Northern Ireland Seabird Report 2013

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Northern Ireland Seabird Report 2013

NI Seabird Steering Group

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This report is the published outcome of the work of the Northern Ireland Seabird Network – a network of volunteers, researchers and organisations – coordinated by the BTO Seabird Coordinator, and funded by NIEA.

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SHANE WOLSEY

Articles by contributors included in this report have not been subject to editorial control or scientific peer-review and therefore reflect their individual work, views and conclusions and not those of the BTO.

Editorial

This is the first edition of the Northern Ireland Seabird Report, covering 2013, a report we plan to publish annually. This report is the published outcome of the work of the BTO Seabird Co-ordinator, appointed in February 2013, and the activities of the evolving NI Seabird Network of volunteers, and organisations such as National Trust, Ulster Wildlife and RSPB that have provided data for 2013 and previous years.

The Co-ordinator, the Network and this report are, in part, a response to the huge increase in our society's interest in the marine environment. Legislatively there is the EU's Marine Strategic Framework Directive (MSFD), and the local instrument that transposes the MSFD regulations, the Marine Act (Northern Ireland) 2013. This includes powers to designate Marine Conservation Zones as part of a coherent MPA (Marine Protected Area) network. The implied spatial planning and designations require high quality marine biodiversity data of various types, including for birds. Monitoring, and any further designations, of our SPA (Special Protected Area) network also require high quality bird data.

Added to this is a hugely increased interest in offshore commercial development, particularly energy related developments. There is a large offshore wind farm proposed east of the Lecale coast, two tidal energy proposals off the northeast Antrim coast, and proposals to investigate oil and gas resources in Belfast Lough, Larne Lough and near Rathlin. Two energy storage proposals near Larne just add to this mix of proposed marine developments.

Finally, there is our increasing societal awareness of climate change and the impacts it may have: increasing seawater temperatures, changing acidity, increased storminess and thus turbidity, and many other associated changes. The work of the Northern Ireland Seabird Network in gathering robust seabird population data is a vital component in this context. The data in this report, and from future surveying, will underpin marine conservation policy-making and action planning in Northern Ireland.

We would like to thank everyone who has contributed to this report, and to encourage more people to join the Seabird Network and contribute to future reports.

Shane Wolsey
BTO NI Officer

Kerry Leonard
BTO NI Seabird Co-ordinator

March 2014

SHANE WOLSEY

Seabird Monitoring Overview

The National Seabird Monitoring Programme

Since 1986 the majority of annual seabird surveillance in the UK has been undertaken as part of the Seabird Monitoring Programme[1] (SMP) co-ordinated by the Joint Nature Conservation Committee (JNCC). The programme is a partnership of stakeholder organisations throughout the UK, including the BTO, RSPB, The Seabird Group and the country environment agencies. In order to examine trends at individual colonies, and across the UK, it is a great advantage if individual sites can be monitored consistently for many years. Data are gathered in a consistent manner using standard published methods and entered into a central database. The SMP gathers data relating to:

1. breeding abundance – the number of breeding pairs or individuals, which is a medium to long-term measure, and
2. breeding success – the number of eggs laid and, ultimately, chicks fledged.

The SMP generates annual population indices which are expressed as a percentage of the population recorded at sites in 1986 when standardised monitoring began.

Why Monitor Seabirds?

The SMP enables its partners to monitor the health of the marine environment and inform seabird conservation issues. Monitoring seabirds is important for a number of reasons:

- seabirds are an important component of marine biodiversity in the UK with approximately seven million individuals breeding;
- seabirds are top predators and a useful indicator of the state of marine ecosystems;
- human activities impact upon seabirds, both positively and negatively and these effects should be monitored;
- the UK is internationally important for seabirds;
- seabirds are protected by European law and the UK has obligations to monitor and protect populations; and
- monitoring provides data which underpin targeted conservation policy development and action.

The Northern Ireland Seabird Co-ordinator Role

In 2013 a three year post, the 'Northern Ireland Seabird Co-ordinator', funded by the Northern Ireland Environment Agency (NIEA), was created by the BTO. The main aim of the Seabird Co-ordinator is to facilitate an increase in annual seabird monitoring across Northern Ireland. The Co-ordinator is to work closely with JNCC to create a definitive register of Northern Ireland sites, compile an annual report of the state of seabird populations (this report), and coordinate monitoring and research in Northern Ireland. A Seabird Steering Group has been formed to advise on the development of a five year strategy, and to advise on the evolution of a NI wide group of volunteers and the programme of activities that the Seabird Co-ordinator will undertake. A network of seabird surveyors and researchers in Northern Ireland has been created through the work of the Co-ordinator (the NI Seabird Network). More detailed information relating to the aims of the Seabird Co-ordinator is available in the Appendix.

The Northern Ireland Strategy for Seabird Monitoring

The proposed strategy for monitoring seabirds in Northern Ireland over the next five years has been set down in a data collection strategy. Current annual population monitoring and productivity monitoring in Northern Ireland has concentrated on a small number of important sites, with monitoring carried out by local and national NGOs. The aim of the strategy is to provide the context and set minimum requirements for the annual monitoring of breeding seabirds in Northern Ireland to ensure effective management of this natural resource. This document has been prepared with the advice of the NI Seabird Steering Group and JNCC. The NI Seabird Steering Group is made up of Dave Allen (Allen & Mellon Environmental), Kendrew Colhoun (RSPB), Kerry Leonard (BTO), Neil McCulloch (NIEA), Andrew Upton (National Trust) and Shane Wolsey (BTO).

SHANE WOLSEY

The strategy focuses on the monitoring of populations and productivity in Northern Ireland while also facilitating further detailed studies of those populations. The main objectives are:

- to identify priorities for seabird monitoring in Northern Ireland;
- to identify priorities for seabird research in Northern Ireland;

[1]http://jncc.defra.gov.uk/page-1550

- to gather data which will assist NIEA and conservation NGOs in managing protected seabird species and habitats;
- to increase the number of seabird breeding sites monitored annually; and
- to increase the number of people involved in seabird monitoring in Northern Ireland.

The Northern Ireland Site Register

During 2013 a full register of all known, possible or potential seabird nesting sites, which is consistent with the SMP site register, was created. In reality this means that every part of the Northern Ireland coastline now has a recording section. All known inland sites are also listed. Due to legacy issues from historical record keeping, and the way data are held in the JNCC database, Black Guillemots have their own site register.

SHANE WOLSEY

Breeding Seabirds in Northern Ireland in 2013

Kerry Leonard
BTO NI Seabird Co-ordinator

The following species accounts summarise the known status of each breeding seabird species in Northern Ireland. Species accounts also provide a summary of population trends at the main breeding sites, where that data exists. These data have been collected by a large number of volunteers and site wardens across Northern Ireland and a list of those contributors is given at the end of this report. Many other people have contributed records from the 1960s onwards, when concerted monitoring began for some species, and without that recording we would not be able to generate these population graphs and tables.

Table 1 Seabird species breeding in Northern Ireland

Species	NI**** Priority	BOCCI Status*	IUCN Status**
Northern Fulmar	N	GREEN	Least Concern
Manx Shearwater	N	AMBER	Least Concern
European Storm-petrel***	N	AMBER	Least Concern
Great Cormorant	N	GREEN	Least Concern
European Shag	N	GREEN	Least Concern
Great Skua	N	AMBER	Least Concern
Black-legged Kittiwake	N	AMBER	Least Concern
Black-headed Gull	Y	RED	Least Concern
Mediterranean Gull	N	AMBER	Least Concern
Common Gull	N	AMBER	Least Concern
Lesser Black-backed Gull	N	AMBER	Least Concern
Herring Gull	Y	RED	Least Concern
Great Black-backed Gull	N	AMBER	Least Concern
Little Tern***	Y	AMBER	Least Concern
Sandwich Tern	N	AMBER	Least Concern
Common Tern	N	AMBER	Least Concern
Roseate Tern	Y	AMBER	Least Concern
Arctic Tern	N	AMBER	Least Concern
Common Guillemot	N	AMBER	Least Concern
Razorbill	N	AMBER	Least Concern
Black Guillemot	N	AMBER	Least Concern
Atlantic Puffin	N	GREEN	Least Concern

* Birds of Conservation Concern in Ireland 2 (2007 update)
** International Union for Conservation of Nature
*** Not currently breeding, historical only
**** NI Priority[2] species are those identified during the preparation of the NI Biodiversity Strategy (2002) and subsequently, using criteria set out by stakeholders.

[2] http://www.habitas.org.uk/priority/

Species accounts are structured as follows:

Overview – brief summary of the main breeding sites for the species in Northern Ireland.

Breeding numbers – a summary of current knowledge on breeding numbers in Northern Ireland, with historical trends where data are available, and comparison with UK populations and trends. A detailed summary of data gathered in 2013.

Breeding success – a summary of current knowledge on breeding success in Northern Ireland, with historical trends where data are available, and comparison with UK populations and trends. A detailed summary, where available, of data gathered in 2013.

Surveying methods

Seabird surveys in the UK and Ireland are undertaken using a standard set of survey guidelines for each species (Walsh *et al.* 1995). Tables 2 and 3 briefly outline the survey units used and methods for each species under consideration in Northern Ireland. For further information please refer to Walsh *et al.* (1995).

Table 2 Seabird survey units

Unit	Abbreviation	Description
Apparently Occupied Nest	AON	An active nest occupied by a bird, pair of birds, or with eggs or chicks present.
Apparently Occupied Site	AOS	An active site occupied by a bird, pair of birds, or with eggs or chicks present. Used for species without obvious nests such as Northern Fulmar.
Apparently Occupied Burrow	AOB	An apparently active and occupied burrow which may have a nest.
Individuals	Ind	Individual birds.

Table 3 Seabird survey methods

Species	Unit	Notes
Northern Fulmar	AOS	Count between 09.00 and 17.30, and 15th May to 5th July. Apparently occupied sites are those ledges suitable for nesting with a bird present.
Manx Shearwater	AOB	Late May to mid-June. Survey using tape playback between 09.00 and 17.00.
Great Cormorant	AON	Count period 15th May to 25th June.
European Shag	AON	Count period 1st May to 25th June.
Great Skua	AOT	Count period late May-June.
Black-legged Kittiwake	AON	Count late May to mid-June. Only count completed nests with at least one adult attending.
All gull species	AON Ind	Count late May to mid-June. Counts of adults on nests, or transects to count nests. Alternatively flush counts of individual adults.
All tern species	AON Ind	Count mid-June. Counts of adults on nests, or transects to count nests. Alternatively flush counts of individual adults.

Table 3 (contd) Seabird survey methods

Species	Unit	Notes
Common Guillemot	Ind	Count between 08.00 and 16.00, and from 1st – 21st June. Birds on tidal rocks or sea excluded.
Razorbill	Ind	Count between 08.00 and 16.00, and from 1st – 21st June. Birds on tidal rocks or sea excluded.
Black Guillemot	Ind	Count between 05.00 and 09.00, and from 26th March to 15th May.
Atlantic Puffin	Ind	Count period April-May or peak numbers at any stage of season. Evening or early morning visits will produce highest counts. Birds on the sea within 200m are counted.

Northern Fulmar *Fulmarus glacialis*

EC Birds Directive – migratory species
Not listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

Northern Fulmars (Fulmars) are one of the commonest seabirds in Britain and adult birds are present in UK waters all year round. Their food comes from a wide variety of sources including zooplankton, fish and fishing discards. An increase in the use of commercial discards has been cited as one of the reasons for a massive increase in breeding range and population size across the North Atlantic in the 20th Century (Mitchell *et al.* 2004). Fulmars nest in loose colonies and can utilise relatively small cliff faces, sometimes several miles inland.

In Northern Ireland Fulmars are a widespread breeding species, with the most important site being at Rathlin Island. Other sites are Downhill, Binevanagh, The Gobbins and Muck Island. Small numbers are scattered the whole way round the coast where suitable cliff habitat occurs.

Table 4 Fulmar numbers at sites in 2000 and 2013

Master Site	Site	Seabird 2000 AOS	2013 AOS	%Change
Downhill	Downhill East	17	13	-24
Downhill	Umbra	58	15	-74
Downhill	Downhill West	296	91	-69
Downhill	Castlerock	167	31	-81
North Antrim Coast	Portrush sites 1-4	57	26	-54
Whitehead	Whitehead 1	25	3	-88
Blackhead	Blackhead 1	39	4	-90
East Antrim Coast	Ballygalley Head	9	4	-56
East Antrim Coast	Sugarloaf Hill	0	0	0
East Antrim Coast	Whitebay	10	8	-20
East Antrim Coast	Park Head	25	14	-44
East Antrim Coast	Galboly	4	3	-25
East Antrim Coast	Crearlargh	11	7	-36
East Antrim Coast	Caranure	68	7	-90
East Antrim Coast	Carrivemurphy	8	0	-100
East Antrim Coast	Glenarm Quarry 1	0	0	0
East Antrim Coast	Glenarm Quarry 2	0	0	0

Breeding numbers

Long-term data are available for The Gobbins, Muck Island and Rathlin Island (Figures 1, 2 & 3). For other sites a comparison can be made between Seabird 2000 counts and 2013 counts. The Gobbins held 167 AON in 2013 and Muck Island 35 AON. Rathlin Island, in 2011, held 1518 AON. Nationally the population increased by approximately 80% between 1969/70 and 1985/88, a change mirrored in Northern Ireland. The population in NI had increased by another 69% in 2000 (JNCC 2013). Since that date numbers have decreased (Table 4), a trend also seen across the UK (JNCC 2013). The east and north Antrim coasts in particular have seen large declines since 2000. Across all the sites surveyed in both 2000 and 2013 there has been a 59% decline in population.

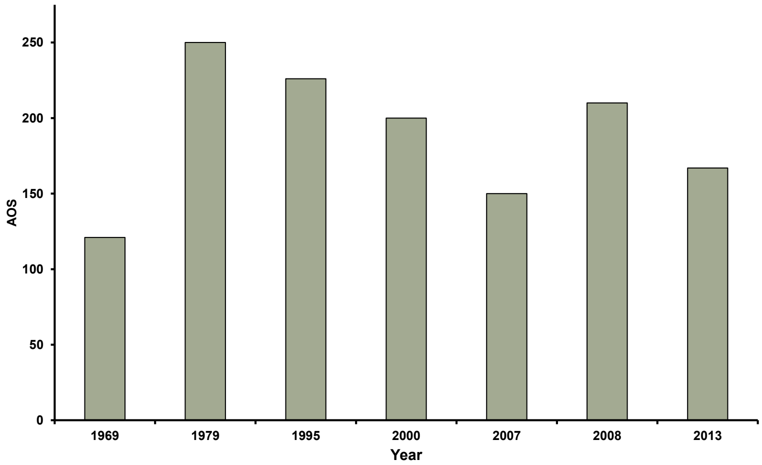

Figure 1 Northern Fulmars at The Gobbins 1969 – 2013

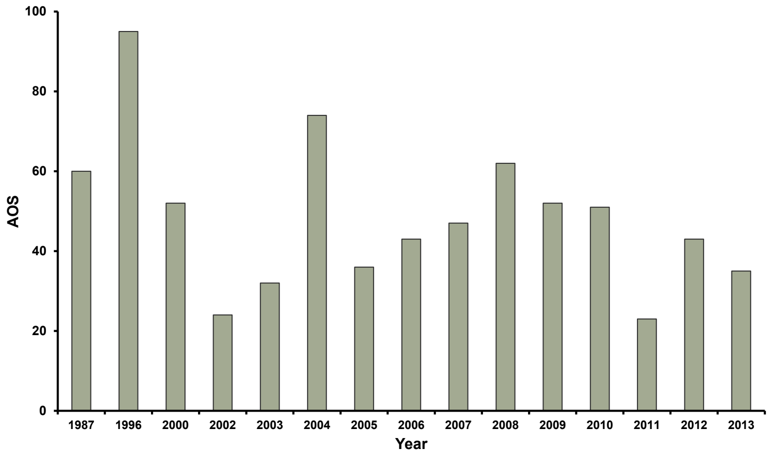

Figure 2 Northern Fulmars at Muck Island 1987–2013

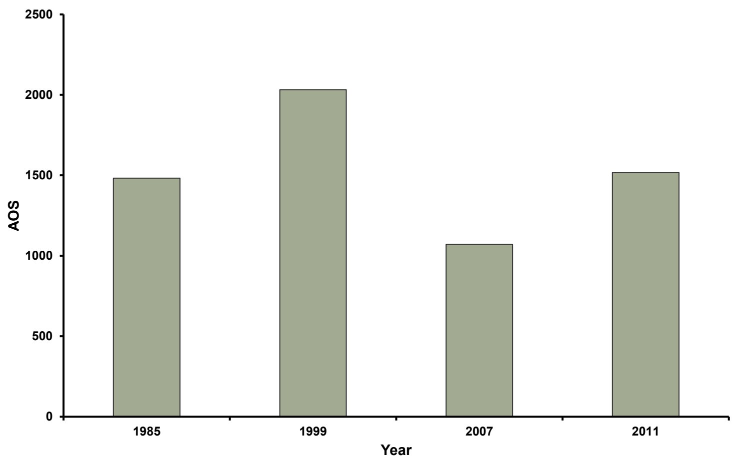

Figure 3 Northern Fulmars on Rathlin 1985–2013

Breeding success

The only data collected were at Lighthouse Island, Copeland Islands (5 AOS, 3 chicks, 0.6 chicks per pair), Ballygalley Head (4 AOS, 0 chicks) and Park Head, Co. Antrim (4 AOS, 2 chicks, 0.5 chicks per pair). Nationally productivity has been steadily decreasing since 1986 (JNCC 2013). Analysis of the SMP dataset by Cook and Robinson (2010) found that mean breeding success of Fulmars was 0.39 and declined at a rate of 0.005 chicks per nest per year. This equates to a decline in breeding success of 11% between 1986 and 2008. Using available life history information (population size, clutch size, age at first breeding and survival rates of different age classes) it is predicted that the UK Fulmar population would decline by about 12% over 25 years.

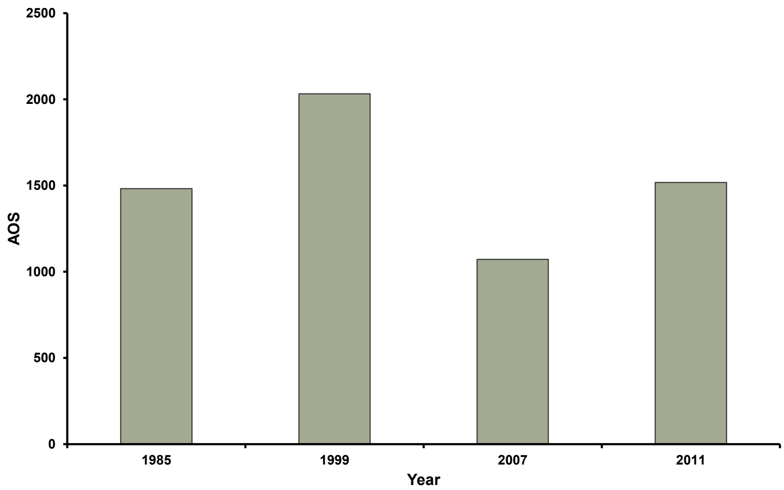

Figure 4 Northern Fulmar productivity at Copeland Bird Observatory

Manx Shearwater *Puffinus puffinus*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

Manx Shearwaters are a highly pelagic species and spend most of the year at sea. They nest in burrows, only coming ashore under the cover of darkness to avoid avian predators. Manx Shearwaters became extinct from the eponymous colony on the Calf of Man during the 18th Century, probably due to Rat *Rattus norvegicus* predation (Mitchell *et al.* 2004). However around 100 pairs do now breed on the Calf (Kate Hawkins *pers. comm.*), and a rat eradication programme is aiming to make the island more suitable for this species (BBC 2012). The largest colony in the world is on the island of Skomer in Wales. Formerly thought to hold around 100,000 pairs at the turn of the century (Smith *et al.* 2001) a new survey in 2011 suggested that the population was approximately 316,000 pairs (Perrins *et al.* 2012).

The only confirmed extant colony in Northern Ireland is on the Copeland Islands. Rathlin Island formerly held a colony of unknown size (Brook 1990) but the species has not been confirmed breeding for many years (Liam McFaul *pers. comm.*) and surveys for Seabird 2000 did not detect any birds (Mitchell *et al.* 2004). Deane (1954) estimated 150 pairs on Rathlin but the Operation Seafarer figure was 1,000-10,000 pairs (Mitchell *et al.* 2004). The inaccessibility of the cliffs and the cryptic nature of the species make these estimates unreliable. All that is certain is that a huge decline has occurred, possibly to extinction.

Breeding numbers

The Copeland Islands were last surveyed in 2007 (Stewart & Leonard 2007). At that time there were approximately 4,850 pairs - 3,444 pairs on Lighthouse Island and 1,406 pairs on Big Copeland. This was approximately a 5.3% increase on the previous survey in 2000. However the previous (2000) survey result was within the 2007 survey confidence limits and it is likely there was little change between 2000 and 2007. It is estimated that the colony is now 8–10 times larger than it was in the 1950s.

Breeding success

Breeding success has been monitored on Lighthouse Island by Copeland Bird Observatory since 2007, using study burrows. These consist of natural burrows which are excavated outside the breeding season and a concrete slab placed over the nesting chamber to allow easy access. In the seven years of monitoring, breeding success on Copeland has been within the range of other sites, although extremely wet weather in 2007 resulted in a success rate of just 0.38 chicks per pair. On Rum, in Scotland, the average is approximately 0.7 chicks per pair. On Bardsey and Skomer, in Wales, breeding success varies from 0.55 to 0.8 chicks per pair, though success on Bardsey is higher. If a Manx Shearwater chick hatches the chance of successful fledging is high with most losses during incubation.

Table 5 Manx Shearwater productivity at Copeland Bird Observatory

Year	Nest sampled	Chicks hatched per pair	Chicks fledged per pair
2007	71	Not recorded	0.38
2008	67	0.70	0.67
2009	76	0.83	0.82
2010	65	0.88	0.88
2011	60	0.86	0.86
2012	50	0.78	0.76
2013	54	0.82	0.80

European Storm Petrel *Hydrobates pelagicus*

EC Birds Directive – listed in Annex 1 and as a migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

European Storm Petrels are highly pelagic, only returning to land to breed. The species has no known breeding sites in Northern Ireland. Ussher and Warren (1900) reported that in relation to breeding in Ireland 'two small islands off the north coast of Antrim are also resorted to'. Deane (1954) reported up to a dozen pairs on Sheep Island, Antrim, but the species is considered unlikely to be still there. It may be present on Rathlin Island but no modern surveys have been conducted. The nearest colony is on Sanda Island which is just 37km to the east. The Skerries, off Portrush, are another potential breeding site. A survey of these locations is long overdue.

Great Cormorant *Phalacrocorax carbo*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

Great Cormorants (Cormorants) are a widespread breeding species, often in few dense colonies. In England increasing numbers of Cormorants breed inland, in trees, but this is a trend that has not yet been seen in Northern Ireland. In Northern Ireland, Cormorants have, historically, principally bred at two sites – Sheep Island and Bird Island (Strangford Lough). Smaller numbers are found at The Gobbins, Burial Island on the outer Ards Peninsula and The Skerries, islands offshore from Portrush.

Breeding numbers

Numbers at Bird Island, Strangford Lough, increased erratically until 2005, to a peak of 490 AON (Figure 5). Since then numbers have fallen back to 306 AON in 2013. Numbers at The Gobbins cliffs (Figure 6) have been very erratic in recent years, dropping as low as 2 AON in 2007, returning to 33 AON in 2008, but have fallen again to 11 AON in 2013. The colony at Sheep Island has fluctuated in numbers annually but shows an overall decrease since 1985 (380 pairs) to 112 pairs in 2013. The colony at the Skerries, which held 98 AON in 2013, has been monitored since 2007 since numbers started to increase (Ian Enlander *pers. comm.*). The colony there has increased as Sheep Island has decreased, so much so that in 2013 Sheep Island was larger by only 14 pairs. It seems probable that the original population is now spread between the two sites (Figure 7), and interchange with the colony at Inishowen (Co. Donegal) is possible.

The UK abundance index for Cormorants 1986–2012 indicates that the population increased and stayed high until 2005 but has now rapidly returned to 1986 levels. The pattern at The Skerries/Sheep Island reflects this, although the population has now stabilised. Strangford is still well above 1986 levels but the recent rapid decrease will be closely monitored.

Breeding success

Productivity data were collected at The Gobbins, where five nests produced 11 young. UK productivity has declined from circa 2.5 chicks/pair in 1992 to under two chicks/pair in 2012.

