GALWAY HARBOUR EXTENSION:
WATERBIRD SURVEY, WINTER 2022/23

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SUMMARY

This report presents the results of the waterbird surveys that were carried out for the Galway Harbour Extension project in the winter of 2022/23 and compares these results with previous surveys that were carried out between 2011 and 2014.

Monthly tidal cycle counts and vantage point watches were carried out between October 2022 and March 2023. The vantage point watches covered the same area as the 2011-2014 surveys: the shoreline and subtidal habitat of the proposed Galway Harbour Extension project area (the GHE count area), as well as adjacent intertidal areas at Renmore Beach and the eastern end of South Park Shore. The tidal cycle counts covered the wider area between the Mutton Island causeway and Ballyloughane Beach.

The results of the waterbird surveys show that, as in the previous survey period, the GHE count area usually supports very low numbers of waterbirds. More significant numbers of several species were recorded in the tidal cycle counts. However, the numbers that occurred in the sectors adjacent to the GHE count area were relatively low.

The only frequently used high tide roosting area was exposed intertidal rocks at the western end of South Park Shore. A flock of 76 Ringed Plovers were recorded roosting on a gravel area within the Galway Harbour Extension area on one date. A raft of 6 Great Northern Divers was observed in the GHE count area at dusk on one of the survey days; this was probably a pre-roost group assembling to swim to a nocturnal roost.

Turnstones occurred less frequently and in lower numbers in GHE count area during the 2022/23 waterbird surveys, compared to the waterbird surveys carried out in 2011-2014. This is in line with the decreases in the national population of this species. Apart from Turnstone, there do not appear to have been major changes in waterbird usage of the GHE count area and adjacent areas since the 2011-2014 surveys.

The density of waterbirds in the subtidal zone in the GHE count area decreased with distance from the shoreline, It seems likely that, at least for some species, the decrease in density with distance from the shoreline is due to lower detection rates of more distant birds.

The most frequently recorded disturbance impacts to waterbirds were from pedestrian and dog activity. Only 20% of observations of powered watercraft activity, and none of the observations of non-powered watercraft activity, resulted in observed disturbance impact to waterbirds. There were no observations of watercraft activity causing disturbance impacts to Great Northern Divers.

In conclusion, the results of the 2022/23 waterbird surveys are not likely to significantly change the previous assessment of the potential impact of the Galway Harbour Extension project.

1. INTRODUCTION

1.1. GENERAL

This report presents the results of the waterbird surveys that were carried out for the Galway Harbour Extension project in the winter of 2022/23.

These waterbird surveys were commissioned by the Port of Galway.

The waterbird surveys were designed by Tom Gittings. The survey work was carried out by David Miley under the supervision of Tom Gittings. The data analysis and report writing were carried out by Tom Gittings.

The full survey data is included in the database that accompanies this report (see Appendix 1).

1.2. BACKGROUND

The Galway Harbour Extension project involves the proposed reclamation of tidal habitat for the construction of a major extension to the Port of Galway.

The project was the subject of a planning application. This planning application included the preparation of an Environmental Impact Statement and a Natura Impact Statement in 2013, and additional assessments of potential impacts to waterbirds in 2014 (Gittings, 2014).

The assessments in the planning application were based on waterbird surveys that were carried out between 2011 and 2014. Due to the time that has passed since those waterbird surveys, the Port of Galway commissioned further waterbird survey work.

1.3. OBJECTIVES

The objectives of the 2022/23 Galway Harbour Extension waterbird survey were to:

- provide updated waterbird survey data for the development area that is comparable to the waterbird survey data from 2011-2014; and to
- provide additional coverage of areas adjacent to the development area, which had limited coverage during the 2011-2014 surveys.

1.4. STATEMENTS OF COMPETENCE

1.4.1. Tom Gittings

Tom Gittings holds a BSc (Hons) in Ecology from the University of East Anglia and a PhD in Ecology from University College Cork. Tom is a member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). He has over 27 years' experience as a professional ecologist. From 1995-2001, he worked fulltime as an ecological consultant with RPS Group in their Cork office. From 2001-2009, he was employed as a postdoctoral researcher in the Department of Zoology, Ecology and Plant Science, University College Cork where he carried out research into biodiversity and land use. During this period, he also worked as an independent ecological consultant. Since 2010, he has worked full-time as an independent ecological consultant.

During his career, he has been involved in numerous ecological assessments for conservation plans and development projects and has dealt with issues covering a wide range of Irish habitats and species of conservation importance. Since 2010, he has been working for the Marine Institute on the preparation of full Appropriate Assessments assessing the impacts of fisheries and aquaculture on coastal Special Protection Areas. He has also prepared Appropriate Assessment screening statements and Natura Impact Statements for development projects in relation to various Special Areas of Conservation and Special Protection Areas and has dealt with Appropriate Assessment issues as an expert witness at various oral hearings. In addition, he teaches modules on Ecological Impact Assessment and Appropriate Assessment to the MSc Ecological Assessment course at University College Cork.

1.4.2. David Miley

David Miley has a BSc in Marine Science, and a MSc in Applied Environmental Science. He has eight years of ornithological experience having worked in conservation (terns, breeding waders, seabirds), the agri-environment sector (The Hen Harrier Project, The Irish Breeding Curlew EIP), monitoring rare breeding waders in Ireland (Shannon Callows, Lough Corrib), survey coordination and fieldwork for the National Red Grouse Survey 2021/2022 and various ornithological surveys for wind energy projects in Ireland (vantage point surveys, breeding bird surveys, waterbird surveys, Hen Harrier roost watches, Red Grouse call-back surveys, and other species-specific surveys). Contributions to support planning applications have variously included survey field work, avian impact and mitigation advice, GIS shapefiles and attribute tables, and inputs for EIS/EIAR and NIS reports.

2. METHODOLOGY

2.1. SURVEY DESIGN

2.1.1. 2011-2014 waterbird surveys scope and methods

The 2011-2014 waterbird surveys focussed on coverage of a single count area (the GHE count area), which extended around 2 km out from the shoreline of the outer part of the Port of Galway (Map 2.1). This count area included all of the proposed footprint of the Galway Harbour Extension, as well as a buffer of subtidal habitat around the footprint.

Waterbird monitoring of the GHE count area was carried out from March 2011-March 2012, October 2012-March 2013 and from March-September 2014. There were at least monthly counts during each of those periods, with multiple counts in some months. Each count involved 3-8 hour watches from a vantage point at the northern edge of the Galway Harbour Extension development site. Maximum counts of all species were recorded for each 30-60 minute interval during these counts. Some counts also recorded bird numbers in the adjacent intertidal areas at Renmore Beach and the eastern end of Nimmo's Pier - South Park Shore.

The majority of the counts were carried out at around low tide or on ebb/flood tides: of the 324 hourly / half-hourly counts of the GHE count area carried out in 2011-2014, 44% were carried out at low tide, and 33% on ebb/flood tides, with only 23% at high tide. This probably reflects a focus on recording waterbird usage of the intertidal zone within the count sector.

2.1.2. Reconnaissance visit

I carried out a reconnaissance visit on 6th October 2023 to assist in the development of the survey design. I used this visit to help define count sectors and distance bands and to assess logistical constraints.

2.1.3. 2022/23 survey design

The 2022/23 waterbird survey comprised two components:

- vantage point watches of the GHE count sectors; and
- tidal cycle counts of the wider area from Nimmo's Pier-South Park Shore to Ballyloughane Beach.

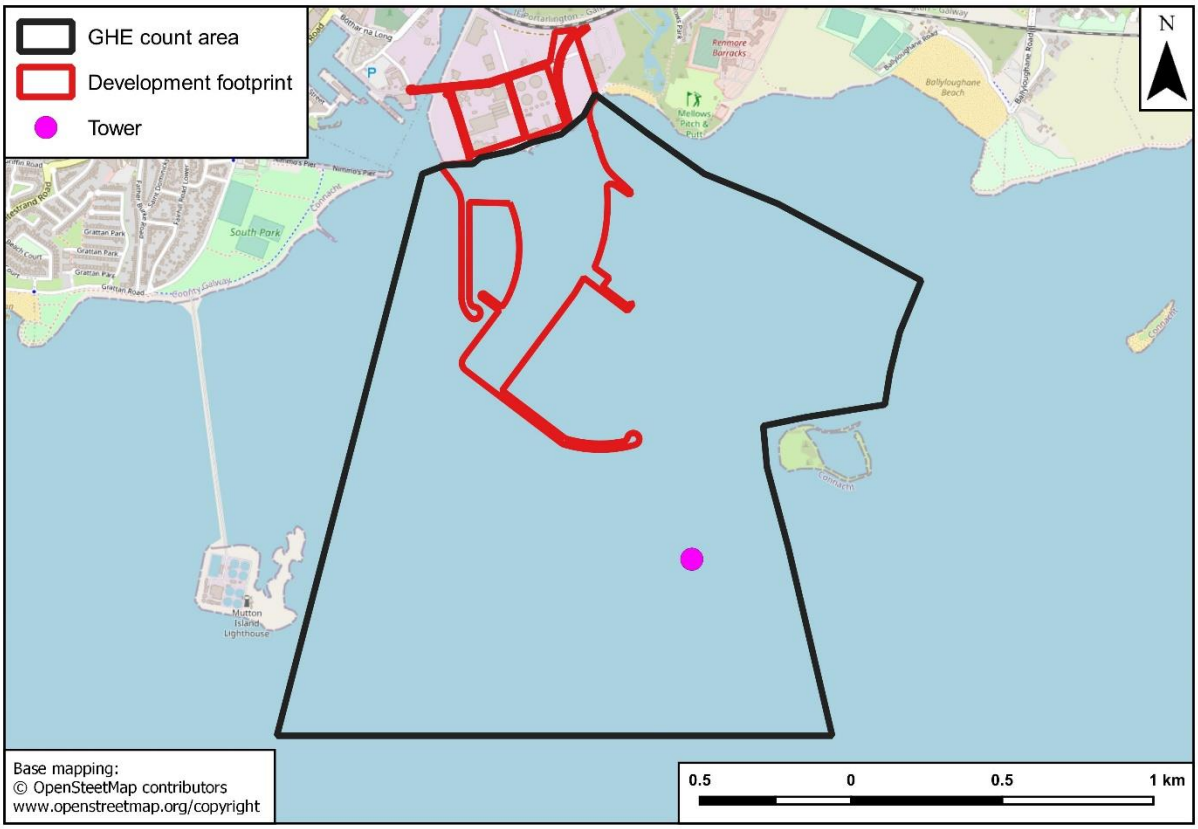
The GHE count sectors were based on the GHE count area, which was subdivided into three sectors, and had modifications to its boundary.

The vantage point watches of the GHE count sectors involved watches of eight hours duration with counts carried out at 30 minute intervals. These watches were centred around low tide: i.e., each watch included the three hour period centred on low tide. These watches also included some counts of the nearest section of Nimmo's Pier - South Park Shore and of Renmore Beach. The watches were designed to produce data that was comparable to the 2011-2014 waterbird surveys.

The tidal cycle counts of the wider area comprised sequences of single low tide - flood tide - high tide, or high tide - ebb tide - low tide, depending on the tidal sequence. On each count, the waterbirds were counted in nine sectors.

The area covered by the tidal cycle counts contained the maximum likely extent of construction disturbance impacts, based on the review in Gittings (2014) and the 55 dB noise contours in Figures 10.4.1-10.4.4 of the Environmental Impact Statement. The tidal cycle counts provide data that can be used as a baseline for monitoring disturbance impacts during construction work. They will also help to evaluate the usage of the development site by providing a wider context to the survey work.

Some of the surveys were timed to finish at sunset so that the occurrence of any nocturnal roosts can be detected. There was a particular focus on detecting any nocturnal roosts of Great Northern Diver.



Map 2.1. The GHE count area used for the 2011-2014 waterbird surveys.

2.2. SURVEY AREA AND COUNT SECTORS

The overall survey area extended from the Mutton Island causeway in the west to Ballyloughane Beach in the east and offshore to Mutton Island and Hare Island.

The survey area for the vantage point watches comprised a modified version of the GHE count area used in the 2011-2014 surveys. The eastern and western boundaries were slightly modified so that they were aligned with clear features than could be used to define the boundaries in the field. The southern extent of the survey area was redrawn so that Hare Island, Mutton Island and the marine tower could be used to define the boundary. The new southern boundary was around 500 m closer to the northern shore, compared to the mapped boundary of the GHE count area. However, it is unclear whether the mapped boundary of the GHE count area corresponded to the actual boundary that was used in the field: the description in the Environmental Impact Statement implies that the actual boundary was a line between Hare Island and Mutton Island.

