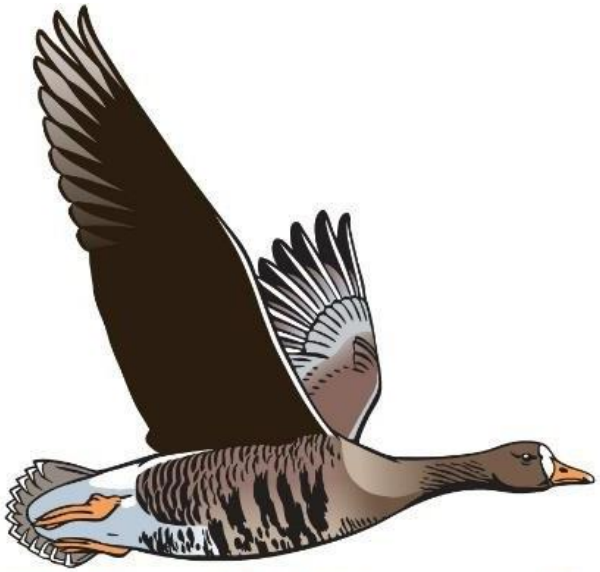


BirdWatch Ireland
protecting birds and biodiversity

BirdWatch Ireland response to Arklow Bank Wind Park 2 application Offshore Renewable Energy

A submission by staff at BirdWatch Ireland

Contact: Anita Donaghy
Email adonaghy@birdwatchireland.ie

Address for correspondence: BirdWatch Ireland, Unit 20 Block D, Bullford Business Campus, Kilcoole/Greystones, Co. Wicklow A63 RW83.

Phone: + 353 1 2819878

Introduction

BirdWatch Ireland is Ireland's leading charity focused on the conservation of wild birds. Established in 1968, we currently have over 15,000 members and supporters and a local network of over 30 branches nationwide. As an organisation, our conservation team is actively involved in seabird conservation, research, and monitoring. Our policy and advocacy team are active stakeholders contributing to marine conservation at a national and EU level. We are proud members of Birdlife International, the Irish Environmental Network, Stop Climate Chaos, and the Sustainable Water Network, and a founding partner of the Fair Seas coalition.

Our vision is that Ireland should become a world leader in marine conservation and the sustainable management of our marine environment. As an island nation, Ireland could be a pioneer in ocean protection within the EU by putting in place ambitious legislation to protect at least 30% of Ireland's sea by 2030, with at least 10% strictly protected.
BirdWatch Ireland is calling on the government to expand Ireland's network of Marine Protected Areas to protect our seabirds, marine life, and ecosystems. An ecologically coherent network of well-managed and well-resourced MPAs will enable Ireland to meet its commitments under the Marine Strategy Framework Directive, the OSPAR Convention, and the Kunming-Montreal Agreement under the UN Convention on Biological Biodiversity (COP15). In addition, it is critical that existing coastal and marine Special Protection Areas (SPAs) have complete Conservation Objectives and management plans put in place to restore to favourable conservation status of many declining seabirds and waterbirds.

Where the protection and restoration of Irish ecosystems is vital, so too is rapid decarbonisation. The Intergovernmental Panel on Biological Diversity (IPCBD) and the Intergovernmental Panel on Climate Change (IPCC) make it clear that we face twin climate and nature emergencies.
BirdWatch Ireland therefore supports the production of renewable energy and offshore wind; however, ORE devices and infrastructure must be sensitively located to minimise negative impacts on seabirds, marine and terrestrial ecosystems, and other biodiversity including terrestrial bird species.

BirdWatch Ireland's marine science background

For many years BWI has been working to gather data and information on the importance and usage of the Irish sea for seabirds and waterbirds. Our work includes tagging and tracking of seabirds at key sites, Digital Aerial Survey (DAS) work and observations on the daily movements and flight lines of a range of seabirds in the Irish sea, as part of our annual monitoring and management of key seabird colonies in the Irish Sea more than the past 20 years

General comments on the impacts of ORE windfarm projects.

The main impacts of ORE windfarm projects on seabirds and waterbirds are outlined below. Although reports on Displacment and Collision Risk have been submitted, we do not believe that all of the impacts below have been comprehensively assessed.
-Displacement
-Collision risk
-Cumulative impacts - how are the cumulative impacts being examined? We believe it is not enough to state the cumulative impacts will be assessed as part of the site assessments for each project. If the Arklow Bank Wind Park 2 development proceeds along side the other two submitted to date (Oriel and North Irish Sea Array (NISA)), and those expected soon (Codling and Dublin Array), collectively, there will be a near continuous chain of turbines stretching from Dundalk to north Wexford. This will likely precipitate changes at an ecosystem level to both the biotic and abiotic environments. Offshore sandbanks, geomorphology and coastal erosion will all be impacted with knock-ons to the benthos and small prey-fish populations on which our seabirds are dependent.

-Wider ecological impacts on fish stocks/prey base, particularly during construction. Knowledge of the impact on the prey base/fish stocks is essential to be able to fully assess the impacts on seabirds. This is not addressed in any of the reports.
-Impacts on fishing effort and location – how will fishing efforts be shifted and what is the likely impact of such a shift? This has also not been addressed.
- Impacts on non-seabird species, waterbirds and other larger birds using the air space. The flight heights are not known for key species and this data has not been collected, as the digital aerial surveys don't collect height data. This impact has therefore not been assessed.

BWI concerns about overlap with the distribution and foraging areas of key species

We are very concerned that there are key data gaps and questions remaining on the impact of the windfarm on important species, that have been omitted from the many ornithological reports which have been submitted. We set out some of these concerns below, but due to a lack of capacity within our organisation and the very tight timescales for scrutiny of the large number of reports submitted, there may well be other questions.

Although the National Parks and Wildlife Service have recently proposed new offshore Special Protection Areas, or extensions to existing ones, there is a gap in this network off the south Wicklow north Wexford coast. Key seabird species breeding at the Wicklow Head SPA (Kittiwake, Guillemot, Razorbill and Shag) are likely to forage in the unprotected waters nearby including the Arklow Bank. We are aware that some work is in progress to delineate the feeding areas of Kittiwakes by GPS tracking, but to date we have not seen any output. This tracking approach should be extended to the other three species, with the Shag most likely to utilize the shallow waters of the Arklow Bank.

Wicklow Head is also well known amongst ornithologists as a seabird 'bottleneck' during late summer and autumn migration window (see Keogh et al. 2014, attached with this submission). As the most easterly headland in the Republic of Ireland, in certain conditions (northeast, east or southeast winds), seabirds are pushed close to land and funnelled round the headland, which is also vey close to the north end of the Arklow Bank. The key species involved are Manx Shearwater and Kittiwake.

The seasonal distribution and abundance of seabirds in the whole Irish Sea is described in Jessopp et al. (2018), on the basis of the Government funded ObSERVE Programme. This also shows high usage of the Arklow Bank area year-round for species such as Kittiwake, a globally threatened species (IUCN/BirdLife International).

Tagging work, using geolocators (GLS) as part of the Seatrack Project (link below) shows that Kittiwakes breeding at Irish sea colonies (Rockabill, Dublin and Skomer Island, Wales) tend to remain in the Irish Sea year-round.

https://seatrack.seapop.no/diversitymap/

This type of tagging work should be extended to the breeding seabirds of Wicklow Head so that the annual movements of Shags, Guillemots and Razorbills are better understood. Numbers and breeding success of all seabirds at Wicklow Head should also be monitored long term.

Other migratory flying animals

We note that bats are now of concern with respect to offshore renewable energy developments and that work on this theme is presented in the Arklow Bank 2 EIAR. They recorded both Leisler's and Common Pipistrelle bats. The former are potentially migratory and may move seasonally across the Irish Sea. BirdWatch Ireland is working closely with Bat Conservation Ireland to document this at Rockabill island (Dublin; see attached document). Given we have recorded the presence of Leisler's bats, there is clearly an extensive corridor of bat movement between Britain and the east coast of Ireland. This warrants further work before windfarms are constructed.

References

Jessopp, M. et al. (2018) The seasonal distribution and abundance of seabirds in the western Irish Sea 2016. Government of Ireland Report, 90pp.

Keogh, N. T., Crowe, O. & Newton, S. F. (2014) Seatrack seabird migration survey, 2010 to 2013. BirdWatch Ireland Conservation Report.

BAT CONSE VATION

IRELAND

Investigation of Offshore Bat Activity Rockabill

Island Static Deployment

May to June 2024

DOCUMENT DETAILS

Project Title:	Investigation of Offshore Bat Activity Rockabill Static Deployment
Document Title:	Static Bat Monitoring at Rockabill Island
Analysis:	Fionn O Neill
Prepared By:	John Curtin
Date:	22nd July 2024

Abstract: Bat Conservation Ireland and Birdwatch Ireland co-operated in creating a monitoring project at Rockabill Island off the Dublin Coast. Static surveys commenced on the 14th of May and will continue until November 2024. Preliminary results show the presence of Leisler's bats and Unidentified Myotis. Results are being made public in the hope of co-operative sharing of bat data for offshore bats and is part of wider projects investigating the possibility of migration and offshore feeding bats.

Acknowledgements: Thanks to Stephen Newton and Kyle Coughlan of Birdwatch Ireland

1. Introduction

Bat Conservation Ireland in conjunction with the Nathusius Pipistrelle Research Group have started a series of projects examining offshore bat activity with a focus on the eastern and south-eastern coasts. Given the difficulty in accessing offshore islands Birdwatch Ireland Research team at Rockabill were approached to set up a static monitoring program on the Island.

2. Static surveys

Two Wildlife acoustic Song meter mini static detectors were deployed on the island on the 14th of May, and they remained deployed for 38 days until the 21st June. One was deployed to the West, on a weathervane nearer the lighthouse building, and the other was located to the East, nearer the coast.

One bat species was positively identified alongside two unidentified Myotis bat calls. 65 bat registrations were recorded during the survey period from both detectors. Of these, 63 registrations were Leisler's bats. One day of particularly high activity was recorded on the 17th of May, where 50 [80%] of Leisler's calls were recorded between the two detectors. The majority of activity occurred between 23:00 and 00:00, with three additional recordings taken after midnight on this night.

Seabirds were calling constantly, and it is likely that the extra chatter will reduce the sensitivity of ultrasonic detectors to more quiet calls; filters were required to prevent noise below 18kHz as these non-bat recordings consumed data space to quickly.

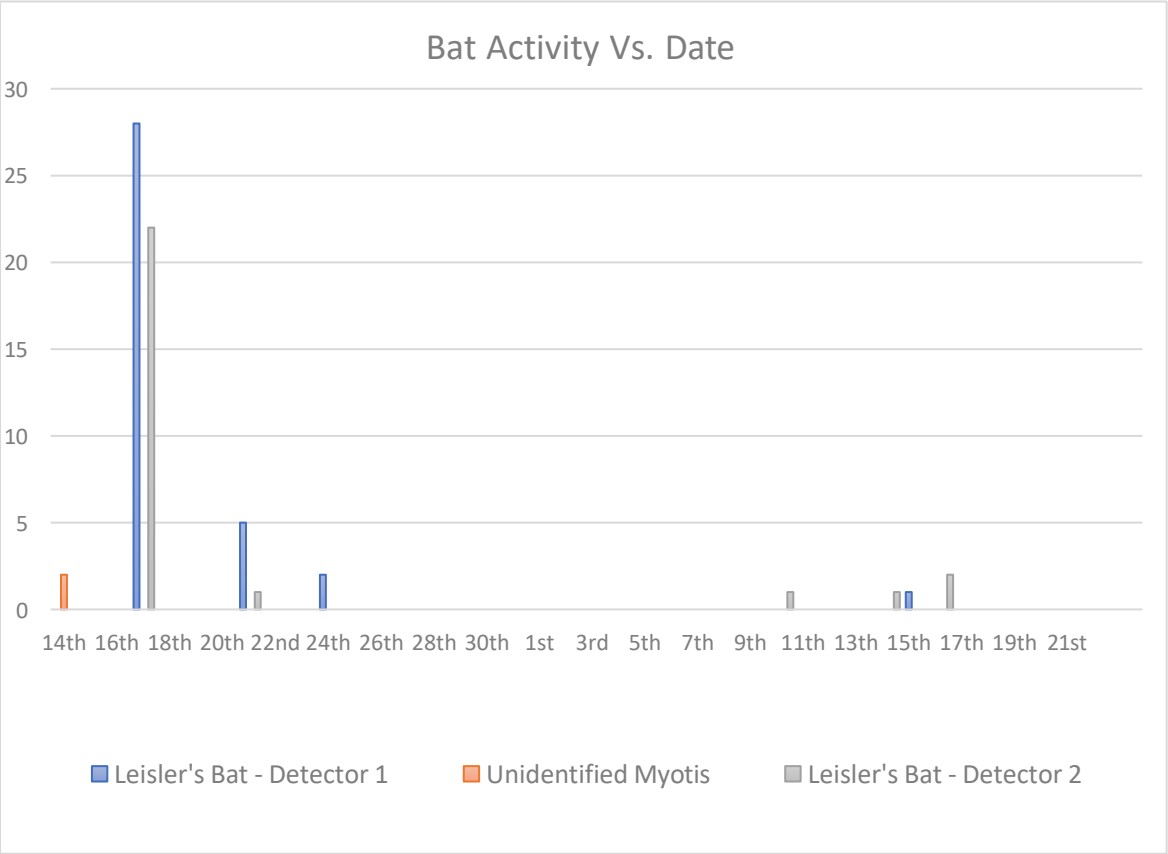
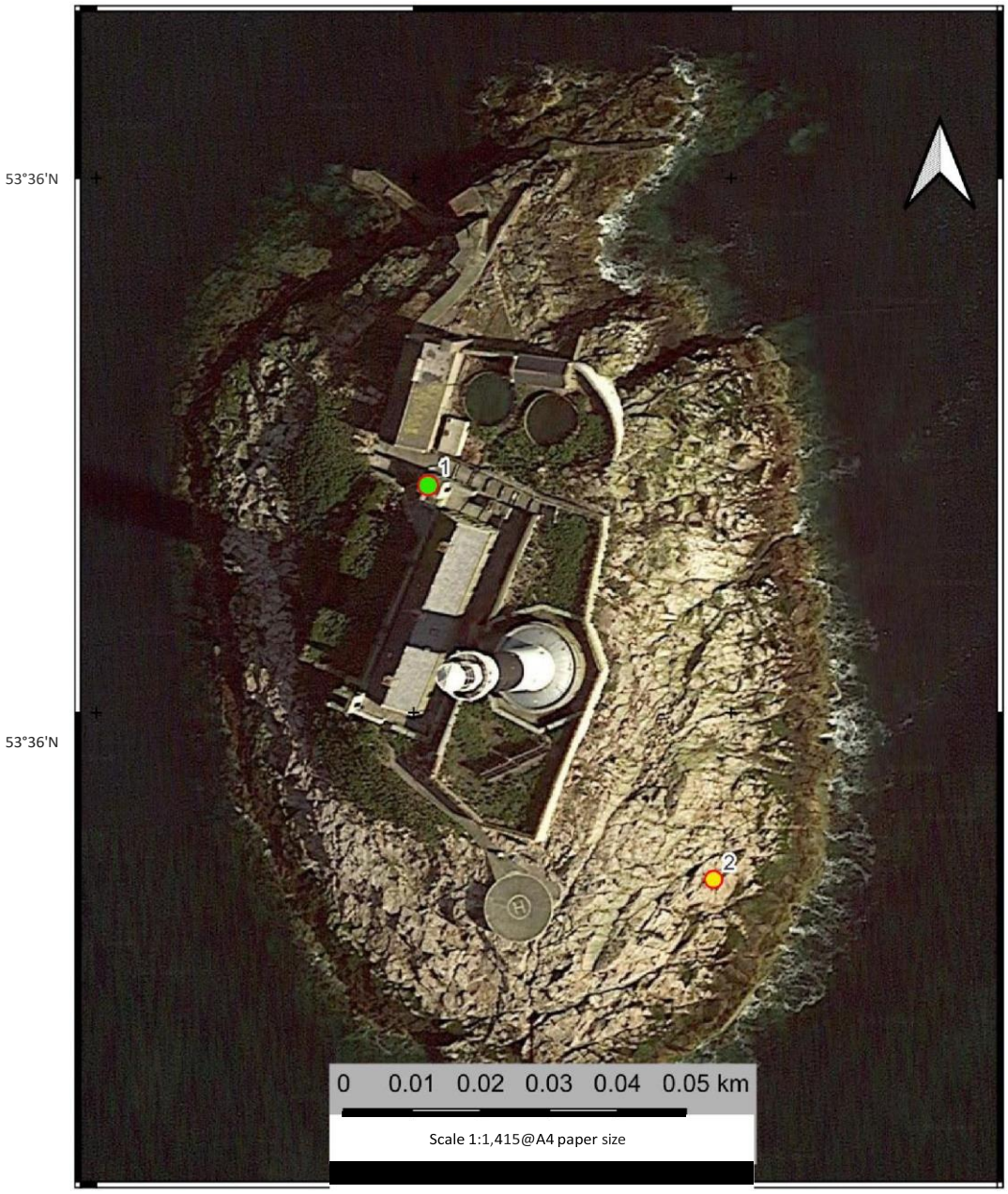


