Inner Galway Bay Special Protection Area

(Site Code 4031)

Conservation Objectives Supporting Document

VERSION 2

National Parks & Wildlife Service

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IMPORTANT: A002 Black-throated Diver (*Gavia arctica*) was added as a Special Conservation Interest (SCI) and **A857 Shoveler (*Spatula clypeata*)** was removed as an SCI after the Site-Specific Conservation Objectives (Version 1) for Inner Galway Bay SPA (site code: 004031) were published. This document, an updated version of the Conservation objectives supporting document V1 (NPWS, 2013), sets out details for the newly listed SCI for the site. Information on the existing SCIs has not been updated.

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SUMMARY

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

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

Part Two provides site designation information for Inner Galway Bay Special Protection Area (SPA) and Part Three presents the conservation objectives for this site.

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

Part Five provides supporting information that will assist the interpretation of the site-specific conservation objectives. This section includes a review of the ecological characteristics of the SCI species and examines waterbird distribution recorded during the 2009/10 Waterbird Survey Programme, drawing also on data from NPWS monitoring programmes (e.g. benthic surveys) and the Irish Wetland Bird Survey (I-WeBS). Part Five concludes with information on activities and events that occur in and around the site which may interact with waterbirds during the non-breeding season and includes an assessment of activities that were recorded to cause disturbance to non-breeding waterbirds 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, are responsible for the selection and designation of SPAs in Ireland. NPWS have 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 important is compiled. These species are known as **Special Conservation Interests** and can be divided into two categories:

Selection species:

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

- An Annex I species that occurs at the site in numbers that exceed the all-Ireland 1% population threshold;
- A migratory species that occurs at the site in numbers that exceed the biogeographic 1% population threshold; and/or
- A species for which the site is considered to be one of the *'n'* most suitable sites in Ireland for the conservation of that species (where *n* is a variable that is related to the proportion of the total biogeographic population held by Ireland).

Additional Conservations Interests:

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

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

1.2 Introduction to Inner Galway Bay Special Protection Area

Inner Galway Bay is a large, marine-dominated site on the west coast of Ireland, bordered by Co. Galway to the north and Co. Clare to the south. It is protected from the full effects of the Atlantic Ocean by the Aran Islands and Black Head. The SPA comprises the inner part of the bay and extends along the northern Co Galway coast as far west as White Strand near Barna; the southern boundary extends westwards as far Poulacushlaun near Black Head.

The site includes numerous shallow and sheltered intertidal bays including Oranmore, Aughinish and Kinvarra as well as many small islands made of glacial deposits such as Eddy Island, Deer Island and Tawin Island. The site is fed by numerous rivers and streams of which the River Corrib is the largest and flows from Lough Corrib through Galway City before discharging into the bay. The River Clarin flows through Clarinbridge and enters the site through Dunbulcaun Bay while the River Owenboliskey flows into the site at Spiddal. Along the south coast of the bay there are various minor freshwater inputs from streams and submarine sources due to drainage patterns associated with the karst landforms of the Burren (www.infomar.ie).

The site comprises a range of marine, coastal and terrestrial habitats with a diversity of littoral communities. The largely glacial derived substrate of inner Galway Bay from Oranmore Bay to Kinavarra Bay results is wide range of sediments. Intertidally this ranges from cobbles and pebbles with fucoids, to mixed sediment, sand and sandy mud. Within the depositional environment of east Galway Bay this results in a very heterogeneous substrate with a rich infauna of bivalves and polychaetes.

A small bed of *Zostera noltii* occurs intertidally off Blake's Hill on the north shore of the bay while subtidal beds (depths 1-5m) of *Zostera marina* are recorded in the southern bay off Island Eddy and Cregboy.

Shingle and stony beaches are also well represented across the site; the best examples being found along the shores of the southwest, west of Galway City and to the north and east of Finvarra. Salt marshes are frequent and comprise both Atlantic and Mediterranean types, the best examples are found within the sheltered and indented inner bay, east of a line running between Galway City and Kinvarra.

Several lagoons are included within the site including Lough Murree, Aughinish lagoon, Rossalia, and Bridge Lough on the southern shore. Lough Murree was formed in the limestone bedrock and is separated from the sea by a cobble barrier, along which a road now runs. With no direct connection to the sea, the lagoon has variable salinity; seawater enters occasionally by overtopping the barrier but the main routes are percolation and possibly through subterranean fissures in the bedrock (Healy et al. 1997). Aughinish Lagoon is described as a natural sedimentary lagoon situated on karst with high/hypersalinity conditions, while Bridge Lough is an artificial saline lake which is highly eutrophic (Healy et al. 1997). Mweeloon Pools, Ardfry Oyster Pond and Toureen Lough occur on the eastern side of the bay.

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

1.3 Introduction to Conservation Objectives

The overriding objective of the Habitats Directive is to ensure that the habitats and species covered achieve '*favourable conservation status'* and that their long-term survival is secured across their entire natural range within the EU (EU Commission, 2010). In its broadest sense, favourable conservation status means that an ecological feature is being maintained in a satisfactory condition, and that this status is likely to continue into the future. Definitions as per the EU Habitats Directive are given in Box 1.

Box 1

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

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

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

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

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

Site-specific conservation objectives define the desired condition or range of conditions that a habitat or species should be in, in order for these selected features within the site to be judged as favourable. At site level, this state is termed 'favourable conservation condition.' Site conservation objectives also contribute to the achievement of the wider goal of biodiversity conservation at other geographic scales, and to the achievement of favourable conservation status at national level and across the Natura 2000 network[1].

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

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

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

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

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

PART TWO – SITE DESIGNATION INFORMATION

2.1 Special Conservation Interests of Inner Galway Bay SPA

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

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

1. During winter the site regularly supports 1% or more of the biogeographical population of Light-bellied Brent Goose (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 676 individuals.

2. During winter the site regularly supports 1% or more of the all-Ireland population of Red-breasted Merganser (*Mergus serrator*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 249 individuals.

3. During the winter, the site is the highest-ranking site in Ireland for the Annex I species Black-throated Diver (*Gavia arctica*). Within this SPA the mean of peak counts of this species during the baseline period (1995/1996 – 1999/2000) was 36 individuals.

4. During winter the site regularly supports 1% or more of the biogeographical population of the Annex I species Great Northern Diver (*Gavia immer*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 94 individuals.

5. During winter the site regularly supports 1% or more of the all-Ireland population of Cormorant (*Phalacrocorax carbo*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 266 individuals. The site is also selected for its breeding population of Cormorant. In 2000, as part of the Seabird 2000 survey, 200 pairs of Cormorant (based on apparently occupied nests) were estimated on Deer Island; exceeding the all-Ireland 1% threshold and making the site of national importance for this species.

6. During winter the site regularly supports 1% or more of the all-Ireland population of Grey Heron (*Ardea cinerea*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 102 individuals.

7. 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 335 individuals.

8. 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 447 individuals.

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

9. 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 182 individuals.

10. In 1995, as part of the All-Ireland Tern survey, the breeding population of Sandwich Tern (*Sterna sandvicensis*) of Inner Galway Bay was surveyed and 81 pairs (based on apparently occupied nests) were recorded. This exceeds the All-Ireland 1% threshold for this Annex I species.

11. In 1995, as part of the All-Ireland Tern survey, 98 pairs of Common Tern (*Sterna hirundo*) (based on apparently occupied nests) were recorded on Green Island in Ballyvaughan Bay in Co. Clare. The Seabird 2000 Survey recorded 46 pairs of Common Tern (based on apparently occupied nests) on Mutton Island in Co. Galway in 2001. Both counts exceed the All-Ireland 1% threshold for this Annex I species.

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

Wigeon (*Anas penelope*),
Teal (*Anas crecca*),
Golden Plover (*Pluvialis apricaria*),
Lapwing (*Vanellus vanellus*),
Dunlin (*Calidris alpina*),
Curlew (*Numenius arquata*),
Redshank (*Tringa totanus*),
Black-headed Gull (*Chroicocephalus ridibundus*)[4],
Common Gull (*Larus canus*).

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

[4] Formerly *Larus ridibundus.*

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

	Special Conservation Interests	Annex I species	Baseline Population[a]	Population status at baseline	National Importance Rank[1]	Regional Importance Rank[2]	County Importance Rank[3]
Selection Species	Light-bellied Brent Goose		676	International Importance	11	1	1
	Red-breasted Merganser		249	All-Ireland Importance	1	1	1
	Black-throated Diver	Yes	36	Highest ranking site in Ireland	1	1	1
	Great Northern Diver	Yes	94	International Importance	2	1	1
	Cormorant*		266 (winter); 200 pairs (breeding)	All-Ireland Importance	4	1	1
	Grey Heron		102	All-Ireland Importance	1	1	1
	Ringed Plover		335	All-Ireland Importance	3	2	1
	Bar-tailed Godwit	Yes	447	All-Ireland Importance	13	2	1
	Turnstone		182	All-Ireland Importance	5	1	1
	Sandwich Tern*	Yes	81 pairs	All-Ireland Importance	n/c	n/c	n/c
	Common Tern*	Yes	98 pairs	All-Ireland Importance	n/c	n/c	n/c
Additional Special Conservation Interests	Wigeon		1,168	All-Ireland Importance	21	3	2
	Teal		700	All-Ireland Importance	15	2	1
	Golden Plover	Yes	2,430	All-Ireland Importance	25	3	2
	Lapwing		3,969	All-Ireland Importance	15	2	1
	Dunlin		2,155	All-Ireland Importance	15	1	1
	Curlew		697	All-Ireland Importance	17	1	1
	Redshank		505	All-Ireland Importance	15	1	1
	Black-headed Gull		1,941	All-Ireland Importance	9	1	1
	Common Gull		1,066	All-Ireland Importance	6	1	1
Other conservation designations associated with the site[b]		**SAC**	**RAMSAR SITE**	**IMPORTANT BIRD AREA (IBA)**	**WILDFOWL SANCTUARY**	**OTHER**	**OTHER**
		Yes (SAC 0268)	Yes	Yes	Yes		

* breeding species; n/c = not calculated.

[a] Baseline data from I-WeBS with the exception of Light-bellied Brent Goose (Robinson et al. 2004), breeding Cormorants (Mitchell et al. 2004) and Sandwich and Common Terns (Hannon, 1996; Mitchell et al. 2004).

[b] Note that other designations associated with Inner Galway Bay may relate to different areas and/or some of these areas may extend outside the SPA boundary.

[1]National importance rank - the number given relates to the importance of the site for the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to other sites in Ireland.

[2]Regional importance rank - the number given relates to the importance of the site for the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within the Western region.

[3]County importance rank - the number given relates to the importance of the site for the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within Counties Galway and Clare.

PART THREE - CONSERVATION OBJECTIVES FOR INNER GALWAY BAY SPA

3.1 Conservation Objectives for the non-breeding Special Conservation Interests of Inner Galway Bay SPA

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

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

Conservation Objectives for Inner Galway Bay 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 waterbird Special Conservation Interest species listed for Inner Galway Bay SPA.*

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

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

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

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

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

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

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

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

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

- ❖ 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 Inner Galway Bay SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.*

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

- To be favourable, the permanent **area** occupied by the wetland habitat should be stable and not significantly less than the area of **13,267 ha**, other than that occurring from natural patterns of variation.

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

Subtidal areas refer to those areas contained within the SPA that lie below the mean low water mark and are predominantly covered by marine water. Tidal rivers, creeks and channels are included in this category. For Inner Galway Bay SPA this broad category is estimated to be **10,352 ha.** Subtidal areas are continuously available for diving ducks (e.g. Red-breasted Merganser) and piscivorous/other waterbirds (e.g. Great Northern Diver). Various waterbirds roost in subtidal areas.

The intertidal area is defined, in this context, as the area contained between the mean high water mark and the mean low watermark. For Inner Galway Bay SPA this is estimated to be **2,111 ha**. When exposed or partially exposed by the tide, intertidal habitats provide important foraging areas for many species of waterbirds, especially wading birds, as well as providing roosting/loafing[8] areas. When the intertidal area is inundated by the tide it becomes available for diving ducks and piscivorous/other waterbirds (e.g. divers and grebes). During this tidal state this area can be used by various waterbirds as a loafing/roosting resource.

The supratidal category refers to areas that are not frequently inundated by the tide (i.e. occurring above the mean high watermark) but contain shoreline and coastal habitats and can be regarded as an integral part of the shoreline. For Inner Galway Bay SPA this is estimated to be **762 ha**.

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

Supratidal areas are used by a range of waterbird species as a roosting resource as well as providing feeding opportunities for some species.

The category known as ‘lagoon and associated habitats’ in this context refers to lagoons and freshwater/brackish lakes. For Inner Galway Bay SPA this habitat category is estimated to be **42 ha**.

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 non-breeding waterbird Special Conservation Interests of Inner Galway Bay SPA.

Objective 1: *To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Inner Galway Bay SPA, which is defined by the following list of attributes and targets:*				
Parameter	**Attribute**	**Measure**	**Target**	**Notes**
Population	Population trend	Percentage change as per population trend assessment using waterbird count data collected through the Irish Wetland Bird Survey and other surveys.	The long term population trend should be stable or increasing	Waterbird population trends are presented in Part Four of this document.
Range	Distribution	Range, timing 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 2009/10 waterbird survey programme is reviewed in Part Five of this document.
Objective 2: *To maintain the favourable conservation condition of the wetland habitat at Inner Galway Bay SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attributes and targets:*				
Parameter	**Attribute**	**Measure**	**Target**	**Notes**
Area	Wetland habitat	Area (ha)	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of **13, 267 ha**, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as **13,267 ha** using OSI data and relevant orthophotographs. For details on known permanent wetland habitat loss see section 5.4.3.

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

4.1 Population data for non-breeding waterbird SCI species of Inner Galway Bay SPA

Inner Galway Bay is a large, marine-dominated site on the west coast of Ireland. Non-breeding waterbirds have been counted regularly at this site as part of the Irish Wetland Bird Survey (I-WeBS) since the survey commenced in 1994. The total I-WeBS count area is 10,300 ha (Crowe, 2005).

Table 4.1 presents population[9] data for the non-breeding waterbird Special Conservation Interest (SCI) species of Inner Galway Bay SPA based on data from the I-WeBS database. For the calculation of the individual species populations shown, total numbers are calculated from counts summed across all subsites counted in each month surveyed (I-WeBS months: Sept – March). The annual maxima is then identified and used to calculate the five-year mean peak. The baseline period is 1995/96 – 1999/00. The most recent five-year average is 2005/06 – 2009/10. All data are from I-WeBS.

When examining waterbird data, it is standard practice to use the mean of peak counts because they reflect more accurately the importance of a site for a particular species. Data are assessed within five-year periods (i.e. five-year peak mean) which help to account for inconsistencies in data gathering (i.e. differing coverage) or fluctuations in numbers. But 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).

In addition to I-WeBS, special species-specific surveys are also conducted on an annual or regular basis and these data are, where appropriate, integrated into the I-WeBS database. These surveys are described further in Appendix 2.

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

Gull species are not assigned 1% thresholds in Table 4.1. The wintering distributions of gull species are widespread and not monitored routinely during I-WeBS therefore standard methods of population estimation and threshold setting are difficult. SCI selection in relation to gull species therefore relates to the known most important sites for the gull species in question and a 'threshold of significance' is applied (Crowe, 2005).[10]

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

[10] Current threshold of significance is 1,000 for Black-headed Gull and 500 for Common Gull.

Table 4.1 Population data for non-breeding waterbird Special Conservation Interest Species of Inner Galway Bay SPA

Site Special Conservation Interests (SCIs)	Baseline Period (1995/96 - 1999/00)	Recent Site Data (2005/06 – 2009/10)
Light-bellied Brent Goose*	676 (i)	1,142 (i)
Red-breasted Merganser*	249 (n)	219 (n)
Black-throated Diver*	36	14†
Great Northern Diver*	94 (i)	182 (i)
Cormorant*	266 (n)	263 (n)
Grey Heron*	102 (n)	107 (n)
Ringed Plover*	335 (n)	392 (n)
Bar-tailed Godwit*	447(n)	381 (n)
Turnstone*	182(n)	330 (n)
Wigeon	1168 (n)	1,869 (n)
Teal	700 (n)	973 (n)
Golden Plover	2,430 (n)	2,343 (n)
Lapwing	3,969 (n)	3,282 (n)
Dunlin	2,155 (n)	2,304 (n)
Curlew	697 (n)	674 (n)
Redshank	505 (n)	855 (n)
Black-headed Gull	1,941 (t)	2,091 (t)
Common Gull	1,066 (t)	1,292 (t)

* denotes site selection species. n/c = not calculated.
(i) denotes numbers of international importance; (n) denotes numbers of all-Ireland importance; (t) denotes numbers that are above the threshold of significance applied by Crowe (2005)
International thresholds used for the baseline period are given in Wetlands International (2002). Recent site data uses thresholds as per Wetlands International (2006). All-Ireland thresholds are shown within Crowe et al. (2008).
† Note: these data are for the period 2004/05 – 2008/09.

4.2 Waterbird population trends at Inner Galway Bay SPA

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

For Inner Galway Bay SPA, annual population indices were calculated for each SCI species for the data period 1994/95 to 2008/09. This analysis was undertaken using data from the Irish Wetland Bird Survey (I-WeBS).

Table 4.2 presents site population trends for the waterbird Special Conservation Interest species of Inner Galway Bay SPA. Trends are given for the 'long-term' 12-year period (1995/96–2007/08) and the recent five-year period (2002/03 - 2007/08). The values given represent the percentage change in index (population) values across the specified time period. Positive values equate to increases in population size while negative values reflect a decrease in population size across the specified time period.

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

Trend analysis using population indices was not carried out for Black-throated Diver, Great Northern Diver, Black-headed Gull or Common Gull. Consistent data for Black-throated Diver and Great Northern Diver are difficult to attain because the species often occur at distances offshore that are difficult to survey from land-based counts. Gull species are not counted routinely during I-WeBS. For these species, a measure of population change was calculated using the generic threshold method (JNCC, 2004) which compares population size at two time intervals, based on five-year means (see Appendix 3 for methods).

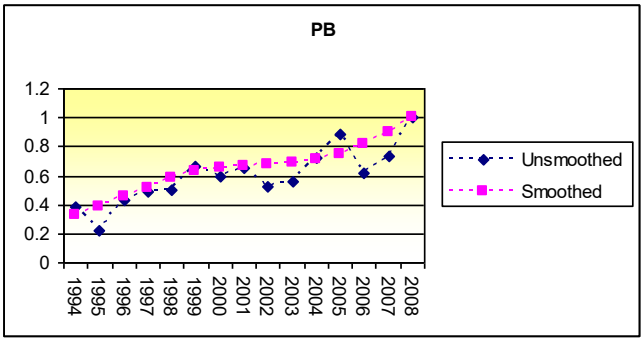
Table 4.2 Site Population Trends for waterbird Special Conservation Interest species of Inner Galway Bay SPA

	Special Conservation Interests	Site Population Trend[1] 12 Yr	Site Population Trend[2] 5 Yr	Population Change[3]
Site Selection Species	Light-bellied Brent Goose	+ 135	+ 32.5	
	Red-breasted Merganser	- 4.1	- 17.6	
	Black-throated Diver			- 61[†]
	Great Northern Diver			+ 93
	Cormorant	+ 42.8	- 14.1	
	Grey Heron	+ 52.4	- 6.6	
	Ringed Plover	+ 73.1	+ 34.2	
	Bar-tailed Godwit	+ 26.4	- 14.4	
	Turnstone	+ 104.6	+ 30	
Additional Special Conservation Interests	Wigeon	+ 17.6	- 10.5	
	Teal	+ 71.2	- 5.1	
	Golden Plover	+ 23.6	- 43.9	
	Lapwing	+ 1.6	- 29.2	
	Dunlin	+ 11	- 24.8	
	Curlew	+ 10.6	- 14.5	
	Redshank	+ 81	+ 1.4	
	Black-headed Gull			+ 8
	Common Gull			+ 21

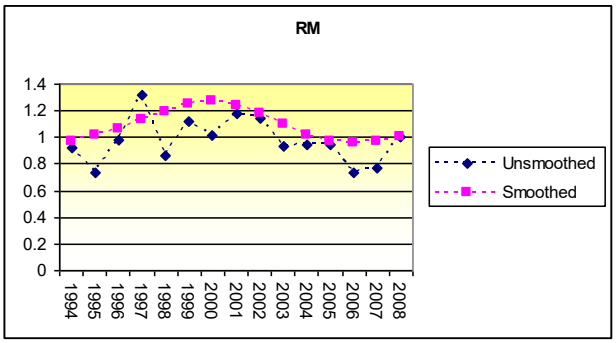
[1]Site population trend analysis: 12 yr = 1995/96 – 2007/08
[2]Site population trend analysis: 5 yr = 2002/03 – 2007/08.
[3]Site population change based on two five-year – means (1995/96 – 1999/00 and 2005/06 – 2009/10).
[†]This site population change is based on a comparison of two five-year mean of peak counts - 1995/96 – 1999/00 and 2004/05 – 2008/09.

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

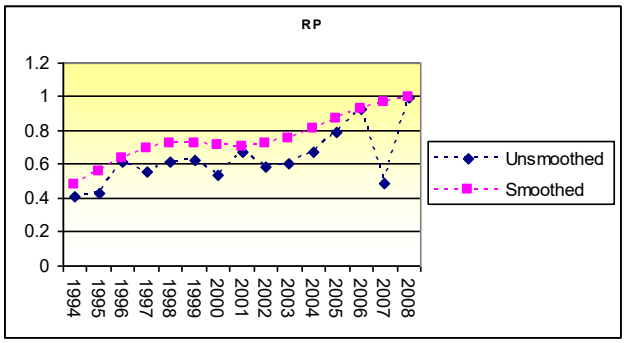
Light-bellied Brent Goose – shows a trend for progressive increase at Inner Galway Bay. This is consistent with the national trend (Crowe et al. 2008; Boland & Crowe, 2012) and the increasing numbers at flyway level (e.g. Fox et al. 2010).



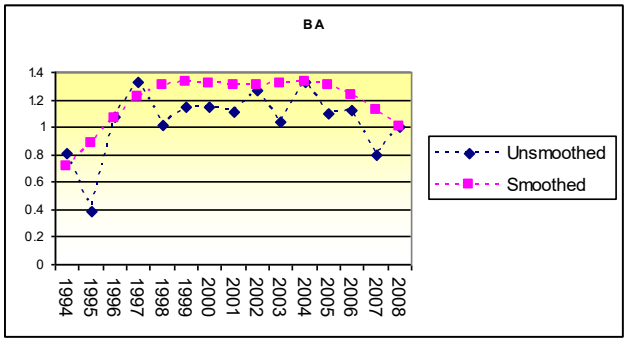
Red-breasted Merganser – numbers increased up to 2001/02 but then decreased to levels similar to the mid 1990's. This has resulted in a relatively small long-term trend for decline; the larger five-year trend for decline reflecting the recent drop in numbers.



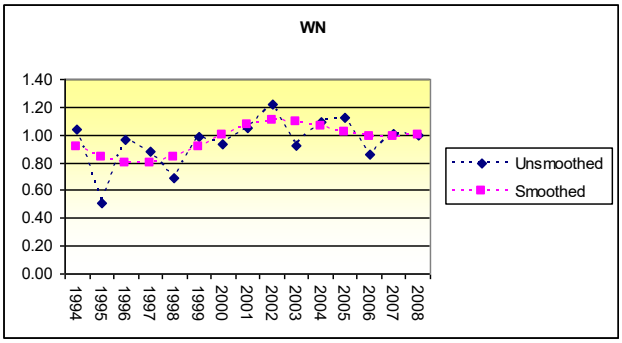
Ringed Plover – shows a trend for progressive increase at Inner Galway Bay. This is in line with the national trend for increase but contrasts with the observed declines in Northern Ireland and Britain (Calbrade et al. 2010). Note that numbers dropped significantly in 2007.



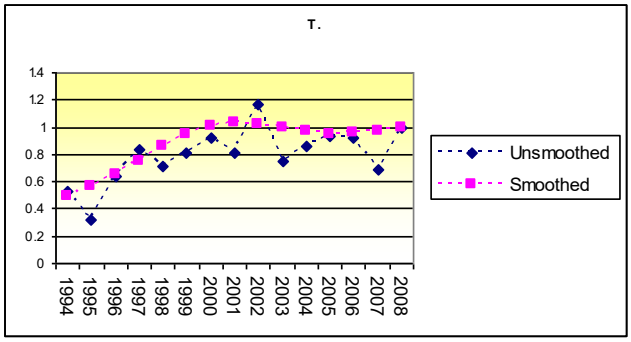
Bar-tailed Godwit – site numbers increased from 1994/95 to 1997/98 then remained relatively stable until 2005/06. Numbers have since declined leading to the short-term trend for decline.



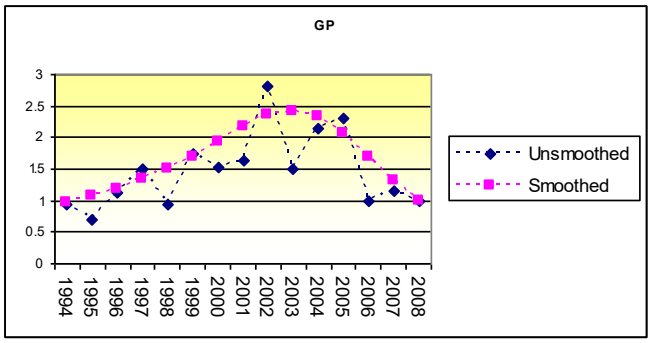
Wigeon – widely-fluctuating numbers in the mid to late 1990's have been smoothed to reveal an increase in the site population over the long-term. More recently however, numbers have declined leading to the short-term negative trend.



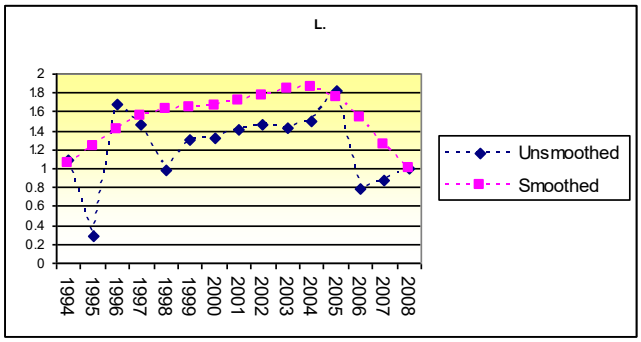
Teal – exhibited a steady increase in numbers between 1994/95 and 2002/03. Since then numbers have been largely stable.



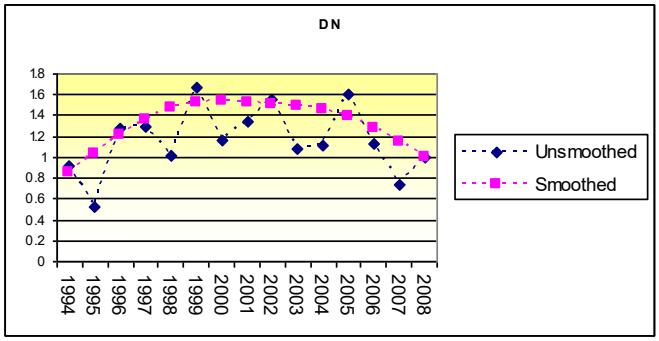
Golden Plover – the long term trend for increase indicates that numbers were stable. However during this time period, site numbers more than doubled between 1994/95 and 2002/03 and subsequently declined between 2002/03 and 2008/09 to former mid 1990's levels, as reflected by the short-term negative trend.



Lapwing – the long-term trend suggests a relatively stable site population. However, as for Golden Plover, Lapwing numbers increased substantially up to 2004/05 and subsequently declined rapidly to former levels, as reflected by the short-term negative trend.



Dunlin – the long-term trend indicates a long-term increase in numbers at the site. However within this time period numbers have increased 1994/95 to 2004/05 and subsequently declined, as reflected by the short-term negative trend. This trend for decline follows the national trend and that evident in Northern Ireland and Britain (Calbrade et al. 2010).



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

Conservation condition of waterbird species is determined using the longer-term site population trend and is assigned using the following criteria:

Favourable population = population is stable/increasing.

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

Moderately 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-throated Diver, Great Northern Diver, Black-headed Gull and Common Gull, conservation condition has been assigned using % population change (See Section 4.2) but this is tentative given factors (described above) in relation to their count coverage during the non-breeding season.

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

With regards the 18 non-breeding waterbird species of Special Conservation Interest for Inner Galway Bay SPA, and based on the long-term (12-year) population trend for the site, it has been determined that (Table 4.3):-

1. 1 species is considered as **intermediate (unfavourable)** (Red-breasted Merganser);

2. 1 species is considered as **highly unfavourable** (Black-throated Diver)

3. 16 species are currently considered as **favourable** (Light-bellied Brent Goose, Great Northern Diver, Cormorant, Grey Heron, Ringed Plover, Bar-tailed Godwit, Turnstone, Wigeon, Teal, Golden Plover, Lapwing, Dunlin, Curlew, Redshank, Black-headed Gull and Common Gull).

Site conservation condition and population trends for waterbird species of Special Conservation Interest at Inner Galway Bay SPA have been reviewed in light of species' all-Ireland and international trends (Table 4.3). The calculation of all-Ireland trends (island of Ireland) for the long-term (12-year) data period has been facilitated by the provision of indices from the I-WeBS and the WeBS database (kindly provided by the I-WeBS Office and the British Trust for Ornithology). International trends follow Wetlands International (2006).

Table 4.3 Non-breeding SCI species of Inner Galway Bay SPA – Current Site Conservation Condition

Site Special Conservation Interests (SCIs)	BoCCI Category[a]	Current Site Trend[b]	Site Conservation Condition	Current all-Ireland Trend[c]	Current International Trend[d]
Light-bellied Brent Goose*	Amber	+ 135	Favourable	+ 58	Increase
Red-breasted Merganser*	Green	- 4.1	Intermediate (Unfavourable)	- 11	n/c
Black-throated Diver*	Green	- 61	Highly unfavourable	n/c	Decline
Great Northern Diver*	Green	+ 93	Favourable	n/c	n/c
Cormorant*	Amber	+ 42.8	Favourable	+ 31.5	Increase
Grey Heron	Green	+ 52.4	Favourable	+ 29.2	Increase
Ringed Plover*	Amber	+ 73.1	Favourable	+ 21.8	Decline
Bar-tailed Godwit*	Amber	+ 26.4	Favourable	+ 1.5	Stable
Turnstone*	Green	+ 104.6	Favourable	+ 16.1	Decline
Wigeon	Amber	+ 17.6	Favourable	- 20.2	Stable
Teal	Amber	+ 71.2	Favourable	+ 11.3	Increase
Golden Plover	Red	+ 23.6	Favourable	- 2.2	Decline
Lapwing	Red	+ 1.6	Favourable	- 40.1	Decline
Dunlin	Amber	+ 11	Favourable	- 46.5	Stable (*alpina*)
Curlew	Red	+ 10.6	Favourable	- 25.7	Decline
Redshank	Red	+ 81	Favourable	+ 22.7	Stable/Decline
Black-headed Gull	Red	+ 8	Favourable	n/c	n/c
Common Gull	Amber	+ 21	Favourable	n/c	n/c

*Denotes site selection species; [a]See Lynas *et al.* (2007) for detailed listing criteria; [b] Current site population trend: see Section 4.2 for details. [c]all-Ireland trend calculated for period 1994/95 to 2008/09; [d]international trend after Wetland International (2006); n/c = not calculated.

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

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

Orange, pink and red categories, which are not used in the current assessment for Inner Galway Bay, highlight where populations are stable at national level, but where significant declines are seen at site level. In these cases it would be reasonable to suggest that site-based management issues may be responsible for the observed declining site population trends (Leech et al. 2002). However, while site conservation condition, based on the long-term trend, is favourable for the majority of species, it is notable that ten species are showing a trend for decline over the short-term (recent 5-year period) and for four of these species (Cormorant, Grey Heron, Bar-tailed Godwit and Teal) the trends are contrary to the all-Ireland trend.

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 Inner Galway Bay SPA.

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

The information provided in Part Five 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 November 2011.

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

Waterbirds, defined as ‘*’birds that are ecologically dependent on wetlands”* (Ramsar Convention, 1971), are a diverse group that includes divers, grebes, swans, geese and ducks, gulls, terns and wading birds. The I-WeBS database shows 77 waterbird species that have been recorded at Inner Galway Bay SPA during the period 1994/95 – 2008/09 representing ten families: *Gaviidae* (divers), *Podicipedidae* (grebes), *Anatidae* (swans, geese and ducks), *Rallidae* (Water Rail, Moorhen & Coot), *Haematopodidae* (oystercatchers), *Charadriidae* (plovers and lapwings), *Scolopacidae* (sandpipers and allies) and *Laridae* (gulls and terns) plus *Phalacrocoracidae* (Cormorants) and *Ciconiiformes* (Herons).

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

In the period 1994/95 to 2008/09, Inner Galway Bay supported 38 waterbird species on a regular basis[12] during the non-breeding season. Of these, 18 species are listed as Special Conservation

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

[12] Regular is defined as a species occurring in 12 of the 15-year data period.

Interest species for the site and a further 20 are non-SCI species. These additional non-SCI waterbird species are listed in Table 5.1 together with population data taken from the I-WeBS database. Note that the International and all-Ireland 1% thresholds used to compare with the baseline and recent site averages are different. These thresholds (periods 1994/95 – 1998/99 and 1999/00 – 2003/04) are outlined in Crowe et al. (2008).

Table 5.1 Regularly-occurring non SCI waterbird species that occur at Inner Galway Bay SPA during the non-breeding season

Species	Baseline Data Period (1995/96 – 1999/00)	Site Average (2004/05 – 2008/09)
Mute Swan (*Cygnus olor*)	150 (n)	183 (n)
Shelduck (*Tadorna tadorna*)	146	135
Shoveler (*Spatula clypeata*)	88	137†
Mallard (*Anas platyrhynchos*)	200	221
Tufted Duck (*Aythya fuligula*)	13	15
Scaup (*Aythya marila*)	40	33
Long-tailed Duck (*Clangula hyemalis*)	21	7
Common Scoter (*Melanitta nigra*)	87	35
Goldeneye (*Bucephala clangula*)	9	6
Red-throated Diver (*Gavia stellata*)	13	22 (n)
Little Grebe (*Tachybaptus ruficollis*)	35 (n)	64 (n)
Great Crested Grebe (*Podiceps cristatus*)	16	33
Oystercatcher (*Haematopus ostralegus*)	576	668
Grey Plover (*Pluvialis squatarola*)	60	124 (n)
Snipe (*Gallinago gallinago*)	46	23
Black-tailed Godwit *(Limosa limosa)*	57	282 (n)
Greenshank (*Tringa nebularia*)	20 (n)	39 (n)
Lesser Black-backed Gull (*Larus fuscus*)	15	14
Herring Gull (*Larus argentatus*)	216	419
Great Black-backed Gull (*Larus marinus*)	129	106

(n) denotes numbers of all-Ireland importance.
Annex I species are shaded in grey.
† Note: these data are for the period 2005/06 – 2009/10

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

Table 5.2 provides selected ecological information for waterbird SCI species of Inner Galway Bay SPA. Information is provided for Selection species (Table 5.2a) and for additional Conservation Interests (Table 5.2b). Information is provided for the following categories[13]:

- waterbird family (group);
- winter distribution – species distribution range during winter. Please note this is based on the period 2001/02 – 2008/09 (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).