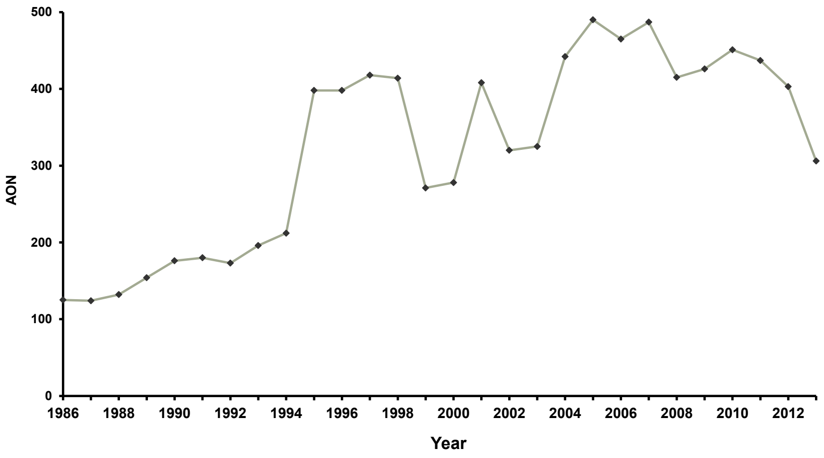

Figure 5 Cormorants at Bird Island, Strangford Lough 1986–2013

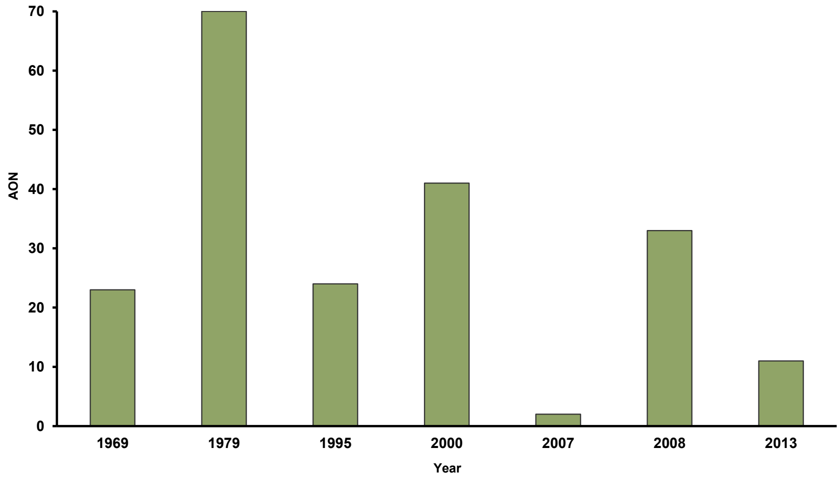

Figure 6 Cormorants at The Gobbins 1969–2013

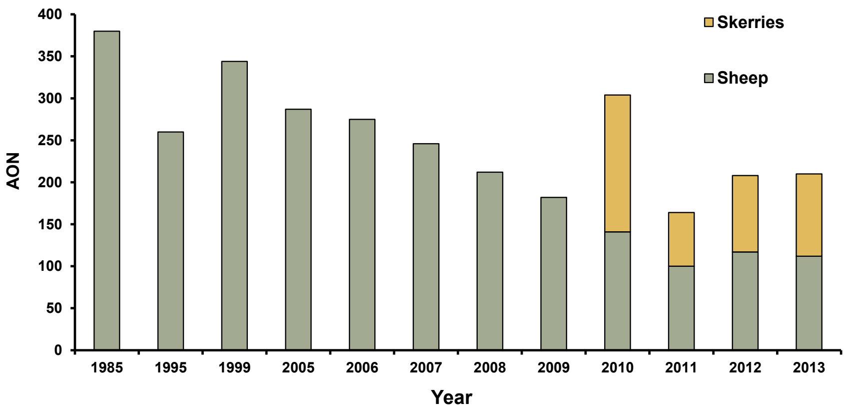

Figure 7 Cormorants at Sheep Island and The Skerries 1985–2013

European Shag *Phalacrocorax aristotelis*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The European Shag (Shag) is endemic to the northeast Atlantic and the Mediterranean. It is a marine inshore species that is almost never observed out of sight of land (Mitchell *et al.* 2004). In Northern Ireland the Shag is a widespread breeding species, with the largest colonies being at The Maidens, offshore from Larne, and Rathlin Island, with other breeding pairs scattered widely around the coast in smaller groups.

Breeding numbers

The long-term trend for Rathlin is downwards with the last survey in 2011 recording 47 AON (Figure 8). At the Maidens there has probably been a slight decrease since 2000. Numbers at Muck Island and The Gobbins have fluctuated over the long term but in 2013 were at their highest ever levels (21 and 20 AON respectively – Figures 10 and 11). While this species stopped breeding in Strangford Lough in 2007 (Figure 9), it has been recorded at several new locations in 2013, namely Maggie's Leap (3 AON), Portrush (1 AON) and Castlerock (3 AON). In 2012 a suspected AON was in a cave on Big Copeland. For the UK the JNCC population index shows a 40% decline since 1986, though this is predominantly in Scotland with populations in England and Wales showing little change (JNCC 2013). Annual return rates of adults are usually in the order of 80–90% (JNCC 2013) but Shags are vulnerable to one off extreme events and the return rate has dropped to below 15% as a result of their impact (Fredericksen *et al.* 2008).

Breeding success

There were 14 nests at the north end of Muck Island in June, of these nine nests produced 19 young, 1.36 chicks per nest. One pair at the Gobbins produced two chicks. Productivity at monitored colonies in the UK 1986–2012 has been approximately 1–1.6 chicks/nest, with an average of 1.21 (Cook and Robinson 2010). Population Viability Analysis suggests that if all population parameters remain the same (survival, clutch size *etc.*) the UK population will decline by 9% over the next 25 years.

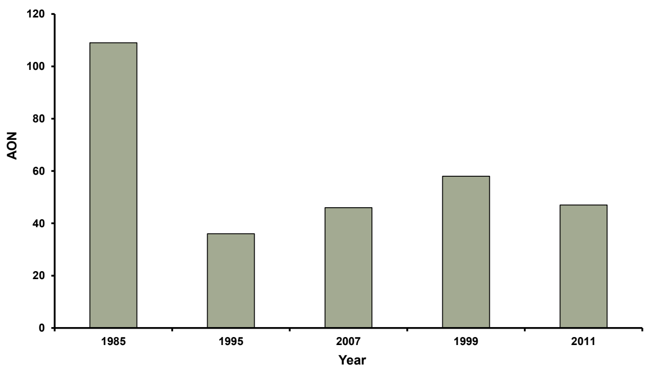

Figure 8 European Shags population at Rathlin 1985–2011

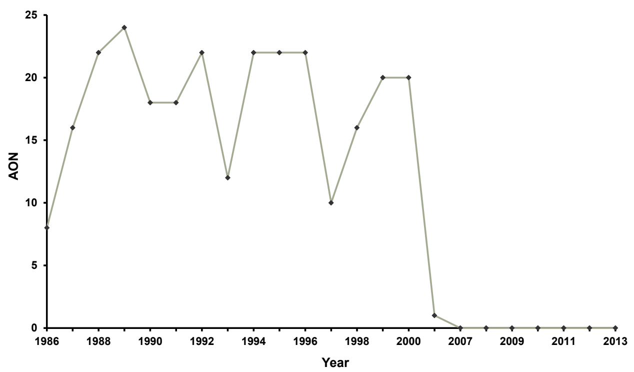

Figure 9 European Shag population at Strangford Lough 1986–2013

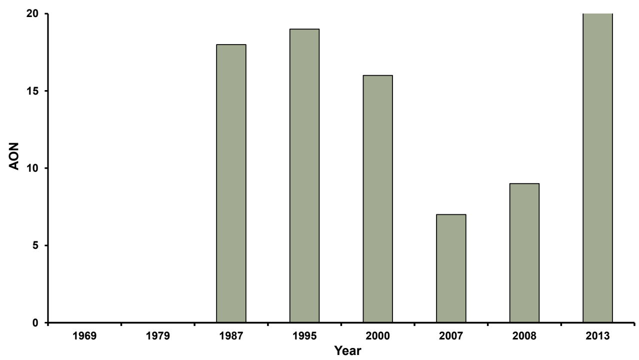

Figure 10 European Shag population at The Gobbins 1969–2013

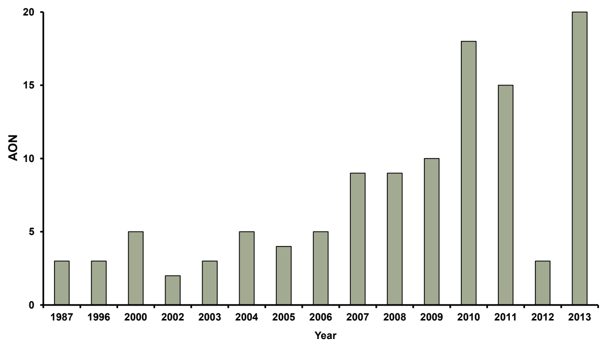

Figure 11 European Shags at Muck Island

Great Skua *Stercorarius skua*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

During the Seabird 2000 surveys the UK held 60% of the Great Skua world population. Orkney and Shetland are the core breeding area but the species has now spread through the Western Isles (JNCC 2013). On Orkney the population increased 23% from 2000 to 2010 (Meek *et al.* 2010) and on Fair Isle the number of pairs 1986–2008 increased from 84 to 294 (JNCC 2013).

In the Republic of Ireland the first breeding occurred in the late 1990s in Co. Mayo (Mitchell *et al.* 2004) and there are now thought to be approximately 15 pairs, although no complete survey has been undertaken (Steve Newton *pers. comm.*). The UK population is healthy and the recent breeding attempts on Rathlin could be considered overdue. Great Skuas have been shown to be serious predators of Leach's Petrels *Oceanodroma leucorhoa* on St. Kilda. This is a potential cause for concern in relation to Storm Petrel populations on islands off the west coast of Ireland (Phillips *et al.* 1999, Votier *et al.* 2006).

Breeding Numbers

A single pair laid eggs in 2010 but they failed to hatch. Presumably the same pair returned in 2011 and again nested, laying two eggs, one of which hatched successfully. The single chick fledged in late summer. This was the first successful breeding attempt by this species in Northern Ireland. At least five birds were seen around Rathlin in late May 2011. A pair was present in 2012 but did not breed successfully. In 2013 two adults were present throughout the summer and were joined later by two further birds. There was no evidence of a breeding attempt in 2013 and the behaviour of the birds suggested there was no nest.

Black-legged Kittiwake *Rissa tridactyla*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The Black-legged Kittiwake (Kittiwake) is an oceanic gull which is the most numerous gull species in the world, with the largest UK colonies in Scotland (Mitchell *et al.* 2004). The largest colony, by far, in Northern Ireland is on Rathlin Island, the second largest colony at The Gobbins being only 10% the size of Rathlin. Other small colonies are dotted around the coast at Muck Island, Maggie's Leap, Castlerock, Carrick-a-rede, Dunluce, Strangford Lough, The Skerries and Gun's Island (current status unknown).

Breeding numbers

There are good historical datasets for The Gobbins (Figure 13), Muck Island (Figure 12) and Strangford Lough. In 2013 The Gobbins held 694 AON, a 24% decrease from the last survey in 2008. Muck Island held 194 AON, a 25% decrease since 2008 but two more nests than 2012. The Portrush cliffs held 254 AON, a decrease of 8% from Seabird 2000. Castlerock held 66 pairs, an 81% decrease from Seabird 2000. At the largest colony, Rathlin, numbers grew from 6,822 AON in 1985 to 9,917 AON in 1999, but in the latest survey (2011) had dropped back to 7,922 AON, a decrease of 20%. At Strangford Lough a peak of 466 nests was reached in 1996 but the species now does not breed.

Over the last 6–7 years the three largest colonies in Northern Ireland have shown a decrease of 20–25% but despite this decline the NI population is still above 1986 levels. The UK population has shown a decline of 44% since 1986. In this time the adult return rate at the Isle of May has declined from over 90% to under 70% so the survival of adults may be a key issue for Kittiwake conservation (JNCC 2013). Relative to the overall national trend since 1986, and its historical status, the NI population is still healthy.

Breeding success

Three study plots at the Gobbins were used to determine productivity in 2013. In plot one productivity was 0.45 chicks per pair, in plot two 0.2 chicks per pair and in plot three 0.46 chicks per pair. The productivity on Muck Island, at 0.48 chicks/pair, was similar. This is in line with current trends across the UK where productivity is rarely over 0.6 and regularly under 0.4 for many colonies (JNCC 2013, Miles 2013).

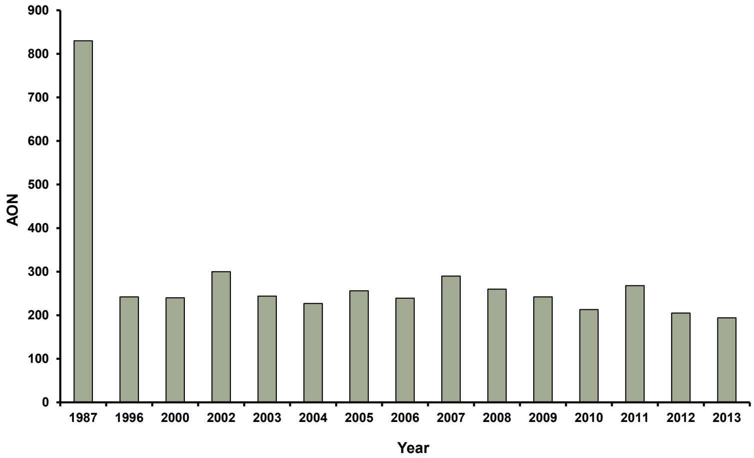

Figure 12 Black-legged Kittiwake at Muck Island 1987-2013

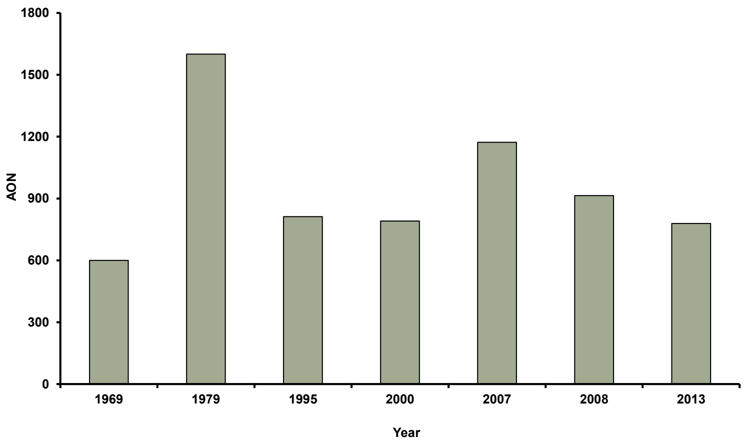

Figure 13 Black-legged Kittiwake at The Gobbins 1969-2013

Mediterranean Gull *Larus melanocephalus*

EC Birds Directive – Annex 1 and migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The Mediterranean Gull is the most recent addition to the breeding seabird fauna of the UK and Ireland. From just one pair in the 1985-88 census there were over 100 pairs during Seabird 2000 and there are now well over 1,000 pairs across the UK. Breeding was first proved in Northern Ireland in 1995.

Breeding numbers

After the first breeding in 1995 there have typically been 1–3 pairs annually at three sites in Northern Ireland. This has increased to 5–7 pairs annually, mostly at Strangford and Larne Loughs, though there has been one pair on Lower Lough Erne in 2012 and 2013. There were six pairs in Northern Ireland in 2013, one less than the peak of seven pairs in 2012.

Breeding success

One pair in Larne Lough is known to have fledged three young (Matthew Tickner *pers. comm.*).

Black-headed Gull *Chroicocephalus ridibundus*

EC Birds Directive – migratory species
Red listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

A common breeding species in the UK, with 5.6% of the world population during Seabird 2000. In Northern Ireland a widespread breeding species in relatively few large colonies, with major concentrations at Strangford Lough, Belfast Lough, Larne Lough, Copeland Islands, Lough Neagh and Lough Erne.

Breeding numbers

Breeding numbers at the main sites have fluctuated massively over the last 25 years, even in consecutive years. At Strangford Lough the 2013 count (1,205) represented the lowest since 1986 when annual monitoring began. The numbers at Larne Lough have grown from just 109 pairs in 1987 to over 2,000 pairs in 2008, but quickly receded. At the Copeland Islands the 2013 count of 275 pairs was well below the peak of the early 2000s, but not far below the average for 1997–2013. Figure 14 shows the total population for Cockle Island, Larne Lough, Strangford Lough and the Copeland Islands, 1986–2013, in years where data were available for all four sites. The total population for these major eastern colonies is the lowest since before 1986. There are no recent data for Lough Neagh populations.

Breeding success

No productivity data were collected in 2013. Despite being on the 2007–2013 BOCCI list very little productivity data have ever been collected in Northern Ireland. In the UK as a whole productivity fluctuates from 0–1.2 chicks per nest. This pattern of 'boom or bust' is seen frequently in local colonies (*pers. obs.*), with extreme weather, predation and food shortages appearing to be the main reasons for breeding failure. The potential impact of predators such as Mink (Craik 1997) on inland colonies in NI are largely unstudied.

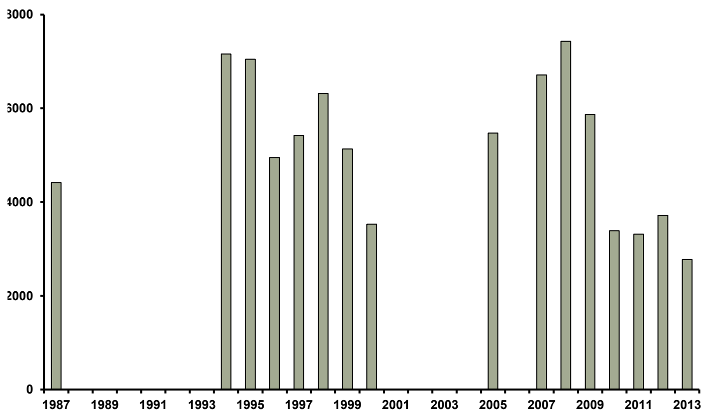

Figure 14 Total population of Black-headed Gulls at Cockle Island, Larne Lough, Strangford Lough and the Copeland Islands, 1986–2013

Common Gull *Larus canus*

EC Birds Directive –migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

Scotland held 98% of breeding Common Gulls in the UK during Seabird 2000. In Northern Ireland the species breeds in small numbers around the coast but by far the largest concentrations are on the Copeland Islands and at Strangford Lough. This species has undoubtedly increased since Seabird 2000.

Breeding numbers

Historically the Common Gull was a scarce breeding species which belied its name but since the mid-1990s a steady increase has occurred, which then accelerated after 2000. The Copeland Islands were not completely surveyed in 2013, but in 2012 there were 452 AON, down from a peak of 830 AON in 2009. On Strangford Lough there were 330 AON in 2013, down from a peak of 532 in 2010 – Figure 15. The pattern of population increase, and subsequent check, at Strangford and Copeland are remarkably similar. Although there may have been some decline in the last few years numbers are still relatively high.

The species has spread around the coast since 2000 with small numbers at many locations, although unfortunately not formerly monitored. For example one such new colony was discovered in late July 2013 at Torr Head, Co. Antrim. This was too late in the season to carry out a proper survey but this colony may number 20–25 pairs. On the Copeland Islands, although numbers have dropped, birds have spread out from a few large sub-colonies to form new satellite sub-colonies around the shore of all three islands.

The Northern Ireland trend contrasts with the overall national picture where a modest increase occurred to Seabird 2000, but the JNCC population index suggests that the UK population has decreased again to 1986 levels.

Breeding success

No productivity data were collected in 2013. Intermittent data collected on the Copeland Islands have shown productivity varies from 0.3–1.5 chicks fledged per nest each year. In Scotland 0.1–0.7 chicks per nest has been recorded (JNCC 2013). American Mink predation has a large impact at some colonies (Craik 1997).

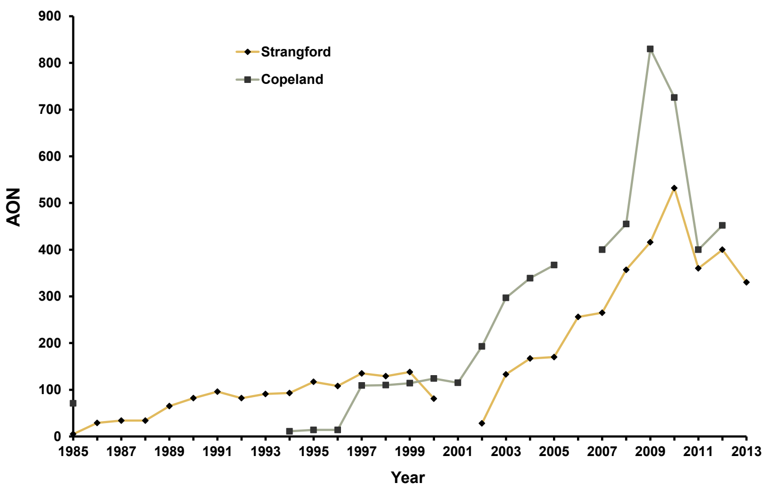

Figure 15 Common Gulls at Strangford Lough and the Copeland Islands 1985–2013

Lesser Black-backed Gull *Larus fuscus*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

During Seabird 2000 the UK held 38.4% of the world population. The species breeds across north and west Europe and has increased in numbers throughout its range during much of the 20th Century. Lesser Black-backs nest colonially in a wide variety of places including islands and roofs. The Lesser Black-backed Gull is a widespread breeding species in Northern Ireland, mainly in a few large colonies at the Copeland Islands, Strangford Lough, Lower Lough Erne and Lough Neagh. There are smaller numbers at Rathlin Island, The Skerries and Muck Island. Roof nesting is widespread in Belfast and there is also a colony in Antrim town. This practice is unrecorded in the rest of Northern Ireland and other records would be welcome.

Breeding numbers

Strangford Lough had 360 AOT and Lower Lough Erne over 800 AOT in 2013. Lesser Black-backed Gull has shown a large population increase since Seabird 2000, particularly in the last 5–6 years. This increase is very apparent at the Copeland Islands and mirrored at Strangford Lough and Lower Lough Erne. Since Seabird 2000 the combined population for these three sites has increased from 798 AOT to 1883 AOT. No count was undertaken on the Copeland Islands in 2013 but there were approximately 1,009 AOTs in 2012, up from just 420 AOTs in 2005. This is probably lower than the actual number of pairs as the common practice of dividing the number of individuals present by two, in order to arrive at the number of AOT (Walsh 1995), probably greatly underestimates the population. There are no up-to-date count data for Lough Neagh and the last survey there was in 2000. As a matter of priority a count of all Lough Neagh colonies is needed to ascertain the complete status of the species in Northern Ireland.

The JNCC population index for the UK population indicates that the UK population increased up to 2000 but has since decreased and is now at 1986 levels. The available evidence shows this is in marked contrast to the Northern Irish population which has continued to increase since 2000.

Breeding success

No data on productivity were gathered in 2013.

Herring Gull *Larus argentatus*

EC Birds Directive – migratory species
Red listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

Common breeding species with concentrations at the Copeland Islands and Strangford Lough. Smaller colonies on Rathlin Island, Burial Island, Muck Island and The Skerries.

Breeding numbers

Herring Gulls suffered a well publicised catastrophic decline in the late 1980s, probably largely as a result of botulism (Mitchell *et al.* 2004). For example, the population of Rathlin declined from 4037 AOTs in 1985 to just 19 AOTs in 1999 (Mitchell *et al.* 2004). A similar decline occurred on the Copeland Islands, from approximately 7,000 pairs in 1985 to 225 pairs in 2004. The figures for Strangford Lough (Figure 16) mirror this trend, with a massive and rapid decline in the mid-1980s, followed by the crash and a low point reached just after the turn of the century. Since 2007 both sites have shown sustained growth in AOTs. Across the UK the decline was not as severe and there was even a small recovery in the 1990s, although populations are declining again (JNCC 2013), in contrast to Northern Ireland where populations have been modestly increasing. If existing UK population parameters (survival, clutch size *etc.*) remain the same then a 60% decrease in national population is predicted over the next 25 years (Cook and Robinson 2010).

Breeding success

No data on productivity were gathered in 2013.