Figure 2-1: Bat activity per day


-30dB
120kHz
100kHz
40kHz
30kHz
0.4
0.6
1.2
1.4

Figure 2-2:One of two Myotis Species Recorded during Surveys

Rockabill Static Detectors



DISCLAIMER

Although great care wastaken in the preparation of this map, the authors cannot be held responsible for any loss or damage emanating from its use

THIS MAP MUST NOTBECONSIDEREDAN AUTHORITYON THE□ELIMITATION

OF INTERNATIONAL AND OTHER BOUNDARIES

Map CRS: EPSG:3857

Coordinate Units: Meters
MapScale: 1:1,415

Page Size: 210 x 297 mm
Made with: QGIS 3.36 in Windows

Drawn by: FO'N.
Checked by, Env. JC,
App.-oWld by, Env. JC,
Date, 22/07/2024,

Legend

Detector Locations - Rockabill

Detector 2 - East

0

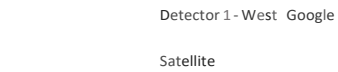


Figure 2-3: Rockabill Static Detector Location

Appendix: Static Survey Data

Table 1: Species Breakdown

Detector	Leisler's Bat	Unidentified Myotis	Total	Minutes recorded	Bat passes per hour	Leisler's	Unidentified Myotis
2	27	0	27	19716	0.08	0.1	0.0
Total	**63**	**2**	**65**	**39432**	0.1	0.2	0.0

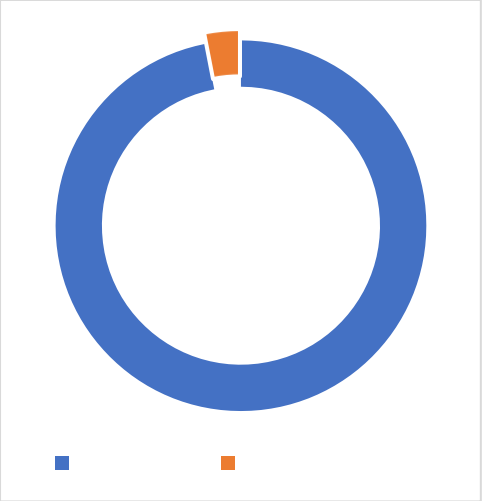


Figure 1: Species breakdown

Table 2: Detector 1, Results Summary

Days per season	Date	Leisler's Bat	Unidentified Myotis	Total
2	15th May	0	0	0
3	16th May	0	0	0
4	17th May	28	0	28
5	18th May	0	0	0
6	19th May	0	0	0
7	20th May	0	0	0
8	21st May	5	0	5
9	22nd May	0	0	0
10	23rd May	0	0	0
11	24th May	2	0	2
12	25th May	0	0	0
13	26th May	0	0	0
14	27th May	0	0	0
15	28th May	0	0	0
16	29th May	0	0	0
17	30th May	0	0	0
18	31st May	0	0	0
19	1st June	0	0	0
20	2nd June	0	0	0
21	3rd June	0	0	0
22	4th June	0	0	0
23	5th June	0	0	0
24	6th June	0	0	0
25	7th June	0	0	0
26	8th June	0	0	0

13AT CONSERVATION

Rockabill Static

Bat Monitoring

2024

IRELAND

Table

3: Detector 2, Results Summary

FAME

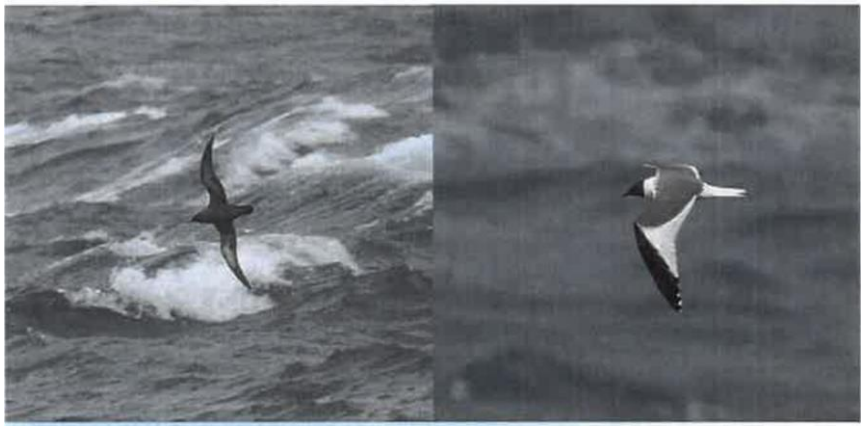
Days per Date Leisler's Unidentified Total season	Bat Myotis	Days per Date Leisler's Unidentified Total season	Bat Myotis					
				8	21st May		0	
				9	22nd May	0	0	0
				10	23rd May	0	0	0
				11	24th May	0	0	0
				12	25th May	0	0	0
				13	26th May	0	0	0
				14	27th May	0	0	0
				15	28th May	0	0	0
				16	29th May	0	0	0
				17	30th May	0	0	0
				18	31st May	0	0	0
				19	1st June	0	0	0
				20	2nd June	0	0	0
				21	3rd June	0	0	0
				22	4th June	0	0	0
				23	5th June	0	0	0
27	0	9th June		24	6th June	0	0	0
28	0	10th June		25	7th June	0	0	0
29	0	11th June		26	8th June	0	0	0
30	0	12th June		27	9th June	0	0	0
31	0	13th June		28	10th June	0		2
32	0	14th June		29	11th June	0	0	0
33	0	15th June		30	12th June	0	0	
34	0	16th June		31	13th June	0	0	0
35	0	17th June		32	14th June	0		
36	0	18th June		33	15th June	0	0	0
37	0	19th June		34	16th June	0	2	2
38	0	20th June		35	17th June	0	0	0
39	0	21st June		36	18th June	0	0	0
				37	19th June		0	0
				38	20th June		0	0
				39	21st June		0	0
					14th May	0	0	0
				2	15th May	0		
				3	16th May	0	0	0
				4	17th May	22	0	22
				5	18th May	0	0	0
				6	19th May	0	2	2
				7	20th May	0	2	2

ATLANTIC AREA
ESPACIOATLANT/CO
ESP.-\Ct Al'LANTIQlIE
ESPA(,:C) ATt.ANTICO

r o p e a n U n i o n

E u r o p e a n R e g i o n a l D e v e l o p m e n t F u n d I n v e s t i n g I n y o u

'Seatrack' seabird migration survey 2010 to 2013



Niall T. Keogh, Olivia Crowe and Stephen F. Newton*

Birdwatch Ireland, Unit 20, Block D, Bullford Business Campus, Kilcoole, Co. Wicklow

Citation: Keogh, N. T., Crowe, 0. & Newton, S. F. (2014) Seatrack seabird migration survey, 2010 to 2013. Birdwatch Ireland Conservation Report.

*Corresponding author: snewton@birdwatchireland.ie

Cover images: Sooty Shearwater (top left) by John N. Murphy. Sabine's Gull (top right) by Kris De Rouck. Seawatchers at The Bridges of Ross (bottom) by Niall T. Keogh

Table of contents

Summary

'Seatrack' is the name given to Birdwatch Ireland's co-ordinated seawatching scheme initiated as part of the INTERREG Atlantic Area FAME (Future of the Atlantic Marine Environment) Project.

Seawatches are conducted from coastal headlands, to monitor seabird migration, and have been undertaken on the island of Ireland for several decades. Seatrack is the first truly co-ordinated programme, in which observers are simultaneously tracking seabirds at multiple key sites.

Seawatches are 3-hours in length and start one hour after dawn. The focus of Seatrack is to cover autumn migration and 8 pre-selected weekends are chosen spanning the period late July to early November. These include the first Saturday of the months of August, September, October and November and they are conducted in parallel with similar schemes in Atlantic France, Spain and Portugal thereby facilitating an extensive series of observations along the Atlantic coasts of Europe.

About 20 sites received coverage in Ireland but of these nine were sufficiently well covered over a four year period (2010-2013) and are analysed in this report. They comprise one site in the northwest, Bloody Foreland, two in the midwest, Annagh Head and the Bridges of Ross, two in the southwest, Dursey Head and Galley Head, two in the southeast, Brownstown Head and Carnsore Point, and finally two in the east, Wicklow Head and Dalkey. In all 705 hours of observations were made at these sites, averaging 150-200 hours per year.

Overall, the total of seabirds counted at these sites are (and the three most numerous species at each site are given in parentheses): Annagh Head 100,845 (Gannet, Manx Shearwater, Fulmar), Bridges of Ross 59,596 (Manx Shearwater, Sooty Shearwater, Arctic Tern), Dursey Head 49,066 (Manx Shearwater, Kittiwake, Gannet), Carnsore Point 43,089 (Manx Shearwater, Gannet, Kittiwake), Bloody Foreland 31,440 (Gannet, Manx Shearwater, Fulmar), Brownstown Head 22,013 (Manx Shearwater, Gannet, Kittiwake), Wicklow Head 15,168 (Kittiwake, Manx Shearwater, Gannet), Dalkey 15,133 (Common/Arctic Tern, Kittiwake, Manx Shearwater) and Galley Head 14,892 (Manx Shearwater, Gannet, Kittiwake).

Observations of one Critically Endangered species, the Balearic Shearwater *Puffinus mauretanicus,* were one of the over-riding reasons why Irish seawatching was co-ordinated with that in France and Iberia. The non-breeding range of this seabird has increasingly included Irish coasts and we made the species a priority target for our observations. Balearic Shearwaters were recorded at all nine sites, mostly in August and early September, with highest numbers predictably at the two southeastern sites; overall 122 birds were recorded with most in 2010 and fewest in 2012.

Seatrack will continue as a BirdWatch Ireland survey for a fifth consecutive year, starting on 2nd August 2014.

Acknowledgments

Seatrack is a volunteer-based project and would not be possible if wasn't for the dedicated team of observers who were responsible for data collection at all sites mentioned in this report during the project survey between mid-July and early-November from 2010 to 2013. They are as follows:

Dave Andrews, Colin Barton, Keith Bennett, Dan Brown, Jonathan Bulfin, Mark Carmody, Alan Clewes, Simon Collins, David A. Cooke, Dick Coombes, Dave Cooper, John Cooper, John Cromie, Kevin Cronin, John Dempsey, Gareth Doherty, Connor Finch, Tony Gallagher, Kieran Grace, Chris Heard, Shane Farrell, Dave Farrow, Owen Foley, Kieran Finch, Niall Hatch, Michael Hoit, Stuart Housden, Neill Hunt, Chris Ingram, Rob Innes, Ario Jacques, Chris Jones, Eleanor Keane, Katherine Keogan, Noel Keogh, Niall T. Keogh, Tom Kilbane, Reg Land, Keith Langdon, Alan Lauder, Tom Lowe, Stephen McAvoy, Barry McCarthy, Ronan Mclaughlin, John Meade, Allan Mee, Killian Mullarney, John N. Murphy, Michael John O'Mahony, Stephen F. Newton, Jonathan Osborne, Dan Pointon, Brian Porter, Ashley Powell, Paul Rowe, Derek A. Scott, Joanna E. Scott, Ken Shaw, Ralph Sheppard, Darragh Sinnott, Michael Stocker, Dave Suddaby, Paul Thomason, Paul Troake, Frank Turpin, Alyn Walsh, Paul M. Walsh, Neal Warnock and Simon Woodhouse.

Introduction

The high ranking position of seabirds in marine trophic food-web structures makes them excellent indicators of marine ecosystem health (Parsons et al., 2008). They essentially 'track' their prey closely, timing their breeding and migration in order to coincide with the seasonal availability of their preferred food or in response to variations in environmental conditions (Dias et al., 2010). As such, any effects resulting from climate change or over-exploitation of marine resources are likely to be reflected by changes in the distribution and status of seabirds.

One method of assessing any potential changes in seabird abundance is to undertake land-based 'seawatching' surveys of migrating or dispersing seabirds. Volunteer recording of seabird migration from Irish coastal headlands in late summer and autumn has been a long standing tradition since the 1960's (Sharrock, 1960; Sharrock, 1967; Ruttledge, 1967; Waters, 1967). Thus, there is already a significant volume of records in existence which could provide a means of measuring temporal and spatial patterns in the movements of seabirds around Ireland.

