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Canna seabird studies 2005

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Summary

- 1.1 Three visits were made to Canna during 2005 to count and ring seabirds, monitor their breeding success and collect food samples.
- 1.2 The timing of the 2005 breeding season was earlier than average for shags, but later than average for auks and black-legged kittiwakes.
- 1.3 Counts showed that many seabird species are still undergoing major declines on Canna. This trend continued in 2005 with European shag, lesser black-backed gull, herring gull, great black-backed gull, common guillemot and razorbill numbers reaching record lows. Northern fulmar numbers remained stable whereas black-legged kittiwakes, following years of increase, showed a marked decline.
- 1.4 Breeding success was exceptionally poor for most species. Virtually all herring gull, great black-backed gull and black legged kittiwakes failed to rear young. Breeding success was below average for northern fulmars and European shags. Common guillemots and razorbills had a well below average breeding success, and surviving chicks had weights significantly below average. Food shortages and high levels of predation were implicated.
- 1.5 Totals of 142 fully grown and 810 pullus seabirds were ringed with BTO metal rings and 545 fully grown birds were retrapped in breeding colonies.
- 1.6 Retrapping of adult common guillemots resulted in 103 birds ringed as chicks being located back in colonies for the first time. One 3-year old, one 4-year old and eight 5-year olds were amongst those caught. The 1996 and 1998 cohorts, of which very few were reported as dead in their first year of life, continue to show high return rates. The 1997 and 2000 cohorts had low return rates, though this figure is an under estimate, due to many failed breeders having left the colony prior to our visit. Nine razorbills and fourteen European shags that had been ringed as chicks were also retrapped in colonies for the first time.
- 1.7 Only 11 fish were collected from adult common guillemots. Sandeels dominated in number (68%), followed by Sprats *Sprattus sprattus* (18%) and whiting *Merlangius merlangus* (18%). The sandeels were significantly larger in size compared to the 2001-04 average. Black-legged kittiwake samples mainly contained sandeels and gadoids.
- 1.8 Once again there was evidence of high levels of predation were affecting the breeding success of breeding seabirds on Canna. Depredated auk and European shag eggs were found under boulders. Birds forced to nest in more open sites, to escape predation by brown rats *Rattus norvegicus*, were subject to high levels of predation by gulls and common ravens. White-tailed eagles were preying adult common guillemots and northern fulmar and European shag chicks.

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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 2005, the 37th 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, and this is the final year of the current two-year contract with JNCC.

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, 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

Three visits were made to Canna during 2005 to cover the seabird breeding season: 27-30 May, 1-8 July and 1-6 August.

Since 1997, our second visit to the island was a few days later than normal (i.e. from late June into early July) due to circumstances beyond our control. This, combined with a series of earlier than average breeding seasons, meant that in some years many razorbills and a few common guillemots had left the island prior to our arrival, thus affecting the validity of our counts for these two species. In 2005, we are quite confident that no young auks had fledged prior to our early July visit to the island.

2.2 Counts

Manx shearwaters

On the first visit to the island in 2005, using tape playback methods (Walsh *et al* 1995) two observers checked the known traditional shearwater areas between the Nunnery and Garrisdale, with tapes played at 50 burrow entrances.

Common guillemot and razorbill

Counts were made of the number of occupied sites in accessible colonies at Geugasgor and other smaller colonies. Occupied 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 1 July and 7 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, Nunnery and Garrisdale, 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 dramatic decline in numbers of this species on Canna most of our original study nests are now abandoned. We therefore altered our methodology to monitor breeding success of European shag. At Garrisdale, where some birds still nest under boulders all active nests located in May were marked using paint. At the Nunnery, 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. All marked 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 the nests were again checked so that the number of young actually fledging could be calculated.

Herring gull

Nest counts were made in five sub-colonies scattered throughout the island. Two were counted in late May to provide details on clutch size. All were counted in early July and checked for signs of hatching (e.g. copious droppings, food remains, chicks). Nests with no such signs were classed as having failed. In order to estimate breeding success in colony A, nests were counted in late May. On the first sweep through the colony all nests were marked with a plastic coloured tag. On the second sweep each nest found with a tag was given a second tag and those without were given a different coloured tag. Using the information from the second sweep we can calculate our efficiency in finding nests and estimate the total number of nests in the colony.

Great black-backed gull

Accessible pairs were plotted on a map in late May. The sites were revisited in early July 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 to see how many had eggs or chicks. The size and number of chicks was also noted.

