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Canna seabird studies 2015

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Summary

Three summer visits were made to Canna during 2015 to count and ring seabirds, monitor their breeding success and collect food samples.

Compared to the previous two years 2015 was a relatively early breeding season similar to that seen in 2010-12 and typical of that regularly recorded in the years between 1980 and 2000.

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. Great black-backed gull, lesser black-backed gull and herring gull remain at very low levels. European shags and black-legged kittiwakes, however, showed welcome increases in numbers.

Northern fulmar, European shag, and black-legged kittiwake all had breeding productivity figures above their long term averages. Great skua and great black-backed gulls had figures close to average, whilst herring gull appeared to have below average productivity. Guillemot chicks close to fledging had weights close to the long-term average.

A total of 335 fully grown seabirds and 1,179 seabird chicks were ringed with BTO metal rings and 480 fully grown birds were re-trapped in breeding colonies. In addition 59 geolocators, provided by Marine Scotland were fitted to adults (4 northern fulmar, 25 black-legged kittiwake, 10 razorbill, 20 common guillemot) and 33 fitted in 2014 were retrieved (4 northern fulmar, 20 black-legged kittiwake, 4 razorbill, 5 common guillemot).

Re-trapping of adult common guillemots resulted in 81 birds ringed as chicks being located back in colonies for the first time. Six razorbills and six European shags that had been ringed as chicks were also re-trapped in colonies for the first time. Following the very low return rates of the 2004-2008 auk cohorts, there are signs of improved recruitment from the 2009 to 2012 cohorts, suggesting improved survival of young produced from these years.

Twenty-six fish being carried by adult common guillemots were collected and identified. The sample was dominated by sprats (46%). European shag regurgitations and pellets were dominated by 0 group sandeel otoliths and to a lesser extent gadid otoliths. Black-legged kittiwake regurgitations contained roughly equal amounts of sandeel and gadoid remains, with only a few containing clupeids and crustacea.

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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 2015, the forty-sixth 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 common guillemots *Uria aalge*.
- to collect, identify and measure diet samples from auks, black-legged kittiwakes, other gulls *Larus* spp. and European shags.
- to retrieve geolocators fitted in 2014 and deploy a further 50.

2. Methods

2.1 General

Three visits were made to Canna during 2015 to cover the seabird breeding season: 24 - 27 May, 3 - 11 July, 25 July - 1 August.

We attempt to arrange our early July trip to coincide with the main seabird chick rearing period. Unfortunately in summer 2015 many common guillemots and razorbills had fledged prior to our visit.

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.

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 suitable breeding location.

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.

Other seabirds

Whole island counts were conducted on various occasions between 24 May and 8 July. All counts were made from land with the exception of northern fulmars at Tialasgor and Geugasgor and black-legged 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 late July/early August. At Buidhe Sgor, 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 late July/early August.

European shag

At Tallabrig, the Dun Mor area of Sanday and Rubha Langanais, where birds nest on narrow cliff ledges, 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. At Geugasgor and Lamasgor marked study nests were checked in early July and their contents recorded. In late July all 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 sandy and Buidhe Sgor study plots were marked on photographs. The nests were checked again in early then late July to see how many contained eggs or chicks. The size and number of chicks was also noted.

3. Results

3.1 Breeding seabird counts

Details are given of the 2015 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 2007-2015. Counts in brackets are known to be underestimates.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	Peak (year)
Norther fulmar ¹	346	223	324	327	291	222	179	184	174	669 (1977)
European shag ²	361	375	324	305	(226)	270	255	191	336	1,753 (1984)
Great skua ⁴	5	6	6	6	8	8	9	9	8	9 (2013)
Mew gull ⁴	13	13	21	20	16	25	30	33	27	33 (2014)
Lesser black-backed gull ⁴	9	6	9	11	10	10	11	9	13	69 (1975)
Herring gull ⁴	74	70	66	70	63	83	95	75	85	1,525 (1988)
Greater black-backed gull ⁴	24	25	17	18	17	18	15	16	18	93 (1997)
Black-legged kittiwake ²	1,018	739	960	960	1002	1083	820	935	1141	1,340 (2004)
Common tern ³	2	2	0	0	0	0	0	0	0	18 (1992)
Common guillemot ⁵	587	337	459	(291)	402	423	373	460	nc	1,249 (2001)
Razorbill ⁵	288	170	288	209	245	(206)	194	213	nc	520 (1985)
Black guillemot ⁶	68	68	63	78	40	47	59	78	79	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 174 apparently occupied sites were counted in 2015, showing the Canna population continues to decline (Figure 1).