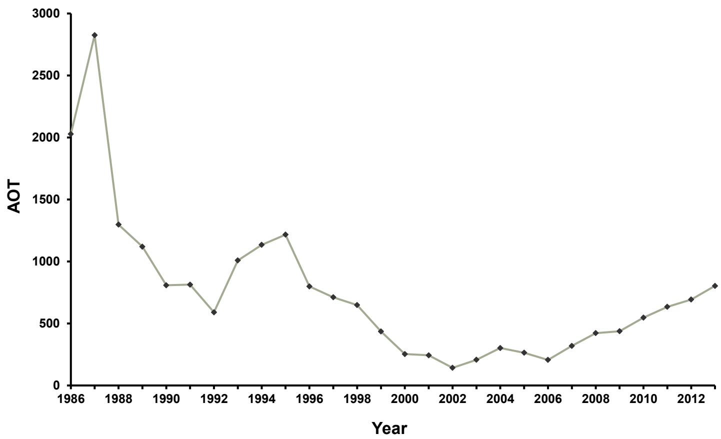

Figure 16 Herring Gulls at Strangford Lough 1986–2013

Great Black-backed Gull *Larus marinus*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The JNCC population index for Great Black-backed Gull indicates that the population increased from the 1980s into the 1990s but has since decreased steadily so that the index is at its lowest point in the period 1986-2013 (JNCC 2013). The most important site in Northern Ireland, by far, is on Great Minnis's Island, Strangford Lough (Figure 17). The second most important colony is probably now at Burial Island, Outer Ards peninsula. Although this colony has not been completely surveyed since 1998 (when no birds were present) a population has again established itself on the island (*pers. obs.*). The third most important site is Carlingford Lough.

Breeding numbers

Strangford Lough held 102 AONs in 2013, and this equals the highest count since annual monitoring began and the highest since 1987. Since 1986 the UK population index has fluctuated but recently has started to drop steadily.

Breeding success

The only data collected were for one pair at Maggie's Leap which fledged two young. Monitoring across the UK has shown that productivity dropped since the early 2000s and this may, in part, be responsible for population declines.

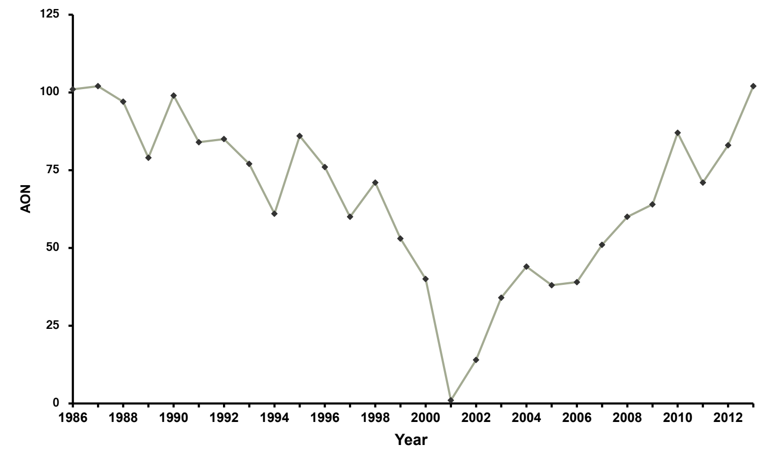

Figure 17 Great Black-backed Gull populations at Strangford Lough 1986–2013

Sandwich Tern *Sterna sandvicensis*

EC Birds Directive – Annex 1 and migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The UK holds approximately 10% of the world population of Sandwich Terns. The JNCC population index indicates that from the 1960s to the 1980s there was a 40% population increase, before numbers declined again. The current index is just above that for 1986 but numbers can fluctuate greatly from year to year (JNCC 2013). There has been a long-term decline in breeding success (JNCC 2013). In Northern Ireland most breed in a few large colonies at Strangford Lough, Larne Lough and Lower Lough Erne.

Breeding numbers

The three largest colonies are in the east: Cockle Island, Groomsport; Strangford Lough; and Larne Lough (Figure 18). Sandwich Terns formerly bred at Carlingford Lough but this site is no longer utilised on a regular basis. Figure 18 shows the cumulative annual Sandwich Tern population for these four sites each year since 1969. The highest ever population was in 2005 but a steep decline has occurred since then.

Breeding success

Breeding success has been monitored intermittently at Lower Lough Erne since 1990. The success rate has rarely been greater than 0.5 chicks per nest and usually much lower (B. Robson *pers. comm.*).

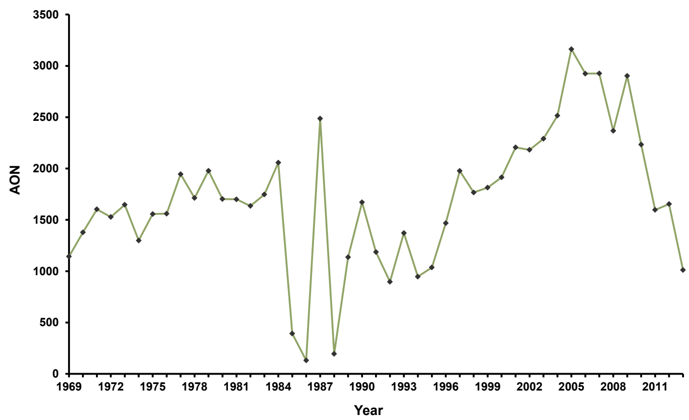

Figure 18 Cumulative Sandwich Tern populations at Cockle Island, Strangford, Carlingford and Larne Lough 1969–2013

Common Tern *Sterna hirundo*

EC Birds Directive – listed in Annex 1 and as a migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

Across the UK the population remained steady 1986–2006 but since then there has been a decline with the JNCC Index now 20% below that of 1986 (JNCC 2013). Although the reasons for this are unproven there has been a decrease in breeding success in the last ten years (JNCC 2013). Common Terns are the most widespread breeding tern species in Northern Ireland with coastal and inland populations. Significant numbers breed at several sites on Lough Neagh but these are poorly monitored. The main coastal sites are Strangford Lough, Larne Lough and Belfast Lough.

Breeding numbers

Historical data for the main colonies are incomplete. In the late 1960s the total population was probably 5–600 pairs. In the late 1980s there was a sudden increase to over 1,000 pairs and, by the early 21st Century there were over 2,000 pairs. Since this peak the population has again declined and numbers are now similar to the late 1980s (Figure 19). The current population for the four main east coast colonies is just above the average for the recording period 1980–2013. National surveys and the JNCC population index indicate that the UK population as a whole has remained stable (JNCC 2013) over the long-term.

Unfortunately no recent data have been gathered on Lough Neagh so it is not possible to determine how the population there has changed and a survey of those colonies is urgently needed.

Breeding success

In 2013 terns at Belfast Harbour RSPB produced 0.77 chicks per pair (C. Sturgeon *pers. comm.*). Productivity data for Common Terns in Northern Ireland show they had an average fledging rate of 0.32 chicks per pair between 1999 and 2011.

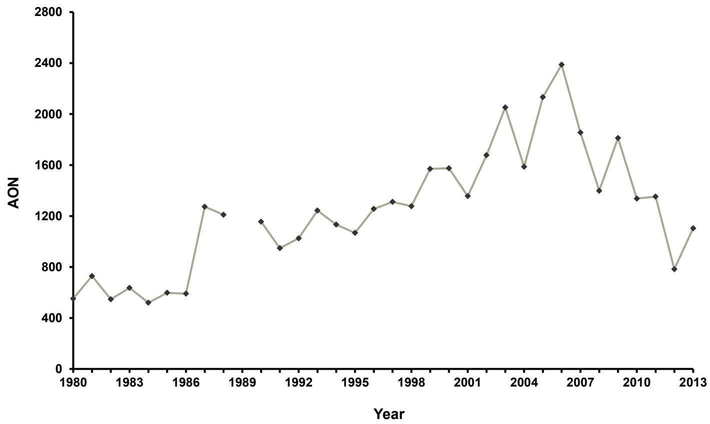

Figure 19 Cumulative Common Tern populations at Cockle Island, Strangford, Carlingford, Copeland Islands, Belfast Lough and Larne Lough 1980–2013

Roseate Tern *Sterna dougallii*

EC Birds Directive - *e.g.* listed in Annex 1 and as a migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

European populations of the Roseate Tern declined during the 20th Century, a decline which was mirrored by population declines in North America (del Hoyo *et al.* 1996). Numbers stabilised in the late 20th Century and while some European populations have continued to decline other colonies have increased, with focused conservation measures helping this recovery (Newton and Crowe 2000). The Roseate Tern in fact has a worldwide population and occurs in the Atlantic, Indian and Pacific oceans with populations in places such as Australia and east Africa. This fragmented population could make the species vulnerable to local population declines and extinctions.

In Scotland the main colony on the Firth of Forth appears to have been extirpated, partly due to a growth in the local Herring Gull population (JNCC 2013). The only colony in England, on Coquet Island, has increased slowly this century but still has a population under 100 pairs. It may have benefited from emigration from other sites. The stronghold for the species within these islands is now in south-east Ireland at Rockabill Island and Lady's Island Lake. Historically Mew Island in the Copeland Group was one of the major sites for Roseate Tern in Ireland (Thompson 1851). However the species ceased to breed in Northern Ireland around 1880 before apparently re-colonising in the first quarter of the 20th century (Deane 1954). Good numbers were again breeding on Mew by 1941 (Williamson *et al.* 1941).

Breeding numbers

The species is all but extinct in Northern Ireland having suffered a near-terminal decline in the late 1980s. In 2013 there was just one pair present at Larne Lough. In 2012 there were several sightings around the Copeland Islands and up to two birds were present on Cockle Island in Groomsport (per obs.), but breeding was not proven. In 2013 there was only a single sighting on the Copeland Islands.

Breeding success

A single pair in Larne Lough laid at least one egg but no young were known to have been fledged.

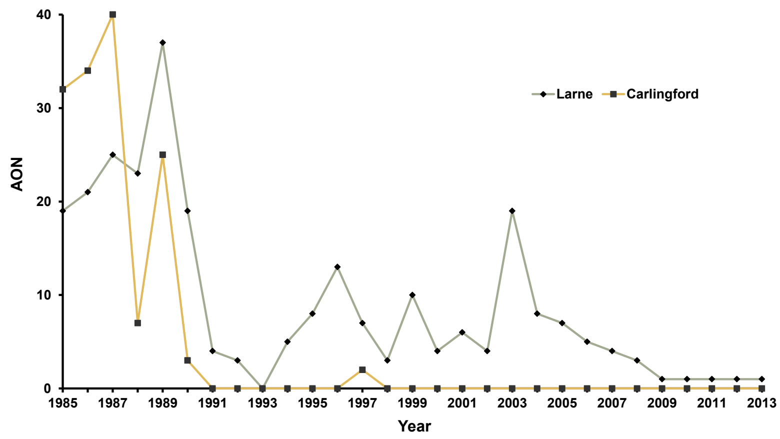

Figure 20 Roseate Tern populations in Northern Ireland 1985–2013

Arctic Tern *Sterna paradisaea*

EC Birds Directive - listed in Annex 1 and as a migratory species
Amber listed in Birds of Conservation Concern in Ireland 2

Overview

Arctic Terns are the commonest tern breeding in the UK. The UK population has fluctuated greatly since the 1960s. There was an apparent large increase between 1969 and 1986, though there is uncertainty to the true magnitude of this change due to questions of compatibility of methods between censuses. The Arctic Tern abundance index based on the SMP sample showed an apparent rapid increase, followed by decrease, during 1986 to 1990. From 1990 the index has fluctuated, mainly above 1986 levels. The JNCC Index suggests that the UK population has not changed much since 1986 (JNCC 2013). The majority of the UK population nests in the Northern Isles, with 73% occurring there. In Northern Ireland the species is concentrated into just a few colonies with the largest of these currently on the Copeland Islands.

Breeding numbers

In 2013 the Copeland Islands held a maximum of 1,250 AONs, mainly on Lighthouse and Mew Islands. This is a record tern population for the islands in modern times. Strangford held just 164 AONs, Cockle Island 60 pairs and Belfast Harbour 48 pairs.

In the last 25 years the Copeland Islands and Strangford Lough have held the majority of breeding birds in Northern Ireland. The population at Copeland has fluctuated between 600 and 1,250 pairs since 2000. Between 2008 and 2012 the populations of these sites decreased, but on Copeland the population stabilised at approximately 750 pairs. At Strangford the decrease was 90%. The reduction in the Strangford population during this period was not accounted for by an increase in other local colonies at the same time. Overall the Northern Ireland population remains very healthy (Figure 21).

Breeding success

In 2013 an estimated 700 chicks fledged on the Copeland Islands, representing 0.6 fledged chicks per pair. At Belfast Harbour RSPB Reserve only 0.1 chicks per pair were fledged.

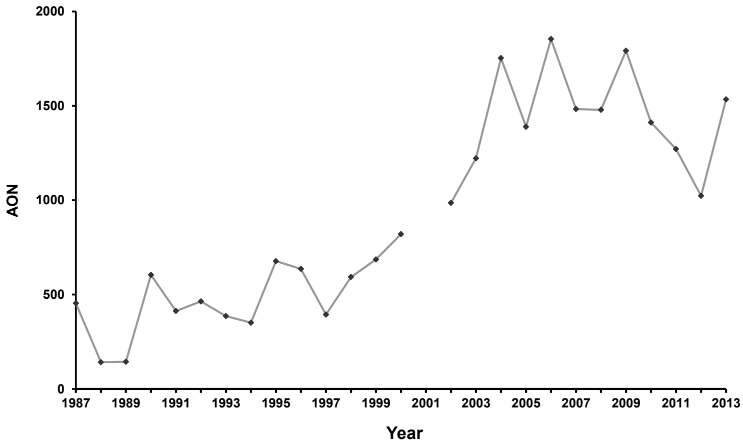

Figure 21 Arctic Tern populations at Copelands, Strangford, Belfast Lough and Cockle Island colonies 1987–2013

Little Tern *Sternula albifrons*

EC Birds Directive – listed in Annex 1 and as a migratory species
Amber listed in Birds of Conservation Concern in Ireland 2008–2013 (2013 update)

Overview

This is the smallest species of tern breeding in the UK, nesting exclusively on the coast usually on beaches. They do not forage far from their breeding site. On the island of Ireland the main breeding concentrations are on the south and east coast. In Northern Ireland it has always been a rare breeding species and has not been reported nesting since 1996 when two pairs were present at an undisclosed location – it is probable this was Bird Island, Portavogie.

Common Guillemot *Uria aalge*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The Common Guillemot (Guillemot) is one of the most abundant seabirds in the northern hemisphere. There are very large populations in the Atlantic and Pacific Oceans. Guillemots are extremely gregarious and colonies can contain many tens of thousands of individuals (Mitchell *et al.* 2013). In Northern Ireland the main colony is on Rathlin Island with smaller satellites at The Gobbins, Muck Island and at scattered cliff faces between Ballycastle and Portrush.

Breeding numbers

The last full survey of Rathlin, in 2011, recorded 130,445 individuals (Allen *et al.* 2011). After a 50% decrease between 1999 and 2007 this was a 60% increase which probably makes Rathlin the largest colony in the UK and Ireland. In 2013, 2,084 individuals were recorded at The Gobbins and 1880 individuals at Muck Island. This is the highest number ever recorded at The Gobbins, a 30% increase since the last survey in 2008 (Figure 22). The Muck count was slightly down on the 2012 peak (2,157) but still represents a 60% increase since 2008 (Figure 23).

The Guillemot population in Northern Ireland is very healthy. This correlates well with the JNCC population index which suggests that across the UK Guillemots are approximately 50% more common than in the 1980s (JNCC 2013). However the increase at Rathlin is in contrast to Handa, the largest colony during Seabird 2000. The Guillemot population there has decreased by over 50% (JNCC 2013). Studies on the Isle of May have shown that Guillemot adults have a 90% annual return rate (JNCC 2013), but this was much lower in 2007–2008, which may give clues to the reasons for the low count on Rathlin in 2007.

Breeding success

Guillemots are difficult to survey adequately for breeding success but a productivity survey at the Gobbins revealed very low breeding success with less than 0.15 chicks per nest fledged (*pers. obs.*). Hooded *Corvus cornix* and Carrion *Corvus corone* Crows were responsible for the predation of many Guillemot eggs at The Gobbins while Great Black-backed Gulls predated adults. Across the UK productivity has decreased slowly since the 1980s, with the pace of decrease becoming more rapid after 2000. Between 2002 and 2007 just 0.3 chicks per pair were fledged. Levels of productivity have recovered slightly since 2007 but are still far below that of the 1980s (JNCC 2013).

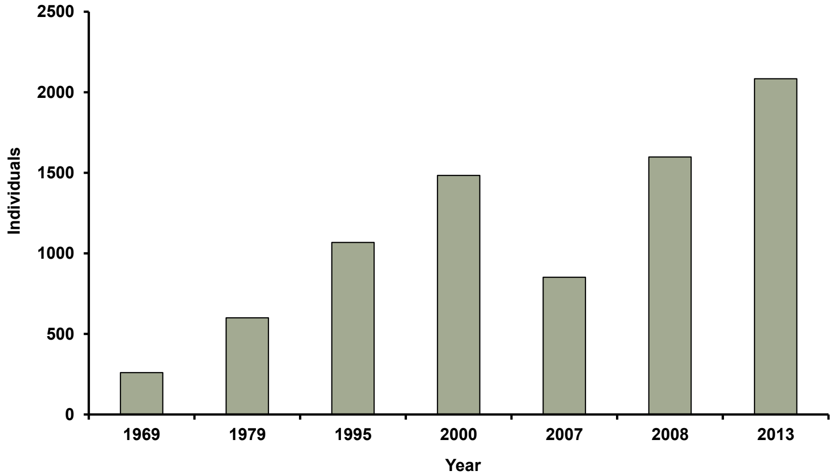

Figure 22 Common Guillemot populations at The Gobbins 1969–2013

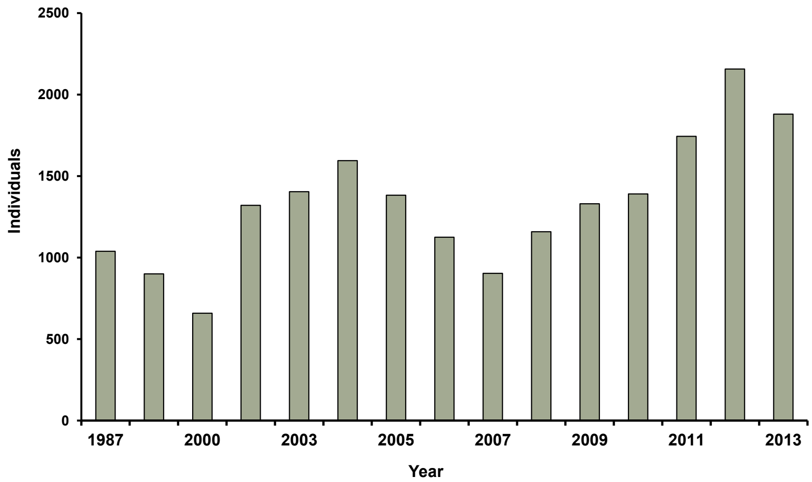

Figure 23 Common Guillemot populations at Muck Island 1987-2013

Razorbill *Alca torda*

EC Birds Directive - migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The Razorbill is a bird of the north Atlantic and Arctic Ocean. Razorbills nest on ledges with Common Guillemots but also frequently in clefts, holes and under boulders. In Northern Ireland the main colony is on Rathlin Island with smaller satellites at The Gobbins, Muck Island and at scattered cliff faces between Ballycastle and Portrush.

Breeding numbers

The last full survey of Rathlin, in 2011, recorded 22,975 individuals. This was double the figure recorded in 2007, but only 10% above the 1999 total. Rathlin is probably now the largest colony in the UK and Ireland. The 2013 population at The Gobbins (854 Individuals) was at a record level (Figure 25). The count at Muck Island (868 individuals) has only been bettered by that in 2003 (Figure 24). The JNCC population index has fluctuated over the last 25 years but is still well above 1980s levels.

Breeding success

Across the UK annual productivity has declined slowly over the last 25 years and is now approximately 0.5 chicks per pair. No data are available for Northern Ireland in 2013.

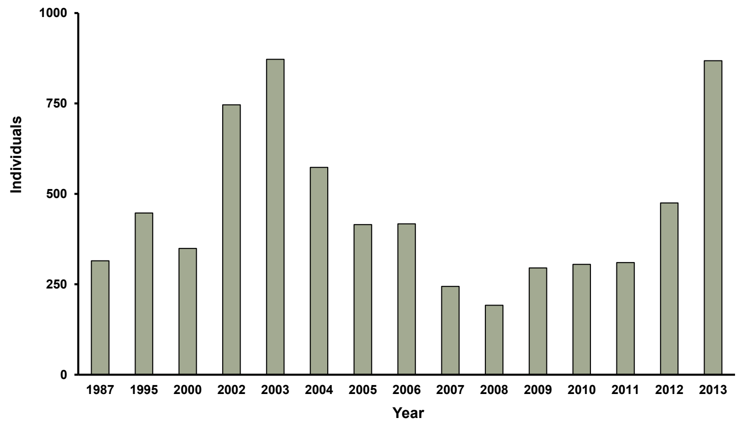

Figure 24 Razorbill populations at Muck Island 1987–2013

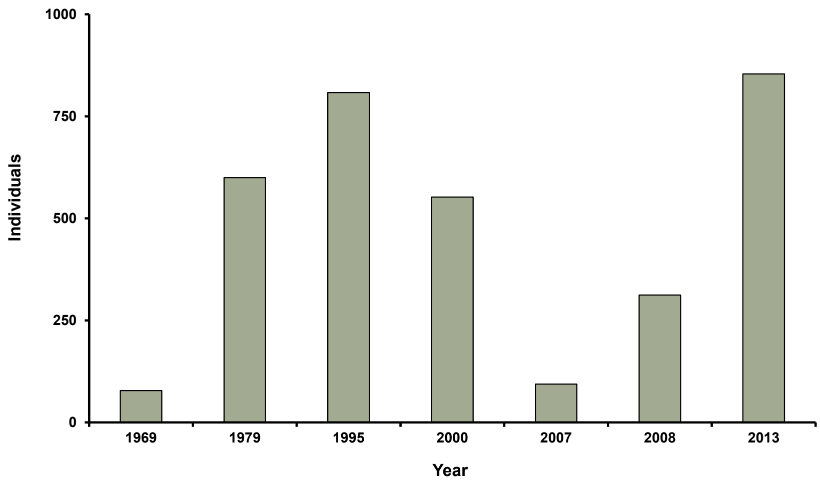

Figure 25 Razorbill populations at The Gobbins 1969–2013

Black Guillemot *Cepphus grylle*

Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The Black Guillemot is a circumpolar species which in the UK has historically been a predominantly Scottish species. Between censuses in 1969/70 and 1985–91 there was a range expansion and the species increased dramatically around the coast of Northern Ireland (JNCC 2013). This increase continued through Seabird 2000 to this day. Black Guillemots nest in crevices (natural or man-made) and can be difficult to survey. It is essential the recommended methodology is followed.

Breeding numbers

The sites counted by surveyors in 2013 held approximately 80% of the population at Seabird 2000. The total population across these locations in 2013 is very similar, but the distribution has changed dramatically. Table 6 divides the counts into broad geographic areas. The majority of East Antrim/north Belfast Lough sites have shown large decreases, although Larne Lough and The Maidens go against this trend. The two north coast sites surveyed show large decreases also. In comparison sites in Co. Down, from the south side of Belfast Lough southwards have shown a huge increase. In 2013 Bangor had the most nests on record (Julian Greenwood *pers. comm.*). This hints at a redistribution of the population within Northern Irish waters.

Black Guillemots, like other seabirds, show a high degree of philopatry once they start to breed (Brooke 1990), but juveniles will disperse readily to other colonies (Frederiksen & Peterson 2000). Increased juvenile dispersal away from poorer sites, coupled with poorer adult survival but better survival for Co. Down birds, could be responsible for these changes. However, we simply do not know for sure. Black Guillemots in Northern Ireland feed almost exclusively on the

Butterfish *Pholis gunnellus* (pers obs.) and the distribution and abundance of this species must be a key factor influencing Black Guillemot populations and distribution. This is only a single set of counts, in a single year, but already we are getting valuable data on changes in Black Guillemot populations in Northern Ireland.

Breeding success

In 2013 the Bangor colony had 38 pairs which fledged 0.82 per pair (Julian Greenwood *pers. comm.*).

