River Shannon & River Fergus Estuaries

Special Protection Area

(Site Code 4077)

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Conservation Objectives Supporting Document

VERSION 1

National Parks & Wildlife Service

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SUMMARY

This document presents conservation objectives for the Special Conservation Interests of the River Shannon and River Fergus Estuaries 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 the River Shannon and River Fergus Estuaries Special Protection Area. The subject of conservation objectives and their formulation is also introduced.

Part Two provides site designation information for the River Shannon and River Fergus Estuaries Special Protection Area and Part Three presents the conservation objectives for this site.

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

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

PART ONE - INTRODUCTION

1.1 Introduction to the designation of Special Protection Areas

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

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

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

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

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

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

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

Site specific information relevant to the selection and designation of a SPA is collated from a range of sources including the Irish Wetland Bird Survey (I-WeBS), The Wetland Bird Survey (WeBS) in Northern Ireland, species specific reports and a wide range of scientific publications, reports and other surveys. If, following collation of all the available scientific data, a site meets the relevant criteria for designation and is selected as an SPA, a list of species for which the site is nationally 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 the River Shannon and River Fergus Estuaries Special Protection Area

The site designated as the River Shannon and River Fergus Estuaries SPA comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in Co. Clare and Dooneen Point in Co. Kerry. The River Shannon and River Fergus estuaries form the largest estuarine complex in Ireland, which lies within the counties of Clare, Limerick and Kerry. It encompasses/is surrounded by the largest port and some of the most extensive areas of industrial development in the west of Ireland.

The Shannon Estuary is subject to permanent marine inundation with a tidal flow in a generally west to east aligned main channel that measures almost 100 km from its mouth to Limerick City (Hickey & Healy, 2005). The estuary is macrotidal, having the largest tidal range (5.44 m at Limerick Docks) on the Irish coast. Water depths vary from *c*.37m at the estuary mouth to less than 5m near Limerick City. In addition to the Shannon and Fergus, the site has numerous sub-estuaries including Ballylongford Creek (Ballylongford Bay), the Glencorbly river at Glin, the White river at Loghill, Robertstown River and Poulweala creek at Foynes and Aughinish, the River Deel at Courtbrown Point and the Maigue at Rinekirk Point.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats. The smaller sub-estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay, which is stony and unusually rich in species and biotopes (NPWS, 2006). In the innermost parts of estuaries, and typically observed in the Fergus Estuary, are tidal channels or creeks fringed with Common Reed (*Phragmites australis*) and Clubrushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important including saltmarsh within the Fergus Estuary and at Ringmoylan Quay (NPWS, 2006). The

mouth of the Fergus Estuary has numerous islands across it including Inishmore or Deer Island, Coney Island and Inishcorker.

Extensive reclamation of intertidal mudflats has been carried out around the site over the last two hundred years and particularly in the mid- to late 19th century (Hickey & Healey, 2005). A minimum 6,500ha is estimated to have been reclaimed, distributed mostly within the main Shannon estuary basin and along its sub-estuaries such as the Fergus and the Maigue (Healy and Hickey, 2002). These areas are protected from tidal flooding by flood embankments, a common feature across the site.

The inner site (Limerick City to the Fergus estuary) has the greatest proportion of intertidal habitat, the proportion of subtidal habitat within the site increasing westwards towards the mouth. West of the Fergus Estuary the northern shoreline of the site becomes rocky with the exception of Clonderlaw Bay and Poulnasherry Bay. The southern shoreline is lined mostly by mudflats and sandflats punctuated by estuaries of the many rivers and creeks entering the site. In the western section of the site, Bunaclugga Bay has both sandy and muddy sediments and boasts a vegetated shingle spit, a rare habitat in Co Kerry (Moore & Wilson, 2006).

The designated site includes the freshwater lake at Cooperhill and the eastern section of the freshwater Bunlickey Lake (up to the N7 road crossing) at Castlemungret, just outside Limerick City. The latter, a small man-made lake, lies in the grounds of Irish Cement and was formed as a by-product of the extraction of alluvial clays which were used in the manufacture of cement during the early operations at the site.

The designated site also includes the Shannon Airport Lagoon, an artificial saline lake that was developed in the 1940's when a seawall was constructed out to the estuary to prevent Shannon Airport from flooding. Water levels are managed via a sluiced outlet and the lagoon is surrounded by a diverse range of habitats including saltmarsh, reed bed and freshwater marsh (Murphy et al. 2003). This man-made feature has become a local biodiversity hot-spot and a well-known local birding area. A brackish lagoon 'Mangan's Lagoon' near Aughinish Island is also included within the designated site.

The Site Synopsis for the River Shannon and River Fergus Estuaries 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[3] 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 the River Shannon and River Fergus Estuaries Special Protection Areas).

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

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

[3] Note that conservation objectives are not presented for breeding Cormorant in this document.

PART TWO – SITE DESIGNATION INFORMATION

2.1 Special Conservation Interests of the River Shannon and River Fergus Estuaries Special Protection Area

The River Shannon and River Fergus Estuaries SPA is selected as a Special Protection Area because it regularly supports over 20,000 waterbirds during the non-breeding season making this a site of international importance.

The **Selection Species** and **Additional Special Conservation Interests**[4] for the River Shannon and River Fergus Estuaries SPA are listed below and summarised in Table 2.1. This table also shows the importance of this SPA for SCI species relative to the importance of other wetland sites within Ireland, within the mid-western region, and within Counties Limerick, Clare and Kerry.

The Selection Species listed for the River Shannon and River Fergus Estuaries SPA are as follows:-

1. During winter the site regularly supports 1% or more of the all-Ireland population of the Annex I species Whooper Swan (*Cygnus cygnus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 118 individuals.

2. 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 494 individuals.

3. During winter the site regularly supports 1% or more of the all-Ireland population of Shelduck (*Tadorna tadorna*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,025 individuals.

4. During winter the site regularly supports 1% or more of the all-Ireland population of Wigeon (*Anas penelope*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 3,761 individuals.

5. During winter the site regularly supports 1% or more of the all-Ireland population of Teal (*Anas crecca*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,260 individuals.

6. 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 245 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 223 individuals.

8. During winter the site regularly supports 1% or more of the all-Ireland population of the Annex I species Golden Plover (*Pluvialis apricaria*). The mean peak number of this

[4] 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.

species within the SPA during the baseline period (1995/96 – 1999/00) was 5,664 individuals.

9. During winter the site regularly supports 1% or more of the all-Ireland population of Grey Plover (*Pluvialis squatarola*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 558 individuals.

10. During winter the site regularly supports 1% or more of the all-Ireland population of Lapwing (*Vanellus vanellus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 15,126 individuals.

11. During winter the site regularly supports 1% or more of the all-Ireland population of Knot (*Calidris canutus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,015 individuals.

12. During winter the site regularly supports 1% or more of the biogeographic population of Dunlin (*Calidris alpina*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 15,131 individuals.

13. During winter the site regularly supports 1% or more of the biogeographical population of Black-tailed Godwit (*Limosa limosa*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,035 individuals.

14. During winter the site regularly supports 1% or more of the all-Ireland population of the Annex I species Bar-tailed Godwit (*Limosa lapponica*). The mean peak number within the SPA during the baseline period (1995/96 – 1999/00) was 460 individuals.

15. During winter the site regularly supports 1% or more of the all-Ireland population of Curlew (*Numenius arquata*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,396 individuals.

16. During winter the site regularly supports 1% or more of the all-Ireland population of Greenshank (*Tringa nebularia*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 61 individuals.

17. During winter the site regularly supports 1% or more of the all-Ireland population of Redshank (*Tringa totanus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,645 individuals.

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

Pintail (*Anas acuta*)
Shoveler (*Anas clypeata*)
Scaup (*Aythya marila*)
Cormorant (*Phalacrocorax carbo*) (breeding population)
Black-headed Gull (*Chroicocephalus ridibundus*).

The wetland habitats contained within the River Shannon and River Fergus Estuaries SPA are identified to be of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore the wetland habitats are considered to be an additional Special Conservation Interest.

Table 2.1 Designation Summary: species listed for the River Shannon and River Fergus Estuaries 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	Whooper Swan	Yes	118	All-Ireland Importance	16	2	2
	Light-bellied Brent Goose		494	International Importance	13	1	3
	Shelduck		1,025	All-Ireland Importance	1	1	1
	Wigeon		3,761	All-Ireland Importance	1	1	2
	Teal		2,260	All-Ireland Importance	2	1	1
	Cormorant (non-breeding)		245	All-Ireland Importance	6	1	1
	Ringed Plover		223	All-Ireland Importance	8	2	4
	Golden Plover	Yes	5,664	All-Ireland Importance	9	1	2
	Grey Plover		558	All-Ireland Importance	3	1	1
	Lapwing		15,126	All-Ireland Importance	1	1	1
	Knot		2,015	All-Ireland Importance	4	1	1
	Dunlin		15,131	International Importance	1	1	1
	Black-tailed Godwit		2,035	International Importance	2	1	1
	Bar-tailed Godwit	Yes	460	All-Ireland Importance	11	1	2
	Curlew		2,396	All-Ireland Importance	1	1	1
	Greenshank		61	All-Ireland Importance	1	1	1
	Redshank		2,645	All-Ireland Importance	1	1	1
Additional Special Conservation Interests	Pintail		62	All-Ireland Importance	8	1	2
	Shoveler		107	All-Ireland Importance	10	2	2
	Scaup		102	All-Ireland Importance	6	1	3
	Cormorant (breeding)		93 pairs	All-Ireland Importance	12	-	-
	Black-headed Gull		2,681	All-Ireland Importance	6	1	1
Other conservation designations associated with the site[b]		**SAC**	**RAMSAR SITE**	**IMPORTANT BIRD AREA (IBA)**	**WILDFOWL SANCTUARY**	**OTHER**	
		Yes	Yes	Yes	Yes		

[a] Baseline data from I-WeBS with the exception of Whooper Swan (Robinson et al. 2004a) and Light-bellied Brent Goose (Robinson et al. 2004b).

[b] Note that other conservation designations associated with the River Shannon and River Fergus estuaries 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 wetland SPA 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 wetland SPA sites within the mid-western region (note that this site does extend into the south-western region but for the purpose of this assessment only the mid-western region is considered; the mid-western region includes Counties Clare, North Tipperary and Limerick).

[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 wetland SPA sites within Counties Limerick, Clare and Kerry.

PART THREE - CONSERVATION OBJECTIVES FOR THE RIVER SHANNON AND RIVER FERGUS ESTUARIES SPA

3.1 Conservation Objectives for the non-breeding Special Conservation Interests of the River Shannon and River Fergus Estuaries SPA

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

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

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

Objective 1: *To maintain the favourable conservation condition of the non-breeding waterbird Special Conservation Interest species listed for the River Shannon and River Fergus Estuaries 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 effect the achievement of Objective 1 include:

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

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

- ❖ 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

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

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

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

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 the River Shannon and River Fergus Estuaries 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 **32,261 ha**, other than that occurring from natural patterns of variation.

The boundary of the River Shannon and River Fergus Estuaries SPA was defined to include the primary wetland habitats of this expansive 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 five broad types: subtidal; intertidal; supratidal; lagoon and associated; and freshwater and associated. Over time and though natural variation these subcomponents of the overall wetland complex may vary due to factors such as changing rates of sedimentation, erosion etc. Many waterbird species will use more than one of the habitat types for different reasons throughout the tidal cycle.

Subtidal areas refer to those areas contained within the SPA that lie below the mean low water mark and are predominantly covered by marine water. Tidal rivers, creeks and channels are included in this category. For the River Shannon and River Fergus Estuaries SPA this broad category is estimated to be 20,636 ha. Subtidal areas are continuously available for benthic feeding and dabbling ducks (e.g. Wigeon and Teal) and piscivorous/other waterbirds (e.g. Cormorant). 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 the River Shannon and River Fergus Estuaries SPA this is estimated to be 9,085 ha. When exposed or partially exposed by the tide, intertidal habitats provide important foraging areas for many species of waterbirds, particularly wading birds, as well as providing roosting/loafing[8] areas. When the intertidal area is inundated by the tide it becomes available for benthic and surface-feeding ducks and piscivorous/other waterbirds. During this tidal state this area can be used by various waterbirds as a loafing/roosting resource.

The supratidal category, in this context, 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 the River Shannon and River Fergus Estuaries SPA this is estimated to be 2,448 ha. Supratidal areas are used by a range of waterbird species as a roosting resource as well as providing feeding opportunities for some species.

The category known as 'Lagoon and associated habitats' in this context refers to lagoons and brackish lakes and their associated habitats. For the River Shannon and River Fergus Estuaries SPA this habitat category is estimated to be 36 ha, and relates to Mangan's Lagoon, near Aughinish Island, and the larger Shannon Airport Lagoon. This latter area provides was included in the SPA primarily for supporting large concentrations of Black-tailed

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

Godwit but it also provides both feeding and roosting/refuge habitats for a several other waterbird species.

The category known as ‘Freshwater and associated habitats’ in this context refers to freshwater lakes and their associated habitats. For the River Shannon and River Fergus Estuaries SPA this habitat category is estimated to be 56 ha, and relates specifically to Bunlickey Lake and Cooperhill Lakes. These habitats provide both feeding and roosting/refuge habitats for a variety of waterbird species that also use the wider estuarine habitats.

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 the River Shannon and River Fergus Estuaries SPA.

Objective 1: *To maintain the favourable conservation condition of the non-breeding waterbird Special Conservation Interest species listed for the River Shannon and River Fergus Estuaries SPA, which is defined by the following list of attributes and targets:*				
Parameter	**Attribute**	**Measure**	**Target**	**Notes**
Population	Population trend	Percentage change as per population trend assessment using waterbird count data collected through the Irish Wetland Bird Survey and other surveys.	The long term population trend should be stable or increasing	Waterbird population trends are presented in Part 4 of this document.
Range	Distribution	Range, timing and intensity of use of areas used by waterbirds	There should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest, other than that occurring from natural patterns of variation.	Waterbird distribution from the 2010/11 waterbird survey programme is reviewed in Part 5 of this document.
Objective 2: *To maintain the favourable conservation condition of the wetland habitat at the River Shannon and River Fergus Estuaries 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 32,261 ha, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as 32,261 ha using OSI data and relevant orthophotographs.

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

4.1 Population data for non-breeding waterbird SCI species of the River Shannon and River Fergus Estuaries SPA

Non-breeding waterbirds have been counted regularly at the River Shannon and River Fergus estuaries as part of the Irish Wetland Bird Survey (I-WeBS) since the survey commenced in 1994 (Crowe, 2005) (Appendix 2). The River Shannon and River Fergus estuaries form the largest estuarine complex in Ireland (Crowe, 2005), and the achievement of co-ordinated ground-based counts across the site in impracticable, partly because of the unfeasibly large number of counters that would be required, and also due to limitations on time, accessibility and visibility.

The site is covered once or twice per season by aerial census. This enables complete coverage of the entire site. However the quality of the counts undertaken during aerial census is limited by many factors, especially at this site which supports large numbers (tens of thousands) of birds of many species. These limitations are discussed elsewhere (Boland & Crowe, 2012) and are summarised below:

1. Aerial census only allows a limited timeframe and the counts provided of large flocks are estimates;
2. It is often difficult to discern/identify birds that remain on the ground and that are not flushed by the aircraft;
3. Species occurring in low densities (such as Pintail, Teal, Grey Plover) are overlooked. Aerial counts are more suitable for dispersed and distinguishable species such as Lapwing, Golden Plover and Shelduck whereas small, scarce or skulking species are likely underestimated (e.g. Dunlin, Turnstone, Redshank, Greenshank) (Crowe, 2005) and are better covered by ground observations.

Up to 62 ground-based subsites have been used and up to 29 aerial subsites. Coverage of these subsites has varied greatly throughout I-WeBS. There was better ground coverage during the earlier years of I-WeBS while in more recent years the counts have focused more on smaller sections with a recommended focus on the key areas within the site.

To assess waterbird numbers at a site, it is standard practice to use the mean of peak counts as these give a more accurate reflection of the total numbers using a site. Data are assessed within five-year periods (i.e. five-year peak mean) to help 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).

Table 4.1 a & b presents baseline and recent population[9] data respectively for the non-breeding waterbird Special Conservation Interest (SCI) species of the River Shannon and River Fergus Estuaries SPA. All data are from the I-WeBS database with the exception of Whooper Swan and Light-bellied Brent Goose which are the subject of separate, species-specific surveys (see Appendix 2). For the calculation of the baseline data shown (1994/95 – 1999/00), the annual maxima was identified from either the ground or aerial survey, and used to calculate the five-year mean peak. As there were only two aerial surveys during the baseline period most peaks came from ground-based surveys. For the calculation of the recent data shown (2006/07 – 2010/11),

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

means were calculated from annual maxima but one or more years were excluded if peak counts came from ground-based counts obtained in years with limited coverage, or if the peaks came from aerial counts but were considered unrepresentative for the species concerned (e.g. small, scarce or skulking species as described above). In some cases (e.g. Pintail, Shoveler) there are few data in recent years so a recent peak count is shown. The table footnotes reveal how data presented were derived.

Table 4.1b further shows the peak count attained during the 2010/11 NPWS Waterbird Survey programme. This survey programme is described further in Part 5 of this document and is relevant to assessments undertaken in the following Section 4.2.1.

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). 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 the Black-headed Gull therefore relates to the known most important sites for this species and a 'threshold of significance' is applied (Crowe, 2005).[10]

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

Table 4.1 Population data for waterbird Special Conservation Interest Species of the River Shannon and River Fergus Estuaries SPA

(a) Baseline period 1995/96 – 1999/00

Site Special Conservation Interests (SCIs)	Baseline data
Whooper Swan	118 (n)
Light-bellied Brent Goose	494 (i)
Shelduck	1,025 (n) ‡
Wigeon	3,761 (n) ‡
Teal	2,260 (n) †
Cormorant	245 (n) †
Ringed Plover	223 (n) †
Golden Plover	5,664 (n) †
Grey Plover	558 (n) †
Lapwing	15,126 (n) ‡
Knot	2,015 (n) †
Dunlin	15,131 (i) †
Black-tailed Godwit	2,035 (i) ‡
Bar-tailed Godwit	460 (n) †
Curlew	2,396 (n) ‡
Greenshank	61 (n) †
Redshank	2,645 (i) †
Pintail	62 (n) †
Shoveler	107 (n) †
Scaup	102 (n) ‡
Black-headed Gull	2,681 (n) †

(i) and (n) denote numbers of international and all-Ireland importance respectively.
International and all-Ireland thresholds are given in Wetlands International (2002) and Crowe et al. (2008) respectively.

† denotes I-WeBS data from ground-based surveys; ‡ denotes I-WeBS data taken from a combination of ground and aerial surveys; with the exception of data for Whooper Swan (Robinson et al. 2004a) and Light-bellied Brent Goose (Robinson et al. 2004b).

(b) Recent period 2006/07 – 2010/11

Site Special Conservation Interests (SCIs)	Recent data	Data Origin	Peak Count (2010/11 NPWS Waterbird Survey Programme)
Whooper Swan	269 (i) $	5-yr mean 2006/07 - 2010/11	52
Light-bellied Brent Goose	176 ‡	3-yr mean 2006/07 - 2010/11 (2007/08 and 2008/09 excluded)	214
Shelduck	291 (n) ‡	5-yr mean 2006/07 - 2010/11	857 (n)
Wigeon	1,821(n) $	5-yr mean 2006/07 - 2010/11	2,057 (n)
Teal	812 (n) ‡	5-yr mean 2006/07 - 2010/11	3,267 (n)
Cormorant	237 (n) ‡	5-yr mean 2006/07 - 2010/11	623 (n)
Ringed Plover	92 †	2-yr mean 2006/07 & 2008/09	223 (n)
Golden Plover	1,929 (n) ‡	5-yr mean 2006/07 - 2010/11	11,221 (i)
Grey Plover	69 (n) ‡	4-yr mean 2006/07 - 2010/11 (2007/08 excluded)	206 (n)
Lapwing	2,012 ‡	5-yr mean 2006/07 - 2010/11	10,873 (n)
Knot	100 †	Recent peak 2006/07	621 (n)
Dunlin	3,374 (n) ‡	4-yr mean 2006/07 - 2010/11 (2007/08 excluded)	14,537 (i)
Black-tailed Godwit	740 (i) $	2-yr mean 2007/08 & 2010/11	9,052 (i)
Bar-tailed Godwit	72 † $	Recent peak 2006/07	885 (n)
Curlew	767 (n) $	5-yr mean 2006/07 - 2010/11	2,634 (n)
Greenshank	30 (n) ‡	3-year mean 2006/07 - 2010/11 (2009/10 & 2010/11 excluded)	157 (n)
Redshank	292 ‡	5-yr mean 2006/07 - 2010/11	2,445 (n)
Pintail	30 (n) †	Recent peak 2009/10	94 (n)
Shoveler	45 (n) †	Recent peak 2008/09	68 (n)
Scaup	24 †	Recent peak 2006/07	29
Black-headed Gull	1,303 (n) $	5-yr mean 2006/07 - 2010/11	8,550 (n)

(i) and (n) denote numbers of international and all-Ireland importance respectively.
International and all-Ireland thresholds are given in Wetlands International (2006) and Crowe et al. (2008) respectively.
† denotes I-WeBS data from ground-based surveys; ‡ denotes I-WeBS data taken from a combination of ground and aerial surveys; $ denotes data from aerial surveys only.
All data are from I-WeBS with the exception of the final column which gives peak numbers from the 2010/11 NPWS Waterbird Survey Programme.

4.2 Waterbird population trends – The River Shannon and River Fergus Estuaries SPA

4.2.1 Methods used to examine waterbird population trends

Given the differences in count coverage over time described in Section 4.1, the estimation of accurate waterbird population trends for this site is difficult. With the exception of 2004/05, ground-based coverage since 2001/02 has been considerably lower when compared to the baseline period. This factor limits the accuracy of the trends. To examine species trends, the following methods were therefore adopted:

In all cases the baseline period refers to 1995/99 – 1999/00 and the recent period to 2006/07 to 2010/11, the count for 2010/11 being the highest number recorded during either one of the aerial surveys.

(Type 1) For species where peak counts are generally attained through aerial surveys and/or there has been good continuity in the dataset across the years, an estimation of population change over time was calculated by the 'generic threshold method' (after JNCC, 2004). This compares population size for two different five-year time periods, the change being expressed as a proportion of the initial population, as follows:

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

where: I_y = recent population and I_x = baseline population

(Type 2) For species where one or more peak counts within the recent five-year dataset was excluded and the recent peak mean therefore attained across fewer than five counts, the generic threshold method was used (as above) but necessary caution is highlighted.

The measures of percentage change resulting from analyses (Type 1) and (Type 2) above were then categorised as follows:-

- Population increase/stable
- Population decline (declines of 1.0% to 24.9%);
- Population decline (declines of 25.0% to 49.9%);
- Population decline (declines of >50%).

Analyses could not be undertaken for four species due to limited availability of data for the recent time period (Pintail, Shoveler, Scaup and Bar-tailed Godwit).

It is expected that poor recent ground-based coverage relative to the baseline period may have resulted in inaccurate estimates of population change for many species. Therefore, once the status assessment was made for each species based on I-WeBS data, the results were compared with those from the NPWS Waterbird Survey Programme, for which the ground-based coverage was considered to be of high quality.[11] The co-ordinated ground-based counts of the NPWS Waterbird Survey Programme achieved much greater coverage than I-WeBS in recent years and therefore provide more robust recent peak numbers for the site. However it should be noted that these counts were undertaken during a winter that experienced particularly harsh weather conditions. The cold weather that occurred between December 2010 and February 2011 is likely to have affected waterbird distribution and numbers across sites (see Crowe & Boland, 2011 for a review).

[11] For further details of the NPWS Waterbird Survey Programme please refer to Part Five.

The validation took the form of the generic threshold calculation (described above) but with the recent I-WeBS peak mean replaced by the peak count from the 2010/11 NPWS Waterbird Survey Programme. Where the estimates obtained from this study contradict the result from I-WeBS suggests caution is needed in interpreting the results. This validation was then used to assign levels of caution to the status assessments as follows:

High caution - this is assigned where an estimate was obtained from analysis (Type 2) above and the result is not validated by the peak count obtained during NPWS Waterbird Survey programme.

Moderate caution - this is assigned where an estimate was obtained from analyses explained in (Type 1) above but the result was not or only partially validated by the peak count obtained during NPWS Waterbird Survey programme.

Moderate caution - this is assigned where an estimate was obtained from analysis (Type 2) above and the result was validated by the peak count obtained during NPWS Waterbird Survey programme.

Low caution – this is assigned where an estimate was obtained from analyses explained in (Type 1) above and the result was validated by the peak count obtained during NPWS Waterbird Survey programme.

4.2.2 Site conservation condition

Conservation condition of SCI species is determined using species estimated site trends and is assigned using the following criteria:

Favourable population = population is stable/increasing.

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

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

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

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

For the River Shannon and River Fergus estuaries, conservation condition was assigned only to SCI species that had a 'low caution' and hence a higher level of confidence applied to their population trend assessment (Section 4.2.1). This resulted in conservation condition being assigned to two species only: Whooper Swan (Favourable condition) and Wigeon (Highly Unfavourable condition) (Table 4.2). Conservation condition is undetermined for all other SCI species.

