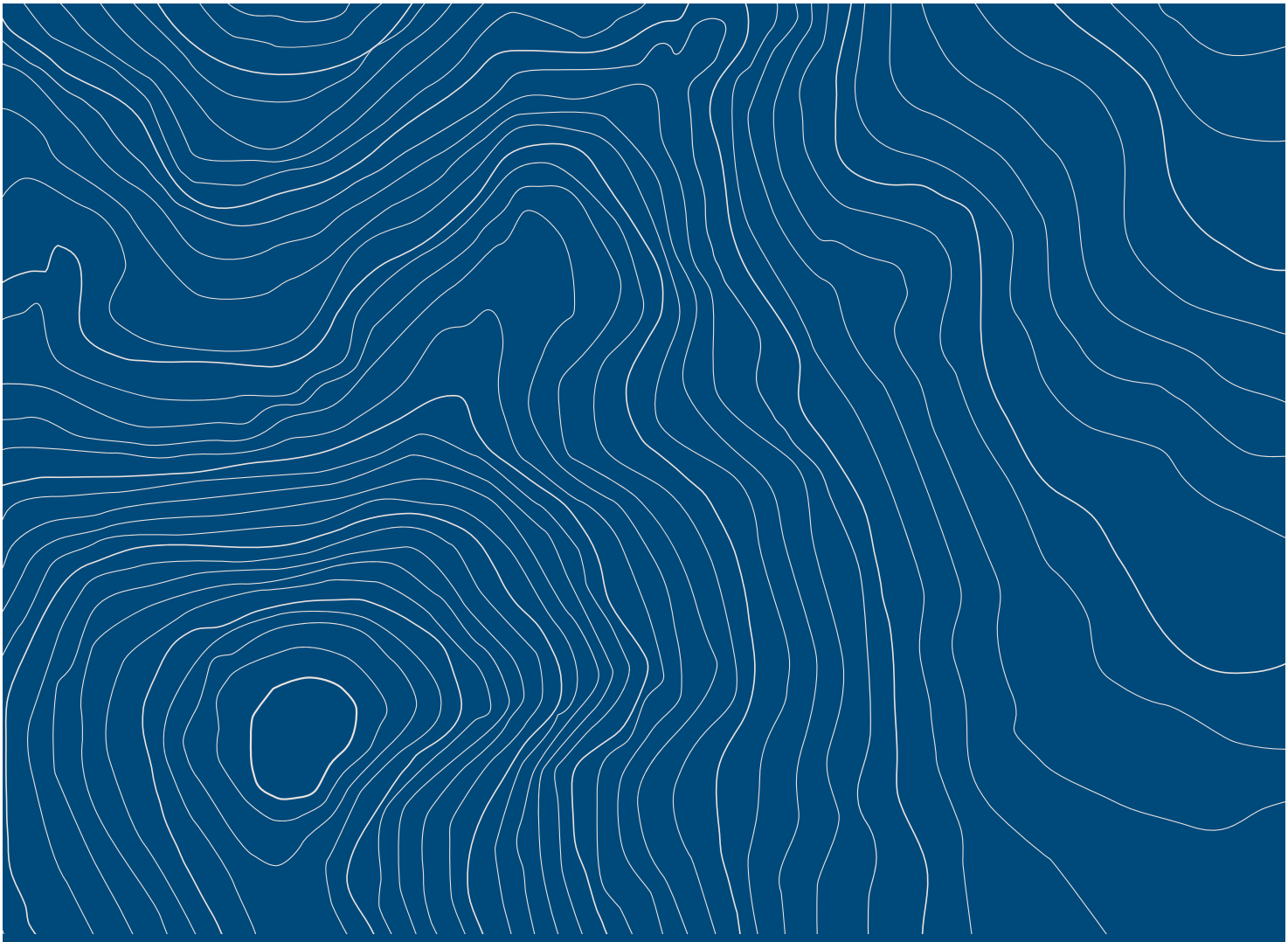

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Kish Offshore Wind Ltd

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DUBLIN ARRAY OFFSHORE WIND FARM

IR0539 Boat Based Bird and Marine Mammal

Survey Report June 2019 - September 2020

Prepared for: Kish Offshore Wind Ltd

& Bray Offshore Ltd

SLR Ref: 501.00571.00002
Version No: 1
June 2021

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Executive Summary

SLR Consulting Ireland (SLR) was appointed by RWE Renewables to undertake boat-based marine bird and mammal surveys to inform the Environmental Impact Assessment (EIA) and planning submission for the Dublin Array Offshore Windfarm. These surveys were to establish baseline information on seabird and marine mammal distributions within the proposed project area, while considering seasonal variations.

A substantial body of data is available for both seabirds and marine mammals in the western Irish Sea, including surveys previously undertaken for the Dublin Array project. Due to the natural variability in seabird distribution and abundance, additional baseline surveys were required to supplement the historical data and provide a robust account on the current baseline data.

The aim of the boat-based surveys was to collect data from Kish and Bray Banks with a 4 km buffer zone. Surveys have been carried out since June 2019, and are ongoing until April 2021, collecting data on species density, abundance, distribution, and patterns of behaviour within the study area. This report presents the findings of the surveys carried out over the period June 2019 to September 2020. The subsequent surveys will be addressed in a separate report.

1.0 Introduction

SLR Consulting Ltd (SLR) was commissioned in April 2019 to carry out boat-based marine bird and mammal surveys for the Dublin Array Offshore Wind Farm project. This report presents the findings of the surveys carried out over the period June 2019 to September 2020 with subsequent surveys addressed in a separate report.

1.1 Background

RWE Renewables Limited (formerly known as Innogy Renewables Ltd) proposes to develop and operate an offshore wind farm, known as the Dublin Array, offshore of County Wicklow, Dun Laoghaire-Rathdown County & the city of Dublin. The Dublin Array project in its entirety is comprised of the offshore wind turbine array, ancillary offshore structures, marine export cables and onshore infrastructure. The Dublin Array has a proposed electrical generating capacity of 600-900MW and is to be located within an area of 54 km^2.

1.2 Location and Setting

A 4 km buffer around the Kish & Bray bank development areas has been used, based on guidance from the Department of Communications, Climate Action and Environment (DCCAE, 2018) and the Collaborative Offshore Wind Research Into the Environment (COWRIE), (Maclean et al 2009)[1].

The proposed offshore development area for Dublin Array overlaps with the Rockabill to Dalkey Island Special Area for Conservation (SAC). Other SACs[2] and designated areas such as Special Protected Areas[3] (SPA), reasons for designations and proximity to the Dublin Array study area can be seen in Table 1.1 & Figure 1.

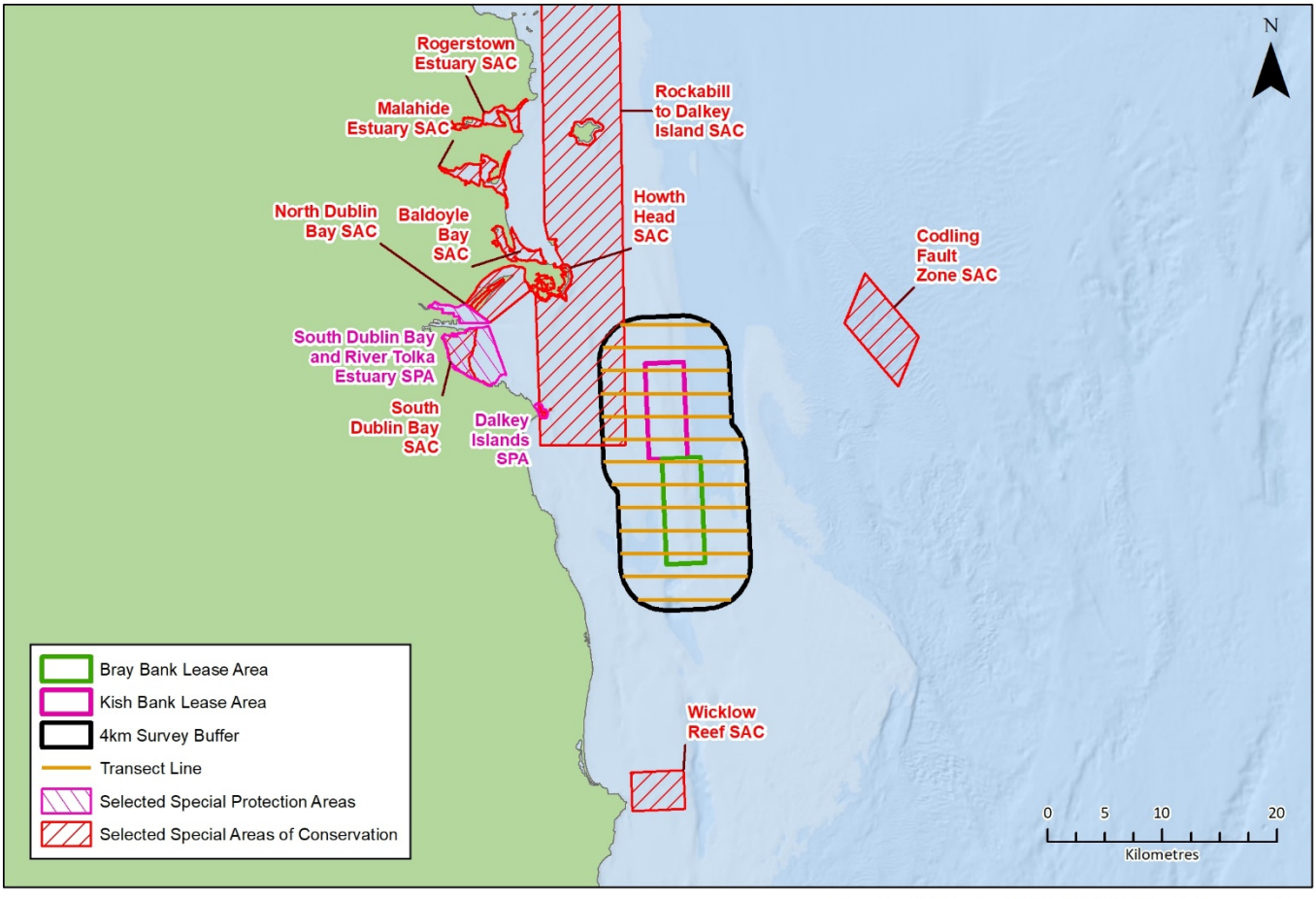
Table 1-1: Designated Areas & Reasons for Designation

Name	Designation	Reason for Designation
Rockabill to Dalkey Island	SAC	Reefs & Harbour Porpoise.
Codling Fault Zone	SAC	Submarine structures made from natural gases.
Bray Head	SAC	Vegetated sea cliffs of Atlantic and Baltic coasts & European dry heaths.
Murrough Wetlands	SAC	Annual vegetation of drift lines, perennial vegetation of stony banks, Atlantic salt meadows, Mediterranean salt meadows, calcareous and alkaline fens.
Wicklow Reef	SAC	Reefs.
Dalkey Islands	SPA	Roseate tern, Common tern & Arctic tern.
Rogerstown & Malahide Estuaries	SAC	Estuaries, mudflats, sandflats, Atlantic salt meadows, Mediterranean salt meadows, white dunes, fixed coastal dunes with herbaceous vegetation.

[1] https://tethys.pnnl.gov/sites/default/files/publications/Maclean-et-al-2009.pdf
[2] https://www.npws.ie/protected-sites/sac
[3] https://www.npws.ie/protected-sites/spa

Name	Designation	Reason for Designation
Baldoyle Bay, North Dublin Bay & South Dublin Bay	SAC	mudflats, sandflats, Atlantic salt meadows, Mediterranean salt meadows, white dunes, fixed coastal dunes with herbaceous vegetation.
South Dublin Bay and River Tolka Estuary	SPA	Light-bellied Brent goose, Oystercatcher, Ringed plover, Grey plover, Knot, Sanderling, Dunlin, Bar-tailed godwit, Redshank, Black-headed gull, Roseate Tern, Common tern, Arctic tern, wetland and waterbirds.

Figure 1: Designated Areas & Proximity to Dublin Array



Base Map: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

1.3 Purpose of the Report

This survey report presents the findings of the boat-based seabird and marine mammal surveys carried out by SLR between June 2019 and September 2020 for the Dublin Array offshore project area. The purpose of this survey report is to present the findings of the boat-based seabird and marine mammal surveys carried out between June 2019 and September 2020. This report is supplemented by a separate report prepared for the

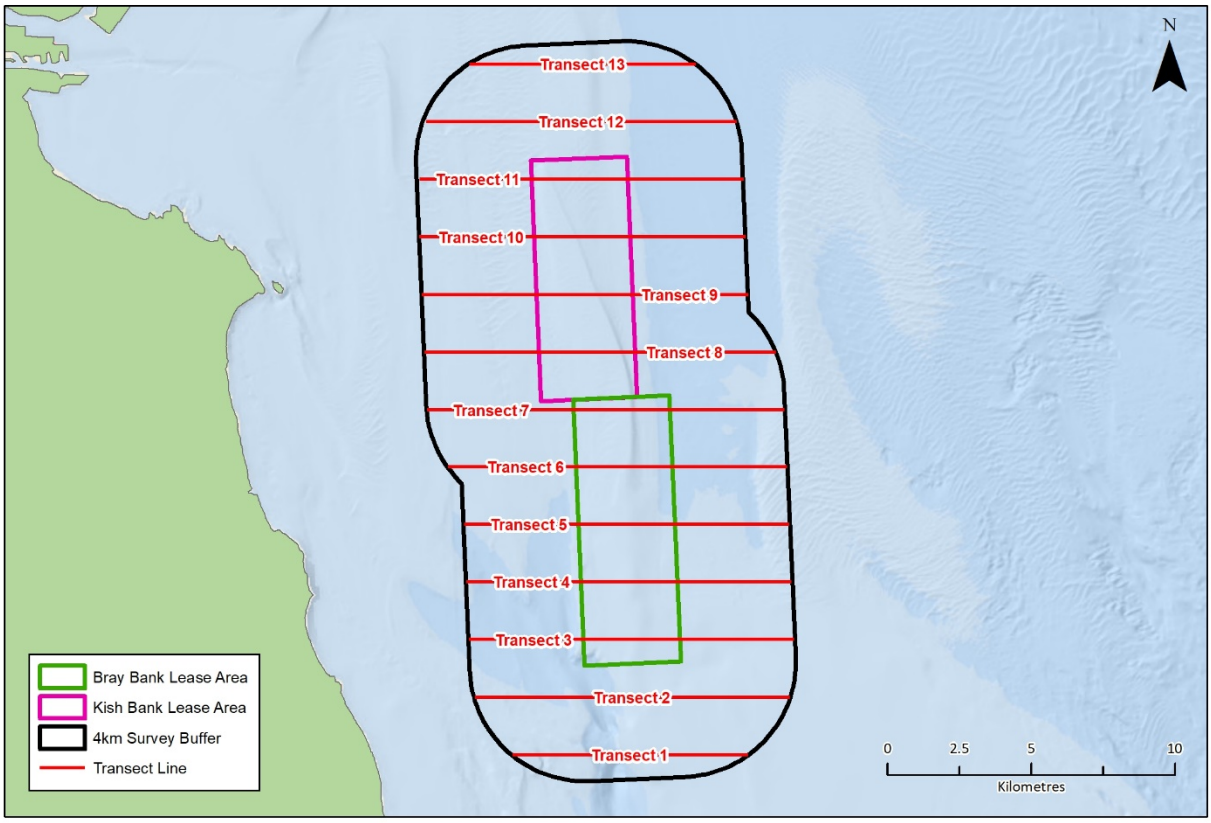
survey period October 2020 to April 2021. The assessment of impacts resulting from the proposed development and the development of mitigation measures, if required, are beyond the scope of this survey report.