Table 6 Comparison of Spring counts of adult Black Guillemots at selected survey sites in 2000 and 2013

Site	2000	2013	% Change
Lighthouse Island, Copeland Islands	72	124	
Groomsport	0	12	
Donaghadee	4	9	
Annalong	36	64	
Ardglass	2	18	
Bloody Bridge - Newcastle	35	106	
Co Down total	**149**	**333**	**+124**
Barr Head - Blackhead	108	43	
Larne Lough	112	105	
The Maidens	12	38	
Muck Island	13	14	
Carrickfergus - Whitehead	207	158	
South-east Antrim total	**452**	**358**	**-21**
Glenarm Harbour	48	42	
East Antrim total	**48**	**42**	**-12.5**
Rathlin Island	212	129	
Portnaboe - Runkerry	66	30	
North Antrim total	**278**	**159**	**-43**
Overall total	**927**	**892**	**-4**

Atlantic Puffin *Fratercula arctica*

EC Birds Directive – migratory species
Amber listed in Birds of Conservation Concern in Ireland 2 (2007 update)

Overview

The Atlantic Puffin is the most instantly recognisable of all North Atlantic seabirds. They are a secretive bird on land, nesting in burrows, and we also know relatively little about their pelagic lifestyle. This is however changing with the use of new technology (Harris *et al.* 2010; Guilford *et al.* 2011). Around 10% of the world population breed in the UK and Ireland, where it is the second most abundant breeding seabird (Mitchell *et al.* 2004).

In Northern Ireland the main colony is on Rathlin, with small numbers at The Gobbins. Some are occasionally seen at Muck Island although breeding has not been confirmed. A conservation project on the Copeland Islands is attempting to create a new colony using decoys and sound lures.

Breeding numbers

In 2013 a peak count of 55 was recorded at the Gobbins (Leonard 2013). Seven were recorded at Muck Island in July – these likely related to young birds but breeding is always possible. Up to 100 birds were present around Lighthouse Island, Copeland Islands, during June. Birds were observed digging, displaying and mating although attempted breeding was not proven.

Breeding success

There are no productivity data available for Northern Ireland. Research in the UK has shown that productivity is highly variable between 0.3 and 0.8 chicks per pair.

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Strangford Lough Breeding Seabird Summary 2013

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Introduction

The 2013 breeding season was characterised by one of the coldest springs on record, followed by the best summer since 2006. Of particular concern to the National Trust is the continuing decline in the number of breeding terns. National Trust staff and volunteers again completed a comprehensive monitoring programme of breeding seabird populations on islands within Strangford Lough. The following species accounts summarise the results.

Cormorant *Phalacrocorax carbo*

306 pairs bred on Bird Island. This was the lowest count since 2000.

Black-headed Gull *Chroicocephalus ridibundus*

1,205 pairs bred on eight islands. This is a substantial decline since a peak of 4,351 pairs in 2008 and 7,023 pairs in 1994. The main colonies in 2013 were on Dunsy Rock and at Castle Espie.

Mediterranean Gull *Ichthyaetus melanocephalus*

Two pairs bred on Strangford Lough this year. This species first bred in 2002 and 1-3 pairs have bred in most years since then.

Common Gull *Larus Canus*

330 pairs bred on 20 islands, with the largest colony on Drummond. There was a long-term increase in numbers up to 2010, when the population peaked at 532 pairs. Numbers have declined in recent years.

Lesser Black-backed Gull *Larus fuscus*

360 pairs bred on 19 islands, with the largest colony on Green Island off Killyleagh. It has only nested regularly on Strangford Lough since 1982. Since then there has being a sustained long-term increase in the breeding population.

Herring Gull *Larus argentatus*

803 pairs bred on 14 islands, with the largest colonies on Round Island and Bird Island. Numbers have being increasing over the past ten years and this was the highest count since 1991.

Great Black-backed Gull *Larus marinus*

102 pairs bred on 10 islands, with the majority of the population on Great Minnis's Island. This was the highest count since 1972. There has being a substantial recovery in numbers since the population crash in 2001, when only one pair nested.

Sandwich Tern *Thalasseus sandvicensis*

677 pairs bred on Dunsy Rock and Black Rock (Ringdufferin). This is the lowest count since 1998. Birds appeared to have improved breeding success this year at the main colony on Dunsy Rock with an estimated 0.15 chicks fledged per pair, following a number of years of almost total breeding failure. Mammalian deterrents were trialled for the first time on Dunsy Rock following concerns about the impact of predation by mustelids on nesting terns. The average count over the past five years is 1,125 pairs and therefore the SPA feature is in favourable condition.

Common Tern *Sterna hirundo*

352 pairs bred on 11 islands, with a further seven pairs of 'comic' terns on a further two islands. The main colony was on Dunnyneill (Lower) this year. The total count was an improvement on the low total recorded last year, but is still one of the lowest counts on record. Despite the good summer weather, virtually no chicks fledged again on Strangford Lough this year. The average count for the last five years is *c.*690 pairs and therefore the SPA feature is considered to be still in favourable condition.

Arctic Tern *Sterna paradisaea*

164 pairs bred on seven islands, with the main colonies on the Sheelaghs NE and Black Rock (Ringdufferin). The total count was an improvement on the low total recorded last year, but is still one of the lowest totals on record. Despite the good summer weather virtually no chicks fledged again on Strangford Lough this year.

National Trust

Lower Lough Erne Islands RSPB Nature Reserve Breeding Seabird Report 2013

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Introduction

The islands of Lower Lough Erne, Co.Fermanagh are home to seven regularly breeding seabird species on twelve islands across the lough. Due to the continual presence of an RSPB warden since 1968 there has been regular monitoring of most species since then, both on and off the RSPB's Lower Lough Erne Islands Nature Reserve, formerly known as Castle Caldwell Forest Nature Reserve.

Sandwich Tern *Sterna sandvicensis*

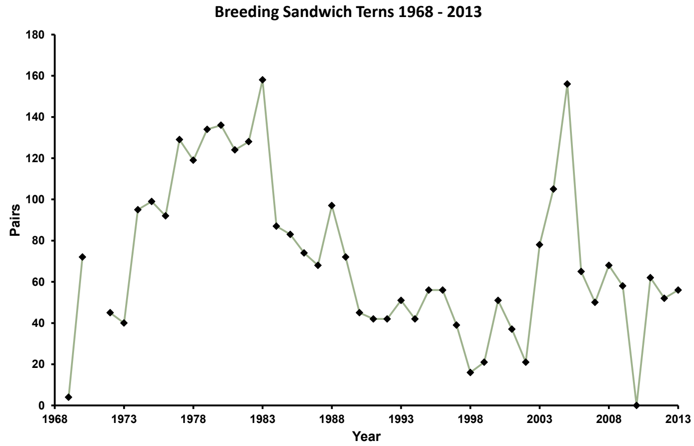
The presence of this possibly unique inland colony of freshwater breeding Sandwich Terns has been known since at least the late 1800s and is referred to by Praeger (1937). Nesting has most often occurred on Gravel Ridge Island though other islets in the same area have occasionally been used. All of these islets were 'created' by the lowering of water levels in the lough in 1958 and as exposed bare gravel and limestone, islands would have been attractive to nesting terns and gulls. Since then, first colonisation and subsequent succession of vegetation has reduced the area of suitable nesting habitat. From 1998 the nesting area favoured by Sandwich Terns has been strimmed annually to create short vegetation and bare ground. In 2005 Himalayan Balsam *Impatiens glandulifera* became established on Gravel Ridge Island bringing a new threat to the site and the terns. Intensive management, greatly hindered by the need not to disturb the gulls and terns during the breeding season eventually resulted in eradication of the balsam in 2013. The constant supply of seed from this plant along the banks of the Kesh River to the northeast will mean that ongoing monitoring and occasional intervention will continue to be necessary. The terns did not breed on the lough in 2010 and moved to a nearby island in 2011, once the Black-headed Gull *Chroicocephalus ridibundus* colony with which the terns associate, became established there. Both species moved back to Gravel Ridge Island in 2012. In response to this situation RSPB staff decided to clear all scrub, cut short all of the vegetation and to create two small new areas of bare gravel across four islands in winter 2012/13. It is hoped that this will provide more options for the terns and Black-headed Gulls to move between sites. Gravel Ridge Island was declared an Area of Special Scientific Interest in 2009 because of its importance for breeding Sandwich Terns and Black-headed Gulls.


GREGORY WOULAHAN

Figure 1 Work to create gravel area on Gravel Ridge Island 2013

The population has fluctuated over the years with peaks of 158 pairs in 1983 and 156 pairs in 2005 but has more often been around forty to seventy pairs. It is possible that the Lower Lough Erne birds are part of a much larger meta-population moving between Fermanagh and three sites in north Donegal. Monitoring productivity in the colony is very difficult because of the height of the vegetation and because adults lead fledged juveniles off to the coast soon after fledging. Fledging success recorded has ranged from 0.05 to 0.79 fledged chicks per pair.

For many years it was apparent that the Sandwich Terns did not feed on the Lower Lough but instead travelled to Donegal Bay to catch prey. They can frequently be seen passing over the Rosscor Viaduct on the Erne River 15km west of the colony whilst travelling to and from the sea a further 15km beyond. There have been occasional reports of fishing on the lough though these were not substantiated until 2012 and in 2013 when many Sandwich Terns were observed frequently catching freshwater fish fry on the lough though some adults continued to make the 60+km round trip to the coast.



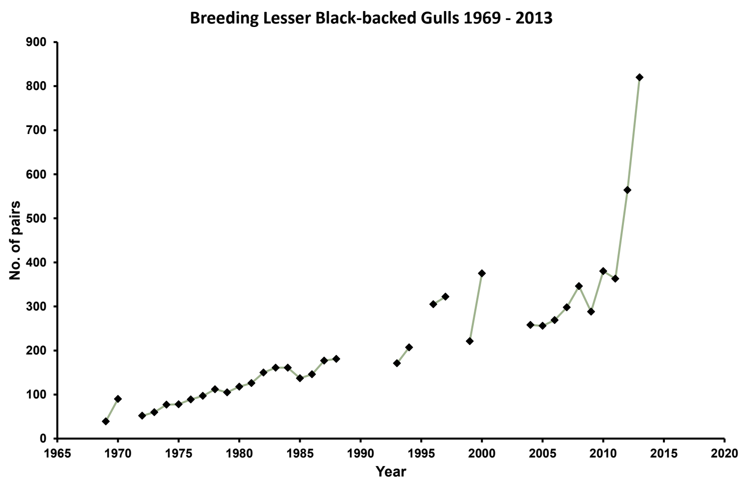
Common Tern *Sterna hirundo*

Common Terns have bred more or less annually since monitoring began in 1969. In ten years their numbers were not counted or not recorded and in five years (1969, 1970, 1980, 1981 and 1982) the number nesting is unclear due to reports of mixed and separate colonies of Arctic Terns *Sterna paradisaea* being recorded on the lough.

Numbers were highest early in the period when recently exposed islands and spoil heaps from dredging operations provided new nesting opportunities. In more recent years, nesting sites have become limited due to encroachment by vegetation and higher spring and summer water levels in the lough. Management aimed mainly at Sandwich Terns in early 2013 provided suitable gravel and bare ground areas on Gravel Ridge Island ASSI and ten pairs of Common Terns nested, the highest number since 1991. Productivity has rarely been monitored though 1.44 fledged young per nest were recorded from nine nests in 2006.

Lesser Black-backed Gull *Larus fuscus*

The population of this large gull slowly but steadily increased from thirty-nine pairs in 1969 to 380 pairs in 2011 before suddenly exploding to more than 800 pairs over the last two years. Enniskillen has an open landfill site which attracts large numbers of gulls throughout the year but especially this species during the summer months. Lesser Black-backed Gulls also feed extensively on pasture around the shores of Lough Erne. However, this situation has not suddenly changed in recent years so it is not immediately obvious why the population increased so rapidly in 2012 and 2013. The removal of scrub around the shores of grassland islands for the benefit of breeding waders may have helped but a recent meeting with Andrew Speer and colleagues of National Parks and Wildlife Service revealed a more likely source. An island colony of *c.*800 pairs of Lesser Black-backs on Lough Derg, Co.Donegal has been vacated in recent years; probably as a result of habitat change. This site lies approximately 12km from the breeding islands on Lower Lough Erne so perhaps we can expect the increase to continue to more than 1,100 pairs before too long.



Herring Gull *Larus argentatus*

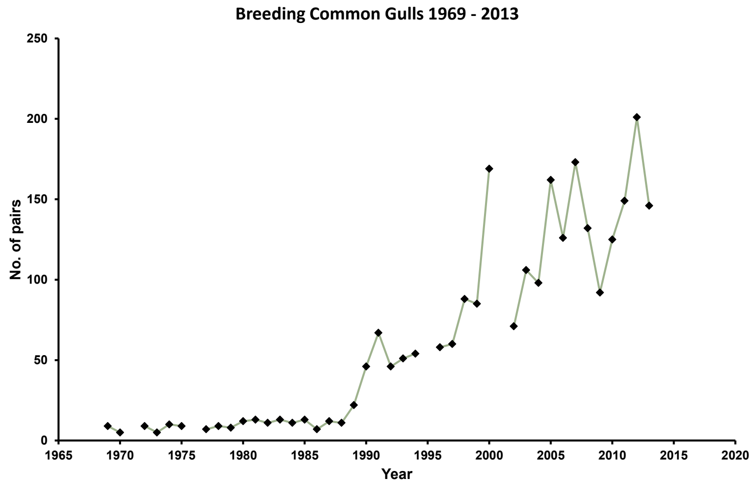
Herring Gull was not recorded breeding on the lough before 1986. In contrast to its darker-backed cousin this species has declined during the same period and teeters on the brink of extinction as a breeding bird on the lough. Never numerous, the population increased slowly to 25 pairs in 1997. No subsequent counts were then undertaken until Seabird 2000 when only five pairs were found to be present. The population has wavered between zero and three pairs ever since with three pairs in 2013, the highest since 2000. A very large aggregation of immigrant birds gathers at the Enniskillen landfill site in winter though they mostly roost at night in Donegal Bay, approximately 46km away.

Great Black-backed Gull *Larus marinus*

This species has bred on the lough since 1969 at least, though numbers of pairs remained in single figures until a brief increase between 1985 and 1997 when the population peaked at eighteen pairs. The population has since fallen back to one to two pairs annually, with two pairs in 2013.

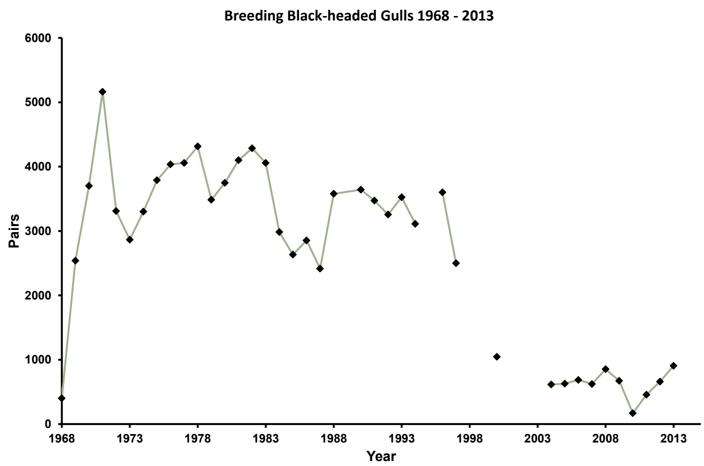
Common Gull *Larus canus*

Common gulls have increased slowly, mainly nesting on grassland islands and spoil heaps at the western end of Lower Lough Erne. This species increased from nine pairs in 1969 to 169 pairs in 2000. However, in the early 2000s Badgers *Meles meles* colonised two of the favoured islands and the colony moved to Cruninish further east. The colony has subsequently split between several islands and peaked at 201 pairs in 2012. In 2013 146 pairs were spread across three islands.



Black-headed Gull *Chroicocephalus ridibundus*

This species was formerly much more numerous and widespread than it is today. The population peaked at 5,163 pairs in 1971, but between 1971 and 1979 up to 40% of eggs per year were injected with formalin and up to 24% of nests raked out, all in the belief that this would benefit nesting Sandwich Terns. Up to six colonies were present on the Lower Lough during the 1970s. Despite the attempts to control them, numbers of pairs remained high (2,400 – 4,285) through the eighties and nineties before dropping rapidly to 1,046 pairs in two colonies by Seabird 2000. By 2004 there were just 614 pairs and a low point of 170 pairs at a single colony was reached in 2010. Since then numbers have increased and a new island was used temporarily. In 2013 there were 906 pairs on Gravel Ridge Island ASSI following scrub removal.



Mediterranean Gull *Larus melanocephalus*

Occasional adults have been seen at gull colonies since the late 1990s. In 2010 a single adult was present for three days in a gull colony in July. In 2011 an adult and a second summer bird were present from 30th March until 2nd July. The birds frequented three different colonies and although they were seen on the same island at the same time they were not seen to interact. The adult was seen to display to a Black-headed Gull and was clearly a male. In 2012 two adults were present between April and June, presumably the same birds as in 2011. One, a male bird, persistently displayed to Common Gulls throughout its stay. In 2013 the presumed same male was again associating with Common Gulls, whilst an adult and a second summer were present at another site throughout the breeding season. A breeding attempt was suspected but not proven.

The gulls are not popular with fishermen and some land owners on the lough and at times have suffered disturbance and nest/egg destruction. One accusation is that some species eat too many May Fly *Ephemeroptera* spp.

BRAD ROBSON

Figure 2 Adult Mediterranean Gull

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BRAD ROBSON

The Breeding Success and Foraging Ecology of Seabirds at Rathlin Island

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Introduction

Rathlin Island lies off the north coast of County Antrim and holds one of the largest seabird breeding colonies in Ireland. It supports over 150,000 seabirds which are protected within a Special Protection Area. Between 1999 and 2007 most populations of seabirds on Rathlin declined (Allen & Mellon 2007). Common Guillemots *Uria aalge* (Guillemots) declined by 15% and Razorbills *Alca torda* declined by 49% but the Black-legged Kittiwake *Rissa tridactyla* (Kittiwake) population was found to be stable. However, breeding success for Kittiwakes on Rathlin was low from 2005 to 2008 and for Guillemots from 2005 to 2007 (Chivers 2008). This was a worrying situation so, in 2009, The Northern Ireland Environment Agency funded a PhD at Queen's University Belfast to look at possible causal factors. Observations of seabirds breeding on Rathlin indicated that low food availability may have caused low breeding success (Chivers 2008) and so the study focused on foraging ecology. One important aspect of the PhD was to use new technology in the form of Global Positioning System (GPS) data loggers to map seabird foraging areas at sea and use this information to inform the identification of a marine protected area (MPA).

The study found that between 2008 and 2010, the breeding success of Guillemots and Razorbills remained constant and similar to the UK mean despite substantial inter-annual and inter-specific differences in the composition of chick diet (Chivers *et al.* 2012a; Table 1). Guillemots fed their chicks on clupeids (small sprats *Sprattus sprattus* or herring *Clupea harengus*), gadoids (small cod fishes) and sandeels (*Ammodytidae*). In two of the years, clupeids made up the highest proportion of chick diet but in 2010, gadoids were the main prey species. Razorbills fed their chicks sandeels and clupeids with sandeels making up the highest proportion of chick diet in all three years but clupeids making up a larger proportion in 2009.

Table 1

	Breeding success (mean no. of chicks per pair ± s.e.)			
	2008	2009	2010	UK mean (1986-2005)*
Guillemot	0.79 ± 0.07 (n=33)	0.69 ± 0.07 (n=46)	0.68 ± 0.07 n=44)	0.69 ± 0.02 (3-5 colonies annually)
Razorbill	0.55 ± 0.09 (n=33)	0.57 ± 0.08 (n=35)	0.53 ± 0.08 (n=39)	0.65 ± 0.02 (1-7 colonies annually)
Kittiwake colonies	0.42 ± 0.08	1.11 ± 0.11 (n=38)	0.45 ± 0.08 (n=37)	0.68 ± 0.03 (30-61 (n=38) annually)

* JNCC data

Kittiwakes were also found to be highly reliant on clupeids during the breeding season which is different to UK colonies in the north eastern North Sea where Kittiwakes depend on sandeels (Chivers *et al.* 2012b). In contrast to Guillemots and Razorbills, Kittiwakes showed substantial inter-annual variation in breeding success which was good in 2009 but poor in both 2008 and 2010 (Table 1). In 2009, GPS tracking showed that Kittiwakes foraged near to the colony, at a mean distance of 22.9 ± 1.51 km, and so were able to feed their chicks at a high enough rate to fledge good numbers of chicks (Chivers *et al.* 2012c). In 2010 Kittiwakes had to travel much further from the colony, at a mean distance of 42.4 ± 6.46 km, nearly to the Scottish coast, to obtain food for chicks. This meant that they couldn't maintain a high enough feeding rate to provide enough food for chicks and, as a result, chicks starved and breeding success was low.

Using modelling techniques and geographic and remotely sensed data, the feeding locations identified using the GPSs were described using environmental variables (Chivers *et al.* 2013). Kittiwakes were found to prefer to forage in areas <30km from the colony, <40km from land, and in productive waters (indicated by chlorophyll-a concentration) which are 25–175m deep. Potential feeding areas were then modelled for 2009 and 2010 and it was found that the extent of potential feeding habitat for Kittwakes was lower in 2010 than in 2009, providing further evidence for

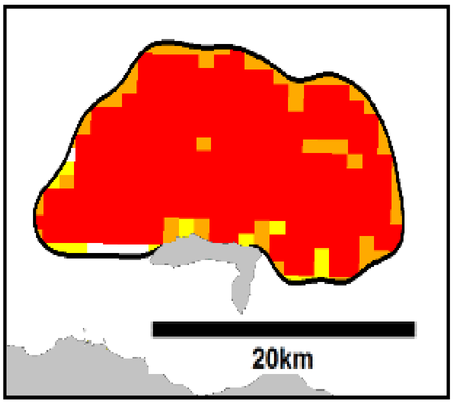

Figure 1 Proposed MPA boundaries for Rathlin Island

low food availability in 2010. Using a combination of the 2009 and 2010 models, a potential MPA was identified for Kittiwakes breeding at Rathlin (Figure 1).

Another whole colony census carried out in 2011 revealed that breeding numbers of Guillemots and Razorbills on Rathlin had substantially increased since 2007 (Figure 2). So, poor breeding success in 2005, 2006 and 2007 did not appear to detrimentally affect auk populations at this colony. The 2007 census was probably carried out in a year of poor breeding success and low food availability, indicated by large numbers of starving chicks (RSPB unpubl. data). Therefore, auk numbers may have been low in 2007 because many did not breed at all and/or many may have failed and deserted before being counted. An alternative suggestion is that, as was found at other colonies, the breeding season may have been late and so many Guillemots may not have been present at the colony until after the count was performed (JNCC 2013).

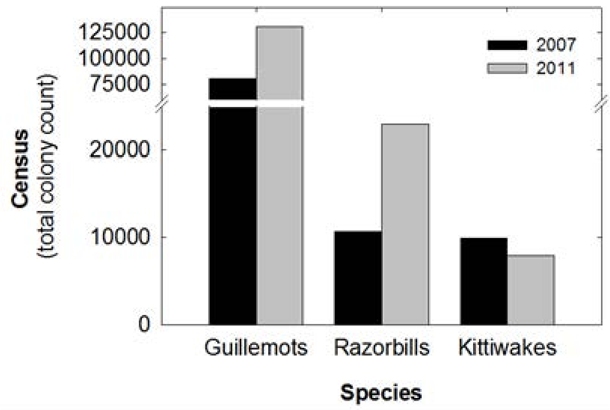

Figure 2 Total census counts for seabirds breeding on Rathlin Island during 2007 and 2011 (Northern Ireland Environment Agency unpubl. data)

In contrast to Guillemots and Razorbills, the 2011 census suggested that breeding Kittiwake numbers at Rathlin had declined since 2007 (Figure 2), during which time breeding success had been poor in most years, probably as a consequence of low food availability. Recent declines in UK Kittiwake populations have been attributed to low reproductive success since 2005 (JNCC 2013) and this also appears to be the case for the colony at Rathlin. Kittiwakes appear to be more vulnerable to changes in prey availability than other seabird species and protection of food resources on which they depend should be an urgent priority for the conservation of this species.

Acknowledgements

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Northern Ireland Black-headed Gull Study

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Introduction

Black-headed Gull *Chroicocephalus ridibundus* populations have undergone declines throughout Ireland (Crowe 2005). In Northern Ireland, the species declined by over 74% (Mitchell *et al.* 2004) between 1985 and 2000 (Table 1). Consequently, the Black-headed Gull is classified as a priority species in Northern Ireland (Allen & Mellon 2011) and as a red-listed species in Ireland (Lynas *et al.* 2007). In Great Britain, the species is amber-listed (Eaton *et al.* 2009) and the population is considered to be in favourable condition in Europe, although there was a moderate decline in the number of breeding pairs from 1990-2000 (Birdlife International 2004).

Understanding the factors which have led to this decline in Northern Ireland is critical for successfully implementing conservation measures to stabilise or increase the population to former levels. Long-term ringing and/or colour-marking studies are often an essential component of monitoring population processes. These projects need to be carried out over a number of years to minimise the effects of stochastic variation in, for example, inter-annual variations in productivity due to the effects of weather. We hope to gain a fuller understanding of the patterns of long distance migration, juvenile dispersal, survival rates, and breeding and winter site fidelity by colour-marking individuals during the winter and summer.

