



**JNCC Report  
No: 474i**

**Canna seabird studies 2012**

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ISSN 0963-8091

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**This report should be cited as:**

Swann, R.L., Aiton, D.G., Call, A., Foster, S., Graham, A., Graham, K. & Young, A. 2016.  
Canna seabird studies 2012. *JNCC Report No. 474i*. JNCC, Peterborough.

## Summary

Three summer visits were made to Canna during 2012 to count and ring seabirds, monitor their breeding success and collect food samples.

Based on chick size and the percentage of birds still on eggs in early July it was clear that following several years of late breeding seasons the timing of the 2012, like the 2010 and 2011 breeding seasons, for all species was more typical of that seen in the 1980-2000 period and around two weeks earlier than the 2009 season.

Counts showed that the breeding populations of many seabird species on Canna remain at low levels when compared to the peak counts of the 1980s. Northern fulmar continued their long term decline. European shags, common guillemots, razorbills, black guillemot, great black-backed gull and lesser black-backed gull remained relatively stable at historic low levels. Mew gull, herring gull and black-legged kittiwake showed increases in breeding numbers. Great skua breeding numbers showed no change from 2011.

Great black-backed gulls and black-legged kittiwakes recorded their highest productivity since monitoring began. Northern fulmar, European shag and herring gull all maintained the improvement in breeding productivity of the last four years, compared to the low period of much of the 2000s. The presence of large numbers of chicks in the study sites suggested that common guillemots also had good breeding success, with pre-fledging weights being the highest recorded since monitoring began.

A total of 284 fully grown seabirds and 1,577 seabird chicks were ringed with BTO metal rings and 653 fully grown birds were re-trapped in breeding colonies.

Re-trapping of adult common guillemots resulted in 122 birds ringed as chicks being located back in colonies for the first time. Eleven razorbills and five European shags that had been ringed as chicks were re-trapped in colonies for the first time. Return rates of the 2005-07 auk cohorts are unusually low.

Twenty-four fish being carried by adult common guillemots were collected and identified. For the first time since 2004 the sample was dominated by sprats (47%). The European shag pellets collected mainly contained gadid otoliths, with a few sandeels. Black-legged kittiwakes food samples were solely comprised of gadid remains.

# Contents

<b>1</b>	<b>Introduction and Objectives</b>	<b>1</b>
<b>2</b>	<b>Methods</b>	<b>2</b>
2.1.1	General	2
2.1.2	Counts	2
2.1.3	Monitoring breeding success	3
<b>3</b>	<b>Results</b>	<b>4</b>
3.1	Breeding seabird counts	4
3.1.1	Northern fulmar	5
3.1.2	Manx shearwater	5
3.1.3	European shag	5
3.1.4	Great skua	6
3.1.5	Mew gull	6
3.1.6	Lesser black-backed gull	6
3.1.7	Herring gull	7
3.1.8	Great black-backed gull	7
3.1.9	Black-legged kittiwake	8
3.1.10	Common guillemot	8
3.1.11	Razorbill	9
3.1.12	Black guillemot	9
3.1.13	Atlantic puffin	10
3.2	Timing of breeding	10
3.3	Breeding success	10
3.3.1	Northern fulmar	11
3.3.2	Manx shearwater	11
3.3.3	European shag	11
3.3.4	Great skua	11
3.3.5	Herring gull	11
3.3.6	Great black-backed gull	12
3.3.7	Black-legged kittiwake	12
3.3.8	Common tern	12
3.3.9	Common guillemot	12
3.4	Ringling studies	13
3.4.1	Ringling totals	13
3.5	Return and survival rates	14
3.5.1	Common guillemot	14
3.5.2	Razorbill	14
3.5.3	European shag	15
3.6	Feeding studies	15
3.6.1	Common guillemot	15
3.6.2	Razorbill	16
3.6.3	European shag	16
3.6.4	Black-legged kittiwake	16
<b>4</b>	<b>Acknowledgements</b>	<b>17</b>
<b>5</b>	<b>References</b>	<b>17</b>
<b>6</b>	<b>Appendices</b>	<b>18</b>
6.1	Appendix 1. Common guillemot chick weights	18
6.2	Appendix 2. Common guillemot diet samples	18

# 1 Introduction and Objectives

The Joint Nature Conservation Committee (JNCC) has a responsibility to advise on the condition of the natural marine environment. Seabirds are an important component of this environment and Britain has internationally important populations of several species. The JNCC's Seabird Monitoring Programme has been designed to assess population changes and breeding success of selected species of seabird at a range of colonies. In addition, selected 'key site' colonies have been targeted for more detailed monitoring of breeding performance, annual survival rates and feeding ecology. These sites are geographically spread in order to give as full coverage as possible of British waters. Canna is a very suitable site off north-west Britain, situated in the Sea of the Hebrides.

This report covers seabird monitoring work on Canna during 2012, the forty-fourth year of the Highland Ringing Group's long-term seabird studies on the island. Since 1986, the Group has received funding support from JNCC (formerly NCC) for its seabird monitoring work on Canna.

During the period covered by this report the main aims were as follows:

- to continue counts of all seabird species breeding on the island;
- to monitor the breeding success of selected seabird species (Northern fulmar *Fulmaris glacialis*, European shag *Phalacrocorax aristotelis*, herring gull *Larus argentatus*, great black-backed gull *Larus marinus* and black-legged kittiwake *Rissa tridactyla*);
- to continue the ringing programme in order to establish dispersal patterns from the island, survival rates and causes of mortality, and ages of return to the island and of first breeding;
- to collect biometric data (wing length and weight) from young common guillemots *Uria aalge*; and
- to collect, identify and measure diet samples from auks, black-legged kittiwakes, other gulls *Larus* spp. and European shags.

## 2 Methods

### 2.1 General

Three visits were made to Canna during 2012 to cover the seabird breeding season: 25 - 28 May, 1 - 8 July, 28 July - 3 August.

Visits to Canna are designed to conduct monitoring work at the optimum time and to give a degree of continuity from year to year. We are very confident that no young guillemots had fledged prior to our early July visit to the island, though it is likely some razorbill and shag chicks had fledged, which may affect the counts and productivity data for these two species. The locations of the study sites named in the text are shown in Figure 1.