Seatrack was initiated by BirdWatch Ireland in 2010 in an attempt at coordinating Irish seawatching and to collate records from multiple sites. The principal aim of Seatrack

is to follow the seasonal distribution and movements of seabirds passing through Irish waters from late July to early November, thus providing data which could prove useful for designating future Marine Protected Areas as 'migratory corridors' or 'hotspots' (Birdlife International, 2010). The project was run in conjunction with similar surveys undertaken by Birdlife International partners in the UK, France, Spain & Portugal under the FAME (Future of the Atlantic Marine Environment) initiative.

As a focal point for the survey, Seatrack set out to clarify the status and distribution of Balearic Shearwater *(Puffinus mauretanicus)* in Irish coastal waters where it is a scarce but regular migrant, most often observed from coastal headlands between late July and early October. This movement occurs during post-breeding dispersal from their nesting grounds in The Mediterranean Sea, where approximately 3,200 pairs breed exclusively on The Balearic Islands from February to June (Arcos,

2011). Balearic Shearwater is currently the only European seabird listed as Critically Endangered (IUCN, 2011) due to a recent, rapid decline of their small and range restricted breeding population, with models suggesting that the survival of the species may be threatened with extinction within a few generations (Oro et al., 2004). Factors such as predation by introduced mammals, increased development pressure at nesting sites and negative interactions with commercial fisheries have all been attributed as likely causes (Le Mau & Yesou, 1993; Mourino et al., 2003).

In recent years there has been an apparent northward shift in the non-breeding distribution of the Balearic Shearwater with an increase in numbers off northern France, in The English Channel & off the Irish coast (Yesou, 2003; Wynn & Yesou, 2007; Wynn, 2009). It has been suggested that this northward expansion has been facilitated by rising ocean temperatures as a result of climate change (Wynn et al., 2007). Despite the increased presence of Balearic Shearwaters off Ireland in recent years however, our understanding of its ecological requirements and preferred destinations whilst inhabiting our waters remains quite poor.

This report provides a synthesis of the data gathered through Seatrack between 2010 and 2013. It illustrates the distribution of seabirds around the coastline of Ireland, highlighting key areas that are regularly used as favoured feeding areas, as well as migration routes.

Methodology

A series of co-ordinated surveys were carried out from coastal headlands around Ireland across eight weekends from late July to early November in all years between 2010 and 2013 inclusive. The locations of these headlands are illustrated in **Figure 4.** With the exception of July, the first Saturday of each month was selected as a priority day for surveying in order to coincide with similar seawatching surveys taking place on those dates in Spain, Portugal and France also as part of the FAME project. On other co-ordinated survey dates, usually taking place on the second weekend of each month, more flexibility was offered with Sunday available as a substitute.

In each year of the project, surveying began approximately one hour after dawn. In 2010, watch periods of four hours were requested. This period was reduced to three hours for surveys in subsequent years so as to make the survey more attractive and user friendly for the volunteer observers taking part, thus increasing participation. If environmental conditions were poor, impairing survey quality at a particular site, then an option of undertaking an evening watch instead, starting four hours before dusk was made available. This worked well for sites which faced directly East, where morning sun could impair visibility and detection. In general, observers were asked to stay in the one spot and using both binoculars and telescopes, scan a 180® field of view left to right as best possible in relation to the layout of each site.

Figure 1. Seatrack volunteer conducting a survey at Carnsore Point © Niall T. Keogh

In 2010, the total number of each species observed was recorded in 15 minute intervals for the duration of the survey. This was increased to 30 minute intervals for surveys conducted in subsequent years as it was felt that the 15 minute intervals were difficult to manage during hectic passage. Seabird passage was recorded as numbers of birds flying 'left' or 'right', noting that the true direction varies between locations. The true direction relating to left or right was noted on each record form. Those birds observed which were not on passage were recorded as 'milling'. This term related to birds which were present on the water, circling around, loafing or feeding. When seabird colonies were located near a watch site, high numbers of milling birds were to be expected. When this occurred, counts of milling species in question from nearby colonies could be suspended and simply marked as present. Counts of these species was then encouraged later in the season when breeding activity had ceased.

During busy periods, where many seabirds were present, observers were asked to prioritise their recording. This maximised the accuracy of counts of priority species.

The priority order recommended was:

1. Balearic Shearwater
2. All other Shearwaters
3. Petrels
4. Wildfowl & Divers
5. Gannet, Fulmar, Kittiwake, Guillemot & Razorbill
6. Skuas, Terns, Puffin, Little Auk, Phalaropes, Sabine's Gull, Little Gull & Mediterranean Gull

7. Any other species of note

Recording of additional data relating to age classes of certain species such as Gannet and Kittiwake or colour morphs of skuas was also encouraged where possible.

Environmental conditions were noted at the start of each recording interval. Weather data included direction, wind force (using the 0-12 Beaufort Scale), wind direction, precipitation (none, mist/drizzle, light rain, intermittent showers, heavy rain) & visibility (poor, good, excellent). Any perceived increase or decrease in seabird passage in relation to changes in weather during the survey period was also required to be noted. Sightings of other marine wildlife (cetaceans, sharks, turtles, seals & sunfish) were also recorded (results of which are presented in Appendix 4).

Figure 2. Records of marine 'megafauna' were also collated, such as this Leatherback Turtle (Dermochelys coriacea) seen from The Bridges of Ross © Mike Flanagan

All seabird, marine wildlife and environmental data collated during a survey was submitted on a standardised excel records form. In addition, the submission of supplementary seawatching records from anytime of the year, during or outside of co-ordinated survey weekends was encouraged.

Data received was then analysed on Microsoft Excel 2013 to create a series of tables, graphs and maps in relation to observer effort, species richness, species abundance and mean rates of passage per hour for each species at each site across all years.

In order to publicise the Seatrack project and generate interest from both potential volunteer observers and members of the public, a project blog was launched on 15th August 2011 under the title 'A View frorn the Headland' (www.seabirdwatchireland.blogpsot.com). It featured periodic updates with sightings and pictures provided by Seatrack volunteer observers as well as showcasing other aspects of seabird conservation and FAME related activities being carried out in

Ireland. By March 2014, project blog had amassed over 61,500 page views from more than 30 countries worldwide. Furthermore, two public events were organised during 'Heritage Week' in August 2011 and August 2012 which involved an outing led by the Clare Branch of Birdwatch Ireland to The Bridges of Ross (a Seatrack survey watch point). At each of these events, Birdwatch Ireland Seatrack staff and volunteers were present with telescopes to show members of the public migrating seabirds

and cetaceans as well as inform generally in relation to the FAME project. Each event was well received with 40-50 members of the public in attendance.

Figure 3. Attendees of a Birdwatch Ireland/FAME seabird event at The Bridges of Ross during Heritage Week 2011 © Andrew Power

Results

Effort

Results are presented from 9 Seatrack watch points located around the coast of Ireland from Co. Donegal in the North West, to Co. Dublin in the East (Fig. 4). A cumulative total of 705.41 hours of observations was undertaken by 69 volunteer surveyors during 36 designated survey weekends across all four years. The minimum survey time conducted at a site in a given year across all designated survey weekends was 9 hours (Galley Head, 2013) and the maximum was 56.17 hours (Bridges of Ross, 2011) (Table 1). A more detailed presentation of effort at each site across all years can be found in Appendix 1.

Figure 4. Location and name of Seatrack watch points from which results are presented.

Table 1. Survey time (hours) conducted at each watch point from 2010 to 2013

Site	2010	2011	2012	2013	Total
Annagh Head	24	28.83	21	15	**88.83**
Bloody Foreland	20	21.5	21	24.17	86.67
Bridges of Ross		56.17	43.17	14.25	113.59
Brownstown Head	23	24	26	24	97
Carnsore Point	19.33	9.75	21.5	15.75	66.33
Dalkey	17.25	12	12	18	59.25
Dursey Island	24	28.5	14	14	80.5
Galley Head	13	9.5	18.5	9	SO
Wicklow Head	7.75	18.5	21	16	63.25
Total	148.33	208.75	198.17	150.17	705.42

Table 2. Total observation periods conducted at each watch point from 2010 to 2013

Site	2010	2011	2012	2013	Total
Annagh Head	96	43	42	30	211
Bloody Foreland	80	39	42	48	209
Bridges of Ross		5	34	4	43
Brownstown Head	90	47	52	48	237
Carnsore Point	73	20	39	32	164
Dalkey	69	24	24	36	153
Dursey Island	96	50	28	28	202
Galley Head	37	5	30	3	75
Wicklow Head	16	34	42	32	124
Total	557	267	333	261	1418

Species Richness and Abundance

A total of 36 key seabird species were recorded across all sites and all years with the highest diversity generally found along the West coast Atlantic seaboard e.g. Annagh Head & Bridges of Ross and the lowest on East coast sites in the Irish Sea e.g. Dalkey & Wicklow Head (Table 3). Species lists and abundance for each year is presented here for each site, listed in alphabetical order (Tables 4- 12). Species lists and abundance for other bird species recorded (such as wildfowl) and marine 'megafauna' (cetaceans, seals, reptiles, fish etc.) are presented in Appendix 3 and Appendix 4 respectively. A taxonomic list of species detailed in this report is presented in Appendix 2. For birds,

- this follows the Irish list as set out by the Irish Rare Bird Committee (IRBC, 2012).

Cumulative seabird abundance across all four years was highest on sites along the West coast e.g. Annagh Head (100845), Bloody Foreland (31440), Bridges of Ross (59596) and Dursey Island (49066) (Tables 4, 5, 6 & 10), whilst abundance on the East coast was much lower e.g. Dalkey (15133) and Wicklow Head (15168) (Tables 9 & 12).

Carnsore Point (Table 8) stands out as having both high species richness (30) and abundance (43089) whilst being located in the South East, on the boundary between the Irish Sea and Celtic Sea.

Table 3. Species richness of key seabirds counted at each site between 2010 and 2013

Site	2010	2011	2012	2013	Total
Annagh Head	19	25	23	23	29
Bloody Foreland	17	20	20	21	24
Bridges of Ross	n/c	24	25	18	31
Brownstown Head	17	19	18	17	25
Carnsore Point	23	22	22	21	30
Dalkey	17	13	14	15	22
Dursey Island	21	20	15	16	26
Galley Head	17	15	22	15	24

Wicklow Head	13	18	16	13	22
Total	31	33	34	30	36

Table 4. Species list and totals from Annagh Head between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Seater	132	9	26	30	197
Red-throated Diver	10	11	4	15	40
Black-throated Diver			1	1	2
Great Northern Diver	26	61	8	11	106
Fulmar	1184	2941	3597	1528	9250
Cory's Shearwater		6			6
Great Shearwater		339		91	430
Sooty Shearwater	53	574	181	313	1121
Manx Shearwater	1064	12167	8865	12426	34522
Balearic Shearwater		7	1	5	13
European Storm-petrel	9	14	27	22	72
Leach's Storm-petrel	1				1
Gannet	5050	21437	10957	4610	42054
Grey Phalarope	75	10		90	175
Pomarine Skua	3	47	7	2	59
Arctic Skua	13	63	14	11	101
Long-tailed Skua		3	4		7
Great Skua	44	89	80	55	268
Puffin	18	55	112	10	195
Black Guillemot		9	7	2	18
Razorbill	245	245	139	57	686
Guillemot	130	48	51	39	268
Auk sp. (Guillemot/Razorbill)	252	2646	591	48	3537
Black Tern			1		1
Sandwich Tern		9	3	5	17
Common Tern				4	4
Arctic Tern	37	25	23	45	130
Commie Tern (Common/Arctic Tern)			5		5
Sabine's Gull	3	4	1		8
Kittiwake	618	6439	437	57	7551
Glaucous Gull		1			1
Total	8967	47259	25142	19477	100845

Table S. Species list and totals from Bloody Foreland between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Scoter	10	9	5	14	38
Red-throated Diver	16	14	24	28	82
Black-throated Diver			1	5	6
Great Northern Diver	41	44	25	62	172
Unidentified diver sp.		5	2	3	10
Fulmar	967	338	906	763	2974
Cory's Shearwater				2	2
Sooty Shearwater	32	109	16	278	435
Manx Shearwater	450	1470	480	1947	4347
Balearic Shearwater		4			4
European Storm-petrel	3	20		24	47
Gannet	3263	6008	3930	5176	18377
Grey Phalarope				1	1
Pomarine Skua	2	3	1	5	11
Arctic Skua	11	13	16	7	47
Unidentified small skua sp.	1	3	4	7	15
Great Skua	32	24	49	32	137
Puffin	6	41	150	12	209
Black Guillemot		5	3	5	13
Razorbill	53	359	169	177	758
Guillemot	33	74	94	29	230
Auk sp. (Guillemot/Razorbill)	185	374	351	936	1846
Sandwich Tern	21	17	39	33	110
Common Tern		1	5		6
Arctic Tern	15	8	11	41	75
Commie Tern (Common/Arctic Tern)	4	3	2	4	13
Kittiwake	261	185	441	587	1474
Iceland Gull			1		1
Total	5406	9131	6725	10178	31440

Table 6. Species list and totals from the Bridges of Ross between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Scoter	n/c	37	25	3	65
Red-throated Diver	n/c	23	11		34
Great Northern Diver	n/c	1	2	1	4
Unidentified diver sp.	n/c		2		2
Fulmar	n/c		1382	108	1490
Blue Fulmar	n/c	1			1
Fea's/Zino's Petrel	n/c	1			1
Cory's Shearwater	n/c		14		14
Great Shearwater	n/c	59	164		223
Sooty Shearwater	n/c	2212	288	34	2534
Manx Shearwater	n/c	33000	6554	134	39688
Balearic Shearwater	n/c	7	7	1	15
Wilson's Storm-petrel	n/c	3			3
European Storm-petrel	n/c	60	171	1	232
Leach's Storm-petrel	n/c	56	8		64
Gannet	n/c		1808	187	1995
Grey Phalarope	n/c	150	1		151
Pomarine Skua	n/c	6	5	1	12
Arctic Skua	n/c	234	32	22	288
Long-tailed Skua	n/c	94		3	97
Great Skua	n/c	134	42	25	201
Puffin	n/c	105	57		162
Black Guillemot	n/c	1	3		4
Razorbill	n/c		151	87	238
Guillemot	n/c		69	43	112
Auk sp. (Guillemot/Razorbill)	n/c		1098	57	1155
Black Tern	n/c	27	1		28
Sandwich Tern	n/c	70	148	2	220
Common Tern	n/c	1			1
Arctic Tern	n/c	8581	44	9	8634
Sabine's Gull	n/c	1053	11		1064
Kittiwake	n/c		827	31	858
Little Gull	n/c	3		2	5
Mediterranean Gull	n/c	1			1
Total	n/c	45920	12925	751	59596