Table 1 Changes in numbers of breeding pairs of Black-headed Gull in Northern Ireland between SCR Census and Seabird 2000 (adapted from Mitchell *et al.* 2004)

	SCR Census (1985-88)	Seabird 2000 (1998-2002)	Percentage change since SCR
Co. Londonderry		100	
Co. Antrim	6,960	3,884	-44%
Co. Down	4,486	2,203	-51%
Co. Armagh	4,200	50	-99%
Co. Fermanagh	800	2,800	250%
Co. Tyrone	22,000	1,070	-95%
TOTAL	**38,446**	**10,107**	**-74%**

Methods

This project complements other, ongoing colour-ringing studies across Europe. It has been registered with the European co-ordinator, Kjeld Pedersen, who assigns a colour and the BTO, who assign a series of four digit, alpha-numeric codes to the project. This protocol ensures that the same colour/code combination is only used once across Europe.

The colour which was assigned to the Northern Ireland project was orange and the individually identifiable four digit codes, which are engraved on the rings, began with the number ‘2’, followed by a combination of letters (Figure 1).

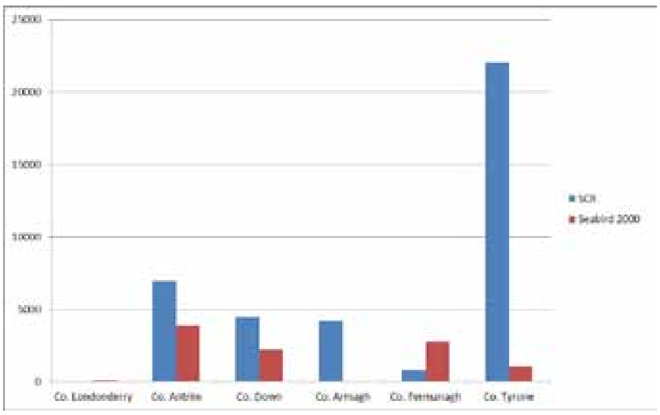

Figure 1

In November 2012 catching and colour-marking Black-headed Gulls began at various sites in Northern Ireland. Birds are caught, mostly by hand, and ringed with a standard metal BTO ring on the right leg. The field-readable, plastic ring is fitted on the left leg. Following conversations with Kane Brides and Ciaran Hatsell, who run a similar project in north-west England, a newer batch of colour-rings have been produced which are engraved with an email address, as well as the individual code (Figure 2).

Throughout the year, but particularly during winter months, birds are ringed as and where opportunities and permissions exist. To date, birds have been ringed at nine sites in Counties Antrim and Down. During the breeding season, pulli at several colonies on the east coast of Northern Ireland have also been colour-marked. Young birds are of known age and origin and this technique facilitates relatively large numbers of birds being efficiently marked. As well as catching and colour-ringing birds, contact has also been made with ringers across Europe and records are being kept of Black-headed Gulls ringed / colour-marked elsewhere and re-sighted in Northern Ireland. This information will provide more detail of where birds are coming from to winter or breed here.

One of the aims of the project was to raise awareness of the conservation status of Black-headed Gulls in Northern Ireland, and promote the project through social media, such as Facebook, Twitter and a project blog (www.bhgullsni.blogspot.com). As well as encouraging members of the public to check birds for colour-rings and report them, the blog also provides some background information on the study, a contact email address (bhgni@ymail.com) and regular updates on the progress of the study.


GARETH PLATT

Figure 2 Example of a colour ring

Results to date

As of 31st December 2013, a total of 149 birds have been colour-marked (52 fledged birds and 97 pullus) resulting in 671 re-sightings of 55 individual birds by 33 different observers. This is a re-sighting rate of almost 37%. The most notable movement so far has been 2AAR which was ringed in Antrim in December 2012, and subsequently re-sighted on Polish breeding grounds in April before being recorded back at Antrim in October 2013 (Figure 3 and Figure 4).

Three colonies were visited during June and July 2013, namely Mew Island, Copeland Islands; Blue Circle Island, Larne Lough; and Castle Espie, Strangford Lough. A total of 92 pulli were colour-ringed.

Seven juveniles, six of which were colour-ringed, from two of the three colonies included in the study, have been recorded since fledging (Table 2).

Figure 3 Known movements of 2AAR in 2013

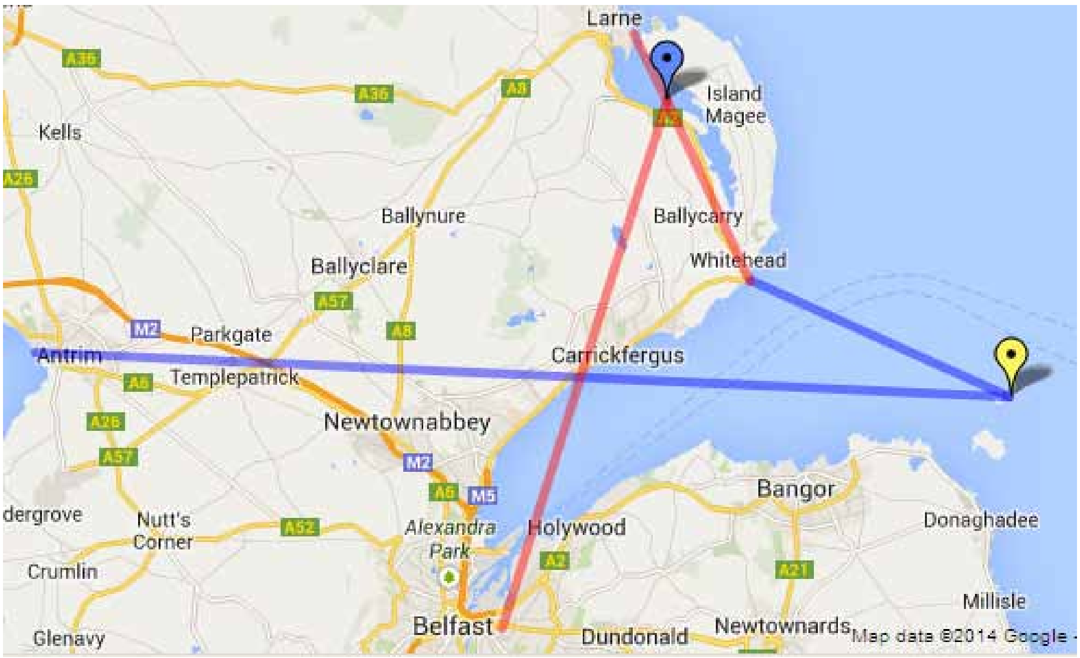

Figure 4 Juvenile dispersal 2013 (red (paler track) - movement of one bird, blue - movement of two birds) Maps courtesy of Google Maps.

Table 2

Bird	Date ringed	Location recorded post-fledging	Date first	Location	Obs
Unknown*			01 Jul 13	Glynn Station, Co Antrim	AMC
2ADN	19 Jun 13	Mew Island	18 Jul 13	Whitehead, Co Antrim	CM
2ASA	19 Jun 13	Mew Island	18 Jul 13	Whitehead, Co Antrim	CM
2BCD	01 Jul 13	Blue Circle Isl	25 Jul 13	Whitehead, Co Antrim	CM
EX97278^	19 Jun 13	Mew Island	01 Aug 13	Antrim Marina, Co Antrim	AMC
2AKA	18 Jun 13	Blue Circle Isl	11 Aug 13	Larne, Co Antrim	NW
2AJN	18 Jun 13	Blue Circle Isl	21 Sep 13	Connswater, Co Down	AD
2ADP	19 Jun 13	Mew Island	13 Nov 13	Antrim Marina, Co Antrim	NW

*Colour-ringed juvenile seen, but could not get code. Presumably a bird ringed on nearby Blue Circle Island on 18th June 2013.
^Metal ringed only, no colour-ring was fitted

Since November 2012, colour-ringed or ringed birds from 12 countries including Belarus, Sweden and Lithuania have been recorded wintering in Northern Ireland (Figure 5 and Figure 6). These records support the assumption that our Black-headed Gull population is augmented in winter by birds migrating from continental Europe (Allen & Mellon 2011).

Figure 5 Original ringing locations of wintering Black-headed Gulls, recorded in Northern Ireland since November 2012. Map courtesy of Google Maps.

Discussion

The cause for the drastic decline in Northern Ireland's breeding population is unknown. While predation of eggs is a well-known threat, other issues could include habitat change, disturbance and even illegal egg theft (Allen & Mellon 2011) or deliberate nest destruction (Brad Robson *pers. comm.*). It is also possible that the population has declined as a result of more efficient refuse management, a ready and easily accessible food supply which is no longer available (McGeehan & Wyllie, 2012).

There is currently a network of fifteen colour-ringing studies of Black-headed Gulls across the UK and Ireland, including the project in Northern Ireland. Although it is thought that the British and Irish populations of Black-headed Gull are mainly sedentary, recoveries of pulli ringed as part of several studies in England have shown a tendency to move west (Flegg & Cox 1972; Reading & Basingstoke Ringers 2012). This westerly movement is consistent with the large scale influx of birds from continental Europe to the British Isles in winter (Atkinson *et al.* 2006).

As Black-headed Gulls are long-lived birds (the longevity record for the species being 29 years, 3 months and 12 days (Robinson & Clark 2013)), it is envisaged that this will be a long-term study. Future monitoring work of this species will continue to concentrate on populations of wintering birds to establish their origins, with further work being carried out at breeding colonies to record dispersal of young birds. The largest declines have been recorded at inland colonies (Table 1); should permissions, time and funding permit, a detailed study comparing and contrasting the fortunes of coastal colonies versus inland colonies, in particular those on Lough Neagh, would be recommended.

In the short-term, a census should be conducted to establish an accurate, up-to-date population estimate for the species in Northern Ireland. This study, as with similar projects, demonstrates the effectiveness of using colour-rings to obtain re-sighting data. Currently, only one report has been received where the metal BTO ring was also read, although the presence of a colour-ring may have discouraged observers from making an effort to read / report the metal ring number. It is recommended that any project concentrated on seabirds should consider the use of colour-rings to increase the chances of re-sighting.

ADRIAN MCCLURE

Figure 6 P736, bird from Lithuania at Ballywalter, Co. Down

Acknowledgements

Permission to enter land and mark gulls was given by North Down Borough Council, WWT Castle Espie, RSPB NI and Copeland Bird Observatory. Thank you to everyone who has taken the time to report sightings of ringed birds, permit the use of their photographs or helped during ringing sessions.

I would also like to thank CEDaR who have supported the project financially through the Environmental Recorders' Group grant and RSPB NI who contributed to the project by purchasing rings for use on Blue Circle Island, a gesture which is much appreciated.

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The Post-hatching Survival and Natal Dispersal of Common Gulls Prior to Fledging

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Introduction

Common Gull (*Larus canus*) is a species of conservation concern in the E.U. and in the U.K. and Ireland. This is due to significant declines in population numbers between 1990-2000, from which it has not yet recovered (Birdlife International 2004, European Commission 2009). An E.U. Management Plan published in 2009 highlighted that there is a lack of data concerning demographic parameters in Common Gulls and encouraged more research in the area (European Commission 2009). In the report, predation on Common Gull chicks was specified as a factor leading to population declines, and several studies have shown that predation on chicks by larger gull species, especially Herring Gull *Larus argentatus*, has been responsible for declines in the breeding success of Common Gull colonies (Kilpi 1995, Rattiste 2006, McGreal 2009).

The study was carried out on Big Copeland Island in June 2011 (Irish Grid Reference: J 593 835). Big Copeland Island is the largest island (1.3 km^2) of the three Copeland Islands, which are situated in the North Irish Sea close to the entrance of Belfast Lough, one mile from the Northern Ireland mainland. The location of the Copeland Islands is shown in Figure 1. These islands are classified as an ASSI (Area of Special Scientific Interest) and an SPA (Special Protected Area). Apart from Common Gull, other notable bird species that nest on this island are Oystercatcher *Haematopus ostralegus*, Herring Gull, Great Black-backed Gull *Larus marinus*, Lesser Black-backed Gull *Larus fuscus* and Arctic Tern *Sterna paradisaea*. There are a small number of houses on the island which are used as holiday/weekend homes. The perimeter of the island is made up of large rocky outcrops interspersed with shingle beaches and further inland the habitat is mainly calcareous dune grassland and marsh.

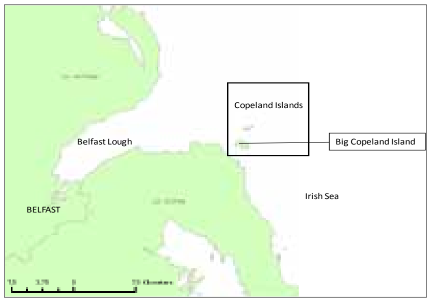

Figure 1 Map showing location of the Copeland Islands and Big Copeland Islands in relation to the mainland of Northern Ireland

The Common Gull colony on Big Copeland Island is of national importance to the island of Ireland and is the largest Common Gull colony in Northern Ireland (JNCC 2010). It exhibited very high levels of growth up until 2008 when the growth leveled off (S Wolsey *pers. comm.*). On the 2nd of June 2011 there were 610 adult Common Gulls on the island, the majority of them nesting in the main breeding colony at the south side of the island. The chicks used for this study originated from nests in two areas: at the edge and in the centre of the main colony. The nest locations within the colony are marked on the map (Figure 2).

The size and density of seabird colonies and an individual's position within a colony are key factors affecting the breeding success of seabirds, including the Common Gull, and it has been hypothesised that seabirds nesting in the centre of colonies are more likely to produce more eggs and fledge more young than those nesting on the periphery (Coulson 1968). Some studies have found that the reason for the enhanced success of the core breeders has been directly due to lower levels of predation occurring on their eggs and young (Suryan *et al.* 2006; Forster & Phillips 2009). Other studies have shown that the individuals breeding at the centre of colonies are older, and so have more breeding experience and better parenting skills (Andrew & Day 1990; Porter 1990). Whatever the reason for the enhanced reproductive success of core breeders compared to peripheral breeders the majority of studies agree that nesting in the centre of colonies is advantageous to breeding seabirds (Andrew & Day 1990; Regehr *et al.* 1998; Stenhouse *et al.* 2000; Herring & Ackerman 2011).

Figure 2 Map of Big Copeland showing extent of the common gull colony (marked by the green stars) and the colony edge and colony centre study sites

As well as predation and nest position within a colony, the short-term small-scale dispersal of semi-precocial chicks before they fledge is of interest when studying the reproductive success of seabirds. These movements provide information about the type of habitat used by chicks at this vulnerable stage and, as a result, can be used to inform management plans in nature reserves and protected areas (Bradley *et al.* 2004). For example, if it is known that young chicks prefer to hide in a certain type of vegetation, this vegetation can be left untouched during the breeding season.

There were three aims to this study:

1. To investigate whether Common Gull chicks in this colony are being depredated and, if so, do chicks from the edge of the colony experience higher levels of depredation than those from the colony centre.
2. To investigate the habitat use of Common Gull chicks post-hatching to fledging.
3. To determine the effectiveness of using radiotelemetry (the practice of attaching radio transmitters to animals and tracking their movements over a period of time) as a method to investigate the above mentioned parameters in Common Gulls.

Methods

In total 23 chicks (17 from the colony edge and six from the colony centre) were fitted with radio-tags at their nests when they were one week old. Tags were Biotrack VHF transmitters, consisting of a transmitter, a battery, a transmitting antenna and leather strap. The tags were attached to the birds by using a staple to secure the leather strap around each chick's leg. A small dab of glue was also applied to the strap just beyond the staple. The leather strap was attached in such a way so that it was not tightly wrapped around the leg. After attaching the radio-tags to the chicks they were observed for several minutes to ensure that their movements were not being impeded by the tag. Each radio-tag was tuned to a unique frequency after it was placed on a chick, and each unique frequency was programmed into a Biotrack Sika receiver attached to a Yagi antenna.

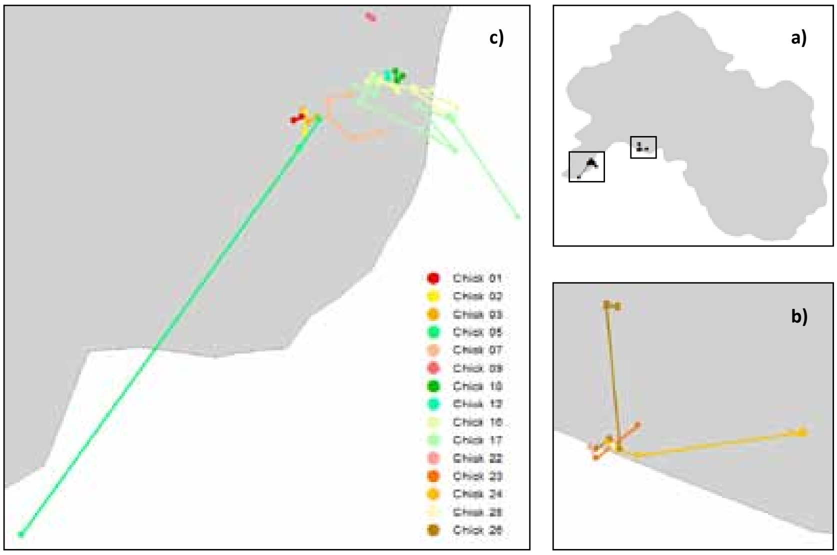

Figure 3(a) Location of Common Gull Chicks during radiotracking in June 2011 at Big Copeland, Co. Down; **3(b)** movement of individual chicks at the centre; and **3(c)** movement of individual chicks at the edge of the colony. Movements beyond the land (white) were into the intertidal zone or offshore islets at low tide.

Originally, it was planned to radio-tag 20 chicks each from the centre and the edge of the colony but due to a storm which occurred on the 23rd of May 2011 which destroyed many nests and eggs (mainly those located at the centre of the colony) this was not possible.

The daily movement patterns of chicks were analysed using the Animal Movements extension for ArcView 3.3 (ESRI, California, USA). A Trimble GeoExplorer CE Series (provided by NIEA), with an accuracy of one metre, was used to identify locations.

Results

Tracks were obtained from 15 chicks over a period of 19 days (10th – 29th June 2011) (Figure 3a). Movement tracks were recovered for a total of five chicks from the centre of the colony (Fig. 3b), and 10 chicks from the edge of the colony (Figure 3c). There was no relationship between daily chick movement and time ($Fdf=1,51= 0.559$, $p=0.458$), *i.e.* older chicks did not wander further than younger chicks (Figure 4a). There was also no difference in the movements of chicks from the centre and edge of the colony ($Fdf=1,52= 0.055$, $p=0.816$; Fig. 4b).

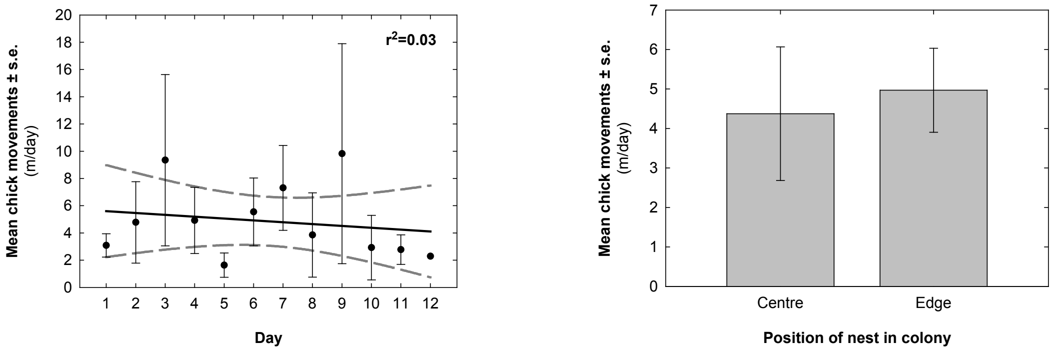

Figure 4 The relationship between mean daily chick movement and (a) time and (b) the position of the nest in the colony.

A total of seven chicks (30.4%) were found dead; six of these were known to have been predated by larger gull species (five by Herring Gulls and one by a Great Black-backed Gull). Five of the six radio-tags were found at the nests of these

Figure 5 Map showing the location of the nests of three of the four gulls responsible for the predation of Common Gull chicks.

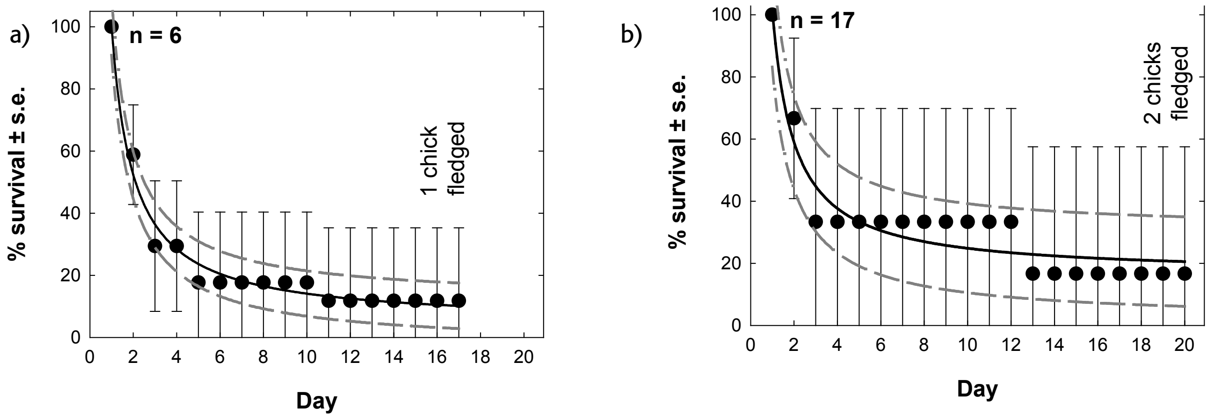

Figure 6 Inverse regression survival curve (bold black line) ± 95% prediction limits (dark grey dashed line) for Common Gull chicks (mean age at tagging = 7 days) from tagging until fledging (24–27 days old) at the (a) centre and (b) the edge of the colony.

predators, and the predator nest locations are shown in Figure 5. The remaining chick that was found dead had drowned in a small stream near its nest. A total of 13 chicks (56.5%) disappeared shortly after tagging and were presumably predated by larger gulls. Only three chicks (13.0%) successfully fledged; two chicks fledged 16 days after tagging (23 days old), and one chick fledged 19 days after tagging (26 days old). Thus, a total of 20 chicks (87%) failed to fledge. There was no significant difference in survival between chicks from the centre and edge of the colony (Figure 6).

Discussion

With respect to habitat use by the chicks, the general pattern observed was that younger chicks (up to about two weeks old) stayed very close to their nest. Many of the nests at the edge of the colony were located beside clumps of nettles, and the chicks were usually found hiding beneath them. In comparison, most nests at the centre of the colony were found on rocks, and the younger chicks were found hiding in rock crevices close to their nest. At the edge of the colony, chicks older than two weeks old were usually found in crevices in the rocks on the edge of the island, and the oldest chicks paddled out to small rocky islands at low tide. For the centre of the colony, only movements from two chicks older than two weeks old were obtained. Both of these chicks were found inland of their nests, hiding in reeds. These two chicks from the centre of the colony moved in the opposite direction (rocks on the edge of the island to inland) to the chicks from the edge of the colony (inland of beaches to the edge of the island).

The lack of chicks caused by the storm previously mentioned meant that the two study groups (*i.e.* centre and edge of colony chicks) consisted of a small and unequal number of individuals and this somewhat limits the findings of this study. However, some interesting observations are summarised below.

1. Predation

Herring Gull and Great Black-backed Gull were confirmed as predators of Common Gull chicks in this study. As well as being responsible for the predation of at least one Common Gull chick, one individual pair of Herring Gulls was found to have depredated 50–60 Arctic Tern eggs. There was no significant difference between the survival of chicks from the edge and centre of the colony, which is contrary to the findings of the studies mentioned earlier (*e.g.* Andrew & Day 1990). However, three different gulls depredated chicks from the edge of the colony, whereas only one gull was responsible for the depredation of chicks from the centre of the colony. This indicates that there was a higher predation risk to chicks at the edge of the colony compared to the centre. However, further study, involving larger sample sizes of chicks, would need to be carried out in order to confirm this.

2. Habitat Use

The two chicks which survived the longest (one fledged and one was tracked until the 24th of June) from the colony centre moved inland to marshy areas with reeds when they got older. It is assumed that these reeds hid them from predators. Vegetation (nettles) was also used as a hiding place at the colony edge by chicks that were 1–2 weeks old. It is tentatively concluded from these preliminary findings that available vegetation cover may influence the survival of Common Gull chicks during the pre-fledging period.