3 Count results

A summary of the 2005 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 1996-2005.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Peak (year)
Norther fulmar ¹	585	435	471	386	443	402	406	434	436	439	669 (1977)
European shag ²	890	1,148	1,140	742	838	844	638	603	495	327	1,753 (1984)
Mew gull ⁴	14	13	18	14	15	10	8	5	6	9	18 (1983)
LBB gull ⁴	40	43	(33)	42	41	43	42	31	13	4	69 (1975)
Herring gull: pairs ⁴	1,226	1,320	(1,251)	1,159	1,282	1006	862	587	372	112	1,525 (1988)
Herring gull: nests ³	615	729	748	640	610	525	381	292	182	76	809 (1988)
GBB gull ⁴	72	93	86	80	89	72	68	60	44	29	93 (1997)
Blk-leg'd kittiwake ²	1,087	1,193	1,133	1,252	1,274	1,179	1,264	1,290	1,340	968	1,340 (2004)
Common tern ³	0	1	1	7	3	0	0	3	1	3	18 (1992)
Common guillemot ⁵	1,190	-	(991)	(996)	(950)	1,249	-	(881)	906	(79)	1,249 (2001)
Razorbill ⁵	396	-	(355)	-	(274)	252	-	-	169	(27)	520 (1985)
Black guillemot ⁶	88	75	58	73	(54)	67	35	36	44	47	137 (1986)

Notes: Units used are as follows:

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

Counts in brackets are known to be underestimates.

Northern fulmar

A total of 439 apparently occupied sites were counted. This is very similar to the 2002-2004 counts, but continues the trend of low numbers recorded since 1997 (Figure 1).

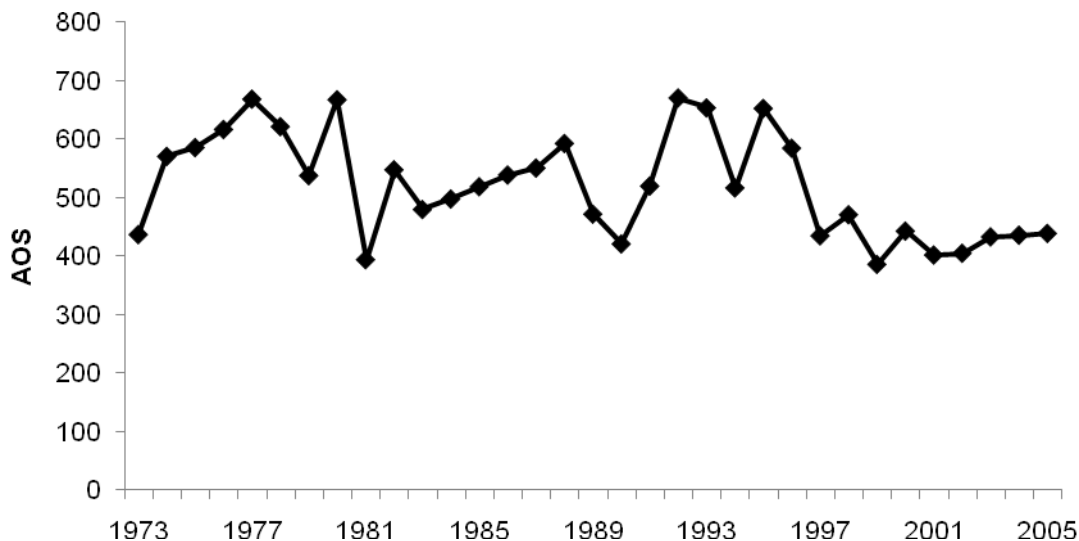


Figure 1. Number of apparently occupied Northern fulmar sites on Canna 1973-2005.

Manx shearwater

No birds responded to taped calls from the 50 burrows checked between the Nunnery and Garrisdale. One predated adult was found at the Nunnery colony.

European shag

Numbers dropped further in 2005, to 327 apparently occupied nests, compared with the 495 in 2004. This is the lowest figure recorded since 1974 (Figure 2). Much redistribution continues with birds moving away from boulder sites and relocating on narrow cliff ledges. This is assumed to be a strategy to avoid mammal predators. No birds now nest under boulders at the former Garrisdale or Nunnery colonies. Figure 3 shows how rapid the declines have been at these colonies. Large decreases are continuing to take place at the Geugasgor colony with many birds moving to nest on the cliff edge.