Table 7. Species list and totals from Brownstown Head between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Scoter	61	19	101	126	307
Red-throated Diver	10	11	6	3	30
Great Northern Diver	4	4	12		20
Unidentified diver sp.		1	1	1	3
Fulmar	143	118	333	277	871
Cory's Shearwater		2			2
Great Shearwater			1	1	2
Sooty Shearwater	2		2		4
Manx Shearwater	2366	1827	3646	1221	9060
Balearic Shearwater	4	4		1	9
European Storm-petrel	1			1	2
Gannet	1363	2211	906	1512	5992
Pomarine Skua	1	2	1		4
Arctic Skua	10	20	10		40
Unidentified small skua sp.			4	1	5
Great Skua	19	7	12	11	49
Puffin			12	9	21
Black Guillemot	4	2		4	10
Razorbill	25	93	82	49	249
Guillemot		28	77	20	125
Auk sp. (Guillemot/Razorbill)	71	313	620	592	1596
Sandwich Tern	242	767	200	214	1423
Common Tern	2				2
Roseate Tern		2			2
Arctic Tern	4	13		3	20
Commie Tern (Common/Arctic Tern)	71	29	18	1	119
Sabine's Gull			1		1
Kittiwake	242	1018	346	432	2038
Mediterranean Gull		1	2	4	7
Total	4645	6492	6393	4483	22013

Table 8. Species list and totals from Carnsore Point between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Scoter	25	24	83	141	273
Red-throated Diver	11	6	12		29
Great Northern Diver	1	3		2	6
Fulmar	29	4	222	94	349
Fea's/Zino's Petrel			2		2
Cory's Shearwater				1	1
Great Shearwater		3		1	4
Sooty Shearwater	5	20	3	2	30
Manx Shearwater	2610	7638	9671	1266	21185
Balearic Shearwater	44	10	1	7	62
European Storm-petrel	10	1	4	2	17
Gannet	1301	613	1909	1954	5777
Grey Phalarope	1				1
Pomarine Skua		1			1
Arctic Skua	10	2	11	2	25
Long-tailed Skua			2		2
Unidentified small skua sp.		2		1	3
Great Skua	8	5	11	5	29
Puffin	3	6	1	13	23
Black Guillemot	7	2		3	12
Razorbill	74	63	120	337	594
Guillemot	56	17	58	56	187
Auk sp. (Guillemot/Razorbill)	4001	1648	1583	1212	8444
Little Tern			6	3	9
Black Tern	2	5	27	1	35
Sandwich Tern	99	21	56	24	200
Common Tern	1	2			3
Roseate Tern	11		315		326
Arctic Tern	1				1
Commie Tern (Common/Arctic Tern)	312	124	1180	620	2236
Kittiwake	680	202	1874	461	3217
Little Gull	1	1	1	2	5
Mediterranean Gull			1		1
Total	9303	10423	17153	6210	43089

Table 9. Species list and totals from Dalkey between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Scoter	38	14	117	56	225
Red-throated Diver	22	12	4	8	46
Great Northern Diver	1		2	5	8
Fulmar	86	9	53	29	177
Sooty Shearwater	1				1
Manx Shearwater	895	2	1062	465	2424
Balearic Shearwater	1				1
European Storm-petrel	3				3
Gannet	797	218	263	696	1974
Pomarine Skua	1	1			2
Arctic Skua	22		2		24
Great Skua		1		1	2
Puffin				5	5
Black Guillemot	3	1	46	26	76
Razorbill		1	11	75	87
Guillemot		19	8	98	125
Auk sp. (Guillemot/Razorbill)	181	27	464	530	1202
Sandwich Tern	39	188	139	169	535
Common Tern	18				18
Roseate Tern	4				4
Arctic Tern	1		1	1	3
Commie Tern (Common/ Arctic Tern)	183	3963	112	1044	5302
Kittiwake	1063	1144	236	396	2839
Mediterranean Gull		4	11	35	50
Total	3359	5604	2531	3639	15133

Table 10. Species list and totals from Dursey Island between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Scoter	17	11	7	2	37
Red-throated Diver	5	1			6
Great Northern Diver	2	2	2	1	7
Fulmar	1155	182	998	15	2350
Great Shearwater		1			1
Sooty Shearwater	72	2490	192	216	2970
Manx Shearwater	4861	8498	1797	8028	23184
Balearic Shearwater	3			1	4
European Storm-petrel			5		5
Leach's Storm-petrel				2	2
Gannet	1763	2798	n/c	n/c	4561
Grey Phalarope	18	7			25
Pomarine Skua	1	13	2		16
Arctic Skua	8	18	2	4	32
Long-tailed Skua		1			1
Unidentified small skua sp.			1		1
Great Skua	24	44	3	8	79
Puffin	14	54	2		70
Razorbill	9	20	n/c	n/c	29
Guillemot	19	18	n/c	n/c	37
Auk sp. (Guillemot/Razorbill}	1311	2699	1661	2829	8500
Black Tern		4			4
Sandwich Tern	19		4	4	27
Common Tern	13			3	16
Arctic Tern	19	878		42	939
Commie Tern (Common/Arctic Tern)	43	125	2	91	261
Sabine's Gull	1	41			42
Kittiwake	2999	1214	923	723	5859
Mediterranean Gull	1				1
Total	12377	19119	5601	11969	49066

Table 11. Species list and totals from Galley Head between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Scoter	5		106	30	141
Great Northern Diver			2		2
Fulmar	306	n/c	n/c	n/c	306
Cory's Shearwater	1		464		465
Great Shearwater	3	7	91	4	105
Sooty Shearwater	10	8	124	10	152
Manx Shearwater	3805	1600	2735	1784	9924
Balearic Shearwater	8	2		2	12
Wilson's Storm-petrel	2				2
European Storm-petrel	119	3	19	10	151
Gannet	853	n/c	538	n/c	1391
Pomarine Skua		1	16		17
Arctic Skua		1	4		5
Long-tailed Skua			1		1
Great Skua	9	4	24	9	46
Puffin	21		182	8	211
Black Guillemot	1	2	1		4
Razorbill	33	n/c	3	n/c	36
Guillemot	13	n/c	1	n/c	14
Auk sp. (Guillemot/Razorbill)		n/c	1172	n/c	1172
Sandwich Tern	43		1	2	46
Common Tern	27		2		29
Arctic Tern		12	62	3	77
Commie Tern (Common/Arctic Tern)			12		12
Kittiwake	61	n/c	500	9	570
Mediterranean Gull			1		1
Total	5320	1640	6061	1871	14892

Table 12. Species list and totals from Wicklow Head between 2010 and 2013

Species	2010	2011	2012	2013	Total
Common Scoter		38	109	**88**	235
Red-throated Diver	11	16	16	16	59
Great Northern Diver		6			6
Fulmar	8	18	77	21	124
Cory's Shearwater		1	1		2
Sooty Shearwater		4	4		8
Manx Shearwater	183	366	4116	229	4894
Balearic Shearwater			2		2
European Storm-petrel		2			2
Gannet	116	284	489	173	1062
Arctic Skua	5	14	14		33
Long-tailed Skua	2				2
Great Skua			6	1	7
Black Guillemot	3	41	57	17	118
Razorbill	35	11	10	52	108
Guillemot	2	140	21	270	433
Auk sp. (Guillemot/Razorbill)	21	131	97	77	326
Sandwich Tern	18	130	153	69	370
Common Tern	19	18	4	13	54
Arctic Tern		1	1		2
Commie Tern (Common/Arctic Tern)		4			4
Kittiwake	25	4062	1197	1996	7280
Little Gull	1	10		20	31
Mediterranean Gull				6	6
Total	449	5297	6374	3048	15168

Select species accounts

Common Scoter *(Melanitta nigra)*

Passage was greatest at sites in the Irish Sea and South East with similar number of birds moving in both directions suggesting local movement between feeding sites. Passage along the West coast was more unidirectional in a general South (or Westerly) direction suggesting true passage away from breeding grounds in Northerly latitudes (Fig. 5). Overall numbers were highest in 2012 and 2013 when greatest cumulative mean rates per hour was recorded across all sites (Fig. 6).

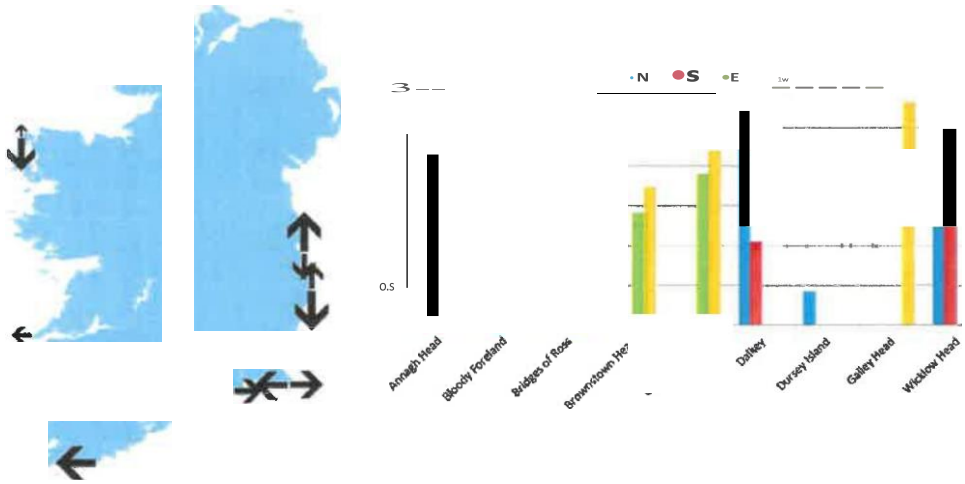


Figure 5. Mean rates per hour and direction of Common Scoter passage at watch points across all years 2010 to 2013.

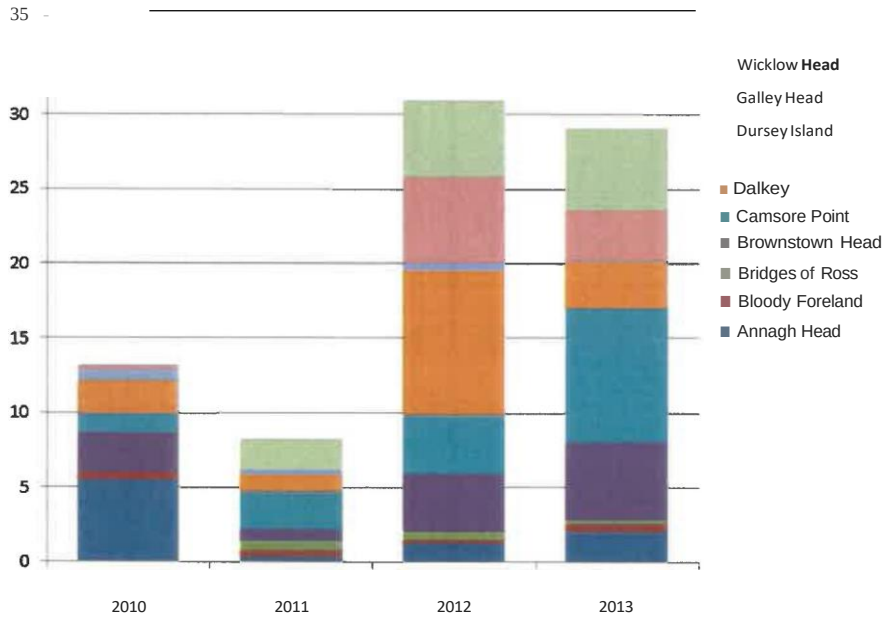


Figure 6. Cumulative mean rates per hour of Common Scoter recorded from all watch points between 2010 and 2013.

Fulmar *(Fulmarus glacialis)*

Passage was greatest at sites on the West, with higher rates per hour moving in a South or West direction. Sites in the South East also showed stronger movement West (Fig. 7). Overall numbers were highest in 2012 when greatest cumulative mean rates per hour was recorded across all sites (Fig. 8).

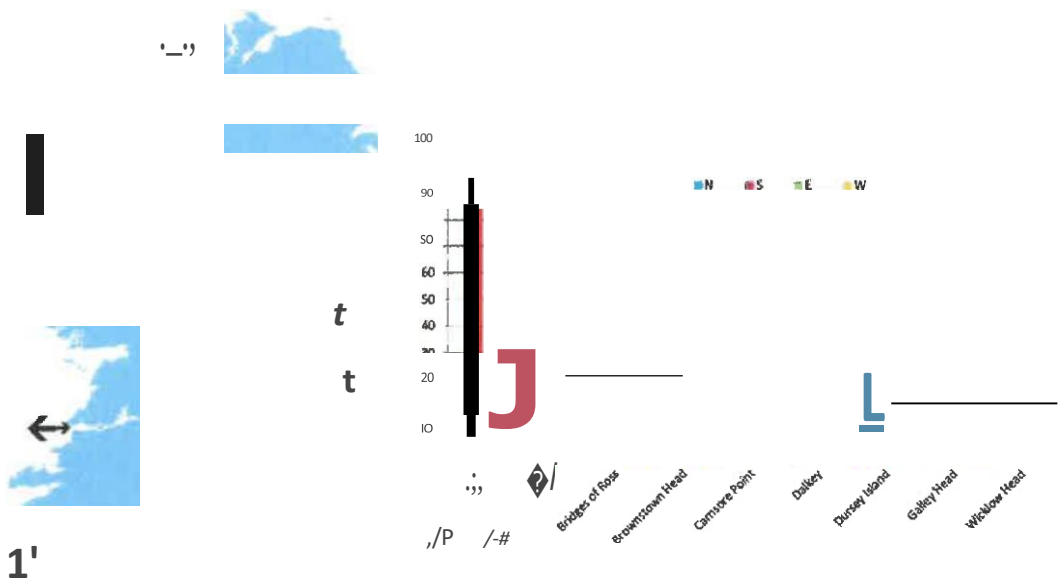


Figure 7. Mean rates per hour and direction of Fulmar passage at watch points across all years 2010 to 2013.

