# Castlemaine Harbour Special Protection Area

# (Site Code 4029)

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## Version 2

# Conservation Objectives Supporting Document

National Parks & Wildlife Service

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## SUMMARY

This document presents conservation objectives for the waterbird Special Conservation Interests of Castlemaine Harbour 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 Castlemaine Harbour Special Protection Area, as well as introducing the concept of conservation objectives and their formulation.

Part Two provides site designation information for Castlemaine Harbour Special Protection Area.

Part Three presents the conservation objectives for this site together with a supporting summary table.

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

Part Five (Conservation Advice Notes) provides supporting information that is intended to assist the interpretation and understanding of the site-specific conservation objectives. This section includes a review of ecological characteristics of the Special Conservation Interests of Castlemaine Harbour SPA and examines waterbird distribution recorded during the 2009/10 waterbird survey programme, drawing also on data from SAC surveying and monitoring programmes. This section concludes with information and advice on events and activities at the site which may interact with waterbirds during the non-breeding season and includes an assessment of those activities that have the potential to cause disturbance to site Special Conservation Interest species and other non-breeding waterbirds.

# 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 the EU Birds Directive, Ireland, along with other Member States, is required to classify the most suitable territories in number and size as Special Protection Areas (SPAs) for the conservation of certain wild bird species, which are:

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

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

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

- A site holding 20,000 waterbirds or 10,000 pairs of seabirds;
- A site holding 1% or more of the all-Ireland population of an Annex I species;
- A site holding 1% or more of the biogeographical population of a migratory species;
- A site is one of the most suitable sites in Ireland for an Annex I species or a migratory species.

The biogeographic population estimates and the recommended 1% thresholds for wildfowl and waders are taken from Wetlands International (Wetlands International, 2002), these thresholds reflecting the baseline data period used. All-Ireland population estimates for 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 has the relevant criteria for designation and is selected as an SPA, a list of species is compiled for which the site is nationally important. These species are called Special Conservation Interests.

The **Special Conservation Interests** of a site can be divided into two categories:

**Selection species**:

The species (or species assemblage) that a site is selected for, including all species that are internationally important, and nationally important species where the site is regarded as one of the most suitable site in the country for the conservation of that species.

**Additional Conservations Interests:**

- Annex I or migratory species which exceed the all-Ireland 1% threshold (but were not selection species for the site);
- Wetland and Waterbirds - in establishing their SPA network, Member States are explicitly required under Article 4 of the Birds Directive to pay attention to the protection of wetlands. To this end the wetland habitat that is contained within a specified SPA, and the waterbirds that utilise this resource, are considered of Special Conservation Interest.

### 1.2 Introduction to Castlemaine Harbour Special Protection Area

Castlemaine Harbour SPA is a large coastal site occupying the innermost part of Dingle Bay. The site extends from the lower tidal reaches of the River Maine and River Laune, to a point some 5km west of the Inch and Rosbehy peninsulas. The average width of the estuary is 4 to 5km although it is about 11km at the outer limit. The site comprises the estuaries of the River Maine and the River Laune, both substantial rivers, but a number of other rivers, e.g. the Caragh and the Emlagh also flow into the site, together with numerous small streams.

The site has extensive areas of intertidal sand and mud flats together with expanses of shallow marine water, most extensive in the outer, western section of the site. Conditions in the bay are very sheltered due to the presence of three protruding sand spits on its seaward side. These spits overly gravel bars. Two of the spits, Rosbehy and Inch, are included within the site and support extensive dune systems.

Castlemaine Harbour SPA is one of the most important sites for wintering waterbirds in the south-west. It provides good quality feeding and roosting habitats for an excellent diversity of waterbirds, including geese, waders, divers and seaduck. A further Special Conservation Interest for the site is the non-waterbird, Annex I species, Chough. Although not breeding within the site, these birds of the family Corvidae (Crows) are regularly observed on the sand dunes at Inch and Rosbehy where they feed and socialise (Trewby et al. 2006).

The Site Synopsis for Castlemaine Harbour SPA together with a map showing the SPA boundary is shown 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 on a long-term basis.*

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].

### 1.4 How Castlemaine Harbour SPA Conservation Objectives were formulated

This document presents conservation objectives for the waterbird Special Conservation Interests of Castlemaine Harbour SPA. Conservation objectives for Chough (in. prep) are not presented here.

Conservation objectives for SPA sites are aimed at maintaining bird populations through the protection of habitats supporting them and against negative impacts of disturbance. Therefore conservation objectives are determined, not only waterbird populations, but importantly, for the biotic and non-biotic components of the site that underpin the long-term maintenance of the waterbirds abundance, distribution and range. To this end, conservation objectives are defined for attributes[2] relating to waterbird species populations, and for attributes related to the maintenance and protection of habitats that support them. These attributes are:

[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).

- Population Status
- Population distribution.
- Habitat range and area (extent).

## PART TWO – SITE DESIGNATION INFORMATION

### 2.1 SPA Qualifying Features – Castlemaine Harbour Special Protection Area

Castlemaine Harbour has been identified as qualifying for SPA status because:

1. 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 694 individuals. Further to the species assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species[3]

2. 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 6,819 individuals. Further to the species assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species.

3. The site regularly supports 1% or more of the all-Ireland population of Pintail (*Anas acuta*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 145 individuals. Further to the species assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species.

4. The site regularly supports 1% or more of the all-Ireland population of Common Scoter (*Melanitta nigra*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 3,637 individuals. Further to the species assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species.

5. The site regularly supports 1% or more of the all-Ireland population of the Annex I species Red-throated Diver (*Gavia stellata*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 56 individuals. Further to the species assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species.

6. 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 206 individuals. Further to the species assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species.

7. The site regularly supports 1% or more of the all-Ireland population of Sanderling (*Calidris alba*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 335 individuals. Further to the species

[3] This refers to the selection process and particularly to the number of species supported by a site relative to the proportion of the total biogeographic population of a species held by Ireland.

assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species.

8. 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 of this species within the SPA during the baseline period (1995/96 – 1999/00) was 397 individuals. Further to the species assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species.

9. The site regularly supports 1% or more of the all-Ireland population of the Annex I species Chough (*Pyrrhocorax pyrrhocorax*). In winter, Castlemaine Harbour SPA supports 40 - 64 Chough (counts from winter 2002/03 and 2003/04 respectively) which exceeds the All-Ireland 1% threshold for this species. Further to the species assessment, Castlemaine Harbour was selected because it is one of the most suitable sites in the country for the conservation of this species.

The following species are identified as additional Special Conservation Interests (SCIs) for Castlemaine Harbour SPA:

Mallard (*Anas platyrynchos*),
Scaup (*Aythya marila*),
Cormorant (*Phalacrocorax carbo*),
Oystercatcher (*Haematopus ostralegus*),
Greenshank (*Tringa nebularia*),
Redshank (*Tringa totanus*),
Turnstone (*Arenaria interpres*).

The wetlands contained within Castlemaine Harbour SPA have been identified of conservation importance for non-breeding migratory waterbirds. Therefore the wetland habitats and the waterbirds that utilise this resource are considered to be an additional Special Conservation Interest.

Table 2.1 provides a designation summary for Castlemaine Harbour SPA.

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

**Table 2.1 Designation Summary: Castlemaine Harbour Special Protection Area**

| SPA Site Name: Castlemaine Harbour<br>SPA Site Code: 4029 | | | | | | |
|---|---|---|---|---|---|---|
| | **Special Conservation Interests** | **Annex I species** | **Baseline population[a]** | | **Population status at baseline** | |
| **Selection Species** | Light-bellied Brent Goose | | 694 | | International Importance | |
| | Wigeon | | 6,819 | | All-Ireland Importance | |
| | Pintail | | 145 | | All-Ireland Importance | |
| | Common Scoter | | 3,637 | | All-Ireland Importance | |
| | Red-throated Diver | Yes | 56 | | All-Ireland Importance | |
| | Ringed Plover | | 206 | | All-Ireland Importance | |
| | Sanderling | | 335 | | All-Ireland Importance | |
| | Bar-tailed Godwit | Yes | 397 | | All-Ireland Importance | |
| | Chough | Yes | 40 - 64 | | All-Ireland Importance | |
| **Additional Special Conservation Interests** | Mallard | | 487 | | All-Ireland Importance | |
| | Scaup | | 74 | | All-Ireland Importance | |
| | Cormorant | | 135 | | All-Ireland Importance | |
| | Oystercatcher | | 1,035 | | All-Ireland Importance | |
| | Greenshank | | 46 | | All-Ireland Importance | |
| | Redshank | | 341 | | All-Ireland Importance | |
| | Turnstone | | 144 | | All-Ireland Importance | |
| | **Other conservation designations associated with the site[b]** | **SAC** | **Ramsar** | **IBA** | **Wildfowl Sanctuary** | **Other** |
| | | Yes | Yes | Yes | Yes | Nature Reserve |

[a]Baseline data is the mean peak for the period 1995/96 – 1999/00 (I-WeBS) with the exception of Light-bellied Brent Geese (Robinson et al. 2004) and Chough (data from winter 2002/03 and 2003/04) (Trewby et al. 2006).
[b]Note that other designations associated with Castlemaine Harbour may relate to different areas and/or some of these areas may be outside the SPA boundary.

## 2.2 Castlemaine Harbour SPA – species importance in relation to populations occurring at National, Regional and County spatial scales

Table 2.2 shows the importance of the non-breeding populations of the Special Conservation Interest species of Castlemaine Harbour SPA (site-scale) relative to national populations, and the species' occurrence at regional and county levels.

Species data for the site from the baseline period (1995/96 – 1999/00) is compared with data for the same period across all Irish wetland SPA sites to gain all-Ireland importance; and likewise against regional and county sites to gain these respective importance levels. 'Region' refers to regions as defined by Irish Regions Office and 'County' refers to wetland SPA sites in County Kerry.

**Table 2.2 Non-breeding waterbird populations of Castlemaine Harbour SPA – all-Ireland, regional and county importance**

| | Site Special Conservation Interests (SCIs) | National Importance Rank[1] | Regional Importance Rank[2] | County Importance Rank[3] |
|---|---|---|---|---|
| Selection Species | Light-bellied Brent Goose | 10 | 2 | 2 |
| | Wigeon | 3 | 1 | 1 |
| | Pintail | 3 | 1 | 1 |
| | Common Scoter | 1 | 1 | 1 |
| | Red-throated Diver | 2 | 1 | 1 |
| | Ringed Plover | 7 | 2 | 2 |
| | Sanderling | 2 | 1 | 1 |
| | Bar-tailed Godwit | 15 | 4 | 2 |
| Additional Special Conservation Interests | Mallard | 7 | 2 | 2 |
| | Scaup | 4 | 2 | 2 |
| | Cormorant | 8 | 2 | 1 |
| | Oystercatcher | 11 | 3 | 2 |
| | Greenshank | 8 | 1 | 1 |
| | Redshank | 21 | 5 | 2 |
| | Turnstone | 10 | 3 | 2 |

[1]All-Ireland importance rank - the number given relates to the importance of the non-breeding population a SCI species during the baseline period (1995/96 – 1999/00) relative to the overall all-Ireland population.
[2]Regional importance rank - the number given relates to the importance of the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to the numbers that occur at sites within the south-west region.
[3]County importance rank - the number given relates to the importance of the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to the numbers that occur at wetland sites within Co Kerry.

## PART THREE - CONSERVATION OBJECTIVES FOR CASTLEMAINE HARBOUR SPA

### 3.1 Conservation Objectives for the Special Conservation Interests of Castlemaine Harbour SPA

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

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

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

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

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

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

- To be favourable, there should be no significant decrease in the numbers or **range (distribution)** of areas used by the waterbird species of Special Conservation Interest, other than that occurring from natural patterns of variation.[6]

Note that disturbance of a singular or cumulative nature could result in displacement of waterbirds or a reduction in their numbers and therefore adversely affect the achievement of Objective 1.

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

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

[6] Distribution from the 2009/2010 waterbird survey programme is introduced in Section 5.

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

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

- To be favourable the permanent **area** occupied by the wetland habitat should be stable and not significantly less than the areas of 7472, 3983 & 322 hectares for subtidal, intertidal and supratidal habitats respectively, other than that occurring from natural patterns of variation.[7]



[7] These are apparent areas as defined by SPA boundary to MLWN, MLWM to MHWM, and MHWM to SPA boundary (the latter value is minus the sand dunes at Inch and Rosbehy) as illustrated in the Ordnance Survey Discovery 1:50,000 series database.

**Table 3.1**. Conservation Objectives for the waterbird Special Conservation Interests of Castlemaine Harbour SPA.

| **Objective 1:**<br><br>*To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Castlemaine Harbour SPA, which is defined by the following list of attributes and targets (note that this objective relates to all waterbird species of Special Conservation Interest).* | | | | |
|---|---|---|---|---|
| **Parameter** | **Attribute** | **Measure** | **Target** | **Notes** |
| | | | | |
| Population | Population trend | Percentage change | The long term population trend should be stable or increasing | Population trend assessment (Generalised Additive Modelling (GAM)) is undertaken (where appropriate) using waterbird count data collected through the Irish Wetland Bird Survey and other surveys |
| Range | Distribution | Number and range of areas used by waterbirds | There should be no significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation | As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2009/2010 waterbird survey programme is discussed in Section 5 |

| **Objective 2:**<br><br>*To maintain the favourable conservation condition of the wetland habitat at Castlemaine Harbour 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 | Subtidal, Intertidal and Supratidal habitat areas | Area (Ha) | The permanent area occupied by the wetland habitat should be stable and not significantly less than the areas of 7472, 3983 & 322 hectares for subtidal, intertidal and supratidal habitats respectively, other than that occurring from natural patterns of variation | As defined by SPA boundary to MLWM; MLWM to MHWM; and MHWM to SPA boundary (the latter value is minus the sand dunes of Inch and Rosbehy) as illustrated in the Ordnance Survey Discovery 1:50,000 series database |

## PART FOUR – REVIEW OF THE CONSERVATION CONDITION OF WATERBIRD INTEREST FEATURES

### 4.1 Waterbird population data - Castlemaine Harbour SPA

Table 4.1 presents waterbird population[8] data for Castlemaine Harbour SPA. The five-year average for the baseline period (1995/96 – 1999/00) is given together with the most recent five-year average (2005/06 – 2009/10). These averages are based on annual peak counts from the Irish Wetland Bird Survey (I-WeBS), a survey undertaken on a rising or high tide. To allow calculation of the recent five-year average, the dataset comprises I-WeBS data for the period 2005/06 – 2008/09 and count data from the high tide count undertaken as part of the 2009/10 waterbird survey programme.

Note that the International and all-Ireland 1% thresholds used to assess the baseline period and the recent site average are different. These thresholds (periods 1994/95 – 1998/99 and 1999/00 – 2003/04) are outlined in Crowe et al. (2008).

**Table 4.1 Site population data for waterbird Special Conservation Interest Species of Castlemaine Harbour SPA**

| Special Conservation Interests | Baseline Data Period (1995/95 – 1999/00) | Recent Site Average (2005/06 – 2009/10) |
|---|---|---|
| Light-bellied Brent Goose | 694 (i) | 535 (i) |
| Wigeon | 6,819 (n) | 341 |
| Pintail | 145 (n) | 133 (n) |
| Common Scoter | 3,637 (n) | n/c |
| Red-throated Diver | 56 (n) | n/c |
| Ringed Plover | 206 (n) | 101 |
| Sanderling | 335 (n) | 468 (n) |
| Bar-tailed Godwit | 397 (n) | 163 (n) |
| Mallard | 487 (n) | 149 |
| Scaup | 74 (n) | 6 |
| Cormorant | 135 | 48 |
| Oystercatcher | 1035 (n) | 629 |
| Greenshank | 46 (n) | 18 |
| Redshank | 341 (n) | 380 (n) |
| Turnstone | 144 (n) | 64 |

Denotes numbers of International importance; (n) denotes numbers of all-Ireland importance.
n/c = not calculated.

Castlemaine Harbour is a large site that presents several challenges in terms of achieving complete coverage during waterbird counts. Inch dune system poses a particular problem in terms of accessing adequate vantage points along its eastern shoreline. The northern section of tidal flats to the east of this dune system has not been covered consistently during I-WeBS counts in several recent years (largely 2001 to 2008) due to restricted access to suitable vantage points.

The southern section to the east of the dune system is some considerable distance from shoreline vantage points in the north and while adequate counts of some larger species such as Light-bellied Brent Geese or Wigeon may have been achieved by some counters in some years, the quality and consistency of any data gathered from this section has varied greatly across the

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

dataset due to many factors including observer experience and weather conditions. Complete coverage of both northern and southern tidal flats has been achieved in recent years due to extra effort undertaken to navigate Inch Strand and/or dunes to access vantage points, and complete coverage was achieved during the 2009/10 waterbird survey programme.

The largely subtidal areas to the west of Inch and Rosbehy dune systems support offshore species such as Red-throated Diver and Common Scoter. These species are only detected when located sufficiently close to land-based vantage points and/or during suitable weather conditions. The area west of Rosbehy dune system has not been consistently counted during I-WeBS, with relatively few counts undertaken across eight winters. The subtidal area west of Inch Strand has not, until recently, been included within I-WeBS counts. For these reasons the recent five-year mean numbers of Common Scoter and Red-throated Diver are not presented in Table 4.1.

Population trend analysis and the conservation condition of Special Conservation Interest Species at Castlemaine Harbour are presented in the following two sections of this report. Factors related to incomplete coverage during I-WeBS counts, as described above, have been taken into consideration during these analyses; details presented in the methodologies as appropriate.

### 4.2 Waterbird population trends at Castlemaine Harbour SPA

Annual population indices were calculated for each SCI species. These indices were then smoothed using GAM analysis (Generalised Additive Modelling) and used to assess population change over a given time period. Analysis was undertaken using data from the Irish Wetland Bird Survey (I-WeBS). Details of methodology are provided in Appendix 2.

Table 4.2 presents site population trends for the waterbird Special Conservation Interest species of Castlemaine Harbour. Trends are calculated for the long-term 12-year period (1995/96–2007/08) and the recent five-year period (2002/03-2007/08). Positive values equate to increases in population size while negative values reflect a decrease in population size across the specified time period.

Trend analysis was not carried out for the following species:

**Pintail** – this species was not recorded at the site during the period 2003/04 to 2007/08 inclusive.

**Red-throated Diver & Common Scoter** – inconsistent counts of the offshore areas to the west of Inch and Rosbehy dune systems.

**Scaup –** this species was not recorded at the site during several years of the I-WeBS survey programme.

For Pintail and Scaup a measure of population change was calculated using the generic threshold method (JNCC, 2004) comparing population size at two time intervals, based on five-year means (see Appendix 2 for methods).

**Table 4.2 Site Population Trends for waterbird Special Conservation Interest Species of Castlemaine Harbour SPA**

| Special Conservation Interests | Site Population Trend[1] 12 Yr | Site Population Trend[2] 5 Yr | Population Change[3] | Recent Direction[4] |
|---|---|---|---|---|
| Light-bellied Brent Goose | - 6.1 | - 7.2 | | No change/Increasing |
| Wigeon | - 60.0 | - 54.6 | | Still declining |
| Pintail | n/c | n/c | - 8 | Improving |
| Common Scoter | n/c | n/c | | Improving |
| Red-throated Diver | n/c | n/c | | No identified change |
| Ringed Plover | - 57.7 | + 2.5 | | Stable |
| Sanderling | + 158 | +124 | | Increase/Stable |
| Bar-tailed Godwit | - 46.6 | - 44.8 | | No change |
| Mallard | - 13.9 | - 6.2 | | Slightly improving |
| Scaup | n/c | n/c | - 92 | No change |
| Cormorant | - 40.8 | + 1.83 | | Stable |
| Oystercatcher | - 53.1 | + 10.4 | | Stable/Improving |
| Greenshank | - 31.4 | - 19.4 | | Improving |
| Redshank | + 41.1 | + 79.3 | | Increasing |
| Turnstone | - 59.8 | + 31.6 | | Improving |

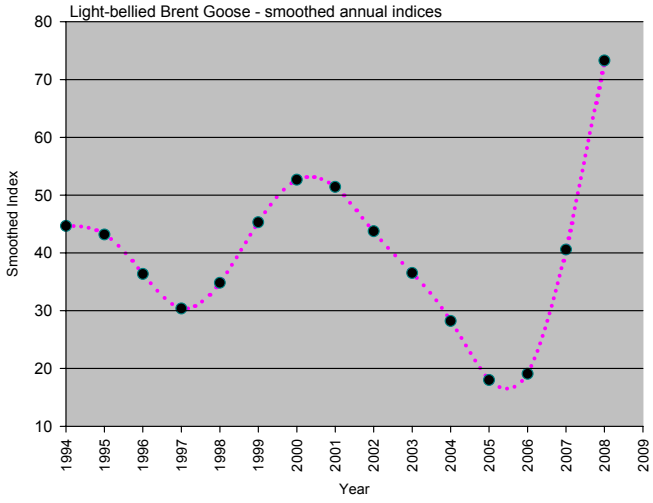
[1]Site population trend analysis: 12 yr = 1995/96 – 2007/08
[2]Site population trend analysis: 5 yr = 2002/03 –2007/08.
[3]Site population change based on two five-year means (1995/96 – 1999/00 and 2005/06 – 2009/10).
[4]Recent direction – see explanatory text below.
n/c = not calculated.

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

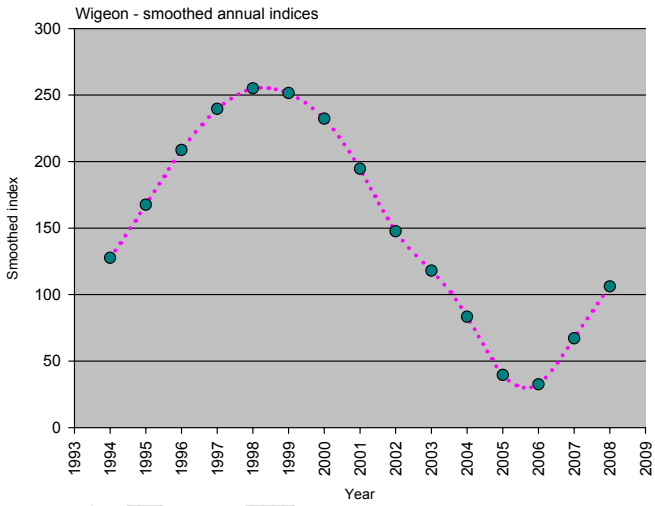
The final column of Table 4.2 gives an indication of the recent direction in population change. Explanatory notes for the long and short-term trends and recent direction are given below together with cautions regarding interpretation where necessary.

**Light-bellied Brent Geese** - counts have shown inter-annual variation but the smoothed index suggests a relatively stable population across time with only a small decline evident from 13 and 5 year trends.

Note that recent 'increases' in numbers reflect better coverage of the site during counts and should be interpreted accordingly.

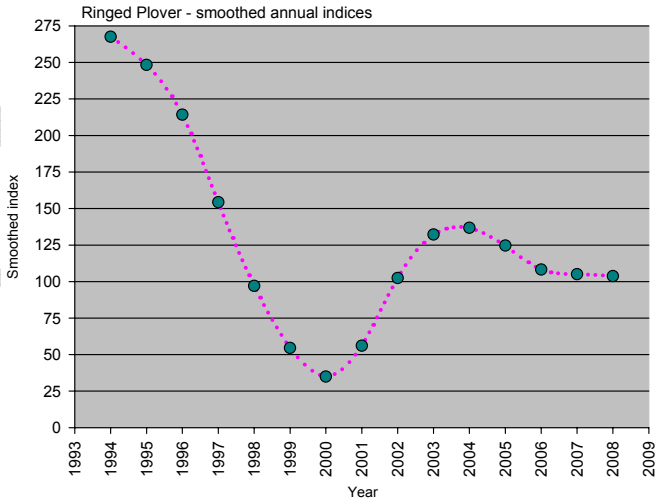


**Wigeon** – the site population increased annually from 1994 to 2001 then underwent a steady decline.




**Pintail, Common Scoter, Red-throated Diver and Scaup** - rather than the 5-year trend, a tentative direction is given in Table 4.3 based on the assessment of data from recent counts with full coverage. Note however, that more long-term data will be required to assess these species with any confidence.

**Ringed Plover** – higher numbers present at the site in the early 1990's have influenced the long-term trend for decline. The short-term trend shows a relatively stable population of lower numbers than were present during the early part of the dataset.




**Sanderling** – exceptionally high numbers during the winter of 2005/06 influences the level of positive change. An overall trend for increase.

**Bar-tailed Godwit** – great inter-annual variation in the early 1990's results in the trend for this species being difficult to interpret. Numbers have been more stable since 2001 with the exception of extremely low numbers in 2006.

**Mallard** – this species exhibited an increase in numbers from 1997 to 2001, followed by a decline to 2005. The short-term trend suggests improvement. Mallard populations are difficult to assess with confidence because of the influence of captive-reared birds, hunting and within-season movements to smaller inland wetlands (Crowe et al. 2008).

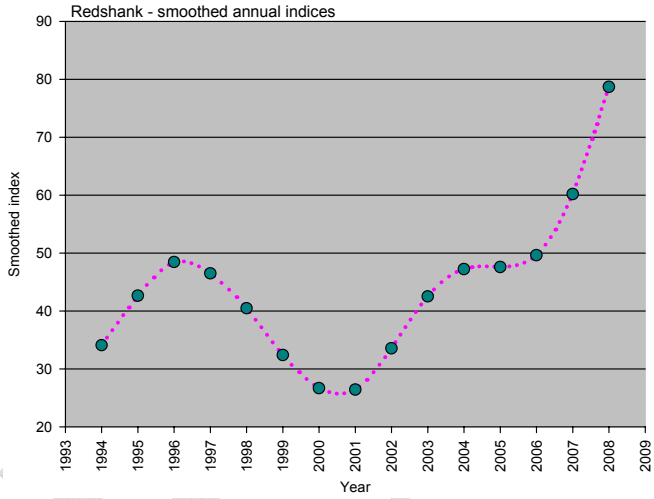
**Cormorant** – annual numbers at Castlemaine have been relatively stable since 2003 but lower than those recorded in the 1990's, hence the long-term trend for decline.