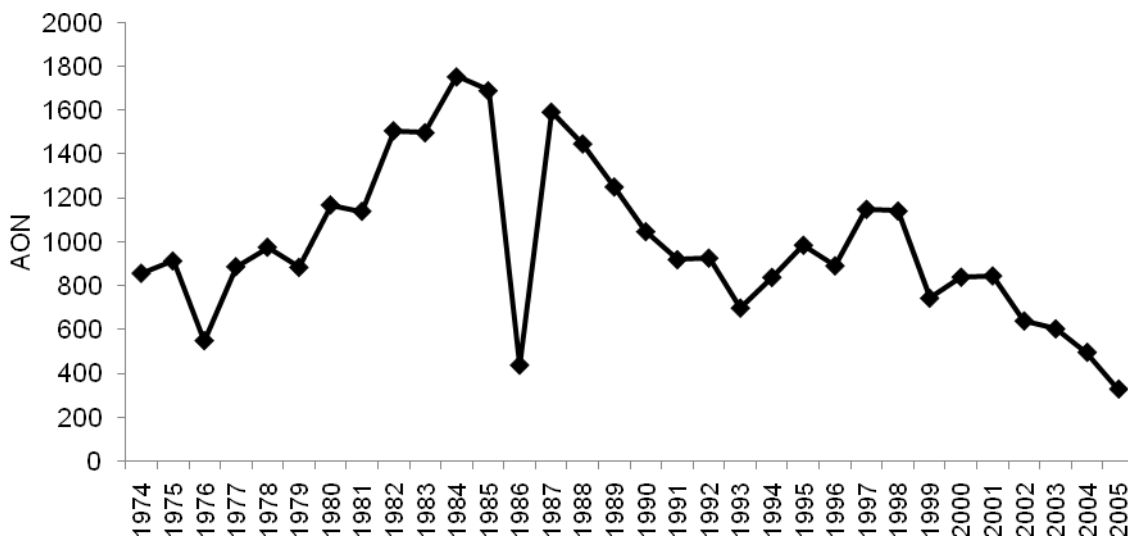


Figure 2. Number of apparently occupied European shag nests on Canna 1974-2005.

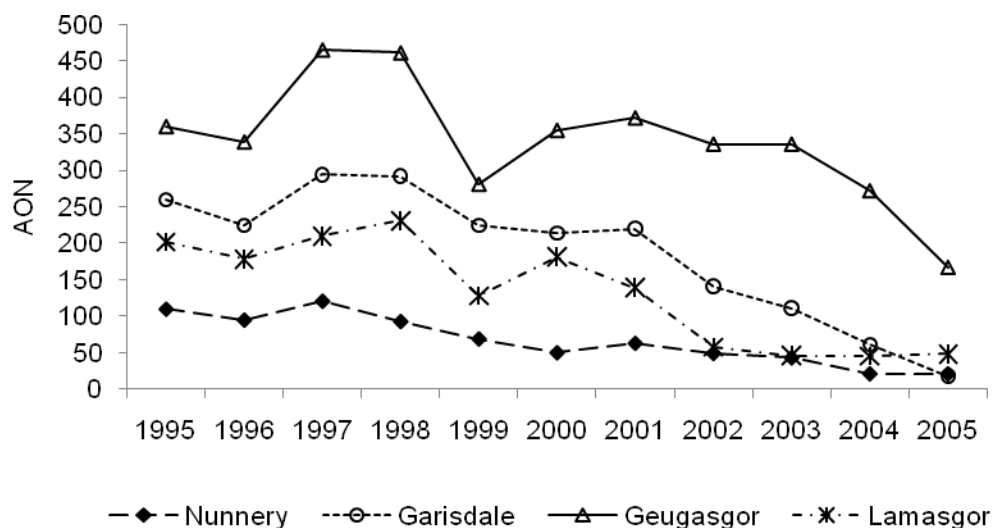


Figure 3. The recent changes in the number of apparently occupied European shag nests at the main sub-colonies on Canna.

Great skua

Two pairs of great skua *Catharacta skua* were present and one pair bred.

Mew gull

The number of mew gulls *Larus canus* was again very low in 2005, but showed a slight increase with 9 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 only 4 in 2005 (Figure 4).

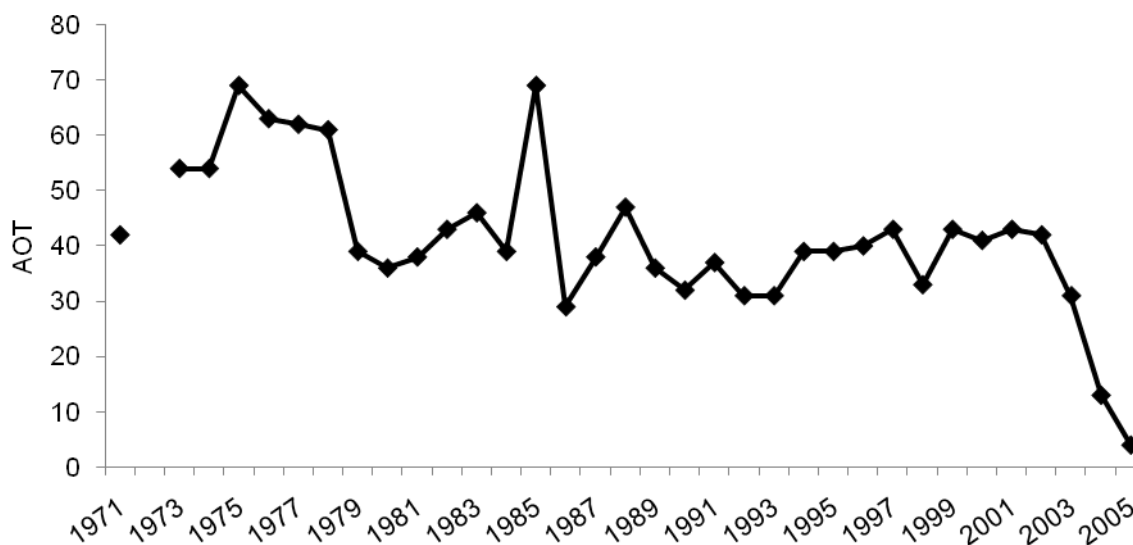


Figure 4. Number of apparently occupied Lesser Black-backed Gull territories on Canna 1971-2005.

