benthic community type is 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). This intertidal community complex is recorded extensively throughout the site from Drumleck Point to Dollymount (NPWS, 2012) and characterising species of this complex include polychaetes *Scoloplos armiger*, *Tharyx* sp. *Arenicola marina* and *Capitella* sp., the bivalve *Cerastoderma edule* and the amphipod *Corophium volutator*.

The peak intertidal foraging density was 3 Curlew ha^{-1} recorded for 0U464 (South of Wooden Bridge). 0UL43 (Fairview Park) recorded a peak density of 2 Curlew ha^{-1}. The whole site average intertidal foraging density was 0.3 Curlew ha^{-1}.

Roosting Distribution

Curlews were regularly observed in roosting/other behaviour in small numbers across ten subsites overall. But most records were irregular and involved small numbers only. The exceptions to this were 0U464 (South of Wooden Bridge) and 0U465 (Wooden Bridge – Causeway) which recorded individuals in all low tide surveys, with peaks of 22 and 38 individuals respectively. 0U466 (North of Causeway (to saltmarsh)) supported 141 roosting individuals on 02/02/12.

Just three individuals roosted intertidally during the high tide survey. However 530 Curlew roosted supratidally, located within 0U466 (North of Causeway (to saltmarsh)) (272) and 0U465 (Wooden Bridge – Causeway) (258).

Curlews were recorded roosting in five subsites during the November 2011 roost survey (spring tide) (0U462, 0U465, 0U466, 0UL47 and 0UL48). 0U465 held the majority of birds; the largest roost being of 60 individuals positioned in the NE corner of the subsite in saltmarsh (inner/landward side of Bull Island). The largest flock of 230 Curlew were recorded in 0UL48 and were amongst saltmarsh on the inner (landward) side of Bull Island. The second largest flock was 97 Curlew within 0U465, these birds again in saltmarsh on the inner (landward) side of Bull Island. 0U465 recorded the most number of roosting flocks.

The February roost survey (neap tide) recorded good numbers of Curlew roosting across four subsites: 0U465, 0U466, 0UL47 and 0UL48, with peak flock sizes of 285, 110, 68 and 363 individuals respectively. Almost without exception, these birds were roosting in saltmarsh on the inner (landward) side of Bull Island.

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

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

Numbers

Total numbers of Redshank were variable across the survey months but all surveys recorded numbers that surpassed the threshold of all-Ireland importance. Numbers peaked at 1,196 on 05/10/11. This early peak most likely indicates the presence of some passage birds. Thereafter numbers dropped at each survey with just 522 recorded during the February low tide count. 954 Redshanks were recorded during the high tide survey.

Redshanks were widespread and recorded within 15 subsites overall and all bar one (0U468) recorded this wader in all four low tide surveys. 0U465 (Wooden Bridge – Causeway) recorded peak numbers in the first three low tide surveys and numbers ranked as second highest in the final two low tide surveys. 0UL48 (Sutton Strand South) held peak numbers on 05/12/11 and 0UL43 (Fairview Park) on 02/02/12. The peak subsite count of 375 Redshanks was recorded for 0U465 (Wooden Bridge – Causeway) on 05/10/11.

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 widely across the site and within 15 subsites overall. A total of 14 subsites supported foraging Redshanks in all four low tide surveys: 0U460, 0U461, 0U462, 0U464, 0U465, 0U466, 0U469, 0U472, 0UL40, 0UL41, 0UL43, 0UL44, 0UL47 and 0UL48.

0U465 (Wooden Bridge – Causeway) recorded peak numbers of foraging individuals during the first two low tide surveys (maximum number 267) and numbers ranked as second highest during the final two low tide surveys. Redshanks were widely distributed within the subsite and on both sides of the channel. 0UL48 (Sutton Strand South) held peak numbers (154) on 05/12/11, and 0UL43 (Fairview Park) held peak numbers (76) on 02/02/12. The intertidal benthic community of these three subsites is classified as 'fine sand to muddy sand with the polychaete *Pygospio elegans* and the crustacean *Crangon crangon'* (NPWS, 2012). The sediment of this community complex is largely that of fine sand; localised areas of muddier sediment occur to the north of the causeway linking North Bull Island to the mainland and at Kilbarrack. (subsites 0U465 and 0U466). Redshanks therefore appear to preferentially use the muddier parts of the site. The characterising species of this community complex include polychaetes *Scoloplos armiger*, *Tharyx* sp., *Arenicola marina* and *Capitella* sp., the bivalve *Cerastoderma edule* and the amphipod *Corophium volutator*. The oligochaete *Tubificoides benedii* and the gastropod *Peringia (Hydrobia) ulvae* are also common within this community complex.

0U466 (North of Causeway (to saltmarsh)) was notable in recording numbers ranked in the top six in all low tide surveys (maximum number 188 recorded on 05/10/11).

The peak intertidal foraging density was 8 Redshanks ha^{-1} recorded for 0U461 (Booterstown Reserve). 0U466 (North of Causeway (to saltmarsh)) recorded a peak foraging density of 7 Redshanks ha^{-1} while 0U465 (Wooden Bridge – Causeway) recorded a peak density of 4 Redshanks ha^{-1}. The whole site average intertidal foraging density was 0.5 Redshank ha^{-1}.

Roosting Distribution

Roosting individuals were recorded within 12 subsites overall during low tide surveys. The October 2011 survey recorded the greatest number roosting/other intertidally when 383 Redshanks were recorded within nine subsites and three of these (0U462, 0U465 and 0U466) supported more than 100 individuals). Thereafter there was little pattern to roosting/other behaviour although 0U465 and 0U466 supported good numbers in November 2011 982 and 66 respectively).

61 Redshanks roosted intertidally during the high tide survey, the largest proportion (31%) within 0U465 (Wooden Bridge – Causeway). A further 279 roosted supratidally on this day; 164 again positioned within 0U465.

Redshanks were recorded roosting in 11 subsites during the November 2011 roost survey (spring tide); six of these held good sized flocks, the largest being a flock of 192 recorded in saltmarsh in the NE corner of 0U465. Further north behind Bull Island a flock of 160 Redshanks roosted in the south-western corner of 0U466, a flock of 150 roosted in saltmarsh of 0UL47 and 80 roosted in saltmarsh of 0UL48.

The February roost survey (neap tide) recorded Redshanks roosting in seven subsites (0U461, 0U465, 0U466, 0U469, 0U472, 0UL47 and 0UL48). The largest roost was recorded in 0U466, where 246 Redshanks roosted in the south-western corner. 0U465 recorded eight different roosting positions, the largest flock comprising 190 Redshanks. 0U461 (Booterstown Marsh) held one roost of 121 Redshanks. The other subsites listed above held far fewer numbers with no roost greater than 20 individuals.

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

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

Numbers

Peak low tide numbers were recorded in November 2011 (131 Turnstones). 183 Turnstones were recorded in total during the high tide survey. Three low tide counts and the high tide count surpassed the threshold of all-Ireland importance.

Across the entire survey period, Turnstones were recorded in 13 count subsites. Nine subsites recorded Turnstones in all four low tide surveys: 0U460, 0U462, 0U464, 0U465, 0U468, 0U469, 0UL43, 0UL44 and 0UL48.

Ten subsites supported Turnstones during the high tide survey on 10/01/12.

Foraging Distribution

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

Turnstones foraged regularly (three low tide surveys or more) in 11 subsites (0U460, 0U462, 0U464, 0U465, 0U468, 0U469, 0U472, 0UL43, 0UL44, 0UL47, 0UL48).

0U464 (South of Wooden Bridge) supported peak numbers of foraging individuals on 05/10/11 and 04/11/11, these birds foraging along the base of the Bull Wall. 0UL44 (Clontarf Baths) supported peak numbers on 05/12/11 and 02/02/12, the birds on both occasions foraging within the gravely substratum in the north of the subsite.

0U460 (Dún Laoghaire – Seapoint) was notable in recording numbers ranked in the top four in all low tide surveys (maximum number 18 recorded on 04/11/11). The birds were largely associated with a rocky intertidal substratum that occurs in parts of this subsite, classified as an intertidal reef community by NPWS (2012). The species associated with this community are the brown algae *Fucus vesiculosus*, *F. serratus*, *F. spiralis*, *Ascophyllum nodosum* and *Pelvetia canaliculata*, the gastropods *Patella vulgata* and *Littorina littorea*, the barnacle *Semibalanus balanoides* and the bivalve *Mytilus edulis.*

Roosting Distribution

Turnstones were rarely recorded in roosting/other behaviour during low tide surveys. A total of 72 individuals roosted during the high tide survey, the largest single flock roosting supratidally on rock in 0U469 (Sutton - Dinghy Club). 23 individuals roosted intertidally within 0U465 (Wooden Bridge - Causeway). 14 additional Turnstones were recorded in 0U472 (11), 0U466 (2) and 0UL44 (1).

Turnstone were recorded roosting in ten subsites during the November 2011 roost survey (spring tide) (0U460, 0U462, 0U465, 0U468, 0U469, 0U472, 0UL40, 0UL43, 0UL47 and 0UL48). Most roosts comprised relatively low numbers (<15 individuals). One exception was 0U465 which held a peak number of 95 individuals while 0U472 held a roosting flock of 24 Turnstone.

The February roost survey (neap tide) recorded Turnstone roosting in seven subsites (0U460, 0U464, 0U465, 0U466, 0U472, 0UL44 and 0UL48). 0U465 held the largest roost of 95 individuals. 19 Turnstone roosted terrestrially (outside SPA) at Bullock Harbour in 0U472, and 13 roosted supratidally along the western border of 0U466. All other records were for ten individuals or less.

Black-headed Gull *Chroicocephalus ridibundus* - Family (group): Laridae (gulls)

Black-headed Gulls breed widely throughout the middle latitudes of the Palearctic and in north-eastern North America (Mitchell et al. 2004). It is the most widespread breeding seabird within Ireland, breeding both inland and on the coast. Winter numbers are boosted by birds arriving from northern and eastern Europe (Wernham et al. 2004). There is some evidence that gulls from Iceland also move into Ireland for the winter (BWPi, 2004).

Numbers

More than 2,000 Black-headed Gulls were recorded in all low tide surveys; the peak was 2,933 individuals counted on 02/02/12.

Black-headed Gulls were recorded within 19 subsites overall (all except 0UL52). The subsite peak of 631 individuals was recorded for 0UL43 (Fairview Park) on 05/10/11. Peak numbers were also recorded for 0U462 (Booterstown - Merrion Gates) (04/11/11), 0UL40 (Sandymount Strand North) (05/12/11) and 0U464 (South of Wooden Bridge) (02/02/12). 0U466 (North of Causeway (to saltmarsh)) held good numbers in all months and numbers ranked as second highest on two survey occasions.

491 Black-headed Gulls were recorded in 0UL48 (Sutton Strand South) during the high tide survey, accounting for nearly 30% of all counted on that date.

Foraging Distribution

Black-headed Gulls were recorded foraging intertidally in 14 subsites (0U460, 0U461, 0U462, 0U464, 0U465, 0U466, 0U468, 0U469, 0UL40, 0UL41, 0UL43, 0UL44, 0UL47 and 0UL48). 0UL40 (Sandymount Strand North) held peak numbers during the first three low tide surveys and numbers ranked as second highest on the final survey date. 0U464 (South of Wooden Bridge) held peak numbers on 02/02/12 (509 gulls) having not recorded large numbers previously. 0U460 (Dún Laoghaire – Seapoint) was notable in supporting highly ranked numbers in all low tide surveys and the peak number during the high tide survey.

Fewer individuals foraged subtidally; this behaviour recorded across eight subsites overall. 0U472 (East Pier - Bullock Harbour) supported peak numbers on two low tide survey occasions. 0UL48 (Sutton Strand South) supported lower numbers in most surveys.

Roosting Distribution

A greater number of Black-headed Gulls were recorded in roosting/other behaviour than foraging. Intertidal roosting/other was recorded across 15 subsites overall. 0UL43 (Fairview Park) held peak numbers on 05/10/11, 05/12/11 and 02/02/12 (maximum number 507). 0U462 (Booterstown - Merrion Gates) supported peak numbers on 04/11/11. A further eight subsites supported roosting individuals in all four low tide surveys: 0U460, 0U464, 0U465, 0U466, 0U468, 0U469, 0UL44 and 0UL48.

Roosting/other behaviour was recorded to a lesser extent in subtidal habitat with the exception of 0U466 (North of Causeway (to saltmarsh)) which recorded peak numbers in all four low tide surveys and a maximum subsite count of 318 individuals on 02/02/12.

816 Black-headed Gulls roosted subtidally during the high tide survey, the peak number within 0U465 (Wooden Bridge – Causeway) a further 205 in 0UL48 (Sutton Strand South). 689 Black-headed Gulls roosted intertidally, the peak number within 0UL48 (Sutton Strand South) (230 gulls). A further 107 roosted supratidally across four subsites (0U460, 0U465, 0UL47 and 0UL48).

Black-headed Gulls were recorded roosting in 13 subsites during the November 2011 roost survey (spring tide). The largest flock was recorded in 0U472 (185 individuals) that roosted supratidally on rock in the western corner of the subsite. A flock of 126 roosted subtidally within 0UL43, further flocks of 74, 20 and 12 in the same subsite at the same survey time. 0U465 recorded this species roosting/other in six different positions, mostly subtidally, and the peak flock size was 102. A single flock of 118 roosted subtidally within 0U461, while 0U462 recorded two intertidal roosts of 121 and 91 individuals.

The February roost survey (neap tide) recorded good numbers of Black-headed Gulls roosting across 14 subsites. The peak flock size was 301 that roosted subtidally in 0UL44 and this subsite recorded a total seven different positions for roosting individuals. 0UL43 recorded a subtidal roosting/loafing flock of 261 individuals, a further 202 individuals recorded in two flocks of 190 and 12. 0U465 recorded roosting/other individuals in six different positions, with a maximum flock size of 185 Black-headed Gulls.

Merne et al. (2009) documented the importance of Dublin Bay for five species of gull throughout the year and as both a daytime feeding and loafing site, and a night- time roost site. In addition, survey data suggests that Dublin Bay is a major staging area for Black-headed Gulls prior to spring migration; a maximum count of 39,535 Black-headed Gulls recorded in February 2007. The dusk roost survey undertaken as part of the 2011/12 Waterbird Survey Programme recorded a total of 40,585 Black-headed Gulls, the Tolka Estuary recording the largest proportion of these (full results in Appendix 8). These results are very similar to those recorded in 2007 and further confirm that Dublin Bay is a major staging site on the Irish east coast for gulls prior to migrating to breeding grounds.

5.4 Dublin Bay - Activities and Events

5.4.1 Introduction

The overriding objective of the Habitats Directive is to ensure that the habitats and species covered achieve *'favourable conservation status'* and that their long-term survival is secured across their entire natural range within the EU (EU Commission, 2012). In its broadest sense, favourable conservation status means that an ecological feature is in a satisfactory condition, and that this status is likely to continue into the future.

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

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

5.4.2 Assessment Methods

Information on 'activities' and 'events' across the site was collected during a desk-top review which included NPWS site reporting files, County Development and other plans (e.g. Dublin City Council, 2008, 2010a & b; Dún Laoghaire–Rathdown County Council (2009; 2010a,b), Fingal County Council, 2011a; 2011b), Eastern River Basin District documents (e.g. ERBD, 20010a, b) and other available documents relevant to the ecology of the site.

In addition, information was collected during the 2011/12 waterbird survey programme (NPWS, 2011a) 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 220+ hours of surveyor effort across the site. All data collected were entered into a database. As the dataset will be subject to change over time, the assessment that follows should be viewed as a working and evolving process.

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

Data are presented in three ways:-

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

   O observed or known to occur in or around Dublin Bay;
   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 the site, those that have the potential to cause disturbance to waterbird species are highlighted.

3. Data from the 2011/12 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 Dublin Bay

Activities and events identified to occur in and around the site are shown in Appendix 9, listed in relation to the subsites surveyed during the 2011/12 Waterbird Survey Programme. Activities highlighted in grey are those that have the potential to cause disturbance to waterbirds (see Section 5.4.4). Only wetland subsites were included in this assessment so terrestrial subsites 0UL53 and 0UL54 were excluded.

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

Adjacent landuse and habitat loss and modification

Lying adjacent to the capital city, Dublin Bay encompasses unquestionably two of, if not the most, developed of all Ireland's coastal SPAs. In addition to reclamation, both historical and more recent, the shoreline is modified along nearly all of its length with linear defences (rock-armoured embankments and sea walls), as well as the North and South Bull Walls, sea walls of Dublin Port. A large proportion of the bay is bordered by road, while a rail line borders more than half of South Dublin Bay. A causeway to Bull Island was built in 1964-65. The vast majority of riverbank, shoreline and channels of the Tolka Estuary, as well as the Liffey and Dodder rivers have been modified over time (e.g. channelisation of the river, building of retaining walls and flood defences, and maintenance dredging).

Booterstown Railway (DART) Station lies adjacent to Booterstown Marsh (subsite 0U461). The marsh, lying between the embankment that carries the rail line and the road from Dublin to Blackrock (Rock Road), resulted from the building of the rail line in the 1800's. The marsh habitats have varied greatly over the years. McCorry & Ryle (2009b) describe how part of the marsh was reclaimed and used for vegetable growing in the early 20th century; agricultural grazing occurred in the 1960's. ….' *in the 1950's and 1960's, land was further infilled at both ends of the marsh; a car park was constructed at the south-western corner, while the Trimleston stream was culverted along the northern edge of the marsh, to discharge to the sea (Reynolds and Reynolds, 1990). However, the valves of the sluice corroded allowing tidal influence to re-enter the site. This created a brackish marsh with freshwater, brackish and saltmarsh vegetation present (Reynolds and Reynolds, 1990). There is a salinity gradient from the western to eastern side of the marsh. The site was affected by oil spills in the early 1980's. The damaged valves where removed by the local authority in recent years to allow more saline water to re-enter the site'*. Leased by An Taisce in the 1970's, the marsh is now managed as a Nature Reserve. Blackrock, Seapoint and Salthill and Monkstown Railway Stations also lie adjacent to South Dublin Bay.

The construction of the causeway to Bull Island in 1964-65 had a significant impact on current flows and sedimentation patterns in the intertidal area (McCorry & Ryle, 2009a,b). This led to the accretion of a sediment bank north of the causeway that was soon vegetated by Glasswort, creating *Salicornia* flats, and colonised by Common Cordgrass (*Spartina anglica*); although this plant had first been recorded at the site in 1934 (Doyle, 1934). The growth of extensive green algal mats also appeared to be facilitated by the causeway. There have been several surveys and assessments carried out to examine these issues over the years (see discussion in McCorry & Ryle, 2009a), and to examine the potential for re-opening the causeway. The most recent, an Environmental Impact Assessment (ESB International 2002) came to the conclusion that re-opening the causeway would have a minimal or no impact on sedimentation and that the 'do-nothing approach' was recommended.

As noted above, Common Cordgrass initially began to spread on the mudflats north of the Bull Island causeway after its construction in 1965. Clumps are now found both north and south of the causeway, although there are no signs that it is spreading extensively on the saltmarsh (McCorry & Ryle, 2009b). Dublin City Council attempted to control spread during the period 1970-1995 with varying success (McCorry & Ryle, 2009a).

A natural feature, embryonic dune formation, is occurring along Sandymount Strand (subsite 0UL40/41), in the northwest corner of South Dublin Bay (adjacent Sean Moore Park 0UL53) and adjacent (south) of Irishtown Park (0UL54).

Dublin City Council (2012) (chapter 10) discusses the deposition of sand that has occurred in South Dublin Bay since the late 1990s. A sand bar between Merrion Gates and Booterstown Railway Station has developed in relatively recent years and accumulated a significant amount of sand. Although sand bars are used as roosts by waders, gulls and terns as the tide floods and ebbs in the south bay, they appear to be modifying the intertidal habitat to some extent, in that, as conditions become more sheltered on their inner/landward side, the substrate is becoming increasingly muddy with increased cover of green macroalgae.

Dublin Port is situated on the River Liffey which flows through the city of Dublin and between the great South Wall and North Bull Wall before entering Dublin Bay. The port facilities span both sides of the Liffey and form the southern boundary of the Tolka Estuary. Dublin Port is Ireland's biggest sea port and handles almost 50% of the Republic's trade, two thirds of all containerised trade and approximately 1.8 million tourists per year via associated ferry companies (www.dublinport.ie).

Dublin Bay Powerstation (ESB Power Generation Station) is located at Ringsend and discharges cooling water to the Liffey Estuary (under IPCC licence). The water used for cooling is abstracted from the Liffey Estuary. Planning approval for the Dublin Waste to Energy Facility (www.dublinwastetoenergy.ie) was granted by An Bord Pleanála in November 2007, subject to a number of conditions which include a requirement for waterfowl monitoring. A further condition was the provision of a winter feeding area for Light-bellied Brent Geese. An area of grassland known variously as Goose Green, the DCC Brent Field Ringsend or the 'compensatory grassland' lies to the east of the temporary construction compound for the facility, south of Ringsend WWTP, and to the north of Irishtown Nature Park (refers to count subsite 0UL54). The grassland is managed by Dublin City Council Parks Department.

The west pier of Dún Laoghaire harbour, situated *c.*7km south of Dublin city centre, is the most southerly extent of both the SPA and the I-WeBS count area for Dublin Bay. The harbour is protected by two piers (east and west) made of granite and rock armour which provide some roosting and feeding sites for birds. The West Pier, in particular, is well known as a landfall for rare and unusual migrants, mainly in the autumn months (Dún Laoghaire Harbour, 2011). The harbour is home to a 450-berth marina.

Dredging activities occur at Dublin Port and at Dún Laoghaire harbour to maintain the required channel depth (Byrne, 2009).

Navigation in the Dublin Bay area is difficult due to the presence of sand banks. Recreational sailing activities in Dublin Bay are governed by guidelines set out by the Dublin Port Company and the Irish Sailing Association.

Dublin City and the greater Dublin area are constantly subject to development proposals and consequently, Dublin Bay is under continual pressures for development (Crowe, 2005).

Water quality

Waste water arising from Dún Laoghaire-Rathdown is collected and pumped to the waste water treatment plant (WWTP) at Shanganagh. Treated effluent is discharged into Killiney Bay (outside SPA) via a 1.7km long sea outfall. Other catchments in the Dún Laoghaire-Rathdown area flow to a pumping station on the West Pier of Dún Laoghaire Harbour, and from there to Ringsend Waste Water Treatment Plant (Dún Laoghaire–Rathdown County Council, 2010b) which is the main WWTP for Dublin City, operated by Dublin City Council. Ringsend WWTP also receives wastewater from the Ringsend Main Lift Pumping Station, Dodder Valley Gravity Sewer and Sutton Pumping Station (www.caw.ie).

There are various surface water discharges into the bay.

Dublin Bay has suffered from nutrient enrichment and eutrophication for many years (McCorry & Ryle 2009b). The pathways (chiefly riverine and sewage discharges) and subsequent impacts of nutrient inputs to the bay have been studied extensively (e.g. ERU 1992a-d; Jeffrey *et al.* 1991, Wilson & Parks 1998); benthic studies and an impoverished infauna indicating that organic enrichment has occurred in the sediments of the lower Liffey Estuary, the Tolka Estuary and in inner Dublin bay (e.g. Wilson et al. 1986; Wilson & Jeffrey 1987). Many studies emphasised the role of particulate nutrients in the system and their contribution to macroalgal growth though remineralisation (e.g. Jeffrey et al. 1995; Jennings & Jeffrey 2005) as one consequence of the eutrophication was blooms of the brown alga, *Ectocarpus*

siliculosis that washed up on Dollymount Strand each summer (ERU, 1992d). Another is the proliferation of green macroalgal mats (filamentous *Ulva,* formerly *Enteromorpha*)[22] which can occur in abundance in both north and south Bull lagoons, towards Bull Bridge and the Tolka Estuary.

Water quality of Dublin Bay and its estuaries improved following the opening of a new waste water treatment works at Ringsend in 2003; verified by improvements in EPA monitoring results (see below). However, there have been some failings in the past decade with recurring problems of odour pollution as well as the plant often working over capacity (Fehily, 2008).

The Eastern River Basin District (ERBD) River Basin Management Plan 2011 – 2015 covers the implementation of the Water Framework Directive (WFD) (2000/60/EEC) for the east coast of Ireland and covers Dublin Bay and its inflowing rivers, primarily the Liffey, Dodder and Tolka. Water quality monitoring is carried out by the EPA and the WFD status is determined by combining assessment results for biological, chemical and physicochemical quality elements of a waterbody. The current status of both transitional (upper and lower Liffey Estuary, Tolka Estuary) and coastal waters (Dublin Bay) is classified as 'moderate' (ERBD, 2010a,b,c); wastewater and industrial discharges being identified as the main pressures.

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)[23] and Nitrates Directive (91/676/EEC). Following assessment, waterbodies are classified as eutrophic, potentially eutrophic, intermediate or unpolluted (O'Boyle et al. 2010). For the period 1998-2000, the EPA reported eutrophic conditions in the Liffey Estuary (McGarringle et al. 2002). Under the Urban Wastewater Treatment Directive (91/271/EEC),[23] the Liffey Estuary from Islandbridge weir to Poolbeg Lighthouse, including the River Tolka basin and South Bull Lagoon, was designated a nutrient sensitive area. The trophic status of the Liffey Estuary improved from eutrophic to Intermediate during the period 1999-2006. Recent results for the period 2007-2009, reveal that the lower Liffey estuary and Dublin Bay (coastal waters) are now classified as unpolluted (improved); the Tolka estuary is 'potentially eutrophic' and the upper Liffey is classified as intermediate (O'Boyle et al. 2010).