2.0 Methods

The DCCAE Guidance recommends that between two and three years of ornithological and marine mammal baseline survey should be undertaken (DCCAE, 2018) but that the requirement for this is dependent on the sensitivity of the survey area and availability of existing data.

Two dedicated teams of Seabird Observers (SBOs) and Marine Mammal Observers (MMOs) collected sightings data for the Dublin Array project between June 2019 and April 2021.The SBO and MMO were aboard the same survey vessel each month, when weather conditions were suitable, collecting data for future analysis. The vessel travelled at an average speed of 10 knots along each of the 13 predetermined transect lines spaced 2 km apart on an east-west course as shown in Figure 2. The transects coordinates are provided in Appendix 1.

Figure 2: Location of Study Area & Transects



Base Map: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Four different survey vessels were used during the survey period June 2019 – September 2020 as set out in Table 2-1. AMS Panther was the vessel most used for the Dublin Array surveys with AMS Husky and MV Keary and Fastnet Petrel used when AMS Panther was not available. All survey vessels used had an observer eye-height of greater than 5 m and birds were counted ahead of the ship and out to one side of the survey vessel in a 90° arc. A transect width of 300 m was used with two surveyors as recommended for ESAS and MMO surveys (Webb & Durinck 1992, Camphuysen et al., 2004).

Unstable weather conditions in February and March 2020 meant that it was not possible survey while the COVID-19 global pandemic prevented survey in April 2020. However, an extra survey was conducted in early May to cover lost survey time in April. On completion of each survey, survey forms (see Appendix 2) were scanned, digitised into excel and manually checked before any subsequent data analysis.

Table 2-1: Summary of Survey Effort & Vessels used

Survey Date	Vessel	Sea State Range	Maximum Sea State	% Coverage[4]
24/06/2019	RV Keary	1-3	3	100%
27/07/2019	Fastnet Petrel	3-4	4	100%
07/08/2019	AMS Panther	1-3	3	100%
27/08/2019	Fastnet Petrel	1-4	4	100%
10/09/2019	AMS Panther	2-4	4	100%
22/09/2019	AMS Panther	1-4	4	100%
26/10/2019	AMS Panther	3-4	4	100%
06/11/2019	AMS Panther	1-2	2	100%
17/12/2019	AMS Panther	3	3	100%
27/01/2020	AMS Panther	1-3	3	100%
February 2020	No survey	-	-	0%[5]
March 2020	No survey	-	-	0%[6]
April 2020	No survey	-	-	0%
06/05/2020	AMS Panther	1-5	5	99.03%
26/05/2020	AMS Panther	1-2	2	100%
25/06/2020	AMS Panther	1-2	2	100%
14/07/2020	Husky	2-3	3	100%
27/08/2020	AMS Panther	3-4	4	100%
07/09/2020	AMS Panther	3-4	4	100%

[4] Where coverage is less than 100% it is due to survey / part of survey being carried out in Sea State 5. Surveys in Sea State 5 were not included in the analysis.
[5] February 2020 there was no survey carried out due to unsuitable weather.
[6] Mar– April 2020 there were no surveys carried out due to Irish government restrictions due to COVID-19.

2.1 Marine Bird Monitoring

Three ESAS accredited surveyors were on board for surveys between June 2019 and January 2020. However, due to Covid-19 restrictions, there was only space for two ESAS accredited surveyors on surveys between May and September 2020. At any one time, one surveyor was acting as the primary observer, with a second acting as scribe and secondary observer, while the third surveyor (if present) was on a break. Binoculars were used to confirm identifications as well as to scan ahead for easily disturbed species.

Two additional surveys were conducted in both August and September 2019 to provide additional coverage of post breeding seabird activity and distribution. As recommended in the DCCAE 2018 Guidance Part 2, the methods used to conduct the baseline seabird surveys followed standard COWRIE approved survey methodology (Camphuysen et al., 2004).

Birds on the water were assigned to distance bands (A = 300 m), according to their perpendicular distance from the ship's track. A snapshot method was used for flying birds, which considers the ship's speed and prevents overestimation of flying seabird densities. In addition, the estimated height of flying birds was also recorded in five height bands above sea level: 0-5 m, 5-10 m, 10-20 m, 20-30 m, >30 m.

The count interval for surveys was 1 minute intervals, and synchronised GPS recorders were used to record the vessel position every minute. Any uncommon bird species or large flocks of feeding birds seen on the 'non-survey' side of the vessel were also recorded. All terrestrial bird species seen were also recorded.

Environmental conditions such as wind direction and force, sea state, swell height and visibility were recorded every 15 minutes throughout survey days. Surveys were carried out in good weather where possible, to maximise detection rates of birds on the water. Surveys were halted if the sea state exceeded sea state 4, as recommended in Camphuysen et al., (2004).

Baseline surveys were conducted by the following team of ESAS accredited surveyors: Ciarán Cronin (Survey Leader), André Robinson, Laura Kavanagh, Niall Keogh, Nick Veale and Paul Connaughton. Seabird data was recorded on field sheets (found in Appendix 2) in preparation for future data entry and analysis in the ornithology technical baseline report.

2.2 Marine Mammal Monitoring

The marine mammal surveys were conducted simultaneously to the seabird surveys using boat-based line transect survey methodology as outlined by JNCC. Line-transect surveys are the most frequently used method for monitoring marine mammals in a predefined series of transects within a survey area. This survey technique provides information on abundance and distribution of species and requires favourable (sea state of 3 or less) weather conditions to minimise influence from environmental variables[7].

Marine mammal sightings were collected from a single platform and to meet the requirements of the bird-survey protocol, the vessel did not deviate from the transect to collect additional data on species composition or group size. The survey team used GPS units to record the vessel position every 15 seconds and were also supported by the ship navigation systems.

Two MMOs were on watch simultaneously with one MMO on each side of the vessel for each transect (survey forms can be found in Appendix 2). Sightings were recorded from perpendicular to the vessel (90° from the bow) to 10° from the bow to ensure survey effort did not overlap.

Observation effort was focused within 1km of the vessel, searching primarily with the naked eye and supplemented with binoculars. Binocular reticles were used to estimate distance, and a compass was used to determine angles. The presence of fishing vessels and static fishing gear was recorded on all surveys from August 2019 onwards. A towed hydrophone array was initially deployed to provide supplementary acoustic data, however due to the high level of static fishing gear present in the survey area, they were not continued.

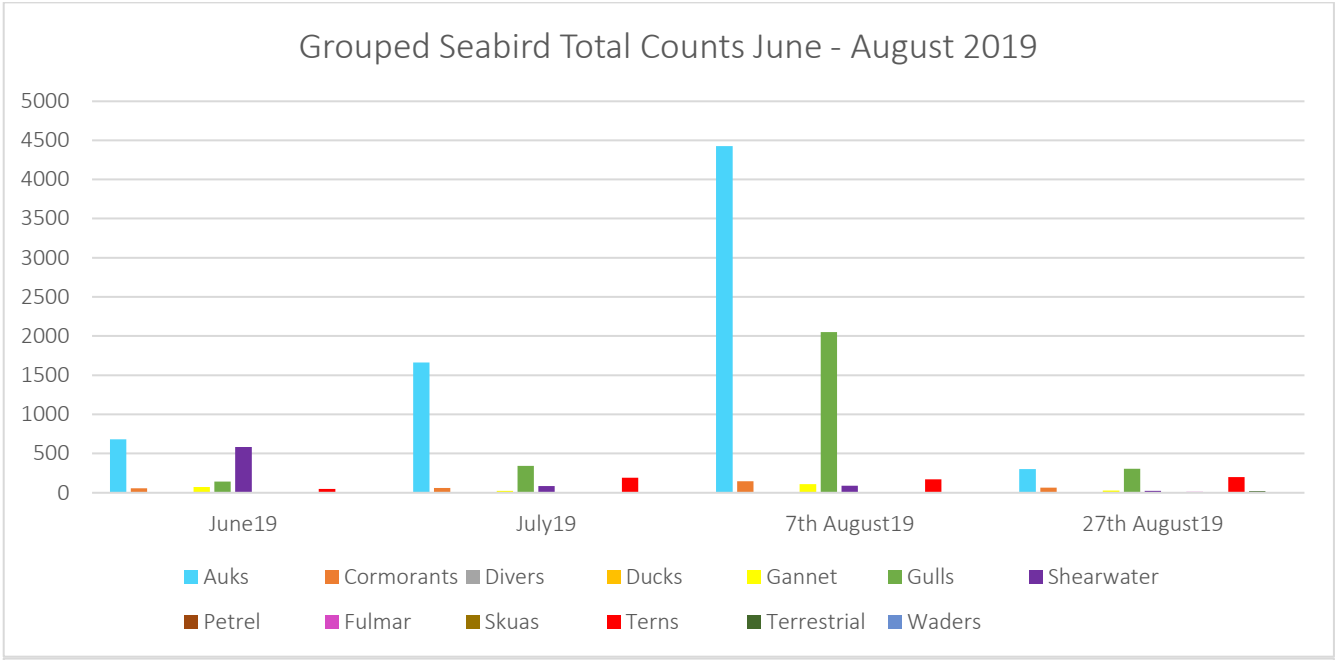
[7] https://tethys.pnnl.gov/sites/default/files/publications/SMRU_2010_Monitoring.pdf

3.0 Results

Total survey counts of sightings, as opposed to a transect-by-transect analysis of sightings, has been displayed to allow easy visualisation of data for each survey. The seabird data presented in this report has been 'grouped' where appropriate, to allow visual representation of seabirds throughout the survey period (see Appendix 3 for bird species, total counts and assigned groups). Marine mammal total counts can be found in Appendix 04.