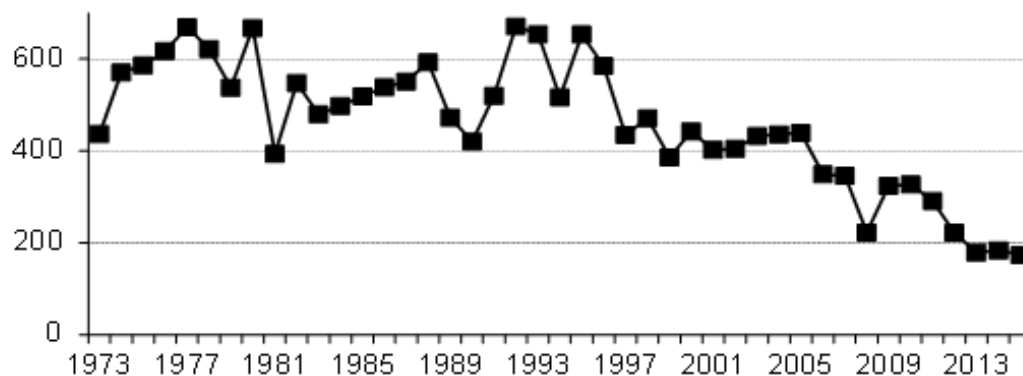


Figure 1. Number of apparently occupied northern fulmar sites on Canna 1973-2015.

3.1.2 Manx shearwater

At the Tarbert Road colony two occupied burrow were confirmed from over 500 burrows checked in late May. At the Nunnery 100 burrows were checked, with four birds responding to taped calls. No bird were located at Garrisdale from over 150 checked burrows.

3.1.3 European shag

The number of European shags on Canna showed a welcome rise from the record low count of 191 AONs in 2014 to 336 nests in 2015, the highest total since 2008 (Figure 2).

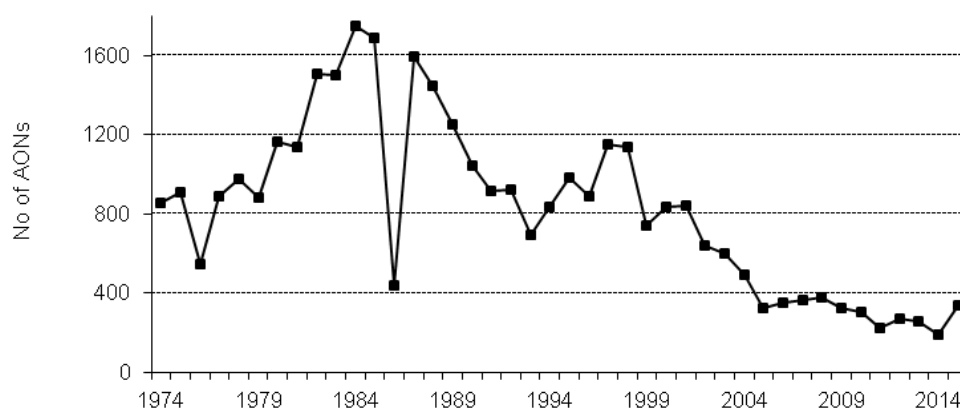


Figure 2. Number of apparently occupied European shag nests on Canna 1974-2015.

Note: 1985 was a non-breeding year for shags.

3.1.4 Great skua

Eight pairs of great skua *Stercorarius skua* were present in 2015 and seven pairs were known to have laid eggs. One pair nested east of Tarbert on Canna, the rest were on Sanday.

3.1.5 Mew gull

The count of mew gulls *Larus canus* in 2015 was 27 Apparently Occupied Territories (AOT), slightly down from the previous year's record count of 33 AOTs (Table 1).

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 4 in 2005. Numbers have since increased slightly since 2005 with 13 AOTs in 2015 (Figure 3).

