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Canna seabird studies 2008

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Summary

1.1 Four visits were made to Canna during 2008 to count and ring seabirds, monitor their breeding success and collect food samples.

1.2 The timing of the 2008 breeding season was later than 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. Northern fulmar, common guillemot and herring gull continued to decline to new record low levels. Razorbills and black-legged kittiwakes declined sharply. European shag, great black-backed gull and great skua showed slight increases in breeding numbers, whilst black guillemot and mew gull numbers remained stable.

1.4 Breeding success for most species was again poor. For only the second time since monitoring began in 1986, black-legged kittiwakes had a complete breeding failure. Northern fulmar productivity was the lowest recorded. Herring gull and great black-backed gull productivity was well below the long term average. European shag productivity was close to the long-term average. Observations suggested that common guillemots and razorbills also had poor breeding success.

1.5 Very low totals of 110 fully grown seabirds and 780 seabird chicks were ringed with BTO metal rings and only 171 fully grown birds were retrapped in breeding colonies.

1.6 Retrapping of adult common guillemots resulted in only 27 birds ringed as chicks being located back in colonies for the first time. Only two razorbills and five European shags that had been ringed as chicks were retrapped in colonies for the first time.

1.7 Partly due to low provisioning rates, only 8 fish being carried adult common guillemots were identified. These were a sprat *Sprattus sprattus*, five sandeels and two gadids. European shags mostly fed on whiting and 0 group sandeels. Black-legged kittiwakes were taking rockling *Ciliata/Gaidrosparus* sp., but the sample size was small.

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. The numbers of European shags slowly continues to increase as did Atlantic puffins at the Geugasgor colony. White-tailed eagles and golden eagles were once again predating adult northern fulmars in large numbers.

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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 2008, the 40th 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 biometrics data from young common guillemots *Uria aalge*; and
- to collect, identify and measure food samples from auks, black-legged kittiwakes, other gulls *Larus* spp. and European shags.

2 Methods

2.1 General

Four visits were made to Canna during 2008 to cover the seabird breeding season: 30 May-2 June, 4-12 July, 19-25 July and 1 -8 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 in 2008. We are very confident that no young auks had fledged prior to our early July visit to the island.

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 *Cepphus 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 late July-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, samples 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 2008 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 2000-2008.

	2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*Peak (year)*
Norther fulmar [1]	443	402	406	434	436	439	349	346	223	669 (1977)
European shag [2]	838	844	638	603	495	327	349	361	375	1,753 (1984)
Great Skua [4]	0	2	2	2	2	3	3	5	6	3 (2005)
Mew gull [4]	15	10	8	5	6	9	7	13	13	18 (1983)
LBB gull [4]	41	43	42	31	13	4	7	9	6	69 (1975)
Herring gull: pairs [4]	1,282	1,006	862	587	372	112	96	74	70	1,525 (1988)
Herring gull: nests [3]	610	525	381	292	182	76	50	30	21	809 (1988)
GBB gull [4]	89	72	68	60	44	29	20	24	25	93 (1997)
Black-legged kittiwake [2]	1,274	1,179	1,264	1,290	1,340	968	905	1,018	739	1,340 (2004)
Common tern [3]	3	0	0	3	1	3	3	2	2	18 (1992)
Common guillemot [5]	(950)	1,249	-	(881)	906	(79)	697	587	337	1,249 (2001)
Razorbill [5]	(274)	252	-	-	169	(27)	273	288	170	520 (1985)
Black guillemot [6]	(54)	67	35	36	44	47	49	68	68	137 (1986)

Notes: Units used are as follows:
1. Apparently occupied site for northern 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 223 apparently occupied sites (AONs) were counted. This represents a marked decrease on the 2007 count (Figure 1), and is the lowest total since monitoring began. 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.