**Oystercatcher** – the overall trend for decline is driven by higher numbers between 1994 and 1996. Since 1998, annual numbers have shown variability but appear relatively stable, albeit lower than recorded in the earlier years of the dataset.

**Greenshank** – significantly lower numbers at the site during the period 1999 – 2001 following a year (1998) with exceptionally high numbers influences the long-term trend for decline. Stable/improving over the short-term.

**Redshank** – an increase in numbers since 2001 follows the national long-term trend for increase (Crowe et al. 2008).

**Turnstone** – a long-term trend for decline due to higher numbers recorded during the 1990's. The population appears relatively stable since 2001 with a short-term trend for increase.




### 4.3 Castlemaine Harbour SPA – site conservation condition of non-breeding waterbirds

Conservation condition of waterbird species is determined using the long-term (12-year) site population trend (Table 4.3). For Pintail and Scaup, conservation condition is assigned using % population change but this is tentative given the factors (described in Section 4.1) relating to incomplete coverage during counts and species' absence during counts.

Conservation condition is assigned using the following criteria:

**Favourable population =** population is stable/increasing.

**Intermediate (unfavourable) =** Population decline in the range 1 - 24%.

**Moderately Unfavourable population =** populations that have declined between 25 – 49% from the baseline reference value.

**Highly Unfavourable population =** populations that have declined > 50% from the baseline reference value.

The threshold levels of >25% and >50% follows standard convention used for waterbirds (e.g. Lynas et al. 2007; Leech et al. 2002). The 'Intermediate' range (1% - 24% decline) allows for natural fluctuations and represents a range within which relatively small trends for decline 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% are deemed of greater ecological significance for the long-term.

With regards the 15 waterbird species of Special Conservation Interest for Castlemaine Harbour SPA it has been determined that:-

1. 5 species are currently considered **highly unfavourable** (Wigeon, Ringed Plover, Scaup, Oystercatcher & Turnstone);
2. 3 species are currently considered as **moderately unfavourable** (Bar-tailed Godwit, Cormorant & Greenshank);
3. 3 species are considered as **intermediate (unfavourable)** (Light-bellied Brent Goose, Pintail & Mallard);
4. 2 species are currently considered as **favourable** (Sanderling & Redshank).

Conservation condition is indeterminable for 2 species (Common Scoter and Red-throated Diver).

**Table 4.3 Non-breeding waterbirds of Castlemaine Harbour SPA – Current Site Conservation Condition**

| Special Conservation Interests | Site Population Trend 12 Yr | Site Conservation Condition |
|---|---|---|
| Light-bellied Brent Goose* | - 6.1 | Intermediate (unfavourable) |
| Wigeon* | - 60 | Highly Unfavourable |
| Pintail* | - 8 | Intermediate (unfavourable) |
| Common Scoter* | n/c | n/c |
| Red-throated Diver* | n/c | n/c |
| Ringed Plover* | - 57.7 | Highly Unfavourable |
| Sanderling* | + 158 | Favourable |
| Bar-tailed Godwit* | - 46.6 | Moderately Unfavourable |
| Mallard | - 13.9 | Intermediate (unfavourable) |
| Scaup | - 92 | Highly Unfavourable |
| Cormorant | - 40.8 | Moderately Unfavourable |
| Oystercatcher | - 53.1 | Highly Unfavourable |
| Greenshank | - 31.4 | Moderately Unfavourable |
| Redshank | + 41.1 | Favourable |
| Turnstone | - 59.8 | Highly Unfavourable |

* Denotes site selection species. n/c = not calculated.

## 4.4 Conservation condition in light of all-Ireland and International trends

Site conservation condition and population trends for waterbird species of Special Conservation Interest at Castlemaine Harbour SPA have been reviewed in light of species' all-Ireland and international trends. The information review is presented in Table 4.4.

The calculation of all-Ireland trends (island of Ireland) for the long-term (12-year) data period has been facilitated by the provision of indices from the I-WeBS and the WeBS database (kindly provided by the I-WeBS office and the British Trust for Ornithology). International trends follow Wetlands International (2006).

An additional assessment is carried out in Table 4.4 which examines the relationship between a species' site trend and the current all-Ireland trend for the same time period (1994/95 to 2008/09). The colour coding used represents the following cases:-

- Grey – species for which analysis was not undertaken.
- Green – species whose populations are stable or increasing at both site level and all-Ireland level.

- Beige – species whose populations are declining at both site level and all-Ireland level. Therefore there is a potential for factors at a larger spatial scale to be influencing the observed trend at site level.
- Orange - species whose populations are exhibiting an intermediate (1 - 25%) decline at site level but are stable or increasing at all-Ireland level.
- Pink - species whose populations are exhibiting a moderate (25 – 49%) decline at site level but are stable or increasing at all-Ireland level.
- Red - species whose populations are exhibiting a high (>50%) decline at site level but are stable or increasing at all-Ireland level.

In the case of both pink and red categories where populations are stable at national level, but significant declines are seen at site level, it is reasonable to suggest that site-based management issues may be responsible for the observed declining site population trends (Leech et al. 2002).

**Table 4.4 Non-breeding waterbird populations of Castlemaine Harbour SPA – additional population review, status and trends**

| Site Special Conservation Interests (SCIs) | BoCCI Category | Current Site Conservation Condition | Current Site Trend 12 Yr[a] | Current all-Ireland Trend[c] | Current International Trend[d] |
|---|---|---|---|---|---|
| Light-bellied Brent Goose* | Amber | Intermediate (unfavourable) | - 6.1 | + 58 | Increase |
| Wigeon* | Amber | Highly Unfavourable | - 60.00 | - 20.2 | Stable |
| Pintail* | Red | Intermediate (unfavourable) | (- 8)[b] | + 26.8 | Stable |
| Common Scoter* | Red | n/c | n/c | n/c | Stable |
| Red-throated Diver* | Amber | n/c | n/c | n/c | Stable |
| Ringed Plover* | Amber | Highly Unfavourable | - 57.7 | + 21.8 | Decline |
| Sanderling* | Green | Favourable | + 158 | + 109.4 | Stable/Increase |
| Bar-tailed Godwit* | Amber | Moderately Unfavourable | - 46.6 | + 1.5 | Stable |
| Mallard | Green | Intermediate (unfavourable) | - 13.9 | - 16 | Decline/Stable |
| Scaup | Amber | Highly Unfavourable | (-92)[b] | + 88.7 | Stable |
| Cormorant | Amber | Moderately Unfavourable | - 40.8 | + 31.5 | Increase |
| Oystercatcher | Amber | Highly Unfavourable | - 53.1 | + 23.6 | Decline |
| Greenshank | Amber | Moderately Unfavourable | - 31.4 | + 79.7 | Stable |
| Redshank | Red | Favourable | + 41.1 | + 22.7 | Stable/Decline |
| Turnstone | Green | Highly Unfavourable | - 59.8 | + 16.1 | Decline |

*Denotes site selection species; [a]Site population trend analysis: 12 yr = 1995/96 – 2007/08; [b]based on two five year averages (see text).; [c]all-Ireland trend calculated for period 1994/95 to 2008/09; [d]international trend after Wetland International (2006); n/c = not calculated.

## PART FIVE – CONSERVATION ADVICE NOTES

### 5.1 INTRODUCTION

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

The information provided in Part Five is intended to:-

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

Section 5.2 provides selected ecological summary information for the non-breeding waterbirds of Castlemaine Harbour SPA. This is intended to aid the interpretation of species distribution data provided within Section 5.3 of this report and related appendices. Finally, Section 5.4 provides summary information for current activities and events that occur at Castlemaine Harbour 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.

Note that the information provided in this document does not provide a comprehensive assessment on which to assess plans and projects as required under the Habitats Directive, but rather should inform the scope of the assessments and help direct where further detailed examinations are required.

Part 5 should be reviewed with cognisance of the results of SAC benthic surveying and monitoring programmes (Aquatic Services Unit, 2008; Marine Institute, 2010) and the NPWS Marine Advisory Document for Castlemaine Harbour cSAC (Version June 2010).

The information provided is based on best-available information at time of report production (July 2010).

### 5.2 WATERBIRD SPECIES – ADDITIONAL 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 60 waterbird species that have been recorded at Castlemaine Harbour SPA during the period 1994/95 – 2007/08 representing ten families: *Gaviidae* (divers), *Podicipedidae* (grebes), *Anatidae* (swans, geese and ducks), *Rallidae* (Water Rail, Moorhen & Coot), *Haematopodidae* (oystercatchers), *Charadriidae* (plovers and lapwings), *Scolopacidae* (sandpipers and allies) and *Laridae* (gulls and terns) plus *Phalacrocoracidae* (Cormorants) and *Ciconiiformes* (Herons).

Waterbird Special Conservation Interest species for a SPA are selected as per the criteria outlined in Section 1.1, which focus on numbers of waterbirds at a site. As described in Section 1.1, the wetland habitat that is contained within a SPA, and the waterbirds that utilise this resource are considered an additional Special Conservation Interest for the site. This acknowledges the importance of wetland habitats for waterbirds, and importantly the total

assemblage of waterbirds that utilise a site including those species that occur neither regularly or in significant numbers but for which the site is of importance. It also gives due consideration to seasonality; to species which utilise the site upon passage or are present during months of the year outside of the non-breeding season[9] or species that use the site at certain times only (e.g. as a cold weather refuge).

Table 5.1 gives population data (five-year mean peaks) for a selection of additional waterbird species (non-SCI species) that occur at Castlemaine Harbour during the non-breeding season. Data are taken from the I-WeBS database. To facilitate calculation of the recent five-year average, the dataset comprises I-WeBS data for the period 2005/06 – 2008/09 and count data from the high tide count undertaken as part of the 2009/10 waterbird survey programme.

**Table 5.1 Other regularly-occurring waterbirds at Castlemaine Harbour SPA during the non-breeding season**

| Species | Baseline Average (1995/95 – 1999/00) | Recent Site Average (2005/06 – 2009/10) |
|---|---|---|
| Shelduck (*Tadorna tadorna*) | 90 | 97 |
| Teal (*Anas crecca*) | 287 | 146 |
| Red-breasted Merganser (*Mergus serrator*) | 25 | 9 |
| Great Northern Diver (*Gavia immer*) | 23 | 16 |
| Golden Plover (*Pluvialis apricaria*) | 972 | 36 |
| Lapwing (*Vanellus vanellus*) | 1095 | 723 |
| Knot (*Calidris canutus*) | 199 | 88 |
| Dunlin (*Calidris alpina*) | 909 | 877 |
| Curlew (*Numenius arquata*) | 471 | 394 |
| Black-headed Gull (*Chroicocephalus ridibundus*) | 536 | 397 |
| Herring Gull (*Larus argentatus*) | 175 | 55 |

Although waterbirds are 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 non-breeding waterbirds of Castlemaine Harbour SPA which will aid the interpretation of species distribution data. Information is provided for Special Conservation Interest species and for other regularly-occurring non-breeding waterbird species of Castlemaine Harbour SPA. Information is provided for each of the following categories:

- waterbird family (group);
- winter distribution – species distribution range during winter. Please note this is based on the period 1996/97 – 2000/01 (after Crowe, 2005);
- trophic (foraging) guild (after Weller, 1999; see Appendix 4);
- food/prey requirements;
- principal supporting habitat within the site;
- ability to utilise other/alternative habitat in/around the site;
- site fidelity (species 'faithfulness' to wintering site).

Further information to aid understanding of categories and codes is provided in the table sub text.

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

**Table 5.2** Waterbirds – Ecological characteristics, requirements & specialities of Special Conservation Interest 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 (in & around the site)[E] | Site Fidelity[F] |
|---|---|---|---|---|---|---|---|
| Light-bellied Brent Goose* *Branta bernicla hrota* | Anatidae (geese) | Highly restricted | 1, 5 | Highly specialised | Intertidal mud and sand flats, *Zostera* beds | 2 | High |
| Wigeon* *Anas penelope* | Anatidae (dabbling ducks) | Very widespread | 1, 5 | Narrower | Intertidal mud and sand flats & sheltered & shallow subtidal | 1 | Weak |
| Pintail* *Anas acuta* | Anatidae (dabbling ducks) | Localised | 1 | Wide | Sheltered & shallow subtidal over sand flats | 1 | Weak |
| Common Scoter* *Melanitta nigra* | Anatidae (sea ducks) | Localised | 3 | Highly specialised | Sheltered & shallow subtidal over sand flats | 1 | Unknown |
| Red-throated Diver* *Gavia stellata* | Gaviidae (divers) | Intermediate | 3 | Highly specialised | Sheltered & shallow subtidal over sand flats | 1 | Unknown |
| Ringed Plover* *Charadrius hiaticula* | Charadriidae (wading birds) | Localised | 4 | Wide | Intertidal mud and sand flats | 3 | High |
| Sanderling* *Calidris alba* | Scolopacidae (wading birds) | Localised | 4, 6 | Wide | Intertidal sand flats | 3 | High |
| Bar-tailed Godwit* *Limosa lapponica* | Scolopacidae (wading birds) | Localised | 4 | Wide | Intertidal mud and sand flats | 3 | Moderate |
| Mallard *Anas platyrynchos* | Anatidae (dabbling ducks) | Very widespread | 1 | Wide | Very shallow water above intertidal mud and sand flats, intertidal mud and sandflats | 1 | Moderate |
| Scaup *Aythya marila* | Anatidae (diving ducks) | Localised | 2 | Wide | Sheltered & shallow subtidal over sand flats | 1 | Unknown |
| Cormorant *Phalacrocorax carbo* | Phalacrocoracidae (cormorants) | Very widespread | 3 | Highly specialised | Sheltered & shallow subtidal over sand and mud flats | 1 | Weak |
| Oystercatcher *Haematopus ostralegus* | Haematopodidae (wading birds) | Intermediate | 4 | Narrower | 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 totanus* | Scolopacidae (wading birds) | Widespread | 4 | Wide | Intertidal mud and sand flats | 2 | Moderate |
| Turnstone *Arenaria interpres* | Scolopacidae (wading birds) | Very widespread | 4 | Wide | Intertidal mud and sand flats | 3 | High |

**Table 5.2** continued.. Waterbirds – Ecological characteristics, requirements & specialities of other regularly-occurring waterbird species

| | Family (group) | Winter distribution[A] | Trophic Guild[B] | Food/Prey Requirements[C] | Principal supporting habitats[D] | Ability to utilise other/alternative habitats (in & around the site)[E] | Site Fidelity[F] |
|---|---|---|---|---|---|---|---|
| Shelduck *Tadorna tadorna* | Anatidae (shelducks) | Intermediate | 1, 5 | Wide | Intertidal mud and sand flats | 3 | High |
| Teal *Anas crecca* | Anatidae (dabbling ducks) | Very widespread | 1 | Wide | Very shallow water above intertidal mud and sand flats | 3 | Weak |
| Red-breasted Merganser *Mergus serrator* | Anatidae (sea ducks) | Intermediate | 2 | Highly specialised | Sheltered & shallow subtidal over sand flats | 1 | Unknown |
| Great Northern Diver *Gavia immer* | Gaviidae (divers) | Intermediate | 3 | Highly specialised | Sheltered & shallow subtidal over sand flats | 1 | Unknown |
| Golden Plover *Pluvialis apricaria* | Charadriidae (wading birds) | Intermediate | 4 | Wide | Intertidal mud and sand flats | 2 | Moderate |
| Lapwing *Vanellus vanellus* | Charadriidae (wading birds) | Very 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 |
| Curlew *Numenius arquata* | Scolopacidae (wading birds) | Very widespread | 4 | Wide | Intertidal mud and sand flats | 2 | High |
| Dunlin *Calidris alpina* | Scolopacidae (wading birds) | Intermediate | 4 | Wide | Intertidal mud and sand flats | 3 | Moderate |
| Black-headed Gull *Chroicocephalus ridibundus* | Lariidae (gulls) | n/c | 1, 2, 4, 6 | Wide | Intertidal mud and sand flats & sheltered & shallow subtidal | 2 | Moderate |
| Herring Gull *Larus argentatus* | Lariidae (gulls) | n/c | 1, 2, 4, 6 | Wide | Intertidal mud and sand flats & sheltered & shallow subtidal | 2 | Moderate |

[A] Winter distribution: 1 = very widespread (>300 sites); 2 = widespread (200 – 300 sites); 3 = intermediate (100 – 200 sites); 4 = localised (50-100 sites); 5 = 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 4.

[C] Food/prey requirements - where 1 = species with a wide prey/food range; 2 = species with a narrower prey range (e.g. species that forage upon a few species/taxa only), and 3 = highly specialised foraging requirements (e.g. piscivores). Note: known link between Light-bellied Brent Goose and Zostera relates to a 'highly specialised' diet although the species does forage upon grassland when *Zostera* is depleted. Although Wigeon tend to show preference for *Zostera* they do eat other macroalgae species hence a 'narrow' rather than 'highly specialised' diet is given. Common Scoters forage predominantly on one prey group (bivalves) hence they are classed as specialised. Oystercatchers are classed as 'narrow' because they rely on larger (and more energy–rich) prey items predominantly bivalve molluscs, in comparison with smaller wader species which can achieve sufficient energy from a more varied range of smaller prey species.

[D] Principal supporting habitat present within Castlemaine Harbour SPA. Note that this is the main habitat used when foraging, other habitats may be used at other times, for example when roosting.

[E] Ability to utilise alternative habitats refers to the species ability to utilise other habitats adjacent to the site. 1 = wide-ranging species with requirement to utilise the site as and when required; 2 = reliant on site but highly likely to utilise alternative habitats at certain times (e.g. high tide); 3 = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements. Note, a score of 1 for majority of sea ducks, divers and others (e.g. Pintail, Teal) 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; high (based on available published information).

## 5.3 THE 2009/10 WATERBIRD SURVEY PROGRAMME

### 5.3.1 Introduction

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

At Castlemaine Harbour SPA, a survey programme of four low tide counts (Oct & Nov 2009 and Jan & Feb 2010) and a single high tide count (Jan 2010) was completed across the site. Waterbird species were counted across a series of 24 count sections (subsites) (Appendix 5). Behaviour was recorded within two categories (foraging or roosting/other) and position of birds was noted in relation to broad habitat types (Table 5.3). The definitions of the broad habitats intertidal, subtidal, supratidal and terrestrial were defined specifically for the survey programme and these definitions are not the same as strict scientific definitions for these habitats.

**Table 5.3 Definition of broad habitat types used**

| Broad Habitat Type | Broad Habitat Description |
|---|---|
| Intertidal (areas 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 gravel/pebbles or shingle and gravel shores. |
| Subtidal (areas that lie 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/Coastal | 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*) surrounded by intertidal flats, were included in the intertidal category. |
| Terrestrial | Used where birds were recorded within habitats close to the shoreline but were above the intertidal and supratidal levels. |

In addition to the main survey programme described above, an additional 'roost survey' was undertaken at high tide on 26th February 2010. During this survey, roost sites were located, species and numbers counted and the position of the roosts marked onto field maps.

### 5.3.2 Data analyses

The primary aim of data analyses was to understand how waterbirds are distributed across Castlemaine Harbour SPA during the non-breeding season. By assessing patterns of waterbird distribution at low tide (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 support critical waterbird functions (i.e. foraging & 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 site as a whole. Analyses were undertaken on datasets as follows:

- Total numbers (low tide surveys);
- Total numbers foraging intertidal;
- Total numbers foraging subtidal;

- Total numbers of roosting birds;
- Density – foraging intertidal.

For each of the analyses 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. The highest rank position for each subsite across any of the low tide count dates was brought forward as the final rank position for each species.

Final rank positions were converted to categories (Box 1) with the exception of assessments related to the single high tide survey (Jan 2010) which are presented simply by subsite rankings.

**Box 1**

**Rank Position - Categories**

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

Waterbird count data are also presented as species distribution maps ('dot density maps'). Dot-density maps show species distribution divided into 'foraging' birds and 'roosting/other' birds, for low tide and high tide surveys separately. 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 count sections and broad habitat types for the birds counted, the resulting map is equivalent to presenting numbers and densities, and provides a relatively quick way of assessing species distribution. **Note however, that dot-density maps are not intended to show the actual position of each bird; the dots are placed randomly within count sections so no conclusions can be made at a scale finer than count section. This is particularly relevant to the high tide count where dots are placed randomly across count sections although the intertidal habitat was largely submerged.**

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.

Please note that in places, standard waterbird codes are used in figures, tables or data files; these codes are listed in Appendix 3.

### 5.3.3 Summary Results

A total of 48 waterbird species were recorded during the 2009/10 survey programme of Castlemaine Harbour SPA. Please see Cummins and Crowe (2010) for a summary of waterbird data collected.

With the exception of Scaup that were recorded in 75% of counts, all other SCI species were recorded within all counts undertaken. Table 5.4 presents peak numbers (whole site) recorded during the low tide (LT) and high tide (HT) surveys. Average % occupancy, defined as the average proportion of subsites in which the species occurred during low tide counts, ranged from 80% (Oystercatcher) to only 3% (Scaup), highlighting the great variation in site usage by different species. Average % area occupancy, defined as the average proportion of the whole site that the species occurred in, varied from 51% (Oystercatcher) to 2% (Pintail); the latter representing a very restricted distribution within the site.

Note that % area occupancy is calculated on the total areas of subsites. As a species may have been distributed within only a selected area inside the subsite, rather than over the entire subsite, these calculations should be treated as a maximum.

**Table 5.4 Castlemaine Harbour SPA - 2009/2010 waterbird surveys – summary data**

| Site Special Conservation Interests (SCIs) | Peak number recorded during LT surveys[I] | Peak number recorded during HT surveys[II] | Average subsite % occupancy [III] | Average % area occupancy[III] |
|---|---|---|---|---|
| Light-bellied Brent Goose* | 1,374 (i) | 819 (i) | 31.3 (7.2) | 30.6 (23.0) |
| Wigeon* | 1,612 (n) | 567 | 32.8 (7.1) | 21.9 (8.4) |
| Pintail* | 105 (n) | 49 (n) | 7.3 (2.1) | 2.1 (0.8) |
| Common Scoter* | 1,892 (n) | 979 (n) | 9.3 (4.0) | 27.3 (11.2) |
| Red-throated Diver* | 33 (n) | 2 | 8.3 (3.4) | 19.9 (3.8) |
| Ringed Plover* | 731 (n) | 205 (n) | 18.8 (7.2) | 12.4 (2.7) |
| Sanderling* | 325 (n) | 428 (n) | 15.6 (7.9) | 10.2 (3.9) |
| Bar-tailed Godwit* | 284 (n) | 318 (n) | 22.9 (4.2) | 17.1 (5.3) |
| Mallard | 1,401 (n) | 380 (n) | 55.2 (8.6) | 31.2 (7.6) |
| Scaup | 14 | 0 | 3.1 (2.1) | 4.2 (3.1) |
| Cormorant | 141 (n) | 48 | 45.8 (13.2) | 36.3 (10) |
| Oystercatcher | 1,897 (n) | 1,049 (n) | 80.0 (2.1) | 51.5 (3.0) |
| Greenshank | 77 (n) | 47 (n) | 50 (12.3) | 30.2 (6.4) |
| Redshank | 1,170 (n) | 822 (n) | 60.4 (8.0) | 36.8 (6.2) |
| Turnstone | 136 (n) | 147 (n) | 29.2 (7.6) | 22.4 (8.6) |

* Denotes 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).
[I] 4 low-tide counts undertaken on (05/10/09, 21/11/09, 04/01/2010 and 01/02/2010).
[II] 1high-tide count undertaken on (25/01/2010).
[III] Mean (± s.d.) calculated across low tide counts.

Species richness (total number of species) across the whole site was relatively constant throughout the survey programme; species numbers of 37, 39, 42 and 42 for the four low tide counts respectively, with 34 species recorded during the high tide count in January 2010.

Subsite species richness varied considerably ranging from 25 species (Subsite 0K468) to subsites that recorded only one species (e.g. 0K915 & 0K916 on 21/11/09) (Appendix 6). Average subsite species richness (low tide) was greatest in 0K468 (Table 5.5). Generally, higher diversity was found within subsites dominated by intertidal habitats. There was no relationship between subsite size (area) and species richness.

**Table 5.5 Subsite Species Richness – averaged across the four low tide surveys of the 2009/10 waterbird survey programme**

| Subsite | Average LT Species Richness (Mean ±S.D) |
|---|---|
| 0K443 | 15 (4) |
| 0K444 | 14 (3) |
| 0K445 | 20 (3) |
| 0K446 | 17 (5) |
| 0K447 | 19 (4) |
| 0K448 | 13 (1) |
| 0K449 | 13 (3) |
| 0K455 | 18 (3) |
| 0K456 | 13 (2) |
| 0K457 | 12 (2) |
| 0K458 | 11 (2) |
| 0K466 | 3 (2) |
| 0K467 | 20 (3) |
| 0K468 | 23 (3) |
| 0K469 | 16 (3) |
| 0K473 | 9 (3) |
| 0K474 | 7 (3) |
| 0K475 | 9 (4) |
| 0K915 | 2 (2) |
| 0K916 | 1 (1) |
| 0K917 | 4 (1) |
| 0K918 | 6 (5) |
| 0K919 | 4 (3) |
| 0K920 | 2 (1) |

### 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. Selected results of these 'subsite assessments' are shown in Tables 5.6 (a–h). The categories L, M, H, V used in Table 5.6 (a-e) relate to final rank positions (see 5.3.2 for methodology). Rank positions themselves are used in Tables 5.6 (f-h) for the single high tide survey (Jan 2010). Note that boxes left blank refer to subsites within which a species was not recorded.

