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**Canna seabird studies 2009**

**Swann, R.L.**

Highland Ringing Group  
14 St. Vincent Road  
Tain  
Ross-shire  
IV19 1JR

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**For further information please contact:**

Seabirds and Cetaceans  
Joint Nature Conservation Committee  
Inverdee House  
Baxter Street  
Aberdeen  
AB11 9QA

[www.jncc.defra.gov.uk](http://www.jncc.defra.gov.uk)

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## Summary

- 1.1 Three visits were made to Canna during 2009 to count and ring seabirds, monitor their breeding success and collect food samples.
- 1.2 The timing of the 2009 breeding season was two to three weeks later than the 1980-2000 average for auks and black-legged kittiwakes.
- 1.3 Counts showed that the breeding populations of many seabird species on Canna remain at very low levels, in comparison to the peak counts of the 1980s. Great black-backed gull and herring gull continued to decline to new record low levels. Northern fulmar, common guillemot, razorbill and black-legged kittiwake showed modest increases counteracting the declines noted in 2008. Mew gull showed a large increase in numbers.
- 1.4 There was a marked improvement in breeding success for most monitored species. Several species had above average breeding success. Black-legged kittiwakes recorded their highest productivity figure since monitoring began in 1986, great black-backed gull best since 2000, herring gull second best since 1977, and European shag best since 2004. Northern fulmar productivity was below average, though better than in 2007-08. Observations suggested that common guillemots and razorbills also had good breeding success and guillemot chicks were significantly heavier than the 2005-08 cohorts.
- 1.5 A total of 446 fully grown seabirds and 1507 seabird chicks were ringed with BTO metal rings and 941 fully grown birds were retrapped in breeding colonies.
- 1.6 Retrapping of adult common guillemots resulted in 243 birds ringed as chicks being located back in colonies for the first time. Twenty one razorbills and fourteen European shags that had been ringed as chicks were retrapped in colonies for the first time.
- 1.7 Eighty-four fish being carried by adult common guillemots were collected and identified. The sample was dominated by sandeels (67%), followed by gadids (29%), mainly whiting. Only three sprat *Sprattus sprattus* were recorded. The diet of European shags was mostly dominated by gadids, whilst black-legged kittiwakes were taking an unusually high percentage of clupeids
- 1.8 Following the successful rat eradication project undertaken on Canna over the 2005/06 winter there were no signs of rat predated eggs or chicks. White-tailed eagles and golden eagles were once again predated large numbers of adult northern fulmars.

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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 2009, the 41<sup>st</sup> 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 seabird counts 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 2009 to cover the seabird breeding season: 20-23 May, 3-11 July, 30 July - 7 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. As there has been a trend in recent years for seabirds to start breeding later we visited Canna slightly later than normal again in 2009. We are very confident that no young auks had fledged prior to our early July visit to the island. The location of the study sites named in the text is 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.

#### **Common guillemot and razorbill**

Counts were made of the number of occupied sites in accessible colonies at Geugasgor. 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.

#### **Other seabirds**

Whole island counts were conducted between 4 and 10 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**

Due to the decline in numbers of this species on Canna most of our original study nests are now abandoned. We have adapted our methodology in order to continue monitoring breeding success of European shag. At the Nunnery, Tallabric and Dun Mor area of Sanday and Rubha Langanais, where birds have shifted to nesting on narrow ledges on the present sea cliff, the position of all nests was mapped on a sketch map in late May. At Lamasgor all nests were individually marked. All nests were checked a second time, in early July, to record nest contents including the number and ages of young that had hatched. In early August the nests were again checked so that the number of young actually fledging could be calculated.

### **Herring gull**

Due to the decline in herring gull numbers we have had to adapt our methodology to calculate breeding success. Swann (2004) gives details of the original methodology. Since 2007 a sample of nesting pairs were 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.

### **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 July and late July/early August to see how many had eggs or chicks. The size and number of chicks was also noted.

### 3 Count results

A summary of the 2009 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 2001-2009.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	Peak (year)
Norther fulmar <sup>1</sup>	402	406	434	436	439	349	346	223	324	669 (1977)
European shag <sup>2</sup>	844	638	603	495	327	349	361	375	324	1,753 (1984)
Great Skua <sup>4</sup>	2	2	2	2	3	3	5	6	6	3 (2005)
Mew gull <sup>4</sup>	10	8	5	6	9	7	13	13	21	21 (2009)
LBB gull <sup>4</sup>	43	42	31	13	4	7	9	6	9	69 (1975)
Herring gull: pairs <sup>4</sup>	1,006	862	587	372	112	96	74	70	66	1,525 (1988)
Herring gull: nests <sup>3</sup>	525	381	292	182	76	50	30	21	15	809 (1988)
GBB gull <sup>4</sup>	72	68	60	44	29	20	24	25	17	93 (1997)
Black-legged kittiwake <sup>2</sup>	1,179	1,264	1,290	1,340	968	905	1,018	739	960	1,340 (2004)
Common tern <sup>3</sup>	0	0	3	1	3	3	2	2	0	18 (1992)
Common guillemot <sup>5</sup>	1,249	-	(881)	906	(79)	697	587	337	459	1,249 (2001)
Razorbill <sup>5</sup>	252	-	-	169	(27)	273	288	170	288	520 (1985)
Black guillemot <sup>6</sup>	67	35	36	44	47	49	68	68	63	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

Counts in brackets are known to be underestimates.