The count area was divided into three sectors (GHE1, GHE2 and GH3) for the vantage point watches. These sectors are shown in Map 2.2 and their boundaries are defined in Table 2.1.

The survey area for the tidal cycle counts included the GHE sectors, as well as four sectors to the west and two sectors to the east. These sectors are shown in Map 2.2 and their boundaries are defined in Table 2.2.

Table 2.1. Definitions of the GHE count sectors.

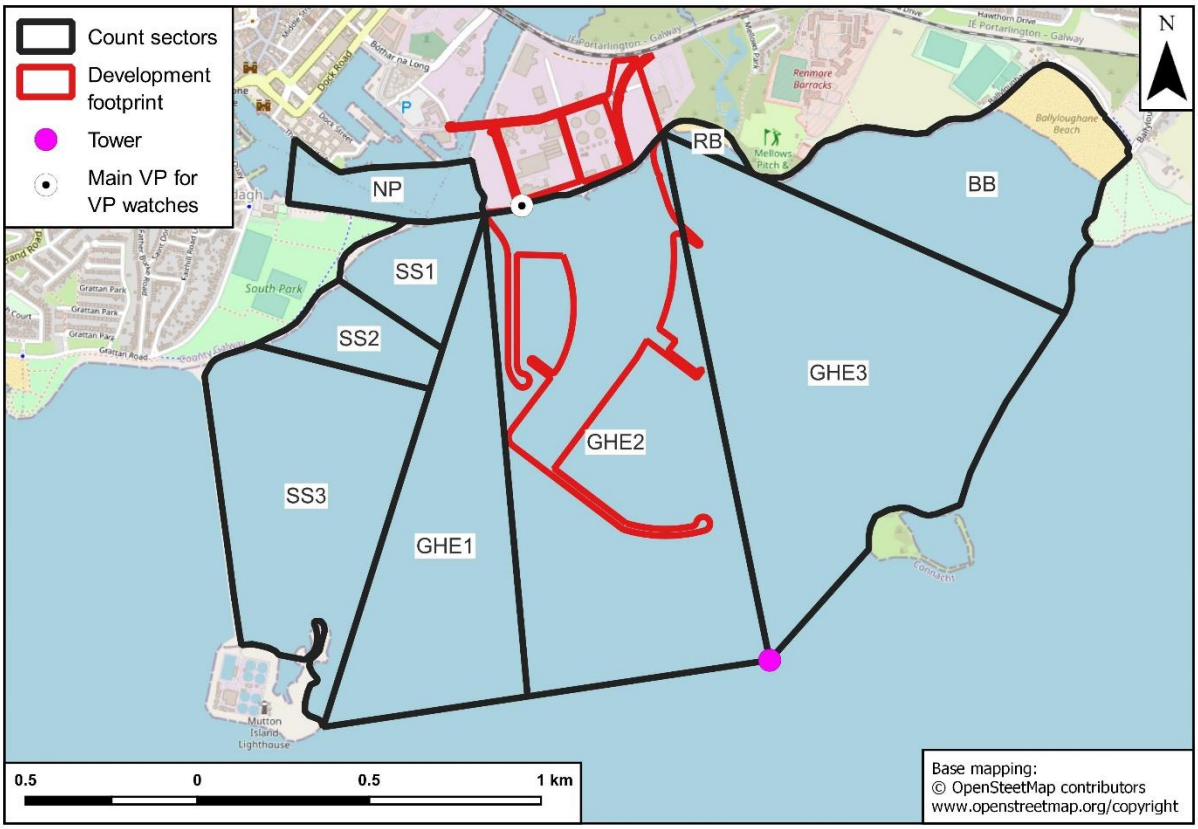
Sector	Definition
GHE1	Western boundary: line from the western end of the small pier to the easternmost point of Mutton Island. Eastern boundary: perpendicular bearing from shoreline at the western end of the small pier. Southern boundary: line from easternmost point of Mutton Island to the marine tower.
GHE2	Western boundary: perpendicular bearing from shoreline at the western end of the small pier. Eastern boundary: line from the end of the grey metal palisade fencing to the marine tower. Southern boundary: line from easternmost point of Mutton Island to the marine tower.
GHE3	Western boundary: line from the end of the grey metal palisade fencing to the marine tower. Eastern boundary: line from the end of the grey metal palisade fencing to the southernmost point of the small island on the causeway to Hare Island. Southern boundary: line from the marine tower to Hare Island and along the causeway north from Hare Island.

The end of the metal palisade fencing, which is used as a reference point for defining the count sector boundaries, is shown in Plate 2.1. The causeway to Hare Island is only exposed at low tide.

Table 2.2. Definitions of the other count sectors.

Sector	Definition
SS1-SS3	These sectors are subdivisions of the shoreline between Nimmo's Pier and the Mutton Island causeway. The boundaries between the sectors are defined by old breakwaters, which can be seen on the aerial imagery and are clear boundaries in the field.
NP	This sector comprises the River Corrib channel east of the small pier next to Claddagh Hall.
RB	This sector comprises the small beach adjacent to the Galway Harbour Extension shoreline and to the north of the GHE3 count sectors
BB	This sector comprises Ballyloughane Beach and adjacent areas to the north of the GHE3 count sector and to the west of the causeway to Hare Island.

The causeway to Hare Island is only exposed at low tide.



Map 2.2. Count sectors for the 2022/23 Galway Harbour Extension waterbird survey.

Plate 2.1. End of the grey metal palisade fencing, at the eastern end of the Galway Harbour Extension shoreline, which was used as a reference point for defining the count sector boundaries.

2.3. COUNT DATES AND TIMINGS

The survey was planned to comprise 1 no. vantage point watch and 1 no. tidal cycle count per month between October 2022 and March 2023. However, due to the timing of the commissioning of this work, and the time required to design the survey, the October tidal cycle count was carried out in early November.

Each vantage point watch was of eight hours duration and was timed to include the three hour period around low tide.

Each tidal cycle count included single low tide, ebb/flood tide and high tide counts. There was no fixed duration specified for the tidal cycle counts; the durations were the time required to complete the counts. Some of the monthly tidal cycle counts were split across two days, due to short daylengths in mid-winter.

Some counts were timed to finish around sunset, so that that the occurrence of any nocturnal roosts could be detected.

Dull details of the count dates and timings are included in the database that accompanies this report (see Appendix 1), and summaries are included in Appendix 2.

2.4. COUNT METHODS

2.4.1. Vantage point watches

The vantage point watches covered the GHE1, GHE2, GHE3, RB, NP and SS1 count sectors. The GHE1, GHE2 and GHE3 count sectors were the priority. The RB, NP and SS1 count sectors are mainly of interest during low tide. Counts of the latter sectors were discretionary depending on time availability during the count periods, although efforts were made to count them during the low tide count periods.

The GHE1 sector boundary included part of the intertidal zone along the eastern side of Mutton Island, while the GHE3 sector boundary included intertidal zones around the headland east of Renmore Beach and around the shoreline of Hare Island. These were included in the mapped sector boundaries for convenience of defining the sectors at high tide when these intertidal zones are flooded. However, when these intertidal zones were exposed, they were excluded from the counts of the GHE sectors: i.e., the only intertidal zone included in the counts of the GHE sectors was the intertidal zone along the northern shoreline of these sectors.

The main vantage point for the counts was located adjacent to the Galway Ocean Sports Club (Map 2.2). However, the surveyor moved along the shoreline at the northern edge of the GHE1-GHE3 sectors, as required. The RB sector was counted from the eastern end of the shoreline, while the NP and SS1 count sectors were counted from the western end of the shoreline.

On each vantage point watch, the survey period was split into 16 no. consecutive periods, each of 30 minutes duration. During each period, the maximum number of each waterbird species observed was recorded. However, birds that were only commuting across the sector were recorded, or not, at the discretion of the observer.

The counts were divided by count sector, distance band from the shoreline, tidal zone, and behaviour.

The count sectors are defined in Section 2.1.

The distance bands were as follows: 0-400 m, 400-800 m, and > 800 m. These were defined by navigation buoys: the nearest green and red buoys were around 400 m out from the shoreline, and the next closest red buoy was around 800 m out from the shoreline.

The tidal zone and behaviour categories are defined in Section 2.4.3.

The surveyor also mapped the extent of tidal exposure (if any) and the locations of any significant flocks or aggregations, and recorded disturbance events and impacts (see Section 2.4.4).

2.4.2. Tidal cycle counts

The tidal cycle counts covered all the sectors included within the overall survey area. The SS1-SS3 sectors were counted from the South Park Shore, and walking out along the Mutton Island causeway, if required. The BB sector was counted by walking east along the shoreline from Renmore Beach, or by driving around to Ballyloughane Beach.

The monthly counts comprised single high tide, ebb/flood tide and low tide counts. On each of these counts, there was a single count of all waterbirds in each sector. However, birds that were only commuting across the sector were recorded, or not, at the discretion of the observer.

The counts were divided by count sector, tidal zone, and behaviour. The counts of the GHE1-GHE3 sectors were also divided by distance from the shoreline (see Section 2.4.1).

The count sectors are defined in Section 2.1. The counts of sectors SS1-SS3 included any waterbirds on the playing fields above the shoreline.

The tidal zone and behaviour categories are defined in Section 2.4.3.

The surveyor also mapped the extent of tidal exposure (if any) and the locations of any significant flocks or aggregations, and recorded disturbance events and impacts (see Section 2.4.4).

2.4.3. Tidal zone and behaviour categories

The tidal zone categories were as used for the NPWS Waterbird Survey Programme (Lewis and Tierney, 2014). These are defined in Table 2.3.

Table 2.3. Tidal zone categories for the Galway Harbour Extension waterbird survey.

Category	Definition
INT	Intertidal habitat: exposed, unvegetated tidal habitat. Includes buoys, rafts, etc., that are within the intertidal zone.
SUB	Subtidal habitat: flooded tidal habitat. Includes buoys, rafts, etc., that are within the subtidal zone.
SUP	Supratidal habitat: saltmarsh and other habitats above the intertidal zone with a strong marine influence.
TER	Terrestrial habitats: habitats above the supratidal zone with, at most, a weak marine influence. Includes piers and jetties.
AQU	Terrestrial (aquatic) habitats: lagoons, drainage ditches, etc.

See Lewis and Tierney (2014) for further guidance.

The behaviour categories were a modified version of those used for the NPWS Waterbird Survey Programme (Lewis and Tierney, 2014). These are defined in Table 2.4.

Table 2.4. Behavioural categories used for the waterbird survey.

Category	Behaviour
F	Feeding; including aerial feeding
R	Non-feeding behaviour, excluding Y1, Y2 and H categories
Y1	Flying bird that is using the sector: e.g., a bird that was present in the site, but flew off before its behaviour could be categorised
Y2	Flying bird that is not using the sector: e.g., a bird commuting across the sector
H	Bird flushed by the observer before its behaviour was categorised

2.4.4. Disturbance recording

All potentially disturbing activities (including activities that did not result in an observed disturbance response) in the intertidal and subtidal zones, and their impacts, were recorded and mapped. Activities above the intertidal zone were only recorded if they were observed to cause disturbance impacts.

The recording methods were based on those used for the NPWS Waterbird Survey Programme (Lewis and Tierney, 2014). This involved mapping potentially disturbing activities and categorising

them by their type, duration, whether they affected birds and the strength of the response if they did. Definitions of these categories are shown in Table 2.5 - Table 2.7.

Table 2.5. Categories for recording potentially disturbing activity types.

Code	Activity	Notes
1	human, on-foot - shoreline	
2	human, on foot – intertidal aquaculture	
3	bait-diggers	
4	non-powered watercraft	record type of watercraft (e.g., kayak, rowing boat, etc.)
5	powered watercraft	record type of boat (e.g., RIB, trawler, yacht, container ship, etc.)
6	water-based recreation	record type of recreation (e.g., wind surfing)
7	horse riding	
8	dogs	includes accompanied and unaccompanied dogs
9	aircraft	
10	shooting	
11	other	record details of activity
12	winkle pickers	
13	aquaculture machinery	

See Lewis and Tierney (2014) for further guidance.

Table 2.6. Categories for recording durations of potentially disturbing activity types.

Code	Definition	Notes
A	short / discrete event	add * if the activity was already occurring within the subsite when the count started
B	activity occurs for up to 50% of the count period	add * if the activity was already occurring within the subsite when the count started
C	activity length estimated at >50% but < 100% of the count period	add * if the activity was already occurring within the subsite when the count started
D	activity continues after the count period has ended	add * if the activity was already occurring within the subsite when the count started

See Lewis and Tierney (2014) for further guidance.

Table 2.7. Categories for recording strengths of disturbance responses.