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

It should be borne in mind that a single wetland site seldom meets all the ecological requirements of a diverse assemblage of waterbirds (Ma et al. 2010). Although some waterbird species will be faithful to specific habitats within the SPA, many will at times also use habitats situated within the immediate hinterland of the site or in areas ecologically connected to the SPA. These areas may be used as alternative high tide roosts, as a foraging resource or, be simply flown over, either on migration or on a more frequent basis throughout the non-breeding season as waterbirds 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 mainly 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 but also makes good use of terrestrial 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 terrestrial grasslands increasingly when intertidal seagrass and algae become depleted (Benson, 1999).

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

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

Table 5.2a Waterbirds – Ecological characteristics, requirements & specialities – non-breeding waterbird selection species

	Family (group)	Winter distribution[A]	Trophic Guild[B]	Food/Prey Requirements[C]	Principal supporting habitat within site[D]	Ability to utilise other/alternative habitats[E]	Site Fidelity[F]
Light-bellied Brent Goose* *Branta bernicla hrota*	Anatidae (geese)	Localised	1, 5	Highly specialised	Intertidal mud and sand flats	2	High
Red-breasted Merganser *Mergus serrator*	Anatidae (sea ducks)	Localised	2	Highly specialised	Sheltered & shallow subtidal	1	Unknown
Black-throated Diver *Gavia arctica*	Gaviidae (divers)	Highly restricted	3	Highly specialised	Sheltered & shallow subtidal	2	Unknown
Great Northern Diver *Gavia immer*	Gaviidae (divers)	Localised	3	Highly specialised	Sheltered & shallow subtidal	1	Unknown
Cormorant *Phalacrocorax carbo*	Phalacrocoracidae (cormorants)	Widespread	3	Highly specialised	Sheltered & shallow subtidal	1	Moderate
Grey Heron *Ardea cinerea*	Ardeidae (herons)	Widespread	6	Narrower	Sheltered & shallow subtidal; coastal lagoons	1	Unknown
Ringed Plover *Charadrius hiaticula*	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Bar-tailed Godwit *Limosa lapponica*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	Moderate
Turnstone *Arenaria interpres*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High

[A] Winter distribution: Very widespread (>300 sites); Widespread (200 – 300 sites); Intermediate (100 – 200 sites); Localised (50-100 sites); Highly restricted (<50 sites) (based on 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 Inner Galway Bay SPA. Note that this is the main habitat used when foraging.

[E] Ability to utilise alternative habitats refers to the species ability to utilise other habitats adjacent to the site. 1 = wide-ranging species with requirement to utilise the site as and when required; 2 = reliant on site but highly likely to utilise alternative habitats at certain times (e.g. high tide); 3 = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements. Note, a score of 1 for sea ducks and divers relates to propensity for within-season movements although the site is an important part of the species' wintering range.

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

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

	Family (group)	Winter distribution[A]	Trophic Guild[B]	Food/Prey Requirements[C]	Principal supporting habitat within site[D]	Ability to utilise other/alternative habitats[E]	Site Fidelity[F]
Wigeon *Anas penelope*	Anatidae (dabbling ducks)	Widespread	1, 5	Narrower	Intertidal mud and sand flats, sheltered & shallow subtidal and lagoons	1	Weak
Teal *Anas crecca*	Anatidae (dabbling ducks)	Widespread	1	Wide	Intertidal mud and sand flats, sheltered & shallow subtidal and lagoons	3	Weak
Golden Plover *Pluvialis apricaria*	Charadriidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate
Lapwing *Vanellus vanellus*	Charadriidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	Moderate
Dunlin *Calidris alpina*	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	3	High
Curlew *Numenius arquata*	Scolopacidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	High
Redshank *Tringa totanus*	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate
Black-headed Gull *Chroicocephalus ridibundus*	Lariidae (gulls)	n/c	1, 2, 4, 6, 7	Wide	Intertidal mud and sand flats & sheltered & shallow subtidal	2	Moderate
Common Gull *Larus canus*	Lariidae (gulls)	n/c	1, 2, 4, 6, 7	Wide	Intertidal mud and sand 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). Gulls are not included because they are not counted routinely at all sites during I-WeBS.
[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 Inner Galway Bay SPA. Note that this is the main habitat used when foraging with the exception of Golden Plover & Lapwing (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 information).

5.3 The 2009/10 waterbird survey programme

5.3.1 Introduction

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

Inner Galway Bay is a large wetland complex; the SPA covering over 13,000 hectares and including many small bays and islands. Achieving full coverage of this area during counts is therefore extremely challenging, not least because of the unfeasibly large number of counters this would necessitate but also due to limitations on time, accessibility and visibility. Therefore the main survey objective was to complete surveys across areas covered previously by I-WeBS and to include additional areas where practicable. As a consequence there are sections of the designated SPA that were not counted (e.g. compare maps in Appendix 1 and Appendix 6). It should also be borne in mind that several of the listed SCI species (e.g. Red-breasted Merganser, Great Northern Diver) often occur too far offshore to be observed, particularly when sea conditions are rough. The many islands within the site also add to the observation difficulties. Necessary caution should therefore be applied when examining data.

The survey programme comprised four low tide counts (Oct, Nov & Dec 2009 and Feb 2010) and a high tide count (Feb 2010).[14] Waterbirds were counted within a series of count sections (subsites) across the site (Appendix 6). Between 21 and 29 subsites were counted on the different survey dates. Differences in coverage relate to various factors including weather conditions (failing weather during a survey resulting in some subsites being abandoned) and the subdivision of some subsites during the survey programme. Further details are available in Cummins and Crowe (2010) and outlined in Appendix 6.

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

[14] Low tide surveys: 23/10/09, 06/11/09, 04/12/09 & 19/02/10; High tide survey: 09/02/10.

Table 5.3 Definition of broad habitat types used during surveys

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. Includes aquatic habitats that are not tidal and therefore includes lagoons that occur within the study area.

A roost survey scheduled for the 2009/10 season, although attempted, was abandoned due to poor visibility (fog). Data on roosting waterbirds were therefore collated from a variety of sources including the high tide count on 09/02/10.

5.3.2 Waterbird distribution data and analyses

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

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

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

For each of the analyses listed above and for each survey date completed, subsites were ranked in succession from the highest to the lowest in terms of their relative contribution to each species' distribution across all subsites surveyed. Rank positions were then converted to categories (see below) with the exception of those relating to the 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).

Waterbird count data from low tide surveys were used to prepare distribution maps ('dot density maps'). 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 (intertidal/subtidal/lagoon only) for the birds counted, the resulting map is equivalent to presenting numbers and densities and provides a relatively quick way of assessing species foraging distribution.

Notes on data interpretation and methodological limitations

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

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 (intertidal/subtidal/lagoon only) 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. One example is 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. In general, 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.

Please note that standard waterbird codes are often used in figures, tables and data files; these codes are listed in Appendix 4.

5.3.3 Summary Results

A total of 48 waterbird species were recorded during the 2009/10 survey programme at Inner Galway Bay. Cummins and Crowe (2010) provide a summary of waterbird data collected.

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

Average subsite occupancy, defined as the average proportion of subsites in which a species occurred during low tide counts[15], varied greatly and ranged from the restricted distribution of Black-throated Diver (*c* 14% of subsites) to the most widespread species across the site, Black-headed Gull that occurred on average within 89% of subsites (Table 5.4). Of the 18 non-breeding waterbird SCI species, three occurred on average within less than 25% of subsites (Black-throated Diver, Ringed Plover and Golden Plover) and four species occurred within 25-50% of subsites (Great Northern Diver, Bar-tailed Godwit, Lapwing and Dunlin). Of the remaining 11 species, four occurred in greater than 75% of all subsites surveyed (Curlew, Redshank, Black-headed Gull and Common Gull).

Species richness (total number of species) across the whole site was relatively consistent throughout the survey programme. A relatively consistent total of 40, 41, 44 and 41 species were recorded during the four low tide counts respectively and 42 species were recorded during the high tide count (09/02/10).

Species richness at subsite level varied considerably (Table 5.5) and was greatest within 0G031 (Lough Rusheen) and within 0G495 (Oranmore Bay) which both supported 27 species on one low tide survey occasion. The highest average low tide subsite diversity was recorded for 0G495 (Oranmore Bay) (an average 25 species). Lough Rusheen (0G031) held the greatest number of species (27) during the high tide survey. Lowest diversity was recorded for 0H488 (Rine Lough Murree Flaggy Shore) that supported an average five species during low tide surveys (maximum eight species) and six species during the high tide survey.

[15] Calculation takes into account different number of subsites covered on each survey date and takes average across the four LT surveys.

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

Site Special Conservation Interests (SCIs)	Peak number recorded - LT surveys[I]	Peak number recorded - HT survey[II]	Average subsite % occupancy [III]
Light-bellied Brent Goose*	1,042 (i)	1,195 (i)	62.9 (8.6)
Red-breasted Merganser*	187 (n)	154 (n)	52.0 (7.3)
Black-throated Diver*	23	6	13.6 (6.6)
Great Northern Diver*	105 (i)	47	31.5 (9.9)
Cormorant*	180 (n)	113	58.8 (11.3)
Grey Heron	117 (n)	18	66.8 (13.7)
Ringed Plover*	382 (n)	208 (n)	21.3 (9.5)
Bar-tailed Godwit*	402 (n)	570 (n)	46.0 (9.3)
Turnstone*	466 (n)	305 (n)	53.2 (10.3)
Wigeon	1,334 (n)	1,621 (n)	70.8 (5)
Teal	945 (n)	997 (n)	55.3 (4.8)
Golden Plover	3,015 (n)	361	16.6 (6.1)
Lapwing	2,260 (n)	719	47.8 (13)
Dunlin	2,592(n)	948 (n)	39.3 (7.3)
Curlew	733 (n)	700 (n)	86.9 (4)
Redshank	988 (n)	664 (n)	86.0 (6.3)
Black-headed Gull	2,302 n/c	1,976 n/c	88.8 (4.2)
Common Gull	1,049 n/c	795 n/c	80.0 (8)

* site selection species. n/c = not assessed. (i) denotes numbers of International importance; (n) denotes numbers of all-Ireland importance (1% thresholds; 1999/00 – 2003/04 Crowe et al. 2008).
[I] 4 low-tide counts undertaken on (23/10/09, 06/11/09, 04/12/09 & 19/02/10); [II] 1high-tide count undertaken on (09/02/10); [III] Mean (± s.d.) calculated across 4 low tide counts (with the exception of data for Light-bellied Brent Geese that were averaged across three surveys only (a solitary individual recorded on 23/10/09 was excluded).

Table 5.5 Subsite species richness

Subsite	Subsite Name	Mean (±S.D) LT Survey	n	HT Survey	Peak Overall
0G031	Lough Rusheen	21 (4)	4	27	27 (H)
0G032	Lough Atalia	17 (3)	4	13	21 (L)
0G479	Rinville & Ardfry South	17 (1)	3	16	18 (L)
0G480	Rinville & Ardfry North	13 (4)	3	13	16 (L)
0G481	Tawin South	21 (3)	4	25	25 (H)
0G482	Tawin North	16 (4)	4	12	19 (L)
0G483	Bayynacourty South	13 (4)	2	16	16 (H)
0G484	Ballynacourty North	15 (1)	2	16	16 (H)
0G485	Tyrone House & Morans	8 (4)	4	6	13 (L)
0G486	Killeenaran	15 (4)	4	11	21 (L)
0G487	Tarrea & adjacent areas	14 (1)	4	13	15 (L)
0G488	Kinvarra	13 (1)	4	9	14 (L)
0G489	Traught & Doorus	22 (5)	4	22	26 (L)
0G490	Cave – Clarinbridge	16 (5)	4	13	20 (L)
0G491	Ballynacourty	15	1	-	15 (L)
0G493	Kilcaimin	18 (3)	4	16	22 (L)
0G494	Rinville & Ardfry	21	1	-	21 (L)
0G495	Oranmore Bay	25 (2)	4	21	27 (L)
0G496	Rosshill	9 (3)	4	11	12 (L)
0G497	Ballyloughlan	12 (5)	4	14	18 (L)
0G498	Nimmo's Pier & Docks	11 (2)	4	8	14 (L)
0G499	Salthill & environs	22 (4)	4	19	26 (L)
0G923	Deer Island	5	1	4	5 (H)
0H444	Coranroo	16 (3)	4	13	20 (L)
0H445	Martello Tower, L. Muree & shore	15 (4)	4	17	18 (L)
0H446	Castle – Bell Harbour – Finvarra	17 (1)	4	20	20 (H)
0H447	Bishop's Quarter	10 (9)	4	15	19 (L)
0H448	Ballyvaughanan Bay	18 (1)	3	17	19 (L)
0H449	Aughinish	21 (1)	4	19	22 (L)
0H465	Rinn	21 (3)	3	18	25 (L)
0H488	Rine Lough Murree Flaggy Shore	5 (2)	4	6	8 (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–e). The relative importance of each subsite is based on the final rank positions (see 5.3.2 for methodology). Where a box is left blank, simply means that a species was not recorded in that subsite.

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

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

Tables 5.6 (a–e) are followed by species discussion notes 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) Inner Galway 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). *n* = number of low tide surveys in which subsite was counted (Section 5.3.1 & Appendix 6). Waterbird species codes are presented in Appendix 4).

Species ► Subsites ▼	*n*	PB	RM	BV	ND	CA	H.	RP	BA	TT	WN	T.	GP	L.	DN	CU	RK	BH	CM
0G031	4		M		H	V	H	H	H	L	H	L	L	M	V	H	V	H	M
0G032	4		M			L	H			M	H	M		H		L	H	H	H
0G479	3	M	H			M	V		M	M	L	L		M	L	M	M	L	M
0G480	3	M	H		M	H	V		L	M						L	L	M	H
0G481	4	V	H		M	H	H	M	H	H	L	L	H	H	V	M	M	M	M
0G482	4	M	M		H	M	M			H	L	H	M	V	V	M	H	L	M
0G483	2	H	L		M			L	H	H					L	L	M		M
0G484	2	V	V				L	L	M	H	L		M	H	H	M	H		
0G485	4						M			H	M	H		H		M	L	L	
0G486	4	M		M	L		M		L	M	H	M	H	H	M	H	M	M	H
0G487	4	M	M	H		H	H				M	L		L		M	L	M	M
0G488	4	L				H	M			H	H	M		H	V	M	M	H	H
0G489	4	H	H	L	H	M	H	L		H	H	H		H	H	V	V	H	H
0G490	4	H	M		M	M	M			H	H	M		H	L	H	H	M	L
0G491	1	H	V			M					L	M	M	V		L	M	M	
0G493	4	L					L		H	M	M	H	H	H	H	H	H	H	H
0G494	1		V			M	V		M	M	L	L		L		M	M	L	M
0G495	4	H	M			H	V		H	H	V	V	V	V	H	V	V	H	H
0G496	4								M		L	H		L	L	H	M	M	L
0G497	4	L	H		M	H	L	M	H	M	M				M	L	M	H	L
0G498	4		L			H	H			H	L					L	L	H	H
0G499	4	M	M		V	V	H	V	V	H	M	M			H	M	H	V	V
0G923	1					H													H
0H444	4	M	V	H		H	H		M	H	H	H		H	M	H	H	M	H
0H445	4	H	M	V	V	H	M	L	L	L				L	M	M	H	M	V
0H446	4	H	H			H	H		M		M	H	M	L		H	H	H	H
0H447	3	M	H	H	L	M	M	H		L	L	M	H		L	L	L	M	H
0H448	3	L	H	V		H	H	M	H	L	H			L	L	H	M	M	H
0H449	4	V	V	H	H	V	H	V	H	V	M		V		H	V	H	H	V
0H465	3	H	H	V	V	M	M	V	H	M	M	M			H	H	H	H	H
0H488	4						L				V	L						M	

Table 5.6 (b) Inner Galway Bay Subsite assessment – total numbers foraging intertidally,[I] subtidally[II] and intertidal/subtidal combined [III](LT surveys).

Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods). *n* = number of low tide surveys in which subsite was counted (Section 5.3.1 & Appendix 6). Note H.* Grey Heron – data is shown for all habitats combined.

Species ► Subsites ▼	*n*	PB[I]	PB[II]	RM[II]	BV[II]	ND[II]	CA[II]	H.*	RP[I]	BA[III]	TT[III]	WN[I]	WN[II]	T.[I]	T.[II]	GP[I]	L.[I]	DN[III]	CU[III]	RK[I]	BH[I]	CM[I]
0G031	4	M		M		H	H	H	H	H	L	V		H		L	H	V	H	V	H	H
0G032	4			H			L	H			L	H	V	L	H		H		L	M	H	L
0G479	3		M	H			H	L		M	L		L		L				M	M	M	
0G480	3	M	L	V		M	H	V		L	M								M	L		M
0G481	4	H	V	V		M	H	M	M	H	H		M		L	L	M	H	M	M		L
0G482	4		L	L		H	L	M			L		L		L	M	L	L	L	H		L
0G483	2	M	H	L		L				V	H							L	L	H		L
0G484	2		H					M	L	M	H								M	M		
0G485	4							M			H		L		L				M	L		
0G486	4		H							L	L	L	V	M	H				H	M	L	
0G487	4		M	H	V		V	H					M						M	L	L	M
0G488	4						H	M			H	M	H		H			L	M	M		
0G489	4	M	H	H	H	H	H	H	L		H	V	M	H	M		L	H	H	V	M	H
0G490	4		L	M		M	M				H		H	M	H			L	H	H		
0G491	1	V	H	V																		
0G493	4		L					L		M	M	M	L	H	M			V	H	H	M	
0G494	1			H				V		M	L			M					L	M		L
0G495	4	M	M	H			H	V		H	M	V	V	V	V		V	V	V	V	H	H
0G496	4									M			M		H			L	H	M	M	M
0G497	4	L		H		L	H	L	M	H	M	L	M					M	L	M	H	M
0G498	4			L			M	M			M		L							L	H	H
0G499	4	H		M		V	V	V	V	V	H	H	M		V			H	M	H	V	V
0G923	1																					
0H444	4		M	V	H					M	H	M	H	L	H		H	H	H	H	H	M
0H445	4	M	M	M	V	V	V		L	L	L							M	M	H	L	
0H446	4	H	M	H			H	M		M				V	M	M			H	H	L	M
0H447	3	H	H	M	H	L	M	M	H		L		L	M		H		M	L	L	L	H
0H448	3	L		M	H		H	M		H	L		H				V	L	M	M	L	H
0H449	4	V	V	H	H	H	H	H	V	H	V					V		V	V	H	H	V
0H465	3	H	M	M	H	V	V	M	V	H	M			L	M			H	H	H	M	H
0H488	4											H	V		L							

Table 5.6 (c) Inner Galway Bay Subsite assessment – total numbers (roosting/other behaviour) within LT surveys (Intertidal[I], Subtidal[II], Intertidal/Supratidal[III] and Int/Supra/Sub combined[IV]. Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods). *n* = number of low tide surveys in which subsite was counted (Section 5.3.1 & Appendix 6).

Species ► Subsites ▼	*n*	PB[I]	PB[II]	RM[II]	BV[II]	ND[II]	CA[III]	H.[III]	RP[III]	BA[IV]	TT[III]	WN[II]	WN[III]	T.[II]	T.[III]	GP[I]	L.[IV]	DN[III]	CU[IV]	RK[IV]	BH[II]	BH[III]	CM[II]	CM[III]
0G031	4						V										M			V		H		H
0G032	4																H			H	V	V	H	V
0G479	3		L	M				H		M	H	M	L	L			M	M		M	L	L	M	M
0G480	3						H																	
0G481	4	L	M	V		V	M	H		H	V	M	M		L	V	H	V	M	M	M	M	M	M
0G482	4			V		V	L	L				M	M	V	M	H	V	V	M	M		M	M	M
0G483	2		M	L					H															L
0G484	2		M	V							M	M				H	H	V	L	V				
0G485	4							H				M	H	V			H		M		M	M		
0G486	4		L		V	M		H			M	V	V	M	M	H	H	M	H	H	L	H	M	H
0G487	4	H		M			H	V				L	M	L			L		H	L		H		M
0G488	4	M					M	H				V	V	L	L		M	V	H		M	V	M	H
0G489	4		V			M	M	H			H	M	H	M	V		H		H	V	L	M	H	H
0G490	4		V				L	H				H	V		M		H		M	M	H	M	M	L
0G491	1	H					M						L		H	M	V		L	M		M		
0G493	4		L							V		H	L	V	H	H	M	M	V	V	H	H	V	H
0G494	1			H			M	L		V	M	L		L			L		M		H	L	L	H
0G495	4						M	L			L	L	M	L	V	V	V		L	M	H	V	H	L
0G496	4																L							
0G497	4						H			V														
0G498	4																				V		V	
0G499	4						H															H		H
0G923	1						V																	V
0H444	4						H	V		V		V	H	H	V		H	H	V		V	M	V	V
0H445	4				V	V	H	M			M						L	L		M		L		H
0H446	4		V				H	V				H	M	H	V		L		H	M	M		V	H
0H447	3		M	M			M	M				M		H	L				M		H		H	L
0H448	3		H	L	V		M	H	V	V	L	H	H				L		M		M	M	M	H
0H449	4	V	H	H		H	V	H	V		V	H							V		H	M	M	H
0H465	3	V		L	V	V	M	H					M	M	L				H		H	V	M	V
0H488	4											H	L								H			

Table 5.6 (d) Inner Galway Bay Subsite assessment – ranked total numbers HT Survey (all habitats).
n = number of subsites species was recorded in.

Species ► Subsites ▼	PB	RM	BV	ND	CA	RP	H.	BA	TT	WN	T.	GP	L.	DN	CU	RK	BH	CM
0G031	11	11		11	2	1	5	2		13		2	7	1	13	1	4	18
0G032									11	16	14		2			22	5	6
0G479	6	13		11			5		9	18	12		14		20	22	22	
0G480	8	7		6	6		1			24					23	17	18	22
0G481	4	1		3	8	9	4	5	1		17	1	4	4	15	2	11	3
0G482	3			2					13	15	12				16	22	22	
0G483	12	8		6		5			6	5	14			8	5	13	22	15
0G484	17	3					5	7	5	14			9	10	4	10	14	22
0G485		15		11						20	11						18	
0G486	7									9	1		13		16	15	16	19
0G487	20	11								10					23	11	20	21
0G488									13	12	9		5		12	21	20	17
0G489	1			3	8	6	5	8	1	4	6		1	9	1	17	13	5
0G490	15			11						7	10		10		9	14	14	22
0G491																		
0G493	19							6	13	17	4			3	6	3	9	1
0G494																		26
0G495	16	16		5	10				3	2	2		3	7	3	7	6	9
0G496							5	10		21	8			12	18	16	7	19
0G497	18	9		10		2		4	4	19					19	19	3	22
0G498			2		10		2									26	2	7
0G499	20				3			1	6	23				13	20	6	1	3
0G923					1													
0H444		6								1	3		8		10	4	10	8
0H445	5	5	1	11	6	8	5				17		12	5	8	12		9
0H446	10	2	2		4	4	2		10	8	5		6		2	5	8	2
0H447	12			6		7				21	7				22	19	11	13
0H448	9	4				3		3		6	16		11	6	10	22	17	12
0H449	2	9		1	5			9	8	11				2	13	8	22	16
0H465	14	14	1	6				10	11					11	7	8		11
0H488										3	19							13
n	21	16		15	11	9	10	11	15	24	19	2	14	13	24	26	25	26

Table 5.6 (e) Inner Galway Bay Subsite assessment – total numbers (roosting/other behaviour) within HT surveys (Intertidal[I], Subtidal[II], Intertidal/Supratidal[III] and Int/Supra/Sub combined[IV].

Species ► Subsites ▼	PB[I]	PB[II]	RM[II]	BV[II]	ND[II]	CA[III]	H.[III]	RP[III]	BA[IV]	TT[III]	WN[II]	WN[III]	T.[II]	T.[III]	GP[I]	L.[IV]	DN[III]	CU[IV]	RK[IV]	BH[II]	BH[III]	CM[II]	CM[III]
0G031																5					8		11
0G032																1			11			3	
0G479			6										3			14				10			
0G480												5									15		16
0G481	3	3	1		1	4	2	6	5	3				6	1	3	8	12	6	3	10	6	4
0G482					1				4		8			8				13	16	10			
0G483		4	4		3			2		7				3			7	4	12		15	9	9
0G484		5	2							2	4					7	3	2	4	10	13		16
0G485			7		4															6			
0G486		5					2				6		1	5		13		15	8	6	11		13
0G487		10	7				1											18		9		9	16
0G488											3	4				4		11	8		14		10
0G489	1	1			4	4		3		1	1	1	2	4		10	6	5	15	6		8	12
0G490											3	3		6		9		6		4	15	9	
0G491																							
0G493		7								7	6						5	8	5	1	7	1	1
0G494																							
0G495										4						2	3	2			4		7
0G496																					3		13
0G497									3												2		16
0G498																							
0G499						2			1								9		1		1		
0G923						1																	
0H444											2	2		1		6		9	3		5		5
0H445	1												4			12		16	12				6
0H446		8		1		3		3		5	5			10		8		1	2	2	6	2	2
0H447								5						2				17	16	5	9	5	16
0H448			3				2	1	2				5	8		11	2	10	16		11		8
0H449		2	4				2		6								1	13	7			7	
0H465										6								7	12				15
0H488							2											19				4	

Inner Galway Bay - Waterbird Survey Programme 2009/10

Waterbird distribution - discussion notes

Where mentioned, information on benthic communities or sediment is from the intertidal and subtidal sampling programme commissioned by the National Parks & Wildlife Service and Marine Institute. The reader is also referred to the Inner Galway Bay SAC Marine Conservation Objectives Supporting Document (NPWS, 2013). 'I-WeBS' refers to count data recorded at Inner Galway Bay as part of the Irish Wetland Bird Survey (I-WeBS).

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

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

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

Numbers

Internationally-important numbers of Brent Geese were recorded in all surveys undertaken from November 2009 to February 2010.
The peak count of 1,195 was recorded during the high tide survey of 09/02/10. The I-WeBS peak count for this species for the 2009/10 season was 1,419 individuals.

Only one Brent Goose was recorded in 0G031 during the first low tide survey (12/10/09) and this record is excluded from the average low tide subsite occupancy and also excluded in the following discussion.

Across Inner Galway Bay, Brent Geese was a relatively widespread species, recorded within between 15 and 21 subsites during the survey programme. Eleven subsites (0G031, 0G481, 0G489, 0G490, 0G499, 0H445, 0H446, 0H447, 0H448, 0H449 & 0H465) supported this species during all three low-tide surveys dated 06/11/09, 04/12/09 and 19/02/10.

Highest proportions of Brent Geese were recorded within the following subsites: 0G481 (Tawin South), 0G484 (Ballynacourty North) and 0H449 (Aughinish) for the November, December and February low tide surveys respectively. Ballynacourty was counted as one combined subsite during the November survey (0G491) and recorded the second highest number of Brent Geese. 0G481 (Tawin South) was notable in supporting the highest or second highest numbers of Brent Geese in all three low tide surveys.

The peak subsite count of 360 individuals was recorded within 0G489 (Traught & Doorus) during the high tide survey (09/02/10). This number, surpassing the international threshold, accounted for 30% of the total Brent Geese recorded on that date. The low tide peak subsite count was 293 individuals in 0H449 (Aughinish) on 19th February 2010.

Foraging Distribution

Brent Geese are grazers and are known for their preference for foraging in intertidal areas with the Eelgrass *Zostera* sp. (Robinson et al. 2004). Where this food source is absent the birds feed upon algae species, saltmarsh plants and may also undertake terrestrial grazing. The only documented intertidal Zostera bed (*Zostera noltii*) (NPWS, 2012) is located in the west of 0G499 (Salthill and environs). However, macroalgae are recorded widely across the site and form an extensive 'fucoid-dominated community complex' (NPWS, 2012).

Intertidal foraging occurred regularly (3 LT surveys or more) in only four subsites: 0G031, 0G499, 0H449 and 0H465. Subtidal foraging occurred regularly (3 surveys or more (incl. HT survey)) within nine subsites: 0G481, 0G482, 0G483, 0G489, 0G490, 0H445, 0H447, 0H449 and 0H465.

During low tide surveys the majority of Brent Geese were recorded foraging subtidally. For example, 74% of all individuals recorded foraging on 06/11/09 were foraging subtidally rather than intertidally. 0G481 (Tawin South) held peak numbers foraging subtidally on 06/11/09 (224 individuals) and on 19/02/10 (224 individuals). Good numbers were regularly observed in the sheltered, inner part of this subsite just west of Inishcorra. 0H449 (Aughinish) supported peak numbers foraging subtidally on 04/12/09; this subsite also supported peak numbers foraging intertidally on 04/12/09 and 19/02/10. Aughinish appeared to have two key areas for Brent Geese (and other species), one was along the northern shoreline northeast of Aughinish lagoon, and the other south of this within the inner sheltered intertidal south of the causeway; the latter used particularly when the prevailing wind was from the north.

During the high tide survey 132 Brent Geese foraged subtidally within 0G489 (Traught & Doorus).

Ballynacourty (0G491) supported the highest numbers foraging intertidally on 06/11/09 (40 individuals), these birds located just east of Mweenish Island (later coded as subsite 0G483); a further 31 Brent Geese also foraged subtidally within this subsite on the same date. Both Ballynacourty South (0G483) and Ballynacourty North (0G484) supported individuals foraging intertidally and subtidally on other survey occasions. Terrestrial foraging was recorded in areas adjacent to the SPA and this is likely to occur regularly.

Roosting Distribution

Relatively low numbers of Brent Geese were recorded during low tide surveys in roosting/other behaviour within intertidal habitat. One exception was November 2009 when 95 were distributed across four subsites, the majority (42%) in 0H465 (Rinn). Low tide surveys recorded the majority of roosting/loafing individuals in subtidal habitat. Three subsites supported the greatest numbers roosting/other subtidally (0G490 Cave – Clarinbridge; 0H446, Castle - Bell Harbour – Finvarra and 0G489 Traught & Doorus) for the three low tide surveys (Nov – Feb).

466 Brent Geese were recorded roosting/other subtidally within ten subsites during the high tide survey (09/02/10). 0G489 (Traught & Doorus) supported the greatest number (221 individuals), the majority within the inner sheltered area of Parkmore. 0H449 (Aughinish) supported a 182 individuals and 0G481 (Tawin South) recorded 39 individuals; thereafter most flocks were small (<10 individuals). 15 Brent Geese roosted intertidally across three subsites (0G481 Tawin South; 0G489 Traught & Doorus; 0H445 Martello Tower, L. Murree and shore). A further 18 were recorded undertaking roosting/other behaviour supratidally (0G480 Rinville & Ardfry North). The majority of Brent Geese foraged rather than roosted during the high tide survey.

Brent Geese roost communally at night, often close to water. Although observed to roost on Goose Island and on nearby mudflats (tide allowing) of Loughnahulla Bay (C. Peppiatt *pers. comm.),* there are likely to be many unidentified roosts, some of which could be outside the SPA boundary.

Red-breasted Merganser *Mergus serrator* - Family (group): Anatidae (sea ducks)

Red-breasted Mergansers have a wide breeding range which spans northern Europe, Russia, Siberia and North America. The Irish breeding population is thought to be sedentary. Large flocks of moulting birds congregate at several sites in Ireland and numbers remain relatively stable throughout the wintering season apart from some peaks possibly reflecting passage populations or cold weather movements (Crowe, 2005).
The wintering population is thought to be increased to some extent by the addition of birds from central Europe, eastern Greenland (Robinson, 1999) and Iceland (Scott & Rose, 1996).

Numbers

The all-Ireland wintering population of Red-breasted Mergansers is estimated at 3,390 individuals (Crowe et al. 2008) which results in the all-Ireland 1% threshold of 35 individuals. At Inner Galway Bay, numbers of Red-breasted Merganser of all-Ireland importance were recorded during all five surveys. The site peak of 187 individuals was recorded during the December low tide survey. The I-WeBS peak count for this species for the 2009/10 season was 207 individuals, recorded in January 2010.

Only four subsites supported this species during all five surveys of the 2009/10 Waterbird Survey Programme: 0G481 (Tawin South), 0G495 (Oranmore Bay), Rinville & Ardfry (0G494/0G479 & 0G480) and 0H449 (Aughinish). The subsite peak of 48 individuals was recorded for 0G484 (Ballynacourty North) on 04/12/09 and surpassed the all-Ireland threshold.

Peak proportions of individuals during low tide surveys were recorded for 0G494/0H444, 0G491, 0G484 and 0G484/0H449 for the four low tide surveys respectively. 0G481 (Tawin South) supported the greatest number (23% of total) during the high tide survey (09/02/10).

Note that Red-breasted Mergansers are a species for which survey constraints such as poor visibility and coverage apply directly. This species can occur at considerable distances offshore and out of observation range. In addition sea conditions may affect detectability and many of the islands provide barriers to observing open areas of water.

Foraging Distribution

Red-breasted Mergansers are sea ducks that feed on fish that are caught by frequent dives from the surface. They prefer shallow waters (range 3 – 6m) (BWPi, 2004).

Across the entire count area, up to 95 Red-breasted Mergansers were recorded foraging subtidally during low tide surveys. Peak numbers were recorded within 0H444 (Coranroo), 0G491 (Ballynacourty), 0G481 (Tawin South) and 0G480 (Rinville & Ardfry North) for the four respective survey dates. The peak number foraging subtidally within any one subsite was 24 individuals (0G491).

0G489 (Traught & Doorus) recorded the second highest numbers on two separate low tide survey occasions. 0H449 (Aughinish) also supported peak or second highest numbers on two separate survey occasions. 0G495 (Oranmore Bay) was one of a total three subsites to support foraging individuals during all five surveys completed.

Roosting Distribution

Red-breasted Mergansers were recorded in roosting/other behaviour during low tide surveys; the maximum number during any one survey was 71 individuals distributed across five subsites. During the high tide survey, 60 roosting/other individuals were distributed across eight subsites.

Notable concentrations of roosting/other individuals occurred subtidally within 0G481 (Tawin South) during all surveys including peak numbers during the February high tide survey. 0G484 (Ballynacourty North) held peak numbers during the latter two low tide surveys.