3.1 Grouped Seabird Abundance June 2019-September 2020

Figure 3: Charts of Grouped Seabird Total Count June 2019-November 2019



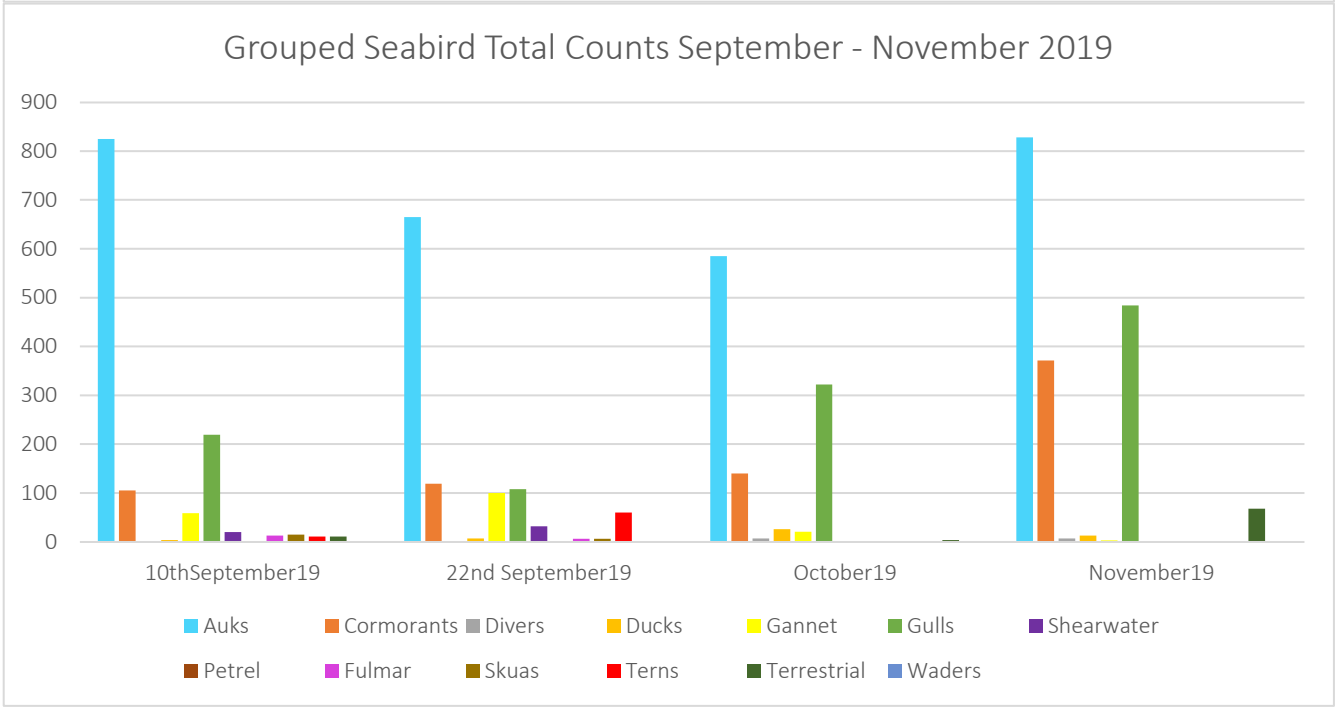
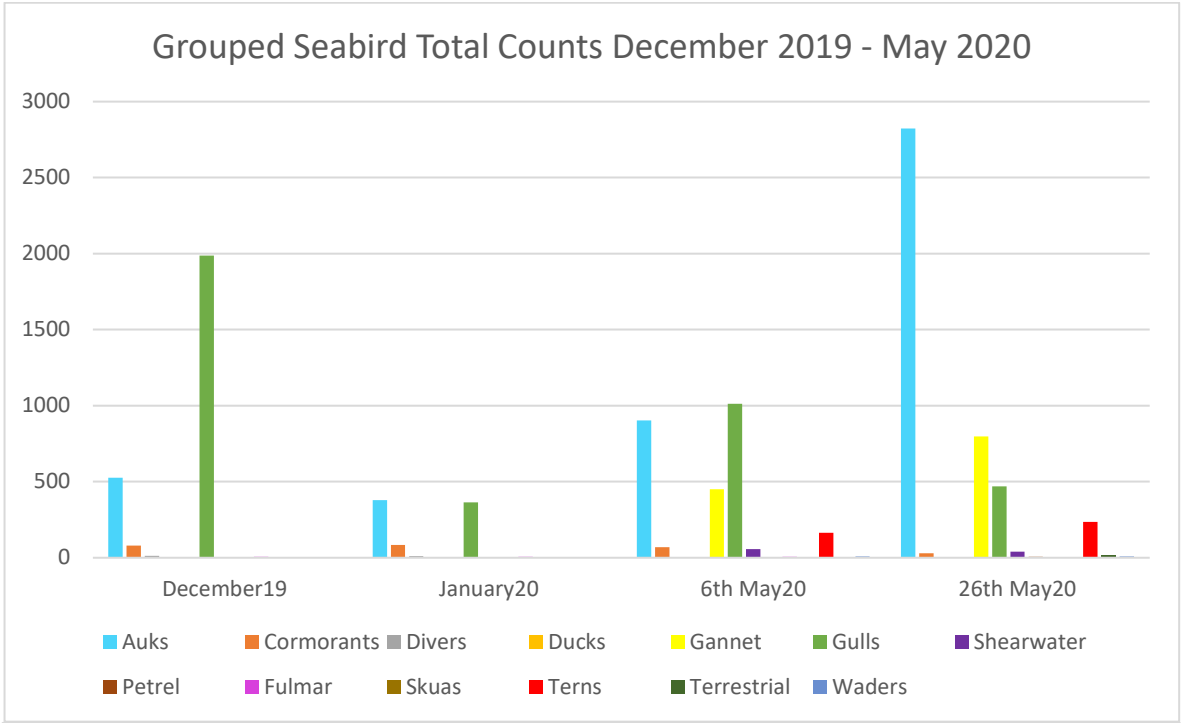


Figure 4: Charts of Grouped Seabird Total Count December 2019-September 2020



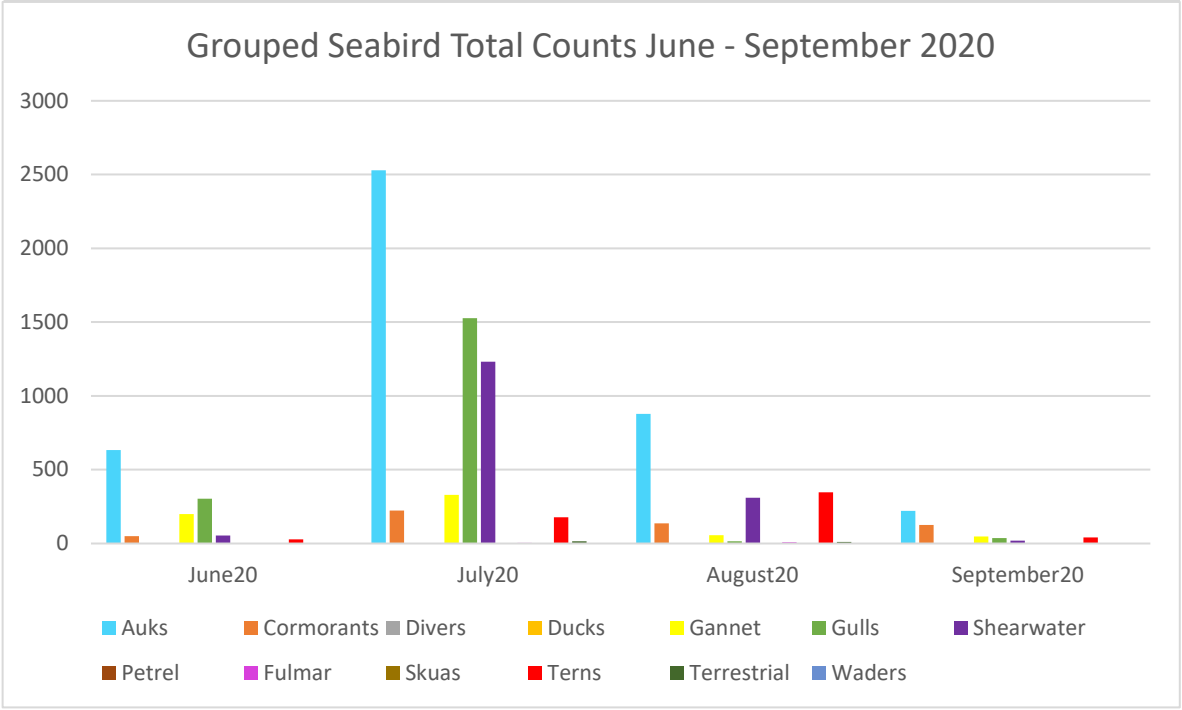
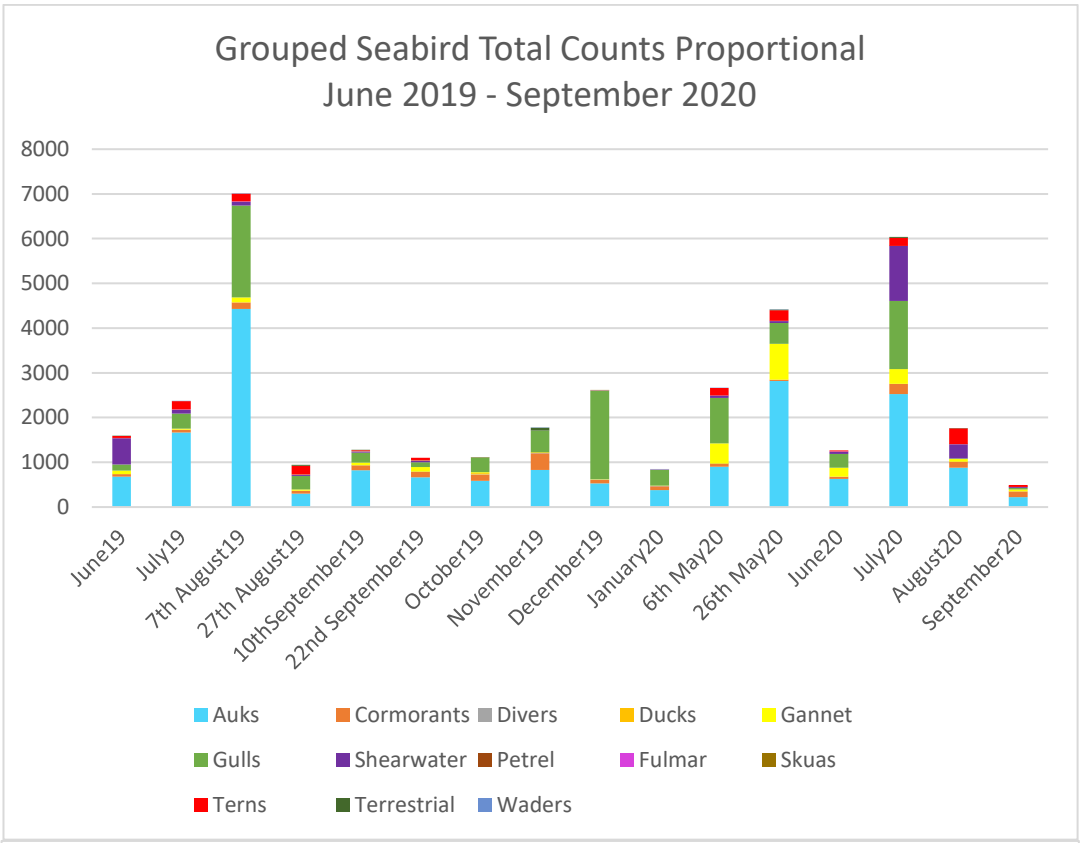
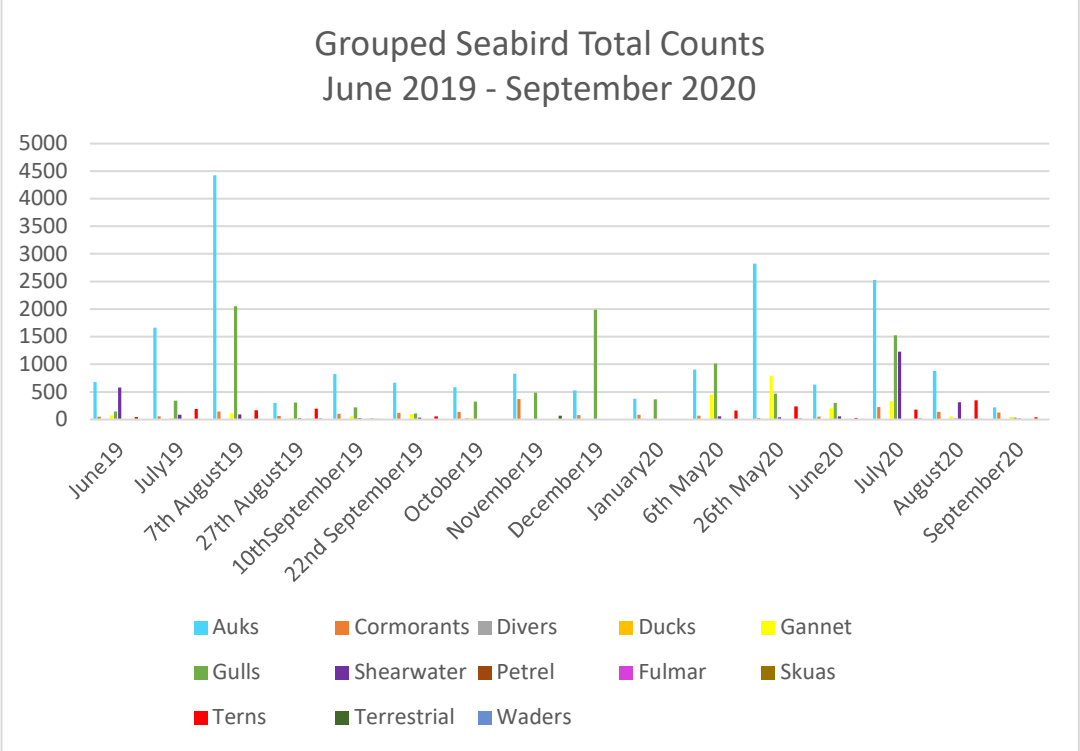


Figure 5: Charts of Grouped Seabird Total Count June 2019-September 2020



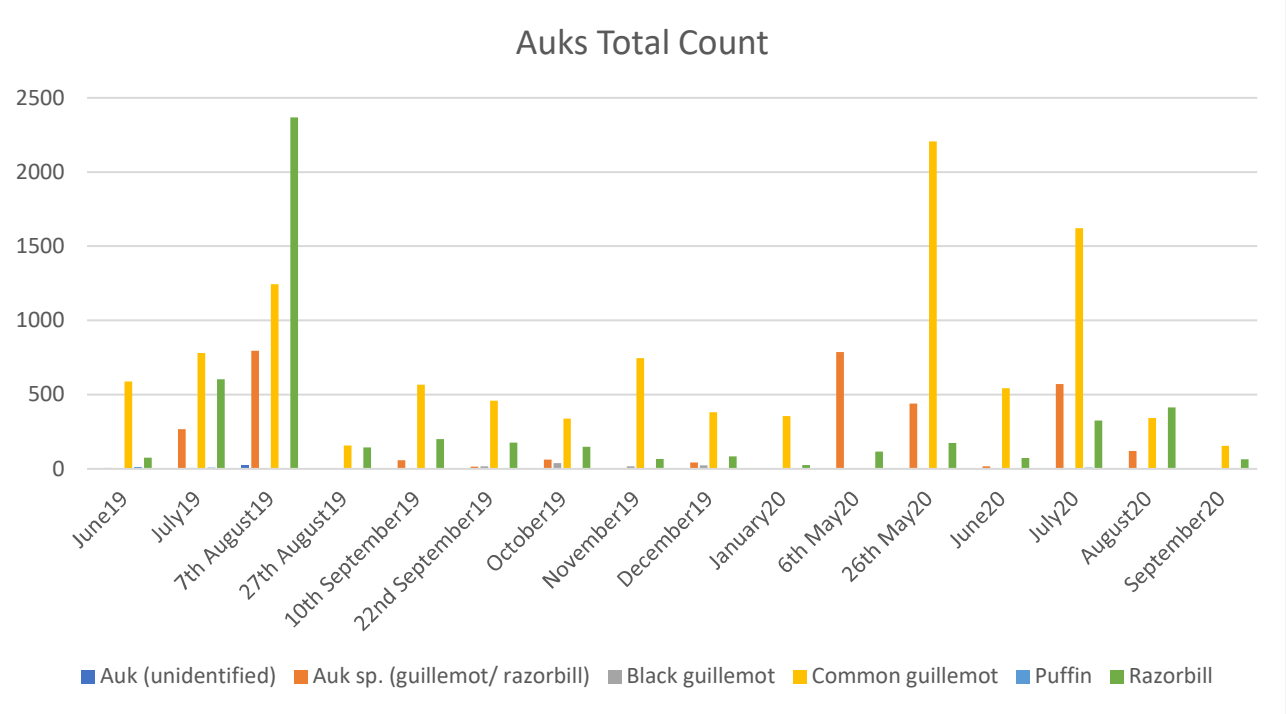


3.2 Marine Bird Summaries

3.2.1 Auks: Common guillemot, Black guillemot, Razorbill & Puffin

Auks are excellent swimmers and spend most of their time at sea, visiting cliffs to breed every spring[8]. Between the June 2019-Septmber 2020 surveys, Auks (particularly Common guillemots) consistently outnumbered any other species of birds recorded. Auks were found in significantly high numbers (4000+) during the 7 August 2019 survey with a high proportion of those identified as Razorbills.