Table 4.2 Results – SCI species site population status assessment

Special Conservation Interests (SCIs)	Method used for trend analysis[1]	Resulting % Change[1]	Level of caution applied[1]	Conservation Condition[2]	BoCCI Category[3]	Current all-Ireland Trend[4]	Current International Trend[5]
Whooper Swan*	1	Increase	Low	Favourable	Amber	+ 43.9	Increase
Light-bellied Brent Goose*	2	Decline >50%	Moderate	Undetermined	Amber	+ 58	Increase
Shelduck*	1	Decline >50%	Moderate	Undetermined	Amber	+ 4.46	Stable
Wigeon*	1	Decline >50%	Low	Highly unfavourable	Amber	- 20.1	Stable
Teal*	1	Decline >50%	Moderate	Undetermined	Amber	+ 11.3	Increase
Cormorant*	1	Decline 1.0 – 24.9%	Moderate	Undetermined	Amber	+ 31.5	Increase
Ringed Plover*	2	Decline >50%	High	Undetermined	Amber	+ 21.8	Decline
Golden Plover*	1	Decline >50%	Moderate	Undetermined	Red	- 2.2	Decline
Grey Plover*	2	Decline >50%	Moderate	Undetermined	Amber	- 33.1	Decline
Lapwing*	1	Decline >50%	Moderate	Undetermined	Red	- 40.1	Decline
Knot*	2	Decline >50%	Moderate	Undetermined	Red	- 2.91	Decline
Dunlin*	2	Decline >50%	High	Undetermined	Amber	- 46.5	Stable (*alpina*)
Black-tailed Godwit*	2	Decline >50%	High	Undetermined	Amber	+ 70.2	Increase
Bar-tailed Godwit*	n/c	-	-	Undetermined	Amber	+ 1.5	Stable
Curlew*	1	Decline >50%	Moderate	Undetermined	Red	- 25.7	Decline
Greenshank*	2	Decline -25.0% to -49.9%	High	Undetermined	Amber	+ 79.7	Stable
Redshank*	1	Decline >50%	Moderate	Undetermined	Red	+ 22.7	Stable/Decline
Pintail	n/c	-	-	Undetermined	Red	+ 26.8	Stable
Shoveler	n/c	-	-	Undetermined	Red	+ 21.3	Stable
Scaup	n/c	-	-	Undetermined	Amber	+ 88.7	Stable
Black-headed Gull	1	Decline -25.0% to -49.9%	Moderate	Undetermined	Red	n/c	n/c

*Denotes site selection species; [1] See methods in Section 4.2.1; [2] See methods in Section 4.2.2. n/c = not calculated.
[3] See Lynas *et al.* (2007) for detailed listing criteria; [4] all-Ireland trend calculated for period 1994/95 to 2008/09; [5] international trend after Wetland International (2006).

PART FIVE – SUPPORTING INFORMATION

5.1 Introduction

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

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

The information provided is intended to:-

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

Note that the information presented 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 April 2012.

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

Waterbirds, defined as ‘*’birds that are ecologically dependent on wetlands”* (Ramsar Convention, 1971), are a diverse group that includes divers, grebes, swans, geese and ducks, gulls, terns and wading birds. The I-WeBS database shows a total of 82 waterbird species that have been recorded at the River Shannon and River Fergus Estuaries SPA during the period 1994/95 – 2010/11 representing eleven 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), *Ciconiiformes* (Herons) and the Kingfisher (*Alcedo atthis*).

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 other waterbird species which are part of the total waterbird assemblage of the site but are not specifically listed as Special Conservation Interests. These species may include those that stopover at the site during passage[12], those that are present in months of the year outside of the

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

non-breeding season[13] or species that use the site at certain times only (e.g. as a cold weather refuge).

During the period 1994/95 to 2009/10, 41 waterbird species were recorded on a regular basis during I-WeBS across the site.[14] Of these 41 species, 20 are listed as SCI species for the SPA[15] (see table 2.1) and the remaining 21 regularly-occurring species are listed in Table 5.1 along with recent count data.

Table 5.1 Regularly-occurring non SCI waterbird species that occur at the River Shannon and River Fergus Estuaries SPA during the non-breeding season

Species	Recent Peak Number (2005/06 – 2009/10) (I-WeBS)
Mute Swan *Cygnus olor*	135 (i)
Greylag Goose *Anser anser*	140
Mallard *Anas platyrhynchos*	289
Pochard *Aythya ferina*	37
Tufted Duck *Aythya fuligula*	93
Goldeneye *Bucephala clangula*	17
Red-breasted Merganser *Mergus serrator*	7
Great Northern Diver *Gavia immer*	8
Little Grebe *Tachybaptus ruficollis*	7
Great Crested Grebe *Podiceps cristatus*	31
Little Egret *Egretta garzetta*	29
Grey Heron *Ardea cinerea*	23
Moorhen *Gallinula chloropus*	33
Coot *Fulica atra*	51
Oystercatcher *Haematopus ostralegus*	81
Snipe *Gallinago gallinago*	115
Turnstone *Arenaria interpres*	57
Common Gull *Larus canus*	83
Lesser Black-backed Gull *Larus fuscus*	16
Herring Gull *Larus argentatus*	8
Great Black-backed Gull *Larus marinus*	8

grey shading denotes an Annex I species; (i) denotes numbers of international importance

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 the River Shannon and River Fergus Estuaries SPA. Information is provided for Selection species (Table 5.2a) and for additional Conservation Interests (Table 5.2b). Information is provided for the categories[16] below:-

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

[14] Regular is defined here as a species that occurred in 13 out of the 16-year data period.

[15] The SCI species Pintail is not included in the list because it occurred in 12 of the 16 years.

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

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

A single wetland site seldom meets all the ecological requirements of a diverse assemblage of waterbirds (Ma et al. 2010). Although some waterbird species will be faithful to specific habitats within the SPA, many will at times 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 during 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 waterbird species may utilise wetland habitats in different ways. For example, while the majority of wading birds forage across exposed tidal flats, species such as Lapwing and Golden Plover are considered to be 'terrestrial waders' typically foraging across grassland and using tidal flats primarily for roosting. When tidal flats are covered at high water, intertidally-foraging waterbirds are excluded and many will move to nearby fields to feed. Terrestrial foraging is also important when environmental factors (e.g. low temperature) reduce the profitability of intertidal foraging (e.g. Zwarts & Wanink, 1996b). Some waterbird species are simply generalists, and make use of a range of habitats, for example the Black-tailed Godwit that forage across intertidal mudflats but also readily use grassland habitats. Other species such as Greenland White-fronted Goose (*Anser albifrons flavirostris*) or Bewick's Swan (*Cygnus columbianus bewickii*) are herbivores and are therefore reliant on terrestrial areas, often outside of the SPA boundary, and use the wetland site primarily for roosting. Some species switch their habitat preference as food supplies become depleted; an example being Light-bellied Brent Geese that exploit grasslands increasingly when intertidal seagrass and algae become depleted.

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

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

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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]
Whooper Swan *Cygnus Cygnus*	Anatidae (swans & geese)	Widespread	1, 7	Wide	Lagoon and associated habitats, Intertidal mudflats and shallow subtidal	2	Moderate/ High
Light-bellied Brent Goose *Branta bernicla hrota*	Anatidae (geese)	Localised	1, 5, 7	Highly specialised	Intertidal mud and sand flats	2	High
Shelduck *Tadorna tadorna*	Anatidae (shelducks)	Localised	1, 5	Wide	Intertidal mudflats and shallow subtidal	3	High
Wigeon *Anas Penelope*	Anatidae (dabbling ducks)	Widespread	1, 5	Narrower	Intertidal mud and sand flats and sheltered and shallow subtidal	2	Weak
Teal *Anas crecca*	Anatidae (dabbling ducks)	Widespread	1	Wide	Intertidal mud and sand flats and sheltered and shallow subtidal	3	Weak
Cormorant *Phalacrocorax carbo*	Phalacrocoracidae (cormorants)	Widespread	3	Highly specialised	Sheltered & shallow subtidal over sand and mud flats	1	Moderate
Ringed Plover *Charadrius hiaticula*	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Golden Plover *Pluvialis apricaria*	Charadriidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate
Grey Plover *Pluvialis squatarola*	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Lapwing *Vanellus vanellus*	Charadriidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	Moderate
Knot *Calidris canutus*	Scolopacidae (wading birds)	Localised	4	Narrower	Intertidal mud and sand flats	3	Moderate
Dunlin *Calidris alpina*	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	3	High
Black-tailed Godwit *Limosa limosa*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	High
Bar-tailed Godwit *Limosa lapponica*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	Moderate
Curlew *Numenius arquata*	Scolopacidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	High
Greenshank *Tringa nebularia*	Scolopacidae (wading birds)	Intermediate	6	Wide	Intertidal mud and sand flats	3	High
Redshank *Tringa tetanus*	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	High

[A] Winter distribution: Very widespread (>300 sites); Widespread (200 – 300 sites); Intermediate (100 – 200 sites); Localised (50-100 sites); Highly restricted (<50 sites) (based on Crowe (2005).
[B] Waterbird foraging guilds. 1 = Surface swimmer, 2 = water column diver (shallow), 3 = water column diver (deeper), 4/5 = intertidal walker (out of water), 6 = intertidal walker (in water), 7 = terrestrial walker. Further details are given within Appendix 5.
[C] Food/prey requirements - species with a wide prey/food range; species with a narrower prey range (e.g. species that forage upon a few species/taxa only), and species with highly specialised foraging requirements (e.g. piscivores).
[D] Principal supporting habitat present within the SPA. Note that this is the main habitat used when foraging with the exception of Whooper Swan that utilise wetland habitats for roosting and forage within terrestrial grasslands outside of the SPA.
[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).

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

	Family (group)	Winter distribution[A]	Trophic Guild[B]	Food/Prey Requirements[C]	Principal supporting habitat within site[D]	Ability to utilise other/alternative habitats[E]	Site Fidelity[F]
Pintail *Anas acuta*	Anatidae (dabbling ducks)	Localised	1	Wide	Intertidal mud and sand flats and sheltered and shallow subtidal	2	Weak
Shoveler *Anas clypeata*	Anatidae (diving ducks)	Intermediate	1	Wide	Lagoon, brackish and freshwater lakes plus intertidal mud and sand flats	3	Moderate
Scaup *Aythya marila*	Anatidae (diving ducks)	Highly restricted	2	Wide	Subtidal	1	Unknown
Black-headed Gull *Chroicocephalus ridibundus*	Lariidae (gulls)	n/c	1, 2, 4, 6, 7	Wide	Intertidal flats & sheltered & shallow subtidal	2	Moderate

[A] Winter distribution: Very widespread (>300 sites); Widespread (200 – 300 sites); Intermediate (100 – 200 sites); Localised (50-100 sites); Highly restricted (<50 sites) (based on Crowe (2005).
[B] Waterbird foraging guilds. 1 = Surface swimmer, 2 = water column diver (shallow), 3 = water column diver (deeper), 4/5 = intertidal walker (out of water), 6 = intertidal walker (in water), 7 = terrestrial walker. Further details are given within Appendix 5.
[C] Food/prey requirements - species with a wide prey/food range; species with a narrower prey range (e.g. species that forage upon a few species/taxa only), and species with highly specialised foraging requirements (e.g. piscivores).
[D] Principal supporting habitat present within the SPA. Note that this is the main habitat used when foraging.
[E] Ability to utilise alternative habitats refers to the species ability to utilise other habitats adjacent to the site. 1 = wide-ranging species with requirement to utilise the site as and when required; 2 = reliant on site but highly likely to utilise alternative habitats at certain times (e.g. high tide); 3 = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements. Note, a score of 1 for sea ducks and divers relates to propensity for within-season movements although the site is an important part of the species' wintering range.
[F] Site fidelity on non-breeding grounds: Unknown; Weak; Moderate; or High (based on published information).

5.3 The 2010/11 Waterbird Survey Programme

5.3.1 Introduction

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

The River Shannon and River Fergus Estuaries SPA is the largest wetland complex in Ireland; the SPA covering some 32,261 hectares. 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 some sections of the designated SPA that were not counted (Appendix 6).

Following a reconnaissance visit by fieldworkers in September 2010, it was decided to divide the site into two halves, and to count the site over two days on each survey occasion. A programme of four low tide counts (October 20th/21st and November 22nd-24th 2010[17], plus January 6th/7th and February 18th/19th 2011) and a high tide count (26th/27th January 2011) were completed across the site (Appendix 6).

A total of up to 66 count sections (subsites) were used, comprising of up to 35 subsites on day one and up to 30 subsites on day two on each survey occasion (Appendix 6). Further discussion on subsite coverage is provided in Cummins & Crowe (2011).

During counts the behaviour of waterbirds 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. For a detailed survey methodology, please refer to NPWS (2011).

Table 5.3 Definition of broad habitat types used

Broad Habitat Type	Broad Habitat Description
Intertidal (area between mean high water and mean low water)	Refers to the area uncovered by the tide and most likely dominated by mudflats and sandflats. It may also include areas of rocky shoreline, areas of mixed sediment and grave/pebbles or shingle and gravel shores.
Subtidal (area that lies below mean low water)	Refers to areas that are covered by seawater during counts. During low-tide counts it will include offshore water, tidal channels and creeks as well as tidal rivers.
Supratidal	This category pertains to the shore area and habitats immediately marginal to and above the mean high-water mark. The supratidal section is an integral part of the shoreline. This broad habitat also includes areas of saltmarsh where the saltmarsh is contiguous with coastal habitats lying above. Note that patches of lower saltmarsh (e.g. *Spartina* sp.) surrounded by intertidal flats, were included in the intertidal category.
Terrestrial	Used where birds were recorded within habitats close to the shoreline but were above the intertidal and supratidal levels. Includes aquatic habitats that are not tidal that occur within the study area (i.e. brackish lagoons, freshwater lakes).

[17] This survey was actually undertaken across three days due to fog disrupting one of the days.

Although aerial I-WeBS surveys[18] were planned to coordinate with the ground-based counts, this proved difficult in practice due to weather conditions and the aerial surveys were undertaken on 14th December 2010 and 17th January 2011.

In addition to the main survey programme described above, a 'roost survey' was undertaken during the high tide period on 24th and 25th February 2011. Waterbird roosts were located, species and numbers counted, and the position of the roosts marked onto field maps.

5.3.2 Waterbird data, analyses and presentation

For each survey undertaken, subsite totals were obtained by summing the individuals counted across each behaviour and broad habitat type within each subsite. When a subsite was counted by more than one fieldworker, often in the case of large subsites that required fieldworkers at more than one vantage point, these counts were added together to form a total subsite count. Monthly site totals for each species were obtained by summing across each subsite counted in each month. Given that each monthly count was obtained over a two-day period leads unavoidably to the possibility of double counting birds, as does the extreme large area of the site and the fact that birds could move between sections during each count session; however these are usual and assumed limitations when counting mobile waterbird species.

The main aim of data analyses was to understand how waterbirds were distributed across the site 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 were 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.

Subsite rank positions were converted to categories (see box below). The highest rank position for each subsite across any of the low tide count dates is presented for each SCI species in a subsite by species matrix. For high tide surveys simple rank numbers are presented.

[18] See Section 4.1 for more details on I-WeBS surveys.

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
Low (L)	Lower third of ranking placings (where n = total number of count sections species was observed in).

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

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

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

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

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

small creeks that are not shown on OS maps. These habitat complexities are discussed as necessary in the individual species text tables.

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

5.3.3 Summary Results

Note that hereafter the name 'River Shannon and River Fergus Estuaries' or reference made to the 'site' refers to the count area used during the 2010/11 waterbird survey programme. There are differences between the total extent of the count area and the total area designated as the River Shannon and River Fergus Estuaries SPA; these are mapped within Appendix 6. Within this report, standard waterbird codes are often used in figures, tables and data files; these codes are listed in Appendix 4.

A total of 57 waterbird species were recorded during the 2010/11 survey programme at the River Shannon and River Fergus Estuaries. Cummins and Crowe (2011) 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 percentage occupancy is defined as the average percentage of subsites in which a species occurred during low tide counts. This varied greatly across the SCI species (Table 5.4) and ranged from an average two percent only (Pintail and Scaup) to a peak average occupancy of over 70% (Black-headed Gull). Only five species (Teal, Dunlin, Curlew, Redshank and Black-headed Gull) were on average, recorded in over 50% of subsites, and nearly half of all species occurred in less than 20% of subsites counted.

Average percentage area occupancy is defined as the average proportion of the total count area that a species occurred in during low tide counts (based on subsite areas). Although this is a broad calculation across all habitat types it gives some indication of the range of a species across the site as a whole. The least widespread-occurring species was Scaup (3.8%) which occurred mostly in one subsite only (0H519 Poulnasherry outer bay). Restricted distributions were also recorded for Pintail and Shoveler; both occurring in less than 10% of the total area counted. Light-belied Brent Geese, Ringed Plover, Knot and Bar-tailed Godwit also exhibited relatively restricted ranges occurring in 26% or less of the total area counted during surveys.

Percentage occupancy and percentage area occupancy results were relatively low for Whooper Swan but it should be noted that this species forages predominantly within grassland habitats which were largely outside of the count area covered by the 2010/11 Waterbird Survey programme.

Table 5.4 River Shannon and River Fergus Estuaries – summary data from the 2010/2011 waterbird surveys

Site Special Conservation Interests (SCIs)	Peak number recorded - LT surveys[I]	Peak number recorded - HT survey[II]	Average subsite % occupancy [III]	Average % area occupancy [III]
Whooper Swan*	52	0	4.0 (3.8)	5.4 (6.4)
Light-bellied Brent Goose*	214	78	5.9 (2.7)	17.3 (8.5)
Shelduck*	857 (n)	527 (n)	27.1 (10.4)	33.8 (12.8)
Wigeon*	2,057 (n)	1,714 (n)	45.8 (9.9)	63.5 (11.1)
Teal*	3,267 (n)	1,570 (n)	54.5 (4.3)	60.9 (4.8)
Cormorant*	623 (n)	197 (n)	37.2 (13.0)	50.2 (12.5)
Ringed Plover*	223 (n)	104	13.1 (2.1)	25.8 (3.1)
Golden Plover*	11,221 (i)	249	22.6 (4.6)	31.4 (3.8)
Grey Plover*	206 (n)	30	15.4 (3.7)	30.5 (6.2)
Lapwing*	10,873 (n)	4,609 (n)	45.6 (16.3)	52.7 (9.2)
Knot*	621 (n)	198 (n)	14.7 (4.8)	26.6 (8.7)
Dunlin*	14,537 (i)	6,566 (n)	54.3 (11.6)	67.6 (10.4)
Black-tailed Godwit*	9,052 (i)	683 (i)	32.4 (15.9)	40.4 (21.3)
Bar-tailed Godwit*	552 (n)	885 (n)	14.3 (4.5)	25.4 (10.4)
Curlew*	2,634 (n)	1,611 (n)	71.9 (10.3)	63.5 (38.9)
Greenshank*	157 (n)	43	44.4 (8.1)	63.4 (11.7)
Redshank*	2,445 (n)	1,016 (n)	76.0 (8.2)	85.2 (4.3)
Pintail	94 (n)	80 (n)	2.0 (0.8)	5.3 (2.9)
Shoveler	45 (n)	68 (n)	4.8 (1.8)	7.1 (4.7)
Scaup	29	9	2.0 (0.7)	3.8 (1.6)
Black-headed Gull	8,550 (x)	1,405 (x)	76.6 (5.7)	81.4 (4.7)

* site selection species. (i) denotes numbers of International importance; (n) denotes numbers of all-Ireland importance (1% thresholds; 1999/00 – 2003/04 Crowe et al. 2008); (x) denotes surpassing threshold of significance (after Crowe, 2005).
[I] 4 low-tide counts undertaken on 20-21/10/10, 22-24/11/10, 6-7/01/11 & 18-19/02/11. [II] High-tide count undertaken on 26-27/01/11. [III] Mean (± s.d) averaged across low tide surveys.

Species richness (total number of species) across the total count area ranged from 42 species in October 2010 to 48 species recorded in both November 2010 and January 2011. 41 species were recorded during the high tide count on 26/27th January 2011.

Species richness at subsite level varied considerably with a greater proportion of subsites supporting in the range of six to ten species (see graph). Ten subsites supported 15 or more species.

A list of the top ten subsites based on highest average diversity (species richness) across the four low tide surveys is given in Table 5.5. This table also shows the diversity recorded during the high tide survey and the overall peak diversity recorded. The full subsite list is given in Appendix 7.

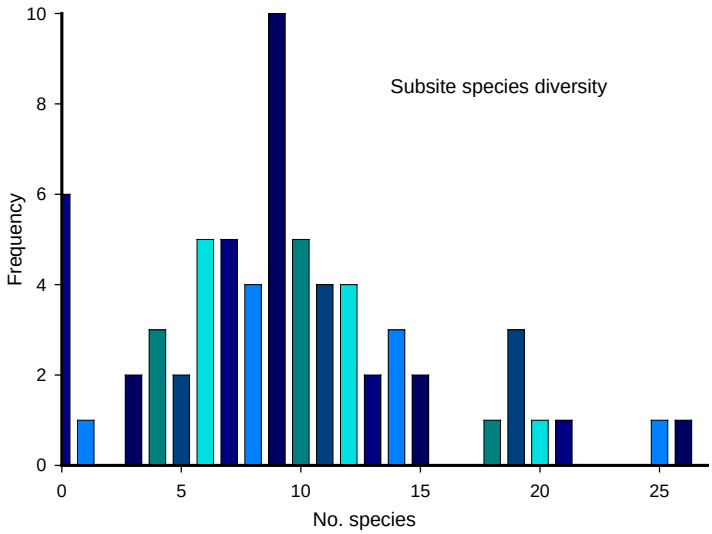

Table 5.5 Subsite species richness – top ten subsites
(L) refers to a peak obtained during a low tide survey

Subsite	Subsite Name	Mean (±S.D) LT Surveys	HT Survey	Peak Overall
0K509	Carrig Island	26 (4.4)	17	30 (L)
0H519	Poulnasherry outer bay	25 (4.6)	15	31 (L)
0K508	Bunaclugga Bay	21 (1.9)	11	22 (L)
0K507	Dooneen Pt - Corcas	20 (3.6)	10	23 (L)
0I438	Aughinish Isl	19 (2.6)	14	23 (L)
0H528	Drumquin Pt.-Inishmore Pt.	19 (1.5)	19	21 (L)
0I437	Aughinish East	19 (1.3)	10	20 (L)
0H533	Inishmore Pt-Inishoul	18 (0.6)	13	18 (L)
0H534	Cahiracon	15 (3.3)	11	20 (L)
0H522	Clonderlaw Bay Inner	15 (5.2)	14	19 (L)

5.3.4 Waterbird distribution

Data analyses determined the proportional use of subsites by each Special Conservation Interest (SCI) species, relative to the site as a whole during surveys. Selected results from these 'subsite assessments' are shown in Tables 5.6 (a–g). 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 or a subsite is not present within the list, means that species were 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–g) 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 8 and summary roost data and maps are presented in Appendix 9; these appendices provided in a separate document due to their large size.