### 2.2 Counts

#### Manx shearwaters

During late May, using tape playback methods (Walsh *et al* 1995) three observers checked the known traditional Manx shearwater *Puffinus puffinus* breeding areas along the Tarbert Road and between the Nunnery and Garrisdale Point. In addition Martin Carty re-checked sites along the Tarbert Road in late June and July.

#### Common guillemot and razorbill

Counts were made of the number of occupied sites in accessible colonies at Geugasgor. Count methods differ from those prescribed in Walsh *et al* (1995). Due to the fragmented nature of the colonies on Canna it is possible to visit each colony and count the numbers of chicks or eggs at each site. Occupied common guillemot sites were recognised by the presence of an egg or chick. Occupied razorbill sites were recognised by an egg or eggshell, chick or dense mass of droppings in a crack or under a boulder.

#### Black guillemot

Black guillemots *Cephus grylle* were counted on various sections of the island on different days during the second visit. Counts were made in the late afternoon or evening. All birds seen on land or adjacent areas of sea were counted. This method is known to underestimate the true number of birds present. In addition Richard Luxmoore (NTS Head of Nature Conservation) on 12 and 13 April counted birds on the water below the cliffs within an hour and a half after sunrise.

#### Other seabirds

Whole island counts were conducted between 1 and 5 July. All counts were made from land with the exception of fulmars at Tialasgor and Geugasgor and kittiwakes at Geugasgor, which were made by boat. The units used differ from species to species and are indicated in the results section.

## 2.3 Monitoring breeding success

### Northern fulmar

At the Sanday study plots the position of apparently occupied sites (AOS) were marked on a photograph in late May and the number of large chicks at these sites noted in early August. At Buidhe Sgor and the Nunnery, the number of birds that had laid was noted in late May and the number of large chicks produced from these eggs was recorded in early August.

### European shag

At Tallabrig, the Dun Mor area of Sanday and Rubha Langanais, where birds nest on narrow ledges on the present sea cliff, the position of all nests was mapped on a sketch map in late May. All nests were checked a second time, in early July, to record nest contents including the number and ages of young. In late July the nests were again checked so that the number of young fledging could be calculated.

### Herring gull

A sample of nesting pairs were plotted on a map in late May. The sites were revisited in early and late July to count the number of large young present.

### Great black-backed gull

A sample of accessible pairs was plotted on a map in late May. The sites were revisited in early and late July/early August to count the number of large young present.

### Black-legged kittiwake

In late May, apparently occupied nests (AON) at the study plots were marked on photographs. These were checked again in early then late July to see how many had eggs or chicks. The size and number of chicks was also noted.

### 3 Results

#### 3.1 Breeding seabird counts

Details are given of the 2012 counts for each species and comparisons with past years are shown in Table 1. Further long-term analyses are detailed in Swann (2000).

**Table 1.** Counts of breeding seabirds on Isle of Canna 2004-2012. Counts in brackets are known to be underestimates.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	Peak (year)
Norther fulmar <sup>1</sup>	436	439	349	346	223	324	327	291	222	669 (1977)
European shag <sup>2</sup>	495	327	349	361	375	324	305	(226)	270	1,753 (1984)
Great Skua <sup>4</sup>	2	3	3	5	6	6	6	8	8	(2008)
Mew gull <sup>4</sup>	6	9	7	13	13	21	20	16	25	21 (2009)
LBB gull <sup>4</sup>	13	4	7	9	6	9	11	10	10	69 (1975)
Herring gull <sup>4</sup>	372	112	96	74	70	66	70	63	83	1,525 (1988)
GBB gull <sup>4</sup>	44	29	20	24	25	17	18	17	18	93 (1997)
Black-legged kittiwake <sup>2</sup>	1,340	968	905	1,018	739	960	960	1002	1083	1,340 (2004)
Common tern <sup>3</sup>	1	3	3	2	2	0	0	0	0	18 (1992)
Common guillemot <sup>5</sup>	906	(79)	697	587	337	459	(291)	402	423	1,249 (2001)
Razorbill <sup>5</sup>	169	(27)	273	288	170	288	209	245	(206)	520 (1985)
Black guillemot <sup>6</sup>	44	47	49	68	68	63	78	40	47	137 (1986)

Notes: Units used are as follows:

1. Apparently occupied site for norther fulmar
2. Apparently occupied nests for European shag and black-legged kittiwake
3. Nest with egg or chick for common tern or herring gull (nest)
4. Apparently occupied territory for gulls and skuas
5. Egg or chick in study plot for common guillemot and razorbill
6. Individual bird for black guillemot



### 3.1.1 Northern fulmar

A total of only 222 apparently occupied sites were counted, suggesting a continued decline in the Canna population of this species (Figure 1). It was evident during checks of the study plots that very few non-breeding birds were present on the ledges this summer.