Figure 6: Auks Total Count & Species Composition June 2019- September 2020

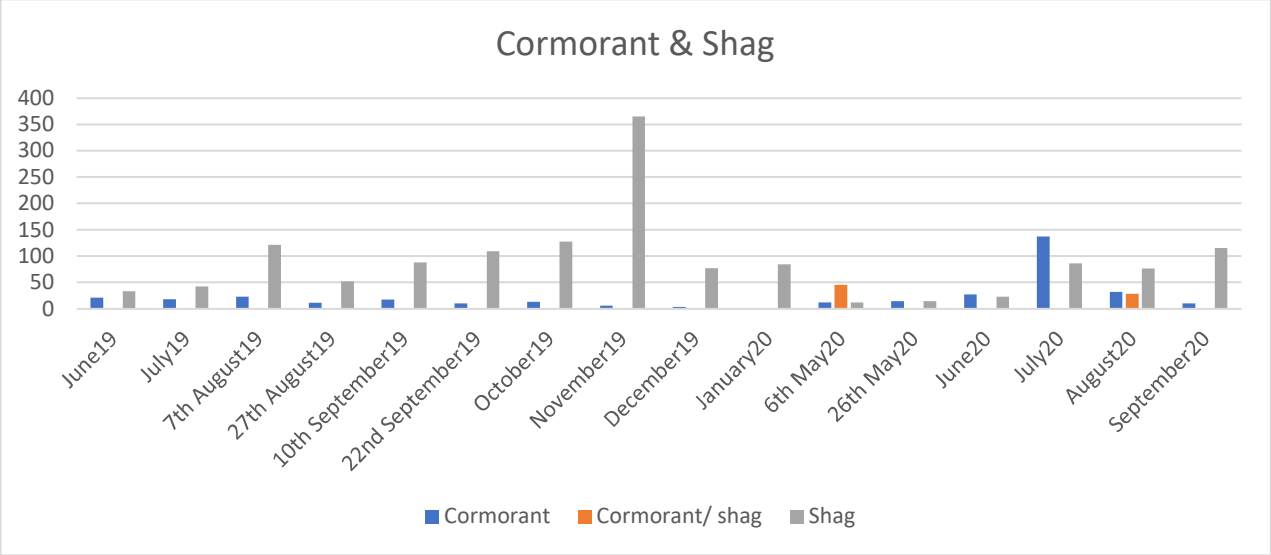


[8] https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/auk-family/

3.2.2 Cormorant & Shag

Cormorants are generally an inshore species, feeding in coastal waters. [9]. Cormorants were seen on every survey apart from January 2020 with particularly high numbers seen in the July 2020 survey. Shags are resident to Irish coastal environments and usually stay within 100-200km of their breeding colonies[10]. They were seen in all surveys with significantly high numbers recorded in the November 2019 survey.

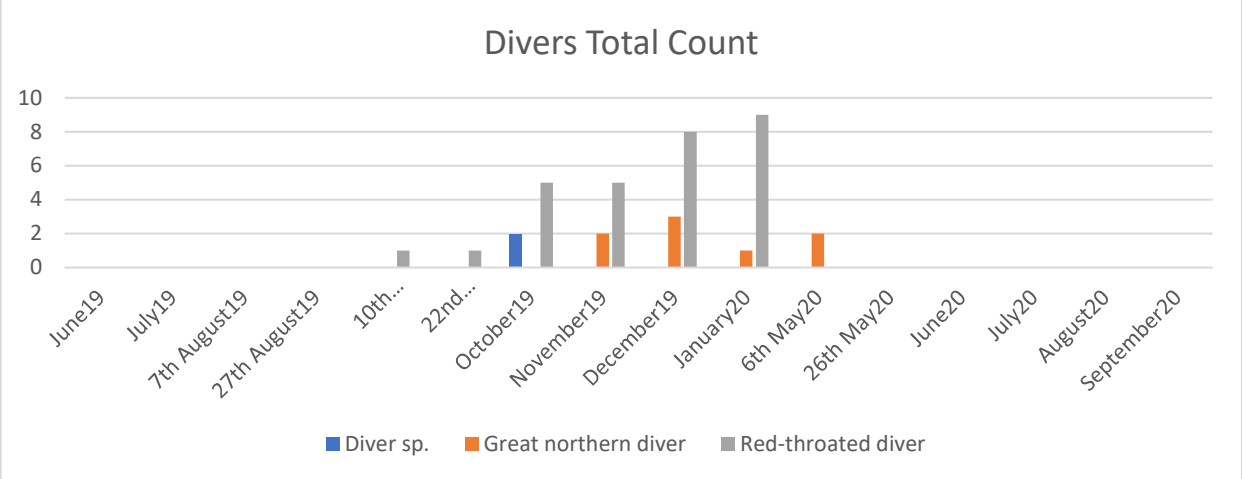
Figure 7: Cormorant & Shag Total Species Count June 2019- September 2020



3.2.3 Divers: Great northern & Red-throated Diver

Great northern & Red-throated divers are winter visitors to the Irish coasts[11] and combined peak numbers appeared in the December 2019 survey.

Figure 8: Divers Total Count & Species Composition June 2019- September 2020

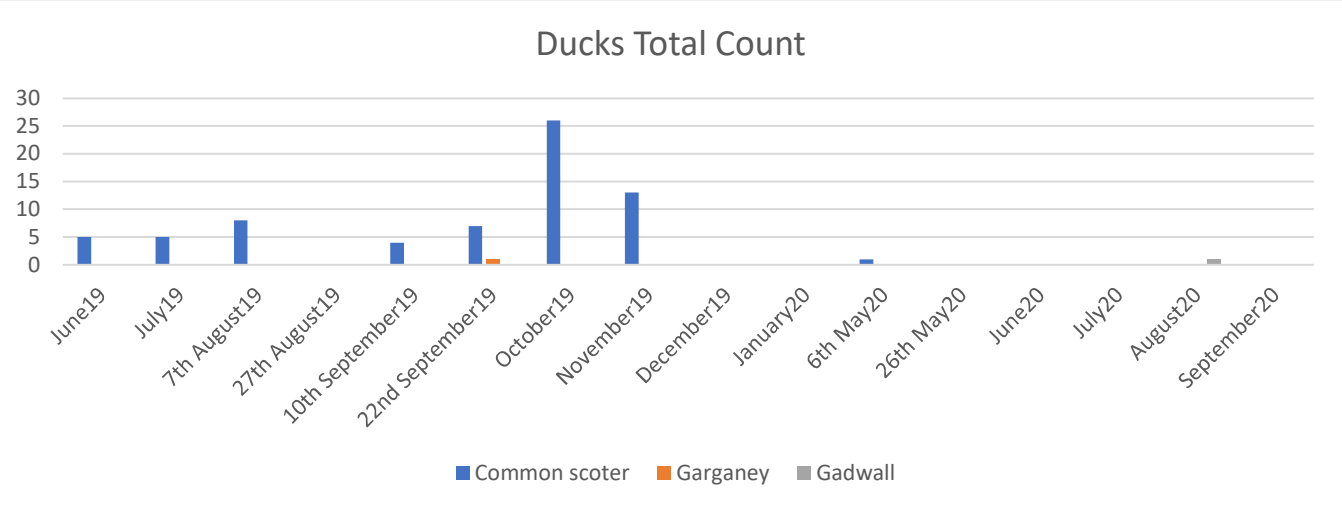


[9] https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/cormorants-and-shags/
[10] https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/shag/
[11] https://www.wildlifetrusts.org/wildlife-explorer/birds/grebes-and-divers/red-throated-diver

3.2.4 Ducks: Common scoter

The highest numbers of Common scoters recorded was in the October 2019 survey however, they were generally seen in small numbers throughout the survey period of June 2019-September 2020. In addition, singles of two freshwater species (garganey and gadwall) were also recorded in September 2019 and August 2020 respectively.

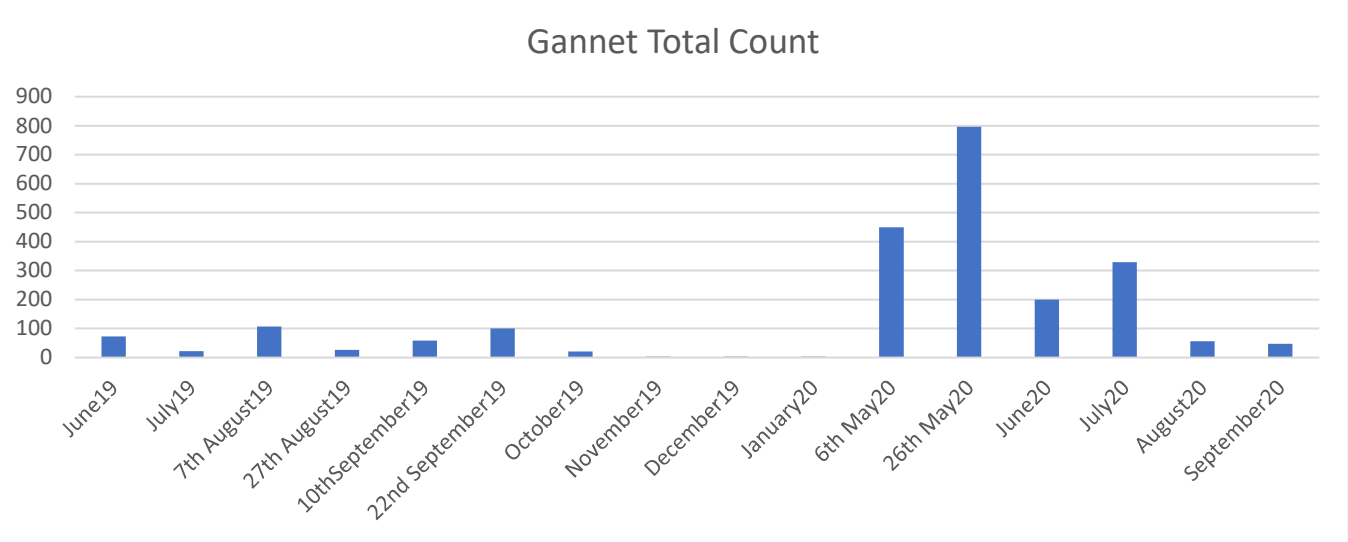
Figure 9: Ducks Total Count & Species Composition June 2019- September 2020



3.2.5 Gannet

Gannets are common seabirds in Irish waters in summer, breeding at several large colonies around the coast. In winter, the majority of birds travel to more southern waters[12]. Gannets were seen in every survey with peak numbers seen between May-July 2020 surveys.

Figure 10: Gannet Total Count June 2019- September 2020

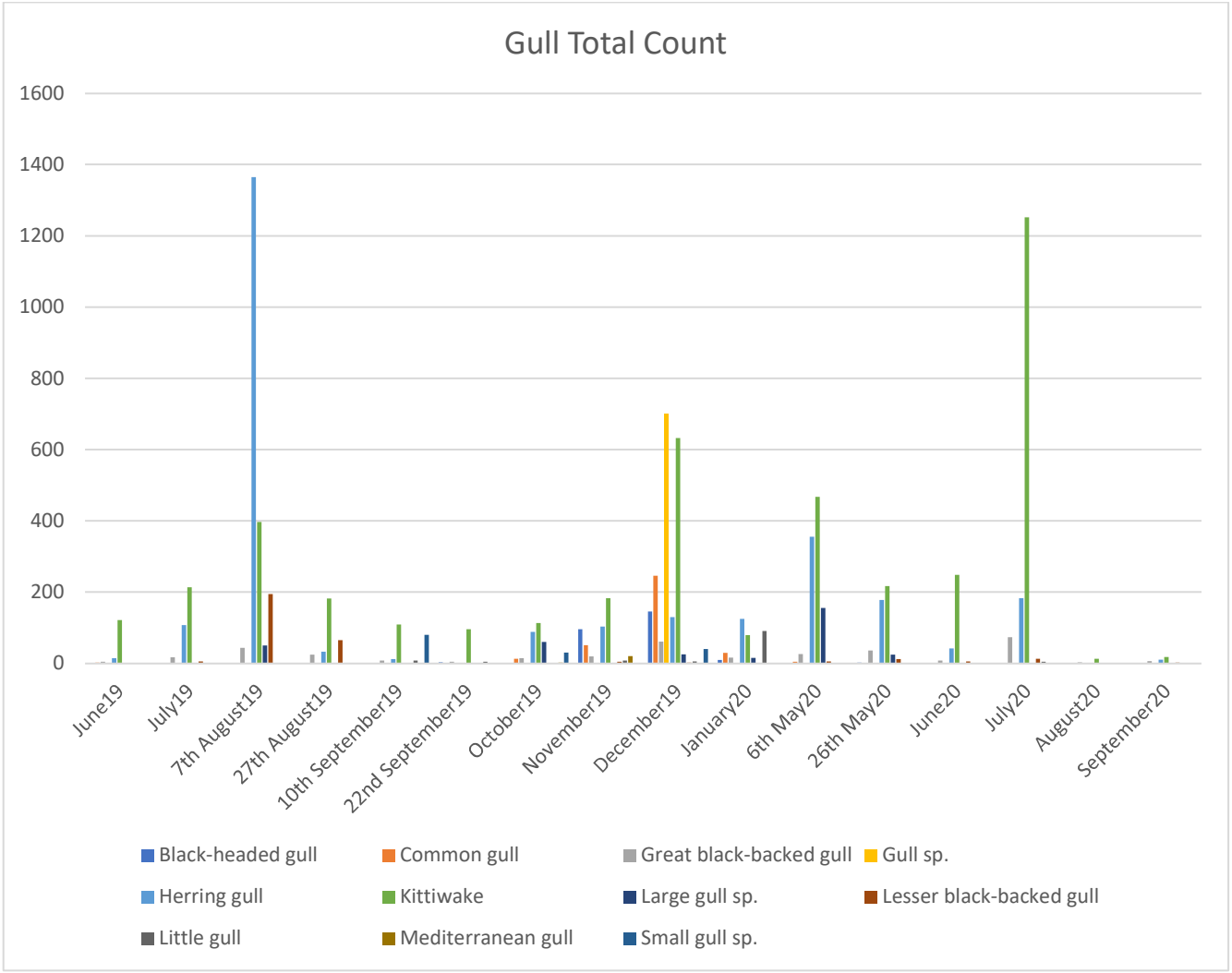


[12] https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/gannet/

3.2.6 Gulls: Black-headed, Common, Great black-backed, Herring, Kittiwake, Lesser black-backed, Little & Mediterranean Gulls

Gulls are a diverse and opportunistic group of seabirds feeding in coastal and inland environments all year round. The species consistently making up the highest proportion of sightings were Herring gulls & Kittiwakes and as a group, were seen in particularly high numbers during surveys on 7 August 2019 and during December 2019 surveys.