### Northern fulmar

A total of 324 apparently occupied sites were counted. This represents an increase on the 2008 count (Figure 1), but is still well below the numbers counted up to 2005. Once again a large number of northern fulmars were predated by golden eagle *Aquila chrysaetos* and white-tailed eagle *Haliaeetus albicilla*. It is not known what effect this is having on breeding northern fulmar numbers on Canna.

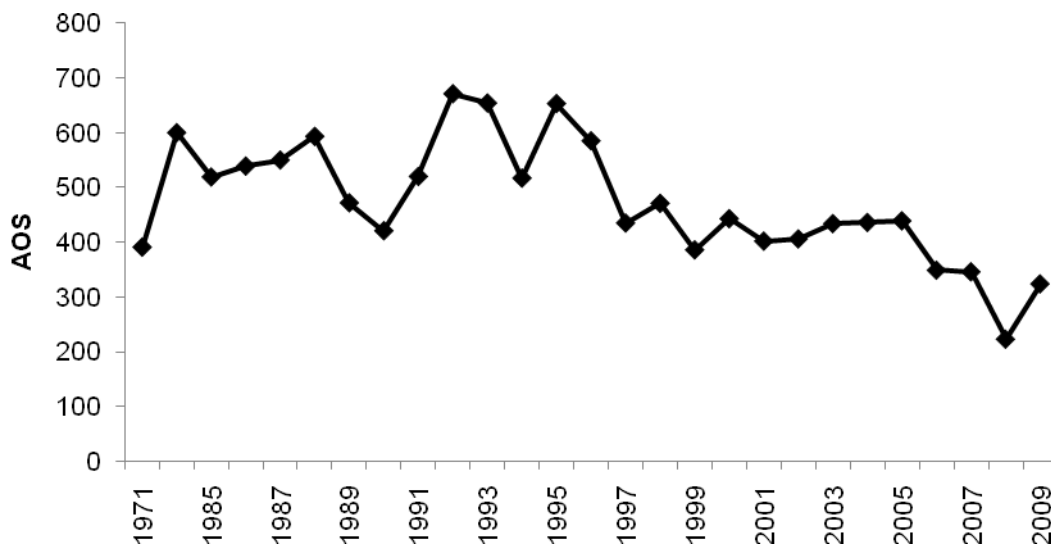


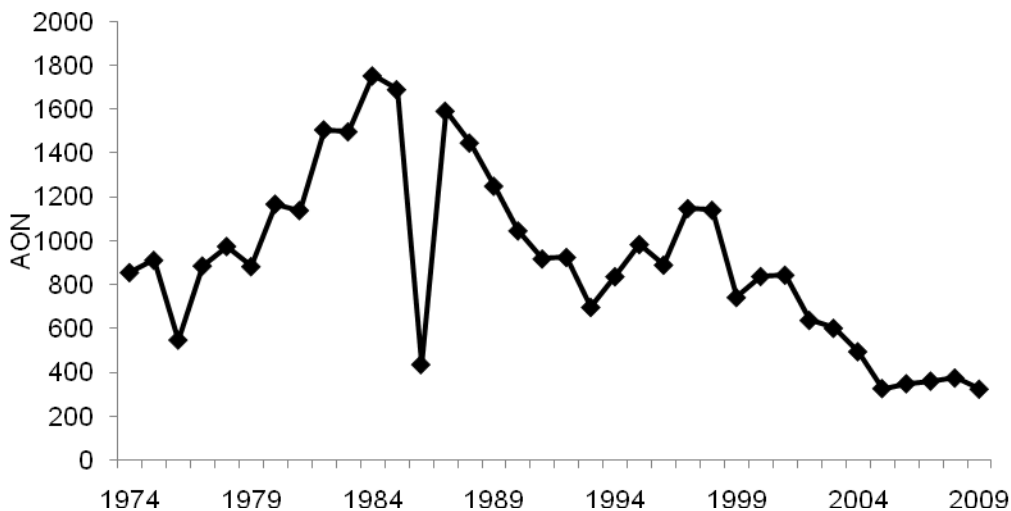
Figure 1. Number of apparently occupied Northern fulmar sites on Canna 1973-2009.

### Manx shearwater

At the former Tarbert Road colony two birds responded to taped calls from over 600 burrows checked in late May. Several birds were also heard calling over this site at night in early April and early May. At the Nunnery 50 burrows were checked, with no responses. Between Bresgor and Garrisdale Point, 50 burrows were checked and one bird responded to the tape playback.