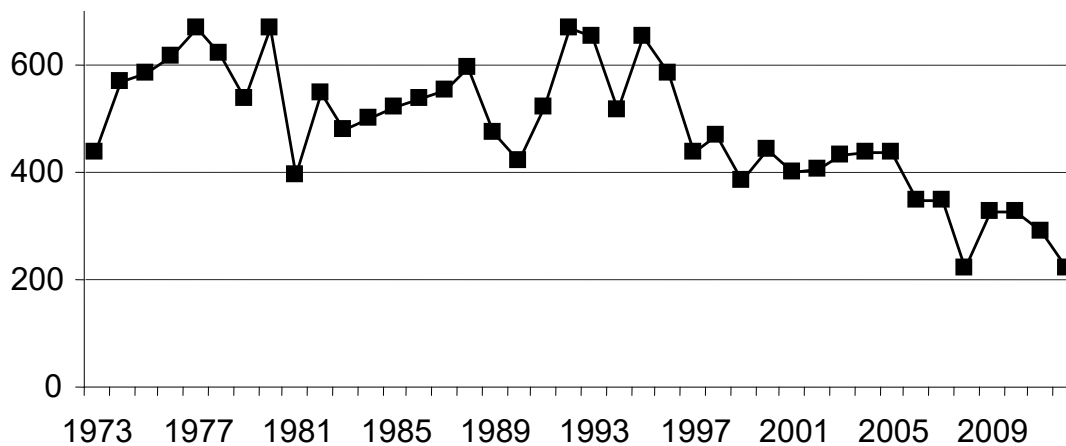


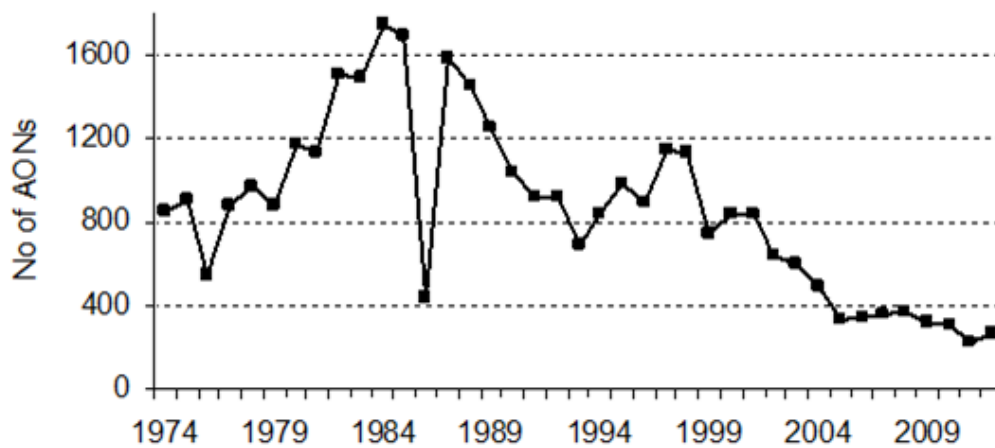
Figure 1: Number of apparently occupied Northern fulmar sites on Canna 1973-2012.

### 3.1.2 Manx shearwater

At the Tarbert Road colony one bird responded to taped calls from over 300 burrows checked in late May, and one other occupied burrow was located. At the Nunnery 30 burrows were checked, with two birds responding. In late June/July Martin Carty located birds calling at night from at least 11 different sites in the cliffs above the Tarbert Road.

### 3.1.3 European shag

Numbers continue to decline with only 226 AONs counted (Figure 2), the lowest figure we have recorded. Many birds are starting to nest early and it is possible that our July counts missed some early nesters that failed, but did not relay. Some had also fledged prior to our arrival and there was evidence that some broods had been predated by white-tailed eagles *Haliaeetus albicilla*. Very heavy rain and gale force winds in late May also washed out nests. These factors are likely to mean that our count underestimated the true number of AONs.



**Figure 2.** Number of apparently occupied European shag nests on Canna 1974-2012.  
 Note: 1985 was a non-breeding year for shags.

### 3.1.4 Great skua

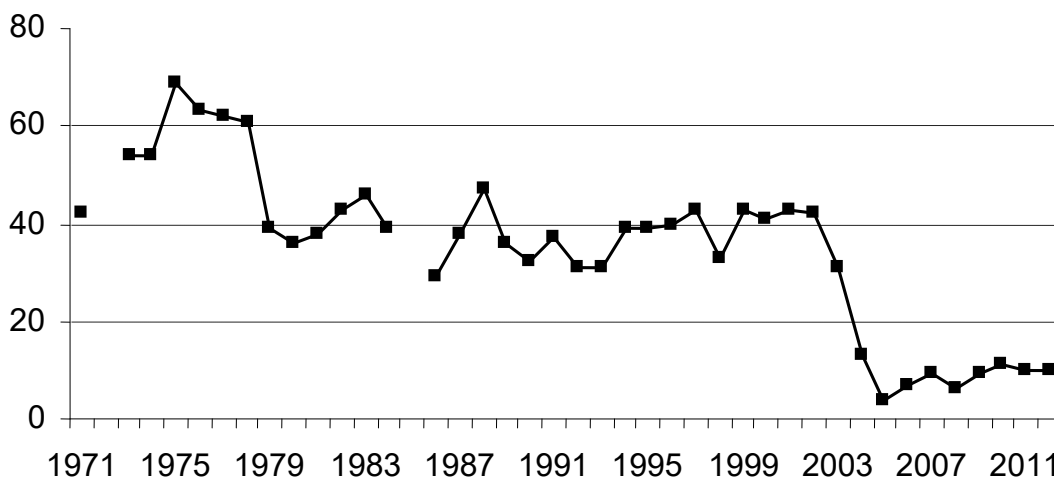
Eight pairs of great skua *Stercorarius skua* were present on Sanday and seven pairs laid eggs.

### 3.1.5 Mew gull

The number of mew gulls *Larus canus* increased with 25 Apparently Occupied Territories (AOT) counted (Table 1), a new highest count.

### 3.1.6 Lesser black-backed gull

The number of lesser black-backed gulls *Larus fuscus* has declined dramatically since 2002 from about 40 AOTs to four in 2005. Numbers have since increased slightly since 2005 and appear to have levelled out at a new lower level. There were 10 AOTs in 2012 (Figure 3).



**Figure 3.** Number of apparently occupied Lesser Black-backed Gull territories on Canna 1971-2012.

### 3.1.7 Herring gull

There has been a notable decline in the number of AOTs on Canna since 2000. Numbers remain very low, though showed a slight rise from the record low of 63 AOTs in 2011 to 83 AOTs (Figure 4). Most traditional herring gull colonies on the island have now been abandoned. Over the last few years many of the remaining gulls have switched to new nesting sites, particularly the scree slopes above the Tarbert Road, cliff and moorland sites on Sanday and above Rubha Langanais. Only the small colonies at Rubha Langanais and Geugasgor occupy traditional sites.

