

Marine Institute

**Castlemaine Harbour
Waterbird Survey**

Winter 2019-20

Bird Survey Report

July 2020

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It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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The logo for INIS, featuring the word "Inis" in a dark blue serif font. The letter "i" has a small leaf-like flourish above it.

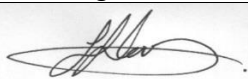


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The findings outlined within this report and the data we have provided are to our knowledge true and express our bona fide professional opinions. This report has been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) Code of Professional Conduct. Where pertinent, CIEEM Guidelines used in the preparation of this report include the *Guidelines for Ecological Report Writing* (CIEEM, 2017), *Guidelines for Preliminary Ecological Appraisals* (CIEEM, 2015) and *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine*, (CIEEM, 2018). CIEEM Guidelines include model formats for Preliminary Ecological Appraisal and Ecological Impact Assessment. Also, where pertinent, evaluations presented herein take cognisance of recommended Guidance from the EPA such as *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EPA, 2017), and in respect of European Sites, *Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC* (European Commission, 2018).

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No method of assessment can completely remove the possibility of obtaining partially imprecise or incomplete information. In line with Best Practice, any limitation to the methods applied or constraints however are clearly identified within the main body of this document.

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Title		Castlemaine Harbour Waterbird Survey – Winter 2019-20 Bird Survey Report		

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1. INTRODUCTION

INIS Environmental Consultants Ltd were contracted to co-ordinate a series of waterbird surveys at Castlemaine Harbour, Co. Kerry during the 2019/20 winter season. Following standard methodology used for surveying wintering waterbirds at low tide (Lewis & Tierney, 2014), the surveys included four low tide surveys and a single high tide survey.

This report details the results of the 2019/20 waterbird survey programme at Castlemaine Harbour. The results are examined and discussed in light of the baseline low tide survey undertaken during 2009/10 as part of the National Parks & Wildlife Service (NPWS) Waterbird Survey Programme (NPWS, 2011b).

1.1. Constraints and limitations

There are a number of limitations inherent to field-based surveying. These particularly relate to availability of suitable weather conditions for completing surveys, with good visibility and little wind or rain of paramount importance. As such, when undertaking and completing fieldwork, careful consideration and planning is made to ensure optimal weather conditions during survey periods. The data presented here were all collected in optimal weather conditions.

When counting shorebirds, disturbance can substantially impact on the birds present within small areas if they are able to disperse away from the source of disturbance to adjacent areas of similar habitat but out with the areas where surveying is taking place. Such disturbance may happen in advance of the count taking place or during the survey period. To gauge levels of disturbance Best Practice methods include an assessment of disturbance levels encountered during the recording period. Such an assessment of disturbance allows the likely impact on shorebird numbers and distribution to be determined, particularly when looking at likely response to different disturbance events. Details of recorded disturbance are therefore provided.

Constraints and any limitations to available datasets used for comparative analysis are presented in where known.

1.2. Statement of Authority

Mr Howard Williams MCIEEM CEnv CBiol MRSB MIFM is Lead Ecologist with Inis and has more than 20 years' experience as a professional ecologist, specialising in birds. Following his degree, he worked as a biologist for the ESB for three years (1997-2000). Mr Williams has completed in excess of 500 separate ecology assessments in Ireland and the UK since 2000. Mr Williams is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). He is a Chartered Environmentalist (CEnv) with the Society for the Environment (Soc Env) and a Chartered Biologist (CBiol) with the Society of Biology. He is also a full member of the Institute of Fisheries Management. Mr Williams is principal ecologist with INIS Environmental Consultants Ltd and currently project manager on all INIS projects in the Republic of Ireland and the UK.

Dr. Lesley Lewis BSc PhD MCIEEM is a specialist waterbird ecologist. Lesley has a first-class honours degree in Zoology and a PhD in waterbird ecology (PhD Title: Ecological disturbance and its effects on estuarine benthic invertebrate communities and their avian predators).

Lesley has run the ecological consultancy 'Limosa Environmental' for the past 16 years. Lesley acts as Project Manager for each contract and over the years has gained considerable experience working on a range of contracts including Environmental Impact Assessments, Ecological Assessments (EclA), Stage I Screening for Appropriate Assessment and Natura Impact Statements (NIS).

In addition, Lesley has worked part-time for BirdWatch Ireland since 2009, and from 2009 to 2014 was contracted to the National Parks and Wildlife Service (NPWS) as a Waterbird Ecologist. In this role, Lesley was responsible for the design and implementation of the NPWS baseline low tide waterbird survey programme and the preparation of site-specific Conservation Objectives for 32 coastal SPA sites. This work culminated in the publication of standard low-tide survey methods for waterbirds (Lewis & Tierney, 2014). Since November 2014, Lesley has been engaged in a number of BirdWatch Ireland projects including various aspects of the Irish Wetland Bird Survey (I-WeBS), as well as work on forestry birds, seabirds and the Hen Harrier. In 2015 she was assistant project manager on the Seabird4 Survey (survey of cliff-nesting seabirds 2015, NPWS). From September 2017, Lesley took over the management of both the Irish Wetland Bird Survey (I-WeBS) and the Countryside Bird Survey (CBS).

2. EXISTING ENVIRONMENT

2.1. Site Description

Castlemaine Harbour SPA is a large coastal site occupying the innermost part of Dingle Bay (Grid Ref: Q 71825 00209). 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 site comprises the estuaries of the River Maine and the River Laune and 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 and 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 of Ireland. Consequently, the bay is designated as a Special Protection Area (SPA) under the EU Birds Directive (2009/147/EC)¹ and 15 waterbird species are listed as Special Conservation Interests (SCIs) for this site. A further Special Conservation Interest for the site is the non-waterbird Annex I species Chough (*Pyrrhocorax pyrrhocorax*). Although not thought to be 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). Castlemaine Harbour is also a designated Special

¹ Directive 2009/147/EC on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended).

Area of Conservation (SAC; Site Code 000343) under the EU Habitats Directive². The SPA and SAC site synopses are given in Appendix 1.

2.2. Waterbirds of Castlemaine Harbour

2.2.1. Waterbird Special Conservation Interests (SCIs)

Castlemaine Harbour SPA (Figure 2.1.1) covers a total area of 11,777ha³ and is of special conservation interest for 15 waterbird species (Table 2.2.1). In addition, the SPA Conservation Objectives Supporting document (NPWS, 2011b) lists a further 11 waterbird species that occur regularly, as follows:

Shelduck (<i>Tadorna tadorna</i>)	Knot (<i>Calidris canutus</i>)
Teal (<i>Anas crecca</i>)	Dunlin (<i>Calidris alpina</i>)
Red-breasted Merganser (<i>Mergus serrator</i>)	Curlew (<i>Numenius arquata</i>)
Great Northern Diver (<i>Gavia immer</i>)	Black-headed Gull (<i>Chroicocephalus ridibundus</i>)
Golden Plover (<i>Pluvialis apricaria</i>)	Herring Gull (<i>Larus argentatus</i>)
Lapwing (<i>Vanellus vanellus</i>)	

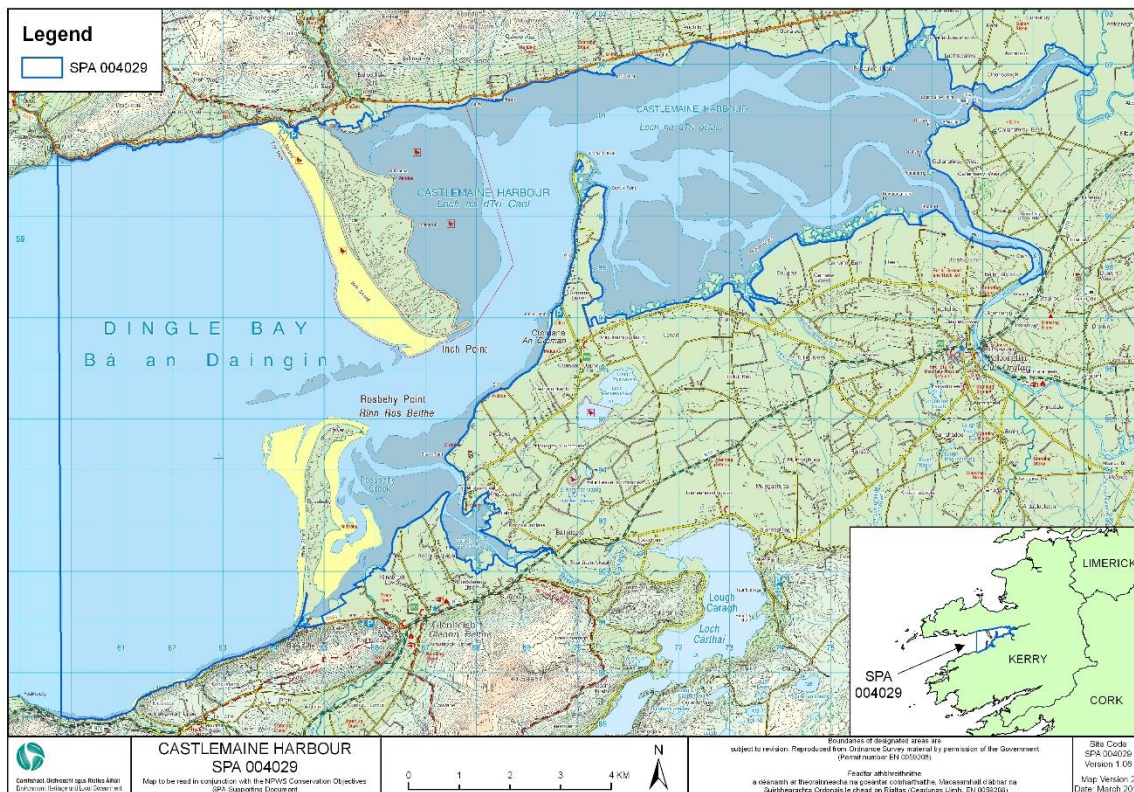


Figure 2.2.1: Castlemaine Harbour SPA in Co. Kerry (source: NPWS, 2011b).

² Council Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna, as amended by Council Directive 97/62/EC. The Directive was transposed into Irish law by the European Communities (Natural Habitats) Regulations, SI 94/1997 which were amended and later consolidated by the European Communities (Birds and Natural Habitats) Regulations 2011 – 2015 (S.I. 355/2015).

³ Combined area of intertidal, subtidal and supratidal habitats (NPWS, 2011b).

Table 2.2.1: Waterbird Special Conservation Interest (SCI) species listed for Castlemaine Harbour SPA.

Special Conservation Interests	Baseline Population ^a	Population status at baseline
Light-bellied Brent Goose <i>Branta bernicla hrota</i>	694	International Importance
Wigeon <i>Anas penelope</i>	6,819	All-Ireland Importance
Mallard <i>Anas platyrhynchos</i>	487	All-Ireland Importance
Pintail <i>Anas acuta</i>	145	All-Ireland Importance
Scaup <i>Aythya marila</i>	74	All-Ireland Importance
Common Scoter <i>Melanitta nigra</i>	3,637	All-Ireland Importance
Red-throated Diver <i>Gavia stellata</i> ^b	56	All-Ireland Importance
Cormorant <i>Phalacrocorax carbo</i>	135	All-Ireland Importance
Oystercatcher <i>Haematopus ostralegus</i>	1,035	All-Ireland Importance
Ringed Plover <i>Charadrius hiaticula</i>	206	All-Ireland Importance
Sanderling <i>Calidris alba</i>	335	All-Ireland Importance
Bar-tailed Godwit <i>Limosa lapponica</i> ^b	397	All-Ireland Importance
Greenshank <i>Tringa nebularia</i>	46	All-Ireland Importance
Redshank <i>Tringa totanus</i>	341	All-Ireland Importance
Turnstone <i>Arenaria interpres</i>	144	All-Ireland Importance

^aFive year peak mean for the period 1995/96 – 1999/00; ^bAnnex I species

2.2.2 Published status and trends of waterbirds of Castlemaine Harbour

The site trends for waterbird SCI species of Castlemaine Harbour, based on I-WeBS data, were reported in the SPA Conservation Objectives Supporting Document (NPWS, 2011b) (Table 2.2.2 column d). However, largely based on I-WeBS data for the period up to 2007/08, these site trends are now considered out-of-date. Comparing baseline data (Table 2.2.2, column a) against the most recently available I-WeBS data (column b) in Table 2.2.2 suggests a decline in numbers for 12 out of the 15 waterbird SCI species.