In addition to nutrient enrichment, other pressures such as hazardous substances and morphological alterations can impact on the quality of aquatic systems (EPA, 2010). A recent data collation and review process by the Marine Institute supported an assessment of the chemical/ecological status regarding dangerous substances (i.e. priority substances and other relevant pollutants) for transitional waters (Marine Institute, 2010). The overall status for Dublin Bay, based on a range of parameters including water, sediment and biota sampling, was 'good' for most parameters, with the exception of metals and sediment which were classified as 'less than good' (exceedances of certain parameters and/or low data quality).

There are current proposals to extend and upgrade the Ringsend WWTP and to cease point discharge of treated water into the Liffey Estuary by creating an offshore discharge point in outer Dublin Bay (waters >20m depth). The environmental effects of this are complex. While improvements in WWTP treatment and cessation of point discharges 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)), there may be various consequences for the

[22] Hayden et al. (2003), using genetic information, reassigned the genus *Enteromorpha* to the genus *Ulva.*

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

ecology of the estuarine system. For example, a reduction in organic and nutrient loading could lead to reduced abundances of benthic invertebrate prey species (e.g. Burton et al. 2002) particularly those invertebrates that thrive (proliferate) in organically-enriched sediments. This could have subsequent 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 in Dublin Bay, especially in the north and south lagoons of Bull Island. 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) while herbivores such as Light-bellied Brent Geese and Wigeon benefit from the algae being a source of food. Sustained high levels of macroalgal growth are linked to organic enrichment, therefore there is a potential for changes in macroalgal abundance as a result of cessation of discharges from Ringsend WWTP. A review by Jennings and Jeffrey (2005) (and references therein) confirm that biogeochemical nitrogen cycling plays a key role in the supply of inorganic nitrogen to macroalgae in the bay, while the input of organic matter from sewage treatment was shown to represent the main source of organic nitrogen in Dublin Bay (Brennan et al. 1994). Once the proposed new Ringsend scheme is operational, the proposed changes to waste water effluent in the bay are estimated to result in a decline in the average DIN values in the North Bull Lagoon of *c.*70%; while average DIN values in the South Bull Lagoon are predicted to decline by between 38 and 51% (Dublin City Council, 2012). Further information and an assessment of potential impacts and their significance can be found in the Environmental Impact Statement for this proposal (Dublin City Council, 2012).

Fisheries and Aquaculture

Various commercial inshore fishing activities are likely to occur adjacent to the site (detail and spatial scale unknown). There are no known shellfish waters or aquaculture activities within the site. Relatively little fishery activity occurs within the bay apart from potting for crabs and lobster (Byrne, 2009).

Shore fishing is popular off Dollymount Strand (0U468) for Bass (*Dicentrarchus labrax*), Codling (*Gadus morhua*), Flounder (*Platichthys flesus*) and Eels (*Anguilaa anguilla*), and off the Southern Bull Wall for Pollack (*Pollachius pollachius*), Codling, Whiting (*Merlangius merlangus*), Bass and Flounder (ERFB, 2009). Sandymount Strand and the beach at Seapoint are also used for shore fishing while pier fishing is popular at Dún Laoghaire port.

Bait-digging occurs at the site and was recorded at five subsites (0U464, 0U465, 0U469, 0UL40 and 0UL48) during the 2011/12 Waterbird Survey programme. McCorry & Ryle (2009a) discuss the threat of the more organised 'commercial' bait-digging observed in recent years and the need to regulate this activity.

Recreational pressures

Dublin Bay is subject to significant recreational pressure due to its proximity to a major population centre. North Bull Island is an important amenity area and is managed as a public park and Nature Reserve by the Parks and Landscape Services, Dublin City Council. The island supports two golf courses (St Anne's Golf Course and Royal Dublin Golf Course). A Management Plan, commissioned by Dublin City Council in 2009, (McCorry & Ryle, 2009a) discusses the current management issues affecting the natural heritage of the island and outlines recommendations to manage them. Current management activities include the use of *Ectocarpus* sp. detritus to prevent dune erosion, vehicle management on Dollymount Strand and removing invasive Sea Buckthorn (a dune species). Former measures have included controlling Common Cordgrass (*Spartina anglica*) and planting Marram-grass in eroded dune areas (McCorry & Ryle, 2009a).

Dollymount Strand was formerly used for driving practice by learner-drivers (pers. obs.). Nowadays, although cars are parked on the beach (and observed during 2011/12 surveys), vehicle access along the beach is restricted by Dublin City Council Bye-laws. Walking, dog-

walking, swimming, kite-flying and water sports are among the regular activities at the site. Wind-surfing, kite-surfing, land-surfing, land-boarding and land-yachting occur on Dollymount Strand and due to their potential impacts upon other beach users and wildlife, measures have been taken to regulate them including restricting their use to certain areas (McCorry & Ryle, 2009a). People are requested to keep dogs on leads when walking on Bull Island as per Dublin City Council Bye-laws. Sutton beach, managed by Fingal County Council, is subject to beach bye-laws which specify certain restrictions in terms of exercising dogs and horses and the use of powered watercraft such as jet-skis.

Under the Quality of Bathing Waters Regulations, 1992, four stretches of beach within Dublin Bay have been designated as bathing water protected areas:- Dollymount Strand, Sandymount Strand, Merrion Strand, and Seapoint. Dollymount Strand achieved Blue Flag status in 2012. Each of these beaches are used extensively for recreational activities, probably the most prevalent activity being walking (including with dogs), particularly in winter. This was the most widespread activity recorded during the 2011/12 waterbird Survey programme (see Section 5.4.4).

Various water sports (e.g. power boating, sailing) originate from Dún Laoghaire marina, while sailing is popular around Sutton and Clontarf.

Other pressures

Wildfowling was not recorded at the site during the 2011/12 Waterbird Survey Programme and is not known, although it did occur historically. Part of the site is protected by a no shooting order.

Aircraft fly over Dublin Bay but were not recorded to cause disturbance to waterbirds during the 2011/12 survey period, or in a previous study (Phalan & Nairn, 2007).

Predation by birds of prey can be a significant pressure upon wading birds (e.g. Whitfield, 1985). At Dublin Bay, five birds of prey were observed throughout the survey programme: Short-eared Owl (*Asio flammeus*), Peregrine Falcon (*Falco peregrinus*), Sparrowhawk (*Accipiter nisus*), Merlin (*Falco columbarius*), and Kestrel (*Falco tinnunclus*). The majority of observations reported no observed disturbances to waterbirds and no kills were witnessed.

5.4.4 Disturbance Assessment

Six activities were recorded during 2011/12 survey work that had the potential to cause disturbance to waterbirds (bait-digging, humans walking along shore (with/without dogs), motorised vehicles, wind-surfing (water-based recreation) and hand-gathering of molluscs (Table 5.8).

Walking (including with dogs) was by far the most widespread activity occurring in ten subsites overall and responsible for the peak disturbance score in all of these. 0U460 (Dún Laoghaire – Seapoint), 0U462 (Booterstown - Merrion Gates) and 0U468 (Dollymount Strand) recorded disturbance scores classified as 'high' due to the presence of dogs on a regular basis. 0UL40 (Sandymount Strand north) and 0UL41 (Sandymount Strand south) also recorded dogs but less frequently, hence the lower overall score. 0U468 (Dollymount Strand) was the 'busiest' subsite; walking activity was almost always recorded to have started before the count commenced, and generally continued throughout the count period and beyond.

Bait-digging was the second most frequently-recorded activity, recorded for five subsites overall and with the exception of 0UL40 ((Sandymount Strand north) all within the northern part of the site.

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

Table 5.8 Disturbance Assessment Summary Table

Number of activities recorded during field surveys (2011/12 waterbird survey programme) that have the potential 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
0U460	Dún Laoghaire - Seapoint	1	7	• Walking (incl. with dogs)
0U461	Booterstown	1	4	• Walking (incl. with dogs)
0U462	Booterstown - Merrion Gates	1	7	• Walking (incl. with dogs)
0U464	South of Wooden Bridge	1	4	• Bait-digging
0U465	Wooden Bridge - Causeway	1	5	• Bait-digging
0U466	North of Causeway (to saltmarsh)	-	-	
0U468	Dollymount Strand (incl. open water)	4	7	• Walking (incl. with dogs)
0U469	Sutton-Dinghy Club	2	4	• Walking (incl. with dogs) • Hand-gathering molluscs
0U472	East Pier to Forty Foot	1	4	• Walking (incl. with dogs)
0UL40	Sandymount Strand North	1	6	• Walking (incl. with dogs)
0UL41	Sandymount Strand South	1	6	• Walking (incl. with dogs)
0UL43	Fairview Park	-	-	
0UL44	Clontarf Baths	-	-	
0UL45	Dublin Port	-	-	
0UL46	Dublin Port Extension	-	-	
0UL47	Kilbarrack	1	5	• Walking (incl. with dogs)
0UL48	Sutton Strand South	3	6	• Walking (incl. with dogs)
0UL52	South Dublin Bay-Outer	-	-	

Table 5.9 North Bull Island and South Dublin Bay and River Tolka Estuary - subsite rankings based on total numbers of waterbirds (LT surveys) by peak disturbance score

	0U460	0U461	0U462	0U464	0U465	0U466	0U468	0U469	0U472	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	0UL47	0UL48	0UL52	0UL53	0UL54
PB	L	L	L	M	V	M	L	H		H	V	V	M			H	V	L		L
SU					V	V							L			V	M			
PT					H	V										V				
SV					V	H														
OC	L	L	M	H	H	M	M	H	L	V	H	M	H	L		M	H		L	
GV			M	V	V	M	M	M		L		M	H			H	V			
KN	V	M	V	V	V	H		L		H	L		H			M	M			
SS	V		V	L			H			L	V									
DN	M		H	V	V	M	M	L		V	M	M				H	V			
BW	M	L	H		H	V		M		M	L	V	H			H	L			
BA	V		V	H	M	M	H	M		M	H	H				L	M			
RK	M	M	H	H	V	H	L	M	L	M	H	V	H			H	V			
TT	H		L	V	H	M	H	M	H	M		H	V			H	H			
T.		M			V	V							L			V	M			
RP			V							V	H					V	V			
GP					V															
CU	L		L	V	V	V	M	H	L	M	M	V	M			H	H			
BH	H	L	V	V	H	H	M	L	M	V	M	V	H	L	L	M	M			H

5.4.5 Discussion

It is clear that Dublin Bay is a highly modified site. While physical loss such as land claim might be considered more historic in nature, there is evidence that former physical modifications such as the construction of the Bull island causeway, are leading to on-going effects upon intertidal and coastal habitats. Improvements to water quality, especially of the Liffey and Tolka estuaries are beneficial recent changes. Proposals such as the cessation of WWTP discharge from Ringsend are likely to bring about further changes to the estuarine system. Natural processes such as sand bar development, sediment accretion and deposition, along with future management measures, will all contribute to the ever-evolving nature of this site.

Human recreational activities at coastal areas occur less frequently during winter months. The range of activities recorded, in comparison with the range of events known to occur, is also much reduced during winter, as evident from results from 2011/12 survey work. Nevertheless recreational activity in the form of walkers (with/without dogs) was widespread across the site and of a highly active level in certain subsites. In a previous study in the Irishtown area of South Dublin Bay, a similar result was found in that walkers, joggers and dogs accounted for the greatest majority of disturbance events; dogs alone (off the leash) accounted for nearly half of all events recorded (Phalan & Nairn, 2007). Results of current and previous studies therefore suggest that recreational activities at this site occur to such a level that are likely, at minimum, to effect waterbird survival during stressful periods (e.g. cold weather events, pre- and post migration) (Phalan & Nairn, 2007) if not during other periods as well.

The significance of the impact that results from even a short-term displacement following disturbance 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, if birds are concentrated into

fewer or smaller disturbance-free areas. 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[24] (reduced survival or reproductive success) consequences at population level may result.

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

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

and be influenced by:-

- Temporal availability – whether waterbirds have the opportunity to exploit the food resources in a disturbed area at times when the disturbance does not occur;
- Availability of compensatory habitat - whether there is suitable alternative habitat to move to during disturbance events;
- Behavioural changes as a result of a disturbance - e.g. degree of habituation;
- Time available for acclimatisation - whether there is time available for habituation to the disturbance. (there may be a lack of time for waterbirds during the staging period);
- Age - for example when feeding, immature (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.

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

REFERENCES

Atkinson, P. W., Austin, G. E., Rehfisch, M. M., Baker, H., Cranswick, P., Kershaw, M., Robinson, J., Langston, R. H. W., Stroud, D. A., Turnhout, C. van. & Maclean, I. M. D. (2006) Identifying declines in waterbirds: the effects of missing data, population variability and count period on the interpretation of long-term survey data. *Biological Conservation* 130, 549-559.

Benson, L. (2009a) *Use of inland feeding sites by Light-bellied Brent geese in Dublin 2008 – 2009.* Unpublished Master's thesis, University College Dublin.

Benson, L. (2009b) Use of inland feeding sites by Light-bellied Brent geese in Dublin 2008 – 2009: a new conservation concern. *Irish Birds* 8, 563-570.

Birdlife International (2006) *Monitoring Important Bird Areas: a global framework.* Cambridge, UK.

Boland, H. and Crowe, O. (2012) *Irish wetland bird survey: waterbird status and distribution 2001/02* – 2008/09. BirdWatch Ireland, Co. Wicklow, Ireland.

Brennan, M.T., Wilson, J.G., Jeffrey, D.W., Dowley, A., Jennings, E. and Hussey, M. (1994) *Particulate Nutrient Inputs and Their Role in Macroalgal Development in Dublin Bay.* Report to STRIDE Measure 3 Environment Sub-programme. Dublin. Department of the Environment.

Bryant, D.M. & Leng, J. (1975) Feeding distribution and behaviour of Shelduck in relation to food supply. *Wildfowl* 26: 20–30.

Burton, N.H.K., Paipai, E., Armitage, M.J.S., Maskell, J.M., Jones, E.T., Struve, J., Hutchings, C.J. & Rehfisch, M.M. (2002) E*ffects of reductions in organic and nutrient loading on bird populations in estuaries and coastal waters of England and Wales.* Phase 1 Report. BTO Research Report, No. 267 to English Nature, the Countryside Council for Wales and the Environment Agency. BTO. Thetford, UK.

BWPi (2004) *Birds of the Western Palearctic Interactive*. BirdGuides Ltd. 2004.

Byrne, G. M. (2009) *A marine spatial plan of Dublin Bay and outer reaches*. Institute of Estuarine and Coastal Studies, University of Hull.

Calbrade, N.A., Holt, C.A., Austin, G.E., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. & Musgrove, A.J. (2010) *Waterbirds in the UK 2008/09: The Wetland Bird Survey.*
BTO/RSPB/JNCC in association with WWT. Thetford. UK.

Colhoun, K. & Cummins, S. (2013) Birds of conservation concern in Ireland 2014-2019. *Irish Birds* 9, 523-544.

Cook, A. S. C. P., Barimore, C., Holt, C. A., Read, W. J. & Austin, G. E. (2013) Wetland Bird Survey Alerts 2009/2010: changes in numbers of wintering waterbirds in constituent countries of United Kingdom Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs). BTO Research report 641. BTO. Thetford. http://www.bto.org/webs/alerts

Cooney, T. (2011) (ed) *North Bull Island Bird Report 2011.* (www.bullislandbirds.com)

CRFB (2008) *Sampling fish for the Water Framework Directive. Transitional waters 2008. Tolka Estuary.* The Central and Regional Fisheries Board, Ireland 2008.

Crowe, O. (2005) *Ireland's Wetlands and their waterbirds: status and distribution*. BirdWatch Ireland. Co. Wicklow, Ireland.

Crowe, O. & Holt, C. (2013) Estimates of waterbird numbers wintering in Ireland 2006/07 – 2010/11. *Irish Birds* 9, 545-552.

Crowe, O., Boland, H. & Walsh. A. (2011) Irish Wetland Bird Survey: results of waterbird monitoring in Ireland in 2009/10. *Irish Birds* 9, 229-240.

Crowe, O., Austin, G, E., Colhoun, K., Cranswick, P., Kershaw, M. & Musgrove, A. J. (2008) Estimates and trends of waterbird numbers wintering in Ireland, 1994/95-2003/04. *Bird Study* 55, 66-77.

Cummins, S. & Crowe, O. (2012) *Collection of baseline waterbird data for Irish coastal Special Protection Areas 2011/ 2012.* Report to National Parks & Wildlife Service. June 2012. Birdwatch Ireland. Co. Wicklow, Ireland.

CWC (2008) *Report on bird counts for Dublin Gateway*. In: Royal Haskoning Ltd - Dublin Gateway Environmental Impact Statement. Final report to Dublin Port Company Ltd. August 2008.

Dekinga, A. & Piersma, T. (1993) Reconstructing the diet composition on the basis of faeces in a mollusc-eating wader, the Knot *Calidris canutus. Bird Study* 40, 144-156.

Delaney, S., Scott, D., Dodman, T. & Stroud, D. (2009) (eds) *An atlas of wader populations in Africa and Western Eurasia*. Wetlands International, Wageningen, The Netherlands.

Dit Durell, S. E. A. Le V. & Kelly, C. P. (1990) Diets of Dunlin *Calidris alpina* and Grey Plover *Pluvialis squatarola* on the Wash as determined by dropping analysis. *Bird Study* 37, 44-47.

Doyle, J. (1934) *Spartina townsendi* H & J Groves, at the north Bull, Co. Dublin. *Irish Naturalists' Journal* 5, 158.

Dublin City Council (2008) *Dublin City Biodiversity Plan* 2009-2013. Dublin. www.dublincity.ie

Dublin City Council (2010a) *Dublin City Development Plan 2011-201. Written Statement.* Dublin City Council www.dublincity.ie

Dublin City Council (2010b) *Natura Impact report of the Dublin City Development Plan 2011-201. Appropriate Assessment (AA).* Dublin City Council www.dublincity.ie

Dublin City Council (2012) *Ringsend Wastewater Treatment Works Extension, Volume 1, Environmental Impact Statement.* March 2012. Report by Camp Dresser & McKee (CDM) and JB Barry & Partners for Dublin City Council.
http://www.dublincity.ie/WaterWasteEnvironment/WasteWater/RingsendWastewaterTreatmentWorksExtension.

Dublin Port Company (2012a) *Dublin Port Masterplan 2012 – 2040.* www.dublinport/masterplan

Dublin Port Company (2012b) *Dublin Port Masterplan – Strategic Environmental Assessment.* Report by Jacobs Engineering Ireland Limited for Dublin Port Company. February 2012.

Dún Laoghaire–Rathdown County Council (2009) Dún Laoghaire–Rathdown *Biodiversity Action Plan* 2008-2012.

Dún Laoghaire–Rathdown County Council (2010a) *County Development Plan 2010-2016.* Dún Laoghaire–Rathdown County Council (www.dlrcoco.ie).

Dún Laoghaire–Rathdown County Council (2010b) *County Development Plan 2010-2016. Strategic Environmental Assessment.* Report produced by CAAS for Dún Laoghaire–Rathdown County Council April 2010. (www.dlrcoco.ie).

Dún Laoghaire Harbour (2011) *Dún Laoghaire Harbour Master Plan Strategic Environmental Assessment.* MacCabe Durney Barnes. 2011.

Environmental Protection Agency (2010) *Water quality in Ireland 2007-2009.* Eds: M. McGarrigle, J. Lucey and M. O'Cinnéide (Eds).

ERBD Eastern River Basin District (2010a) *River Basin Management Plan* 2009-2015. 6th July 2010.

ERBD Eastern River Basin District (2010b) *Eastern River Basin Management Plan 2009-2015 – Coastal waters Programme of measures Summary Report.* For download. www.erbd.ie

ERBD Eastern River Basin District (2010c) *Eastern River Basin Management Plan 2009-2015 – Transitional water bodies. Programme of measures. Summary Report.* For download. www.erbd.ie

ERFB (2009) *A Guide to sea angling in the Eastern Fisheries Region.* Report by N Dunlop. 2009. Eastern Region Fisheries Board. Dublin.

Environmental Research Unit (1992a) *Dublin Bay water quality management plan. Technical Report No. 1.* Recreation,amenity and wildlife conservation study. Prepared for Dublin Corporation, Dublin County, Dún Laoghaire Corporation by Reid McHugh and Partners. Environmental Research Unit, Dublin.

Environmental Research Unit (1992b) *Dublin Bay water quality management plan. Technical Report No. 3.* Field studies of currents and dispersion. M.J. Mansfield. Environmental Research Unit, Dublin.

Environmental Research Unit (1992c). *Dublin Bay water quality management plan. Technical Report No. 6.* Studies on the benthos. Benthos Research Group. Environmental Research Unit, Dublin.

Environmental Research Unit (1992d) *Dublin Bay water quality management plan. Technical Report No. 7. Algal growths and foreshore quality.* Environmental Research Unit, Dublin.

ESB International (2002) *Breaching of the causeway and provision of bridge at North Bull Island.* Environmental impact Statement (Draft). ESB Dublin.

EU (2007) *Management Plan for Pintail Anas acuta* 2007-2009.

EU Commission (2012) *Commission note on setting Conservation Objectives for Natura 2000 sites.* Final version 23/11/2012. DG Environment.

Fehily, B. (1998) *A review of and report on certain matters relating to Dublin City Council's Ringsend Wastewater Treatment Plant.* Report for the Minister for Environment, Heritage and Local Government Mr. John Gormley TD. October 2008.

Fewster, R.M., Buckland, S.T., Siriwardena, G.M., Baillie, S.R. & Wilson, J.D. (2000) Analysis of population trends for farmland birds using generalized additive models. *Ecology* 81, 1970–1984.

Fingal County Council (2006) Fingal County Council Beach/Foreshore Bye-Laws 2006. www.fingalcoco.ie

Fingal County Council (2011a) *Fingal Development Plan 2011 – 2017.* 2011.

Fingal County Council (2011b) *Fingal Development Plan 2011 – 2017. Natura Impact Statement.* April 2011.

Gill, J. A., Norris, K. & Sutherland, W. J. (2001a) Why behavioural responses to disturbance may not reflect the population consequences of human disturbance. *Biological Conservation* 97, 265-268.

Gill, J. A., Sutherland, W. J. & Norris, K. (2001b) Depletion models can predict shorebird distribution at different spatial scales. *Proceedings of the Royal Society B* 267, 369-376.

Gillings, S., Austin, G. E., Fuller, R. J., & Sutherland, W. J. (2006) Distribution shifts in wintering Golden Plover *Pluvialis apricaria* and Lapwing *Vanellus vanellus* in Britain. *Bird Study* 53, 274-284.

Gregory, R. D., van Strien, A., Vorisek, P., Gmelig Meyling, A. W., Noble, D. G., Foppen, R. P. B. & Gibbons D. W. (2005) Developing indicators for European birds. *Philosophical Transactions of the Royal Society B* 360, 269-288.

Harris, C. R. (1977) Sedimentology and geomorphology. In: *North Bull Island Dublin Bay - a modern coastal natural history*. (Eds. D.W. Jeffrey, R.N. Goodwillie, B. Healy, C.H. Holland, J.S. Jackson & J.J. Moore). Royal Dublin Society, Dublin.

Hayden, H.S., Blomster, J., Maggs, C.A., Silva, P.C., Stanhope, M.J., Waaland, J.R. (2003) Linnaeus was right all along: *Enteromorpha* and *Ulva* are not distinct genera. *European Journal of Phycology* 38, 277–293.

Hill, D., Hockin, D., Price, D., Tucker, G., Morris, R & Treweek, J. (1997) Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34, 275-288.

Hill, D., Rushton, S. P., Clark, N., Green, P & Prys-Jones, R. (1993) Shorebird communities on British estuaries: factors affecting community composition. *Journal of Applied Ecology* 30, 220-234.

Holt, C., Austin, G., Calbrade, N., Mellan, H., Hearn, R., Stroud, D., Wotton, S. & Musgrove, A. (2012) *Waterbirds in the UK 2010/11: The Wetland Bird Survey.* British Trust for Ornithology, Royal Society for the Protection of Birds and the Joint Nature Conservation Committee in association with the Wetlands & Wildfowl Trust.

Houlahan, J. E., Findlay, C. S., Schmidt, B. R., Meyer, A. H. & Kuzmin. S. L. (2000) Quantitive evidence for global amphibian population declines. *Nature* 404, 752-755.

Jeffrey, D. W. (ed.) (1977) *North Bull Island Dublin Bay – a modern coastal natural history.* The Royal Dublin Society, Dublin.

Jeffrey, D. W., Brennan, B. M., Jennings, E., Madden, B. & Wilson, J. G. (1995) Nutrient sources for in-shore nuisance macroalgae: the Dublin Bay case. *Ophelia* 42, 147-61.

Jeffrey, D. W., Madden, B., Rafferty, B., Dwyer, R. & & Wilson, J. G. (1991) Indicator organisms as a guide to estuarine management. In D.W. Jeffrey and B.M. Madden (eds) *Bioindicators and environmental management.* Academic Press, London.