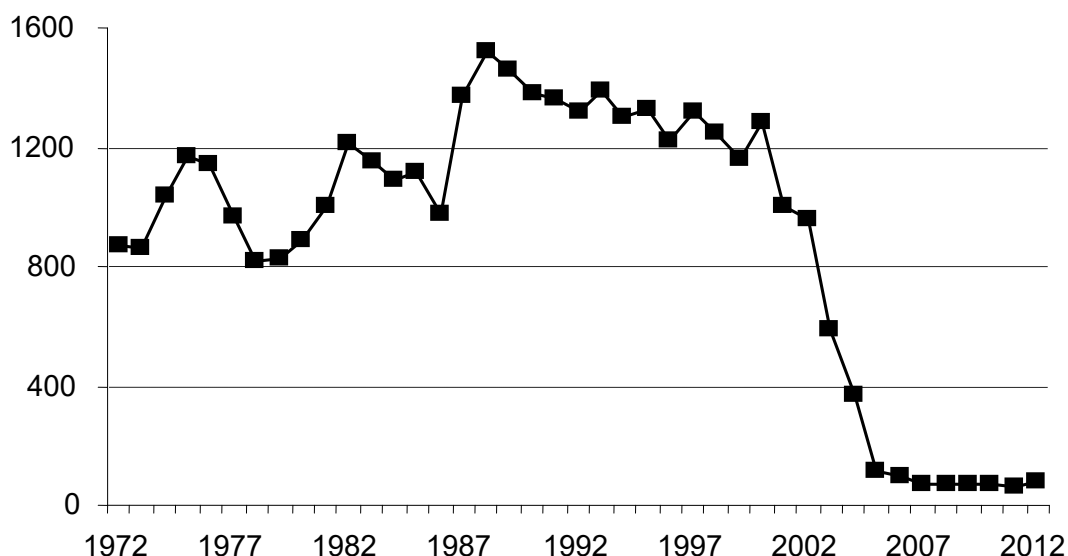


Figure 4. Number of apparently occupied herring gull territories on Canna 1971-2012.

### 3.1.8 Great black-backed gull

There has been a substantial decline in numbers on Canna since 2000. Numbers now appear to have levelled out at a low level with only 18 AOTs in 2012 (Figure 5).

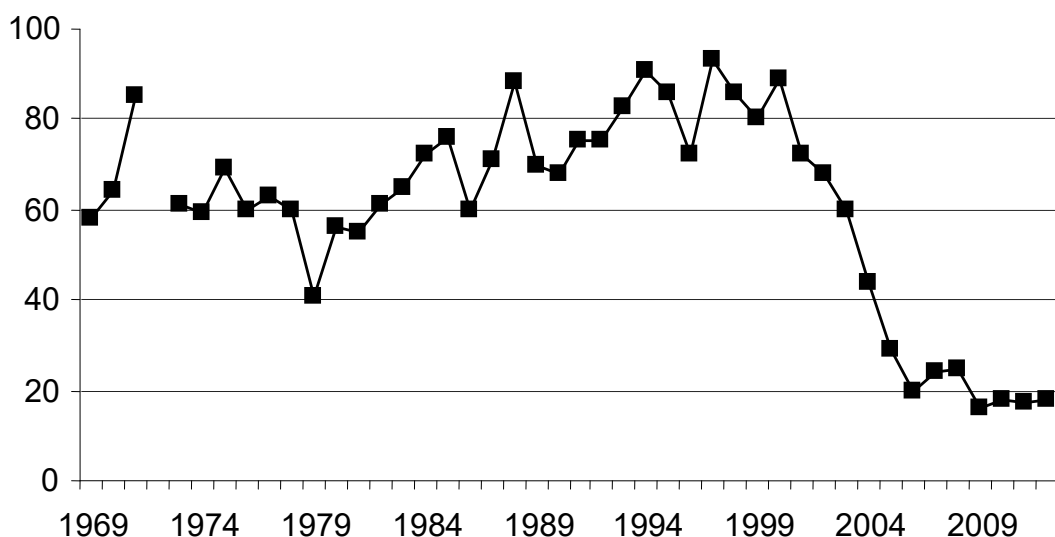
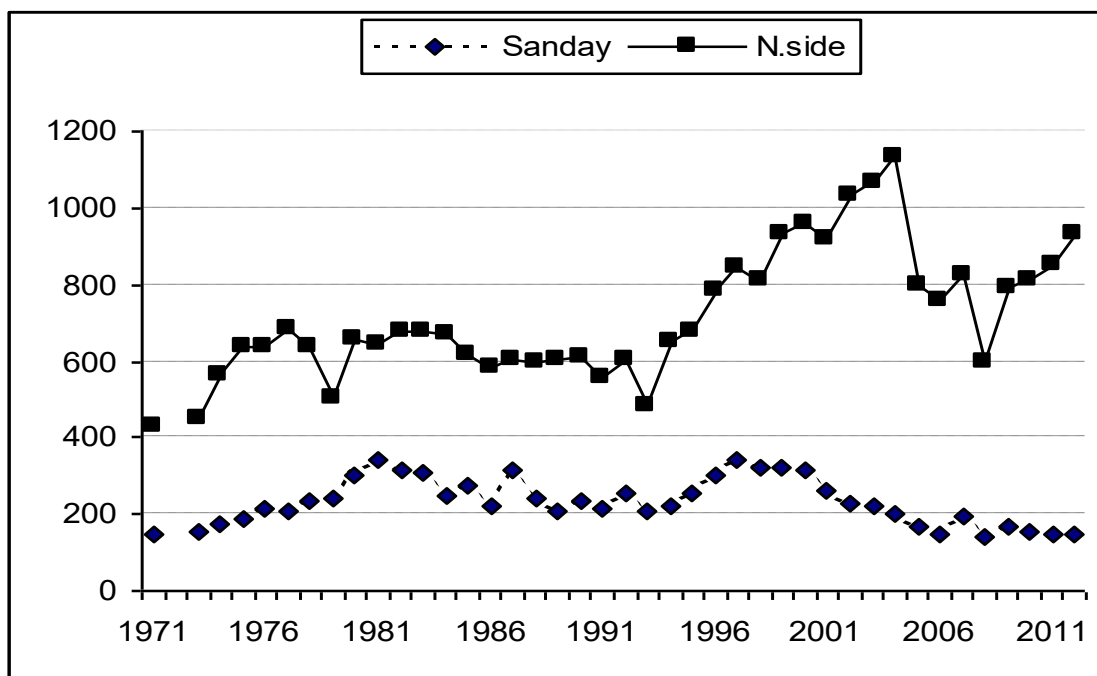


Figure 5. Number of apparently occupied great black-backed gull territories on Canna 1969 - 2012.