Table 2.2.2: Baseline and recent data for waterbird SCI species of Castlemaine Harbour SPA (I-WeBS data) plus the reported site trend (NPWS, 2011b).

Special Conservation Interests	(a) Baseline data (95/96 – 99/00) ⁱ	(b) Recent data (14/15 – 18/19) ⁱⁱ	(c) Comparison (a) vs (b)	(d) Reported trend (NPWS, 2011b)
Light-bellied Brent Goose	694 (i)	1,111 (i)	Increase	Intermediate (unfavourable)
Wigeon	6,819 (n)	4,421 (n)	Decrease	Highly Unfavourable
Mallard	487 (n)	254	Decrease	Intermediate (unfavourable)
Pintail	145 (n)	88 (n)	Decrease	Intermediate (unfavourable)
Scaup	74 (n)	0	Decrease	Highly Unfavourable
Common Scoter	3,637 (n)	78	Decrease	Not calculated
Red-throated Diver	56 (n)	0	Decrease	Not calculated
Cormorant	135 (n)	44	Decrease	Moderately Unfavourable
Oystercatcher	1,035 (n)	533	Decrease	Highly Unfavourable
Ringed Plover	206 (n)	105	Decrease	Highly Unfavourable
Sanderling	335 (n)	266 (n)	Decrease	Favourable
Bar-tailed Godwit	397 (n)	305 (n)	Decrease	Moderately Unfavourable
Greenshank	46 (n)	41 (n)	Stable	Moderately Unfavourable
Redshank	341 (n)	629 (n)	Increase	Favourable
Turnstone	144 (n)	13	Decrease	Highly Unfavourable

ⁱFive year peak mean for the period 1995/96 to 1999/00;

ⁱⁱFour year peak mean for the five-year period 2014/15 to 2018/19 (data for 2018/19 excluded as incomplete);

ⁱⁱⁱFavourable (stable/increasing); intermediate unfavourable (population declines 1.0 – 24.9%); unfavourable (population declines 25.0 – 49.9%); highly unfavourable (population declines > 50%) (NPWS, 2012);

n = numbers of all-Ireland importance (Baseline: after Crowe & Holt, 2013; Current: Burke et al. 2019);

i = numbers of international importance (Baseline: after Wetlands International, 2012; Current: after AEWA, 2018).

3. METHODOLOGIES

3.1. Background to the low tide survey programme

The Irish Wetland Bird Survey (I-WeBS) is the primary method by which data are collected for wintering waterbird populations at Irish wetland sites. These data, largely collected by volunteer field surveyors since the winter season of 1994/95, have underpinned the designation of Special Protection Areas (SPAs), and have enabled the production of waterbird population estimates and trends at national and at site level (e.g. Crowe & Holt, 2013; Burke *et al.* 2019; Lewis *et al.* 2019). I-WeBS surveys are undertaken primarily on a rising or high tide, when birds are pushed closer to shore or are gathering at roost sites and are therefore easier to count than when widely distributed across exposed tidal flats.

However, while I-WeBS surveys are designed to obtain the most accurate peak counts of waterbirds at a site, they cannot provide information about waterbird abundance or distribution during the low tide period, when many waterbirds are feeding. This gap in knowledge was addressed somewhat in 2009/10, when the National Parks and Wildlife Service (NPWS) initiated a programme of low tide surveys which took place over the three winter seasons of 2009/10, 2010/11 and 2011/12 at 32 coastal SPAs (The NPWS Waterbird Survey Programme). Each SPA site was surveyed in a single winter season and Castlemaine Harbour was surveyed in 2009/10. Standard methodology was designed to ensure consistency in data capture and recording at each site (Lewis & Tierney, 2014).

Waterbird surveys at Castlemaine Harbour during the 2019/20 winter season therefore followed the standard methodology developed by the NPWS waterbird survey programme.

3.2. Survey design and count area

During the 2019/20 season, a survey programme of four low tide counts and one high tide count was undertaken. Low tide surveys were carried out on 14th November 2019, 14th December 2019, 13th February 2020 and 16th March 2020. The high tide survey was undertaken on 20th January 2020.

Optimum dates were chosen in each month when the survey period spanned midday to facilitate travel to/from the site, but also to ensure surveys were carried out in the best weather and light conditions.

The surveys covered the same count area and count subdivisions (subsites) of Castlemaine Harbour as used during the 2009/10 NPWS Waterbird Survey Programme. The survey area, covering over 12,644ha (NPWS, 2011b), was subdivided into 24 count subsites (Table 3.2.1; Figure 3.2.1) The 2019/20 season fieldworkers were: Sam Bailey, Chris Cullen, Sean Doyle, Davey Farrar, Tony Kenneally, Alan McCarthy, Donncha Ó Catháin, Barry O'Mahony and Mark Shorten.

Table 3.2.1 Count Subsites of Castlemaine Harbour

Subsite Code	Subsite name
OK443	Inch Point
OK444	Dromdarrig
OK445	Midden
OK446	Inch East
OK447	Ballinagroun
OK448	Lack Point
OK449	Roscullen Island
OK455	Laghtcallow
OK456	Lower River Maine
OK457	Pointantirrig
OK458	Clash Island
OK466	Cloon Island
OK467	Reennacannana Point
OK468	Douglas Strand
OK469	Crow's Point, Cromane East
OK473	Cromane West
OK474	Inch 5
OK475	Rosbehy Creek
OK915	Kells Point
OK916	Feakleally
OK917	Knockatinna
OK918	Outer Inch Strand
OK919	Inch Strand North
OK920	Inch Strand South

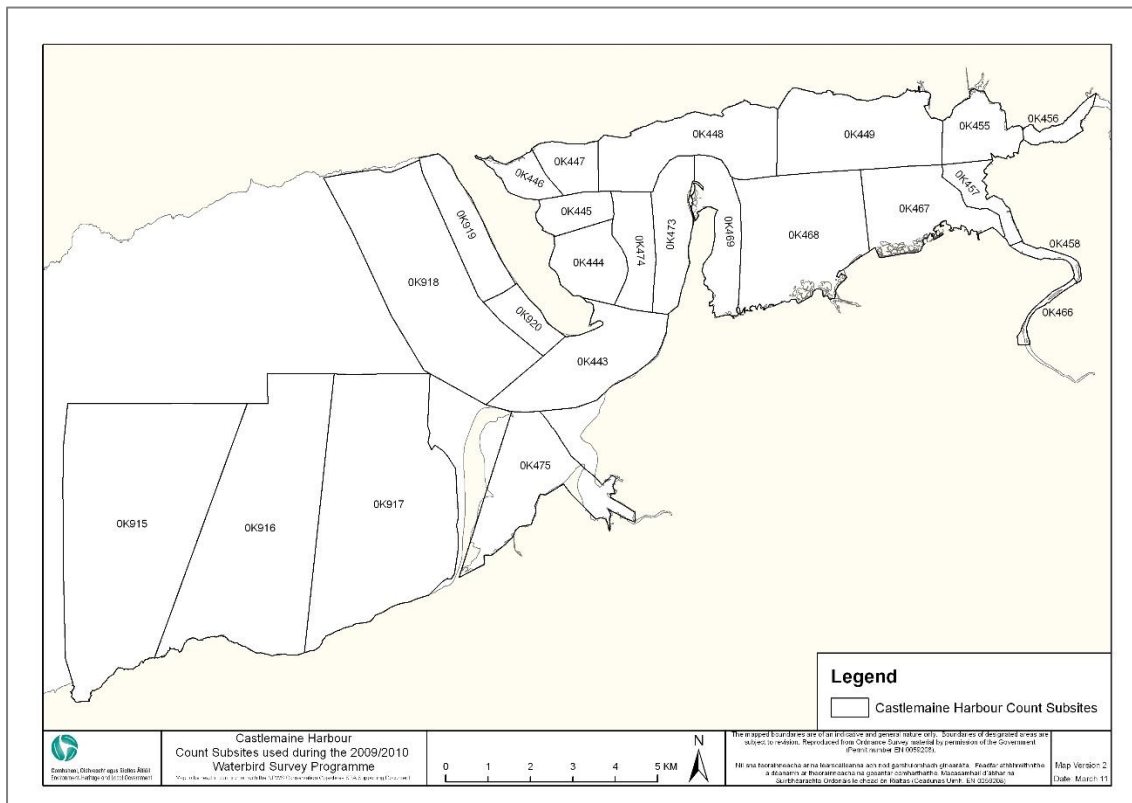


Figure 3.2.1: Count subsites used for the Castlemaine Harbour waterbird surveys. (Image credit: NPWS, 2011b).

3.3. Field survey methods

The survey period on each day extended from two hours either side of low or high tide (depending on the survey being undertaken). Waterbirds were counted within each count subsite, and the data for each subsite were recorded separately. Waterbird counts were conducted on the ‘look-see’ basis (Bibby et al. 2000) which involves scanning across the survey area and counting all birds seen. Birds were recorded according to their species code following the two-letter coding system used by I-WeBS and developed by the British Trust for Ornithology.

In addition to counts of each species, the behaviour of waterbirds during counts was attributed to one of two categories (foraging or roosting/other) while the position of the birds was recorded as per one of four broad habitat types (intertidal, subtidal, supratidal and terrestrial). Field maps of count subsites were used to map significant flocks of foraging/roosting birds (‘flock maps’).

Information on the presence of activities that could cause disturbance to waterbirds was also recorded. Following Lewis & Tierney (2014), activity types were categorised as follows:

(1) human, on-foot - shoreline (2) human, on foot – intertidal aquaculture, (3) bait-diggers (4) non-powered watercraft (5) powered watercraft, (6) water-based recreation (e.g. wind-surfers) (7) horse-riding (8) dogs (9) aircraft (10) shooting (11) other (12) winkle pickers (13) aquaculture machinery (14) other vehicles.

When an activity was observed to cause a disturbance, the waterbird species affected were recorded and a letter code system used to indicate the bird’s response to the activity as follows:-

W - Weak response, waterbirds move slightly away from the source of the disturbance.

M - Moderate response, waterbirds move away from the source of the disturbance to another part of your subsite; they may return to their original position once the activity ceases.

H - High response, waterbirds fly away to areas outside of your subsite and do not return during the current count session.

The length of the activity was also recorded by adding by the codes **A – D** (see below) and a record was made as to whether the activity was already occurring within the subsite when the count started.

A – short/discrete event.

B – activity occurs for up to 50% of the count period.

C – activity length estimated at >50% but < 100% of the count period.

D – activity continues after the count period has ended.

3.4. Data analysis

3.4.1. General

Field data were collected in notebooks and later transferred by field surveyors into Excel datasheets. At the end of the survey season the Excel datasheets were compiled and validated before being

formatted and entered into an Access database. From Access, data summaries were produced such as site totals, subsite totals etc.

Waterbird numbers were assessed with reference to national and international threshold levels as follows:

- A waterbird species that occurs in numbers that correspond to 1% or more of the individuals in the all-Ireland population of the species is said to occur in numbers of all-Ireland importance. Current population threshold values are published in Burke *et al.* (2019).
- A waterbird species that occurs in numbers that correspond to 1% or more of the individuals in the biogeographic population of the species or subspecies is said to occur in ‘internationally important numbers.’ Current international population threshold values are published by the African-Eurasian Migratory Waterbird Agreement (AEWA) Conservation Status Review 7 (CSR7) (AEWA 2018) (published online at wpe.wetlands.org).