Herring gull

A total of only 112 apparently occupied territories were counted, and in the study colonies 76 nests were counted. This is a continuation of a long-term decline that started in 1989 (Figure 5). Several 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. The population is now at the lowest level since monitoring started in 1971.

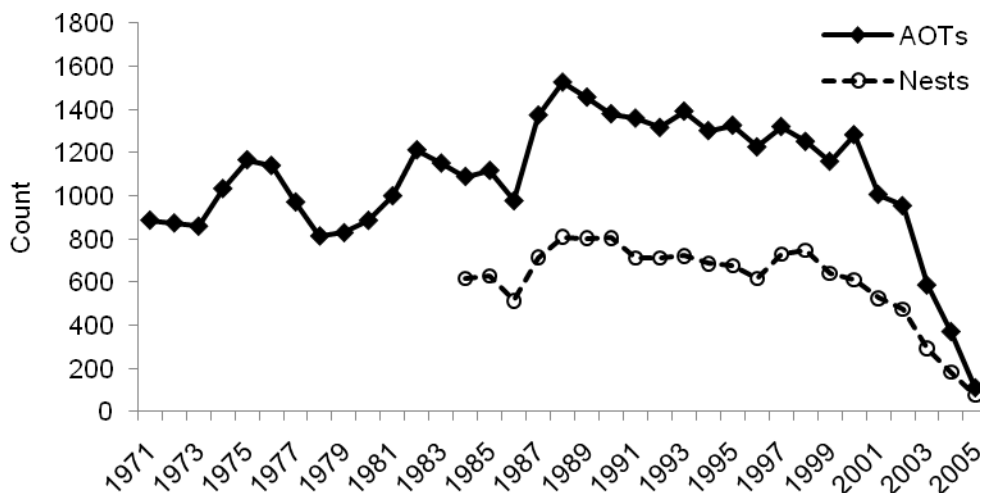


Figure 5. Number of apparently occupied herring gull territories on Canna and nest counts in sample study colonies 1971-2005.

Great black-backed gull

There has been a substantial decline in numbers on Canna since 2000 with only 29 apparently occupied territories in 2005 (AOTs) (Figure 6).

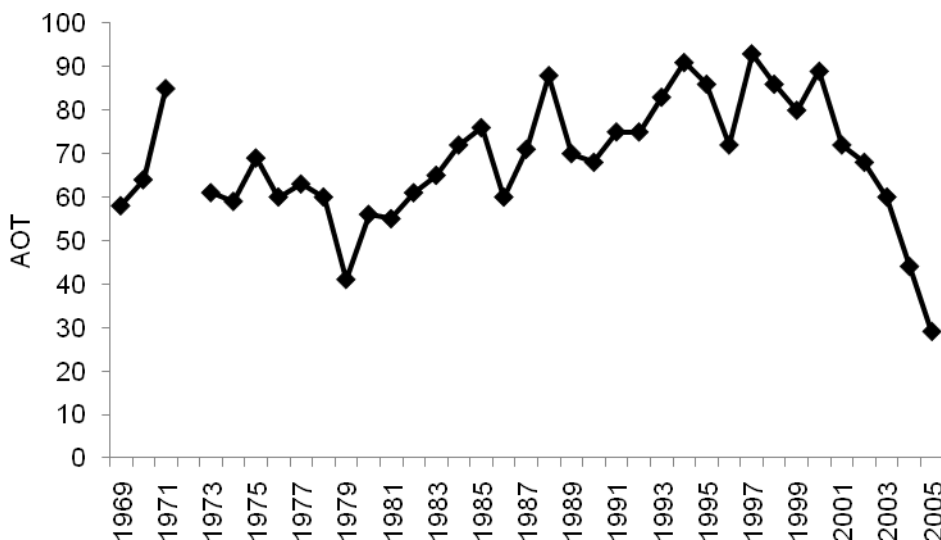


Figure 6. Number of apparently occupied great black-backed gull territories on Canna 1969-2005.

Black-legged kittiwake

Following the rise to the record count of 1,340 AONs in 2004, numbers dropped sharply in 2005 to 968 AONs. The decline was most marked at colonies on the north side of the island (Figure 7). The Sanday colony continued its long term decline.