Black-throated Diver – Family (group): Gaviidae (divers)

The population of Black-throated Diver *Gavia arctica* that breeds across northern European and western Siberian has a large wintering range that includes northwest Europe, the Mediterranean, Black and Caspian Seas. Black-throated Diver is the rarest of the three diver species that regularly over-winter around the Irish coastline (Crowe, 2005). The exact origin of the birds that over-winter in Irish waters is unknown but are most likely from populations the breed in Scotland, Fennoscandia and north-west Russia (Wernham *et al.*, 2002). The species appears to prefer sheltered bays around Ireland. It is not currently possible to generate estimates of the population over-wintering in Ireland or its trends.

Numbers

During the 2009/10 survey programme, the total number of Black-throated Diver recorded across the site as a whole ranged from six (09/02/2010) to 23 (23/10/2009). The peak count for this site from the Irish Wetland Bird Survey (I-WeBS) during the 2009/10 season was 16 individuals in March 2010 (with a count of five from January 2010 also).

During the 2009/10 Waterbird Survey programme, this species was recorded in a maximum of 21% of sub-sites,13.6% of sub-sites on average across all four low-tide surveys, and in 13.7% of sub-sites on average across all low- and high-tide surveys. The species occurred most regularly in 0H445 (in each of the five survey visits) and 0H465 (in four of the survey visits). The subsite peak (also the site peak) of 23 individuals was recorded in sub-site 0H445 during the October low-tide survey (23/10/2009). A total of 11 individuals were recorded within subsite 0H465 during the low tide survey on 06/11/2009. All other records within sub-sites were of one, two or three individuals.

Note that Black-throated Divers are a species for which survey constraints such as poor visibility and coverage apply directly. In addition, sea conditions may affect detectability and many of the islands provide barriers to observing open areas of water.

Foraging Distribution

Black-throated Divers are primarily piscivores, although will also consume aquatic invertebrates, molluscs (including squid), crustaceans and some plant matter. The species forages primarily by diving, with dives of 3 – 6 m recorded, averaging 45 seconds in duration (Russell, 2020).

Across the entire count area, a maximum of 10 Black-throated Diver was recorded foraging between the five survey visits of 2009/2010 (during the visit of 23/10/2026, in sub-site 0H445). Across the five survey visits, Black-throated Diver was most frequently recorded foraging in sub-site 0H445 (recorded foraging in four of the five survey visits), and the next most used sub-sites for foraging were 0G487 and 0H465 (recorded in two survey visits each).

On average, across all five survey visits, 63% of recorded Black-throated Divers were foraging (range: 24% to 86%). When taking the four low-tide surveys only, an average of 58% were foraging. When looking at the single high-tide survey only (when six individuals were recorded), 83% were foraging.

Roosting Distribution

This species roosts almost exclusively on water during the non-breeding period. Across the entire count area, a maximum of 13 Black-throated Divers were recorded roosting/other between the five survey visits of 2009/10, with 13 recorded roosting/other during the October survey (in sub-site 0H445) and 13 recorded roosting/other during the November visit (two in sub-site 0H445 and 11 in sub-site 0H465). Only single individuals were recorded roosting/other in other sub-sites.

On average, across all five survey visits, 37% of recorded Black-throated Divers were roosting/other (range: 14% to 76%). When taking the four low tide surveys only, on average 42% were roosting/other. When looking at the single high tide survey only (when six individuals were recorded), only 17% (1 individual of a total six recorded) were roosting/other.

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

The Great Northern Diver breeds in Canada, parts of the northern United States, Greenland and Alaska with a smaller breeding population in Iceland. The species winters along coasts of Europe and America. During winter, the waters off Britain and Ireland are thought to support individuals from Iceland, Greenland and possibly Canada (Wernham et al. 2002).
The species occurs further offshore than many diver species so obtaining counts and estimating population size is difficult. However, they tend to come closer to shore and into sheltered estuaries during periods of bad weather.

Numbers

Numbers of Great Northern Diver across the whole site ranged from 17 (06/11/09) to 105 (04/12/09). This latter number and those recorded during the final low tide survey (71 individuals) represent numbers that surpass the threshold of international importance. The I-WeBS peak count for this species for the 2009/10 season was 168 individuals recorded in January 2010.

During the 2009/10 Waterbird Survey programme, this species was recorded in up to 50% of subsites surveyed on any one date. They occurred with most regularity (all five surveys) in four subsites: 0G482, 0G489, 0H445 and 0H449. The subsite peak of 30 individuals was recorded for 0H445 (Martello Tower, L. Murree and shore) on 23/10/09. This subsite also supported peak numbers on 04/12/09 (20). 0G499 (Salthill and environs) supported 26 individuals during the final low tide survey (19/02/10) with very few individuals recorded in other surveys. 0H449 (Aughinish) supported good numbers and always ranked in the top four subsites throughout the survey programme. 0H465 (Rinn) supported peak numbers on 06/11/09.

Note that Great Northern Divers are a species for which survey constraints such as poor visibility and coverage apply directly. This diver often occurs at considerable distances offshore and out of observation range. In addition sea conditions may affect detectability and many of the islands provide barriers to observing open areas of water.

Foraging Distribution

Great Northern Divers are primarily fish-eaters although a variety of other prey items can be taken including molluscs and crustaceans. Although generally diving in waters of depths 4m to 10m when foraging (BWP*i*, 2004), Great Northern Divers can forage successfully in deeper waters and can therefore occur up to 10km offshore. Indeed they tend to forage further offshore than smaller divers although they come closer to shore during periods of bad weather (Wernham et al. 2002).

The species foraged with regularity (three LT surveys or more) in four subsites: 0G480 (Rinville & Ardfry North), 0G489 (Traught & Doorus), 0H445 (Martello Tower, L. Murree and shore) and 0H449 (Aughinish).

0H445 supported peak proportions on two low tide survey occasions (23/10/09 & 04/12/09) with nine and 20 individuals respectively. 0H465 (Rinn) supported peak numbers on 06/11/09 (five individuals) and 0G499 supported peak numbers (26) during the final low tide survey.
0H449 (Aughinish) supported peak numbers foraging during the high tide survey (09/02/10). 0G489 (Traught & Doorus) supported between three and six individuals during all surveys.

Roosting Distribution

Relatively few Great Northern Divers were recorded roosting during low tide surveys with usually one or two individuals recorded at any one time. The exception is 18 individuals within 0H445 (Martello Tower, L. Murree and shore) on 23/10/09.

During the high tide survey (09/02/10), 0G481 (Tawin North) and 0G482 (Tawin South) both supported five roosting/other individuals; three other subsites supported one or two individuals each.

Cormorant *Phalacrocorax carbo* - Family (group): Phalacrocoracidae (cormorants)
The nominate race of *Phalacrocorax carbo* breeds along the coasts of the North Atlantic from eastern Canada and the Norwegian coast in the north, to northwest France in the south. The species is only partially migratory or dispersive (Wernham et al. 2002). Most Cormorants in Ireland are of the nominate race and breed primarily on rocky cliffs and offshore islands. Although wintering historically along the coast, since the 1960s there has been a gradual shift towards the use of inland freshwater sites (Mitchell et al. 2004).
Numbers
Numbers of Cormorants at the site ranged from 107 individuals to a site peak of 180 individuals on 23/10/09. Numbers recorded during three low tide surveys surpassed the threshold of all-Ireland importance. The I-WeBS peak count for this species for the 2009/10 season was 204 individuals. Cormorants were widespread across the site, occurring in up to 19 subsites in any one survey. A degree of subsite preference is evident in the dataset as follows. 0G499 (Salthill and environs) recorded the greatest number of individuals during three low tide surveys. 0H449 (Aughinish) jointly supported peak numbers on 23/10/09 (with 0G499). 0G031 (Lough Rusheen) recorded the highest proportion present on one survey occasion (04/12/09) and the second highest on a further two occasions; 0G923 (Deer Island (Galway Bay) supported the greatest number during the high tide survey and the second highest during the final low tide survey. The subsite peak of 73 individuals was recorded for 0G499 (Salthill and environs) (19/02/10). Note that Cormorants are a species for which survey constraints such as poor visibility and coverage apply directly. This species can occur at considerable distances offshore and out of observation range. In addition sea conditions may affect detectability and many of the islands provide barriers to observing open areas of water.
Foraging Distribution
Cormorants are large piscivorous (fish-eating) seabirds that obtain food by diving with typical depths of 3-9m (BWP*i*, 2004). Cormorants foraged subtidally within 11 subsites during the first three low tide surveys and within six subsites during the latter two surveys. The birds were dispersed with no obvious pattern for subsite preference. Four subsites supported peak proportions during low tide surveys: 0G499, 0G487/0H465, 0H445 and 0G499 for the four dates respectively. 0G487 (Tarrea & adjacent areas), 0G495 (Oranmore Bay) and 0H445 (Martello Tower, L. Murree and shore) supported foraging Cormorants during all four low tide surveys. 0H449 (Aughinish) recorded peak numbers foraging during the high tide survey (nine individuals) representing 36% of the individuals present on that day.
Roosting Distribution
Relatively few observations were made of Cormorants undertaking subtidal roosting/other behaviour, the exception being 11 individuals within 0G497 (Ballyloughan) on 06/11/09. Cormorants roosted intertidally or supratidally within 20 subsites overall. Good numbers roosted intertidally in the outer (southern) section of 0G031 (Lough Rusheen) on two low tide survey occasions, these birds located in the same position, at the low water mark (MLWM), on both occasions. 58 Cormorants roosted terrestrially within 0G031 during the high tide survey and 45 individuals roosted terrestrially during the final low tide survey (19/02/10). 0G923 (Deer Island) supported good numbers of roosting individuals on the two survey occasions that it was counted, with a maximum 80 individuals during the high tide survey (09/02/10) which represented 73% of all Cormorants recorded roosting on that date.

Grey Heron *Ardea cinerea* - Family (group): Ardeidae (herons)

Grey Herons occur throughout much of the Palearctic, Africa and south Asia. Although the breeding population is considered resident in Ireland, the species is migratory and numbers during winter may be enhanced by birds from Scandinavia and northwest Europe. Mortality is high during the first winter, particularly during cold weather (Wernham et al. 2002).

Numbers

Numbers of Grey Heron were variable across the months and peaked with 117 individuals during the December low tide survey. Numbers present during all four low tide survey surpassed the threshold of all-Ireland importance. Fewer numbers (18) were recorded during the high tide count (09/02/10).

The I-WeBS peak count for this species for the 2009/10 season was 56 individuals.

Grey Herons were widespread across the site, occurring in a maximum 20 subsites. As Grey Herons are generally solitary when feeding (Draulans & Van Vessem, 1986), a widespread distribution is perhaps to be expected; aggregations of birds are unlikely, especially as many individuals hold territories when feeding.

The peak subsite count was 19 individuals within 0G495 (Oranmore Bay) on 19/02/10. This subsite also supported peak numbers on 04/12/09 and good numbers on two additional survey occasions. Rinville & Ardfry (0G479/0G480/0G494) supported Grey Herons in all surveys and peak numbers on three separate occasions.

Foraging Distribution

Grey Herons have a wide diet and although fish generally forms the greatest proportion it can also include plant material, insects, amphibians, worms, small mammals and birds (BWPi, 2004). Foraging is likely to take place in terrestrial and freshwater habitats outside the SPA on a regular basis.

Grey Herons foraged regularly (three surveys or more) within nine subsites (0G031, 0G480, 0G481, 0H489, 0G495, 0G499, 0H446, 0H448 and 0H449). 0G495 (Oranmore Bay) recorded the greatest number of foraging Grey Herons during three low tide surveys (across all habitats combined) with a maximum 19 individuals on 19/02/10. Rinville & Ardfry (0G479/0G480/0G494) supported peak numbers on two survey occasions. Very few individuals (seven) were recording foraging during the high tide survey.

Roosting Distribution

Roosting/other behaviour was recorded across 20 subsites in total (intertidal/supratidal habitat combined); generally one to three individuals recorded within a subsite at any one time. 0H446 (Castle - Bell Harbour - Finvarra) was notable in supporting good numbers of roosting individuals across the first four surveys of the programme. 0G487 (Tarrea & adjacent areas) supported roosting individuals in all four low tide surveys.

Grey Herons are a widespread species during winter and can occur in a wide variety of habitats; both coastal and freshwater/brackish. As a consequence, significant time may be spent outside of the SPA boundary, particularly when roosting. Grey Herons tend to roost on the ground during the day and communally in trees at night (Draulans & Van Vessem, 1986).

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 Britain and Ireland, southern Scandinavia and northern and eastern Europe and winters in Europe and north-west and west Africa (Thorisson et al. 2012). The Irish breeding population is thought to be largely sedentary; wintering numbers enhanced by birds that breed further north, but Ireland also provides important passage sites for birds breeding in east Canada, Greenland and Iceland *en route* to wintering areas in Africa (Delany et al. 2009; Thorisson et al. 2012).

Numbers

Total site numbers of Ringed Plovers were variable across the survey programme (165, 382, 162 and 211 for the four respective LT surveys). Numbers peaked in November 2009 (382 individuals). Numbers recorded in all surveys surpassed the threshold of all-Ireland importance, including the high tide survey (09/02/10) when 208 Ringed Plovers were recorded. The I-WeBS peak count for this species for the 2009/10 season was 245 individuals (January 2010).

Ringed Plovers were recorded in a total 13 subsites throughout the survey programme but subsite use during individual surveys ranged from three subsites (23/10/09) to ten subsites (19/02/10) and accounted for 14% to 34% of the subsites surveyed on the respective dates.

Four subsites were used by Ringed Plovers with the most regularity (three surveys or more): 0G031 (Lough Rusheen), 0G497 (Ballyloughan), 0G499 (Salthill and environs) and 0H449 (Aughinish).

0H449 (Aughinish) supported peak numbers during two low tide surveys (23/10/09 & 04/12/09). 0G499 (Salthill and environs) supported peak numbers on 06/11/09; 128 individuals also the subsite peak. 0H465 (Rinn) supported peak numbers on 19/02/10.

0G031 (Lough Rusheen) recorded peak numbers (77) during the high tide survey.

Ringed Plovers occur widely along Irish coastlines with a significant proportion occurring on non-estuarine shores, outside of the area counted routinely for I-WeBS (Crowe et al. 2008; Boland & Crowe, 2012). Given the expansive nature of Galway Bay it should therefore be expected that this species will occur regularly along shoreline that is outside of the SPA boundary.

Foraging Distribution

Ringed Plovers are 'visual foragers' searching the sediment surface for the visible signs of prey such as worms, crustaceans and insects. They forage in a variety of habitats including sand and mudflats, shingle shores and sandbanks, as well as saltmarshes, short grassland, flooded fields and artificial habitats.

At Inner Galway Bay, Ringed Plovers foraged with regularity (three surveys or more) in four subsites: 0G031 (Lough Rusheen), 0G497 (Ballyloughan), 0G499 (Salthill and environs) and 0H449 (Aughinish).

0H449 (Aughinish) supported peak numbers foraging intertidally on two survey occasions (23/10/09 & 04/12/09). 0G499 (Salthill and environs) supported peak numbers of 128 during the November low tide survey. 0H465 (Rinn) supported peak numbers (75) on 19/02/10 despite this subsite recording almost no individuals previously during the survey programme. 0G031 (Lough Rusheen) supported good numbers throughout and peak numbers during the high tide survey (77 individuals) representing 60% of all Ringed Plovers recorded foraging on that date.

Intertidal habitats of the survey area fall into three broad classifications. A fucoid-dominated community complex occurs along most shores; often interspersed with shingle. Areas within 0H449, 0G499 and 0H465, as well as the wider site also support intertidal sandy mud (particularly 0G499) and the community 'intertidal sand.' Both of the latter two sediment communities are characterised by a range of invertebrate species that could form potential prey of Ringed Plover including polychaetes, molluscs and crustaceans.

Roosting Distribution

Ringed Plovers often roost on rocky shores and are known to be highly faithful to roost sites (e.g. Rehfisch et al. 2003).

During low tide surveys, few Ringed Plovers were recorded in roosting/other behaviour. The exceptions were 41 individuals roosting supratidally within 0H448 (Ballyvaughan Bay) on 06/11/09 and 57 roosting intertidally within 0H449 (Aughinish) on 19/02/10.

During the high tide survey (09/02/10), 76 Ringed Plovers were recorded roosting (intertidal/supratidal combined) within six subsites. 0H448 (Ballyvaughan Bay) supported the greatest number (28), the birds roosting on fucoid-covered shore (hard substratum). Smaller numbers were present within 0G481, 0G483, 0G489, 0H446 and 0H447. A further 132 individuals were recorded foraging during this survey.

A number of other potential roosting sites occur within the site including various small islands such as Hare Island and Rabbit island. Mutton Island is a known roost site for Ringed Plover (Nairn, 2005) although this island was not covered comprehensively within the current survey count area.

Bar-tailed Godwit *Limosa lapponica* - Family (group): Scolopacidae (wading birds)
The Bar-tailed Godwit has a widespread breeding distribution across the sub-arctic and low Arctic zones of the Palearctic and extending into western Alaska (Delaney et al. 2009). The taxonomy of the species is complex but five subspecies are generally recognised. The nominate subspecies *L. l. lapponica* breeds across the higher latitudes of Northern Europe, Russia and Siberia and west and winters mainly in Western Europe. The Wadden Sea is used by *L. l. lapponica* and other populations as a staging and moulting area in autumn and spring.
Numbers
Numbers of all-Ireland importance were recorded in three of the low tide surveys (23/10/09, 04/12/09 & 19/02/10) plus during the high tide survey when the site peak of 570 individuals was recorded. The I-WeBS peak count for this species for the 2009/10 season was 467 individuals. Across the entire survey period, Bar-tailed Godwits were recorded in 20 count subsites, subsite occurrence during individual low tide surveys ranging from nine to 15 subsites. The species was recorded with regularity (three surveys or more) within 12 subsites: 0G031, 0G481, 0G493, 0G495, 0G496, 0G497, 0G499, 0H444, 0H446, 0H448, 0H449 and 0H465. 0G499 (Salthill and environs) supported peak numbers during all five surveys of the survey programme. The subsite peak number (321 individuals) was recorded during the high tide survey, this number surpassing the threshold for all-Ireland importance and representing 56% of all Bar-tailed Godwits recorded on that date.
Foraging Distribution
Bar-tailed Godwits are a wader species considered characteristic of coastal wetland sites dominated by sand. The birds forage by probing within the sediment for invertebrate species such as Lugworm *Arenicola marina.* The species is characteristic of sites with sandy substrates (e.g. Hill et al. 1993). 0G499 (Salthill and environs) supported peak numbers during three low tide surveys (23/10/09, 06/11/09 & 19/02/10). The peak count for this subsite was 120 individuals (19/02/10) which represented 39% of the total number of foraging Bar-tailed Godwits recorded on that date. The intertidal habitat of this subsite is classified largely as intertidal sandy mud (NPWS, 2012). Both *Nephtys hombergi* and *Arenicola marina*, large polychaetes favoured by Bar-tailed Godwits (e.g. Scheiffarth, 2001), are characterising species of this community type. Lough Rusheen (0G031) supported good numbers on two survey occasions including 125, the subsite peak count of foraging individuals, during the high tide survey on 09/02/10. The godwits were counted within two separate locations within the inner part of the subsite (White Strand). This subsite largely comprises the broad intertidal community described above although areas in the north and east of the subsite, including White Strand, are sandier. A further 34 Bar-tailed Godwits foraged with their feet in water (classified as subtidal) during the high tide survey within 0H449 (Aughinish). 0G483 (Ballynacourty South) supported peak numbers foraging intertidally on 04/12/09 (40) but this was the only occasion for this subsite to record the species. 0H465 (Rinn) supported good numbers on two survey occasions.
Roosting Distribution
During low tide counts, very few Bar-tailed Godwits were recorded undertaking roosting/other behaviour, the exception being 49 individuals roosting within 0G497 (Ballyloughan) on 19/02/10. During the high tide survey 408 Bar-tailed Godwits were counted roosting out of a total 570 individuals counted on that date. Roosting occurred within six subsites but the majority (79%) were located within 0G499 (Salthill and environs) where they roosted intertidally just south of Claddagh. A further 66 individuals roosted supratidally within 0H448 (Ballyvaughan Bay). Smaller numbers occurred within 0G481, 0G484, 0G497 and 0H449. Good numbers have roosted traditionally on Mutton Island (within 0G499) (Nairn, 2005) and sites such as this are likely to become important on higher tides when intertidal areas still exposed on neap tides, are covered.

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

Numbers of all-Ireland importance were recorded in all low tide surveys plus during the high tide survey. The whole site peak of 466 individuals was recorded on 04/12/09 (low tide survey). In contrast the I-WeBS peak count for this species for the 2009/10 season was 222 individuals, recorded in January 2010.

Across the entire survey period, Turnstones were recorded in 26 count subsites, but subsite use during individual surveys ranged from 11 subsites (23/10/09) to 19 subsites on 04/12/09, the latter representing 68% of subsites counted on that date.

The species was recorded with regularity (three surveys or more) within 15 subsites. The subsite peak number (225 individuals) was recorded within 0H449 (Aughinish) on 04/12/09. This subsite supported peak numbers during all low tide surveys accounting for between 29% and 55% of all Turnstones counted during surveys.

0G489 (Traught & Doorus) supported peak numbers during the high tide survey (09/02/10) and during the December 2009 low tide survey.

Foraging Distribution

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

Across the entire survey programme, Turnstones were recorded foraging intertidally within 25 subsites. 0H449 (Aughinish) supported peak numbers during all four low tide surveys with a maximum 157 individuals Turnstones on 04/12/09. Similar to Brent Geese, Aughinish had two key areas for Turnstones, one along the northern shoreline northeast of Aughinish lagoon, and the other south of this within the inner sheltered intertidal south of the causeway, the latter used particularly when the prevailing wind was from the north.

0G489 (Traught & Doorus) and 0G495 (Oranmore Bay) supported good numbers throughout the survey programme with numbers ranked as 'high' on two separate survey occasions.

Roosting Distribution

The main concentrations of birds involved in roosting/other behaviour during low tide surveys were close to the foraging areas. 0H449 (Aughinish) supported peak numbers during the first three low tide surveys (72, 43 and 68 individuals respectively). 0G481 (Traught & Doorus) supported peak numbers during the final low tide survey, although this was only five individuals.

During the high tide survey, 113 Turnstones were recorded roosting within 8 subsites. 0G489 (Traught & Doorus) recorded the highest number, 30 individuals, which were roosting intertidally along the northern section of this subsite along with a further 22 that were foraging. 26 individuals were recorded roosting within 0G484 (Ballynacourty North). 0G481 (Tawin South), 0G495 (Oranmore Bay) and 0H446 (Castle - Bell Harbour - Finvarra) recorded 21, 18 and 13 individuals respectively.

Wigeon *Anas penelope* - Family (group): Anatidae (ducks)

Wigeon have a widespread breeding distribution across northern Europe and Asia, from Iceland and northern Britain across Scandinavia, and northern Russia to the Russia to the Bering Sea coast (Wernham et al. 2002). The species is highly migratory. Five main wintering groups are known; birds breeding in northwest and northeast Europe and west Siberia spend winter in northwest Europe.

Numbers

Whole site numbers of Wigeon were above the threshold of all-Ireland importance during all survey months. The peak count of 1,621 individuals was recorded during the high tide count on 09/02/10. Site numbers did not appear overly affected by the cold weather event of 2009/10 (Met Éireann, 2010a,b) as the total numbers and site peak recorded during I-WeBS for 2009/10 (2,211) are in line with previous I-WeBS totals.

Wigeon was a widespread species, occurring in a total 29 subsites across the 2009/10 Waterbird Survey Programme. During individual surveys they were present in between 16 (23/10/09) and 24 (09/02/10) subsites, the latter representing 83% of the subsites surveyed on that date.

Eleven subsites supported Wigeon during all five surveys: 0G031, 0G032, 0G479/0G480, 0G486, 0G488, 0G489, 0G490, 0G493, 0G495, 0H444 and 0H488. 0G495 (Oranmore Bay) and 0H488 (Rine Lough Murree Flaggy Shore) were notable in supporting peak numbers twice during low tide surveys. The peak subsite count (497 Wigeon) was recorded within 0H488 on 06/11/09.

Foraging Distribution

The Wigeon diet is largely vegetarian and a major part of the diet comprises coastal seagrass and algae species which are taken by grazing or dabbling in shallow water. They may also feed upon grasslands and agricultural crops for seeds, stems and rhizomes. A gregarious bird, they are rarely seen far from water. Macroalgae are recorded widely across the site of Inner Galway Bay. The only documented intertidal Zostera bed (*Zostera noltii*) (NPWS, 2012) is located in the west of 0G499 (Salthill and environs).

Within Inner Galway Bay, Wigeon were recorded foraging in intertidal, subtidal, supratidal and terrestrial habitats. During all surveys, 60% or more of Wigeon counted were recorded foraging.

Wigeon foraged within intertidal habitats with regularity (three surveys or more) in only four subsites: 0G031 (Lough Rusheen), 0G493 (Kilcaimin), 0G495 (Oranmore Bay) and 0H444 (Coranroo). Peak numbers were recorded in different subsites on each low tide survey occasion – 0G495, 0G489, 0G495 and 0G031 for the four dates respectively. Counts of 132 Wigeon in 0G489 (Traught & Doorus) and 150 Wigeon in 0H488 (Rine Lough Murree Flaggy Shore) were single observations; the species not recorded foraging intertidally in either subsite during other surveys. Note that Lough Muree only has a very narrow strip of intertidal habitat and that dot density maps represent these birds across the wider habitat 'lagoon.'

Wigeon also foraged subtidally but there was little pattern with regards subsite preference with the exception of 0G495 (Oranmore Bay) which supported good numbers during all five surveys and peak numbers (295 Wigeon) during the February low tide survey. Subtidal foraging was more widespread during the high tide survey when 858 Wigeon foraged subtidally across 18 subsites. 0H488 (Rine Lough Murree Flaggy Shore) supported good numbers foraging subtidally with a peak count of 497 Wigeon on 06/11/09 and the peak subsite count during the high tide survey (192 Wigeon).

Given that this species may also forage terrestrially (e.g. flooded grassland), foraging may take place outside of the SPA boundary.

Roosting Distribution

Wigeon roosted intertidally/supratidally across a wide range of subsites although many observations were solitary, suggesting no regularity in use. Peak numbers roosted within 0G488 (Kinvara) on two low tide survey occasions and these birds were positioned in relatively similar positions along the inner northern shoreline. 0G489 (Traught & Doorus) and 0G490 (Cave - Clarinbridge) both supported roosting individuals in all five surveys.

Peak numbers roosting/other subtidally within low tide surveys were recorded within 0G488, 0G486, 0H444 and 0H444 for the four low tide survey dates respectively.

During the high tide survey, the majority of Wigeon recorded as roosting/other were positioned subtidally. The peak number (69) was recorded within 0G489 (Traught & Doorus) along with a further 53 individuals that roosted intertidally off Bush Island. A further 41 individuals were located along the inner northern shoreline of 0G488 (Kinvara). 58 individuals roosted subtidally within 0H444 (Coranroo), a subsite that was favoured during the three latter surveys.

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

Across the whole site, numbers of Teal were above the threshold of all-Ireland importance (450 individuals) during all survey months. A peak count of 997 individuals was recorded during the high tide survey on 09/02/10. The I-WeBS peak count for this species for the 2009/10 season was 1,054 individuals (January 2010). Site numbers did not appear overly affected by the cold weather event of 2009/10 (Met Éireann, 2010a,b) as total numbers recorded during low tide surveys and site peak recorded during I-WeBS for 2009/10 are in line with previous I-WeBS totals.

Teal was a widespread species, occurring in a total 25 subsites across the entire survey programme. Subsite use during individuals surveys ranged from 12 (23/10/09) to a peak of 19 subsites during the high tide survey (09/02/10), the latter representing 65% of the subsites surveyed on that date.

Nine subsites supported Teal during all five surveys: 0G032, 0G486, 0G488, 0G489, 0G493, 0G495, 0H444, 0H446 and 0G479/0G494. 0G495 (Oranmore Bay) supported the greatest numbers in all four low tide surveys and the second highest numbers during the high tide survey.

The overall peak subsite count was 418 individuals within Oranmore Bay (0G495) on 06/11/09. The peak high tide count of 193 individuals was recorded for 0G486 (Killeenaran).

Foraging Distribution

Non-breeding Teal are widely distributed throughout Ireland, favouring areas of shallow water on estuarine coastal lagoons, coastal and inland marshes, and flooded pastures and ponds. Teal are omnivores and have a variety of foraging methods (e.g. dabbling and up-ending) within differing habitats and water depths.

The majority of Teal were recorded foraging either intertidally or subtidally. With the exception of the first low tide survey (23/10/09), more Teal foraged subtidally than intertidally during all surveys.

Across the entire survey programme, Teal foraged intertidally within 15 subsites and there was little pattern to the distribution, many subsites supporting low numbers on single occasions. The exception to this was 0H446 (Castle - Bell Harbour - Finvarra) which supported peak numbers during three low tide surveys and the second highest numbers during the high tide survey, inner Bell Harbour the favoured position. 0G495 (Oranmore Bay) supported good numbers regularly and held the peak number foraging intertidally on 04/12/09.

0G493 (Kilcaimin) supported the peak number foraging intertidally during the high tide survey (77 individuals).

Teal showed a clear preference for foraging subtidally within 0G495 (Oranmore Bay). A peak count of 418 Teal foraging subtidally on 06/11/09 represented 98% of all individuals foraging subtidally and 55% of all Teal recorded on that day. Smaller numbers of Teal foraged subtidally with regularity in 0G486 (Killeenaran) and 0G493 (Kilcaimin).

Roosting Distribution

Peak numbers of Teal roosting intertidally/supratidally (combined) were recorded for both 0G495 (Oranmore Bay) and 0H444 (Coranroo) on two survey occasions. The Teal on both occasions within 0G495 (Oranmore Bay) were positioned within the inner sheltered mixed substrata shore of Rusheen Point close to the Bellanabradaun stream. 0G489 (Traught & Doorus) recorded roosting Teal in all five surveys and peak numbers roosting intertidally/supratidally (combined) on 19/02/10. The western shore is an extremely varied area with a substratum ranging from mud or mixed sediment to rock and with saltmarsh, creeks, freshwater inflow and small islands. Together with its sheltered nature, makes this area an important roosting area for many species including Teal. 0H446 (Castle - Bell Harbour - Finvarra) supported peak numbers (40 individuals) roosting intertidally/supratidally on 06/11/09 positioned in the very inner area of Bell Harbour.

Subtidal roosting/other behaviour showed no link to subtidal foraging behaviour in that there were almost no records from 0G495 (Oranmore Bay). Subtidal roosting/other behaviour occurred with most regularity within 0G482 (Tawin North), 0G493 (Kilcaimin), 0H444 (Coranroo) and 0H446 (Castle - Bell Harbour - Finvarra). A one-off count of 74 individuals roosted/other subtidally within 0G485 (Tyrone House and Morans) was the peak count (roosting subtidally) 06/11/09.

During the high tide survey, a total of 135 Teal roosted within intertidal/supratidal habitats together with a further 146 Teal that roosted subtidally. The peak subsite count was 81 individuals that roosted subtidally within 0G486 (Killeenaran), the majority positioned within the inner subsite (Brandy Harbour) along with additional Teal and Wigeon that were foraging. 45 Teal roosted intertidally/supratidally just north of Green Island within 0H444 (Coranroo) and 42 Teal roosted within 0H447 (Bishop's Quarter). Thereafter smaller numbers were distributed across a further 12 subsites.

Golden Plover *Pluvialis apricaria* - Family (group): Charadridae (wading birds)
The Eurasian Golden Plover is a Palearctic species, occurring mainly at higher latitudes of Western Europe to north-central Siberia and wintering south in Europe, north Africa and parts of Asia. Two subspecies are currently described. *P. a. altifrons* is the 'northern' form and breeds at high latitudes in Western Eurasia from Iceland and the Faeroes across northern Scandinavia to 125^{0}E in the north Siberia lowlands south of Taymyr (Delaney et al. 2009). The nominate *P. a apricaria* breeds at more southerly latitudes including Ireland and Britain and migrates south for winter. The Golden Plover that winter in Ireland are thought to be mostly Icelandic-breeding birds *P. a. altifrons* (Wernham et al. 2002).
Numbers
Whole site numbers of Golden Plover were highly variable and rose from 906 on 23/10/09 to a peak count the following month (3,015) after which numbers steadily dropped. Numbers were significantly lower in February 2010 when 439 and 361 were recorded during the low and high tide surveys respectively. The decline in numbers can be most likely attributed to the cold weather event, Ireland experiencing the coldest January for over 25 years (Met Éireann, 2010a) and site numbers certainly followed the same pattern for decline as numbers nationally (Crowe et al. 2011). During cold weather events species such as Golden Plover and Lapwing, Teal and Wigeon often move across to mainland Europe, especially the Iberian coast (Wernham et al. 2002). Golden Plovers occurred in a total of eleven subsites across the entire survey programme but subsite use during individuals surveys ranged from two subsites (23/10/09 & 06/11/09) to seven subsites (19/02/10). The following subsites supported the species with most regularity (three surveys or more): 0G481 (Tawin South), 0G493 (Kilcaimin) and 0G495 (Oranmore Bay). 0G495 (Oranmore Bay) supported peak numbers during three low tide survey occasions and recorded the subsite peak (1,615 Golden Plover) on 06/11/09.
Foraging Distribution
During winter, Golden Plovers feed primarily within agricultural grassland and arable land and tidal flats are used mainly as a roosting/resting habitat. As a consequence, Golden Plovers tend to be in large aggregations when observed upon tidal flats. Intertidal feeding can be observed at times, and to a greater degree during cold weather periods when grassland feeding options are frozen over. Although Golden Plovers eat a wide range of invertebrate species, relatively little is known about intertidal feeding patterns (Gillings et al. 2006). Golden Plovers were recorded foraging intertidally within the survey area during the final low tide survey on 19/02/10. On this day, 318 Golden Plovers foraged across six subsites, the majority (56%) within 0H449 (Aughinish). These birds were located within two separate flocks south of the causeway. No terrestrial foraging was recorded during the survey programme but is known to occur widely around the site (outside the SPA boundary).
Roosting Distribution
All records of roosting Golden Plovers were from intertidal habitat. Six subsites were used in total across the survey period. 0G481 (Tawin South), 0G493 (Kilcaimin) and 0G495 (Oranmore Bay) were used with most regularity (three or more surveys). 0G495 (Oranmore Bay) supported peak numbers during the first three low tide surveys including the peak subsite count of 1,615 roosting Golden Plovers on 06/11/09. Several intertidal roosting positions were noted within Oranmore Bay including flocks located close to Black Islands (a group of rocks in the western part of the subsite), and flocks that were located along the NE shoreline close to Castle Pier, for example a flock of 690 individuals on 04/12/09. Previous roost data for the site confirms the importance of Oranmore Bay for Golden Plovers (Appendix 8). 0G481 (Tawin South) supported peak numbers during the high tide survey (09/02/10) and during the final low tide survey (19/02/10) and good numbers (1,160) on 06/11/09, the birds positioned within the inner intertidal reaches south of Tawin Island. Previous roost data for this subsite (Appendix 8) shows birds positioned intertidally south of Inishdorra. The inner sheltered mudflats of 0G493 (Kilcaimin) were also used by roosting Golden Plovers on three survey occasions, 403 individuals on 23/10/09.