3.4.2. Waterbird distribution

Following the methods used in NPWS (2012), data analyses were undertaken to determine the proportional use of subsites by each waterbird Special Conservation Interest (SCI) species, relative to the whole area surveyed on each survey occasion. This gives an indication of the preferred distribution of each species. Analyses were undertaken on datasets as follows:

- Total numbers of waterbirds (low tide surveys),
- Total numbers of waterbirds (high tide survey),
- Total numbers of intertidally foraging waterbirds (low tide surveys),
- Total numbers of subtidally foraging waterbirds (low tide surveys).

For each of the analyses listed above and for each survey date completed, subsites were ranked in succession from the highest to the lowest in terms of their relative contribution to each species’ distribution across all subsites surveyed. Subsite rank positions were then converted to categories (see box below). The highest rank position for each subsite across any of the low tide count dates is presented for each SCI species in a subsite by species matrix. For the high tide survey, simple rank numbers are presented.

<u>Subsite Rank Position - Categories</u>	
Very High (V)	Any section ranked as 1.
High (H)	Top third of ranking placings (where n = total number of count sections species was observed in)
Moderate (M)	Mid third of ranking placings (where n = total number of count sections species was observed in)
Low (L)	Lower third of ranking placings (where n = total number of count sections species was observed in).

3.4.3. Trends

Trends in waterbird numbers was examined in three ways as follows:

1. The peak low tide count from the 2019/20 winter was compared with the peak low tide count from the baseline surveys of 2009/10. The percentage change in numbers was calculated as

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

where I_y is the peak count from 2019/20 and I_x is the peak count from the 2009/10 season.

Changes of between 25 and 49% are deemed to be moderate, while changes of greater than 50% are considered to be 'large'. The threshold levels of >25% and >50% follows standard convention used for waterbirds (e.g. Lynas et al. 2007; Leech et al. 2002).

2. The high tide count from the 2019/20 season was compared with (i) the high tide count from 2009/10 and (ii) the baseline five-year mean peak count from I-WeBS for the period 1995/96-1999/00 (high tide data). This analysis was undertaken for waterbird SCI species only.
3. The percentage change in mean peak numbers between the baseline period (1995/96-1999/000) and recent period (2013/14-2017/18) was calculated for selected waterbird species of Castlemaine Harbour and Rossbehy I-WeBs site (using I-WeBS data).

I-WeBS data were supplied by the Irish Wetland Bird Survey (I-WeBS), a scheme that is funded by the National Parks and Wildlife Service of the Department of Culture, Heritage & the Gaeltacht and that is co-ordinated by BirdWatch Ireland.

4. RESULTS

4.1. Survey schedule and conditions

The 2019/20 winter waterbird survey season proceeded relatively unhampered by weather conditions. Most surveys were carried out in reasonable weather conditions with rain affecting counts on one day (16th March) only (Table 4.1.1). The weather on 16th March deteriorated as the day went on and subsequently the count of the offshore subsite 0K918 (Outer Inch Strand) was not completed as wind and sea swell made counting divers and sea ducks impossible.

Table 4.1.1: Weather conditions for the 2019/20 survey programme.

Date	Survey	Wind	Cloud	Rain	Visibility	Notes
14.11.19	LT1	Breezy	Variable 0 - 100%	None	Moderate - Good	No survey constraints
14.12.19	LT2	Moderate-Breezy	Variable 34- 100%	Some showers	Moderate - Good	No survey constraints
20.01.20	HT1	Calm – light breeze	0 -33%	None	Moderate - Good	No survey constraints
13.02.20	LT3	Breezy	Variable 0 - 100%	Some showers	Moderate - Good	Choppy sea conditions made counting divers and seaducks difficult.
16.03.20	LT4	Breezy	Variable 0 - 100%	Showers/rain at times	Moderate - Poor	Rain showers hampered counts at times, especially seaward subsites.

4.2. Species assemblage and diversity

A total of 42 waterbird species were recorded during the 2019/20 surveys, along with three unidentified taxa. The species list includes 21 wildfowl and allies, 16 wader species, five gull species and one each of unidentified taxa, diver, wader and gull species (Table 4.2.1).

The total species list includes five species (red-throated Diver, Great Northern Diver, Little Egret, Golden Plover and Bar-tailed Godwit) listed on Annex I of the EU Bird's Directive, and 28 species that are on the *Birds of Conservation Concern in Ireland* lists (Colhoun & Cummins, 2013), including seven that are Red-listed and are of highest concern. All Special Conservation Interest (SCI) species listed for Castlemaine Harbour SPA were recorded except Scaup that was not recorded during any survey.

Whole site species diversity during low tide surveys ranged between 33 species (December 2019 and March 2020) and a peak of 37 species, recorded during the January high tide survey. 23 species were recorded in all five surveys undertaken.

Subsite species diversity ranged from a total of three species within the open water subsite 0K474, to a peak of 28 species within 0K467, a large intertidal subsite in the south-east of the site (Figure 4.2.1, Table 4.2.2).

Five species (Cormorant, Oystercatcher, Black-headed Gull, Herring Gull and Great Black-backed Gull) occurred in twenty or more subsites overall and were therefore the most widespread (Table 4.2.2). Twenty waterbird species occurred in ten or more subsites, including Light-bellied Brent Goose,

Shelduck, Common Scoter, Great Northern Diver, and Dunlin. The most scarce species, occurring in one subsite only, were Pink-footed Goose, Surf Scoter, Spoonbill, Water Rail and Moorhen.

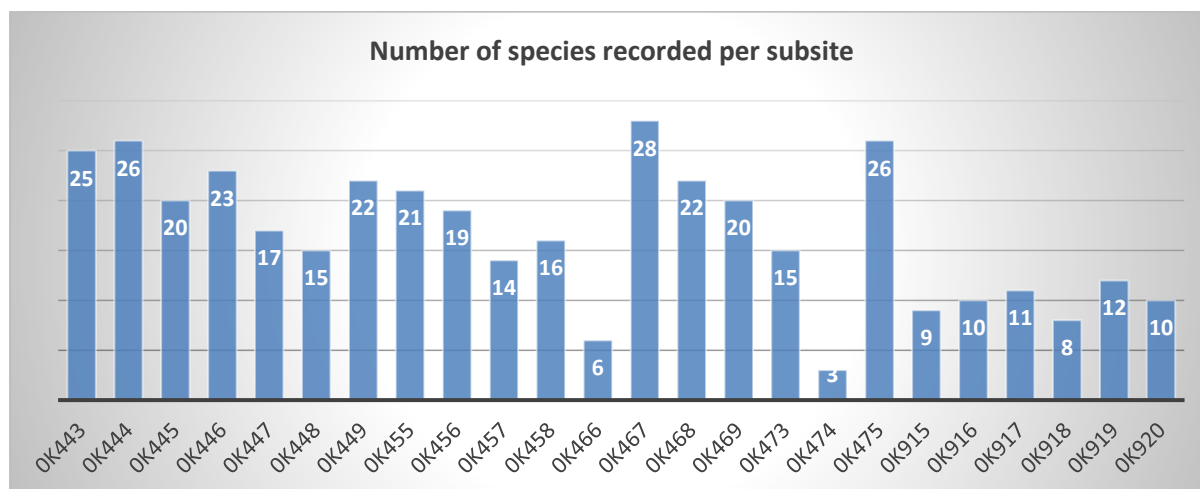


Figure 4.2.1: Subsite diversity

Table 4.2.1: Species recorded during the winter surveys at Castlemaine Harbour. The table highlights Annex I species (EU Bird's Directive) and Red and Amber-listed species under 'Birds of Conservation Concern' (Colhoun & Cummins, 2013).

Species name	Latin name	Code	BoCCI 2013	Annex 1
Mute Swan	<i>Cygnus olor</i>	MS	A	
Pink-footed Goose	<i>Anser brachyrhynchus</i>	PG		
Light-bellied Brent Goose	<i>Branta bernicla hrota</i>	PB	A	
Shelduck	<i>Tadorna tadorna</i>	SU	A	
Wigeon	<i>Anas penelope</i>	WN	A	
Teal	<i>Anas crecca</i>	T.	A	
Mallard	<i>Anas platyrhynchos</i>	MA		
Pintail	<i>Anas acuta</i>	PT	R	
Common Scoter	<i>Melanitta nigra</i>	CX	R	
Surf Scoter	<i>Melanitta perspicillata</i>	FS		
Red-breasted Merganser	<i>Mergus serrator</i>	RM		
Red-throated Diver	<i>Gavia stellata</i>	RH	A	Yes
Great Northern Diver	<i>Gavia immer</i>	ND		Yes
Unidentified Diver	<i>Gavia sp.</i>	UL		
Great Crested Grebe	<i>Podiceps cristatus</i>	GG	A	
Cormorant	<i>Phalacrocorax carbo</i>	CA	A	
Shag	<i>Phalacrocorax aristotelis</i>	SA		
Little Egret	<i>Egretta garzetta</i>	ET		Yes
Grey Heron	<i>Ardea cinerea</i>	H.		
Spoonbill	<i>Platalea leucorodia</i>	NB		
Water Rail	<i>Rallus aquaticus</i>	WA	A	
Moorhen	<i>Gallinula chloropus</i>	MH		
Oystercatcher	<i>Haematopus ostralegus</i>	OC	A	
Ringed Plover	<i>Charadrius hiaticula</i>	RP	A	
Golden Plover	<i>Pluvialis apricaria</i>	GP	A	Yes
Grey Plover	<i>Pluvialis squatarola</i>	GV	A	
Lapwing	<i>Vanellus vanellus</i>	L.		

Knot	<i>Calidris canutus</i>	KN	R	
Sanderling	<i>Calidris alba</i>	SS		
Dunlin	<i>Calidris alpina</i>	DN	A	
Jack Snipe	<i>Lymnocyptes minimus</i>	JS		
Snipe	<i>Gallinago gallinago</i>	SN	A	
Black-tailed Godwit	<i>Limosa limosa</i>	BW	A	
Bar-tailed Godwit	<i>Limosa lapponica</i>	BA	A	Yes
Curlew	<i>Numenius arquata</i>	CU	R	
Greenshank	<i>Tringa nebularia</i>	GK	A	
Redshank	<i>Tringa totanus</i>	RK	R	
Turnstone	<i>Arenaria interpres</i>	TT		
Unidentified wader sp.		U.		
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	BH	R	
Common Gull	<i>Larus canus</i>	CM	A	
Lesser Black-backed Gull	<i>Larus fuscus</i>	LB	A	
Herring Gull	<i>Larus argentatus</i>	HG	R	
Great Black-backed Gull	<i>Larus marinus</i>	GB	A	
Unidentified gull	<i>Larus sp.</i>	UU		

Table 4.2.2: Subsite diversity (blue shading indicates that a species was recorded in that subsite). The 'Total' column shows the number of subsites that a species was recorded in overall.