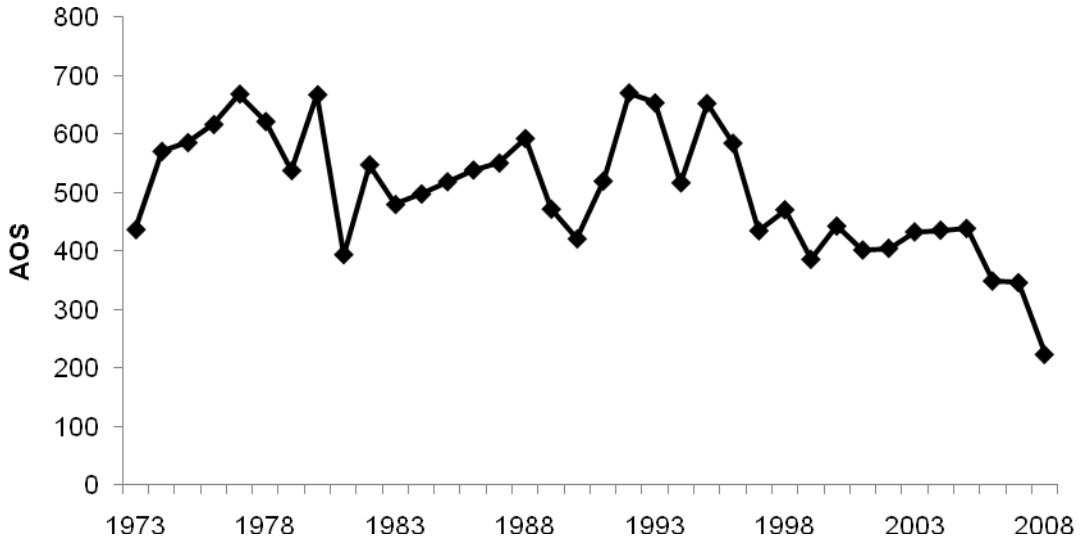

Figure 1. Number of apparently occupied Northern fulmar sites on Canna 1973-2008.

Manx shearwater

At the former Tarbert Road colony no birds responded to taped calls from over 550 burrows checked in late May. Several birds, however, were heard calling over this site at night in early April and early May and 3 in early August. At the Nunnery 48 burrows were checked and between Bresgor and Garrisdale Point 96 burrows were checked, but no birds responded to tape playback. The remains of two predated birds were found close to a peregrine falcon *Falco peregrinus* site at Garrisdale, indicating that birds are probably still prospecting this former sub-colony. Past observations on Canna showed that raptors tend to predate non-breeding shearwaters visiting potential nesting areas at night (Swann pers. obs.).

European shag

Numbers increased slightly again in 2008, to 375 apparently occupied nests up from the low count of 327 AONs in 2005 (Figure 2).

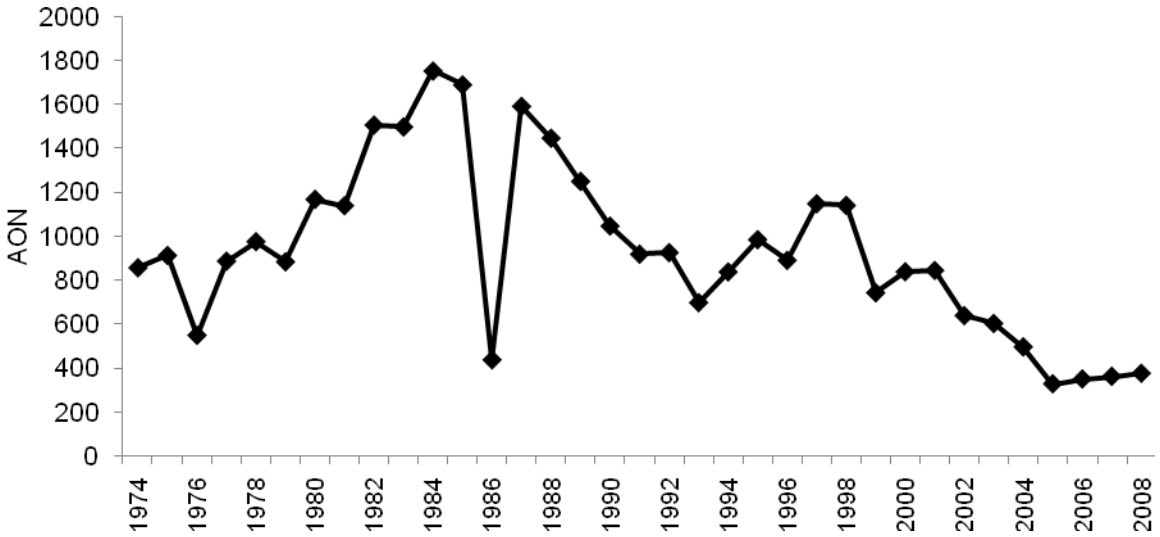

Figure 2. Number of apparently occupied European shag nests on Canna 1974-2008.