Table 5.6 (a) River Shannon and River Fergus Estuaries 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)

	WS	PB	SU	WN	T.	CA	RP	GP	GV	L.	KN	DN	BW	BA	CU	GK	RK	PT	SV	SP	BH
n =	*8*	*6*	*38*	*45*	*50*	*44*	*17*	*25*	*21*	*50*	*22*	*52*	*39*	*16*	*61*	*41*	*61*	*2*	*5*	*2*	*60*
0H418			L	M	M			M		M		H			M		L				M
0H419			L	M	M					M		H			M		M				H
0H505				L	L					L					L	M	L				L
0H506			L	M	H			L		H			L		M	H	L				L
0H507						M									L		L				M
0H508			H							H	M	H	H		H		M				H
0H509	**V**			H	H								H						**V**		L
0H510			L						M	M	H	H	H				H				H
0H511			L			H				L		L	L		L		L				H
0H512			M	H		H		H		H	H	H	**V**		L	H	H				H
0H513				L	M					H		H	L		M		M				M
0H514			L	M		L				H		H	H		M		H				H
0H515			L		M			**V**		H		H	H		M		H				H
0H516					H							L	L		L	H	M				M
0H517				L	H		H			M		L			M	H	M				L
0H518						M				L		L			M		H				
0H519	**V**	H	**V**	H	**V**	M	H	L	**V**	H	H	H	M		H	H	H	**V**	M	**V**	M
0H520		**V**				H								L	L		L				L
0H521				H	L	H			L	L		H			H	**V**	**V**			**V**	M
0H522			H	M	H	M	M	H	H	M	M	**V**		**V**	**V**	H	**V**				H
0H523			H	H	H	M		L		M		L		**V**	H	H	H				H
0H524			H	M	H	M	L	M			H	H	L	H	H		H				H
0H525						L		L		L			L		L						M
0H526				H	H	M	L			M	L	L			M	M	M				L
0H527				H	M		M			H		L			H	H	M				L
0H528		L	H	**V**	H	H	L	H	**V**	H	**V**	**V**	H	**V**	H	H	**V**				H
0H529					M							H	L								
0H530			**V**									**V**	H		M		H				M
0H531			**V**	H	H	M		**V**	H		**V**	H	**V**		H	M	H				M
0H532			M	M	M	M			L	L		H	H		H	M	M				H
0H533			M	H	H	H		M		M	H	H	M	**V**	H	**V**	**V**				H
0H534	L		M	M	M	M	H	L	H	M	M	H		M	H	H	H				M
0H535				M											L	M					
0H552			M		M				**V**	M		H	H		H		M				**V**

	WS	PB	SU	WN	T.	CA	RP	GP	GV	L.	KN	DN	BW	BA	CU	GK	RK	PT	SV	SP	BH
0I425					H		H					L			M		M				M
0I426			L	H	H	M				M	M	M		L	H	H	H				H
0I427			L		H	M	L			H		L			L	H	M				H
0I428			H	H	M	H				H	L	M	H		H	M	H				H
0I429			H	H	H	M		L	M	H		M	M		H	H	H				M
0I430	L		M	L	L	H			L	L		H	M		H		M				M
0I431	**V**		M	H	M	**V**		M		M		M	M		M	M	M		H		H
0I432			M		L				M	M	H	L	M		M	H	H				M
0I433										H											
0I436				M	H	M				**V**			H		H	H	H				M
0I437			M	H	H	H			**V**	L		H	**V**	H	H	**V**	H				M
0I438			H	H	H	M	L		L			M	L	L	H	H	H		**V**		H
0I439	H		M	L	M	H		H		H	L	L	H	M	H	H	H				H
0I440			M	L	M	M				L			L	L	M	H	M				H
0I441			M	M	M	L	H	M		H	L	M			**V**	H	H				H
0I442				L	L	L	H					L			L	H	M				H
0I443				M	L	M	H	M		M		M			H	H	M				M
0I444	M			H	H	**V**		M		**V**		**V**	M		L		H				H
0I445				H	H	H		**V**		**V**		H	M		H	H	H				H
0I446				H	H	L				H		M	M		H	H	L				H
0I447					H	M				L		L			L		L				**V**
0I448						H											L				**V**
0I449			L			**V**									H	L	L				H
0I457					L	L				L		L			L		L				
0I458			M	L	H				M		M		L		M	H	H				
0I489			H	H	H	L		H	H	M	H	H	H		H	M	H				M
0I490			M	H	L	M		M	M	H	L	M	H	H	M		L				H
0I491			M	**V**	H			L	L	H		M	M		H	H	H				M
0I496				L											L	M	L				L
0K507		**V**				H	M	H	H	H	L	L		M	H	H	M				H
0K508		**V**		**V**	L	H	**V**		M	M	L	H	M	H	H	**V**	H				H
0K509	**V**	**V**	H	**V**	**V**	H	H	**V**	M	**V**	L	H	M	H	H	**V**	H	**V**	M		H

Table 5.6 (b) River Shannon and River Fergus Estuaries Subsite assessment – total numbers foraging intertidally within LT surveys. Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods) (note that for wader species intertidal and subtidal data have been combined)

	WS	PB	SU	WN	T.	RP	GP	GV	L.	KN	DN	BW	BA	CU	GK	RK	PT	BH
n =	*1*	*6*	*35*	*33*	*44*	*18*	*9*	*18*	*38*	*21*	*51*	*37*	*16*	*60*	*40*	*58*	*1*	*57*
0H418			L		L				M		H			M				M
0H419			L		L				H		H			H		M		H
0H505					L									L	M	L		L
0H506					L				H			M		L	H	L		L
0H507																L		
0H508			H						H	M	H	H		L		M		H
0H510			L					M		H	H	**V**		H		H		H
0H511			L									L		L		L		L
0H512			M	H			H		M	H	H	L		L	H	H		H
0H513					L				H		H	L		M		M		M
0H514			L						M		H	H		M		H		H
0H515			L		H				M		H	H		M		H		H
0H516					H						L	L		L		M		L
0H517				L	H	H			M		L			M	H	M		L
0H518									L		L			H		H		
0H519	**V**	H	**V**	H	**V**	H	H	**V**	H	H	H	L		H	H	H	**V**	H
0H520		H											M	L		L		L
0H521				H	L						H			**V**	**V**			M
0H522			H	M	H	M	**V**	H		M	**V**		**V**	**V**	H	H		**V**
0H523			H	H	H	L	M		M		L		**V**	H	H	H		M
0H524			H	H	M	L	H			H	H	L	H	H		H		H
0H525														L				
0H526				H	H	L			L	L	L	L		M	M	M		L
0H527				H	M	M			H		L			H	H	M		L
0H528		L	H	**V**	M	L		**V**	M	**V**	**V**	H	**V**	M	H	**V**		H
0H529											H							
0H530			**V**								**V**	H		M		H		H
0H531			**V**					H		**V**	H	**V**		H	M	H		H
0H532			L	L	M			L	L		H	H		H	M	H		H
0H533			M	H	H		**V**		H	H	H	M	**V**	H	**V**	**V**		H
0H534			M	M	L	H			L	H	H		M	H	H	H		H
0H535														L				
0H552			M		H			**V**	L		H	H		H		M		**V**

	WS	PB	SU	WN	T.	RP	GP	GV	L.	KN	DN	BW	BA	CU	GK	RK	PT	BH
0I425				L	**V**	H					L			M	M	M		M
0I426			L	H	**V**					M	M		L	H	H	H		M
0I427			L		H	L			M		L			L	M	M		M
0I428			H	L	H				H		M	H		M	M	H		H
0I429			H						H		M	M		M	M	H		H
0I430			M		L			L			H	M		M		M		H
0I431				M					H		H	M		M	L	M		H
0I432			L		M			M		M	L	M		M	M	H		M
0I436				M	H				H			M		H	H	H		M
0I437			H	**V**	H			**V**	M		H	**V**	H	H	**V**	H		H
0I438			H		L	L		L		L	M	L	L	H	H	H		H
0I439			M	L	H				M	L	L	H	M	H	H	H		H
0I440			M	L	M				L			L	L	M	H	M		H
0I441			H	M	L	H			H	L	M			M	L	H		M
0I442				L	M	H					L			L	M	M		M
0I443				L	L	H			L		M			M	M	M		L
0I444				M	H				**V**		**V**	H		L		H		H
0I445				**V**	L				**V**		H	M		L	H	H		H
0I446				H	M				H		M	L		M	H	M		H
0I447					M						L			L		L		H
0I448																L		L
0I449														L	L	L		L
0I457					M						L			L				
0I458			M	M	L			M				L			H	H		
0I489			H	H	L		**V**	M	M	H	H	H		H	M	H		H
0I490			H		L		L	M	M	L	L	H	H	M		L		H
0I491			M	H	H		**V**	L	**V**		M	M		H	H	H		M
0I496				L										L	M	L		L
0K507		**V**				M		M	M	L	L		M	H	H	M		H
0K508		**V**		**V**		**V**		M	L	L	H	H	H	H	**V**	H		H
0K509		**V**	H	H	H	H		M	M	L	H	L	H	H	H	H		M

Table 5.6 (c) River Shannon and River Fergus Estuaries Subsite assessment – total numbers foraging subtidally within LT surveys. Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods)

	SU	WN	T.	CA	SV	SP	BH
n =	*6*	*14*	*18*	*31*	*2*	*2*	*25*
0H418			M				
0H505		M					M
0H506	M						L
0H507				H			
0H509					**V**		
0H510							M
0H511				H			H
0H512				M			
0H513		L	M				
0H514		V					H
0H516							L
0H518				H			
0H519		M		M		**V**	
0H520				L			
0H521				H		**V**	
0H522	**V**		M	L			
0H523			**V**				
0H524	H						
0H525				L			L
0H526			L				
0H528	H	M	H	M			H
0H531		**V**		M			
0H532		**V**	H	H			H
0H533	**V**		H				
0H534	**V**						
0I425			**V**				
0I426		L					L
0I427			**V**	M			H
0I428				M			
0I430		L		L			
0I431		H	L				L
0I436				M			
0I437				**V**			
0I438				H	**V**		

	SU	WN	T.	CA	SV	SP	BH
0I439				H			
0I440				M			H
0I441			L	L			H
0I442		M					
0I443		H	L	L			H
0I444			L	L			M
0I445		H					
0I446							M
0I447			**V**	H			**V**
0I448				M			**V**
0I449				**V**			M
0I457			L	L			
0I489			M	M			
0I496							M
0K507				**V**			H
0K508				**V**			**V**
0K509		**V**	H	L			H

Table 5.6 (d) River Shannon and River Fergus Estuaries Subsite assessment – total numbers (roosting/other behaviour) within LT surveys (Intertidal[I], Subtidal[II], intertidal/subtidal combined[III]); Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods) (note WS, PB, BA, PT, SV & SP are not included due to minimal/no data).

	SU[I]	WN[I]	WN[II]	T:[I]	T:[II]	CA[I]	RP[I]	GP[III]	GV[I]	L.[III]	KN[I]	DN[III]	BW[III]	CU[III]	GK[III]	RK[III]	BH[I]	BH[II]
n =	*4*	*30*	*16*	*34*	*15*	*25*	*4*	*23*	*4*	*41*	*2*	*7*	*9*	*34*	*11*	*17*	*32*	*20*
0H418		H	M	L				M								**V**		
0H419		H		H													L	
0H505		L			L					L				M			L	M
0H506	**V**	H	M		M			L		H			M	H		H	M	L
0H508										H							M	
0H510										M			**V**	M			M	
0H511						H				L				L			M	
0H512		M	L			H		H		**V**			**V**	L			M	
0H513			L	L	H									L		M	M	L
0H514						M				H			H	**V**			M	
0H515				L				**V**		H				L			H	
0H516				L	H								M	L		L	L	L
0H517		L		H														
0H519		**V**		**V**						H								
0H520						M												
0H521									**V**	L						**V**	L	
0H522						M		H		H								
0H523						L				L								
0H524						L												
0H525								L		L				M				
0H526		L		L			**V**			H						L		
0H527		L								L				H				
0H528	M	**V**	M	M	M	H		H		H		H	L	H	H	**V**	H	**V**
0H531		H		**V**				**V**										
0H532			L		L	L												
0H533		M		H				M		M		**V**			**V**			
0H534				M		L		M	**V**	M					**V**			
0H552				M						M								
0I425		H			**V**		**V**								H		M	M
0I426		M	H	H	L	L				M				H		H	H	H
0I427				M	H	M	**V**	L		H		**V**			H		H	**V**
0I428	**V**	H	H	L		**V**				H	**V**	H		H	H		M	

	SU'	WN'	WN''	T.'	T.''	CA'	RP'	GP'''	GV'	L.'''	KN'	DN'''	BW'''	CU'''	GK'''	RK'''	BH'	BH''
0I429		H	**V**	H		M		L	H	H				H			M	L
0I430			M	L						L				H				
0I431	H	**V**	**V**	M		M		M		H			H	H			H	L
0I432										M				M				
0I436		M		**V**						**V**			H	L		H		
0I437		M				M							**V**				M	
0I439		L				M		H		H				M			H	
0I440				M														
0I441		M		H	M			L		H				**V**	H	**V**	**V**	**H**
0I442			M	L										L	**V**	H	H	M
0I443		L				L	**V**	M		M		H		H	H	H	L	M
0I444		H	**V**	H	**V**	**V**		H		M				M				M
0I445				H		H		**V**		**V**				H		M	H	
0I446		**V**		H		L				L				H			M	
0I447				M	L	L				L						H	**V**	**V**
0I448						M										M	**V**	**V**
0I449	**V**					**V**								**V**			L	H
0I457				L	**V**					L						M		
0I458				H							**V**			M				
0I489		M	H	M	M			H		M				M				
0I490		H	H	L				M		H		**V**		H				M
0I491		H		M				L		H				H				
0I496		L												L	**V**		L	M
0K507								H		H							M	
0K508		H		L						L		**V**		H				
0K509		M	**V**	M	**V**	M		**V**		**V**				M	H	H	H	L

Table 5.6 (e) River Shannon and River Fergus Estuaries Subsite assessment – rank average intertidal foraging density: top ten subsites for selected species (LT surveys)

	PB	SU	WN	T.	RP	GV	KN	DN	BW	BA	CU	RK
0H419								7			10	
0H505											9	10
0H508								5				
0H510						9	3		2			
0H512							9					
0H513								6				
0H514								2				
0H515									7			8
0H516				1								7
0H517	7		10	3	1							4
0H518											7	6
0H519	5	3		9		5						
0H520	2									8		
0H521			2					9			1	
0H522						7		10				9
0H523		6	6	10						1	3	
0H524		2	8		9		1			2	4	2
0H526			3	4								
0H527			7		5						6	
0H528	6						5			9		
0H529								1				
0H530		4						3	3			
0H531		8					8					
0H532									10			
0H533							7			6		
0H534							6					
0H535											5	
0H552						4			6			
0I425				2	6							
0I426				6								
0I427				7								
0I428									9			
0I429		7										
0I432							10					
0I436			9	5					4		2	5
0I437						2			8	7		

	PB	SU	WN	T.	RP	GV	KN	DN	BW	BA	CU	RK
0I438		9										
0I439				8						5	8	
0I441		5			10							
0I442					2							
0I443					3							
0I444								4				
0I445			5					8				
0I446			1									
0I458		1				1						1
0I489						10	2		1			3
0I490						3	4		5	3		
0K507	1				8	6				4		
0K508	4		4		4					10		
0K509	3	10			7	8						

Table 5.6 (f) River Shannon and River Fergus Estuaries Subsite assessment – ranked total numbers (HT survey & across all habitats). Note WS was not recorded during the HT survey.

	PB	SU	WN	T.	CA	RP	GP	GV	L.	KN	DN	BW	BA	CU	GK	RK	PT	SV	SP	BH
n =	*4*	*23*	*37*	*46*	*17*	*3*	*3*	*7*	*26*	*4*	*19*	*10*	*7*	*43*	*21*	*40*	*2*	*4*	*1*	*31*
0H418			2	3					2		16			12		4				
0H419			17	14	5									38	10	9				
0H505				33										38						
0H506				12					7					27		8				
0H507					13															19
0H508											3	3								9
0H509			4	5														2		
0H510			30																	24
0H511		17			6			5	13	4	2			38		3				12
0H512		13	33	11				7	19					25		10				4
0H513			32	17	12									35		31				22
0H514			5	32					24					19						10
0H515			16	10	6									38						27
0H516			33	8							14				6	19				
0H517	1			21										33	10	32				
0H518																				
0H519		4	12	1					9					19	10	12	1	1		13
0H520						3		5					6	33		29				
0H521		21							23					15		32				21
0H522		2	24	21					20		7		2	2	10	1			1	29
0H523		12	33						10					32	10	21				29
0H524		11	33												10					
0H525														35		32				
0H526			23	16					11				7	25	10	26				
0H527			25						15					6		15				27
0H528		1	6	2	2				4	3	1	2	1	16	10	5				6
0H529																				
0H530											10	6								17
0H531		5	15	7	13					1	4	5				2				
0H532		8	27	15								7		18		6				
0H533		19	9	39	16				14					6	6	16				24
0H534		9	20	24					22					4	1	16				29
0H535																				
0H552				33	9									22		22				17

	PB	SU	WN	T.	CA	RP	GP	GV	L.	KN	DN	BW	BA	CU	GK	RK	PT	SV	SP	BH
0I425																				
0I426		9	14	18										38		22				
0I427																35				
0I428		3	21	24	6				12		19			27	3	35				7
0I429				24	9															5
0I430		13		13					17	2	11									
0I431		22	3	6	4									10						
0I432				36										8	10					
0I433																				
0I436			11	27					21			1		12		22				
0I437		7		37	13			3			15		5	24		26				
0I438			10	19							9			27	1	26		3		
0I439		18	21	31					17			4		5						2
0I440		13		30										27		16				8
0I441		13	18	23			2	4	6		18			23	4	14				19
0I442			30	28			3		26		13			35	10	35				16
0I443		19	26	20	16				16			9		14	6	35				26
0I444			13	9	2				5		8			10		7				
0I445		22	7	41					1					9						
0I446			27	41																
0I447				37																14
0I448				39	9											35				1
0I449					1	2					5			38	10					22
0I457				41																
0I458				41																
0I489			19	28								9		16				4		
0I490			27	41										31	6	29				11
0I491				41			1		8		6					11				
0I496			37												10	35				
0K507	2							2			17		4	21		20				3
0K508	3		8	33		1			25				3	3	4	25				15
0K509	4	6	1	4				1	3		12	8		1		13	2			

Table 5.6 (g) River Shannon and River Fergus Estuaries Subsite assessment – total numbers (roosting/other behaviour) within HT survey (Intertidal[I], Subtidal[II], Intertidal/Subtidal[III] combined). Note – no data in these categories for RP, GP, PT, SP or GK.

	PB[II]	SU[II]	WN[II]	T.[II]	CA[I]	GV[I]	L.[III]	KN[I]	DN[III]	BW[III]	BA[I]	CU[III]	RK[III]	SV[I]	BH[II]
n =	*3*	*6*	*14*	*14*	*3*	*3*	*8*	*1*	*3*	*1*	*1*	*13*	*12*	*2*	*16*
0H418			1	1									4		
0H419			7	7									3		
0H506				4											
0H508										1					3
0H509														1	
0H510			12												16
0H511						1	4	1	1			10	1		13
0H512			13												8
0H513												10	10		15
0H514												1			11
0H515				9											
0H519							8					3			
0H521													10		
0H525												9			
0H526							5					6			
0H527							7					10	9		
0H528		1	2	6			3		3		1	4	6		1
0H531													2		
0H552												5	7		
0I426													7		
0I428		2	9		3										12
0I429				8											6
0I430		3		5											
0I431		6	3	2											
0I439		4													7
0I440															2
0I441		5		13		1	6						12		13
0I442			13	12											10
0I443			11	11											
0I444			5	3	2		1		2				5		
0I445												7			
0I447				13											9
0I448															4

	PB	SU	WN	T.	CA	GV	L.	KN	DN	BW	BA	CU	RK	SV	BH
0I449					1		0					10			
0I489			8									2		2	
0I490			10									8			4
0K507	1														
0K508	2		4	9											
0K509	3		6			2	2					1			

River Shannon and River Fergus Estuaries
Waterbird Survey Programme 2010/11

Waterbird distribution - discussion notes

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

'I-WeBS' refers to count data collected for the River Shannon and River Fergus Estuaries as part of the Irish Wetland Bird Survey.

Whooper Swan *Cygnus cygnus* - Family (group): Anatidae (geese)

The Whooper Swan is a migratory species and has a widespread breeding distribution across the northern Palearctic, ranging from Iceland and northern Scandinavia in the west, to Russia in the east. Five breeding populations have been identified in the Western Palearctic and Asia and those wintering in Britain and Ireland come almost exclusively from the Icelandic breeding population.

Historically the species was known to winter in freshwater wetland habitats or brackish lagoons and coastal bays. A change to feeding on terrestrial habitats has been observed since the mid 1990's (Crowe, 2005) with grassland and increasingly, arable habitats used by foraging individuals.

Numbers

A peak low tide count of 52 Whooper Swans was recorded on 20/21 October 2010 with almost no birds present during the subsequent two low tide surveys. No individuals were present during the high tide count (26/27 January 2011) and 17 individuals were counted during the final low tide count on 18/09 February 2011. These figures contrast with the peak number of 200 Whooper Swans recorded during aerial I-WeBS survey on 17th January 2011. A count of 200 individuals surpasses the threshold of all-Ireland importance, and is close to the threshold (210) for international importance.

During the 2010/11 Waterbird Survey programme, Whooper Swans were recorded from eight subsites: 0H509, 0H519, 0H534, 0I430, 0I431, 0I438, 0I443 and 0K509. Only two subsites recorded the species on more than one occasion: 0H509 (Golf Tee- Shannon) and 0H519 (Poulnasherry outer bay). The subsite peak count (21 individuals) was recorded for 0K509 (Carrig Island) on 20th October 2010.

Foraging Distribution

Whooper Swans forage diurnally and roost at night. They are primarily herbivorous, feeding on aquatic plants, grasses and agricultural plants such as grain, vegetables and stubble. During the most recent international swan census, just over half of habitat records for Whooper Swans were for dry improved pasture (Boland et al. 2010). Whooper Swans that spend winter at the Shannon and Fergus estuaries complex therefore forage primarily outside of the SPA boundary, highlighting the need for sympathetic management of agricultural habitats close to wetland sites. Changes in feeding distribution occur through the winter as food supplies become exhausted and new ones are exploited. The species also appears selective in their choice of sites dependent on recent management.

Please note that due to relatively few intertidal/subtidal observations of Whooper Swan, dot density maps were not produced for this species.

Whooper Swans were recorded foraging intertidally within 0H519 (Poulnasherry outer bay) on two low tide survey occasions, the maximum number of individuals was 13 on 20/10/10. Three once-off records of terrestrially-foraging individuals were made in association with 0I431 (Way Rock), 0I438 (Aughinish Isl.) and 0K509 (Carrig Island). The maximum number of individuals was 21 (0K509 on 20/10/11).

59 Whooper Swans were recorded foraging terrestrially during the roost survey on 24th and 25th February 2011 in association with the following subsites: 0H531 (Ing Point - Deenish Isl.), 0I429 (Ringmoylan Qy.-Shannongrove Pt), 0I430 (Black Rock to Mellon Pt.) and 0I438 (Aughinish Isl.)).

Robinson et al. (2004a) describe the following previously recorded foraging grounds for Whooper Swans: low-lying grasslands of Islandavanna, Fergus estuary (adjacent subsite 0H529), Latoon creek (adjacent 0H535), Clonderlaw bay and grassland around the Crompaun river (adjacent 0H522), an area in the upper estuary near Mungret between the Maigue Estuary and Limerick City (adjacent subsites 0I457 and 0I427), and grasslands at Cooperhill (adjacent 0I457), Scarlet Reach (adjacent 0I445) and Newtown (adjacent 0I446), the latter three being protected from the estuary by embankments. Flocks are also known to forage a distance from the SPA including within grasslands associated with the lakes of Moanmore and Tullaher in Co Clare (NE of Poulnasherry Bay) and the Doonbeg river valley. There are therefore regularly-used flight paths between such areas and the estuary.

Roosting Distribution

Due to relatively little intertidal/subtidal observations of roosting/other Whooper Swans, dot density maps were not produced for this species.

Whooper Swans tend to congregate at discrete and safe wetland sites during the evening to roost, and disperse by day to forage. As a result, roosting data from the diurnal Waterbird Survey Programme are limited. Three records of roosting/other behaviour were made. Seven individuals were recorded roosting at Shannon Airport Lagoon (0H509 Golf Tee- Shannon) on 21/10/11. Two individuals were recorded intertidally within 0I430 (Black Rock to Mellon Pt.) on 21/10/11. Six Whooper Swan loafed subtidally within 0I443 (Long Rock (Glin)) on 20/10/11. Shannon Airport Lagoon has been noted previously as a regularly-used site during autumn (Robinson et al. 2004a).

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. 2004b).
Numbers
During the 2010/11 waterbird survey programme whole-site numbers of Brent Geese were variable and ranged from 12 individuals (20/21 October 2010) to a low tide peak count of 214 on 6th and 7th January 2011. 78 Brent Geese were counted during the high tide survey (26/27 January 2011); a few days earlier the aerial I-WeBS census had recorded 137 Brent Geese at the site. Brent Geese exhibited a relatively restricted distribution occurring in only seven subsites, and were associated mostly with the outer section of the site: 0H517, 0H519, 0H520, 0H528, 0K507, 0K508 and 0K509. The subsite peak count of 135 Brent was recorded for 0K507 (Dooneen Pt - Corcas) on 20/10/10.
Foraging Distribution
Brent Geese are grazers and are known for their preference for foraging in intertidal areas with the Eelgrass *Zostera* sp. (Robinson et al. 2004b). Where this food source is absent the birds feed upon algae and saltmarsh plants and the species also grazes terrestrially. Brent geese foraged intertidally across seven subsites: 0H517 (Querin), 0H519 (Poulnasherry outer bay), 0H520 (Poulnasherry inner bay), 0H528 (Drumquin Pt.-Inishmore Pt.), 0K507 (Dooneen Pt - Corcas), 0K508 (Bunaclugga Bay) and 0K509 (Carrig Island). With the exception of 0H528 (Drumquin Pt.-Inishmore Pt.) in the Fergus Estuary (where only a single individual was recorded), all of these subsites occur in the outer Shannon Estuary and are characterised by areas of intertidal soft sediment (sand) and stretches of fucoid-dominated intertidal reef (rocky habitat). 0K507 (Dooneen Pt - Corcas) recorded peak numbers on two survey occasions and supported a peak number of 135 individuals foraging intertidally on 07/01/11. *Zostera noltii* has been recorded previously within Poulnasherry Bay (Falvey et al. 1997) but was not recorded in recent surveys (NPWS, 2012). Terrestrial foraging was recorded close to 0H520 on one occasion only, although this activity is likely to occur regularly around the site and often outside of the SPA boundary. The overall peak intertidal foraging density was recorded for 0K507 (Dooneen Pt – Corcas) which supported 2.5 Brent Geese ha^{-1} on 07/01/11. The whole site average intertidal foraging density was 0.01 Brent Geese ha^{-1}.
Roosting Distribution
A single observation of four Brent Geese roosting within intertidal habitat was recorded for 0K509 (Carrig island) on 18/02/11. 23 individuals were recorded in roosting/other behaviour subtidally during the high tide survey (26/27 January 2011), the majority (16) were within 0K507 (Dooneen Pt - Corcas). A total of 156 Brent Geese were recorded during the roost survey (24/25 February 2011). 73 individuals roosted intertidally within 0H519 (Poulnasherry outer bay) at four different locations, the largest single roost being 42 individuals. A further 57 Brent Geese roosted subtidally at one location (just off Baurnakard Point) within 0H520 (Poulnasherry inner bay). Smaller numbers roosted subtidally within 0K508 and 0K509.

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

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

Numbers

Whole-site low tide numbers of Shelduck peaked on 18/19th February 2010 when 857 individuals were counted, representing numbers of all-Ireland importance. 527 individuals were counted during the high tide survey (26/27 January 2010). The aerial I-WeBS survey on 14th December recorded 408 Shelducks. The roost survey on 24th and 25th February 2011 recorded a total 755 Shelducks.

During the 2010/11 waterbird survey programme, Shelducks were recorded within 41 subsites overall, and within 38 during low tide surveys. 0H519 (Poulnasherry outer bay), 0H522 (Clonderlaw Bay Inner) and 0H524 (Kilmurry Creek) are notable for supporting Shelducks in all four low tide surveys and during the high tide survey. Three subsites held peak numbers during low tide surveys: 0H519, 0H530 and 0H531. 0H528 (Drumquin Pt.-Inishmore Pt.) supported peak numbers during the high tide survey (170 individuals). The peak subsite count of 217 individuals was recorded for 0H531 (Ing Point - Deenish Isl.).

Foraging Distribution

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

Shelducks foraged intertidally across 35 subsites. One subsite (0H519 Poulnasherry outer bay) recorded Shelducks foraging intertidally during all four low tide surveys.