The fact that different subsites may be categorised as 'Very High' for the same species highlights the fact that several subsites may be equally important for the aspect of the species' wintering ecology in question. This approach, rather than averaging across all low tide 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 and availabilities.

Tables 5.6 (a-h) highlight where species have a relatively restricted distribution across the site, most notable in divers and ducks, but also for species such as Bar-tailed Godwit and Sanderling. The tables also highlight where particular subsites are extremely important for many different species, most notable being subsites 0K446 and 0K447.

Waterbird distribution maps ('dot-density maps') from the four low tide surveys and the single high tide survey are provided in Appendix 7. In addition, summary roost data and a map showing actual[10] locations of roost sites (26th Feb 2010) are presented in Appendix 8.

[10] The roost map shows the actual recorded position of roost sites (in contrast to dot-density maps).

To aid interpretation of maps and tables, a discussion on the distribution of each SCI species is provided in the following pages. This information draws upon the full extent of the data collected and analysed for Castlemaine Harbour SPA. Please note that where mentioned, information about benthic communities or sediment data is taken from intertidal survey data (Aquatic Services Unit, 2008) and marine subtidal surveys (Marine Institute, 2010).

Overall, the analyses and mapping provides comprehensive information on the distribution and abundance of non-breeding waterbirds at Castlemaine Harbour SPA. However, it should be borne in mind that information from the 2009/10 waterbird survey programme refers to a single season of surveys. Information provided should not be considered as absolute because 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.

**Table 5.6 (a) Castlemaine Harbour SPA Subsite assessment – total numbers (all behaviours) during LT surveys.**

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | H | V | H | V | V | H | | | | | | | M | M | H | M | H | H | | | | | | |
| **WN** | | | H | V | V | H | M | H | H | | M | | V | H | H | | H | H | | | | | | |
| **PT** | | | | H | V | | | | | | | | | | | | H | | | | | | | |
| **CX** | | | | | | | | | | | | | | | | | | | | H | V | V | | |
| **RH** | | | | | | | | | | | | | | | | M | V | | V | M | V | H | | |
| **RP** | H | V | H | M | V | | H | M | | | | | V | | M | | | H | | | | | | |
| **SS** | | M | H | H | V | | | | | | | | V | V | | | | | | | | | M | |
| **BA** | M | V | H | V | | | | M | | H | | | H | V | H | | H | H | | | | | | |
| **MA** | L | H | V | V | V | H | M | H | M | M | M | H | H | H | M | | H | H | | | | | | |
| **SP** | | | | | | | | | | | | | V | V | | | | | | | | | | |
| **CA** | H | M | V | H | M | H | H | H | H | M | | | H | V | M | M | L | | | | | H | | V |
| **OC** | M | H | H | V | V | H | H | H | M | H | M | | H | H | H | L | L | M | | L | L | M | H | L |
| **GK** | H | | H | V | V | M | V | H | V | M | H | | M | V | H | L | M | H | | | | | | |
| **RK** | M | M | H | H | V | H | H | V | H | H | V | M | H | H | H | L | L | M | | | | | | |
| **TT** | H | H | | V | V | H | H | H | | H | H | | H | V | H | H | | V | | | | | | |

**Table 5.6 (b) Castlemaine Harbour SPA Subsite assessment – total numbers foraging intertidally during LT surveys.**

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | M | V | H | V | V | H | | | | | | | | H | V | | | H | | | | | | |
| **WN** | | | V | V | V | M | L | M | | | | | L | H | H | | | H | | | | | | |
| **RP** | M | H | V | M | V | | | H | | | | | V | | M | | | H | | | | | | |
| **SS** | | M | H | H | V | | | | | | | | V | V | | | | | | | | | M | |
| **BA** | M | V | H | V | | | | | | H | | | H | V | M | | | H | | | | | | |
| **MA** | L | | V | V | V | H | | | | | | | | M | L | | | H | | | | | | |
| **OC** | M | H | H | V | V | H | H | H | M | H | M | | H | H | H | L | L | M | | M | | L | H | M |
| **GK** | M | | M | V | V | L | V | H | H | M | M | | | H | M | | | V | | | | | | |
| **RK** | M | M | H | V | V | M | H | V | H | H | H | | H | H | | L | L | M | | | | | | |
| **TT** | H | H | | V | V | H | H | H | | H | H | | H | V | H | H | | V | | | | | | |

**Table 5.6 I Castlemaine Harbour SPA Subsite assessment – total numbers foraging subtidally during LT surveys**

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | V | | | | | H | | | | | | | | | V | | V | | | | | | | |
| **WN** | | | | | | M | V | | V | | | | M | V | | | | | | | | | | |
| **PT** | | | | V | V | | | | | | | | | | | | | | | | | | | |
| **CX** | | | | | | | | | | | | | | | | | | | | H | V | H | | |
| **RH** | | | | | | | | | | | | | | | | H | H | | V | | V | H | | |
| **MA** | | | | | | H | H | V | H | H | H | V | | V | | | V | | | | | | | |
| **SP** | | | | | | | | | | | | | | V | | | | | | | | | | |
| **CA** | H | | V | | | H | H | | H | | | | H | H | M | H | | | | | | V | | V |

**Table 5.6 (d) Castlemaine Harbour SPA Subsite assessment – average foraging density (intertidal foraging only)**

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | L | H | H | V | M | L | | | | | | | | L | M | | | M | | | | | | |
| **WN** | | | H | V | H | M | L | L | | | | | | L | M | | | M | | | | | | |
| **PT** | | | | | | | | | | | | | | | | | | | | | | | | |
| **CX** | | | | | | | | | | | | | | | | | | | | | | | | |
| **RH** | | | | | | | | | | | | | | | | | | | | | | | | |
| **RP** | M | M | H | M | H | | L | L | | | | | V | | L | | | L | | | | | | |
| **SS** | | L | M | H | V | | | | | | | | H | L | | | | | | | | | M | |
| **BA** | | V | L | M | | | | | | M | | | H | H | H | | | L | | | | | | |
| **MA** | | | | | | | | | | | | | | | | | | | | | | | | |
| **SP** | | | | | | | | | | | | | | | | | | | | | | | | |
| **CA** | | | | | | | | | | | | | | | | | | | | | | | | |
| **OC** | M | M | H | H | H | L | L | M | M | M | H | | L | L | M | L | | L | | H | | L | H | L |
| **GK** | M | | L | H | H | L | M | H | H | M | V | | L | L | M | | | M | | | | | | |
| **RK** | | | M | H | M | L | L | H | H | M | V | | M | L | M | L | | L | | | | | | |
| **TT** | M | L | | H | H | L | M | M | | L | V | | V | M | M | H | | M | | | | | | |

**Table 5.6 (e) Castlemaine Harbour SPA Subsite assessment – total number (roosting/other behaviour) during LT surveys** (note that species not analysed recorded insufficient data in this behaviour)

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | M | H | | M | V | H | | | | | | | H | | V | M | H | | | | | | | |
| **WN** | | | | M | V | V | | H | H | | H | | V | H | H | | H | | | | | | | |
| **PT** | | | | H | V | | | | | | | | | | | | H | | | | | | | |
| **RP** | V | | | | | | | | | | | | V | | | | | | | | | | | |
| **MA** | | V | | H | V | H | M | V | H | M | H | H | H | H | H | | H | H | | | | | | |
| **CA** | H | M | V | V | H | M | H | H | H | M | | | H | V | | H | M | | | | | M | | H |
| **OC** | V | H | | | | H | H | H | M | M | M | | H | V | M | | | | | | | H | V | |
| **GK** | | | | V | | H | H | | | V | H | V | | | H | H | | | | | | | | |
| **RK** | H | | V | | | | | V | M | | H | H | V | V | | | | | | | | | | |
| **TT** | H | | | | | | | | | | | | | | V | V | | V | | | | | | |

**Table 5.6 (f) Castlemaine Harbour SPA Subsite assessment – total numbers (roosting/other behaviour) during the HT survey** (note that species not analysed recorded insufficient data in this behaviour)

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | | | 1 | | 2 | | | | | | | | | | | | | | | | | | | |
| **WN** | | | 1 | | | | | 2 | | | 6 | | 4 | 3 | | | | 5 | | | | | | |
| **PT** | | | | | 1 | | | | | | | | | | | | | | | | | | | |
| **RP** | | | | | | | | | | | | | | | 3 | 1 | | 2 | | | | | | |
| **BA** | | | | | | | | 2 | | | | | | 1 | | | | | | | | | | |
| **MA** | | | 1 | | | | | 2 | | 4 | 6 | 3 | 6 | 6 | | | | 5 | | | | | | |
| **CA** | 2 | | | | | | | 4 | | | | 6 | 1 | 3 | | 6 | | 5 | | | | | | |
| **OC** | 2 | 11 | | | 4 | 7 | 9 | 3 | | | | | 6 | 1 | 5 | | | 8 | | | | | 10 | |
| **GK** | | 3 | | | | | | 1 | 2 | | | | | 3 | 3 | | | | | | | | | |
| **RK** | | 7 | | | | | | 1 | 3 | 6 | 8 | 8 | 2 | 4 | 5 | | | | | | | | | |
| **TT** | | | | | 3 | | | 5 | | | | | | | 2 | 4 | | 1 | | | | | | |

**Table 5.6 (g) Castlemaine Harbour SPA Subsite assessment – total numbers (foraging intertidally) during the HT survey** (note that species not analysed recorded insufficient data in this behaviour).

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | 5 | 2 | 1 | 6 | 6 | 6 | | | | | | | | 6 | 4 | | | 3 | | | | | | |
| **WN** | | 4 | | 3 | 1 | | | | | | | | | | | | | 2 | | | | | | |
| **RP** | 4 | 1 | | | 6 | | | 5 | | | | | | | | | | 3 | | | | | 2 | |
| **MA** | | | | 2 | 1 | | | | | | | | | | | | | | | | | | | |
| **OC** | 7 | 6 | 1 | 4 | 3 | | 8 | | | | | | | | | | | 5 | | | | 2 | | |
| **GK** | | | 4 | 6 | 2 | 2 | 6 | | 4 | | | | | 6 | | | | 1 | | | | | | |
| **RK** | 9 | 5 | 1 | 12 | 2 | 9 | 6 | 6 | 3 | | | | | 8 | | 11 | | 4 | | | | | | |
| **TT** | 5 | 4 | 3 | | 1 | 2 | | | | | | | | | | | | 6 | | | | | | |

**Table 5.6 (h) Castlemaine Harbour SPA Subsite assessment – total numbers (foraging subtidally) during the HT survey** (note that species not analysed recorded insufficient data in this behaviour).

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | | | | | | | | | | | | | | | | | 1 | 2 | | | | | | |
| **WN** | | | | | | 4 | 3 | | | | 4 | | 2 | | | | | 1 | | | | | | |
| **PT** | | | | 1 | | | | | | | | | | | | | | | | | | | | |
| **CX** | | | | | | | | | | | | | | | | | | | | | 2 | 1 | | |
| **RH** | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | |
| **MA** | | | | | | | | | | 3 | 4 | | | | | | 1 | 2 | | | | | | |
| **CA** | | | | | | | | | 1 | | | | 2 | | 2 | 2 | | 2 | | | | | | |

## Castlemaine Harbour (4029) – Waterbird Survey Programme 2009/10

## Waterbird distribution – discussion notes

| Light-bellied Brent Goose - Family (group): Anatidae (geese) |
|---|
| **Numbers** |
| Light-bellied Brent Geese (hereafter called 'Brent Geese') begin to arrive in Ireland in late August when the majority congregate at Strangford Lough in Northern Ireland before dispersing to other sites (Robinson et al. 2004). There is some evidence that some Brent Geese may travel directly to Castlemaine Harbour and Tralee Bay, by-passing Strangford Lough. An early 'Brent Survey' carried out on 23rd September 2009, recorded 167 at Castlemaine Harbour and a total 303 within Tralee Bay, partially supporting this view.<br><br>Throughout the main survey period, high numbers of Brent Geese were sustained during all months, and were greatest in October and November (1063 and 1374 respectively). Across all months, Brent Geese occurred in internationally important numbers. In terms of total numbers (across all behaviours and zones), Subsites 0K444, 0K446 and 0K447 supported the greatest numbers in all four low tide surveys. |
| **Foraging Distribution** |
| In early winter Brent Geese, as grazers, rely almost entirely on intertidal areas with the Eelgrass *Zostera* sp. (Robinson et al. 2004). As this primary food source is depleted the birds may then move towards feeding upon other algae species, saltmarsh plants and to terrestrial grazing. In Castlemaine Harbour, Brent Geese were recorded foraging within 9 subsites overall. However, in the first three low tide surveys, c 70% of the total number of Brent Geese present on the day were recorded together in a single subsite, these being 0K446, 0K444 and 0K447 for October to December counts respectively. Brent Goose distribution during October and November therefore relates directly to the presence of an extensive *Zostera* bed that extends from 0K444 northwards to 0K446. However, as *Zostera* is limited within 0K447, this suggests that by 4th January, Brent Geese were seeking alternative foraging in the form of green algae in 0K447. The final LT count (1st Feb) found Brent Geese numbers relatively evenly split between four subsites (0K447, 0K448, 0K468 & 0K469); foraging Brent Geese therefore distributing more widely in the latter part of the season.<br><br>The greatest foraging densities (foraging intertidal) recorded were 7.82 birds $ha^{-1}$ (0K446, Oct 2009) and 4.06 birds $ha^{-1}$ (0K444, Nov 2009). |
| **Roosting Distribution** |
| In both October and November 2009, 0K469 supported the greatest proportion of roosting Brent Geese during the low tide period. 0K445 supported 80% (252 birds) of the total number of Brent Geese present during the high tide count on 25th January 2010. The roost survey (26th Feb) recorded 1077 roosting Brent Geese in three subsites: 0K444 supported 77% of these birds while 0K469 and 0K445 supported *c*10%. The roost in 0K444 was located intertidally whereas in 0K445 the birds were roosting/loafing subtidally. Roosting birds in 0K469 were associated with saltmarsh habitat. |

| Wigeon - Family (group): Anatidae (dabbling ducks) |
|---|
| **Numbers** |
| Wigeon numbers peaked in October 2009 (1,612), less than half this number being present in all subsequent counts. An early 'Wigeon/Brent Survey' carried out on 23rd September 2009, recorded 950 individuals, also relatively high in comparison with counts November onwards. This data, together with historic I-WeBS data that shows large numbers in Sep/Oct compared with the remaining season, suggests that Wigeon might use Castlemaine Harbour as a stopover site or congregation site before re-distributing to other sites for the main winter period.<br><br>In terms of total numbers (across all behaviours and zones), Subsites 0K446, 0K447 and 0K467 supported the greatest numbers during low tide surveys, the latter subsite on two separate occasions. |
| **Foraging Distribution** |
| Wigeon have a similar diet to Light-bellied Brent Geese, with the Eelgrass *Zostera* sp and intertidal algae from the genus *Ulvaceae* favoured grazing items. In October 2009, 90% of Wigeon foraging intertidally were recorded in 0K446. Thereafter significant proportions of the birds were recorded in 0K447. This distribution does not mirror the location of *Zostera* but is perhaps more likely related to the presence of freshwater, with stream inflow points in both 0K446 and 0K447 (which would enable 'dabbling), together with the presence of saltmarsh and an 'algal zone' along the shoreline.<br><br>Flock position maps (field maps) support this conclusion as does previous research that found Wigeon, together with other dabbling ducks, to be notably high around freshwater flows (Ravenscroft & Beardall, 2003). The dominant sediment type in 0K446 and 0K447 is mud, in comparison to the majority of Castlemaine Harbour being dominated by sediments comprising various proportions of sand.<br><br>The greatest foraging density (foraging intertidal) recorded was 9.39 birds $ha^{-1}$ (0K446, Oct 2009); considered high in comparison with some other published examples (e.g. Holloway et al. 1996; Musgrove et al. 2003). In months following, 0K447 supported the greatest densities of 2.51 birds $ha^{-1}$ and 0.77 birds $ha^{-1}$ (Jan 4th and Feb 1st 2010 respectively). |
| **Roosting Distribution** |
| Intertidal roosting during low tide counts was recorded in ten subsites. The following sequence is the subsites that supported the greatest proportions of roosting Wigeon in each of the four low tide counts: 0K447, 0K467, 0K448 and 0K447.<br><br>0K445 supported 75% of roosting Wigeon on the high tide count in January.<br><br>The roost survey (26th Feb) found the majority of Wigeon roosting subtidally with 70% of the total recorded within 0K446 (315 birds). 0K445 and 0K444 supported considerably fewer (55 and 40 respectively). |

| Pintail - Family (group): Anatidae (dabbling ducks) |
|---|
| **Numbers** |
| Numbers of Pintail were relatively low throughout the study period with a whole site peak of 105 (Feb 1st 2010). Pintail distribution was restricted to four subsites, three of these being dominated by intertidal habitat (0K445, 0K446 and 0K447) and the subtidal subsite 0K474. Numbers were highest throughout in 0K447, peaking in February 2010 (67 birds). |
| **Foraging Distribution** |
| Foraging Pintail were recorded in both 0K446 and 0K447, both subsites supporting the greatest proportions in different surveys hence both being ranked 1 in this analysis. However 0K447 was found to support the most Pintail in terms of total numbers (low tide and high tide), foraging intertidally and subtidally, and number of roosting birds.<br><br>Pintail feed on a variety of plant and animal material most often obtained from the substratum by upending in shallow water. Together with a preference for sheltered parts of estuaries, muddy substratum, adjacent saltmarsh and freshwater flows in which to loaf or drink, may explain the preferred distribution of Pintail within subsite 0K447 (also see foraging description for Wigeon above). |
| **Roosting Distribution** |
| Roosting behaviour was recorded in only the first and the final low tide counts with 0K447 supporting *c*75% of the roosting birds on both occasions. These birds were roosting intertidally beside the freshwater channel that flows into the site in the north-west corner of 0K446. The greatest proportion of roosting Pintail during the January high tide count was also in subsite 0K447. In contrast, the roost survey (26th Feb) recorded roosting Pintail only within 0K446 although these birds were roosting subtidally adjacent to saltmarsh habitat. |

| Common Scoter - Family (group): Anatidae (sea ducks) |
|---|
| **Numbers** |
| Across the whole site, Common Scoter numbers peaked in October 2009 (1892) with a further high count of 1121 in February 2010. This species was restricted to three subtidal subsites: 0K916, 0K917 and 0K918. In terms of total numbers, 0K917 held the greatest numbers of Common Scoters during the first three low tide surveys (05/10/09, 21/11/09 & 04/01/10) and 0K918 supported greatest numbers during the final low tide survey (01/02/10). The high tide count (Jan 25th 2010) recorded Common Scoters in two subsites only with 0K918 supporting the greatest numbers. |
| **Foraging Distribution** |
| During winter Common Scoters are generally distributed in shallow coastal waters with a depth of no more than 20m (BWPi, 2004). These shallow waters provide the ideal depth-range for them to dive for their preferred prey of bivalve molluscs, other prey items being taken less frequently (Kaiser et al. 2006).<br><br>Common Scoters were recorded foraging within three subtidal subsites: 0K916, 0K917 and 0K918. Based on bathymetry data, these subsites provide suitable depths for foraging. The greatest proportion of foraging Common Scoters was recorded in 0K917 during all four low tide surveys; this subsite supporting all foraging individuals on 05/10/09 and 04/01/10. The SAC benthic monitoring programme classifies this subsite together with the wider subtidal habitats within the outer section of the site as 'fine sand with variable amounts of very fine sand characterised by polychaetes and bivalves.'<br><br>The high tide count (25th Jan 2010) recorded 979 scoters divided almost exactly into two between 0K917 and 0K918. Such differences in positions are not unexpected. As it is likely that Common Scoters distribute themselves in order to maximise prey intake, this distribution is likely to change in response to a range of factors including water depth (that varies with the tidal cycle), prey distribution and abundance (which depletes throughout a season) and various other environmental factors such as wind speed and direction and currents. |
| **Roosting Distribution** |
| Roosting Common Scoters were only observed in subsite 0K918 on two occasions (Oct 2009 & Feb 2010). The roost survey (26th Feb) however recorded 335 and 220 Common Scoters within subsites 0K917 and 0K916 respectively. |

| Red-throated Diver - Family (group): Gaviidae (divers) |
|---|
| **Numbers** |
| Numbers of Red-throated Divers were low (<5 individuals) in all surveys with the exception of the low tide survey on 1st February 2010 when 33 individuals were counted. An additional 'diver survey' undertaken on 8th March 2010 recorded 262 Red-throated Divers within subsite 0K918; the highest count recorded during the 2009/10 field season. |
| **Foraging Distribution** |
| Red-throated Divers are typical of shallow sandy bays where they feed primarily upon fish that are seized as the bird propels itself through the water column. Dive depths are in the range 2-9m (BWPi, 2004) Within Castlemaine Harbour, Red-throated Divers were recorded foraging in five subsites overall (0K473, 0K474, 0K915, 0K916, 0K917 & 0K918), all shallow subtidal areas. Across the low tide counts, the greatest proportions of foraging Red-throated Divers were recorded within two subsites: 0K915 and 0K917, the latter supporting peak numbers during three low tide surveys and during the high tide survey. |
| **Roosting Distribution** |
| With the exception of one bird in 0K474 (4th Jan 2010), all observed Red-throated Divers were foraging. |

| Ringed Plover - Family (group): Charadriidae (wading birds) |
|---|
| **Numbers** |
| Numbers of Ringed Plover rose from 16 in October 2009 to a peak of 731 in January 2010; this latter total just surpassing the international importance threshold. This wader species was recorded in a total 12 subsites throughout the survey period but frequency of occurrence within subsites varied considerably, only two subsites (0K443 & 0K447) supported this species in four out of the five surveys.<br>In terms of total numbers, three subsites supported the greatest proportions of Ringed Plover during the four low tide surveys: 0K444, 0K447 & 0K467, the latter on two survey occasions. The peak count of Ringed Plover in any one subsite was 486 (0K467, 4th January). |
| **Foraging Distribution** |
| Ringed Plovers are a wader species generally considered characteristic of coastal wetland sites dominated by sand, as Castlemaine Harbour is, but they may also be found in areas with a varying degree of mud content. Understanding patterns of distribution across a site can therefore be difficult but foraging distribution is likely related to the abundance and availability of their prey species (various shallow depth or surface dwelling benthic polychaetes and molluscs) and distance to their roost sites (i.e. feeding grounds and roosting sites being reasonably close to one another) (Luis et al. 2001).<br><br>During the 2009/10 surveys, foraging Ringed Plovers were largely concentrated into three subsites: 0K445, 0K447 & 0K467 which vary somewhat in their characteristics; 0K445 being largely dominated by muddy sand sediment with Eelgrass and mussel beds, 0K447 muddy sediment with freshwater influence and adjacent saltmarsh and 0K467 largely muddy sand with a gradation to muddier sediment closer to saltmarsh and the upper shore. Flock position maps showed Ringed Plovers to rarely forage alone – In 0K445, Ringed Plovers were usually foraging as part of larger loose flocks also comprising Dunlin; this pattern similar within 0K467.<br><br>The greatest foraging density (foraging intertidal) recorded was 1.45 birds $ha^{-1}$ (0K467 Jan 2010), considered high in comparison with some other published examples. Average foraging density (across all counts) was greatest in 0K467 (0.51 birds $ha^{-1}$) followed by 0K447 (0.41 birds $ha^{-1}$) and 0K445 (0.12 birds $ha^{-1}$). |
| **Roosting Distribution** |
| During low tide counts the majority of Ringed Plovers were observed foraging and few were engaged in roosting/other behaviour (generally 1-2 birds only), The high tide count on 25th January 2010 recorded 18 roosting Ringed Plovers in 0K473 but the majority of birds during this survey were observed foraging in areas uncovered by the neap high tide.<br><br>The roost survey (26th Feb) recorded all roosting Ringed Plovers within 0K473 (saltmarsh) but as only 8 birds were recorded it is unclear whether this subsite provides the main roosting area for this species or whether other roost sites are used but not recorded during the surveys. As Ringed Plovers are highly faithful to their roost sites (Rehfisch et al. 2003) it is likely that the shoreline along 0K473 is one of the main roosting grounds for this species within the site. |

| Sanderling - Family (group): Scolopacidae (wading birds) |
|---|
| **Numbers** |
| Apart from October 2009 (4 birds), numbers of Sanderling were above the threshold of all-Ireland importance in all survey months. Peak numbers (428) were recorded during the high tide count on 25th January 2010. Across the entire survey period Sanderlings were recorded in a total 10 subsites. In low tide surveys, peak numbers were recorded in three subsites: 4 individuals, 158 and 150 Sanderlings in 0K447, 0K467 & 0K468 respectively. Rosbehy Creek (0K475) recorded a peak of 162 during the January high tide survey. |
| **Foraging Distribution** |
| Often foraging along the tide line where they rush in and out with the waves searching for small prey such as sandhoppers, Sanderlings are shorebirds characteristic of sandy shorelines, indeed significant proportions are found along non-estuarine coastlines (Crowe, 2005) or outer parts of estuaries (Musgrove et al. 2003). The species has a flexible foraging strategy however, with the diet very much related to the local conditions at a site (Reneerkens et al. 2009). The distribution recorded at Castlemaine Harbour during 2009/10 showed that the outer sandy shore subsites (0K919 and 0K920) supported few Sanderlings apart from during the high tide count on January 25th 2010. Foraging Sanderlings were largely concentrated into five subsites: 0K445, 0K446, 0K447, 0K467 and 0K468, although low tide survey peak proportions were recorded in three subsites only: 0K447, 0K467 and 0K468.<br>A common feature of the subsites used by Sanderlings is the presence of the tide edge or low tide channel. Flock position maps often show flocks of Sanderlings foraging alongside flocks of Dunlin, sometimes at the tide edge but sometimes within open tidal flats. Benthic invertebrate data is limited for the subsites concerned but sampling within 0K467 revealed several potential prey species for Sanderling (and other smaller waders) such as crustaceans *Corophium volutator* and *Crangon crangon* and small polychaete worms which can occur in abundance such as *Pygospio elegans* (ASU, 2008).<br>The greatest foraging density (foraging intertidal) recorded was 1.29 birds $ha^{-1}$ (0K446 Nov 2009). Average foraging density (across all counts) was greatest in 0K447 (0.45 birds $ha^{-1}$). |
| **Roosting Distribution** |
| All observations of Sanderlings during the main survey programme were of foraging individuals, with the exception of 26 roosting within 0K443 during the high tide count of 25th January 2010. The species was not recorded during the roost survey of 26th February 2010. |