Species	OK443	OK444	OK445	OK446	OK447	OK448	OK449	OK455	OK456	OK457	OK458	OK466	OK467	OK468	OK469	OK473	OK474	OK475	OK915	OK916	OK917	OK918	OK919	OK920	TOTAL
Mute Swan																									3
Pink-footed Goose																									1
Light-bellied Brent Goose																									11
Shelduck																									12
Wigeon																									9
Teal																									12
Mallard																									14
Pintail																									2
Common Scoter																									10
Surf Scoter																									1
Red-breasted Merganser																									16
Red-throated Diver																									2
Great Northern Diver																									17
Unidentified Diver																									1
Great Crested Grebe																									4
Cormorant																									21
Shag																									10
Little Egret																									16
Grey Heron																									12
Spoonbill																									1
Water Rail																									1
Moorhen																									1
Oystercatcher																									21
Ringed Plover																									6
Golden Plover																									2

Species	0K443	0K444	0K445	0K446	0K447	0K448	0K449	0K455	0K456	0K457	0K458	0K466	0K467	0K468	0K469	0K473	0K474	0K475	0K915	0K916	0K917	0K918	0K919	0K920	TOTAL
Grey Plover																									4
Lapwing																									6
Knot																									5
Sanderling																									5
Dunlin																									12
Jack Snipe																									2
Snipe																									5
Black-tailed Godwit																									4
Bar-tailed Godwit																									5
Curlew																									18
Greenshank																									14
Redshank																									17
Turnstone																									7
Unidentified wader sp.																									2
Black-headed Gull																									20
Common Gull																									18
Lesser Black-backed Gull																									5
Herring Gull																									21
Great Black-backed Gull																									20
Unidentified gull			1																						1
Number of species/taxa per subsite	24	26	20	23	17	15	22	21	19	14	16	6	28	22	20	15	3	26	9	10	11	8	12	10	

4.3. Total numbers of waterbirds

During winter 2019/20, total numbers of waterbirds during low tide ranged from 3,315 (March 2020) to a peak count of 10,579 waterbirds (November 2019). A total of 7,162 waterbirds was counted during the January 2020 high tide survey. The peak count of 2019/20 represents a drop in numbers of some 4,900 waterbirds (over 30%) in comparison with the peak count of 2009/10 (Table 4.3.1). Note that the site totals from individual surveys are not directly comparable, low tide surveys in 2009/10 were undertaken during the months October, November, January and February, while in 2019/20 they took place in November, December, February and March.

Table 4.3.1: Total numbers of waterbirds counted at Castlemaine Harbour during winter 2019/20, plus totals from the baseline low tide survey programme of 2009/10 (NPWS, 2011b).

Winter	Total Numbers of Waterbirds (Site totals)				
	LT1	LT2	LT3	LT4	HT
2019/20	10,579	10,571	7,216	3,315	7,162
2009/10	15,510	11,327	14,917	14,687	12,087
% Change 2009/10 – 2019/20	-31.8	-6.67	-51.6	-77.4	-40.8

4.4. Species totals

Waterbird species peak counts for the 2019/20 at Castlemaine Harbour are shown in Table 4.4.1.

During low tide surveys, one species was recorded in numbers of international importance (Light-bellied Brent Goose) and a further 18 species occurred in numbers of all-Ireland (national) importance, eight of which are listed as waterbird SCI species for Castlemaine Harbour SPA.

During the high tide survey, one species was recorded in numbers of international importance (Light-bellied Brent Goose) and a further 15 species occurred in numbers of all-Ireland importance.

Table 4.4.2 shows species monthly site totals.

Table 4.4.1: Peak counts of waterbird species during low tide (LT) and high tide (HT) surveys at Castlemaine Harbour during 2019/20, plus peaks from the baseline low tide survey in 2009/10. Waterbird SCI species for Castlemaine Harbour SPA are in bold font.

Site Special Conservation Interests (SCIs)	Peak number LT surveys ¹	Peak number HT surveys ¹	Peak number LT surveys ¹	Peak number HT surveys ¹
	2019/20	2019/20	2009/10	2009/10
Mute Swan <i>Cygnus olor</i>	7	0	17	16
Pink-footed Goose <i>Anser brachyrhynchus</i>	1	0	0	0
Light-bellied Brent Goose <i>Branta bernicla hrota</i>	2,160 (i)	1,727 (i)	1,374 (i)	819 (i)
Shelduck <i>Tadorna tadorna</i>	237 (n)	221 (n)	235 (n)	189 (n)
Wigeon <i>Anas penelope</i>	3,201 (n)	459 (n)	1,612 (n)	567
Teal <i>Anas crecca</i>	227	316	557 (n)	225
Mallard <i>Anas platyrhynchos</i>	670 (n)	262	1,401 (n)	380 (n)
Pintail <i>Anas acuta</i>	45 (n)	70 (n)	105 (n)	49 (n)
Common Scoter <i>Melanitta nigra</i>	618 (n)	519 (n)	1,892 (n)	979 (n)
Surf Scoter <i>Melanitta perspicillata</i>	1	0	0	0
Red-breasted Merganser <i>Mergus serrator</i>	37 (n)	28 (n)	49 (n)	20
Red-throated Diver <i>Gavia stellata</i>	3	22 (n)	33 (n)	2
Great Northern Diver <i>Gavia immer</i>	102 (n)	121 (n)	33	19
Great Crested Grebe <i>Podiceps cristatus</i>	2	1	5	0
Cormorant <i>Phalacrocorax carbo</i>	181 (n)	38	141 (n)	48
Shag <i>Phalacrocorax aristotelis</i>	53	35	0	0
Little Egret <i>Egretta garzetta</i>	44 (n)	25 (n)	109	15
Grey Heron <i>Ardea cinerea</i>	9	6	62	10
Spoonbill <i>Platalea leucorodia</i>	0	1	0	0
Water Rail <i>Rallus aquaticus</i>	2	0	0	0
Moorhen <i>Gallinula chloropus</i>	2	0	1	0
Oystercatcher <i>Haematopus ostralegus</i>	494	751 (n)	1,843 (n)	1,049 (n)
Ringed Plover <i>Charadrius hiaticula</i>	310 (n)	59	731 (n)	205 (n)
Golden Plover <i>Pluvialis apricaria</i>	95	88	345	0
Grey Plover <i>Pluvialis squatarola</i>	22	1	87 (n)	99 (n)
Lapwing <i>Vanellus vanellus</i>	747	213	2,000	1,211
Knot <i>Calidris canutus</i>	184 (n)	229 (n)	616 (n)	190 (n)
Sanderling <i>Calidris alba</i>	214 (n)	60	325 (n)	428 (n)
Dunlin <i>Calidris alpina</i>	968 (n)	527 (n)	1,777 (n)	2,530 (n)
Jack Snipe <i>Lymnocyptes minimus</i>	1	0	0	0
Snipe <i>Gallinago gallinago</i>	23	14	50	29
Black-tailed Godwit <i>Limosa limosa</i>	365 (n)	0	366	175
Bar-tailed Godwit <i>Limosa lapponica</i>	296 (n)	200 (n)	284 (n)	318 (n)
Curlew <i>Numenius arquata</i>	691 (n)	483 (n)	1,502 (n)	690 (n)
Greenshank <i>Tringa nebularia</i>	32 (n)	61 (n)	77 (n)	47 (n)
Redshank <i>Tringa totanus</i>	1,044 (n)	297 (n)	1,170 (n)	822 (n)
Turnstone <i>Arenaria interpres</i>	31	17	136 (n)	147 (n)
Black-headed Gull <i>Chroicocephalus ridibundus</i>	677	116	2,351	657
Common Gull <i>Larus canus</i>	382	17	552	125
Lesser Black-backed Gull <i>Larus fuscus</i>	23	1	84	0
Herring Gull <i>Larus argentatus</i>	496	136	835	13
Great Black-backed Gull <i>Larus marinus</i>	87	38	210	4

¹Table highlights numbers of international (i) and national (n) (all-Ireland) importance. The thresholds used are applicable to the timing of the survey hence all-Ireland thresholds currently follow (Burke et al. 2019) while Crowe et al. (2008) was used for the baseline survey. International thresholds currently follow AEWA (2018) with Wetlands International, 2006 used previously.

Table 4.4.2: Monthly counts of waterbird species during low tide (LT) and the high tide (HT) surveys at Castlemaine Harbour during 2019/20.

Species name	Latin name	LT1	LT2	LT3	LT4	HT1
Mute Swan	<i>Cygnus olor</i>	7	5	1	4	
Pink-footed Goose	<i>Anser brachyrhynchus</i>	1				
Light-bellied Brent Goose	<i>Branta bernicla hrota</i>	2160	1636	772	862	1727
Shelduck	<i>Tadorna tadorna</i>	7	237	174	99	221
Wigeon	<i>Anas penelope</i>	3201	1781	178	20	459
Teal	<i>Anas crecca</i>	108	227	200	20	316
Mallard	<i>Anas platyrhynchos</i>	276	670	116	41	262
Pintail	<i>Anas acuta</i>	2	45			70
Common Scoter	<i>Melanitta nigra</i>	618	283	450	353	519
Surf Scoter	<i>Melanitta perspicillata</i>				1	
Red-breasted Merganser	<i>Mergus serrator</i>	27	37	18	11	28
Red-throated Diver	<i>Gavia stellata</i>	2		3		22
Great Northern Diver	<i>Gavia immer</i>	39	102	54	33	121
Unidentified Diver	<i>Gavia sp.</i>	1				
Great Crested Grebe	<i>Podiceps cristatus</i>	1		2	1	1
Cormorant	<i>Phalacrocorax carbo</i>	147	181	46	15	38
Shag	<i>Phalacrocorax aristotelis</i>	47	53	42	17	35
Little Egret	<i>Egretta garzetta</i>	31	44	33	19	25
Grey Heron	<i>Ardea cinerea</i>	9	8	5	2	6
Spoonbill	<i>Platalea leucorodia</i>					1
Water Rail	<i>Rallus aquaticus</i>				2	
Moorhen	<i>Gallinula chloropus</i>	2				
Oystercatcher	<i>Haematopus ostralegus</i>	467	440	494	158	751
Ringed Plover	<i>Charadrius hiaticula</i>	116	310	43		59
Golden Plover	<i>Pluvialis apricaria</i>			95	8	88
Grey Plover	<i>Pluvialis squatarola</i>	5	22	6		1
Lapwing	<i>Vanellus vanellus</i>	300	747	170		213
Knot	<i>Calidris canutus</i>	2	84	16	184	229
Sanderling	<i>Calidris alba</i>		214	134	10	60
Dunlin	<i>Calidris alpina</i>	260	670	968	40	527
Jack Snipe	<i>Lymnocyptes minimus</i>				1	2
Snipe	<i>Gallinago gallinago</i>		23		9	14
Black-tailed Godwit	<i>Limosa limosa</i>	18	365	117	276	
Bar-tailed Godwit	<i>Limosa lapponica</i>	16	34	296		200
Curlew	<i>Numenius arquata</i>	657	691	601	319	483
Greenshank	<i>Tringa nebularia</i>	26	32	24	7	61
Redshank	<i>Tringa totanus</i>	1044	805	393	230	297
Turnstone	<i>Arenaria interpres</i>	28	28	8	31	17
Unidentified wader sp.				64		1
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	652	383	677	89	116
Common Gull	<i>Larus canus</i>	14	153	382	259	17

Lesser Black-backed Gull	<i>Larus fuscus</i>		18	1	23	1
Herring Gull	<i>Larus argentatus</i>	244	186	496	153	136
Great Black-backed Gull	<i>Larus marinus</i>	44	57	87	18	38
Unidentified gull	<i>Larus sp.</i>			50		

4.5. Trends in waterbird numbers

The percentage change in numbers between the peak low tide count of 2019/20 and the peak low tide count recorded during the winter of 2009/10 was calculated. Of the 34 species assessed, 22 species (65%) exhibit a large decline based on this assessment (Table 4.5.1) and include eight waterbird SCI species for Castlemaine Harbour SPA. A further four species including Sanderling, a SCI species, exhibit a moderate decline in numbers. Four species (Light-bellied Brent Goose, Wigeon, Great Northern Diver and Cormorant) exhibit a moderate or large increase, while four species are considered stable.

A comparison of the high tide count from 2019/20 with the baseline mean peak number for the period 1995/96-1999/00 (I-WeBS data, high tide counts) was undertaken for waterbird SCI species of Castlemaine Harbour SPA. Table 4.5.2 shows a trend for declining numbers for ten out of the 15 species assessed. Comparing the high tide count from 2019/10 with that recorded during the baseline NPWS surveys of 2009/10 shows relatively similar results (Table 4.5.2).

Finally, the percentage change in mean peak numbers of selected waterbird species between the baseline period (1995/96-1999/2000) and recent period (2013/14-2017/18) (I-WeBS data) are shown in Table 4.5.3. This shows declining trends for 13 of the 15 waterbird species assessed.

Table 4.5.1: Trend (% change %) between the peak low tide count of 2019/20 and the peak low tide count recorded during the winter of 2009/10. Waterbird SCIs for Castlemaine Harbour SPA shown in bold font.