Code	Type	Definition
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

See Lewis and Tierney (2014) for further guidance.

2.5. DATA ANALYSIS

2.5.1. General

The data analyses presented in this report are mainly tabular or graphical summaries of waterbird occurrence and distribution patterns. All the analyses exclude records where the behaviour was categorised as Y2.

2.5.2. Boxplots

I used boxplots to provide graphical summaries of the occurrence patterns of waterbird species and to compare occurrence patterns between survey periods.

Waterbird count data is usually not normally distributed, but typically shows a left-skewed distribution (i.e., with a long tail of infrequent high counts). This means that means and confidence

intervals are not usually appropriate methods of summarising waterbird counts. Boxplots provide a convenient method of showing the variability in this type of data. In a boxplot, the box shows the range of values occupied by the middle 50% of the data distribution (i.e., from the 25th to the 75th percentile; the interquartile range). The thick line in the box shows the median value (where half the data is less than or equal to this value, and half the data is greater than or equal to this value). The whiskers show the range from the maximum to the minimum values. However, outliers are excluded from this range and are shown instead as black dots above, or below, the whiskers. The outliers are defined as values, where the difference from the median is more than 1.5 times the interquartile range.

2.5.3. Comparison with previous surveys

I compared the results of the 2022/23 waterbird surveys with the waterbird surveys carried out in 2011-2014. I limited the data I used from the 2011-2014 surveys to surveys carried out during the same seasonal period as the 2022/23 surveys (October-March). I used means, rather than medians, to compare species numbers between survey periods because, due to the low numbers, the median counts for many species were zero.

GHE count area (all species)

I compared occurrence patterns in the GHE count area using the vantage point watch data from both periods. I did not include data from the tidal cycle counts because of the differences in the survey methods. The vantage point watches involved continuous watches of the GHE count area for 30 or 60 minute periods, while the tidal cycle counts involved single counts of the GHE count area with a mean duration of 15 minutes.

For the 2011-2014 period the only data that was available for all species were the maximum counts on each survey day in marine and shore zones. Therefore, I used the mean maximum counts in the marine and shore zones to compare occurrence patterns across the three winters with adequate coverage (2011/12, 2012/13 and 2022/23). For the data from the 2022/23 winter, I classified records from the subtidal zone as marine zone records, and records from all other zones as shore zone records.

I did not consider differences in the watch timings relative to the tidal state in making the comparisons between winter because I did not have data on when the maximum counts occurred within the survey days for the 2011/12 and 2012/13 vantage point watches.

The coverage of the GHE count area by vantage point watches in the winters of 2011/12, 2012/13 and 2022/23 is summarised in Table 2.8.

Table 2.8. Coverage of the GHE count area by vantage point watches in the winters of 2011/12, 2012/13 and 2022/23.

Winter	Number of survey days	Survey duration per day	Duration of individual watches
2011/12	5	3 hours	60 minutes
	6	8 hours	
2012/13	12	8 hours	60 minutes
2022/23	6	8 hours	30 minutes

Data was only included for survey days from the October - March period.

GHE count area (Turnstone)

The Turnstone counts for the individual 60 minute watches are available for the 2011/12 and 2012/13 winters. I used this data to make more detailed comparisons of Turnstone occurrence patterns between the three winters. However, as Turnstones were only recorded on one survey day in the 2022/23 winter, I did not carry out statistical modelling of Turnstone occurrence patterns.

Renmore Beach and the eastern end of the South Park Shore

I compared occurrence patterns in the areas adjacent to the GHE count area using the vantage point watch data from both periods, and the data from the tidal cycle counts for the 2022/23 winter.

The 2011-2014 vantage point watches included some counts of an area described as Nimmo's Pier – South Park Shore. From discussions with the surveyor when I was preparing my previous report, I understood that these counts referred to the intertidal area at the eastern end of South Park Shore (Gittings, 2014). Therefore, the area counted probably corresponded to the Sector SS1 used in the 2022/23 surveys. The 2011-2014 vantage point watches also included some counts of an area described as Renmore Beach. The area counted presumably corresponded closely to the Sector RB used in the 2022/23 surveys.

There are no details available of the number of counts per day carried out of eastern end of South Park Shore and Renmore Beach areas in the 2011-2014 vantage point watches. However, from my general discussions with the surveyor, my understanding was that there were variable numbers of counts per day, and these were focused around the low tide period.

There were not enough vantage point watch days with counts of the eastern end of South Park Shore and the Renmore Beach area in the 2011-2014 period to analyse data separately for different winters. Therefore, I used the combined dataset for the 2011-2014 period, excluding data from vantage point watches outside the October - March period. For comparison with the 2011-2014 data, I used the maximum count per day (excluding the high tide period) in the combined datasets from the tidal cycle counts and the vantage point watches from the 2022/23 winter.

The coverage of the the eastern end of South Park Shore and the Renmore Beach area by in the 2011-2014 and 2022/23 period is summarised in Table 2.9.

Table 2.9. Coverage of the eastern end of the South Park Shore and the Renmore Beach area in the 2011-2014 and 2022/23 survey periods.

Area	Period	Survey method	Survey days	Counts / day
Renmore Beach	2011-2014	vantage point watch	10	not known
	2022/23	tidal cycle count	6	3
		vantage point watch	6	2-8
Eastern end of South Park Shore	2011-2014	vantage point watch	10	not known
	2022/23	tidal cycle count	6	3
		vantage point watch	6	4-11

Data was only included for survey days from the October - March period.

2.5.4. Waterbird groups

I classified waterbird species into ecological / taxonomic groups for analyses of the sector distribution in the tidal cycle counts. These groups are defined in Table 2.10.

Table 2.10. Waterbird groups used for analyses of the sector distribution in the tidal cycle counts.

Group	Definition
Swans, geese and ducks	All swan, geese, and dabbling duck species; diving ducks are not included in this group.
Diving waterbirds	All diving duck, grebe, cormorant and shag, and auk species
Herons and egrets	All heron and egret species
Waders	All wader species
Gulls	All gull species

3. RESULTS

3.1. OVERVIEW

The full survey data is included in the database that accompanies this report (see Appendix 1).

A total of 29 waterbird species were recorded in the tidal cycle counts (Table 3.1), with two additional species recorded in the vantage point watches (Kittiwake and Mediterranean Gull).

In the tidal cycle counts, the most abundant species were Oystercatcher, Ringed Plover, Bar-tailed Godwit, Dunlin, Black-headed Gull and Herring Gull (Table 3.1). For the four wader species, most of the high counts occurred on the low tide or ebb/flood tide counts. The highest Black-headed Gull and Herring Gull numbers occurred on the low tide counts.

Most waterbird species occurred in very low numbers in the GHE sectors with most monthly maximum counts in the vantage point watches being less than ten birds (Table 3.2). Black-headed Gull occurred in slightly higher numbers with three monthly maxima of greater than ten birds and peak counts of over 100 in the October vantage point watch. Herring Gull also occurred in relatively high numbers in the October vantage point watch. There was also a single high count of Ringed Plover: 76 in the March vantage point watch. This involved a flock roosting on a gravel area above the shoreline.

There were higher waterbird numbers recorded in the vantage point watches in the sectors adjacent to the Galway Harbour Extension area (Table 3.3), despite the fact that these sectors were not covered on all the watches. The higher counts mainly occurred in the NP and/or SS1 sectors.

There only counts that exceeded thresholds for national importance were the counts of 217 Ringed Plovers from the November ebb/flood tide count, and the counts of 200 Bar-tailed Godwit from the February low tide and March ebb/flood tide counts. The maximum counts of all the other species were well below the thresholds for national importance (Table 3.4).

The maximum Ringed Plover tidal cycle count exceeded the five-year mean peak count from recent I-WeBS counts of Inner Galway Bay (Table 3.4). The maximum Bar-tailed Godwit tidal cycle counts were over 50% of the five-year mean peak counts (Table 3.4). Excluding species of irregular occurrence, or which are poorly recorded by I-WeBS counts, the maximum tidal cycle counts of the other species were 25% or less of the five-year mean peak counts (Table 3.4).

The maximum Ringed Plover count from the GHE sectors in the vantage point watches was around 40% of the five-year mean peak count from recent I-WeBS counts of Inner Galway Bay, while the maximum Great Black-backed Gull count was 15% of the five-year mean peak count (Table 3.4). Excluding species of irregular occurrence, or which are poorly recorded by I-WeBS counts, the maximum counts from the Galway Harbour Extension sectors in the vantage point watches of the other species were 6% or less of the five-year mean peak counts (Table 3.4).

The maximum Herring Gull count from the sectors adjacent to the Galway Harbour Extension area in the vantage point watches was around 20% of the five-year mean peak count from recent I-WeBS counts of Inner Galway Bay, while the maximum Mute Swan, Turnstone and Black-headed Gull counts were 10-14% of the five-year mean peak count (Table 3.4). Excluding species of irregular occurrence, or which are poorly recorded by I-WeBS counts, the maximum counts from these sectors in the vantage point watches of the other species were 7% or less of the five-year mean peak counts (Table 3.4).

3.2. COMPARISONS BETWEEN SEASONS

3.2.1. GHE count area

The mean daily maximum counts in the GHE count area in the winters of 2011/12, 2012/13 and 2022/23 are compared in Table 3.5 and Figure 3.1 and Figure 3.2. These show separate data for

the shore and marine zones (for species which occurred in both zones) because the available data for the winters of 2011/12 and 2012/13 were divided that way.

The species that showed the most obvious differences between winters were Turnstone and Black-headed Gull.

Turnstone occurred regularly in the first two winters and were recorded on almost all the vantage point watch days, while they were only recorded on a single vantage point watch day in the winter of 2022/23 (Table 3.6). While the frequency of records was similar in the first two winters, the numbers recorded were higher in the winter of 2011/12 with six counts of ten or more birds, compared to no counts of ten or more birds in the other winters (Table 3.6). This is reflected in the decreasing trend shown by the daily maximum counts across the three winters (Figure 3.1).

Black-headed Gull showed an increasing trend across the three winters in both the shore and marine zones (Table 3.5 and Figure 3.1 and Figure 3.2). It is notable that the interquartile ranges in the boxplots show little overlap between winters, although the sample size of six counts for the winter of 2022/23 is on the low side for representation using boxplots. As the individual count data is not available for the first two winters, it is not possible to analyse the Black-headed Gull trends in greater detail.

Other species showed indications of differences between the winters, but, due to the very low numbers involved, and the variability in the data, these differences may just be due to sampling effects. However, the absence of any records of Cormorant from the marine zone in the winter of 2022/23 was notable.

Great Northern Diver, along with Turnstone, was one of the key species of concern in the assessment of the previous planning application. The numbers recorded in the winter of 2022/23 were similar to the previous winters.

3.2.2. South Park Shore and Renmore Beach areas

The waterbird numbers at the eastern end of the South Park Shore area in the 2011-2014 period and the winter of 2022/23 are compared in Table 3.7 and Figure 3.3. While there were some differences in the mean counts, these are most likely to be due to sampling effects. For the most regularly occurring species, the boxplots generally do not show consistent differences between the datasets, although Common Gull numbers appear to have been lower in the winter of 2022/23.

The waterbird numbers in the Renmore Beach area in the 2011-2014 period and the winter of 2022/23 are compared in Table 3.8 and Figure 3.4. The mean counts were very similar between the two periods although the median Black-headed Gull count was lower in the winter of 2022/23.

3.3. DISTRIBUTION PATTERNS

3.3.1. Tidal cycle counts

The sector distribution of waterbird groups in the tidal cycle counts is summarised in Figure 3.5. For this analysis, the GHE1-3 sectors, and the SS1-SS3 sectors have been grouped into single sectors to improve the clarity of the boxplots.

Across all tidal states, most of the waterbird groups occurred mainly in the SS and/or BB sectors reflecting the greater availability of intertidal habitat in these sectors. However, at low tide, most of the groups were more widely distributed, reflecting exposure of intertidal habitat in the other sectors.

The diving waterbirds occurred mainly in the SS and GHE sectors, which were the sectors with the greatest amounts of subtidal habitat.

3.3.2. Vantage point watches

The intertidal habitat in the GHE count area was restricted to the GHE2 sector and 0-400 m distance band, so the following analyses are restricted to birds occurring in the subtidal zone.

The highest overall waterbird numbers occurred in the GHE2 sector, with median counts in the GHE1 and GHE3 sectors of zero (Figure 3.6). However, the GHE2 sector covers a larger area than the other two sectors and the highest densities of three of the four regularly occurring species occurred in the GHE1 sector (Table 3.9). In the case of the two gull species, this reflects the proximity of the GHE1 sector to the South Park Shore sectors, where the highest gull numbers occurred in the tidal cycle counts (Figure 3.6).