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* remained stable with 13 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 4 in 2005. Numbers since increased slightly with 9 AOTs in 2007 but only 6 in 2008 (Figure 3).

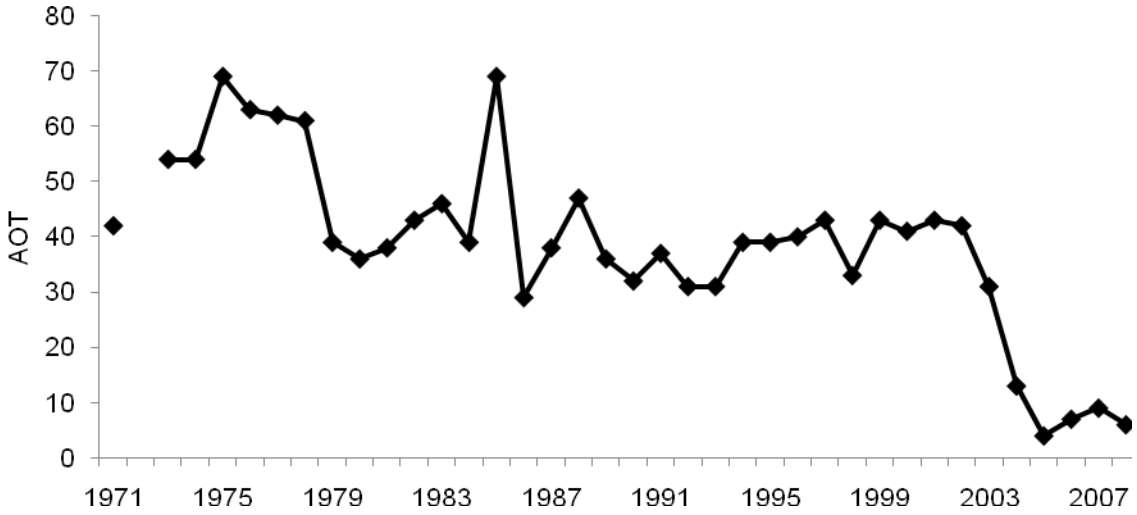

Figure 3. Number of apparently occupied Lesser Black-backed Gull territories on Canna 1971-2008.

Herring gull

There has been a notable decline in the number of AOTs on Canna since 2000. The figure of 70 AOTs in 2008 is the lowest since monitoring began in 1971 (Figure 4). 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.

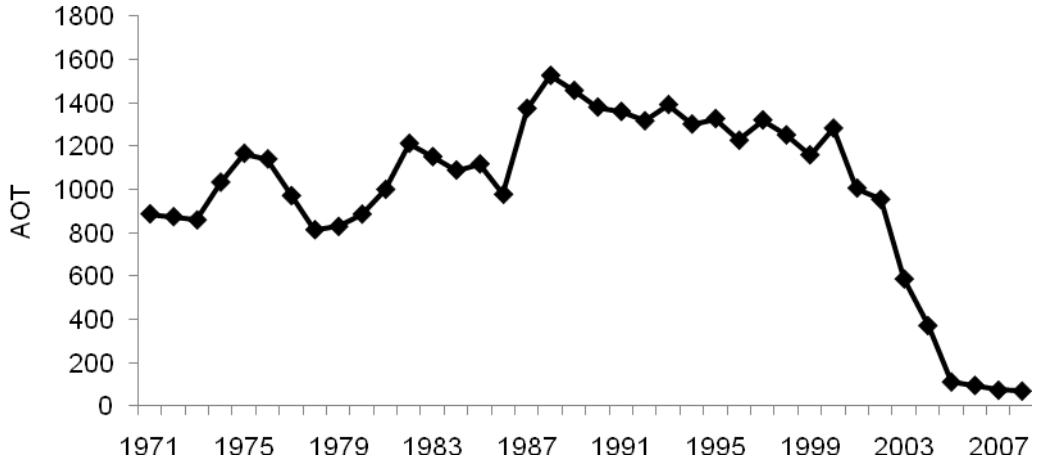

Figure 4. Number of apparently occupied herring gull territories on Canna 1971-2008.

Great black-backed gull

There has been a substantial decline in numbers on Canna since 2000 down to 20 AOTs in 2006. This increased slightly to 24 AOTs in 2007 and 25 in 2008 (Figure 5).