Species	2019/20	2009/10	% Change	Difference
Mute Swan	7	17	-58.8	Large decline
Light-bellied Brent Goose	2160	1374	57.2	Large increase
Shelduck	237	1612	-85.3	Large decline
Wigeon	3201	1612	98.6	Large increase
Teal	227	557	-59.2	Large decline
Mallard	670	1401	-52.2	Large decline
Pintail	45	105	-57.1	Large decline
Common Scoter	618	1892	-67.3	Large decline
Red-breasted Merganser	37	49	-24.5	Stable
Red-throated Diver	3	33	-90.9	Large decline
Great Northern Diver	102	33	209.1	Large increase
Great Crested Grebe	2	5	-60.0	Large decline
Cormorant	181	141	28.4	Moderate increase
Little Egret	44	109	-59.6	Large decline
Grey Heron	9	62	-85.5	Large decline

Oystercatcher	494	1843	-73.2	Large decline
Ringed Plover	310	731	-57.6	Large decline
Golden Plover	95	345	-72.5	Large decline
Grey Plover	22	87	-74.7	Large decline
Lapwing	747	2,000	-62.7	Large decline
Knot	184	616	-70.1	Large decline
Sanderling	214	325	-34.2	Moderate decline
Dunlin	968	1777	-45.5	Moderate decline
Black-tailed Godwit	365	366	-0.3	Stable
Bar-tailed Godwit	296	284	4.2	Stable
Curlew	691	1502	-54.0	Large decline
Greenshank	32	77	-58.4	Large decline
Redshank	1044	1170	-10.8	Stable
Turnstone	31	136	-77.2	Large decline
Black-headed Gull	677	2,351	-71.2	Large decline
Common Gull	382	552	-30.8	Moderate decline
Lesser Black-backed Gull	23	84	-72.6	Large decline
Herring Gull	496	835	-40.6	Moderate decline
Great Black-backed Gull	87	210	-58.6	Large decline

Table 4.5.2: Comparison of the peak high tide count of 2019/20 and the (i) baseline mean peak count for the period 1995/96-1999/00, and (ii) the high tide count from the 2009/10 baseline surveys. Waterbird SCIs of Castlemaine Harbour SPA only. The change of direction arrow indicates if the most recent mean peak is greater or less than the baseline value.

Species	(a) Peak HT count 2019/20	(b) 5-year mean peak (1995/96-1999/00)	Direction (b vs a)	(c) High tide count from 2009/10	Direction (c vs a)
Light-bellied Brent Goose	2160	694	↑	819	↑
Wigeon	3,201	6,819	↓	567	↑
Mallard	670	487	↑	380	↑
Pintail	70	145	↓	49	↑
Scaup	0	74	↓	0	-
Common Scoter	618	3,637	↓	979	↓
Red-throated Diver	3	56	↓	2	-
Cormorant	181	135	↑	48	↑
Oystercatcher	494	1,035	↓	1,049	↓
Ringed Plover	310	206	↑	205	↑
Sanderling	214	335	↓	428	↓
Bar-tailed Godwit	296	397	↓	318	↓
Greenshank	32	46	↓	47	↓
Redshank	1,044	341	↑	822	↑
Turnstone	31	144	↓	147	↓

Table 4.5.3: Percentage Change in mean peak numbers between the baseline period (1995/96-1999/2000) and recent period (2013/14-2017/18) for selected waterbird species of Castlemaine Harbour and Rossbehy I-WeBS site* (I-WeBS data).

Species	Baseline Mean Peak 1995/96-1999/00	Recent Mean Peak 2013/14- 2017/18	% Change
Light-bellied Brent Goose	694	1107	60
Shelduck	90	60	-33
Wigeon	6,819	4,338	-36
Mallard	487	275	-44
Pintail	145	95	-35
Scaup	74	0	-99
Red-throated Diver	56	1	-99
Cormorant	135	37	-73
Oystercatcher	1035	527	-49
Ringed Plover	206	90	-57
Sanderling	335	283	-16
Bar-tailed Godwit	397	301	-24
Greenshank	46	33	-27
Redshank	341	666	95
Turnstone	144	11	-93

* The low tide survey area encompasses three I-WeBS count areas: (i) Castlemaine Harbour & Rossbehy, (ii) Castlemaine Outer: Inch offshore, and (iii) Castlemaine Outer: Kells Bay East - Rossbehy Beach. The analysis in Table 4.5.3 uses data for Castlemaine Harbour & Rossbehy only and therefore species such as Common Scoter, Red-throated Diver and Sanderling that utilise the outer harbour to a large extent have not been included.

4.6 Subsite totals

OK446 (Inch East) is a subsite that lies in the north-western corner of Castlemaine Harbour, sheltered by Inch dunes system. This relatively small subsite by comparison with some others, held peak numbers of waterbirds on two low tide survey occasions (Table 4.6.1), although the subsite season peak count was for OK447 (Ballinagroun), the subsite just to the east of OK446. OK468 (Douglas Strand) held peak numbers on one survey occasion (LT3), while OK444 (Dromdarrig), the southern subsite behind Inch dunes held peak numbers during the high tide survey.

Table 4.6.1: Total numbers of waterbirds within subsites during winter 2019/20.

SubSite Code	LT1	LT2	LT3	LT4	HT1
OK443	214	75	154	34	68
OK444	53	1145	895	235	1,923
OK445	338		542	546	1,037
OK446	1,928	2,879	639	548	283
OK447	3,250	1,133	819	22	216
OK448	233	107	311	4	51
OK449	325	157	100	23	292
OK455	599	788	359	234	527
OK456	378	549	197	28	334
OK457	104	109	0	10	71
OK458	44	87	65	72	31

OK466	98	60	28	7	16
OK467	205	780	480	501	161
OK468	581	486	1,025	167	401
OK469	96	311	448	47	83
OK473	82	61	82	41	114
OK474	3	4	2	2	4
OK475	1,305	1,292	370	336	727
OK915	17	32	50	10	203
OK916	164	210	173	151	93
OK917	253	190	256	230	257
OK918	32	54	27	nc ^a	138
OK919	254	43	176	55	125
OK920	23	19	18	12	7
TOTALS	10,579	10,571	7,216	3,315	7,162

^anc= not counted

4.7 Waterbird distribution

During low tide surveys, OK475 supported the largest number of waterbird SCI species (ten) in numbers ranked as ‘very high’, ‘high’ or ‘moderate’ (Table 4.7.1) with numbers of five, four and one species ranked in these three categories respectively. OK446 was the only other subsite to support five waterbird species in numbers ranked as ‘very high.’ Thereafter, OK443, OK444, OK455 and OK468 are notable for each supporting eight waterbird SCIs in numbers ranked as ‘very high’, ‘high’ or ‘moderate’. 14 of the 24 subsites (58% of the subsites) supported numbers of waterbird SCIs in numbers ranked as ‘very high.’

During the high tide survey, OK475 supported the largest number of waterbird SCI species (seven) in numbers ranked as ‘very high’, ‘high’ or ‘moderate’ (Table 4.7.2) with numbers of three, two and two species ranked in these three categories respectively. The outer offshore subsite OK917 held numbers of Common Scoter and Red-throated Diver ranked as ‘very high’. Overall, ten subsites (42%) held numbers of waterbird SCI species ranked as ‘very high’.

Table 4.7.1: Relative importance of each subsite based on total numbers of waterbird SCI species during low tide surveys (highest ranking during ant of the four low tide surveys).

SubSite Code	Very High	High	Moderate
OK443		CA, SS, TT	PB, CX, OC, BA, RK
OK444	OC, SS, BA, TT	CA, RP, GK, RK	
OK445	OC	PB, GK, RK	CA,
OK446	PB, WN, MA, PT, RP	OC, RK	
OK447	PB, WN, RK	MA, OC	
OK448	CA	OC	PB, GK
OK449	CA, GK	OC, RK	TT
OK455	BA, GK, RK	PB, WN, MA, CA, OC	
OK456		MA, OC, GK, RK	
OK457			
OK458		RK	MA, GK
OK466		MA	
OK467		MA, CA, OC, GK, RK, TT	CX
OK468	WN, BA, GK, TT	PB, RK	MA, OC
OK469		CA, RK	PB, OC, GK
OK473	RP	BA	CA, OC
OK474		CA	
OK475	WN, OC, RP, SS, TT	PB, MA, CA, GK	RK
OK915	CA		
OK916	CX, CA		
OK917	CX, RH	CA, OC	
OK918			CX
OK919	CX		CA, OC, RP, SS
OK920		CA	

Table shows waterbird species by their standard two-letter codes – waterbird species codes are shown in Appendix 2.

Table 4.7.2: Relative importance of each subsite based on total numbers of waterbird SCI species during the high tide survey.

SubSite Code	Ranked 1	Ranked 2	Ranked 3
OK444	RK	PB, RP	TT*
OK445	PB, PT		TT*
OK446		WN, MA	
OK447			WN
OK449	TT		MA
OK455	BA	OC	
OK456			RK
OK457		GK*, RK	
OK467			RP
OK468	OC	GK*	
OK473	RP		CA
OK475	WN, MA, GK	RH, TT	PB, OC
OK915	CA	CX	
OK916		CA	
OK917	CX, RH		
OK918			CX
OK919	SS		

*Indicates where two subsites held the same number of a waterbird species.

Tables 4.7.3 - 4.7.5 provide an assessment of waterbird distribution where subsites have been ranked in succession from the highest to the lowest in terms of their relative contribution to each species'

distribution during low tide, and for selected species foraging intertidally and subtidally. As before, the ranks have been converted into the categories Very high (V), High (H), Moderate (M) and Low (L). Numbers at high tide are simply ranked by number (only 1-10 shown) (Table 4.7.6). Results from the NPWS baseline low tide surveys of 2009/10 are shown in brackets with the exception of the high tide rankings which are not available.

Table 4.7.3: Subsite ranking (categories) based on **total numbers** during low tide surveys.

	OK443	OK444	OK445	OK446	OK447	OK448	OK449	OK455	OK456	OK457	OK458	OK466
PB	M (H)	L (V)	H (H)	V (V)	V (V)	M (H)	L (-)	M (-)	-	-	-	-
WN	-	-	- (H)	V (V)	-V(V)	- (H)	- (M)	M (H)	- (H)	L (-)	- (M)	-
MA	- (L)	L (H)	- (V)	V (V)	H (V)	- (H)	- (M)	H (H)	M (M)	L (M)	V (M)	H (H)
PT	-	-	-	V (H)	- (V)	-	-	-	-	-	-	-
CX	M (-)	-	-	-	L (-)	L (-)	-	-	-	-	-	-
RH	-	-	-	-	-	-	-	-	-	-	-	-
CA	H (H)	H (M)	M (V)	- (H)	- (M)	V (H)	V (H)	H (H)	L (H)	L (M)	L (-)	-
OC	M (M)	V (H)	V (H)	H (V)	H (V)	H (H)	H (H)	H (H)	L (M)	L (H)	- (M)	-
RP	- (H)	H (V)	- (H)	H (M)	- (V)	-	- (H)	- (M)	-	-	-	-
SS	H (-)	V (M)	- (H)	- (H)	- (V)	-	-	-	-	-	-	-
BA	M (M)	V (V)	- (H)	- (V)	-	-	-	V (M)	-	- (H)	-	-
GK	- (H)	H (-)	H (H)	L (V)	- (V)	M (M)	V (V)	V (H)	M (V)	- (M)	V (H)	-
RK	M (M)	H (M)	H (H)	M (H)	V (V)	L (H)	H (H)	V (V)	M (H)	L (H)	H (V)	- (M)
TT	H (H)	V (H)	-	- (V)	- (V)	- (H)	M (H)	- (H)	-	- (H)	- (H)	-
	OK467	OK468	OK469	OK473	OK474	OK475	OK915	OK916	OK917	OK918	OK919	OK920
PB	- (M)	H (M)	M (H)	L (M)	- (H)	H (H)	-	-	-	-	-	-
WN	L (V)	V (H)	- (H)	-	- (H)	V (H)	-	-	-	-	-	-
MA	H (H)	M (H)	L (M)	-	- (H)	H (H)	-	-	-	-	-	-
PT	-	-	-	-	- (H)	-	-	-	-	-	-	-
CX	M (-)	-	-	-	-	-	L (-)	V (H)	V (V)	M (V)	V (-)	-
RH	-	-	-	- (M)	- (V)	-	- (V)	- (M)	V (V)	- (H)	-	-
CA	H (H)	- (V)	V (M)	H (M)	H (L)	H (-)	V (-)	V (-)	H (-)	L (H)	M (-)	H (V)
OC	H (H)	M (H)	M (H)	M (L)	-	V (M)	L (-)	- (L)	H (L)	L (M)	M (H)	L (L)
RP	- (V)	-	- (M)	H (-)	-	V (H)	-	-	-	-	M (-)	-
SS	- (V)	- (V)	-	-	-	V (-)	-	-	-	-	M (M)	L (-)
BA	- (H)	V (V)	- (H)	H (-)	- (H)	- (H)	-	-	-	-	-	-
GK	H (M)	V (V)	M (H)	- (L)	- (M)	M (H)	-	-	-	-	-	-
RK	H (H)	M (H)	H (H)	L (L)	- (L)	M (M)	L (-)					
TT	H (H)	V (V)	- (H)	- (H)	-	V (V)						

Table 4.7.4: Subsite ranking based on numbers **foraging intertidally** during low tide surveys – selected species only.