Jeffrey, D.W., Pitkin, P. & West, A.B. (1978) Intertidal environment of northern Dublin Bay. *Estuarine & Coastal Marine* Science 7, 163 - 171.

Jennings, E. & Jeffrey, D. W. (2005) The link between biogeochemical nitrogen cycling and intertidal green macroalgae in Dublin Bay. In: *The intertidal ecosystem: the value of Ireland's shores.* (Eds: G.J. Wilson). Royal Irish Academy. 2005.

JNCC (1998) *Statement on common standards monitoring*. Joint Nature Conservation Committee.

JNCC (2004) *Common standards monitoring for birds.* Version August 2004. Joint Nature Conservation Committee. ISSN 1743-8160 (online).

Kushlan, J. (2006) Integrating waterbird conservation: populations, habitats and landscapes. Workshop Introduction. In: *Waterbirds around the world (*Eds. G.C. Boere, C.A. Galbraith & D.A. Stroud.). The Stationery Office, Edinburgh, UK.

Larkin, A. (2012) A study on Brent Goose behaviour in Dublin. Feeding, agonistic, and anti-predator behaviour in response to disturbance. Unpublished Master's thesis, University College Dublin.

Leech, D. I., Rehfisch, M. M. & Atkinson, P. W. (2002) *A Guide to Waterbird Alerts.* BTO Research Report No. 281.

Lewis, L.J. and Kelly, T.C. (2001) A short-term study of the effects of algal mats on the distribution and behavioral ecology of estuarine birds. *Bird Study* 48, 354-360.

Ma, Z., Cai Y., Li, B. & Chen, J. (2010) Managing Wetland Habitats for Waterbirds: An International Perspective. *Wetlands* 30, 15-27.

Marine Institute (2010) *An assessment of dangerous substances in Water Framework Directive Transitional and Coastal Waters: 2007 – 2009.* A report by the Marine Institute for the Environmental Protection Agency. October 2010.

McCorry, M & Ryle, T. (2009a) *A Management plan for North Bull Island.* A report commissioned by Dublin City Parks and landscapes services. August 2009. www.dublincity.ie

McCorry, M & Ryle, T. (2009b) *Saltmarsh Monitoring Project 2007-2008.* Volume 2. Final Report 2009. Report for Research Branch, National Parks & Wildlife Service.

McGarrigle, M. L., Bowman, J. J., Clabby, K. J., Lucey, J., Cunningham, P., MacCárthaigh, M., Keegan, M, Cantrell, B., Lehane, M., Clenaghan, C. & Toner, P. F. (2002) *Water quality in Ireland 1998 – 2000.* Environmental Protection Agency. Wexford.

MERC (2012) *Intertidal benthic survey of South Dublin Bay and South Dublin Bay SAC and River Tolka Estuary SPA.* Carried out by MERC on behalf of the Marine Institute in partnership with National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Merne, O. J., Madden, B., Archer, E & Porter, B. (2009) Abundance of non-breeding gulls in Dublin Bay 2006-2007. *Irish Birds* 8, 549-562.

Mitchell, P. I., Newton, S. F., Ratcliffe, N. & Dunn, T. E. (2004) *Seabird populations of Britain & Ireland*. T & A D Poyser.

Musgrove, A. J., Langston, R. H. W., Baker, H. & Ward, R. M. (eds) (2003) *Estuarine waterbirds at Low Tide: the WeBS Low Tide Counts 1992/93 to 1998/99.* WSG/BTO.RSPB/JNCC, Thetford.

NPWS (2011) *Waterbird surveys within Irish coastal Special Protection Areas. Survey methods and guidance notes.* Unpublished Report. National Parks & Wildlife Service June 2010.

NPWS (2012) North Dublin Bay SAC (Site Code 0206). Conservation objectives supporting document – marine habitats and species. Version 1. April 2012.

NPWS (2013) South Dublin Bay SAC (Site Code 0210). Conservation objectives supporting document – marine habitats. Version 1. July 2013.

O'Boyle, S., Wilkes, R., McDermott, G. & Noklegaard, T (2010) Chapter Five Quality of estuarine and coastal waters. In: (eds: M. McGarrigle, J. Lucey and M. Ó Cinnéide) *Water quality in Ireland 2007 – 2009.* Environmental Protection Agency. Wexford.

O'Briain M. (1991) Use of a *Zostera* bed in Dublin Bay by Light-bellied Brent Geese, 1981/82 – 1990/91. *Irish Birds* 4, 299-316.

O'Briain M., Healy B. (1991) Winter distribution of Light-bellied Brent Geese, 1981/82 to 1990/91. *Irish Birds* 4, 229 – 316.

O'Reilly, H. & Pantin, G. (1957) Some observations on the salt marsh formation in Co. Dublin. *Proceedings of the Royal Irish Academy* 58B, 89-128.

Olney, P.J.S. (1965) The food and feeding habits of Shelduck *Tadorna tadorna. Ibis,* 107: 527–532.

Phalan, B. & Nairn, R. G. W. (2007) Disturbance to waterbirds in South Dublin bay. *Irish Birds* 8, 223-230.

Prater, A. J. (1981) *Estuary birds of Britain & Ireland.* Poyser.

Ramsar Convention Bureau (1971) Convention on wetlands of international importance especially as waterfowl habitat. Ramsar Convention Bureau, Gland, Switzerland.

Rehfisch M.M., Insley, H. & Swann, B. (2003) Fidelity of overwintering shorebirds to roosts on the Moray Basin, Scotland: implications for predicting impacts of habitat loss. *Ardea* 91, 53-70.

Reneerkens, J., Benhoussa, A., Boland, H., Collier, M., Grond, K., Günther, K., Hallgrimsson, G.T., Hansen, J., Meissner, W., de Meulenaer, B., Ntiamoa-Baidu, Y., Piersma, T., Poot, M., van Roomen, M., Summers, R.W., Tomkovich, P.S. & Underhill, L.G. (2009) Sanderlings using African–Eurasian flyways: a review of current knowledge. *Wader Study Group Bulletin* 116, 2–20.

Reynolds, J. D. & Reynolds, S.C.P (1990) Development and present vegetational state of Booterstown Marsh, Co. Dublin, Ireland. *Bulletin of the Irish Biogeographical Society* 13, 173-184.

Robinson, J. A., Colhoun, K., Gudmundsson, K. A., Boertman, D., Merne, O. J., O'Briain, M., Portig, A. A., Mackey, K. & Boyd, H. (2004) *Light-bellied Brent Goose Branta bernicla hrota (East Canadian High Arctic population) in Canada, Ireland, Iceland, France, Greenland, Scotland, Wales, England, the Channel Islands and Spain. 1960/61 – 1999/2000.* Waterbird Review Series. The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee. Slimbridge. UK.

Ryle T, Connelly, K., Murray, A. & Swan, M. (2009) *Coastal Monitoring Project.* Unpublished survey for the National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.

Santos, C. D., Granadeiro, J. P. & Palmeirim, J. M. (2005) Feeding ecology of Dunlin (*Calidris alpina*) in a southern European estuary. *Ardeola* 52, 235-252.

Scheiffarth G. (2001) The diet of Bar-tailed Godwits *Limosa lapponica* in the Wadden Sea: combining visual observations and faeces analyses. *Ardea* 89, 481-494.

Shepherd, P. C. F., Evans Ogden, L. J. & Lank, D. B. (2003) Integrating marine and coastal terrestrial habitats in shorebird conservation planning. *Wader Study Group Bulletin* 100, 40-42.

Thaxter, C. B., Sansom, A., Thewlis, R. M., Calbrade, N. A. & Austin, G. E. (2010) *Wetland Bird Survey Alerts 2006/2007: Changes in numbers of wintering waterbirds in the Constituent Countries of the United Kingdom, Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs).* BTO Research Report 556.

Tierney, N. (2013) Delving deeper into Dublin Bay. *I-WeBS News* 17: 4. August 2013.

Underhill, L. G. & Prŷs-Jones, R. P. (1994) Index numbers for waterbird populations. I. Review and methodology. *Journal of Applied Ecology* 31, 463-480.

Van der Kam, J., Ens, B., Piersma, T & Zwarts, L (2004) *Shorebirds: an illustrated behavioural ecology.* KNNV Publishers, Utrecht, The Netherlands.

Viain, A., Corre, F., Delaporte, P., Joyeax, E. & Bocher, P. (2011) Numbers, diet and feeding methods of Common Shelduck *Tadorna tadorna* wintering in the estuarine bays of Aiguillon and Marennes-Oléron, western France. *Wildfowl* 61, 121-141.

Warnock, N. (2010) Stopping vs. staging: the difference between a hop and jump. *Journal of Avian Biology* 41, 621-626.

Weller, M. W. (1999) *Wetland Birds: habitat resources and conservation implications*. Cambridge University Press. UK.

Wernham, V. V., Toms, M. P., Marchant, J. H., Clark, J. A., Siriwardena, G. M. & Baillie, S. R. (eds) (2002) *The Migration Atlas: movements of birds of Britain and Ireland*. T & A D Poyser. London.

Wetlands International (2002) *Waterfowl Population Estimates – Third Edition*. Wetlands International, Wageningen, The Netherlands.

Wetlands International (2006) *Waterfowl Population Estimates – Fourth Edition*. Wetlands International, Wageningen, The Netherlands.

Wetlands International (2012) *Waterfowl Population Estimates – Fifth Edition*. Wetlands International, Wageningen, The Netherlands.

Whitfield, D. P. (1985) Raptor predation on wintering waders in southeast Scotland. *Ibis* 127: 544–558.

Wilson, J. G. & Parkes, A. (1998) Network analysis of the energy flow through the Dublin Bay ecosystem. *Biology and the Environment. Proceedings of the Royal Irish Academy* 98B, 179-90.

Wilson, J. G., Allot, N., Bailey, F. & Gray, N. F. (1986) A survey of the pollution status of the Liffey estuary. *Irish Journal of Environmental Science* 3, 15-20.

Wilson, J. G. & Jeffrey, D. W. (1987) Europe-wide indices for monitoring estuarine quality. In (eds: D.H.S. Richardson) *Biological indicators of pollution.* Royal Irish Academy. Dublin.

Zwarts, L. & Wanink, J. H. (1993) How the food supply harvestable by waders in the Wadden sea depends on the variation in energy, density, bodyweight, biomass, burying depth and behaviour of tidal-flat invertebrates. *Netherlands Journal of Sea Research* 31, 441-476.

Zwarts, L. Ens, B., Goss-Custard, J. D., Hulscher, J. B. & Dit Durrell, S. E. A. le vit (1996) Causes of variation in prey profitability and its consequences for the intake rate of the Oystercatcher *Haematopus ostralegus. Ardea* 84A, 229-268.

APPENDIX 1

SITE NAME: NORTH BULL ISLAND SPA

SITE CODE: 004006

This site covers all of the inner part of north Dublin Bay, with the seaward boundary extending from the Bull Wall lighthouse across to Drumleck Point at Howth Head. The North Bull Island sand spit is a relatively recent depositional feature, formed as a result of improvements to Dublin Port during the 18th and 19th centuries. It is almost 5 km long and 1 km wide and runs parallel to the coast between Clontarf and Sutton. Part of the interior of the island has been converted to golf courses.

Saltmarsh extends along the length of the landward side of the island and provides the main roost site for wintering birds in Dublin Bay. The island shelters two intertidal lagoons which are divided by a solid causeway. These lagoons provide the main feeding grounds for the wintering waterfowl. The sediments of the lagoons are mainly sands with a small and varying mixture of silt and clay. Green algal mats (*Ulva* spp.) are a feature of the flats during summer. These sediments have a rich macro-invertebrate fauna, with high densities of Lugworm (*Arenicola marina*) and Ragworm (*Hediste diversicolor*).

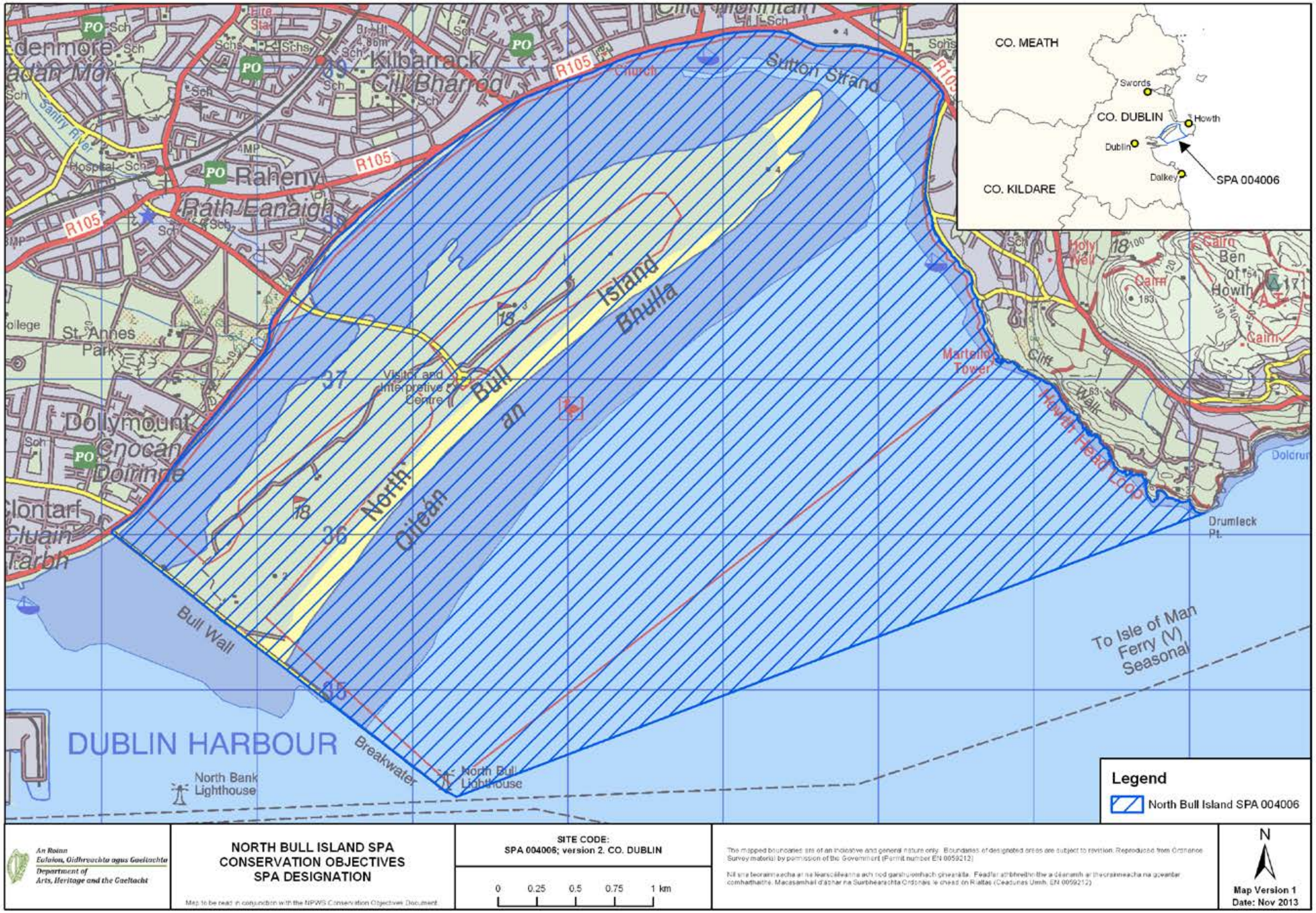
The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Light-bellied Brent Goose, Shelduck, Teal, Pintail, Shoveler, Oystercatcher, Golden Plover, Grey Plover, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Turnstone and Black-headed Gull. The site is also of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

The North Bull Island SPA is of international importance for waterfowl on the basis that it regularly supports in excess of 20,000 waterfowl. The site supports internationally important populations of three species, Light-bellied Brent Goose (1,548), Black-tailed Godwit (367) and Bar-tailed Godwit (1,529) - all figures are mean peaks for the five winters between 1995/96 and 1999/2000. The site is one of the most important in the country for Light-bellied Brent Goose. A further 14 species have populations of national importance – Shelduck (1,259), Teal (953), Pintail (233), Shoveler (141), Oystercatcher (1,784), Grey Plover (517), Golden Plover (2,033), Knot (2,837), Sanderling (141), Dunlin (4,146), Curlew (937), Redshank (1,431), Turnstone (157) and Black-headed Gull (2,196). The populations of Pintail and Knot are of particular note as they comprise 14% and 10% respectively of the all-Ireland population totals. Other species that occur regularly in winter include Grey Heron, Cormorant, Wigeon, Goldeneye, Red-breasted Merganser, Ringed Plover and Greenshank. Gulls are a feature of the site during winter and, along with the nationally important population of Black-headed Gull (2,196), other species that occur include Common Gull (332) and Herring Gull (331). While some of the birds also frequent South Dublin Bay and the River Tolka Estuary for feeding and/or roosting purposes, the majority remain within the site for much of the winter. The wintering bird populations have been monitored more or less continuously since the late 1960s and the site is now surveyed each winter as part of the larger Dublin Bay complex.

The North Bull Island SPA is a regular site for passage waders, especially Ruff, Curlew Sandpiper and Spotted Redshank. These are mostly observed in single figures in autumn but occasionally in spring or winter.

The site formerly had an important colony of Little Tern but breeding has not occurred in recent years. Several pairs of Ringed Plover breed, along with Shelduck in some years. Breeding passerines include Skylark, Meadow Pipit, Stonechat and Reed Bunting. The island is a regular wintering site for Short-eared Owl, with up to 5 present in some winters.

The North Bull Island SPA is an excellent example of an estuarine complex and is one of the top sites in Ireland for wintering waterfowl. It is of international importance on account of both the total number of waterfowl and the individual populations of Light-bellied Brent Goose, Black-tailed Godwit and Bar-tailed Godwit that use it. Also of significance is the regular presence of several species that are listed on Annex I of the E.U. Birds Directive, notably Golden Plover and Bar-tailed Godwit, but also Ruff and Short-eared Owl.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CO. KILDARE
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SPA 004006
Kilbarrack
Cill Bharróg
Raheny
Ráth Eanaigh
Dollymount
Cnocán Doirinne
Clontarf
Cluain Tarbh
St. Annes Park
Sutton Strand
North Bull Island
Oileán an Bhulla
Visitor and Interpretive Centre
Martello Tower
Howth Head Loop
Cliff Walk
Ben of Howth
Drumleck Pt.
To Isle of Man Ferry (V) Seasonal
Bull Wall
Breakwater
DUBLIN HARBOUR
North Bank Lighthouse
North Bull Lighthouse
Legend
North Bull Island SPA 004006
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
NORTH BULL ISLAND SPA
CONSERVATION OBJECTIVES
SPA DESIGNATION
Map to be read in conjunction with the NPWS Conservation Objectives Document.
SITE CODE:
SPA 004006; version 2. CO. DUBLIN
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Map Version 1
Date: Nov 2013

SITE NAME: SOUTH DUBLIN BAY AND RIVER TOLKA ESTUARY SPA

SITE CODE: 004024

The South Dublin Bay and River Tolka Estuary SPA comprises a substantial part of Dublin Bay. It includes the intertidal area between the River Liffey and Dún Laoghaire, and the estuary of the River Tolka to the north of the River Liffey, as well as Booterstown Marsh. A portion of the shallow marine waters of the bay is also included.

In the south bay, the intertidal flats extend for almost 3 km at their widest. The sediments are predominantly well-aerated sands. Several permanent channels exist, the largest being Cockle Lake. A small sandy beach occurs at Merrion Gates, while some bedrock shore occurs near Dún Laoghaire. The landward boundary is now almost entirely artificially embanked. There is a bed of Dwarf Eelgrass (*Zostera noltii*) below Merrion Gates which is the largest stand on the east coast. Green algae (*Ulva* spp.) are distributed throughout the area at a low density. The macro-invertebrate fauna is well-developed, and is characterised by annelids such as Lugworm (*Arenicola marina*), *Nephthys* spp. and Sand Mason (*Lanice conchilega*), and bivalves, especially Cockle (*Cerastoderma edule*) and Baltic Tellin (*Macoma balthica*). The small gastropod Spire Shell (*Hydrobia ulvae*) occurs on the muddy sands off Merrion Gates, along with the crustacean *Corophium volutator*. Sediments in the Tolka Estuary vary from soft thixotrophic muds with a high organic content in the inner estuary to exposed, well-aerated sands off the Bull Wall. The site includes Booterstown Marsh, an enclosed area of saltmarsh and muds that is cut off from the sea by the Dublin/Wexford railway line, being linked only by a channel to the east, the Nutley stream. Sea water incursions into the marsh occur along this stream at high tide. An area of grassland at Poolbeg, north of Irishtown Nature Park, is also included in the site.

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, Ringed Plover, Grey Plover, Knot, Sanderling, Dunlin, Bar-tailed Godwit, Redshank, Black-headed Gull, Roseate Tern, Common Tern and Arctic Tern. The E.U. Birds Directive pays particular attention to wetlands, and as these form part of the SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

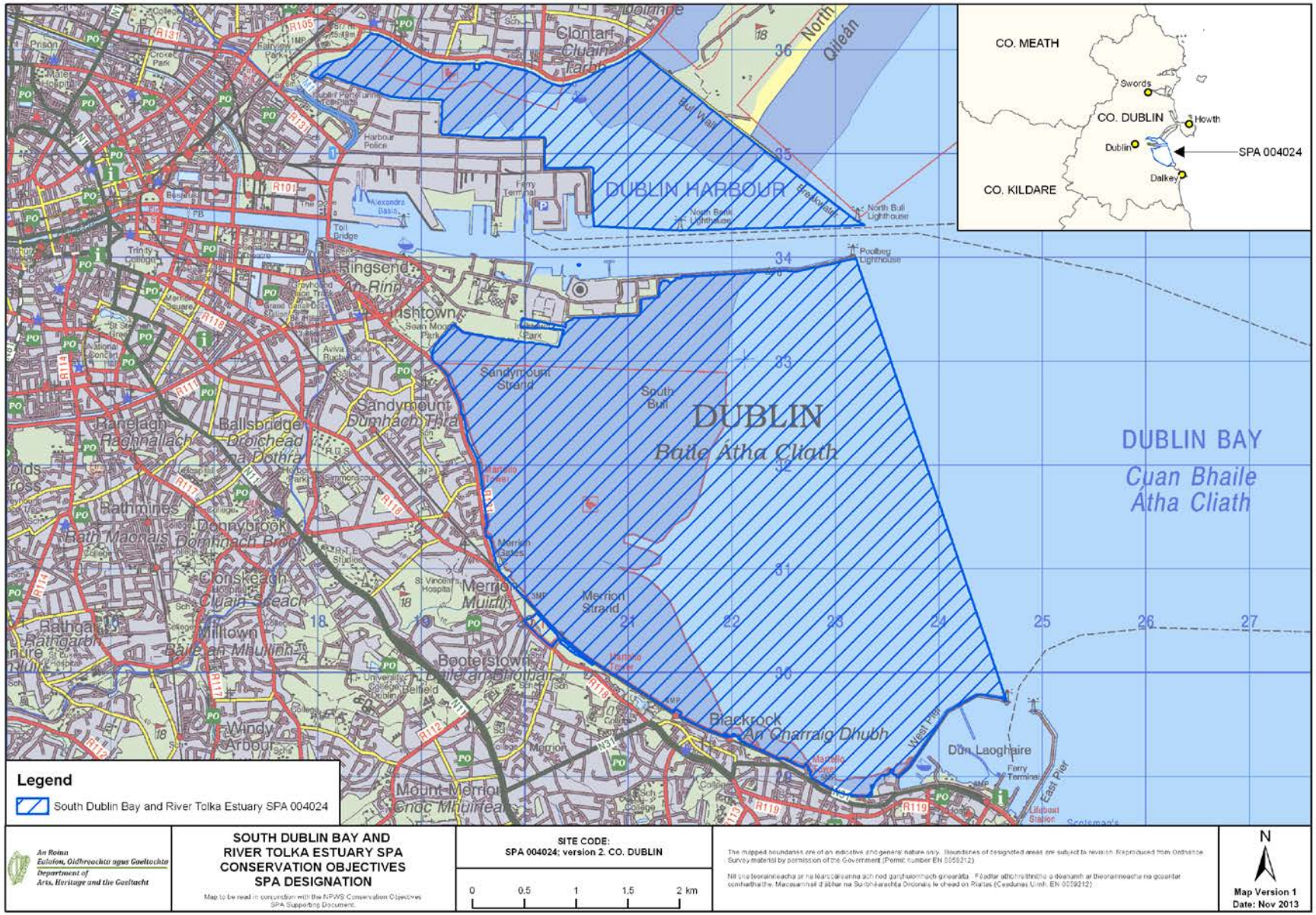
The site is an important site for wintering waterfowl, being an integral part of the internationally important Dublin Bay complex – all counts for wintering waterbirds are five year mean peaks for the period 1995/96 to 1999/2000. Although birds regularly commute between the south bay and the north bay, recent studies have shown that certain populations which occur in the south bay spend most of their time there. An internationally important population of Light-bellied Brent Goose (525) occurs regularly and newly arrived birds in the autumn feed on the Eelgrass bed at Merrion. The site supports nationally important numbers of a further nine species: Oystercatcher (1,263), Ringed Plover (161), Grey Plover (183), Knot (1,151), Sanderling (349), Dunlin (2,753), Bar-tailed Godwit (866), Redshank (713) and Black-headed Gull (3,040). Other species occurring in smaller numbers include Great Crested Grebe (21), Curlew (397) and Turnstone (75).