The relatively small subsite 0H530 (Ing) in the Fergus Estuary supported peak numbers (52) on 21/10/10 representing 31% of the total numbers foraging intertidally during that survey. This subsite also held numbers ranked as second highest during the November low tide survey but no further observations of foraging individuals were made for this subsite. 0H519 (Poulnasherry outer bay) recorded peak numbers during the November 2011 and January 2011 low tide surveys, a peak of 196 individuals during the latter survey accounted for 65% of all Shelducks foraging intertidally during that survey. 0H531 (Ing Point - Deenish Isl.), also in the Fergus Estuary, held peak numbers during the February low tide survey (and the subsite peak of 217 individuals) and peak numbers foraging intertidally during the January 2011 high tide survey (25 individuals). A further 13 subsites supported foraging individuals in numbers that were ranked as high on their respective survey days.

The benthic community of the Fergus Estuary and Poulnasherry Bay is assigned the broad classification 'Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans' (NPWS, 2012). The gastropod mollusc *Hydrobia ulvae*, a favoured prey of Shelduck, is a distinguishing invertebrate of this community, occurring in moderate to high abundances.

Subtidally foraging Shelducks were recorded to a lesser degree, the peak number recorded during the final low tide survey (98 individuals) when the majority (83%) were located within 0H522 (Clonderlaw Bay Inner). 48 Shelducks foraged subtidally during the January 2011 high tide survey, across four subsites only (0H511, 0H512, 0H528 and 0I441).

The peak intertidal foraging density was 0.8 Shelduck ha^{-1} recorded for both 0I458 (Askeaton) and 0H524 (Kilmurry Creek). The second highest density was 0.61 Shelduck ha^{-1} recorded for 0H519 (Poulnasherry outer bay). The whole site average intertidal foraging density was 0.05 Shelduck ha^{-1}.

Roosting Distribution

Relatively few Shelduck were recorded in roosting/other behaviour during low tide surveys. During the high tide survey a total of 45 Shelduck roosted intertidally and 150 roosted/other subtidally. 0H519 (Poulnasherry outer bay) supported 31 Shelduck roosting intertidally. 0H528 (Drumquin Pt.-Inishmore Pt.) supported peak numbers roosting subtidally (90 individuals) with a further 37 individuals within 0I428 (Pigott's Island).

632 Shelducks roosted during the dedicated roost surveys on 24th and 25th February 2011. The peak number (130) roosted at four locations within 0H519 (Poulnasherry outer bay). Three of these roost locations were the rocks/islands named Illaunmore, Illaunbeg and Black Island on OS 6"maps. 124 individuals also roosted within 0H531 (Ing Point - Deenish Isl.), highlighting the relationship between foraging areas and roosting areas. 0I437 (Aughinish East) supported 57 Shelducks at three different roost locations. Thereafter a further 22 subsites supported 40 or less roosting individuals each.

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, including Ireland.

Numbers

Whole site numbers of Wigeon rose steadily to a peak on 6/7th January 2010 when a count of 2,057 Wigeon represented numbers of all-Ireland importance. This count was undertaken during a cold spell which had recorded the coldest December on record (Met Éireann, 2010). 1,976 Wigeon were recorded during the aerial I-WeBS survey on 14th December 2010.

Wigeon were recorded in 48 subsites overall and 45 subsites during low tide surveys. They occurred regularly (three LT surveys or more) within 23 subsites: 0H509, 0H519, 0H521, 0H527, 0H528, 0H531, 0H533, 0H534, 0I425, 0I426, 0I428, 0I431, 0I436, 0I437, 0I438, 0I439, 0I442, 0I444, 0I446, 0I489, 0I491, 0K508 and 0K509. Different subsites held peak numbers for the four low tide surveys: 0K508, 0K509, 0I491 and 0H528 for the four dates respectively.

The peak subsite count was 446 Wigeon within 0I491 (Greenish Island) on 6th January 2011.

Foraging Distribution

The Wigeon diet is almost entirely vegetarian and a major part of the diet comprises seagrass and algae species which are taken by grazing or dabbling in shallow water. Wigeon also forage within grasslands and agricultural crops for seeds, stems and rhizomes. A gregarious bird, they are rarely seen far from water.

Wigeon foraged intertidally across 33 subsites. Eleven subsites recorded the species foraging intertidally on a regular basis (three or more low tide surveys): 0H519, 0H521, 0H527, 0H528, 0I426, 0I436, 0I437, 0I439, 0I489, 0K508, and 0K509. Only two subsites held intertidally-foraging individuals during all four low tide counts: 0I437 (Aughinish East) and 0K509 (Carrig Island). Peak numbers were recorded for 0K508 (Bunaclugga Bay), 0I437 (Aughinish East), 0I445 (Scarlet Reach) and 0H528 (Drumquin Pt.-Inishmore Pt.) for the four low tide surveys respectively. 0I426 (Ballydonoghue) was notable in supporting numbers ranked as second highest during both a low tide survey (24/11/10) and the high tide survey. The peak number recorded foraging intertidally was 226 (0K508 on 21/10/10).

In general, fewer individuals foraged subtidally during low tide surveys; the maximum number of 123 individuals was recorded across three subsites during the November 2010 low tide survey. 258 Wigeon foraged subtidally during the high tide survey (in comparison with 177 that foraged intertidally). 93 of these (36% of total) were within 0H514 (Saint's Island) with less than 50 individuals distributed across a further nine subsites.

Shannon Airport Lagoon (0H509: Golf Tee- Shannon) recorded foraging Wigeon in three of the four low tide surveys with a peak number of 83 individuals on 06/01/11. Good numbers were also recorded in Mangan's Lagoon at Aughinish Island (within subsite 0I438) with over 50 individuals present in all but one survey, and a peak subsite count of 84 on 22/11/10.

Terrestrial foraging was recorded for 0I439 (Robertstown River), 0I91 (Greenish Island) and 0K509 (Carrig Island), all outside of the SPA boundary.

The overall peak intertidal foraging density was 2.61 Wigeon ha^{-1} recorded for 0I446 (The Whelps); the only subsite to record a density of greater than 2 Wigeon ha^{-1}. Seven subsites recorded densities of over 1.25 Wigeon ha^{-1} during the survey programme: 0H521, 0H523, 0H526, 0H527, 0I445, 0I446 and 0K508. The whole site average intertidal foraging density was 0.08 Wigeon ha^{-1}.

Roosting Distribution

Wigeon were recorded undertaking roosting/other behaviour intertidally across 33 subsites. The peak number during any one low tide survey was 515 individuals (November 2010) which represented 37% of the total number of Wigeon recorded during that survey. Subsite peak numbers were recorded for 0H519 (Poulnasherry outer bay), 0I431 (Way Rock), 0I446 (The Whelps) and 0H528 (Drumquin Pt.-Inishmore Pt.) for the four low tide surveys respectively. 0I431 (Way Rock) is notable for supporting good numbers in all low tide surveys and numbers ranked in the top two on three of these, including a peak number of 112 individuals on 22/11/10.

A total of 844 Wigeon were recorded in roosting/other behaviour during the high tide survey on 26th and 27th January 2011. Across all broad habitats combined, 0H418 (Moyhill Marsh) held the most Wigeon (196 individuals). Only one other subsite held over 100 individuals (0K509 - Carrig Island). A relatively low number of individuals (51) were recorded roosting intertidally, the majority (76%) within 0H531 (Ing Point - Deenish Isl.). Intertidal foraging options were available during this survey; a total 177 Wigeon also recorded foraging during this survey. 567 Wigeon were recorded roosting/other subtidally across the site, the greatest number within 0H418 (Moyhill Marsh) (196 individuals).

During this survey a total of 216 Wigeon roosted terrestrially in association with seven subsites. The largest number were positioned within 0K509 (Carrig Island) where 40 roosted terrestrially as part of a large mixed-species roost on Kilelton Polder (note that this roost was outside of the SPA boundary) and a further 26 roosted terrestrially adjacent to the SPA. 55 Wigeon also roosted terrestrially in two locations within and adjacent to 0H533 (Inishmore Pt-Inishoul). 0I436 (Poulaweala Creek) supported a further 50 terrestrially-roosting Wigeon (outside SPA boundary).

998 Wigeon were recorded roosting during the dedicated roost surveys on 24th and 25th February 2011. These birds were positioned at 64 locations across 27 subsites. 0K509 (Carrig Island) recorded the largest number (192 Wigeon) at three roosts, although 145 of these birds actually roosted terrestrially (outside the SPA) as part of a large mixed-species roost on Kilelton Polder.

0H522 (Clonderlaw Bay Inner) recorded 129 Wigeon, also recorded at three locations and in terrestrial/supratidal habitat (inside SPA boundary). Other subsites to support over 50 roosting individuals were 0H418 (86 Wigeon), 0I444 (84 Wigeon), 0I431 (80 Wigeon), 0I446 (79 Wigeon) and 0H552 (70 Wigeon).

Teal *Anas crecca* - Family (group): Anatidae (ducks)

Anas crecca has five breeding subspecies that occur across north and northwest Europe, Siberia and into Asia (Wetlands International, 2006). Teal are largely migratory, moving south of their breeding range during winter. Being highly responsive to cold spells they can show rapid and extensive movement during these periods. Teal breeding in Britain and Ireland are supplemented during winter by birds from a range extending from Iceland, through Scandinavia to northwest Siberia (Wernham et al. 2002).

Numbers

Whole site numbers of Teal peaked early in the season, with 3,267 recorded on 22/24 November 2010. 1,570 Teal were recorded during the high tide survey. All surveys recorded numbers of all-Ireland importance.
Lower numbers were recorded during the aerial I-WeBS survey with 945 Teal recorded on 17th January 2010. Lower numbers from aerial survey are not unexpected given the species' tendency to occur amongst saltmarsh and shoreline vegetation where they could be hidden from view.

Teal were relatively widespread occurring in 53 subsites overall and within 50 subsites during low tide surveys. 33 subsites supported the species on a regular basis (three or more low tide surveys). 0H519 (Poulnasherry outer bay) was notable in supporting peak numbers on three low tide survey occasions and the subsite peak count (510 individuals) on 20th October 2010. 0K509 (Carrig Island) held peak numbers on 24th November 2010.

Foraging Distribution

Teal are omnivorous and have a variety of foraging methods (e.g. dabbling and up-ending) within differing habitats. Areas of shallow water are favoured including shallow estuaries, tidal creeks and the edges of salt and freshwater marsh.

Across the Shannon & Fergus estuaries, the numbers of intertidally-foraging Teal surpassed the number foraging subtidally during all surveys, including the high tide survey. Indeed, intertidal foraging was a widespread activity occurring within 44 subsites overall. Only three subsites recorded the species during all four low tide surveys: 0H519 (Poulnasherry outer bay), 0I426 (Ballydonoghue) and 0I437 (Aughinish East).
0I426 (Ballydonoghue) supported peak numbers during the October low tide survey, and the adjacent 0I425 (Cook's Pt (Tarbert)) supported peak numbers the following month, the birds positioned along low tide channels and creeks. Thereafter, 0H519 (Poulnasherry outer bay) supported peak numbers in all remaining surveys, including the January 2011 high tide survey. These birds favoured intertidal muds in and around a small low tide channel in the northeast corner of the subsite during all of these surveys (Moyasta), where they foraged together with Pintail and Mallard ducks. Therefore, although assigned to intertidal habitat, this species is clearly associated with water in the form of small creeks and channels or freshwater flows over the mudflat.

Teal foraged subtidally within 0H528 (Drumquin Pt.-Inishmore Pt.) and 0I427 (Coonagh Point) during all four low tide surveys. A small low tide channel extending out from Drumquin Point was favoured within 0H528. Good numbers were also recorded within 0I457 (Corkanree) on three survey occasions. 287 Teal foraged subtidally during the January 2011 high tide survey, over 50% of these birds within 0H528 (Drumquin Pt.-Inishmore Pt.).

Shannon Airport Lagoon (0H509: Golf Tee- Shannon) recorded foraging Teal in all surveys, the maximum number was 95 individuals during the high tide survey (26/01/2011). Good numbers were also recorded in Mangan's Lagoon at Aughinish Island (within subsite 0I438) with a peak number of 63 individuals. Terrestrial foraging was recorded in association with 0H552 (Rineanna Point), 0I432 (Ballinvoher) and 0K509 (Carrig Island).

The subsite peak intertidal foraging density was 13.3 Teal ha^{-1} recorded for 0H516 (Tarbert Point). This was followed closely by a density of 11.1 Teal ha^{-1} recorded for Cook's Pt (Tarbert). Thereafter all recorded densities were lower than 5 Teal ha^{-1}. The whole site average intertidal foraging density was 0.14 Teal ha^{-1}.

Roosting Distribution

Good numbers of Teal were recorded roosting/other during all surveys. Intertidally this behaviour was recorded across 36 subsites but 0H531 (Ing Point - Deenish Isl.) is notable for supporting peak or second highest numbers during all surveys, with a peak number of 230 individuals on 22/11/10. These birds favoured an area close to a creek off Rine Point (called Eskgarriff or Clenagh Creek on OS maps).
0H519 (Poulnasherry outer bay) supported the peak number (503) of individuals roosting intertidally during the October low tide survey, good numbers in January 2011 and peak numbers during the high tide survey, although the latter related to a relatively low 23 individuals.
Other notable subsites were 0I436 (Poulaweala Creek), 0H506 (Ballycorrick Creek) and 0H517 (Querrin), the latter which supported 170 individuals on 24/11/10.

Lower numbers of Teal were recorded subtidally in roosting/other behaviour, although this was recorded across 24 subsites overall. No patterns with regards distribution are evident.

A total of 1,061 Teal were recorded roosting during the roost surveys on 24th and 25th February 2011. 0H528 (Drumquin Pt.-Inishmore Pt.) supported the greatest number with 93 Teal at five different roost locations. A further six subsites supported more than 50 individuals: 0H512, 0H515, 0H516, 0H552, 0I445 and 0K509.

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 occur year-round, breeding primarily on rocky cliffs and offshore islands. Whilst most breeding birds are resident, a proportion of the population move south during winter.
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), although the greatest concentrations of Cormorants still occur at coastal sites (Boland & Crowe, 2012).

Numbers

The whole-site peak number of Cormorants occurred in January 2011 (623 individuals) but only 197 individuals were counted later in the month during the high tide survey (January 26/27th). All surveys recorded total numbers of all-Ireland importance. 113 Cormorants were recorded during the aerial I-WeBS survey on 17th January 2011.

Cormorants were recorded in 48 subsites overall and within 44 during low tide surveys. 15 subsites held the species on a regular basis (three or more low tide surveys).

0I449 (Glin castle to Colmanstown) held peak numbers on two low tide survey occasions (24/11/10 and 07/01/11). 0I431 (Way Rock) held peak numbers on 21/10/10. 0I444 (Carriglogher pt) held peak numbers on 18/02/11. The subsite peak of 575 individuals was recorded for 0I449 (Glin castle to Colmanstown) and represents numbers of all-Ireland importance.

Foraging Distribution

Cormorants are piscivorous (fish-eating) seabirds that forage in shallow water. Roycroft et al. (2009) found that Cormorants were recorded in highest densities in waters of less than 30m depth.

Within the Shannon and Fergus estuaries, subtidal foraging was recorded across 34 subsites overall although only two subsites in the outer site (0K507: Dooneen Pt – Corcas & 0K508: Bunaclugga Bay) recorded individuals during all four low tide surveys (but none during the high tide survey). 0I449 (Glin castle to Colmanstown) recorded peak numbers during one low tide survey (November 2010) and during the January 2011 high tide survey.

Roosting Distribution

Cormorants were recorded in roosting/other behaviour across intertidal habitat of 25 subsites. Peak numbers were recorded for 0I428 (Pigott's Island), 0I449 (Glin castle to Colmanstown) (on two occasions), and 0I444 (Carriglogher pt) for the four low tide surveys respectively. 0I449 (Glin castle to Colmanstown) recorded peak numbers during two low tide surveys and during the high tide survey and had a peak count of 701 individuals during January 2011. The birds were located along the northern shore of this subsite and on and around Boland's Rock, in numbers often considered to be underestimated due to the distance of the birds from vantage points. The numbers recorded here accounted for between 74% and 98% of all Cormorants counted roosting/other on the respective survey days.
0I444 (Carriglogher pt) was notable for supporting good numbers ranked as peak or second highest in all surveys (peak number 36 individuals) and Laheen's Rock and Grass Island were favoured positions.

Notable aggregations of Cormorants roosting supratidally were 75 individuals in 0I449 (Glin castle to Colmanstown) during the January high tide survey (on Boland's Rock), and 74 individuals on Maiden Rock (within 0I431 - Way Rock) on 21/10/10.

Fewer individuals were recorded roosting during the high tide survey and a relatively low 67 individuals roosted during the roost survey in February 2011, numbers highest in 0H529, 0I440 and 0I445.

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

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

Numbers

Total site numbers of Ringed Plovers peaked early in October 2010 when 223 individuals surpassed the threshold of all-Ireland importance. 104 Ringed Plovers were recorded during the high tide survey during January 2011.

Ringed Plovers were recorded in a total 20 subsites throughout the survey programme but subsite use during individual low tide surveys ranged from seven to ten, with only three subsites supporting the species during the high tide survey. Furthermore, this wader species occurred regularly (three low tide surveys or more) within only three subsites: 0I442 (Glin Pier), 0K508 (Bunaclugga Bay) and 0K509 (Carrig Island). 0K508 (Bunaclugga Bay) held peak numbers during all surveys and recorded the subsite peak of 91 individuals (20/10/10).

Foraging Distribution

Ringed Plovers are 'visual foragers' searching the sediment surface for the visible signs of prey such as worms, crustaceans and insects.

Across the survey programme, the proportions of Ringed Plover recorded foraging ranged from 97% to 100%. Combining data for intertidal, supratidal and subtidal habitats (the latter where birds had their feet in water), Ringed Plovers foraged across a total of 19 subsites overall. Only two subsites recorded the species during all four low tide surveys: 0K508 (Bunaclugga bay) and 0K509 (Carrig Island). Bunaclugga Bay supported peak numbers during all low tide surveys and accounted for up to 42% of all foraging individuals on one occasion, with a peak number of 91 individuals. 0K509 (Carrig Island) supported a maximum number of 39 individuals during the November 2010 low tide survey. Both of these subsites are in the outer section of the estuary, towards the mouth, a pattern that is evident in the distribution of this species at other sites (Musgrove et al. 2003). Indeed a substantial proportion of Ringed Plovers occur on non-estuarine coasts, the species exhibiting a degree of plasticity in habitat choice and being found in habitats such as shingle shores, saltmarsh and short grassland as well as artificial habitats.

0H519 (Poulnasherry outer bay) held relatively good numbers (28) on one occasion (20/10/10) as did 0I443 (Long Rock (Glin)), 24 individuals during the November low tide survey. 0I442 (Glin pier) held lower numbers during three low tide surveys. Thereafter 13 subsites held lower numbers (<20) irregularly.

The intertidal sediments of 0K508 (Bunaclugga bay) and 0K509 (Carrig Island) are predominantly sandy with a benthic community classified as 'intertidal sand with *Scolelepis squamata* and *Pontocrates* spp.' (NPWS, 2012). The upper shore is characterised by a Fucoid-dominated intertidal reef. Bunaclugga Bay (0K508) also has a vegetated shingle spit. The amphipod *Pontocrates* spp. and other burrowing amphipods that are characteristic of these shores are likely to form a major part of the diet of the Ringed Plover here.

The peak intertidal foraging density was 1.2 Ringed Plover ha^{-1} recorded for 0H517 (Querrin), the only subsite to record a density of greater than one bird per hectare. The whole site average intertidal foraging density was 0.02 Ringed Plover ha^{-1}.

Roosting Distribution

During low tide surveys Ringed Plovers were recorded roosting intertidally on single occasions only in the following four subsites: 0H526 (Labasheeda Bay west Redgap pt), 0I425 (Labasheeda Bay west Redgap pt), 0I427 (Coonagh point) and 0I443 (Long Rock (Glin)).

86 Ringed Plovers were recorded roosting during the high tide survey, all in supratidal habitat. 0K508 (Bunaclugga Bay) supported the majority (66 birds) and 0I449 (Glin castle to Colmanstown) recorded 20 individuals.

59 Ringed Plover were recorded roosting across five subsites during the roost survey (February 2011). The peak number (28) were located at a single mixed species roost on shingle/mixed sediment within 0K508 (Bunaclugga Bay) where the plovers roosted with Redshank, Turnstone, Greenshank and Curlew.

Ringed Plovers are thought to be highly faithful to roost sites (e.g. Rehfisch et al. 2003) with a key criteria of suitable roosting sites being proximity to feeding areas. It is interesting to note the preference of 0K508 (Bunaclugga Bay) for roosting area given its importance as a foraging ground.

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 125^0E in the north Siberia lowlands south of Taymyr (Delaney et al. 2009). The nominate *P. a apricaria* breeds at more southerly latitudes including Ireland and Britain and migrates south for winter. The Golden Plovers that winter in Ireland are thought to be mostly Icelandic-breeding birds *P. a. altifrons* (Wernham et al. 2002).

Numbers

Numbers of Golden Plover rose from 7,075 in October 2010, to 11,221 in November 2010, before declining sharply to 1,453 in January 2011 with only 249 individuals during the January high tide count. This decline in numbers is likely due to the cold weather spell in December and January, Golden Plovers being noted for wide-scale movements with the onset of severe cold weather (see refs in Wernham et al. 2002). While the October and November 2010 counts surpassed the threshold of all-Ireland importance, the November 2010 count surpassed the threshold of international importance.

Golden Plovers were recorded in 26 subsites overall and regularly (three low tide surveys or more) within 12 subsites: 0H512, 0H522, 0H524, 0H528, 0H531, 0H534, 0I431, 0I439, 0I441, 0I489, 0K507 and 0K509.

Four subsites held peak numbers during low tide surveys: 0I445 (Scarlet Reach), 0H515 (Tullyvarraga Pt.-Inishcullin P), 0H531 (Ing Point - Deenish Isl.) and 0K509 (Carrig Island) for the four dates respectively. The peak subsite count was 2,200 Golden Plovers within 0H515 on 22/11/10.

Foraging Distribution

During winter, Golden Plovers feed primarily within agricultural grassland and arable land. Tidal flats are used more as a roosting/resting habitat and the birds tend to favour large, open tidal flats. As a consequence, Golden Plovers tend to be in large aggregations when observed upon tidal flats. Intertidal feeding is observed to a greater degree during cold weather periods when grassland feeding areas are frozen over. Although Golden Plovers eat a wide range of invertebrate species, relatively little is known about intertidal feeding patterns (Gillings et al. 2006).

During the 2010/11 Waterbird Survey Programme, Golden Plovers were recorded foraging intertidally within nine subsites. Most records were single observations with the exception of 0H524 (Kilmurry Creek) which recorded foraging birds on three survey occasions (6, 49 & 6 individuals during the November, January and February low tide surveys respectively). Of note was a flock of 1,000 foraging individuals in 0I489 (Beagh Castle to Bushy Is.) on 22/11/10.

Terrestrial foraging was recorded on one occasion only (ten individuals adjacent 0K509 on 20/10/10), although it is likely to be undertaken widely around the site and outside of the SPA boundary.

Roosting Distribution

Roosting Golden Plovers were recorded across intertidal habitat of 23 subsites; the peak number was 9,330 individuals during the November 2010 low tide survey. 0H534 (Cahiracon) recorded roosting individuals during all four low tide surveys but the subsite peak number was recorded for 0H515 (Tullyvarraga Pt.-Inishcullin P) on 22/11/10 (2200 Golden Plovers). Significant numbers (>1500 individuals) were also recorded within 0H512 (Connor's Rock), 0H531 (Ing Point - Deenish Isl.), 0I445 (Scarlet Reach) and 0I489 (Beagh Castle to Bushy Is.).

No intertidal roosting was recorded during the high tide survey but supratidally roosting birds were recorded within 0I441 (Hiphall Pt - Coalhall Pt.) and 0I443 (Long Rock (Glin)). In addition 197 Golden Plovers roosted terrestrially in 0I491 (Greenish Island).

Terrestrially roosting birds were recorded adjacent to 0K509 (Carrig Island) during the October and November 2010 low tide surveys (maximum number 1,150). These birds were part of a large mixed-species roost on Kilelton Polder (outside the SPA boundary).

The roost survey recorded birds in association with two subsites only: 0I491 and 0K509. 75 birds roosted supratidally within 0I491 (near to Tomdeely Point) and 1,155 birds roosted as part of a large mixed-species roost on Kilelton Polder (outside SPA boundary).

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

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

Numbers

Numbers of Grey Plover peaked early with 206 individuals counted during the October 2010 low tide survey, representing numbers of all-Ireland importance. Numbers were significantly lower during the January 2011 low and high tide counts, likely due to the cold weather spell in December and January which may have caused birds to migrate south.

Grey Plovers were recorded in 25 subsites overall (21 during low tide surveys) but regularly (three low tide surveys or more) within only five subsites: 0H510, 0H519, 0H528, 0H552 and 0I437. Four of these also held peak numbers during low tide surveys 0I437 (Aughinish east) on 21/10/10, 0H519 (Poulnasherry outer bay) on 24/11/10 and 07/01/11, and 0H528 (Drumquin Pt.-Inishmore Pt.) and 0H552 (Rineanna Point) (jointly) on 19/02/11. The peak subsite count was 96 Grey Plovers within 0I437 on 21/10/10.

Foraging Distribution

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

During the 2010/11 Waterbird Survey Programme, Grey Plovers were recorded foraging in intertidal habitat only. 91% of all recorded Grey Plovers were foraging individuals and the species was distributed across a total 19 subsites. 0H519 (Poulnasherry outer bay) and 0H528 (Drumquin Pt.-Inishmore Pt.) were the only two subsites to support this species during all four low tide surveys.