3. Effectiveness of radiotelemetry as a tool for measuring predation and habitat-use in Common Gull chicks pre-fledging

Radiotelemetry does not seem to be effective for tracking the movements of Common Gull chicks from the post-hatching to fledging period due to the fact that they spend much of their time hiding in rock crevices and sitting in water. In these situations no signal is emitted from the radiotracker. However, radiotelemetry was generally effective in locating the chicks when they were hiding in vegetation. This was useful because they were nearly impossible to see with the naked eye in these situations. It may be more beneficial to investigate the movements of the chicks by simply ringing them and observing them visually. Conversely, radiotelemetry was found to be a very effective and informative method for identifying predatory individuals on this island.

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Tracking the Foraging and Migratory Movements of Manx Shearwaters on Copeland Bird Observatory

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Abstract

As top marine predators, seabirds are among the first to be affected by anthropogenic disturbance to oceans. Well-informed conservation decisions require a good understanding of seabirds' at-sea distribution and use of ocean resources; however the foraging movements of most pelagic seabirds remain poorly known. Recent advances in miniature tracking technology are now making it possible to track seabirds during their summer foraging trips as well as during their winter migratory journey. In 2008, the Oxford Navigation Group (OxNav) started a long-term tracking program of adult Manx Shearwaters *Puffinus puffinus* breeding on Copeland Bird Observatory, Northern Ireland, during the incubation and the chick-rearing stage. Here we present some of the results obtained on the variability of foraging distributions between years. We found that within one year, foraging distributions of incubating and chick-rearing birds were mostly similar but that there were some differences, especially among individuals. Inter-annual variability was relatively high. We also present migration data collected on Copeland Manx Shearwaters during the winters 2008 to 2010, which show the birds wintering along the Patagonian shelf in the southeast Atlantic.

Introduction

Pelagic seabirds are invaluable indicators of ocean health but are also vulnerable to changes in the marine environment (Einoder 2009). Many seabird populations are declining, due to anthropogenic disturbance such as intensive fisheries (Frederiksen et al. 2004), offshore energy production (Furness *et al.* 2012) and potentially climate change (Gremillet & Boulinier 2009). However, decisions related to sustainable use of ocean resources and seabirds conservation plans are hindered by the lack of knowledge about their at-sea movements. Traditional methods of study of seabird distributions mostly rely on ringing recoveries and at-sea surveys, which provide scant data and mainly focus on small, coastal areas. As a consequence, the important foraging areas of most pelagic seabirds remain unknown. In the last decade, advances in miniaturisation of GPS trackers have enabled tracking ever smaller seabirds (Guilford *et al.* 2008; Weimerskirch et al. 2002), which can help understand the spatial behaviour of seabirds at sea (Dean *et al.* 2012), their navigational abilities (Guilford *et al.* 2011) and the how they interact with their environment (Shaffer et al. 2006; Weimerskirch *et al.* 2012; Freeman *et al.* 2013).

Since 2007, the OxNav group has developed a long term tracking programme of breeding Manx Shearwaters from major UK colonies (Copeland Bird Observatory (CBO) in Northern Ireland, Skomer Island in Wales, the Isle of Rum in Scotland and the Isle of Lundy in England), where the work has been conducted in close collaboration with ornithologists and volunteers. Manx Shearwaters are pelagic seabirds breeding along the North Atlantic coasts, mainly in the UK and Ireland (Brooke 1990). From April to September they nest in dense colonies of burrows, only visiting at night to reduce predation risk. They migrate south during September/October and winter along the Argentinean coast (Guilford *et al.* 2009). They are amber-listed on the UK Birds of Conservation Concern (Eaton *et al.* 2009).

The core of the project involves the use of state-of-the-art telemetry systems to track the at-sea behaviour of breeding Manx Shearwaters during their incubation and chick-rearing stage, as well as tracking their year-round migratory and winter movements. During the breeding season (April-August), we used miniature GPS logging devices to elucidate detailed behaviour during foraging excursions, while miniature archival light loggers (geolocators) were used to track migratory movements and phenology year-round. We report here on our successful tracking of the migration and foraging routes of individual Manx Shearwaters breeding on CBO. These results, added to data collected in past and future years as part of the long-term study, will help understand how foraging and migratory behaviour in this species relates to seasonal, annual, and long-term changes in resource availability and environmental conditions, and will yield data invaluable to inform conservation decisions.

Methods

Study site

Copeland Bird Observatory is located on Lighthouse Island in the Copeland Islands, approximately 6km off the north coast of Donaghadee, County Down, Northern Ireland. It is an important home to a variety of seabird species. The island is home to ~4,000 pairs of Manx Shearwaters (Stewart & Leonard 2007).

GPS tracking

Incubation (early May - late June)
IgotU GPS loggers GT-120 (Mobile Action Technology, http://www.i-gotu.com/) were stripped of their plastic casing, configured to record a position every five or 10 min and waterproofed in heat shrink tubing. Incubating adults were removed from previously identified study burrows (which have a flagstone hatch to facilitate access to the nest chamber) when they were about to leave on a foraging trip (*i.e.* when their partner had just returned). All birds were already carrying a BTO metal ring. A GPS tracker was attached to small bundles of back feathers using 3–5 thin strips of marine cloth tape (Tesa 4651) as described in Guilford *et al.* 2008 (Figure 1a). The total weight of the device and attachments was less than 5% of the total body mass of the bird, and the handling time was kept to a minimum (~10 min). The bird was then gently released in its burrow. Burrows with tracked birds were checked daily until the tracked bird returned. The GPS logger was carefully removed and the bird returned to its burrow after weighing. The data on the logger were then downloaded.

Chick-rearing (late June - early September)
A similar method was used to track chick-rearing birds. Study burrows were checked every 20 min during the night until one of the adult birds returned to its nest to feed its chick. The bird was undisturbed for 30 min so that it could feed its chick; then was taken from its nest for GPS deployment and returned to the nest within 10-15 min. In the following nights, the burrows were checked every 20 min. When tracked birds return, they were left to feed their chick for at least 30 min. The GPS logger was carefully peeled off their feathers; the birds were weighed and returned to their burrows. Chicks were weighed at the start and at the end of every night to collect information on the amount of food brought by their parents.

Geolocator tracking
Geolocators are archival light loggers which measure latitude and longitude from light levels (day length and time of sunrise/sunset). They can also record immersion activity, *i.e.* patterns of immersion, which can be used to identify flying/foraging/resting behaviour (Dean *et al.* 2012; Freeman *et al.* 2013). Geolocators can last up to 3-5 years but need downloading every year to empty the memory. During the breeding season, adults in a set of study burrows were fitted with a geolocator (model Mk9, Mk13, Mk14, Mk15, Mk18 or Mk19 from British Antarctic Survey) attached to a plastic leg ring with two lightweight cable-ties Figure 2a). The total weight of the device and the attachment was less than 3g. The following summer, the same study burrows were checked and study birds had their device downloaded or removed and replaced with a new one before being returned to their burrow.

Data analysis

GPS data were downloaded using the @Trip software, then processed and analysed using ArcMap (ESRI Inc. 1999-2013) and the Geospatial Modelling Environment (Spatial Ecology LLC). Kernel densities were estimated using a search radius of 0.3° and a cell size of 0.01.

Geolocation data were processed using the BASTrack software suite 19 (British Antarctic Survey). Transitions were allocated using a light threshold of 10 and minimum dark period of four hours for all individuals, trajectories were calculated with a sun elevation angle of -3.5° to -4.5°. Any movements with an apparent speed of more than 80kmh-1¬ were removed; as well as points within 10 days of the spring and autumn equinoxes. Estimated locations have an average error of 85km ± 47km and may therefore appear over land areas (Phillips *et al.* 2004). Data were visualised in ArcMap (ESRI Inc. 1999-2013). The distribution of different behavioural states (rest, flight, foraging) during the winter were inferred from a combination of GPS and immersion data using neural networks (see Freeman *et al.* 2013 for details of the methods).

Results

Foraging trips
Each year between 2009 and 2011, 11 foraging trips were successfully recorded during incubation, while 13-20 trips were recorded during chick-rearing. Foraging trips were longer during incubation: median trip duration was seven days during incubation, and two days during chick-rearing (on average a single incubation trip was recorded per deployment, while during chick rearing over two trips were generally recorded). Figure 1b-e shows some of the foraging trips and distributions of tracked birds.

In both breeding stages the majority of foraging was local, birds typically foraged within 100-120km from the colony (Figure 1). Other high density spots common to both incubation and chick-rearing periods are the area between the east coast of Isle of Man and the Scottish coast, as well as the Firth of Clyde (area around the Isle of Arran). Foraging areas varied between individuals, *e.g.* Figure 1b shows three chick-rearing birds foraging in different areas in 2011: while one bird flew mainly north of the colony, another one went south, and the other west of the Isle of Man. Although the foraging distributions each year overlap, we found inter-annual differences. For example incubation foraging was more localised in 2009. In both 2010 and 2011, the coastal area south of the colony was a high density spot, many birds flew south towards the Irish Sea front (Figure 1d & 1e), while this area was not visited by any of the tracked birds in 2009 (Figure 1c). This highlights the dynamic nature of seabird foraging distributions.

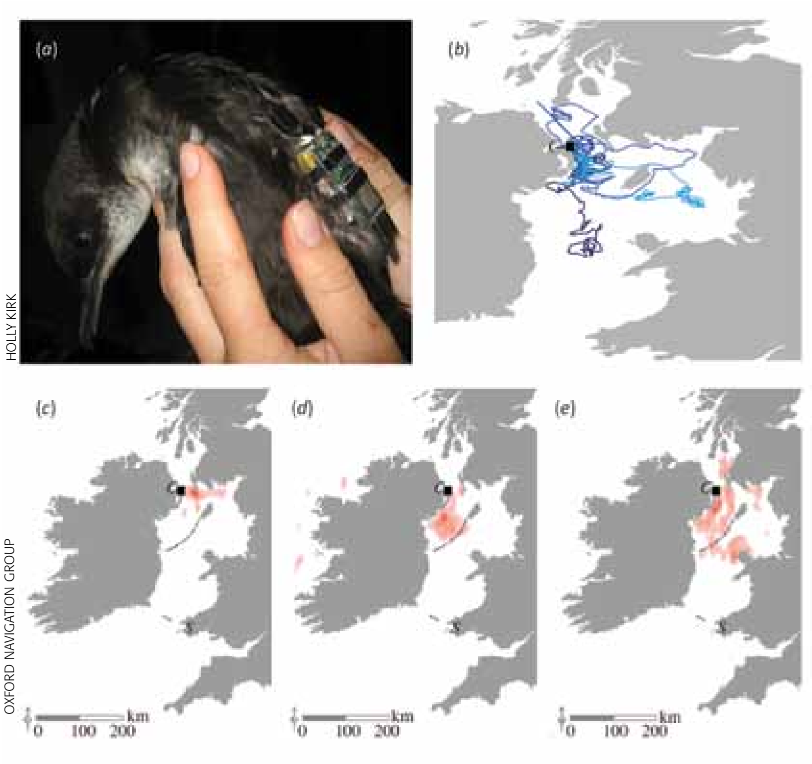

Figure 1

Migration and the non-breeding season

Geolocation devices were successfully recovered each year since 2008. Figure 2b shows the estimated occupancy contours for a subset of individuals' migratory route for resting, flying and foraging behaviour (mainly determined from immersion data – see details in Freeman *et al.* 2013). The pattern of movement during migration remains generally consistent with other colonies (Guilford *et al.* 2009). Individuals depart in September, travelling south along the western coast of Africa, crossing the Atlantic to Brazil then continuing down the eastern coast of South America. During February-March, northbound movements are also generally consistent with individuals returning to the UK by first entering the Caribbean before continuing across the north Atlantic to return to UK waters.

Discussion

Impact

We tried to minimize disturbance by keeping handling time to a minimum, by limiting the weight of the attached devices, and by trying to avoid tracking birds several times in the same breeding season. The attachment of GPS loggers with marine tape allows the device to fall off within 2-3 weeks if the bird is not recaptured. The total weight of the deployed loggers was under 18g, which represents less than 5% of the birds' total body mass. We replaced the original batteries with smaller batteries on some devices, which we used on the lighter birds. Birds in poor body condition were not tracked. The OxNav group has been deploying similar devices on Manx Shearwaters for over seven years and no deleterious effect has been detected (Guilford *et al.* 2008; Dean *et al.* 2012; Dean 2013; Freeman *et al.* 2013). Birds were weighed before and after deployment to measure potential mass change due to the additional weight. During incubation tracking, all tracked birds which were recaptured gained weight during deployment. During chick-rearing tracking, the mass changes during deployment were within the range of a single meal (some positive, some negative).

Geolocator attachments are more permanent (*i.e.* the device will not fall off naturally and needs retrieving). The total weight of the attachment is under 3g, which represents less than 1% of the birds' body mass. Similar geolocators have been successfully deployed on Manx Shearwaters and other small pelagic seabirds without creating any obvious deleterious effect (Guilford *et al.* 2009, 2011, 2012; Dean *et al.* 2012). Geolocator tracking only requires handling each bird once per year, to download, replace or remove the logger. This usually takes less than 5 min.

Variability in foraging trips

The inter-individual and inter-annual diversity in summer foraging trips and the variable distributions of foraging adults at different stages of the breeding season highlights the dynamic nature of at-sea resources and the flexibility of such oceanic predators. Such dynamically changing foraging patterns can make identifying key areas for conservation and protection difficult. However, it is clear that the waters surrounding CBO are fundamental. Here, locations are consistently recorded

HOLLY KIRK

OXFORD NAVIGATION GROUP

Figure 2

at high densities with individuals returning to raft before coming on land, and some individuals foraging very locally. The area between CBO and the Irish Sea front, as well as the one around the Isle of Man are also likely to be important for the foraging needs of Copeland Manx Shearwaters. This variability also demonstrates the need for long-term studies to allow comparisons across years and colonies.

Migratory routes

As observed previously in past years and in other colonies, individuals migrate to a consistent and specific location off the Patagonian shelf. However, it seems to emerge from our long-term tracking programme that this consistency at a global scale may reveal more complexity and structure at a finer scale (work in progress, unpublished). For example, it is clear on Figure 2b that different activities take place in different areas. Furthermore, we have found some differences between individuals. Thus, even within the core wintering area, there appears to be between-individual variation and specificity that may highlight different strategies and resource utilisations during winter. In addition, our results suggest that Manx Shearwaters spend significantly less flight behaviour than in their summer movements (see Freeman *et al.* 2013 for details), which might indicate that individuals may select specific areas to moult.

Conclusion

A recent revolution in miniaturisation of tracking technologies is now making it possible to gather insights into the complex, varying behaviour of elusive pelagic seabirds such as the Manx Shearwater. The first results show that foraging and migratory movements and behaviour are highly dynamic and flexible, with varying patterns of individual consistencies and inter-year variations. It is essential to continue long-term tracking of pelagic species to understand the mechanisms behind these variations and consistencies. In the current context of climate change and novel environmental conditions, it is critical that we understand how individual movements are driven by the environment in which they occur. This may enable us to make predictions of the future distributions and behaviour of Manx Shearwaters and other pelagic seabirds which entirely rely on oceanic resources for their survival.

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Arctic Terns on the Copeland Islands – Improving Breeding Success by Artificial Manipulation of the Nesting Distribution

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Background

The Copeland Islands are situated off the north Co. Down coast, Northern Ireland, and have a large population of breeding seabirds. The islands have been designated a Special Protection Area under European legislation, with the qualifying feature species being Arctic Tern *Sterna paradisaea* and Manx Shearwater *Puffinus puffinus* (NIEA 2009). There are three islands – Big Copeland, Mew Island (which has the Lighthouse) and Lighthouse Island, the home of Copeland Bird Observatory. The Copeland Islands have long been known to hold important populations of terns, with Arctic, Common *Sterna hirundo* and Roseate *Sterna douglii* recorded as far back as the first half of the 19th Century when Mew was a known breeding site (Thompson 1851, Ussher Warren 1900). However all terns ceased to breed on Mew around 1880 before apparently re-colonising in the first quarter of the 20th century (Deane 1954). Very large numbers were again breeding on Mew by 1941 (Williamson *et al.* 1941) but by the 1960s they had, more or less, disappeared again.

Although Arctic Terns have been sporadically present since this time on Big Copeland, from the late 1980s the colony has grown steadily from four pairs in 1987 to at least 1,150 pairs in 2004, fluctuating from 600–1,050 pairs annually since then and peaking at 1,250 pairs in 2013. At the time of the last major survey, Seabird 2000, the Copeland Islands held around 30% of the All-Ireland population (Mitchell *et al.* 2004). The colony has regularly suffered very poor breeding success, particularly in recent years and a few very good seasons have kept the colony going. Most nesting activity has been on Big Copeland where levels of predation and disturbance are relatively high (Leonard 2005, 2006). If the birds could be attracted to the outer two islands (Mew and Lighthouse) it was felt there would be a better chance of protecting and expanding the colony.

Project

With grant assistance through the 2012 NIEA Challenge Fund, administered by the Northern Ireland Environment Link, Natural Copeland purchased two sound systems from which to play Common and Arctic Tern calls. The bespoke sound systems were created by local company Spark 4. They were designed to be completely autonomous, using a solar panel to trickle charge an integral sealed lead acid battery and continuously play MP3 calls for one or more species. The system incorporates a light sensor so that the sound is switched on during daylight hours only, thus conserving the battery. Fifty tern decoys were also purchased from Mad River Decoys in the United States, and 100 wooden nest boxes constructed (these are primarily for Common and Roseate Terns). One sound lure was placed on the north-east shore of Mew. The second was placed close to the southern jetty on Mew. Most decoys were deployed on Mew and a few on the southern shore of Lighthouse Island. In 2013 a further NIEL grant allowed a number of 'land rafts' holding suitable nesting substrate to be constructed by volunteers on Mew Island. This involved manually transporting four tonnes of stones to the island.

Outcomes – 2012

The deployment of decoys on Mew Island was just a little late in 2012, simply because the decoys, nest boxes and sound system were not available until late May. By this time the terns were already nesting on Big Copeland. However a small number of birds settled at the southern tip of Mew and were clearly attracted to the lure and decoys. Observations at the decoy colony on the northern end of Mew, which was near the lighthouse, showed that birds were regularly over flying the decoys and coming in to look at the 'colony'. It was therefore hoped that if anything untoward did happen on Big Copeland the birds would relocate to the outer islands.

Extreme wet weather on 22nd June caused most of these birds to abandon Big Copeland, an event which is unfortunately not that unusual. These birds then moved to Mew and Lighthouse Islands, the majority being to the southern shore of Lighthouse Island and a small number to the northern end of Mew. The sound from the playback system at the southern end of Mew was echoing around the cliffs on Lighthouse Island and must have helped make the site even more attractive to the terns. Despite the late date approximately 500 pairs of Arctic terns proceeded to lay on Lighthouse Island and at the brief peak in early July nearly 800 pairs were present. Numbers declined steadily throughout July but remarkably hatching

SHANE WOLSEY

Figure 1 Spark 4 custom made solar powered sound system started and the breeding season, which was looking lost, turned into a great success. Over 250 chicks were ringed and it is thought that between 200 and 300 fledged. This was the first confirmed fledging of youngsters since 2006. Many of these fledglings were still present in mid-August, astonishingly late for the species on Copeland.


SHANE WOLSEY

Figure 2 Mad river tern decoy and new shelter


KERRY LEONARD

Image 3 Volunteers ringing young terns on Lighthouse Island

Outcomes – 2013

After the late season success of 2012 we waited with baited breath to see if the Arctic Terns would come back to the outer two islands in 2013. Sure enough the first birds arrived in early May and it soon became apparent that almost the entire population had decided that the outer islands were the place to be. Older Arctic Terns lay first (Coulson and Horobin 1976) and approximately 500 pairs laid eggs in early June. In mid-June these were joined by more birds so that by the end of the month there were close to 1,000 pairs associated with the colony. The method of estimating populations is to make counts of all birds at the colony and use a modification factor (Bullock and Gommersall 1981) to generate the number of pairs. Many of these later young birds only stay briefly and make a hurried breeding attempt. On Mew Island a peak of 275 pairs were present in early July, making for an overall estimate of 1,250 pairs, a record for the islands. In June 4-5 pairs of Common Terns were present on Lighthouse Island but this increased to 25 pairs by mid-July. The early nesters raised at least six young, the first successful breeding on Lighthouse Island for many years.

In 2013 the best estimate of Kerry Leonard was that 700 chicks fledged. Several hundred were ringed in early July across the two islands but by the end of July hundreds of young birds were present around the islands, with the evening roost on Gavney holding 300 young each night, less than half of which were ringed. However only half of the breeding adult birds remained at this time, many having presumably left with their fledged young. Approximately 150 chicks were still on the beach on Lighthouse Island and these fledged in early August. Mew Island still had 100 adults present in late July, although the island was not visited then. Therefore an estimate of 700 fledged young seems a very conservative best guess and it was without doubt the best year for breeding success in over half a century.

Reasons for Success

Most birds moved to Lighthouse Island and bred on areas of shoreline which have always been the best potential sites on all islands. The authors believe the subsequent success of this sub-colony in 2012 and 2013 can be attributed to a number of factors.

1. Sound lures – there is little doubt that the sound lures attracted the birds to the outer islands. Although no lure was stationed on Lighthouse Island the lure at the southern end of Mew could be heard clearly and the cliffs acted as an amphitheatre to enhance the sound. The sound lure, which played through the entire breeding season, appeared to hold the birds at the colony and encouraged them to persist well into August. It is our opinion that this was a core reason for the breeding success in 2012.

2. Vegetation cover – there is relatively little vegetation cover where terns nested previously. The southern shore of Lighthouse Island has extensive Sea Campion *Silene uniflora* with some Red campion *Silene dioica* and Bracken *Pteridium aquilinum*. Young birds in their first week are very susceptible to exposure and this may be the chief cause of death. Excessive heat or cold can quickly lead to the death of very young birds. In 2012 heavy rain in July caused chick deaths on the exposed beach, but birds nesting close to the campion and bracken had more shelter and were relatively unaffected by this episode.

3. Lack of disturbance – Big Copeland has open public access. In contrast landing at Lighthouse Island is controlled by Copeland Bird Observatory and unauthorised visitors are relatively rare. Mew has more regular visitors than Lighthouse Island but again in relatively low numbers compared to Big Copeland. Both islands are better locations for breeding terns. Dogs are also regularly on Big Copeland but as far as can be ascertained they cause no problems in the tern colonies beyond general disturbance. One dog in 2005 followed Kerry Leonard around the colonies but paid no attention to tern nests and there is therefore no direct evidence that dogs have ever damaged the colony. However in 2005 50 tern chicks were killed by a dog on the nearby Cockle Island colony in Groomsport (George Henderson *pers. comm.*) and this shows the clear potential for problems to occur.

4. Gulls and other predators – the southern end of Lighthouse Island has the lowest density of breeding large gulls on any part of the shore across all three islands. Lesser Black-backed Gulls *Larus fuscus* have been observed catching flying young mid-air in previous seasons, and predating eggs (K Leonard pers obs). Predation by a single pair of Herring Gulls was proven to have played a big part in the abandonment of the terns breeding in the Sandylands area on Big Copeland in both 2011 and 2012, with over 50 tern eggs found at a single Herring Gull nest site in both years. Gulls were probably entirely responsible for the complete failure of all the sub-colonies in the Sandylands area in those years. Herring Gulls were observed predating eggs on Lighthouse Island. Although Peregrine Falcons *Falco peregrinus* were present in the area all summer during 2013 no predation was observed. Several chicks were found in Bluebell Gully, and on the Lower Shore, which showed signs of Otter *Lutra lutra* predation. These chicks may have already been dead and this was not thought to be a major issue in 2012 or 2013.
5. Bird density – the number of birds breeding in one relatively compact area was very high, and this high density meant it was very difficult for predators (particularly gulls) to enter the colony. Larger gulls were frequently observed to be attacked as they passed the colony.

Summary

Arctic Terns are fickle birds and are prone to moving to new breeding sites regularly and without warning. The great success of this colony in 2012 and 2013 will hopefully provide another generation of terns to perpetuate the colony for 7–8 years, and imprint on the young birds that Lighthouse and Mew islands are the best place to nest. We look forward to a successful 2014.