## European shag

There appeared to be a small decline in 2009 with only 324 AONs counted (Figure 2). It was an unusual season with many birds starting to nest early, followed by a period of inactivity before the bulk of the birds began to nest. It is possible that our counts missed some early nesters that failed, but did not relay.



**Figure 2.** Number of apparently occupied European shag nests on Canna 1974-2009.

## Great skua

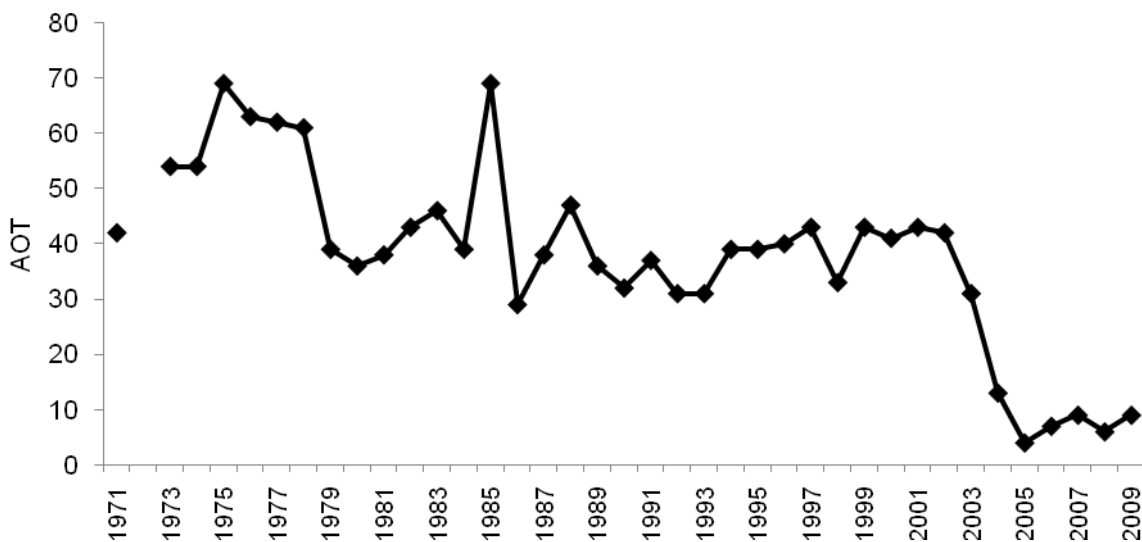
Six pairs of great skua *Catharacta skua* were present on Sanday and five pairs laid eggs.

## Mew gull

The number of mew gulls *Larus canus* showed a major increase with 21 Apparently Occupied Territories (AOT) counted (Table 1).

### 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 since increased slightly with nine AOTs in 2007, six in 2008 but back up to nine in 2009 (Figure 3).



**Figure 3.** Number of apparently occupied Lesser Black-backed Gull territories on Canna 1971-2009.

### Herring gull

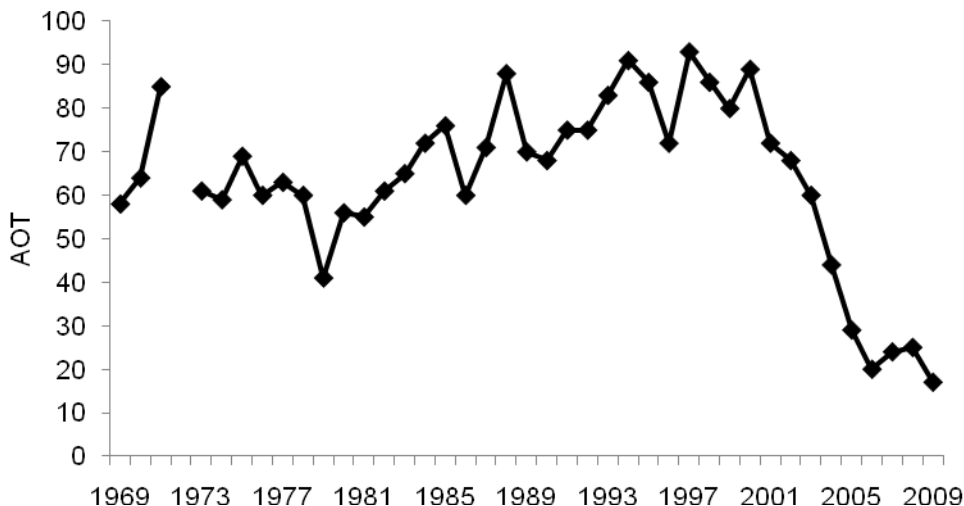
There has been a notable decline in the number of AOTs on Canna since 2000. The figure of 66 AOTs in 2009 is the lowest since monitoring began in 1971 (Figure 4). The most traditional herring gull sub-colonies on the island have now been totally abandoned, in particular there are now no colonies left on the western half of the island. Over the last few years many of the remaining gulls have switched to new nesting sites, particularly the scree slopes above the Tarbert road and cliff and moorland sites on Sanday and above Rubha Langanais. Only the small colonies at Tallabric and Geugasgor occupy traditional sites, though in 2009, seven nests were found at the traditional Rubha Langanais colony.