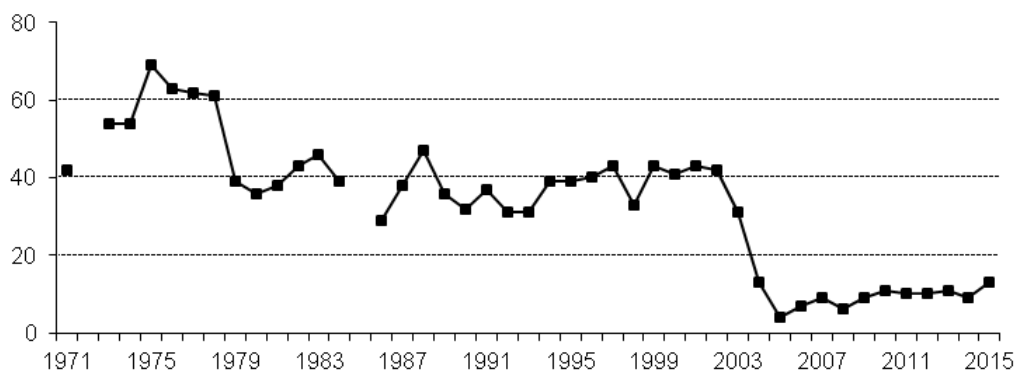


Figure 3. Number of apparently occupied Lesser Black-backed Gull territories on Canna 1971-2015

3.1.7 Herring gull

There was a notable decline in the number of AOTs on Canna between 2000 and 2005. Since then numbers have remained broadly stable. The lowest level of 63 AOTs was recorded in 2011. In 2015 85 AOTs were counted (Figure 4).

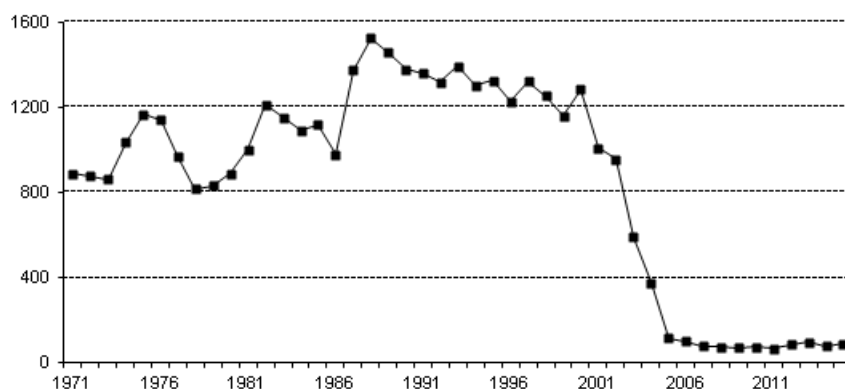


Figure 4. Number of apparently occupied herring gull territories on Canna 1971-2015.

3.1.8 Great black-backed gull

As with other large gull species there was a substantial decline in numbers on Canna between 2000 and 2005. Numbers now appear stable at a low level with only 18 AOTs in 2015 (Figure 5).

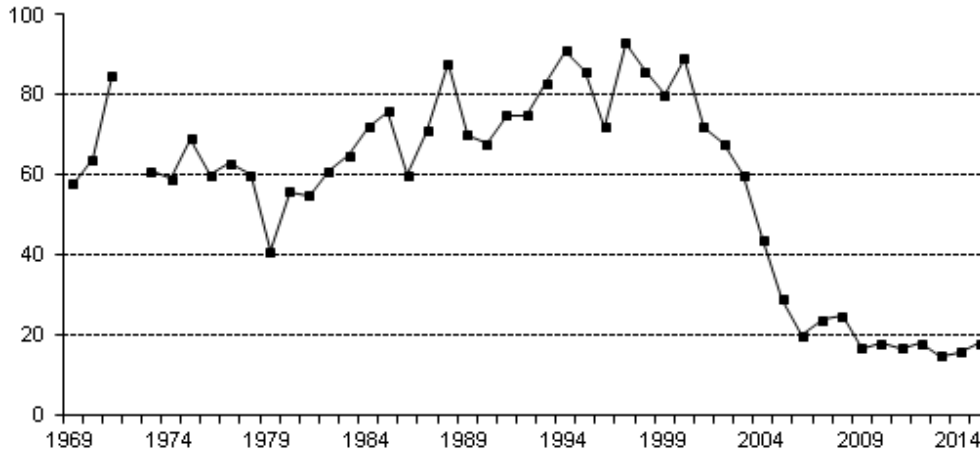


Figure 5. Number of apparently occupied great black-backed gull territories on Canna 1969 -2015.