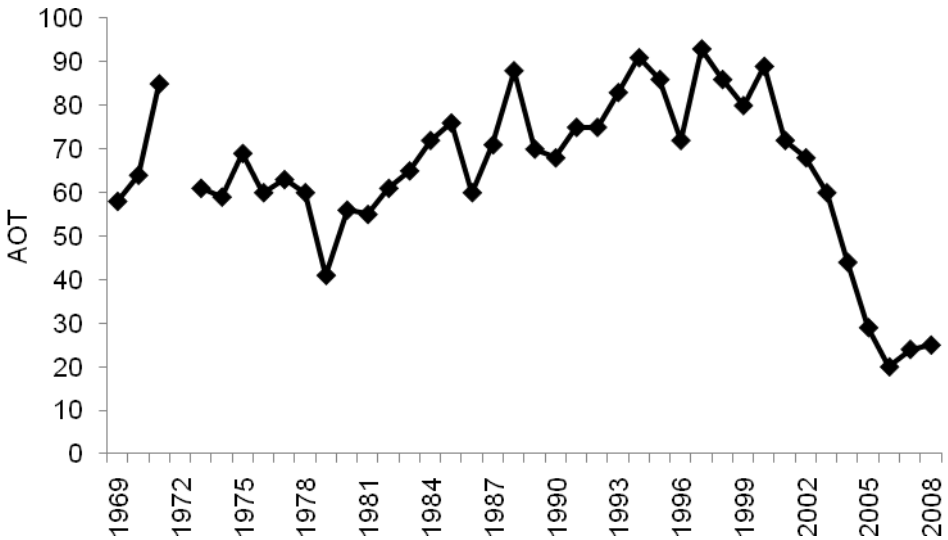

Figure 5. Number of apparently occupied great black-backed gull territories on Canna 1969-2008.

Black-legged kittiwake

Following the rise to the record count of 1,340 AONs in 2004, numbers decreased to 905 AONs in 2006. In 2007, AONs increased to 1,018, however in 2008 they declined to 739 (Figure 6). This was particularly marked at colonies on the north of the island, which have shown a rapid decline in recent years, back to the levels recorded in the 1980s.

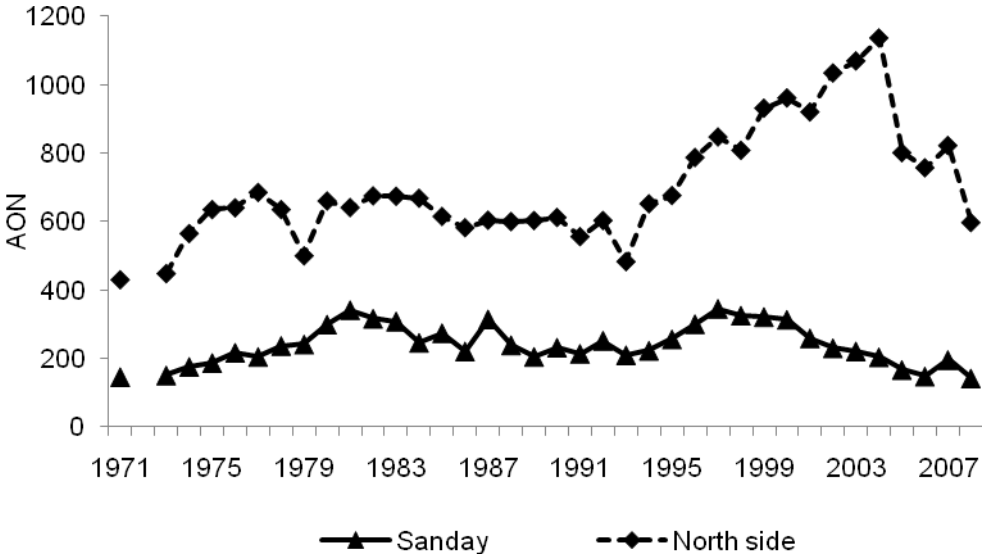

Figure 6. Number of apparently occupied black-legged kittiwake nests on Sanday and north side of Canna 1971-2008.

Common tern

Two pairs of common tern *Sterna hirundo* nested in 2008.