0I437 (Aughinish East) held peak numbers in October 2010 (96 Grey Plovers). 0H519 (Poulnasherry outer bay) held peak numbers in November 2010 and January 2011; and 0H528 (Drumquin Pt.-Inishmore Pt.) held peak numbers during the final (February 2011) low tide survey. In addition, 0H552 (Rineanna Point) supported good numbers on three survey occasions and 0H531 (Ing Point - Deenish Isl.) on two occasions (peak number 40).

A degree of subsite preference is therefore evident although the subsites favoured are not clustered and occur in both the inner and outer site. The benthic community of subsites used by Grey Plovers is classified as 'intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans' (NPWS, 2012). This broad community type has a wide variability in sediment type from gravel to fine sand to muds. While fine sands occur around Aughinish, the northwest inner reaches of Poulnasherry are muddy sand. Distinguishing invertebrates of this community type include polychaete *Hediste diversicolor,* bivalve *Macoma balthica*, mollusc *Hydrobia ulvae* and amphipod *Corophium volutator*. The latter is particularly abundant in the Fergus estuary (relating to 0H528).

The peak intertidal foraging density was 1.2 Grey Plover ha^{-1} recorded for 0I458 (Askeaton). This subsite only recorded foraging individuals on one occasion (February 2011). The second highest recorded density was 0.5 individuals ha^{-1} recorded for 0I437 (Aughinish East). The whole site average intertidal foraging density was 0.02 Grey Plover ha^{-1}.

Roosting Distribution

Relatively few observations of Grey Plovers in roosting/other behaviour were made during low tide surveys; single observations were made for 0H521 (Clonderlaw Bay outer), 0H534 (Cahiracon) and 0I429 (Ringmoylan Qy.-Shannongrove Pt).

Supratidal roosting was recorded in four subsites during the high tide survey: 0H512 (Connor's Rock), 0I437 (Aughinish East), 0I441 (Hiphall Pt - Coalhall Pt.) and 0K507 (Dooneen Pt - Corcas) with a peak subsite number of seven birds (0K507).

Terrestrial roosting was recorded adjacent to 0K509 (Carrig Island) (outside of the SPA boundary). During the October low tide survey, six birds roosted in Sean's Polder and during the January 2011 high tide survey three birds roosted in Sean's Polder and six roosted in Kilelton Polder, both mixed-species roosts.

The February 2011 roost survey recorded birds in association with three subsites only: 0H511 (Rinnanna South) in the inner estuary and 0H519 (Poulnasherry outer bay) and 0K509 (Carrig Island) in the outer estuary. 16 Grey Plover were recorded on Sean's Polder, again part of a mixed-species roosting flock. 21 individuals roosted intertidally within 0H519 but the largest single roost was recorded on the intertidal flats of 0H511 (39 individuals).

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

Numbers of Lapwing peaked in November 2010 when 10,873 Lapwings surpassed the threshold of all-Ireland importance. Numbers fell sharply in December and January likely due to the cold weather spell in December and January; similar to the pattern noted during the cold spell of 2009/10 (Crowe et al. 2011).

Lapwings were recorded in 51 subsites overall and regularly (three low tide surveys or more) within 22 subsites: 0H506, 0H508, 0H512, 0H514, 0H526, 0H527, 0H528, 0H533, 0H552, 0I427, 0I428, 0I436, 0I437, 0I441, 0I443, 0I444, 0I445, 0O446, 0I489, 0I491, 0K507 and 0K509.

Peak numbers during low tide surveys were supported by 0I445 (Scarlet Reach), 0I436 (Poulaweala Creek), 0I444 (Carriglogher pt) and 0K509 (Carrig Island) for the four dates respectively. The peak subsite count was 2,158 Lapwings for 0I436 (Poulaweala Creek) on 22/11/10.

Foraging Distribution

Lapwings are traditionally 'inland' waders. During winter they can be observed across a wide variety of habitats, principally using lowland farmland and freshwater wetlands (e.g. turloughs and callows) but also coastal wetlands where they feed on a variety of soil and surface-living invertebrates. They are opportunistic and mobile birds and will readily exploit temporary food sources such as newly-ploughed fields. Estuaries are typically used as roosting areas where large flocks may be observed upon the tidal flats. Coastal habitats tend to be used more during cold weather events when farmland and freshwater habitats freeze over.

Lapwings were recorded foraging intertidally across 37 subsites overall, a relatively widespread distribution for this species. Five subsites recorded the species foraging on three or more low tide survey occasions: 0H506 (Ballycorrick Creek), 0H512 (Connor's Rock), 0I437 (Aughinish East), 0I444 (Carriglogher pt) and 0I445 (Scarlet Reach). Few patterns in terms of distribution are evident however, with many subsites recording the birds on a single occasion only. Three subsites held peak numbers during low tide surveys, all in the inner estuary: 0I491 (Greenish Island) (October 2010 and February 2011), 0I445 (Scarlet Reach) (November 2010) and 0I444 (Carriglogher pt) (January 2011).

Terrestrial foraging was recorded adjacent to 0H552 (Rineanna Point) and 0I433 (Washpool Creek) on a single occasion each during low tide surveys and adjacent to four subsites during the high tide survey on 26/27th January 2011 (0H418 (Moyhill Marsh), 0I441 (Hiphall Pt - Coalhall Pt.), 0I444 (Carriglogher pt) and 0K509 (Carrig Island)). With regard the latter, 136 Lapwing foraged along with Wigeon and Curlew in a grass field just east of Kilelton Polder.

Roosting Distribution

Lapwings were recorded roosting intertidally across 42 subsites during the survey programme. Ten subsites supported roosting individuals on three or more survey occasions: 0H506, 0H512, 0H528, 0H533, 0I427, 0I428, 0I441, 0I443, 0I444 and 0K509. 0I436 (Poulaweala Creek) recorded the peak number (2158) on 22/11/10. There is little pattern to the roosting distribution but 0I427 (Coonagh Point) is notable for supporting numbers ranked in the top four in all low tide surveys and 0K509 (Carrig Island) supported peak numbers in one low tide survey plus numbers ranked as second highest numbers in a further low tide survey plus the high tide survey.

Lapwings roosted supratidally across 11 subsites during the January high tide survey, the greatest number located within 0H418 (Moyhill Marsh). Terrestrial roosting was recorded in/adjacent to 12 subsites during the high tide survey. In contrast, the high tide roost survey in February 2011 recorded only 26 individuals across two subsites, the majority within 0H419.

Knot *Calidris canutus* - Family (group): Scolopacidae (wading birds)
Knot are a high Arctic breeding species. Two populations are recognised in Western Eurasia and Africa - *C. c canutus* and *C. c. islandica*. The latter breeds in north and east Greenland and northern Canada and winters in north-west Europe. Knot that winter in Ireland are almost entirely from the *islandica* population. The Wadden Sea is an important staging ground for the species after a non-stop flight from the breeding grounds (van der Kam, 2004).
Numbers
Numbers of Knot peaked in October 2010 when 621 individuals surpassed the threshold of all-Ireland importance. Thereafter numbers were variable with 550 counted during the January low tide count but only 198 recorded later that month during the high tide survey. Knot were recorded in 25 subsites overall but with regularly (three low tide surveys or more) within only five subsites: 0H522, 0H528, 0H531, 0H533, 0H534. Two of these held peak numbers during low tide surveys; 0H531 (Ing Point - Deenish Isl.) during October and November 2010, and 0H528 (Drumquin Pt.-Inishmore Pt.) during the January and February 2011 surveys. 0H531 also supported peak numbers (112) during the high tide survey, accounting for 57% of all Knot recorded during that survey.
Foraging Distribution
Knots are specialist intertidal foragers; pecking visible items off the surface or probing to the depth that their bill (3.5cm) allows. The preferred prey items are bivalve molluscs including *Scrobicularia plana, Macoma balthica* and *Mytilus edulis* of smaller size-classes (shell length in the range 6 – 16mm depending on bivalve species and shape of shell) (Dekinga & Piersma, 1993). *Hydrobia ulvae* may also be an important prey at some sites (Moreira, 1994). Knot foraged intertidally across 21 subsites during the survey programme although 14 of these recorded the species on one occasion only. A relatively localised distribution is evident in the dataset; 0H531 (Ing Point - Deenish Isl.) supported peak numbers during October and November 2010 and during the January 2011 high tide survey, and 0H528 (Drumquin Pt.-Inishmore Pt.) recorded peak numbers during the January and February 2011 low tide surveys. The subsite peak number was 350 foraging individuals (0H528 06/01/11). These subsites are adjacent to each other in the mid Fergus Estuary and have a benthic community classified as 'intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans' (NPWS, 2012). This broad community type has a wide variability in sediment type from gravel to fine sand to muds. Distinguishing invertebrates of this community type include polychaete *Hediste diversicolor,* bivalve *Macoma balthica*, mollusc *Hydrobia ulvae* and amphipod *Corophium volutator*. 0H522 (Clonderlaw Bay Inner) was notable in supporting foraging Knot during all four low tide surveys, as did 0H533 (Inishmore Pt-Inishoul), the latter on the western side of the Fergus estuary. The peak intertidal foraging density was 2.4 Knot ha^{-1} recorded for 0H524 (Kilmurry Creek). The second highest was 1.41 Knot ha^{-1} recorded for 0I489 (Beagh Castle to Bushy Is.). All other densities recorded were less than 0.5 individuals per hectare. The whole site average intertidal foraging density was 0.07 Knot ha^{-1}.
Roosting Distribution
Relatively few records of roosting Knot were made with only two observations during low tide surveys; the peak number of 51 within 0I458 (Askeaton) on 19/02/11 (although note that this subsite was included in counts on this survey date only). During the January 2011 high tide survey, 50 Knot roosted supratidally within 0I430 (Black Rock to Mellon Pt.). During the roost survey (February 2011) 92 Knot roosted terrestrially in Sean's Polder as part of a mixed species flock (adjacent to 0K509 (Carrig Island) and outside the SPA).

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 numbers peaked in November 2010 when a site total of 14,537 were recorded, representing numbers of international threshold. The lower number recorded during the high tide survey (6,566) is partially attributed to an underestimation of numbers as a result of the availability of roosts in areas inaccessible to fieldworkers (Cummins & Crowe, 2011).

Overall, Dunlin were recorded within 53 subsites. They occurred regularly (three low tide surveys or more) within 32 subsites: 0H419, 0H510, 0H512, 0H514, 0H515, 0H519, 0H522, 0H524, 0H528, 0H530, 0H531, 0H533, 0H534, 0H552, 0I426, 0I428, 0I429, 0I430, 0I431, 0I437, 0I438, 0I441, 0I442, 0I443, 0I444, 0I445, 0I446, 0I489, 0I490, 0I491, 0K508 and 0K509.

Peak low tide numbers were recorded for 0H530 (Ing), 0I444 (Carriglogher pt), 0H522 (Clonderlaw Bay Inner) and 0H528 (Drumquin Pt.-Inishmore Pt.) for the four dates respectively. The subsite peak count of 6,440 Dunlin was recorded for 0H528 on 19/02/11.

Foraging Distribution

Dunlin foraged in intertidal habitat widely across the site, occurring in 51 subsites overall. They foraged most regularly (in all four low tide surveys) within 11 subsites: 0H510 (Brackinish Rock to Carrigkeal), 0H519 (Poulnasherry outer bay), 0H522 (Clonderlaw Bay Inner), 0H528 (Drumquin Pt.-Inishmore Pt.), 0I431 (Way Rock), 0I437 (Aughinish East), 0I441 (Hiphall Pt - Coalhall Pt.), 0I444 (Carriglogher pt), 0I445 (Scarlet Reach), 0K508 (Bunaclugga Bay) and 0K509 (Carrig Island). Peak numbers during low tide surveys were recorded for 0H430 (Ing) (1,800 individuals), 0I444 (Carriglogher pt) (2,213 individuals), 0H522 (Clonderlaw Bay Inner) (2,620 individuals) and 0H528 (Drumquin Pt.-Inishmore Pt.) (6,440 individuals) for the four surveys respectively; the latter subsite also supported peak numbers foraging intertidally during the high tide survey (2,400 Dunlin). Other subsites of note were 0H508 (Tullyglass Pt to Tullyvanga Pt), (2,264 Dunlin on 22/11/10), 0H514 (Saint's Island) (2,024 individuals on 06/01/11), 0H529 (Islandavanna Upper) that recorded Dunlin only on one occasion but in large numbers (2,000), 0H531 (Ing Point - Deenish Isl.) which supported numbers ranked as second highest on two survey occasions (peak number 1,725), and 0I445 (Scarlet Reach) that supported second highest numbers on 22/11/10 (1,887 individuals) and regularly held good numbers.

These results suggest that Dunlin have a widespread foraging distribution across the site and as a versatile species, they are likely to exploit a variety of intertidal food resources. The dominant intertidal benthic community type across the site is 'intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans' (NPWS, 2012). This broad community type has a wide variability in sediment type from gravel to fine sand to muds. Distinguishing invertebrates of this community type include polychaete *Hediste diversicolor,* bivalve *Macoma balthica*, mollusc *Hydrobia ulvae* and amphipod *Corophium volutator*.

The peak intertidal foraging density was 31.9 Dunlin ha^{-1} recorded for 0H529 (Islandavanna Upper) during February 2011. 0H514 (Saint's Island) recorded a density of 19.4 Dunlin ha^{-1} and 0H530 (Ing) a density of 17.5 Dunlin ha^{-1}. Nine subsites recorded a density over 10 individuals per hectare. The whole site average intertidal foraging density was 1.7 Dunlin ha^{-1}.

Roosting Distribution

During low tide surveys, most Dunlin were recorded foraging. Intertidal roosting/other behaviour was recorded irregularly, and often on a once-off basis for seven subsites: 0H528, 0H533, 0I427, 0I428, 0I443, 0I490 and 0K508; the birds generally associated with larger flocks that were foraging.

During the high tide survey (January 2011), 2,950 Dunlin were recorded roosting across intertidal, supratidal and terrestrial habitats. 1,376 Dunlin roosted intertidally - 1,206 Dunlin within 0H511 (Rinnanna South), 160 within 0I444 (Carriglogher pt) and ten within 0H528 (Drumquin Pt.-Inishmore Pt.). 1,019 Dunlin roosted supratidally, the greatest proportion (37%) located within 0I449 (Glin castle to Colmanstown). 210 were located within 0H508 (Tullyglass Pt to Tullyvanga Pt), and 120 were within 0I438 (Aughinish Isl.), smaller numbers across a further ten subsites. 275 Dunlin roosted terrestrially in 0H522 (Clonderlaw Bay Inner) and a further 280 within 0I491 (Greenish Island), both outside of the SPA boundary.

During the February 2011 roost survey, a relatively low 275 Dunlin were recorded roosting, these birds distributed across ten subsites. A further 1,573 Dunlin were recorded foraging on this day.

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

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

Numbers

Numbers of Black-tailed Godwits peaked early with 9,052 recorded during the October low tide survey. Thereafter numbers were variable and reduced significantly during January 2011 (780 and 683 counted during low and high tide surveys respectively), likely as a result of the cold weather at this time. Numbers increased slightly again for the final low tide count in February 2011 (1,025). All counts surpassed the threshold of international importance. 1,112 Black-tailed Godwits were recorded during the aerial I-WeBS survey on 14th December 2010.

Black-tailed Godwits were relatively widespread in their distribution and recorded within 40 subsites overall. They occurred regularly (three low tide surveys or more) within 13 subsites: 0H510, 0H514, 0H516, 0H528, 0H530, 0H531, 0H532, 0I428, 0I432, 0I436, 0I444, 0I489 and 0K509. Three subsites held peak numbers during low tide surveys. 0H512 (Connor's Rock) held peak numbers during October but did not record the species again all season. The count of 2,403 Black-tailed Godwits was also the highest subsite count recorded during the survey programme. 0I437 (Aughinish East) held peak numbers in November 2010 (672 individuals) (international importance). 0H531 (Ing Point - Deenish Isl.) supported peak low tide numbers in January and February 2011.

Foraging Distribution

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

Black-tailed Godwits were relatively widespread and foraged intertidally across 37 subsites overall. Only two subsites 0H531 (Ing Point - Deenish Isl) in the Fergus estuary, and the small subsite 0I436 (Poulaweala Creek) recorded foraging individuals in all four low tide surveys. A further eight subsites recorded foraging individuals during three surveys: 0H510 (Brackinish Rock to Carrigkeal), 0H528 (Drumquin Pt.- Inishmore Pt.), 0H530 (Ing), 0H532 (Deenish Is. - Rineanna Pt), 0I428 (Pigott's Island), 0I432 (Ballinvoher), 0I444 (Carriglogher pt), and 0I489 (Beagh Castle to Bushy Is.). All of these subsites are in the inner Shannon estuary count area and four of them are in the Fergus Estuary.

Peak numbers during low tide surveys were recorded for 0H510 (Brackinish Rock to Carrigkeal), 0I437 (Aughinish East), 0H531 (Ing Point - Deenish Isl.), and 0H531, for the four low tide surveys respectively. The peak subsite count was 1,335 supported by 0H510 (Brackinish Rock to Carrigkeal) on 21/10/10. Other subsites of note were 0H530 (Ing) which supported numbers ranked in the top four on three survey occasions, and 0H532 (Deenish Is. - Rineanna Pt) which recorded numbers ranked in the top five on three survey occasions.

0H509 (Golf Tee- Shannon), otherwise known as Shannon Airport Lagoon, held 1,068 foraging individuals during the October 2010 low tide survey. Terrestrial foraging, outside of the SPA boundary, was not recorded regularly but is likely to be widespread around the site. Birds foraged terrestrially adjacent to 0K509 (Carrig island) on three survey occasions.

Although relatively versatile in terms of habitat choice, Black-tailed Godwits are generally found in muddier sediments within inner estuaries, favouring biotopes that support favoured prey such as bivalves *Macoma balthica*, *Scrobicularia plana* or polychaete *Hediste diversicolor.* This is in agreement with the pattern of distribution noted above i.e. the preference for inner estuary subsites. The dominant intertidal benthic community type across the site is 'intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans' (NPWS, 2012). This broad community type has a wide variability in sediment type from gravel to fine sand to muds. The polychaete *Hediste diversicolor* and the bivalve *Macoma balthica* are recorded in moderate to high abundances throughout this community complex, both potential prey items for Black-tailed Godwits.

The overall peak intertidal foraging density was 9.4 Black-tailed Godwits ha^{-1} recorded for 0I489 (Beagh Castle to Bushy Is.). This was closely followed by 0H510 (Brackinish Rock to Carrigkeal) with 9.3 Black-tailed Godwits ha^{-1}. 0H530 (Ing) and 0I436 (Poulaweala Creek) also recorded densities of greater than five godwits per hectare. The whole site average intertidal foraging density was 0.28 Black-tailed Godwits ha^{-1}.

Roosting Distribution

Records of Black-tailed Godwits in roosting/other behaviour during low tide surveys were irregular and recorded for nine subsites overall: 0H506, 0H510, 0H512, 0H514, 0H516, 0H528, 0I431, 0I436 and 0I437. Of note was the count of 2,400 roosting within 0H512 (Connor's Rock) on 21/10/10.

During the January 2011 high tide survey, 373 Black-tailed Godwits were recorded roosting (309 recorded foraging). 197 Black-tailed Godwits roosted terrestrially (outside SPA) within 0I436 (Poulaweala Creek); 125 roosted with their feet in water within 0H508 (Tullyglass Pt to Tullyvanga Pt.).

The February 2011 roost survey recorded 189 Black-tailed Godwits roosting across six subsites: 0H514, 0H529, 0H531, 0I428, 0I430 and 0I431. All of these subsites are in the inner Shannon estuary count area and two of them are in the Fergus Estuary. The largest single roost was 89 individuals at a single mixed-species roost along the north-eastern shoreline of 0H514 (Saint's Island).

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

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

Numbers

In contrast to species that were present in lower numbers during the cold weather period (December 2010 – January 2011), Bar-tailed Godwits were more numerous at this time with 885 recorded during the high tide survey at the end of January 2011, and 522 recorded earlier in the month during the low tide survey. The highest count previous to this was in October 2010 when 303 individuals were recorded. All site counts surpassed the threshold of all-Ireland importance.

Bar-tailed Godwits were recorded in 17 subsites overall, although subsite occurrence during individual low tide surveys ranged from seven to 13 subsites. The species was recorded regularly (three low tide surveys or more) in seven subsites: 0H520, 0H522, 0H523, 0H533, 0H534, 0I437 and 0K507. Peak counts for the four low tide counts were recorded for 0H533 (Inishmore Pt-Inishoul), 0H522 (Clonderlaw Bay Inner), 0H528 (Drumquin Pt.-Inishmore Pt.) and 0H523 (Burrane Pt - Kilmore Pt) for the four respective dates. The peak subsite count was 250 Bar-tailed Godwits on 06/01/11.

Foraging Distribution

Bar-tailed Godwits forage by probing within intertidal sediment for invertebrate species, predominantly large polychaete worms such as *Arenicola marina* and *Nepthys* sp. They often feed at the tide edge with their heads in water. The species is characteristic of sites with sandy substrates (e.g. Hill et al. 1993) or sections of a site that have sandy (as opposed to muddy) sediment.

During the 2010/11 survey programme, Bar-tailed Godwits were only recorded foraging intertidally. They had a relatively restricted foraging distribution; recorded foraging within 17 subsites overall. Only two subsites recorded foraging individuals in all four low tide surveys: 0H520 (Poulnasherry inner bay) and 0H533 (Inishmore Pt-Inishoul), and the latter supported peak numbers during the October 2010 low tide survey and numbers ranked as second highest on one other survey occasion. 0H522 (Clonderlaw Bay Inner) supported peak numbers during the November low tide survey (51 individuals) and 0H528 (Drumquin Pt.-Inishmore Pt.) recorded peak numbers during January 2011 with a subsite peak number of 250 birds. 0H523 (Burrane Pt - Kilmore Pt) supported 100 foraging individuals during the final (February 2011) low tide survey, accounting for 41% of all those recorded during that survey.

The dominant intertidal benthic community type across the site is 'intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans' (NPWS, 2012). This broad community type has a wide variability in sediment type from gravel to fine sand to muds. Distinguishing invertebrates of this community type include polychaete *Hediste diversicolor,* bivalve *Macoma balthica*, mollusc *Hydrobia ulvae* and amphipod *Corophium volutator*. Of note are high abundances of *Nephtys hombergii* that occur from the lower Fergus Estuary (relating to subsite 0H533) westwards, this polychaete a known prey species of Bar-tailed Godwits (e.g. Scheiffarth, 2001).

The overall peak intertidal foraging density was 1.9 Bar-tailed Godwits ha^{-1} recorded for 0H523 (Burrane Pt - Kilmore Pt). This was closely followed by 0H524 (Kilmurry Creek) which supported a peak 1.5 Bar-tailed Godwits ha^{-1}. Only one other subsite recorded over 0.5 Bar-tailed Godwits ha^{-1} (0I490 Bushy Point). The whole site average intertidal foraging density was 0.04 Bar-tailed Godwits ha^{-1}.

Roosting Distribution

Bar-tailed Godwits were not recorded in roosting/other behaviour during low tide surveys.
Roosting behaviour was observed during the high tide survey (26/27 January 2011). During this survey a total 867 individuals were recorded roosting and 69% of these were located within 0H528 (Drumquin Pt.-Inishmore Pt.) positioned intertidally near Drunquin. A further 190 birds roosted terrestrially just outside the SPA, just east of where Kilmurry Creek enters the site in 0H522 (Clonderlaw Bay Inner). Smaller numbers were located within three further subsites: 0I437 (Aughinish East), 0K507 (Dooneen Pt – Corcas), and 0K508 (Bunaclugga Bay).

The February 2011 roost survey recorded just 173 roosting Bar-tailed Godwits. 115 of these were located within 0K507 (Dooneen Pt - Corcas) in a single mixed-species shoreline roost. A further four subsites supporting roosting individuals: 0H522 (16), 0H524 (27), 0H533 (11) and 0K508 (4).

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 are 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

Numbers of Curlew of all-Ireland importance were recorded in all but one of the surveys completed. Numbers peaked during the final low tide survey (2,634). 1,611 Curlew were recorded during the January high tide survey. The aerial I-WeBS survey recorded a peak number of 476 Curlew on January 17th 2011.

Curlew had a widespread distribution across the site, occurring in 61 subsites overall. 29 subsites recorded the species in all four low tide surveys: 0H510, 0H521, 0H522, 0H523, 0H524, 0H525, 0H526, 0H527, 0H528, 0H532, 0H533, 0H534, 0H552, 0I425, 0I426, 0I428, 0I429, 0I431, 0I432, 0I436, 0I438, 0I439, 0I441, 0I443, 0I489, 0I496, 0K507, 0K508 and 0K509.

0H522 (Clonderlaw Bay Inner) in the outer site supported peak numbers during three low tide surveys (October, November and January). 0I441 (Hiphall Pt - Coalhall Pt.) supported peak numbers during the final (February 2011) survey, and recorded the peak subsite count of 328 Curlew.

Foraging Distribution

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

Curlews exhibited a widespread foraging distribution, foraging in a total of 60 subsites during the survey programme. 22 subsites supported foraging individuals in all four low tide surveys: 0H510, 0H522, 0H523, 0H524, 0H526, 0H527, 0H528, 0H532, 0H533, 0H534, 0H552, 0I425, 0I426, 0I428, 0I431, 0I438, 0I439, 0I441, 0I443, 0I489, 0K507 and 0K508. Despite this widespread nature, a degree of subsite preference was noted. 0H522 (Clonderlaw Bay Inner) recorded peak numbers during the October, November and January low tide surveys numbers peaking at 225 individuals in October 2010. 0H521 (Clonderlaw Bay outer) supported peak numbers in the final (February 201) low tide survey with 245 foraging Curlews, having recorded relatively few prior to then. Other subsites of note included 0H519 (Poulnasherry outer bay) which supported numbers ranked as second highest on two low tide survey occasions plus 0K508 (Bunaclugga bay) and 0H524 (Kilmurry creek) that recorded good numbers (ranked in top five) on three survey occasions.