3.1.9 Black-legged kittiwake

In the late 1970s and 1980s black-legged kittiwake numbers fluctuated around 840 AONs. They then increased reaching a peak of 1,340 AONs in 2004. Numbers then fluctuated between around 800 and 1000 AONs. 2015 saw a large increase up to 1141 AONs, the highest count since 2004 (Figure 6).

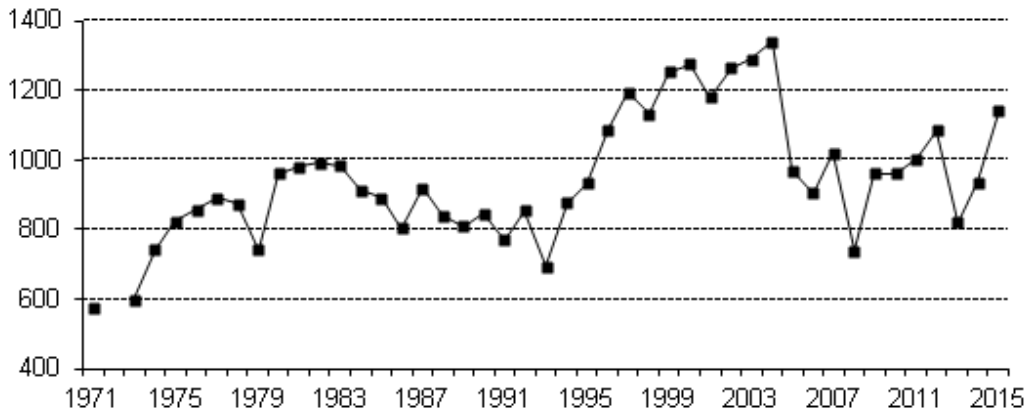


Figure 6. Number of apparently occupied black-legged kittiwake nests on Canna 1971-2015.

3.1.10 Common guillemot

Common guillemot numbers peaked in 2001 when 1,249 ‘nests’ were counted in our studies areas on the island. There was then a long term decline down to 291 ‘nests’ in 2010. Since then numbers have fluctuated at a very low level with 460 ‘nests’ counted in 2014. Unfortunately many birds had vacated the colony prior to our visit in 2015 so we have no reliable data on numbers.

3.1.11 Razorbill

Razorbill numbers on Canna have undergone a long term decline since the early 1990s. 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 but remain low with only just over 200 'nests' counted in our study plots. Unfortunately many birds had vacated the colony prior to our visit in 2015 so we have no reliable data on numbers.

3.1.12 Black guillemot

A total of 79 individual adult birds were counted in 2015 (Table 1). As noted under Methods this under-estimates the true number present and does not follow the methodology suggested by Walsh *et al* (1995).

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 and 2015 was no exception.

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/summaries/anomacts>) comparing 2015 data to the 1981-2010 mean. Winter temperatures between December and April were around the long term average, with mostly average rainfall. May was, however, 2°C cooler than average and 175-200% wetter than average. Temperatures in June and July remained 1°C below average, but with average rainfall.

2015 was a much earlier laying year than expected possibly a week to two weeks ahead of that recorded in 2013 and 2014. This meant that many common guillemots and razorbills had already fledged prior to our arrival on the island.

3.3 Breeding success

Details are given of the 2015 results for each species and comparisons with past years are shown in Table 5. Further long-term analyses are given in Swann (2000).

Table 5. Breeding success of selected seabirds on Canna 2006-2015.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Northern fulmar	0.47	0.27	0.23	0.36	0.42	0.46	0.37	0.37	0.23	0.44
European shag ^a	1.2*	1.4*	1.5*	1.8*		1.4*		1.0*	1.5*	1.8*
European shag ^b	0.7	1.0	0.3	0.7	1.5	0.8	1.6	1.0	0.7	1.2
Herring gull	0.24	1.8	0.5	0.7	1.8	2.1	1.6	1.6	1.1	0.7
Great black-backed gull	0.2	0.8	0.5	0.9	1.6	1.0	2.2	0.7	0.9	0.9
Black-legged kittiwake	0.45	0.3	0	1.1	0.8	0.7	1.1	0.5	0.9	0.9

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, large chicks per nest for European shags and black-legged kittiwakes, large chicks per occupied territory for great black-backed gulls and since 2006 for herring gull. For pre 2006 methodology see Swann (2004-11)
3. For European shag ^a refers to no of young fledged per marked nest in the boulder colonies, whilst ^b 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 2 shows the breeding success from the Canna study plots. This gives an overall success rate across all sites combined of 0.44 chicks per apparently occupied site, with large variations between study plots. This is above the long term average of 0.38.