Common guillemot

Common guillemot numbers peaked in 2001 when 1249 ‘nests’ were counted in our study areas with 655 ‘nests’ in the core area. In 2005, there was a dramatic decline with only 79 ‘nests’ counted overall and just 32 in the core area. Numbers recovered in 2006 with 697 ‘nests’ overall with 515 in the core area. This ‘recovery’ was reversed in 2007, when only 587 ‘nests’ were counted, with 387 in the core area. In 2008 this decline continued with only 337 ‘nests’ counted and only 237 in the core area (Figure 7). Once again there was much evidence that many adults had returned but had not attempted to breed, as at some sub-colonies colonies lots of adults were occasionally present, but very few were incubating eggs or brooding young.

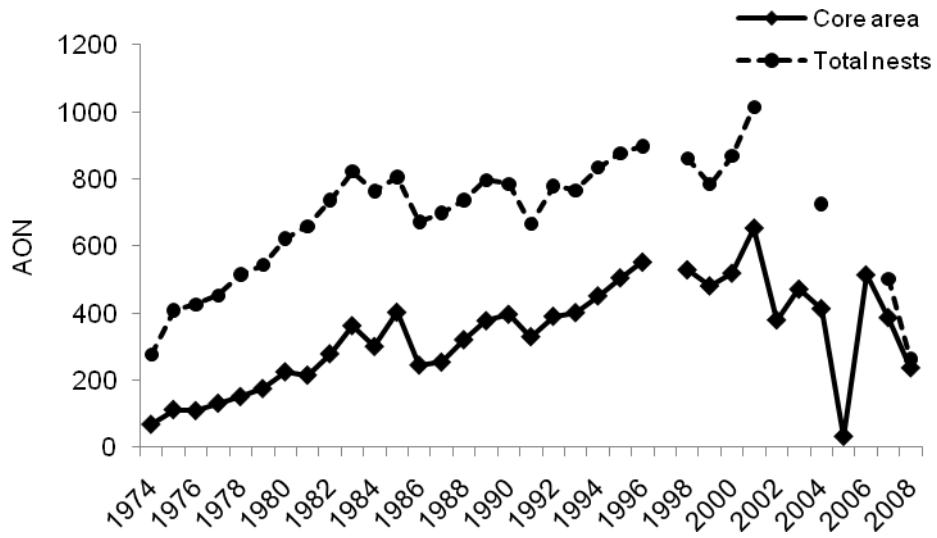

Figure 7. Number of common guillemot ‘nests’ in all study plots on Canna and in the section 1-4 plots only 1974-2008.

The overall decline is less in the core area, where the guillemots nest in small groups amongst boulders along with shags and razorbills. Major declines have occurred in some of the larger more exposed sub-colonies.

Razorbill

Razorbills numbers on Canna have undergone a long term decline since the early 1990s (Figure 10). The years 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.

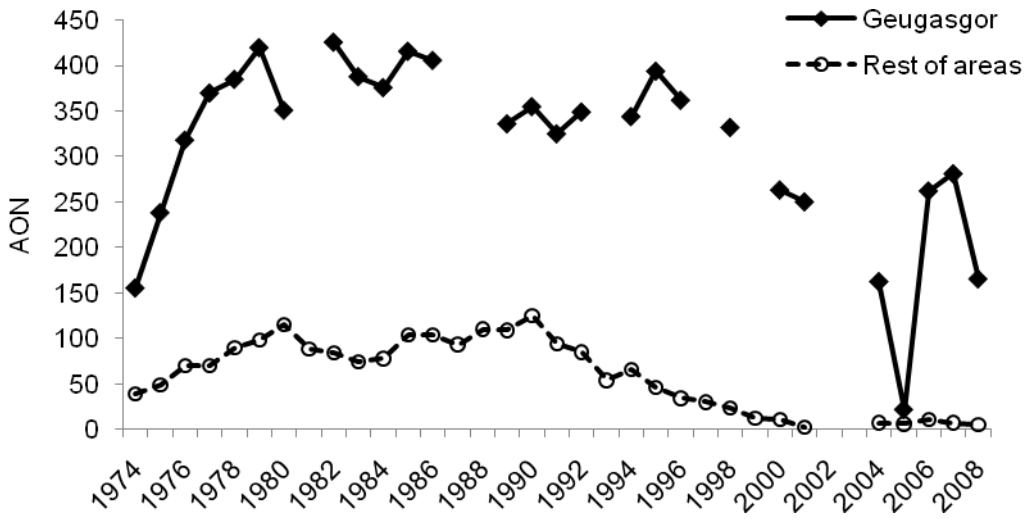

Figure 8. Number of razorbill ‘nests’ at Geugasgor and at all other sites on the island 1974-2008.