	OK443	OK444	OK445	OK446	OK447	OK448	OK449	OK455	OK456	OK457	OK458	OK466
PB	- (M)	- (V)	H (H)	V (V)	- (V)	H (H)	L (-)	H (-)	-	-	-	-
OC	M (M)	V (H)	V (H)	H (V)	H (V)	H (H)	H (H)	H (H)	M (M)	L (H)	- (M)	-
RP	- (M)	H (H)	- (V)	V (M)	- (V)	-	-	- (H)	-	-	-	-
SS	M (-)	V (M)	- (H)	- (H)	- (V)	-	-	-	-	-	-	-
BA	M (M)	V (V)	- (H)	- (V)	-	-	-	V (-)	-	- (H)	-	-
RK	L (M)	H (M)	M (H)	H (V)	V (V)	L (M)	M (H)	V (V)	H (H)	M (H)	L (H)	-
TT	H (H)	V (H)	-	- (V)	- (V)	- (H)	- (H)	- (H)	-	- (H)	- (H)	-
	OK467	OK468	OK469	OK473	OK474	OK475	OK915	OK916	OK917	OK918	OK919	OK920
PB	-	M (H)	L (V)	M (-)	-	V (H)	-	-	-	-	-	-
OC	H (H)	M (H)	M (H)	M (L)	- (L)	V (M)	L (-)	- (M)	H (-)	L (L)	M (H)	L (M)
RP	- (V)	-	- (M)	V (-)	-	V (H)	-	-	-	-	M (-)	-
SS	- (V)	- (V)	-	-	-	V	-	-	-	-	H (M)	-
BA	- (H)	V (V)	- (M)	H (-)	-	- (H)	-	-	-	-	-	-
RK	H (H)	M (H)	H (-)	L (L)	- (L)	M (M)	-	-	-	-	-	-
TT	- (H)	V (V)	- (H)	- (H)	-	V (V)	-	-	-	-	-	-

Table 4.7.5: Subsite ranking based on numbers **foraging subtidally** during low tide surveys – selected species only. Note Pintail is not included as it was not recorded foraging subtidally.

	OK443	OK444	OK445	OK446	OK447	OK448	OK449	OK455	OK456	OK457	OK458	OK466
PB	- (V)				V (-)	V (H)						
WN					V (-)	- (M)	- (V)	V (-)	- (V)	M (-)		
MA					V (-)	- (H)	- (H)	H (V)	- (H)	M (H)	V (H)	H (V)
CX	M (-)				H (-)	H (-)						
RH												
CA	V (H)	H (-)	- (V)			L (H)	- (H)	M (-)	M (H)		M (-)	
	OK467	OK468	OK469	OK473	OK474	OK475	OK915	OK916	OK917	OK918	OK919	OK920
PB			- (V)		- (V)	H (-)						
WN	H (M)	- (V)										
MA	H (-)	- (V)	V (-)		- (V)	V (-)						
CX								H (H)	V (V)	L (H)	V (-)	
RH				- (H)	- (H)		- (V)		V (V)	- (H)		
CA	L (H)	- (H)	M (M)	V (H)	H (-)		V (-)	V (-)	M (-)	- (V)	L (-)	H (V)

Table 4.7.6: Subsite ranking based on numbers **at high tide** (subsites ranked from 1-10)

	OK443	OK444	OK445	OK446	OK447	OK448	OK449	OK455	OK456	OK457	OK458	OK466
PB		2	1									
WN				2	3		6	5	4			
MA		9	5	2			3	4	10	6		10
PT			1									
CX	6											
RH												
CA						4	5		5			
OC	5	6			4	7	10	2				
RP		2										
SS												
BA								1				
GK	7		4				5	6		2		
RK		1	5	4			10	9	3	2		
TT		3	3				1					
	OK467	OK468	OK469	OK473	OK474	OK475	OK915	OK916	OK917	OK918	OK919	OK920
PB			5	4		3						
WN	7					1						
MA	8	7				1						
PT												
CX							2		1	3	4	5
RH						2			1			
CA		5	5	3			1	2	5	5	5	
OC		1	9	8		3						
RP	3			1								
SS											1	
BA												
GK	7	2				1						
RK	8	5				7						
TT	5					2						

4.8 Activities and disturbance

Five types of activity were recorded during the 2019/20 survey season and within six subsites only (Table 4.9.1). The majority of activity at the site occurred in the outer subsite OK919 which is the upper (northern) section of Inch Strand, closest to the carpark. Activities relating to aquaculture occurred in three subsites (OK449, OK468 and OK469). Four activity types were observed to cause disturbance to waterbirds: (1) People walking along shore, (2) Aquaculture machinery, (3) Aquaculture personnel on shore, and (4) Vehicles. All were observed to cause moderate or high responses in that the waterbirds either flew to another part of the subsite or flew out of subsite and out of the observers view. The exception to this on one occasion was walkers walking along Inch Strand beach causing slight movements of Sanderling.

Table 4.8.1 Activities recorded at Castlemaine Harbour 2019/20.

Subsite Code	Activity	Number of survey occasions activity recorded
0K445	Person walking along shore	1
0K449	Aquaculture machinery	2
0K468	Aquaculture personnel on shore	1
0K469	Person walking along shore	1
	Bait diggers	1
	Vehicles	1
	Aquaculture machinery	1
0K475	Person walking along shore	2
	Bait diggers	1
0K919	People walking along shore	3
	Vehicles	1

5 DISCUSSION

5.1 Overview of the 2019/20 season

To our knowledge, the 2019/20 winter waterbird survey programme at Castlemaine Harbour is the first time a fully coordinated series of low and high tide surveys has been carried out at the site since the winter of 2009/10 (The NPWS baseline low tide survey programme).

While winter 2019/20 was a relatively mild winter, it was a difficult winter to arrange waterbird surveys, with a series of six named storms (Elsa and Brendan to name a few) (Met Éireann, 2020) causing difficulties in arranging surveys in optimum weather conditions. However overall, the survey season proceeded relatively unhampered by weather conditions apart from the last March survey where the weather deteriorated and made counting sea ducks and divers offshore difficult.

A total of 42 waterbird species were recorded during winter 2019/20, along with three unidentified taxa. The species list included 21 wildfowl and allies, 16 wader species, and five gull species. By comparison, a total of 48 waterbird species was recorded during winter 2009/10.

All Special Conservation Interest (SCI) species listed for Castlemaine Harbour SPA were recorded except Scaup which was not recorded during any survey. Scaup was recorded during the 2009/10 surveys but has not been recorded at Castlemaine Harbour in recent winters. The last record during I-WeBS was during winter 2013/14 and this was just two individuals. Scaup has undergone a sustained decline within the Republic of Ireland (12-year trend – 89.5%) (Lewis et al. 2019) and the reasons for the decline are unknown. A review of records on Irish Birding (<http://www.irishbirding.com/birds/web>) shows no records of Scaup at Castlemaine Harbour (Glenbeigh) since 2018.

5.2 Waterbird numbers and trends

The total number of waterbirds recorded across Castlemaine Harbour each winter clearly shows great variation between months. There was a difference of over 7,000 waterbirds between the minimum and maximum low tide counts recorded during 2019/20, with numbers highest during November and December 2019. This is largely due to two species which occur in high numbers, namely Light-bellied Brent Goose and Wigeon, dropping considerably in number after the first two low tide surveys. This pattern has been noted previously, for example NPWS (2011b) suggested that Wigeon might use Castlemaine Harbour as a stopover site or congregation site before re-distributing to other sites for the main winter period.

The percentage change in numbers between the peak low tide count of 2019/20 and the peak low tide count recorded during the winter of 2009/10, revealed that of the 34 species assessed, 22 species (65%) have exhibited a large decline in numbers and a further four species including Sanderling, a SCI species, exhibit a moderate decline in numbers. Some of the largest declines (over 70%) are observed for Shelduck, Red-throated Diver, Grey Heron, Oystercatcher, Golden Plover, Grey Plover, Knot, and Turnstone along with Black-headed and Lesser Black-backed Gull. Many of these species also have declining wintering populations at national level. Of note however is the decline in the numbers of Sanderling which is not in line with the national long-term trend for increase. Scaup, a waterbird SCI species for Castlemaine Harbour SPA was not recorded at all during winter 2019/20 (see below) yet occurs relatively close by at Tralee Bay.

For a large site as important as Castlemaine Harbour to be experiencing such wide declines in waterbird numbers is worrying. However, the calculation of percentage change in numbers used in this report is a basic calculation and possibly not strong enough to provide a robust assessment. We would recommend that site trends should be examined in greater detail using standard and robust methods of modelling and indexing, as shown in SPA conservation objectives documents and also used in national trend assessments (e.g. Lewis et al. 2019; Crowe & Holt, 2013).

5.3 Waterbird distribution

Despite the inherent variability in estuarine ecosystems, broad-scale low tide distribution of waterbirds is expected to remain relatively consistent over time, so long as major changes do not occur at a site (Musgrove et al. 2003; Lewis & Kelly, 2012; Lewis et al. 2016). The following section discusses the distribution of waterbird SCI species of Castlemaine Harbour SPA during winter 2019/20 in light of the baseline survey undertaken during winter 2009/10.

5.3.1 *Light-bellied Brent Goose*

The Light-bellied Brent Goose population (hereafter Brent Goose) that spends winter in Ireland breeds in Canada's eastern Queen Elizabeth Islands. The flyway population has increased in number over the long-term, but some recent years of almost zero productivity means that the ten- and five-year trend for this species is for decline (Lewis et al. 2019). In line with the long-term increase in flyway

population, the trend for numbers wintering at Castlemaine Harbour is also for increase. Numbers of international importance were recorded during both the low tide and high tide surveys of 2019/20.

The species was recorded within twelve subsites during both the baseline low tide surveys of 2009/10, and the surveys of 2019/20 and in both surveys, ten years apart, numbers ranked as ‘very high’ were recorded within 0K446 and 0K447, two subsites located in the north-west corner of the inner harbour behind Inch dune system. 0K446 held numbers of international importance during November and December 2019, (peak number 1,080), while 0K447 held numbers of international importance during November. According to NPWS (2011c) *Zostera* beds do not extend into 0K446 and 0K447, the main *Zostera* distribution relating to 0K444 and 0K445, directly behind Inch dune system, so the goose distribution is perhaps puzzling. However low tide surveys starting two hours before low tide, may have missed the key foraging period on the ebbing tide (L. J. Lewis *pers. obs*). The geese may then move northwards into 0K446 and 0K447 during low tide and perhaps as a result of aquaculture activity, before returning to forage on the flooding tide. This hypothesis is somewhat supported by the fact that the majority of geese (97% of the site total number) were located within 0K444 and 0K445 during high tide survey.