Table 2. Northern fulmar breeding success on Canna in 2015

<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)	15	5	0.33
Buidhe Sgor	27	14	0.52
Sec 5	13	7	0.54
Nunnery	1	1	
Total	78	34	0.44

3.3.2 Manx shearwater

Of six known occupied burrows, three were known to contain an egg in late May. In early August all three burrows contained a large chick.

3.3.3 European shag

There was much variation in productivity between the monitored plots (Table 3). Productivity was particularly high in the boulder colony at Lamasgor.

Table 3. European shag fledging success on Canna in 2015.

<i>Young fledged per nest laid in</i>	<i>Rubha Langanais*</i>	<i>Tallabric Sanday*</i>	<i>Dun Mor area, Sanday*</i>	<i>Lamasgor</i>	<i>Gegasgor</i>
<i>Total No. of nests</i>	8	5	9	33	24
<i>outcome unknown</i>	4	3	2	1	1
0 young	2	2	2	3	6
1 young	0	0	0	4	3
2 young	1	0	3	15	9
3 young	1	0	2	9	5
4 young	0	0	0	1	0
Av	1.25	0	1.71	2.03	1.5
young/AON					

* = nests located on narrow cliff ledges.

Twelve nests still contained eggs or very small young on our final visit, so the outcome of these nests was not known. Of the rest only 15 (23%) failed to produce any young, resulting in a productivity figure of 1.74 young per AON, the highest figure we have recorded since 1997 and well above the long-term average of 1.31 young/AON.

3.3.4 Great skua

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

3.3.5 Herring gull

Only ten pairs were suitable for monitoring. Of these, six pairs failed, two pairs fledged a single chick, one pair fledged two chicks and one pair fledged three chicks giving an overall productivity figure of 0.7 chicks, the lowest recorded since 2009 (Table 6), though the sample size was very small.

3.3.6 Great black-backed gull

Eighteen pairs of great black-backed gull were monitored, eleven pairs failed, one pair produced one young, three pairs produced two young and three pairs produced three young, giving an overall average productivity of 0.9 young per nesting pair. This is similar to the figure recorded in 2014 (0.9) and is close to the long term average figure of 0.8 young/nest.

3.3.7 Black-legged kittiwake

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

Table 4. Number of occupied black-legged kittiwake nests and number of large young per nest in study plots in 2015.

	<i>Sanday,K1</i>	<i>Sanday,K2</i>	<i>Sanday,K3</i>	<i>Sanday,K4</i>	<i>Buidhe Sgor</i>
<i>No. nests</i>	46	27	23	26	99
Empty	13	13	14	11	30
1 young	18	14	6	14	47
2 young	14	8	3	1	18
3 young	1	1	0	0	4
av. young per nest	1.07	1.22	0.52	0.61	0.96

There was much variation in breeding productivity between the different study plots, ranging from 0.52 young per AON at K3 to 1.22 at K2. Overall the mean number of young fledged per AON was 0.93, above the long term average of 0.67.

3.3.8 Common tern

No Common terns nested on Canna in 2015.

3.3.9 Common guillemot

Seventy four guillemot chicks with a wing length greater than 60mm were weighed (appendix 1). The mean weight of 266.6g was similar to the pre 2015 sample, which had a mean weight of 266g. The weights of large chicks prior to fledging can show significant fluctuations from year to year (Figure 7). This is likely to be related to food availability. This suggests that food was not a major issue in summer 2015.