Lapwing *Vanellus vanellus* - Family (group): Charadriidae (wading birds)

The Lapwing is a monotypic species and has a wide Palearctic breeding distribution from Britain and Ireland in the west to Eastern and southern Siberia in the east with a southern limit extending into Spain (Delaney et al. 2009). Birds breeding in Britain and Ireland are partial migrants with some residing over winter and some migrating south. The wintering population is enhanced by Lapwings moving in from continental Europe and northern and western Britain (Wernham et al. 2002). Cold weather movements can see a greater flux of birds to Ireland's estuaries.

Numbers

Whole site numbers of Lapwing peaked in December 2009 (2,260 individuals) which represents numbers of all-Ireland importance. Thereafter numbers dropped to 719 individuals during the high tide survey (09/02/10) with only 35 present during the final low tide survey (19/02/10). The decline in numbers can be most likely attributed to the cold weather event, Ireland experiencing the coldest January for over 25 years (Met Éireann, 2010a) and the coldest February since 1986 (Met Éireann, 2010b). Nationally, numbers dropped from a peak in December 2009 (38,325) to a relatively low 14,107 in February 2010 (Crowe et al. 2011). During cold weather events species such as Golden Plover and Lapwing, Teal and Wigeon often move across to mainland Europe, especially the Iberian coast (Wernham et al. 2002).

Across the whole survey programme, Lapwings were recorded within 21 subsites. Subsite use during individual surveys was relatively consistent with the species present in 13-14 subsites during most surveys representing 46-62% of the total subsites surveyed.

Eleven subsites were used with regularity (three surveys or more) as follows: 0G031 (Lough Rusheen), 0G032 (Lough Atalia), 0G479/0G494 (Rinville & Ardfry), 0G481 (Tawin South), 0G484/0G491 (Ballynacourty), 0G486 (Killeenaran), 0G488 (Kinvara), 0G489 (Traught & Doorus), 0G490 (Cave - Clarinbridge), 0G495 (Oranmore Bay) and 0H444 (Coranroo). The peak subsite count (735 Lapwings) was recorded for 0G495 (Oranmore Bay) on 04/12/09.

Foraging Distribution

Lapwings are traditionally 'inland' waders. During winter they can be observed across a wide variety of habitats, principally using lowland farmland and freshwater wetlands (e.g. turloughs and callows) but also coastal wetlands where they feed on a variety of soil and surface-living invertebrates. They are opportunistic and mobile birds and will readily exploit temporary food sources such as newly-ploughed fields. Estuaries are used typically as roosting areas where large flocks can be observed roosting upon the tidal flats. Coastal areas will also be used to a greater degree during cold weather events when farmland and freshwater habitats freeze over. There is evidence in the UK that utilisation of coastal habitats has increased, coupled with an increase in intertidal feeding (Gillings et al. 2006).

At Inner Galway Bay, Lapwings foraged intertidally within eight subsites during the first low tide survey (23/10/09) and within four subsites on 06/11/09. Thereafter, only occasional observations of a few individuals were recorded.

On 23/10/09, 214 Lapwings foraged within 0G495 (Oranmore Bay) accounting for 64% of all individuals recorded foraging on that day. Smaller numbers foraged intertidally within 0G031, 0G032, 0G481, 0G482, 0G488, 0G489 and 0H444. 0G495 (Oranmore Bay) supported the peak number foraging intertidally on 06/11/09 (94 individuals) and the only individuals recorded foraging on 19/02/10 (2 individuals). On 04/12/09 eight individuals foraged within 0H488 (Rine Lough Murree Flaggy Shore).

No terrestrial foraging was recorded during the survey programme but is known to occur widely around the site (outside the SPA boundary).

Roosting Distribution

Apart from the first low tide survey, over 90% of all Lapwings recorded during surveys were involved in roosting/other behaviour. Lapwings roosted intertidally, supratidally, terrestrially and subtidally (feet in water). Intertidal, supratidal and subtidal birds were combined when examining distribution. Relatively few birds were observed during the final low tide survey (19/02/10).

Roosting was relatively widespread across the site, observed in 21 subsites overall. Peak proportions of roosting Lapwings were recorded in 0G495 (Oranmore Bay) (23/10/09 & 04/12/09), 0G491 (Ballynacourty) (06/11/09), 0G482 (Tawin North) (19/02/10) and 0G032 (Lough Atalia) during the high tide survey (09/02/10). The maximum number recorded roosting within a subsite was 735 Lapwing (0G495, 04/12/09).

In Oranmore Bay, Lapwings favoured the inner NE shoreline of the subsite when roosting (shoreline between St Mary's Quay and Castle Pier), for example flocks of 136 and 60 individuals on 06/11/09 and a flock of 460 on 04/12/09. The importance of this area is also confirmed by previous roost data for the site (Appendix 8).

0G484 (Ballynacourty North) supported a single flock of 500 roosting Lapwings on 04/12/09 (by Shanmullen Channel). Good numbers were recorded regularly within 0G481 (Tawin South), 0G486 (Killeenaran), 0G488 (Kinvara), 0G484/0G491 (Ballynacourty) and 0G490 (Cave - Clarinbridge).

Roosting distribution was most widespread during the high tide survey (09/02/10) when 572 Lapwings were distributed across 14 subsites. Peak numbers on this date were located within 0G032 (Lough Atalia). 0G495 (Oranmore Bay) supported the second highest numbers (113), 62 of which were positioned at Rinnatinnaan Point, with a further 43 in a mixed-species flock in the inner NE corner of the subsite. 104 Lapwings roosted within 0G481 (Tawin South), positioned within the inner intertidal reaches south of Tawin Island (27) and along the western shoreline of Inishdorra (75). A flock of 63 roosted within inner Kinvarra Bay (0G488), thereafter subsites supported <50 individuals.

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

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

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

Numbers

Dunlin were recorded in numbers of all-Ireland importance during the December 2009 low tide survey and during the February 2010 low and high tide surveys. The site peak of 2,592 individuals was recorded on 04/12/09 and 948 were recorded during the high tide survey. The I-WeBS site peak count for the 2009/10 season was 1,409 individuals (January 2010). The drop in numbers in January and February 2010 compared to December 2009 was most likely attributed to the cold weather event (Met Éireann, 2010a,b).

Overall, Dunlin were recorded within 21 subsites. Regular use (three surveys or more) was recorded for ten subsites: 0G031, 0G481, 0G484, 0G488, 0G489, 0G493, 0G495, 0G499, 0H449 and 0H465.

The subsite peak of 1,100 Dunlin were recorded within 0G488 (Kinvara) on 04/12/09, and represented numbers of all-Ireland importance.

Foraging Distribution

With the exception of 04/12/09, the majority of Dunlin during low tide surveys were recorded foraging (range 70% - 89%).

Peak numbers were supported by 0G493 (Kilcaimin), 0G495 (Oranmore Bay), 0H449 (Aughinish) and 0G031 (Lough Rusheen) for the four low tide surveys respectively. 0G489 (Traught & Doorus) held good numbers regularly.

The intertidal benthic communities of Inner Galway Bay are classified as *intertidal sandy mud* and *intertidal sand*. Fucoid shores also occur widely around the site. Characterising invertebrate species of the sandy mud and sand communities that may form prey items for Dunlin include polychaetes *Nephtys hombergii and Scoloplos armiger* and the bivalve molluscs *Scrobicularia plana* and *Macoma balthica.* The Dunlin diet is relatively wide and in general this wader prefers muddier areas within sites (e.g. Hill et al. 1993; Santos et al. 2005).

Roosting Distribution

Roosting/other behaviour was irregularly recorded during low tide surveys. Of note was 1,100 Dunlin that roosted within 0G488 (Kinvara) on 04/12/09. These birds roosted in two flocks (700 + 400) together with Lapwing along the northern rocky shore of this sheltered subsite. 0G484 (Ballynacourty North) supported good numbers of roosting individuals on two survey occasions; maximum number 245 Dunlin on 04/12/09.

A relatively low number of 242 Dunlin were recorded roosting during the high tide survey (09/02/12). The peak number (112: 46%) were located within 0H449 (Aughinish) and roosted as one flock along the rocky shore in the far eastern section of this subsite. 52 Dunlin roosted within 0H448 (Ballyvaughan Bay) and smaller numbers were distributed across a further seven subsites: 0G481, 0G483, 0G484, 0G489, 0G493, 0G495 and 0G499.

Nairn (2005) reports on good numbers (1998-2003 mean peak of 465) using Mutton island as a roost site.

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

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

Numbers

Whole-site numbers of Curlew were variable and ranged from 409 individuals in October 2009 to the site peak of 733 on 04/12/09. All site counts with the exception of the first low tide survey (23/10/09) surpassed the threshold of all-Ireland importance. The peak count recorded during I-WeBS for the 2009/10 season was 843 individuals (January 2010).

Curlew had a widespread distribution across the site, occurring in 29 subsites across all surveys (range 19 – 26). 17 subsites supported Curlew in all four low tide surveys: 0G031, 0G481, 0G482, 0G479/0G494, 0G486, 0G487, 0G488, 0G489, 0G490, 0G493, 0G495, 0G496, 0G499, 0H444, 0H445, 0H446 & 0H449.

The peak subsite count of 235 was recorded for 0H449 (Aughinish) on 19/02/10; this subsite also supporting peak numbers on 04/12/09. 0G489 (Traught & Doorus) recorded peak numbers during the November low tide survey and during the high tide survey (09/02/10). 0G495 (Oranmore Bay) recorded peak numbers on 23/10/09 and good numbers in all other surveys.

Good numbers occurred with regularity within 0G031 (Lough Rusheen), 0G486 (Killeenaran), 0G490 (Cave - Clarinbridge), 0G493 (Kilcaimin), 0H444 (Coranroo), 0H446 (Castle - Bell Harbour – Finvarra) and 0H465 (Rinn).

Foraging Distribution

Curlews are the largest intertidal wader to spend the non-breeding season within Ireland. Within intertidal areas they seek out larger prey items such as crabs, large worms and bivalves. Their de-curved bill is ideally suited to extracting deep-living worms such as Lugworms (*Arenicola marina*). Curlews rely on large prey that takes more time to handle (long handling time) in contrast to many other wader species that swallow prey relatively quickly upon finding it (short handling time). As a consequence, Curlews are territorial foragers and tend to occur widely spaced from each other to avoid competitive conflicts.

Curlews will also feed amongst damp grasslands for terrestrial worms. Terrestrial foraging was recorded around Inner Galway Bay (outside of the SPA boundary) and this activity, perhaps more common during the high tide period, is likely to play an important part in the achievement of sufficient daily energy intake.

14 subsites supported foraging Curlews in all four low tide surveys (0G031, 0G479/0G484, 0G481, 0G482, 0G486, 0G489, 0G490, 0G493, 0G495, 0G496, 0H444, 0H445, 0H446& 0H449). Two subsites are notable in terms of the numbers of foraging individuals that they supported:-

- 0G495 (Oranmore Bay) supported peak numbers of Curlew foraging intertidally on 23/10/09 and during the high tide survey (09/02/10). All other counts of Curlew within this subsite were ranked either second or third.
- 0H449 (Aughinish) supported peak numbers of foraging individuals on three low tide occasions (06/11/09, 04/12/09 & 19/02/10) and the second highest numbers on 23/10/09. On all occasions, substantial numbers were positioned within the sheltered inner intertidal just south of the causeway.

The intertidal habitat of 0G495 (Oranmore Bay) is characterised by a wide fucoid shore and a sandy mud community complex. The latter has both large polychaete worms *Arenicola marina* and *Nephtys hombergi* as characterising species. Areas north and south of the causeway in 0H449 (Aughinish) are comprised of muddy sand or intertidal sand, both supporting the polychaete worms described above.

Good numbers of foraging Curlew were also recorded within 0G489 (Traught & Doorus), 0G031 (Lough Rusheen), 0G496 (Rosshill), 0H444 (Coranroo), 0H446 (Castle - Bell Harbour - Finvarra) and 0H465 (Rinn), all supporting numbers ranked as 'high' on more than one survey occasion.

Roosting Distribution

During the high tide survey (09/02/10) 480 Curlews were recorded roosting within 18 subsites. Intertidal, supratidal and subtidal (feet in water) records were combined for analysis. The peak number (85) was recorded within 0H446 (Castle - Bell Harbour – Finvarra) accounting for 18% of all Curlews counted on that day. 49 individuals were recorded within both 0G484 (Ballynacourty North) and 0G495 (Oranmore Bay), a further 45 individuals within 0G483 (Ballynacourty South). Thereafter, smaller numbers were distributed across the remaining 14 subsites. 0G489 (Traught & Doorus) also supported 74 Curlews that roosted terrestrially.

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. The taxonomy of the species has proved complex but generally five populations are recognised including *T. t. britannica,* a small and declining population that breeds in Britain and Ireland and *T. t. robusta* which breeds in Iceland and the Faeroes and winters in Britain, Ireland and the North Sea area (Delaney et al. 2009).

Numbers

Total numbers of Redshanks were variable across the survey months although numbers in all months surpassed the threshold of all-Ireland importance. Whole site numbers peaked at 988 individuals on 06/11/09. The I-WeBS peak site count for the 2009/10 season was 624 individuals; this count , the lowest site peak since 2000/01, together with the noticeable drop in numbers during the Waterbird Survey programme, suggests that numbers were affected by the cold weather event of 2009/10 (Met Éireann, 2010a,b). Although Redshanks may have undertaken movements to warmer climes, some over-winter mortality is likely to have occurred particularly as Redshank appear to be a species particularly susceptible to cold weather (e.g. Davidson & Evans, 1982).

Redshanks were widespread and recorded within 29 subsites overall. 13 subsites supported Redshanks during all four low tide surveys.

0G495 (Oranmore Bay) supported peak numbers during the October 2009 low tide survey (238 Redshanks). 0G031 (Lough Rusheen) supported peak numbers during the November 2009 and February 2010 low tide surveys (178 and 62 individuals respectively) and during the high tide survey (139 Redshanks). A peak count of 102 Redshanks was recorded within 0G489 (Traught & Doorus) on 04/12/09.

Foraging Distribution

Redshanks forage mainly by pecking at the surface or probing within intertidal mudflats; favouring the muddier sections of sites (e.g. Rehfisch et al. 2000) where they prey upon species such as the ragworm *Hediste diversicolor* or mud snail *Hydrobia ulvae.* A particularly favoured prey is the burrowing amphipod *Corophium volutator.*

At Inner Galway Bay Redshanks foraged regularly (3 low tide counts or more) within 14 subsites. 0G495 (Oranmore Bay) supported peak numbers foraging intertidally during the October 2009 low tide survey and good numbers in all other surveys. Thereafter, 0G031 (Lough Rusheen) supported peak numbers of foraging individuals in all surveys, including the high tide survey when 139 Redshanks represented 32% of all recorded on that day. 0G489 (Traught & Doorus) supported joint peak numbers on 04/12/09 and good numbers in all other low tide surveys. The intertidal habitat of these aforementioned subsites is classified as a 'sandy mud community complex' (NPWS, 2012). The subsites represent some of the 'muddiest' areas within the site. The fauna of this complex is distinguished by the bivalves *Tellina tenuis, Macoma balthica* and *Cerastoderma edule* and the polychaete *Glycera tridactyla* and *Nephtys hombergii.*

Other subsites of note include 0H465 (Rinn) (149 foraging Redshanks on 06/11/09), 0H449 (Aughinish) and 0H446 (Castle - Bell Harbour - Finvarra) that supported good numbers in all low tide surveys.

Roosting Distribution

Redshank were observed roosting/other within terrestrial, intertidal, supratidal and subtidal (feet in water) habitats; data for these latter three habitats were combined for analysis.

During low tide surveys the majority of Redshanks were observed foraging (between 77% and 96%). During the high tide survey, 201 Redshanks roosted across 18 subsites. The peak number (40) were located within 0G499 (Salthill and environs) accounting for 20% of the total number counted. A further 39 Redshanks roosted within 0H446 (Castle - Bell Harbour - Finvarra), 22 of which were positioned within the inner subsite (Bell Harbour). 30 Redshanks roosted within 0H444 (Coranroo) within two distinct flocks. All other subsites supported <20 individuals.

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
Numbers of Black-headed Gulls occurred in the range 837 individuals (04/12/09) to a peak of 2,302 (23/10/09). Black-headed Gulls were recorded within a total 30 subsites across the survey programme. The subsite peak of 1,317 individuals was recorded for 0G499 (Salthill and environs) on 23/10/09. 14 subsites supported Black-headed Gulls during all five surveys: 0G031, 0G032, 0G481, 0G482, 0G486, 0G487, 0G489, 0G495, 0G496, 0G497, 0G498, 0G499, 0H444 and 0H446. 0G499 (Salthill and environs) was notable in supporting peak numbers in all five surveys. 0G498 (Nimmo's Pier & Docks) recorded the second or third highest numbers of Black-headed Gulls in all surveys undertaken. Good numbers were recorded within 0G495 (Oranmore Bay) during all surveys as well as 0G032 (Lough Atalia) and 0G031 (Lough Rusheen).
Foraging Distribution
During low tide surveys, the majority of Black-headed Gulls foraged intertidally, the converse being the case during the high tide survey when the majority foraged subtidally. 0G499 (Salthill and environs) supported peak numbers foraging intertidally during all four low tide surveys. The subsite peak was 682 individuals on 23/10/09. 0G498 (Nimmo's Pier & Docks) recorded good numbers foraging intertidally on one occasion (364 on 23/10/09). 0G489 (Traught & Doorus), 0G496 (Rosshill), 0G497 (Ballyloughan) and 0H444 (Coranroo) supported few numbers with regularity (on every low tide survey occasion). There was little pattern with regards subtidal foraging, high numbers recorded on a once-off basis e.g. 600 within 0G499 on 23/10/09. During the high tide survey, 495 Black-headed Gulls foraged subtidally, the majority within 0G498 (Nimmo's Pier & Docks) (334 individuals) with a further 132 individuals recorded within 0G032 (Lough Atalia). 29 other individuals were distributed across a further five subsites.
Roosting Distribution
Black-headed Gulls were recorded roosting/other within 29 subsites overall (intertidal/supratidal data combined). Peak proportions during low tide surveys were recorded within 0G488 (Kinvarra), 0H465 (Rinn), 0G495 (Oranmore Bay) and 0G032 (Lough Atalia) for the four low tide surveys respectively. During the high tide survey 1,307 Black-headed Gulls were recorded roosting/other within 17 subsites. Peak numbers were recorded within 0G499 (Salthill and environs), 617 individuals representing 47% of the total number. A further 212 Black-headed Gulls roosted/other within 0G497 (Ballyloughan).

Common Gull *Larus canus* - Family (group): Laridae (gulls)
The Common Gull breeds widely across the Palearctic and in North America (Mitchell et al. 2004). In Ireland, the species is most widely seen during winter when wintering birds arrive from Scotland and continental Europe (Wernham et al. 2004).
Numbers
Numbers of Common Gull across the whole site ranged from 614 individuals (23/10/09) to a peak 1,049 individuals (04/12/09). Common Gulls were widespread across the site. They occurred with most regularity (all five surveys) within 14 subsites: 0G031, 0G480/0G494, 0G481, 0G487, 0G489, 0G493, 0G495, 0G496, 0G497, 0G498, 0G499, 0H444, 0H446 and 0H449. Peak numbers occurred within 0G499 (Salthill & environs), 0H445 (Martello Tower, L. Murree and shore), 0H449 (Aughinish) and 0H449 (Aughinish) for the four low tide surveys respectively. The subsite peak of 240 individuals was recorded for 0H449 (Aughinish) on 04/12/09.
Foraging Distribution
Common Gulls foraged across 20 subsites overall and within four habitat types (intertidal, subtidal, supratidal and terrestrial). During low tide surveys, most Common Gulls foraged intertidally; the converse was the case during the high tide survey when most foraged subtidally. Common Gulls foraged within seven subsites during all four low tide surveys: 0G489 (Traught & Doorus), 0G495 (Oranmore Bay), 0G496 (Rosshill), 0G497 (Ballyloughlan), 0G499 (Salthill and environs), 0H444 (Coranroo) and 0H449 (Aughinish). 0G499 (Salthill and environs) supported peak numbers foraging intertidally on two occasions (23/10/09 & 19/02/10) and 0H449 (Aughinish) on two occasions (06/11/09 & 04/12/09). 0G489 (Traught & Doorus) supported good numbers during the first three low tide surveys. Subtidal foraging was recorded across 20 subsites with irregular pattern. The peak number recorded was 71 individuals (0G480, Rinville & Ardfry North) on 04/12/09. 0G489 (Traught & Doorus) supported the greatest number during the high tide survey (34 Common Gulls foraging subtidally).
Roosting Distribution
Data for intertidal and supratidal habitat were combined and showed that Common Gulls undertaking this behaviour were widespread across the site. 0H444 (Coranroo) supported peak numbers on two survey occasions (23/10/09 & 04/12/09). 0H465 (Rinn) supported peak numbers (42) on 06/11/09. 0G032 (Lough Atalia) and 0G923 (Deer Island (Galway Bay) jointly supported peak numbers of 23 during the final low tide survey. Eight subsites were used on a regular basis (3 low tide surveys or more): 0G481, 0G482, 0G486, 0G487, 0G489, 0G493, 0H446 and 0H448. Common Gulls were distributed across 23 subsites during the high tide survey. 423 Common Gulls were recorded roosting/other within intertidal/supratidal habitat together with a further 277 that were positioned subtidally. 0G493 (Kilcaimin) supported the peak number both within intertidal/supratidal habitat (85 individuals) and subtidal habitat (110 individuals). 0H446 (Castle - Bell Harbour - Finvarra) supported 83 roosting intertidally/supratidally along with a further 79 individuals loafing subtidally. 0G481 (Tawin South) and 0G499 (Salthill and environs) both supported 62 individuals and Lough Atalia supported 41 individuals. Thereafter subsites each held less than 30 individuals.

5.4 Inner Galway Bay - Activities and Events

5.4.1 Introduction

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

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

Section 5 of the Conservation Advice Notes provides information on activities and events that occur in and around Inner Galway 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 and categorised based on the standard EU list of pressures and threats as used in Article 17 reporting under the EU Habitats Directive. Only factors likely to directly or indirectly affect waterbirds were included but the resulting list is broad and includes built elements (e.g. man-made structures such as roads and bridges), factors associated with pollution (e.g. industrial discharges and waste water treatment plants), various recreational and non-recreational activities as well as biological factors such as saltmarsh erosion and siltation.

Information was collected during a desk-top review which included NPWS site reporting files, Galway City Development Plan (Galway City Council, 2011a), related documents (e.g. Galway City Council, 2011b) and other available documents pertaining to the ecology of the site.

In addition, information was collected during the 2009/10 waterbird survey programme (NPWS, 2010) as field workers recorded activities or events that occurred at the site during their survey work. This information, together with results from a 'site activity questionnaire' provides valuable information gained from 110+ hours of coordinated surveyor effort across the site. The activity questionnaire was also completed by local NPWS Conservation Rangers.

All activities and events data collected were entered into a database but as the dataset will be subject to change over time, the assessment should be viewed as a working and evolving process.

Data are presented in three ways:-

1. Activities and events identified to occur at Inner Galway 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 within Inner Galway 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 at Inner Galway Bay, those that have the potential to cause disturbance to waterbird species are highlighted.

3. Data from the 2009/10 waterbird survey programme were used to inform an assessment which examined the level of disturbance caused by activities recorded during field surveys. The methodology was adapted from that used for monitoring Important Bird Areas (IBAs) (Birdlife International, 2006) and involved assigning scores which ranged between 0 and 3, to three selected attributes of each disturbance event (1) frequency/duration; (2) intensity and (3) likely response of waterbirds (after Hill et al. 1997) (Table 5.7). The rationale for scoring is provided in Appendix 11.

Table 5.7 Scoring system for disturbance assessment

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

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

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

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

5.4.3 Overview of activities at Inner Galway Bay

Activities and events identified to occur across Inner Galway Bay are shown in Appendix 9, listed in terms of the subsites surveyed during the 2009/10 Waterbird Survey Programme. Activities highlighted in grey are those that have the potential to cause disturbance to waterbirds.

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

Habitat loss and modification

One of the main pressures upon Inner Galway Bay has been through coastal development (CAAS, 2009; Clare County Council, 2011; Galway City Council, 2011b). Development has been as a result of both urbanisation and industrial development and includes seaside resorts, recreational facilities and the development of coastal defences (Clare County Council, 2011).

Inner Galway Bay is a large and complex site and activities and events tend to be clustered around certain areas. The main infrastructure adjacent to the site occurs in the northern part and includes Galway City and harbour (adjacent to subsite 0G498). Lands zoned as commercial, light enterprise and industrial and related, are located next to this subsite (Galway City Council, 2011a).

Salthill is the largest residential area associated with the site and is a popular seaside resort with hotels and golf course etc. It borders subsite 0G499. Mutton Island is located within this subsite and was linked to the mainland via a causeway in 1999 and developed as a Waste Water Treatment Plant for Galway Main Drainage. The effects of this development on roosting waterbirds using the island was assessed during the planning process and reported by Nairn (2005).

Habitat loss of intertidal and subtidal habitat has occurred at several places at the site including as a result of the building of the aforementioned causeway to Mutton Island (refer to Nairn, 2005), some loss of upper shore intertidal habitat in 0G499 (Salthill & environs) and the previous development of Galway Harbour.

McCorry & Ryle (2009) report on the previous infilling of saltmarsh alongside the minor road that leads to Finvarra Point (relates to subsite 0H445). This infilling may have related to coastal protection and/or disposal of waste road material. Similarly, infilling relating to the construction of a seawall has occurred near Oranmore (subsite 0G495).

Apart from developed areas, the site is surrounded by a gently rolling agricultural landscape with the dominant land use being predominantly low-intensity livestock grazing. Some grazing of saltmarsh habitat is evident across the site (McCorry & Ryle, 2009) and has been heavy at times in the past (NPWS, 1998).

In total over the past 18 years (since S.I. No 394/1994), we estimate a total loss of eight hectares of intertidal habitat and one hectare of subtidal habitat.

Water quality

Point source pressures to the site include water treatment plants, combined sewer overflows and agricultural discharges as well as those arising from Integrated Prevention Pollution Control (IPPC) licensed industries. Diffuse source pressures may include agricultural and forestry activities and on-site waste water treatment systems.

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 (UWWT) Directive (91/271/EEC)[16] and Nitrates Directive (91/676/EEC). Following assessment, waterbodies are classified as eutrophic, potentially eutrophic, intermediate, or unpolluted (EPA 2010). Water quality within Galway Bay (Corrib Estuary & Inner Galway Bay) was classified as unpolluted for the period 2002-2006 (Clabby et al. 2008). The most recent results for the period 2007-2009, reveal that three sample areas, Kinvara Bay, Corrib Estuary and inner Galway Bay, are classed as unpolluted.

The Western River Basin District Transitional and Coastal Waters Action Plan classify the waters of inner Galway Bay as *good* quality; although Dunbulcaun Bay (subsite 0G490) is classified as *moderate* (Western RBD, 2010).

Galway City and environs are served by Mutton Island Waste Water Treatment Plant that opened officially in 2004 (www/galwaycity.ie). WWTPs also discharge into Kinvara Bay and Ballyvaughan Bay amongst others.

Improvements in WWTP treatment are aimed at meeting objectives of the Urban Waste Water Treatment Regulations (EU Council Directive 91/271/EEC, as transposed by S.I. No. 254 of 2001 as amended by S.I. 48 of 2010) and the Water Framework Directive (2000/20/EC as transposed by the European Communities (Water Policy) (Amendment) Regulations, 2010)), and to ensure that the quality of the bathing and shellfish waters in Galway Bay are not compromised by discharges. However an overall long-term reduction in organic and nutrient loading to an estuary may have various consequences for the ecology of the estuarine system. For example, there could be a reduction in the abundance of benthic invertebrate prey species (e.g. Burton et al. 2002) particularly those invertebrates that thrive (proliferate) in organically-enriched sediments. This could have subsequent knock-on effects upon waterbird foraging distribution, prey intake rates, and ultimately upon survival and fitness[17]. Such factors will need to be considered in future assessments for this site.

Fisheries & Aquaculture

Fishing activities, both professional and recreational, are widespread across the site and, in addition to Galway Harbour (see above), there are numerous harbours and piers including Ballyvaughan (0H448) and Kinvarra (0G488) that are both traditional fishing villages and ports.

Professional inshore fishery activities occur within the site although their spatial extent is largely unknown (hence coded 'U' - known to occur but unknown area' in Appendix 9). The western inshore region is an important fishery, the most important quota species fished in the western 12-mile zone (Loop Head to Erris Head) being Herring (*Clupea harengus*), prawns (*Nephrops*) and whitefish (BIM, 1999). All large and medium-sized trawling boats however, fish largely outside of the designated area and land their catch at Rossaveal which is the main fishing port in the region and located some 20km to the west of the designated area. A relatively small number of these boats use the nearshore waters and fishing within the designated site is undertaken mainly by smaller boats that fish within a few miles from their harbours (Hind, 2010). Fishing methods used within the designated area include small otter or midwater trawls (primarily used for herring and sprats in inshore waters), dredges (related to a scallop fishery), and static gear including trammel, gill and tangle nets (various fish species) and pots and creels for shrimp and lobster.

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

[17] Fitness can be defined as the contribution of individuals to future generations; a combination of survival and reproduction.

Inner Galway Bay includes three areas designated as Shellfish Waters under the EU Shellfish Waters Directive: Clarinbridge/Kinvarra Bay, Aughinish Bay and Ballyvaughan/Poulnaclough Bay[18]. The areas of the three Shellfish waters are 27, 4.8 and 2.8 km^2, respectively (DoEHLG, 2009a,b,c). Native and Pacific oysters and mussels are the most important shellfish species harvested within these areas.

Several areas within the site are classified as Bivalve Mollusc Production Areas[19] as follows:

- Ardfry Point to Kilcolgan Point (Mweeloon Bay);
- Kilcolgan Point to Deer Island to Aughinis Point Excl Kinvarra Bay (Carraduff beds, Killeenaran beds and Clarinbridge);
- Knockapreaghaun Point to Goragh Island to Traught Point (8º 59.1'W and 53º10.4'N) (Kinvarra Bay & Doorus Point) (Kinvarra Bay);
- Aughinis Point to New Quay;
- Finnivarra Point to Muckinis Point (Poulnaclough Bay & Ballyvaughan).

Aquaculture has in some cases resulted in modification of intertidal habitats. One example, reported by McCorry & Ryle (2009b) is the development of a pool on the inner shoreline of Kilcaimin, probably related to fishing or aquaculture in the area.

The hand gathering of molluscs and seaweeds has taken place historically across the site and still occurs today. The hand-gathering of molluscs (e.g. edible winkles *Littorina littorea*) was recorded within 19 subsites during the 2009/10 Waterbird Survey Programme. This activity is mainly by individuals for personal consumption while seaweed harvesting is generally for commercial purposes. Edible seaweeds include Dillisk (*Palmaria palmata*) and Carrageen (*Chondrus crispus*) while Egg Wrack (*Ascophyllum nodosum*) is sought for the production of seaweed meal for alginate extraction in Scotland and other European countries.

Recreation and disturbance

Inner Galway Bay offers a great deal in terms of coastal and marine leisure and tourism for the region. Galway City's coastal area is an important tourist and recreational amenity. Although sandy beaches are relatively limited across the site, two areas (Salthill beach (subsite 0H499) and Silverstrand (subsite 0G031) have achieved EU Blue Flag status in recent years. The urban village of Salthill is a traditional seaside resort and major tourist attraction. Silverstrand and Ballyloughaun beaches (subsite 0G497) are also considered significant recreational assets for the city (Galway City Council, 2011a).

Walking is a popular activity and is widespread across the site, recorded within 21 subsites during the 2009/10 waterbird survey programme. Coastal walks are considered important amenities by Galway City Council (2011a) and supported by the Co Galway Biodiversity Action Plan 2008 - 2013 (Galway County Council, 2009), and a specific objective of the former is to '*facilitate the extension of existing coastal greenway and linkages to create a city-wide coastal path from*

[18] European Communities (Quality of Shellfish Waters) Regulations 2004 (SI 200 of 1994) and European Communities (Quality of Shellfish Waters) (Amendment) Regulation 2009, (SI 55 of 2009).

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

Silverstrand (0G031) to Oranmore (0G495)……in conjunction with approved coastal protection works'.

Other recreational activities recorded across the site tend to be largely water-based. Angling and recreational fishing are popular and widespread activities. Sailing and canoeing occur as do windsurfing and sailboarding, although these are likely to be more frequent during the summer months.

Others

There is one No-Shooting Area within the Inner Galway Bay SPA: Lough Rusheen Wildfowl Sanctuary (designated under the Wildlife Act, 1976, as amended 2000) (subsite 0G031). Although shooting/wildfowling is documented at the site (NPWS, 1998), it was not recorded during the 2009/10 Waterbird Survey Programme. January 2010 was the coldest January for 25 years (Met Éireann (2010a) and in response to the freezing conditions, the Department of the Environment, Heritage and Local Government extended a temporary closure of the hunting season for wild birds (6th January 2010 to 20th January 2010).

Grazing of saltmarsh habitat is a common activity across the site (McCorry & Ryle, 2009a,b).

5.4.4 Disturbance Assessment

Appendix 9 highlights the activities and events that have the potential to cause disturbance to waterbirds across Inner Galway Bay.[20] 0G490 (Cave-Clarinbridge) supports the highest total number of activities that have the potential to cause disturbance, activities ranging from those associated with fishing harbours and slips, to powered watercraft, fishing and aquaculture. Numerous activities were reported across 0G499 (Salthill & environs) and 0H448 (Ballyvaughan Bay). It should be borne in mind however, that not every activity such as walking, winkle picking or boating will cause disturbance to waterbirds. Waterbird responses are likely to vary with each individual event and to be species-specific, and the significance of disturbance events upon waterbirds depends on a range of factors (see Section 5.4.5).

Seven activities were recorded causing disturbance to waterbirds during the 2009/10 Waterbird Survey Programme: flight path (aircraft flying over), motorised watercraft, walking (incl. dogs), motorised vehicles, bait-digging, hand-gathering of molluscs and activities associated with intertidal aquaculture. Summary data are shown in Table 5.8 and full results of the disturbance assessment are shown in Appendix 10. Note that individual activities/events are scored separately and there has been no attempt to produce cumulative scores for different activities occurring at the same time, although cumulative effects are likely.

Of the activities that were recorded as causing disturbance during field surveys, walking (intertidal areas and including dogs) was the most widespread (13 subsites) and responsible for the peak disturbance score for 11 subsites (Table 5.8). 64% of field observations resulted in a response from waterbirds, the most common response being 'moderate' in that the waterbirds were displaced for short periods of time, most often to another part of the subsite. Higher disturbance scores relate to records where dogs, and particularly loose dogs, were involved in the activity. The overall 'high' score attained at 0G497 (Ballyloughlan) relates to humans and loose dogs recorded walking within this subsite frequently, with waterbirds displaced whilst the activity was occurring.