| Bar-tailed Godwit - Family (group): Scolopacidae (wading birds) |
|---|
| **Numbers** |
| Across the whole site, numbers of Bar-tailed Godwits rose from 52 in October 2009 to a peak of 318 recorded during the high tide count (Jan 25th 2010).<br>Bar-tailed Godwits were recorded in 11 subsites overall but were most frequently observed and most numerous within 0K468 followed by 0K444 and 0K446. 0K468 held the greatest proportion of all Bar-tailed Godwits observed during the survey on three separate occasions and ranked a close second on another occasion; supporting 202 individuals (all-Ireland importance) in a single low tide survey on Feb 1st 2010. |
| **Foraging Distribution** |
| Bar-tailed Godwits are a wader species generally considered characteristic of coastal wetland sites dominated by sand, as Castlemaine Harbour is. Indeed a preference for sand-influenced sediment provides a point of difference between the Bar-tailed Godwit and the closely-related Black-tailed Godwit (*Limosa limosa*) which exhibits a preference for silty (muddy) substrata. Given that Bar-tailed Godwits forage upon a wide-range of benthic invertebrates from surface-dwelling species to those obtained from a probing depth of *c*10cm in the sediment, suggests a wide range of suitable foraging areas within Castlemaine inner harbour. However, although this wader was recorded within nine subsites overall, they only foraged in any numbers or regularity in three subsites (in decreasing order of numbers): 0K468, 0K444 and 0K446 which suggests a relatively restricted range across the site.<br>The majority of 0K468 is classified as muddy sand. Invertebrate species recorded within this subsite during the 2008 SAC monitoring programme include several polychaete species taken by Bar-tailed Godwits e.g. Lugworm (*Arenicola marina*), Ragworm (*Hediste diversicolor*) and *Pygospio elegans* together with favoured bivalve species *Macoma balthica*. Similarly, 0K444 is classified as muddy sand with varying proportions of silt whereas 0K446 shows a gradient in sediment towards a more silt (mud) influenced sediment on the upper shore and close to the entry of a freshwater stream.<br>Bar-tailed Godwit distribution is likely to be related to the distribution, abundance and availability of favoured prey species but may also relate to the degree of shelter (to minimise energy loss), especially from prevailing winds during the very cold winter of 2010; Inch dune system and Cromane Point perhaps providing important additional shelter.<br><br>The greatest foraging density (foraging intertidal) recorded was 0.47 birds $ha^{-1}$ (0K444 Nov 21st 2009). Average foraging density (across all counts) was greatest in 0K444 (0.14 birds $ha^{-1}$) followed by 0K468 (0.12 birds $ha^{-1}$). |
| **Roosting Distribution** |
| During low tide counts, very few Bar-tailed Godwits were recorded roosting (generally 1-2 birds only). The high tide count (Jan 25th 2010) recorded 300 Bar-tailed godwits roosting intertidally within 0K468. These birds were located at the edge of patches of saltmarsh that occur within the intertidal zone. 18 Bar-tailed godwits were also recorded roosting intertidally within 0K455 (Note that Bar-tailed Godwits were not recorded foraging within this subsite at any point during the survey programme). This roost (at the edge of saltmarsh) was in a sheltered location and was a multi-species roost including Dunlin, Lapwing, Redshank and Curlew, birds potentially flocking to minimise heat loss (Luis et al. 2001).<br><br>The roost survey (26th Feb) recorded 300 roosting Bar-tailed Godwits within 0K468, with a further 314 roosting within 0K444 (two locations). It is notable that these subsites were also favoured for foraging which suggests that the birds were roosting close to their foraging grounds in order to be able to resume foraging once they had either, digested prey ingested earlier, or when the tide has retreated sufficiently. |

| Mallard- Family (group): Anatidae (dabbling ducks) |
|---|
| **Numbers** |
| Across the whole site, numbers of Mallard varied considerably between the survey months; numbers peaking in October 2009 (1401 birds) and thereafter ranging from 721 during the January low tide count to 203 in November 2009. The early peak in numbers is consistent with the pattern described in Crowe (2005) whereby Mallard congregate early on at some of the larger sites, with a subsequent reduction in numbers attributable to both the start of the hunting season and the re-distribution of some ducks to other smaller and suitable wetland sites.<br>Mallards were one of the most widely distributed species across the site, occurring within 17 subsites overall. The subsite peak number was 415 birds (0K445, Oct 5th 2009), but overall Mallards were most numerous in 0K447, this subsite supporting the greatest proportion on three of the four low tide surveys. |
| **Foraging Distribution** |
| In October 2009, Mallard ducks that foraged intertidally were distributed more widely, occurring within seven subsites. Thereafter those that foraged intertidally were distributed almost exclusively within three subsites: 0K445, 0K446 & 0K447. This distribution, as with some other duck species, is most likely related to the fact that these three subsites are diverse in habitat factors such as sediment type (gradation from muddy sand to muds) and hence diversity of potential prey species, shoreline character (i.e. mixed substratum shore with a defined algal (wrack) zone merging into saltmarsh) and the presence of freshwater to enable 'dabbling.' Being bordered by a dune system and associated habitats and low-lying coastal grassland, these subsites are also sheltered and relatively undisturbed. Given that Mallards are a widely distributed species occurring in many different habitat types (albeit with water as a common factor) and with a varied diet of both plant (e.g. algae) and animal (e.g. crustacea) material, the relatively restricted distribution within Castlemaine Harbour is interesting.<br><br>The greatest foraging density (foraging intertidal) recorded was 3.36 birds $ha^{-1}$ (0K446, Oct 2009). In months following, 0K445, 0K446 and 0K447 supported the greatest densities of Mallards foraging intertidally.<br><br>The distribution of Mallards foraging subtidally during low tide surveys did not follow that of those foraging intertidally. Subsites 0K455, 0K466 and 0K474 supporting the greatest proportions of these birds. Two of these subsites (0K455 and 0K466) are located around the main entry points of the Rivers Laune and Maine into Castlemaine Harbour. |
| **Roosting Distribution** |
| Mallards that roosted intertidally were recorded within 18 subsites. Subsites which recorded the greatest proportions (relative to the total number present on the survey day) were 0K444, 0K447 and 0K455. The roost survey (26th Feb) however, found the majority of Mallards (269) roosting within 0K446 (5 locations) with a further 62 within 0K445 at a single location. |

| Scaup - Family (group): Anatidae (diving ducks) |
|---|
| **Numbers** |
| Scaup were recorded in three out of the four low tide surveys in low numbers (2, 10 & 14 for the November, January and February surveys respectively). |
| **Foraging Distribution** |
| The majority of Scaup recorded within Castlemaine Harbour were foraging (21 out of the total 26 birds recorded) and all were recorded foraging subtidally within the shallow low tide channels within subsite 0K468.<br><br>During the non-breeding season, Scaup are considered a true marine duck species with a distribution concentrated along open coasts and within partially enclosed estuaries, with little or no association with freshwater or brackish habitats. A diving species, Scaup take a variety of food items including crustaceans, insects and plant material although molluscs are thought to dominate the diet in many areas (BWPi, 2004). Diving depth is generally within the range 0.5 – 3.5 m, maximum dives up to 6m (BWPi, 2004). |
| **Roosting Distribution** |
| 2 Scaup were observed roosting/other subtidally within subsite 0K467 and 3 roosting/other subtidally within 0K467. The species was not recorded during the roost survey (26th Feb). |

| Cormorant - Family (group): Phalacrocoracidae (cormorants) |
|---|
| **Numbers** |
| Across the whole site, numbers of Cormorant peaked in October 2009 (141), surveys thereafter recording less than half of this number in each case. This species was recorded in 19 out of the total 24 subsites but many subsites only recorded occasional observations hence the mean (average) % subsite occupancy being a relatively low 45%.<br><br>The highest number recorded in any one subsite was 52 Cormorants in 0K445 in October 2009. The species was recorded most frequently however within 0K467 and 0K468 (present within all surveys undertaken). During low tide surveys the subsites that supported the most Cormorants (those ranked 1st or 2nd in terms of the proportions of total birds supported) were as follows: 0K445, 0K446, 0K467, 0K468, 0K918 & 0K920. 0K467 held the greatest proportion of Cormorants during the high tide survey (Jan 25th 2010) followed by 0K443 and 0K468. |
| **Foraging Distribution** |
| Cormorants were recorded foraging subtidally within 13 subsites and there was relatively little pattern to their foraging distribution. Greatest proportions foraging (relative to total numbers foraging across the site) were recorded for 0K445, 0K918/0K920, 0K445 and 0K918 for the four low tide surveys respectively, which suggests some pattern for greater foraging effort within the outer subtidal subsites.<br><br>Cormorants rely almost entirely upon fish which they catch by diving from the surface propelled by their feet, their dives are generally shallow; up to about 9m (BWPi, 2004). Foraging distribution is therefore likely to be determined by the spatial distribution of fish species. Although the species may sometimes congregate when foraging, Cormorants are often solitary feeders so foraging may either be an active pursuit or a more opportunistic activity, as the birds swim around a site. |
| **Roosting Distribution** |
| A greater number of Cormorants were observed roosting or occupied in another behaviour (e.g. preening) within intertidal areas, than were observed foraging during all low tide surveys. This is not unexpected as Cormorants often haul out of the water and form flocks to roost during the low tide period, during which time they may preen, rest and digest previous meals. 0K468 held the greatest proportions of roosting Cormorants on two survey occasions (755 and 59% of total respectively) while 0K445 and 0K446 also supported greatest proportions on a further two survey occasions. As with foraging behaviour there is little pattern to the roosting distribution with birds generally widely distributed, however there is a trend within the latter three surveys (Jan 4th, Jan 25th and Feb 1st) for a greater proportion and greater numbers of Cormorants to be roosting within subsites 0K467 and 0K468. Similarly the roost survey (26th Feb) recorded the majority of roosting Cormorants within these two subsites. |

## Oystercatcher - Family (group): Haematopodidae (wading birds)

**Numbers**

Across the whole site, numbers of Oystercatchers were relatively stable: 1712, 1897, 1673 & 1726 for the four successive low tide surveys. Lower numbers (1049) during the high tide count (Jan 25th 2010) are not unexpected given that this species often moves into fields to forage terrestrially during this stage of the tidal cycle.
Oystercatchers were widespread across the site, recorded in 21 subsites overall. The greatest proportion of individuals within any one subsite during a low tide survey was never greater than 37%, highlighting the widespread distribution of the species. In terms of total numbers (across all zones and behaviours) subsites 0K446 and 0K447 supported the greatest numbers and greatest proportions (relative to the total recorded on each survey day) during all four low tide surveys. 0K919, 0K468, 0K444 and 0K445 also supported significant numbers. The subsite peak was 647 Oystercatchers (0K447, Feb 1st 2010).

**Foraging Distribution**

Between 88 and 98% of all Oystercatchers recorded during low tide surveys were foraging. Oystercatchers were observed foraging within 21 subsites overall, representing a widespread foraging distribution across the site. However two subsites held the greatest proportions (relative to the total recorded on each survey day) in all four low tide counts – 0K446 during October and November 2009 and 0K447 during January and February 2010. Significant numbers of Oystercatchers were also observed foraging within 0K444, 0K445, 0K468 and 0K919.

Oystercatchers are large wading birds that eat a wide variety of prey items within intertidal habitats including several species of bivalve mollusc and polychaete worms. With a large, robust bill, Oystercatchers have the capability of opening large bivalve species such as Cockles *Cerastoderma edule* and Blue Mussel *Mytilus edulis* and these large and profitable prey items are often favoured. Oystercatcher distribution within subsites 0K444, 0K445 and 0K447 can therefore be at least partially linked to the presence of an intertidal nursery of the Blue Mussel *Mytilus edulis*, the nursery area coinciding with the lower shore of subsites 0K444 and 0K445 and being partially present within 0K447. The nursery area, operated under licence by the Castlemaine Harbour Co-operative Society Ltd, is an area where seed mussels, obtained by dredging subtidal areas in the outer part of the site, are placed for on-growing in a sheltered intertidal environment. Much of the nursery area is only available as a foraging ground on spring low tides but a substantial area is still exposed on each low tide, particularly as the mussels have expanded into a greater area than the delineated nursery area itself. It is notable that positions of foraging Oystercatchers within 0K444 and 0K445 were often along the tide edge (i.e. within nursery area).

It is interesting to note however, that the two subsites supporting the greatest proportions of foraging Oystercatchers during October and November 2009 are not the main subsites that overlap the mussel nursery area. The mussel nursery area is not present within 0K446 and is present in the southern section only of 0K447. Unfortunately there is limited benthic data for these subsites. However, given that they have muddy sand sediment which becomes more silt influenced closer to a stream entry, may suggest that there is a variety of prey options from bivalves characteristic of the muddy sand sediment sampling areas (e.g. Cockles), to Mussels associated with the nursery area to Ragworms *Hediste diversicolor* and other species more characteristics of silty sediments. The site as a whole provides good foraging options for Oystercatcher. Suitable alternative prey species recorded during the intertidal benthic sampling including Baltic Tellin (*Macoma balthica*) and the bivalve *Scrobicularia plana*.

The highest recorded foraging density was 5.34 birds $ha^{-1}$ (0K447 Feb 1st 2010). Average foraging density (across all counts) was highest in 0K446 (2.69 birds $ha^{-1}$) followed by 0K447 (2.33 birds $ha^{-1}$). These densities are considered relatively high, for example in comparison with the average densities recorded across 18 estuaries in UK surveys conducted in a similar way (WeBS Low Tide Counts) (Holt et al. 2009).

**Roosting Distribution**

During low tide surveys, Oystercatchers were recorded roosting or engaged in other behaviour within 15 subsites. Between 70 – 80% of all roosting Oystercatchers were observed roosting along the sandy Inch strand (0K919) on two separate low tide survey occasions. During high tide (Jan 25th 2010) significant Oystercatcher roosts were recorded within subsites 0K468, 0K443 and 0K455 with 228, 138 & 115 Oystercatchers respectively. Within 0K468 Oystercatchers roosted amongst lower saltmarsh habitat, along intertidal sandflats within 0K443 and within 0K455, along the edge of the shoreline as part of larger mixed species roosts.

During the roost survey (26th Feb) Oystercatchers were recorded at 20 separate roost locations within 12 subsites. 0K448 and 0K468 recorded three separate roost sites for Oystercatchers. The largest single roost site was located within 0K447 (110 birds) along shoreline saltmarsh habitat. 0K449 held two separate shoreline roost sites with a total 101 Oystercatchers. Roost locations varied greatly in their numbers of Oystercatchers – unlike some wader species that may flock together at high tide into a few roost locations with large numbers of birds, Oystercatchers are known to distribute themselves between roost sites due to factors such as social rank (or dominance) in relation to the quality of nearby foraging grounds (Swennen, 1984; Durrell et al. 1996) and hence there is likely to be different population structures amongst the different roost sites.

| Greenshank - Family (group): Family (group): Scolopacidae (wading birds) |
|---|
| **Numbers** |
| Across the survey period total Greenshank numbers ranged from 44 (Nov 21st 2009) to 77 (Feb 1st 2010); all months recording numbers of all-Ireland importance. Apart from certain times when they flock together, Greenshanks are generally a species that exhibits a widespread distribution across their wintering grounds, related to a territorial nature over their foraging patch; hence a relatively even distribution in numbers across subsites, as found at Castlemaine is considered usual. During low tide surveys, Greenshanks were recorded within 16 subsites, a subsite peak of 20 Greenshanks within 0K447 (Jan 4th 2010) possibly due to the birds aggregating in a food-rich patch due to the extreme low temperatures. |
| **Foraging Distribution** |
| Greenshanks usually forage within or beside watercourses where they exhibit a variety of feeding methods to take diverse prey including insects, polychaete worms and small fish. The highest proportions within each low tide survey were recorded for subsites 0K446, 0K447, 0K449 and 0K475. Little or no pattern in terms of foraging distribution was exhibited by Greenshanks other than a widespread distribution and presence within subsites that had low tide channels or creeks.<br>The highest recorded foraging density was recorded for 0K458 on three separate survey occasions (peak density 0.25 birds $ha^{-1}$). Average densities across all sites ranged 0.01 birds $ha^{-1}$ to 0.12 birds $ha^{-1}$. |
| **Roosting Distribution** |
| During low tide counts, generally only solitary Greenshanks were recorded as roosting/other, with the exception of 8 Greenshanks roosting within 0K456 in October 2009. The high tide survey (Jan 25th 2010) recorded 1-2 Greenshanks roosting within 5 subsites, 0K455 recorded 7 roosting Greenshanks.<br>During the roost survey (26th Feb) Greenshanks were observed roosting at 8 locations within 7 subsites. 0K457 supported a roost of 19 Greenshank, roosting alongside the river's edge. 0K445 and 0K446 held roosts of 15 and 14 Greenshanks respectively, these birds part of larger mixed-species roosts. |

| Redshank - Family (group): Family (group): Scolopacidae (wading birds) |
|---|
| **Numbers** |
| Across the whole site, numbers of Redshank were relatively stable across the low tide surveys; counts of 1170, 1133, 1135 and 1026 for the four successive surveys. All surpass the threshold (310) for all-Ireland importance. Redshanks were relatively widespread across the site, recorded in 18 subsites overall with % occupancy of subsites ranging from 50-70% across the entire survey period. The greatest proportion held by any one subsite during a low tide survey was never greater than 35%, highlighting the widespread distribution of the species. The subsite peak was 361 Redshanks (0K447 Feb 1st 2010). |
| **Foraging Distribution** |
| Over 90% of all Redshanks recorded during low tide surveys were foraging. No one subsite ever held more than 36% of the total number of foraging Redshanks observed on the day. 0K455 is notable in supporting the greatest proportion of foraging Redshanks on two separate survey occasions but generally, different subsites supported the greatest numbers on different surveys.<br><br>That Redshanks occur in such abundant numbers at Castlemaine Harbour is surprising given the species' general association with estuaries with high proportions of mud (e.g. Rehfisch et al. 2000). This relationship is borne from the fact that many favoured prey species of Redshanks occur within mid to upper estuarine areas with variable salinity due to the presence of freshwater inflows, channels or creeks. However at Castlemaine it can be seen that all subsites that were ranked first or second in terms of greatest proportions foraging within each count, were characterised by silt (mud) sediment and many are associated with river or stream inflow, channels and creeks. Flock position maps also confirm that Redshanks were foraging within the 'muddier' parts of subsites (note that dot density diagrams place the dots randomly across the whole subsites). Invertebrate data from the intertidal benthic sampling (Aquatic Services Unit, 2008) recorded species such as *Corophium volutator* and *Hediste diversicolor* at 'muddy' sampling sites; muddy sand sediment within 0K455 also supporting abundant*Corophium volutator*, a favoured prey species of Redshanks.<br><br>The highest recorded foraging density was 37 birds $ha^{-1}$ (0K458 Oct 5th 2009); considered exceptionally high. This small subsite (8 Ha) has a limited amount of intertidal habitat alongside the channel of the River Laune and hence will support upper estuarine 'muddy' sediment invertebrate communities. Within other subsites, average foraging density (across all counts) was highest in 0K446 (1.45 birds $ha^{-1}$) followed by 0K445 (1.41 birds $ha^{-1}$). |
| **Roosting Distribution** |
| During the high tide survey on January 25th 2010, roosting Redshanks were largely concentrated into three subsites: 0K455, 0K467 and 0K456 with 153, 81 and 71 Redshanks respectively (note that as some intertidal was exposed during this high tide that a greater number of Redshanks were foraging and not roosting). Redshanks within all three subsites formed part of larger mixed species roosting flocks along the shoreline or amongst saltmarsh habitat.<br><br>During the roost survey (26th Feb) Redshanks were observed roosting at 14 locations within 6 subsites. 0K444 and 0K446 supported the highest numbers of roosting Redshanks, with three separate roost sites within each. In both 0K444 and 0K446, Redshank formed part of large diverse mixed-species roosting flocks, other species including Light-bellied Brent Geese, Oystercatcher and Ringed Plover. |

| Turnstone - Family (group): Family (group): Scolopacidae (wading birds) |
|---|
| **Numbers** |
| Across the survey period, whole site Turnstone numbers ranged from 77 (Oct 5thst 2009) to 147 (Jan 25th 2010). This wader species was recorded in 15 subsites overall; only one subsite 0K443 recording the species in all five surveys. A subsite peak of 45 Turnstone was recorded in 0K475 (Feb 1st 2010). The species has a widespread distribution and is a familiar species of non-estuarine, rocky shorelines. |
| **Foraging Distribution** |
| Over 80% of all Turnstones recorded during low tide surveys were foraging. Although Turnstones generally exhibit a widespread distribution, some subsite preference is evident from the data; 0K446, 0K447, 0K468 and 0K475 recording the highest proportions of foraging birds during the low tide surveys. Turnstones are associated with shorelines with rocky substratum, particularly those with algal wrack zones within which the birds forage for prey species such as amphipods (crustaceans), insects and small molluscs. A mixed substrata shoreline (to varying degrees) is found on the upper shore in many locations around the site and particularly along the northern shoreline. Therefore a widespread distribution is to be expected and it is difficult to link this species' distribution to any specific factors.<br><br>The highest recorded foraging density was 0.96 birds $ha^{-1}$ (0K458 Feb 1st 2010). Highest average density was 0.25 birds $ha^{-1}$ (0K458) followed by 0.15 birds $ha^{-1}$ (0K447) and 0.12 birds $ha^{-1}$ (0K446). |
| **Roosting Distribution** |
| During the high tide survey (Jan 25th 2010) 99 Turnstones were recorded roosting within 5 subsites, highest numbers within 0K475 and 0K469 (38 and 22 birds respectively). The roost survey (26th Feb) recorded three roost sites within subsites 0K449, 0K446 and 0K447 (4, 20 & 40 birds respectively). Turnstones roosting in 0K446 and 0K447 formed part of larger mixed-species roosts upon supratidal habitat. Turnstones within 0K449 roosted alongside Redshanks, Mallards and Oystercatchers upon the upper shore. |

## 5.4 CASTLEMAINE HARBOUR – ACTIVITIES AND EVENTS

### 5.4.1 Introduction

The overriding objective of the Habitats Directive is to ensure that the habitats and species relevant to this directive 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.

At site level, the concept of 'favourable status' is referred to as 'conservation condition.' This relates to not only the species numbers themselves, 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 the 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 may impact upon species or habitats of conservation importance will be fundamental to the achievement of site conservation objectives.

This section of the report provides summary information on activities and events that occur at Castlemaine Harbour that may either act upon the habitats within the site, or may interact directly with the Special Conservation Interest species and other waterbirds using the site.

### 5.4.2 Methods

An information review was undertaken which included NPWS site reporting files, bird usage mapping, and other published documents relevant to the ecology of the site.

During field surveys (2009/10 waterbird survey programme) field workers were required to record activities or events that occurred at the site that may potentially impact upon waterbirds. This information, together with results from a 'site activity questionnaire' provides valuable information gained from 30+ hours of coordinated surveyor effort across the whole extent of the SPA site.

Information collected is held in a database for easy maintenance and updating as necessary. Activities and events are categorised based on the standard EU list of pressures and threats used for Natura 2000 reporting.

Activities and events that have the potential to cause disturbance to waterbirds were assessed (scored) according to their frequency, intensity and response level, using a methodology adapted from that used for monitoring Important Bird Areas (IBAs) (Birdlife International, 2006). Please refer to Tables 5.7 and Table 5.8. Scores were assigned based on best-available information. Timing/frequency and intensity were scored in relation to observations recorded during the 2009/10 waterbird survey programme. Response was scored based on best expert opinion.

Note that insufficient information was available to undertake the assessment for fishery activities or wildfowling within the site.

**Table 5.7 Scoring system for disturbance assessment**

| Frequency/Duration | (A) Timing Score | Intensity | (B) Scope Score | Response | (C) Severity Score | TOTAL IMPACT SCORE OF THREAT 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 |

**Table 5.8 Scoring system – definitions & rationale**

| Frequency/Duration | Rationale |
|---|---|
| Continuous | Continuous motion or noise; not necessarily 24-hours per day but zones of fairly continuous activity such as a port or marina. |
| Frequent | 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 | Observed only once or twice during the survey programme and known/considered likely to be infrequent. |
| Rare | Known to occur but not observed during the survey programme and considered likely to be rare in occurrence. |
| **Intensity** | **Rationale** |
| Active, high-level | 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 | 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 | 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 | Any activities considered to impart little effect upon waterbirds. |
| **Response** | **Rationale** |
| Most birds disturbed all of the time | Birds do not return – therefore equivalent to habitat loss. |
| Most birds displaced for short periods | Birds return once disturbance has ceased. |
| Most species tolerate disturbance | Weak response, birds may move slightly away from disturbance source. |
| Most birds successfully habituate to the disturbance | Little determinable effects. |

Scores are added together for the three categories leading to an overall 'disturbance score' as follows:-

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

### 5.4.3 Results and discussion

A table of all activities and events recorded across Castlemaine Harbour is presented within Appendix 9. The term 'activity and event' is broad and the standard Natura list includes various built elements such as roads, bridges and car-parks which may occur adjacent to a site and therefore exert some pressure upon it in terms of disturbance, as well as other factors such as *Spartina* encroachment. In the majority of cases, activities and events are shown in relation to

the subsite within which they were observed or are known to occur. In a few cases, and particularly in relation to fishery activities, activities are simply recorded as 'known to occur' but with unknown spatial extent.