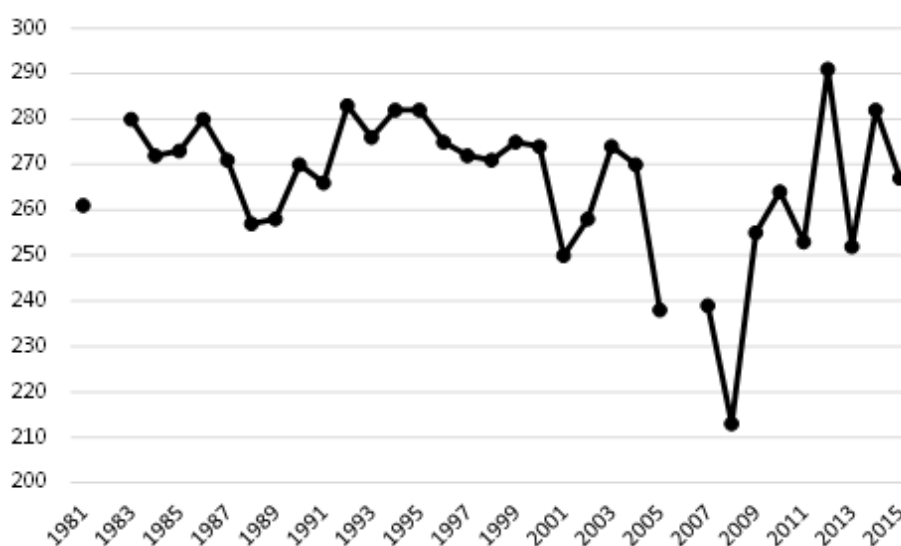


Figure 7. Mean weights of guillemot chicks (g.) with wing-length >60mm.

A sample of 62 adult birds were also weighed. Their mean weight of 871.9g was not significantly different from the 2014 sample, which had a mean weight of 888.6g ($z=-1.72$, $p>0.05$) or the 2013 sample, which had a mean weight of 865.3g ($t=0.591$, $df = 90$, $p>0.05$)

but still significantly lighter than the 912.9g recorded on a sample of 31 birds weighed opportunistically in July between 1976 and 1983 ($z = -3.44$, $p < 0.01$).

3.4 Ringing studies

3.4.1 Ringing totals

Table 6 shows the number of adults and chicks ringed during 2015 and the number of fully-grown birds that were re-trapped.

Table 6. Number of birds ringed and adults re-trapped on Canna in 2015

	<i>Adults ringed</i>	<i>Chicks ringed</i>	<i>Full-grown re-trapped</i>
Northern fulmar	15	16	13
Manx shearwater	2	3	1
European shag	9	287	8
Great skua	0	10	0
Mew gull	0	1	0
Lesser black-backed gull	0	3	0
Herring gull	0	68	0
Greater black-backed gull	0	7	0
Black-legged kittiwake	46	111	57
Common guillemot	146	619	378
Razorbill	57	45	20
Atlantic puffin	60	9	3
Totals	335	1179	480

33 of the Marine Scotland geolocators put on in 2014 were retrieved, 4 from northern Fulmars, 20 from black-legged kittiwakes, 5 from common guillemots and 4 from razorbills. 59 geolocators were deployed, comprising 4 northern fulmar, 25 black-legged kittiwake, 20 common guillemot and 10 razorbills.

3.5 Return and survival rates

3.5.1 Common guillemot

376 adult common guillemots were re-trapped in 2015, of which 80 were birds that had been ringed as chicks on Canna and were re-trapped on the island for the first time. These included: eight 3-year olds, twenty-five 4-year olds, fifteen 6-year olds, but no 7-year to 10-year olds. This is an unusually high number of 3 and 4 year old birds. 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 7. 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 6th 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	1,211	0.5	0.3	0.5	0.6
2007	707	0.8	0.8	0.8	1.6
2008	271	0	0.7	0.7	0.7
2009	966	0.5	2.8	4.3	
2010	310	0.2	1.9		

Suspected high post-fledging mortality between 2004 and 2008 appears to have disrupted this pattern, with very low return rates from the 2004 cohort, many of which perished in a massive wreck off north-west Scotland in September of that year (Swann 2004) and of the 2005-2008 cohorts, whose pre-fledging weights were well below average (Figure 7). Evidence from the 2009 and 2010 cohorts suggests that recruitment rates are showing a marked improvement (Table 7). This also looks to be particularly true of the 2011 cohort, 3.1% of which had been re-trapped in the colony by age 4.

Information from the ringing and re-trapping of this species on Canna is provided to the BTO for their RAS project. This is used to estimate common guillemot adult survival rates, the

quality of the trend is considered to be 'good'. The long-term trend (1981-2014) shows a small, gradual decline for this species, with a large drop in 2004 associated with the wreck (Figure 8). The mean adult survival rate for common guillemot is 87%.