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A Review of Black Guillemots Breeding at Bangor Co. Down, 1985 – 2013

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A brief history of the site

Black Guillemots *Cepphus grylle* (Figure 1) began to breed in the harbour wall at Bangor, Co. Down in 1911 (Workman 1914) and in the last quarter of the 19th century probably did not breed in Co. Down at all (Holloway 1996). When Armstrong (1946) wrote his classic Birds of the Grey Wind the Black Guillemots in Bangor were so unusual that he did not name the site despite devoting a whole chapter to them! By the time of Operation Seafarer in 1969/70 (Cramp *et al.* 1974) the number of breeding pairs had increased to about half-a-dozen. At that time the birds were concentrated on the North Pier (now the Eisenhower Pier), then a stone and wooden construction. By the early 1980s the North Pier was partially rebuilt with stone and concrete replacing the previous wooden structure. At that time, the late Dinah Browne (Regional Officer of RSPB) ensured that 15 holes in the pier remained intact to provide nesting opportunities for Black Guillemots. The present study began in 1985 when seven pairs attempted to breed in the pier although the occasional other pair would attempt to nest at other sites in Bangor bay. That time coincided with the Seabird Colony Register in 1985/7 (Lloyd *et al.* 1991) when the number of breeding pairs on the North Pier reached nine. That time also coincided with a major redevelopment in Bangor bay with the construction of a 560-berth marina. Negotiations with the architects, Kirk McClure and Morton (now RPS) – especially Barry Lightbody – ensured that new nesting provision was included within the design. This new provision included for instance 27 concrete nestboxes beneath the extended Central Pier as well as the refurbishment of six holes beneath the South Pier. But Black Guillemots being Black Guillemots meant that any hole, cranny or nook would be used for nesting as well, for example, access ducts within the marina, holes in the navigational dolphins at the marina entrance, holes that were opened up in the adjacent 'Long Hole', space beneath decking in a private house. In addition, the marina management (Quay Marinas – especially Andrew Jaggers, Kevin Baird and Peter Scott) have installed additional boxes and tubes for the birds. By the time of Seabird 2000 in 1998 – 2002 (Mitchell *et al.* 2004) 32 pairs attempted to breed. In 2013, a record 38 pairs attempted to breed. And in 2013 some additional boxes were provided through the Action for Biodiversity project funded by INTERREG IVA, such that about 60 'holes' are now available for breeding. The steady increase of breeding attempts in Bangor marina is shown in Figure 2. A description of the breeding sites at Bangor marina may be found in Greenwood (2010).


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Figure 1 An adult Black Guillemot sitting on the North Pier in Bangor marina

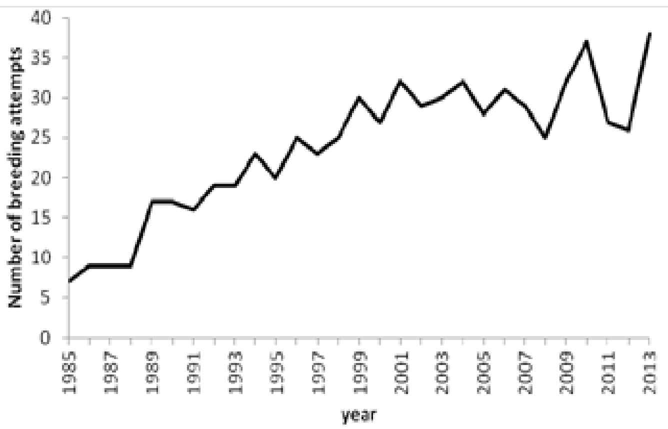

Figure 2. The increase in breeding pairs of Black Guillemots in Bangor marina 1985 – 2013

The increase in Black Guillemots has been seen not only in Bangor but all along the northern, eastern and southern coasts of Ireland. At the time of Operation Seafarer, less than a thousand pairs nested in Ireland; at the time of Seabird 2000, this had increased to over 2000 pairs (the refinement of survey techniques would not account for such a dramatic increase) (Mitchell *et al.* 2004)). At the end of the 19th century, Holloway (1996) estimated that just ten Irish coastal counties held breeding Black Guillemots; these days all 19 coastal counties hold breeders (Balmer *et al.* 2013). There is no doubt that the increase may in part be explained by the use of artificial nest sites (Greenwood & Tickner 2002). As Newton (2013) points out, populations may be limited by resources, like breeding sites, especially by the scarce resources required by many seabirds for nesting.

The start of the breeding season

The start of a bird's breeding season might appear to be obvious; for instance the date at which a tit starts to visit a nestbox rather than the date when nest building starts or indeed rather than when the female has chosen her box and begins laying. But not all species show such an easy to interpret sequence. For instance, male Dunlin *Calidris alpina* nesting in northern Alaska arrive ahead of the females; when the females arrive, males display, pairs form quickly and egg-laying begins (Holmes 1966). However in years when the snow melts late, Dunlins arrive already paired: trying to determine the start of the breeding season in those circumstances can be difficult.

But what about Black Guillemots? It might be assumed that arrival and pairing around the nesting site might be the start of the breeding season. However this behaviour can be quite variable. In the arctic, along the coasts of Greenland and Spitzbergen Black Guillemots come ashore some four to six weeks prior to egg-laying, whilst in northern Alaska on Cooper Island, the time of arrival depends upon snow melt and then Black Guillemots lay just a couple of weeks after coming ashore (Divoky 1998[3]). Along the Baltic coasts they come ashore about four months before laying (Harris & Birkhead 1985) and on Shetland, Ewins (1985) found they came ashore about three months ahead of laying, although some birds appeared on the sea adjacent to breeding sites from October onwards. Ireland is at the southernmost part of the breeding range (Gaston & Jones 1998) and birds appear around the breeding sites even earlier: on Cape Clear Island, Co Cork, some Black Guillemots have been observed coming ashore on calm days in early October (Sharrock 1973). The Bangor birds behave somewhat similarly; they arrive on the water at the end of September and make their first visits ashore, including visits to the breeding holes, from early October (Greenwood 1987, 1991). Bangor's birds also show another fascinating adaptation; for instance, whilst Shetland Black Guillemots do not start moulting from winter into breeding plumage until the New Year (Ewins 1988), some Bangor birds begin moult in early November and all birds have completed moult by early February (Greenwood 2013). Birds really do have to look the part if they are going to lay claim to breeding sites in the autumn. Just as with Common Guillemots *Uria aalge* (Birkhead & Taylor 1977, Harris & Wanless 2006), there must be strong selection pressure to get into breeding plumage in winter for courtship or breeding-site defence. Harris and Wanless (2006) have wondered whether the spread of winter visiting by Black Guillemots and Razorbills *Alca torda* might lead to change in moult timing in British and Irish auks. Evidence from Bangor shows that this might be so.

In conclusion, it can be seen that dating the start of the breeding season in Black Guillemots is difficult. However the same is not true for the beginning of egg-laying.

The start of egg-laying

It is very easy to record the timing of egg-laying in Black Guillemots in Bangor by making daily visits to nesting holes in the North Pier from early May onwards. Visiting other nesting sites within the marina is tide dependent; visiting the nest-boxes beneath the Central Pier can only be achieved around high-water by boat. However median first egg-laying dates can be estimated satisfactorily from the North Pier and has been determined annually since 1985. The earliest median first egg-date was 12th May in 2003 and the latest was 27th May in 1992 and 1993, whilst the mean date was the 21st May (s = 3.7, n = 29). Until the end of the 20th Century it was believed that Bangor's Black Guillemots began egg-laying in the latter third of May (Greenwood 1998); similar timing to Danish populations (Asbirk 1979), but two weeks earlier than birds on Shetland (Ewins 1989) and other Atlantic populations (Harris & Birkhead 1985). However in 1999, Bangor's Black Guillemots began laying earlier for a period of six years (when the onset of egg-laying would be described as the middle third of May) and this was coupled with rising seawater temperature (Greenwood 2007). In 2005 egg-laying started a little later again. The changing pattern of first-egg dates is shown in Figure 3.

[3]George Divoky's study of Black Guillemots began in 1975 and continues to this day being the longest study of this species in the world; see http://www.cooperisland.org

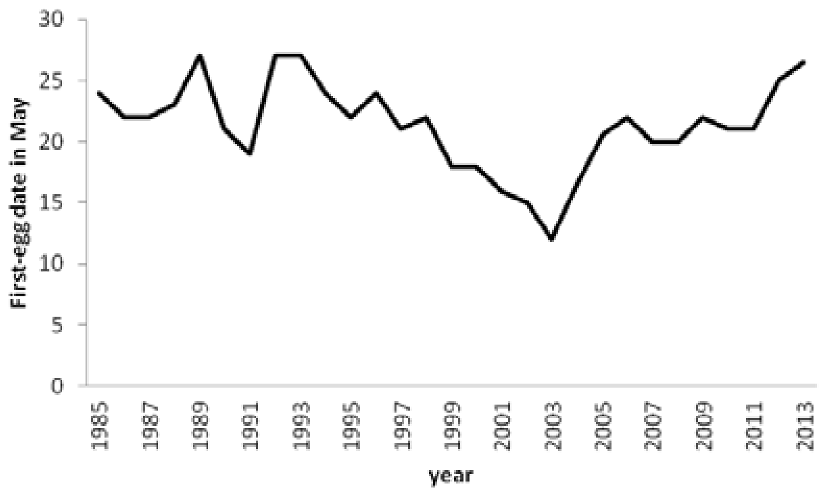

Figure 3. The median first-egg dates in May for Black Guillemots nesting on Bangor's North Pier, 1985 – 2013.

Eggs and young

Unlike other Irish auks, Black Guillemots normally lay a clutch of two eggs. In Bangor, of all the 691 clutches laid between 1985 – 2013, 74% contained two eggs. This is just a little lower than the 80% found in Ewins' (1989) study on Shetland. The second egg is laid three days after the first; incubation begins after clutch completion and lasts for 30 days with the two young commonly hatching just one day apart (Greenwood 1998). The young remain in the nesting hole for about 40 days when they weigh around 450g – about 10% heavier than their parents. The young leave their holes during the night and are only very rarely seen in the marina the morning after their jump. Adults frequently visit their holes after the young have left as if 'just to make sure'.

Breeding success

Since 1985 there have been 691 breeding attempts during which time 1,203 eggs have been laid. But of course not all eggs have hatched and not all young have fledged. During the incubation period some adults desert for no apparent reason and some eggs are probably lost to children egging from rowing boats although most holes are difficult to access so such losses are very few. Upon hatching some young may be predated by for example Brown Rats *Rattus norvegicus*, Herrings Gulls *Larus argentatus* and even domestic/feral cats *Felis catus*. The gulls have even been seen removing sitting adult Black Guillemots as well. This has been a particular problem facing birds nesting on the North Pier where hole entrances are quite large (*c.* 30 cm x 30 cm). The entrances were made smaller in 2011 with modified wooden entrances set in the concrete hole making it more difficult for gulls to fly in. Losses of young are generally quite small and very few young are ever deserted. Overall the breeding success over the 29 years of the study has been 0.94 young fledged per pair. The success rate is lower than Ewins (1989) found on Shetland (1.3 young per pair) but higher than Asbirk (1979) found in Denmark (0.6 young per pair). Rather worryingly, the success rate has lessened during the 29 years as shown in Figure 4. The reason for the decline is uncertain and is an area of investigation at the present time (Greenwood *in litt.*). The overall figure of

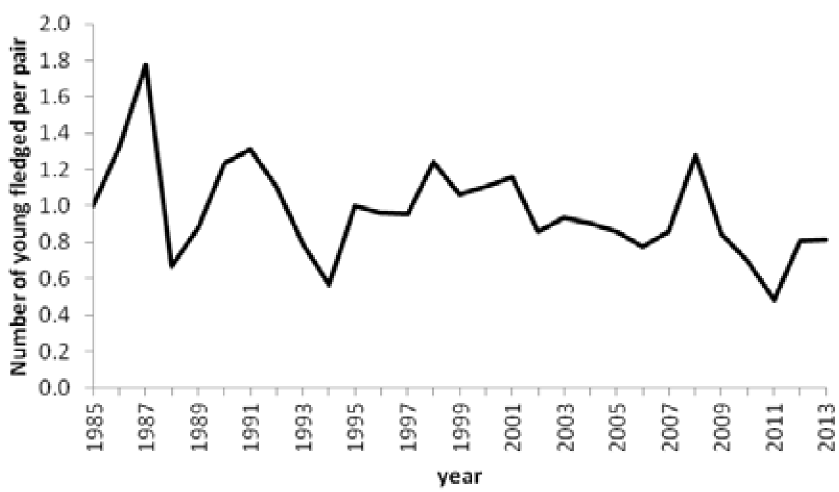

Figure 4. The number of young Black Guillemots fledged per pair in Bangor marina, 1985–2013

0.94 young fledged per pair does mask variation found within the colony. The highest success (1.16) was found on the South Pier (1989 – 2013), followed by the North Pier(1.13, 1985 – 2013), 0.91 in the Long Hole (2009 – 2013), 0.71 on the navigational dolphins (2003 – 2013), with the lowest success (0.63) being on the Central Pier (1989 – 2013). These breeding success data are higher than at another small colony in Belfast Harbour Estate where only 0.53 young per pair were fledged between 2000 – 2009 (when Black Guillemots last attempted to breed at that site).

Conclusion

The study has shown that considerable variation occurs in breeding phenology and breeding success; a conclusion that could only have been drawn from such a long-term study. Long-term studies are imperative for long-lived species like many seabirds (the longevity record for a Black Guillemot in the BTO Ringing Scheme is one of the Bangor birds at 23 years and 17 days). In relation to long-term studies of the Puffin *Fratercula arctica,* Harris and Wanless (2011) stated that 'long-term studies have contributed a disproportionate amount to our knowledge'. It is anticipated that work on Bangor's Black Guillemots will continue well into the future in order to be able to answer further questions like the one mentioned above on colony size and breeding success.

Acknowledgements

This project would have been impossible without the support of the Bangor team at Quay Marinas. I have been accompanied in the field (or more literally in the boat) since the outset by George Henderson and I owe him an enormous amount of gratitude – thank-you George.

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Diving Behaviour of the Black Guillemot in Northern Ireland

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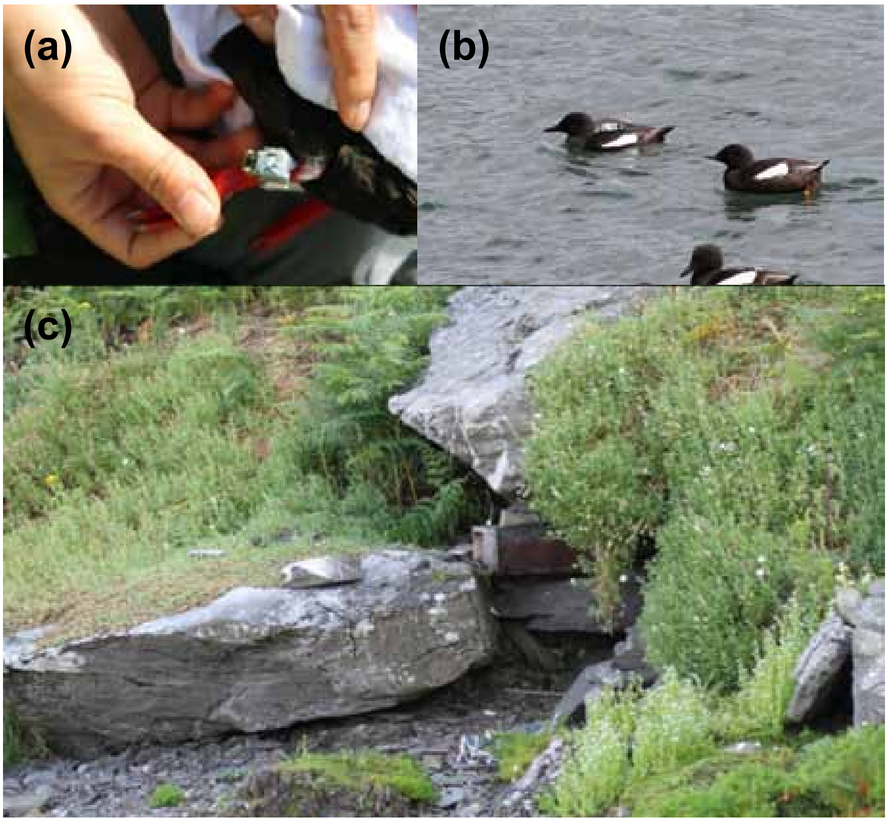
Introduction

The dive behaviour of auks has been well documented (for example, over fifty articles on *Uria* spp. alone), but the dive behaviour of *Cepphus* species has been documented only once using time-depth recorders (TDR). Masden, Foster & Jackson (2013) reported a brief description of the diving behaviour of two Black Guillemots *Cepphus grylle* from the island of Stroma in northern Scotland. This is a critical information gap because guillemots are coastal benthic feeders (Cairns 1992; Nol & Gaskin 1987) likely to be affected by human activity such as nuclear plants, tidal renewable energy devices, or altered sea temperature (Furness *et al.* 2012). Furthermore, the at-sea behaviour of all *Cepphus* species (*C. grylle, C. Columba, C. carbo*) is poorly known (Gaston & Jones 1998) and, to the best of our knowledge, foraging movement has never been reported using GPS loggers. Using biologging equipment, such as GPS loggers or time-depth recorders, provides data-rich and unbiased information on the movement of individuals, which can complement alternative approaches, such as direct observations and transects (those alternative approaches can be biased because they only occur where observations are possible). To fill the knowledge gap, in July 2013 we initiated a preliminary study at the colonies at Bangor Marina, Bangor, and the Copeland Bird Observatory on Lighthouse Island, both Co. Down, Northern Ireland, UK.

Materials and methods

Logger deployments

Time-depth recorders were deployed on Black Guillemots breeding at Bangor Marina (54°39'N, 5°16'W) and Lighthouse Island (54°41'N, 5°31'W), Northern Ireland. Birds were captured during the daytime from artificial nest boxes or in natural burrows and instrumented with TDRs during the chick-rearing period in July 2013. All birds were ringed on capture unless already ringed. Seven birds were simultaneously fitted with a LOTEK LAT1900 time-depth recorder (TDR) and a global positioning system (GPS) logger (modified i-gotU GT-120: Mobile Action, see details in (Dean *et al.* 2012)). One bird carried only a GPS logger. We attached miniature rectangular Lotek 1900 LTD TDRs (sampling interval = 3 s,



(A) LUKE MCCLEAN (B&C) AKIKO SHOJI

Figure 1. (a) Black Guillemot with time-depth recorder. It is attached to a darvic ring that is placed on a leg. (b) Black Guillemot with GPS logger and time-depth recorder after deployment. (c) Artificial nestbox installed at Copeland Bird Observatory, Lighthouse Island, Northern Ireland.

mass = 2.1g, diameter = 15mm, length = 8mm, width = 7mm, LOTEK Marine Technology, St. John's, Newfoundland, Canada). The devices were attached with duct tape to a custom-made darvic ring, which was then attached to the leg (Figure 1a). The GPS loggers were refitted with smaller, lighter batteries, configured to record locations every 10-15 min, sealed in heat-shrink plastic and attached dorsally using thin strips of Tesa marine cloth tape adhering to a small number of contour feathers (Figure 1b). Upon recapture, devices were removed; birds were weighed to the nearest gram. Handling time was <3 min for only TDRs and <20 min for TDR and GPS deployment.

Analysis of dive logs

Data were downloaded from retrieved loggers using the supplied software and exported as time-series data (time-stamped pressure measurements at a 1-second recording interval). Recorded pressure values were converted to depth using the recommended conversion (10 Bar = 1m). The modal depth representing the surface was calculated and a zero offset value calculated as the difference between the modal depth and zero. Corrected depth values were then obtained by adding the zero offset to the measured depth values. Individual dive events were identified as deviations greater than a threshold value of 1m; shallower dives by auks often represent non-foraging behaviour such as socialising or bathing (Gaston & Jones 1998) and are difficult to distinguish from noise within the devices.

Results & Discussion

We successfully deployed GPS loggers on eight birds (two birds at Bangor Marina colony and six birds at CBO colony: Figure 1c). The GPS was not recovered from seven birds. The main reason for the lack of recovery was the loss of GPS because most GPS devices fell off within a few days. Seven of these birds also carried TDRs. We recaptured five of those birds and successfully downloaded data from four of the TDRs. The mean recorded period was 2.5 days (range 1 – 3).

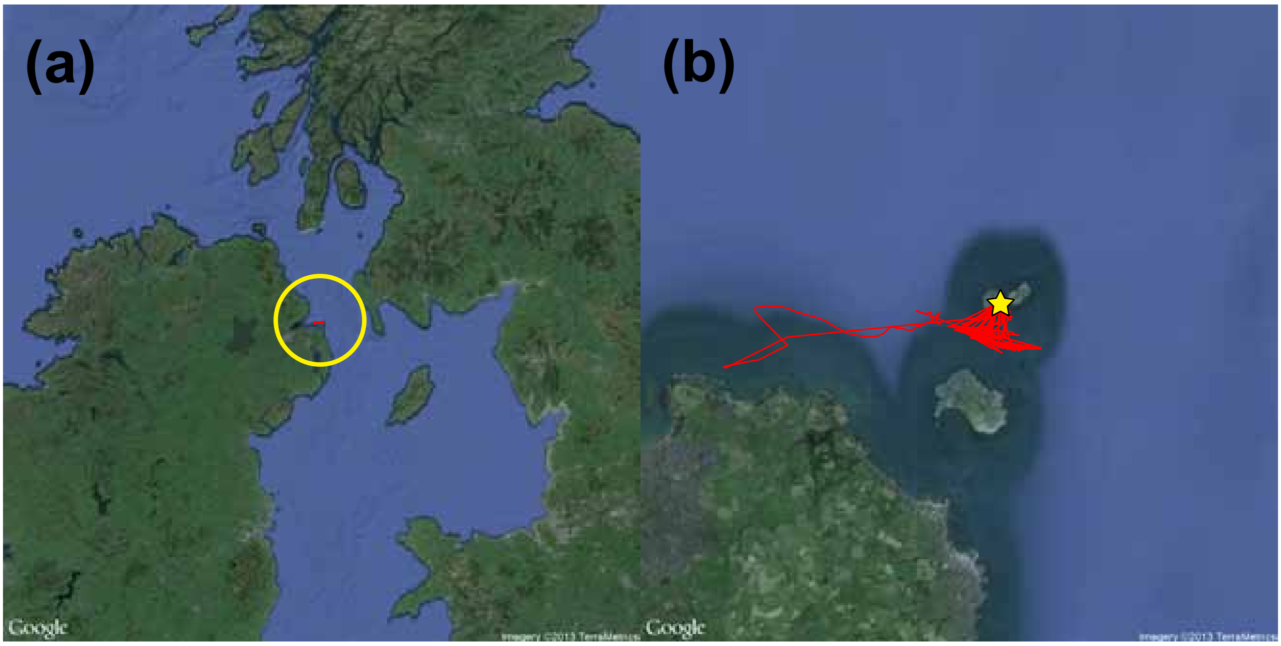


Figure 2 (a) Position of study colonies in Northern Ireland (within the yellow circle) and foraging trip of a breeding black guillemot recorded by GPS logger. Red line indicates the GPS trajectory. (b) A snap of foraging trajectory from the CBO colony. Red line indicates the GPS trajectory and a star indicates the position of the colony.

GPS tracking

The single tracked guillemot was attached to the colony site and the furthest tracked position recorded by GPS was only 2km away from the colony (Figure 2a,b). By assessing the recorded locations and measured ground speed, it was most likely tidal movements which brought the bird away from the colony (as the ground speed was low, suggesting it did not fly) and the majority of diving activity was within 1km of the colony. Direct observations made at the CBO colony from dawn to dusk also confirmed that at least one of the pair members stayed near the nest, either on water or land. In comparison to other auks, foraging distance of breeding Black Guillemots is short (Gaston 2004; Jones 1989). Because the guillemot equipped with the GPS fed young normally and there was no obvious difference in the size or species of prey items fed to offspring by that individual compared to other guillemots (or itself before the deployment), we tentatively suggest that this small foraging range is rather normal. Future research could use GPS loggers with a remote downloading function to improve the recovery rate to study, in more detail, which area these birds use.