### 3.1.9 Black-legged kittiwake

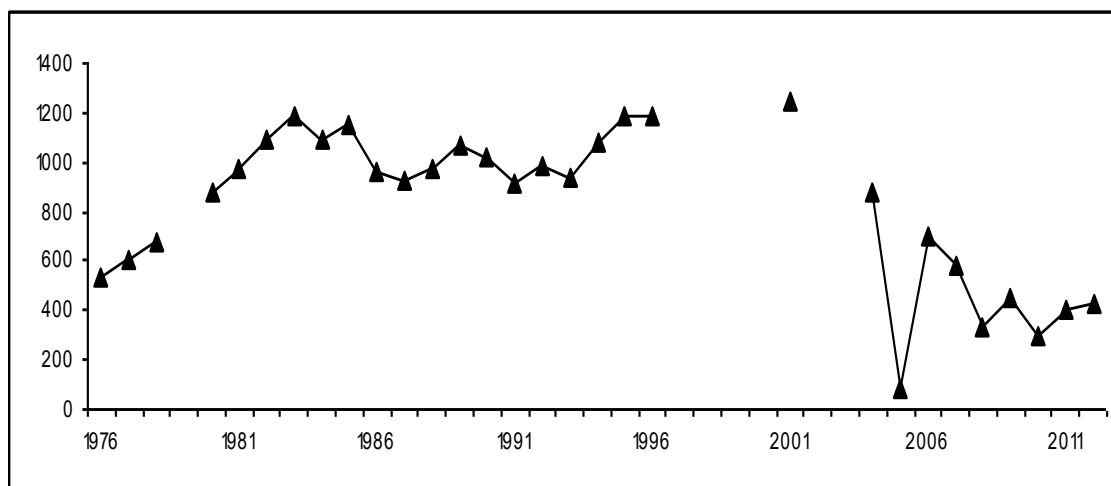
Following the rise to the record whole island count of 1,340 AONs in 2004, numbers decreased drastically in 2005 and reached a low in 2008, since when they have increased (Table 1). In 2012 there was a further increase to 1083 AONs. This increase is restricted to colonies on the north side of Canna (Figure 6).



**Figure 6.** Number of apparently occupied black-legged kittiwake nests on Sanday and north side of Canna 1971-2012.

### 3.1.10 Common guillemot

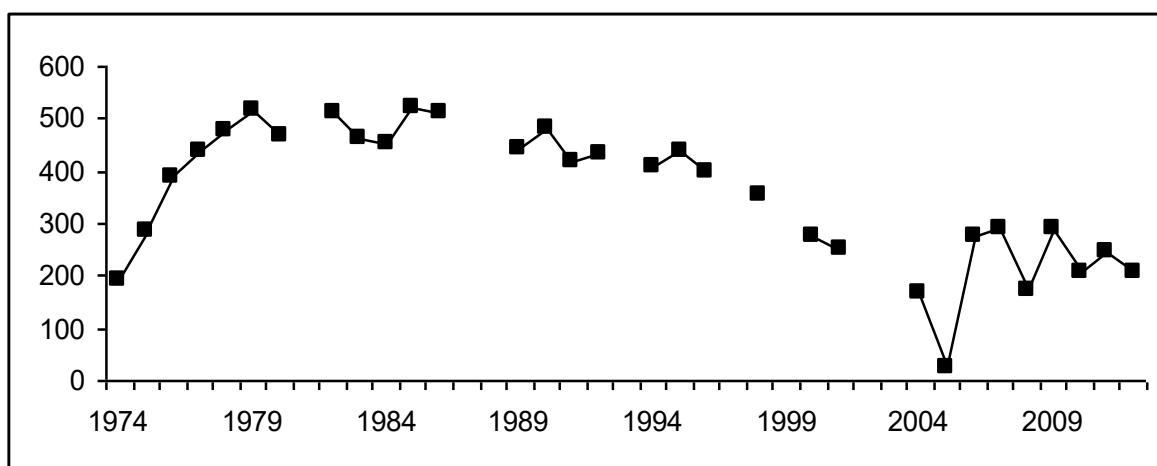
Common guillemot numbers peaked in 2001 when 1,249 'nests' were counted in our studies areas. Since then there has been a long term decline with only 291 'nests' in 2010 (Figure 7). In 2005 there was an almost complete breeding failure of common guillemots on Canna. In 2012 there was a slight increase to 423 'nests'. We believe recent counts (2008-2011) may have underestimated the actual number of birds attempting to breed as many of the more open colonies are apparently subject to increased egg predation from common ravens *Corvus corax* and gulls than has previously been observed. In some cases sites have been virtually abandoned by the time of our July visits. At the large cave colony on the north side 1,750 'nests' were counted in 2001, but this had dropped to 949 by 2006. In 2012, 968 'nests' were counted suggesting that numbers have stabilised at this site, where predation of eggs by birds is thought to be low.



**Figure 7.** Number of common guillemot nests in all study plots on Canna 1974-2012. Note gaps in data correspond with years when large number of chicks had fledged prior to our arrival on the island and no population estimate could be calculated

### 3.1.11 Razorbill

Razorbill numbers on Canna have undergone a long term decline since the early 1990s (Figure 8). In 2006 and 2007 numbers increased following the successful rat eradication campaign over winter 2005/06, with numbers back up to 2001 levels at Geugasgor. Since then numbers have fluctuated. In 2012 only 206 'nests' were counted, though this may have been an underestimate as some chicks had certainly fledged prior to our July visit.



**Figure 8.** Number of razorbill 'nests' at Geugasgor and at all other sites on the island 1974-2012. Note gaps in data correspond with years when large number of chicks had fledged prior to our arrival on the island and no population estimate could be calculated.

### 3.1.12 Black guillemot

A total of 47 individual adult birds were counted in 2012 (Table 1). As noted under Methods this may under-estimate the true number present and does not follow the methodology suggested by Walsh *et al* (1995).