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

Hand gathering of molluscs was the second most widespread activity, recorded within seven subsites. Aquaculture activities were reported within four subsites.

Table 5.8 Disturbance Assessment – Summary Table

Number of activities recorded to cause disturbance to waterbirds during field surveys (2009/10 waterbird survey programme) plus the calculated peak disturbance score (see text for explanation)
Scores 0 – 3 = Low Scores 4 – 6 = Moderate Scores 7 – 9 = High
Grey shading = no activity recorded to cause disturbance during field surveys

Subsite Code	Subsite Name	Number Activities causing disturbance	Peak Disturbance Score	Activity Responsible
0G031	Lough Rusheen	1	3	• Walking (incl. dogs)
0G032	Lough Atalia	1	3	• Walking (incl. dogs)
0G479	Rinville & Ardfry South	2	3	• Flight path (aircraft)
0G480	Rinville & Ardfry North	4	4	• Motorised watercraft
0G481/482	Tawin South & North	0		
0G483/484	Bayynacourty South & North	0		
0G485	Tyrone House & Morans	0		
0G486	Killeenaran	0		
0G487	Tarrea & adjacent areas	0		
0G488	Kinvarra	1	3	• Intertidal aquaculture (associated activities)
0G489	Traught & Doorus	0		
0G490	Cave – Clarinbridge	3	5	• Flight path
0G493	Kilcaimin	2	6	• Walking (incl. dogs)
0G495	Oranmore Bay	2	4	• Walking (incl. dogs)
0G496	Rosshill	0		
0G497	Ballyloughlan	1	7	• Walking (incl. dogs)
0G498	Nimmo's Pier & Docks	1	4	• Walking (incl. dogs)
0G499	Salthill & environs	2	4	• Walking (incl. dogs)
0H444	Coranroo	0		
0H445	Martello Tower, L. Muree & shore	1	6	• Motorised watercraft
0H446	Castle – bell Harbour – Finvarra	3	6	• Walking (incl. dogs)
0H447	Bishop's Quarter	2	5	• Walking (incl. dogs)
0H448	Ballyvaughanan Bay	1	5	• Motorised vehicles
0H449	Aughinish	3	6	• Walking (incl. dogs)
0H465	Rinn	2	6	• Walking (incl. dogs)
0H488	Rine Lough Murree Flaggy Shore	0		

5.4.5 Discussion

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

Many of the 'activities' identified may act so as to modify wetland habitats of the site. While physical loss or habitat modification might be considered more historic in nature (e.g. the construction of piers, slipways etc.) it can also occur through changes in natural processes (e.g. changes in sedimentation or erosion rates) as a result of former physical events such as the development of coastal defences, causeway/bridge building etc. As such these modifications may persist into the future (e.g. sediment accretion/erosion).

Physical damage to wetland habitats can also occur due to trampling or compaction (e.g. horse-riding, humans walking, motorised vehicles). The grazing of saltmarsh can modify waterbird roosting areas. Bait-digging and the hand-gathering of molluscs may cause some physical damage while at the same time removing waterbird prey resources. Fisheries and aquaculture interact with waterbirds in a variety of ways including the direct removal of waterbird prey (e.g. fish species, bivalves), habitat loss/modification (e.g. due to the physical presence of oyster trestles within intertidal habitat), habitat damage (e.g. from machinery, vehicles) and through disturbance to roosting/feeding birds.

Activities that cause disturbance can lead to the displacement of waterbirds. The significance of the impact that results from even a short-term displacement should not be underestimated. In terms of foraging habitat, displacement from feeding opportunities not only reduces a bird's energy intake but also leads to an increase in energy expenditure as a result of the energetic costs of flying to an alternative foraging area. Displacement also has knock-on ecological effects such as increased competition within and/or between different species for a common food source. In areas subject to heavy or on-going disturbance, waterbirds may be disturbed so frequently that their displacement is equivalent to habitat loss. When disturbance effects reduce species fitness[21] (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;

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

- 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.

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

BIM (1999) *Irish Inshore Fisheries Sector; Review and Recommendations*. May 1999. Bord Iascaigh Mhara Irish Sea Fisheries Board.

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, Kilcoole, Co. Wicklow.

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

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) *Effects 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.

CAAS (2009) *The Appropriate Assessment report of the County Development Plan 2009 – 2015.* Report to Galway County Council.

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.

Clabby, K.J., Bradley, C., Craig, M., Daly, D., Lucey, J., McGarrigle, M., O'Boyle, S., Tierney, D. and Bowman, J. (2008) *Water quality in Ireland 2004 – 2006.* Environmental Protection Agency.

Clare County Council (2011) *Habitats Directive Assessment (Natura Impact Statement) of the Clare County Development Plan* 2011-2017.

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

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.

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

Cummins, S. C. & Crowe, O. C. (2010) *Collection of baseline waterbird data for Irish coastal Special Protection Areas 2: Trawbrega Bay, Lough Swilly, Donegal Bay, Blacksod and Broadhaven, Inner Galway Bay and Wexford Harbour & Slobs.* Report by BirdWatch Ireland for the National Parks & Wildlife Service. April 2010.

Davidson, N. C. & Evans, P. R. (1982) Mortality of Redshanks and Oystercatchers from starvation during severe weather. *Bird Study* 29, 183-188.

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.
DoEHLG (2009a) *Shellfish Pollution Reduction Programme. As required by Article 5 of the Shellfish Water Directive 2006/113/EC and Section 6 of the Quality of Shellfish Waters Regulations, 2006 (S.I. No. 268 of*

2006). Characterisation Report Number 1. Aughinish Bay Shellfish Area. County Galway. Department of the Environment, Heritage and Local Government.

DoEHLG (2009b) *Shellfish Pollution Reduction Programme. As required by Article 5 of the Shellfish Water Directive 2006/113/EC and Section 6 of the Quality of Shellfish Waters Regulations, 2006 (S.I. No. 268 of 2006). Characterisation Report Number V. Clarinbridge/Kinvarra Bay Shellfish Area. County Galway.* Department of the Environment, Heritage and Local Government.

DoEHLG (2009c) *Shellfish Pollution Reduction Programme. As required by Article 5 of the Shellfish Water Directive 2006/113/EC and Section 6 of the Quality of Shellfish Waters Regulations, 2006 (S.I. No. 268 of 2006). Characterisation Report Number 8. Ballyvaughan/Poulnaclogh Bay Shellfish Area. County Galway.* Department of the Environment, Heritage and Local Government.

Draulans, D. & Van Vessem, J. (1986) Communal roosting in Grey Herons (*Ardea cinerea*) in Belgium. *Colonial Waterbirds* 9, 18-24.

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

EU Commission (2010) *Setting Conservation Objectives for Natura 2000 sites.* Document of the Expert Group on the Management of Natura 2000 sites. Meeting 22.02.2010.

Fox, A. D., Ebbinge, B. S., Mitchell, C., Heinicke, T., Aarvak, T., Colhoun, K., Clausen, P., Dereliev, S., Farago, S., Koffijberg, K., Kruckenberg, H., Loonen, M., Madsen, J., Mooij, J., Musil, P., Nilsson, L., Pihl, S. & Van der Jeugd, H. (2010) Current estimates of goose population sizes in western Palearctic, a gap analysis and an assessment of trends. *Ornis Svecica* 20, 115-127.

Galway County Council (2009) *Biodiversity Action Plan for County Galway* 2008 – 2013.

Galway City Council (2011a) *Galway City Development Plan 2011 – 2017*.

Galway City Council (2011b) *SEA Environmental Report of Galway City Development Plan 2011 – 2017*.

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.

Goss-Custard, J. D. & Verboven, N. (1993) Disturbance and feeding shorebirds on the Exe Estuary. *Wader Study Group Bulletin* 68, 59-66.

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

Hannon, C. (1996) *The 1995 All-Ireland Tern Survey.* Irish Wildbird Conservancy, Monkstown, Co Dublin.

Harrington, B. A. (2003) Shorebird management during the non-breeding season – an overview of needs, opportunities and management concepts. *Wader Study Group Bulletin* 100, 59-66.

Healy, B., Oliver, G., Hatch, P. & Good, J. (1997) *Coastal lagoons in the Republic of Ireland. Volume III.* Unpublished Report to NPWS.

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.

Hind, E. J. (2010) *Fishers: the forgotten scientists.* The Socio-Economic Marine Research Unit Working paper series. Working Paper 10-WP-SEMRU-1. National University of Ireland Galway.

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.

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.

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

Lucey, J. (2009) *Water quality in Ireland 2007-2008: Key indicators of the aquatic environment*. Environmental Protection Agency.

Lynas, P., Newton, S. F. & Robinson, J. (2007) The status of birds in Ireland: an analysis of conservation concern 2008-2013. *Irish Birds* 8, 149-166.

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

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

McCorry, M & Ryle, T. (2009b) *Saltmarsh Monitoring Project 2007-2008.* Volume 3. Final Report 2009. Report for Research Branch, National Parks & Wildlife Service.

Met Éireann (2010a) *Monthly Weather Bulletin No. 285.* January 2010.

Met Éireann (2010b) *Monthly Weather Bulletin No. 286.* February 2010.

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.

Nairn, R. (2005) Use of a high tide roost by waders during engineering work in Galway Bay, Ireland. *Irish Birds* 7, 489-496.

NPWS (1998) *Conservation Plan for Natura 2000 Site. Galway Bay Complex Proposed Special Area of Conservation including Inner Galway Bay Special Protection Area, Co. Galway and Co. Clare.* Draft. National Parks & Wildlife Service.

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

NPWS (2012) *Conservation Objectives Supporting Document: marine habitats and species. Inner Galway Bay Complex SAC (0268).* Version 1. November 2012.

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

Robinson J. A (1999) Migration and morphometrics of the Red-breasted Merganser *Mergus serrator* in northern Eurasia and the implications for conservation of this species in Britain and Ireland. *Wildfowl* 50, 139-148.

Robinson, J.A. & Colhoun, K. (Compilers) (2006) *International Single Species Action Plan for the Conservation of the Light-bellied Brent Goose (East Canadian High Arctic population) Branta bernicla hrota.* AEWA Technical Series No. 11. Bonn, Germany.

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.

Russell, R. W. (2020). Arctic Loon (*Gavia arctica*), version 1.0. IN Birds of the World 9S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.arcloo.01

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.

Scott D. A. & Rose, P. M. (1996) *Atlas of Anatidae populations in Africa and Western Eurasia. Special Publication 41.* Wetlands International. The Netherlands.

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.

Sheppard, R. (1993) *Ireland's Wetland Wealth. The report of the Winter Wetlands Survey 1984/85 to 1986/87.* Irish Wildbird Conservancy.

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.

Thorisson, B., Eyjólfsson, V., Gardarsson, A., Albertsdóttir, H.B. & Gunnarsson, T.G. (2012) The non-breeding distribution of Icelandic Common Ringed Plovers. *Wader Study Group Bulletin* 119, 97–101.

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.

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.

Western RBD (2010) TraC Action Plan – Transitional and Coastal Waters Action Programme. www/wfdireland.ie

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.

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.

APPENDIX 1

SITE NAME: INNER GALWAY BAY SPA

SITE CODE: 004031

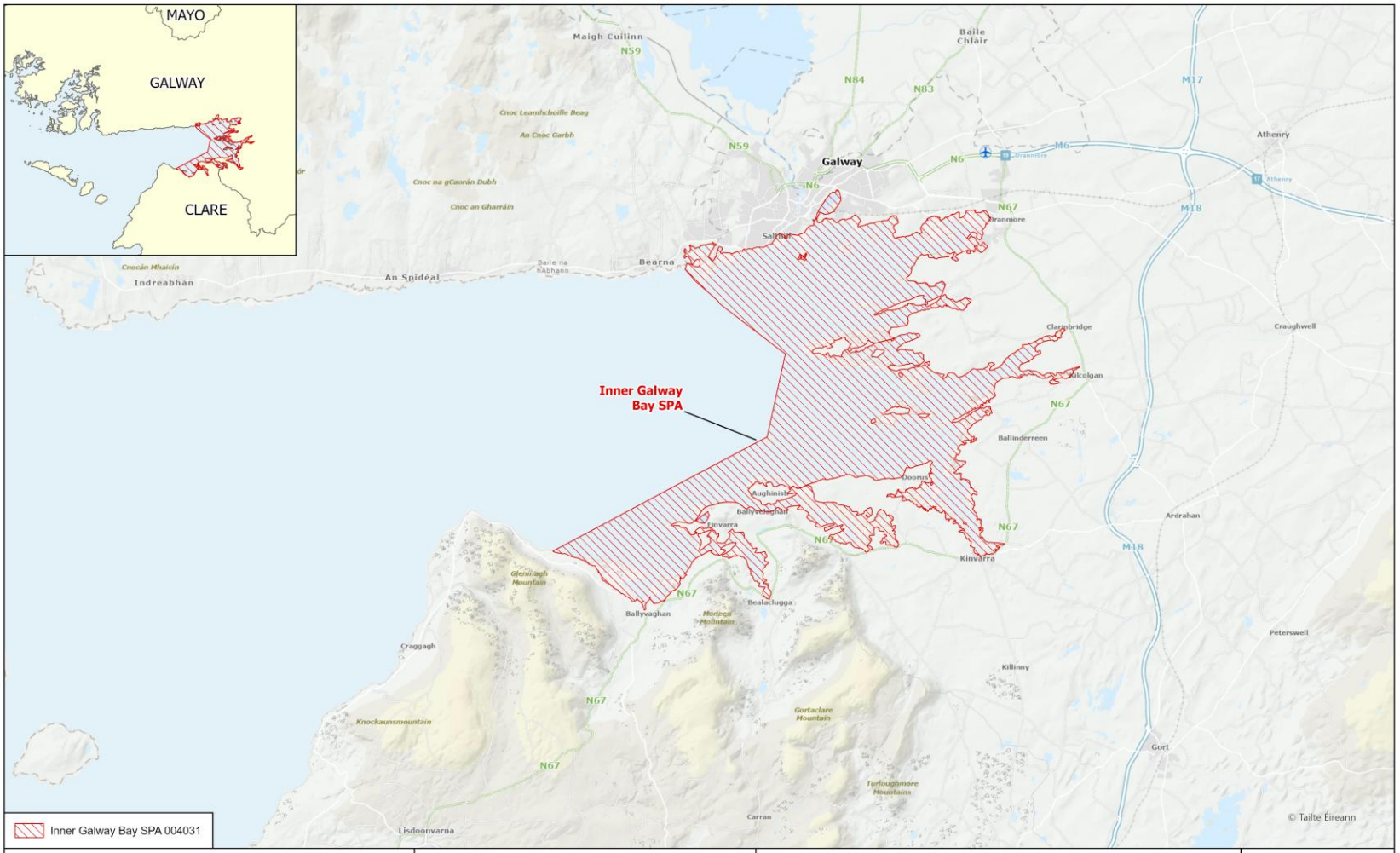
Inner Galway Bay SPA is a very large, marine-dominated site situated on the west coast of Ireland. The inner bay is protected from exposure to Atlantic swells by the Aran Islands and Black Head. Subsidiary bays and inlets (e.g. Poulnaclough, Aughinish and Kinvarra Bays) add texture to the patterns of water movement and sediment deposition, which lends variety to the marine habitats and communities. The terraced Carboniferous (Viséan) limestone platform of the Burren sweeps down to the shore and into the sublittoral. The long shoreline is noted for its diversity, and comprises complex mixtures of bedrock shore, shingle beach, sandy beach and fringing salt marshes. Intertidal sand and mud flats occur around much of the shoreline, with the largest areas being found on the sheltered eastern coast between Oranmore Bay and Kinvarra Bay. A number of small islands and rocky islets in the Bay are included within the site.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Black-throated Diver, Great Northern Diver, Cormorant, Grey Heron, Light-bellied Brent Goose, Wigeon, Teal, Red- breasted Merganser, Ringed Plover, Golden Plover, Lapwing, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Black-headed Gull, Common Gull, Sandwich Tern and Common Tern. 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.

Inner Galway Bay supports an excellent diversity of wintering wetland birds, with divers, grebes, cormorants, dabbling duck, sea duck and waders all well represented. There are internationally important wintering populations of Great Northern Diver (88) and Light-Bellied Brent Goose (676) and nationally important wintering populations of an additional sixteen species i.e. Black-throated Diver (36), Cormorant (266), Grey Heron (102), Wigeon (1,168), Teal (700), Red-breasted Merganser (249), Ringed Plover (335), Golden Plover (2,030), Lapwing (3,969), Dunlin (2,155), Bar-tailed Godwit (447), Curlew (697), Redshank (505), Turnstone (182), Black-headed Gull (1,941) and Common Gull (1,066) - all figures given are five year mean peaks for the seasons 1995/96 to 1999/2000. Of note is that the populations of Red-breasted Merganser and Ringed Plover represent 6.8% and 2.3% of the respective all-Ireland totals. Other species which occur in notable numbers include Little Grebe (35), Long- tailed Duck (21), Scaup (44) and Herring Gull (216). In addition, the following species also use the site: Great Crested Grebe (16), Mallard (200), Common Scoter (87), Oystercatcher (576), Grey Plover (60), Black-tailed Godwit (46), Mute Swan (150) and Great Black-backed Gull (129). The site provides both feeding and roost sites for most of the species. Little Egret, a species which has recently colonised Ireland, also occurs at this site.

The site has several important populations of breeding birds, most notably colonies of Sandwich Tern (81 pairs in 1995) and Common Tern (98 pairs in 1995 on Green Island and 46 pairs in 2001 on Mutton Island). A large Cormorant colony occurs on Deer Island - this had 200 pairs in 1985 and 300 pairs in 1989.

Inner Galway Bay SPA is of high ornithological importance with two wintering species having populations of international importance and a further sixteen wintering species having populations of national importance. The breeding colonies of Sandwich Tern, Common Tern and Cormorant are also of national importance. Also of note is that six of the regularly occurring species are listed on Annex I of the E.U. Birds Directive, i.e. Black-throated Diver, Great Northern Diver, Golden Plover, Bar- tailed Godwit, Sandwich Tern and Common Tern. Inner Galway Bay is a Ramsar Convention site and part of the Inner Galway Bay SPA is a Wildfowl Sanctuary.



NPWS An tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra National Parks and Wildlife Service

INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
SPA DESIGNATION

SITE CODE: 004031 SPA; Version 3.01; CO. GALWAY

0 5 10 Km

The mapped boundaries are of an indicative and general nature only.
Boundaries of designated areas are subject to revision.
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material by permission of the Government (Permit number: CYAL50512861)

Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta.
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis
le chead ón Rialtas (Ceadunas Uimh. CYAL50512861)

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Map Version 2
Date: October 2026

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

APPENDIX 2

Waterbird data sources

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

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

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

- Swan Surveys

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

- Greenland White-fronted Goose

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

- Greylag Geese

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

- Barnacle Goose (*Branta leucopsis*)

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

- Light-bellied Brent Geese

Special autumn surveys of this species have been conducted since 1996, 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' 12-year period (1995–2007) and the recent five-year period (2002-2007). The values given represent the percentage change in index (population) values across the specified time period, calculated by subtracting the smoothed index value at the start of the time-frame (1995) from the smoothed index value in the reference year (2007):-

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

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

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

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

Note that the above % change calculation is the same as the 'generic threshold method' used for e.g. gull species (see Section 4.2).

Example

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

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

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

Limitations

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

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

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

APPENDIX 4

Waterbird species codes

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

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

APPENDIX 5

Waterbird foraging guilds (after Weller, 1999)

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

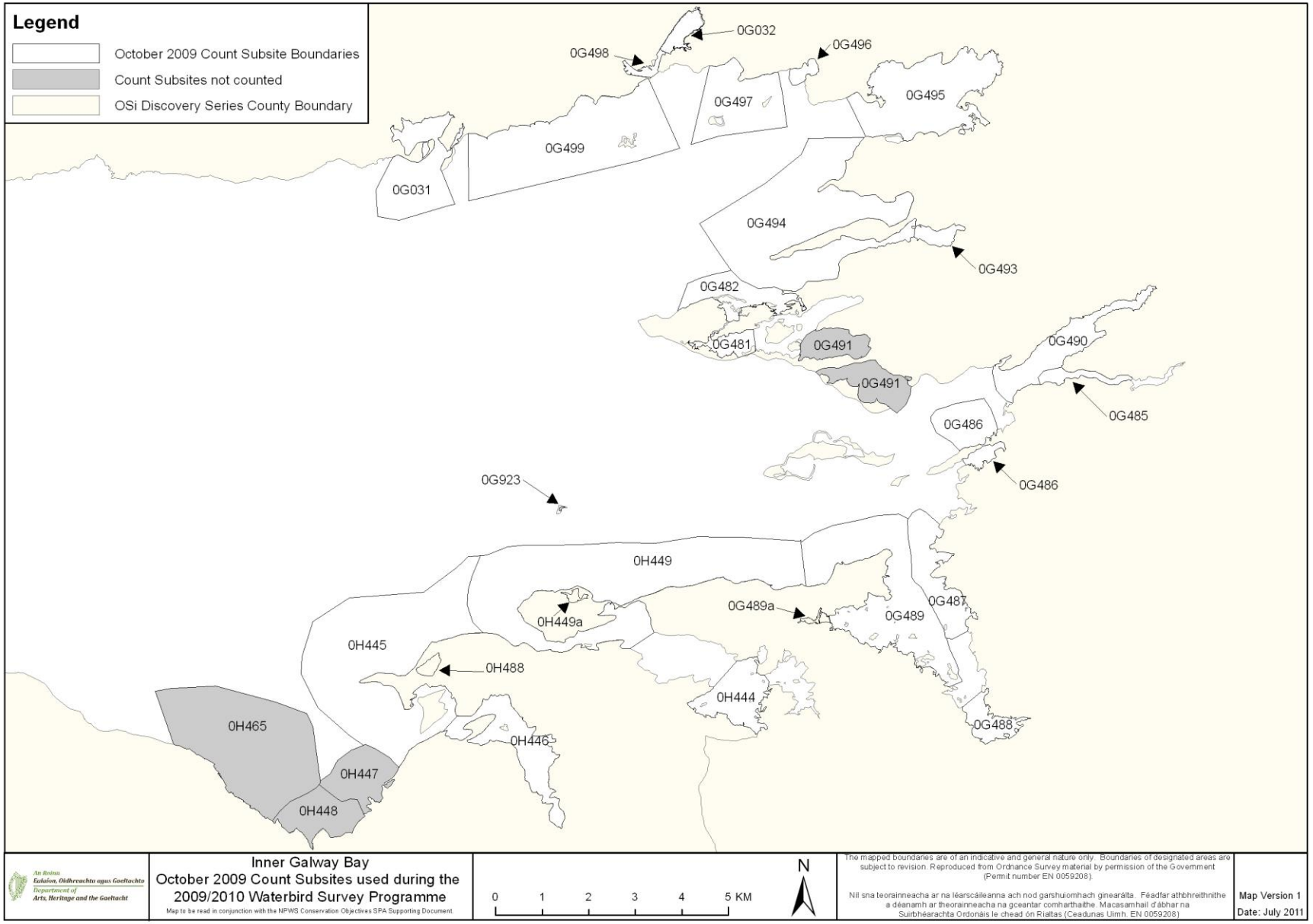
[a] dives <3m.

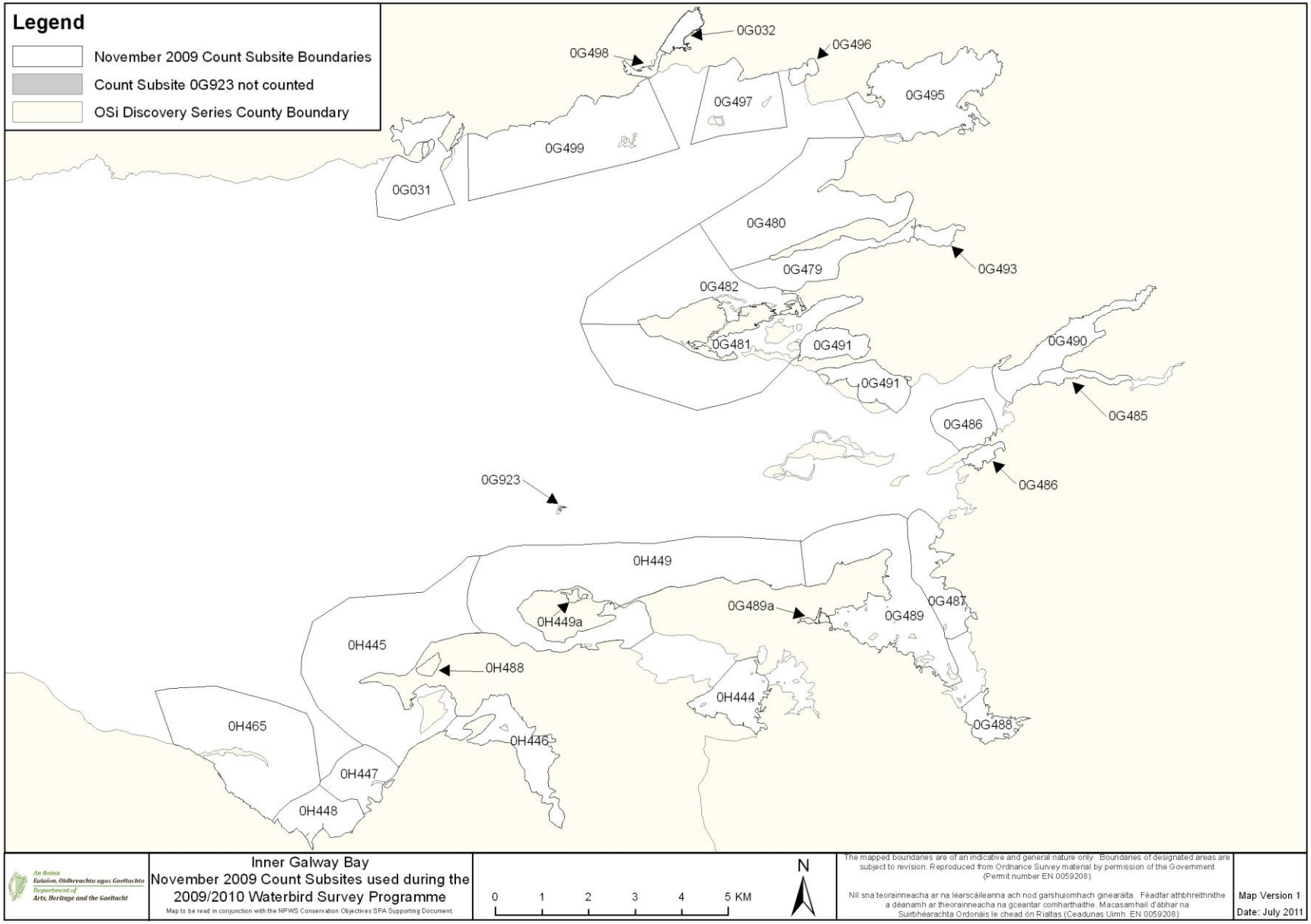
Please note that this table refers to generalised foraging strategies and is meant as a guide only. There is a great deal of variation between sites, seasons, tidal states and indeed, individual birds themselves. For example, some waterbird species may deploy several of the methods, e.g. Shelduck may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

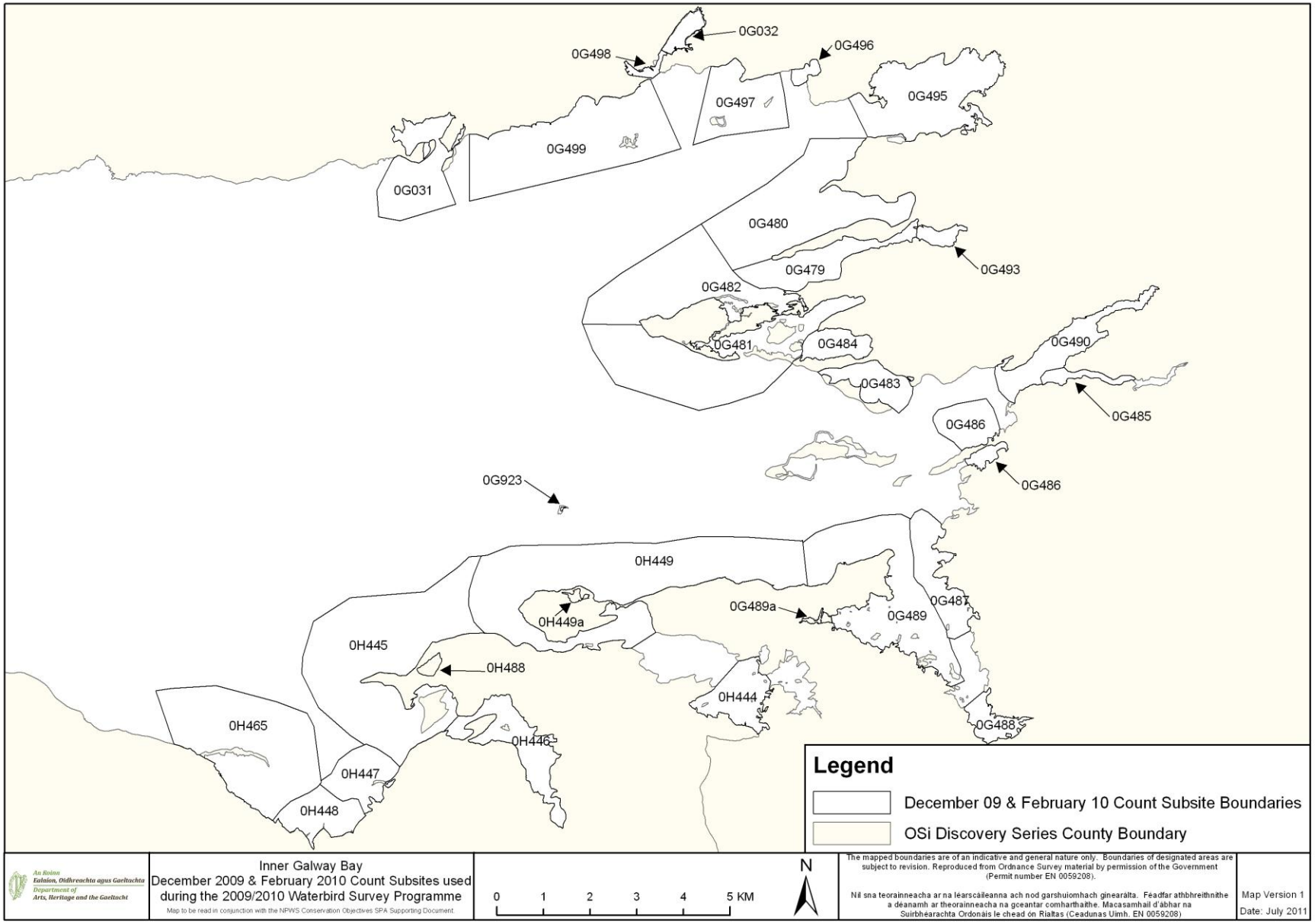
APPENDIX 6

Inner Galway Bay – Waterbird survey programme 2009/10 – Count Subsites

Subsite	Subsite Name	Number of LT surveys	HT Survey	Notes
0G031	Lough Rusheen	4	√	
0G032	Lough Atalia	4	√	
0G479	Rinville & Ardfry South	3	√	
0G480	Rinville & Ardfry North	3	√	
0G481	Tawin South	4	√	
0G482	Tawin North	4	√	
0G483	Bayynacourty South	2	√	Counted during LT surveys 04/12/09 & 19/02/10
0G484	Ballynacourty North	2	√	Counted during LT surveys 04/12/09 & 19/02/10
0G485	Tyrone House & Morans	4	√	
0G486	Killeenaran	4	√	
0G487	Tarrea & adjacent areas	4	√	
0G488	Kinvarra	3	√	Not counted during LT count of 23/10/09.
0G489	Traught & Doorus	4	√	Includes the subdivision 0G489a relating to Bridge Lough, Lough Adoona and associated habitats
0G490	Cave – Clarinbridge	4	√	
0G491	Ballynacourty	1	-	Counted on 06/11/09; subsequently split into 0G483 and 0G484.
0G493	Kilcaimin	4	√	
0G494	Rinville & Ardfry	1	-	Counted on 23/10/09; subsequently split into two subsites 0G479 and 0G480
0G495	Oranmore Bay	4	√	
0G496	Rosshill	4	√	
0G497	Ballyloughlan	4	√	
0G498	Nimmo's Pier & Docks	4	√	
0G499	Salthill & environs	4	√	
0G923	Deer Island	1		Only included during LT count on 19/02/10.
0H444	Coranroo	4	√	
0H445	Martello Tower, L. Muree & shore	4	√	
0H446	Castle – bell Harbour – Finvarra	4	√	
0H447	Bishop's Quarter	4	√	
0H448	Ballyvaughanan Bay	3	√	Not counted during LT count of 23/10/09
0H449	Aughinish	4	√	Includes the subdivision 0H449 relating Aughinish Lagoon & associated habitats
0H465	Rinn	3	√	Not counted during LT count of 23/10/09
0H488	Rine Lough Murree Flaggy Shore	4	√	


Legend
October 2009 Count Subsite Boundaries
Count Subsites not counted
OSi Discovery Series County Boundary
0G032
0G498
0G496
0G497
0G495
0G499
0G031
0G494
0G493
0G482
0G481
0G491
0G490
0G491
0G485
0G486
0G923
0G486
0H449
0G489a
0G487
0H449a
0G489
0H445
0H488
0H444
0G488
0H465
0H446
0H447
0H448
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Inner Galway Bay
October 2009 Count Subsites used during the 2009/2010 Waterbird Survey Programme
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0 1 2 3 4 5 KM
N
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead on Rialtas (Ceadúnas Uimh. EN 0059208)
Map Version 1
Date: July 2011