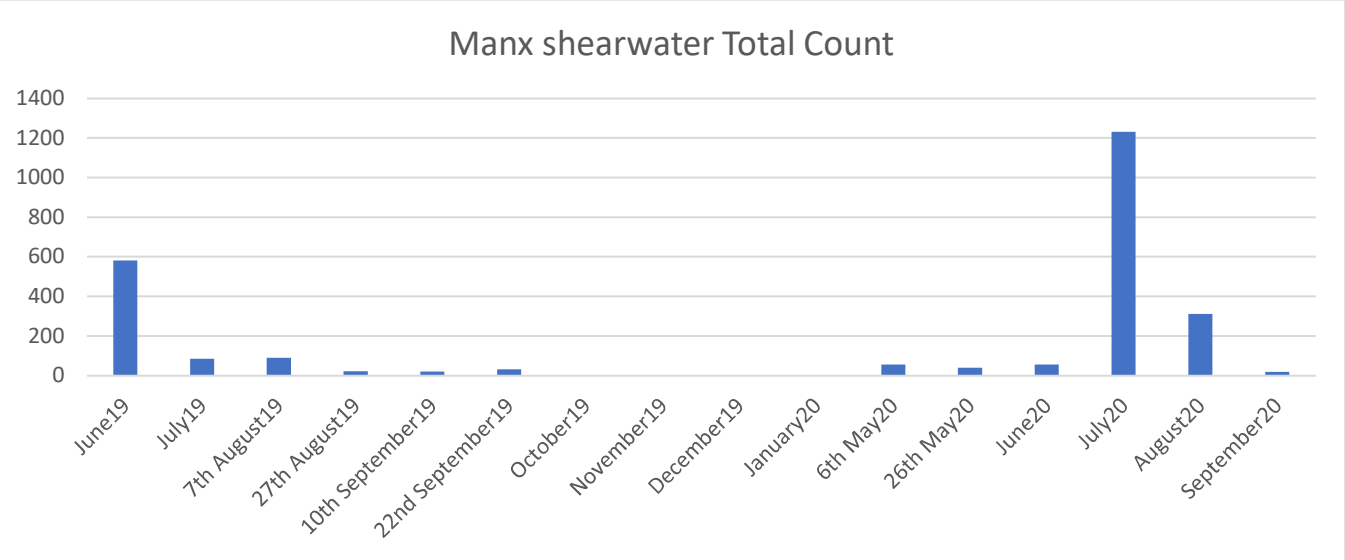
Figure 11: Gull Total Count & Species Composition June 2019- September 2020



3.2.7 Manx Shearwater

Manx shearwaters breed on offshore islands and leave their nests in July to migrate to South America where they spend winter[13], they were seen in particularly high numbers in the July 2020 survey (1000+).

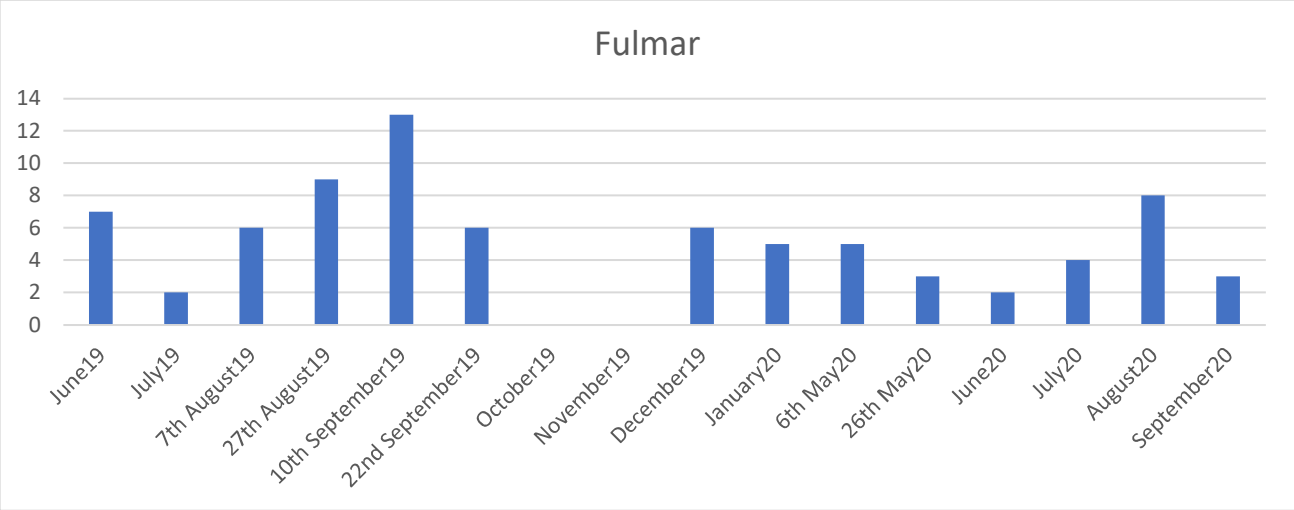
Figure 12: Manx Shearwater Total Count June 2019- September 2020



3.2.8 Fulmar & Storm Petrels

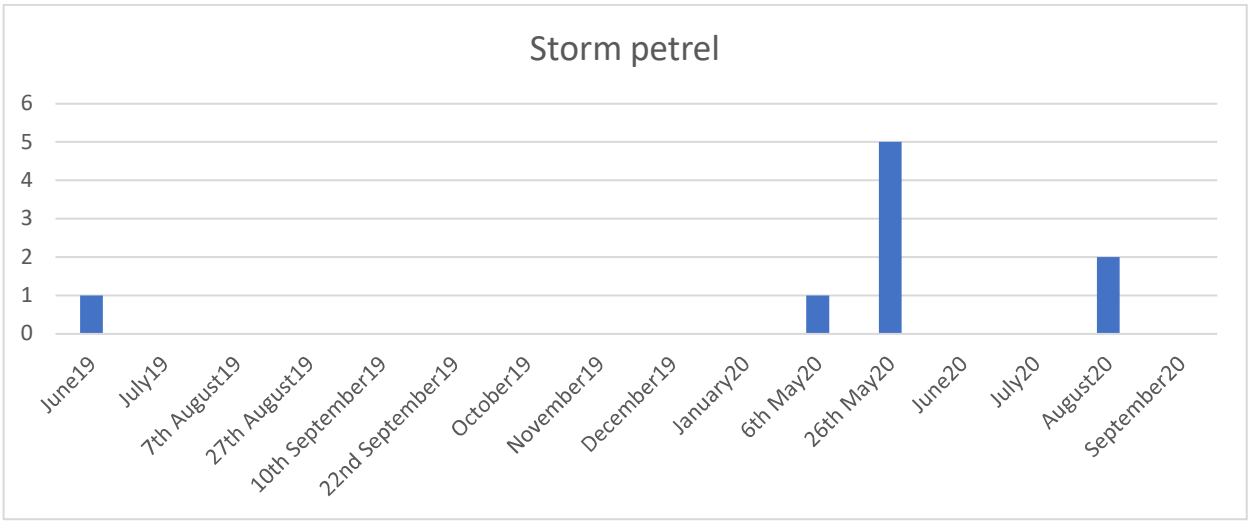
Petrels are pelagic birds that only come ashore to breed. Fulmars are resident to the Irish coasts all year round, breeding on cliff faces and can be found in flocks out at sea where they feed on fish & crustaceans. They were found in small numbers (<15) in every survey except October and November 2019. Storm petrels can be seen in Irish waters from May to September and were recorded in small numbers during the survey on 26 May 2020 & August 2020 surveys.

Figure 13: Fulmar Total Count & Species Composition June 2019- September 2020



[13] https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/petrels-and-shearwaters/

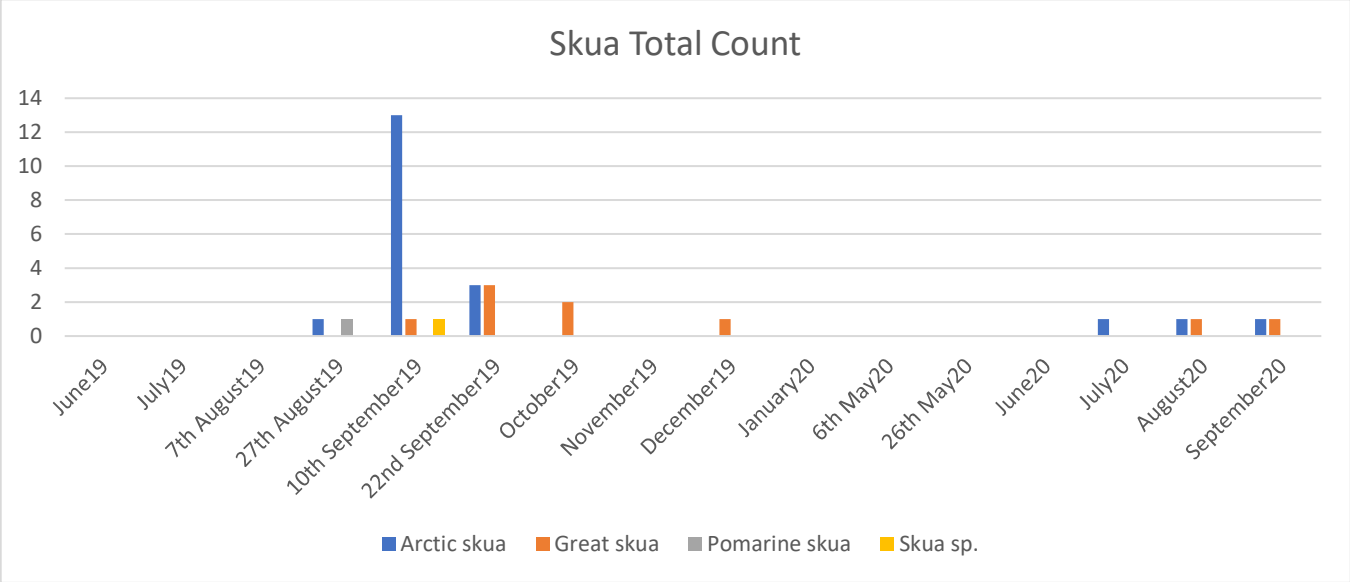
Figure 14: Storm Petrel Total Count & Species Composition June 2019- September 2020



3.2.9 Arctic, Great & Pomarine Skua

Skuas are kleptoparasites, stealing catch from other seabirds. Three species were recorded over the June 2019- September 2020 survey period with a high number (13) of Arctic skua recorded during the 10 September 2019 survey.

Figure 15: Skua Total Count & Species Composition June 2019- September 2020

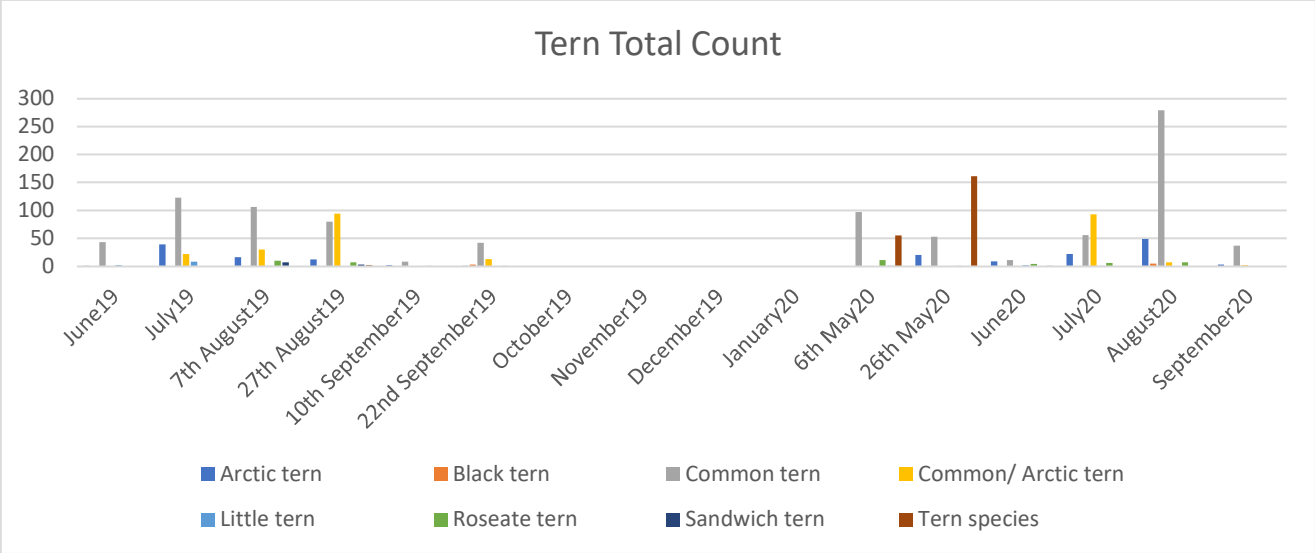


3.2.10 Arctic, Black, Common, Little, Roseate & Sandwich Tern

Terns are seasonal visitors to Irish coasts in summer months and spend winter in the southern hemisphere[14]. No terns were recorded between the October 2019- January 2020 surveys and Common terns were seen more consistently and in high numbers through the summer surveys.