**Figure 4.** Number of apparently occupied herring gull territories on Canna 1971-2009.

### Great black-backed gull

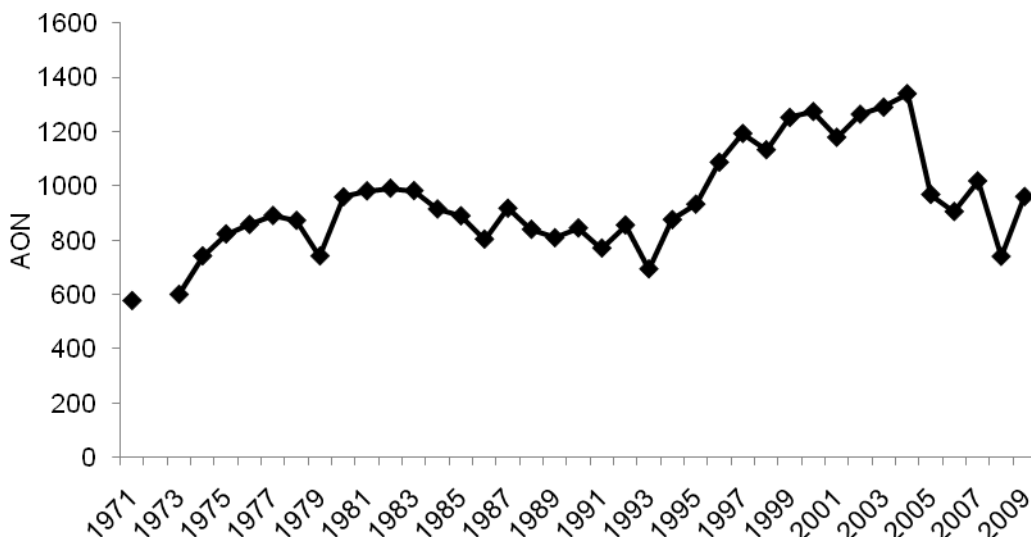
There has been a substantial decline in great black-backed gull numbers on Canna since 2000. The count of only 17 AOTs in 2009 is the lowest we have recorded (Figure 5).



**Figure 5.** Number of apparently occupied great black-backed gull territories on Canna 1969 - 2009.

### Black-legged kittiwake

Following the rise to a record count of 1,340 AONs in 2004, numbers decreased drastically in 2005. Since then numbers have fluctuated, particularly at the north side of the island (Figure 6). In 2009, numbers recovered from the very low levels recorded in 2008 to 960 AONs.



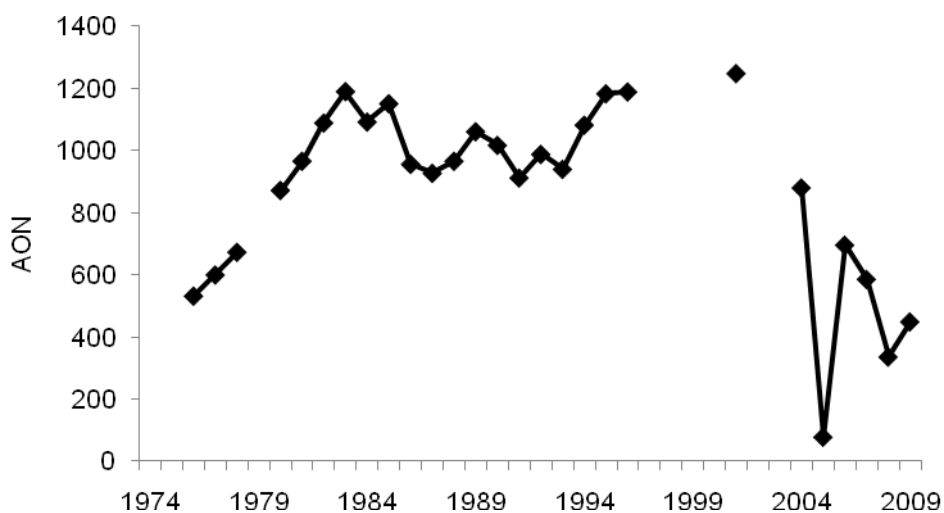
**Figure 6.** Number of apparently occupied black-legged kittiwake nests on Canna 1971-2009.

### Common tern

No common terns *Sterna hirundo* nested in 2009.