The waterbird numbers in the subtidal zone showed a general pattern of decreasing with distance from the shoreline, and the median count in the farthest distance band from the shoreline was zero (Figure 3.7). As the closest distance band to the shoreline had the smallest area, the densities of waterbirds showed an even stronger pattern of decline with distance from the shoreline. These distribution patterns may reflect, at least in part, detectability effects (see Section 4).

3.3.3. High tide roosts

During my reconnaissance visit on 6th October 2023, I noted around 150 Redshank roosting at high tide on the eastern side of Mutton Island, with smaller numbers of other species. This is an established high tide roost, which was monitored by Nairn (2005). It is outside the maximum likely extent of construction disturbance impacts from the Galway Harbour Extension project. It was not included in the tidal cycle counts due to the logistical difficulties of covering this site as part of the counts.

High tide roosts were recorded on three of the six high tide tidal cycle counts and during one vantage point watch (Table 3.11). Roosts were also recorded on four ebb/flood tide tidal cycle counts (Table 3.11); some or all of these roosts may have been high tide roosts forming early or disbanding later.

The roost locations are shown in Map 3.1 and Map 3.2. They comprised: exposed rocks in Sector SS3 (6 records), saltmarsh and exposed rocks in Sector BB (2 records), a rock wall in Sector SS1 (1 record), pitches in Sectors SS1 and SS2 (1 record), the beach in Sector SS1 (1 record) and a gravel area above the shoreline in Sector GHE1 (1 record).

All the high tide roosts were small or medium sized (less than 100 birds), but two larger roosts were recorded on flood tides. The most significant roosts in terms of numbers of species relative to their Inner Galway Bay populations were the Bar-tailed Godwit roosts in Sector SS3 on 22nd February and 8th March, and the Ringed Plover roost in Sector GHE2 on 7th March. The fact that both of these Bar-tailed Godwit roosts were recorded on flood tides, not at high tide, may indicate that this area is used for roosts assembling, with the birds moving elsewhere to roost at high tide (probably to the Mutton Island roost).

3.3.4. Other roosts / aggregations

Aggregations of waders and gulls were recorded on multiple occasions feeding along the tideline in the South Park Shore sectors at low tide, or on ebb/flood tides. No such aggregations were noted in the other sectors.

Rafts of Shags were recorded on two dates: a feeding flock of 6 Shags with 80 Black-headed Gulls feeding around 400 m offshore in sector GHE1 on 27th October 2022: and a non-feeding flock of 8 Shags in the subtidal zone of Sector SS1 on 15th December 2022.

A raft of 6 Great Northern Divers was recorded at dusk on 28th November 2022 around 800-1000 m offshore in Sector GHE3 between the tower and Hare Island. This observation probably relates to a Great Northern Diver communal roost (see Section 4).

3.4. DISTURBANCE

The most frequently recorded potentially disturbing activity was powered watercraft but only 20% of the records produced an observed disturbance response. None of the four records of non-powered watercraft produced observed disturbance responses (Table 3.12). Human and dog activity on the shoreline and in the intertidal produced higher rates of disturbance responses.

Details of the four observed disturbance responses to powered watercraft activity are shown in Table 3.13. The species affected were mainly Shags and Black-headed Gulls, with one record affecting Cormorants. There were no records of observed disturbance responses to powered watercraft activity (or any other activity) by Great Northern Divers despite their relatively high frequency of occurrence in the subtidal waters in the survey area.

Table 3.1. Maximum monthly totals recorded in the tidal cycle counts.

Species	Oct	Nov	Dec	Jan	Feb	Mar
Mute Swan	2	0	5	4	10	2
Light-bellied Brent Goose	0	6	0	0	0	8
Wigeon	2	0	21	24	4	21
Teal	0	0	3	0	0	6
Mallard	7	8	3	0	3	2
Great Northern Diver	4	2	2	8	1	0
Cormorant	4	0	0	1	3	1
Shag	15	2	23	5	7	2
Little Egret	5	1	1	1	1	1
Grey Heron	5	4	7	3	0	0
Great Crested Grebe	6	0	5	0	3	0
Oystercatcher	26	45	9	53	99	38
Ringed Plover	50	217	10	39	90	70
Whimbrel	0	0	0	0	5	0
Curlew	2	1	2	6	4	3
Black-tailed Godwit	0	7	0	1	0	0
Bar-tailed Godwit	11	19	23	81	200	200
Turnstone	30	34	3	12	16	6
Knot	0	0	3	0	0	0
Dunlin	0	123	25	200	190	84
Greenshank	3	0	3	1	0	0
Redshank	30	3	13	18	9	15
Snipe	0	0	3	3	0	0
Sandwich Tern	0	0	0	10	0	0
Black-headed Gull	169	343	160	335	452	112
Common Gull	1	7	10	6	12	2
Lesser Black-backed Gull	0	0	0	1	0	0
Herring Gull	217	101	41	57	13	33
Great Black-backed Gull	3	1	1	4	1	2

The data in this table are the maxima of the monthly high tide, low tide, and ebb/flood tide counts. The October counts were carried out in early November and the November high tide count was carried out in early December.

Table 3.2. Maximum monthly totals recorded in the vantage point watches in the GHE sectors.

Species	Oct	Nov	Dec	Jan	Feb	Mar
Mute Swan	0	0	0	1	3	0
Light-bellied Brent Goose	0	0	0	0	5	0
Wigeon	0	0	5	0	5	9
Great Northern Diver	1	7	1	3	2	2
Cormorant	1	0	0	0	0	0
Shag	8	5	6	8	9	5
Little Egret	2	0	0	0	1	1
Grey Heron	2	1	4	1	1	2
Great Crested Grebe	0	0	0	0	0	1
Oystercatcher	3	0	0	0	1	0
Ringed Plover	0	0	0	0	0	76
Curlew	1	1	1	0	1	0
Turnstone	0	0	0	0	0	6
Redshank	0	2	0	3	0	2
Snipe	0	0	5	1	0	0
Sandwich Tern	0	0	0	0	0	2
Kittiwake	0	0	0	0	1	0
Black-headed Gull	116	9	21	1	9	22
Mediterranean Gull	1	0	0	0	0	0
Common Gull	0	0	1	0	1	1
Lesser Black-backed Gull	0	0	0	1	0	0
Herring Gull	42	15	3	1	6	2
Great Black-backed Gull	13	2	0	3	0	0

The data in this table are the maxima of the 16 consecutive half-hour vantage point watches carried out on a single day each month.

Table 3.3. Maximum monthly totals recorded in the vantage point watches in the NP, RB and SS1 sector.

Species	Oct	Nov	Dec	Jan	Feb	Mar
Mute Swan	0	0	6	2	10	9
Light-bellied Brent Goose	0	0	0	0	3	0
Wigeon	0	0	4	7	1	3
Mallard	0	6	4	2	4	0
Great Northern Diver	0	0	1	1	0	0
Cormorant	0	0	0	1	0	0
Shag	0	1	4	1	0	1
Little Egret	1	0	1	0	1	0
Grey Heron	2	3	2	1	1	1
Oystercatcher	4	6	2	15	33	39
Ringed Plover	0	0	5	0	0	0
Curlew	1	1	1	1	0	1
Black-tailed Godwit	0	0	0	0	0	3
Bar-tailed Godwit	11	9	3	3	6	27
Turnstone	0	4	2	18	0	3
Dunlin	0	0	21	0	0	0
Greenshank	0	2	1	0	0	0
Redshank	0	10	3	1	1	3
Black-headed Gull	42	129	18	42	190	125
Common Gull	10	1	5	2	1	4
Lesser Black-backed Gull	1	0	0	0	0	0
Herring Gull	183	92	3	74	13	23
Great Black-backed Gull	0	3	0	2	1	2

The data in this table are the maxima of the 2-11 half-hour vantage point watches carried out on a single day each month in the NP, RB and SS1 sectors.

Table 3.4. Overall maximum counts from the Galway Harbour Extension waterbird surveys compared to the thresholds for national importance and the five-year mean peaks counts for Inner Galway Bay.

Species	National threshold	Inner Galway Bay 5-year mean	Maximum counts		
			Tidal cycle counts	VP watches (GHE sectors)	VP watches (NP, RB and SS1)
Mute Swan	90	74	10	3	10
Light-bellied Brent Goose	350	1117	8	5	3
Wigeon	560	1593	24	9	7
Teal	360	981	6	0	0
Mallard	280	169	8	0	6
Great Northern Diver	20	221	8	7	1
Cormorant	110	302	4	1	1
Shag	-	276	23	9	4
Little Egret	20	78	5	2	1
Grey Heron	25	168	7	4	3
Great Crested Grebe	30	23	6	1	0
Oystercatcher	610	544	99	3	39
Ringed Plover	120	183	217	76	5
Whimbrel		1	5	0	0
Curlew	350	631	6	1	1
Black-tailed Godwit	200	33	7	0	3
Bar-tailed Godwit	170	353	200	0	27
Turnstone	95	167	34	6	18
Knot	160	41	3	0	0
Dunlin	460	1609	200	0	21
Greenshank	20	44	3	0	2
Redshank	240	498	30	3	10
Snipe	-	14	3	5	0
Sandwich Tern	-	4	10	2	0
Kittiwake	-	0	0	1	0
Black-headed Gull	-	1950	452	116	190
Common Gull	-	1131	12	1	10
Mediterranean Gull	-	0	0	1	0
Lesser Black-backed Gull	-	15	1	1	1
Herring Gull	-	873	217	42	183
Great Black-backed Gull	-	87	4	13	3

Source for the thresholds for national importance and the five-year mean peaks counts for Inner Galway Bay: I-WeBS Site Summary Table for 0G403 Inner Galway Bay (https://shorturl.at/imCEU). Note that thresholds for national importance have not been defined for gull species and other waterbird species for which reliable national population estimates are not available.

Table 3.5. Comparison of the mean daily maximum counts in GHE count area across the three seasons with adequate coverage.

Species	Zone	2011/12	2012/13	2022/23
Mute Swan	Marine	0.8	1.8	0
	Shore	0	0	0.7
Light-bellied Brent Goose	Marine	0.5	3.6	0
	Shore	1.9	0	0.8
Wigeon	Marine	1.5	1	0
	Shore	0.4	0.6	3.2
Red-breasted Merganser	Marine	0.5	2	0
Red-throated Diver	Marine	0.5	0.2	0
Great Northern Diver	Marine	3.2	5.2	2.7
Cormorant	Marine	2.1	5.9	0
	Shore	0.5	0.9	0.2
Shag	Marine	3.3	12.9	5.3
	Shore	0.5	1.6	3.7
Little Egret	Shore	0.2	0	0.7
Grey Heron	Shore	0.8	1.1	1.8
Great Crested Grebe	Marine	1.8	0.9	0.2
Oystercatcher	Shore	3.3	1.9	0.7
Ringed Plover	Shore	0	0	12.7
Curlew	Shore	0.6	0.9	0.7
Turnstone	Shore	7.6	2.8	1
Greenshank	Shore	0.1	0.4	0
Redshank	Shore	0.5	0.5	1.2
Razorbill	Marine	0.8	0.7	0
Black-headed Gull	Marine	7.5	7.3	29.7
	Shore	0.5	1.1	15.2
Common Gull	Marine	0.9	6.3	0.2
	Shore	0.5	0.4	0.3
Herring Gull	Marine	6.3	5.8	4.5
	Shore	1	1.5	8.2
Great Black-backed Gull	Marine	0.7	1.2	0.5
	Shore	0.5	0	2.8

Additional species recorded with mean daily maximum counts of ≤ 0.5: Mallard, Common Scoter, Red-throated Diver, Gannet, Greenshank, Black Guillemot, Guillemot, Sandwich Tern, Kittiwake, Mediterranean Gull, Common Gull, Lesser Black-backed Gull and Iceland Gull.

Table 3.6. Comparison of Turnstone occurrence patterns in the vantage point watches between the winters of 2011/12, 2012/13 and 2013/14.

Attribute	Winter		
	2011/12	2012/13	2022/23
Number of days recorded	10 out of 11	10 out of 12	1 out 6
Number of counts recorded	17 out of 63	24 out of 96	5 out of 96
Number of counts > 10	6	0	0
Mean daily maximum count	7.6	2.8	1.0
Overall maximum count	19	7	6

Table 3.7. Comparison of low tide waterbird occurrence patterns in the eastern end of the South Park Shore between the 2011-2014 period and the 2022/23 winter.