Overall, there is good consistency in Brent goose distribution when comparing results of 2009/10 and 2019/20. The results are important in terms of site management as specific areas clearly support the geese and the quality and longevity of the *Zostera* bed is of prime importance to this species. There have been previous documented cases of damage to *Zostera* beds within Castlemaine Harbour (Coastwatch, 2019) and avoidance of such areas should be of prime importance in any aquaculture operations at the site.

5.3.2 Wigeon

Wigeon breed across north-west and north-east Europe as far as western Siberia, and spend winter in north-west Europe, including Ireland. The flyway population is in decline and long medium and short-term trends for the Irish wintering population are for decline (Lewis et al. 2019). Numbers at Castlemaine Harbour also appear to have decreased based on I-WeBS data. The peak number of Wigeon recorded at low tide (3,201) however, is of national importance and greater than that recorded at low tide during winter 2009/10.

Wigeon were recorded within seven subsites during winter 2019/20, compared to 13 subsites during 2009/10. Notably they were absent from the following subsites where numbers ranked as ‘high’ were recorded during 2009/10: 0K445, 0K448, 0K456, 0K469 and 0K474.

Subsites 0K446, 0K447, 0K468 and 0K475 held numbers ranked as very high during 2019/20, the first two of these supporting numbers of all-Ireland importance, and notably, being ranked the same during winter 2009/10. 0K446 and 0K447 are two subsites located in the north-west corner of the inner harbour behind Inch dune system. Like Light-bellied Brent geese, Wigeon forage preferentially upon *Zostera*, so again this distribution is puzzling. However, the same explanation as described above for Light-bellied Brent Goose is likely, especially as Wigeon is a ‘dabbling’ duck and therefore unable to forage in this way during the period two hours either side of low tide. In addition, stream inflow points

occur in both OK446 and OK447 which would enable ‘dabbling’ during the low tide period, and the presence of saltmarsh and an ‘algal zone’ along the shoreline also provide foraging habitat.

At high tide, the largest flock of Wigeon roosted subtidally within OK446. The second largest flock roosted within saltmarsh at Rosbehy (OK475), while a flock of 50 roosted terrestrially alongside the River Maine, adjacent OK456.

5.3.3 Mallard

The Mallard ducks that occur in Ireland belong to the population that breed across northern Europe and these have a non-breeding range that extends across north-west Europe, east to the Baltic. This population is stable (AEWA, 2018). Irish-breeding birds are resident, numbers increasing each winter by migrants, possibly some from the Icelandic breeding population (Wernham et al. 2002). Numbers of wintering Mallard in Ireland have declined over long, medium and short time periods (Lewis et al. 2019). Frost et al. (2018) suggest that the declines in wintering Mallard could be related to fewer releases by shooting estates and/or perhaps short-stopping by Russian birds. Numbers of Mallard have declined at Castlemaine Harbour based on a comparison of low tide peak counts between 2009/10 and 2019/20, and long-term I-WeBS data, although a comparison of high tide counts during low tide survey programmes suggest an increase (Section 4.5). Robust site trends in the form of indexing and modelling (as shown in SPA conservation objectives documents), would be useful to ascertain an accurate status of Mallard at Castlemaine Harbour.

During winter 2009/10, Mallard were recorded within 17 subsites overall. Twelve subsites supported the species during winter 2019/20, suggesting a decline in distribution (between seven or eight subsites during individual low tide surveys). That said, peak numbers during 2009/10 were recorded within OK445, OK446 and OK447 and the latter two of these held numbers ranked as ‘very high’ and ‘high’ during 2019/20, suggesting consistency in distribution. As noted in NPWS (2011b), this distribution is most likely related to the fact that these 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.

One subsite held numbers of national importance on once survey occasion (OK446 December 2019 – 380 individuals).

During high tide, Mallards were more widely distributed (13 subsites in total) and peak numbers were located within OK475, the majority of ducks foraging intertidally.

5.3.4 Pintail

The Pintail breeds across northern Europe and western Siberia, and winters in north-west Europe, including Ireland. The flyway population is stable. Numbers wintering in the Republic of Ireland have

declined however (Lewis et al. 2019). Castlemaine Harbour is one of 12 sites around the country known to support numbers of national importance, and numbers appear to fluctuate greatly between winters (Lewis et al. 2019). Based on assessments undertaken in this report, numbers at Castlemaine Harbour each winter have declined.

The species was recorded within three subsites during low tide surveys of 2009/10 (OK446, OK447 and OK474) and only one of these – OK446 was found to support the species during 2019/20. Two individuals were recorded during November 2019, and 45 during December 2019, the latter count of national importance. The peak number however (70) was recorded within OK445 during the high tide survey, the birds roosting subtidally.

5.3.5 Common Scoter

The Common Scoter that winter in Ireland come from a wide breeding range that spans between Iceland and Scandinavia east to western Siberia. The status of this population is uncertain but is considered stable/increasing (Wetlands International, 2018). Given that this sea duck can occur at considerable distances offshore and are often undetected or underestimated during I-WeBS counts, no national trend information is available (Lewis et al. 2019).

Castlemaine Harbour is one of ten sites in the republic currently known to support numbers of national importance (Lewis et al. 2019). During the surveys of winter 2019/20, numbers of national importance were recorded in all five surveys. However, based on the assessments in this report, wintering numbers at Castlemaine Harbour have declined. With numbers having exceeded 1,000 birds in the past, the site peak count during winter 2019/20 was 618 individuals.

Common Scoters were recorded within nine subsites during low tide surveys (compared to three during winter 2009/10). Peak numbers were recorded for OK916 (December 2019), OK917 (February and March 2020) and OK919 (November 2019), all outer harbour (offshore) subsites. OK917 also held peak numbers during the high tide survey. All three of the aforementioned subsites supported numbers of national importance.

5.3.6 Red-throated Diver

Red-throated Divers breeds across Arctic and boreal west Eurasia and Greenland, and winter in north-west Europe. The species exhibits a widespread coastal distribution during winter and flocks are often located some distance from the shoreline and are likely frequently undetected or underestimated. Therefore, no national trend information is available (Lewis et al. 2019).

Based on the assessments in this report, wintering numbers at Castlemaine Harbour have declined. However, it is known that species such as Red-throated Diver (and Common Scoter) are better suited to bespoke surveys i.e. vantage point surveys on days with calm conditions and good visibility over a calm sea. Therefore, neither a standard low tide survey programme nor I-WeBS may provide accurate count data.

A peak of three individuals was counted during low tide surveys and 22 individuals were recorded during the high tide survey, the majority of birds recorded in the offshore subsite OK917.

5.3.7 Cormorant

Cormorants breeding and wintering in Ireland belong to the north-west European population, predominantly the subspecies *carbo* that also occurs in Norway, Iceland and Britain. The majority of breeding Cormorants in Ireland are thought to be resident, although some have been recorded moving south for the winter, with recoveries from northern France and the south coast of Portugal (Wernham et al. 2002). Wintering numbers have declined in Ireland by 27.7% in the last 12 years, and by 5% in the last 5 years (Lewis et al. 2019). The assessments in this report resulted in contrasting site trends, so the true site status for Castlemaine Harbour is unclear.

Numbers of national importance were recorded during November and December 2019 (site totals). Cormorants were widespread and recorded from within 20 subsites during winter 2019/20. Most records were of single or 2-3 birds but the peak subsite count was 52 birds that roosted intertidally (OK449) (despite being seabirds, Cormorants sometimes haul out if the water and preen, rest and digest previous meals). Five subsites supported peak numbers during low tide surveys (OK448, OK449, OK469, OK915 and OK916) while OK915 held peak numbers (10) during the high tide survey.

5.3.8 Oystercatcher

Ireland's wintering Oystercatchers are from the population that breeds in northern and western Europe, and that winters in western Europe and northern and western Africa. This population is considered to be declining/stable at flyway level (Wetlands International, 2018). Numbers wintering in Ireland have been in decline from around 2006 (Lewis et al. 2019).

Based on the assessments in this report, wintering numbers at Castlemaine Harbour have declined by a large extent. The site once supported in excess of 1,000 individuals while the peak low and high tide count of the 2019/20 surveys were 494 and 751 Oystercatchers respectively. Only the high tide count exceeded the threshold for national importance (610).

Oystercatcher were recorded from within 20 subsites during winter 2019/20, similar to the 21 subsites during 2009/10. Peak numbers during low tide surveys were recorded for OK444, OK445, and twice for OK475. OK446 and OK447 held peak numbers (numbers ranked as 'very high') during the surveys of winter 2009/10 and numbers ranked as 'high' during winter 2019/20.

Oystercatchers occurred in 13 subsites during the high tide survey, the largest number (292) within OK468. The only other subsite to hold over 100 individuals was OK455. Combined, these two subsites held 64% of all the Oystercatchers counted on that survey. All birds were roosting either intertidally or supratidally. This result is highly consistent with the survey of 2009/10 when significant roosts were recorded within these two subsites.

5.3.9 Ringed Plover

The Ringed Plovers that winter in Ireland originate from the nominate population that breeds in Iceland, Baltic, southern Scandinavia, Britain, Ireland and France, and winters in western Europe, the Mediterranean and north Africa (Wetlands International, 2018). Specifically, the Ringed Plover that winter in Ireland are thought to originate from the population that breeds in western Europe, including southern Scandinavia, but Ireland also provides important passage sites for birds breeding in east Canada, Greenland, Iceland and Fennoscandia *en route* to wintering areas in Africa (Wernham et al. 2002). Numbers wintering in Ireland have been in decline since about 2008/09 (Lewis et al. 2019).

Based on the assessments in this report, the status of wintering numbers at Castlemaine Harbour is unclear but likely decline. Robust site trends in the form of indexing and modelling (as shown in SPA conservation objectives documents), would be useful to ascertain the true status of this species at Castlemaine Harbour.

One low tide count (December 2019) and the high tide count recorded numbers of national importance.

Ringed Plovers were recorded from five subsites during winter 2019/20, half the number that supported the species during winter 2009/10. Subsites that held peak numbers during 2009/10 (OK444, OK447, OK467) did not record peak numbers during 2019/20. Peak numbers during 2019/20 were recorded by OK446, OK473 and OK475, while peak high tide numbers were recorded in OK473. Only one subsite count 260 in OK446 (December 2019) exceeded the national threshold of importance.

A roost survey undertaken during 2009/10 recorded all roosting Ringed Plover within OK473. Consistent with this, the largest number of this wader during the 2019/20 high tide survey were roosting within OK473. This is remarkable consistency given the ten-year time difference.

5.3.10 Sanderling

The Sanderlings that occur in Ireland during winter breed in Greenland and at the flyway level, this population is stable (Wetlands International, 2018). Sanderling are one of very few wading bird species that show an increasing population trend in Ireland (Lewis et al. 2019). Based on the assessments in this report however, numbers wintering at Castlemaine Harbour appear to have declined. A similar pattern is evident when examining I-WeBS data.

During winter 2019/20, Sanderlings were recorded within three low tide surveys (not in November 2019) and during the high tide survey. The peak site count was 214 birds and this count in December 2019, and the one in February 2020, exceeded the threshold for national importance.

Sanderlings were recorded within five subsites during low tide surveys, compared to seven subsites during winter 2009/10. Peak numbers were recorded within OK444 and OK475 during low tide. Subsites OK447, OK467 and OK468 which recorded peak numbers during 2009/10, did not record any Sanderling during winter 2019/20. This change in distribution seems unusual. At high tide all Sanderling were recorded on Inch Strand (OK919) during winter 2019/20. Roosting on Inch Strand means that the birds would be subject to disturbance from walkers (and dogs) so this behaviour is likely to be highly variable and/or ephemeral.