Summary results from the disturbance assessment are presented in Table 5.9. This shows the highest score recorded for each subsite together with the activities that were assigned this score. The disturbance assessment included any activity that was considered to potentially cause disturbance to waterbirds. In practice, the subject is complex and behavioural responses to disturbance can vary from subtle declines in intake rates to more drastic changes such as avoidance of entire estuaries (Mitchell et al. 1989). Note that individual activities 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.

Overall disturbance scores ranged from 0 (low) to 6 (moderate). Although some high-intensity activities were recorded (such as speed boats, quad bikes, motorised vehicles) their frequency was not continuous so an overall 'high' disturbance score was not attained. As Castlemaine Harbour has little/no adjacent industrial development or shoreline development such as ports, the maximum response of birds is likely to be '2' i.e. birds will be displaced for a period of time but with the potential to return once the disturbance event has ceased.

Highest scores were recorded for subsites 0K443, 0K444, 0K446/0K447, 0K468, 0K469, 0K919 and 0K920. The greatest number of activities/events were recorded within 0K443 due to several water-related activities (sailing, motor boats) plus various recreational activities on Inch Strand. Subsites 0K443 and 0K444 were both subject to disturbance from quad bikes driving through the dune system and across sand flats. Activities such as the latter can be managed through the 'Activities Requiring Consent' (ARCs) aspect of the Natura site designation or other regulations.

Activities related to intertidal aquaculture scored moderately (5-6) depending on the maximum observed frequency. Note that this activity has been scored in terms of maximum intensity and response but in practice the effects are likely to vary from day to day; disturbance levels being related to various factors such as number of people, type of boat used (motorised/non-motorised), frequency of visits during a low-tide period, type and length of activity undertaken etc.. Response of waterbirds will also be species-specific. Further information about aquaculture activities within the site would be needed to refine this score.

The extent and frequency of hunting (shooting/wildfowling) at the site is unknown. Only one record of this activity was made (shoreline close to 0K446). On this occasion a single shot from shoreline habitat caused all birds within the subsite to fly away with no return during the count session. Although the shot was fired from outside of the area, 0K446 is part of an area delineated as a Wildfowl Sanctuary.

It is clear that 0K919 and 0K920 are activity 'hot-spots', related to various recreational activities along Inch Strand. Activities were observed to occur with greater frequency within 0K919 due to its proximity to the car-park.

The significance of the impact of even short-term displacements of waterbirds should not be underestimated. In terms of critical foraging habitat, displacement from feeding opportunities will not only reduce energy intake but also lead to an increase in energy expenditure as a result of the energetic costs of flying to an alternative foraging area.

Another important consideration is whether birds have alternative habitat to move to during a disturbance event. Birds that show the greatest response to disturbance and fly away (traditionally seen to be the ones that 'respond' the most to disturbance) may do so because they

have alternative habitats to go to. In contrast, birds that are apparently less-disturbed and do not move away from a patch may be forced to behave in this way because they do not have alternative disturbance-free sites to go to. From a population point of view therefore, the birds most affected will be the ones whose fitness[11] is reduced by them being constrained to stay and 'cope' with the disturbance as opposed to those birds that can move to an alternative habitat of similar quality (Gill et al. 2001).

The significance of disturbance events is therefore highly species-specific. Furthermore, significance will vary according to timing (birds may be more vulnerable pre- and post- migration) and other factors such as weather; birds being more vulnerable during periods of severe cold weather.

As a final review, Table 5.10 shows peak disturbance scores overlaid on the subsite assessment table (total waterbird numbers – Table 5.6a).

As more detailed information becomes available the subsite/activity matrix assessment could be undertaken on a species by species basis for each disturbance-causing activity, furthering the identification of subsites where a species is subject to more pressure or disturbance than others.



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

**Table 5.9 Subsites and their highest-ranking disturbance assessment scores**
Scores 0 – 3 = Low Scores 4 – 6 = Moderate Scores 7 – 9 = High (see text for explanation)
Grey shading refers to subsites where some activities occurred but were unassessed.

| Activity/Event | No. activities | Overall Peak Score | Activity/Activities |
|---|---|---|---|
| **0K443** | 14 | 6 | • Power boating & water-skiing<br>• 4WD, trial & quad bikes |
| **0K444** | 12 | 6 | • 4WD, trial & quad bikes<br>• Intertidal aquaculture (all activity assoc with) |
| **0K445** | 7 | 5 | • Hand raking (mussels) |
| **0K446/447** | 7 | 6 | • Wildfowling |
| **0K448** | 10 | 5 | • Walking, incl. dog walking<br>• Intertidal aquaculture (all activity assoc with) |
| **0K449** | 7 | 5 | • Motorised vehicles<br>• Intertidal aquaculture (all activity assoc with) |
| **0K455** | 8 | 5 | • Walking, incl. dog walking<br>• 4WD, trial & quad bikes<br>• Motorised vehicles |
| **0K456** | 4 | 5 | • Walking, incl. dog walking |
| **0K457** | 1 | | |
| **0K458** | 2 | 2 | • Birdwatching<br>• Angling |
| **0K466** | 4 | 4 | • Canoeing |
| **0K467** | 9 | 5 | • Walking, incl. dog walking<br>• Intertidal aquaculture (all activity assoc with) |
| **0K468** | 6 | 6 | • Intertidal aquaculture (all activity assoc with)<br>• Other hunting-related activities |
| **0K469** | 6 | 6 | • Intertidal aquaculture (all activity assoc with) |
| **0K473** | 8 | 5 | • Walking, incl. dog walking<br>• Motorised vehicles |
| **0K474** | 5 | | |
| **0K475** | 9 | 5 | • Sailboarding & wind-surfing<br>• Intertidal aquaculture (all activity assoc with) |
| **0K915** | 4 | | |
| **0K916** | 4 | | |
| **0K917** | 4 | | |
| **0K918** | 6 | 5 | • Sailboarding & wind-surfing<br>• Surfing |
| **0K919** | 10 | 6 | • Walking, incl. dog walking<br>• 4WD, trial & quad bikes<br>• Motorised vehicles |
| **0K920** | 10 | 6 | • Walking, incl. dog walking<br>• 4WD, trial & quad bikes<br>• Motorised vehicles |

**Table 5.10 Castlemaine Harbour SPA Subsite assessment (total numbers) x disturbance score matrix**

| | 0K443 | 0K444 | 0K445 | 0K446 | 0K447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PB** | H | V | H | V | V | H | | | | | | | M | M | H | M | H | H | | | | | | |
| **WN** | | | H | V | V | H | M | H | H | | M | | V | H | H | | H | H | | | | | | |
| **PT** | | | | H | V | | | | | | | | | | | | H | | | | | | | |
| **CX** | | | | | | | | | | | | | | | | | | | | H | V | V | | |
| **RH** | | | | | | | | | | | | | | | | M | V | | V | M | V | H | | |
| **RP** | H | V | H | M | V | | H | M | | | | | V | | M | | | H | | | | | | |
| **SS** | | M | H | H | V | | | | | | | | V | V | | | | | | | | | M | |
| **BA** | M | V | H | V | | | | M | | H | | | H | V | H | | H | H | | | | | | |
| **MA** | V | H | V | V | V | H | M | H | M | M | M | H | H | H | M | | H | H | | | | | | |
| **SP** | | | | | | | | | | | | | V | V | | | | | | | | | | |
| **CA** | H | M | V | H | M | H | H | H | H | M | | | H | V | M | M | L | | | | | H | | V |
| **OC** | M | H | H | V | V | H | H | H | M | H | M | | H | H | H | L | L | M | | L | L | M | H | L |
| **GK** | H | | H | V | V | M | V | H | V | M | H | | M | V | H | L | M | H | | | | | | |
| **RK** | M | M | H | H | V | H | H | V | H | H | V | M | H | H | H | L | L | M | | | | | | |
| **TT** | H | H | | V | V | H | H | H | | H | H | | H | V | H | H | | V | | | | | | |

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## APPENDIX 1

SITE NAME: CASTLEMAINE HARBOUR SPA

SITE CODE: 004029

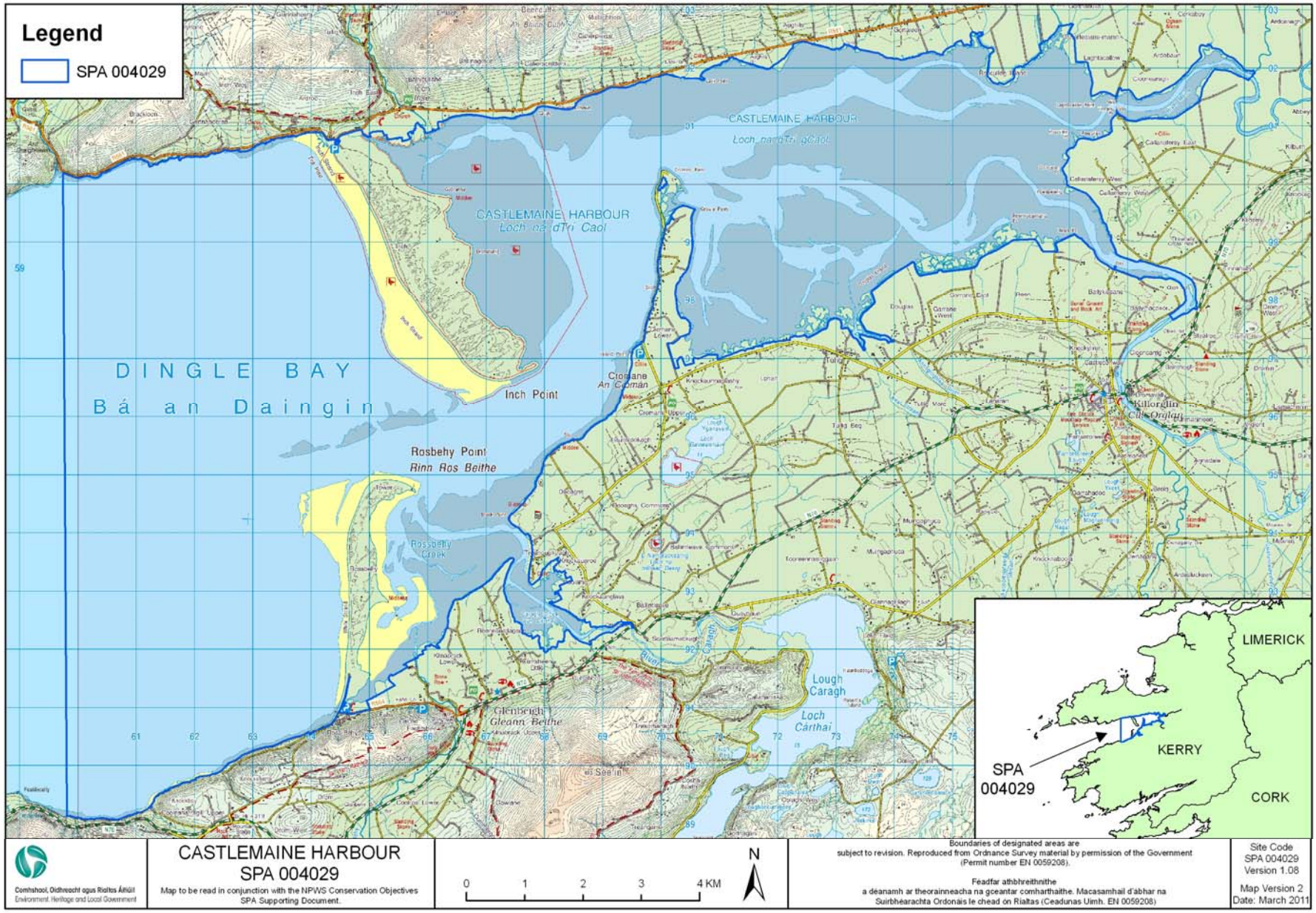
Castlemaine Harbour Spa is a large coastal site occupying the innermost part of Dingle Bay. It extends from the lower tidal reaches of the River Maine and River Laune to west of the Inch and Rosbehy peninsulas (c. 16 km from east to west). The average width of the estuary is 4-5 km though it is c. 11 km wide at the outer limit. The site comprises the estuaries of the River Maine and the River Laune, both substantial rivers, and has extensive areas of intertidal sand and mud flats. A number of other rivers, e.g. the Caragh and the Emlagh, flow into the site, as well as numerous small streams. Conditions in the bay are very sheltered due to the presence of three protruding sand spits on its seaward side. These spits overly gravel bars. Two of the spits, Rosbehy and Inch, are included within the site. Salt marshes fringe much of the shoreline. A very large dune system occurs on the Inch peninsula. A substantial area of shallow marine water is included in the site.

The intertidal flats are mostly muds or muddy sands and have high densities of polychaete worms such as Ragworm (*Hediste diversicolor*) and Lugworm (*Arenicola marina*), along with a good variety of bivalves and molluscs. Eelgrass (*Zostera* spp.) is common in places. The introduced Common Cord-grass (*Spartina anglica*) is found in sheltered areas of the intertidal flats and has colonised the lower part of the saltmarsh at Inch. Salt marsh vegetation includes Thrift (*Armeria maritima*), Common Saltmarsh-grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Sea Rush (*Juncus maritimus*) and Sea Plantain (*Plantago maritima*). The sand dune system at Inch is the largest and arguably the best remaining intact dune system in the country and includes large areas of embryo dunes, Marram (*Ammophila arenaria*) dunes and fixed dunes, as well as dune slacks.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Red-throated Diver, Cormorant, Light-bellied Brent Goose, Wigeon, Mallard, Pintail, Scaup, Common Scoter, Oystercatcher, Ringed Plover, Sanderling, Bar-tailed Godwit, Redshank, Greenshank, Turnstone and Chough. 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.

Castlemaine Harbour SPA is one of the most important sites for wintering waterfowl in the south-west. It provides habitats for an excellent diversity of waterbirds, including divers and seaduck. It is of international importance for its Light-bellied Brent Goose population (694) – figures given are mean peaks for the five winters 1995/96-1999/2000, as well as nationally important populations of a further fourteen waterbird species, i.e. Red-throated Diver (56), Cormorant (136), Wigeon (6,819), Mallard (487), Pintail (145), Scaup (74), Common Scoter (3,637), Oystercatcher (1,035), Ringed Plover (206), Sanderling (335), Bar-tailed Godwit (397), Redshank (341), Greenshank (46) and Turnstone (144). The population of Wigeon is of note, being 7.6% of the all-Ireland total, while that of Sanderling is over 5%. Other species which have important populations include Great Northern Diver (22), Shelduck (90), Teal (287), Red-breasted Merganser (29), Golden Plover (972), Grey Plover (46), Knot (199), Dunlin (933) and Curlew (474). Black-headed Gull occurs frequently (538). The site provides good quality habitat for the feeding and roosting requirements of the various bird species which winter here. Whilst not breeding within the site, Chough occur in nationally important numbers and are regularly found on the sand dunes at Inch where they feed and socialise; during the autumn in 2002/03 and 2003/04 the dunes at Inch held flocks of up to 40 and 64 birds respectively.

Castlemaine Harbour SPA is a very important ornithological site, with one species, Light-bellied Brent Goose, occurring in numbers of international importance. In addition, it supports nationally important populations of a further fifteen species. Of particular note is that five species that occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Red-throated Diver, Great Northern Diver, Golden Plover, Bar-tailed Godwit and Chough. The site includes a Nature Reserve and two Wildfowl Sanctuaries.


Legend
SPA 004029
CASTLEMAINE HARBOUR
Loch na dTri gCaol
CASTLEMAINE HARBOUR
Loch na dTri Caol
DINGLE BAY
Bá an Daingin
Inch Point
Rosbehy Point
Rinn Ros Beithe
Rossbehy Creek
Ceann an Chomáin
Killorglin
Cill Orglan
Glenbeigh
Gleann Beithe
Lough Caragh
Loch Cárthaí
LIMERICK
KERRY
CORK
SPA 004029
CASTLEMAINE HARBOUR
SPA 004029
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0 1 2 3 4 KM
N
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Feadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadunas Uimh. EN 0059208)
Site Code SPA 004029 Version 1.08
Map Version 2 Date: March 2011
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government

## APPENDIX 2

Population Indexing and Trend Analysis: a synopsis

An index number can be defined as a measure of population size in one year expressed in relation to the size of the population in another selected year (Leech et al., 2002). Changes in the index numbers can therefore explain the pattern of population change (Underhill & Prŷs-Jones, 1994).

Population indices are calculated separately for each species at a site. Monthly count data are used from the Irish Wetland Bird Survey (I-WeBS). For each year included in an analysis, a total is obtained by summing the number of birds present in a predetermined number of months. The final year in the series is then scaled to equal 100 (please see example in table below).

| Summed counts | Index |
|---|---|
| 264.41 | 128.11 |
| 262.21 | 127.04 |
| 234.0 | 113.37 |
| 126.0 | 61.05 |
| 197.23 | 95.56 |
| 206.4 | 100.00 |

In order to overcome the problem of counts deemed of poor quality (e.g. poor visibility) or incomplete counts, or where there are missing values in the dataset, values can be imputed by the use of the Underhill Index (Underhill & Prŷs-Jones, 1994). The Underhill Index uses a Generalised Linear Model (GLM) to calculate the influence of both the site surveyed and the timing of the count (month, year), on the number of birds recorded. The Underhill Index is now a standard method for replacing missing data points and is used widely (e.g. Atkinson et al. 2006; Leech et al. 2002; Crowe et al. 2008).

Although indices themselves can be used to assess population trends over time this is primarily through using the line-of-best-fit over a long (e.g. 10-year) time period, which can then give an average annual change (one year to another). However this method is not best suited to assessing the change between one time period and another.

A further step, as used for example by the UK WeBS Alert system (Leech et al. 2002), is to use Generalised Additive Models (GAM) to fit a smoothed curve to the annual population indices. This analysis allows the calculation of changes over shorter time periods, one major advantage being that short-term fluctuations (e.g. a low count in one winter amongst a dataset of relatively stable annual indices) will not lead to the conclusions of a longer-term population decline, or conversely, a high count in one year will not lead to the false interpretation that a population is recovering when in fact it is not.

GAMs are non-parametric and flexible extensions of the generalised linear model where the linear predictor of the GLM is replaced by a general additive predictor which allows mean abundance to vary as a smooth function of time. Count data are assumed to follow independent Poisson distribution.

Further information on population trend modelling using GAMs can be found in various references; for particular reference to waterbirds see Leech et al (2002) and Atkinson et al. (2006).

The result of the GAM analysis is therefore smoothed annual index values. To provide the population trend or proportional change in index values across a selected time period, the following calculation is undertaken:

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

where $I_y$ is the index from the current year and $I_x$ is the index value at the start of the selected time period.

(Note that this calculation is the same as the 'generic threshold method' used where the current and baseline 5-year means are used in place of index values).

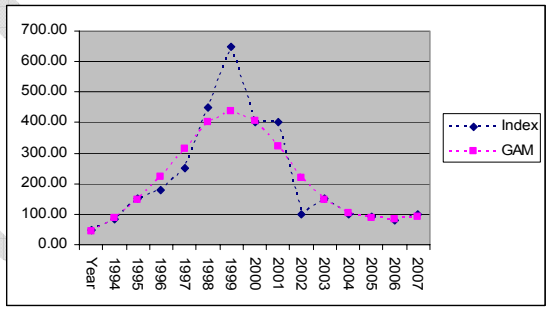
The result of this calculation is the % change in population size based on smoothed annual indices. Larger values indicate larger proportional changes in population size; positive values indicating relative increases while negative values indicate relative decreases over the specified time period.

Limitations

The months chosen for the calculation of population indices aim to reflect the months when the populations at a site are the most stable, excluding months when there may be fluctuations due to passage populations. Despite this, some datasets still present a high degree of variability or fluctuation both within and between years. Caution is therefore needed in interpreting the results.

A high proportion of imputed counts can also limit the effectiveness of the analysis to aid in the interpretation of the dataset. Therefore species for which 50% or more of the monthly count values are imputed are excluded from analysis.

Despite the smoothing effects of the GAM analysis, interpretation of population trends may sometimes still be difficult. In general the results of the GAM analysis need to be assessed together with a thorough examination of the original dataset to identify any confounding factors. Simply accepting the population % change result alone may mask significant population increases/decreases which have taken place within the period assessed. In the example shown to the right, a substantial population increase and subsequent decrease occurs in the middle of the time period analyses yet a comparison of 2005 with 1995 would give a relatively stable 10-year population trend.

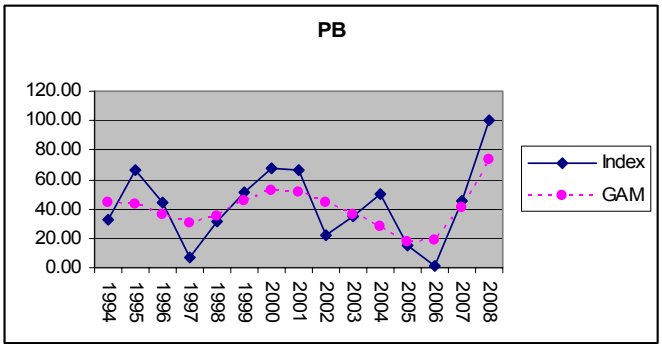



Population Indexing and Trend Analysis: example

The example below shows the population index and smoothed index for Light-bellied Brent Geese at Castlemaine Harbour. Note that the change in population size from the current to a previous specified year is calculated using the penultimate smoothed index value as the 'current' year. This is because during smoothing, the GAM takes into account values from both the preceding and following year. The last value in the smoothed dataset is therefore likely to be the least robust because it has no following year.

| Year | Index | GAM |
|---|---|---|
| 1994 | 32.48 | 44.66 |
| 1995 | 66.31 | 43.18 |
| 1996 | 44.80 | 36.35 |
| 1997 | 7.31 | 30.37 |
| 1998 | 31.82 | 34.82 |
| 1999 | 51.41 | 45.29 |
| 2000 | 67.77 | 52.66 |
| 2001 | 66.84 | 51.42 |
| 2002 | 21.77 | 43.73 |
| 2003 | 35.20 | 36.51 |
| 2004 | 50.29 | 28.22 |
| 2005 | 14.78 | 17.99 |
| 2006 | 1.41 | 19.07 |
| 2007 | 45.72 | 40.57 |
| 2008 | 100.00 | 73.28 |

| Term | Change |
|---|---|
| 5 Year | - 7.23 |
| 10 Year | 33.60 |
| 13 year | - 6.05 |



## APPENDIX 3

**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 4

Waterbird foraging guilds (after Weller, 1999)

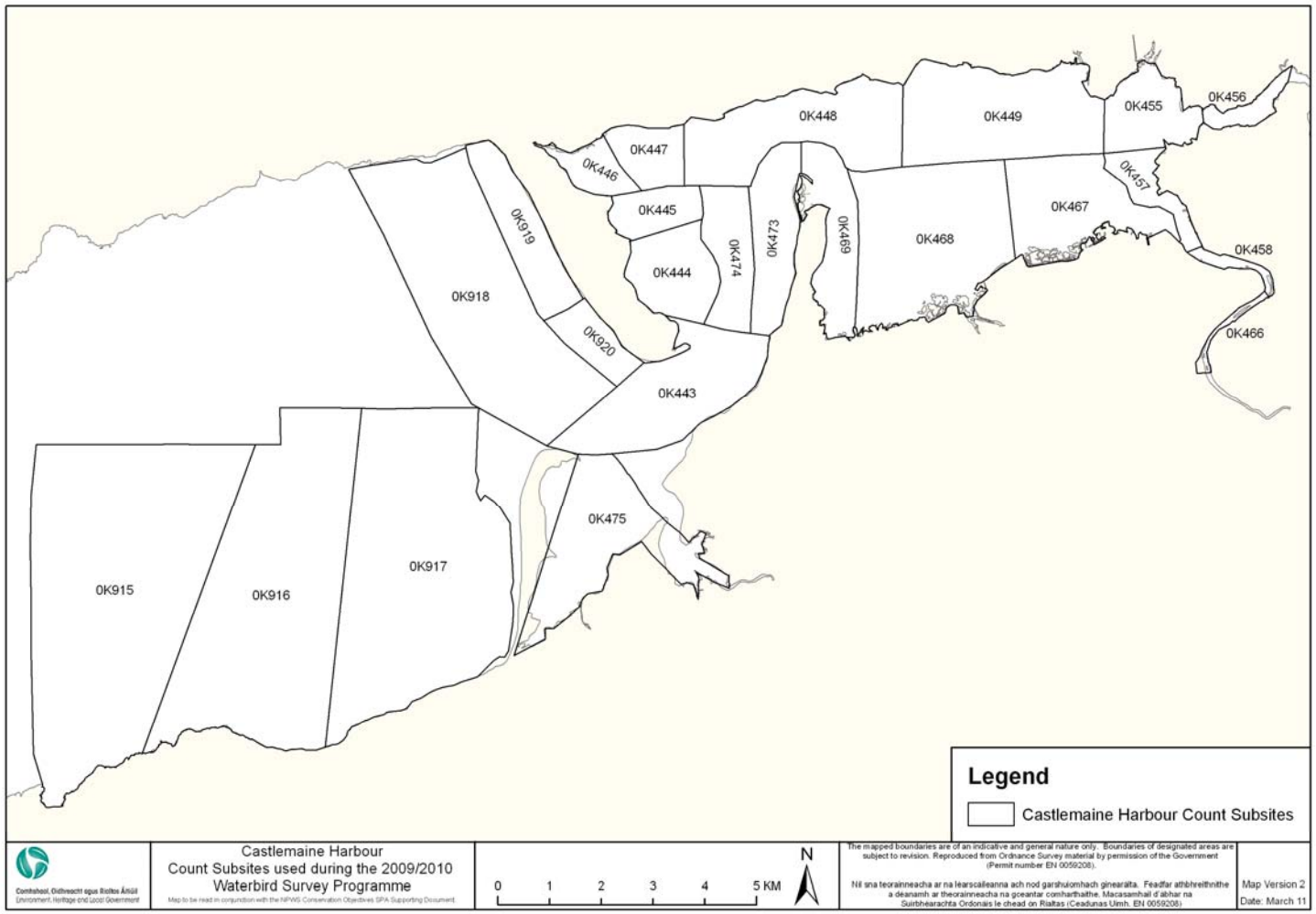
| Guild | Foods | Tactics | Examples… |
|---|---|---|---|
| (1) Surface swimmer | Invertebrates, vegetation & seeds | Strain/sieve/sweep/dabble/ grab/up-ending | 'Dabbling ducks'; e.g. Shoveler, Teal, Mallard, Pintail, Wigeon, Gadwall |
| (2) Water column diver – shallow[a] | Fish & Invertebrates; | 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 | Many sandpipers |

[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 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 do occasionally dive for food.