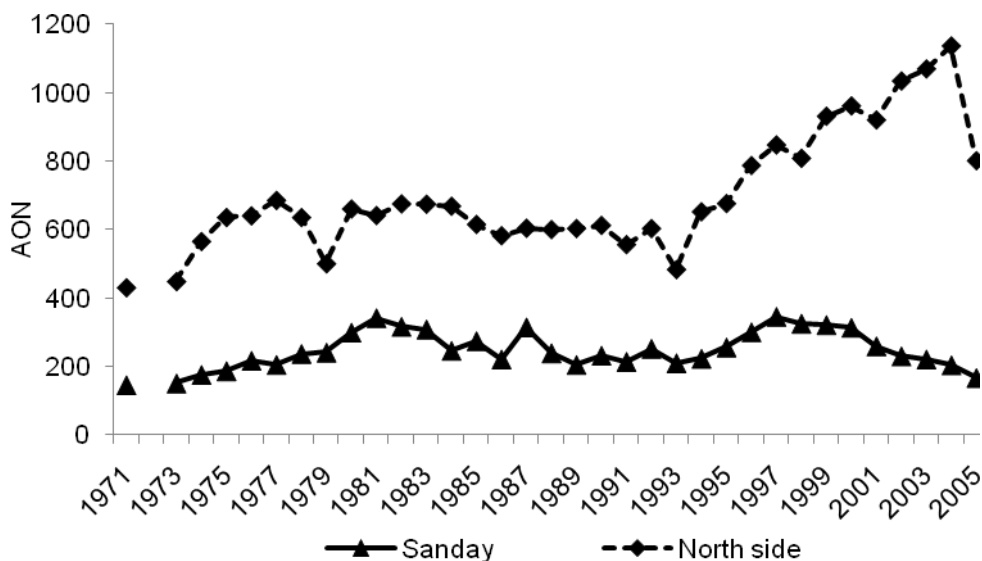


Figure 7. Number of apparently occupied black-legged kittiwake nests on Sanday and north side of Canna 1971-2005.

Common tern

Three pairs of common tern *Sterna hirundo* nested in 2005.

Common guillemot

Common guillemot numbers peaked in 2001 when 1249 ‘nests’ were counted in our studies areas with 655 ‘nests’ in the core area (sections 1-4). Numbers then started to decline with only 906 nests counted in 2004 with 414 in the core area. In 2005 there was a dramatic decline. Only 79 ‘nests’ were counted overall, with only 32 in the core area. (Figure 8). It appeared that many birds had laid but failed prior to our arrival, so these figures underestimate the number of birds that actually tried to breed. There was evidence of high levels of predation at the egg stage. This appears to be due to a combination of factors. Brown rats continue to affect seabird colonies on Canna. In 2005, however, there were also signs of heavy predation on common guillemot eggs by gulls. It appears that there were problems with food supply, which would have led to reduced attendance rates by adults in the colonies, making eggs and chicks more susceptible to predation by avian predators. Surviving birds tended to be located in sites where it was difficult for rats or gulls to obtain access.

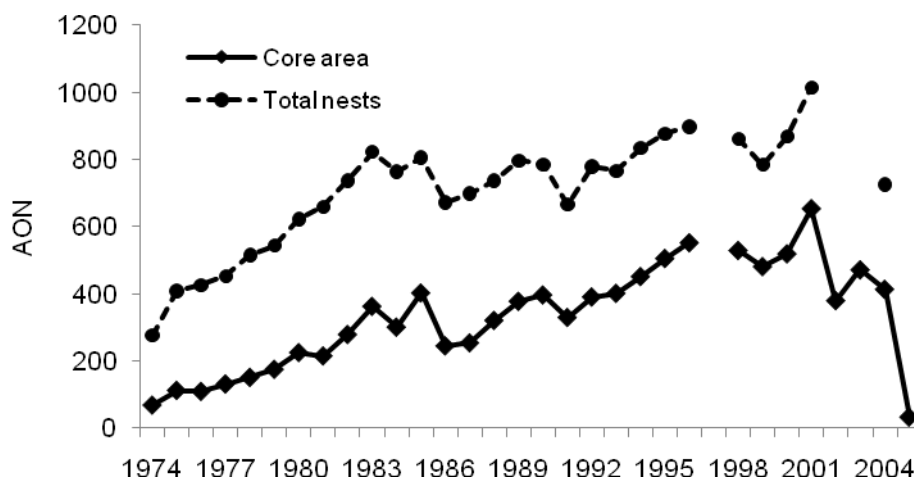


Figure 8. Number of common guillemot ‘nests’ in all study plots on Canna and in the section 1-4 plots only 1974-2005.

Razorbill

Razorbills numbers on Canna have undergone a long term decline since the early 1990s (Figure 9). 2005 saw a further rapid decline in numbers with only 27 'nests' counted; 21 at Geugasgor, 4 at Buidhe Sgor and singles at Lamasgor and the Nunnery. As with guillemots many predated eggs were found, particularly at Geugasgor. It was obvious that many birds had attempted to nest but had failed prior to our arrival. The 2005 count figure therefore greatly underestimates the number of birds attempting to breed. Another worrying trend is the increasing number of adult razorbills predated by great black-backed gulls. In 2003 two ringed predated adults were found, in 2004 we found seven, but in 2005 we found 24.