5.3.11 Bar-tailed Godwit

The nominate population of *Limosa lapponica* breeds in northern Europe and western Siberia and occur during winter in Ireland. This flyway population is increasing (Wetlands International, 2018) while in the Republic of Ireland the long-term trend is broadly stable, although there is a short-term (5-year) trend for decline (Lewis et al. 2019). The site trend for Castlemaine Harbour is unclear. A comparison of low tide counts ten years apart (2009/10-2019/20) suggests a stable population while comparison of peak high tide numbers, and I-WeBS data over a longer time period suggests decline.

Low numbers were recorded at Castlemaine Harbour during November and December 2019 and numbers peaked in February 2020 (296) representing numbers of national importance. The January high tide count (200) also exceeded the 1% national threshold.

Bar-tailed Godwits occurred within nine subsites during winter 2009/10 and in five subsites at low tide during 2019/20. Peak numbers during 2019/20 occurred in OK444 OK455 and OK468. Two of these subsites (OK444 and OK468) held peak numbers during 2009/10 which is highly consistent over the ten-year time period. During the high tide survey, all Bar-tailed Godwits were recorded roosting within OK455. Of note is that this was the main roosting area identified during winter 2009/10.

5.3.12 Greenshank

Greenshanks wintering in Ireland originate from the population that breeds across northern Europe, from Scotland east to Finland and the Baltic States (Delany et al. 2009). The population trend across the breeding range is thought to be stable/increasing (Wetlands International, 2018) and the long-term trend in the Republic of Ireland is for increasing numbers (Lewis et al. 2019). Based on the assessments in this report, the status of wintering numbers at Castlemaine Harbour is for decline.

Site total numbers varied throughout the surveys with a low tide peak of 32 Greenshanks (December 2019) and a high tide count of 61. All monthly counts, with the exception of March 2020, recorded numbers of national importance.

Greenshanks were recorded within 14 subsites overall, compared to 16 in winter 2009/10. Subsites counts ranged from one to nine individuals. The species is often a solitary feeder so discerning a pattern of distribution is difficult but survey results for 2019/20 showed peak numbers to occur in just two subsites: OK444 and OK468, the latter of which also held peak numbers on occasion during winter 2009/10. OK475 held peak numbers (>50% of site total count) during the high tide survey, 30 individuals roosting supratidally. Overall, the species is widespread however, and few patterns in terms of foraging distribution can be discerned other than presence within subsites that have low tide channels or creeks used for foraging.

5.3.13 Redshank

Ireland's wintering Redshanks are thought to originate mainly from the population that breeds in Iceland and the Faeroe Islands. The population is exhibiting a decline at flyway level (Wetlands International, 2018). The overall numbers of this wader wintering in Ireland have shown a decreasing

trend since the mid-2000s (Lewis et al. 2019). Based on the assessments in this report, wintering numbers at Castlemaine Harbour are stable/increasing.

During winter 2019/20, numbers peaked in November 2019 (1,044), gradually dropping month by month thereafter. All site total counts with the exception of the March low tide survey, exceeded the threshold for national importance.

Redshank were widely distributed during winter 2019/20 (17 subsites), consistent with the 17 subsites reported in 2009/10. Subsites that held peak numbers during winter 2009/10 (OK447, OK455) also held peak numbers during 2019/20. OK458 held peak numbers during winter 2009/10 and numbers ranked as 'high' during winter 2019/20. Overall, this is high consistency and shows that despite a wide distribution, the species exhibits a subsite preference (subsite fidelity).

During high tide OK444 held peak numbers representing nearly 30% of the total site numbers. Thereafter OK457, OK456 and OK446 held the largest numbers of birds.

5.3.14 Turnstone

Ireland's wintering Turnstones originate from a nominate population breeding in north-eastern Canada and northern and eastern Greenland. This population is thought to be increasing (Wetlands International, 2018). In Ireland, wintering numbers have declined markedly since 2008 (Lewis et al. 2019) and in line with this, trend assessments in this report suggest numbers at Castlemaine Harbour have declined.

Numbers of Turnstone were relatively low and peaked at 31 individuals during the March 2020 low tide survey. This compares unfavourably with the peak count of 136 individuals during winter 2009/10. No current count exceeded the threshold for national importance.

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 Castlemaine Harbour so a widespread distribution is to be expected, yet the species was only recorded in seven subsites during winter 2019/20, compared to 14 subsites during winter 2009/10. The species was recorded in one to three subsites during any of the low tide surveys.

Peak numbers were held by OK444 (twice), OK468 and OK475, the latter two also supporting peak numbers during winter 2009/10. Overall however the species numbers and distribution around the site appear to have declined although it is worth pointing out that this species is highly camouflaged when foraging in algal wrack and may often be overlooked when scanning such large subsites from vantage points.

6 CONCLUSION

The assessment of trends in this report suggests large and worrying declines in waterbird numbers across Castlemaine Harbour, despite one of the most numerous species, Light-bellied Brent Goose, having increased in number. Comparing total waterbird peak counts from 2009/10 and 2019/10, represents a drop in numbers of nearly 5,000 waterbirds (over 30%) in ten years.

Updated waterbird population estimates for Ireland were published in 2018 and contained stark messages including the loss of 40% of our wintering waterbirds over the past nearly 20 years (Burke et al. 2018). Such large declines nationally, obviously have implications for numbers at individual sites, but conversely, declines at individual sites across the country will have driven the observed national trends. Given that Castlemaine Harbour was once one of the principal wintering sites for species like Common Scoter and Ringed Plover, the decline in waterbird numbers at this site is likely to have had a major negative influence on the national trends of such species.

Along with the decline in total waterbird numbers is a reduced distribution in many species, notably Wigeon, Turnstone, Sanderling, Ringed Plover and Bar-tailed Godwit. On a more positive note is the high level of within-site faithfulness in distribution exhibited by several waterbird species across the site with consistency over the ten-year period; notable examples being Light-bellied Brent Goose, Bar-tailed Godwit and Redshank. However, this subsite faithfulness has important implications for site management because any future changes in the human use or habitat quality of these subsites could potentially lead to displacement of a large proportion of the wintering population of the site.

While the impacts of climate change are being mooted as a possible explanation for declining numbers of some species, with some waterbirds simply not migrating as far as Ireland for winter, site-level factors no doubt have, and continue to contribute to such observed negative population trends, especially when various activities and human use of wetland sites are considered in a cumulative way. How such declines can be addressed and/or reversed is not known. We would recommend in the first instance that site trends for Castlemaine Harbour should be examined in greater detail using standard and robust statistical methods of modelling and indexing, as shown in SPA conservation objectives documents and also used in national trend assessments (e.g. Lewis et al. 2019; Crowe & Holt, 2013). But to undertake such assessments, annual monitoring is essential, at both low and at high tide (Lewis et al. 2016) and low tide survey programmes at more regular intervals than ten years would be useful. In addition, species-specific surveys for 'offshore' species such as Red-throated Diver and Common Scoter would be advantageous i.e. vantage point surveys on days with calm conditions and good visibility over a calm sea because neither a standard low tide survey programme nor I-WeBS may provide accurate count data for these species. Only by monitoring can we continue building on the solid base of good quality and co-ordinated count data, which will ultimately underpin our knowledge of both waterbird site distribution and numbers (trends), and ultimately inform practical site management measures that will help to halt, and hopefully reverse, the observed waterbird population declines.

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APPENDIX I: CASTLEMAINE HARBOUR SPA SITE SYNOPSIS

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.

APPENDIX 2: WATERBIRD SPECIES CODES

AE	Arctic Tern	<i>Sterna paradisaea</i>
BY	Barnacle Goose	<i>Branta leucopsis</i>
BA	Bar-tailed Godwit	<i>Limosa lapponica</i>
BE	Bean Goose	<i>Anser fabalis</i>
BS	Bewick's Swan	<i>Cygnus columbianus</i>
AS	Black Swan	<i>Cygnus atratus</i>
BH	Black-headed Gull	<i>Chroicocephalus ridibundus</i>
BN	Black-necked Grebe	<i>Podiceps nigricollis</i>
BW	Black-tailed Godwit	<i>Limosa limosa</i>
BV	Black-throated Diver	<i>Gavia arctica</i>
CM	Common Gull	<i>Larus canus</i>
CS	Common Sandpiper	<i>Actitis hypoleucos</i>
CX	Common Scoter	<i>Melanitta nigra</i>
CN	Common Tern	<i>Sterna hirundo</i>
CO	Coot	<i>Fulica atra</i>
CA	Cormorant	<i>Phalacrocorax carbo</i>
CU	Curlew	<i>Numenius arquata</i>
CV	Curlew Sandpiper	<i>Calidris ferruginea</i>
DN	Dunlin	<i>Calidris alpina</i>
GA	Gadwall	<i>Anas strepera</i>
GP	Golden Plover	<i>Pluvialis apricaria</i>
GN	Goldeneye	<i>Bucephala clangula</i>
GD	Goosander	<i>Mergus merganser</i>
GB	Great Black-backed Gull	<i>Larus marinus</i>
GG	Great Crested Grebe	<i>Podiceps cristatus</i>
ND	Great Northern Diver	<i>Gavia immer</i>
NW	Greenland White-fronted Goose	<i>Anser albifrons flavirostris</i>
GK	Greenshank	<i>Tringa nebularia</i>
H.	Grey Heron	<i>Ardea cinerea</i>
GV	Grey Plover	<i>Pluvialis squatarola</i>
GJ	Greylag Goose	<i>Anser anser</i>
HG	Herring Gull	<i>Larus argentatus</i>
JS	Jack Snipe	<i>Lymnocyptes minimus</i>
KF	Kingfisher	<i>Alcedo atthis</i>
KN	Knot	<i>Calidris canutus</i>
L.	Lapwing	<i>Vanellus vanellus</i>
LB	Lesser Black-backed Gull	<i>Larus fuscus</i>
PB	Light-bellied Brent Goose	<i>Branta bernicla hrotra</i>
ET	Little Egret	<i>Egretta garzetta</i>
LG	Little Grebe	<i>Tachybaptus ruficollis</i>
AF	Little Tern	<i>Sterna albifrons</i>
MA	Mallard	<i>Anas platyrhynchos</i>
MU	Mediterranean Gull	<i>Larus melanocephalus</i>
MH	Moorhen	<i>Gallinula chloropus</i>
MS	Mute Swan	<i>Cygnus olor</i>
OC	Oystercatcher	<i>Haematopus ostralegus</i>
PG	Pink-footed Goose	<i>Anser brachyrhynchus</i>
PT	Pintail	<i>Anas acuta</i>
PO	Pochard	<i>Aythya ferina</i>
PS	Purple Sandpiper	<i>Calidris maritima</i>
RM	Red-breasted Merganser	<i>Mergus serrator</i>
RH	Red-throated Diver	<i>Gavia stellata</i>

RK	Redshank	<i>Tringa totanus</i>
RP	Ringed Plover	<i>Charadrius hiaticula</i>
RU	Ruff	<i>Philomachus pugnax</i>
SS	Sanderling	<i>Calidris alba</i>
TE	Sandwich Tern	<i>Sterna sandvicensis</i>
SP	Scaup	<i>Aythya marila</i>
SU	Shelduck	<i>Tadorna tadorna</i>
SV	Shoveler	<i>Anas clypeata</i>
SY	Smew	<i>Mergus albellus</i>
SN	Snipe	<i>Gallinago gallinago</i>
NB	Spoonbill	<i>Platalea leucorodia</i>
DR	Spotted Redshank	<i>Tringa erythropus</i>
T.	Teal	<i>Anas crecca</i>
TU	Tufted Duck	<i>Aythya fuligula</i>
TT	Turnstone	<i>Arenaria interpres</i>
WA	Water Rail	<i>Rallus aquaticus</i>
WM	Whimbrel	<i>Numenius phaeopus</i>
WS	Whooper Swan	<i>Cygnus Cygnus</i>
WN	Wigeon	<i>Anas penelope</i>