[14] https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/gulls-and-terns/

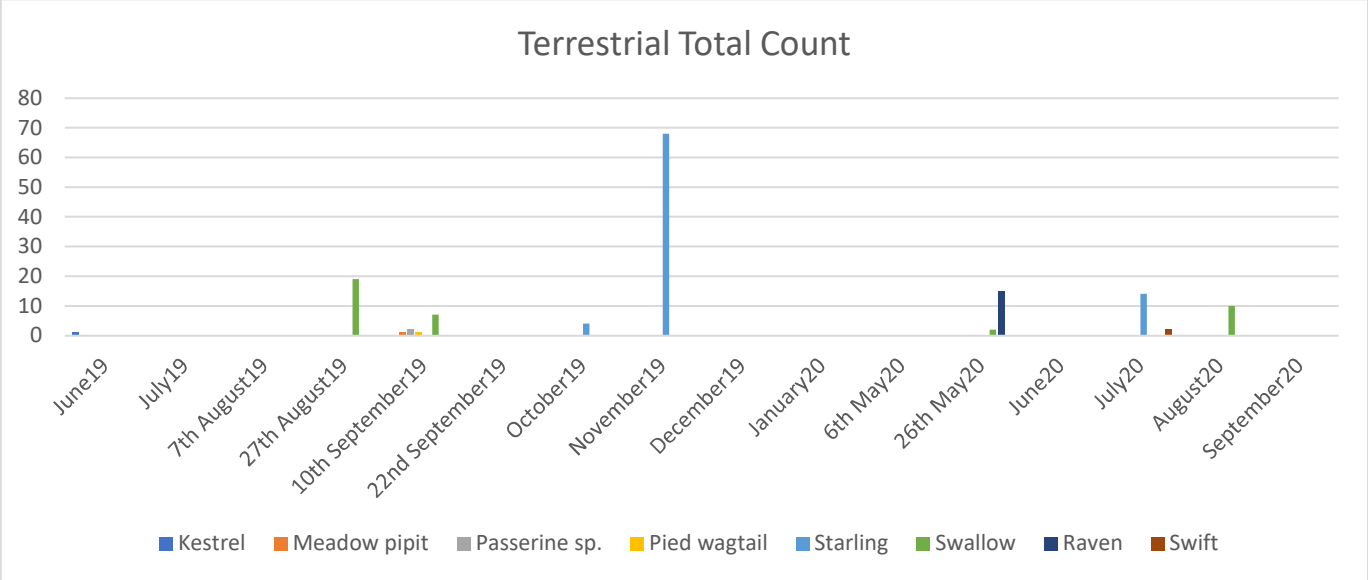
Figure 16: Tern Total Count & Species Composition June 2019- September 2020



3.2.11 Terrestrial Species: Kestrel, Meadow pipit, Pied wagtail, Starling, Swallow, Raven & Swift

Due to the proximity to the coast, terrestrial species were recorded as absent or in consistently low numbers (<20) throughout the survey season with an exception to the November 2019 survey where 68 starlings were recorded.

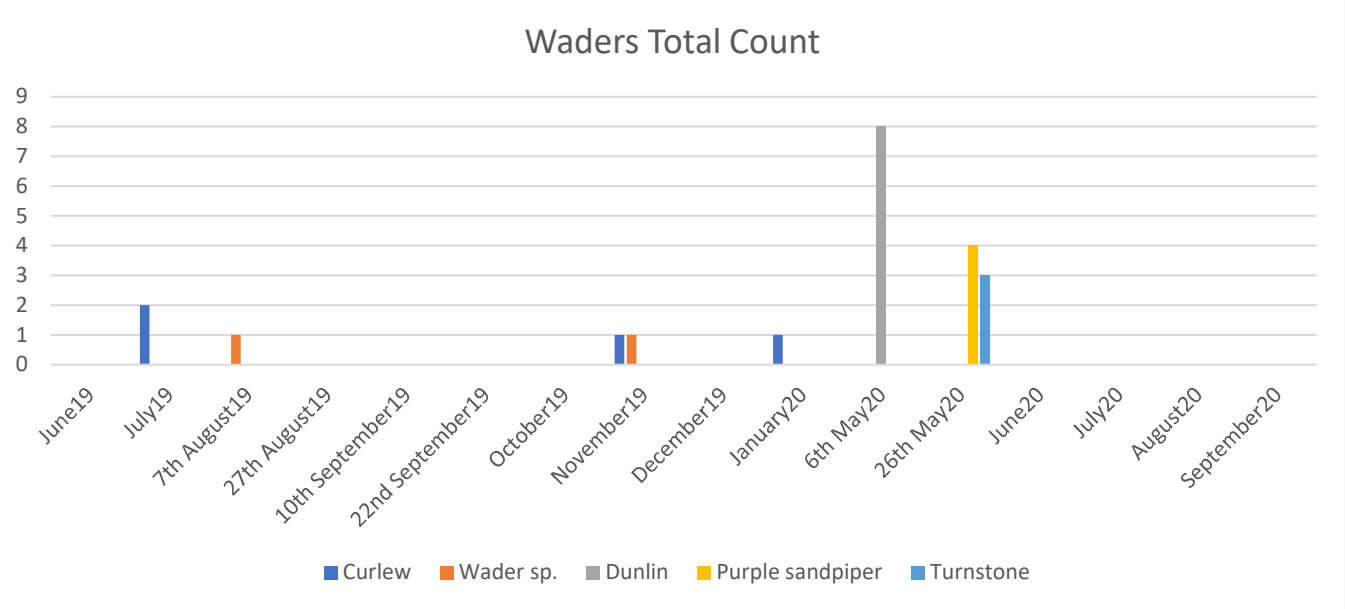
Figure 17: Terrestrial Total Count & Species Composition June 2019- September 2020



3.2.12 Waders: Curlew, Dunlin, Purple sandpiper & Turnstone

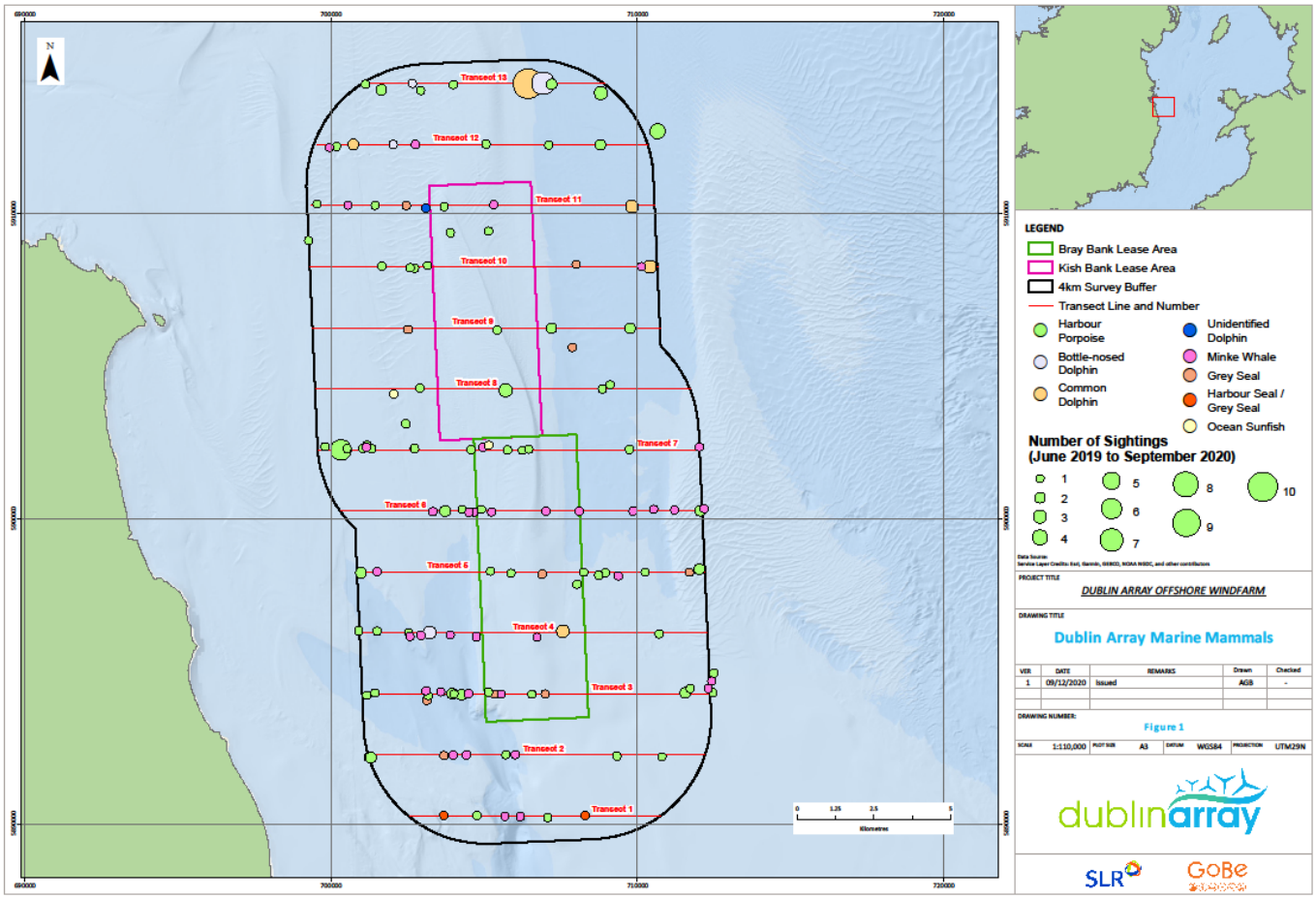
Waders were also consistently recorded in low numbers with a peak of 7 Dunlins seen during the 6 May 2020 survey.

Figure 18: Wading Bird Total Count & Species Composition June 2019- September 2020



3.3 Marine Mammal Location, Species & Abundance June 2019-September 2020

Figure 19: Marine Mammal Location & Abundance, June 2019- September 2020



The GIS map generated, as shown in Figure 19 above, provides a visual representation of where each marine mammal species was seen as well as their abundance throughout the June 2019- September 2020 survey period.

Figure 20: Marine Mammal Total Count & Species Composition June 2019- September 2020

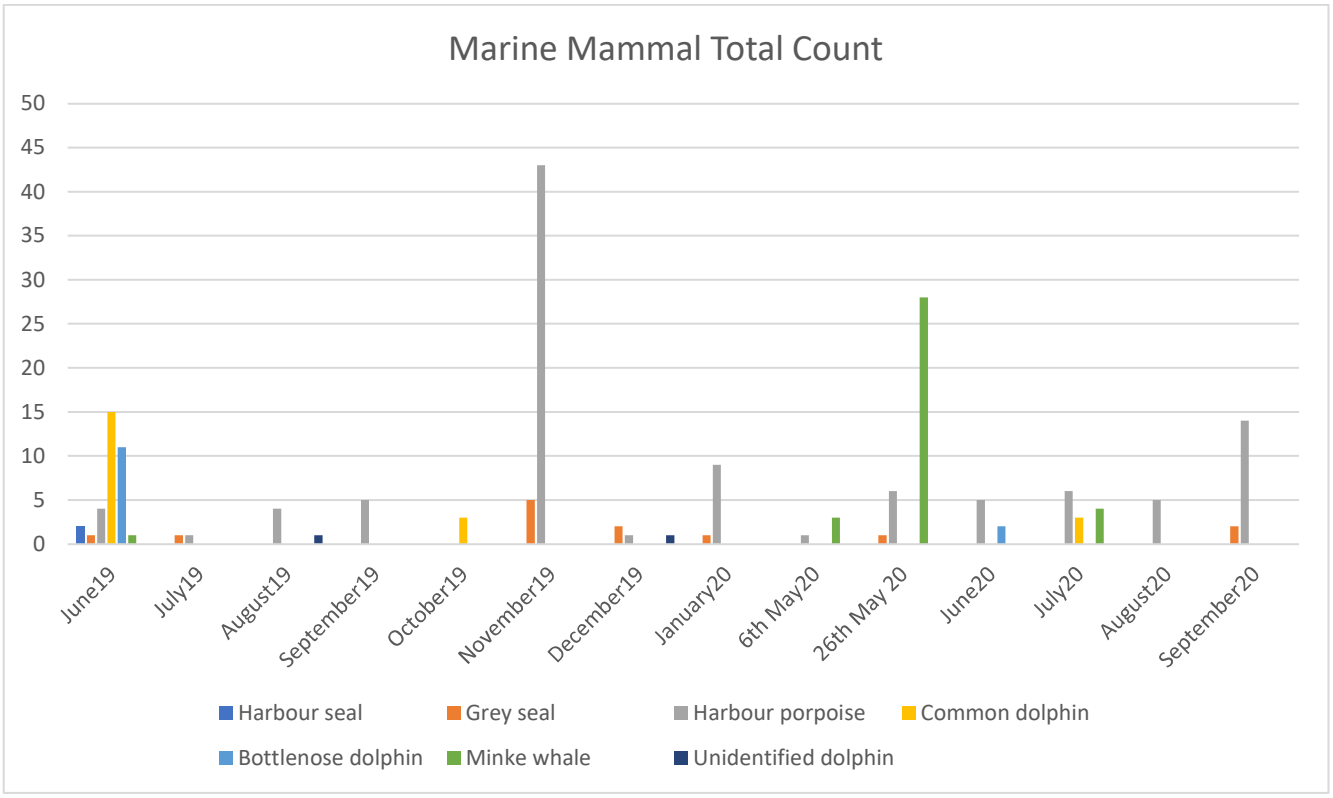
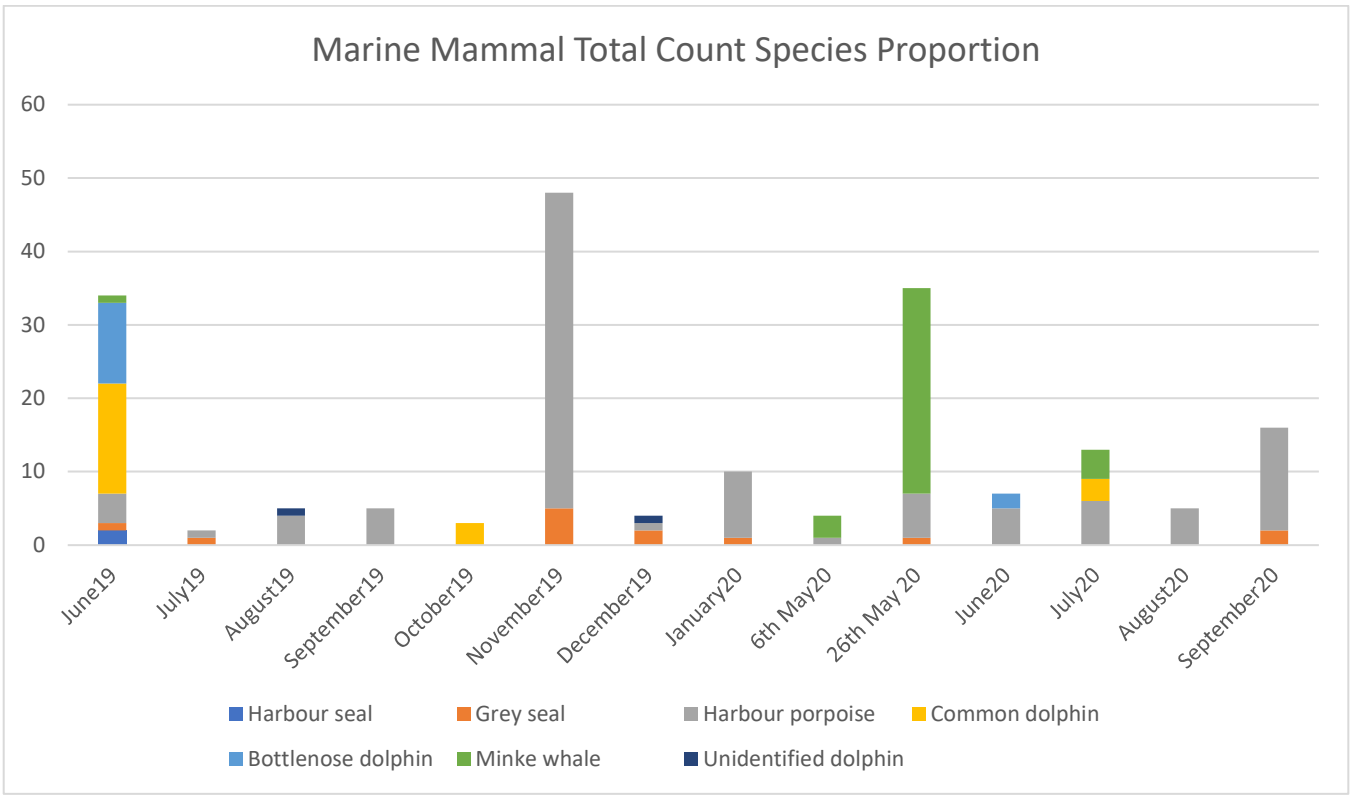