Black guillemot

Numbers remain stable with 68 individual adult birds counted in 2008 (Table 1). As noted under Methods 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 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

January and February were 1-2ºC warmer than average, with above average rainfall. March and April had average temperatures, though it was the coldest April since 2001. May was very warm (2.5ºC above average) with well below average rainfall (25%). June had average temperatures, but above average rainfall, though mainly in the form of occasional heavy showers, rather than days of continuous rain. July had above average temperatures (+1.5ºC) but average rain. August also had above average temperatures (+1ºC) but with above average rainfall (125%).

As has been typical for the last few years, most birds laid later than normal. In the early July visit, most black-legged kittiwakes, guillemot and razorbills 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 may have once again delayed birds getting into condition to breed. Only some European shags and herring gulls appeared to have laid earlier with some chicks being close to fledging in early July.

5 Breeding success results

A summary of the 2008 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 1999-2008.

	1999	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Northern fulmar	0.27	0.44	0.48	0.45	0.46	0.56	0.28	0.47	0.27	0.23
European shag [a]	0.91	0.80	0.10	0.26	0.16	0.01	0.7*	1.2*	1.4*	1.5*
European shag [b]						1.4	0.7	0.7	1.0	0.3
Herring gull [a]	11%	63%	10%	4.5%	2%	3%	4%	2%	-	-
Herring gull [b]	0.4	0.4	0.1	0	0	0.4	0	0	(1.5)	0
Herring Gull [c]				0.07	0.05	0.16	0.13	0.24	1.8	0.5
Great b-b gull	1.1	1.3	0.3	0.1	0.3	0.3	0.1	0.2	0.8	0.5
Blk-legged Kittiwake	0 64	0 51	0.83	0.61	1.01	0.78	0	0.45	0.33	0

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 [a] refers to percentage of nests which produced chicks, [b] refers to young fledged per nest based on capture-recapture at sub-colony A (Tallabric), whilst [c] gives an all-island estimate of chicks per nest.
4. For European shag [a] refers to number 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.

Northern fulmar

Table 3 shows the breeding success from four study plots. This gives an overall success rate, across all sites combined, of 0.23 chicks per apparently occupied site (AOS). This was the lowest figure recorded since monitoring began. The recent decline in breeding success and the number of occupied sites suggests that there is now a cause for concern for this species on Canna.

Table 3. Northern fulmar breeding success on Canna in 2008.

Study site	*No. sites*	*No. young*	*Young per site*
Sanday A	23	4	0.17
Sanday B (Dun Mor)	13	3	0.23
Nunnery/Garrisdale	2	0	
Buidhe Sgor	26	8	0.30
Total	64	15	0.23

Manx shearwater

There are currently no occupied study burrows to monitor this species on Canna.

European shag

As stated in the methods section we have been forced to alter our methods of monitoring European shag breeding performance.

Table 4. European shag fledging success on Canna in 2008.

Young fledged per nest laid in	*Lamasgor*	*Garrisdale**	*Nunnery**	*Rubha Langanais**	*Tallabric Sanday**	*Dun Mor area, Sanday**
No. nests	*73*	*3*	*8*	*14*	*13*	*14*
0	11	1	7	14	7	9
1	22	1	1	0	4	3
2	31	1	0	0	2	2
3	9	0	0	0	0	0
Av young/AON	1.5	1.0	0.1	0	0.6	0.5

* = nests located on narrow cliff ledges.

Success was highly variable between colonies. Birds nesting on open cliff sites on Sanday and at Rubha Langanais and the Nunnery suffered high levels of egg predation from gulls and particularly common ravens, which led to an almost complete breeding failure at two of these sub-colonies. Overall, cliff-nesting birds produced 0.32 young per nest. At Lamasgor where birds still nest under boulders, and at Garrisdale where the three monitored nests were under boulders, success rates were much higher. This is a complete reversal of the situation recorded up till 2005, when rats were eradicated from Canna (Bell *et al* 2006) (Table 6). The overall success rate was 1.04 young per nest, similar to 2006 and 2007.

Great skua

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

Herring gull

Twenty-six pairs of Herring Gull were monitored in two sub colonies. The results are shown in Table 5.

Table 5. Herring gull productivity at two sub-colonies on Canna in 2008.

	Dun Mor, Sanday	*Tarbert Road*
No nests	*10*	*16*
Failed	7	11
One young	2	2
Two young	1	2
Three young	0	1
Average young/pair	0.4	0.6

This gives an overall productivity of 0.5 young per pair, lower than that recorded in 2007. At the Tallabric sub colony all 7 nests appeared to have failed.