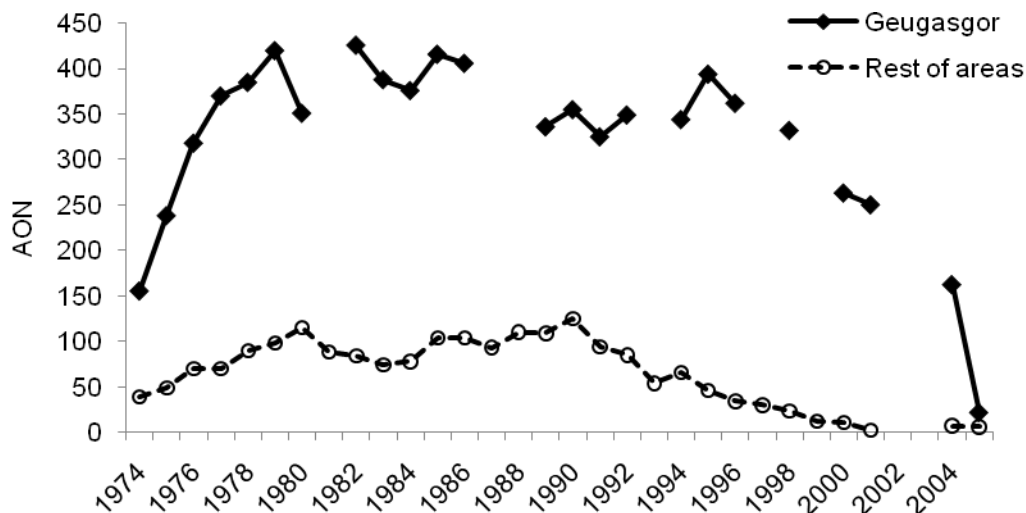


Figure 9. Number of razorbill 'nests' at Geugasgor and at all other sites on the island 1974-2005.

Black guillemot

Only 47 individual adult birds were counted in 2005 (Table 1). As noted under Methods this under-estimates the true number present. It was, however, another low figure and may suggest that this species is also declining on the island.

Photo 1. Section 5 Guillemot colony 2004.



Photo 2. Section 5 Guillemot colony 2005. Completely devoid of birds.



Photo 3. Section 4 at Geugasgor. Only a few auks. Most shags, guillemots and razorbills had failed and abandoned this usually dense colony.



Photo 4. Guillemots in more inaccessible locations were still managing to produce some chicks.



4 Timing of breeding results

January was mild, but very wet. It was also dominated by the severe storm on the 11th/12th when gale force winds and a severe swell not only washed away the bridge that connects Canna to Sanday but caused severe erosion to much of the coast. The lower part of the Lamasgor shag colony was badly affected. Some large boulders, on the raised wave cut platform at Geugasgor, under which Guillemots have nested, were also swept away. February to April were also very mild, but much drier than average. May, however, was much cooler with blasts of arctic air. June was wetter than average, but July much drier.

The mild late winter weather led to many shags laying earlier than normal with many nests containing very large chicks, close to fledging in early July. This gave birds that were predated an opportunity to relay. Of 209 occupied European shag nests checked in early July, only 10% still contained eggs (compared with 27% in 2004, 20% 2003, 7% in 2002, 11% in 2001, 14% in 2000, 12% in 1999, 19% in 1998, 24% in 1997, 68% in 1996 and 50% in 1995). Other seabirds, however laid much later than normal, most Kittiwake nests contained eggs or newly hatched chicks in early July, whilst most auks had chicks less than half grown. There was no evidence of auk chicks having left the colony prior to our July visit.

5 Breeding success results

A summary of the 2005 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 1996-2005.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Northern fulmar	0.32	0.33	0.33	0.27	0.44	0.48	0.45	0.46	0.56	0.28
Manx shearwater	0.13	0.08	-	-	-	-	-	-	-	-
European shag ^a	1.35	1.75	1.32	0.91	0.80	0.10	0.26	0.16	0.01	0.7*
European shag ^b									1.39	0.7
Herring gull ^a	32%	78%	53%	11%	63%	10%	4.5%	2%	3%	4%
Herring gull ^b	0.3	1.3	0.7	0.4	0.4	0.1	0	0	0.4	0
Great b-b gull	-	1.5	1.3	1.1	1.3	0.3	0.1	0.3	0.3	0.1
Blk-legged Kittiwake	0.97	0.95	0.95	0.64	0.51	0.83	0.61	1.01	0.78	0

Notes:

1. For northern fulmar and black-legged kittiwake, figures are overall breeding success across all plots, rather than means of individual plot figures.
2. Figures are large young per apparently occupied site or egg for fulmars, chicks fledged per egg laid for Manx shearwaters, chicks fledged per nest in which eggs were laid for 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 and ^b refers to young fledged per nest based on capture-recapture at sub-colony A. An all-island estimate of chicks per nest was 0.13 in 2005.
4. For shag ^a refers to number of young fledged per marked nest in the boulder colony at Garrisdale and Nunnery, whilst ^b refers to number of young fledged per marked nest on sub-colonies on cliff ledges. * In 2005 the boulder colonies surveyed were Lamasgor and Geugasgor.