Following the guidelines of Walsh *et al* (1995) on 12 and 13 April Richard Luxmoore (NTS) counted 59 adult birds after sunrise on the north side of Canna between Rubha Langanais and Buidhe Sgor, 12 around Rhu Carr-innis and eight on Sanday, a total of 79 birds. This covered most of the main sites, bar Tallabric, the Nunnery and Geugasgor where we had six

birds in total in early July. This would suggest a minimum figure of 85 birds, well below the 211 birds counted by a similar method in April 2000.

### 3.1.13 Atlantic puffin

This species tends to nest on off shore stacks or inaccessible grassy slopes on steep cliffs and is therefore difficult to monitor on Canna. Through visual observations there has, however, been a notable apparent increase in numbers at Geugasgor, following the rat eradication in winter 2005/06. New burrows are appearing each year at several locations on the Geugasgor slopes.

## 3.2 Timing of breeding

Weather data for the Canna area was extracted from Meteorological office anomaly maps (<http://www.metoffice.gov.uk/climate/uk/anomacts/#>) comparing 2012 data to the 1970-2000 mean. Winter temperatures between December and February were c.1°C above average with above average rainfall (130-150% of average). Spring and early summer had below average rainfall (50-75% average) and was characterised by persistent cool northerly and north easterly winds, which probably kept sea temperatures lower than that recorded during much of the 2000s.

Unlike much of the latter 2000s when late breeding was the norm, 2012 like the two previous years saw more typical laying dates. In early July European shag and common guillemot had large chicks with only a small number still on eggs. There was evidence that some shag and razorbill chicks had fledged prior to our visit. Gull chicks were also large and close to fledging by the early July visit. Black-legged kittiwake nests mostly contained small-medium sized young.

## 3.3 Breeding success

A summary of the 2011 results for each species and comparisons with past years are shown in Table 2. Further long-term analyses are given in Swann (2000).

**Table 2.** Breeding success of selected seabirds on Canna 2003-2012.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Northern fulmar	0.46	0.56	0.28	0.47	0.27	0.23	0.36	0.42	0.46	0.37
European shag <sup>a</sup>	0.16	0.01	0.7*	1.2*	1.4*	1.5*	1.8*		1.4*	
European shag <sup>b</sup>		1.4	0.7	0.7	1.0	0.3	0.7	1.5	0.8	1.6
Herring gull	0.05	0.16	0.13	0.24	1.8	0.5	0.7	1.8	2.1	1.6
Great b-b gull	0.3	0.3	0.1	0.2	0.8	0.5	0.9	1.6	1.0	2.2
Black-legged kittiwake	1.0	0.8	0	0.45	0.3	0	1.1	0.8	0.7	1.1

Notes:

1. For northern fulmar and black-legged kittiwake, figures are overall breeding success across all plots, not means of individual plot figures.
2. Figures are large young per apparently occupied site or egg for northern fulmars, chicks fledged per nest in which eggs were laid for European shags, large chicks per occupied territory for great black-backed gulls and since 2006 for herring gull and chicks fledged per apparently occupied nest for black-legged kittiwakes.
3. For herring gull figure gives an estimate of chicks fledged per nest, based on various sub-colonies.
4. For European shag <sup>a</sup> refers to no of young fledged per marked nest in the boulder colonies, whilst <sup>b</sup> refers to number of young fledged per marked nest on sub-colonies on cliff ledges. \* From 2005 onwards the boulder colonies surveyed were Lamasgor and/or Geugasgor, prior to that it was Garrisdale and the Nunnery.

### 3.3.1 Northern fulmar

Table 3 shows the breeding success from four study plots. This gives an overall success rate across all sites combined of 0.4 chicks per apparently occupied site, with big variations between study plots. Although lower than the 0.46 recorded in 2011 it still represents an improvement in productivity from the low recorded in 2008.

**Table 3.** Northern fulmar breeding success on Canna in 2012.

<i>Study site</i>	<i>No. sites</i>	<i>No. young</i>	<i>Young per site</i>
Sanday A	22	7	0.32
Sanday B (Dun Mor)	16	4	0.25
Buidhe Sgor	33	15	0.45
Nunnery	4	2	0.5
<b>Total</b>	<b>75</b>	<b>28</b>	<b>0.37</b>

### 3.3.2 Manx shearwater

Four known occupied burrows were checked, two were known to contain an egg in late May. One subsequently fledged a large chick, whilst the other contained a deserted egg.

### 3.3.3 European shag

Table 4 gives details of the shag monitoring plots. Unfortunately, due to a rockfall, the study colony in the boulder scree at Lamasgor could not be accessed in order to assess breeding productivity.

**Table 4.** European shag fledging success on Canna in 2012.

<i>Young fledged per nest laid in</i>	<i>Rubha Langanais*</i>	<i>Tallabric Sanday*</i>	<i>Dun Mor area, Sanday*</i>
<i>Total No. of nests</i>	10	10	8
0 young	3	2	0
1 young	2	4	2
2 young	3	2	3
3 young	2	2	3
<b>Av young/AON</b>	<b>1.4</b>	<b>1.4</b>	<b>2.1</b>

\* = nests located on narrow cliff ledges.

Overall breeding success was 1.6 young per AON, the highest figure we have recorded since we started monitoring these cliff sites in 2004.

### 3.3.4 Great skua

Of the seven pairs that nested four pairs reared two chicks, two pairs single chicks and one pair failed. Another pair was present but did not nest.

### 3.3.5 Herring gull

On Sanday two pairs fledged a single chick, three pairs fledged two young, two pairs fledged three young and two pairs failed (1.5 young/nest). On the Tarbert Road scree one pair fledged two young, two pairs three young and two pairs failed (1.6). This gives an overall productivity of 1.6 young/nest.

### 3.3.6 Great black-backed gull

Thirteen pairs of great black-backed gull were monitored, one failed, one produced one young, five produced two young and six produced three young, giving an overall average productivity of 2.2 young per nesting pair. This is the highest productivity figure we have ever recorded for this species on Canna (Table 2).

### 3.3.7 Black-legged kittiwake

The results obtained from the study plots are detailed in Table 4.