The overall peak intertidal foraging density was 11.4 Curlews ha^{-1} recorded for 0H521 (Clonderlaw Bay outer). 0I436 (Poulaweala Creek) recorded 5.7 Curlews ha^{-1} on one occasion. Overall nine subsites recorded densities of over 1.0 Curlew ha^{-1}: 0H505, 0H518, 0H521, 0H523, 0H524, 0H527, 0H535, 0I436 and 0I439. The whole site average intertidal foraging density was 0.16 Curlew ha^{-1}.

Roosting Distribution

Curlews were widely recorded undertaking roosting/other behaviour in intertidal habitat across the site, recorded in 37 subsites across the survey period. Of note was 0I441 (Hiphall Pt - Coalhall Pt.) which recorded peak numbers during the November and February low tide surveys with 150 and 317 birds respectively. 0I445 (Scarlet Reach) held good numbers on two survey occasions (peak number 91 individuals).

954 Curlews roosted during the high tide survey (January 2010). 204 of these were in intertidal/subtidal habitat. 413 Curlews roosted in supratidal habitat; 0K509 (Carrig Island) supporting a quarter of these numbers and good numbers also within 0K508 (Bunaclugga bay), 0I4423 (Long Rock (Glin)) and 0I432 (Ballinvoher). 337 Curlews roosted terrestrially within or adjacent to the SPA in association with eight subsites, the greatest number in 0H552 (Clonderlaw Bay Inner) where good numbers formed part of a large mixed-species roost outside of the SPA and just east of where Kilmurry Creek enters the site.

The February 2011 roost survey recorded 1,351 Curlews roosting at 94 roost positions across 39 subsites. 0H531 (Ing Point - Deenish Isl.) recorded the greatest number of individuals (137 birds across four roost sites), having not recorded any roosting Curlews earlier in the survey programme. 100 of these birds roosted as one flock intertidally. 0K509 (Carrig Island) supported 101 individuals with 39 Curlews being part of large mixed-species aggregations outside the SPA in Sean's Polder and Kilelton Polder, as well as individuals distributed across a further seven roost locations. Other subsites to support over 50 roosting individuals were: 0H418, 0H419, 0H522, 0H524, 0H528, 0I441, 0I489, 0K507, and 0K508.

Greenshank *Tringa nebularia* - Family (group): Scolopacidae (wading birds)
The Greenshank is a monotypic species that breeds widely across Northern Eurasia. Two populations are recognised in Western Eurasia and Africa, of which one, breeds in northern Europe and winters mainly in Southwest Europe, Northwest Africa and west Africa (Delaney et al. 2009). Ireland supports a relatively small proportion of this population during winter.
Numbers
Numbers of Greenshank across the whole site peaked in October 2010 (157 individuals); following the pattern noted in Crowe (2005) of an early peak in numbers due to passage birds. Thereafter numbers declined gradually to the lowest count recorded during the high tide count (43 Greenshank). Numbers in all survey months surpassed the threshold for all-Ireland importance. Greenshanks were recorded within 44 subsites overall. Apart from certain times when they flock together (e.g. passage birds), Greenshanks are generally widely distributed due to their territorial nature over their foraging patch; hence a relatively wide distribution is to be expected. 13 subsites recorded Greenshanks in all four low tide surveys: 0H516, 0H519, 0H522, 0H527, 0H533, 0H534, 0I425, 0I437, 0I440, 0I442, 0I496, 0K507 and 0K508. The subsite peak number was 26, recorded for 0I437 (Aughinish East) on 22/11/10.
Foraging Distribution
Greenshanks usually forage within (wading) or beside watercourses where they exhibit a variety of feeding methods to take a diversity of prey including insects, polychaete worms and small fish. Greenshanks foraged widely across the site, foraging intertidally within 40 subsites and subtidally within 13 subsites. Peak numbers foraging intertidally during low tide surveys were recorded for 0K508 (Bunaclugga Bay), 0I437 (Aughinish East), 0H533 (Inishmore Pt-Inishoul) and 0H521 (Clonderlaw Bay outer) for the four low tide surveys respectively, with a peak count of 26 individuals (0I437 on 22/11/10. Intertidal foraging was recorded most regularly (all four low tide surveys) for 0H519, 0H522, 0H527, 0I437, 0I440, 0K507 and 0K508. Subtidal foraging was recorded less frequently and irregularly with the exception of 0H516 (Tarbert Point) which supported one to three individuals on every low tide survey occasion.
Roosting Distribution
Relatively few Greenshanks were recorded in roosting/other behaviour with a total of one to eight individuals recorded during low tide surveys within between one and seven subsites. Only 23 Greenshank were recorded roosting during the high tide survey (January 2011), the peak number within 0I438 (Aughinish Isl.). The February 2011 roost survey recorded 70 Greenshanks roosting across 19 subsites. 0H528 (Drumquin Pt.-Inishmore Pt.) recorded the peak number with 13 Greenshanks positioned between two roost locations, both roosts located in the south of the subsite close to the channel and just off Dee Island. The largest single roosts were of 16 individuals and recorded in 0H518, 0H526, 0I426 and 0I432.

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

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

Numbers

Whole site numbers peaked in October 2010 when 2,445 Redshanks were recorded. Thereafter numbers declined gradually to the lowest count during the final low tide survey (1,248 individuals). All counts undertaken surpassed the threshold of all-Ireland importance.

Redshanks were widespread and recorded within 62 subsites overall and within 61 during low tide surveys. 47 subsites supported the species regularly (three or more low tide surveys) and 30 subsites recorded Redshanks in all four low tide surveys: 0H512, 0H516, 0H522, 0H523, 0H526, 0H527, 0H528, 0H531, 0H532, 0H533, 0H534, 0H552, 0I425, 0I426, 0I428, 0I429, 0I431, 0I436, 0I437, 0I438, 0I439, 0I440, 0I441, 0I442, 0I443, 0I444, 0I447, 0K507, 0K508 and 0K509.

Peak numbers during low tide surveys were recorded for 0H528 (Drumquin Pt.-Inishmore Pt.), 0H533 (Inishmore Pt-Inishoul), 0H522 (Clonderlaw Bay Inner) and 0H521 (Clonderlaw Bay outer) for the four dates respectively. The peak subsite count was 378 Redshank (all-Ireland importance) on 07/01/11.

Foraging Distribution

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

Redshanks foraged widely across the site and were recorded in 58 subsites overall. Such a widespread distribution during the low tide period is considered usual for this species (Musgrove et al. 2003).

29 subsites supported foraging individuals in all four low tide surveys: 0H512, 0H516, 0H522, 0H523, 0H526, 0H527, 0H528, 0H531, 0H532, 0H533, 0H534, 0H552, 0I425, 0I426, 0I428, 0I429, 0I436, 0I437, 0I438, 0I439, 0I440, 0I441, 0I442, 0I443, 0I444, 0I447, 0K507, 0K508 and 0K509. Some degree of subsite preference was noted. 0H528 (Drumquin Pt.-Inishmore Pt.) recorded peak numbers during two low tide surveys (October 2010 and February 2011) and peak numbers foraging intertidally during the January 2011 high tide survey, plus good numbers recorded in all other surveys and an overall subsite peak number of 249 foraging individuals. 0H522 (Clonderlaw Bay Inner) recorded peak numbers during the January 2011 low tide survey and numbers ranked as second highest on two further low tide survey occasions. 0H533 (Inishmore Pt-Inishoul) recorded peak numbers on one occasion (November 2010), second highest numbers during February 2011 and good numbers in all other low tide surveys. The following subsites were noted for regularly supporting good numbers (ranked in the top five subsites): 0H519 (Poulnasherry outer bay), 0H524 (Kilmurry creek) and 0H531 (Ing Point - Deenish Isl.).

The dominant intertidal benthic community type across the site is 'intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans' (NPWS, 2012). This broad community type has a wide variability in sediment type from gravel to fine sand to muds. Distinguishing invertebrates include polychaete *Hediste diversicolor,* bivalve *Macoma balthica*, mollusc *Hydrobia ulvae* and amphipod *Corophium volutator*, the latter two species being particularly favoured prey of Redshank. *Corophium volutator* was noted to be particularly abundant in the inner Fergus Estuary.

The overall peak intertidal foraging density was 5.2 Redshanks ha^{-1} recorded for 0I458 (Askeaton) in February 2011. The second highest was 3.3 Redshanks ha^{-1} recorded for 0H524 (Kilmurry Creek). 14 subsites recorded a peak foraging density of over 1.0 individual per hectare. The whole site average intertidal foraging density was 0.25 Redshanks ha^{-1}.

Roosting Distribution

A greater proportion of Redshank were recorded foraging, the peak number recorded in roosting/other behaviour in any one low tide survey was 242 individuals. Large numbers were recorded on occasion roosting intertidally within 0H521 (Clonderlaw Bay outer) (February 2011) and 0H528 (Drumquin Pt.-Inishmore Pt.) (October 2010).

716 Redshanks were recorded in roosting/other behaviour during the January 2011 high tide survey. 272 of these were in intertidal habitat and the peak number (997) was located within 0H511 (Rinnanna South) accounting for 36% of the total recorded roosting intertidally. 228 roosted supratidally; 0H418 (Moyhill Marsh) and 0H532 (Deenish Is. - Rineanna Pt) being notable for supporting greater than 50 individuals. A further 516 individuals roosted terrestrially (and often outside the SPA) in association with six subsites: 0H522, 0H523, 0H533, 0I436, 0I441 and 0I491.

The February 2011 roost survey recorded 902 Redshank roosting across 34 subsites. Peak numbers (98) were recorded within 0H531(Ing Point - Deenish Isl.) and 0H533 (Inishmore Pt-Inishoul) was a close second with 96 roosting birds. A further five subsites supported over 50 roosting individuals: 0H418, 0H511, 0H519, 0H530 and 0I427. Of note was 0H511 (Rinnanna South) which recorded a single intertidal roost of 90 individuals.

Pintail *Anas acuta* - Family (group): Anatidae (ducks)
The Pintail has a Holarctic distribution breeding widely over northern temperate and arctic zones. Although there is a small population breeding within Ireland, the main numbers that winter in Ireland come from breeding grounds from Iceland eastwards through Fennoscandia to western Russia (Wernham et al. 2002). Although breeding within terrestrial wetlands, wintering takes places primarily within estuaries or coastal brackish lagoons.
Numbers
Numbers of Pintail rose from just three during the October 2010 low tide survey to a site peak of 94 during the final, February 2011 low tide survey. 80 Pintail were recorded during the January high tide survey. Pintail were recorded in only two subsites: 0H519 (Poulnasherry outer bay) and 0K509 (Carrig Island), both in the outer section of the site. Carrig Island held all individuals (three) on 20/10/10; thereafter 0H519 (Poulnasherry outer bay) supported the majority of individuals and recorded the subsite peak (94 Pintail) on 18/02/11.
Foraging Distribution
Pintail feed on a variety of plant and animal material obtained from shallow water although they can be observed foraging on land. Three Pintail foraged terrestrially adjacent to 0K509 during the October 2010 low tide survey. Thereafter all observations of foraging individuals were made for 0H519 (Poulnasherry outer bay). The maximum number was 94 individuals on 18/02/11. These birds were regularly observed foraging in and around a small low tide channel in the northeast corner of 0H519 (Moyasta) where they foraged together with Teal and Mallard. Therefore, although assigned to intertidal habitat, this species is clearly associated with water in the form of small creeks and channels or freshwater flows over the mudflat.
Roosting Distribution
One Pintail roosted terrestrially adjacent 0K509 (Carrig island) during the November 2010 low tide survey (unknown location) and two individuals roosted terrestrially again adjacent to the site (within Sean's Polder) during the high tide survey (27/01/11).

Shoveler *Anas clypeata* - Family (group): Anatidae (dabbling ducks)
The Shoveler has a widespread breeding distribution across north America, Canada, north and eastern Europe, Siberia to central Asia (Wetlands International, 2006). The small numbers of Shoveler breeding in Ireland are largely sedentary or dispersive and are supplemented during winter by migratory birds from other locations within northwest and central Europe. The wintering population is relatively small (c2500 individuals) (Crowe et al. 2008).
Numbers
The peak number of Shoveler during low tide surveys was 45, recorded during November 2010. A site total of 68 Shoveler were recorded during the January 2011 high tide survey. Both of these count totals surpass the threshold of all-Ireland importance. Shovelers were recorded in six subsites overall: 0H509, 0H519, 0I431, 0I438, 0I489 and 0K509, although subsite use during individual low tide surveys ranged from two to four. 0H509 (Golf Tee- Shannon) held peak numbers during the first three surveys with a peak number of 32 Shoveler on 22/11/10. 0I438 (Aughinish Isl.) supported peak numbers during the final low tide survey. 0H519 (Poulnasherry outer bay) held peak numbers during the high tide survey (37 individuals) which accounted for over 50% of all recorded.
Foraging Distribution
Shovelers are omnivorous, taking a range of items from planktonic crustaceans and small molluscs, to insects, larvae, plant material and seeds. A true dabbling duck, Shovelers feed by surface-feeding, swimming with head and neck immersed, up-ending, and less often, by shallow dives (BWPi, 2004). Shovelers were recorded foraging in association with four subsites: 0H509 (Golf-Tee Shannon), 0H519 (Poulnasherry outer bay), 0I438 (Aughinish Isl.) and 0K509 (Carrig Island). Peak numbers occurred at 0H509 (otherwise known as Shannon Airport Lagoon) during the first three low tide surveys, and at Mangan's Lough within 0I438 (Aughinish Isl.) during the final low tide survey, both brackish aquatic habitats. These two subsites were the only subsites to record this species during the high tide survey, recording 15 and 12 individuals respectively. Other foraging records relate to four individuals foraging intertidally in 0H519 on 20/10/10, one individual foraging terrestrially within 0K509 on 20/10/10 and two individuals on 07/01/11.
Roosting Distribution
Low numbers of Shoveler in roosting/other behaviour were recorded within 0H509 (Shannon Airport Lagoon) and at Mangan's Lough within 0I438 (Aughinish Isl.). Of note were 37 individuals that roosted intertidally within 0H519 (Poulnasherry outer bay) during the high tide survey (27/01/10). The February 2011 roost survey recorded two Shoveler roosting supratidally within 0K509 (Carrig Island).

Scaup *Aythya marila* - Family (group): Anatidae (diving ducks)
Two subspecies (*marila, mariloides*) of Scaup have four populations which have a circumpolar breeding distribution (eastern and western Siberia, northern Europe, Alaska and Arctic Canada). The nominate form breeds in northern Europe and western Siberia and spends winter in western Europe, including Ireland. The wintering population is around 4,400 birds (Crowe et al. 2008).
Numbers
Low numbers of Scaup were recorded during the 2010/11 Waterbird Survey Programme, with 2, 8, 8, and 29 individuals recorded for the four respective low tide surveys, and nine individuals recorded during the high tide survey. Scaup were recorded in three subsites: 0H519, 0H521 and 0H522. 0H519 (Poulnasherry outer bay) supported the species in all four low tide surveys and peak numbers in the first three. 0H521 (Clonderlaw Bay outer) recorded individuals on 18/02/11 only. 0H522 (Clonderlaw Bay Inner) recorded Scaup during the high tide survey only (27/01/11).
Foraging Distribution
Scaup were recorded foraging subtidally within 0H519 (Poulnasherry outer bay) during all four low tide surveys (maximum number eight birds). Of note were 26 birds that foraged subtidally within 0H521 (Clonderlaw Bay outer) on 18/02/11. Nine individuals foraged within 0H522 (Clonderlaw Bay inner) during the high tide survey (27/01/10).
Roosting Distribution
No records of roosting individuals were made during the main survey programme. 11 Scaup were recorded roosting subtidally within 0H528 (Drumquin Pt.-Inishmore Pt.) during the roost survey (24/02/11).

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). They are 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
Whole-site numbers of Black-headed Gulls ranged from 1,405 (high tide survey) to a site peak of 8,550 recorded during the February 2011 low tide survey. Black-headed Gulls were recorded within 60 subsites overall. The innermost subsite 0I448 (Cathedral – Limerick) recorded peak numbers during the October and November 2010 low tide surveys (up stream of SPA boundary). 0I447 (Corkanree) recorded the low tide subsite peak in January 2011 (597 individuals) and 0H552 (Rineanna Point) recorded the peak count on the final low tide survey (1,253 individuals).
Foraging Distribution
Black-headed Gulls were recorded foraging intertidally across 57 subsites during the survey programme. 14 subsites recorded individuals in all four low tide surveys: 0H514, 0H519, 0H522, 0H523, 0H528, 0H532, 0H533, 0H552, 0I431, 0I437, 0I438, 0I439, 0I446 and 0I447. 0H522 (Clonderlaw Bay Inner) recorded peak numbers during the first three low tide surveys with numbers peaking at 265 individuals in November 2010. Total numbers foraging intertidally during February 2011 were 6,931; more than three times higher than numbers within previous low tide surveys. 0H552 (Rineanna Point) supported peak numbers with 1,253 individuals foraging intertidally. Numbers foraging intertidally were greater than numbers foraging subtidally in all surveys undertaken. Only the two Limerick city subsites (0I447 Corkanree and 0I448 Cathedral-Limerick) recorded subtidal foraging in all four low tide surveys, and both recorded peak numbers during at least one survey. Peak numbers during the November 2010 low tide survey were recorded for 0K508 (Bunaclugga Bay) (180 birds). 0K507 (Dooneen Pt - Corcas) supported good numbers on three survey occasions.
Roosting Distribution
In general, more Black-headed Gulls were recorded foraging than in roosting/other behaviour, in fact almost double the number of gulls foraged as opposed to roosting/other. Roosting/other behaviour was recorded across intertidal habitat for a total 34 subsites across the survey programme. Peak numbers were recorded for 0I447 (Corkanree) (on two survey occasions), 0I448 (Cathedral-Limerick) and 0I441 (Hiphall Pt - Coalhall Pt.). Other subsites of note were 0H528 (Drumquin Pt.-Inishmore Pt.) and 0I427 (Coonagh Point) which regularly held good numbers. 0I447 (Corkanree) and 0I448 (Cathedral-Limerick) were the only subsites to support individuals roosting/other subtidally during all surveys undertaken and held peak numbers on at least one survey occasion each (peak number recorded 167). 0I427 (Coonagh Point) held peak numbers on one survey occasion (38 roosting subtidally). The February 2011 roost survey recorded 5,135 Black-headed Gulls roosting at 78 roost positions across 36 subsites. The peak number (600) were recorded within 0H514 (Saint's Island), a single roost site supratidally along the NE shoreline of the subsite. 0H528 (Drumquin Pt.-Inishmore Pt.) supported 592 roosting gulls across eight roosts. The largest single roost was 245 individuals roosting subtidally but all other birds were positioned in intertidal or supratidal habitat. 0I448 (Cathedral-Limerick) recorded supported 554 gulls across five locations, 502 of which were roosting terrestrially on man-made structures such as bridges, quays and outside the SPA boundary.

5.4 River Shannon and River Fergus Estuaries – activities and events

5.4.1 Introduction

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

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

This section provides information on activities and events that occur in and around the River Shannon and River Fergus Estuaries SPA that may either act upon the habitats within the site, or may interact with the Special Conservation Interest species and other waterbirds using the site.

5.4.2 Assessment Methods

Information on 'activities' and 'events' across the site was collected during a desk-top review which included NPWS site reporting files, County Development Plans (Limerick County Council, 2010; Clare County Council 2011, and Kerry County Council, 2009), Biodiversity Action Plans (e.g. Limerick City Council, 2011), documents pertaining to the Water Framework Directive (e.g. ShRBD, 2010) and other available documents relevant to the ecology of the site.

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

In addition, information was collected during the 2010/11 waterbird survey programme 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 320+ hours of coordinated surveyor effort across the site. The site activity questionnaire was also completed by NPWS Regional staff.

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

Data are presented in three ways:-

1. Activities and events identified to occur in and around the River Shannon and River Fergus Estuaries (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 the River Shannon and River Fergus Estuaries;
U known to occur but unknown spatial area hence all potential subsites are included (e.g. fisheries activities);
H historic, known to have occurred in the past;
P potential to occur in the future.

2. Activities are highlighted that occur currently in or around the River Shannon and River Fergus Estuaries and have the potential to cause disturbance to waterbird species.

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

Activities and events identified to occur at the River Shannon and River Fergus Estuaries are listed in Appendix 10.

The Shannon estuary is the largest estuary in Ireland with an area of approximately 1500km^2 (SHIRBD, 2010). The site also includes the estuaries of the rivers Fergus, Deel and Maigue. A large proportion of land adjacent to the estuary is low-lying agricultural land. Much of this was reclaimed historically, particularly in the mid to late 19th century (Hickey & Healey, 2005)

and is protected from tidal flooding by embankments which are a common feature across the site, and especially along the Fergus Estuary. In all a minimum of 6500ha is estimated to have been reclaimed, distributed within the main Shannon estuary basin and along its feeder rivers such as the Fergus and the Maigue (Healy and Hickey, 2002). The existing and future suitability of flood embankments to act as flood defence barriers has been the subject of studies as part of county level strategic flood risk assessments (Clare County Council, 2011).

The most extensive landuse around the site is agricultural. Grazing is a common land use with the grazing and poaching of saltmarsh habitat noted across the site (McCorry & Ryle, 2009 a, b). The invasive species Common Cord-grass (*Spartina anglica*) has been known at the site since 1928 (Nairn, 1986) having been planted to assist in the reclamation process and is now widespread across the site (McCorry & Ryle, 2009 a, b). In addition to agriculture, important industrial and transport infrastructure lies adjacent to the estuary, including the Shannon Industrial Complex and Shannon Airport. The largest urban settlement adjacent to the SPA is Limerick City and acts as the main industrial, commercial and transport centre for the Irish mid-west region (Healy & Hickey, 2002). The River Shannon flows through the city centre, canalised in places in places by quay walls. In addition, a canal (Park Canal) was created for navigation through the city to access the upper Shannon River. The river flows in a south-westerly direction with Limerick Docks located along the southern boundary. North of the river are the Westfields wetlands, dissected from the river by the N18 road and outside of the SPA boundary, although included within the Lower River Shannon SAC (Site Code 2165). Further down the estuary at Coonagh West, the Southern Ring Road (N18) passes beneath the river in the Limerick Tunnel, a 675m long twin-bore tunnel that opened in 2010 (www.limericktunnel.com) (relates to count subsite 0I427).

Foynes, Glin, Loghill (Co. Limerick) and Tarbert (Co. Kerry) are four major settlements that occur along the southern boundary. Along the northern shore in Co. Clare, Shannon and Kilrush are the major settlements. Clarecastle lies at the head of the Fergus estuary. A ferry service operates between Tarbert on the south coast and Killimer along the northern coastline. Shannon International Airport lies adjacent to the estuary (adjacent 0H511) at Shannon, Co Clare. Associated with this airport is the Shannon Airport lagoon, an artificial saline lake which was developed in the 1940's when a seawall was constructed out to the estuary to prevent the airport from flooding (Crowe, 2005). Water levels are managed via a sluiced outlet and the lagoon is surrounded by a diverse range of habitats including saltmarsh, reed bed and freshwater marsh (Murphy et al. 2003). As such, this man-made feature has become a local biodiversity hot-spot and a well-known local birding area.

Its relatively deep water and shelter from the Atlantic Ocean has led to the development of the Shannon estuary as an important centre for industry and imports and exports for Ireland (www.infomar.ie). Industry is an obvious feature at many locations within the site, with the main industrial zone along the southern Limerick border plus other locations such as Moneypoint, Shannon and Tarbert. Currently, six ports cater for commercial and industrial activity in the estuary. Two are located in Clare (Moneypoint and Shannon Airport). The port at Shannon Airport is a dedicated fuels terminal and takes regular deliveries of aviation fuel via bulk tankers. The port at Moneypoint is related to the Moneypoint Powerstation, one of the largest electricity generating stations in Ireland. Limerick docks provide a general purpose terminal. A further three ports/terminals occur along the southern shoreline of the estuary at Foynes, Aughinish and Tarbert. Foynes is the only deepwater facility in the estuary, catering for ships up to 240m in length (Limerick County Council, 2010). The port is linked to the national rail network with a single line linking the harbour to Limerick City, although there are no scheduled freight or passenger trains. In addition to commercial enterprises, Foynes Port is also the infrastructural centre of marine tourism in the estuary. The port at Aughinish is linked to the large aluminium refining plant on Aughinish Island (Aughinish Alumina). The port at Tarbert is related to the power station located on Tarbert Island.

The Shannon estuary is one of Ireland's largest marine resources and is extremely important in economic terms for Limerick city, the wider estuary and for the western region as a whole.

Given that the estuary lies within the functional areas of a number of local authorities and other statutory agencies, its successful economic development and management requires a co-operative approach between all bodies concerned. To this end, a Strategic Integrated Framework Plan (SIFP) is being prepared to include environmental assessments on the capacity of the Shannon Estuary to accommodate development, economic growth and employment in a sustainable way (Clare County Council, 2011).

The Atlantic waters off Ireland's south-west coast are renowned for being rich fishing grounds and the Shannon Estuary offers excellent fishing all year round and served by a series of harbours and piers of various scales and specifications. CRFB (2008) recorded a total of 31 fish species, mostly marine species, in the lower Shannon[19], and a total 16 fish species in the upper Shannon Estuary[20] during a survey undertaken in 2008, a species list that included the Red Data book species Smelt (*Osmerus eperlanus*).