South Dublin Bay is a significant site for wintering gulls, with a nationally important population of Black-headed Gull, but also Common Gull (330) and Herring Gull (348). Mediterranean Gull is also recorded from here, occurring through much of the year, but especially in late winter/spring and again in late summer into winter.

Both Common Tern and Arctic Tern breed in Dublin Docks, on a man-made mooring structure known as the E.S.B. dolphin – this is included within the site. Small numbers of Common Tern and Arctic Tern were recorded nesting on this dolphin in the 1980s. A survey of the dolphin in 1995 recorded Common Tern nesting here in nationally important numbers (52 pairs). The breeding population of Common Tern at this site has increased, with 216 pairs recorded in 2000. This increase was largely due to the ongoing management of the site for breeding terns. More recent data highlights this site as one of the most important Common Tern sites in the country with over 400 pairs recorded here in 2007.

South Dublin Bay is an important staging/passage site for a number of tern species in the autumn (mostly late July to September). The origin of many of the birds is likely to be the Dublin breeding sites (Rockabill and the Dublin Docks) though numbers suggest that the site is also used by birds from other sites, perhaps outside the state. This site is selected for designation for its autumn tern populations: Roseate Tern (2,000 in 1999), Common Tern (5,000 in 1999) and Arctic Tern (20,000 in 1996).

The South Dublin Bay and River Tolka Estuary SPA is of ornithological importance as it supports an internationally important population of Light-bellied Brent Goose and nationally important populations of a further nine wintering species. Furthermore, the site supports a nationally important colony of breeding Common Tern and is an internationally important passage/staging site for three tern species. It is of note that four of the species that regularly occur at this site are listed on Annex I of the E.U. Birds Directive, i.e. Bar-tailed Godwit, Common Tern, Arctic Tern and Roseate Tern.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CO. KILDARE
DUBLIN HARBOUR
DUBLIN
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DUBLIN BAY
Cuan Bhaile Átha Cliath
North Bull Wall
Breakwater
North Bull Lighthouse
Poolbeg Lighthouse
Clontarf
Ringsend
Irishtown
Sandymount Strand
South Bull
Sandymount
Ballsbridge
Ranelagh
Rathmines
Donnybrook
Merrion Strand
Merrion
Booterstown
Blackrock
An Charraig Dhubh
Dún Laoghaire
West Pier
East Pier
Legend
South Dublin Bay and River Tolka Estuary SPA 004024
SOUTH DUBLIN BAY AND RIVER TOLKA ESTUARY SPA CONSERVATION OBJECTIVES SPA DESIGNATION
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
SITE CODE: SPA 004024; version 2. CO. DUBLIN
0 0.5 1 1.5 2 km
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Map Version 1
Date: Nov 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).

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 and 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 by the Irish Brent Goose Research Group (IBGRG). The survey is currently conducted on a bi-annual basis during the month of October which coincides with the autumn arrival of the species. Data collected are integrated into the I-WeBS database.

APPENDIX 3

Analysing population trends: a synopsis

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

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

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

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

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

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

Un-smoothed indices are also calculated and provide a means of examining ('eye-balling') the variation across time and can also be used to provide a measure of the mean annual change over the entire period. However, the GAM extension to the methodology and resultant smoothed indices allows for the calculation of proportional change in population size between one season and another. This latter calculation is used in Section 4.2 whereby trends are calculated for the 'long-term' 14-year period (1995/96–2009/10) and the recent five-year period (2004/05-2009/10). 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 (2009):-

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

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 (2010) 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	Smoothed
1994	0.36	0.46
1995	0.81	0.53
1996	0.57	0.60
1997	0.67	0.67
1998	0.64	0.74
1999	0.91	0.79
2000	0.93	0.83
2001	0.87	0.86
2002	1.05	0.87
2003	1.00	0.87
2004	0.67	0.87
2005	0.92	0.88
2006	0.87	0.89
2007	1.24	0.91
2008	0.84	0.93
2009	1.10	0.96
2010	1.00	1.00

Term	Change
5YR	**10.51**
10YR	**21.56**
ALL YR	**83.57**

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*
UM	Unidentified Duck	
UU	Unidentified Gull	
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

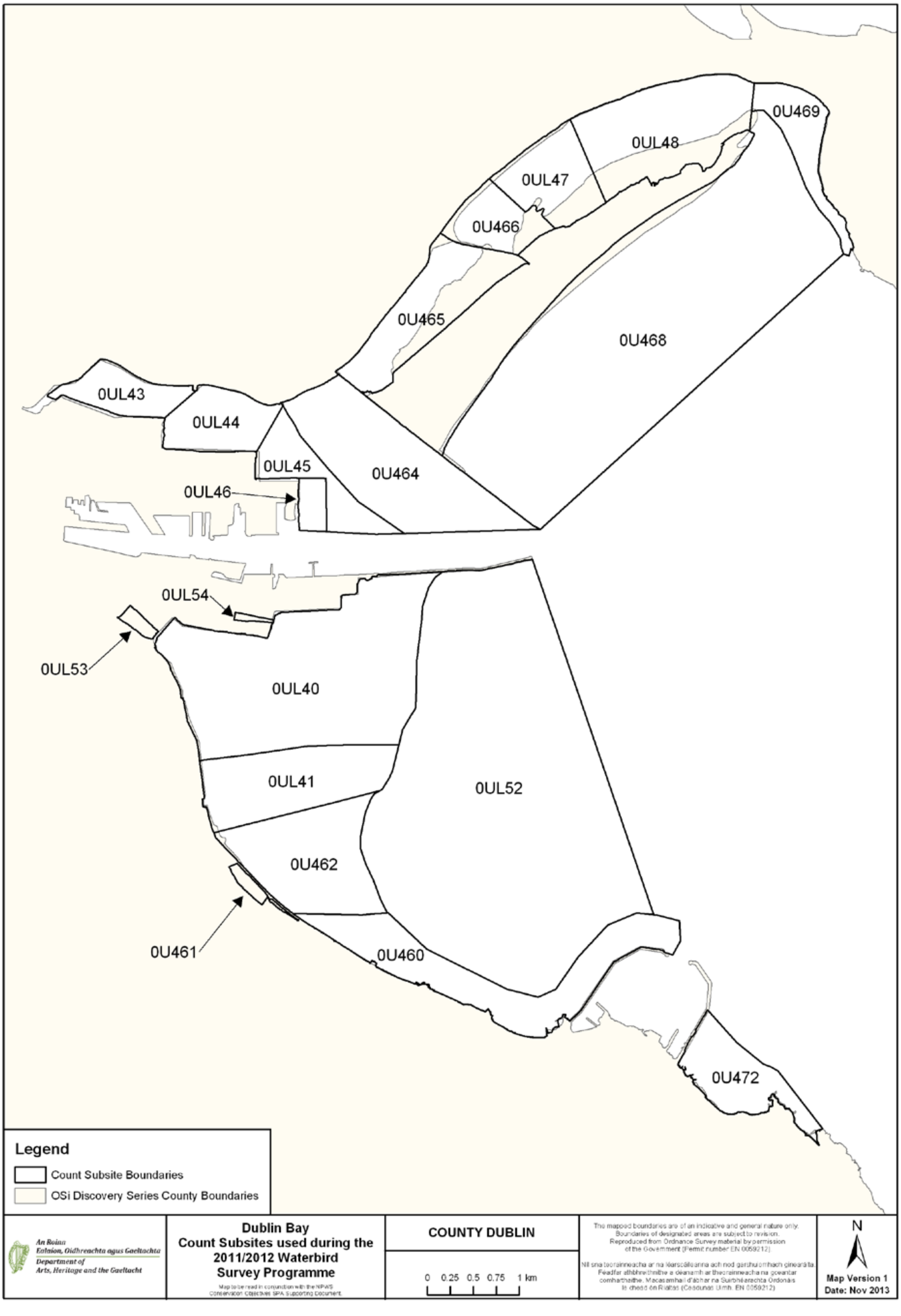
[a] dives <3m.

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

Dublin Bay – Waterbird Survey Programme 2011/12 – Count Subsites

Subsite Code	Subsite Name	Area (ha)
0U460	Dún Laoghaire - Seapoint	174
0U461	Booterstown	7
0U462	Booterstown - Merrion Gates	149
0U464	South of Wooden Bridge	205
0U465	Wooden Bridge - Causeway	122
0U466	North of Causeway (to saltmarsh)	55
0U468	Dollymount Strand (incl. open water)	786
0U469	Sutton-Dinghy Club	60
0U472	East Pier to Forty Foot	82
0UL40	Sandymount Strand North	397
0UL41	Sandymount Strand South	136
0UL43	Fairview Park	52
0UL44	Clontarf Baths	68
0UL45	Dublin Port	63
0UL46	Dublin Port Extension	17
0UL47	Kilbarrack	80
0UL48	Sutton Strand South	167
0UL52	South Dublin Bay-Outer	933
0UL53	Sean Moore Park	7
0UL54	Ringsend-Irishtown Park	2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0UL48
0UL47
0U466
0U465
0U468
0UL43
0UL44
0UL45
0U464
0UL46
0UL54
0UL53
0UL40
0UL41
0UL52
0U462
0U461
0U460
0U472
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundaries
An Roinn
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Department of
Arts, Heritage and the Gaeltacht
Dublin Bay
Count Subsites used during the
2011/2012 Waterbird
Survey Programme
Map to be read in conjunction with the NPWS
Conservation Objectives SPA Supporting Document.
COUNTY DUBLIN
0 0.25 0.5 0.75 1 km
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Boundaries of designated areas are subject to revision.
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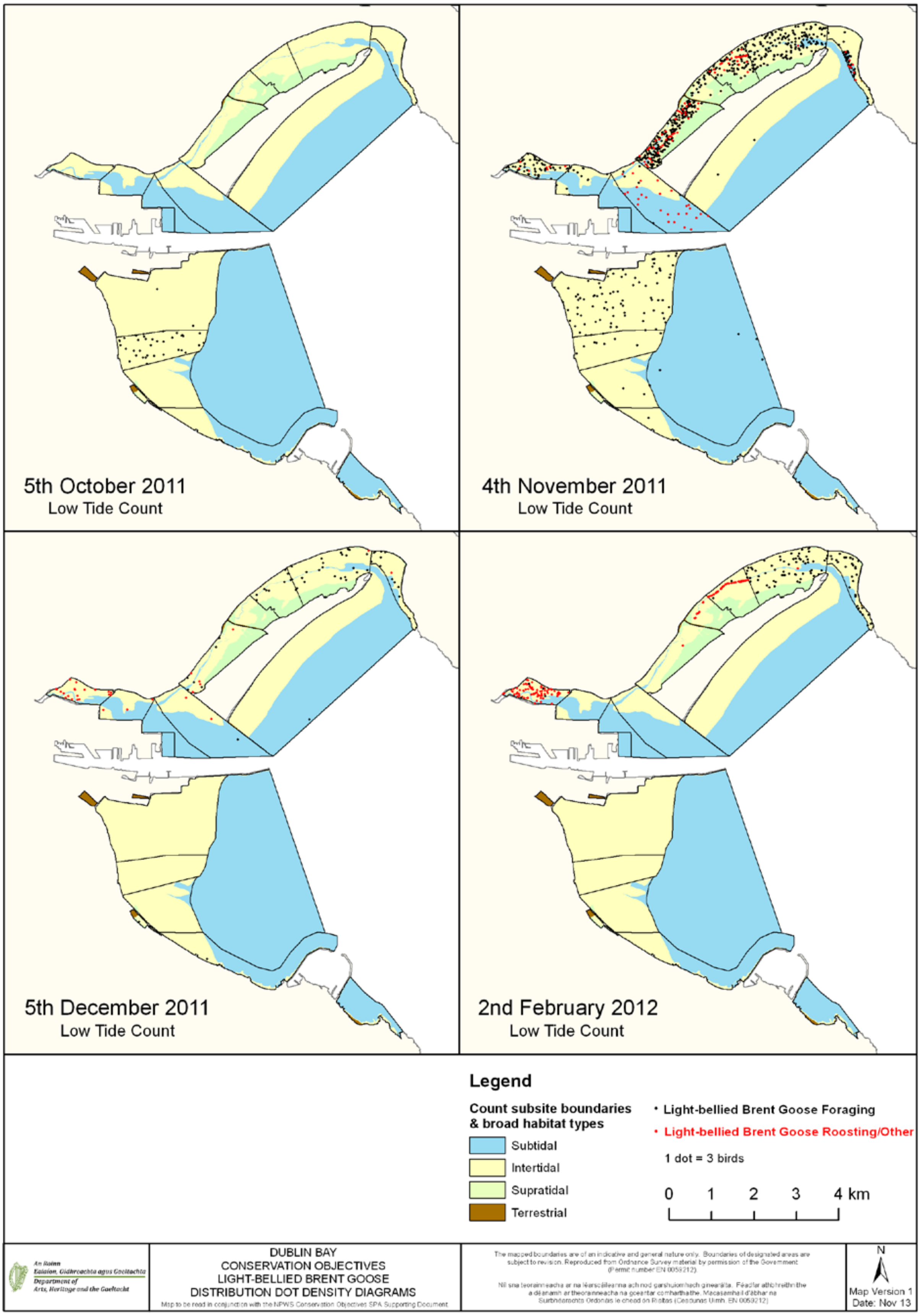
of the Government (Permit number EN 0059212)
Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta.
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis
le chead ón Rialtas (Ceadúnas Uimh. EN 0059212)
N
Map Version 1
Date: Nov 2013

APPENDIX 7

Dublin Bay

Waterbird distribution (dot-density diagrams) recorded during low tide surveys (October 2011 – February 2012)

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


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries
& broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Light-bellied Brent Goose Foraging
Light-bellied Brent Goose Roosting/Other
1 dot = 3 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
LIGHT-BELLIED BRENT GOOSE
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
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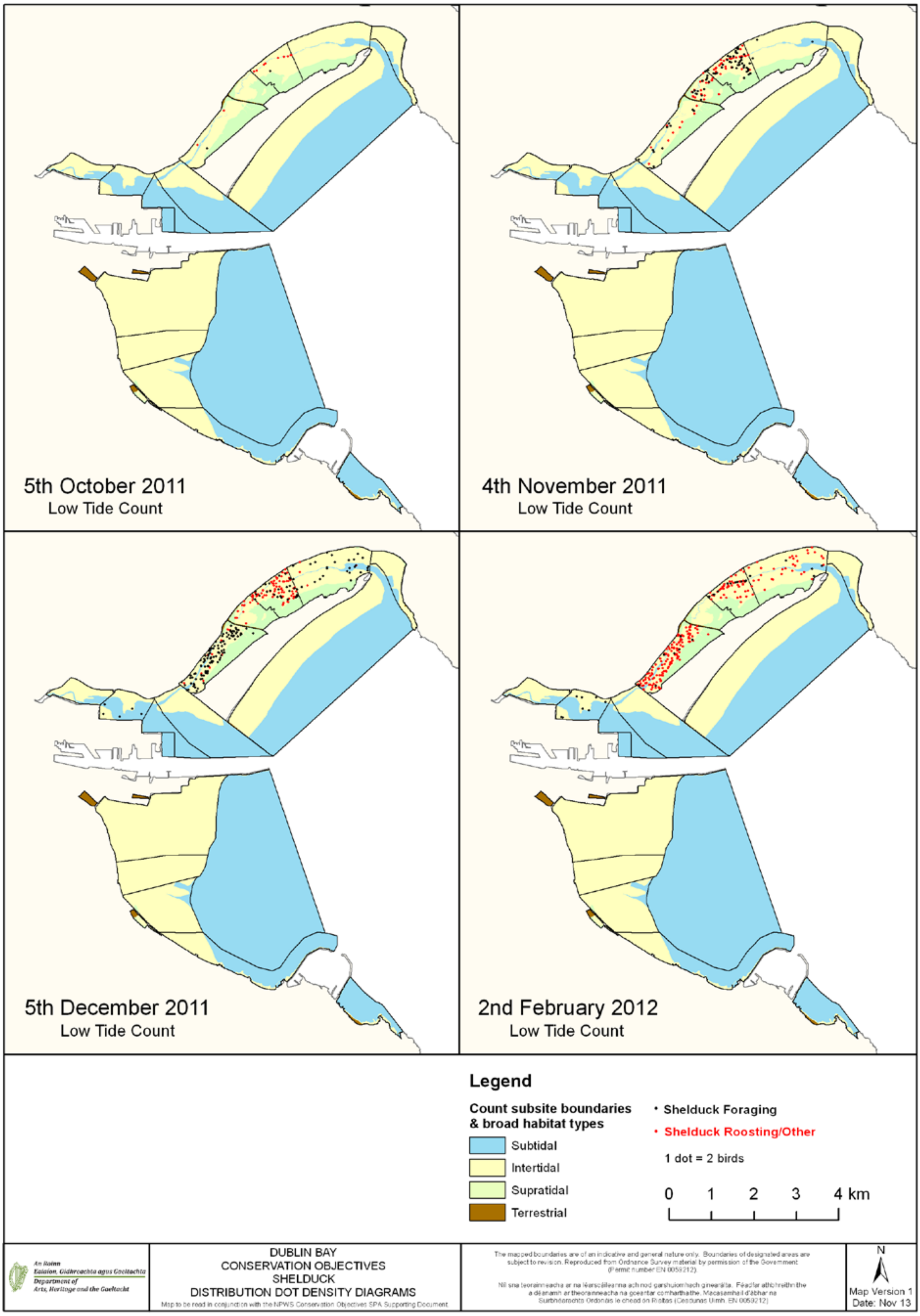
Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordanáis le chead ón Rialtas (Ceadunas Uimh. EN 0059212)
N
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries
& broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Shelduck Foraging
Shelduck Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
An Roinn
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Department of
Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
SHELDUCK
DISTRIBUTION DOT DENSITY DIAGRAMS
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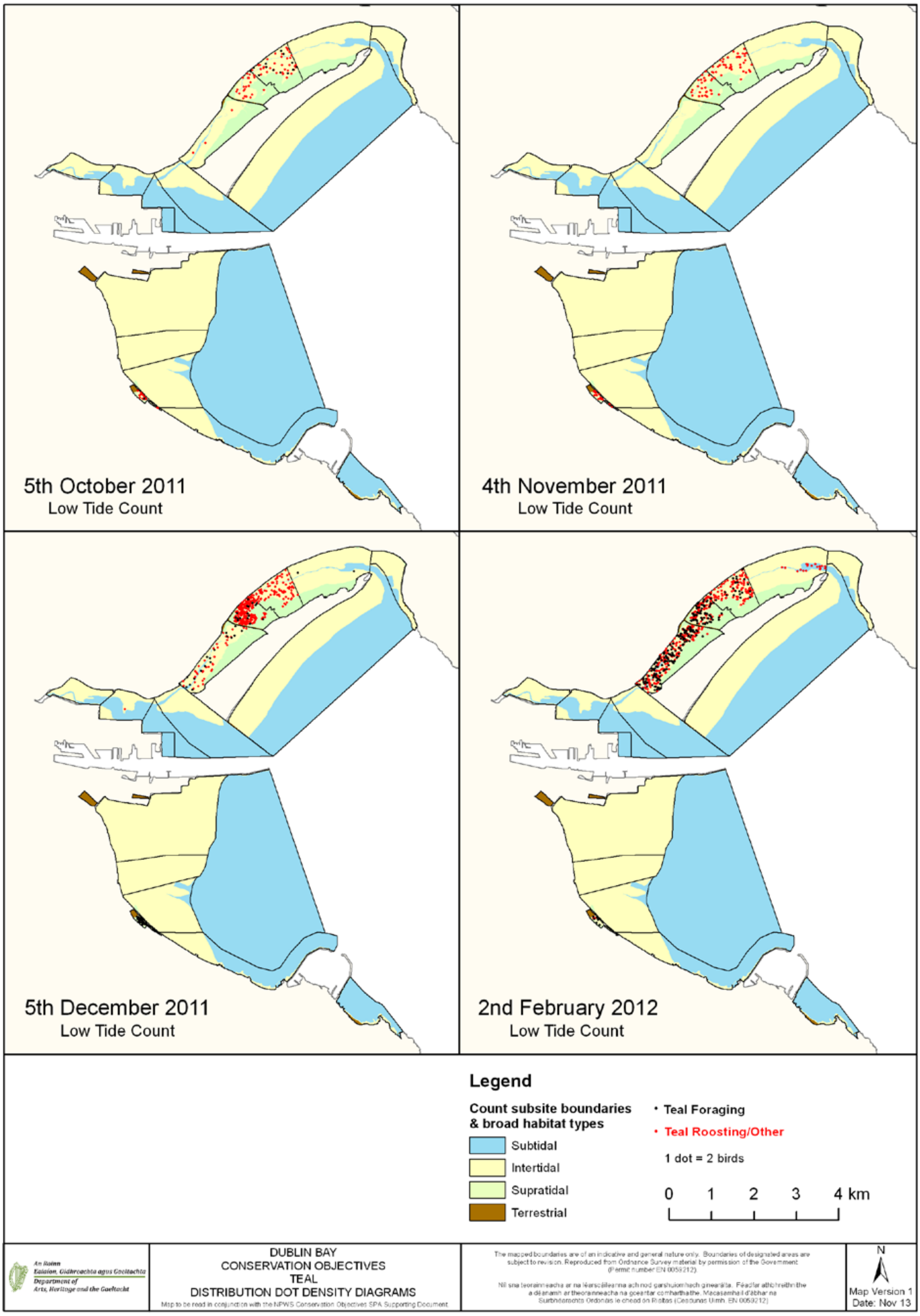
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries
& broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Teal Foraging
Teal Roosting/Other
1 dot = 2 birds
0
1
2
3
4 km
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DUBLIN BAY
CONSERVATION OBJECTIVES
TEAL
DISTRIBUTION DOT DENSITY DIAGRAMS
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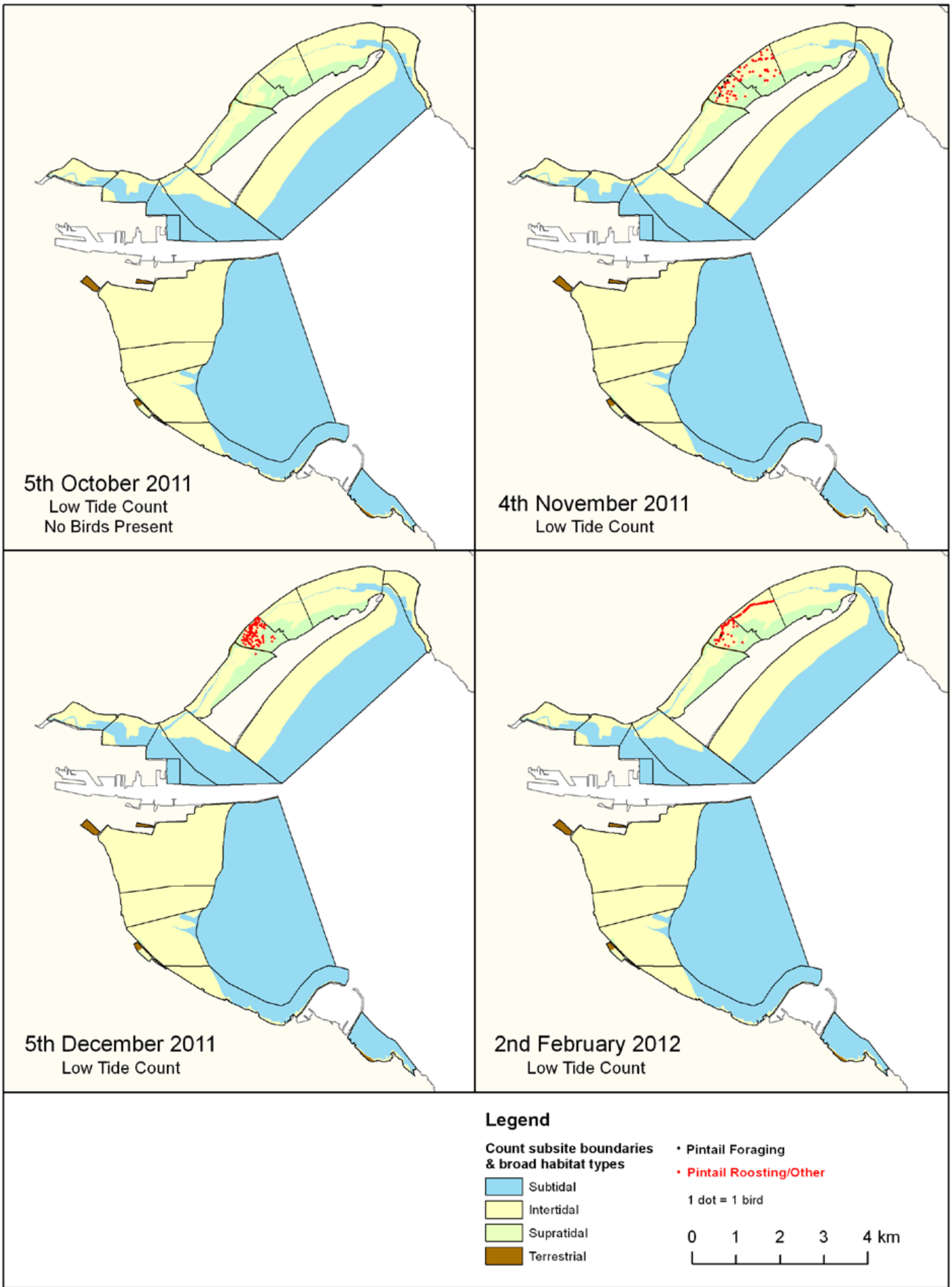
Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadunas Uimh. EN 0059212)
N
Map Version 1
Date: Nov 13