### Common guillemot

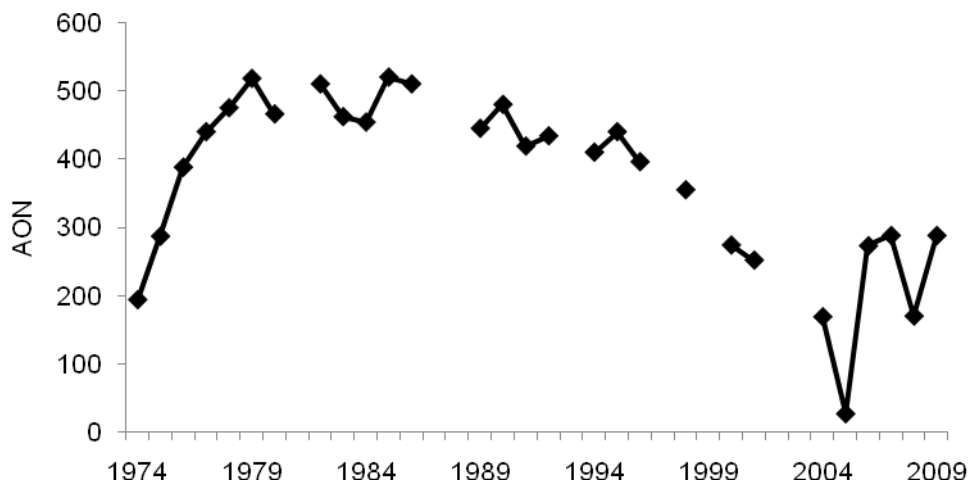
Common guillemot numbers peaked in 2001 when 1249 'nests' were counted in our study areas. In 2005, there was a dramatic decline with only 79 'nests' counted. Numbers increased in 2006 to 697 'nests' and thereafter numbers declined to only 337 'nests' in 2008. In 2009, numbers showed a slight increase to 450 'nests' (Figure 7). These figures underestimate the actual number of birds attempting to breed as many of the more open sub-colonies are subject to severe egg predation from common ravens *Corvus corax* and gulls, and in some cases have been virtually abandoned by the time of our July visits. There was also some evidence that some adults had returned but had not attempted to breed, as at some sub-colonies, large numbers of adults were occasionally present but with very few incubating eggs or brooding young.



**Figure 7.** Number of common guillemot 'nests' in all study plots on Canna 1974-2009.

## Razorbill

Razorbill numbers on Canna have undergone a long term decline since the early 1990s (Figure 8). The years of 2006 and 2007 saw an increase in numbers following the rat eradication campaign over winter 2005/06 (Bell et al 2006), with numbers back up to 2001 levels at Geugasgor. In 2008 this was reversed with only 170 ‘nests’ being counted in our study plots (likely a result of high levels of non-breeding). In 2009, numbers increased to 288 ‘nests’, the highest since the eradication project.



**Figure 8.** Number of razorbill ‘nests’ at Geugasgor and at all other sites on the island 1974-2009.

## Black guillemot

Numbers remain stable with 63 individual adult birds counted in 2009 (Table 1). As noted under the Methods section, this under-estimates the true number present.

## 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. There has, however, been a notable apparent increase in numbers at Geugasgor, following the rat eradication in winter 2005/06 (Bell et al 2006). New burrows are appearing at several locations on the Geugasgor slopes.



## 4 Timing of breeding results

Weather data for the Canna area was extracted from Meteorological office anomaly maps (<http://www.metoffice.gov.uk/climate/uk/anomacts/#>) comparing 2009 data to the 1970-2000 mean. This showed that January to March were 1°C warmer than average, with average rainfall, but February, which was drier than average. April had temperatures 2°C warmer than average and was also wetter than average. May was also wetter than average (+175%), but temperatures were average. June and July had temperatures about 1°C warmer than average, with below average rainfall (50%). Local sea temperatures in July 2009 were reported to be 2°C lower than those recorded in 2008.

As has been typical for the last few years, most birds laid later than normal. In the early July visit, most black-legged kittiwake and common guillemot were still on eggs or small young (less than half grown). There was no evidence of auk chicks having left the island prior to our visit. It is suspected that poor food supplies early in the season may have once again delayed birds getting into condition to breed. Some European shag had laid early, with chicks close to fledging in early July, but the majority of the birds were still on eggs and small chicks.

## 5 Breeding success results

A summary of the 2009 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 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Northern fulmar	0.44	0.48	0.45	0.46	0.56	0.28	0.47	0.27	0.23	0.36
European shag <sup>a</sup>	0.80	0.10	0.26	0.16	0.01	0.7*	1.2*	1.4*	1.5*	1.8*
European shag <sup>b</sup>					1.4	0.7	0.7	1.0	0.3	0.7
Herring Gull			0.07	0.05	0.16	0.13	0.24	1.8	0.5	0.7
Great b-b gull	1.3	0.3	0.1	0.3	0.3	0.1	0.2	0.8	0.5	0.9
Blk-legged Kittiwake	0.51	0.83	0.61	1.01	0.78	0	0.45	0.33	0	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 chicks fledged per apparently occupied nest for black-legged kittiwakes.
3. For herring gull figure gives an all-island estimate of chicks per nest, based on various sub-colonies.
4. For European shag <sup>a</sup> refers to number 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.