Northern fulmar

Table 3 shows the breeding success from four study plots. This gives an overall success rate across all sites combined of 0.28 chicks per apparently occupied site, much lower than the 2004 figure (0.56). There was great variability between plots, with success once again being highest on the Sanday cliff sites. The very low success at Buidhe Sgor was exacerbated by a pair of White-tailed Eagles which were preying large chicks.

Table 3. Northern fulmar breeding success on Canna in 2005.

Study site	No. sites	No. young	Young per site
Sanday A	21	9	0.43
Sanday B	17	7	0.41
Nunnery/Garrisdale	16	4	0.25
Buidhe Sgor	35	5	0.14
Total	89	25	0.28

Manx shearwater

There are now too few occupied burrows to monitor this species adequately on Canna.

European shag

Note that, 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 2005.

Young fledged per nest laid in	Geugasgor	Lamasgor	Garrisdale*	Nunnery*	Rubha Langanais*	Dun Mor area, Sanday*
No. nests	161	48	10	23	18	14
0	111	21	7	21	10	4
1	17	6	1	0	2	5
2	25	15	1	2	3	2
3	8	6	1	0	3	3
Av young/AON	0.6	1.1	0.6	0.2	0.9	1.3

* = nests located on narrow cliff ledges.

Success was highly variable between colonies. Birds nesting on open cliff sites at Garrisdale and the Nunnery suffered high levels of predation from common ravens, which led to low breeding success. Success was highest on rat free cliff sites on Sanday. At Geugasgor and Lamasgor birds still nest under boulders. At the former site there were high levels of predation by both rats (particularly affecting nests under boulders) and gulls (affecting nests in more open locations). The Lamasgor birds, which nest in boulders, well up the tallus slope away from the shore appeared to be less susceptible to losses due to predation. Breeding success at both these colonies, however, was lower than 2004 when Geugasgor produced c.1.5 chicks per nest and Lamasgor c.1.6 chicks per nest.

Great skua

Of the two pairs present on Sanday one pair reared a single chick.

Herring gull

The frequency distribution of clutch sizes recorded in two sub-colonies in late May is shown in Table 5 and information on hatching success in five sub-colonies observed in early July is shown in Table 6.

Table 5. Herring gull clutch size in late May at two study colonies on Canna in 2005.

	<i>Sub-colony</i>	
	A	B
Empty	0	10
1 egg	2	4
2 eggs	5	6
3 eggs	11	16

Mean clutch size (excluding empty nests) was slightly below average, at 2.48.

Table 6. Number of herring gull nests that showed signs of success or failure on Canna in 2005.

	<i>Sub-colony</i>				
	A	B	C	D	E
With chicks	0	0	0	0	3
Failed	36	18	11	4	6

Of the 78 nests checked, only 4% produced chicks indicating another very poor breeding season for this species with an almost total failure in all colonies on the island. At sub-colony A, the number of fledged chicks is estimated by capture-recapture (see Methods). No chicks were found at this colony, indicating a total breeding failure. We estimate that the 112 pairs on the island produced a maximum of 15 chicks (0.13 chicks per pair), with most nests, again, appearing to have failed at the egg stage.

Great black-backed gull

Twenty three pairs of great black-backed gull were monitored, 20 of which failed and three produced a single young, giving an overall productivity of 0.13 young per pair. This is the lowest figure we have recorded.

Black-legged kittiwake

The results obtained from the four Sanday sub colonies, and the cave on the north side of Canna, are detailed in Table 7.

Table 7. Number of occupied black-legged kittiwake nests and number of large young per nest in study plots in 2005.

	<i>Sanday, K1</i>	<i>Sanday, K2</i>	<i>Sanday, K3</i>	<i>Sanday, K4</i>	<i>Cave</i>
<i>No. nests</i>	39	33	27	23	122
empty	39	33	27	23	122
av. young per nest	0	0	0	0	0

For the first time since kittiwake breeding success monitoring began, there was a complete breeding failure with no young at all being fledged in any of our study colonies. Indeed, possibly only 5 young were fledged from the 968 AONs over the entire island.

Common tern

Three pairs of common tern nested, two failed, the other pair reared three young to fledging.

Common guillemot

Most surviving guillemot chicks were small and only 30 of the 550 ringed had a wing length greater than 60mm. The mean weight of these 30 common guillemot chicks was 239.7g (see Appendix 1). The 2005 chicks were significantly lighter than chicks of a similar age in 2004 (mean 270.1g n=50, $t = -5.665$, $df = 78$, $p < 0.001$), and significantly lighter than the overall mean (1983-2004) of 272g (n=903, $U = 5576.5$, $p < 0.05$). This suggests that, in 2005, the chicks were in poor condition. This is almost certainly as a result of adults having difficulty in finding enough fish to adequately provision the chicks. This would probably have led to birds having to spend more time foraging, which would have reduced colony attendance, which would in turn have allowed predators greater access to the colonies resulting in the observed high levels of predation on surviving eggs and chicks.