Great black-backed gull

Twenty-two pairs of great black-backed gull were monitored, 14 of which failed, four produced one young and four produced two young, giving an overall productivity of 0.5 young per pair. This is lower than last year's figure (of 0.8 young per pair), but the second highest figure recorded since 2000.

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Black-legged kittiwake

The results obtained from the four Sanday sub colonies, and the cave and Buidhe Sgor 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 2008.

	Sanday,K1	*Sanday,K2*	*Sanday,K3*	*Sanday,K4*	*Cave*	*Buidhe Sgor*
No. nests	*34*	*26*	*24*	*22*	*90*	*47*
empty	34	26	24	22	90	47
av. young per nest	0	0	0	0	0	0

There was a complete breeding failure throughout the entire colony. This is only the second time breeding failure has been recorded since monitoring began, the previous occasion being 2005. On the 10th July, many nests in all colonies still contained eggs and small young, but by 25th July all had been completely abandoned.

Common tern

Two pairs of common tern nested, one failed, and the other reared two young to fledging.

Common guillemot

Only 25 guillemot chicks were found with a wing length greater than 60mm, all were weighed (Appendix 1). The mean weight of 212.8g was significantly lower than the mean of 239.1g recorded from the 2007 sample ($t= -3.176$, df 40, $p<0.01$). This is the lowest mean weight of large chicks recorded since monitoring began. It should also be noted that the median weight of the 2005 and 2007 cohorts (no birds were weighed in 2006), was significantly lighter than the pre 2005 birds, which had a median weight of 272g ($U=8028.0$, $p<0.05$, Mann-Whitney U test). This suggests that chicks in 2008 were not only late to fledge, but were in very poor condition, possibly a result of food shortages resulting in low provisioning rates by adult birds to their chicks.

Razorbill

A large number of chicks appeared malnourished and were continually calling for food and many eggs were laid late with the majority failing to hatch.

6 Ringing studies

6.1 Ringing totals

Table 7 shows the number of adults and chicks ringed during 2008 and the number of fully-grown birds that were re-trapped. Totals were well below average, partly as a result of declining numbers and poor breeding success. Strong winds prevented access to the largest common guillemot colony, greatly reducing totals for that species. Also no birds were fleyged in 2008.

Table 7. Number of birds ringed and adults retrapped on Canna in 2008.

	Adults ringed	*Chicks ringed*	*Full-grown retrapped*
Northern fulmar	6	11	5
European shag	8	321	5
Great skua	0	7	0
Mew Gull	0	2	0
Herring gull	0	2	0
GBB gull	0	28	0
Black-legged kittiwake	0	8	0
Common tern	12	13	5
Common guillemot	0	2	0
Razorbill	55	271	137
Black guillemot	24	110	18
Atlantic puffin	5	5	1
Total	**110**	**780**	**171**

6.2 Ringing recoveries

The average first year recovery rate of all chicks ringed on Canna between 1973 and 2004, and subsequently reported to the BTO ringing scheme, was 1.4%. Only two (0.4%) of the 550 common guillemot chicks ringed in 2005 were reported. This suggests that most of these chicks, many of which were significantly lighter than usual, perished shortly after fledging. The 2006 first year recovery rate was also 0.4% (5 from 1161), again suggesting a low post-fledging survival rate. The 2007 recovery rate was higher at 0.7% (5 from 707), but still well below the long term average. This suggests that some of the 2007 cohort, which was similar in weight to the 2005 cohort prior to fledging, survived better after fledging.

7 Return and survival rates results

Common guillemot

Only 137 adult guillemots were retrapped in 2008, of which 27 were birds that had been ringed as chicks on Canna and were retrapped on the island for the first time. These included: two 5-year olds, three 7-year olds, four 8-year olds, two 9-year olds and a 10-year old. 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 8. Recovery rates and return rates of common guillemot chicks ringed on Canna.

Year	*No. ringed*	*% recovered in 1st year*	*% back by 5th year*	*% back by 6th year*	*% back by 7th year*
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	
2003	1,911	0.5			

The 1996 and 1998 cohorts, with their very low first year recovery rates, showed high return rates as expected, whilst the 1997 and 2000 cohorts, which had higher first year recovery rates, showed relatively low return rates (Table 8). 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 cohort were retrapped by age 7 than expected.