**Table 5.** Number of occupied black-legged kittiwake nests and number of large young per nest in study plots in 2012.

	<i>Sanday,K1</i>	<i>Sanday,K2</i>	<i>Sanday,K3</i>	<i>Sanday,K4</i>
<i>No. nests</i>	42	40	26	24
Empty	9	11	12	5
1 young	15	14	9	10
2 young	18	13	5	9
3 young	0	2	0	0
<b>av. young per nest</b>	<b>1.2</b>	<b>1.2</b>	<b>0.7</b>	<b>1.2</b>

On Sanday 132 monitored nests produced 144 young giving an overall average breeding success of 1.1 young per AON. This equals previously high record productivity figures and is a marked improvement in breeding success compared to the previous two years (Table 6).

### 3.3.8 Common tern

No Common terns nested on Canna in 2012.

### 3.3.9 Common guillemot

Sixty-six guillemot chicks with a wing length greater than 60mm were weighed (appendix 1). The mean weight of 291.1g was significantly heavier than the pre 2012 sample ( $U=17920$ ,  $p<0.05$ ), which had a median weight of 268g.

**Table 6.** Weights of guillemot chicks (g) with wing-length >60mm.

	2001	2002	2003	2004	2005	2007	2008	2009	2010	2011	2012
mean	250	258	274	270	238	239	213	255	264	253	291
n	56	54	50	50	30	17	25	25	77	70	66

The above accounts compare breeding output in 2012 with that recorded in the previous 2-4 years. Longer term trends in breeding output of the main study species on Canna are given in Table 2



### 3.4 Ringing studies

#### 3.4.1 Ringing totals

Table 7 shows the number of adults and chicks ringed during 2012 and the number of fully-grown birds that were re-trapped.

**Table 1.** Number of birds ringed and adults re-trapped on Canna in 2012

	<i>Adults ringed</i>	<i>Chicks ringed</i>	<i>Full-grown retrapped</i>
Northern fulmar	6	17	8
Manx shearwater	1	1	0
Storm petrel	12	0	0
European shag	8	178	9
Great skua	0	10	0
Mew gull	0	6	0
Lesser black-backed gull	0	8	0
Herring gull	0	60	0
Greater black-backed gull	0	12	0
Black-legged kittiwake	30	91	9
Common guillemot	163	1064	580
Razorbill	52	135	47
Atlantic puffin	12	10	0
<b>Totals</b>	<b>284</b>	<b>1592</b>	<b>653</b>

### 3.5 Return and survival rates

#### 3.5.1 Common guillemot

580 adult common guillemots were retrapped in 2012, of which 122 were birds that had been ringed as chicks on Canna and were retrapped on the island for the first time. These included: four 3-year old, four 5-year olds, two 6-year olds, one 7-year old, three 8-year olds, twenty-two 9-year olds and seven 10-year olds. Swann (2000) showed a negative correlation between the recovery rate of pullus guillemots ringed on Canna and found dead in their first year of life and subsequent return rates of surviving birds to the colony.

**Table 8.** Recovery rates and return rates of common guillemot chicks ringed on Canna.

<i>Year</i>	<i>No. ringed</i>	<i>% recovered in 1st year</i>	<i>% back by 5th year</i>	<i>% back by 6<sup>th</sup> year</i>	<i>% back by 7th year</i>
1984	1,843	2.5	1.5	2.6	4.6
1985	2,224	3.6	0.6	1.3	2.1
1986	1,913	0.3	2.4	5.0	6.7
1987	1,080	2.4	0.7	1.2	2.6
1988	2,423	1.9	0.8	1.8	2.8
1989	2,392	2.8	0.6	1.0	1.4
1990	2,334	1.7	1.4	2.4	3.3
1991	2,299	0.3	2.0	3.1	6.0
1992	2,458	0.9	1.9	3.8	5.9
1993	1,947	0.7	1.8	3.7	7.0
1994	2,671	0.7	1.8	4.4	6.6
1995	2,843	1.4	1.3	2.5	3.9
1996	2,423	0.6	2.3	3.9	6.6
1997	819	1.0	1.0	2.3	3.9
1998	2,221	0.5	2.0	4.0	4.4
1999	2,157	1.3	1.5	2.4	4.0
2000	2,166	1.8	0.6	2.3	3.2
2001	2,217	0.5	1.1	2.3	2.4
2002	1,201	1.6	0.7	0.7	2.1
2003	1,911	0.5	0.4	2.0	2.4
2004	1,895	0.5	0.5	0.6	0.7
2005	550	0.4	0.2	0.5	0.7
2006	1161	0.4	0.3	0.5	
2007	707	0.8	0.8		

Recent high post-fledging mortality appears to have disrupted this pattern, with very low return rates from the 2004 cohort, many of which perished in a massive wreck of NW Scotland in September of that year (Swann 2004) and of the 2005-2007 cohorts, whose pre-fledging weights were well below average. The increased tendency to apparent non-breeding by many adults may also explain why there has been a decline in the return rate in recent years.

#### 3.5.2 Razorbill

Eleven razorbills that had been ringed as chicks were re-trapped on the island for the first time in 2012. These were two 2-year olds, a 3-year old, a 9-year old, a 12-year old and six over 15 year old birds. As with guillemots there has been a major decline in return rates. The

1995-2002 cohorts had a return rate of 6.1% by age 5. For the 2003-07 cohorts the return rate has slumped to 0.2%, probably a reflection of a large increase in post fledging mortality.

### 3.5.3 European shag

In 2012 five shags, that had been ringed as chicks, were retrapped on the island for the first time. All were breeders, being caught on nests, and composed two 3-year old and three 5-year olds.

## 3.6 Feeding studies

### 3.6.1 Common guillemot

Twenty-four fish were collected and/or identified from adult common guillemots on their return to the colony from fishing trips, seven (29%) were sandeels *Ammodytes* spp with 11 (46%) sprat and six gadids. Of the gadids, five were whiting and one was a dragonet. Details of the fish sampled are given in Appendix 2.