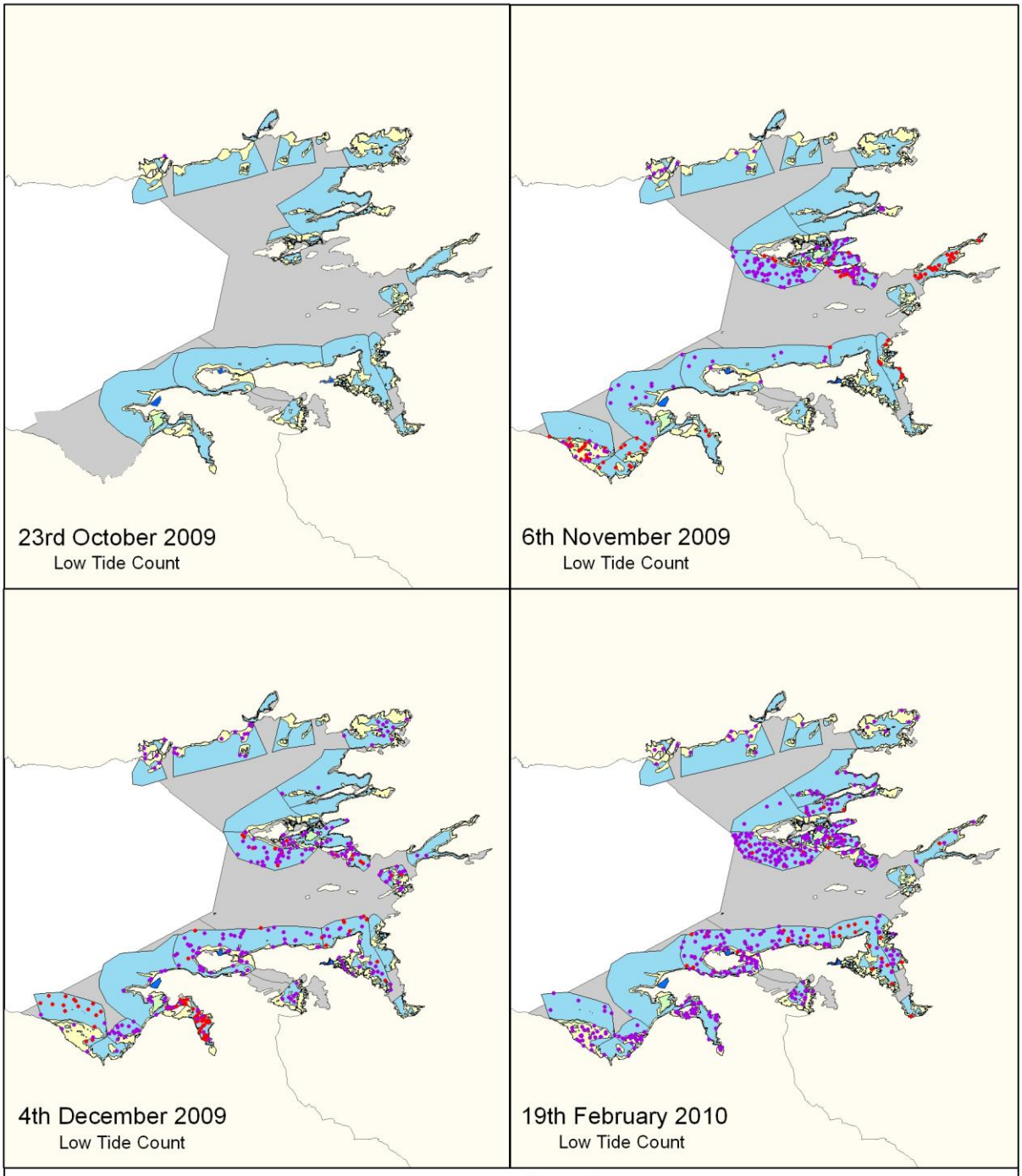

Legend
November 2009 Count Subsite Boundaries
Count Subsite 0G923 not counted
OSi Discovery Series County Boundary
0G032
0G498
0G496
0G497
0G495
0G499
0G031
0G480
0G493
0G479
0G482
0G481
0G491
0G490
0G491
0G485
0G486
0G923
0G486
0H449
0G489a
0G487
0H449a
0G489
0H445
0H488
0H444
0G488
0H465
0H446
0H447
0H448
An Roinn Ealaíon, Oidhreachtaí agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Inner Galway Bay
November 2009 Count Subsites used during the 2009/2010 Waterbird Survey Programme
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0 1 2 3 4 5 KM
N
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh. EN 0059208)
Map Version 1
Date: July 2011

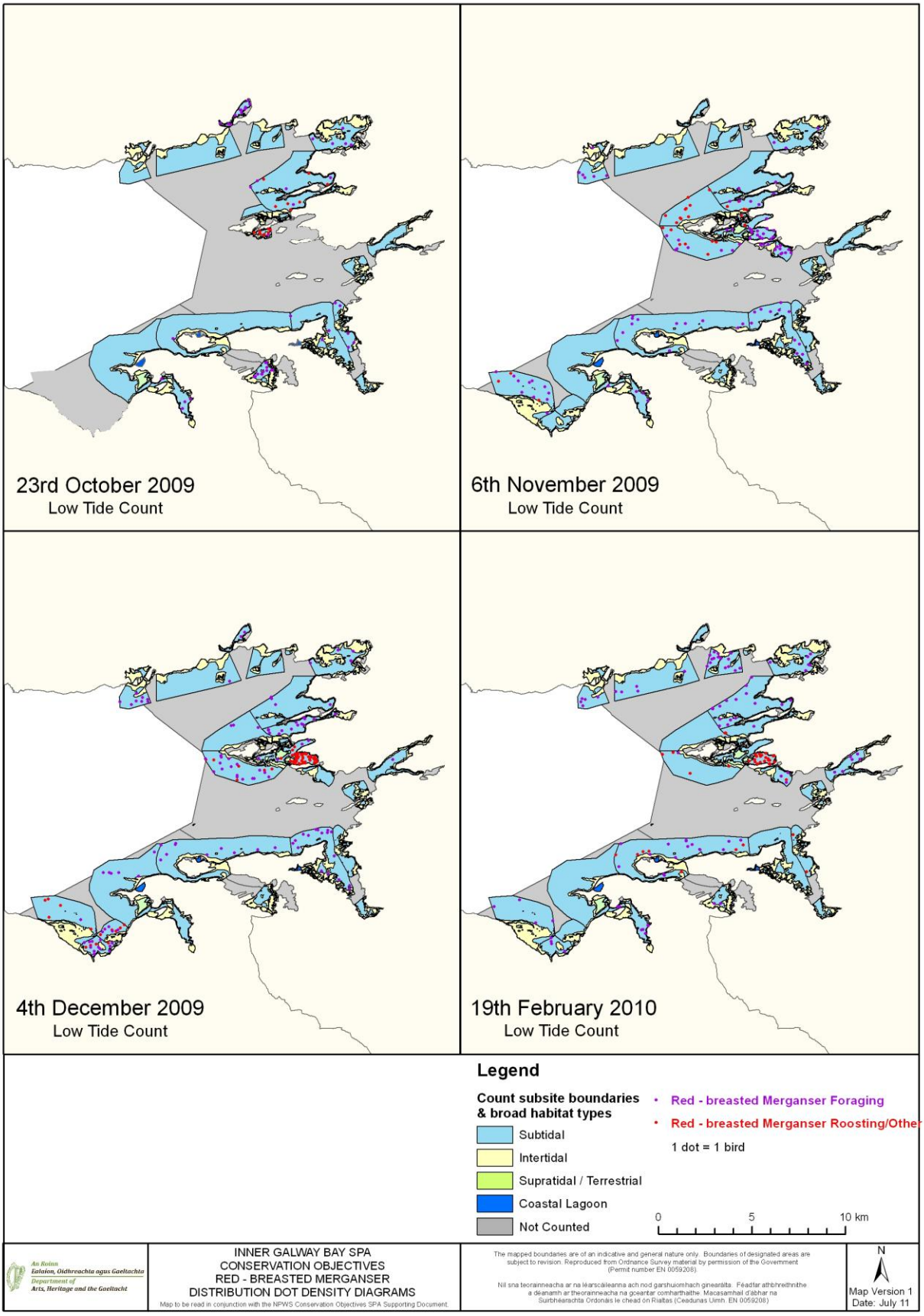

0G032
0G498
0G496
0G497
0G495
0G499
0G031
0G480
0G493
0G479
0G482
0G481
0G484
0G490
0G483
0G485
0G486
0G923
0G486
0H449
0G489a
0G487
0H449a
0G489
0H445
0H488
0H444
0G488
0H465
0H446
0H447
0H448
Legend
December 09 & February 10 Count Subsite Boundaries
OSi Discovery Series County Boundary
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Inner Galway Bay
December 2009 & February 2010 Count Subsites used during the 2009/2010 Waterbird Survey Programme
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0 1 2 3 4 5 KM
N
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Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonais le chead ón Rialtas (Ceadunas Uimh. EN 0059208)
Map Version 1
Date: July 2011

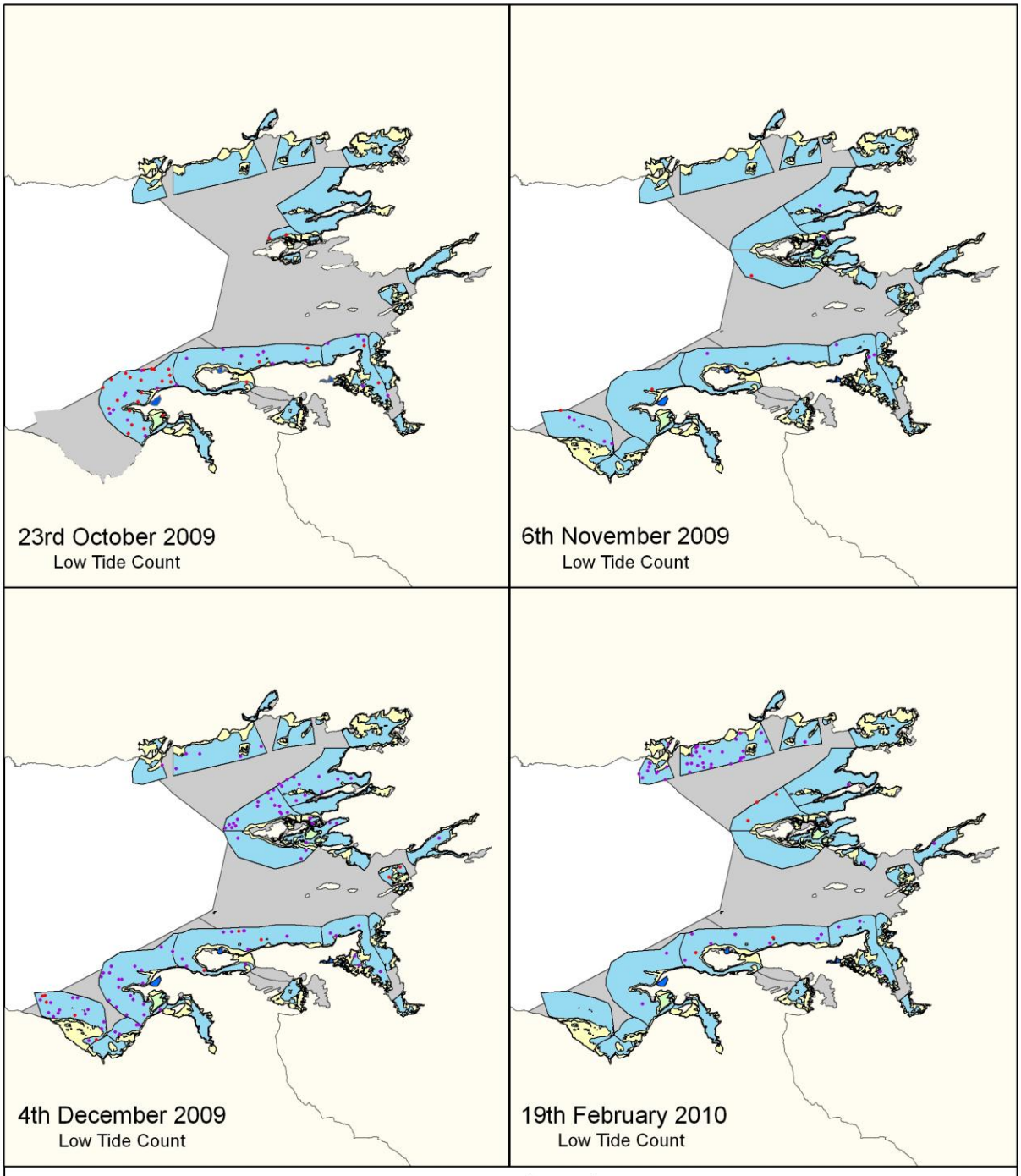
APPENDIX 7

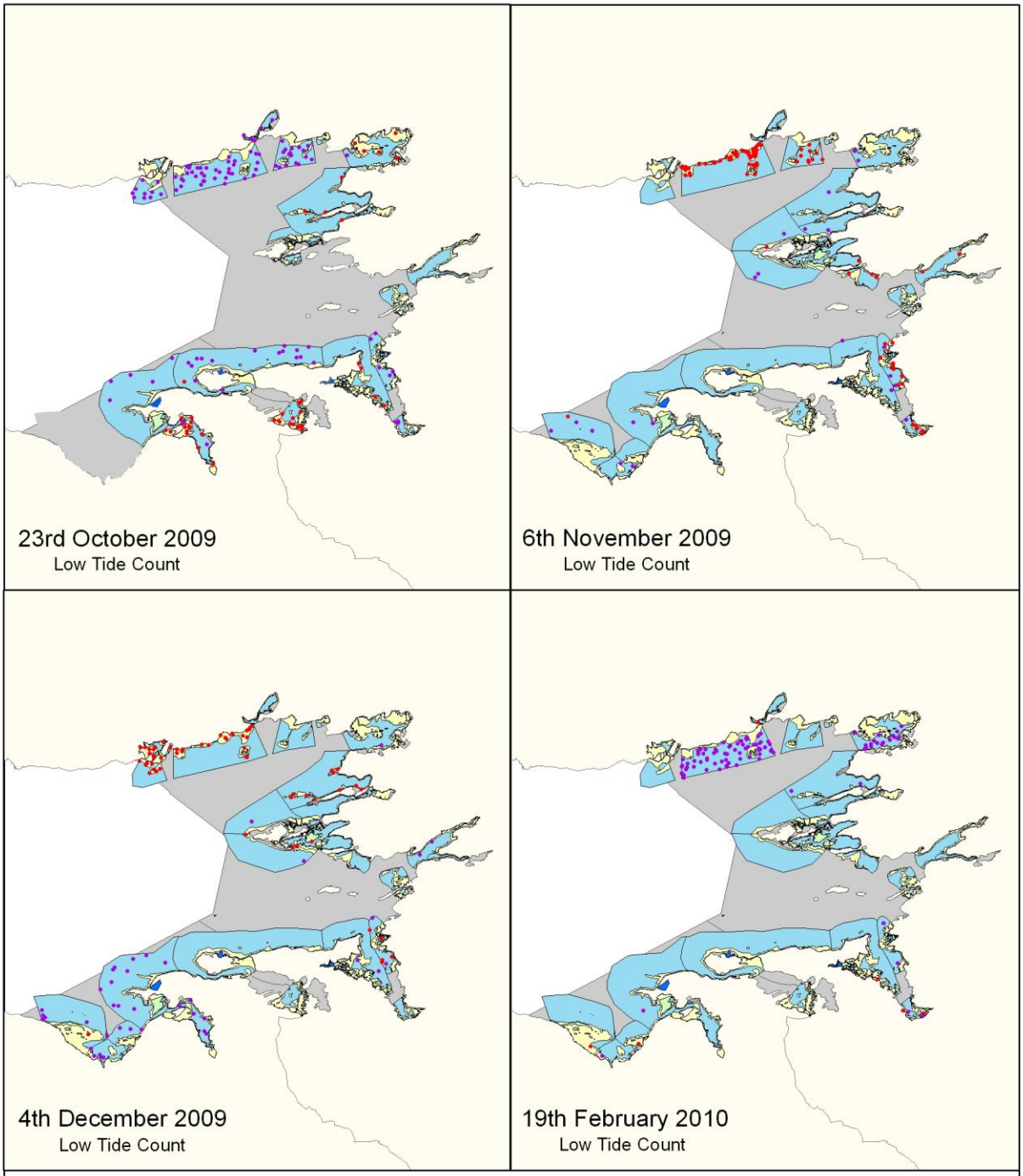
Inner Galway Bay

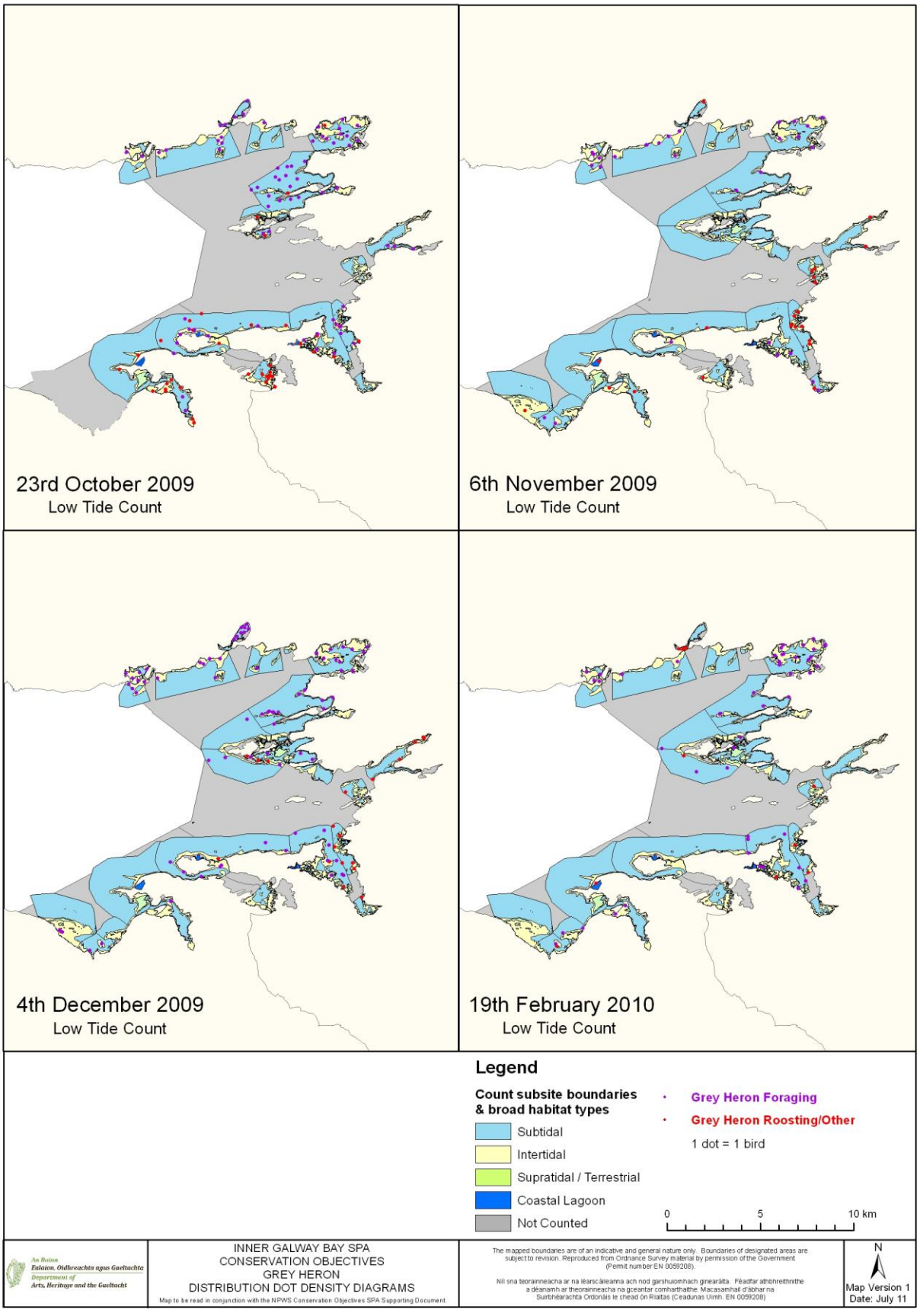
Waterbird distribution (dot-density diagrams) recorded during the low tide surveys (October 2009 – February 2010)

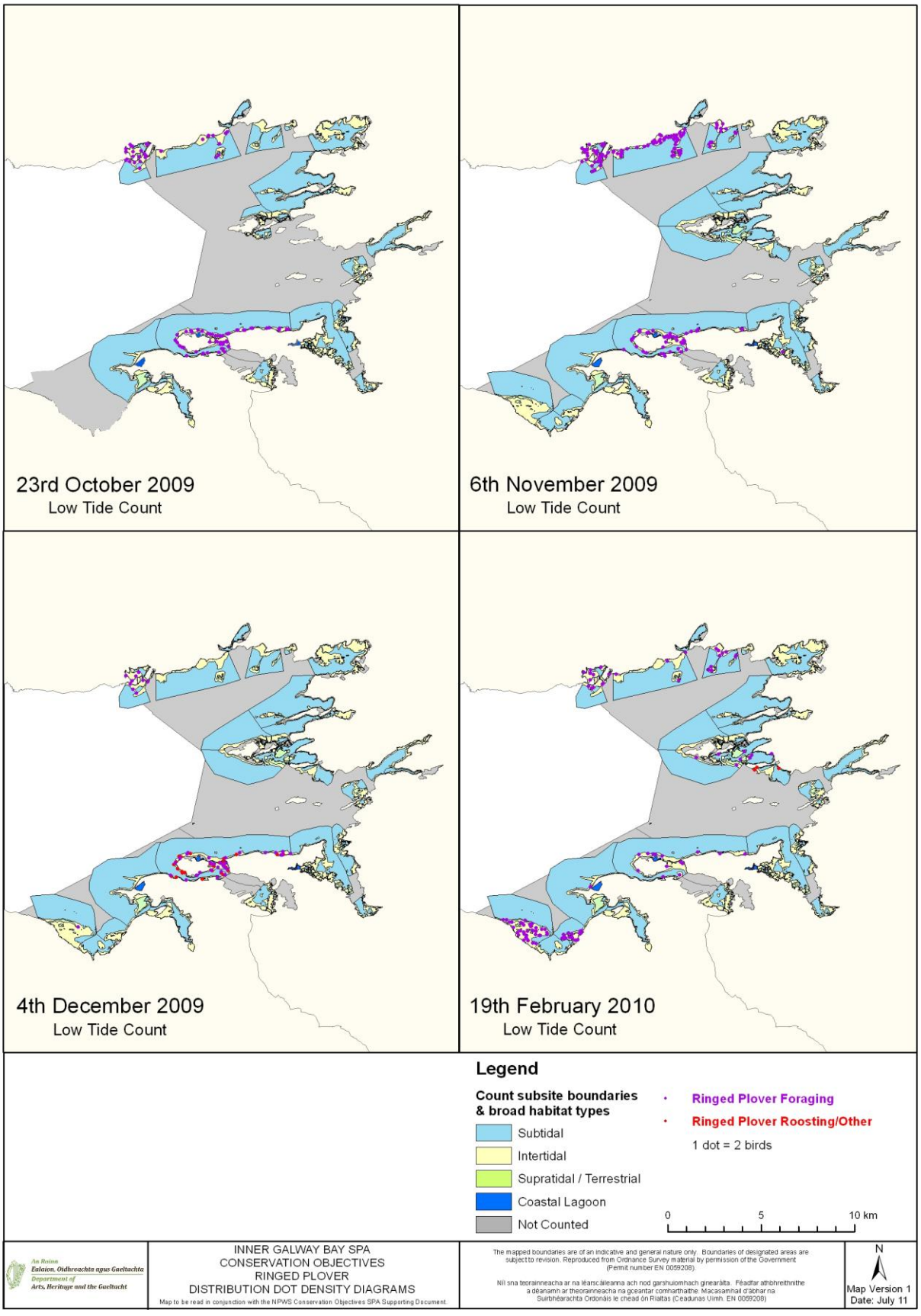

23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Light-bellied Brent Goose Foraging
Light-bellied Brent Goose Roosting/Other
1 dot = 2 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
LIGHT - BELLIED BRENT GOOSE
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: July 11

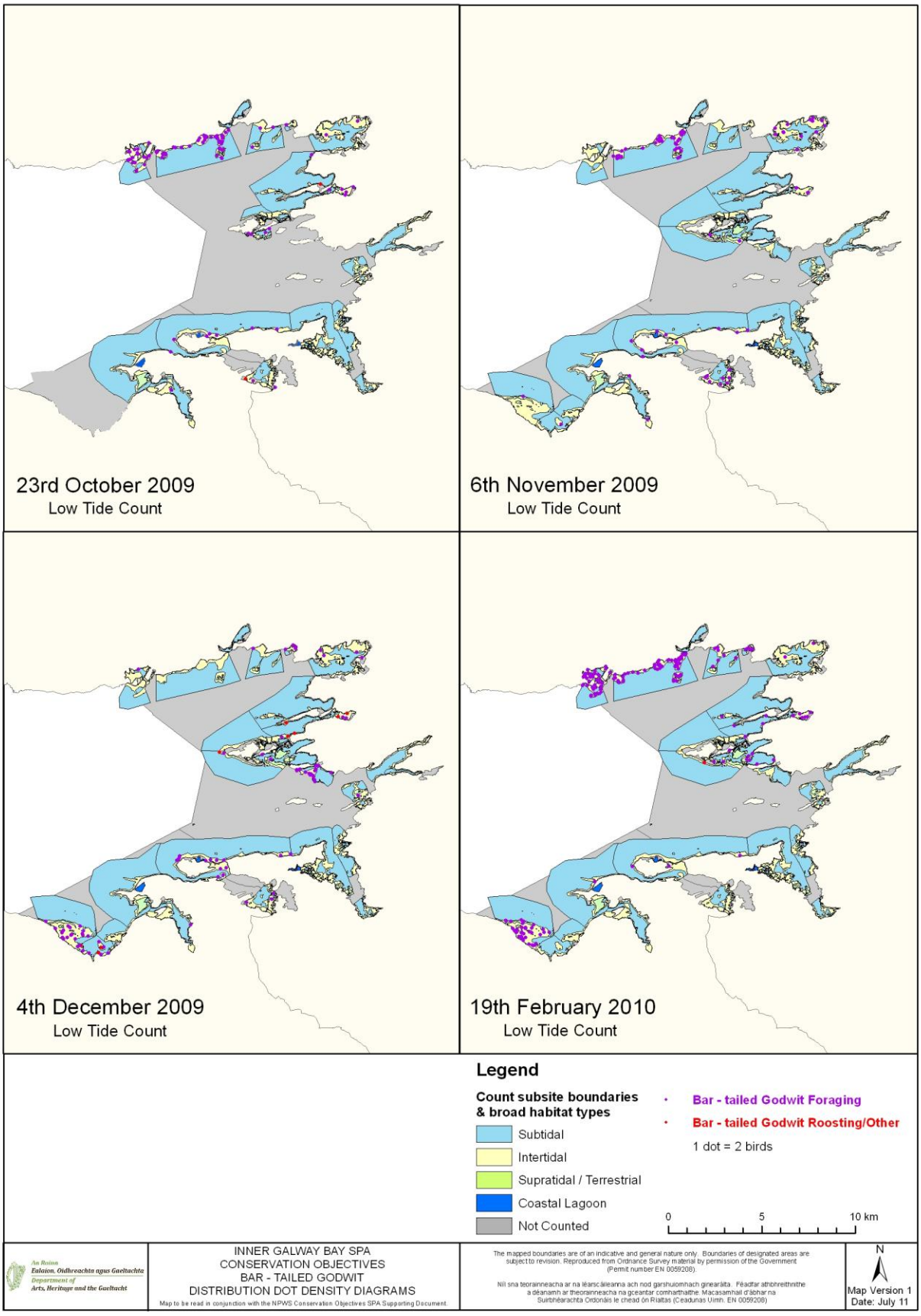

23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Red - breasted Merganser Foraging
Red - breasted Merganser Roosting/Other
1 dot = 1 bird
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
RED - BREASTED MERGANSER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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N
Map Version 1
Date: July 11

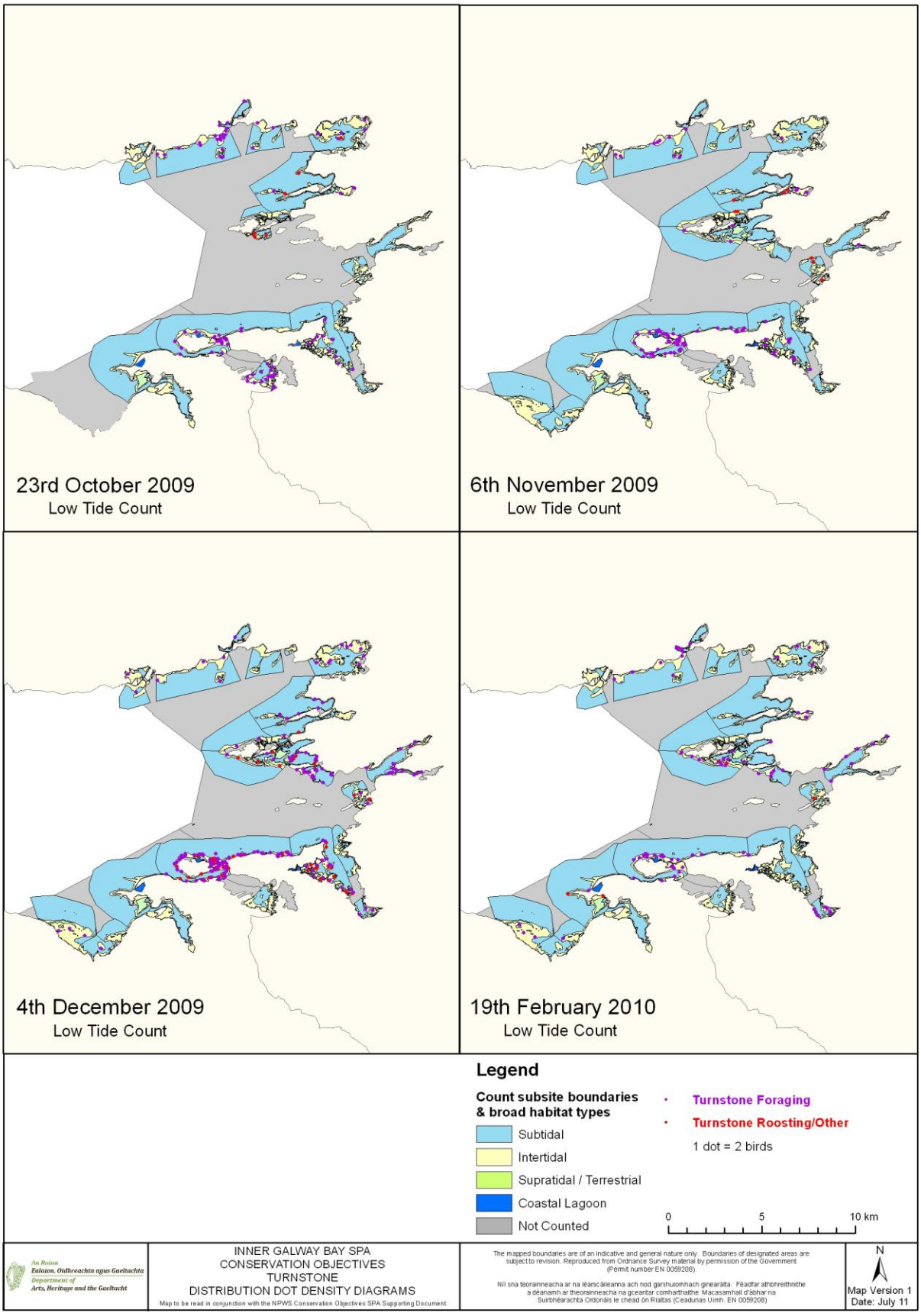

23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Great Northern Diver Foraging
Great Northern Diver Roosting/Other
1 dot = 1 bird
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
GREAT NORTHERN DIVER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
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N
Map Version 1
Date: July 11

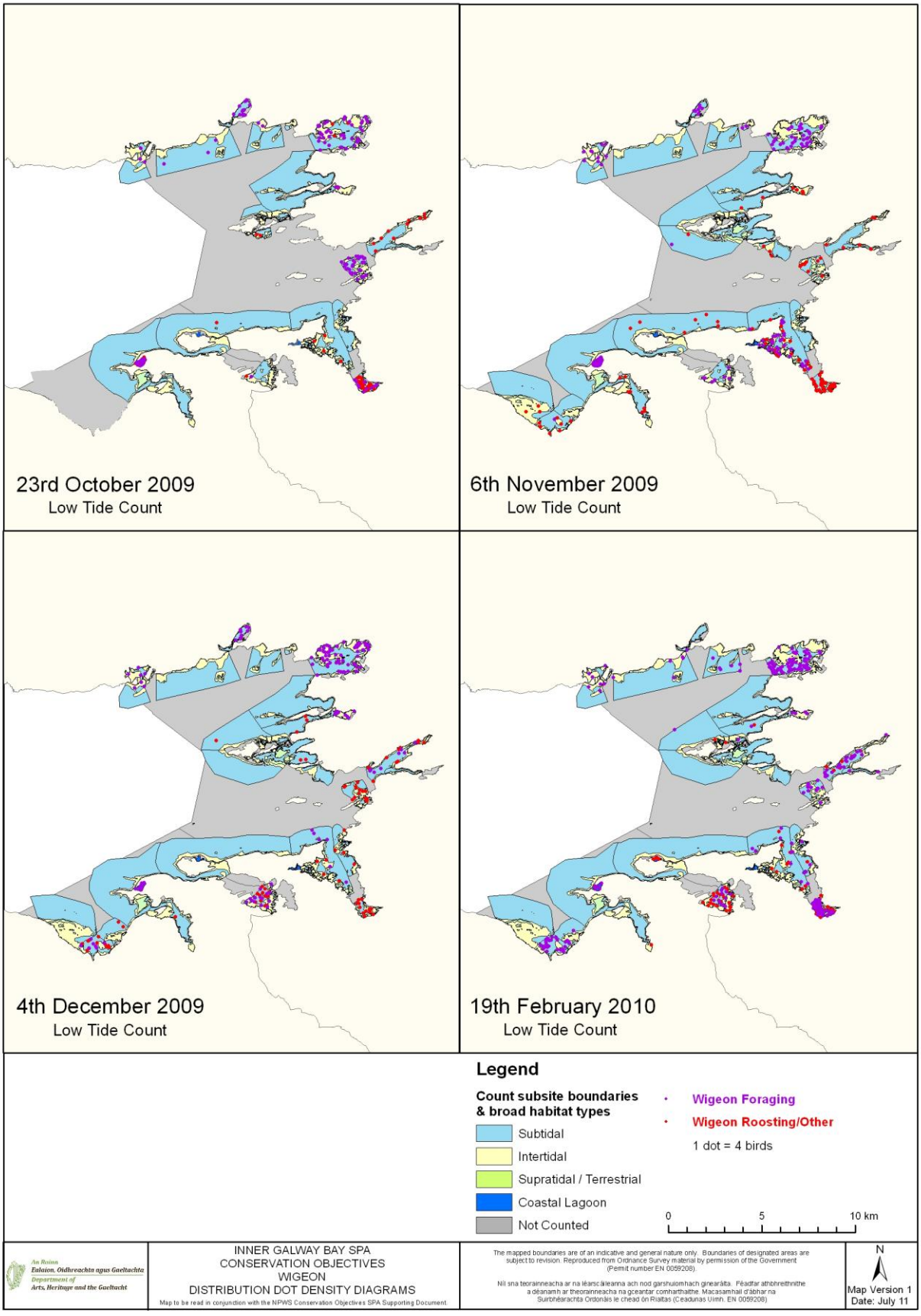

23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Cormorant Foraging
Cormorant Roosting/Other
1 dot = 1 bird
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
CORMORANT
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Nil sna teorainneacha ar na léarscáileanna ach riod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: July 11