### Northern fulmar

Table 3 shows the breeding success of Northern fulmar from four study plots. This gives an overall success rate of 0.36 chicks per apparently occupied site across all sites combined, with big variations between study plots. It also represents an improvement in breeding success compared to the previous two years.

**Table 3.** Northern fulmar breeding success on Canna in 2009.

Study site	No. sites	No. young	Young per site
Sanday A	25	5	0.20
Sanday B (Dun Mor)	19	3	0.16
Nunnery/Garrisdale	3	2	
Buidhe Sgor	31	18	0.58
Total	78	28	0.36

### Manx shearwater

One occupied burrow was known to contain an egg in late May but subsequent checks showed the nesting attempt had failed.

### European shag

As stated in the methods section we have adapted our methods of monitoring European shag breeding success.

**Table 4.** European shag fledging success on Canna in 2009.

<i>Young fledged per nest laid in</i>	<i>Lamasgor</i>	<i>Garrisdale</i>	<i>Nunnery*</i>	<i>Rubha Langanais*</i>	<i>Tallabric Sanday*</i>	<i>Dun Mor area, Sanday*</i>
<i>No. nests</i>	65	4	5	4	11	12
0	10	3	4	0	3	2
1	7	1	1	2	2	0
2	34	0	0	0	2	9
3	14	0	0	2	4	1
Av young/AON	1.8	0.2	0.2	2.0	1.6	1.7

\* = nests located on narrow cliff ledges.

Overall, success was high with 1.6 young per AON, the highest recorded since 2004. Success was low on cliff sites at Garrisdale and the Nunnery due to repeated egg predation by common ravens.

### Great skua

Of the five pairs that nested, two pairs reared two chicks whilst the other three pairs failed. Another pair was present but did not nest.

### Herring gull

Only 18 pairs of Herring Gull were monitored. The results are shown in Table 5.

**Table 5.** Herring Gull productivity on Canna in 2009.

	<i>Dun Mor, Sanday</i>	<i>Tarbert Road</i>	<i>others</i>
<i>Number of nests</i>	5	9	4
Failed	2	7	2
One young	1	0	1
Two young	2	2	1
Three young	0	0	0
Average young/pair	1.0	0.4	0.75

This gives an overall average productivity of 0.7 young per pair, higher than 2008 but still well down on that recorded in 2007.

### Great black-backed gull

Fourteen pairs of great black-backed gull were monitored, seven failed, two produced one young and four produced two young and one produced three young, giving an overall average breeding success of 0.9 young per pair, the highest figure recorded since 2000 as shown in Table 7.

## Black-legged kittiwake

The results obtained from the four Sanday study plots and the cave on the north side of Canna are detailed in Table 6.

**Table 6.** Number of occupied black-legged kittiwake nests and number of large young per nest in study plots in 2009.

	<i>Sanday,K1</i>	<i>Sanday,K2</i>	<i>Sanday,K3</i>	<i>Sanday,K4</i>	<i>Cave</i>
<i>No. nests</i>	38	29	32	32	101
Empty	8	7	12	10	
1 young	9	10	12	13	
2 young	21	12	8	9	
av. young per nest	1.3	1.2	0.9	1.0	1.1

On Sanday, 131 monitored nests produced 116 young and at the cave 131 nests produced 144 young. This gives an overall average breeding success of 1.1 young per AON, the highest breeding success figure recorded since monitoring began in 1986.

## Common tern

No Common terns nested on Canna in 2009.

## Common guillemot

Only 25 guillemot chicks were found with a wing length greater than 60mm, all were weighed (Appendix 1). The mean weight of 254.6g was significantly higher than the mean of 212.8g recorded in 2008 ( $t= 5.487$ ,  $df 51$ ,  $p<0.01$ ). They were, however, significantly lighter than the pre-2005 birds, which had a median weight of 272g ( $U=8486.0$ ,  $p<0.05$ , Mann-Whitney U test). This could partly be due to the fact that the 2009 sample were all weighed in early August and were therefore some of the last chicks to fledge and so may not be totally representative of chicks fledging earlier in the season. Despite this, these birds were significantly heavier than similar sized chicks weighed 2005-2008, indicating that chicks of the 2009 cohort were in much better condition than the previous four years (Table 7).

**Table 7.** Weights of guillemot chicks (g.) with wing-length >60mm.

	1998	1999	2000	2001	2002	2003	2004	2005	2007	2008	2009
mean	271	275	274	250	258	274	270	238	239	213	255
n	51	60	60	56	54	50	50	30	17	25	25

## Razorbill

Based on visual assessment razorbill chicks were found to be in good condition in 2009 compared to 2008.

## 6 Ringing studies

### 6.1 Ringing totals

Table 8 shows the number of adults and chicks ringed during 2009 and the number of fully-grown birds that were re-trapped. Improved breeding success led to higher numbers of birds being ringed compared to 2008. The use of a fleyg net boosted the number of adult Razorbill and Puffin caught.