Species	Mean daily counts		Frequency of non-zero counts	
	2011-2014	2022/23	2011-2014	2022/23
Mute Swan	0.4	2.3	0.15	0.60
Light-bellied Brent Goose	7.9	0.3	0.23	0.13
Wigeon	1.8	1.9	0.38	0.47
Shag	0.0	0.5	0.00	0.27
Grey Heron	0.3	1.2	0.15	0.67
Oystercatcher	17	12	0.92	0.93
Curlew	0.5	0.5	0.38	0.47
Bar-tailed Godwit	24	7.1	0.77	0.80
Turnstone	0.5	3.0	0.15	0.33
Redshank	1.2	1.4	0.54	0.53
Sandwich Tern	0.3	0.7	0.23	0.07
Black-headed Gull	113	50	0.92	0.87
Common Gull	9.8	0.9	0.77	0.40
Herring Gull	17	32	0.85	0.87
Great Black-backed Gull	2.5	0.3	0.38	0.20

Additional species recorded with frequencies of non-zero counts ≤ 0.2: Great Northern Diver, Cormorant, Little Egret, Ringed Plover, Whimbrel, Black-tailed Godwit, Dunlin, Forster's Tern, and Glaucous Gull.

Table 3.8. Comparison of low tide waterbird occurrence patterns at Renmore Beach between the 2011-2014 period and the 2022/23 winter.

Species	Mean daily counts		Frequency of non-zero counts	
	2011-2014	2022/23	2011-2014	2022/23
Grey Heron	0.1	0.4	0.10	0.40
Oystercatcher	1.7	2.9	0.80	0.87
Ringed Plover	0.7	0.6	0.40	0.13
Curlew	0.0	0.3	0.00	0.33
Bar-tailed Godwit	2.7	2.3	0.70	0.67
Redshank	0.0	1.2	0.00	0.40
Black-headed Gull	3.4	2.3	0.90	0.67
Common Gull	0.8	0.7	0.50	0.20
Herring Gull	0.5	0.7	0.30	0.53
Great Black-backed Gull	0.0	0.5	0.00	0.40

Additional species recorded with frequencies of non-zero counts ≤ 0.2: Mute Swan, Mallard, Great Northern Diver, Little Egret, Turnstone, Dunlin, Greenshank, and Lesser Black-backed Gull.

Table 3.9. Overall densities of the regularly occurring waterbird species in the subtidal zone of the GHE sectors during the vantage point watches, 2022/23.

Species	Sector	Bird-hours	Density (bird-hours/ha)
Great Northern Diver	GHE1	18	0.4
	GHE2	72	0.8
	GHE3	54	0.6
Shag	GHE1	76	1.8
	GHE2	140	1.5
	GHE3	62	0.7
Black-headed Gull	GHE1	874	20.7
	GHE2	512	5.6
	GHE3	180	2.1
Herring Gull	GHE1	50	1.2
	GHE2	8	0.1
	GHE3	12	0.1

The data in this table are based on summed totals across all vantage point watches, converted to bird-hours by assuming that birds were present for the full duration of each 30-minute count period in which they were recorded.

Table 3.10. Overall densities of the regularly occurring waterbird species in the distance bands of the GHE sectors during the vantage point watches, 2022/23.

Species	Distance bands (m)	Bird-hours	Density (bird-hours/ha)
Great Northern Diver	0-400	62	1.8
	400-800	44	0.8
	>800	38	0.3
Shag	0-400	160	4.6
	400-800	84	1.4
	>800	34	0.3
Black-headed Gull	0-400	636	18.1
	400-800	876	15.0
	>800	50	0.4
Herring Gull	0-400	22	0.6
	400-800	42	0.7
	>800	6	0.0

The data in this table are based on summed totals across all vantage point watches, converted to bird-hours by assuming that birds were present for the full duration of each 30-minute count period in which they were recorded.

Table 3.11. High tide roosts recorded during the tidal cycle counts and vantage point watches, 2022/23.

Date	Tide	Sector	Total numbers	Species	Details
04/11/2022	HT	BB	71	OC (8), RP (50), CU (1), TT (7), RK (5)	Roosting on small patch of saltmarsh and nearby exposed rocks
04/11/2022	FL	SS2	38		Flock of roosting gulls on beach
04/11/2022	HT	SS3	31	OC (9), RK (1), BH (15), CM (1), HG (5)	Roosting on exposed rocks
25/11/2022	FL	SS1	29	OC (9), RK (1), BH (17)	Roosting on pitches
25/11/2022	FL	SS2	72	OC (22), BH (50)	BH roosting, OC foraging on pitches
13/12/2022	EB	SS3	67	H. (2), BH (44), HG (22)	Roosting on rocks
15/12/2022	HT	SS1	73	SA (3), H. (1), RK (2), BH (66), HG (1)	Roosting on rock wall
15/12/2022	HT	SS3	7	H. (1), OC (1), CU (1), BH (2), CM (1), HG (1)	Roosting on exposed rocks
17/01/2023	HT	BB	37	RP (34), SN (3)	Roosting on small saltmarsh
17/01/2023	HT	SS3	99	OC (2), RP (1), CU (5), BA (14), DN (55), BH (17), HG (4)	Roosting on exposed rocks
22/03/2023	FL	SS3	245	BA (75), BH (170)	Roosting across exposed intertidal rocks
07/03/2023	HT	GHE2	76	RP (76)	Roosting on gravel in fenced off area where turbine nacelles are usually stored
08/03/2023	FL	SS3	180	BA (180)	Roosting on exposed rocks.

Species: BA = Bar-tailed Godwit, BH= Black-headed Gull, CM = Common Gull, CU = Curlew, DN = Dunlin, H. = Grey Heron, HG = Herring Gull, RK = Redshank, RP = Ringed Plover, SA = Shag, SN = Snipe, TT = Turnstone.

Table 3.12. Summary of potentially disturbing activities and disturbance responses recorded during the tidal cycle counts and vantage point watches, 2022/23.

Activity code	Activity type	No response	Response:			
			high	moderate	weak	NC
1	human, on-foot - shoreline	2	2	3	0	0
2	human, on foot - intertidal aquaculture	2	1	0	0	1
4	non-powered watercraft	4	0	0	0	0
5	powered watercraft	16	2	1	1	0
6	water-based recreation	0	0	1	0	0
7	horse riding	0	1	0	0	0
8	dogs	0	6	2	2	7
12	winkle pickers	0	1	0	1	0

Activity types and codes, and response classifications, are as defined by Lewis and Tierney (2014). NC = not classified.

Table 3.13. Disturbances responses to powered watercraft activity observed during the tidal cycle counts and vantage point watches, 2022/23.

Date	Sector	Watercraft type	Duration	Species affected	Response strength
27/10/2022	GHE2	Jet-ski	B*	Shag, Cormorant, Black-headed Gull	High
27/10/2022	GHE1/GHE2	Car ferry	A	Black-headed Gull	Weak
28/11/2022	GHE2	Lobster boat	B	Shag, Black-headed Gull	High
17/01/2023	SS1		D	Shag	Moderate

Duration and response classifications. are as defined by Lewis and Tierney (2014). Duration codes: 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; * = activity was already occurring within the subsite when the count started.

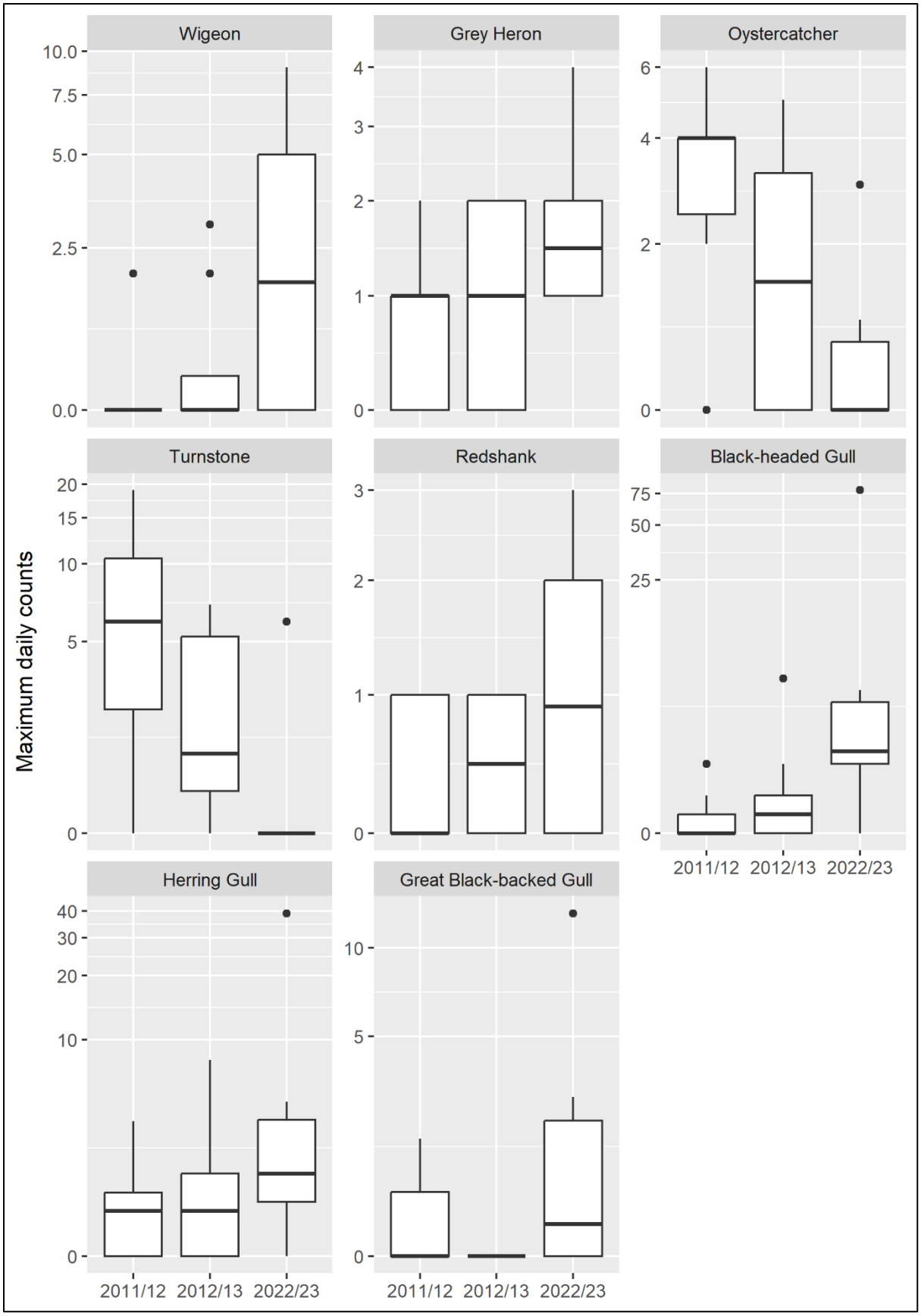


Figure 3.1. Boxplots comparing the maximum daily counts of species occurring in the shore zone of the GHE count area in the winters of 2011/12, 2012/13 and 2022/23.