## APPENDIX 5

**Castlemaine Harbour (4029) – Waterbird survey programme 2009/10 – Count Subsites**



## APPENDIX 6

### Castlemaine Harbour (4029)

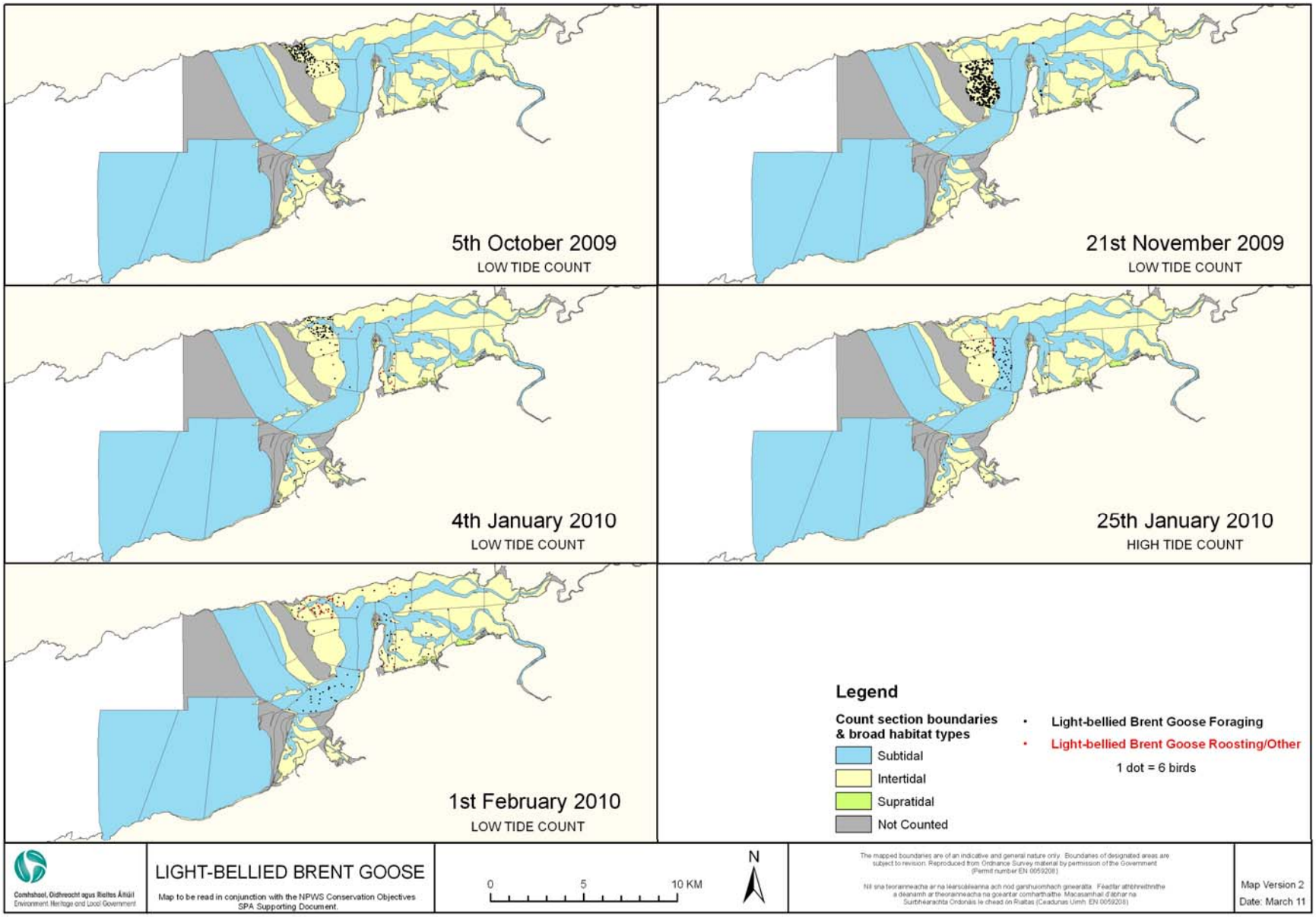
**Subsite species richness for low tide counts (05.10.09, 21.11.09, 04.01.10 and 01.02.10) and high tide count (25.01.10).**
Dominant habitats I = Intertidal; S = Subtidal; Su = Supratidal
(For each date, the three highest values are highlighted in red, blue green for 1, 2 & 3 respectively).
n/c = not counted

| Subsite | Area (Ha) | Dominant habitat | Species Richness | | | | |
|---|---|---|---|---|---|---|---|
| | | | 05.10.09 | 21.11.09 | 04.01.10 | 25.01.10 | 01.02.10 |
| 0K443 | 556.9 | S | 17 | 9 | 15 | 16 | 18 |
| 0K444 | 258.3 | I | 12 | 19 | 13 | 12 | 12 |
| 0K445 | 142.0 | I | 19 | 18 | 24 | 19 | 19 |
| 0K446 | 108.9 | I | 24 | 17 | 12 | 12 | 14 |
| 0K447 | 151.0 | I | 14 | 17 | 21 | 17 | 22 |
| 0K448 | 563.2 | I | 13 | 11 | 14 | 8 | 14 |
| 0K449 | 670.1 | I | 15 | 13 | 13 | 8 | 9 |
| 0K455 | 229.2 | I | 15 | 17 | 21 | 18 | 18 |
| 0K456 | 68.81 | I | 10 | 13 | 15 | 10 | 15 |
| 0K457 | 124.7 | I | 12 | 9 | 14 | 5 | 11 |
| 0K458 | 39.0 | S | 11 | 8 | 13 | 6 | 11 |
| 0K466 | 25.6 | S | 4 | 0 | 4 | 6 | 2 |
| 0K467 | 442.9 | I | 16 | 23 | 21 | 16 | 20 |
| 0K468 | 830.5 | I | 21 | 19 | 25 | 20 | 25 |
| 0K469 | 287.9 | S | 13 | 18 | 19 | 18 | 14 |
| 0K473 | 285.5 | S | 7 | 6 | 12 | 8 | 9 |
| 0K474 | 231.5 | S | 4 | 7 | 11 | 3 | 5 |
| 0K475 | 569.8 | I | 9 | 3 | 9 | 19 | 13 |
| 0K915 | 2027.6 | S | 2 | 1 | 0 | 0 | 3 |
| 0K916 | 1667.5 | S | 0 | 1 | 1 | 0 | 2 |
| 0K917 | 1674.8 | S | 2 | 4 | 3 | 4 | 5 |
| 0K918 | 1251.2 | S | 4 | 10 | n/c | 7 | 9 |
| 0K919 | 300.0 | S | 4 | 0 | 6 | 6 | 7 |
| 0K920 | 138.1 | I | 1 | 3 | 2 | 1 | 2 |