Commercial fishing activities occur within the site (exact spatial scale unknown) with line fishing and pots widespread (Fahy et al. 2008; DoEHLG, 2009a). Some areas are subject to seasonal trawling, mainly in the autumn and in the outer part of the site. Dredging occurs in a small area in the outer site (west of Poulnasherry Bay) (Fahy et al. 2008). The principal commercial fishing activity in the estuary concerns shellfish. Within the SPA there are two Shellfish Waters designated under the EU Shellfish Waters Directive[21] as follows:

- West Shannon Ballylongford Shellfish Area covers an area of 8.6 km^2 and extends from Knockfinglas Point, around Carrig Island and encompasses part of Bunaclugga Bay in the outer section of the site (Co, Kerry) (DoEHLG, 2009a). This area relates to subsites 0K509 and 0K508.

- West Shannon Poulnasherry Shellfish Area covers an area of 7.1 km^2 and extends from Querin Point to Baunahard Point, taking in the entirety of Poulnasherry Bay (Co. Clare) (DoEHLG, 2009b). This area relates to subsites 0H519 and 0H520.

Two further Shellfish Waters occur within the Shannon Estuary but outside of the area designated as a SPA: West Shannon Carrigaholt Shellfish Area (No. 7a) and West Shannon Rinevella Shellfish Area (No. 7b).

The predominant shellfish species cultivated is the Oyster (*Crassostrea gigas*) using bag and trestle cultivation. Poulnasherry Bay is a major producer of oysters (DoEHLG, 2009b).

The Sea Fisheries Protection Authority is responsible for classifying shellfish production areas and the current classification for both Ballylongford and Poulnasherry Bay Bivalve Mollusc Production Area (as of 15th July 2011) is Class A (seasonal classification for the period 01 Dec to 01 June). The DoEHLG published Draft Pollution Reduction Programmes for Ballylongford and Poulnasherry Bay in November 2009 to ensure compliance with the standards and objectives established by the regulations. These documents highlight the fact that there are no significant stressors upon water quality within the vicinity of the shellfish areas (www.environ.ie).

The Shannon River Basin District Transitional and Coastal Waters Action Plan (ShRBD, 2010) classifies the majority of waters of the site as 'Moderate.' The inner estuary

[19] Defined by CRFB (2008) as the area extending from the mouth of the River Fergus estuary downstream to a mid point of Carrig Island.

[20] Defined by CRFB (2008) as the area extending from approx. 4km downstream of Limerick City to the mouth of the Fergus estuary.

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

(approximately from Shannon airport upstream to Limerick City) is classified as 'good' and inner Clonderlaw Bay (relating to subsite 0H522) is also classified as 'good.' The outer estuary (approximately from Kilrush westwards to the open sea) is also classified as 'good.' The parameters recorded below the required threshold and attributed to the moderate classification are Dissolved Oxygen (Fergus estuary) and specific pollutants (lower estuary); nutrient enrichment is listed as a potential impact upon water quality.

Marine and coastal tourism are viewed as under-developed along the Shannon estuary with a lack of, or under-developed tourist facilities (Limerick County Council, 2010). County Development Plans pertaining to the site (Limerick County Council, 2010; Clare County Council, 2011) seek to support the sustainable development of activity-related tourism and marine leisure along the Shannon Estuary (i.e. water sports and on shore activities such as walking and cycling). That said, there are several existing centres of marine tourism and leisure within the site, one example being Kilrush (adjacent subsite 0H520) which has a marina providing moorings for pleasure craft and hosts activities such as canoeing and sailing. Foynes has an active yacht club (subsite 0I440). Bunaclagga Bay hosts a sandy beach (Letterpoint Strand). Cappa beach, a small rocky beach near Kilrush is the Shannon Estuary's only Blue Flag beach. Cruising and boating are important recreational and tourism activities along the estuary and upstream into the Shannon waterway and the Shannon/Erne navigation.

Wildlife watching is a popular leisure pursuit across the site. Various locations are noted for birdwatching while a group of resident Bottlenose dolphins (*Tursiops truncatus*) are a unique attraction in the estuary. The Shannon Dolphin and Wildlife Foundation is noted for helping to develop sustainable marine tourism; dolphin tour operators being licensed by NPWS (www.shannondolphins.ie).

5.4.4 Disturbance events – assessment

The activities listed in Appendix 10 are highlighted (shaded grey) when they have the potential to cause disturbance to waterbirds. These include activities themselves but also hard/built features of the site (e.g. quays or piers) that have associated activities that may cause disturbance to waterbirds.

During field surveys of the 2010/11 Waterbird Survey Programme, activities causing disturbance to waterbirds were recorded for 33 of the total 66 subsites (50%). These activities relate to nine categories as follows: activities associated with intertidal aquaculture, aircraft, bait-digging, hand gathering of molluscs, horse riding, motorised vehicles, powered watercraft, shooting and walking (incl. dogs). A summary is shown in Table 5.8 and full results of the disturbance assessment are shown in Appendix 11. Individual activities/events are scored separately and there has been no attempt to produce cumulative scores for different activities occurring at the same time, although cumulative effects are likely.

Walking (intertidal areas and including dogs) was the most widespread activity and responsible for the peak disturbance score for 14 subsites (Table 5.8). At its maximum, this activity recorded a 'high' score of 7 (0I428 Piggot's Island) which resulted from the frequency of occurrence and the regular presence of loose dogs in this subsite. The second most widespread activities were wildfowling/shooting and aircraft (flying over), both recorded within six subsites. In general, the number of activities recorded to cause disturbance to waterbirds was relatively low, but it should be noted that this assessment does not take into account activities that may have commenced prior to a count being undertaken and therefore may have already caused a disturbance response from waterbirds.

Table 5.8 Disturbance Assessment – Summary Table

Number of activities recorded to cause disturbance to waterbirds during field surveys (2010/11 waterbird survey programme) plus the peak disturbance score (see text for explanation). Scores 0 – 3 = Low Scores 4 – 6 = Moderate Scores 7 – 9 = High.

Subsite Code	Subsite Name	Number Activities causing disturbance	Peak Disturbance Score	Activity Responsible
0H419	Bunratty West	1	5	• Walking (incl. dogs)
0H506	Ballycorrick Creek	1	6	• Wildfowling/shooting
0H508	Tullyglass Pt to Tullyvanga Pt	2	6	• Walking (incl. dogs)
0H509	Golf Tee- Shannon	2	5	• Walking (incl. dogs)
0H510	Brackinish Rock to Carrigkeal	1	3	• Aircraft flying over
0H511	Rinnanna South	1	3	• Aircraft flying over
0H512	Connor's Rock	1	3	• Aircraft flying over
0H513	Tradree Pt - Illaunbeg Pt	1	3	• Aircraft flying over
0H514	Saint's Island	1	3	• Aircraft flying over
0H515	Tullyvarraga Pt.-Inishcullin P	1	3	• Aircraft flying over
0H516	Tarbert Point	1	5	• Walking (incl. dogs)
0H519	Poulnasherry outer bay	2	6	• Intertidal aquaculture
0H520	Poulnasherry inner bay	1	5	• Horse riding
0H525	Mountshannon west	1	6	• Walking (incl. dogs)
0H528	Drumquin Pt.-Inishmore Pt.	3	6	• Walking (incl. dogs) • Wildfowling/shooting • Powered watercraft
0H529	Islandavanna Upper	1	5	• Walking (incl. dogs)
0H531	Ing Point - Deenish Isl.	1	6	• Wildfowling/shooting
0H534	Cahiracon	2	6	• Walking (incl. dogs) • Powered watercraft
0I428	Pigott's Island	1	7	• Walking (incl. dogs)
0I430	Black Rock to Mellon Pt.	1	5	• Walking (incl. dogs)
0I436	Poulaweala Creek	1	5	• Walking (incl. dogs)
0I441	Hiphall Pt - Coalhall Pt.	1	5	• Motorised vehicles
0I442	Glin Pier	2	5	• Walking (incl. dogs)
0I444	Carriglogher pt	2	6	• Walking (incl. dogs)
0I445	Scarlet Reach	1	6	• Powered watercraft
0I446	The Whelps	2	5	• Wildfowling/shooting
0I447	Corkanree	1	6	• Powered watercraft
0I448	Cathedral - Limerick	1	5	• Walking (incl. dogs)
0I449	Glin castle to Colmanstown	1	3	• Hand-gathering (molluscs)
0I489	Beagh Castle to Bushy Is.	1	5	• Wildfowling/shooting
0I490	Bushy Point	1	6	• Wildfowling/shooting
0K508	Bunaclugga Bay	1	3	• Hand-gathering (molluscs)

5.4.5 Discussion

This review has highlighted that many 'activities and events' occur across the site. Many of the 'activities' identified may act, or have acted historically, so as to modify wetland habitats of the site. While physical loss might be considered more historic in nature (e.g. reclamation of intertidal habitat, the construction of piers, slipways etc.), on-going modifications to intertidal habitats may occur from changes in natural processes (e.g. sedimentation or erosion rates) brought about by former physical events such as the development of coastal defences, bridge building etc. Physical damage may occur from trampling or compaction (e.g. horse-riding, humans walking and motor vehicles). The over-grazing of salt marsh areas are noted at this site and can not only lead to changes in vegetation patterns, but also modify waterbird roosting and foraging areas. Fisheries and aquaculture interact with waterbirds in a variety of

ways including the direct removal of waterbird prey items (e.g. fish species, bivalves), habitat loss/modification (e.g. due to the physical presence of oyster trestles within intertidal habitat), habitat damage (e.g. from machinery, vehicles) and indirect effects upon invertebrate distribution and abundance.

While the water quality of the River Shannon and River Fergus Estuaries has an overall classification as 'good' to 'moderate', localised problems are noted such as specific pollutants; lowered oxygen levels and potential nutrient enrichment. These may translate into direct effects upon waterbirds (direct toxicity) or indirect effects due to changes to invertebrate community composition, spatial distribution and/or abundance.

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[22] (reduced survival or reproductive success) consequences at population level may result.

While the nature and the frequency of disturbance-causing activities are key factors when assessing likely impacts, many aspects of waterbird behaviour and ecology will influence a species response. Waterbird responses are likely to vary with each individual event and to be species-specific.

The significance of a disturbance event upon waterbirds will vary according to a range of factors including:-

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

and be influenced by:-

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

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

- Predation and competition – a knock-on effect of disturbance is that waterbirds may move into areas where they are subject to increased competition for prey resources, or increased predation – i.e. the disturbance results in an indirect impact which is an increased predation risk.

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

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APPENDIX 1

SITE NAME: RIVER SHANNON AND RIVER FERGUS ESTUARIES SPA

SITE CODE: 004077

The estuaries of the River Shannon and River Fergus form the largest estuarine complex in Ireland. The site comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in Co. Clare and Dooneen Point in Co. Kerry.

The site has vast expanses of intertidal flats which contain a diverse macro-invertebrate community, e.g. Macoma-Scrobicularia-Nereis, which provides a rich food resource for the wintering birds. Salt marsh vegetation frequently fringes the mudflats and this provides important high tide roost areas for the wintering birds. Elsewhere in the site the shoreline comprises stony or shingle beaches.

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

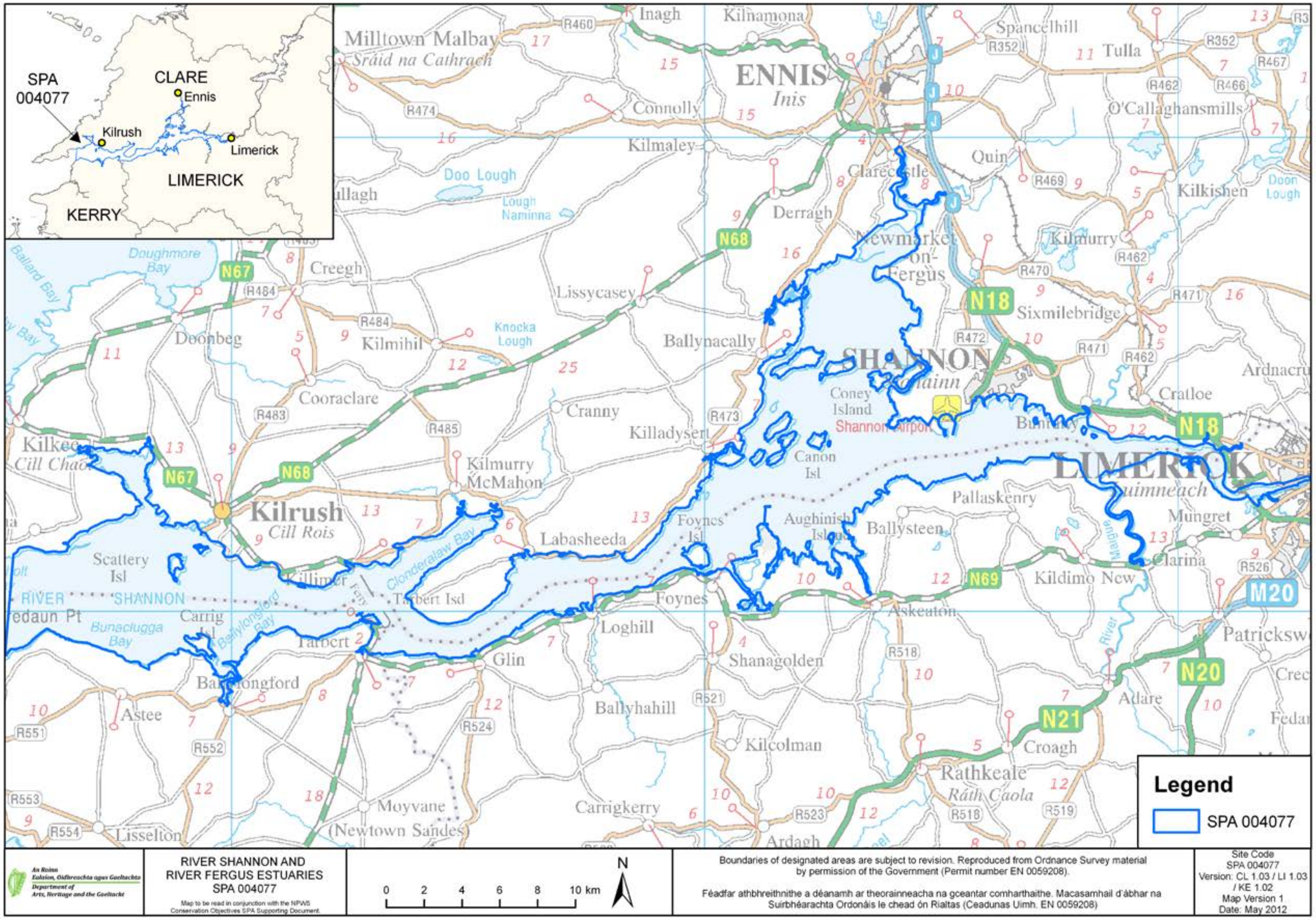
The site is the most important coastal wetland site in the country and regularly supports in excess of 50,000 wintering waterfowl (57,133 - five year mean for the period 1995/96 to 1999/2000), a concentration easily of international importance. The site has internationally important populations of Light-bellied Brent Goose (494), Dunlin (15,131) and Black-tailed Godwit (2,035). A further 18 species have populations of national importance, i.e. Cormorant (245), Whooper Swan (118), Shelduck (1,025), Wigeon (3,761), Teal (2,260), Pintail (62), Shoveler (107), Scaup (102), Ringed Plover (223), Golden Plover (5,664), Grey Plover (558), Lapwing (15,126), Knot (2,015), Bar-tailed Godwit (460), Redshank (2,645), Curlew (2,396), Greenshank (61) and Black-headed Gull (2,681) - figures are five year mean peak counts for the period 1995/96 to 1999/2000. The site is among the most important in the country for several of these species, notably Dunlin (13 % of national total), Lapwing (6% of national total) and Redshank (9% of national total).

The site also supports a nationally important breeding population of Cormorant (93 pairs in 2010).

Other species that occur include Mute Swan (103), Mallard (441), Red-breasted Merganser (20), Great Crested Grebe (50), Grey Heron (38), Oystercatcher (551), Turnstone (124) and Common Gull (445) - figures are five year mean peak counts for the period 1995/96 to 1999/2000.

Apart from the wintering birds, large numbers of some species also pass through the site whilst on migration in spring and/or autumn.

The River Shannon and River Fergus Estuaries SPA is an internationally important site that supports an assemblage of over 20,000 wintering waterbirds. It holds internationally important populations of three species, i.e. Light-bellied Brent Goose, Dunlin and Black-tailed Godwit. In addition, there are 18 species that have wintering populations of national importance. The site also supports a nationally important breeding population of Cormorant. Of particular note is that three of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover and Bar-tailed Godwit.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CLARE
KERRY
LIMERICK
Ennis
Kilrush
Limerick
RIVER SHANNON AND
RIVER FERGUS ESTUARIES
SPA 004077
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0 2 4 6 8 10 km
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Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadunas Uimh. EN 0059208)
Site Code
SPA 004077
Version: CL 1.03 / LI 1.03 / KE 1.02
Map Version 1
Date: May 2012

APPENDIX 2

Waterbird data sources

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

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

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

- Swan Surveys

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

- Greenland White-fronted Goose

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

- Greylag Geese

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

- Barnacle Goose (*Branta leucopsis*)

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

- Light-bellied Brent Geese

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

APPENDIX 3

Generic threshold method

This method (after JNCC, 2004) compares population size for two different five-year time periods, the change being expressed as a proportion of the initial population, as follows:

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

where: I_y = current population and I_x = baseline population

Worked example:

Baseline population: 5-year mean = 694.
Recent data: 5-year mean = 535.

Change = ((535 - 694) / 694) x 100 = - 0.23

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

The River Shannon and River Fergus Estuaries – Waterbird Survey Programme 2010/11 – Survey Dates and count subsites

Survey	Day 1	Day 2	Day 3
Low Tide 1	20.10.10	21.10.10	
Low Tide 2	22.11.10	23.11.10	24.11.10*
Low Tide 3	06.01.11	07.01.11	
Low Tide 4	18.02.11	19.11.02	
High Tide	26.01.11	27.01.11	

* a third day was used in November 2010 due to fog affecting day 2.

Count Subsites Day 1

Subsite Code	Subsite Name	Subsite Area (ha)	Count Day	Number of fieldworkers per count				
				LT1	LT2	LT3	LT4	HT1
0H506	Ballycorrick Creek	112.61	1	1	1	1	1	1
0H508	Tullyglass Pt to Tullyvanga Pt	216.63	1	1	1	1	1	1
0H509	Golf Tee- Shannon	24.16	1	1	1	1	1	1
0H510	Brackinish Rock to Carrigkeal	324.42	1	1	1	1	1	1
0H511	Rinnanna South	79.87	1	1	1	1	1	1
0H512	Connor's Rock	360.94	1	1	1	2	1	1
0H513	Tradree Pt - Illaunbeg Pt	46.07	1	1	2	1	1	2
0H514	Saint's Island	181.53	1	1	1	1	1	1
0H515	Tullyvarraga Pt.-Inishcullin P	185.46	1	1	1	1	2	1
0H528	Drumquin Pt.-Inishmore Pt.	1185.82	1	3	3	2	2	2
0H529	Islandavanna Upper	304.57	1	1	1	1	1	1
0H530	Ing	129.94	1	1	1	1	1	1
0H531	Ing Point - Deenish Isl.	1010.35	1	1	1	1	1	1
0H532	Deenish Is. - Rineanna Pt	1205.40	1	2	2	1	1	1
0H533	Inishmore Pt-Inishoul	811.83	1	1	1	1	1	1
0H534	Cahiracon	981.58	1	1	1	1	1	1
0H535	Latoon Bridge	4.27	1	2	-	-	-	-
0H552	Rineanna Point	183.24	1	1	1	1	1	1
0I428	Pigott's Island	383.78	1	1	1	1	1	1
0I429	Ringmoylan Qy.-Shannongrove Pt	265.39	1	1	1	1	1	1
0I430	Black Rock to Mellon Pt.	114.77	1	1	1	1	1	1

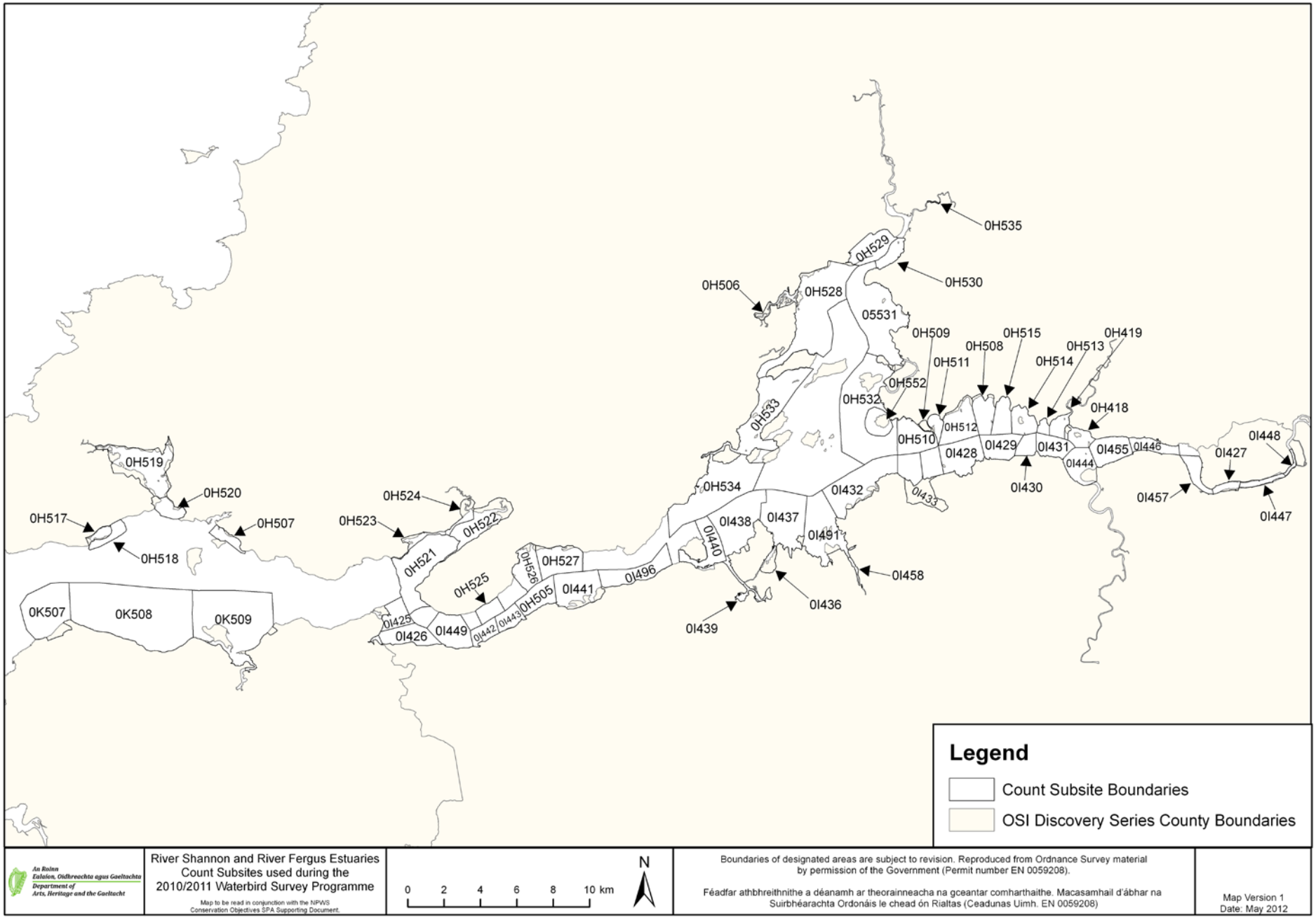
0I431	Way Rock	208.51	1	1	1	1	2	1
0I432	Ballinvoher	636.38	1	1	1	1	1	1
0I433	Washpool Creek	231.45	1	1	1	1	1	1
0I436	Poulaweala Creek	77.66	1	1	1	1	1	1
0I437	Aughinish East	647.92	1	1	1	1	1	1
0I438	Aughinish Isl.	659.62	1	1	1	1	1	1
0I439	Robertstown River	93.75	1	1	1	1	1	2
0I440	Foynes Island	303.70	1	1	1	1	1	2
0I444	Carriglogher pt	288.36	1	2	3	2	1	2
0I445	Scarlet Reach	283.23	1	1	1	1	1	1
0I446	The Whelps	166.88	1	1	1	1	1	1
0I458	Askeaton	20.64	1	-	-	-	1	-
0I489	Beagh Castle to Bushy Is.	190.91	1	1	1	2	3	1
0I490	Bushy Point	169.64	1	1	1	1	1	1
0I491	Greenish Island	622.08	1	2	2	2	1	1

Count Subsites Day 2

Subsite Code	Subsite Name	Subsite Area (ha)	Count Day	Number of fieldworkers per count				
				LT1	LT2	LT3	LT4	HT1
0H418	Moyhill Marsh	121.42	2	-	-	x	1	2
0H419	Bunratty West	108.72	2	-	1	x	1	1
0H505	Garraunbaun Point	263.11	2	1	1	1	1	1
0H507	Aylevarroo Bay	99.90	2	1	1	1	1	1
0H516	Tarbert Point	14.53	2	1	1	2	1	1
0H517	Querrin	67.70	2	1	1	1	1	1
0H518	Corlis - Querrin Pt.	109.99	2	1	1	1	1	1
0H519	Poulnasherry outer bay	675.72	2	1	1	1	1	1
0H520	Poulnasherry inner bay	143.43	2	1	1	1	1	1
0H521	Clonderlaw Bay outer	711.33	2	1	1	1	1	1
0H522	Clonderlaw Bay Inner	406.63	2	1	1	1	1	1
0H523	Burrane Pt - Kilmore Pt	75.43	2	1	1	1	1	1
0H524	Kilmurry Creek	102.41	2	1	1	1	1	1
0H525	Mountshannon west	125.27	2	1	2	1	1	1