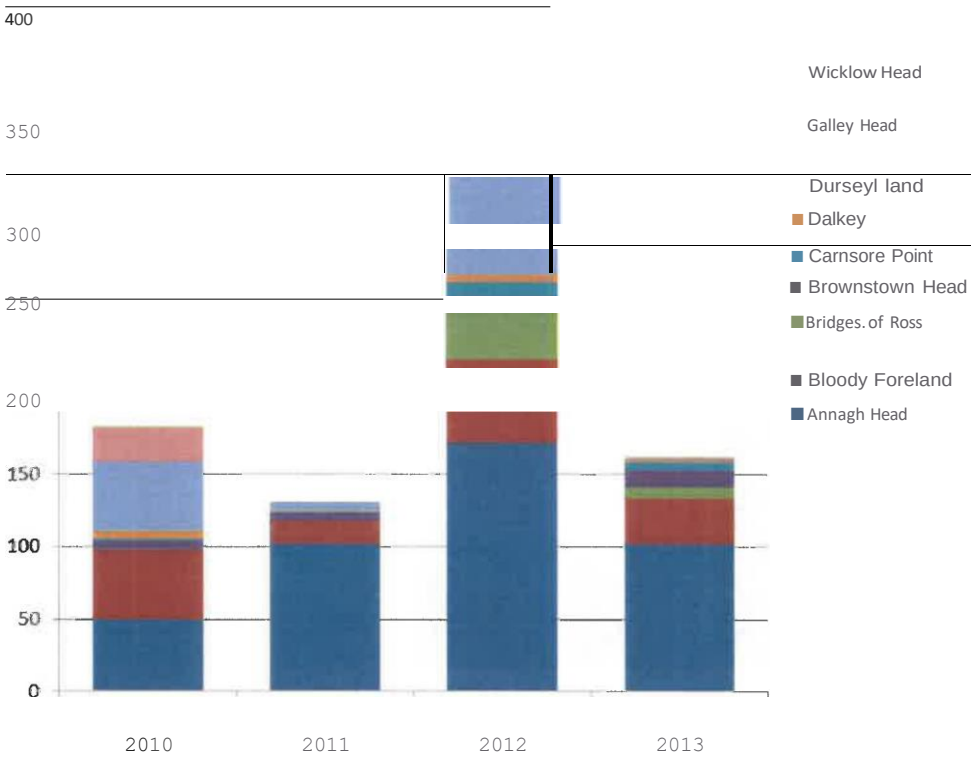


Figure 8. Cumulative mean rates per hour of Fulmar recorded from all watch points between 2010 and 2013.

Sooty Shearwater *(Puffinus grisesus)*

A species with a strong West coast dominance in distribution and abundance. Only small numbers were recorded at sites in the East or South East. Passage along the West coast was greatest in a general South (or Westerly) direction except at Dursey Island where a prominent Northerly movement was recorded (Fig. 9). Overall numbers were highest in 2011 when greatest cumulative mean rates per hour were recorded across all sites (Fig. 10).

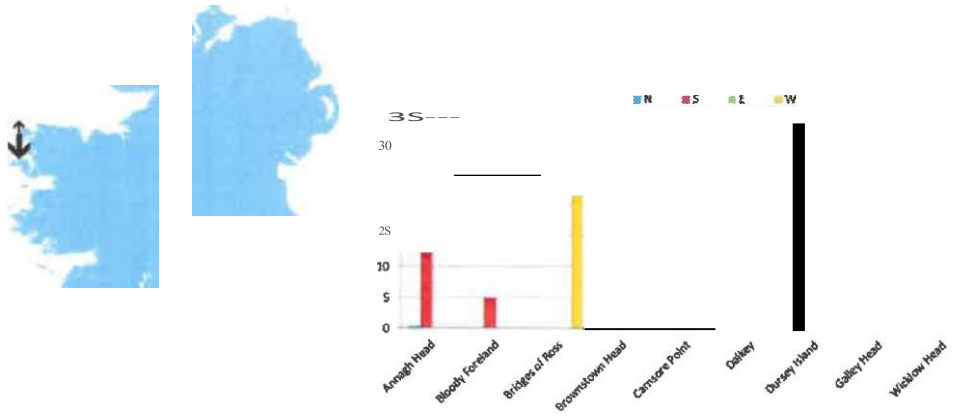


Figure 9. Mean rates per hour and direction of Sooty Shearwater passage at watch points across all years 2010 to 2013.

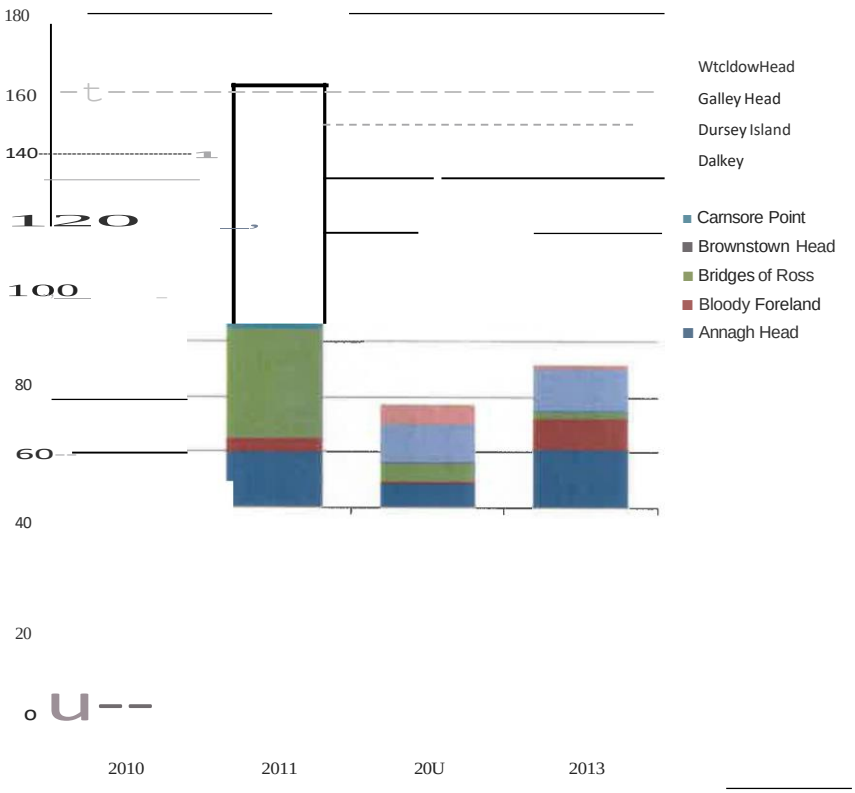


Figure 10. Cumulative mean rates per hour of Sooty Shearwater recorded from all watch points between 2010 and 2013.

Manx Shearwater *(Puffinus puffinus)*

A species which showed a varied pattern of movement in all directions at sites around the country. A strong South or West dominance in passage was noted along the West and South West coasts whilst similar movement in all directions along the East and South suggest movement between local feeding sites (Fig. 11). Overall numbers were highest in 2011, and high again in 2012 and 2013 when greatest cumulative mean rates per hour was recorded across all sites (Fig. 12).

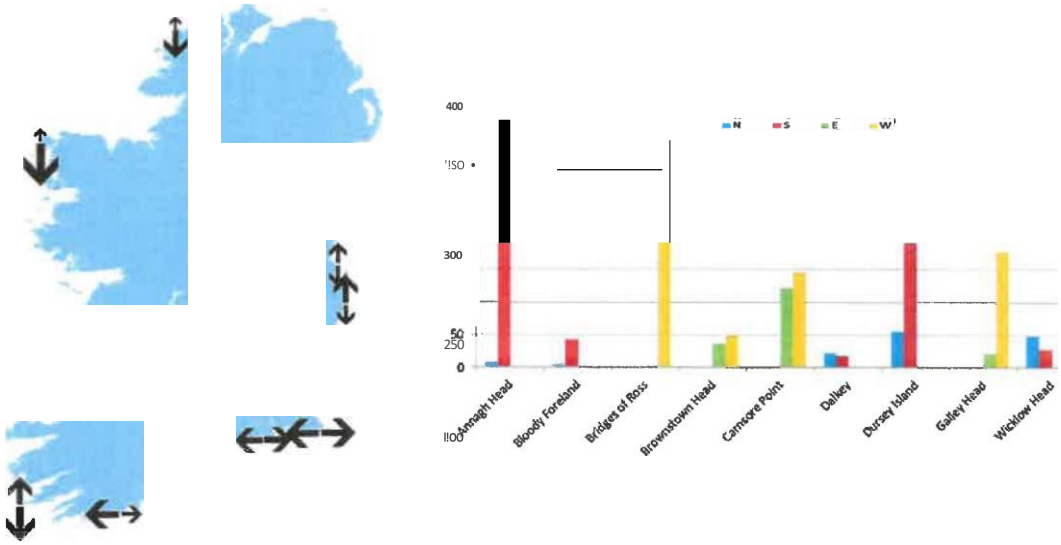


Figure 11. Mean rates per hour and direction of Manx Shearwater passage at watch points across all years 2010 to 2013.

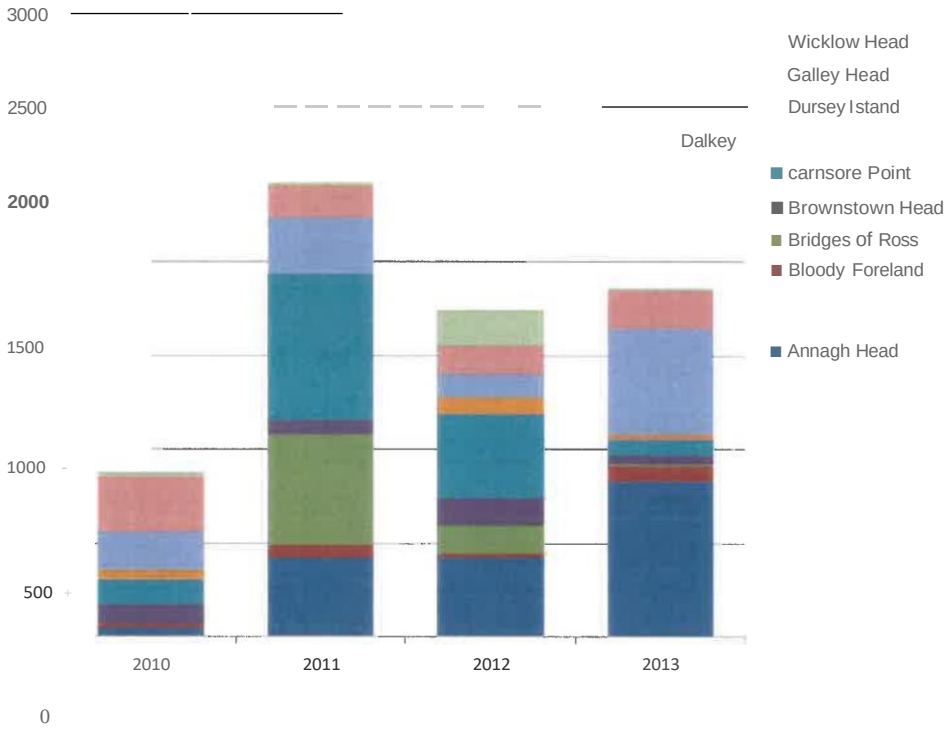


Figure 12. Cumulative mean rates per hour of Manx Shearwater recorded from all watch points between 2010 and 2013.

On the Western seaboard, movement was strongest in a South or West direction. Sites in the Irish Sea also noted a Southward direction of passage (Fig. 13). Sites in the South East (Carnsore Point and Brownstown Head) recorded more birds moving in both directions suggesting movement between local feeding sites as with Manx Shearwater (Fig. 11). Overall numbers were highest in 2010 and lowest in 2012 (Fig. 14). A total of 122 birds was recorded across all four years with the greatest

concentration in August, followed by totals dropping off gradually through September and October. Single birds were recorded in late July and early November (Fig. 15).

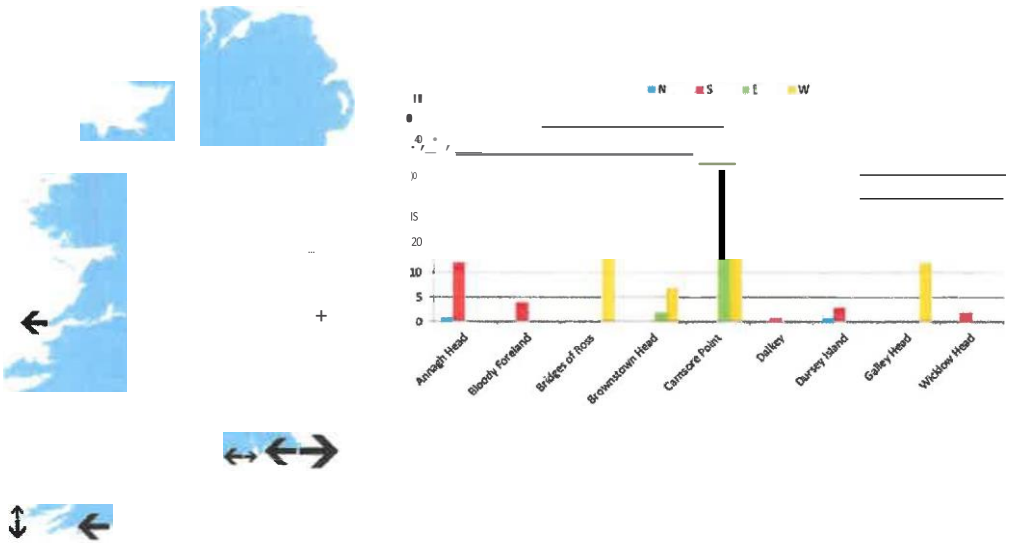


Figure 13. Mean rates per hour and direction of Balearic Shearwater passage at watch points across all years 2010 to 2013.

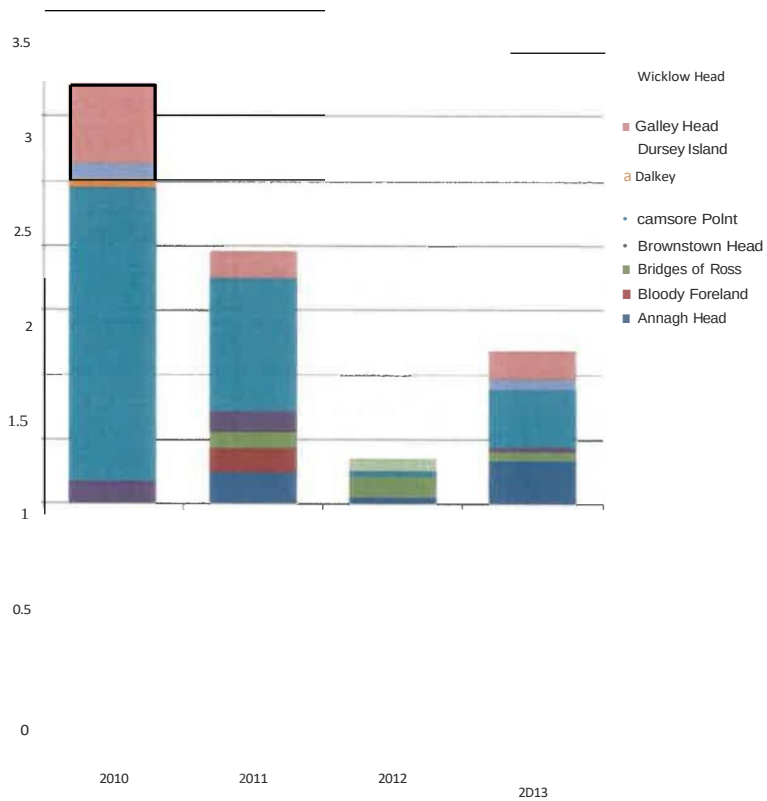


Figure 14. Cumulative mean rates per hour of Balearic Shearwater recorded from all watch points between 2010 and 2013.