Razorbill

Only two razorbills that had been ringed as chicks were re-trapped on the island for the first time in 2008. These were a 7-year old and an 8-year old bird.

European shag

Five shags that were ringed as chicks were retrapped on the island for the first time in 2008. All were breeders, being caught on nests, and comprised two 5-year olds, one 6-year old, one 8-year old and one 13 year old.

For all three species there appears to be a trend of fewer young (age 3-4) birds being caught as first time breeders.

8 Feeding studies

Common guillemot

Due to very low provisioning rates of fish by adult birds to chicks and restricted access, due to weather, to the largest common guillemot colony on Canna, we only collected two fish. Another six fish being carried by adult common guillemots on their return to the colony from fishing trips were identified. Of the eight, one (12%) was a sprat *Sprattus sprattus* and the only clupeid recorded, 5 (63%) were sandeels *Ammodytes* spp. and 2 (25%) were gadids. Caution should be taken with regard to these percentages as the sample size is so small. Figure 9 shows that since 2002 there has been a significant decline in the percentage of clupeidae (sprats), which has been compensated for by more ammodytidae (sandeels).

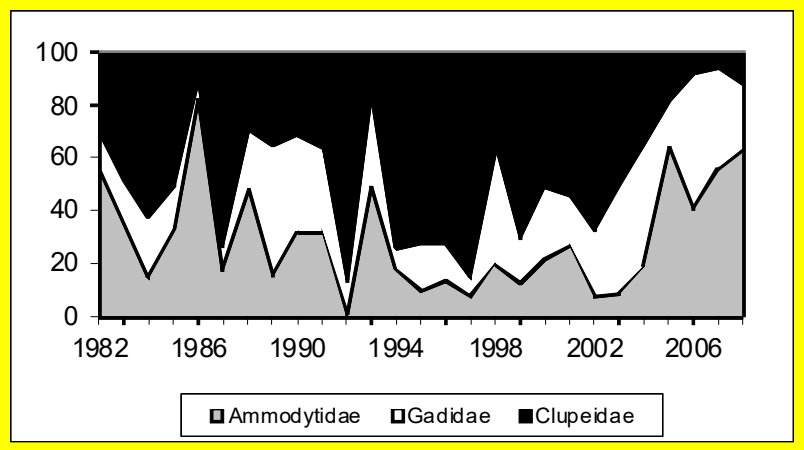

Figure 9. Proportion of fish species taken by common guillemots on Canna 1982-2008.

European shags

One regurgitation from a young European shag, collected on 6th July, contained 4 otoliths of 1+ group sandeels. Seven pellets regurgitated by European shags were also collected (Table 9). Pellets 1-4 were collected on 5th July and pellets 5-7 on 3rd August. The counts in the table 9 refer to the number of otoliths per pellet. As is typical of Canna shags (Swann *et al* 2008), the diet was dominated by gadidae, particularly whiting, though a significant number of 0 group sandeels were also present.

Table 9. Contents of regurgitated shag pellets.

Pellet number	rockling otoliths	whiting otoliths	sandeel otoliths	wrasse otoliths	Other otoliths	REMARKS + details of 'other' fish
1		22		5		
2	2	27				
3		7	91			
4		34	33			
5	2	29	9			
6	1	13				
7		82	2		4	2 flatfish, 2 goby, mollusc

Note: all sandeel otoliths were from '0' group fish.

Black-legged Kittiwake

Three food samples were analysed from regurgitations from young black-legged kittiwakes. Full details are:

1. Rockling otoliths
2. 54 Rockling otoliths + clupeid bones
3. bones of a 1+ group sandeel

Black-legged kittiwake diet on Canna is usually dominated by sandeels (Swann *et al* 2008). These are the first rockling *Ciliata/Gaidrosparus* sp. we have positively identified in Kittiwake samples. No pipefish were observed on any nests in 2008.

9 References

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10 Appendices

Appendix 1. Common guillemot chick weights

Weights in grammes

196	177	190	182	252	210	233	255	260	258
198	212	215	228	230	233	212	246	241	212
186	189	172	148	184					

Note: Weights taken only from chicks with a wing length of >60mm. Mean weight was 212.8g.

Appendix 2. Diet samples

Common guillemot

Details are given of the size (mm) of fish caught by adult guillemots on Canna in 2008.

Sandeels: 2 measured

Length	149	158
No. of fish	1	1