## APPENDIX 7

**Castlemaine Harbour (4029)**

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


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Light-bellied Brent Goose Foraging
Light-bellied Brent Goose Roosting/Other
1 dot = 6 birds
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
LIGHT-BELLIED BRENT GOOSE
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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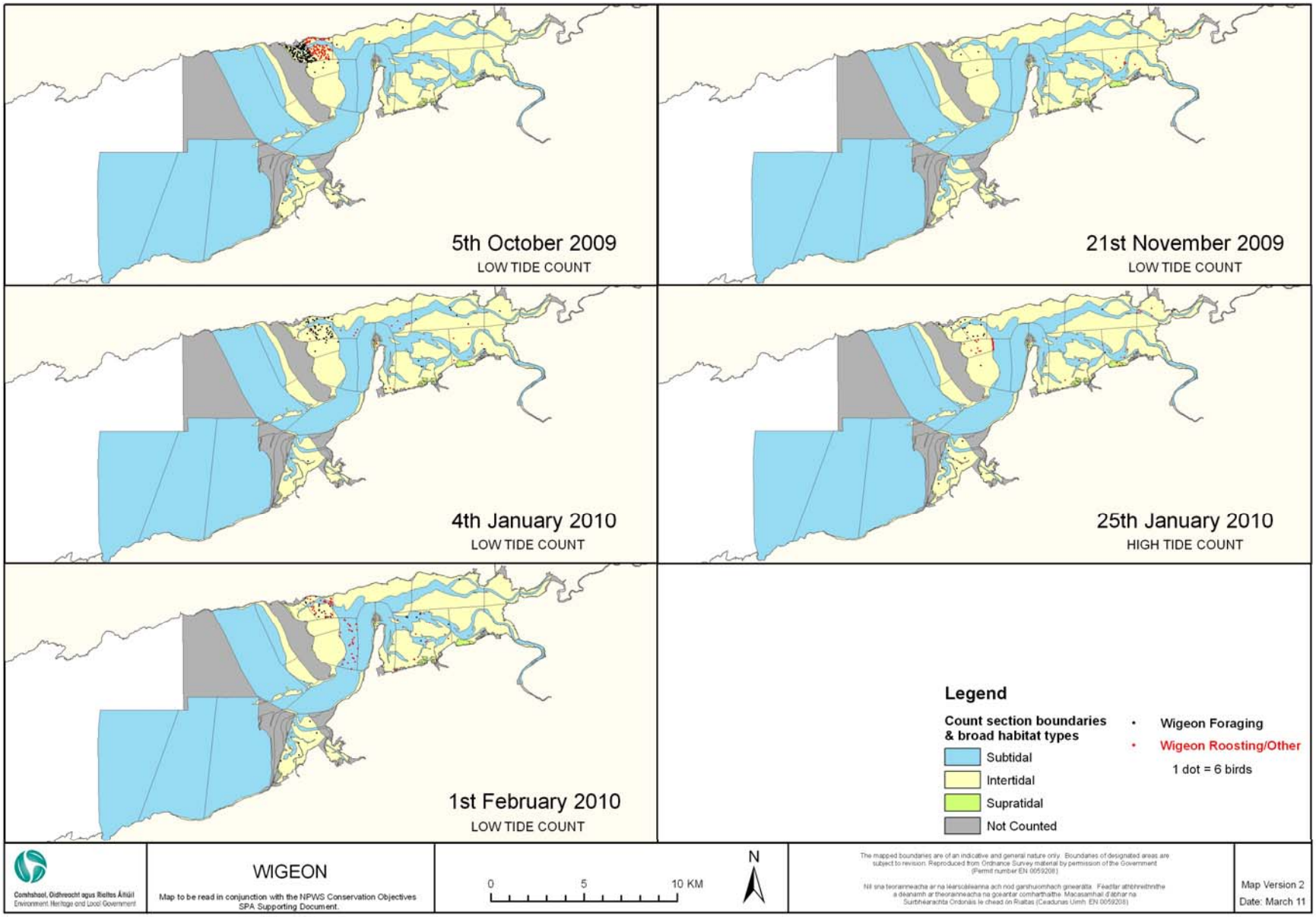
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Wigeon Foraging
Wigeon Roosting/Other
1 dot = 6 birds
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
WIGEON
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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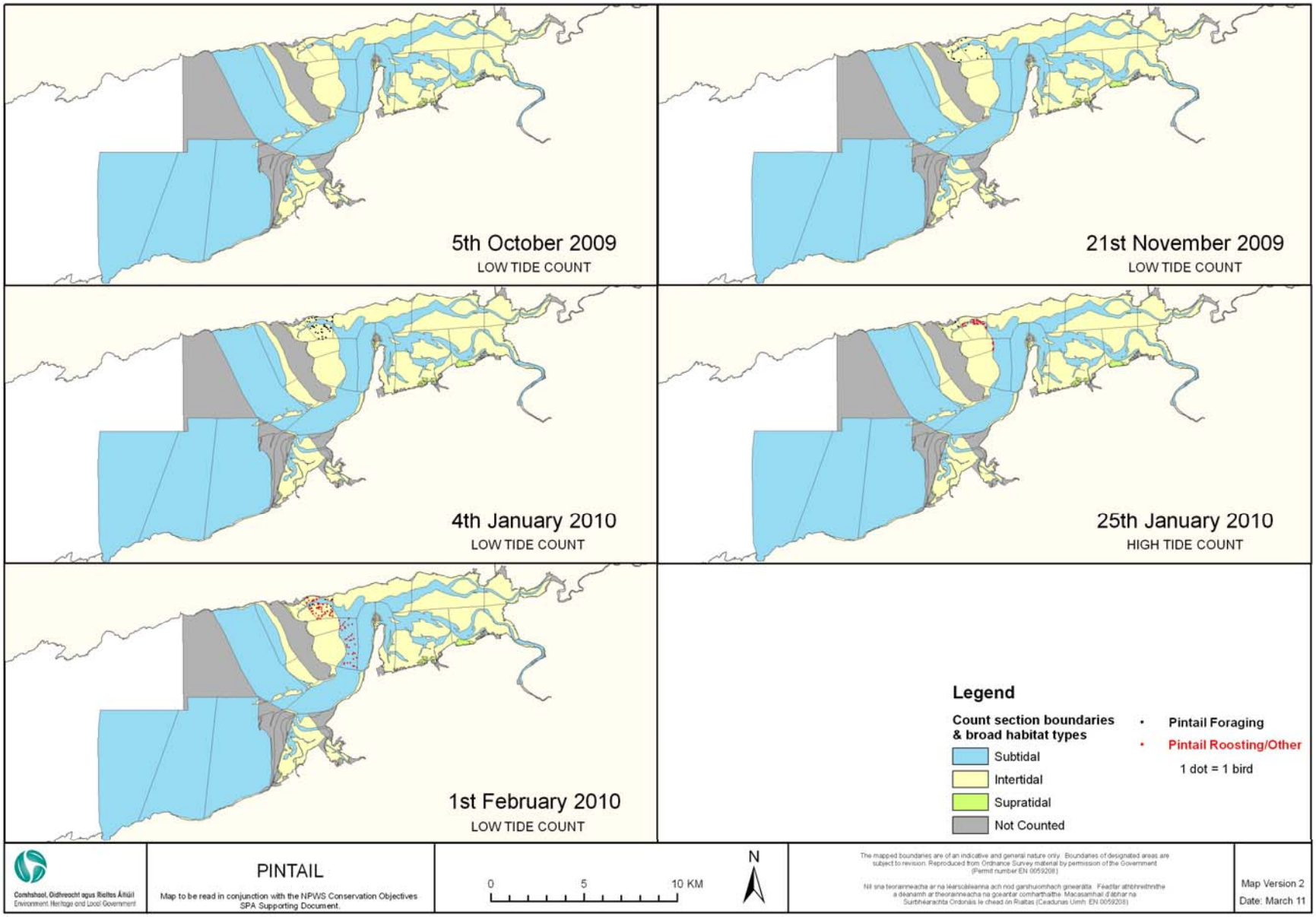
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Pintail Foraging
Pintail Roosting/Other
1 dot = 1 bird
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
PINTAIL
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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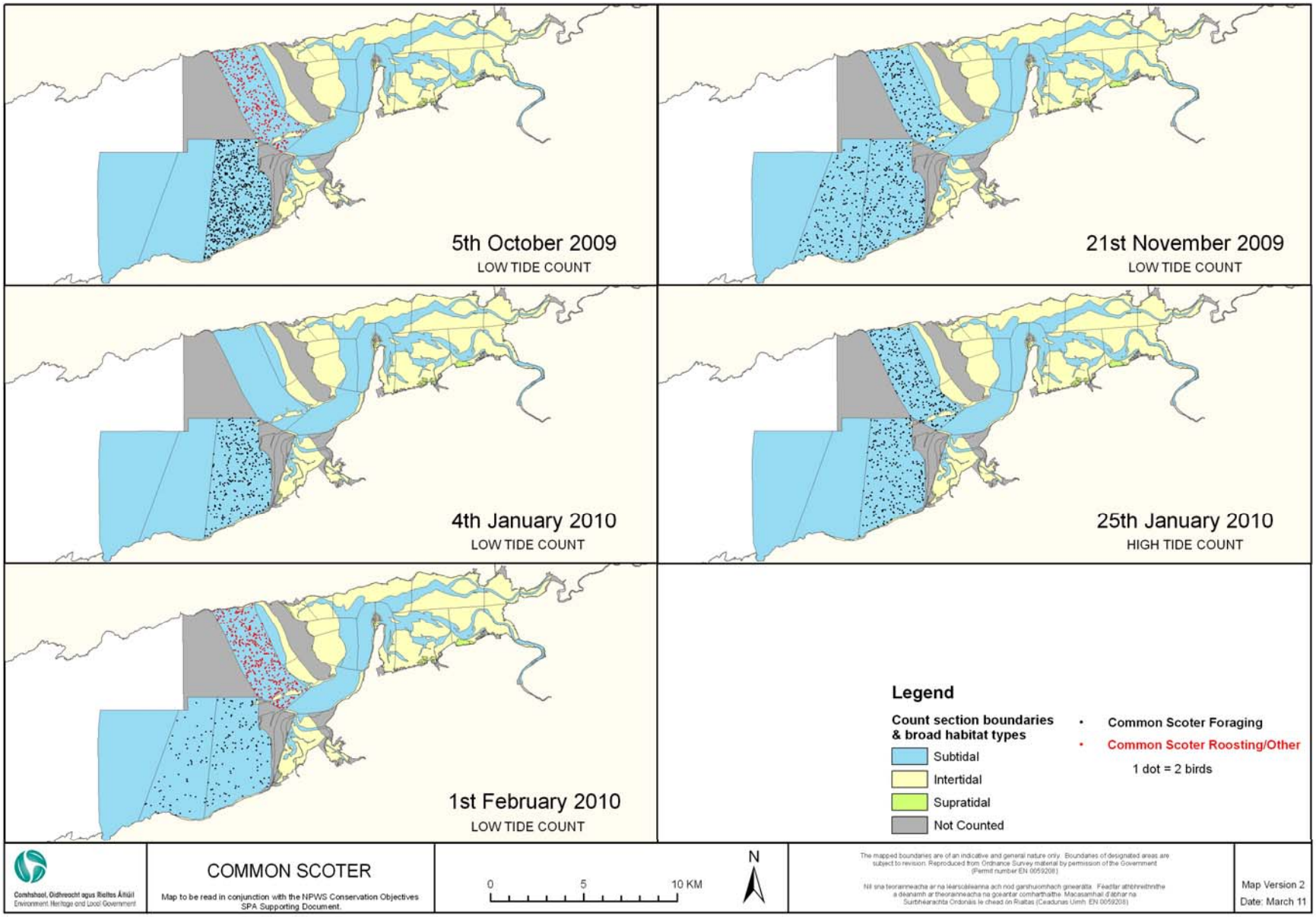
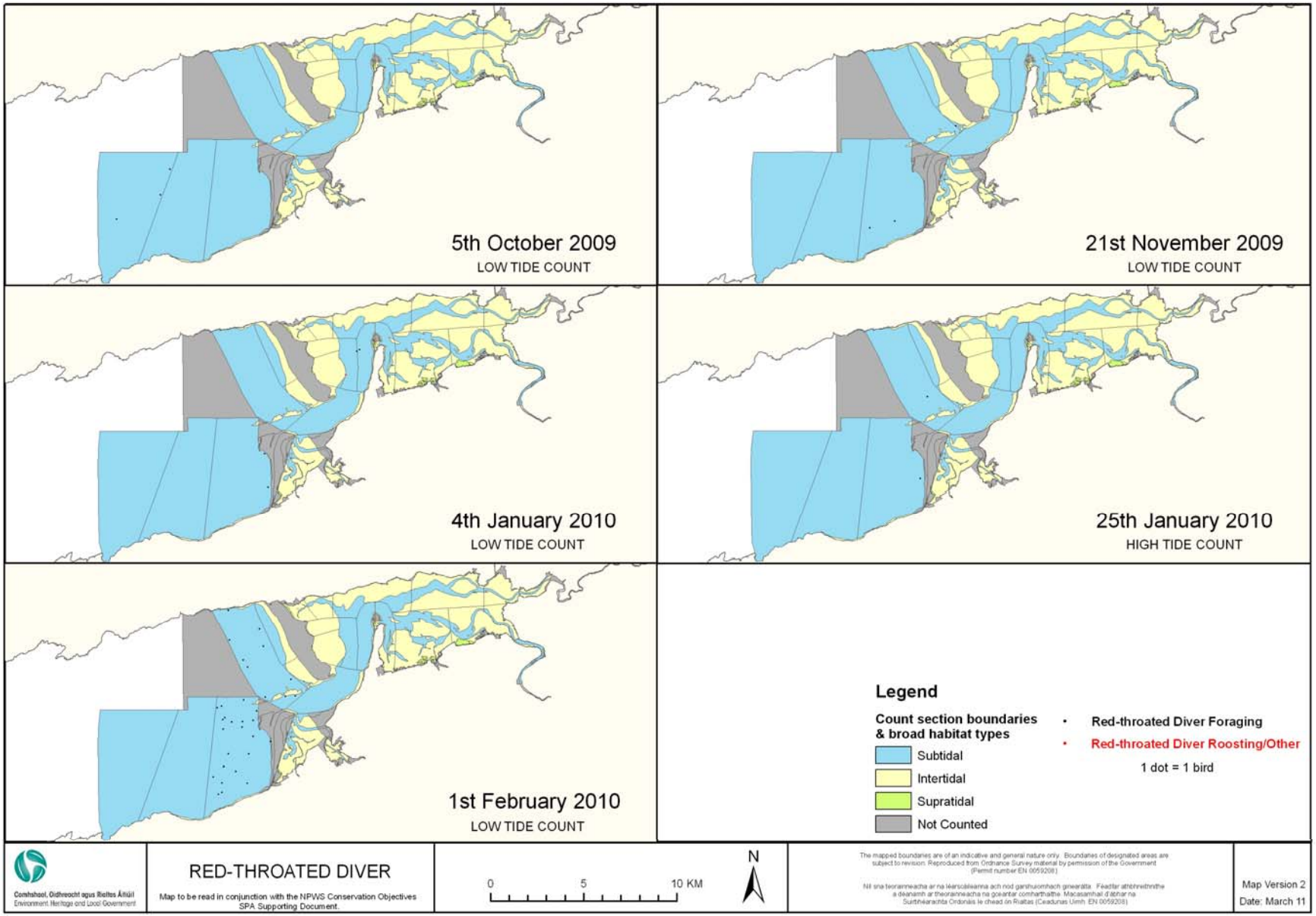
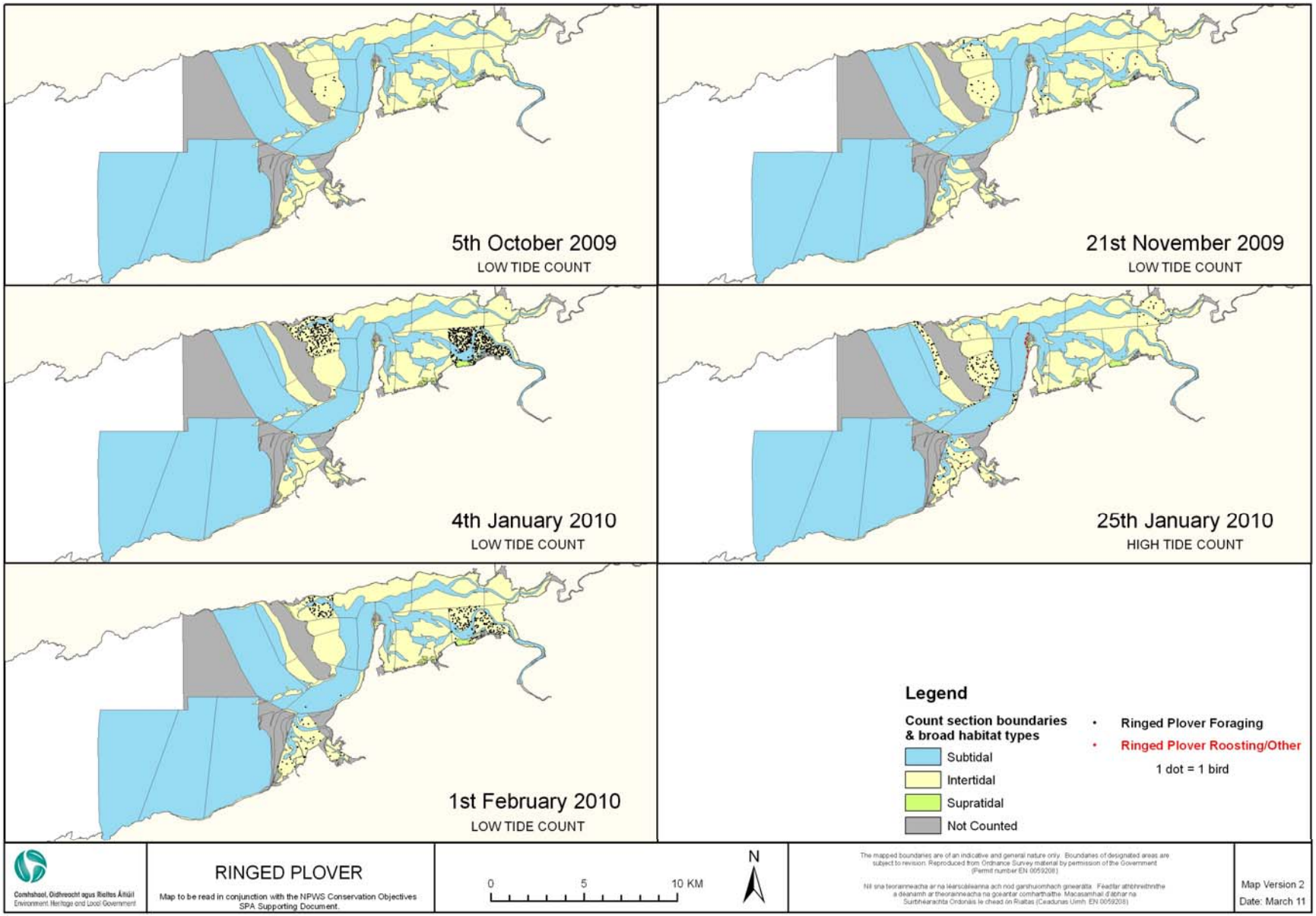
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Common Scoter Foraging
Common Scoter Roosting/Other
1 dot = 2 birds
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
COMMON SCOTER
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208)
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Red-throated Diver Foraging
Red-throated Diver Roosting/Other
1 dot = 1 bird
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
RED-THROATED DIVER
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208)
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Ringed Plover Foraging
Ringed Plover Roosting/Other
1 dot = 1 bird
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
RINGED PLOVER
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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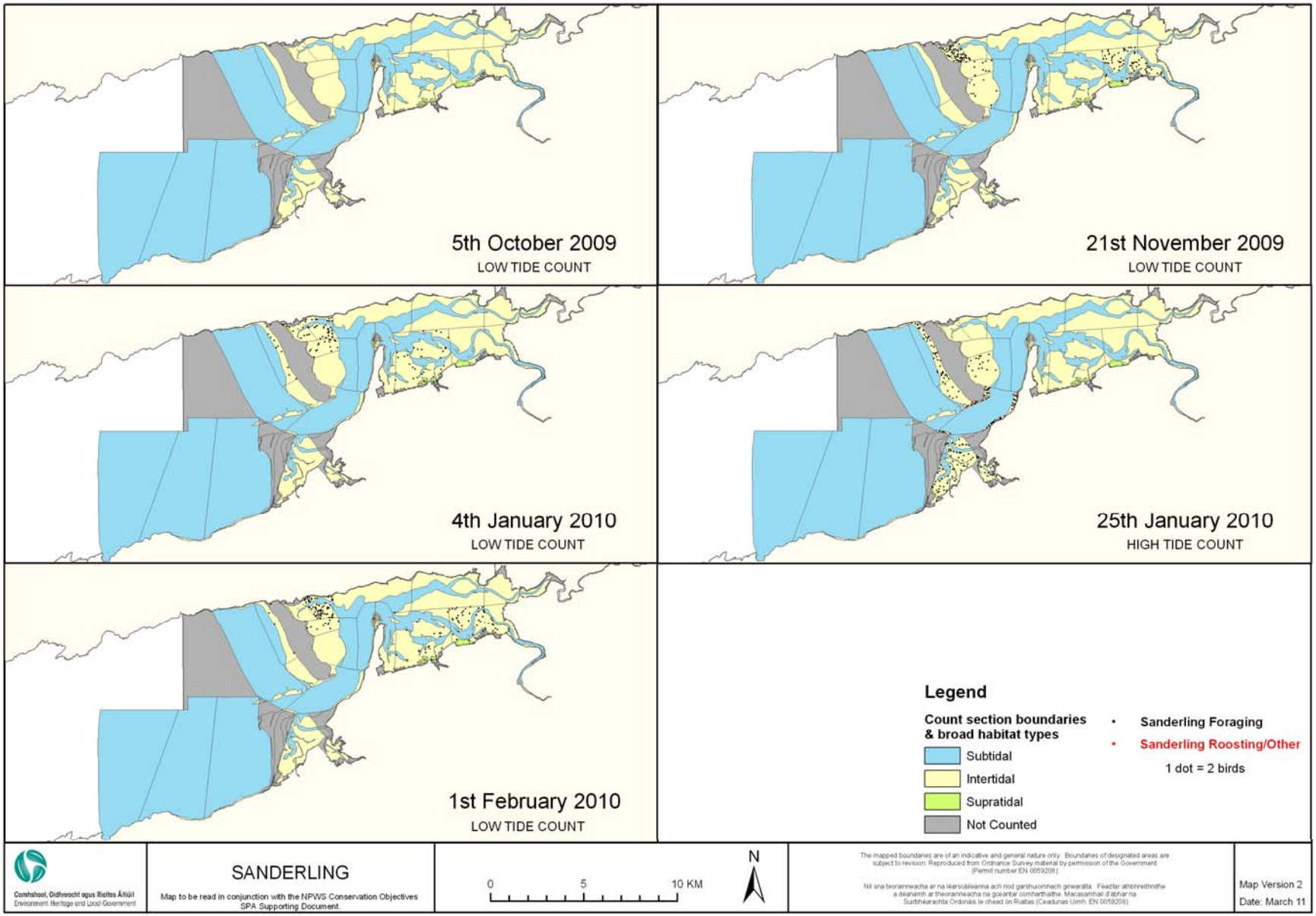
Nil sna teorainneacha ar na léarscáileanna ach nod ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéireachta Ordanáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Sanderling Foraging
Sanderling Roosting/Other
1 dot = 2 birds
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
SANDERLING
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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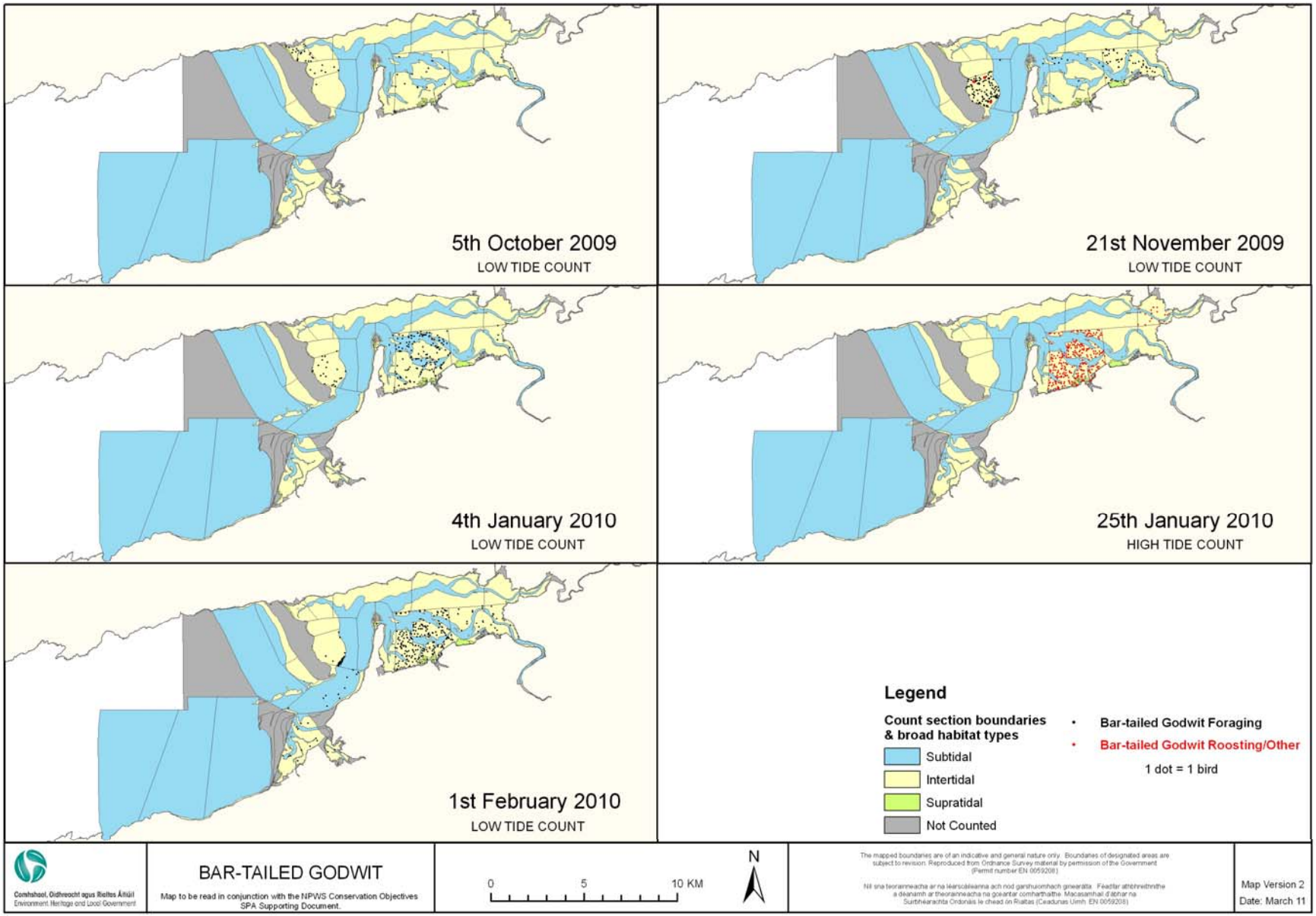
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Bar-tailed Godwit Foraging
Bar-tailed Godwit Roosting/Other
1 dot = 1 bird
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
BAR-TAILED GODWIT
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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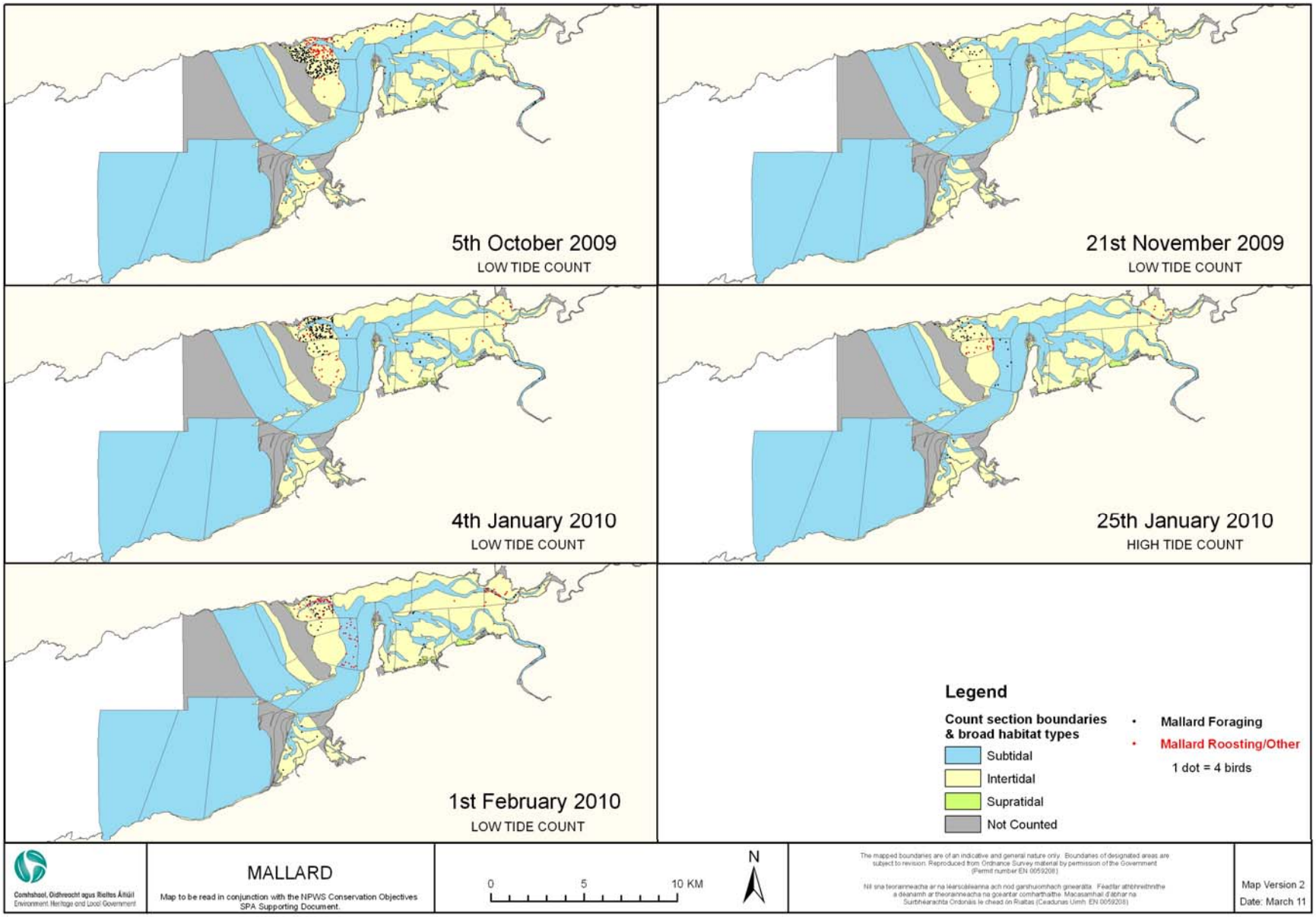
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Mallard Foraging
Mallard Roosting/Other
1 dot = 4 birds
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
MALLARD
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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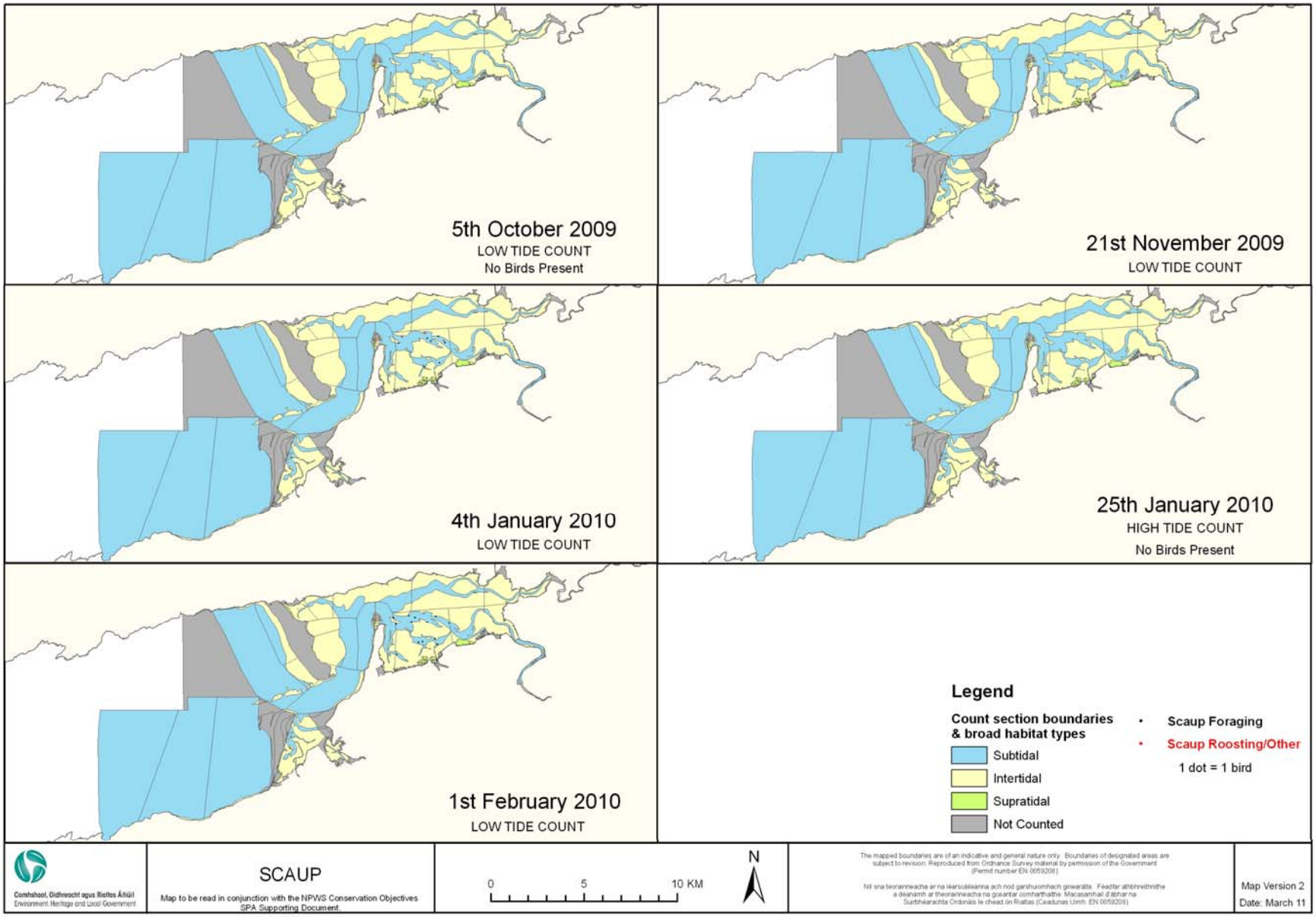
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
No Birds Present
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
No Birds Present
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Scaup Foraging
Scaup Roosting/Other
1 dot = 1 bird
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
SCAUP
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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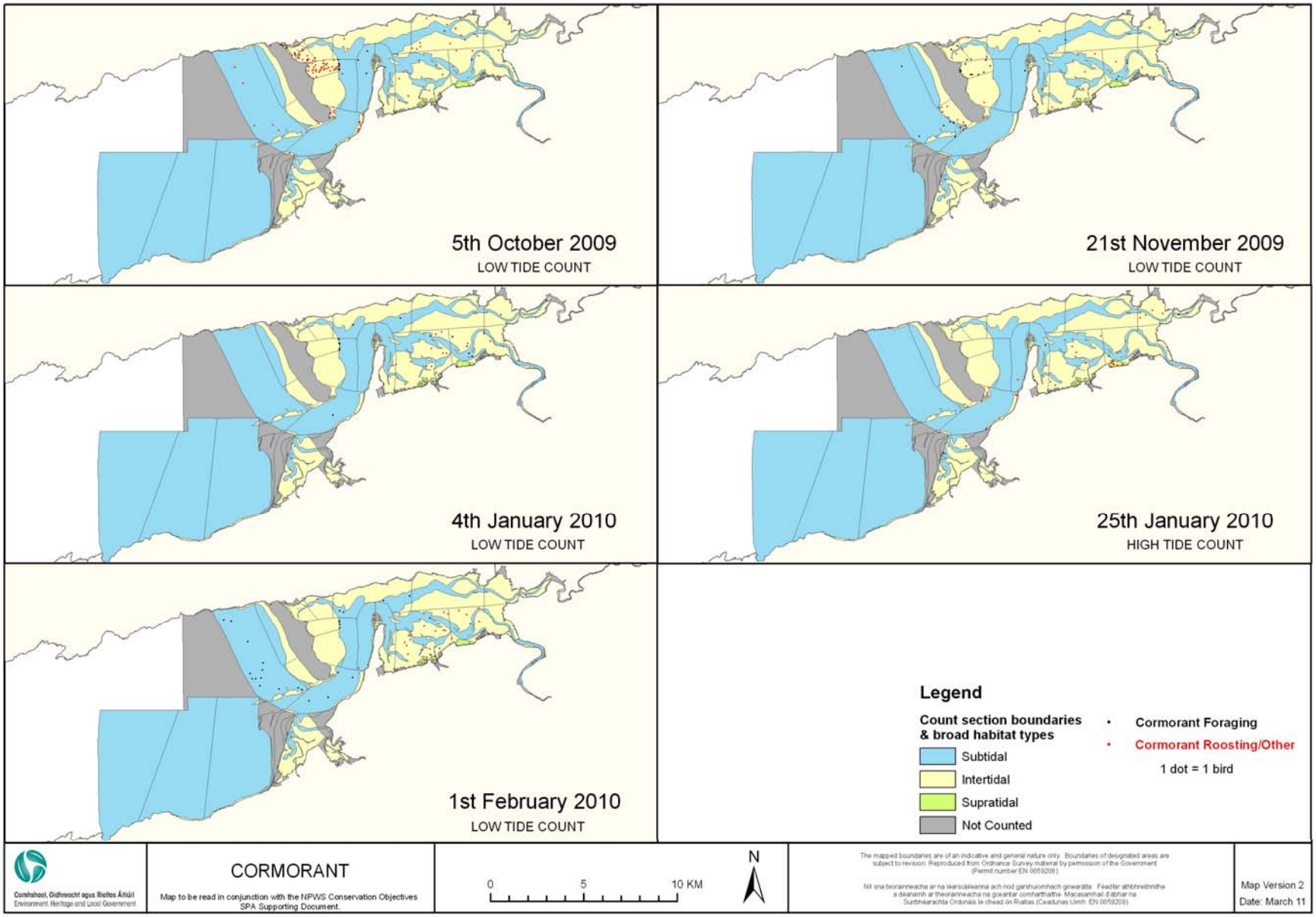
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Cormorant Foraging
Cormorant Roosting/Other
1 dot = 1 bird
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
CORMORANT
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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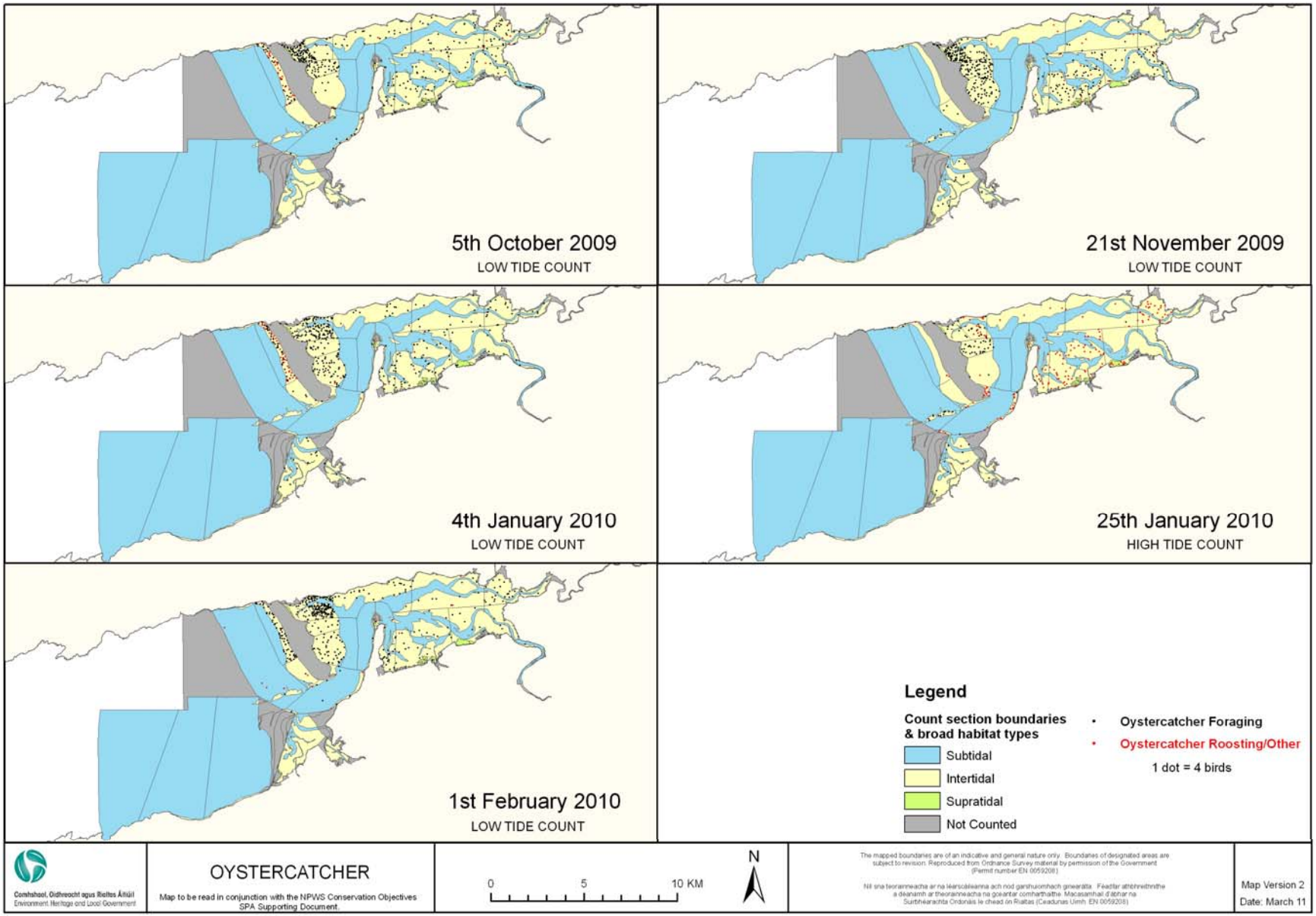
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Oystercatcher Foraging
Oystercatcher Roosting/Other
1 dot = 4 birds
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
OYSTERCATCHER
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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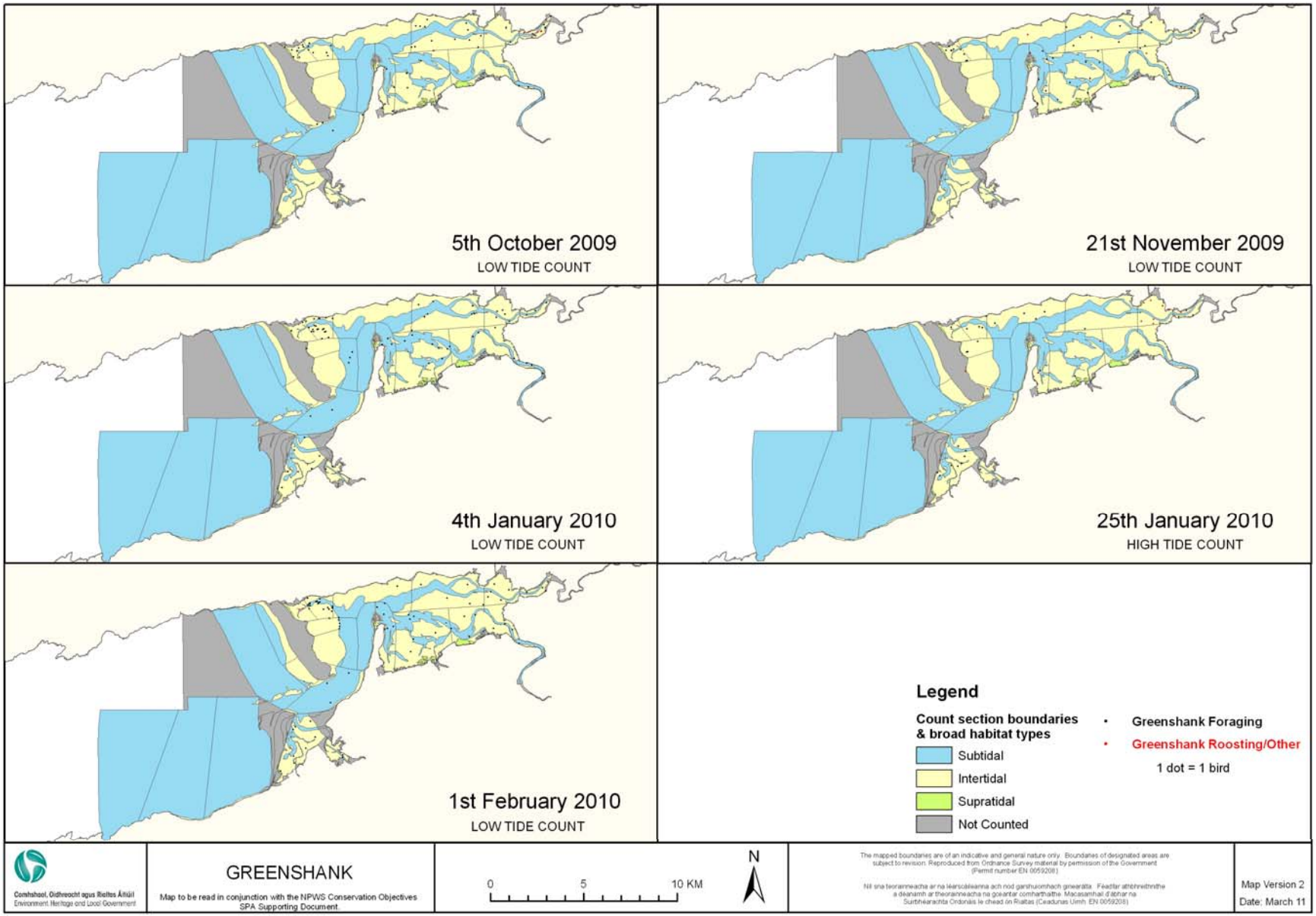
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Greenshank Foraging
Greenshank Roosting/Other
1 dot = 1 bird
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
GREENSHANK
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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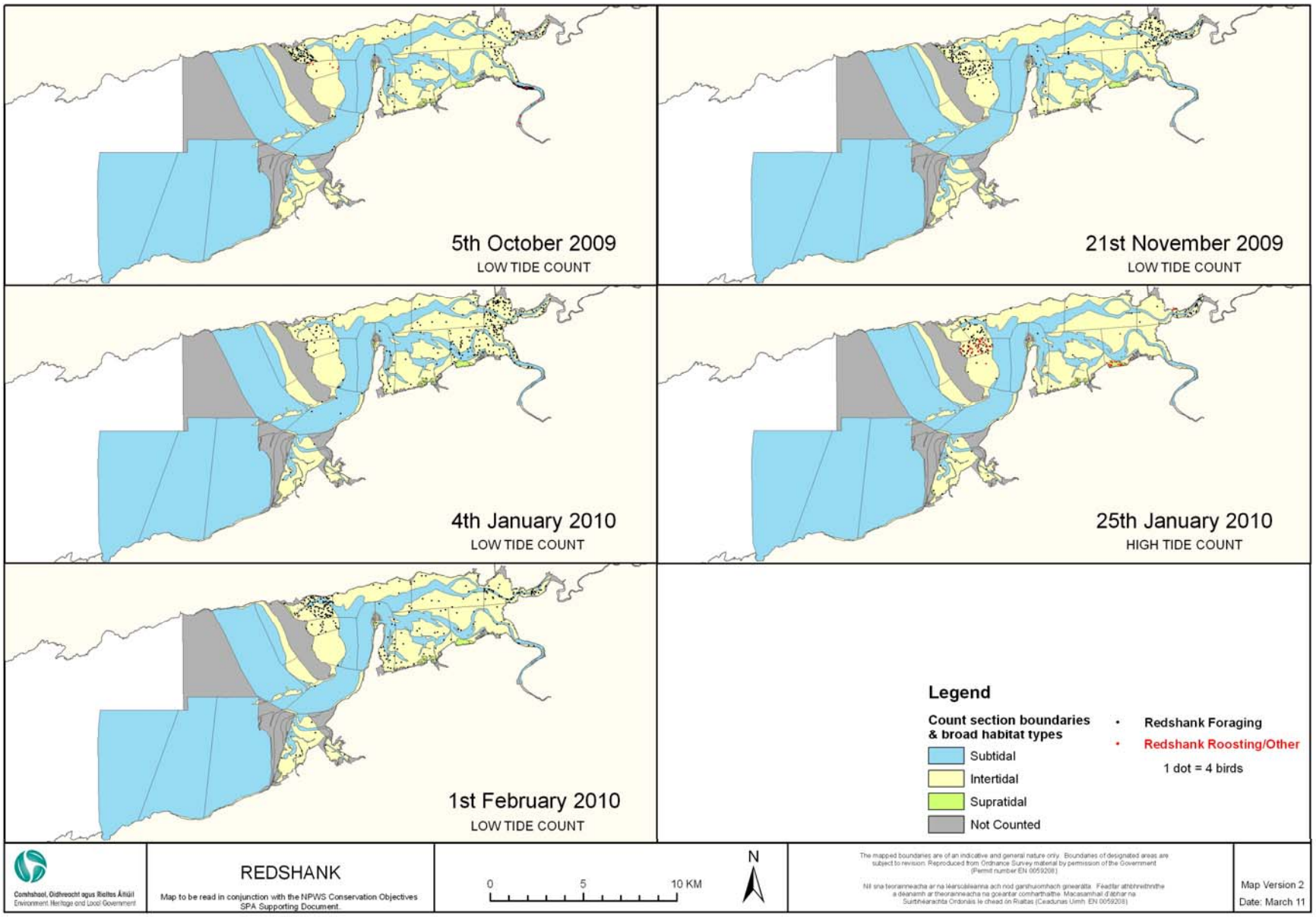
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Redshank Foraging
Redshank Roosting/Other
1 dot = 4 birds
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
REDSHANK
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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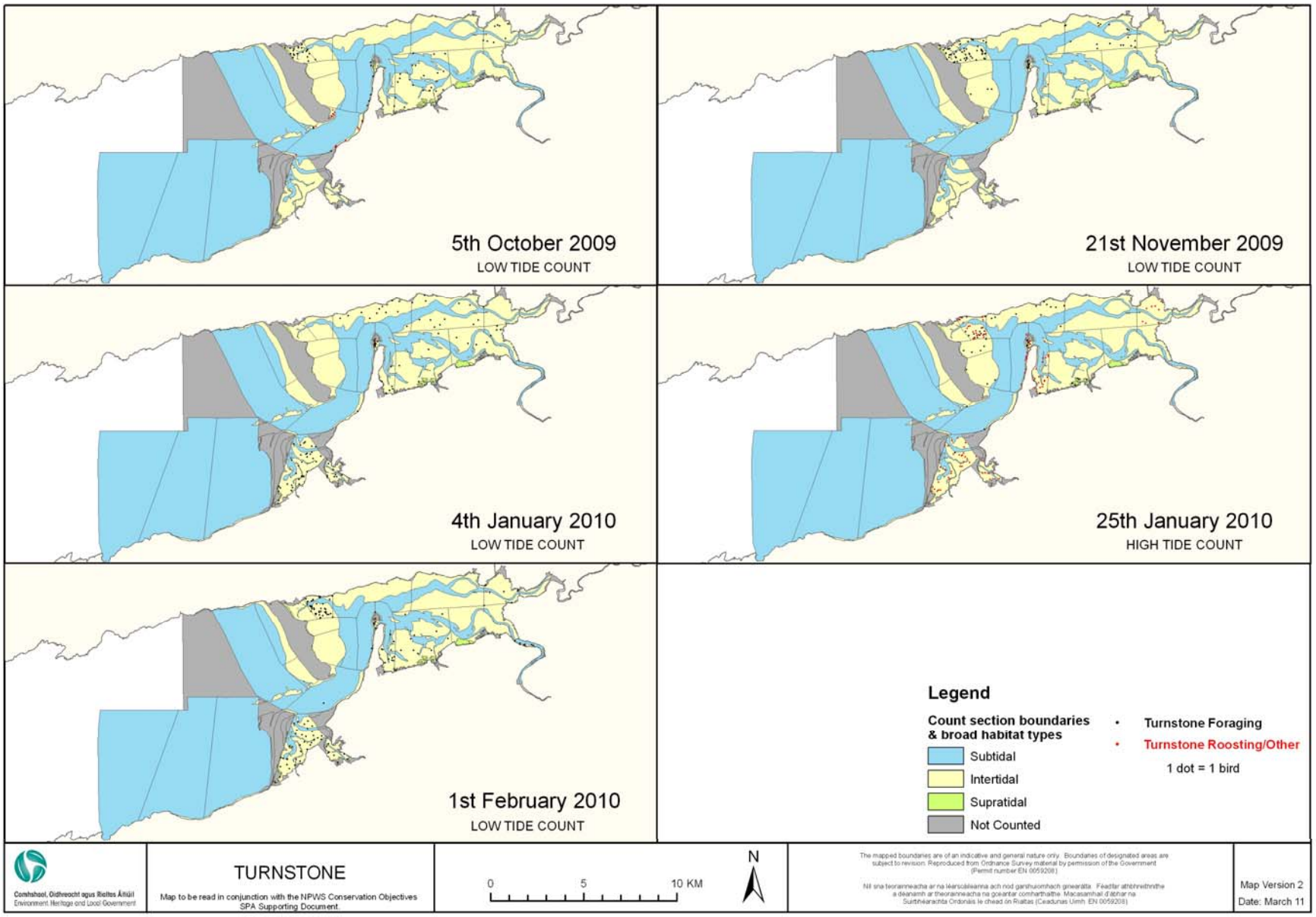
Map Version 2
Date: March 11