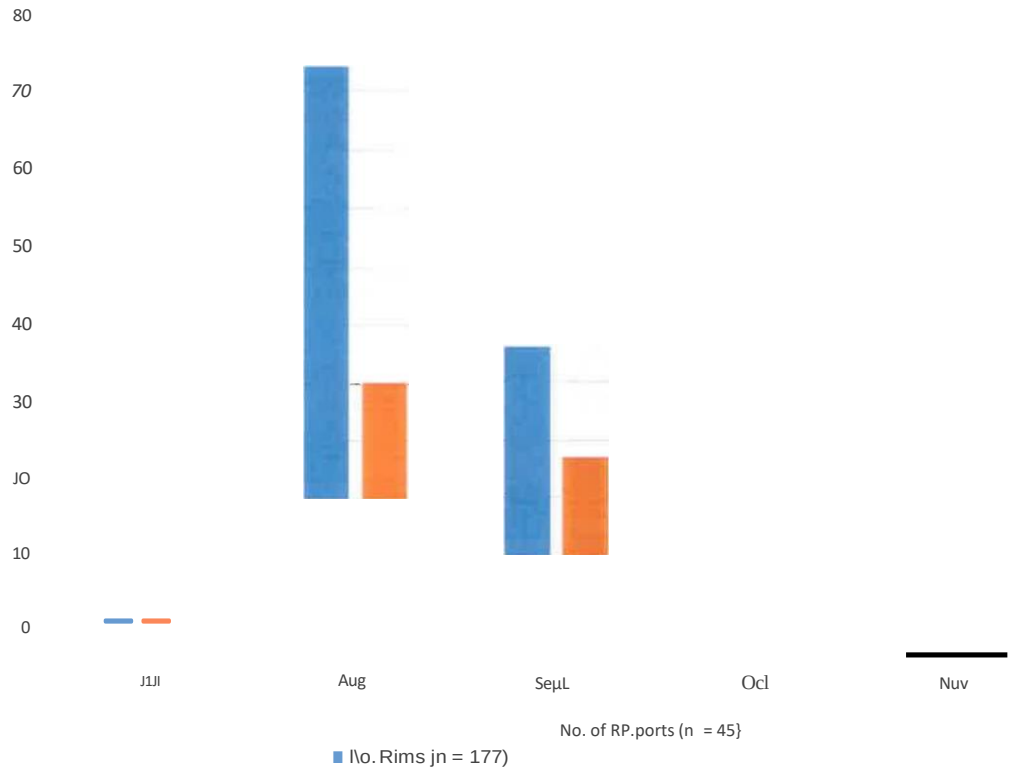


Figure 15. Cumulative temporal distribution of Balearic Shearwater across all watch points from 2010 to 2013.

Gannet *(Morus bassanus)*

A stronger bias towards Southward passage was evident from sites in the North West only, with all other sites showing similar number moving in all directions suggesting birds commuting between local feeding sites {Fig. 16). Overall numbers were highest in 2011, and high again in 2012 and 2013 when greatest cumulative mean rates per hour was recorded across all sites {Fig. 17).

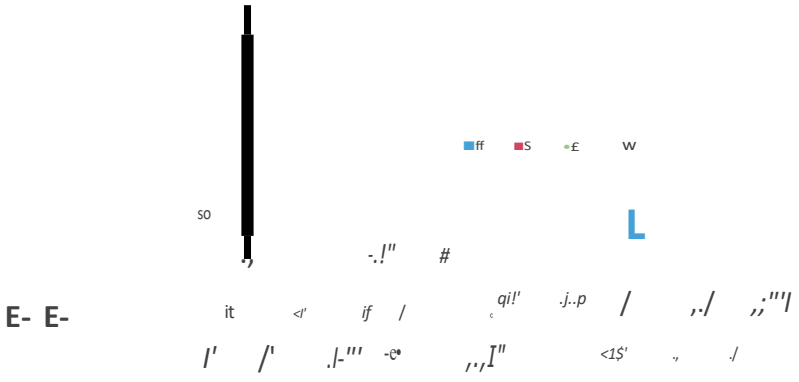


Figure 16. Mean rates per hour and direction of Gannet passage at watch points across all years 2010 to 2013.

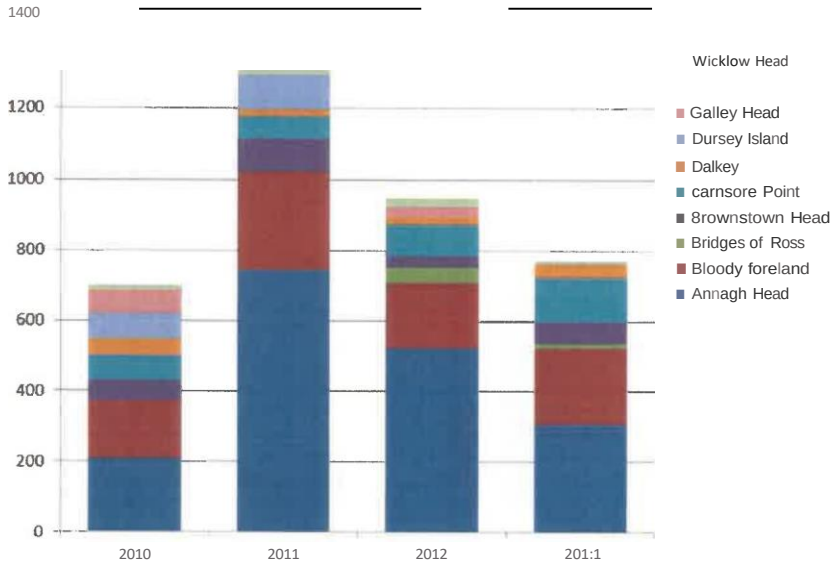


Figure 17. Cumulative mean rates per hour of Gannet recorded from all watch points between 2010 and 2013.

Arctic Skua *(Stercorarius parasiticus)*

Southward passage was more evident from sites in the West and North West only, with all other sites showing similar number moving in all directions suggesting birds following other seabird species moving between local feeding sites (Fig. 18). Overall numbers were highest in 2011 when greatest cumulative mean rates per hour was recorded across all sites (Fig. 19).

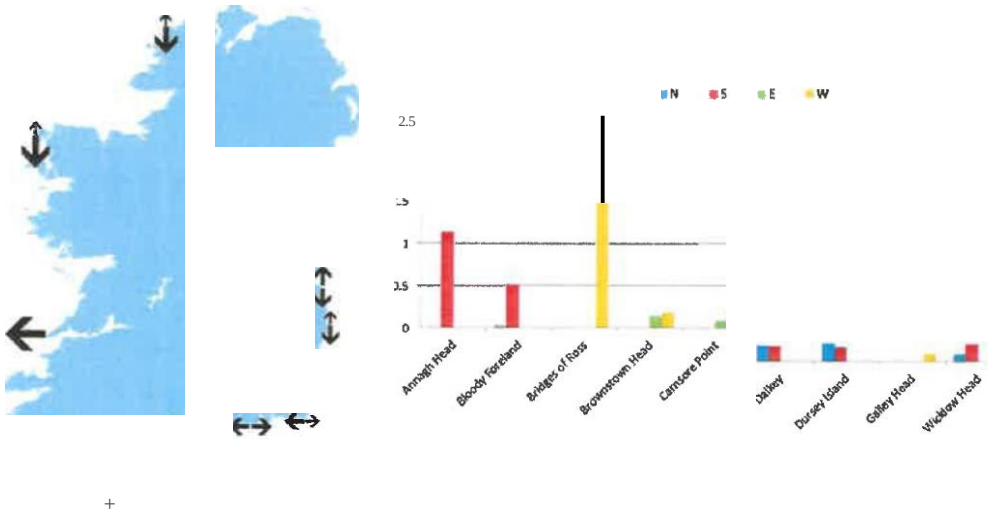


Figure 18. Mean rates per hour and direction of Arctic Skua passage at watch points across all years

2010 to 2013.

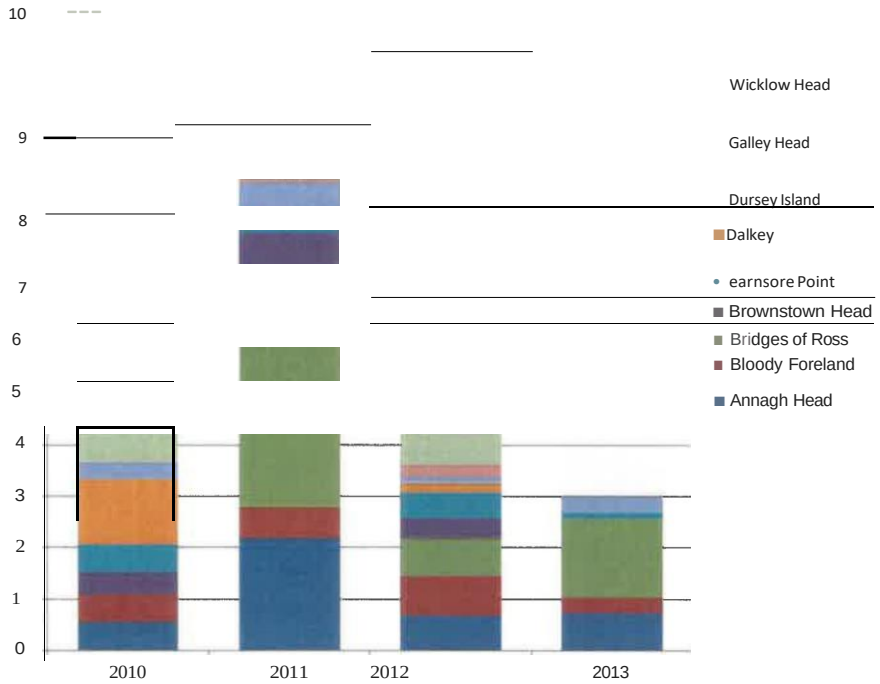


Fig. 19. Cumulative mean rates per hour of Arctic Skua recorded from all watch points between 2010 and 2013.

Great Skua *(Stercorarius skua)*

Passage in a South or West direction was evident from sites along the Atlantic seaboard in the West. Sites in the East and South East showing similar number moving in both directions suggesting birds following other seabird species moving between local feeding sites (Fig. 20). Overall numbers were lowest in 2010 and similar through 2011, 2012 and 2013 (Fig. 21).

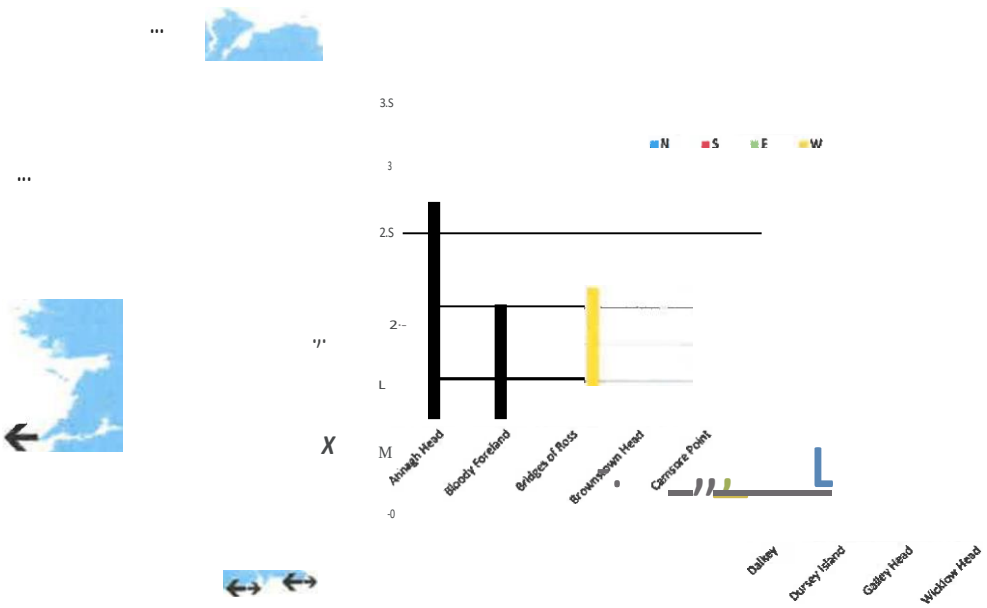


Figure 20. Mean rates per hour and direction of Great Skua passage at watch points across all years 2010 to 2013.

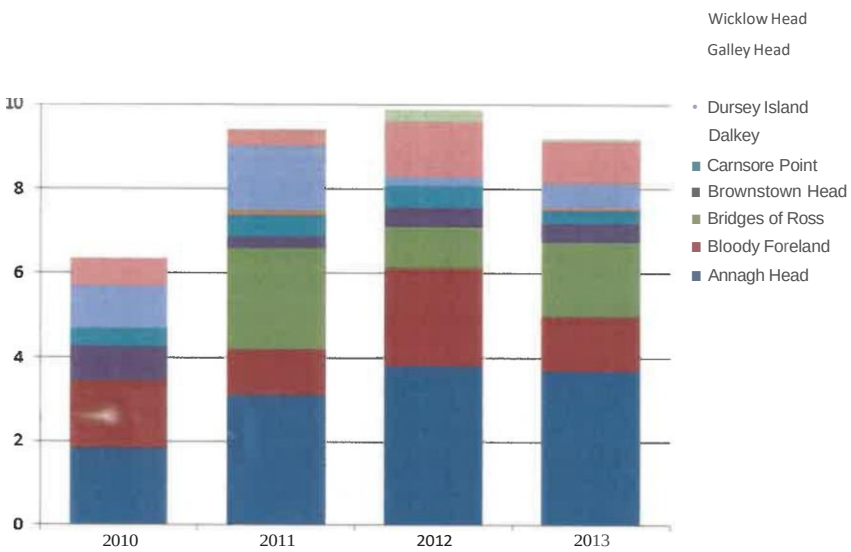


Figure 21. Cumulative mean rates per hour of Great Skua recorded from all watch points between 2010 and 2013.