The mean length of sandeels was 168.8mm (sd 20.23) not significantly larger than the 2011 average (154.3mm, sd 35.91,  $z = 1.13$ , ns). The mean length of sprats was 116.1mm, significantly larger than those taken in during 2001-04 (average 107, sd 9.97,  $z = 2.31$ ,  $p < 0.05$ )

Figure 9 shows that since 2002 there had been a significant decline in the percentage of sprats (*Sprattus sprattus*) brought in and that since 2005 common guillemot chick diet has been dominated by sandeels, with smaller numbers of gadids. 2012 saw a sudden rise in the percentage of sprats and a subsequent decline in sandeels.

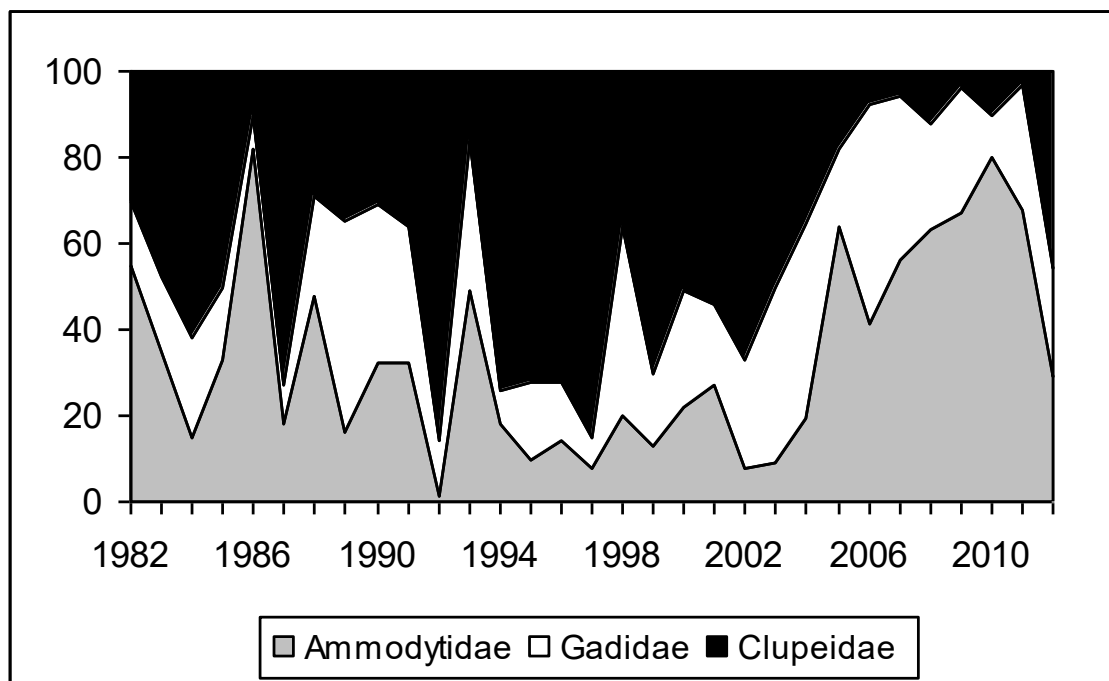


Figure 9. Proportion of fish species taken by common guillemots on Canna 1982-2012

### 3.6.2 Razorbill

Five samples were collected that had been dropped by adults returning to feed chicks. All were sandeels and all were measured (105mm, 100mm, 83mm, 80mm, 50mm).

### 3.6.3 European shag

Six pellets regurgitated by European shags were collected, (1-4 on 1 July, 5-6 on 30 July). These mostly contained gadidae and some sandeel otoliths (Table 9).

**Table 9.** Number of otoliths and other contents of regurgitations from young European shags and shag pellets.

Sample number	Sample type	sandeel otoliths '0', 1+ group	Gadid otoliths Whiting, rockling	Other gadid otoliths	REMARKS + details of 'other' fish
1	pellet	0,0	0,4	16	2 wrasse
2	pellet	0,0	0,2	175	
3	pellet	0,11	0,0	45	
4	pellet	0,0	0,0	24	
5	pellet	0,2	0,0	100	
6	pellet	0,70	0,0	4	

### 3.6.4 Black-legged kittiwake

Twelve food samples were analysed from regurgitations collected from black-legged kittiwake chicks on 5 July, all containing gadids (Table 10). There was a surprising lack of sandeels and clupeids in comparison to previous years diet samples.

**Table 10.** Number of otoliths and other contents of regurgitations from black-legged kittiwake regurgitations.

Sample number	Sample type	sandeel otoliths '0', 1+ group	Gadid otoliths Whiting, unidentifield	Clupeids	REMARKS + details of 'other' items
1	Regurgitation	0,0	2,0	0	
2	Regurgitation	0,0	2,1	0	
3	Regurgitation	0,0	0,1	0	
4	Regurgitation	0,0	0,2	0	
5	Regurgitation	0,0	7,0	0	
6	Regurgitation	0,0	1,0	0	
7	Regurgitation	0,0	9,0	0	
8-12	Regurgitation	0,0	0,0	0	gadid bones

## 4 Acknowledgements

We would like to thank the following people who assisted with collecting the information presented in this report: Fionnlagh Call, Martin Carty and Ronnie Graham. Mark Newell of CEH analysed food samples. The National Trust for Scotland allowed us access to Canna and the islanders provided considerable assistance and hospitality.

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## 6 Appendices

### 6.1 Appendix 1. Common guillemot chick weights

Weights in grammes									
238	246	248	256	258	262	262	262	265	268
269	270	274	276	277	280	280	282	282	283
284	284	284	285	286	288	288	289	290	290
290	290	292	292	294	294	294	294	296	298
298	298	298	300	300	300	300	305	305	305
310	310	310	315	315	315	315	315	315	320
320	320	320	320	320	320				

Note: Weights taken only from chicks with a wing length of >60mm. Mean weight was 291.05g.

### 6.2 Appendix 2. Common guillemot diet samples

Details are given of the size (mm) of fish caught by adult guillemots on Canna in 2012.

Whiting: 5 measured					
<i>Length</i>	75	82	86	90	101
No. of fish	1	1	1	1	1

Sandeel: 7 measured						
<i>Length</i>	137	150	160	175	185	190
No. of fish	1	1	1	1	2	1

Sprat: 11 measured									
<i>Length</i>	109	110	112	113	115	116	118	119	141
No. of fish	1	1	3	1	1	1	1	1	1