**Table 8.** Number of birds ringed and adults retrapped on Canna in 2009

	<i>Adults ringed</i>	<i>Chicks ringed</i>	<i>Full-grown retrapped</i>
Northern fulmar	7	19	10
European shag	17	299	17
Great skua	0	4	0
Mew gull	0	6	0
LBB Gull	0	6	0
Herring gull	0	22	0
GBB gull	0	13	0
Black-legged kittiwake	14	62	7
Common tern	0	0	0
Common guillemot	255	966	848
Razorbill	101	142	59
Atlantic puffin	52	6	0
<b>Total</b>	<b>446</b>	<b>1507</b>	<b>941</b>

### 6.2 Ringing recoveries

The average first year recovery rate of all chicks ringed on Canna between 1973-2004 and subsequently reported to the BTO ringing scheme was 1.4%. The first year recovery rate of chicks ringed between 2005 and 2008 was only 0.4% (12 from 2693 ringed). This suggests that a high percentage of chicks, many of which were significantly lighter than usual, probably perished shortly after fledging.

## 7 Return and survival rates results

### Common guillemot

Eight hundred and fifty-eight adult common guillemots were retrapped in 2009, of which 243 were birds that had been ringed as chicks on Canna and were retrapped on the island for the first time. These included: one 2-year old, two 3-year olds, five 5-year olds, 31 6-year olds, 17 7-year olds, 26 8-year olds, 23 9-year olds and 26 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 the subsequent return rates of surviving birds to the colony.

**Table 9.** 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	
2004	1,895	0.5	0.5		

The 1996 and 1998 cohorts, with their very low first year recovery rates, showed high return rates whilst the 1997 and 2000 cohorts, which had higher first year recovery rates, exhibited relatively low return rates (Table 9). Recent high post-fledging mortality will likely disrupt this pattern in the future as will the increased tendency to non-breeding by many adults. This latter effect may explain why a lower number of the 2001 and 2002 cohorts were retrapped by age 7, and a lower number of the 2003 cohort by age 6, than expected.

### Razorbill

Twenty one razorbills that had been ringed as chicks were re-trapped on the island for the first time in 2009. These included a 5-year old, a 6-year old, five 7-year olds, two 8-year olds and three 10-year old birds.

### European shag

Fourteen shags that were ringed as chicks were retrapped on the island for the first time in 2009. All were breeders, being caught on nests, and comprised one 3-year old, two 4-year olds, three 5-year olds, two 6-year olds, two 7-year olds, three 9-year olds and one 10 year old.

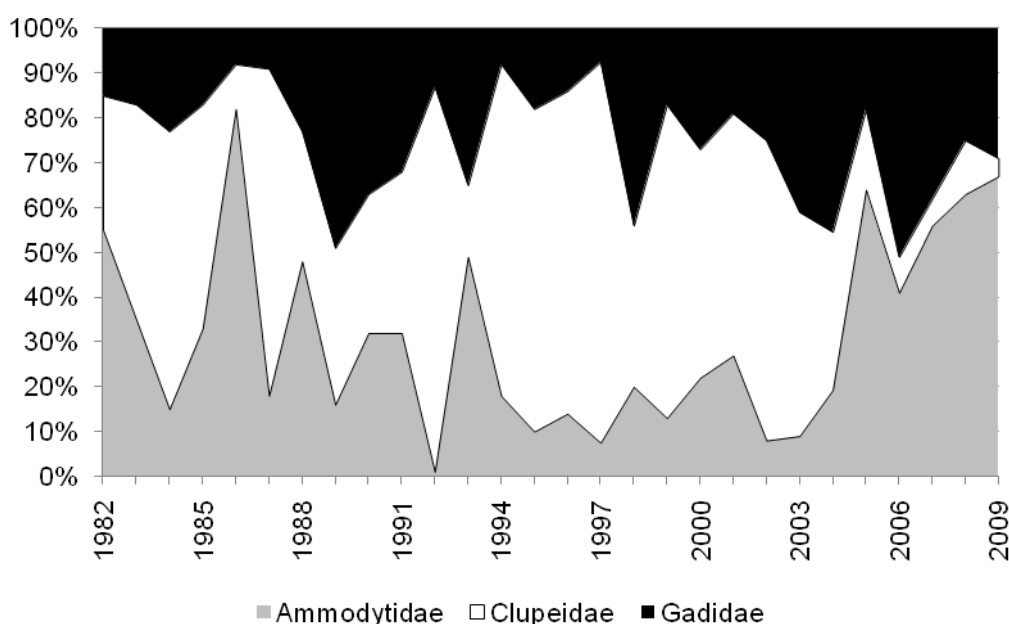
## 8 Feeding studies

### Common guillemot

Eighty four fish were collected from adult common guillemots on their return to the colony from fishing trips; three (4%) were sprats *Sprattus sprattus*, 56 (67%) sandeels *Ammodytes* spp. and 25 (29%) Gadidae. Details of the fish sampled are given in Appendix 2.