Figure 21: Marine Mammal Total Count & Species Proportion June 2019- September 2020

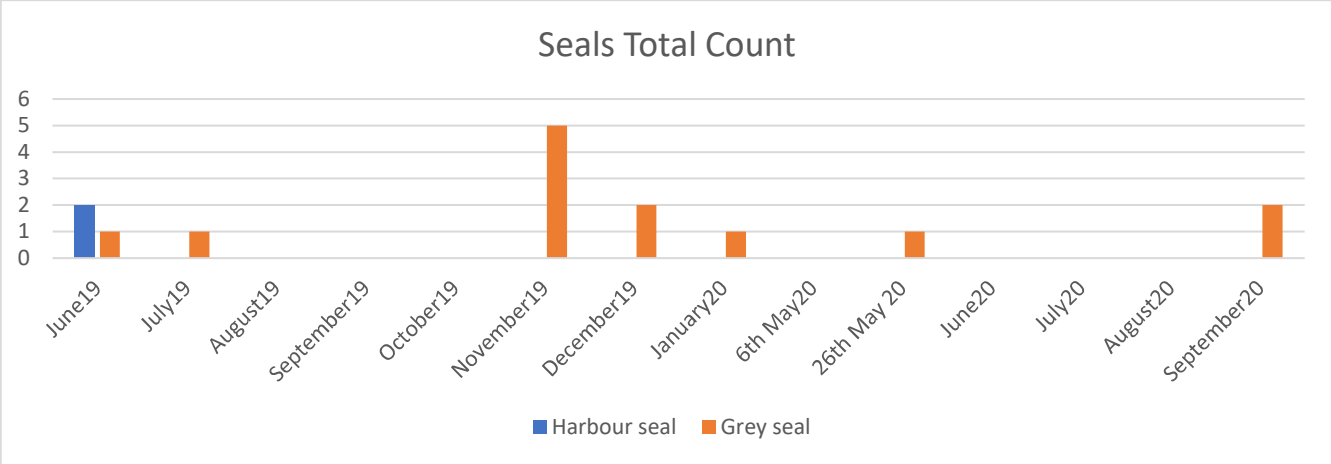


3.4 Marine Mammal Summaries

3.4.1 Seals

Both Grey & Harbour seals are resident to UK & Irish coasts and waters all year around. Harbour seals were only recorded in the June 2019 survey but generally seals were absent or recorded in low numbers throughout the survey period with a maximum of 5 in November 2019.

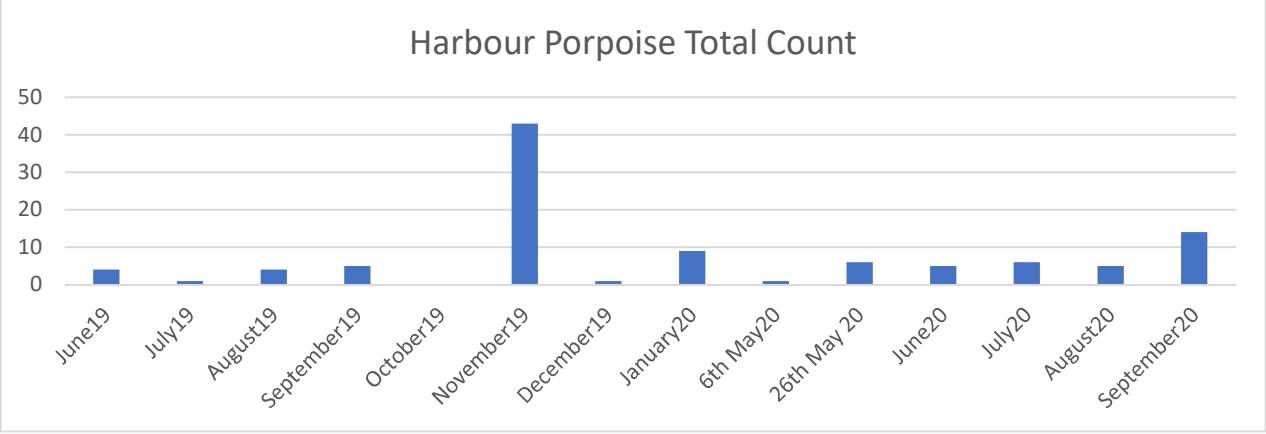
Figure 22: Seals Total Count & Species Composition June 2019- September 2020



3.4.2 Harbour Porpoise

Harbour porpoise are widespread throughout cold and temperate seas of Europe favouring coastal areas of continental shelf and are usually seen in small groups of less than 5 individuals[15]. They were generally seen in numbers less than 10 throughout the survey period and completely absent in the October 2019 survey. A month later however (November 2019), they were recorded in very high numbers (43).

Figure 23: Harbour Porpoise Total Count June 2019- September 2020

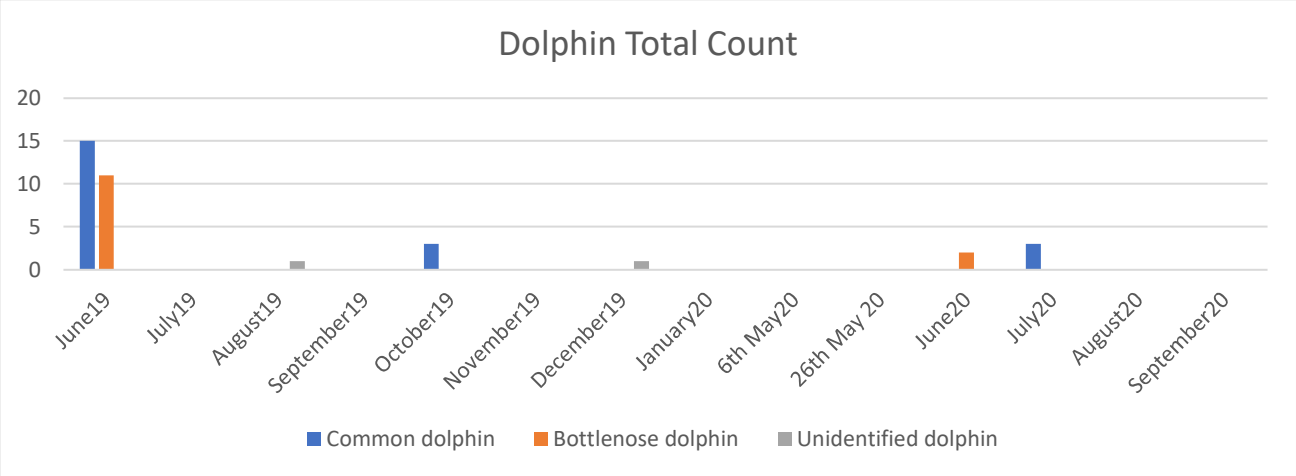


[15] https://sac.jncc.gov.uk/species/S1351/

3.4.3 Dolphins

Generally, very few dolphins were seen over the survey period (usually absent or less than 4) except for June 2019, where 15 Common & 11 Bottlenose dolphins were recorded. Bottlenose dolphins are usually found close to the coast whereas Common dolphins are typically pelagic species and both are found in UK & Irish seas all year around[16].

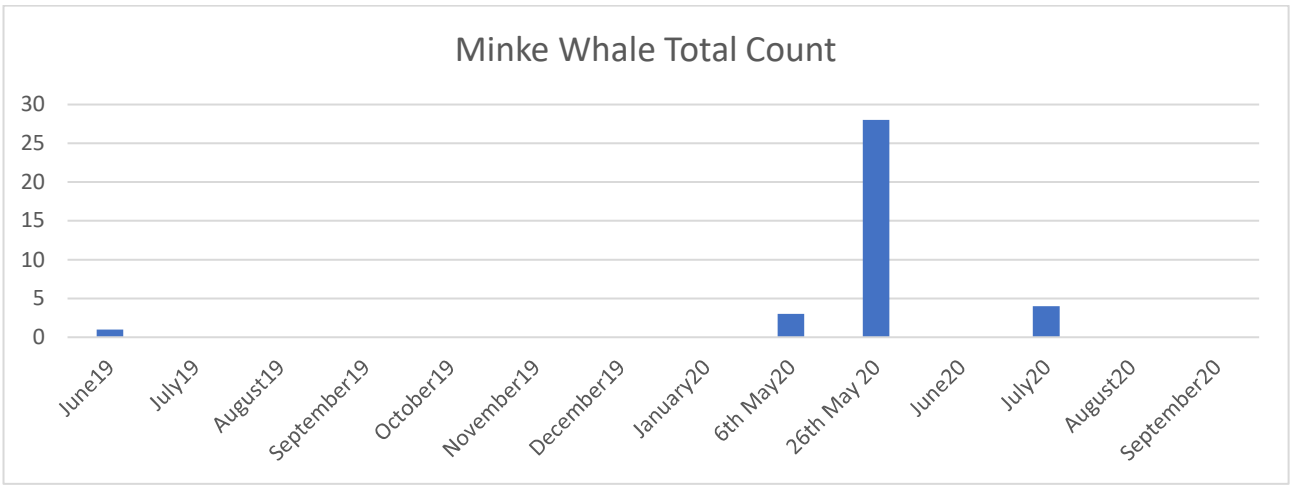
Figure 24: Dolphin Total Count & Species Composition June 2019- September 2020



3.4.4 Minke Whale

Minke whales are usually solitary animals but can be seen in larger groups, particularly when feeding[17]. They were present in only 4 surveys throughout the survey period, and in 3 out of 4 of these they were recorded in numbers less than 5. However, during the 26 May 2020 survey, 28 animals were recorded.

Figure 25: Minke Whale June 2019- September 2020



[16] https://uk.whales.org/whales-dolphins/species-guide/common-bottlenose-dolphin/
[17] https://uk.whales.org/whales-dolphins/species-guide/common-minke-whale/

4.0 Summary & Limitations

Due to unsuitable weather conditions, it was not possible to survey in February or March of 2020. Furthermore, the COVID-19 global pandemic and associated restrictions set out by the Irish government, meant that it was not possible to survey the Dublin Array study area in April of 2020. Surveys resumed in May 2020 however Covid-19 restrictions meant it was not possible to have a full seabird survey team on board. The survey team consisted of 2 seabird and 2 marine mammal observers throughout the survey period May 2020 – September 2020. At any one time, one seabird surveyor was acting as the primary observer, with a second acting as scribe and secondary observer, as specified in the COWRIE seabird survey method. When only two surveyors were on board, stops were made during the surveys to give surveyors a break.

Overall, a total of 6 marine mammal and 30 seabird species (excluding waders & species considered to be typically terrestrial) were recorded on the boat-based surveys in the study area between June 2019 and September 2020.

5.0 References

Camphuysen, K. J., Fox, A. D., Leopold, M. F. and Petersen, I. K. (2004) *Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K.: a comparison of ship and aerial sampling methods for marine birds, and their applicability to offshore wind farm assessments* (PDF, 2.7 mb), NIOZ report to COWRIE (BAM – 02-2002), Texel, 37pp.

DCCAE. (2018), 'Guidance on Marine Baseline Ecological Assessments & Monitoring Activities for Offshore Renewable Energy Projects. Parts I and II' (Dublin: Department of Communications, Climate Action & Environment)

Tasker, M. L., Jones, P. H., Dixon, T. J. and Blake, B. F. (1984) *Counting seabirds at sea from ships: a review of methods employed and a suggestion for a standardized approach.* Auk, 101, 567-577.