5th October 2009
LOW TIDE COUNT
21st November 2009
LOW TIDE COUNT
4th January 2010
LOW TIDE COUNT
25th January 2010
HIGH TIDE COUNT
1st February 2010
LOW TIDE COUNT
Legend
Count section boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Not Counted
Turnstone Foraging
Turnstone Roosting/Other
1 dot = 1 bird
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
TURNSTONE
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0
5
10 KM
N
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Map Version 2
Date: March 11

## APPENDIX 8

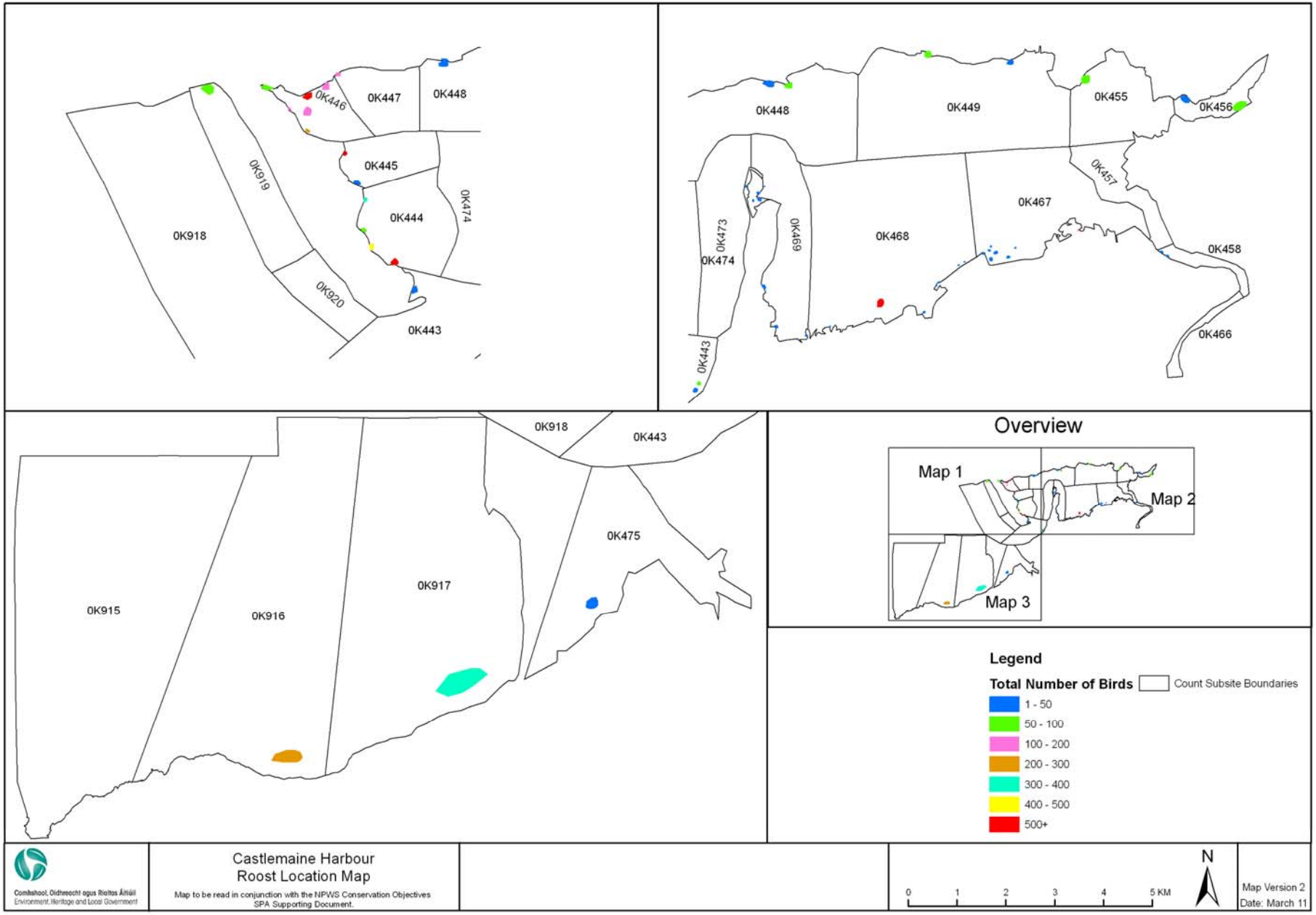
**Castlemaine Harbour (4029)**

**Roost location maps recorded during the roost survey (26th February 2010)**

## Castlemaine Harbour SPA (4029) Roost Summary Table

(three largest roosts in terms of total number of birds are highlighted in blue).

| Subsite | Number individual roost locations | No. Species | Total No. birds | Species (alphabetical order) |
|---|---|---|---|---|
| 0K457 | 2 | 2 | 25 | OC, GK |
| 0K467 | 8 | 15 | 286 | BH, CA, CM, CU, ET, GB, GK, HG, L., MA, OC, RK, SU, T., WN, |
| 0K468 | 4 | 4 | 23 | L., OC, RK, WN |
| 0K443 | 2 | 1 | 74 | OC |
| 0K444 | 5 | 10 | **1806** | BA, CU, GB, GK, GV, KN, OC, PB, RK, SU |
| 0K445 | 2 | 9 | 538 | CU, GK, MA, MS, OC, PB, SU, T., WN |
| 0K446 | 6 | 12 | **1352** | BH, CU, GB, GK, HG, L., MA, PT, RK, T., TT, WN |
| 0K447 | 1 | 3 | 164 | CU, OC, TT |
| 0K448 | 3 | 4 | 95 | BH, CU, GK, OC, |
| 0K449 | 2 | 3 | 124 | MA, OC, TT |
| 0K455 | 1 | 4 | 93 | BH, CU, OC, RK, |
| 0K456 | 2 | 4 | 97 | BH, CU, MA, SU |
| 0K468 | 3 | 7 | **632** | BA, BH, CM, GB, KN, OC, SU |
| 0K469 | 10 | 14 | 327 | BH, CA, CM, GB, GK, HG, L., LB, NB, OC, PB, RK, T., SU |
| 0K473 | 1 | 2 | 13 | DN, RP |
| 0K475 | 1 | 1 | 15 | SU |
| 0K916 | 1 | 1 | 220 | CX |
| 0K917 | 1 | 1 | 335 | CX |
| 0K918 | 1 | 1 | 43 | CM |
| 0K919 | 1 | 2 | 91 | CM, OC |


0K446
0K447
0K448
0K445
0K444
0K474
0K919
0K918
0K920
0K443
0K448
0K449
0K455
0K456
0K457
0K467
0K473
0K469
0K468
0K474
0K458
0K466
0K443
0K918
0K443
0K475
0K917
0K915
0K916
Overview
Map 1
Map 2
Map 3
Legend
Total Number of Birds
Count Subsite Boundaries
1 - 50
50 - 100
100 - 200
200 - 300
300 - 400
400 - 500
500+
Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
Castlemaine Harbour
Roost Location Map
Map to be read in conjunction with the NPWS Conservation Objectives
SPA Supporting Document.
0 1 2 3 4 5 KM
N
Map Version 2
Date: March 11

## APPENDIX 9

### Castlemaine Harbour (4029) - Activities & Events

Activities and events are listed as per standard EU Natura pressure and threat categories. Please note that this list is based on the current review process and is not exhaustive.

| Activity & Events Legend: | |
|---|---|
| **O** | observed or known to occur within Castlemaine Harbour. |
| **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. |

| Activity/Event | 0K443 | 0K444 | 0K445 | 0K446/447 | 0K448 | 0K449 | 0K455 | 0K456 | 0K457 | 0K458 | 0K466 | 0K467 | 0K468 | 0K469 | 0K473 | 0K474 | 0K475 | 0K915 | 0K916 | 0K917 | 0K918 | 0K919 | 0K920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Coastal protection, defences & stabilisation** | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1 Linear defences | | | | | O | O | O | O | | | | | | | | | | | | | | | |
| 1.2 Training walls | O | | | | | | | | | | | | O | | | | | | | | | | |
| 1.4 *Spartina* | O | O | O | O | | | O | | | | | | O | O | | | | | | | | | |
| **Barrage schemes/drainage** | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 Altered drainage/river channel | | | | H | | | | | | | | | | H | | | | | | | | | |
| **Industrial, port & related development** | | | | | | | | | | | | | | | | | | | | | | | |
| 4.2 Fishing harbour | | | | | | | | | | | | | | | O | | | | | | | | |
| 4.3 Slipway | | | | | | | O | O | | | | O | | | O | | | | | | | | |
| 4.4 Pier | | | | | | | | O | | O | O | | | P | | | | | | | | | |
| 4.7 Boat building/repair (v. small-scale) | | | | | | | | | | | | O | | | | | | | | | | | |
| **Pollution** | | | | | | | | | | | | | | | | | | | | | | | |
| 6.1 Domestic & urban waste water | | | | | | | | | | | O | | | | | | | | | | | | |
| 6.4 Agricultural & forestry effluents | | | | | O | O | | O | | | | | | | | | | | | | | | |
| 6.7 Solid waste incl. fly-tipping | O | | | | | | | | | | | | | O | O | | | | | | | | |
| **Transport & Communications** | | | | | | | | | | | | | | | | | | | | | | | |
| 8.3 Bridges & aqueducts | | | | | | | | | | | O | | | | | | | | | | | | |
| 8.6 Car parks | | | | | | | | | | | | | | | O | | | | | | | O | |
| 8.8 Rail lines | | | | | | | | | | | H | | | | | | | | | | | | |
| **Urbanisation** | | | | | | | | | | | | | | | | | | | | | | | |
| 9.1 Urbanised areas, housing (adjacent site) | | | | | | | | | | | O | | | | O | | | | | | | | |
| **Tourism & recreation** | | | | | | | | | | | | | | | | | | | | | | | |
| 12.2 Non-marina moorings | | | | | | | | O | | | | | | | | | | | | | | | |
| 12.4 Caravan parks & chalets | | | | | | | | | | | | | | | | | O | | | | | | |
| 12.6 Power boating & water-skiing | O | | | | | | | | | | | | | | | | | | | | | | |
| 12.8 Sailing | O | | | | | | | | | | | | | | | | | | | | | | |
| 12.9 Sailboarding & wind-surfing | | | | | | | | | | | | | | | | | O | | | | O | O | O |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12.11 Canoeing | | | | | | | | | | | O | | | | | | | | | | | O | O | |
| 12.12 Surfing | | | | | | | | | | | | | | | | | | | | | O | O | O | |
| 12.13 Rowing | | | | | | | | | | | | O | | | | | | | | | | | | |
| 12.14 Tourist boat trips | | | | | | | | | | | | | | | | | | | | | | | | |
| 12.15 Angling | O | | | | | | | | | O | O | | | | | | | | | | | | | |
| 12.16 Other non-commercial fishing | U | U | U | U | U | U | U | | | | | U | U | U | U | U | U | U | U | U | U | | | |
| 12.17 Bathing & general beach recreation | | | | | O | | | | | | | | | | | | | | | | | O | O | |
| 12.18 Walking, incl. dog walking | O | O | | O | O | | O | O | | | | O | | | O | | | | | | | O | O | |
| 12.19 Birdwatching | O | O | | | O | O | O | O | | O | O | O | | | | | O | | | | O | O | O | |
| 12.21 4WD, trial & quad bikes | O | O | | | | | O | | | | | | | | | | | | | | | O | O | |
| 12.22 Motorised vehicles | O | | | | | O | O | | | | | | | | O | | | | | | | O | O | |
| 12.23 Horse-riding | O | | | | | | | | | | | | | | | | O | | | | O | O | O | |
| 12.25 Golf courses | O | | | | | | | | | | | | | | | | | | | | | | | |
| **Wildfowl & hunting** | | | | | | | | | | | | | | | | | | | | | | | | |
| 13.1 Wildfowling | U | U | U | O | U | U | U | U | H | U | U | U | U | U | U | U | U | U | U | U | U | U | U | U |
| 13.2 Other hunting-related activities | | | | O | | | | | | | | | O | | | | | | | | | | | |
| **Bait-collecting** | | | | | | | | | | | | | | | | | | | | | | | | |
| 14.1 Digging for lugworms/ragworms | | | | | | | | | | | | O | | | | | O | | | | | | | |
| **Fisheries & Aquaculture** | | | | | | | | | | | | | | | | | | | | | | | | |
| 15.1 Professional passive fishing | U | U | U | U | U | U | U | | | | | U | U | U | U | U | U | U | U | U | | | | |
| 15.2 Professional active fishing | U | U | U | U | U | U | U | | | | | U | U | U | U | U | U | U | U | U | | | | |
| 15.3 Bottom (benthic) dredging | U | U | U | | U | | | | | | | | | | U | U | | | | | | | | |
| 15.6 Molluscs - hand-gathering | O | O | O | | O | | | | | | | | | O | O | | | | | | | | | |
| 15.7 Hand raking (mussels) | | O | O | O | | | | | | | | | | | | | | | | | | | | |
| 15.9 Intertidal aquaculture | | O | | | O | O | | | | | | O | O | O | | | O | | | | | | | |
| 15.11 Bottom culture | | O | O | O | O | | | | | | | | | | | O | | | | | | | | |
| 15.12 Seaweed harvesting/collection | | | | H | H | | | | | | | | | | | | | | | | | | | |
| **Agriculture & forestry** | | | | | | | | | | | | | | | | | | | | | | | | |
| 16.1 Saltmarsh grazing/harvesting | | | O | O | | | O | O | | | | O | O | O | | | | | | | | | | |
| 16.4 Sand dune grazing | | | | O | | | | | | | | | | | | | | | | | | | | |
| 16.12 Polderisation | | | | | | | | | | | | | | H | | | | | | | | | | |
| 16.13 Agricultural land-claim | H | | | | | H | H | | | | | | H | H | | | | | | | | | | |
| 16.14 In-filling of ditches, ponds, pools, marshes… | | | | | | | | | | | | | | H | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Natural events** | | | | | | | | | | | | | | | | | | | | |
| 19.1 Storms | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O |
| 19.2 Severe cold weather | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O |
| 19. Erosion | | | | | | | | | | | | O | O | O | O | | | | | |