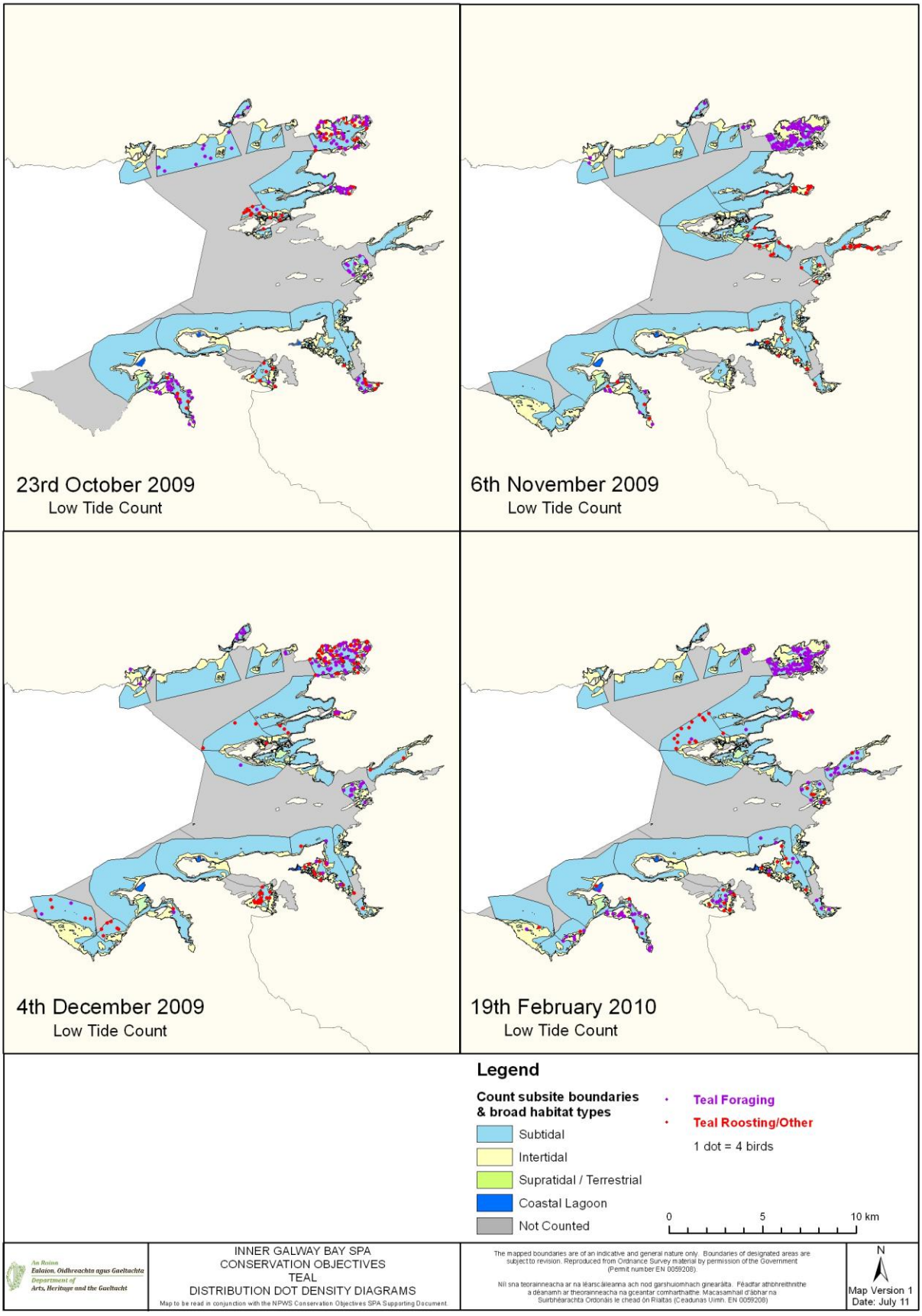

23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Grey Heron Foraging
Grey Heron Roosting/Other
1 dot = 1 bird
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
GREY HERON
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: July 11

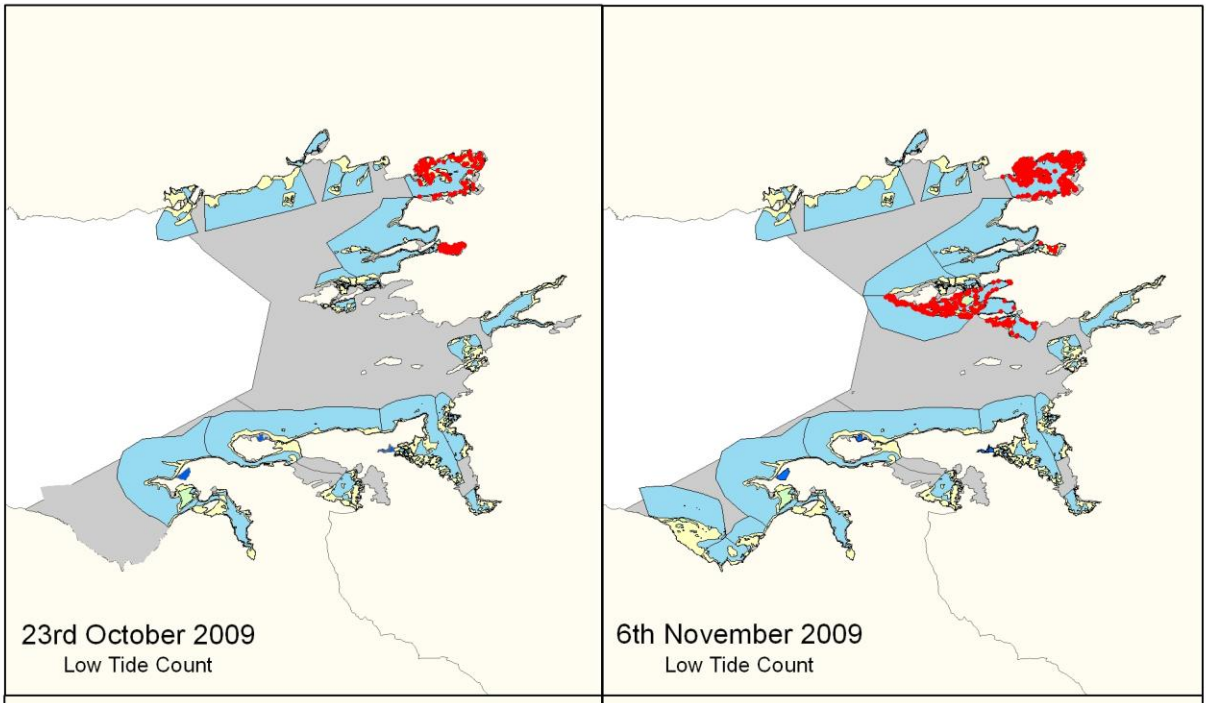

23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Ringed Plover Foraging
Ringed Plover Roosting/Other
1 dot = 2 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
RINGED PLOVER
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: July 11


23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Bar - tailed Godwit Foraging
Bar - tailed Godwit Roosting/Other
1 dot = 2 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
BAR - TAILED GODWIT
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: July 11


23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Turnstone Foraging
Turnstone Roosting/Other
1 dot = 2 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
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: July 11

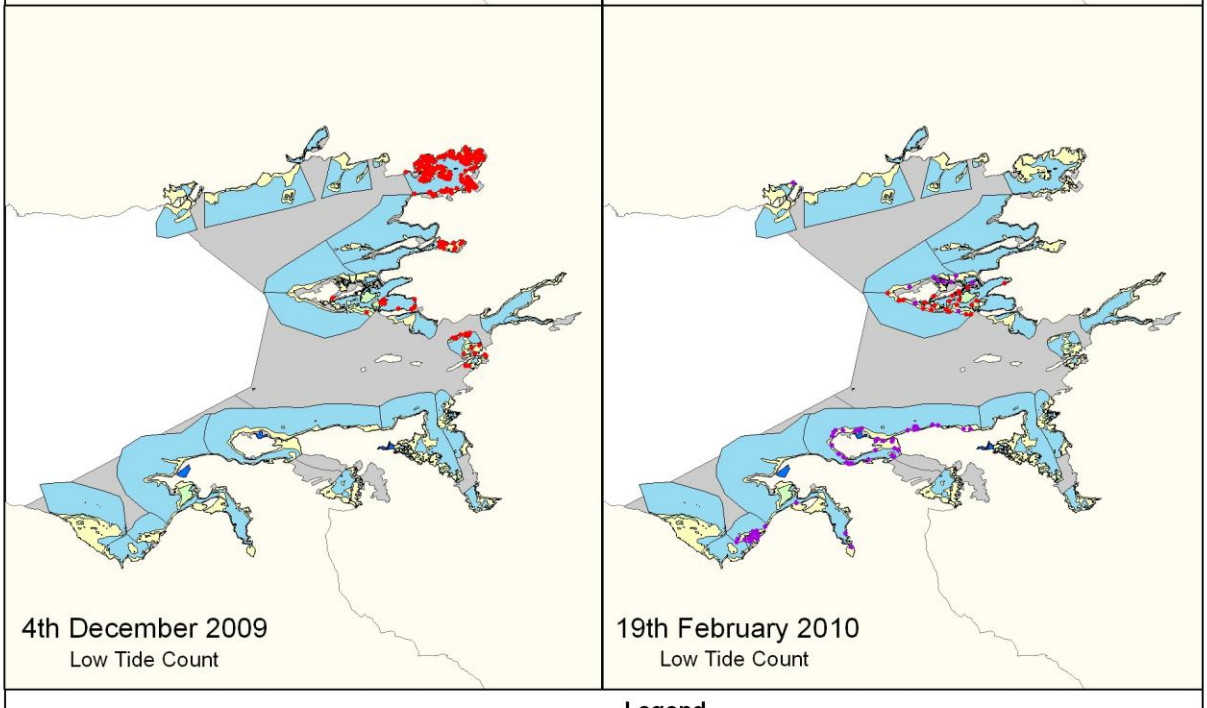

23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Wigeon Foraging
Wigeon Roosting/Other
1 dot = 4 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
WIGEON
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: July 11


23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Teal Foraging
Teal Roosting/Other
1 dot = 4 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
TEAL
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: July 11



23rd October 2009
Low Tide Count

6th November 2009
Low Tide Count



4th December 2009
Low Tide Count

19th February 2010
Low Tide Count

Legend

Count subsite boundaries & broad habitat types

- Subtidal
- Intertidal
- Supratidal / Terrestrial
- Coastal Lagoon
- Not Counted

- **Golden Plover Foraging**
- **Golden Plover Roosting/Other**

1 dot = 5 birds

0 5 10 km

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

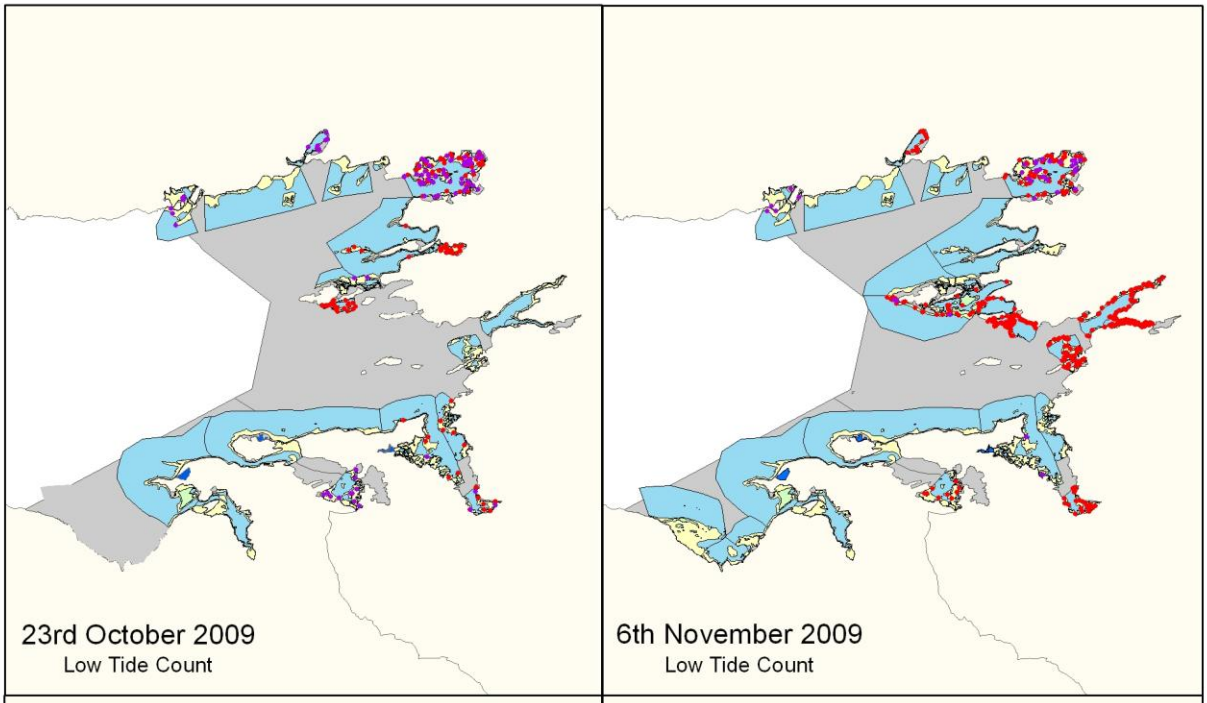
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
GOLDEN PLOVER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.

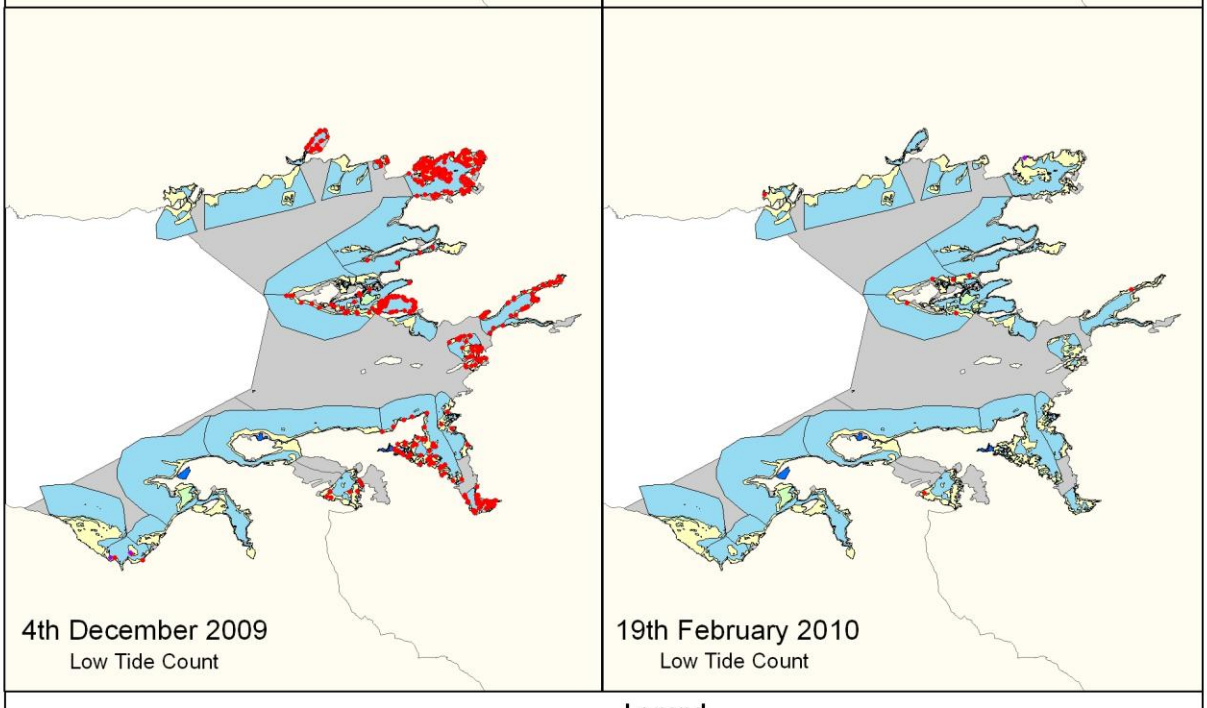
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Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comhartha. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)

N

Map Version 1
Date: July 11





Legend

Count subsite boundaries & broad habitat types

- Subtidal
- Intertidal
- Supratidal / Terrestrial
- Coastal Lagoon
- Not Counted

- **Lapwing Foraging**
- **Lapwing Roosting/Other**

1 dot = 4 birds

0 5 10 km

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

INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
LAPWING
DISTRIBUTION DOT DENSITY DIAGRAMS

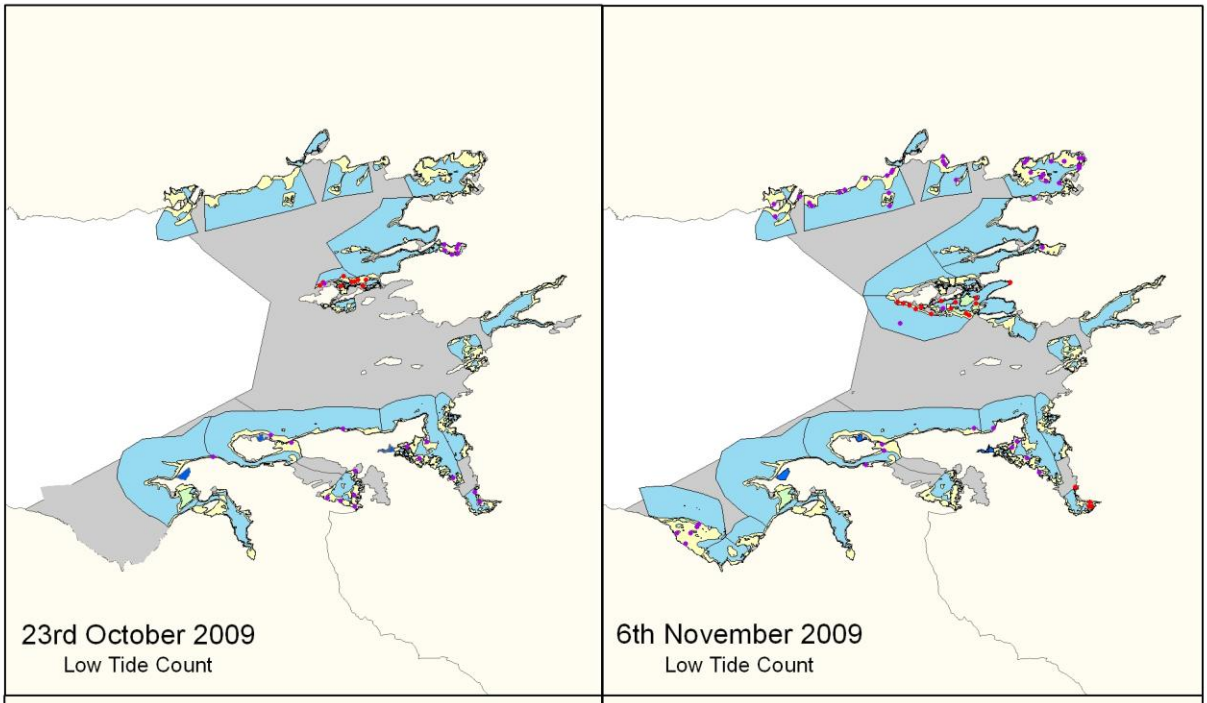
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.

The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).

Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)

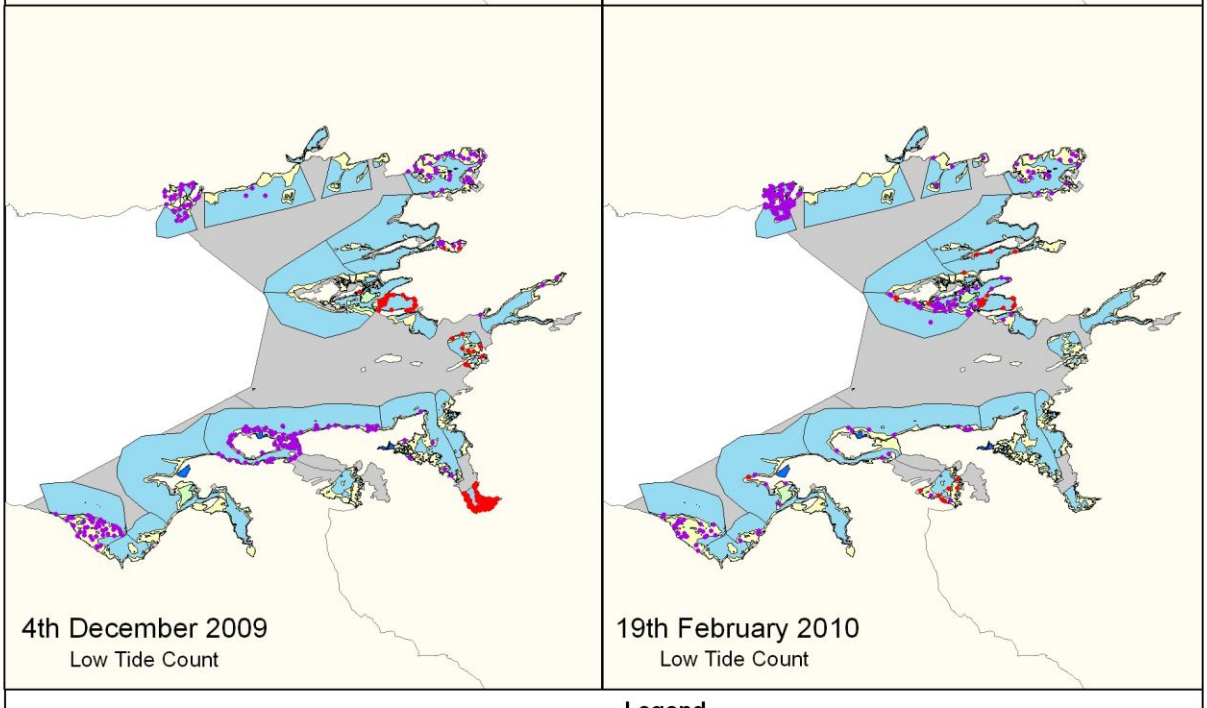
N

Map Version 1
Date: July 11



23rd October 2009
Low Tide Count

6th November 2009
Low Tide Count



4th December 2009
Low Tide Count

19th February 2010
Low Tide Count

Legend

Count subsite boundaries & broad habitat types

- Subtidal
- Intertidal
- Supratidal / Terrestrial
- Coastal Lagoon
- Not Counted

- **Dunlin Foraging**
- **Dunlin Roosting/Other**

1 dot = 5 birds

0 5 10 km

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

INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
DUNLIN
DISTRIBUTION DOT DENSITY DIAGRAMS

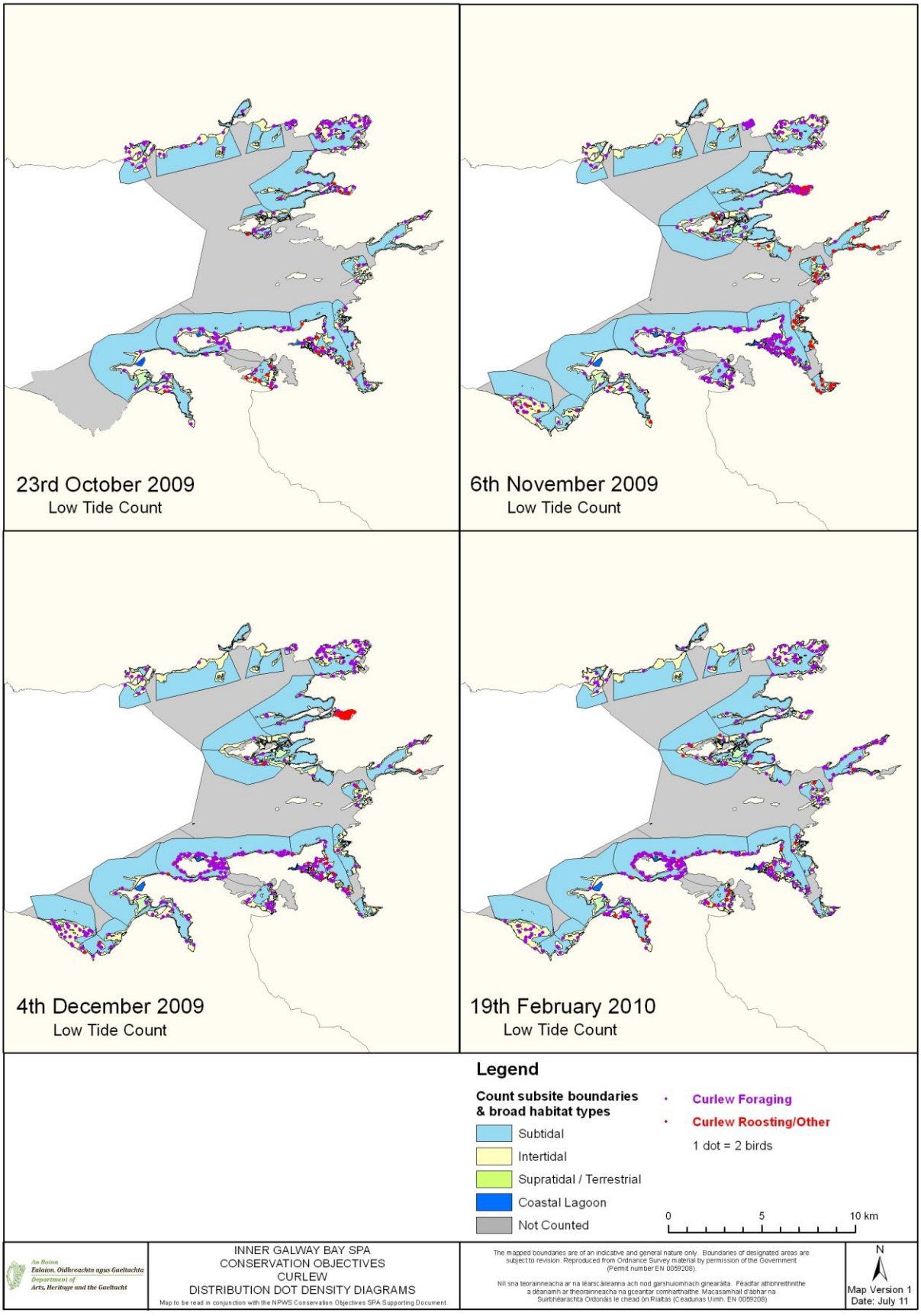
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.

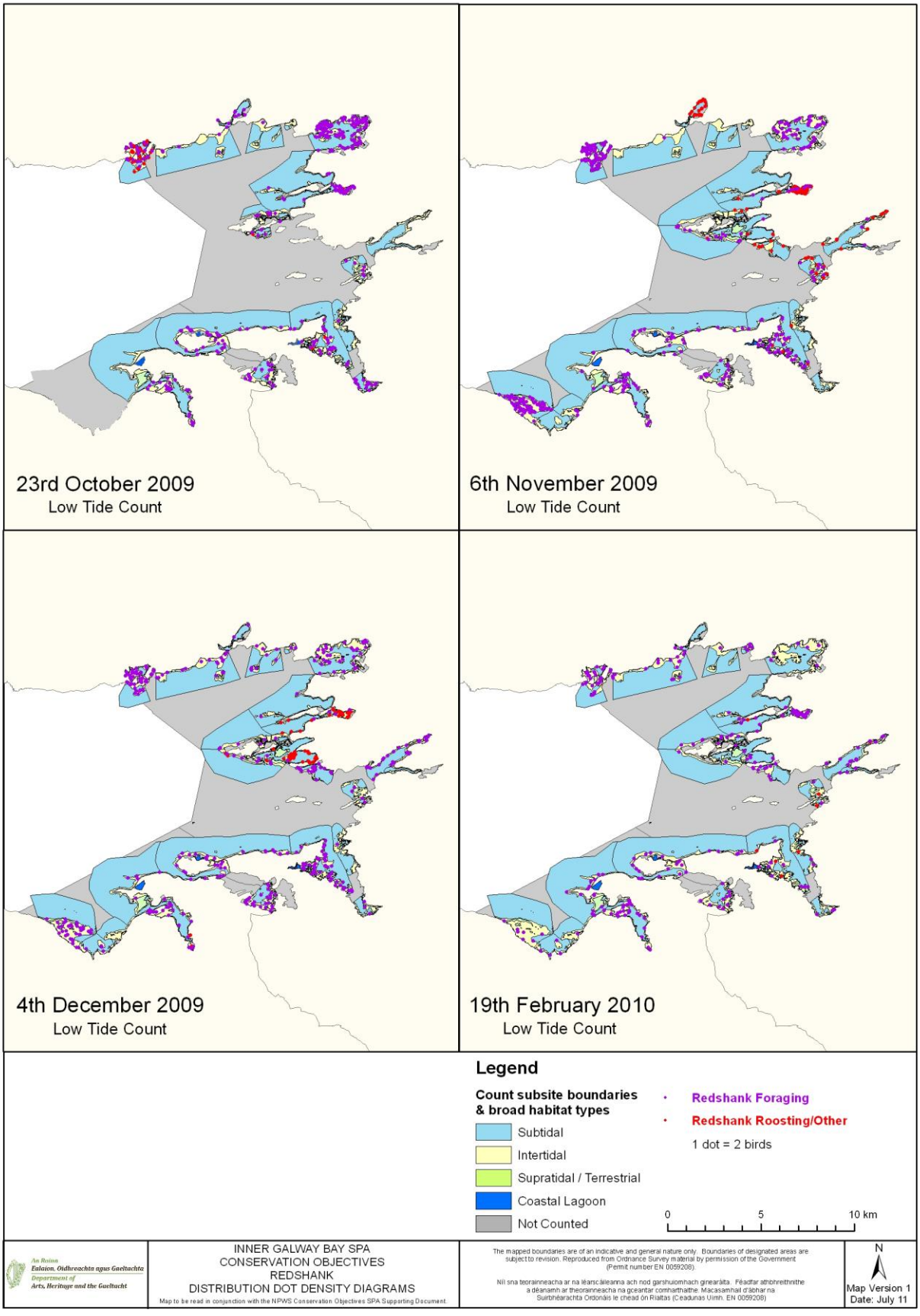
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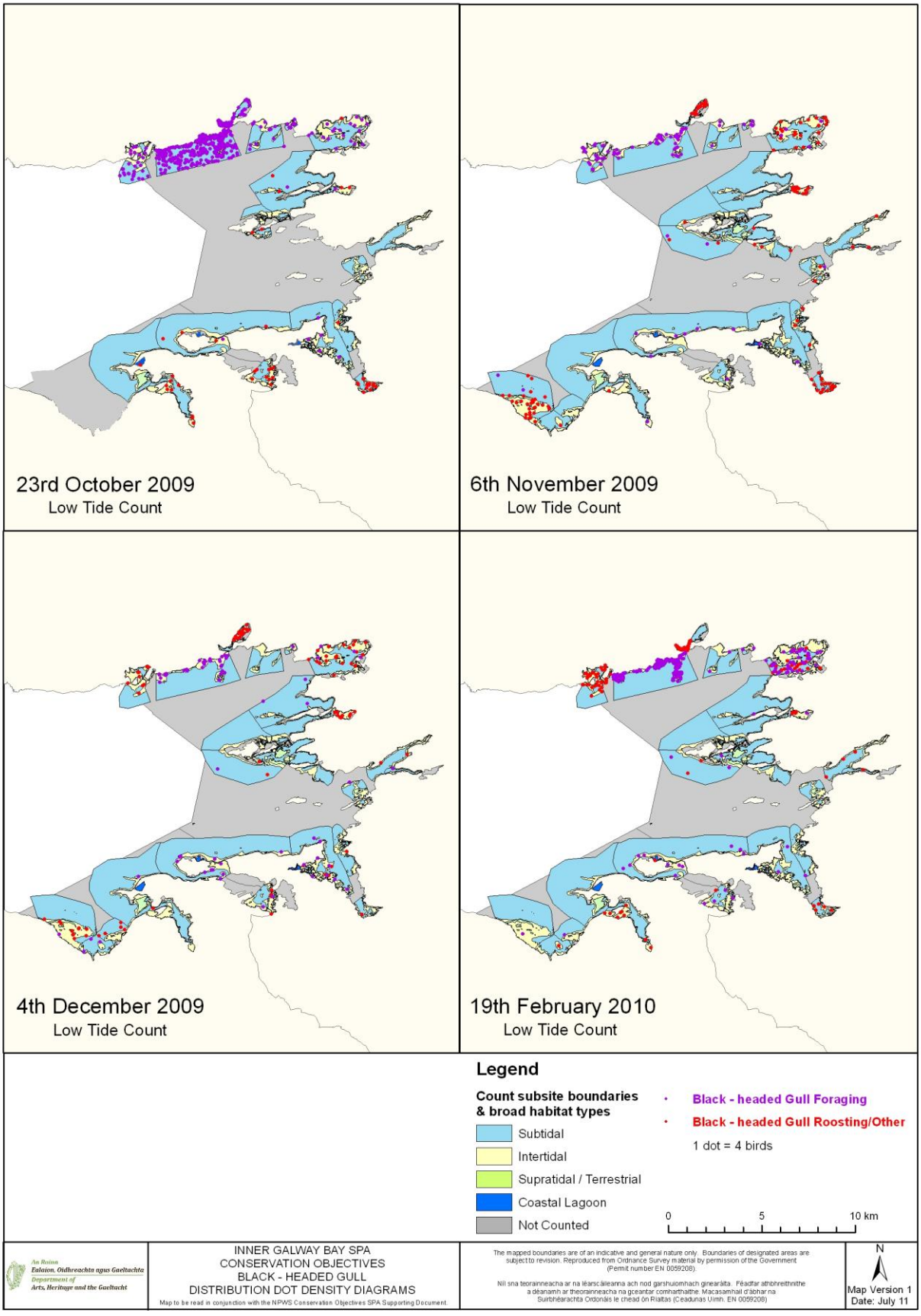
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéireachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)