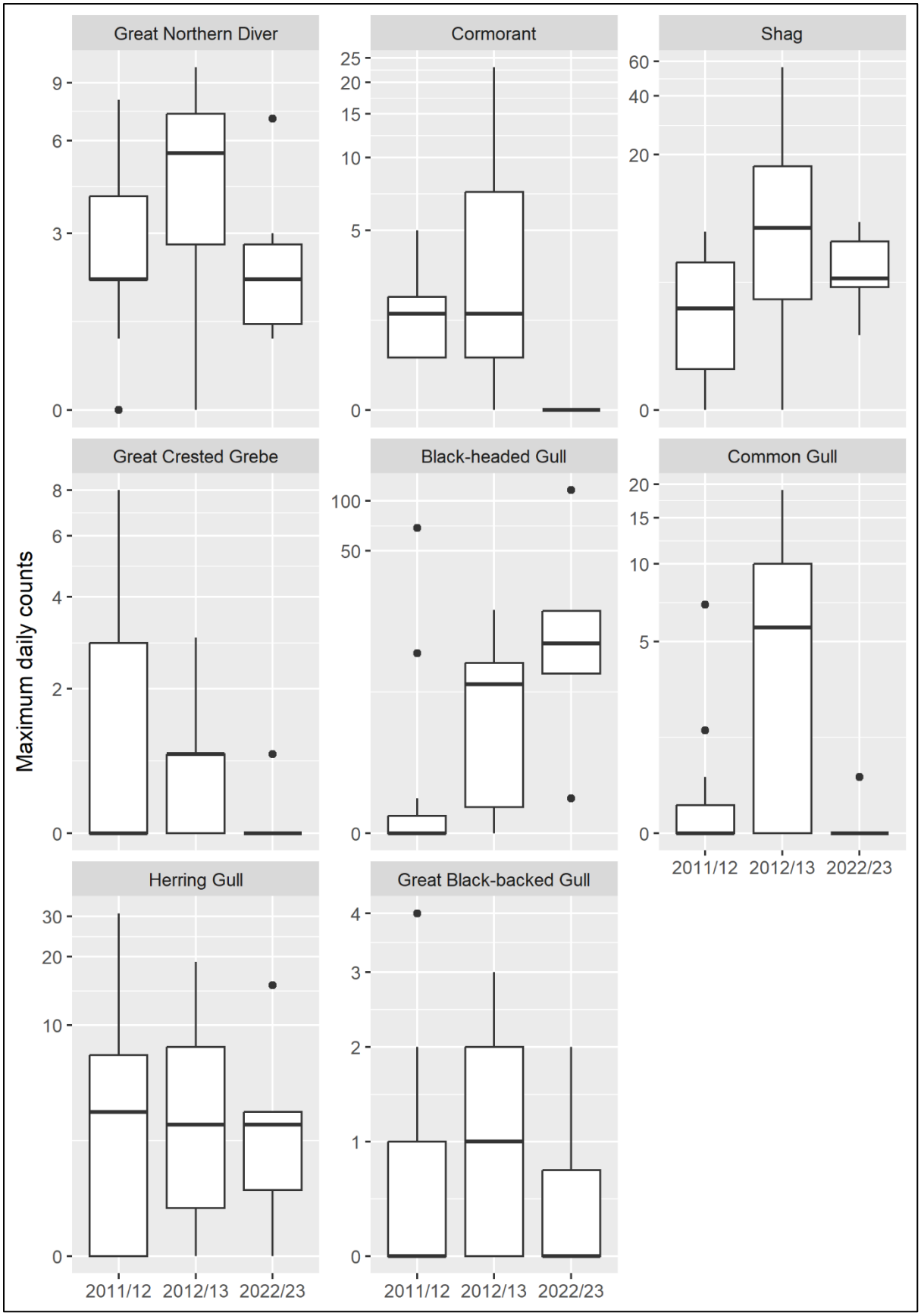


Figure 3.2. Boxplots comparing the maximum daily counts of species occurring in the marine zone of the GHE count area in the winters of 2011/12, 2012/13 and 2022/23.

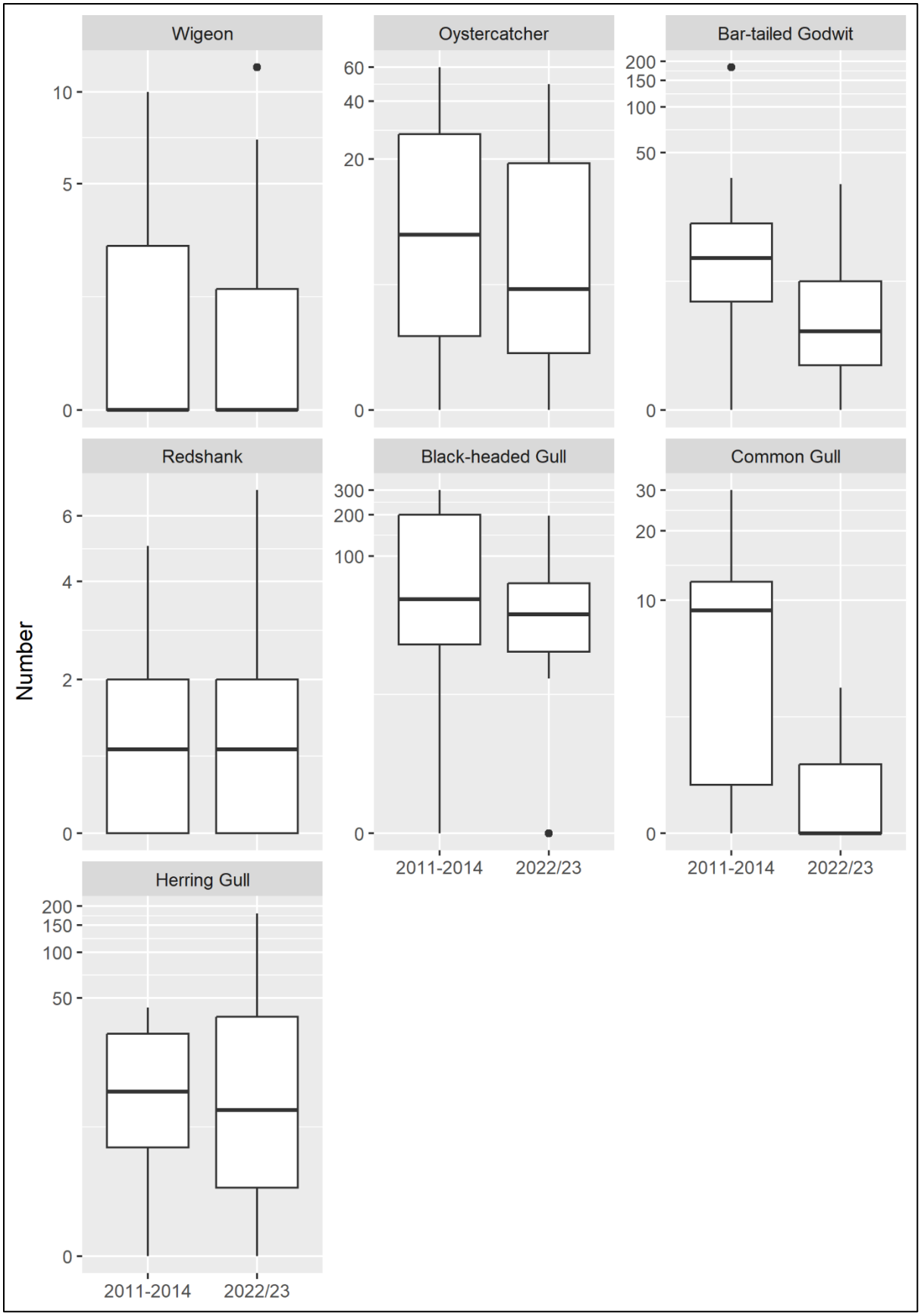


Figure 3.3. Boxplots comparing the low tide counts of regularly occurring species in the South Park Shore area between the 2011-14 period and the winter of 2022/23.

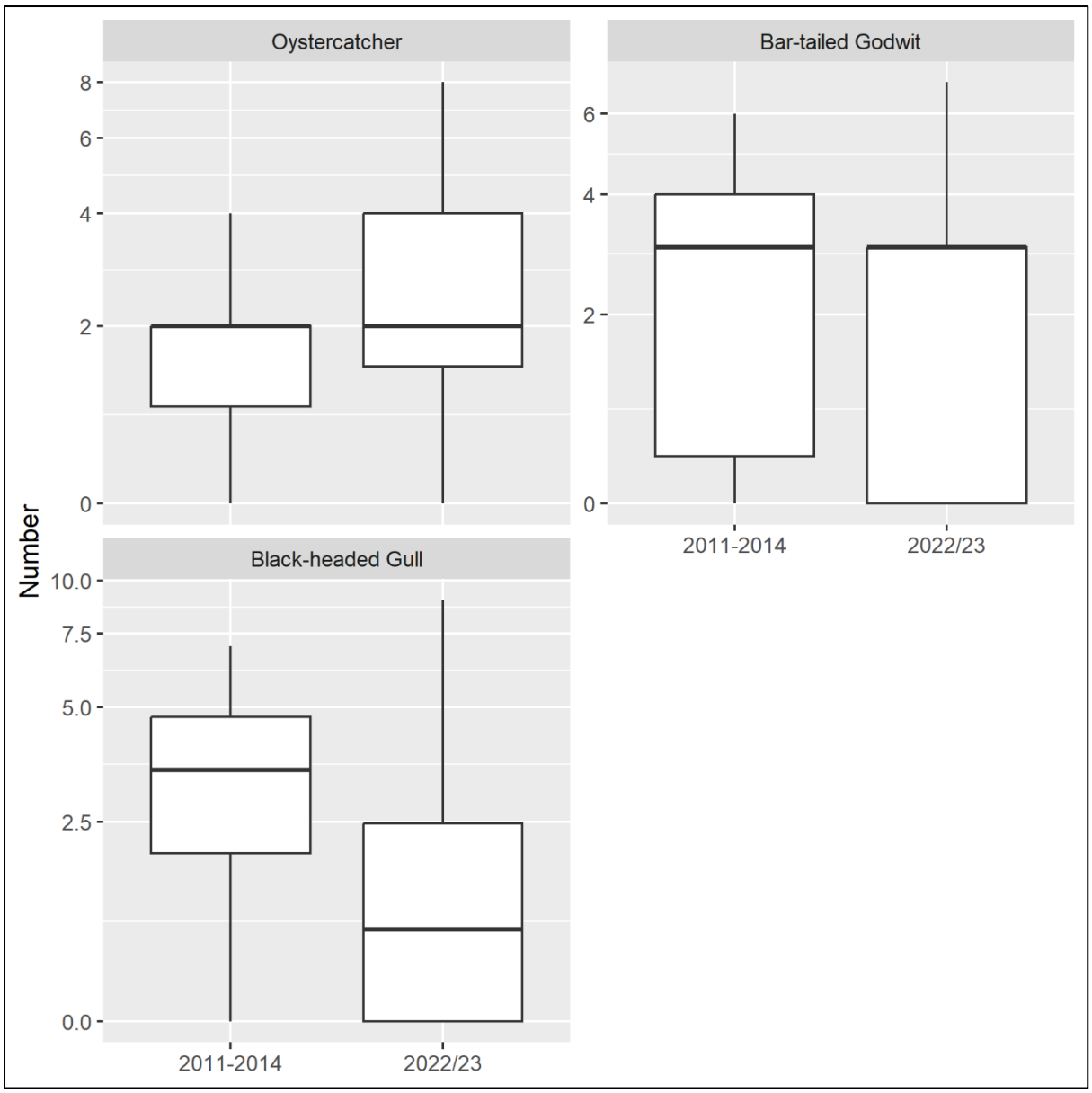


Figure 3.4. Boxplots comparing the low tide counts of regularly occurring species in the Renmore Beach area between the 2011-14 period and the winter of 2022/23.

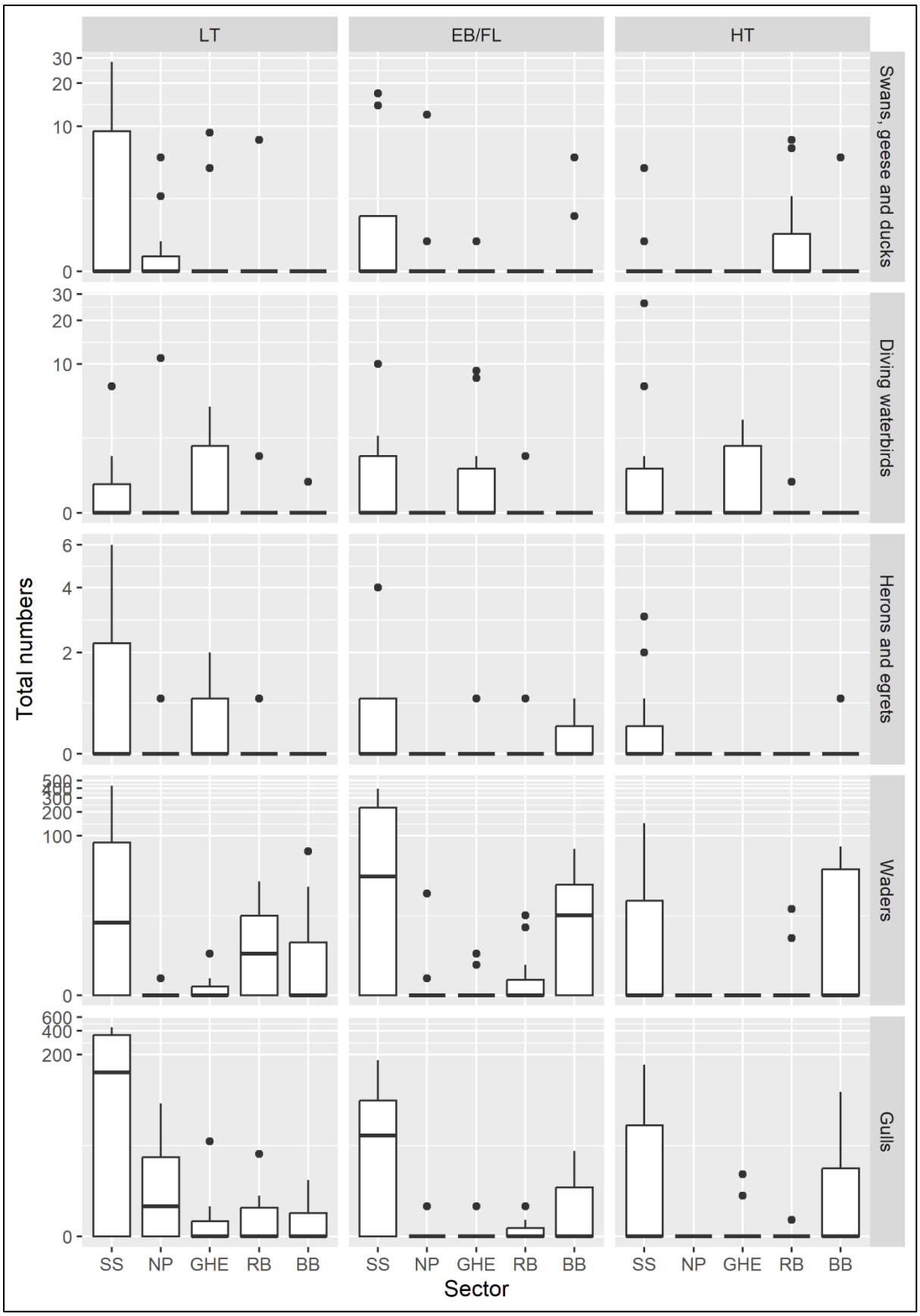


Figure 3.5. Boxplots showing the sector distribution of waterbird groups in the tidal cycle counts, 2022/23.