0H526	Labasheeda Bay west Redgap pt	279.01	2	1	2	2	2	2
0H527	Labasheeda to Acre Pt	369.09	2	1	1	1	1	1
0I425	Cook's Pt (Tarbert)	194.27	2	1	1	2	1	-
0I426	Ballydonoghue	279.63	2	1	1	3	1	2
0I427	Coonagh Point	65.11	2	1	1	1	1	1
0I441	Hiphall Pt - Coalhall Pt.	464.04	2	1	1	1	1	1
0I442	Glin Pier	138.78	2	1	1	1	1	1
0I443	Long Rock (Glin)	147.07	2	1	1	1	1	1
0I447	Corkanree	69.58	2	1	1	1	1	1
0I448	Cathedral - Limerick	26.02	2	1	1	1	1	1
0I449	Glin castle to Colmanstown	342.82	2	1	1	2	1	3
0I457	Coonagh West	143.24	2	1	-	-	1	1
0I496	Mount Trenchard	359.02	2	1	1	1	1	1
0K507	Dooneen Pt - Corcas	682.03	2	1	1	1	1	1
0K508	Bunaclugga Bay	1974.28	2	1	1	1	1	1
0K509	Carrig Island	1391.28	2	6	2	1	2	4

- denotes a subsite that was not covered; x denotes a subsite that was not covered fully.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Legend
Count Subsite Boundaries
OSI Discovery Series County Boundaries
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
River Shannon and River Fergus Estuaries
Count Subsites used during the
2010/2011 Waterbird Survey Programme
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0 2 4 6 8 10 km
N
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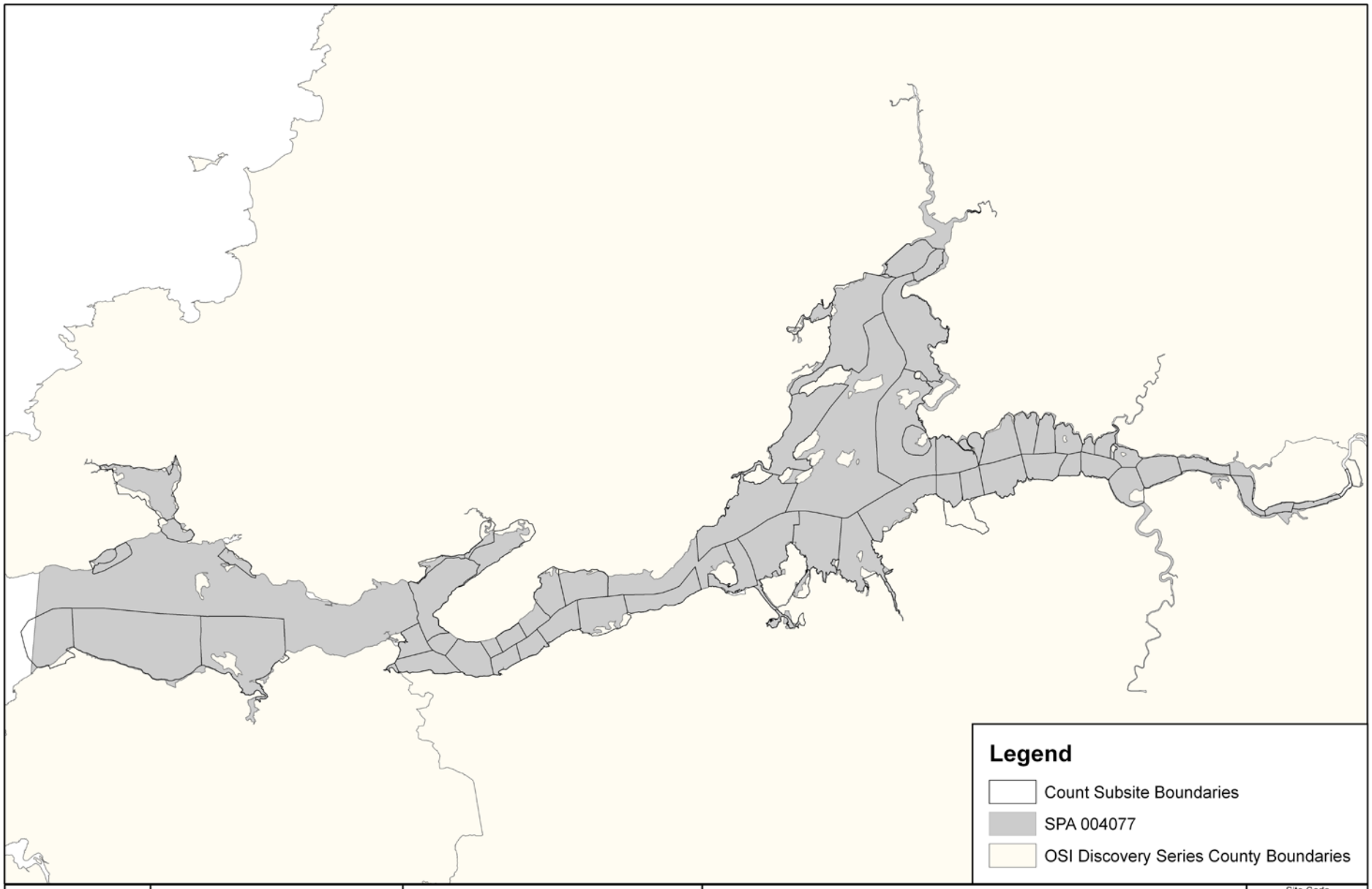

An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht

River Shannon and River Fergus Estuaries
Relationship between SPA 004077
and the Count Subsite Boundaries

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

0 2 4 6 8 10 km

N

Site Code
SPA 004077
Version: CL 1.03 / LI 1.03 / KE 1.02
Map Version 1
Date: May 2012

APPENDIX 7

Subsite diversity – average species richness calculated across the four low tide surveys, plus peak low tide and high tide species richness

Subsite	Mean	SD	Peak LT	HT	Subsite	Mean	SD	Peak LT	HT
0H418	-	-	7	8	0H552	9	3.3	13	8
0H419	-	-	5	6	0I425	0	0.0	0	0
0H505	8	5.3	15	2	0I426	13	2.6	15	6
0H506	9	2.2	11	4	0I427	9	3.1	13	1
0H507	3	1.9	5	4	0I428	14	0.0	14	13
0H508	5	2.4	8	4	0I429	9	2.8	12	5
0H509	7	2.9	10	7	0I430	8	2.2	11	7
0H510	9	1.5	11	5	0I431	14	0.0	14	7
0H511	4	3.3	7	12	0I432	6	1.0	7	4
0H512	10	2.1	12	10	0I433	-	-	1	0
0H513	7	1.7	8	7	0I436	11	3.7	15	6
0H514	6	1.6	8	5	0I437	19	1.3	20	10
0H515	6	1.5	8	5	0I438	19	2.6	23	14
0H516	8	2.2	11	6	0I439	11	4.2	16	7
0H517	7	5.1	14	8	0I440	9	2.1	11	5
0H518	5	1.3	6	2	0I441	14	1.3	16	18
0H519	25	4.5	31	15	0I442	12	1.4	13	10
0H520	6	3.7	11	7	0I443	12	5.0	18	13
0H521	11	4.9	17	11	0I444	11	1.5	12	10
0H522	15	5.2	19	14	0I445	9	2.9	11	4
0H523	13	4.1	18	9	0I446	8	2.2	11	3
0H524	9	4.8	14	6	0I447	10	1.0	11	3
0H525	4	1.3	5	3	0I448	9	2.1	11	12
0H526	12	3.9	17	11	0I449	7	1.8	9	12
0H527	9	1.5	11	9	0I457	3	3.0	6	0
0H528	19	1.5	21	19	0I458	-	-	13	0
0H529	1	0.5	1	0	0I489	10	2.2	12	5
0H530	4	0.6	4	3	0I490	7	1.4	8	6
0H531	12	3.1	16	9	0I491	11	4.3	14	4
0H532	10	6.2	19	7	0I496	6	1.0	6	5
0H533	18	0.6	18	13	0K507	20	3.6	23	10
0H534	15	3.3	20	11	0K508	21	1.9	22	11
0H535	-	-	1	0	0K509	26	4.3	30	17

APPENDIX 8

The River Shannon and River Fergus Estuaries

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

These maps are presented in a separate document. Please note that these maps are best printed on A3 paper or viewed digitally.

(note that data are shown for birds occurring within intertidal and subtidal habitat only)

Maps have not been produced for Whooper Swan due to insufficient data

APPENDIX 9

River Shannon and River Fergus Estuaries

Summary data and roost location maps from the roost survey (24th and 25th February 2011)

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

Maps to accompany this table are shown in a separate document

River Shannon and River Fergus Estuaries - Roost Summary Table

Subsite	Count	No. Locations	No. Species	Species
0H418	250	12	5	BH, CU, RK. T. WN
0H419	226	9	8	BH, CU, T., SU, MA, WN, L. RK
0H505	23	1	2	OC, TT
0H506	143	5	6	CU, MA, RK, SU, T., WN
0H508	276	4	3	BH, XU, SU
0H509	24	4	3	MS, T., MA
0H510	93	3	1	BH
0H511	413	7	6	BH, OC, GV, DN, RK, WN
0H512	326	8	6	BH, T., CU, WN, SU, GB
0H513	11	3	3	BH, T., MA
0H514	781	5	7	CU, BH, SU, BW, DN, RK, T.
0H515	123	5	4	T., WN, CU, BH
0H516	148	13	9	WN, T., DN, RK, GK, SN, T. ET, CU,
0H517	22	1	3	CU, T., RK
0H518	4	1	3	OC, RK, GK
0H519	396	9	9	CA, CU, GK, GV, PB, OC, RK, SU, TT
0H520	57	1	1	PB
0H521	11	1	2	OC, RK, GK
0H522	327	4	6	BA, CU, DN, RK, SU, WN
0H523	28	2	2	CU, RK
0H524	191	4	8	BA, CU, DN, GK, H., OC, RK, SU
0H525	1	1	1	CU
0H526	113	14	11	BH, CU, GK, JS, L., MA, RK, RP, SU, T., WN
0H527	23	5	7	CU, GK, OC, RK, RP, SU, T.
0H528	820	20	8	T., BW, BH, SP, RK, SU, CU, GK
0H529	151	2	2	BH, CA
0H530	98	1	2	RK, DN
0H531	474	6	7	CU, SU, BH, T., RK, OC, BW,
0H532	335	4	7	OC, BH, CA, T., CU, SU, MA.
0H533	678	12	9	CA, RK, WN, GK, BH, SU, CU, MA, BA
0H534	116	5	6	MA, T., CU, BH, GK, WN
0H552	234	2	6	T., WN, CU, BH, SU, RK
0I425	19	3	4	MA, RK, WN, T.

0I426	263	16	12	BH, CM, CU, DN, GK, H., LB, MA, OC, RK, SU, T.
0I427	145	2	2	BH, RK
0I428	371	10	12	GB, BH, LB, CM, SU, BW, RK, GK, CU, T., MA, CA
0I429	257	4	5	SU, T., ET, DN, BH.
0I430	270	8	7	T., CU, BW, BH, RK, SU, MA
0I431	304	15	9	MA, BH, WN, GB, T. SU, RK, BW, CU
0I432	55	14	8	BH, CU, GK, MA, OC, RK,T. WN
0I433	53	1	1	CU
0I436	15	2	3	T., WN, GK
0I437	177	6	5	BH, CU, GB, MA, SU
0I438	39	2	6	CU, GK, MA, RK, SU, TT.
0I439	106	3	5	BH, CM, GK, T., WN
0I440	77	3	5	CA, GB, GK, SU, T.
0I441	157	8	8	CU, HG, LB, RK, SU, T., TT, WN,
0I442	34	3	6	BH, CM, MA, T., RP, RK
0I443	53	4	4	T., WN, MA, CU
0I444	143	16	6	ET, T., WN, MA, CA, BH,
0I445	133	9	5	WN, T., GJ, ET, CA
0I446	86	6	2	CU, WN
0I448	617	7	3	BH, HG, MS
0I449	74	5	4	CA, RK, OC, DN
0I457	229	1	2	BH, CM
0I458	40	3	2	CA, CU
0I489	318	7	4	BH, CA, CU, SU
0I490	79	8	8	GG, MA, WN, T., BH, SU, CA, CU
0I491	345	18	12	WN, CA, CU, RK, CU, BH, CM, GK, GP, MA, SU, T.
0K507	268	4	7	CU, OC, CM, HG, GB, BA, TT,
0K508	296	8	13	CU, HG, WN, BA, BH, PB, TT, RP, GK, RK, OC, H., ET
0K509	1861	24	16	BH, CM, CA, CU, DN, GP, GB, GG, GK, H., GV, KN, PB, ET, LG, MA

APPENDIX 10

River Shannon and River Fergus Estuaries - Activities & Events

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

Legend:	
O	observed or known to occur in and around the River Shannon and River Fergus Estuaries
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.
	Activities considered likely to cause disturbance to waterbirds.

	0H418	0H419	0H505	0H506	0H507	0H508	0H509	0H510	0H511	0H512	0H513	0H514	0H515	0H516	0H517	0H518	0H519	0H520	0H521	0H522	0H523	0H524	0H525
1. Coastal protection, sea defences & stabilisation																							
1.1 Linear defences				O			O	O	O	O		O									O		
1.4 *Spartina* planting/growing									O				O	O	O	O	O	O		O	O		
2. Barrage schemes & drainage																							
2.2 Altered drainage/river channel				H			O	O		O													
2.3 Other channel modifications	O																						
2.5 Other																					O		
4. Industrial, port & related development																							
4.2 Fishing harbour																	O						
4.3 Slipway		O																					
4.4 Pier			O		O			O	O						O						O		
4.5 Manufacturing industries								O	O	O													
6. Pollution																							
6.1 Domestic & urban waste water											O	O		O				O					O
6.2 Industrial							O		O	O													O
6.6 Thermal discharges																							
6.7 Solid waste incl. fly-tipping										O													O
7. Sediment extraction (marine & terrestrial)																							
7.4 Removal of beach materials																							O
8. Transport & communications																							
8.1 Airports							O	O	O	O													
8.2 Flight path	O	O	O			O	O	O	O	O	O	O	O										O
8.3 Bridges & aqueducts		O																					
8.5 Road schemes		O			O	O								O									
8.6 Car parks		O			O			O	O	O	O	O	O	O	O			O					

	0H418	0H419	0H505	0H506	0H507	0H508	0H509	0H510	0H511	0H512	0H513	0H514	0H515	0H516	0H517	0H518	0H519	0H520	0H521	0H522	0H523	0H524	0H525
8.8 Rail lines		H															H	H					
8.9 Cables - suspended		O																					
9. Urbanisation																							
9.1 Urbanised areas, housing			O			O				O				O									
9.2 Commercial & industrial areas		O					O	O	O	O													
9.3 Hotel & leisure complex		O						O	O	O													
12. Tourism & recreation																							
12.2 Non-marina moorings		O																					
12.5 Leisure centres, sports ground						O																	
12.8 Sailing					O													O					
12.15 Angling	O	O													O						O		
12.17 Bathing & general beach recreation																		O					
12.18 Walking, incl. dog walking		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									
12.20 Sand-yachting			O																				
12.22 Motorised vehicles							O	O	O		O	O											
12.23 Horse-riding	O										O	O	O					O					
12.25 Golf courses								O															
13. Wildfowl & hunting																							
13.1 Wildfowling	O	O		O																			O
13.2 Other hunting-related activities											O	O											

	0H418	0H419	0H505	0H506	0H507	0H508	0H509	0H510	0H511	0H512	0H513	0H514	0H515	0H516	0H517	0H518	0H519	0H520	0H521	0H522	0H523	0H524	0H525
15. Fisheries & Aquaculture																							
15.1 Professional passive fishing (e.g. longlining)	U		U		U										U	U	U	U	U	U	U	U	U
15.2 Professional active fishing					U												U	U	U	U			
15.3 Bottom (benthic) dredging															U	U							
15.4 Fish traps & other fixed devices & nets							O																
15.6 Molluscs - hand-gathering																	O						
15.9 Intertidal aquaculture e.g. trestles																	O	O	O				
15.11 Bottom culture																			O				
16. Agriculture & forestry																							
16.1 Saltmarsh grazing/harvesting	O	O		O								O			O						O		
16.2 Grazing: intensive (terrestrial)		O		O							O	O	O										
16.3 Grazing: non-intensive (terrestrial)	O	O	O																				
16.5 Stock feeding	O			O																			
16.10 Mowing/grassland cutting									O	O													
16.12 Polderisation/land claim				H				H													H		
16.14 In-filling of ditches, ponds, pools, marshes				O																			
18. Wildlife habitat management																							
18.1 Control of *Spartina* or other vegetation		O																					
19. Natural events																							
19.1 Storms, floods and storm surges							O							H									
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

	0H526	0H527	0H528	0H529	0H530	0H531	0H532	0H533	0H534	0H535	0H552	0I425	0I426	0I427	0I428	0I429	0I430	0I431	0I432	0I433	0I436	0I437	0I438
1. Coastal protection, sea defences & stabilisation																							
1.1 Linear defences	O	O	O	O	O	O		O	O			O		O	O	O	O	O	O	O		O	O
1.2 Training walls	O	O																				O	
1.3 Groynes															O	O							
1.4 *Spartina* planting/growing		O	O	O	O	O	O	O	O		O		O						O		O	O	O
1.6 Other modifications															O	O	O	O					
2. Barrage schemes & drainage																							
2.2 Altered drainage/river channel			H	H										H									
3. Power generation																							
3.1 Power stations													O										
4. Industrial, port & related development																							
4.3 Slipway	O							O											O				
4.4 Pier	O							O				O		O	O				O			O	O
4.5 Manufacturing industries																						O	O
4.6 Chemical industries												O											
4.8 Other									O			O											
6. Pollution																							
6.1 Domestic & urban waste water	O	O																					
6.2 Industrial												O										O	
6.3 Landfill																						O	
6.6 Thermal discharges													O										
6.7 Solid waste incl. fly-tipping		O																					

	0H526	0H527	0H528	0H529	0H530	0H531	0H532	0H533	0H534	0H535	0H552	0I425	0I426	0I427	0I428	0I429	0I430	0I431	0I432	0I433	0I436	0I437	0I438
8. Transport & communications																							
8.2 Flight path	O	O					O				O		O		O	O	O	O	O	O		O	O
8.3 Bridges & aqueducts												O											
8.4 Tunnel														O									
8.5 Road schemes												O	O	O	O	O				O			
8.6 Car parks												O			O								
8.7 Shipping channel, shipping lanes	O	O										O	O	O	O	O	O	O					
9. Urbanisation																							
9.1 Urbanised areas, housing	O														O	O				O			
9.2 Commercial & industrial areas												O									O	O	O
11. Education & scientific research																							
11.2 Nature trails																					O	O	
12. Tourism & recreation																							
12.2 Non-marina moorings	O																						
12.6 Power boating & water-skiing			O	O					O					O									
12.8 Sailing													O										O
12.11 Canoeing														O									
12.13 Rowing														O									
12.14 Tourist boat trips														O									
12.15 Angling	O							O															
12.18 Walking, incl. dog walking	O	O	O	O					O			O	O	O	O	O	O	O	O		O		O
12.19 Birdwatching	O	O	O										O									O	
12.22 Motorised vehicles			O																				
12.23 Horse-riding																		O					
12.27 Others												O											

	0H526	0H527	0H528	0H529	0H530	0H531	0H532	0H533	0H534	0H535	0H552	0I425	0I426	0I427	0I428	0I429	0I430	0I431	0I432	0I433	0I436	0I437	0I438
13. Wildfowl & hunting																							
13.1 Wildfowling			O			O									O								
13.2 Other hunting-related activities															O					O			
15. Fisheries & Aquaculture																							
15.1 Professional passive fishing (e.g. longlining)	U	U						U	U			U	U						U			U	U
15.9 Intertidal aquaculture e.g. trestles																						O	
16. Agriculture & forestry																							
16.1 Saltmarsh grazing/harvesting				O	O	O		O										O			O		
16.2 Grazing: intensive (terrestrial)	O		O	O		O								O	O		O			O			
16.3 Grazing: non-intensive (terrestrial)	O	O			O	O	O				O			O	O	O	O	O	O	O			O
16.5 Stock feeding	O													O									
16.9 Removal of hedges, scrub			O										H		H	H	H	H		H			
16.10 Mowing/grassland cutting													H					H					
16.12 Polderisation/land claim			H	H		H	H	H	H		H			H	H	H	H	H	H				H
18. Wildlife habitat management																							
18.3 Habitat creation & restoration - terrestrial														H									
19. Natural events																							
19.1 Storms, floods and storm surges												H	H	O	H	H	H	H					
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

	OI439	OI440	OI441	OI442	OI443	OI444	OI445	OI446	OI447	OI448	OI449	OI457	OI458	OI489	OI490	OI491	OI496	OK507	OK508	OK509
1. Coastal protection, sea defences & stabilisation																				
1.1 Linear defences	O	O		O		O	O	O	O	O	O	O		O	O	O				O
1.2 Training walls			O		O		O		O	O							O			O
1.3 Groynes		O																		
1.4 *Spartina* planting/growing	O		O										O	O		O				O
2. Barrage schemes & drainage																				
2.1 Weirs and barrages for river management							H			O										
2.2 Altered drainage/river channel					O				H			H								O
4. Industrial, port & related development																				
4.1 Industrial port		O							O											
4.3 Slipway		O		O						O				H			O			
4.4 Pier		O	O	O					O											
4.5 Manufacturing industries									O				O							
4.7 Ship/boat building or repair		O																		
6. Pollution																				
6.1 Domestic & urban waste water		O		O			H	O	O			O	O							O
6.2 Industrial		O							O				O							
6.7 Solid waste incl. fly-tipping	O								O	O										
7. Sediment extraction (marine)																				
7.1 Channel dredging (maintenance & repair)		O															O			
8. Transport & communications																				
8.2 Flight path	O	O	O	O	O	O	O	O			O	O		O	O	O	O			
8.3 Bridges & aqueducts									O	O										O
8.5 Road schemes				O	O				H		O	O			O					
8.6 Car parks			O	O	O						O						O			O
8.7 Shipping channel, shipping lanes		O		O		O	O	O	O		O	O			O			O	O	O
8.8 Rail lines	H																			

	0I439	0I440	0I441	0I442	0I443	0I444	0I445	0I446	0I447	0I448	0I449	0I457	0I458	0I489	0I490	0I491	0I496	0K507	0K508	0K509
9. Urbanisation									O	O										
9.1 Urbanised areas, housing		O	O	O	O				O	O					O		O			
9.2 Commercial & industrial areas		O							O	O										
9.3 Hotel & leisure complex									O	O										
12. Tourism & recreation																				
12.1 Marinas		O																		
12.2 Non-marina moorings		O						O												
12.6 Power boating & water-skiing							O		O	O		O								O
12.7 Jet skiing									O	O										
12.8 Sailing		O	O	O	O						O						O			
12.11 Canoeing									O	O		O								
12.13 Rowing									O	O										
12.14 Tourist boat trips		O							O											
12.15 Angling			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
12.19 Birdwatching			O		O	O	O	O	O	O		O					O			O
12.22 Motorised vehicles			O						O	O							O			
12.23 Horse-riding						O		O												
13. Wildfowl & hunting																				
13.1 Wildfowling						O	O	O	O					O	O					O
13.2 Other hunting-related activities								O						O	O					
14. Bait-collecting																				
14.1 Digging for lugworms/ragworms				O																

	0I439	0I440	0I441	0I442	0I443	0I444	0I445	0I446	0I447	0I448	0I449	0I457	0I458	0I489	0I490	0I491	0I496	0K507	0K508	0K509
15. Fisheries & Aquaculture																				
15.1 Professional passive fishing (e.g. longlining)		U	U	U	U						U					U	U	U	U	U
15.2 Professional active fishing																		U	U	U
15.5 Leisure fishing									O			O								
15.6 Molluscs - hand-gathering			O								O								O	O
15.9 Intertidal aquaculture e.g. trestles																			O	O
16. Agriculture & forestry																				
16.1 Saltmarsh grazing/harvesting	O					O								O						O
16.2 Grazing: intensive (terrestrial)								O	O			O			O					
16.3 Grazing: non-intensive (terrestrial)	O	O	O	O	O	O	O	O		O	O	O		O	O	O	O			
16.5 Stock feeding						O														
16.9 Removal of hedges, scrub	H			H						O	H				H					
16.10 Mowing/grassland cutting				H							H									
16.12 Polderisation/land claim	H	H				H			H	H		H		H	H					H
16.14 In-filling of ditches, ponds, pools, marshes	O																			
16.18 Forest and plantation management		P																		
18. Wildlife habitat management																				
18.2 Habitat creation & restoration - intertidal		P																		
18.3 Habitat creation & restoration - terrestrial									H			O								
19. Natural events																				
19.1 Storms, floods and storm surges				H					O		H				H					
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

APPENDIX 11

Disturbance Assessment

Scoring system - definitions & rationale

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

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

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

Scoring system – worked example

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

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

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

	0H419	0H506	0H508	0H509	0H510	0H511	0H512	0H513	0H514	0H515	0H516	0H519	0H520	0H525	0H528	0H529	0H531	0H534	0I428	0I430	0I436	0I441	0I442	0I444	0I445	0I446	0I447	0I448	0I449	0I489	0I490	0K508	0K509
8. Transport & communications																																	
8.2 Flight path			3	3	3	3	3	3	3	3														5									
12. Tourism & recreation																																	
12.6 Power boating & water-skiing															6			6							6		6						5
12.18 Walking, incl. dog walking	5		6	5							5			6	6	5		6	7	5	5		5	6				5					
12.22 Motorised vehicles																						5											
12.23 Horse-riding													5													3							
13. Wildfowl & hunting																																	
13.1 Wildfowling/shooting		6													6		6									5				5	6		
14. Bait-collecting																																	
14.1 Digging for lugworms/ragworms																							2										
15. Fisheries & Aquaculture																																	
15.6 Molluscs - hand-gathering												4																	3			3	3
15.9 Intertidal aquaculture e.g. trestles												6																					4