Diving behaviour

In this study, dive profiles for Black Guillemots were usually U-shaped, with a flatter bottom, punctuated by wiggles (Figure 3). The ragged bottoms with several wiggles were similar to those associated with *Spheniscus* penguins feeding on

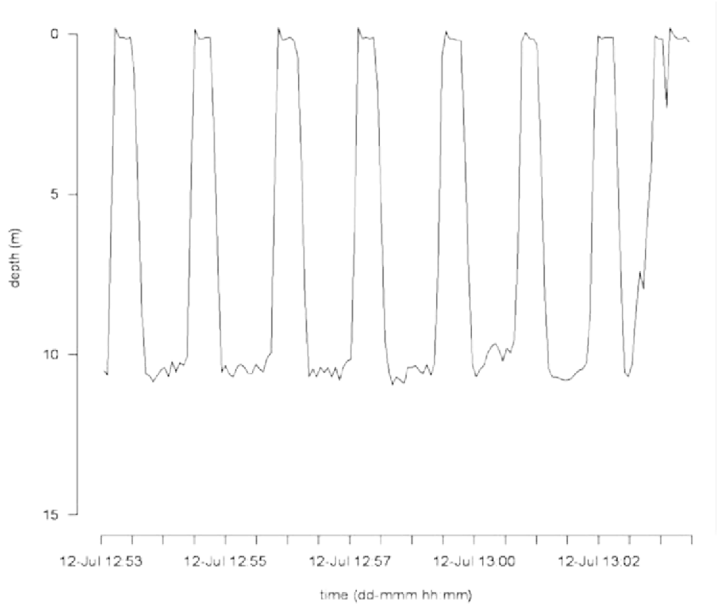


Figure 3 Typical dive profiles of Black Guillemots.

schooling fish (Elliott *et al.* 2010; Simeone & Wilson 2003), but the U-shape was more apparent, with flatter bottoms. The clear U-shaped dive profiles suggest that the guillemots foraged at the bottom in shallow water, rather than chasing schooling fish or krill in the middle of the water column, which normally is associated with either V- or W-shaped dives (Elliott *et al.* 2008; Kuroki *et al.* 2003; Sato *et al.* 2008). Direct observations of diet at the CBO colony (Figure 1c) supported this conjecture as the equipped birds exclusively brought a benthic species, butter fish (*Pholis gunnellus*), to their young.

We concluded that time-depth recorders could provide valuable information about foraging parameters, foraging capture tactics and prey items of benthic feeding alcids. Understanding how animals use the marine environment is essential to assess the impacts of the human activity and therefore to develop appropriate conservations plans. Future research could include identifying time allocated to different behaviours (dive, rest, flying) using temperature data. Time spent flying could help estimate maximum foraging radius of the birds. Knowledge of both horizontal (*e.g.* foraging area) and vertical movement (*e.g.* dive depth) patterns is useful for effective conservation of diving animals.

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Seabirds as Monitors of the Shallow Coastal Habitat

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Summary

Coastal environments are important habitats for biodiversity and humans. It is therefore vital that they are monitored to ensure they are in good health and to detect adverse conditions. Seabirds provide an attractive option as indicator species to reflect the status of coastal habitats as they are relatively easy to monitor and are known to be sensitive to changes in environmental conditions. Our project aims to investigate the potential of seabirds as monitors of shallow coastal habitats across Northern Ireland and south-west Scotland. The main outcome is to develop a monitoring tool which can be easily applied to seabird colonies to inform decision makers, land owners and conservationists on the status of local coastal habitats. Breeding colony counts are frequently used to provide invaluable information about the temporal variation of seabirds, however, detecting significant changes in these trends can be very difficult. Instead we aim to exploit existing spatial variation in population trends to collect information on alternative seabird traits from colonies across the target region. Seabird traits which reflect environmental change over shorter time frames should provide an early warning that colonies are experiencing adverse environmental conditions; enabling management and conservation actions to be considered more immediately. Here we discuss a suite of easy to monitor seabird traits, which can potentially provide details on local environmental conditions.

Background

Marine environments contain some of the most diverse and productive habitats, however, despite their importance to both biodiversity and humans, pressure on marine ecosystems has increased markedly over the last several decades largely due to anthropogenic impacts (Halpern *et al.* 2008). Shallow coastal habitats are particularly susceptible to anthropogenic and natural pressures due to their accessibility and location at the coastal boundary, resulting in being impacted from both the marine and terrestrial environment (Thompson, Crowe & Hawkins 2002; Lopez y Royo *et al.* 2009). Pressures include the accumulation of contaminants from the land and sea, over-exploitation of resources, alien species, disturbances from recreation and aquaculture, habitat destruction, modified coastal processes and climate change (Crowe *et al.* 2000; Thompson *et al.* 2002). To prevent further degradation and improve the condition of our oceans the Marine Strategy Framework Directive (MSFD) was adopted in 2008 under European Union law, with the main aim of delivering "Good Environmental Status" to all European marine ecosystems by 2020 (EU 2008). To meet this objective monitoring and the development of ecological indices have been identified as important processes in assessing the environmental status of marine habitats.

Being top predators, seabirds provide an attractive choice to act as indicator species as they reflect changes occurring within lower trophic levels (Boyd, Wanless & Camphuysen 2006). Additionally they are relatively large and conspicuous making them easy to observe, they are generally colonial so a large number of individuals can be monitored at predictable locations and they are known to be sensitive to various environmental conditions such as food availability, climate and contaminant levels (Furness & Greenwood 1993; Piatt & Sydeman 2007; Einoder 2009).

Project objectives

As part of a larger project funded by EU INTERREG (IBIS, www.loughs-agency.org/ibis) our project aims to investigate the potential of seabirds as monitors of the quality of shallow coastal habitats across Northern Ireland and south-west Scotland. The main outcome of the project is to develop a monitoring tool which can be easily applied to seabird colonies to inform decision makers, land owners and conservationists on the environmental status of the coastal habitat in that locality. Currently, data used to monitor seabirds are focused on colony counts, and to a lesser extent, productivity. Long-term counts provide invaluable information about the temporal variation in seabird abundance, however, identifying statistically even relatively large changes in these trends can be very difficult (Maclean *et al.* 2013). This project therefore aims to investigate the effectiveness of an alternative suite of easy to monitor traits to identify changes in seabird populations over shorter time frames and determine the relationship of these seabird parameters to environmental variables linked to the quality of shallow coastal habitats. This is based on the assumption that alternative traits such as productivity ultimately result in changes to overall colony numbers after a time-lag, which Cook *et al.* (2014) found to be the case in a number of seabird species. This can be investigated along a temporal or spatial gradient. Due to the limited time frame of our project we will exploit existing spatial variation in population trends to test which seabird traits may be suitable to develop a monitoring tool. Using spatial variation to identify relationships between seabird traits and environmental variables relies on existing long-term datasets to identify historic changes in seabird populations to identify whether sufficient spatial variation exists so that data can be collected from multiple colonies over shorter time periods. It is envisaged that the monitoring tool will provide an early warning that local areas are experiencing adverse environmental conditions; enabling management and conservation actions to be considered more immediately than waiting to see a change in overall population numbers.

Species selection

There are several seabird species that are closely associated with coastal habitats, and are common and widespread breeding birds across Northern Ireland and south-west Scotland (Table 1). These species have varied life-history traits enabling different information about that species' environment to be identified and can therefore be classified into functional groups based on the similarity of their foraging behaviour and resource use. By selecting species which represent these functional groups a representative panel will be established to more accurately reflect the environment these species occupy. The species listed can be split into two main functional groups based largely on their foraging strategies; surface feeders, which include the four gull and two tern species, and the remaining four species which are surface diving and pursuit foragers. These two groups can be split further largely based on the resources they then exploit. Within the surface feeders the terns are generally more specialist, predominantly feeding in marine waters within 9km of the coast (Rock, Leonard & Boyne 2007), whereas the gulls are more generalist and opportunistic foragers exploiting marine and terrestrial resources. In marine environments Herring Gulls are predominantly associated with intertidal habitats whilst the Lesser and Great Black-backed Gulls forage more extensively out to sea (Camphuysen 1995). If these large gulls are foraging on terrestrial items it may suggest that there is not enough more typical, and higher quality, intertidal food available within close range of the breeding colony (Belant *et al.* 1993; Bukacińska *et al.* 1996). The gull species are also particularly common and widespread breeding birds across Northern Ireland and the UK and are relatively easy to monitor. It would be advantageous to include one of the tern species on the panel as they are generally more sensitive to environmental change than the other listed coastal species. Being small bodied terns have a tight time/energy budget meaning they may be unable to increase their foraging effort to compensate for reduced food availability (Monaghan 1992). They also have more specialist diets, especially in comparison to the gulls, foraging predominantly in shallow marine waters on fish and invertebrates (Mitchell *et al.* 2004).

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Lesser Black-backed Gull on Lady Isle, Scotland

However, neither tern species are widespread within the region nor are the colonies particularly accessible making them more difficult to efficiently monitor; especially as terns are very susceptible to disturbances. Within the pursuit foraging group European Shag ('Shag') and Great Cormorant ('Cormorant') are both fairly generalist species and have similar foraging techniques feeding within the water column and on benthic species (Gremillet *et al.* 1995). As the Shag is more exclusively associated with the marine environment and is a widespread breeding and wintering bird within the region this seems to be a more suitable species to include on the panel rather than the Cormorant; which may frequently forage inland and is less widespread. The Eider and Black Guillemot are also worth considering as both have fairly specialist diets and are restricted to shallow marine waters, however both can be difficult to monitor as they breed in looser, smaller colonies which are often less accessible especially in the case of the Black Guillemot; although this is made easier when breeding in human structures such as nest boxes and wall crevices.

Table 1 Seabird species breeding across Northern Ireland and south-west Scotland that are closely associated with coastal habitats

Common name	Latin name	Functional group	No of colonies within the target region*[1]
Arctic Tern	*Sterna paradisaea*	Surface/subsurface feeder	66
Black Guillemot	*Cepphus grylle*	Pursuit forager	259
Common Eider	*Somateria mollissima*	Pursuit forager	n/a
Common Gull	*Larus canus*	Surface feeder	164
Common Tern	*Sterna hirundo*	Surface/subsurface feeder	46
European Shag	*Phalcrocorax aristotelis*	Pursuit forager	143
Great Black-backed Gull	*Larus marinus*	Pursuit forager	210
Cormorant	*Phalacrocorax carbo*	Pursuit forager	28
Herring Gull	*Larus argentatus*	Surface feeder	309
Lesser Black-backed Gull	*Larus fuscus*	Surface feeder	161

*[1]Number of colonies within the target region of Northern Ireland and south-west Scotland taken from the Seabird 2000 census (Mitchell *et al.* 2004). Eider are not included in the census therefore the number of colonies is not available.

Seabird Parameters

There are numerous seabird parameters which could feasibly be monitored over the breeding season to provide an indication of what is occurring in the local coastal environment, and therefore be used to establish a monitoring tool; these are outlined below. Ideally data on all these parameters, in addition to the more commonly measured population counts and productivity, will be collected where possible to provide information on resources availability within close proximity of the colony throughout the breeding season.

Egg parameters

Laying, or hatching, date may give an indication of environmental conditions early in the season as high quality adults, due to experience and size but also condition, tend to establish favourable breeding territories and lay earlier (Brouwer *et al.* 1995; Catry *et al.* 1998). In some bird species, particularly those which lay large clutches, clutch size may be able to provide an indication of the female's quality (Monaghan *et al.* 1995) and therefore environmental conditions, specifically food availability. Seabirds however, generally show very little variation in clutch size and establishing that a clutch size is reduced can be difficult as it can be confounded by partial clutch predation. For the species which have accessible nests the egg size, or volume, may instead be used to assess the quality of the female as eggs are costly to produce, therefore if local food availability is poor the females may compensate for this through laying smaller eggs (Coulson *et al.*1982; Hamer, Furness & Caldow 1991). In Lesser Black-backed Gulls supplementary feeding of breeding birds increased egg size indicating that food availability may impact egg production (Hiom *et al.* 1991). Additionally, in gulls, which generally lay a three egg clutch, the third egg is typically smaller than the first two (Parsons 1972; Kilpi *et al.* 1996) however, when food is abundant the extent to which the third egg is smaller can be reduced (Pierotti & Bellrose 1986).


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Shags on Oronsay, Scotland

In addition to egg size, the background colour of the eggshell and the colour, pattern distribution and extent of maculation may be able to provide information on local environmental conditions. Eggshell colouration is controlled by two pigments in birds, protoporphyrin, which produces yellow, red to brown colouration, and biliverdin, which produces blues and greens (Kennedy & Vevers 1976; Kilner 2006). Within the normal colour range of eggshells the level of pigmentation and patterning can be highly variable and several studies have investigated the relationship of this variation with female condition and environmental variables. The extent of maculation colouration associated with protoporphyrin has been found to be related with shell thickness, and therefore calcium availability, suggesting protoprphyrin has structural properties in strengthening the eggshell (Gosler *et al.* 2005; García-Navas *et al.* 2010). Jagannath *et al.* (2007) found that in Sparrowhawk *Accipiter nisus* eggs the extent of maculation colouration associated with protoporphyrin was negatively correlated with the contaminant DDT and shell thickness; with shell thickness being thinner at the spots. DDT is known for eggshell thinning due to blocking calcium receptors (Lundholm 1987) therefore this study provides evidence that egg shell colouration can be used as a non-destructive method for assessing local contaminant levels. Hanley & Doucet (2012) also showed that a suite of environmental contaminants influenced background eggshell coloration in Herring Gulls. Eggshell pigmentation, specifically associated with biliverdin, may also reflect local foraging conditions through influencing female body condition as supplementary fed female Pied Flycatchers *Ficedula hypoleca* were found to lay significantly more intense blue-green eggs than controls (Moreno *et al.* 2006). Many studies looking at eggshell colouration have used spectrometry using a reflectance spectrophotometer (*e.g.* Hanley & Doucet 2012), however, photography is becoming more widely used enabling precise and efficient analysis of egg colouration to be performed in the field (Stevens *et al.* 2007). Therefore, photographs of eggs can be taken in the field and egg measurements and colour analysis undertaken at a later date to reduce the amount of time spent in the seabird colonies.

Foraging behaviour

Once the chicks have hatched nest watches can be carried out to obtain information on adult foraging behaviour through recording adult nest attendance and provisioning rate. Foraging behaviour is thought to be particularly effective in reflecting local environmental conditions, particularly food availability (Croll *et al.* 1998; Wilson *et al.* 2002; Austin *et al.* 2006). Foraging can be impacted upon by numerous factors, particularly by the abundance, availability, quality and distribution of food (Pyke 1984; Quintana 2008) as well as density-dependent competition (Birt *et al.* 1987) and environmental conditions such as weather (Finney *et al.* 1999; Bustnes *et al.* 2010; Bustnes *et al.* 2013). Where these factors result in poorer foraging conditions birds spend longer away from the nest, thus have reduced provisioning rates, and attend the nest less, resulting in lower productivity due to higher chick starvation, predation and exposure risk (Uttley *et al.* 1992; Harding *et al.* 2007; Chivers *et al.* 2012). Therefore, if changeover times at the nest are short it indicates that the adults are required to spend as much time foraging as possible (Quintana 2008). The synchrony of nest attendance is also important as it impacts on the adults ability to protect their young from unfavourable weather conditions and predation (Hamer *et al.* 1991); therefore if the adults do not synchronise their foraging trips the nest contents will be left unattended. The predation risk of unattended nests is exacerbated by poor foraging conditions with evidence that gulls increase predation of eggs and chicks when alternative food availability is reduced (Uttley *et al.*1989; Bukacińska *et al.* 1996; Regehr & Montevecchi 1997).

Diet

To provide further details on food availability and therefore local environmental conditions, the diet of seabirds can be monitored to determine what food resources are available and its relative abundance (Hislop & Harris 1983; Barrett *et al.* 2007). Spatial differences in diet may then indicate differences in the status of local coastal habitats (Anderson *et al.* 2014); with an abundance of high quality food indicating good local environmental conditions. It is therefore advantageous to investigate the quantity and quality of food items the adults are foraging for and bringing back to the chicks. Monitoring several species can increase the amount of information on food availability obtained with seabirds with specialist diets responding rapidly to reductions in their specific prey species (Montevecchi 1993), whilst generalists, which generally consume the most abundant food items from a range of trophic levels, will provide details on a broader range of local food availability and their relative abundances (Martin 1989).

There are a number of methods to analyse the diet of seabirds (reviewed in Barrett *et al.* 2007). Adult birds can be mist-netted as they enter the colony causing them to drop any food bought back for their chicks (Hislop & Harris 1983; Martin 1989); whilst, species which regurgitate food for their chicks can be persuaded to regurgitate when caught at the colony or be stomach flushed to obtain diet samples (Harris & Hislop 1978; Baird 1990). These methods are fairly intrusive. Alternatively, in some species, like Shags and gulls, pellets can be collected from around the colonies and individuals nests (Bukacińska *et al.* 1996; Kubetzki & Garthe 2003). Collecting pellets throughout the season allows changes in the diet to be identified and large sample sizes to be obtained. Pellets will however, under-represent items which are easy to digest and do not contain hard parts; plus in mixed species colonies the pellets may not be able to be assigned to specific species (Barrett *et al.* 2007). The use of pellets will still, however, provide some indication of what the birds have been feeding on, particularly whether they have been foraging within marine or terrestrial environments, and highlight any differences between colonies. In addition to the pellets what the gulls are regurgitating to the chicks can sometimes be identified; although this is not the case for species where the chicks feed from the adult's crop, as for example in Shags.

The greatest variability in diet is expected in the gulls; their preferred diet is intertidal, however, when this food supply is low gulls will utilise terrestrial resources. Another method which can be used to identify this switch in resource utilisation is by using stable isotope analysis. Stable isotopes can be used to obtain information on feeding source from pelagic marine environments to terrestrial (carbon) and trophic position (nitrogen) over a range of temporal and spatial scales depending on the seabird tissue type used (Hobson & Bond 2012). One way to investigate this is by collecting feathers from dead gulls or those being handled during ringing. If feather moult is extended in time different feathers can provide information on different time periods when those feathers were grown; giving a more complete indication on the year-round resource use of the species (Hebert *et al.* 1999; Ramos *et al.* 2009).

Chick condition

Chick condition can provide a finer reflection of local conditions than productivity as it will provide information on the quality of the chicks which are produced, which may influence their post-fledgling survival (Wanless *et al.* 2005). Depending on the location and accessibility, chicks can be measured and weighed on repeated visits to provide information on chick growth rates or age-specific weights. Low chick weights or growth rates suggest that the chicks are not receiving enough food and therefore may indicate low food availability within close vicinity of the colony (Cairns 1987; Uttley *et al.* 1992). Where chicks can only be measured once, then information on the chick weight may still be able to be compared between sites by calculating a condition index through comparing the weight of the chick to head-beak, tarsus and wing chord measurements (Benson, Suryan & Piatt 2003).

Conclusion

Once collected the data from the selected panel of species can be analysed to determine which of the seabird traits reflect most accurately the differences occurring spatially across the target region during the breeding season and which are highly associated with local environmental conditions. Identifying relationships between the seabird and environmental parameters should provide some indication on the environmental status of the coastal habitats in the vicinity of the colonies and how this changes spatially across the study region. Environmental parameters that might influence the seabird parameters include; sea surface temperature and chlorophyll a concentrations, which act as a proxy for local productivity; distance to built-up areas, which the gulls may be exploiting; weather; tidal state; disturbances, including from predators; habitat and wave fetch, which can predict rocky shore community structures (Burrows *et al.* 2008) and therefore may provide information on the availability of this resource to the birds. Those parameters which most closely reflect what is occurring within the coastal areas can be combined to create an Index to summarise this information into more manageable and easily understood values to inform decision makers and land managers and which communicates the status of the shallow coastal habitat to ensure that any management and conservation measures are based on sound science.

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Appendix – The Seabird Co-ordinator Role

Seabird Co-ordinator

The main aim of the Seabird Co-ordinator is to facilitate an increase in annual seabird monitoring across Northern Ireland. The co-ordinator will work closely with JNCC to create a definitive register of Northern Ireland sites. The co-ordinator will publish an annual report of the state of seabirds populations, monitoring and research in Northern Ireland. The Seabird Co-ordinator role is funded by the Northern Ireland Environment Agency.

Steering Group

The NI Seabird Steering Group will advise on the development of a five year strategy, will advise on the evolution of a NI wide group of volunteers, the programme of activities that the Seabird Coordinator will undertake, and on the preparation of a five year data collection strategy.

NI Seabird Network

This is a network of seabird surveyors and researchers in Northern Ireland which that will be created through the work of the Co-ordinator.

Project Aims

The aims and objectives for the Co-ordinator are as follows:

1 To act as a regional co-ordinator for the collection and dissemination of seabird data in NI.

Objectives

1.1 Ensure all data already being collected is submitted to JNCC by end year one.

1.2 Develop a five year data collection strategy within eight months of appointment.

1.3 Publish an NI seabird annual report.

Methodology

i. Identify and liaise with all current surveyors. This will include:
   - a. liaising with JNCC to identify who currently provides data and who does not;
   - b. liaise with known surveyors to ensure their data is available, and to understand exactly what they survey and what they do not (including RSPB, UWT, BTO, NT, consultants, and individuals);
   - c. Gather all currently collected data, collate this, and ensure submission to JNCC.

ii. Identify gaps in data, including for example: geographic omissions, abundance counts, productivity, diet, birds at sea and assess practical methods for collecting these data (volunteers, professional).

iii. With the advice of the NI Seabird Steering Group prepare a five year strategy for formalising the collection of all data.

iv. Working with the NI Project Manager, the Seabird Co-ordinator will prepare an annual 'NI Seabird Report' that is suitable for public distribution at the end of each calendar year.

v. Site data for sensitive species will not be revealed.

Outputs

a. All collected data goes to JNCC Seabird Monitoring Programme, NIEA and the Centre for Environmental Data and Recording (CEDaR) in the following formats:
   - i. A spreadsheet containing species-specific counts, arranged by count section and in a format compatible with the Seabird Monitoring Programme database and the NIEA computer system.

b. A five year strategy document.

c. NI Seabird Report.

2 To encourage and manage the involvement of volunteers in the collection of data.

Objectives

2.1 Create a NI Seabird Group of volunteers and act as secretary.

2.2 Develop an active surveyor network of 30 people by end year one, 40 by end year two, and 50 by end year three.

Methodology

v. Establish, by invitation, an NI Seabird Steering Group to advise on the development of the five year strategy, and to act as an advisory body for the evolution of a NI wide group of volunteers.

vi. Through open invitation, seek volunteers who would like to be members of the NI Seabird Network (with membership being free). This means that the following will be invited to join:

  a. BTO and RSPB members in NI
  b. participants in the Ocean of Wings Film Festival
  c. members of BTO NI Representative's 'bird people' list (about 500 members)
  d. other individuals who are not included in the above.

vii. Organise two seabird events that will bring together the network of volunteers annually. These events could include the following:
  a. Survey methodology training.
  b. Marine environment issues conference or workshop (possibly in partnership with UWT).
  c. A follow-up film festival.
  d. Speaker events (optimising any visit made to NI by noted seabird scientists).

viii. Regular email updates and encouragement sent to members of the NI Seabird Network.

ix. Create an NI Seabird Monitoring web presence that will facilitate the dissemination of results and will link to sources of national and international seabird information and research.

x. The NI Seabird Steering Group, and the NI Seabird Network, will forge links with The Seabird Group www.seabirdgroup.org.uk

Outputs

a. Formalised NI Seabird Steering Group.
b. Creation of NI Seabird Network.
c. Two networking, learning and awareness events annually.
d. Increased number of active volunteers assisting with surveying.
e. NI Seabird Monitoring website.

3 To champion the evolution of NI towards being a role model region within the SMP.

Objectives

3.1 Coordinate with JNCC within UK, and BWI in RoI, throughout period of appointment.

3.2 Promote and encourage new research into seabird distribution, productivity, survival and movements with a view to publication in the scientific literature.

3.3 Act as a focal point for the planning of site coverage within Northern Ireland, assisting with integration of professional and volunteer input as the next cycle of Common Standards Monitoring for national and European designated sites and the UK National Seabird Census approach.

Methodology

i. Maintain regular and appropriate communication with JNCC and BWI.
ii. Identify all historical seabird colonies in Northern Ireland.
iii. Create a comprehensive register of seabird breeding sites in Northern Ireland.
iv. Through advice from the NI Seabird Steering Group and close liaison with NIEA, identify, and prioritise, areas of weak survey coverage, as well as research needs and opportunities.
v. Identify seabird ecology monitoring projects which can be carried out to give improved data on seabird ecology and productivity.
vi. Identify additional sources of funding that will assist with enhanced survey costs.
vii. Encourage NI Seabird Network members to access existing JNCC grants for volunteers.
viii. Actively manage volunteers to survey all seabird breeding sites.
ix. Make appropriate assessments with regard to the ability and expertise of volunteers to undertake certain surveys.
x. Total survey effort – volunteers and professionals – will be recorded.

Outputs

a. Regional (NI) seabird trends will be available for key species.
b. Regional productivity data for key species will be available on an annual basis.
c. Robust data available for regional marine policy making and protection action planning.
d. Increased output of scientific papers.

This is the first edition of the Northern Ireland Seabird Report, covering 2013, a report the BTO plans to publish annually. This report is the published outcome of the work of the Northern Ireland Seabird Network – a network of volunteers, researchers and organisations – coordinated by the BTO Seabird Coordinator, and funded by NIEA.

FRONT COVER IMAGES: ARCTICTERN CHICK – KERRY LEONARD; FULMAR – SHANE WOLSEY. BACK COVER: ARCTICTERN – EDMUND FELLOWES

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