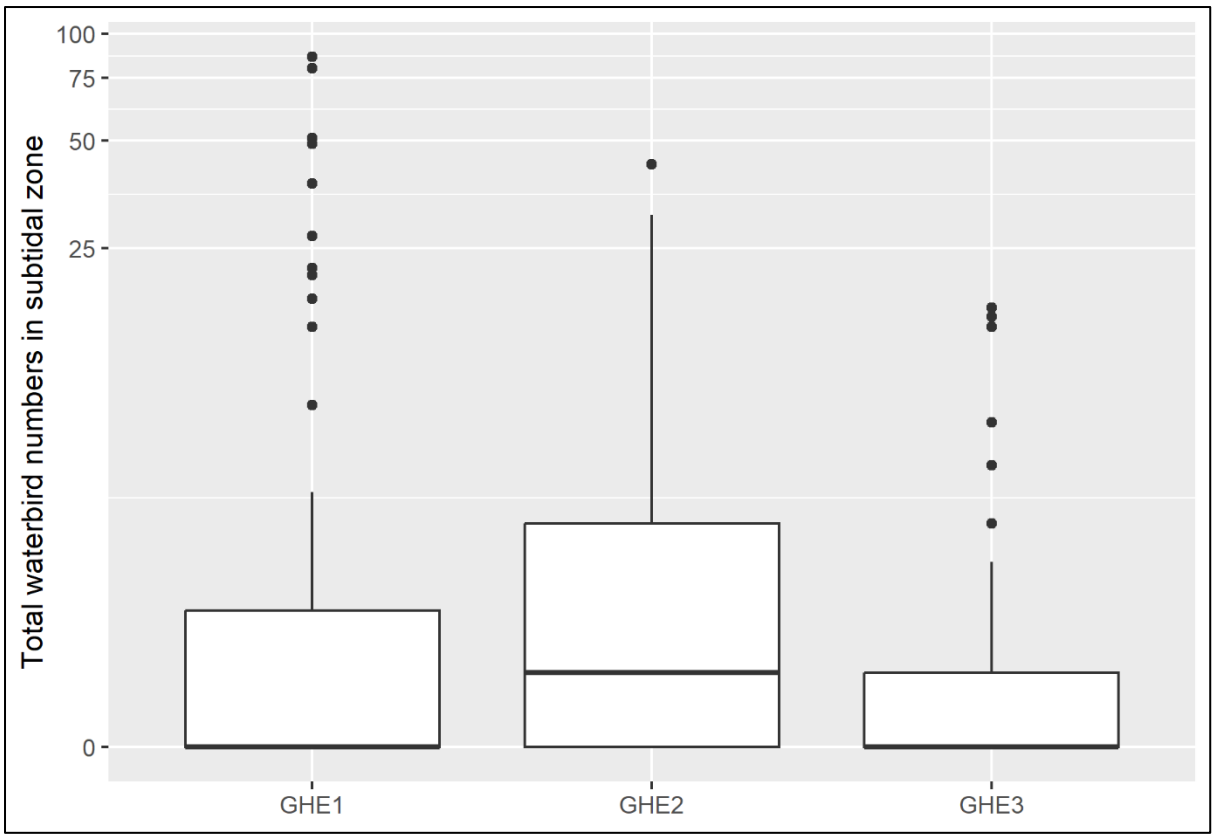


Figure 3.6. Boxplot showing the sector distribution of waterbirds in subtidal zone in the GHE count area during the vantage point watches, 2022/23.

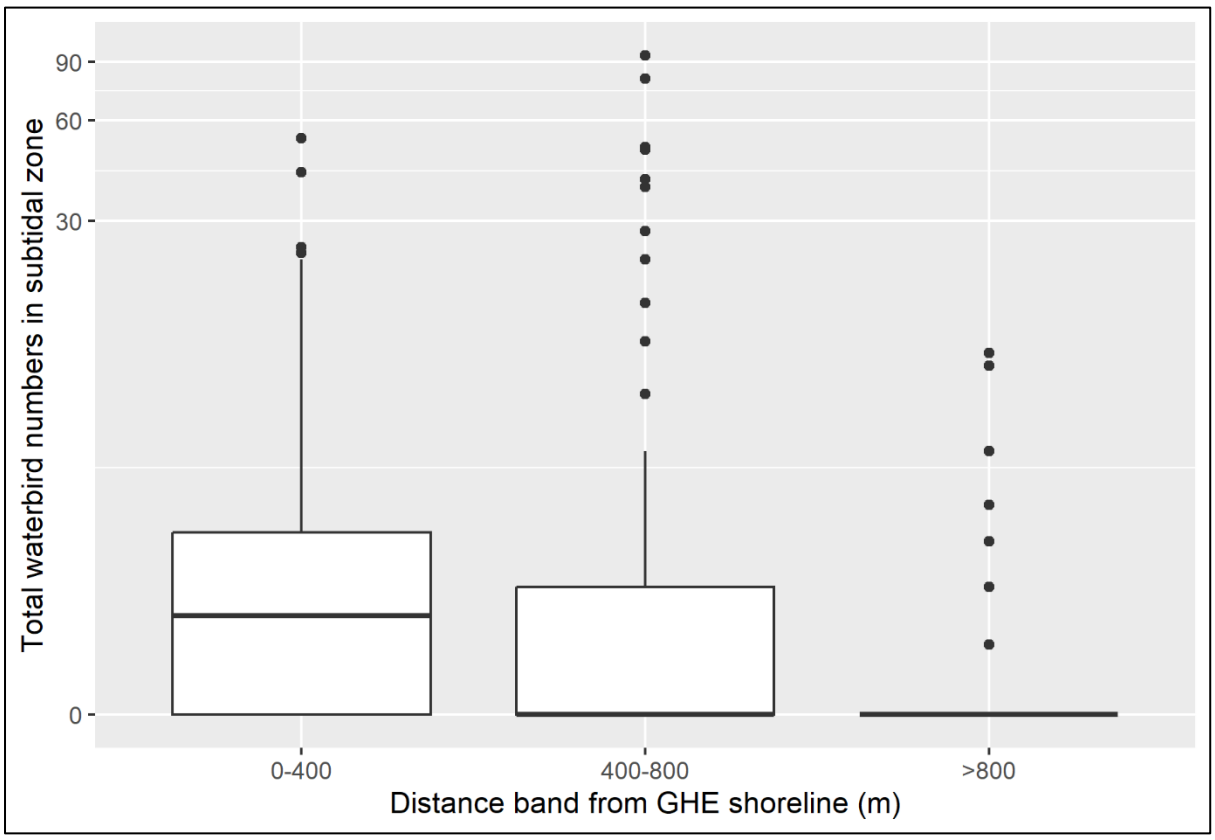
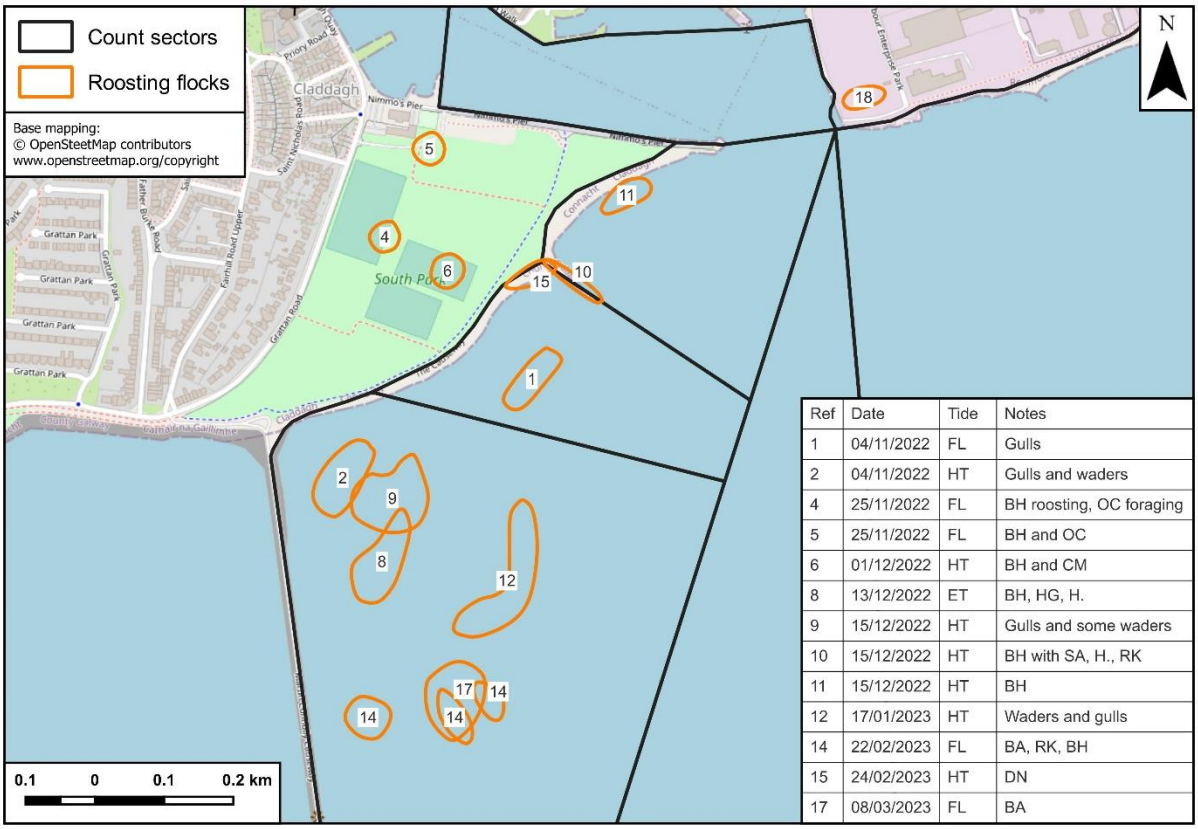
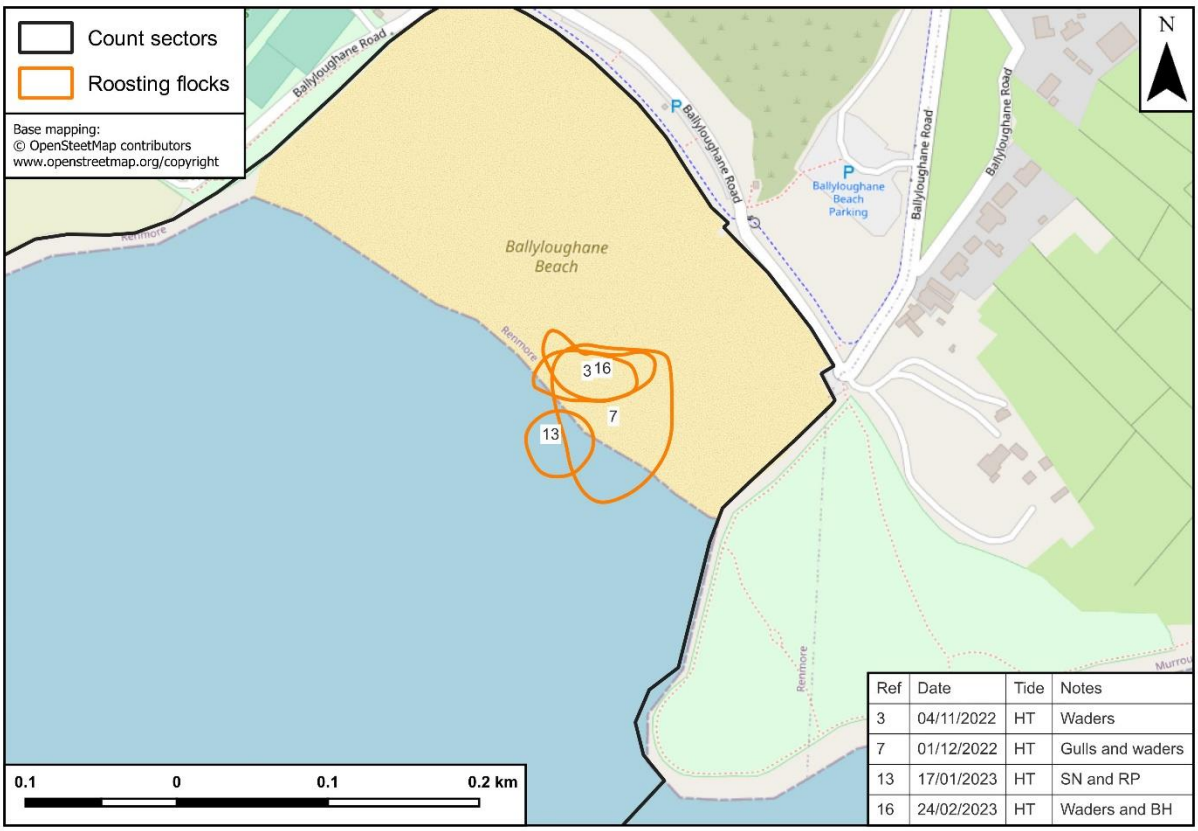


Figure 3.7. Boxplot showing the distance band distribution of waterbirds in subtidal zone in the GHE count area during the vantage point watches, 2022/23.