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DUBLIN BAY
CONSERVATION OBJECTIVES
PINTAIL
DISTRIBUTION DOT DENSITY DIAGRAMS

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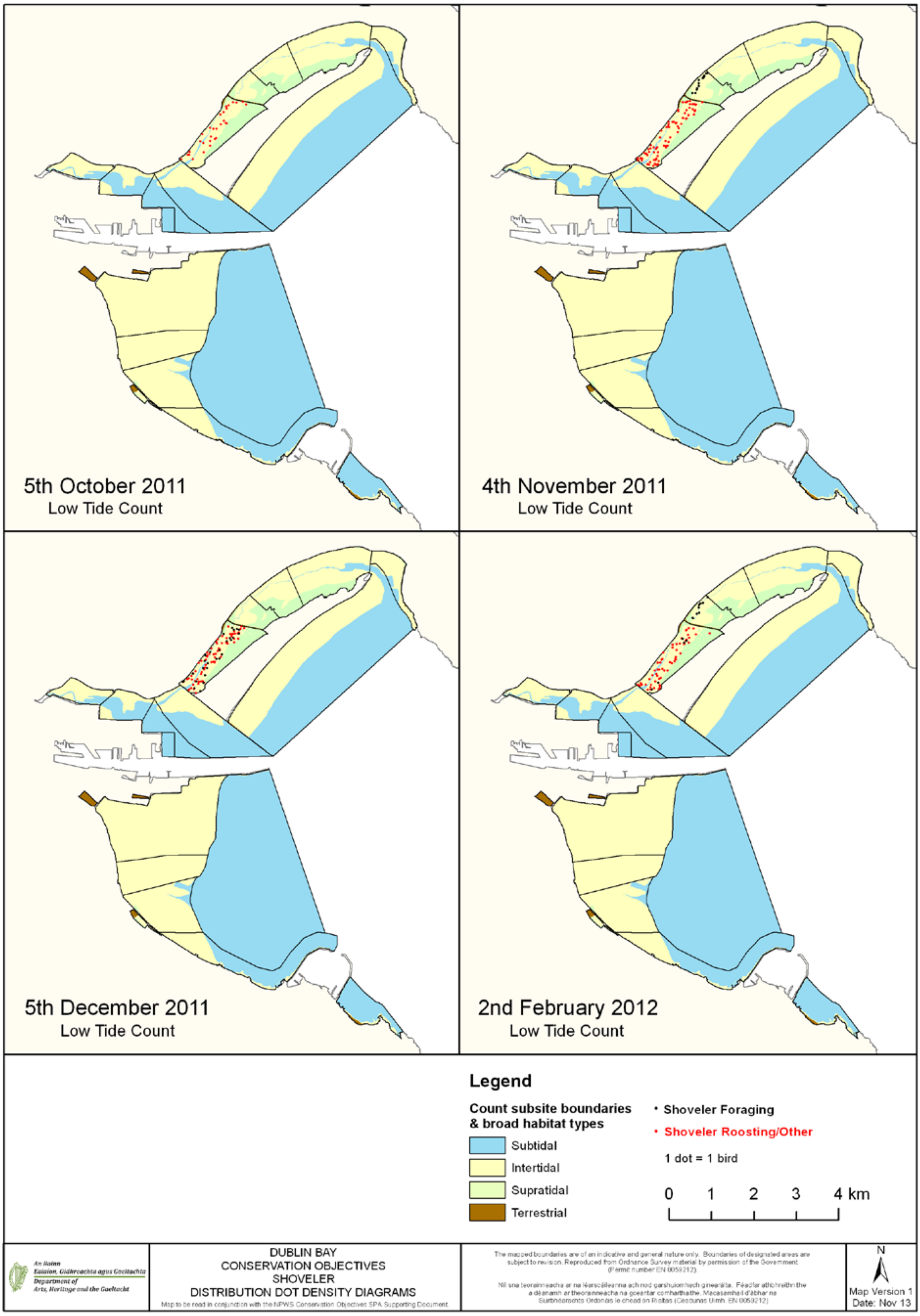
Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordanáis le chead ón Rialtas (Ceadunas Uimh. EN 0059212)

Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Shoveler Foraging
Shoveler Roosting/Other
1 dot = 1 bird
0 1 2 3 4 km
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DUBLIN BAY
CONSERVATION OBJECTIVES
SHOVELER
DISTRIBUTION DOT DENSITY DIAGRAMS
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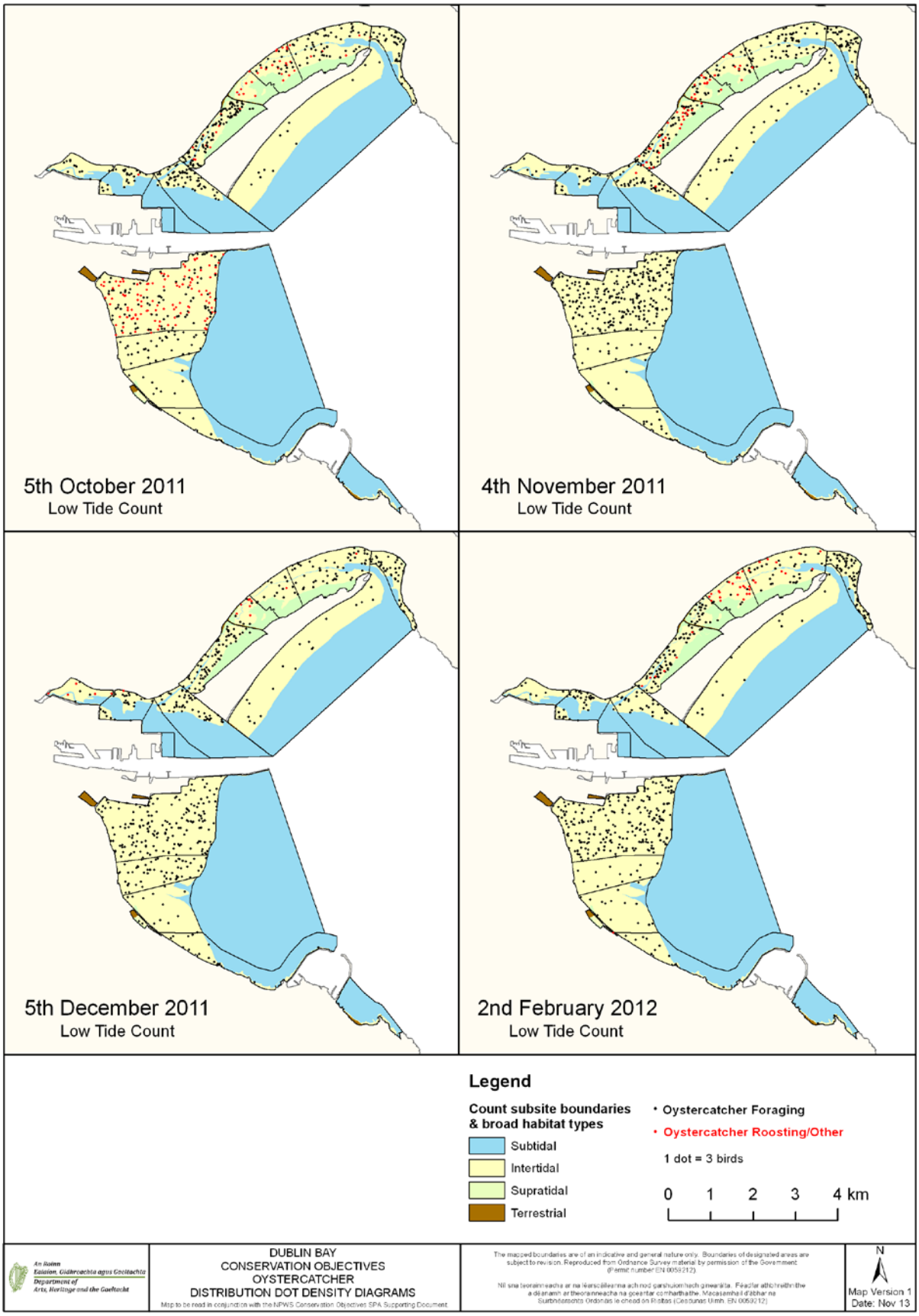
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Oystercatcher Foraging
Oystercatcher Roosting/Other
1 dot = 3 birds
0 1 2 3 4 km
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DUBLIN BAY
CONSERVATION OBJECTIVES
OYSTERCATCHER
DISTRIBUTION DOT DENSITY DIAGRAMS
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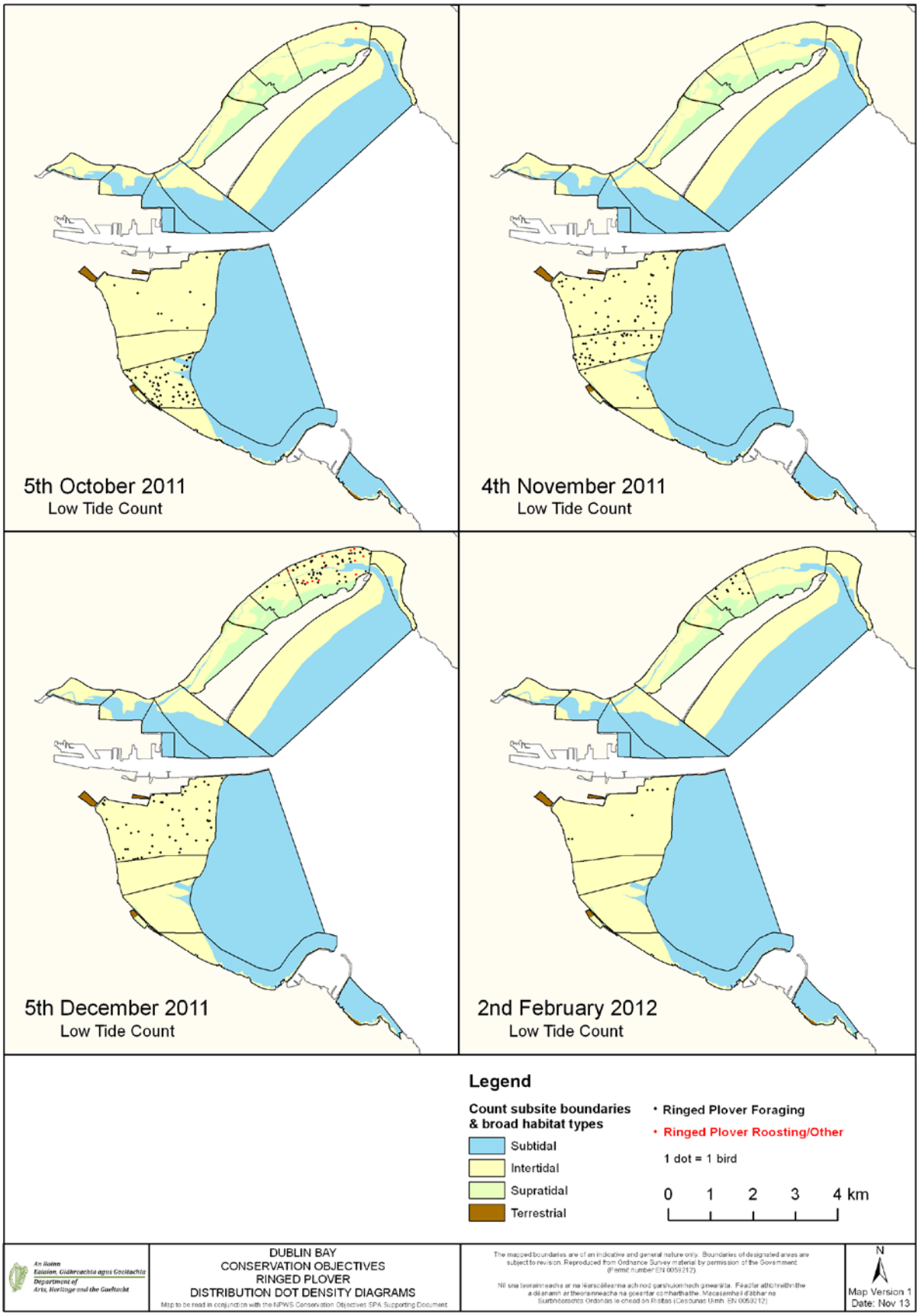
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Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Ringed Plover Foraging
Ringed Plover Roosting/Other
1 dot = 1 bird
0 1 2 3 4 km
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DUBLIN BAY
CONSERVATION OBJECTIVES
RINGED PLOVER
DISTRIBUTION DOT DENSITY DIAGRAMS
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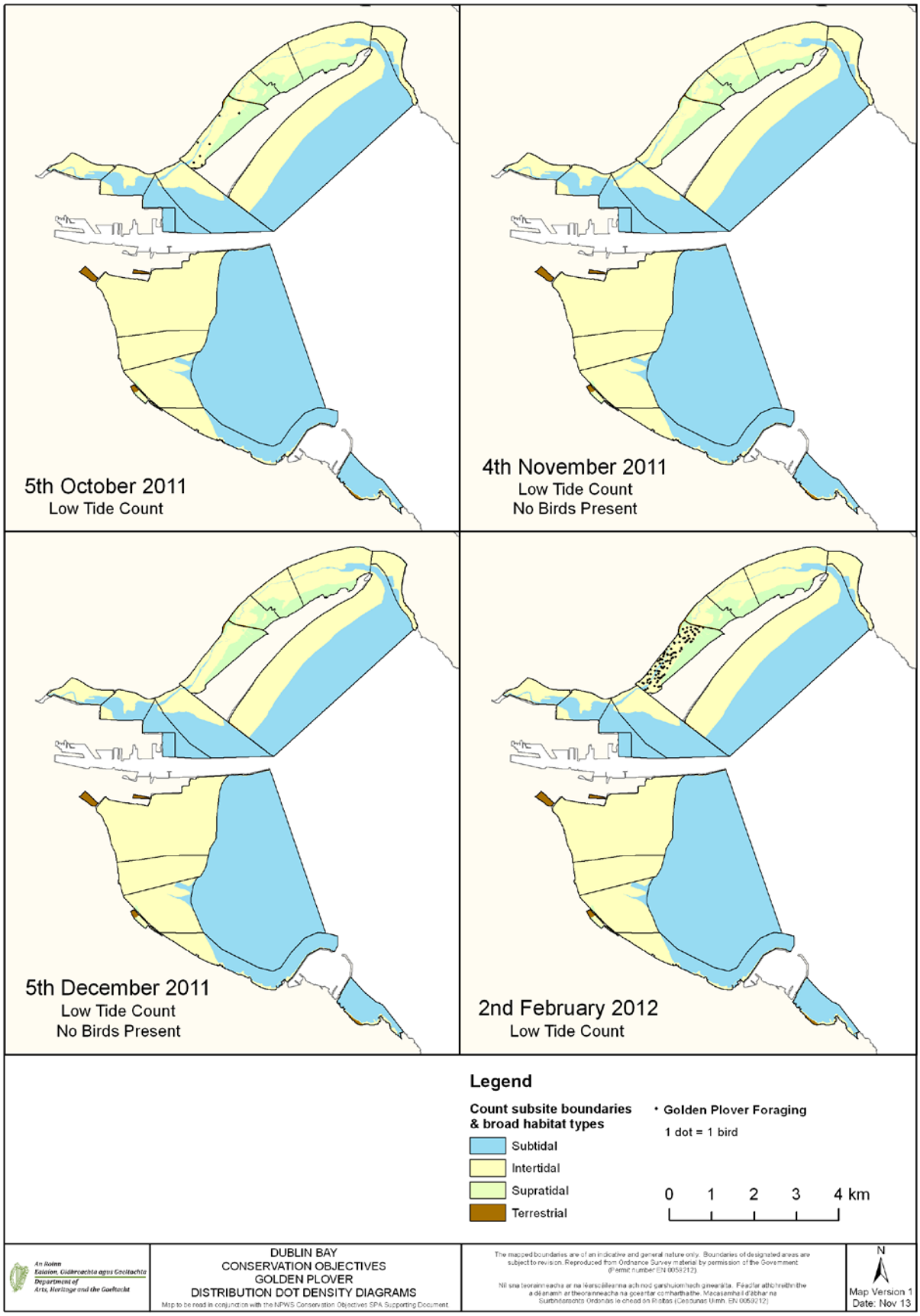
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
No Birds Present
5th December 2011
Low Tide Count
No Birds Present
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Golden Plover Foraging
1 dot = 1 bird
0 1 2 3 4 km
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DUBLIN BAY
CONSERVATION OBJECTIVES
GOLDEN PLOVER
DISTRIBUTION DOT DENSITY DIAGRAMS
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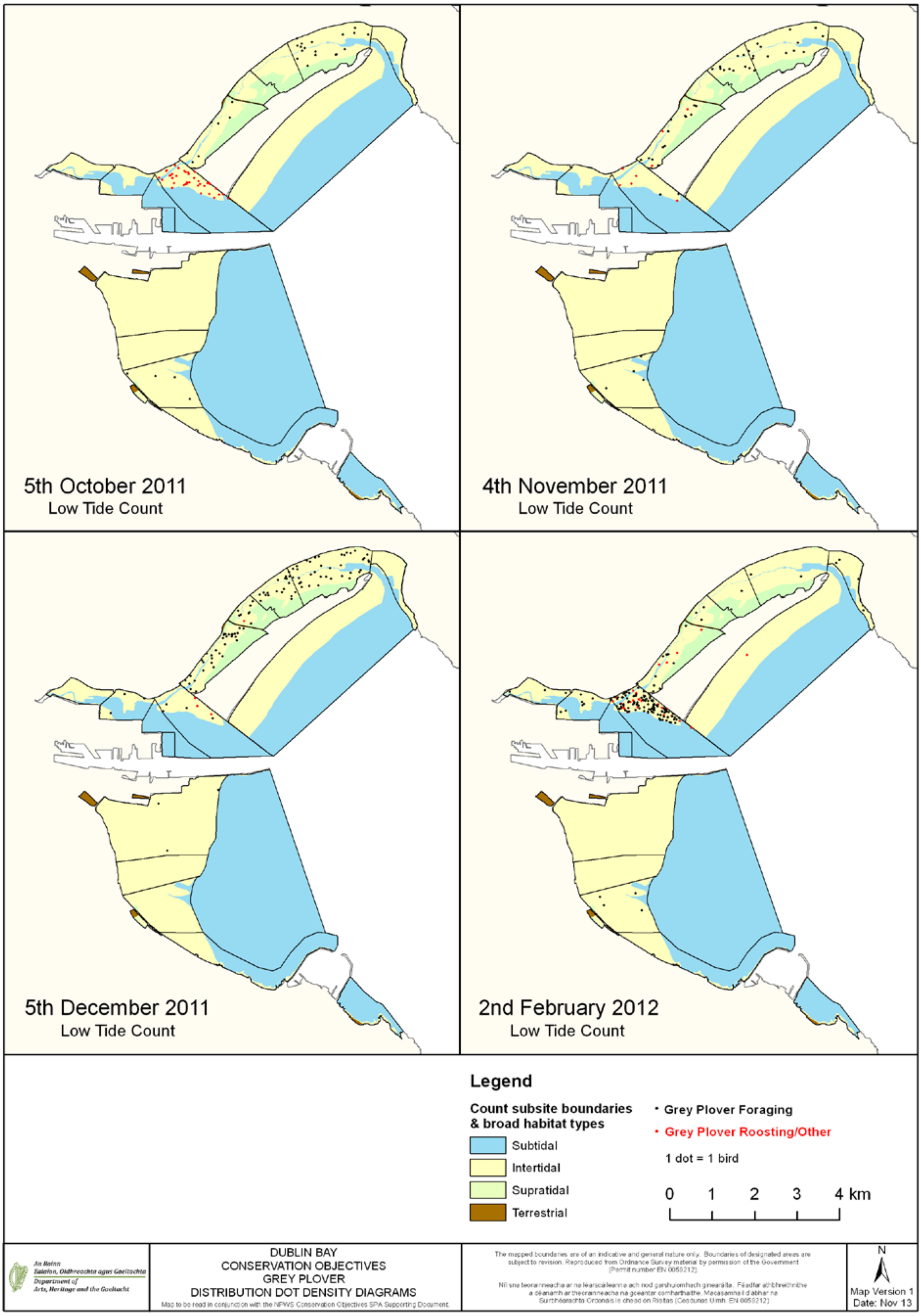
5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries
& broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Grey Plover Foraging
Grey Plover Roosting/Other
1 dot = 1 bird
0 1 2 3 4 km
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DUBLIN BAY
CONSERVATION OBJECTIVES
GREY PLOVER
DISTRIBUTION DOT DENSITY DIAGRAMS
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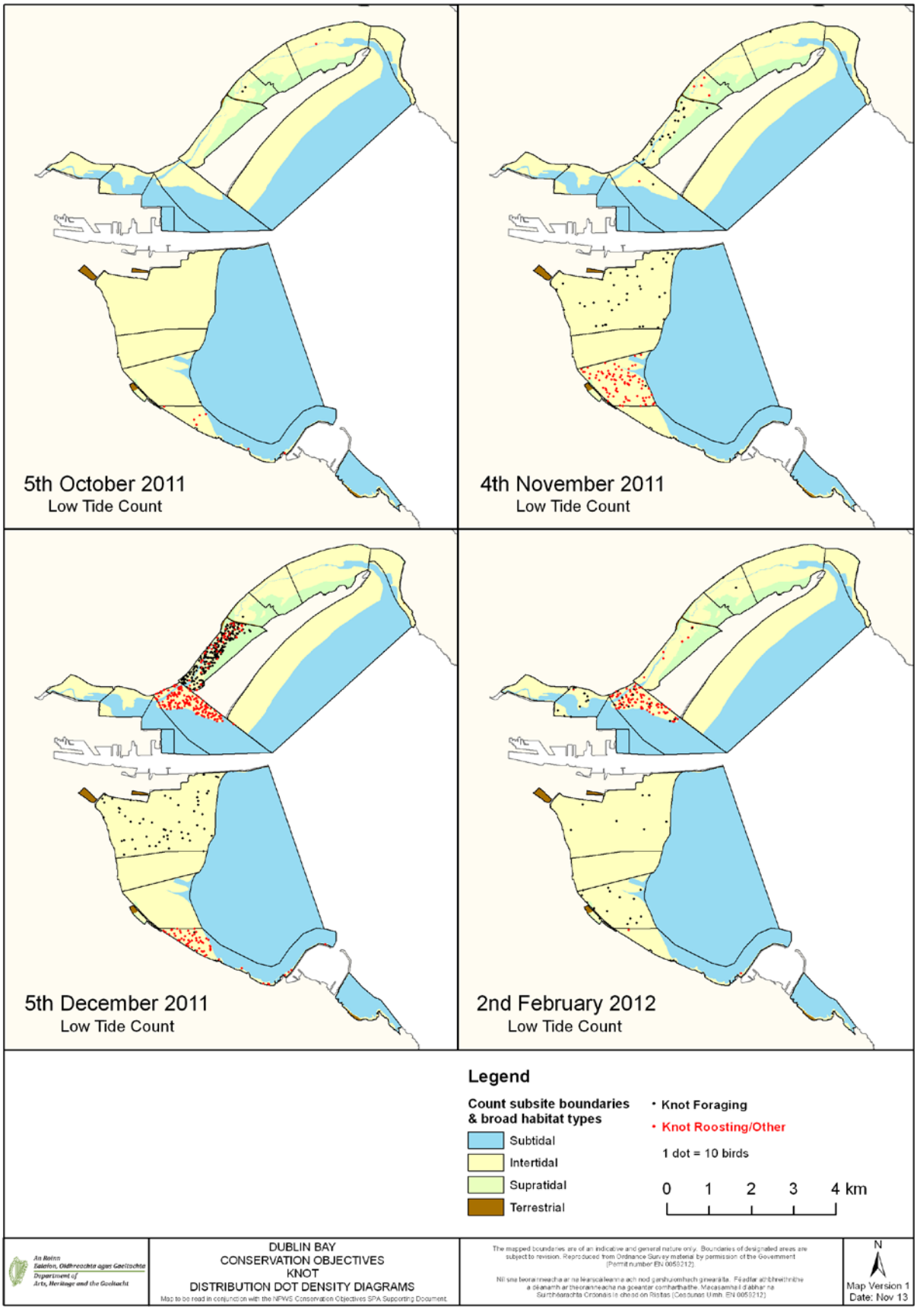
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Knot Foraging
Knot Roosting/Other
1 dot = 10 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
KNOT
DISTRIBUTION DOT DENSITY DIAGRAMS
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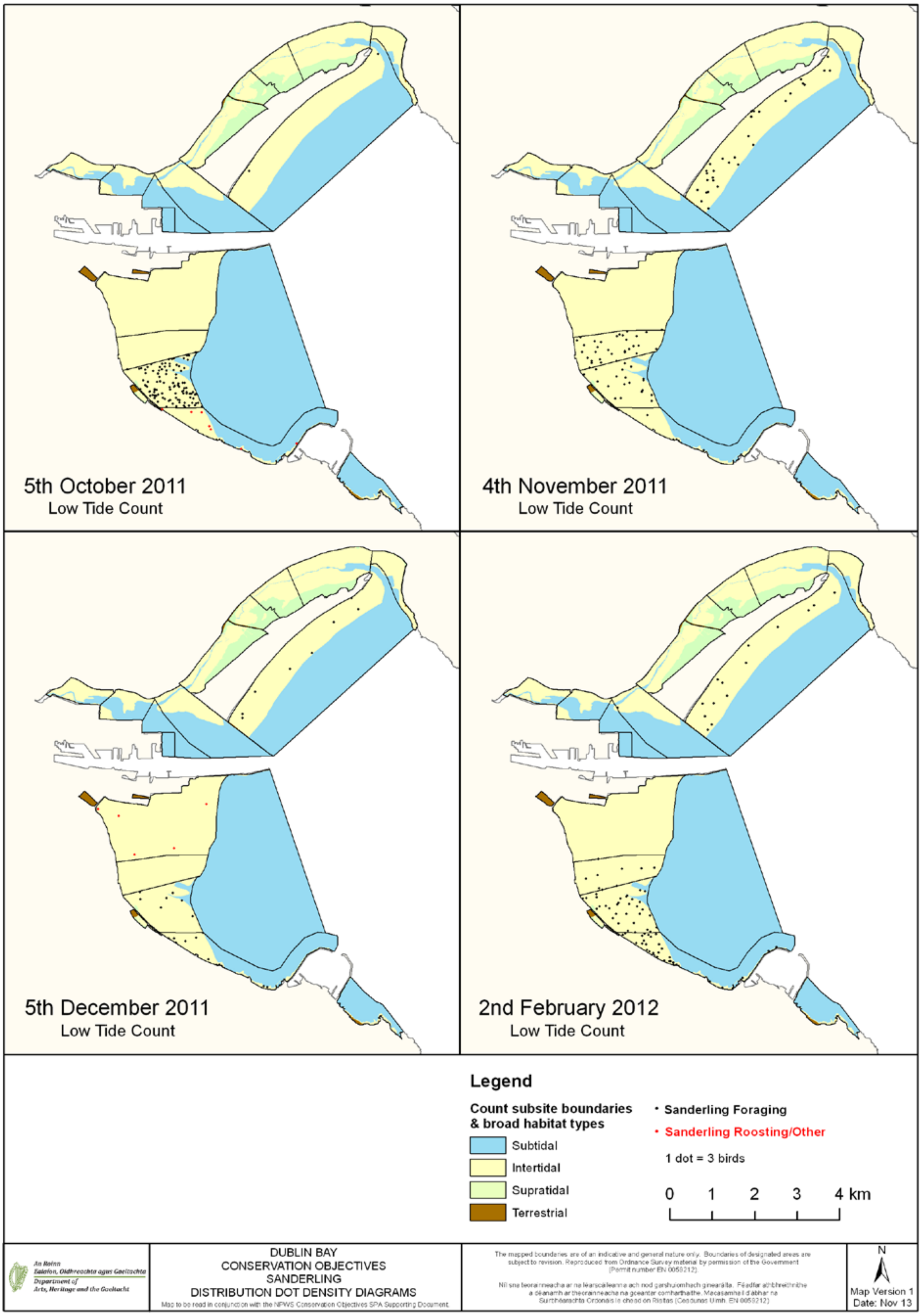
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Sanderling Foraging
Sanderling Roosting/Other
1 dot = 3 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
SANDERLING
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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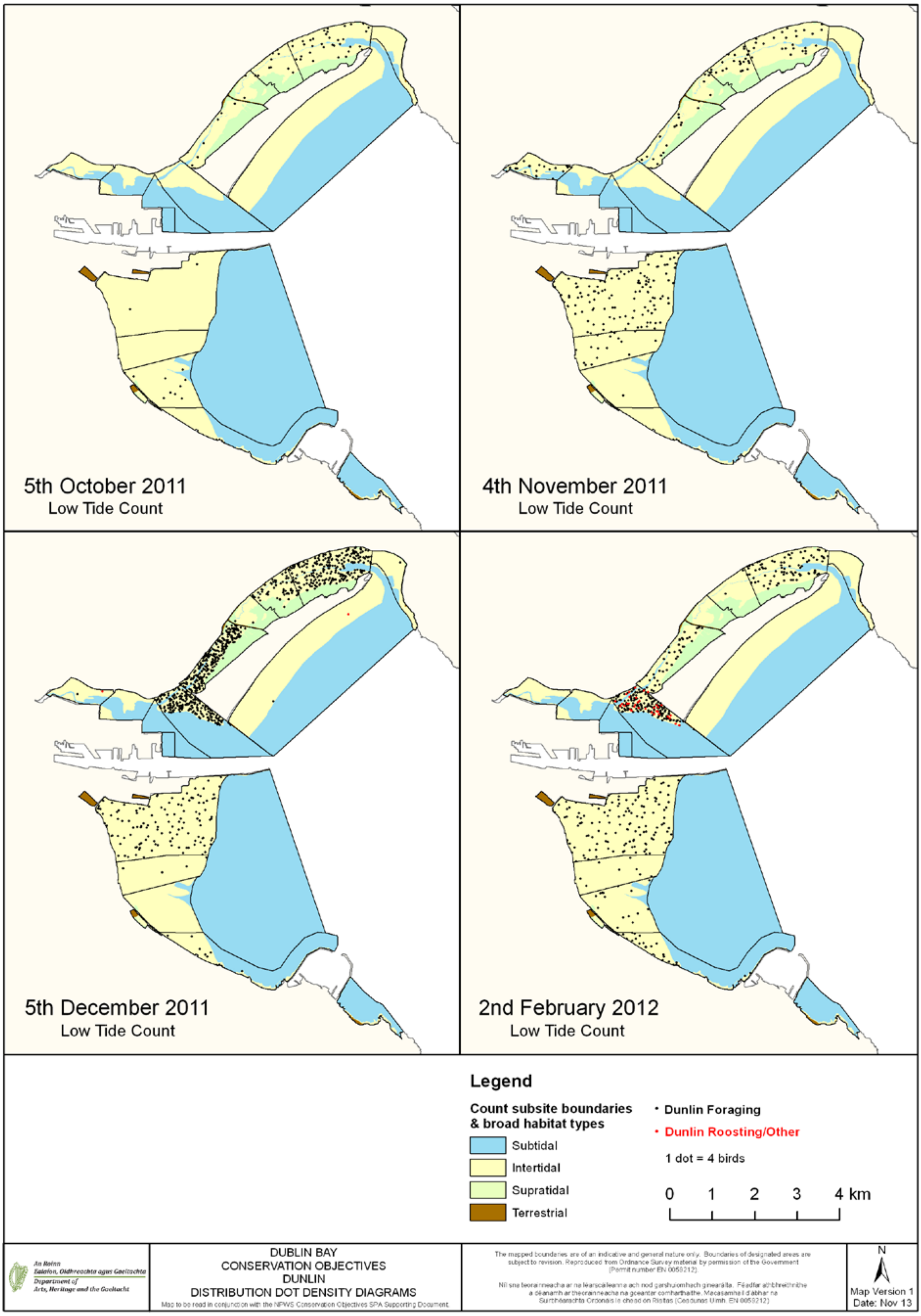
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Dunlin Foraging
Dunlin Roosting/Other
1 dot = 4 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
DUNLIN
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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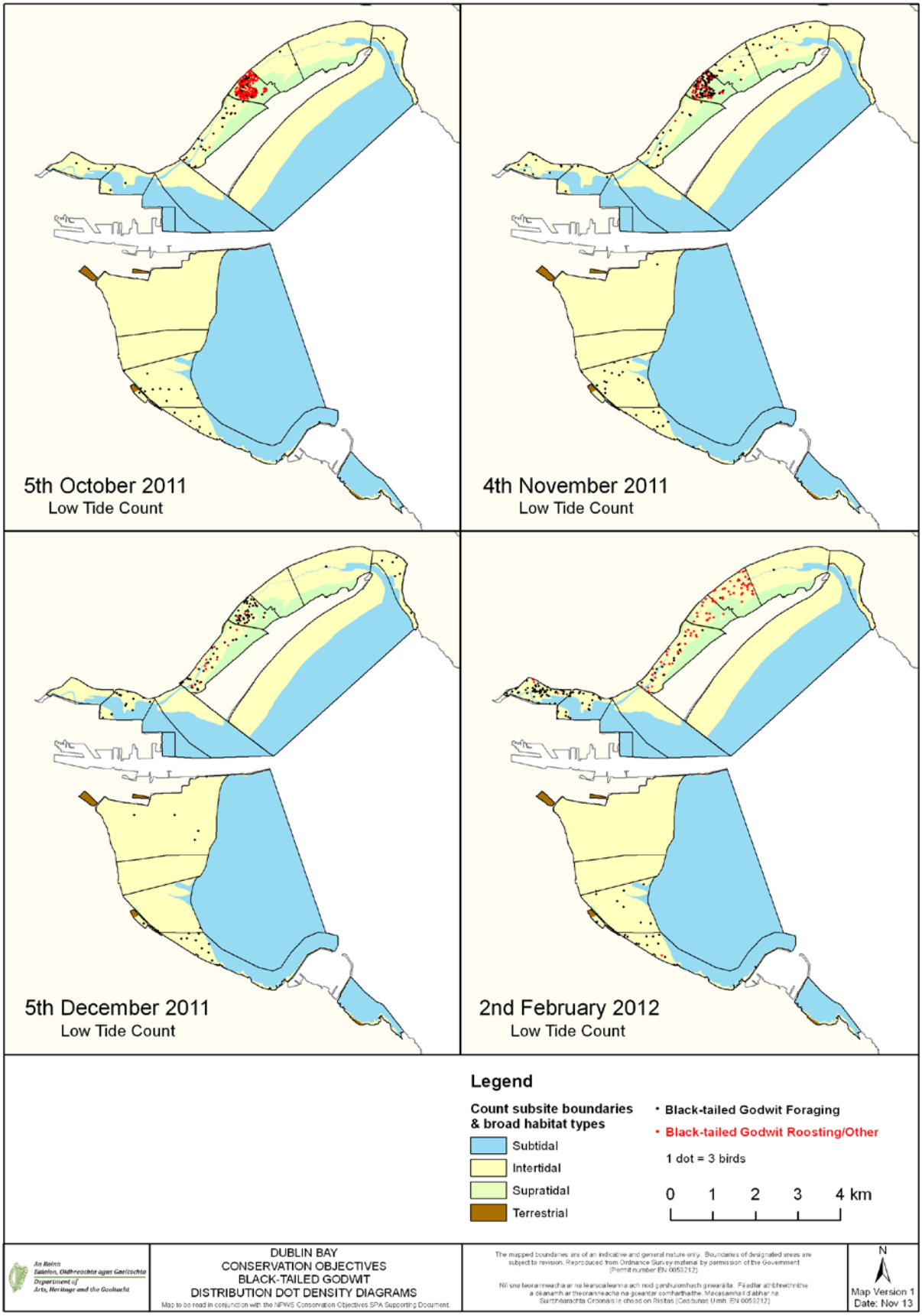
N
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Black-tailed Godwit Foraging
Black-tailed Godwit Roosting/Other
1 dot = 3 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
BLACK-TAILED GODWIT
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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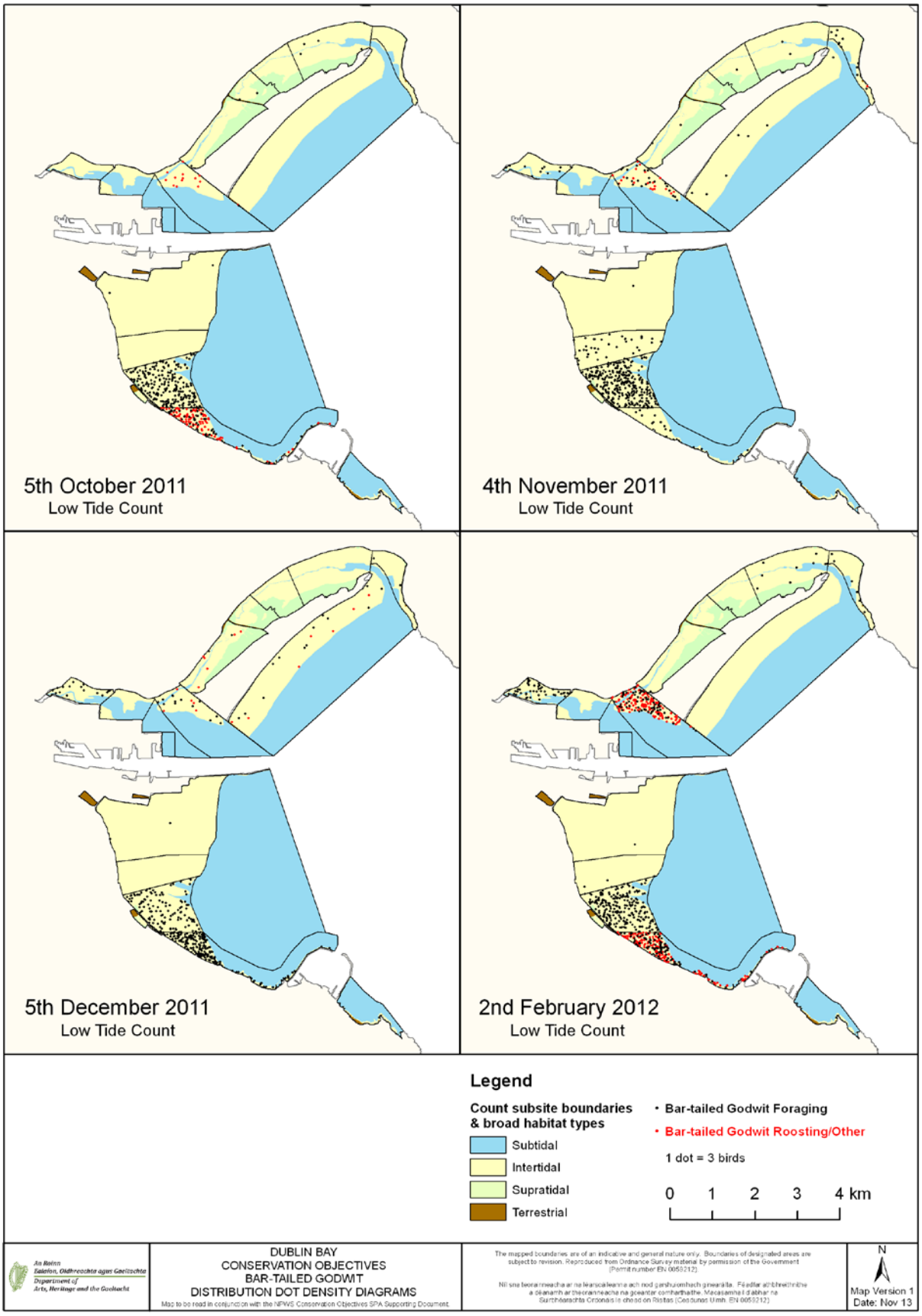
Nil sna teorainneacha ar na feanscaileanna ach mod ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail dáibhar na Suirbhéireachta Ordanáis le cheadúnas Rialtais (Ceadúnas Uimh. EN 0055212).
N
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Bar-tailed Godwit Foraging
Bar-tailed Godwit Roosting/Other
1 dot = 3 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
BAR-TAILED GODWIT
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
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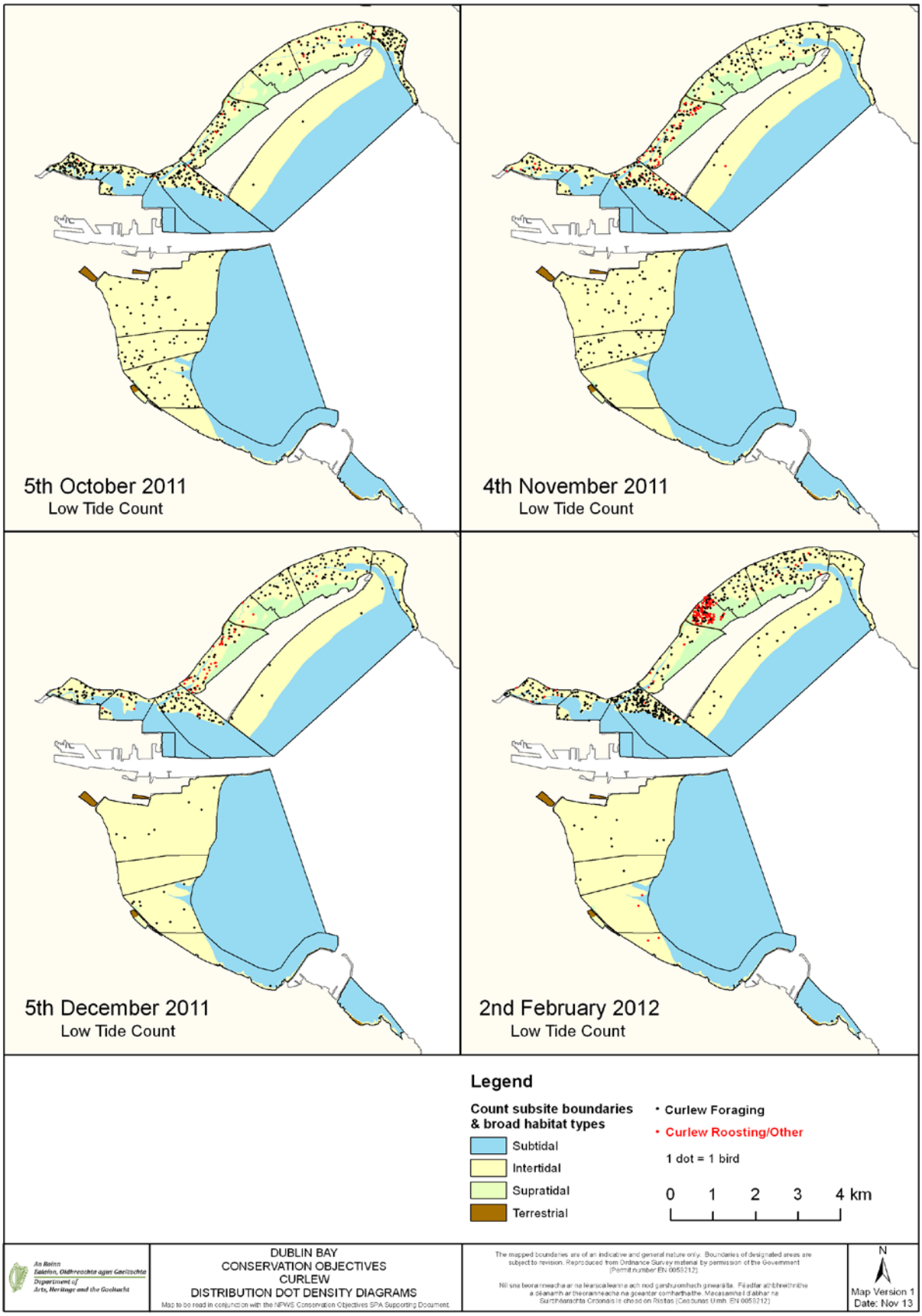
N
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Curlew Foraging
Curlew Roosting/Other
1 dot = 1 bird
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
CURLEW
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
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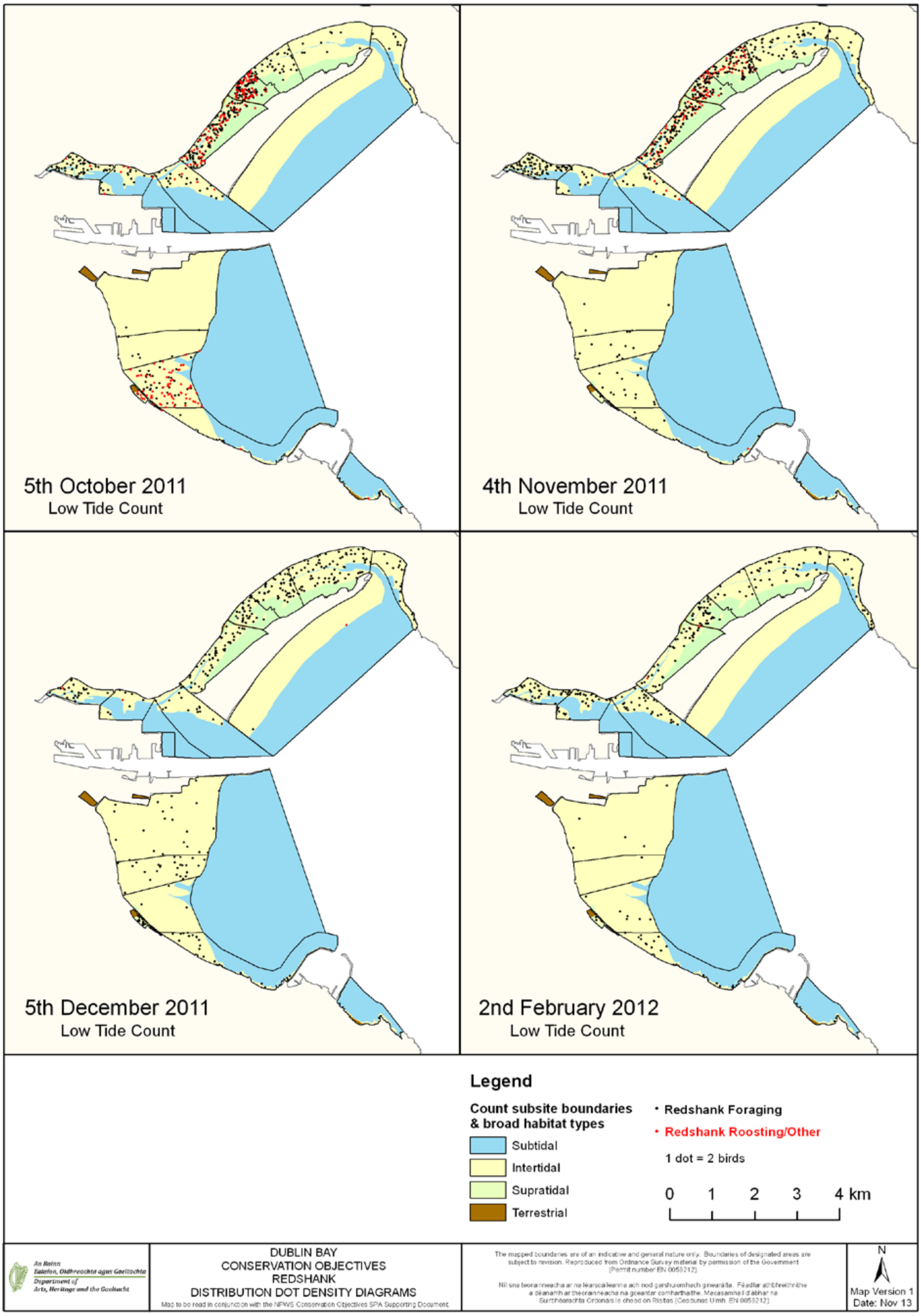
N
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Redshank Foraging
Redshank Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
REDSHANK
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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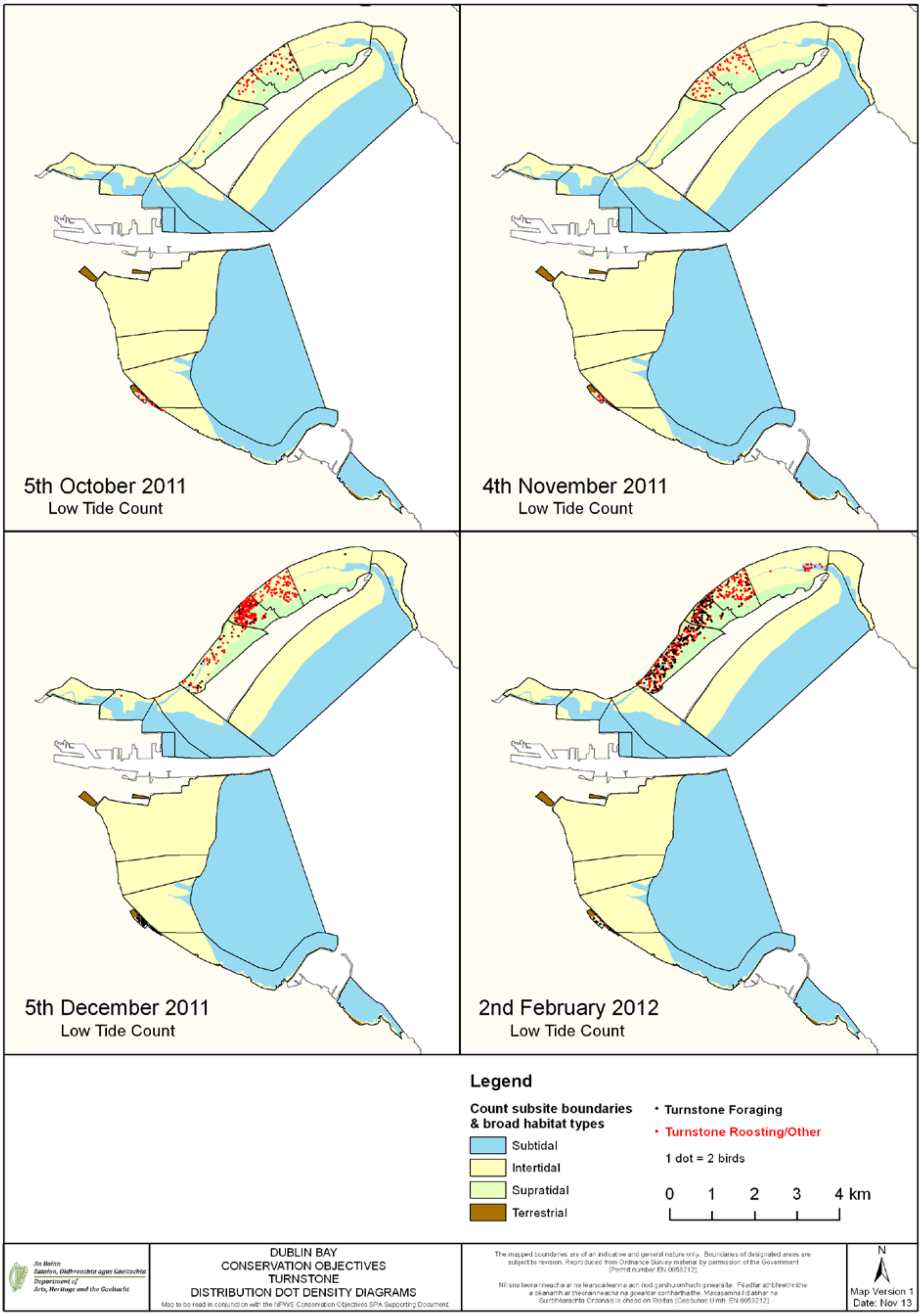
N
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Turnstone Foraging
Turnstone Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
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Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
TURNSTONE
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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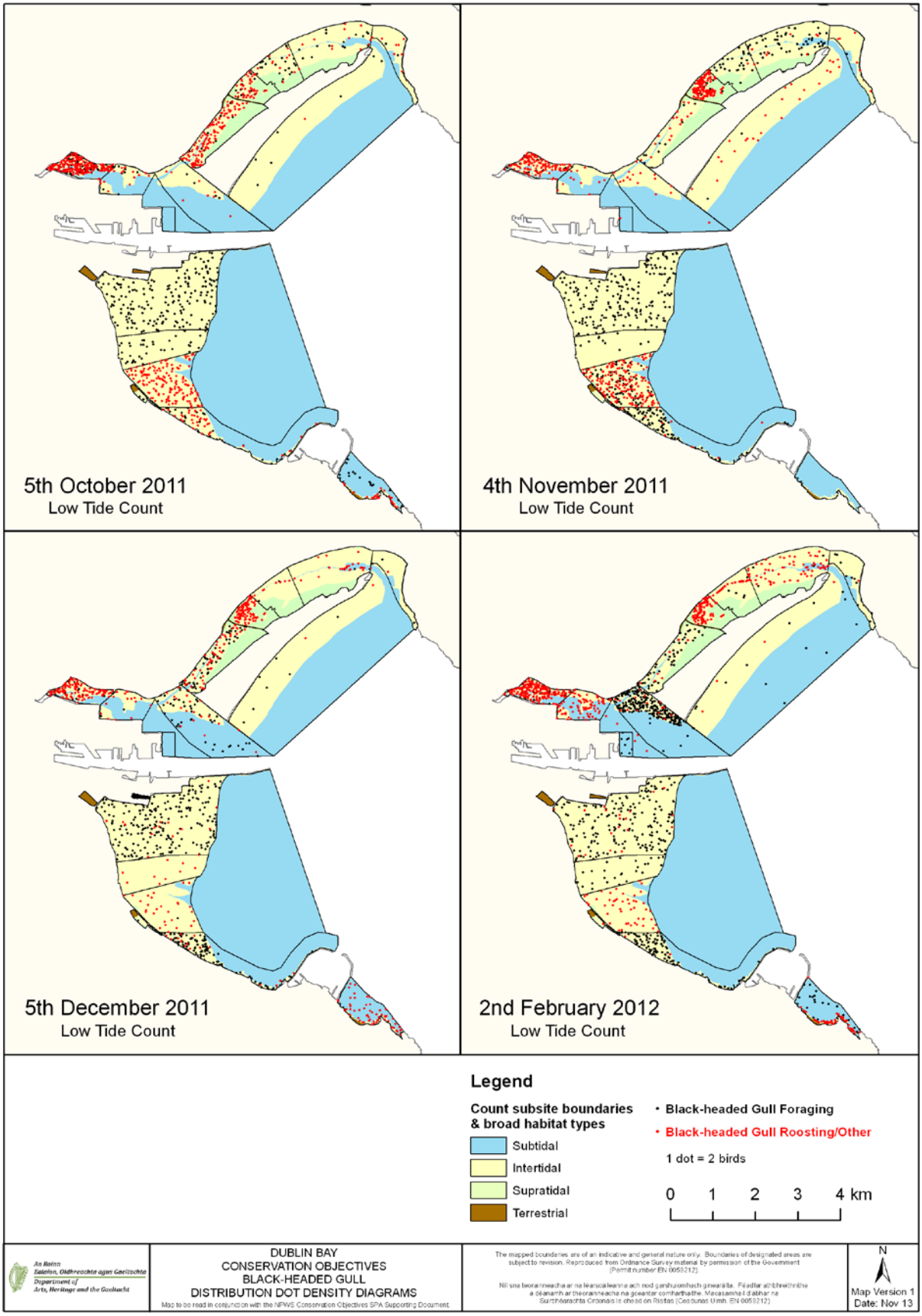
N
Map Version 1
Date: Nov 13