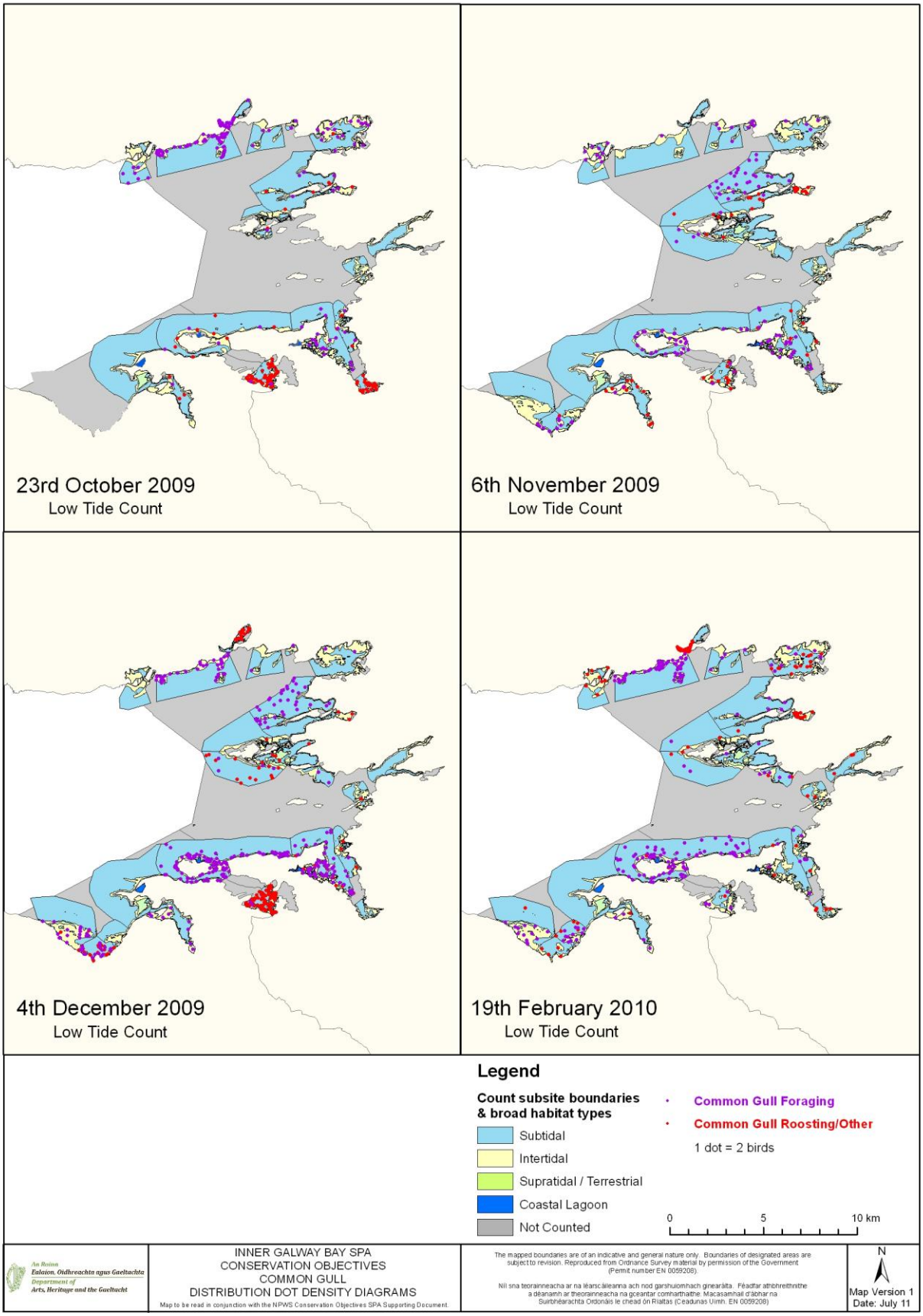
N

Map Version 1
Date: July 11


23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Curlew Foraging
Curlew Roosting/Other
1 dot = 2 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
CURLEW
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: July 11


23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Redshank Foraging
Redshank Roosting/Other
1 dot = 2 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
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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Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: July 11


23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Black - headed Gull Foraging
Black - headed Gull Roosting/Other
1 dot = 4 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
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 0059208).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: July 11


23rd October 2009
Low Tide Count
6th November 2009
Low Tide Count
4th December 2009
Low Tide Count
19th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal / Terrestrial
Coastal Lagoon
Not Counted
Common Gull Foraging
Common Gull Roosting/Other
1 dot = 2 birds
0
5
10 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
INNER GALWAY BAY SPA
CONSERVATION OBJECTIVES
COMMON 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 0059208).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comhartha ithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: July 11

APPENDIX 8

Inner Galway Bay

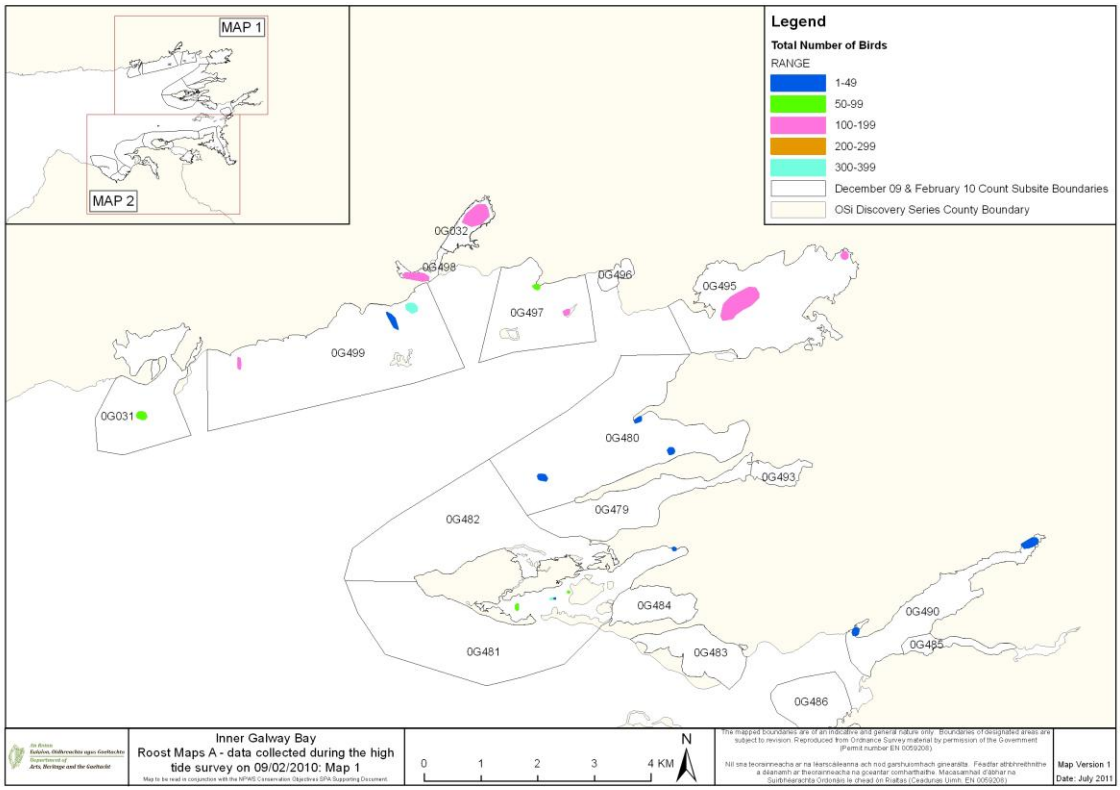
Summary data and roost location maps from the roost survey (date)

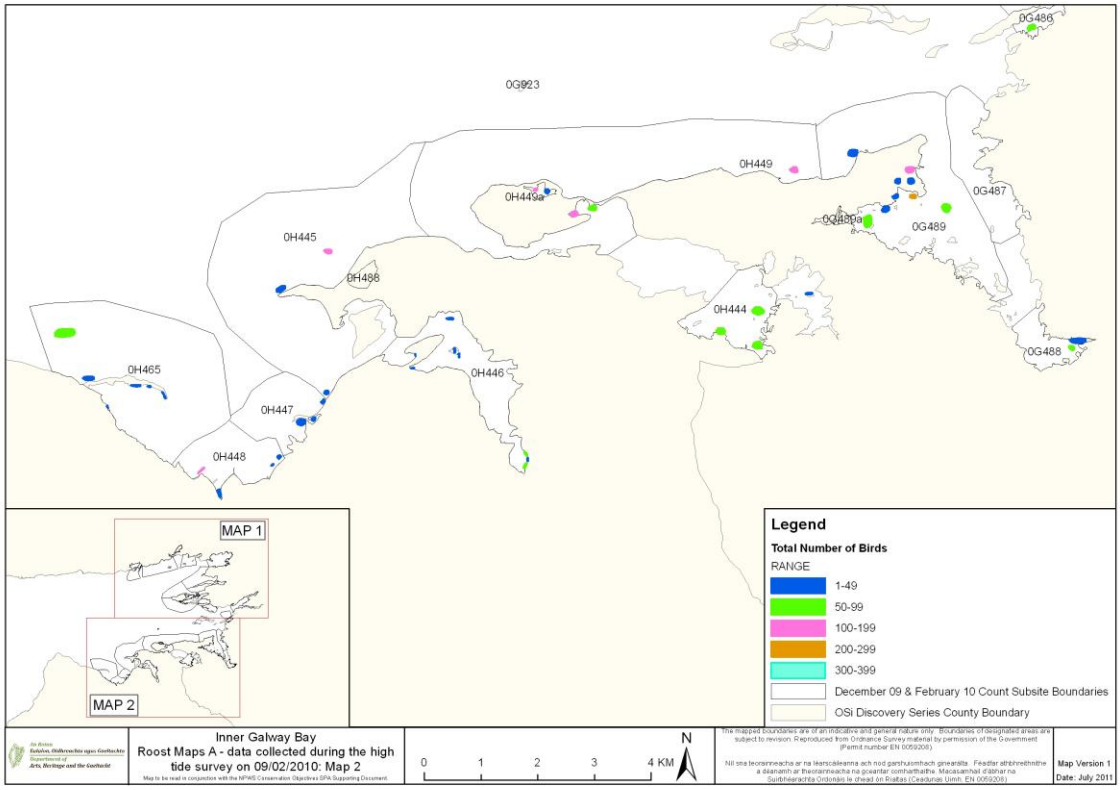
Inner Galway Bay is a large and complex site to survey, presenting various challenges to waterbird counters during both the high and low tide periods. During the high tide period, numbers of waterbirds may vary considerably because the birds range more widely to avail of alternate feeding grounds such as nearby grassland or turloughs. Many species also use offshore islands for roosting and these cannot be surveyed from mainland vantage points. Completeness with regards roost data is therefore difficult to achieve without considerable time and manpower.

The scheduled roost survey for the 2009/10 season although attempted, was abandoned due to poor visibility caused by fog. The roost data summarised below therefore comprises three main elements. Roost Table A shows summary data for the roost positions that were mapped during the high tide survey undertaken on 9th February 2010. However, it must be acknowledged that these data do not represent all roosting waterbirds present on that date. Roost Tables B and C show roost records kindly provided by a fieldworker of the 2009/10 Waterbird Survey programme/I-WeBS counter (C. Peppiatt *personal data*).

Inner Galway Bay
Roost Summary Table A & Roost Maps A – HT Survey 09/02/10

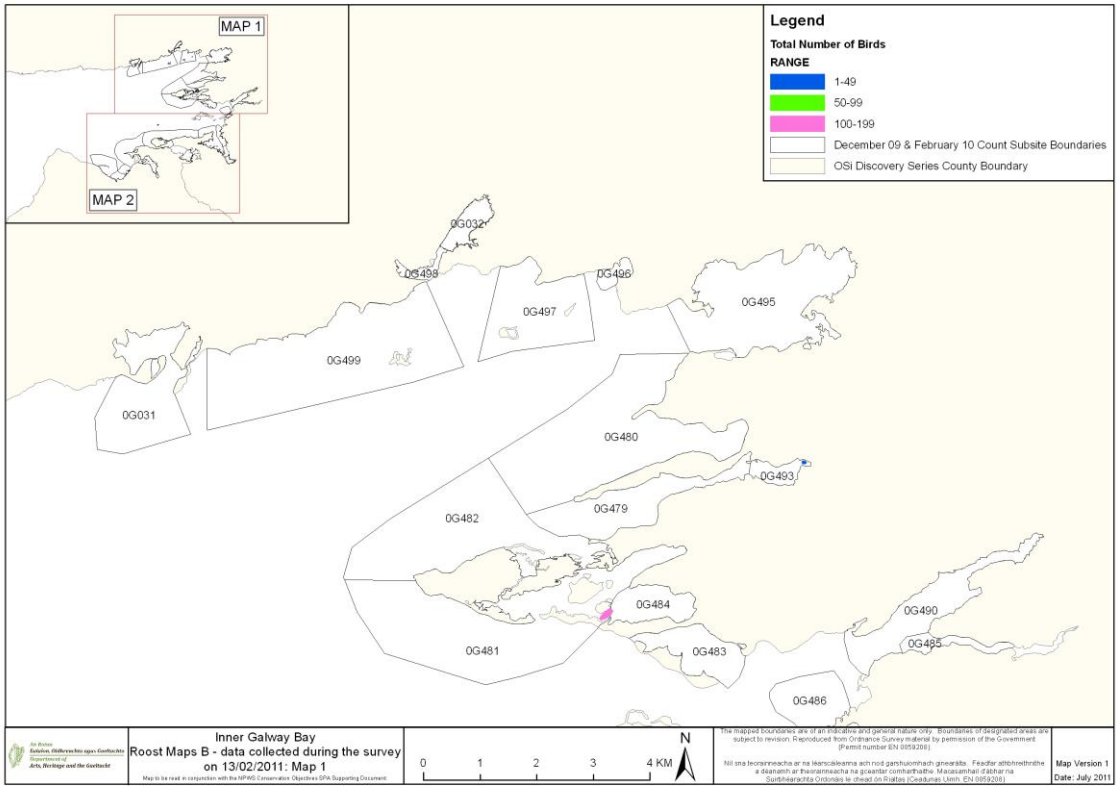
Subsite	Subsite Name	No. of individual roost locations	No. species	Total no. waterbirds	Species
0G031	Lough Rusheen	1	2	27	CA, HG
0G032	Lough Atalia	1	1	133	L.
0G480	Rinville & Ardfry North	3	6	53	BH, CM, HG, OC, PB, SA
0G481	Tawin South	5	6	569	BA, CM, GP, L., OC, TT
0G486	Killeenaran	1	1	66	T.
0G489	Traught & Doorus	9	7	667	CU, L., PB, SU, T., TT, WN
0G490	Cave – Clarinbridge	2	2	62	CU, WN
0G495	Oranmore Bay	2	7	308	BH, CM, CU, DN, L., OC, TT
0G497	Ballyloughlan	2	4	225	BA, BH, CM, GK
0G498	Nimmo's Pier & Docks	1	3	100	BH, CM, MS
0G499	Salthill & environs	3	4	555	BA, BH, CM, OC
0G923	Deer Island				
0H444	Coranroo	4	7	202	BH, CM, L., RK, SV, T., WN
0H445	Martello Tower, L. Muree & shore	3	4	122	BH, CA, GB, OC
0H446	Castle – bell Harbour – Finvarra	10	10	282	BH, CM, CU, L., MA, OC, RK, RP, SU, T.
0H447	Bishop's Quarter	3	3	63	MS, OC, T.
0H448	Ballyvaughanan Bay	4	6	158	BA, BH, CM, CU, DN, L.
0H449	Aughinish	5	6	463	DN, GK, OC, RK, PB, WN
0H465	Rinn	6	8	170	CM, CU, CX, GB, HG, MA, OC, TT
0H488	Rine Lough Murree Flaggy Shore	2	2	104	L., WN

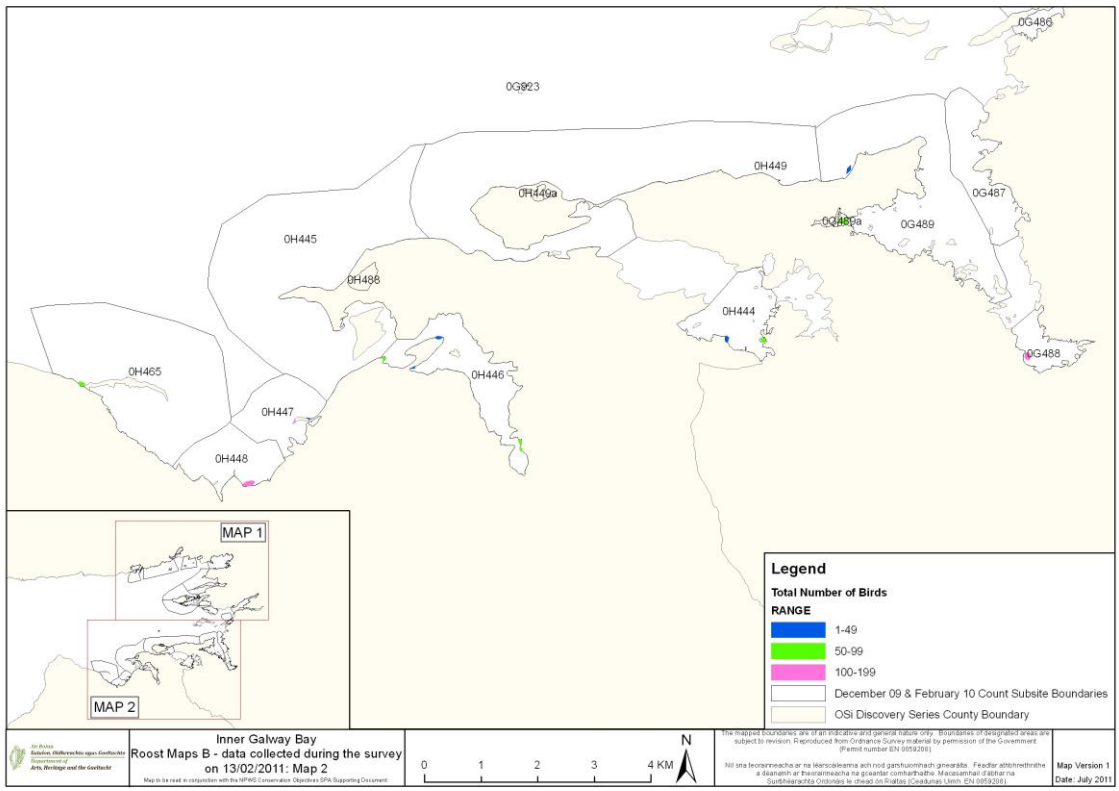

MAP 1
MAP 2
Legend
Total Number of Birds
RANGE
1-49
50-99
100-199
200-299
300-399
December 09 & February 10 Count Subsite Boundaries
OSi Discovery Series County Boundary
0G032
0G498
0G496
0G495
0G497
0G499
0G031
0G480
0G493
0G479
0G482
0G484
0G490
0G485
0G481
0G483
0G486
Inner Galway Bay
Roost Maps A - data collected during the high tide survey on 09/02/2010: Map 1
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
0 1 2 3 4 KM
N
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208)
Map Version 1
Date: July 2011


0G486
0G923
0H449
0H449a
0G487
0G489a
0G489
0H445
0H486
0H444
0G488
0H465
0H446
0H447
0H448
MAP 1
MAP 2
Legend
Total Number of Birds
RANGE
1-49
50-99
100-199
200-299
300-399
December 09 & February 10 Count Subsite Boundaries
OSi Discovery Series County Boundary
Inner Galway Bay
Roost Maps A - data collected during the high tide survey on 09/02/2010: Map 2
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
0 1 2 3 4 KM
N
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Map Version 1
Date: July 2011

Inner Galway Bay
Roost Summary Table B & Roost Maps B – HT Survey 13/02/11

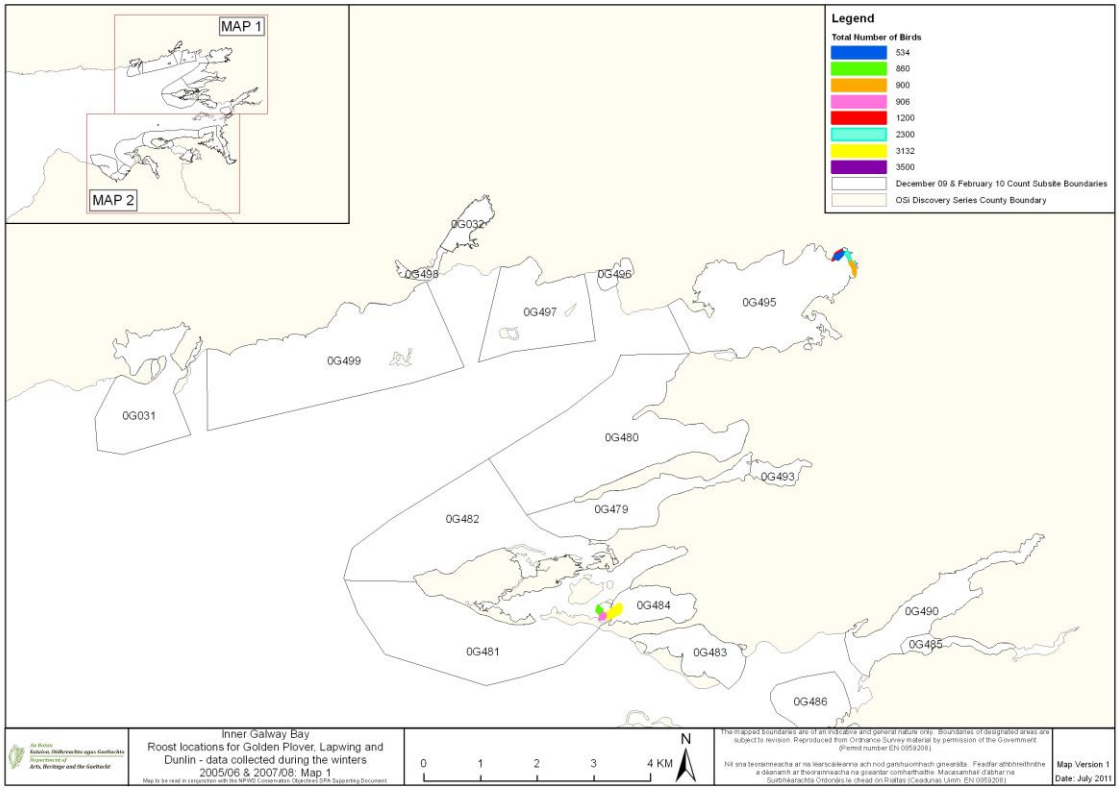
Subsite	Subsite Name	No. species	Total no. waterbirds	Species
0G481	Tawin South	1	106	OC
0G488	Kinvarra	2	191	DN, L.
0G489	Traught & Doorus	3	82	OC, T., WN
0G493	Kilcaimin	1	44	BA
0H444	Coranroo	2	125	CU, L.
0H446	Castle – Bell Harbour – Finvarra	5	249	BH, CM, CU, RK, SU
0H447	Bishop's Quarter	2	161	BH, CM, RP
0H465	Rinn	2	54	DN, PB
0H488	Rine Lough Murree Flaggy Shore	2	129	T., WN

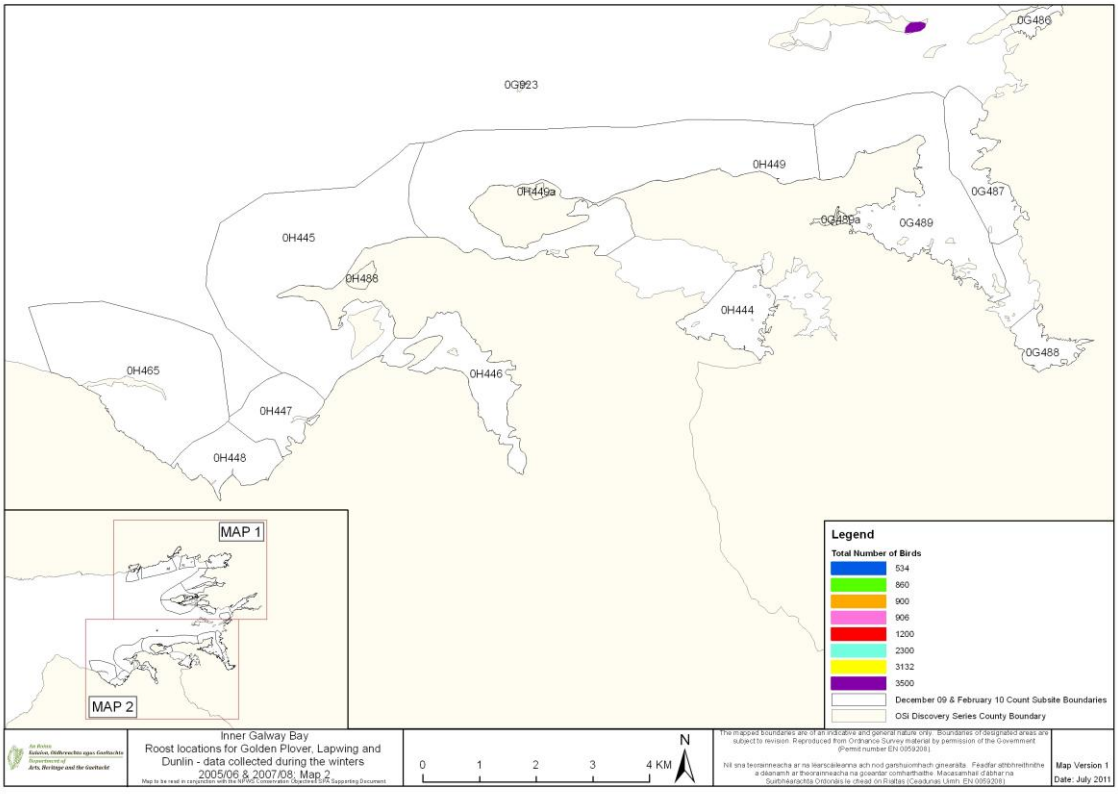

MAP 1
MAP 2
Legend
Total Number of Birds
RANGE
1-49
50-99
100-199
December 09 & February 10 Count Subsite Boundaries
OSi Discovery Series County Boundary
0G032
0G498
0G496
0G497
0G495
0G499
0G031
0G480
0G493
0G479
0G482
0G484
0G490
0G485
0G481
0G483
0G486
Inner Galway Bay
Roost Maps B - data collected during the survey on 13/02/2011: Map 1
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
0 1 2 3 4 KM
N
Map Version 1
Date: July 2011


0G486
0G923
0H449
0H449a
0G487
0G489a
0G489
0H445
0H486
0H444
0G488
0H465
0H446
0H447
0H448
MAP 1
MAP 2
Legend
Total Number of Birds
RANGE
1-49
50-99
100-199
December 09 & February 10 Count Subsite Boundaries
OSi Discovery Series County Boundary
Inner Galway Bay
Roost Maps B - data collected during the survey on 13/02/2011: Map 2
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
0 1 2 3 4 KM
N
Map Version 1
Date: July 2011

Inner Galway Bay
Roost Summary Table C & Roost Maps C – Roost locations for Golden Plover, Lapwing and Dunlin (data collected during the winters 2005/06 & 2007/08).

Subsite	Subsite Name		Species	Total no. waterbirds
0G495	Oranmore Bay	29/01/05	GP	1200
0G495	Oranmore Bay	29/01/05	L.	2300
0G495	Oranmore Bay	19/11/05	GP	534
0G495	Oranmore Bay	19/11/05	L.	900
0G481	Tawin South	14/01/06	GP	860
0G484/ 0G481	Ballynacourty North/Tawin South	14/01/06	DN	3132
-		14/01/06	L., DN	3500
0G481	Tawin South	10/11/07	GP	906


MAP 1
MAP 2
Legend
Total Number of Birds
534
860
900
906
1200
2300
3132
3500
December 09 & February 10 Count Subsite Boundaries
OSi Discovery Series County Boundary
0G032
0G498
0G496
0G497
0G495
0G499
0G031
0G480
0G493
0G479
0G482
0G484
0G490
0G485
0G481
0G483
0G486
Inner Galway Bay
Roost locations for Golden Plover, Lapwing and Dunlin - data collected during the winters 2005/06 & 2007/08: Map 1
0 1 2 3 4 KM
N
Map Version 1
Date: July 2011


0G486
0G923
0H449
0H449a
0G487
0G485a
0G489
0H445
0H488
0H444
0G488
0H465
0H446
0H447
0H448
MAP 1
MAP 2
Legend
Total Number of Birds
534
860
900
906
1200
2300
3132
3500
December 09 & February 10 Count Subsite Boundaries
OSi Discovery Series County Boundary
Inner Galway Bay
Roost locations for Golden Plover, Lapwing and Dunlin - data collected during the winters 2005/06 & 2007/08: Map 2
0 1 2 3 4 KM
N
Map Version 1
Date: July 2011

APPENDIX 9

Inner Galway 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 within Inner Galway 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	0G031	0G032	0G479	0G480	0G481/482	0G483/484	0G485	0G486	0G487	0G488	0G489	0G490	0G493	0G495	0G496	0G497	0G498	0G499	0H444	0H445	0H446	0H447	0H448	0H449	0H465	0H488
Coastal protection, sea defences & stabilisation																										
1.1 Linear defences	O			O	O						O	O	O	O		O		O		O				O		
1.2 Training walls	P						O					O														
1.3 Groynes	P																	O								
1.5 Marram grass planting																									O	
1.6 Other modifications	H													O	O		O		O	O				H		
Barrage schemes/drainage																										
2.1 Weirs and barrages for river management							O																			
2.3 Other channel modifications							H										O									
2.5 Other																				O						
Industrial, port & related development																										
4.1 Industrial port																	O									
4.2 Fishing Harbour				O				O	O	O	O	O					O									
4.3 Slipway				O	O	O	O	O	O	O	O	O		O			O			O			O	O		
4.4 Pier				O			O	O	O	O		O		O			O				O	O	O			
4.7 Ship & boat building/repair																	O						O			
Military activities																										
5.3 Military constructions																O										
Pollution																										
6.1 Domestic & urban waste water	O			O			O			O	O	O		O			O	O					O	O		O
6.3 Landfill																		H								
6.7 Solid waste incl. fly-tipping					O							O	O		O	O										

Activity/Event	0G031	0G032	0G479	0G480	0G481/482	0G483/484	0G485	0G486	0G487	0G488	0G489	0G490	0G493	0G495	0G496	0G497	0G498	0G499	0H444	0H445	0H446	0H447	0H448	0H449	0H465	0H488
Sediment extraction (marine & terrestial)																										
7.1 Channel dredging (maintenance & navigation)																	O	O								
7.3 Sand and gravel extraction	O				H																					
7.4 Removal of beach materials																					H	H		O		
7.6 Removal of estuarine sediment																	O									
Transport & communications																										
8.2 Flight path			O									O														
8.3 Bridges & aqueducts		O			O									O				O								
8.4 Tunnel																										
8.5 Road schemes				O						O	O	O	O							O			O	O	O	O
8.6 Car parks									O	O		O									O	O	O			
8.7 Shipping channel, shipping lanes																	O	O								
8.8 Rail lines		O																								
8.9 Cables - suspended					O																					
Urbanisation																										
9.1 Urbanised areas, housing		O					O	O		O		O		O	O	O	P	O					O			
9.2 Commercial & industrial areas												O		O		O	O									
9.3 Hotel & leisure complex																	P						P			
Education & scientific research																										
11.1 Scientific sampling, specimen collection							O			O		O														
11.2 Nature trails	P																	P								
11.3 Interpretative centre																		O					O			

Activity/Event	0G031	0G032	0G479	0G480	0G481/482	0G483/484	0G485	0G486	0G487	0G488	0G489	0G490	0G493	0G495	0G496	0G497	0G498	0G499	0H444	0H445	0H446	0H447	0H448	0H449	0H465	0H488
Tourism & recreation																										
12.1 Marinas				O													O						P			
12.2 Non-marina moorings		O		O		O				O		O						O		O						
12.3 Dinghy & boat parks		O		O						O																
12.4 Caravan parks & chalets																		O								
12.6 Power boating & water-skiing				O				O				O						O		O						
12.7 Jet-skiing																		O								
12.8 Sailing		O															O	O			O					
12.9 Sailboarding & wind-surfing	O																	O								
12.11 Canoeing	O						O										O	O								
12.14 Tourist boat trips										O	O						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	O	O	O		O	
12.18 Walking, incl. dog walking	O	O		O		O	O	O	O	O	O	O	O	O		O	O	O		O	O	O	O	O	O	
12.19 Birdwatching	O	O		O			O	O	O	O	O	O		O		O	O	O		O	O	O	O	O	O	
12.20 Sand-yachting	O															O										
12.22 Motorised vehicles					O		O			O	O	O											O	O	O	
12.23 Horse-riding	O															O										
12.25 Golf courses															O			O								
Bait-collecting																										
14.1 Digging for lugworms/ragworms																								O		

Activity/Event	0G031	0G032	0G479	0G480	0G481/482	0G483/484	0G485	0G486	0G487	0G488	0G489	0G490	0G493	0G495	0G496	0G497	0G498	0G499	0H444	0H445	0H446	0H447	0H448	0H449	0H465	0H488
Fisheries & Aquaculture																										
15.1 Professional passive fishing (e.g. longlining)	U		U	U	U	U		U	U		U	U		U		U		U	U	U	U	U	U	U	U	
15.2 Professional active fishing	U		U	U	U	U		U	U		U	U		U		U		U	U	U	U	U	U	U	U	
15.3 Bottom (benthic) dredging	U		U	U	U	U		U	U		U	U		U		U		U	U	U	U	U	U	U	U	
15.4 Fish traps & other fixed devices & nets	U		U	U	U	U		U	U		U	U		U		U		U	U	U	U	U	U	U	U	
15.5 Leisure fishing							O			O	O									O	O	O	O		O	
15.6 Molluscs - hand-gathering	O		O	O	O			O	O		O		O	O		O	O	O	O	O	O	O	O	O	O	
15.9 Intertidal aquaculture e.g. trestles			O	O	O	O	O	O	O	O	O	O	O	O						O	O		O	O		
15.10 Suspended cultivation (subtidal)			O	O					O		O										O					
15.11 Bottom culture			O	O																						
Agriculture & forestry																										
16.1 Saltmarsh grazing/harvesting	O			O	O	O		O		O	O	O	O	O	O					O						
16.3 Grazing: non-intensive (terrestrial)	O		O		O	O		O			O		O		O											
16.5 Stock feeding						O																				
16.12 Polderisation												O														
16.13 Agricultural land-claim			H	H	H	H						H														
16.14 In-filling of ditches, pools, marshes and pits					H																					
Natural events																										
19.1 Storms, floods and storm surges																				O						
19.2 Severe cold weather	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
19.3 Eutrophication						O					O															O
19.4 Erosion (saltmarsh)	O							O			O	O	O		O			O								
19.5 Silting up (saltmarsh)	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**

Activity/Event	0G031	0G032	0G479	0G480	0G481/482	0G483/484	0G485	0G486	0G487	0G488	0G489	0G490	0G493	0G495	0G496	0G497	0G498	0G499	0H444	0H445	0H446	0H447	0H448	0H449	0H465	0H488
Transport & communications																										
8.2 Flight path (aircraft flying over)			3									5														
Tourism & recreation																										
12.6 Power boating & water-skiing (motorised watercraft)				4								4								6						
12.18 Walking (incl. dogs)	3	3		3								3	6	4		7	4	4			6	5		6	6	
12.22 Motorised vehicles																							5		4	
Bait-collecting																										
14.1 Digging for lugworms/ragworms																								4		
Fisheries & Aquaculture																										
15.6 Molluscs - hand-gathering			2	2									2					3			2	2		4		
15.9 Intertidal aquaculture (associated activities)				3						3				3							5					