Map 3.1. Roost locations recorded on flood tide, high tide and ebb tide counts along the South Park Shore and in Galway Harbour.



Map 3.2. Roost locations recorded on flood tide, high tide and ebb tide counts at Ballyloughane Beach.

4. CONCLUSIONS

The results of the waterbird surveys carried out in the winter of 2022/23 show that, as in the previous survey period, the GHE count area usually supports very low numbers of waterbirds. No species occurred in numbers of national importance. Apart from a single count of 76 Ringed Plover, the peak counts of all the waterbird species were low compared to their Inner Galway Bay populations (excluding species that are poorly monitored by I-WeBS counts).

More significant numbers of several species were recorded in the tidal cycle counts, which covered the area between the Mutton Island causeway and Ballyloughane Beach. However, the numbers that occurred in the sectors adjacent to the GHE count area (NP, RB, and SS1) were relatively low.

The only frequently used high tide roosting area was exposed intertidal rocks in Sector SS3, and this area supported significant numbers of Bar-tailed Godwits on two dates. However, the largest numbers at this roosting area occurred on flood tides, suggesting that this area is mainly used for roosts assembling, with the birds moving elsewhere to roost at high tide.

A raft of 6 Great Northern Divers was observed in the GHE count area at dusk on one of the survey days. Wintering populations of Great Northern Divers form communal nocturnal roosts (Shackleton, 2012; personal observations). These roosts are usually located well offshore, with the birds first assembling into small groups and swimming purposefully towards the roost location. Given the numbers of Great Northern Diver wintering into Inner Galway Bay, it seems likely that the above observation was of a pre-roost group assembling to swim to the roost location. The actual roost location may have been some distance away as birds can swim several kilometres to the roost.

Turnstones occurred less frequently and in lower numbers in GHE count area during the 2022/23 waterbird surveys, compared to the waterbird surveys carried out in 2011-2014. This is in line with the national trend of a 46% decrease between 2006/07 and 2018/19, and a 33.6% decrease between 2013/14 and 2018/19 (Kennedy *et al.*, 2022). Apart from Turnstone, there do not appear to have been major changes in waterbird usage of the GHE count area and adjacent areas since my previous assessment (Gittings, 2014).

The density of waterbirds in the subtidal zone in the GHE count area decreased with distance from the shoreline, with very low densities recorded in the distance band that was farthest from the shoreline. For some species, such as gulls, higher numbers would be expected closer to the shoreline. However, the boat survey that I carried out (Gittings, 2015; Gittings *et al.*, 2015) recorded Great Northern Divers throughout the area surveyed with no indication of higher numbers closer to shorelines. Therefore, it seems likely that, at least for some species, the decrease in density with distance from the shoreline is due to lower detection rates of more distant birds.

The most frequently recorded disturbance impacts to waterbirds were from pedestrian and dog activity on the shoreline and in the intertidal. Only 20% of observations of powered watercraft activity, and none of the observations of non-powered watercraft activity, resulted in observed disturbance impact to waterbirds. There were no observations of watercraft activity causing disturbance impacts to Great Northern Divers.

In conclusion, the results of the 2022/23 waterbird surveys are not likely to significantly change my previous assessment of the potential impact of the Galway Harbour Extension project (Gittings, 2014). However, they provide more detail about the distribution patterns of waterbirds within, and around, the project area. This will help to support any future re-assessment and will improve the scope of baseline data available for monitoring the impact of the project.

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Kennedy, J., Burke, B., Fitzgerald, N., Kelly, S.B.A., Walsh, A.J. & Lewis, L.J. (2022). Irish Wetland Bird Survey: I-WeBS National and Site Trends Report 1994/95 – 2019/20. BirdWatch Ireland Waterbird Report to the National Parks and Wildlife Service. BirdWatch Ireland, Wicklow. (https://birdwatchireland.ie/app/uploads/2022/04/iwebs_trends_report.html).

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

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Appendix 1 Waterbird survey datasets

WATERBIRD SURVEY DATA TABLES ACCOMPANYING THIS REPORT

Filename: GHEWS_202223_count_data.csv		
Contents: Waterbird count data		
Field	**Data type**	**Details**
Survey	Text	Survey type: tidal cycle count or VP watch
Date	Date	Count date
Tide	Text	EB = ebb tide FL = flood tide HT = high tide LT = low tide Only included for the tidal cycle counts
Count	Integer	Count number Only included for the VP watches
Sector	Text	Count sector
Distance	Text	Distance band from shoreline (m): 0-400 400-800 >800 Only included for the GHE sectors
Species	Text	BTO species code
Zone	Text	Tidal zones as defined by Lewis and Tierney (2014): SUB = subtidal INT = intertidal SUP = supratidal TER = terrestrial AQU = terrestrial (aquatic)
Number	Integer	Species count
Behaviour	Text	F = feeding R = roosting H = flushed Y1 = flying (included in count totals) Y2 = flying (not included in count totals)
Quality	Text	Count quality: OK or LOW
Ref	Integer	Reference number for cross-referencing to count notes and flock maps

Filename: GHEWS_202223_count_details.csv		
Contents: Waterbird count timings and conditions		
Field	**Data type**	**Details**
Survey	Text	Survey type: tidal cycle count or VP watch
Date	Date	Count date
Tide	Text	EB = ebb tide FL = flood tide HT = high tide LT = low tide Only included for the tidal cycle counts
Count	Integer	Count number Only included for the VP watches
Sector	Text	Count sector

Filename: GHEWS_202223_count_details.csv		
Contents: Waterbird count timings and conditions		
Field	**Data type**	**Details**
Time_start	Time	Start time of sector count
Time_finish	Time	End time of sector count
Cloud	Integer	Cloud cover during count: 1 = 0-33% 2 = 34-66% 3 = 67-100%
Rain	Integer	Rainfall during count: 1 = no rain 2 = light showers/drizzle 3 = heavy shows/rain 4 = heavy rain
Wind	Integer	Wind conditions during count: 0 = none 1 = light 2 = moderate 3 = strong
Visibility	Integer	Visibility during count: 1 = good 2 = moderate 3 = poor 4 = very poor
Notes	Text	Free-form field for any relevant additional details: e.g., further details when reduced visibility was recorded

Filename: GHEWS_202223_count_notes.csv		
Contents: Notes about specific observations during the waterbird counts		
Field	**Data type**	**Details**
Survey	Text	Survey type: tidal cycle count or VP watch
Date	Date	Count date
Tide	Text	EB = ebb tide FL = flood tide HT = high tide LT = low tide Only included for the tidal cycle counts
Count	Integer	Count number Only included for the VP watches
Sector	Text	Count sector
Ref	Integer	Reference number for cross-referencing to count data and flock maps
Notes	Text	Free-form field for notes

Filename: GHEWS_202223_disturbance_data.csv		
Contents: Disturbance activities and impacts		
Field	**Data type**	**Details**
Survey	Text	Survey type: Tidal cycle count VP watch
Date	Date	Count date
Tide	Text	EB = ebb tide FL = flood tide HT = high tide LT = low tide Only included for the tidal cycle counts
Count	Integer	Count number Only included for the VP watches
Sector	Text	Count sector
Activity_type_code	Integer	Activity code from Lewis and Tierney (2014)
Activity_type_name	Text	Activity name from Lewis and Tierney (2014)
Activity_details	Text	Further details about activity (e.g., type of watercraft)
Duration	Text	Duration code from Lewis and Tierney (2014)
Affecting_birds	Text	YES or NO
Species_affected	Text	BTO code
Response_strength	Text	Response code from Lewis and Tierney (2014)
Ref	Integer	Reference number for cross-referencing to disturbance notes and maps

Filename: GHEWS_202223_disturbance_notes.csv		
Contents: Notes about specific observations of disturbance activities and impacts		
Field	**Data type**	**Details**
Survey	Text	Survey type: Tidal cycle count VP watch
Date	Date	Count date
Tide	Text	EB = ebb tide FL = flood tide HT = high tide LT = low tide Only included for the tidal cycle counts
Count	Integer	Count number Only included for the VP watches
Sector	Text	Count sector
Ref	Integer	Reference number for cross-referencing to disturbance data and maps
Notes	Integer	Free-form field for notes

WATERBIRD SURVEY GIS DATASETS ACCOMPANYING THIS REPORT

Filename: GHEWS_202223_count_sectors_polygon.shp		
Contents: Count sectors		
Field	**Data type**	**Details**
Sector	Text	Count sector code

Filename: GHEWS_202223_ distance_bands_polyline.shp		
Contents: Distance bands from shoreline		
Field	**Data type**	**Details**
Distance	Integer	Distance band from shoreline (m)

Filename: GHEWS_202223_ flock_maps_point.shp		
Contents: Flock locations recorded as points during the waterbird surveys		
Field	**Data type**	**Details**
Survey	Text	Survey type: Tidal cycle count VP watch
Date	Date	Count date
Tide	Text	EB = ebb tide FL = flood tide HT = high tide LT = low tide Only included for the tidal cycle counts
Count	Integer	Count number Only included for the VP watches
Ref	Integer	Reference number for cross-referencing to count data and count notes

Filename: GHEWS_202223_ flock_maps_polygon.shp		
Contents: Flock locations recorded as polygons during the waterbird surveys		
Field	**Data type**	**Details**
Survey	Text	Survey type: Tidal cycle count VP watch
Date	Date	Count date
Tide	Text	EB = ebb tide FL = flood tide HT = high tide LT = low tide Only included for the tidal cycle counts
Count	Integer	Count number Only included for the VP watches
Ref	Integer	Reference number for cross-referencing to count data and count notes

Appendix 2 Survey dates and timings

Table A2.1. Dates and timings of the tidal cycle counts.

Survey month	Date	Tide	Start time	Finish time
Oct	04/11/2022	FL	09:50	11:58
		HT	12:55	14:53
	05/11/2022	LT	07:45	09:57
Nov	25/11/2022	FL	13:40	16:06
		LT	10:40	12:48
	01/12/2022	HT	10:40	12:30
Dec	13/12/2022	EB	10:05	12:15
		LT	13:15	15:23
	15/12/2022	HT	08:55	10:50
Jan	17/01/2023	FL	08:45	10:50
		HT	11:44	13:35
		LT	14:02	16:02
Feb	22/02/2023	FL	14:20	16:30
		HT	07:26	08:56
		LT	11:10	13:35
Mar	08/03/2023	FL	13:40	15:46
		LT	10:25	13:02
	23/03/2023	HT	17:00	18:32

Table A2.1. Dates and timings of the vantage point watches.

Survey month	Date	Start time	Finish time
Oct	27/10/2022	08:50	16:50
Nov	28/11/2022	08:30	16:30
Dec	14/12/2022	08:30	16:30
Jan	20/01/2023	08:10	16:10
Feb	12/02/2023	09:45	17:45
Mar	07/03/2023	09:30	17:30