Figure 8. Apparent adult survival of common guillemot, based on four RAS projects, including Canna.

3.5.2 Razorbill

Six razorbills that had been ringed as chicks were re-trapped on the island for the first time in 2015. These were one 2-year old, one 3-year old, two 4-year olds and two 6-year olds. 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 2003-08 cohorts the return rate has slumped to 0.3%, probably a reflection of an assumed large increase in post fledging mortality of underweight chicks. The 2009 cohort, however, showed a marked improvement with 6.3% returning by age 5 and already 5.2% of the 2011 cohort has returned by age 4.

The data from ringing and retrapping adults on Canna is submitted to BTO for its RAS project and along with one historic and another two current projects contribute to the national trend; the quality of the trend is considered to be 'good'. The long-term trend (1981-2014) has remained relatively stable, and high, at around 90% since 1981, although the survival rate has dropped slightly in more recent years. The mean adult survival rate for razorbill is 91%.

3.5.3 European shag

In 2015 six shags, which had been ringed as chicks, were re-trapped on the island for the first time. All were breeders, being caught on nests, and composed of one 4-year old, a 5-year old, a 6-year old, a 8-year old and two over 10 year olds.

3.6 Feeding studies

On Canna we aim to collect diet samples from shags, guillemots and kittiwakes to help assess changes in the main food species being exploited by breeding birds.

3.6.1 Common guillemot

Twenty-six fish were collected and/or identified from adult common guillemots on their return to the colony from fishing trips, ten (39%) were sandeels *Ammodytes* spp, twelve were sprats *Sprattus sprattus* (46%) and four were gadoids – all whiting (15%). Details of the fish sampled are given in Appendix 2.

The mean length of sandeels was 115.5mm (sd 48.79) and like the previous year were much smaller than the long term average of 149.3mm. Similarly sprats, which averaged 103.0mm (sd 11.31), were also, like the previous year, smaller than the long term average of 116.6mm.

Figure 9 shows that between 2002 and 2011 there had been a decline in the percentage of *Clupeidae* (sprats) brought in resulting in common guillemot chick diet being dominated by sandeels, with smaller numbers of gadids. Since 2012, sprats have once again increased in the diet, whilst sandeels have declined.

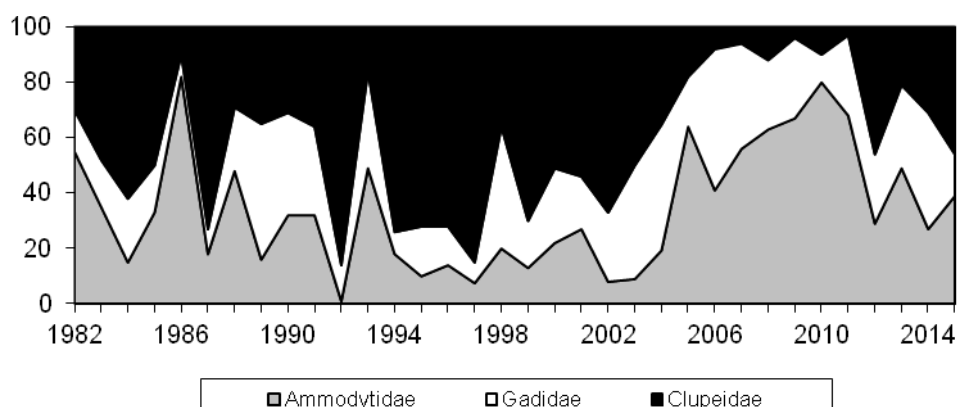


Figure 9. Proportion of fish species taken by common guillemots on Canna 1982-2015.

3.6.2 Razorbill

No data was collected for razorbill in 2015.

3.6.3 European shag

Five regurgitations from chicks were collected on 7 July. Nineteen pellets were collected 3-7 July and two (samples 1&2) on 27 July. Of the 26 samples, 25 contained sandeel otoliths (23 with '0' group and 8 with 1+) and 14 contained gadid remains (Table 8).