Kittiwake *(Risso tridactyla)*

Strongest Southward passage was observed along the West coast whilst sites in the East and South East showed similar movement in both directions suggesting bird commuting between local feeding sites (Fig. 22). Overall numbers were highest in 2011when greatest cumulative mean rates per hour was recorded across all sites (Fig. 23).

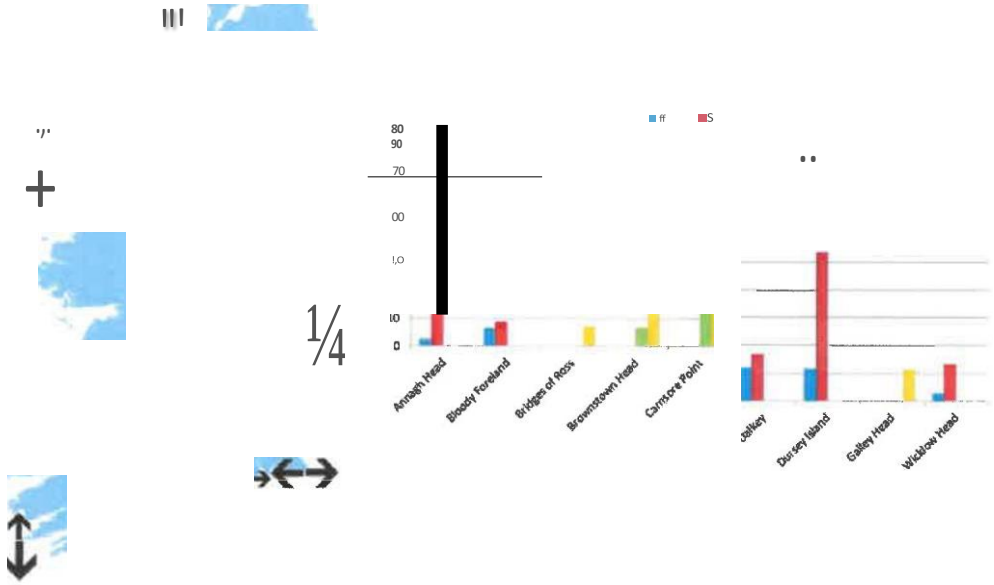


Figure 22. Mean rates per hour and direction of Kittiwake passage at watch points across all years 2010 to 2013.

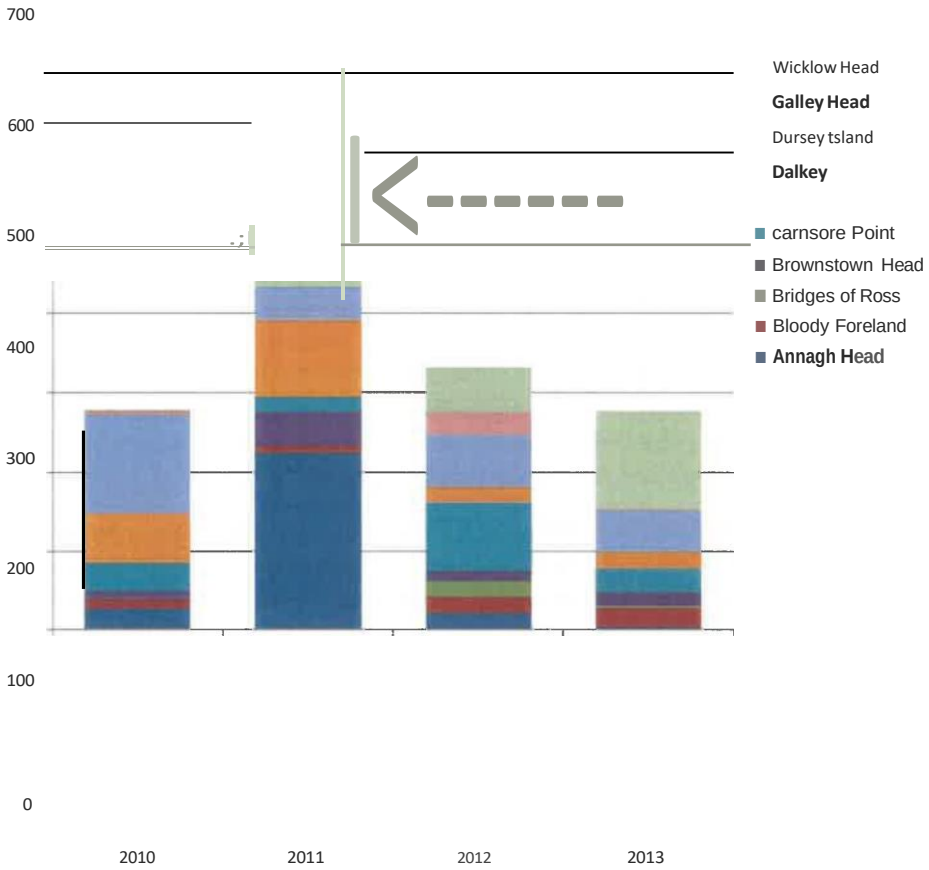


Figure 23. Cumulative mean rates per hour of Kittiwake recorded from all watch points between 2010 and 2013.

Discussion

Observing seabird migration from coastal headlands ('seawatching') in Ireland has been commonplace among resident and visiting birdwatchers and ornithologists since the 1960's, particularly from established bird observatories like Cape Clear where methodical surveys and studies into passage rates was often conducted (Sharrock, 1960; Sharrock, 1967; Ruttledge, 1967; Waters, 1967). The practice of 'seawatching' has continued as a popular seasonal aspect of the Irish ornithological calendar ever since but has focused heavily on recording scarce and rare species driven close to shore by extreme weather events. As such, it has been a long time since any dedicated or standardised documentation of all round seabird passage in Irish coastal waters has been undertaken.

The methodology employed by Seatrack, of standardised counts on designated weekends between late July and early November inclusive ensured that a bias in

recording effort in relation to extreme weather conditions was not present. Surveys were conducted in all weather types and were only terminated when visibility was reduced to 'poor' on account of heavy sea mist or strong sun glare. In this way, a more typical or average rate of seabird passage recorded was to be expected. However, some extreme weather events were encountered on designated survey weekends with volunteers treated to some spectacular seabirds movements e.g. 865 Sabine's Gulls, 8,000 Arctic Terns, 76 Long-tailed Skuas and 10,000 Manx Shearwaters moved West past The Bridges of Ross on 1th September 2011 (included within totals given on Table 6).

The results presented in this report identify a strong flyway along the Atlantic coast of Ireland with cumulative totals of seabird recorded at Bloody Foreland, Annagh Head and the Bridges of Ross being particularly high (31440, 100845 and 59596 individual seabirds respectively) (Table 4; Table 5; Table 6). Species richness is highest overall along the West coast with many rare and scarce species

from breeding areas in the Arctic and sub-Antarctic being recorded in addition to dispersing Irish and European breeding species (Table 3). Cumulative seabird totals and species richness recorded at sites along the South coast (Celtic Sea region) are again high and a marked reduction is noted in both abundance and species richness on the East coast (Irish Sea region) e.g. 25 species and 22013 individual seabirds recorded at Brownstown Head (Celtic Sea) and 22 species and 15168 individual seabirds recorded at Wicklow Head (Irish Sea) (Table 3; Table 7; Table 12).

Direction of movement varied between sites and species but a stronger passage of birds moving South or West from Atlantic sites was noted suggesting birds moving from Northerly breeding latitudes to seasonal foraging areas which become productive further South later in the Autumn and Winter. This supports a long standing idea that a major flyway exist along the West coast of Ireland. Gannet provides a good example of this with highest totals and rates per hour moving South past Annagh Head and Bloody Foreland in the North West (Table 4; Table 5; Fig. 16).

Seabird movements in the Irish Sea and in the eastern Celtic Sea show more varied patterns with many species noted moving in all directions (relative to each site). This would suggest that in these areas, observed 'migration' may involve birds moving between local feeding sites during both the breeding and early post-breeding period. Results presented for Common Seater (Fig. 5), Manx Shearwater (Fig. 11), Gannet (Fig. 16) and Kittiwake (Fig. 22) provide good examples of this. In this case of Gannet, it has been shown that birds from the breeding colony at Great Saltee in Co. Wexford move both West into the Celtic Sea and North into the Irish Sea to forage during the breeding season (Wakefield et al., 2013). This is likely to account for the similar rates of passage in all direction at sites such as Brownstown Head, Carnsore Point and Wicklow Head, particularly in July and August when chick provisioning is ongoing (Nelson, 1966). Similarly, Manx Shearwaters from breeding colonies on Skomer, Wales are known to utilise extensive foraging ranges, moving West into the Celtic Sea and North to the frontal zone between the North Channel and the Irish Sea (Guilford et al., 2008), thus likely to relate to the birds seen passing in both directions in similar numbers past the East and South East coast watch points in question here.

In the case of Sooty Shearwater, their abundance and distribution shows a clear East-West divide between sites with highest numbers of birds recorded moving South or West along the Atlantic coast and with very few seen in the Irish Sea (Fig. 9). There is one obvious exception, that of a high rate of birds moving in a Northerly direction past Dursey Island (Fig. 9). This relates to a large aggregation of birds off the island in 2011 which were believed to be moving in search of prey as some 'milling' birds were noted (Derek A. Scott, pers. comm.). In late September and throughout October, large numbers of Sooty Shearwaters gather in coastal waters of Co. Kerry and West Cork where they appear to be attracted by rich feeding provided by shoaling clupeids such as European Spratt *(Sprattus sprattus)* and Atlantic Herring *(Clupea harengus)* (Niall T. Keogh

pers. obs.).

The focal species of the Seatrack survey, the Balearic Shearwater was recorded from all watch points and during all designated survey weekends during 2010. A total of 45 reports of 122 individuals were received, indicating a peak in abundance through August (Fig. 15) and with highest numbers observed in 2010 (Fig. 14). The peak in occurrence during 2010 included a record of 41 birds seen during a Seatrack survey from Carnsore Point on 8th August, the highest single day total ever recorded in Ireland to date. This coincided with a record influx into the Western English Channel in late July of that year (SeaWatch SW, 2010). Movements of Balearic Shearwaters along the coast followed a predominately South or West direction, consistent with birds undertaking post-breeding dispersal along with other shearwater species. However, sites in the South East (Carnsore Point and to a lesser extent, Brownstown Head) recorded higher numbers of Balearic Shearwaters moving in both directions East and West (Fig. 13) which would indicate foraging behaviour. Direct evidence

from observations in this area in particular revealed that Balearic Shearwaters were often seen travelling and foraging in the company of Manx Shearwaters which themselves were most likely present there in a foraging capacity. It was noted by several volunteer observers that nearly all Balearic Shearwaters recorded were seen very close to shore, keeping in line with their strict coastal foraging habits (Mourino et al., 2003; Yesou, 2003).

The number of Balearic Shearwaters recorded in Irish coastal waters remains low in comparison to their increasing abundance as documented in the English Channel, most notably off South West Cornwall (Wynn et al., 2010). The number of birds recorded in Irish coastal waters across years can vary markedly, even when standardised seawatching surveys are conducted such as the Seatrack project (Fig. 14). It is likely that, here at the Northern and Western edge of their post-breeding dispersal range, numbers of Balearic Shearwaters recorded annually is likely to be influenced by inter-annual variations in prey availability and sea surface temperatures. Yet, given the evidence presented here of a small number of Balearic Shearwaters being regularly seen at certain sites coupled with foraging behaviour being observed also, then it is imperative that monitoring of their numbers and occurrence continues in future years to ascertain if any change in status occurs.

The standardised survey methods undertaken by Seatrack between 2010 and 2013 have proven effective in engaging a sizeable pool of volunteers which have produced excellent effort and coverage leading to a large data set indicating and clarifying at which sites can true passage and local foraging movements can be observed. It has also highlighted foraging ranges of key shearwater species of conservation priority at certain times of the season, some of which are backed up by already published electronic tracking studies.

It is recommended that standardised seabird migration surveys from Irish coastal headlands continue in a manner similar to if not identical as that established by the Seatrack project. This will help improve our understanding of seabird migration and dispersal along the Irish coast by building on an already existing dataset as initiated and presented here and also provide a baseline for investigating potential variations in temporal and spatial patterns in future years. Furthermore, these surveys should also continue to be conducted in tandem with similar coastal seabird surveys being undertaken by fellow FAME partners, thus creating a larger and more dynamic dataset from which to investigate patterns of seabird dispersal along the European Atlantic seaboard.

References

Arcos, J.M. (compiler) (2011) International species action plan for the Balearic Shearwater, *Puffinus mauretanicus.* SEO/Birdlife & Birdlife International.

Birdlife International (2010) Marine Important Bird Areas: priority sites for the conservation of biodiversity. Cambridge, UK: Birdlife International.

Guilford, T., Wynn, R., McMinn, M., Rodriguez, A., Fayat, A., Maurice, L., Jones, A. & Meier, R. (2012) Geolocators reveal migration and pre-breeding behaviour of the critically endangered Balearic Shearwater *Puffinus mauretanicus. PLoS ONE* 7(3): e33753.

IRBC (2012) The Irish List. IRBC website. Available: http://irbc.ie/topbar/IrishList/IRBC Irishlist(31122012).pdf. Accessed 2014 March 21.

IUCN (2011) IUCN Red List of Threatened Species. Version 2011.2. IUCN website. Available: http://www.iucnredlist.org. Accessed 2014 February 26.

Le Mao P. & Yesou P. (1993) The annual cycle of Balearic Shearwaters and western-Mediterranean Yellow-legged Gulls: some ecological considerations. In: Aguilar JS, Monbailliu X, Paterson AM, eds. Status and conservation of seabirds, Proceedings of the 2nd Mediterranean Seabird Symposium. pp 135-145. 9.

Dias, M. P., Granadeiro, J. P., Phillips, R. A., Alonso H. & Catry, P. (2010) Breaking the routine: individual Cory's shearwaters shift winter destinations between hemispheres and across ocean basins. Proc. R. Soc. B. published online 24 November 2010 doi: 10.1098/rspb.2010.2114

Guilford, T. C., Meade, J., Freeman, R., Bino, D., Evans, T., Bonadonna, F., Boyle, D., Roberts, S. & Perrins, C. M. (2008) GPS tracking of the foraging movements of Manx Shearwaters *Puffinus puffinus* breeding on Skomer Island, Wales. *Ibis,* doi: 10.1111/j.1474-919x.2008.00805.x

Mourino, J., Arcos, F., Salvadores, R., Sandoval, A. & Vidal, C, (2003) Status of the Balearic shearwater *(Puffinus mauretanicus)* on the Galician coast (NW Iberian Peninsula). *Scientia. Marina,* 67(52): 135-142.

Nelson, J. B. (1966) The breeding biology of the Gannet *Sula bassana* on the Bass Rock, Scotland.

Ibis, 108(4): 584-626.