The mean length of the sandeels at 142.8mm (sd 17.9) was significantly larger than the 2001-05 average of 121.4mm (sd 37.27 ( $z = 3.97, p < 0.01$ )). Of the Gadidae most (22) were whiting *Merlangius merlangus*, 2 were *Trisopterus* sp. and one haddock *Melanogrammus aeglefinus*. The average size of the whiting was 87.5 mm (sd 12.7), not significantly different to the 2001-05 average of 90mm (sd 12.1) ( $z = 0.71, ns$ ).

Figure 9 shows that since 2002 there has been a significant decline in the percentage of sprats. Since 2005, common guillemot chick diet has been dominated by sandeels, with smaller numbers of gadids and very few sprats.



**Figure 9.** Proportion of fish species taken by common guillemots on Canna 1982-2009.

### European shag

One regurgitation from a young European shag, collected on 5<sup>th</sup> July contained gadid flesh, whilst a second collected on 2<sup>nd</sup> August contained 1+ sandeels along with Gadid flesh and bones. Only four pellets regurgitated by European shags were collected (Table 10). Pellets 1-3 were collected on 2<sup>nd</sup> August and pellet 4 on 6<sup>th</sup> August. The counts in Table 10 refer to the number of otoliths per pellet. As is typical of Canna shags (Swann et al 2008), the diet was dominated by gadidae.

**Table 10.** Contents of regurgitated shag pellets.

Pellet number	<i>trisopterus</i> otoliths	Other gadid otoliths	sandeel otoliths	REMARKS + details of 'other' fish
1	20	70	10	12 small crustacean
2		1	10	
3	4	44		
4		168		1 polychaete jaw

## **Black-legged Kittiwake**

Nine food samples were analysed from regurgitations from black-legged kittiwakes on 9-10<sup>th</sup> July. Two samples contained 0-group sandeels. Five contained small clupeids, one with small rockling, one with a large gadid bone and one with 0-group sandeels. A single sample contained 4 small gadid otoliths with large sandeel bones and a clupeid otolith. The final sample contained a large Clupeid and a 0-group sandeel otolith.

Black-legged kittiwake diet on Canna is usually dominated by sandeels (Swann *et al* 2008). The percentage of samples containing clupeids (77%) was the second highest we have recorded.

## **Atlantic puffin**

Five food samples were collected from puffins. One load contained two small Rockling *Ciliata/Gaidrosparus sp.*, one contained a whiting, two contained small sprats (3 and 5) and one 4 small sprats and a small sandeel. Full details are in appendix 2.

A review of all fish samples collected on Canna between 1981 and 2007 (Swann *et al* 2008) showed there were few significant temporal changes in species composition or the size of prey taken over the 27 years. The results also confirmed earlier findings that gadids are a normal and important part of the diet of seabirds on Canna.



## 9 References

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## 10 Appendices

### Appendix 1. Common guillemot chick weights

Weights in grammes									
226	246	232	176	275	250	231	285	254	229
253	286	275	285	274	262	234	280	281	282
253	280	252	224	250	246	254	254		

Note: Weights taken only from chicks with a wing length of >60mm. Mean weight was 254.6g. All birds were weighed on 3 August 2009, so may not be representative of chicks fledging earlier in the season.

## Appendix 2. Diet samples

### Common guillemot

Details are given of the size (mm) of fish caught by adult guillemots on Canna in 2009.

Whiting: 22 measured

<i>Length</i>	71	72	74	76	78	79	80	82	84
No. of fish	1	1	1	1	1	2	1	2	1

<i>Length</i>	85	86	88	90	92	93	97	101	104
No. of fish	1	1	1	1	1	1	1	1	1

<i>Length</i>	111	120
No. of fish	1	1

*Tisopterus* sp: 2 measured

<i>Length</i>	130	146
No. of fish	1	1

Haddock: 1 measured

<i>Length</i>	108
No. of fish	1

Sprats: 3 measured

<i>Length</i>	91	118	123
No. of fish	1	1	1

Sandeels: 56 measured

<i>Length</i>	102	106	109	116	118	120	125	126	128
No. of fish	1	1	1	1	1	1	2	1	1

<i>Length</i>	130	131	134	136	137	139	140	142	143
No. of fish	1	3	3	2	1	1	3	1	3

<i>Length</i>	144	145	146	147	150	152	153	155	158
No. of fish	2	4	2	2	1	3	1	6	1

<i>Length</i>	160	164	165	175	185	205
No. of fish	1	1	1	1	1	1

## Puffin

Sprat: 12 measured

<i>Length</i>	33	36	37	39	40	44	49	55
No. of fish	1	1	5	1	1	1	1	1

Rockling: 2 measured

<i>Length</i>	35	37
No. of fish	1	1

Whiting: 1 measured

<i>Length</i>	76
No. of fish	1

Sandeel: 1 measured

<i>Length</i>	71
No. of fish	1