5th October 2011
Low Tide Count
4th November 2011
Low Tide Count
5th December 2011
Low Tide Count
2nd February 2012
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
• Black-headed Gull Foraging
• Black-headed Gull Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUBLIN BAY
CONSERVATION OBJECTIVES
BLACK-HEADED GULL
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0055212).
Nil sna teorainneacha ar na leanscaileanna ach mod ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comhartha dhe. Macasamhail d'ábhar na Suirbhéireachta Ordanáis le cead ón Rialtas (Ceadúnas Uimh. EN 0055212)
N
Map Version 1
Date: Nov 13

APPENDIX 8

Dublin Bay – Roost data

Roost maps show the positions of roosts recorded on the two roost survey dates (25/11/11 and 21/02/12). Several large roosts are known to occur amongst saltmarsh along the northern (inner) side of Bull Island. Roosting birds are obscured from view once they have entered the roosts, so in these areas the field observation period started up to two hours prior to high tide, to enable birds to be counted and the positions of roosts to be identified, as the birds entered the roost. The start and end time of all roost observations were recorded. This enabled roosts to be mapped according to the time in relation to high tide as follows:-

Stage 1: HT - (90 minute period before Stage 2 (HT));
Stage 2: HT (60 minute period with HT in the middle);
Stage 3: HT + (90 min period after Stage 2 (HT)).

Not all count areas were subject to prolonged periods of observation so while these data are useful to highlight cases where a roost was recorded over a prolonged period, it should not be inferred that roosts mapped only once were present in one tidal stage only (birds may have been present at a later stage but simply not recorded then)

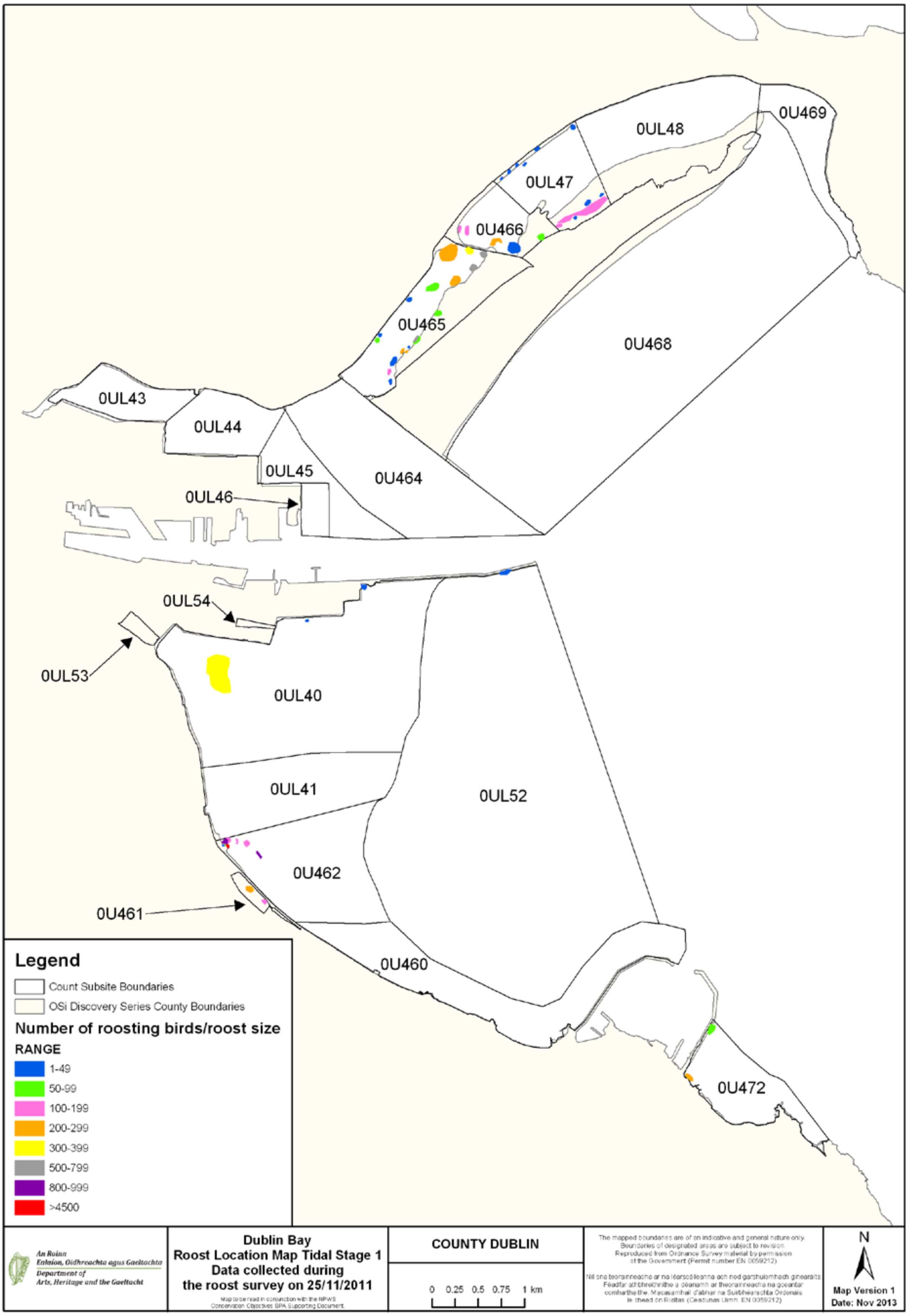
All counts should be treated as best estimates, particularly in the case of subsites on the inner (landward) side of Bull island where large numbers of birds roost in saltmarsh and are often obscured from view, precluding accurate counts.

(1a) Summary data and roost location maps from the roost survey 25th November 2011
(Please see Sections 5.3.1 and 5.3.2 for further details on methods/limitations)

Subsite Code	No. roost locations	No. species	Species (alphabetical order)
0U460	7	9	BH, CA, CM, DN, HG, OC, RK, SA, TT
0U461	2	6	BH, BW, DN, GK, H., RK
0U462	8	16	BA, BH, CM, CU, DN, GB, GV, HG, KN, L., MU, OC, PB, RK, SU, TT
0U464	5	2	BH, RM
0U465	23	22	BH, BW, CM, CU, DN, ET, GK, GV, H., HG, KN, L., MA, OC, PB, PT, RK, SU, SV, T., TT, WN
0U466	6	12	BA, BH, BW, CM, CU, DN, ET, GV, HG, KN, L., RK
0U468	8	10	BH, CA, CM, GB, HG, MU, OC, RM, SA, TT
0U469	4	7	BH, CM, GK, HG, OC, RK, TT
0U472	4	11	BH, CM, DN, GB, HG, MU, OC, RK, RP, SA, TT
0UL40	4	6	BA, BH, DN, OC, RP, TT
0UL41	-	-	
0UL43	9	11	BH, BW, CA, CM, H., HG, LB, MA, PB, RK, TT
0UL44	4	6	BH, CM, GB, HG, PB, T.
0UL45	1	1	RK
0UL46			
0UL47	11	9	CU, DN, ET, LG, MA, RK, SU, T., TT
0UL48	9	9	BH, CU, ET, GK, H., OC, RK, RM. TT
0UL52	1	3	DN, PS, TT
0UL53	-	-	
0UL54	-	-	

(1b) SCI species and recorded roosts 25/11/11 - shows number of roost locations within each subsite, and in brackets, the peak number recorded at a single roost location

Subsite Code	PB	SU	PT	SV	OC	GV	KN	DN	BW	BA	RK	TT	T.	RP	CU	BH
0U460					2 (37)			1 (300)			1 (1)	1 (3)				5 (10)
0U461								1 (200)	1 (12)		1 (40)					1 (118)
0U462	1 (7)	1 (3)			3 (900)	2 (12)	2 (1500)	3 (1100)		2 (1400)	1 (41)	1 (5)			1 (10)	2 (121)
0U464																4 (10)
0U465	7 (330)	7 (152)	1 (7)	4 (10)	7 (425)	3 (160)	6 (100)	4 (200)	2 (40)		8 (192)	5 (95)	3 (60)		5 (97)	6 (102)
0U466						1 (90)	1 (50)	2 (400)	3 (180)	1 (1)	2 (160)				1 (1)	2 (81)
0U468					1 (3)							1 (2)				4 (59)
0U469					1 (20)						1 (3)	2 (8)				2 (19)
0U472					1 (6)			1 (6)			1 (1)	3 (24)		1 (74)		3 (185)
0UL40					2 (20)			2 (260)		1 (3)		2 (6)		1 (50)		1 (20)
0UL41																
0UL43	1 (140)								1 (50)		1 (2)	1 (3)				4 (126)
0UL44	1 (4)												1 (3)			1 (3)
0UL45											1 (5)					
0UL46																
0UL47		1 (181)						2 (35)			5 (150)	4 (13)	1 (8)		1 (38)	
0UL48					2 (665)						4 (80)	1 (13)			2 (230)	3 (33)
0UL52																
0UL53																
0UL54																



0U469
0UL48
0UL47
0U466
0U465
0U468
0UL43
0UL44
0UL45
0U464
0UL46
0UL54
0UL53
0UL40
0UL41
0UL52
0U462
0U461
0U460
0U472
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundaries
Number of roosting birds/roost size
RANGE
1-49
50-99
100-199
200-299
300-399
500-799
800-999
>4500
An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht
Dublin Bay
Roost Location Map Tidal Stage 1
Data collected during
the roost survey on 25/11/2011
Map to be read in conjunction with the NPWS
Conservation Objectives SPA Supporting Document.
COUNTY DUBLIN
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.
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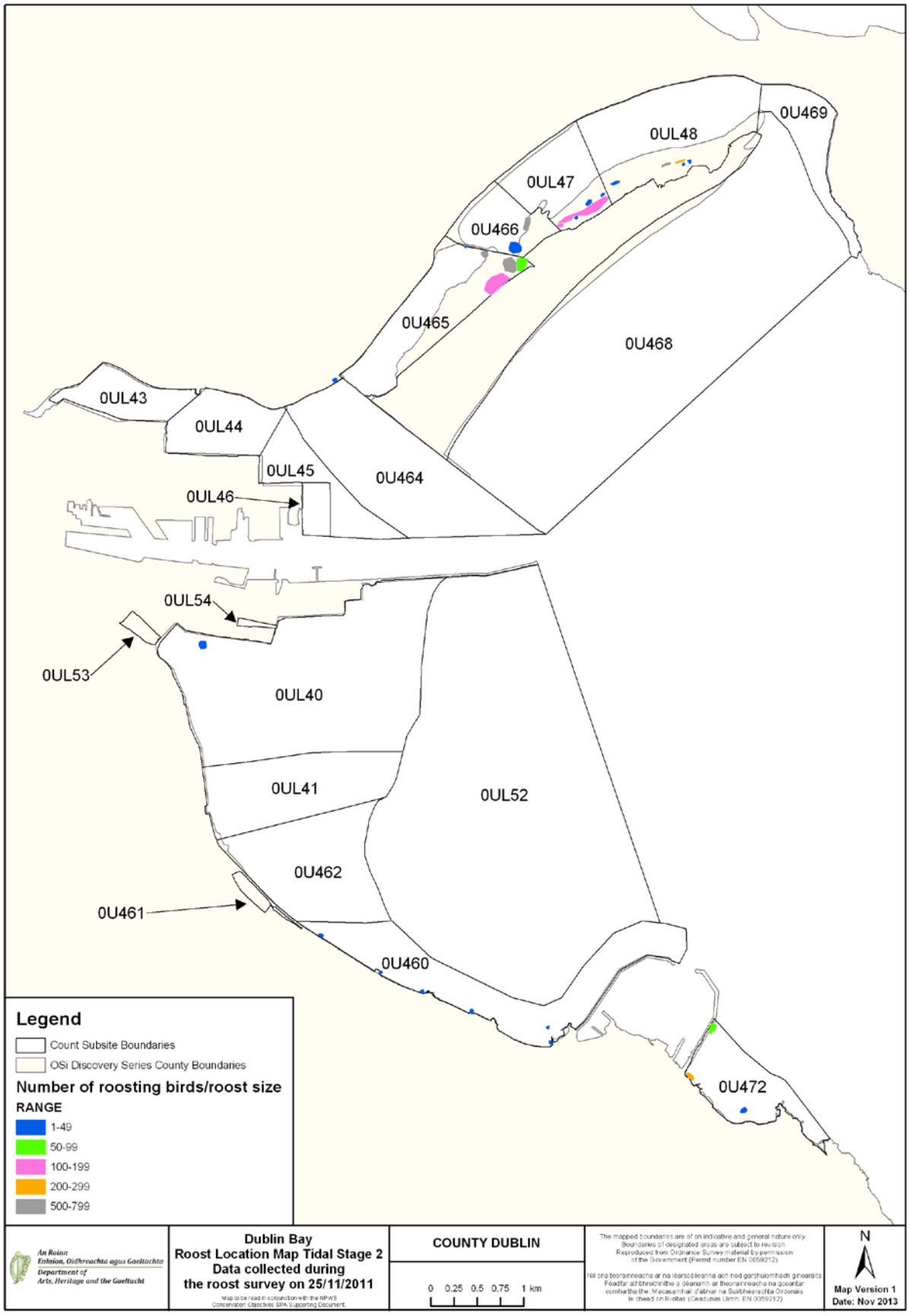
N
Map Version 1
Date: Nov 2013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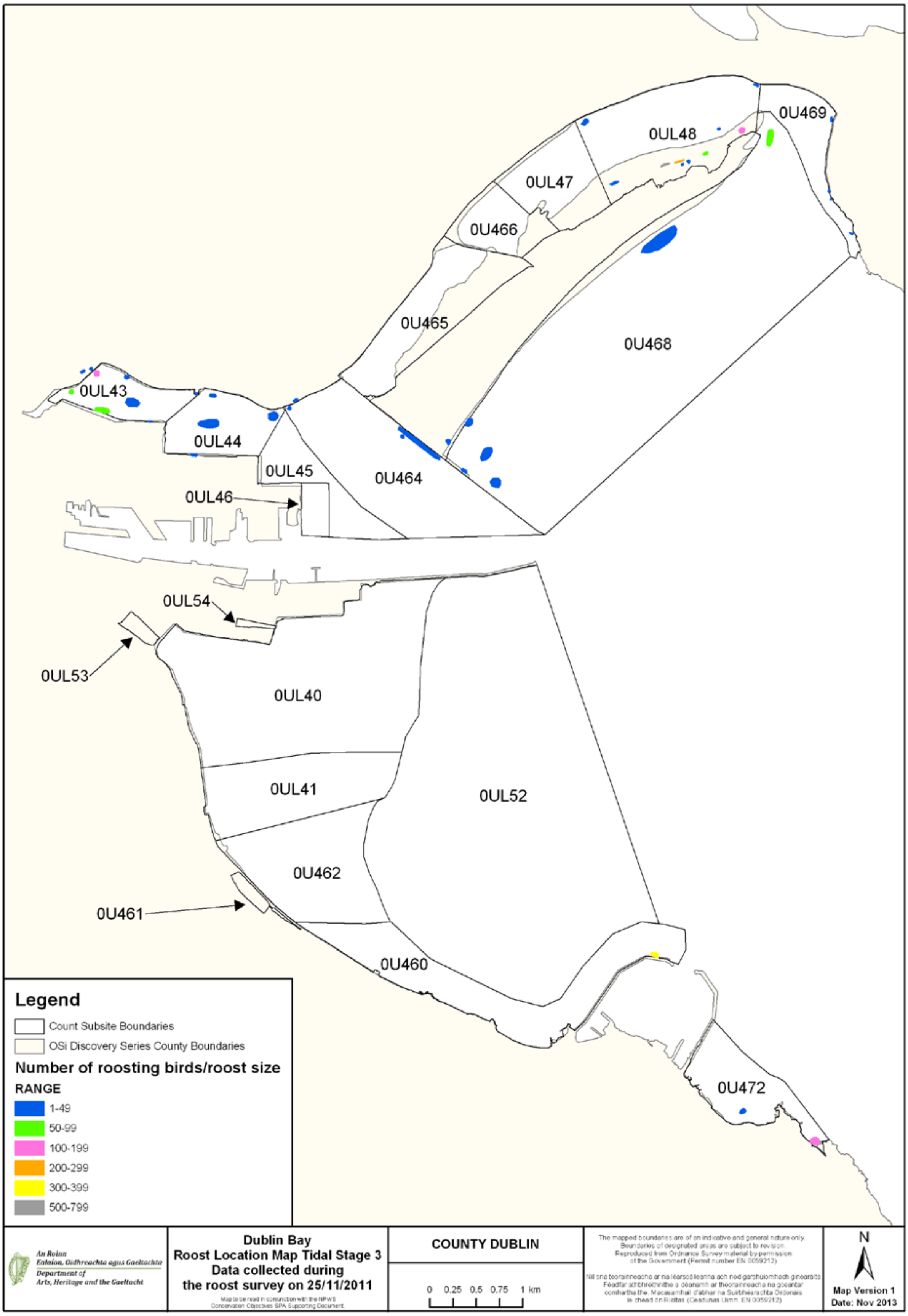
0U469
0UL47
0U466
0U465
0U468
0UL43
0UL44
0UL45
0U464
0UL46
0UL54
0UL53
0UL40
0UL41
0UL52
0U462
0U461
0U460
0U472
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundaries
Number of roosting birds/roost size
RANGE
1-49
50-99
100-199
200-299
500-799
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Dublin Bay
Roost Location Map Tidal Stage 2
Data collected during
the roost survey on 25/11/2011
COUNTY DUBLIN
0 0.25 0.5 0.75 1 km
N
Map Version 1
Date: Nov 2013