Webb, A. and Durinck, J. (1992) Counting birds from ship. In J. Komdeur; J. Berelsen & G. Cracknell *Manual for aeroplane and ship surveys of waterfowl and seabirds.* International Wildfowl Research Bureau, Slimbridge, pp. 24-37.

APPENDIX 01

Coordinates for Foreshore Lease Areas Kish and Bray Banks

Kish Bank		
Ref. Point	Latitude	Longitude
Upper left corner	53° 18' 29.978" N	5° 57' 0.025" W
Upper right corner	53° 18' 29.984" N	5° 54' 0.046" W
Lower left corner	53° 14' 0.000" N	5° 57' 0.000" W
Lower right corner	53° 13' 59.991" N	5° 54' 0.010" W
Bray Bank		
Ref. Point	Latitude	Longitude
Upper left corner	53° 14' 0.000" N	5° 56' 0.036" W
Upper right corner	53° 13' 59.975" N	5° 53' 0.000" W
Lower left corner	53° 08' 59.990" N	5° 56' 0.034" W
Lower right corner	53° 09' 0.000" N	5° 53' 0.018" W

Transect Start/End Coordinates

Transect Ref. Point	Latitude	Longitude
Transect 1 Start	53° 07’ 23.519” N	5° 58’ 21.613” W
Transect 1 End	53° 07’ 12.110” N	5° 51’ 02.200” W
Transect 2 Start	53° 08’ 29.932” N	5° 59’ 27.293” W
Transect 2 End	53° 08’ 14.665” N	5° 49’ 39.611” W
Transect 3 Start	53° 09’ 34.846” N	5° 59’ 33.867” W
Transect 3 End	53° 09’ 19.065” N	5° 49’ 26.474” W
Transect 4 Start	53° 10’ 39.594” N	5° 59’ 33.910” W
Transect 4 End	53° 10’ 23.807” N	5° 49’ 26.161” W
Transect 5 Start	53° 11’ 44.342” N	5° 59’ 33.958” W
Transect 5 End	53° 11’ 28.548” N	5° 49’ 25.836” W
Transect 6 Start	53° 12’ 49.740” N	5° 59’ 59.754” W
Transect 6 End	53° 12’ 33.289” N	5° 49’ 25.520” W
Transect 7 Start	53° 13’ 55.345” N	6° 00’ 33.886” W
Transect 7 End	53° 13’ 38.031” N	5° 49’ 25.197” W
Transect 8 Start	53° 15’ 00.107” N	6° 00’ 34.511” W
Transect 8 End	53° 14’ 43.085” N	5° 49’ 36.627” W
Transect 9 Start	53° 16’ 04.863” N	6° 00’ 34.919” W
Transect 9 End	53° 15’ 49.063” N	5° 50’ 22.840” W
Transect 10 Start	53° 17’ 09.619” N	6° 00’ 35.327” W
Transect 10 End	53° 16’ 53.813” N	5° 50’ 22.899” W
Transect 11 Start	53° 18’ 14.233” N	6° 00’ 30.069” W
Transect 11 End	53° 17’ 58.564” N	5° 50’ 22.962” W
Transect 12 Start	53° 19’ 18.561” N	6° 00’ 13.439” W
Transect 12 End	53° 19’ 03.529” N	5° 50’ 31.124” W
Transect 13 Start	53° 20’ 21.136” N	5° 58’ 47.375” W
Transect 13 End	53° 20’ 10.176” N	5° 51’ 43.022” W

APPENDIX 02

Marine Bird & Mammal Survey Forms

Vessel: _____ Surveyors: _____

Trip Key	Leg no.	Time GMT	Species	Age	Plum	Number	Distance /height	Dirn	Feed	In transect	Notes

Vessel: _____ Surveyors: _____

Trip Key	Time GMT	Start/mid/ end point	Waypoint No	Latitude	Longitude	East/West	Course	Speed (knots)

Trip Key	Time GMT	Wind dirn	Force (B'fort)	Sea State	Swell height (m)	Visibility	Glare	Rain	Notes

Vessel: _____ **Eye height:** _____ **Transect width:** _____

Activity: _____ **Time interval:** _____ **mins** **Angle of view:** _____

Surveyors on board (full names): _____

Trip Key	Leg No.	Time GMT	Observer	Scribe	No of Observers	Method	Direction of view	Species counted	Notes

SIGHTINGS FORM MARINE MAMMALS

Survey Type: Dublin Array 2019-20_Characterisation

STG#	WPT	Date	Time start	Time end	Cue	Observer	Angle	Distance	Sighting heading (at first)	Species	Images (Y/N)

MARINE MAMMAL SIGHTING FORM – 2019_E.K.

Regulatory reference number (e.g. DECC no., MMS permit no., OCS lease no., etc.)	**Ship/ platform name:** **Port:**	**Sighting number** (start at 1 for first sighting of survey)	**Transect number:**
Date: **Observer:** **Operator:**		**Time at start of encounter** (UTC, 24hr clock)	**Time at end of encounter** (UTC, 24hr clock)

Were animals detected visually and/ or acoustically? ☐ visual ☐ acoustic ☐ both	**How were the animals first detected?** ☐ visually detected by observer keeping a continuous watch ☐ visually spotted incidentally by observer or someone else ☐ acoustically detected by PAM ☐ both visually and acoustically before operators/ observers informed each other

Weather conditions filled out: Yes No	**Position** (latitude and longitude)	**Water depth** (metres)

Species: (please circle) **Cetaceans:** HP (harbour porpoise), BND (bottlenose dolphin), CD (common dolphin), MW (minke whale)	**Description** (if unknown give species group, describe features such as overall size; shape of head; colour and pattern; size, shape and position of dorsal fin; height, direction and shape of blow)

APPENDIX 03

Seabird Total Count Per Survey

Species name	Group	June19	July19	7th August19	27th August19	10th September19	22nd September19	October19	November19	December19	January20	6th May20	26th May20	June20	July20	August20	September20
Auk (unidentified)	Auk	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
Auk sp. (guillemot/razorbill)	Auk	5	267	795	0	58	14	62	1	41	0	786	439	17	571	120	0
Black guillemot	Auk	0	6	0	0	1	17	37	15	22	0	0	0	0	2	0	3
Common guillemot	Auk	588	780	1243	157	566	459	338	746	381	354	0	2206	542	1622	341	154
Puffin	Auk	12	8	1	0	0	0	0	1	0	0	1	3	2	8	3	0
Razorbill	Auk	75	602	2367	143	200	175	148	65	82	24	115	174	71	325	414	64
Cormorant	Cormorant	21	18	23	11	17	10	13	6	3	0	12	14	27	137	32	10
Cormorant/shag	Cormorant	0	0	1	0	0	0	0	0	0	0	45	0	0	0	28	0
Shag	Cormorant	33	42	121	52	88	109	127	365	77	84	12	14	23	86	76	115
Diver sp.	Diver	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Great northern diver	Diver	0	0	0	0	0	0	0	2	3	1	2	0	0	0	0	0
Red-throated diver	Diver	0	0	0	0	1	1	5	5	8	9	0	0	0	0	0	0
Common scoter	Duck	5	5	8	0	4	7	26	13	0	0	1	0	0	0	0	0
Garganey	Duck	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Gadwall	Duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Species name	Group	June19	July19	7th August19	27th August19	10th September19	22nd September19	October19	November19	December19	January20	6th May20	26th May20	June20	July20	August20	September20
Fulmar	Fulmar	7	2	6	9	13	6	0	0	6	5	5	3	2	4	8	3
Gannet	Gannet	73	22	107	27	59	100	21	3	3	3	450	796	200	329	56	47
Black-headed gull	Gull	0	0	0	0	0	3	1	96	145	9	0	2	0	0	0	0
Common gull	Gull	2	0	0	0	1	0	13	51	246	29	4	0	0	1	0	0
Great black-backed gull	Gull	4	17	43	24	8	4	14	19	61	16	26	36	8	73	3	6
Gull sp.	Gull	0	0	0	0	0	0	0	0	700	0	0	0	0	0	0	0
Herring gull	Gull	14	107	1365	33	12	0	88	103	130	125	355	178	42	183	0	10
Kittiwake	Gull	121	213	397	182	109	96	113	183	632	79	467	217	248	1252	13	18
Large gull sp.	Gull	0	0	50	0	0	0	60	0	25	15	155	24	0		0	0
Lesser black-backed gull	Gull	1	5	194	65	1	0	1	4	2	0	5	12	5	13	0	2
Little gull	Gull	0	0	1	0	8	4	0	8	5	91	0	0	0	4	0	0
Mediterranean gull	Gull	0	0	1	0	0	1	2	20	0	0	0	0	0	0	0	0
Small gull sp.	Gull	0	0	0	0	80	0	30	0	40	0	0	0	0	0	0	0
Storm petrel	Petrel	1	0	0	0	0	0	0	0	0	0	1	5	0	0	2	0
Manx shearwater	Shearwater	581	85	90	22	20	32	0	0	0	0	55	40	55	1231	311	19
Arctic skua	Skua	0	0	0	1	13	3	0	0	0	0	0	0	0	1	1	1
Great skua	Skua	0	0	0	0	1	3	2	0	1	0	0	0	0	0	1	1
Pomarine skua	Skua	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Skua sp.	Skua	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Species name	Group	June19	July19	7th August19	27th August19	10th September19	22nd September19	October19	November 19	December 19	January20	6th May20	26th May20	June20	July20	August20	September20
Arctic tern	Tern	1	39	16	12	2	1	0	0	0	0	0	20	9	22	49	3
Black tern	Tern	0	0	0	0	0	3	0	0	0	0	0	0	0	0	5	0
Common tern	Tern	43	123	106	80	8	42	0	0	0	0	97	53	11	56	279	37
Common/ Arctic tern	Tern	0	22	30	94	0	13	0	0	0	0	0	0	0	93	7	2
Little tern	Tern	2	8	1	0	0	0	0	0	0	0	0	0	2	1	0	0
Roseate tern	Tern	0	0	10	7	1	1	0	0	0	0	11	1	4	6	7	0
Sandwich tern	Tern	0	0	7	3	0	0	0	0	0	0	1	0	0	0	0	0
Tern species	Tern	0	0	0	2	0	0	0	0	0	0	55	161	1	0	0	0
Kestrel	Terrestrial	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meadow pipit	Terrestrial	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Passerine sp.	Terrestrial	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Pied wagtail	Terrestrial	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Starling	Terrestrial	0	0	0	0	0	0	4	68	0	0	0	0	0	14	0	0
Swallow	Terrestrial	0	0	0	19	7	0	0	0	0	0	0	2	0	0	10	0
Raven	Terrestrial	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0
Swift	Terrestrial	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Curlew	Wading Bird	0	2	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Wader sp.	Wading Bird	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Dunlin	Wading Bird	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0
Purple sandpiper	Wading Bird	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0

Species name	Group	June19	July19	7th August19	27th August19	10th September19	22nd September19	October19	November19	December19	January20	6th May20	26th May20	June20	July20	August20	September20
Turnstone	Wading Bird	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0

APPENDIX 04

Marine Mammal Total Count Per Survey

Survey	Harbour seal	Grey seal	Harbour porpoise	Common dolphin	Bottlenose dolphin	Minke whale	Unidentified dolphin
June19	2	1	4	15	11	1	0
July19	0	1	1	0	0	0	0
August19	0	0	4	0	0	0	1
September 19	0	0	5	0	0	0	0
October19	0	0	0	3	0	0	0
November 19	0	5	43	0	0	0	0
December 19	0	2	1	0	0	0	1
January20	0	1	9	0	0	0	0
6th May20	0	0	1	0	0	3	0
26th May 20	0	1	6	0	0	28	0
June20	0	0	5	0	2	0	0
July20	0	0	6	3	0	4	0
August20	0	0	5	0	0	0	0
September 20	0	2	14	0	0	0	0

APPENDIX 05

List of Scientific Names of Species Mentioned in Report

Common name	Scientific name
Arctic skua	*Stercorarius parasiticus*
Arctic tern	*Sterna paradisaea*
Black guillemot	*Cepphus grylle*
Black tern	*Childonias niger*
Black-headed gull	*Chroicocephalus ridibundus*
Common guillemot	*Uria aalge*
Common gull	*Larus canus*
Common scoter	*Melanitta nigra*
Common tern	*Sterna hirundo*
Cormorant	*Phalacrocorax carbo*
Curlew	*Numenius arquata*
Dunlin	*Calidris alpina*
Fulmar	*Fulmarus glacialis*
Gadwall	*Mareca strepera*
Gannet	*Morus bassanus*
Garganey	*Anas querquedula*
Great black-backed gull	*Larus marinus*
Great northern diver	*Gavia immer*
Great skua	*Stercorarius skua*
Herring gull	*Larus argentatus*
Kestrel	*Falco tinnunculus*
Kittiwake	*Rissa tridactyla*
Lesser black-backed gull	*Larus fuscus*
Little gull	*Hydrocoleus minutus*
Little tern	*Sternula albifrons*
Manx shearwater	*Puffinus*
Meadow pipit	*Anthus pratensis*

Common name	Scientific name
Mediterranean gull	*Larus melanocephalus*
Pied wagtail	*Motacilla alba ssp. yarellii*
Pomarine skua	*Stercorarius pomarinus*
Puffin	*Fratercula arctica*
Purple sandpiper	*Calidris maritima*
Raven	*Corvus corax*
Razorbill	*Alca torda*
Red-throated diver	*Gavia stellata*
Roseate tern	*Sterna dougallii*
Sandwich tern	*Sterna sandvicensis*
Shag	*Phalacrocorax aristotelis*
Starling	*Sturnus vulgaris*
Storm petrel	*Hydrobates pelagicus*
Swallow	*Hirundo rustica*
Swift sp.	*Apodidae*
Turnstone sp.	*Arenaria*
Bottlenose dolphin	*Tursiops truncatus*
Common dolphin	*Delphinus delphis*
Grey seal	*Halichoerus grypus*
Harbour porpoise	*Phocoena*
Minke whale	*Balaenoptera acutorostrata*

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