Oro, D., Aguilar, J. S., lgual, J. M. & Louzao, M. (2004) Modelling demography and extinction risk in the endangered Balearic Shearwater. *Biol. Conserv.* 116: 93-102.

Parsons, M., Mitchell, I., Butler, A., Ratcliffe, N., Frederiksen, M., Foster, S., & Reid, J. B. (2008) Seabirds as indicators of the marine environment. - *ICES Journal of Marine Science,* 65: 1520- 1526.

Ruttledge, R. F. (1967) The sampling theory of sea-passage at Cape Clear, II. *Cape Clear Bird Obs.*

Buff., 18: 12-15.

SeaWatch SW (2010) SeaWatch SW news archive August-September 2010. SeaWatch SW website.

Available: www.seawatch-sw.org/news.html . Accessed 2014 March 21.

Sharrock, J. T. R. (1960) A sea-watch analysis. *Cape Clear Bird Obs. Rep.,* 2: 23-26.

Sharrock, J. T. R. (1967) The sampling theory of sea-passage at Cape Clear. Cape Clear Bird Obs. Bull., 17: 14-17.

Wakefield, E. D., Bodey, T. W., Bearhop, S., Blackburn, J., Colhoun, K., Davies, R., Dwyer, R. G., Green,

J. A., Gremillet, D., Jackson, A. L., Jessopp, M. J., Kane, A., Langston, R. H. W., Lescroel, A., Murray, S., Le Nuz, M., Patrick, S. C., Peron, C., Soanes, L. M., Wanless, S., Votier, S. C. & Hamer, K. C. (2013) Space Partitioning Without Territoriality in Gannets. *Science* 341(6141): 68-70.

Waters, W. E. (1967) The sampling theory of sea-passage at Cape Clear, Ill, Cape Clear Bird Obs. Bull., 18: 15-17.

Wynn, R.B. (2009) Balearic Shearwaters in UK and Irish waters from 2004 to 2006. *British Birds,* 102, 350-354.

Wynn, R.B., Brereton, T.M., Jones, A.R. & Lewis, K.M. (2010) SeaWatch SW Annual Report 2009.

National Oceanography Centre, Southampton, 118 pp.

Wynn, R.B., Josey, S.A., Martin, A.P., Johns, D.J. & Yesou, P. (2007) Climate-driven range expansion of a critically endangered top predator in northeast Atlantic waters, *Biology Letters,* 3, 529-532.

Wynn, R.B. & Yesou, P. (2007) Changing status of the Balearic Shearwater *Puffinus mauretanicus* in northwest European waters. *British Birds,* 100, 392-406.

Yesou, P. (2003) Recent changes in the summer distribution of the Balearic Shearwater *Puffinus mauretanicus* off western France. *Scientia Marina,* 67(suppl. 2): 143-148.

Appendices

Appendix 1. Temporal details of surveys conducted at each watch point from 2010 to 2013

Site	Year	Total duration {hrs)	First date	Last date	Total periods watched	Shortest period {hrs)	Longest period {hrs)
Annagh Head	2010	2012	24.0	18.0		08/0	07/09/2013
Annagh Head						8/20	
Annagh Head	2011	2013	**28.8**	24.0		10	07/08/2010
Annagh Head							
Bloody Foreland	2012	2010	21.0	28.5		06/0	23/07/2011
Bloody Foreland						8/20	
Bloody Foreland	2013	2011	15.0	14.0		11	22/07/2012
Bloody Foreland							
Bridges of Ross	2010	2012	20.0	14.0		22/0	21/07/2013
Bridges of Ross						7/20	
Bridges of Ross	2011	2013	21.5	13.0		12	08/08/2010
Brownstown Head	2012	2010	21.0	9.5			08/08/2011
Brownstown Head						03/0	
Brownstown Head	2013	2011	24.2	18.5		8/20	21/07/2012
Brownstown Head						13	
Carnsore Point	2011	2012	56.2	9.0			21/07/2013
Carnsore Point						07/0	
Carnsore Point	2012	2013	43.2	7.8		8/20	07/08/2010
Carnsore Point						10	
Dalkey	2013	2010	14.3	18.5			06/08/2011
Dalkey						23/0	
Dalkey Dalkey	2010	2011	23.0	21.0		7/20	21/07/2012
Dalkey Dursey	2011	2012	24.0	16.0		11	21/07/2013
Island Dursey							
Island Dursey	2012	2013	26.0			20/1	07/08/2010
Island Dursey						0/20	
Island Galley	2013		24.0			10	23/07/2011
Head Galley							
Head Galley	2010		19.3			20/0	04/08/2012
Head Galley						7/20	
Head	2011		9.8			13	21/07/2013
	2012		21.5			21/0	24/07/2010
Wicklow Head						8/20	
Wicklow Head	2013		15.8			11	23/07/2011
Wicklow Head							
Wicklow Head	2010		17.3			22/0	22/07/2012
						7/20	
	2011		12.0			12	21/07/2013
			12.0				

19/09/2010

07/08/2011

21/07/2012

20/07/2013

06/11/2010

96

05/11/2011

43

21/10/2012

42

06/10/2013

30

06/11/2010

80

06/11/2011

39

03/11/2012

42

02/11/2013

48

18/09/2011

5

18/08/2013

34

08/09/2013

4

17/10/2010

90

06/11/2011

47

03/11/2012

52

02/11/2013

48

06/11/2010

73

06/11/2011

20

03/11/2012

39

02/11/2013

32

04/10/2010

69

02/11/2011

24

07/10/2012

24

02/11/2013

36

06/11/2010

96

05/11/2011

so

03/11/2012

28

03/11/2013

28

21/08/2010

37

17/09/2011

5

02/11/2012

30

17/08/2013

3

06/11/2010

16

06/11/2011

34

03/11/2012

42

03/11/2013

32

0.25

0.50

0.50

0.50

0.25

0.50

0.50

0.50

7.25

0.50

2.00

0.25

0.50

0.50

a.so

0.25

0.25

0.50

0.25

0.25

0.50

0.50

0.25

0.50

0.50

0.25

1.50

0.50

3.00

0.25

0.50

0.50

0.50

0.25

7.83

0.50

a.so

0.25

2.50

a.so

0.67

12.67

6.58

5.75

0.50

1.00

0.50

0.50

1.33

a.so

2.50

0.50

0.25

a.so

0.50

0.50

0.25

3.50

0.50

0.50

1.00

2.00

4.00

3.00

0.50

1.00

a.so

0.50

Appendix 2. Taxonomic list of species detailed in this text

Vernacular Name	Scientific Name

Seabirds

Mute Swan Whooper Swan

Greeland White-fronted Goose
Barnacle Goose

Light-bellied Brent Goose Shelduck

Wigeon Teal
Mallard
Tufted Duck
Scaup

Eider

Common Scoter

Red-breasted Merganser
Red-throated Diver Black-throated Diver Great Northern Diver Fulmar

Fea's/Zino's Petrel
Cory's Shearwater Great Shearwater Sooty
Shearwater Manx
Shearwater Balearic
Shearwater Wilson's
Storm-petrel European
Storm-petrel Leach's Petrel

Gannet
Cormorant

Great Crested Grebe
Whimbrel

Grey Phalarope
Pomarine Skua
Arctic Skua Long-tailed Skua Great Skua Puffin

Black Guillemot
Razorbill
Guillemot

Little Tern

Gull-billed Tern
Black Tern
Sandwich Tern
Common Tern
Roseate Tern
Arctic Tern
Sabine's Gull
Kittiwake

Little Gull

Risso tridactyla Hydrocoloeus minutus

Cygnus olor Cygnus cygnus

Anser albifrons flavirostris
Branta leucopsis

Branta bernicla hrota
Tadorna tadorna Anos penelope

Anos crecca

Anos platyrhynchos
Aythyafuligula Aythya marila Somateria mollissima Melanitta nigra Mergus serrator
Gavia stellata

Gavia arctica

Gavia immer
Fulmarus glacialis

Pterodroma feae I *madeira*

Calonectris diomedea
Puffinus gravis Puffinus griseus Puffinus puffinus
Puffinus mauretanicus
Oceanites oceanicus
Hydrobates pelagicus

Oceanodroma /eucorhoa
Morus bassanus
Phalacrocorax carbo Podiceps cristatus Numenius phaeopus
Phalaropus fulicarius
Stercorarius pomarinus
Stercorarius parasiticus
Stercorarius longicaudus
Stercorarius skua Fratercula arctica Cepphus grylle

Alea torda
Uria aalge

Sternula albifrons
Gelochelidon nilotica
Chlidonias niger Sterno sandvicensis Sterno hirundo Sterno dougallii
Sterno paradisaea Xema sabini

Mediterranean Gull Lesser	*Larus melanocephalus*
Black-backed Gull Iceland	*Larusfuscus graellsii*
Gull	*Larus glaucoides Larus*
	hyperboreus
Glaucous Gull	
Cetaceans Fin	*Balaenoptera physalis*
Whale Minke	*Balaenoptera acutorostrata*
Whale	*Phocoena phocoena Delphinus*
	de/phis
Harbour Porpoise	
Common Dolphin	*Tursiops truncatus*
Bottlenose Dolphin	*Grampus griseus*
Risso's Dolphin	
Other mammals	*Lutra lutra Halichoerus*
Otter	*grypus Phoca vitulina*
Grey Seal	
Common Seal	
	Dermochelys coriacea
Reptiles	
Leatherback Turtle	
	Cetorhinus maximus
Fish	*Mola mo/a*
Basking Shark	
Ocean Sunfish	

Appendix 3. Totals of additional select bird species recorded at watch points from 2010 to 2013

Site	Species	2010	2011	2012	2013	Total
Annagh Head	Barnacle Goose		30			30
Annagh Head	Red-breasted Merganser		1			1
Annagh Head	Whimbrel		2			2
Bloody Foreland	Barnacle Goose	56	61	235	66	418
Bloody Foreland	Light-bellied Brent Goose	4			43	47
Bloody Foreland	Wigeon			4		4
Bloody Foreland	Eider	7	9	17	24	57
Bloody Foreland	Red-breasted Merganser		1	2	4	7
Bloody Foreland	Whimbrel	7		12	94	113
Bloody Foreland	Gull-billed Tern			1		1
Bridges of Ross	Light-bellied Brent Goose			30		30
Bridges of Ross	Teal			8		8
Bridges of Ross	Red-breasted Merganser			1		1

Bridges of Ross	Whimbrel		85	78	2	165
Brownstown Head	Light-bellied Brent Goose	8	7	49	12	76
Brownstown Head	Shelduck		3			3
Brownstown Head	Wigeon		27			27
Brownstown Head	Mallard			3	1	4
Brownstown Head	Eider			1		1
Brownstown Head	Great Crested Grebe				1	1

Brownstown Head	Whimbrel		3	2		5
Carnsore Point	Greenland White-fronted Goose	22				22
Carnsore Point	Light-bellied Brent Goose	6	2	19	2	29
Carnsore Point	Wigeon	12	6	21	15	54
Carnsore Point	Teal		2	2	10	14
Carnsore Point	Scaup			7		7
Carnsore Point	Red-breasted Merganser	1	3	2		6
Carnsore Point	Great Crested Grebe			7		7
Carnsore Point	Whimbrel		1	3	4	8
Carnsore Point	Lesser Black-backed Gull		2			2
Dalkey	Mute Swan			1	2	3
Dalkey	Whooper Swan				4	4
Dalkey	Light-bellied Brent Goose		12	38		S0
Dalkey	Shelduck				11	11
Dalkey	Wigeon			3	3	6
Dalkey	Teal				3	3
Dalkey	Tufted Duck				2	2
Dalkey	Great Crested Grebe			2	4	6
Dalkey	Whimbrel		1	4		5
Dursey Island	Teal	4				4
Dursey Island	Mallard				2	2
Dursey Island	Whimbrel	5				5
Wicklow Head	Mute Swan	3			3	6
Wicklow Head	Whooper Swan			5		5
Wicklow Head	Light-bellied Brent Goose	28	30	17		75
Wicklow Head	Shelduck		3		1	4
Wicklow Head	Scaup		1			1
Wicklow Head	Great Crested Grebe		1			1
Wicklow Head	Whimbrel				2	2
	Total	163	293	576	316	1348

Appendix 4. Totals of marine megafauna recorded at watch points from 2010 to 2013

Site	Species	2010	2011	2012	2013	Total
Annagh Head	Minke Whale				1	1
Annagh Head	Common Dolphin		32			32
Annagh Head	Risso's Dolphin	5			6	11
Annagh Head	Ocean Sunfish				2	2
Bloody Foreland	Harbour Porpoise			2		2
Bloody Foreland	Bottlenose Dolphin		10	18	6	34
Bloody Foreland	Basking Shark		2			2
Bridges of Ross	Harbour Porpoise				3	3
Bridges of Ross	Common Dolphin		7	199	2	**208**
Bridges of Ross	Bottlenose Dolphin		13	37	30	**80**
Bridges of Ross	Unidentified Dolphin			2		2
Bridges of Ross	Grey Seal			1		1
Bridges of Ross	Common Seal				1	1

Bridges of Ross	Leatherback Turtle			2		2

Bridges of Ross	Ocean Sunfish		4	3	4	**11**
Brownstown Head	Harbour Porpoise	6	7	1	5	19
Brownstown Head	Common Dolphin				3	3
Brownstown Head	Grey Seal	5		3	4	12
Carnsore Point	Harbour Porpoise	10	**13**	19		42
Carnsore Point	Risso's Dolphin	15				15
Carnsore Point	Unidentified Dolphin	3				3
Carnsore Point	Grey Seal		4	7	1	12
Dalkey	Harbour Porpoise	2		31	**18**	51
Dalkey	Common Dolphin	1				1
Dalkey	Grey Seal			1		1
Dalkey	Small shark sp.				1	1
Dursey Island	Minke Whale	1	9	1		**11**
Dursey Island	Harbour Porpoise	156	336	58	**98**	648
Dursey Island	Common Dolphin	16	44	6	10	76
Dursey Island	Bottlenose Dolphin				6	6
Dursey Island	Risso's Dolphin	12			2	**14**
Dursey Island	Grey Seal	1				1
Dursey Island	Basking Shark				1	1
Dursey Island	Ocean Sunfish		1			1
Galley Head	Fin Whale	7				7
Galley Head	Harbour Porpoise	2				2
Galley Head	Common Dolphin	85				85
Galley Head	Ocean Sunfish			1		1
Wicklow Head	Harbour Porpoise	8	21	39	6	74
Wicklow Head	Bottlenose Dolphin			1		1
Wicklow Head	Unidentified Cetacean	1				1
Wicklow Head	Otter			1		1
Wicklow Head	Grey Seal		6	11	5	22
	Total	336	509	444	215	1504