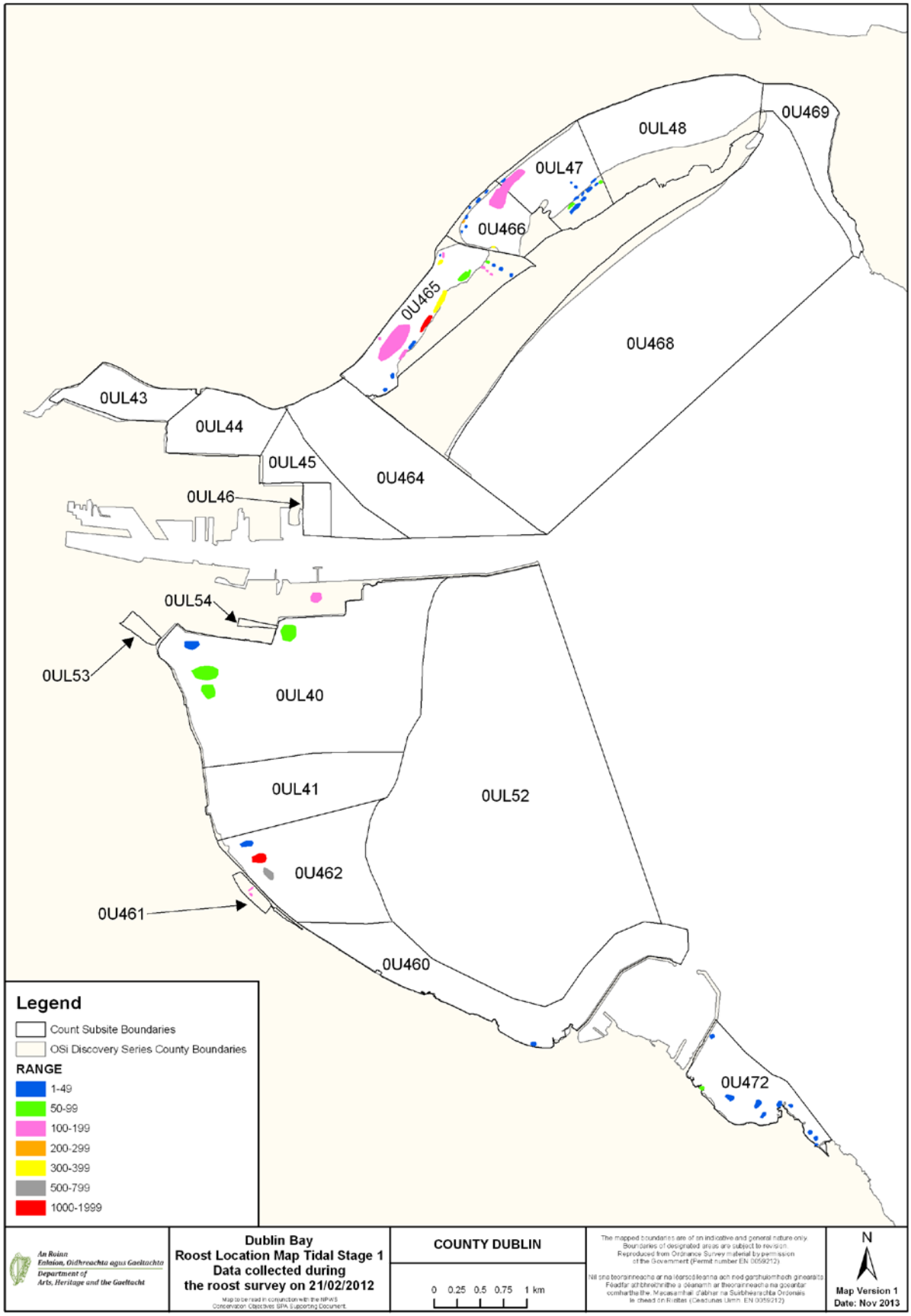

0U469
0UL48
0UL47
0U466
0U465
0U468
0UL43
0UL44
0UL45
0U464
0UL46
0UL54
0UL53
0UL40
0UL41
0UL52
0U462
0U461
0U460
0U472
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundaries
Number of roosting birds/roost size
RANGE
1-49
50-99
100-199
200-299
300-399
500-799
An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht
Dublin Bay
Roost Location Map Tidal Stage 3
Data collected during
the roost survey on 25/11/2011
Map to be read in conjunction with the NPWS
Conservation Objectives SPA Supporting Document.
COUNTY DUBLIN
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)
Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordanáis
le chead ón Rialtas (Ceadunas Uimh. EN 0059212)
N
Map Version 1
Date: Nov 2013

(2a) Summary data and roost location maps from the roost survey 21st February 2012
(Please see Sections 5.3.1 and 5.3.2 for further details on methods/limitations)

Subsite Code	No. roost locations	No. species	Species (alphabetical order)
0U460	9	8	BH, CM, CA, H., HG, PB, OC, TT
0U461	2	5	BH, BW, GK, ET, RK
0U462	3	11	BA, BH, CM, DN, GB, GV, OC, RP, SS, T., UU
0U464	3	5	BH, GG, HG, RM, TT
0U465	21	18	BA, BH, BW, CM, CU, DN, ET, GK, GV, H., KN, PB, OC, RK, RM, SU, T., TT
0U466	12	13	BH, BW, CM, CU, DN, ET, GB, GK, HG, KN, RK, T., TT
0U468	6	5	BH, CM, GB, HG, RM
0U469	12	7	BH, CM, GK, HG, PC, PB, RK
0U472	10	10	BH, CM, CA, GB, HG, MU, OC, RK, SA, TT
0UL40	5	5	BH, CM, OC, PB, SS
0UL43	5	3	BH, CM, LB
0UL44	12	7	BH, CM, GN, HG, PB, RM, TT
0UL45	1	1	PB
0UL46	1	2	CA, RM
0UL47	13	10	BH, CM, CU, OC, PB, PT, RK, SU, T., UM
0UL48	21	17	BA, BH, CM, CU, DN, GK, GP, GV, HG, KN, OC, PB, RK, RM, SU, TT, UM

(2b) SCI species and recorded roosts 21/02/12 - shows number of roost locations within each subsite, and in brackets, the peak number recorded at a single roost location

Subsite Code	PB	SU	PT	OC	GV	KN	SS	DN	BW	BA	RK	TT	T.	RP	CU	BH
0U460	2 (2)			2 (160)								1 (1)				4 (19)
0U461									1 (81)		1 (126)					1 (10)
0U462				1 (406)	1 (45)		1 (13)	1 (450)		1 (650)			1 (6)	1 (76)		1 (35)
0U464												1 (3)				3 (18)
0U465	1 (7)	4 (4)		3 (220)	2 (59)	2 (120)		4 (50)	4 (55)	2 (950)	8 (190)	3 (95)	1 (1)		2 (285)	6 (185)
0U466						1 (5)		1 (95)	5 (120)		6 (246)	1 (13)	1 (33)		4 (110)	2 (95)
0U468																2 (25)
0U469	1 (11)			6 (14)							2 (10)					4 (8)
0U472				2 (4)							1 (1)	3 (19)				5 (24)
0UL40	1 (21)			1 (52)			1 (9)									5 (93)
0UL41																
0UL43																3 (261)
0UL44	2 (27)											2 (8)				7 (310)
0UL45	1 (2)															
0UL46																
0UL47	5 (9)	3 (15)	2 (28)	1 (22)							1 (2)		2 (85)		5 (68)	1 (2)
0UL48	2 (5)	5 (53)		1 (625)	2 (86)	1 (8)		2 (555)		2 (8)	3 (20)	1 (2)			2 (363)	4 (2)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0UL47
0U466
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0U468
0UL43
0UL44
0UL45
0U464
0UL46
0UL54
0UL53
0UL40
0UL41
0UL52
0U462
0U461
0U460
0U472
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundaries
RANGE
1-49
50-99
100-199
200-299
300-399
500-799
1000-1999
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Dublin Bay
Roost Location Map Tidal Stage 1
Data collected during
the roost survey on 21/02/2012
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
COUNTY DUBLIN
0 0.25 0.5 0.75 1 km
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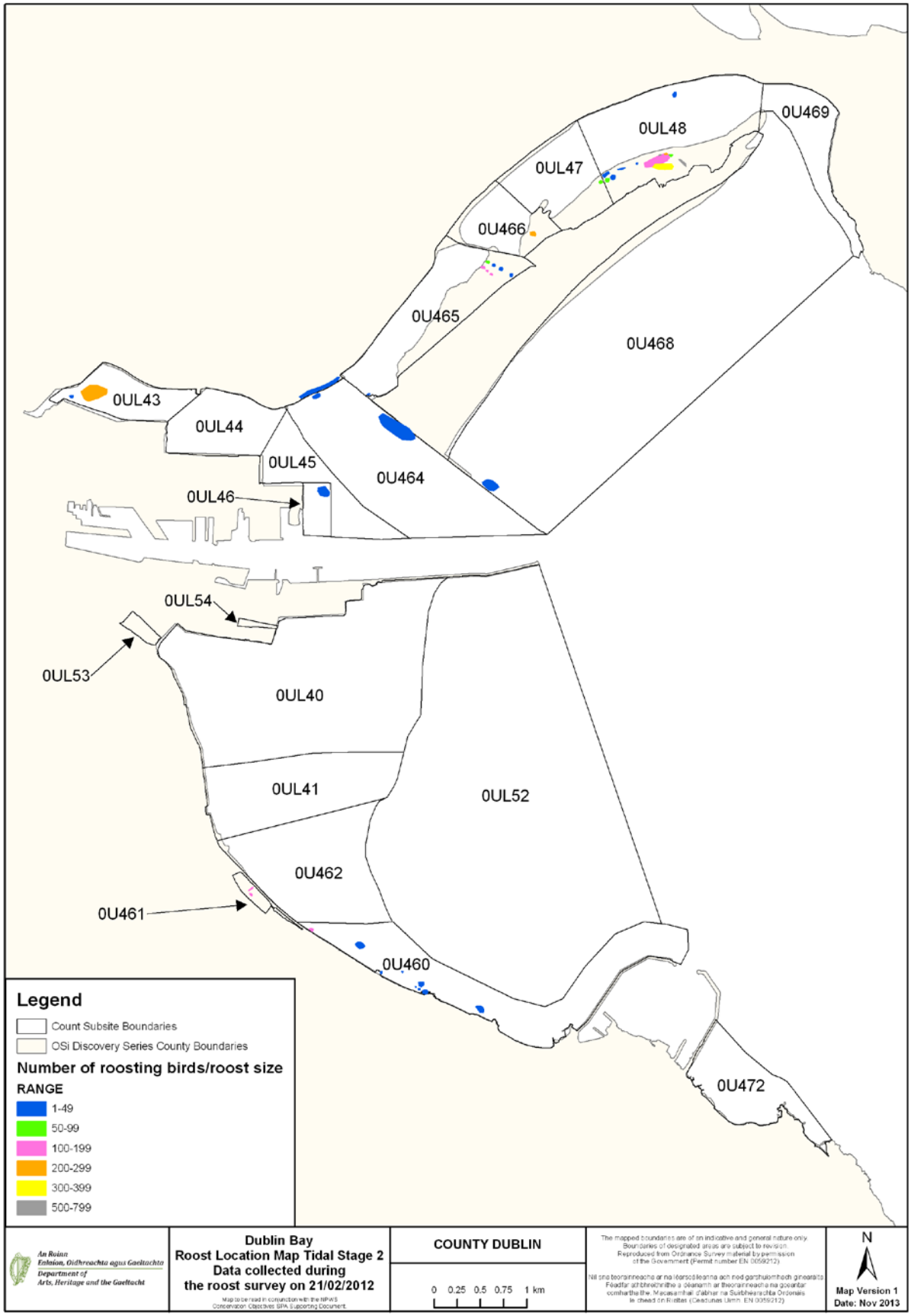
N
Map Version 1
Date: Nov 2013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0UL40
0UL41
0UL52
0U462
0U461
0U460
0U472
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundaries
Number of roosting birds/roost size
RANGE
1-49
50-99
100-199
200-299
300-399
500-799
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Dublin Bay
Roost Location Map Tidal Stage 2
Data collected during
the roost survey on 21/02/2012
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
COUNTY DUBLIN
0 0.25 0.5 0.75 1 km
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Níl sna teorainneacha ar na léarscáileanna ach nod garthuiimhoch ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comhartha thé. Macasamhail d'ábhar na Suirbhéireachta Ordanáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059212)
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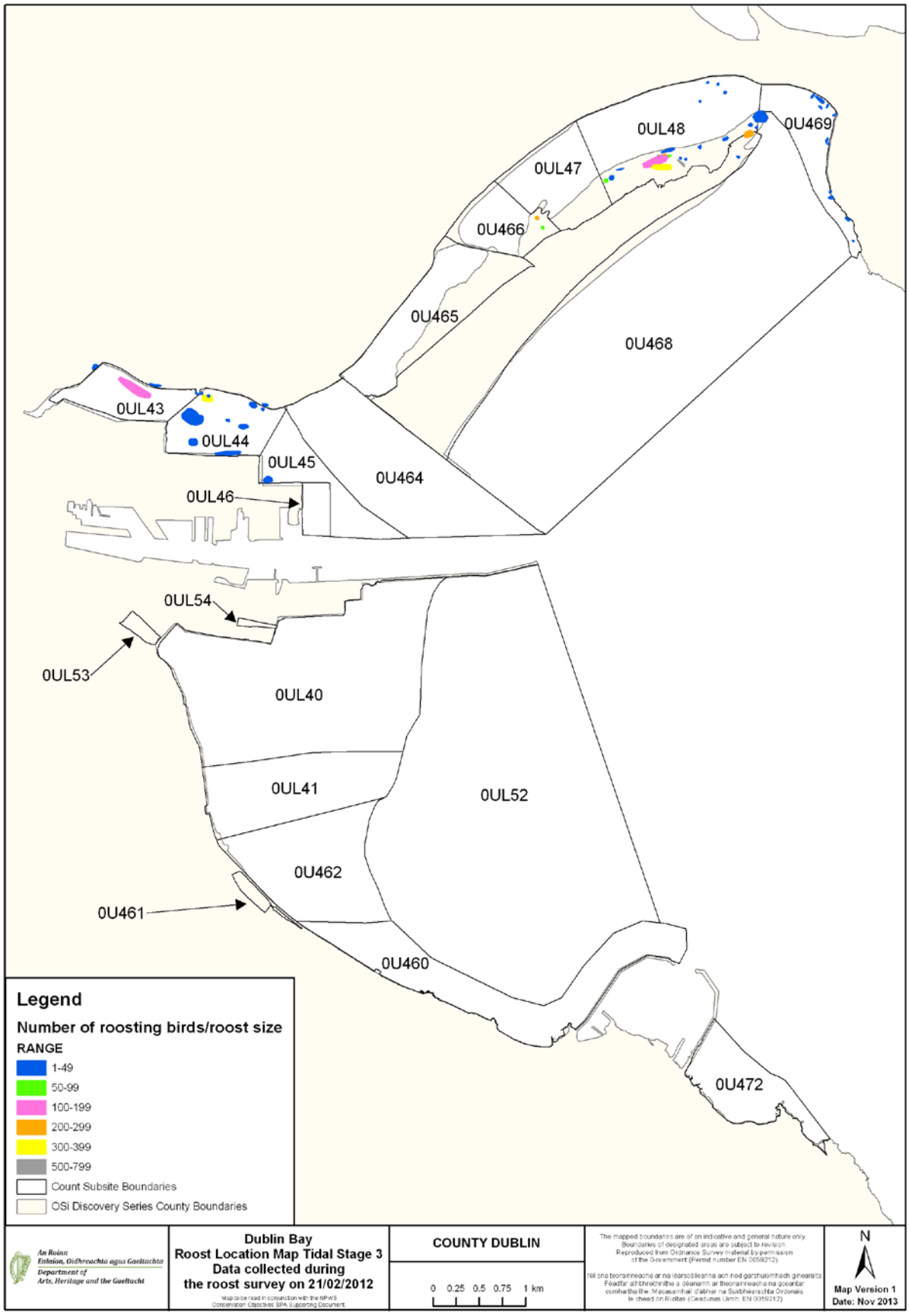
Date: Nov 2013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0UL54
0UL53
0UL40
0UL41
0UL52
0U462
0U461
0U460
0U472
Legend
Number of roosting birds/roost size
RANGE
1-49
50-99
100-199
200-299
300-399
500-799
Count Subsite Boundaries
OSi Discovery Series County Boundaries
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Dublin Bay
Roost Location Map Tidal Stage 3
Data collected during
the roost survey on 21/02/2012
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
COUNTY DUBLIN
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 garthuiomhach ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comharthaithe. Méadaithe d'ábhar na Suirbhéireachta Ordanáis le cead an Rialtais (Ceadúnas Uimh. EN 0059212)
N
Map Version 1
Date: Nov 2013

(3) Gull roost summary data - 21st February 2012

Merne *et al*. (2009) remarked on the abundance of non-breeding gulls in Dublin Bay, particularly peak counts of gulls that occurred in late February; thought to represent birds staging, prior to spring migration. To further this work, a winter dusk count of gulls coming in to roost in Dublin Bay was carried out by a coordinated team of counters on the evening of 21 February 2012. Six counters covered the main roosting areas for the gulls. Further methodological details can be found in Cummins & Crowe (2012).

The Table below details the breakdown of the maximum numbers of each gull species recorded in each subsite over the count period. In addition, summed totals for South Dublin Bay, North Bull Island and the Tolka Estuary are given.

Code	Subsite	BH	CM	GB	HG	LB	MU	IG	TOTAL
0U460	Dún Laoghaire - Seapoint	6700	95	10	55	39	6	0	6905
0U462	Booterstown - Merrion Gates	4904	136	38	1030	59	1	2	6170
0UL40	Sandymount Strand North	420	15	0	20	0	0	0	455
0UL41	Sandymount Strand South	0	0	0	0	0	0	0	0
Totals for South Dublin Bay		12024	246	48	1105	98	7	2	13530
0UL47	Kilbarrack	693	5	0	4	0	0	0	0
0U465	Wooden Bridge - Causeway	579	44	0	14	0	0	0	637
0U466	North of Causeway (to saltmarsh)	63	4	0	16	2	0	0	85
0U468	Dollymount Strand *(incl. open water)*	220	112	5	82	3	0	0	422
0U469	Sutton - Dinghy Club	0	0	0	0	0	0	0	0
0UL48	Sutton Strand South	1356	15	5	11	0	0	0	1387
Totals for North Bull Island		2911	180	10	127	5	0	0	3233
0U464	South of Wooden Bridge	20850	400	2	50	0	0	0	21302
0UL43	Fairview Park	550	6	0	15	0	0	0	571
0UL44	Clontarf Baths	3900	20	0	24	0	0	0	3944
0UL45	Dublin Port	0	0	0	0	0	0	0	0
0UL46	Dublin Port Extension	0	0	0	0	0	0	0	0
None	Power Station Outfall	350	0	0	0	0	0	0	350
Totals for the Tolka Estuary		25650	426	2	89	0	0	0	26167
Overall Site Totals		**40585**	**852**	**60**	**1321**	**103**	**7**	**2**	**42228**

APPENDIX 9

Dublin Bay
-
Activities & Events

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

Legend:	
O	observed or known to occur in or around Dublin Bay
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	0U460	0U461	0U462	0U464	0U465	OU466	0U468	0U469	0U472
1. Coastal protection, sea defences & stabilisation									
1.1 Linear defences	O	O	O	O	O	O	O	O	O
1.2 Training walls									O
1.3 Groynes				O	O		O	O	
1.4 *Spartina* growing/planted						O			
1.5 Marram grass							O		
2.2 Altered drainage/river channel						H			
4. Industrial, port & related development									
4.1 Industrial port	O								O
4.2 Fishing harbour	O								O
4.3 Slipway	O				O			O	O
4.4 Pier	O							O	O
4.6 Chemical industries									O
4.7 Ship & boat building/repair									O
5. Military activities									
5.2 Firing range					H	H	H		
5.4 Military training							H/O		
6. Pollution									
6.1 Domestic & urban waste water	H								
6.2 Industrial		H							
6.7 Solid waste incl. fly-tipping		H				H	H	O	
8. Transport & communications									
8.3 Bridges & aqueducts							O		
8.5 Road schemes				O	O	O	O	O	
8.6 Car parks	O	O				O	O	O	O
8.7 Shipping channel, shipping lanes									O

Activity/Event	0U460	0U461	0U462	0U464	0U465	OU466	0U468	0U469	0U472
8.8 Rail lines	O	O	O						O
8.9 Cables - suspended		O							
9. Urbanisation									
9.1 Urbanised areas, housing	O	O	O			O	O	O	O
9.2 Commercial & industrial areas						O			O
9.3 Hotel & leisure complex							O		
11. Education & scientific research									
11.1 Scientific sampling, specimen collection	O				O	O			
11.2 Nature trails	O								O
11.3 Interpretative centre							O		
12. Tourism & recreation									
12.1 Marinas								O	O
12.2 Non-marina moorings	O								O
12.3 Dinghy & boat parks									O
12.7 Jet-skiing	O								O
12.8 Sailing	O				O		O		O
12.9 Sailboarding & wind-surfing	O						O		O
12.10 SCUBA & snorkeling	O								O
12.11 Canoeing	O				O				
12.12 Surfing							O		
12.13 Rowing					O				
12.15 Angling						O	O	O	O
12.16 Other non-commercial fishing	O								O
12.17 Bathing & general beach recreation	O	O	O				O		O
12.18 Walking, incl. dog walking	O	O	O	O	O	O	O	O	O
12.19 Birdwatching	O	O	O	O	O	O	O	O	O
12.21 4WD, trial & quad bikes								O	

Activity/Event	0U460	0U461	0U462	0U464	0U465	OU466	0U468	0U469	0U472
12.22 Motorised vehicles							H/O		
12.25 Golf courses					O	O	O		
12.26 Clay-pigeon shooting						H	H		
12.26 Other						H	H	O	
13. Wildfowl & hunting									
13.1 Wildfowling						H			
13.2 Other hunting/shooting activities							H		
14. Bait-collecting									
14.1 Digging for lugworms/ragworms	O		O	O	O	O		O	
15. Fisheries & Aquaculture									
15.2 Professional active fishing									O
15.5 Leisure fishing	O								O
15.6 Molluscs - hand-gathering							O		
16. Agriculture & forestry									
16.1 Saltmarsh grazing/harvesting		H							
16.7 Crop production: non-intensive		H							
16.10 Mowing/grassland cutting						O	O		
16.13 Agricultural land-claim		H							
16.14 In-filling of ditches, ponds, pools, marshes and pits		H							
16.16 Agricultural activities (other)		H							
18. Wildlife habitat management									
18.1 Control of *Spartina* or other vegetation						H			
18.2 Habitat creation & restoration - intertidal		O				O	O		
18.3 Habitat creation & restoration - terrestrial						O	O		
18.4 Habitat management		O							

Activity/Event	0U460	0U461	0U462	0U464	0U465	OU466	0U468	0U469	0U472
19. Natural events									
19.1 Storms, floods and storm surges		H/O				H			
19.2 Severe cold weather						O	O		
19.3 Eutrophication				O	O	O			
19.4 Other natural events			O				O		

Activity/Event	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	OUL47	0UL48	0UL52
1. Coastal protection, sea defences & stabilisation									
1.1 Linear defences	O	O	O	O	O	O	O	O	
1.2 Training walls	O								
1.3 Groynes								O	
1.4 *Spartina* growing/planted							O		
2.2 Altered drainage/river channel	H						H		
3.1 Power stations	O								
4. Industrial, port & related development									
4.1 Industrial port	O		O	O	O	O			
4.2 Fishing harbour									
4.3 Slipway				O				O	
4.4 Pier									
4.5 Manufacturing industries	O								
5. Military activities									
5.2 Firing range							H	H	
6. Pollution									
6.1 Domestic & urban waste water	O								
6.2 Industrial	O								
6.3 Landfill	H								
6.7 Solid waste incl. fly-tipping							H		
7. Sediment extraction (marine & terrestrial)									
7.1 Channel dredging (maintenance & navigation)	O								
8. Transport & communications									
8.4 Tunnel	O/P	O/P							

Activity/Event	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	OUL47	0UL48	0UL52
8.5 Road schemes	O	O	O	O	O		O	O	
8.6 Car parks	O	O	O	O			O		
9. Urbanisation									
9.1 Urbanised areas, housing	O	O	O	O			O	O	
9.2 Commercial & industrial areas	O		O	O				O	
9.3 Hotel & leisure complex							O		
11. Education & scientific research									
11.1 Scientific sampling, specimen collection	O	O					O		
11.2 Nature trails	O								
12. Tourism & recreation									
12.2 Non-marina moorings									
12.5 Leisure centres, sports ground	O								
12.6 Power boating & water-skiing									O
12.7 Jet-skiing									
12.8 Sailing				O	O				
12.9 Sailboarding & wind-surfing	O	O							
12.10 SCUBA & snorkeling									
12.15 Angling							O	O	
12.16 Other non-commercial fishing									
12.17 Bathing & general beach recreation	O	O							
12.18 Walking, incl. dog walking	O	O	O	O			O	O	
12.19 Birdwatching	O	O					O	O	
12.22 Motorised vehicles		H							
12.23 Horse-riding	H	H							
12.25 Golf courses							O	O	
12.26 Clay-pigeon shooting							H		
12.26 Other							H		

Activity/Event	0UL40	0UL41	0UL43	0UL44	0UL45	0UL46	OUL47	0UL48	0UL52
13. Wildfowl & hunting									
13.1 Wildfowling							H		
14. Bait-collecting									
14.1 Digging for lugworms/ragworms	O	O					O	O	
15. Fisheries & Aquaculture									
15.1 Professional passive fishing (e.g. longlining)									O
15.2 Professional active fishing									O
15.4 Fish traps & other fixed devices & nets									O
15.5 Leisure fishing									O
15.6 Molluscs - hand-gathering							O	O	
16. Agriculture & forestry									
16.9 Removal of hedges, scrub							O		
16.10 Mowing/grassland cutting	O	O					O		
18. Wildlife habitat management									
18.1 Control of *Spartina* or other vegetation							H		
18.2 Habitat creation & restoration - intertidal							O		
18.3 Habitat creation & restoration - terrestrial	O						O		
18.4 Habitat management		O							
19. Natural events									
19.1 Storms, floods and storm surges			H	H			H		
19.2 Severe cold weather	O	O	H	H			O		
19.3 Eutrophication	O						O	O	
19.4 Other natural events	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 2011/12 Waterbird Survey Programme

Activity/Event	0U460	0U461	0U462	0U464	0U465	0U468	0U469	0U472	0UL40	0UL41	OUL47	0UL48
12. Tourism & recreation												
12.9 Sailboarding & wind-surfing						6						
12.18 Walking, incl. dog walking	7	4	7			7	4	4	6	6	5	6
12.22 Motorised vehicles						6						
14. Bait-collecting												
14.1 Digging for lugworms/ragworms				4	5		4		4			3
15. Fisheries & Aquaculture												
15.6 Molluscs-hand-gathering						4						3