Table 8. 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	unidentified gadid otoliths	REMARKS + details of other 'fish'
1	pellet	20,0	0,0	0	
2	pellet	38,38	0,2	1	
3	pellet	7,0	0,0	24	
4	pellet	56,0	0,0	104	
5	pellet	0,0	0,1	32	
6	pellet	48,0	0,0	0	
7	pellet	36,0	0,0	0	
8	pellet	122,0	0,0	4	
9	pellet	47,0	0,1	0	
10	pellet	68,2	0,0	40	
11	pellet	5,0	0,0	0	1+ sandeel (bones)
12	pellet	36,14	0,0	8	
13	pellet	10,0	0,0	1	
14	pellet	73,2	0,0	23	dragonet (1 otolith)
15	pellet	16,0	0,0	0	
16	pellet	27,0	0,0	1	
17	pellet	76,2	0,0	0	
18	pellet	90,0	0,0	15	
19	pellet	102,0	0,0	16	
20	pellet	41,0	0,0	0	flatfish (2 otoliths)
21	pellet	46,0	0,0	4	
22	pellet	5,0	0,0	0	
23	pellet	5,0	0,0	0	
24	pellet	0,14	0,0	0	gadoid (bones)
25	pellet	0,12	0,0	0	
26	pellet	9,21	0,0	0	

3.6.4 Black-legged kittiwake

Twenty-eight food samples were analysed from regurgitations collected from black-legged kittiwakes between 6 and 9 July. Twenty contained gadid remains, seventeen contained sandeel remains (10: 0-group, 7: 1+ group), four contained clupeid remains and two crustacea (Table 9).

Table 9. Number of otoliths and other contents of regurgitations from black-legged kittiwake regurgitations.

Sample number	Sample type	Sandeel otoliths '0', 1+ group	Gadid otoliths Rockling, unidentified	Clupeids	REMARKS + details of 'other' items
1	Regurgitation	0,0	0,0	0	1+ sandeel (bones), gadoid (bones)
2	Regurgitation	8,0	0,2	0	
3	Regurgitation	0,2	0,0	0	
4	Regurgitation	0,2	21,2	0	
5	Regurgitation	0,0	0,2	0	
6	Regurgitation	0,0	0,0	0	1+ sandeel (bones)
7	Regurgitation	2,0	0,105	0	
8	Regurgitation	0,0	0,3	0	
9	Regurgitation	0,0	0,2	0	
10	Regurgitation	0,2	2,0	0	
11	Regurgitation	0,1	0,4	0	
12	Regurgitation	0,0	0,2	0	
13	Regurgitation	13,0	0,0	0	
14	Regurgitation	0,0	0,0	0	gadoid (bones)
15	Regurgitation	0,2	0,0	0	gadoid (bones)
16	Regurgitation	9,0	0,28	0	
17	Regurgitation	14,0	0,0	15	
18	Regurgitation	8,0	0,0	0	
19	Regurgitation	0,0	0,6	0	
20	Regurgitation	0,2	0,5	0	crustacea
21	Regurgitation	44	0,2	3	
22	Regurgitation	0,0	0,4	0	
23	Regurgitation	1,0	0,0	0	clupeid (bones)
24	Regurgitation	2,0	0,0	7	
25	Regurgitation	5,0	0,4	0	crustacea
26	Regurgitation	0,0	0,4	0	
27	Regurgitation	0,0	0,4	0	
28	Regurgitation	0,0	0,0	0	gadoid (bones)

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6. Appendices

6.1 Appendix 1. Common guillemot chick weights

Weights in grammes									
218	220	228	232	242	244	245	246	248	250
250	250	253	254	258	258	260	260	260	262
262	262	264	264	266	267	268	270	270	270
272	272	272	273	274	274	274	274	275	278
278	278	280	281	282	282	282	284	286	287
288	288	288	288	290	290	292	292	296	296
298	298	300	305	305	310	310	310	310	310
310	310	310	315						

Note: Weights taken only from chicks with a wing length of >60mm, which are assumed to be pre-fledging weights. Mean weight was 266.5g.

6.2 Appendix 2. Common guillemot diet samples

Details are given of the size (mm) of fish caught by adult guillemots on Canna in 2015.

Whiting: 4 measured

<i>Length</i>	81	95	110
No. of fish	2	1	1

Sandeel: 9 measured

<i>Length</i>	81	89	111	117	118	122	128	132	150
No. of fish	1	1	1	1	1	1	1	1	1

Sprat: 9 measured

<i>Length</i>	95	111	115	118	122	123	126
No. of fish	1	1	2	1	1	2	1