Normally in early July we would expect around 20% of birds to still be on eggs. In sections 1-4 the figure was twice as high as normal. We suppose that this was due to birds re-laying after their eggs had been depredated; in the Cave and Buidhe Sgor (colonies that had lower proportions still on eggs) there was little sign, this year, of depredated eggs. Conversely, the colony at section 5 main showed a large decrease in the number of 'nests' and a very high percentage of birds still on eggs.

Razorbill

Once again, many depredated razorbill eggs were found under boulders. This species appears to prefer nesting in small, enclosed sites under boulders, making it particularly susceptible to predation by rats. Very few occupied sites were located in 2005 and those that were, contained very small, emaciated chicks, which continually called, all suggestive of severe food shortages.

6 Ringing studies

6.1 Ringing totals

Table 8 shows the number of adults and chicks ringed during 2005 and the number of fully-grown birds that were re-trapped.

Table 8. Number of birds ringed and adults re-trapped on Canna in 2005.

	<i>Adults ringed</i>	<i>Chicks ringed</i>	<i>Full-grown re-trapped</i>
Northern fulmar	15	10	15
European shag	10	154	21
Great skua	0	1	0
LBB Gull	0	0	0
Herring gull	0	2	0
GBB gull	0	2	0
Black-legged kittiwake	14	53	13
Common tern	0	3	0
Common guillemot	86	550	466
Razorbill	16	35	30
Atlantic puffin	1	0	0
Total	142	810	545

Due to high rates of breeding failure far fewer than normal birds were ringed.

6.2 Ringing recoveries

Details were given in the last report (Swann 2004b) of the wreck of guillemots that affected north-west Scotland in late August-September 2004 when large numbers of dead auks were washed ashore. Beached bird surveys were organised by RSPB staff and 2,115 beached seabirds were counted including 1,793 guillemots (Swann 2004a). These figures greatly underestimate the number of birds affected as only a small percentage of the coastline was covered. In addition, corpses were removed quickly by scavengers and others were buried under tangles thrown up by the large waves. The wreck was apparently due to a lack of suitable fish, exacerbated by the bad weather. Recoveries of ringed birds have continued to trickle in since the last report. In all 37 of the ringed birds originated from the Isle of Canna. Of these birds, seven were youngsters less than three months old, three were immature, but the majority, 27 in total, were adults of breeding age, many of which were in heavy wing moult. The loss of such a high number of experienced breeders may well have impacted on the observed decline in breeding numbers in 2005.

7 Return and survival rates results

Common guillemot

Of the 466 adult guillemots that were retrapped in 2005, 103 were birds that had been ringed as chicks on Canna and were retrapped on the island for the first time. These included: one 3-year old, one 4-year old, eight 5-year olds, 18 6-year olds, nine 7-year olds, two 8-year olds, 12 9-year olds and nine 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. Data collected in 2005 illustrate this further (Table 9).

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 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	
2000	2,166	1.8	0.6		

The 1996 and 1998 cohorts, with their very low first year recovery rates, showed high return rates as expected, whilst the 1997 cohort, which had a higher first year recovery rate, showed relatively low return rates, as does the 2000 cohort. It should be borne in mind, however, that the 2005 data underestimates the true return rate as many birds had failed and left the colony prior to our visits.

Razorbill

For the fifth year running a fleyg net was used to capture adult razorbills. This results in the capture of both breeders and non-breeders so the results are not entirely comparable with figures prior to 2001. Nine razorbills that had been ringed as chicks were re-trapped on the island for the first time in 2005. These included two 4-year olds, one 9-year old and one 10-year old.

European shag

Fourteen shags that were ringed as chicks were retrapped on the island for the first time in 2005. All were breeders, being caught on nests, and comprised one 2-year old, two 3-year olds, one 4-year old, two 5-year olds, three 6-year olds, four 10-year olds and one 12-year old. Of these 14, six had switched colony so were no longer breeding in their natal sub-colony. This is a much higher percentage than previously recorded and is in line with the redistribution of breeding shags that is taking place on the island. Similarly, four out of seven birds retrapped that had originally been ringed as breeding adults had also shifted colony.

8 Feeding studies

Common guillemot

Only 11 fish were collected from adult common guillemots on their return to the colony from fishing trips; two (18%) were Clupeidae, *Sprattus sprattus*, seven (64%) sandeels *Ammodytes* spp. and two (18%) Gadidae. Details of the fish sampled are given in Appendix 2. The mean length of the sandeels was 148.8mm (sd 28.9) significantly larger than the 2001-04 average (117.8mm, sd 36.94, $z = 2.58$, $p < 0.01$). [Of the Gadidae 52 were whiting *Merlangius merlangus* and one a *Trisopterus* sp.]

Figure 11 shows that since 1982 the percentage of sandeels taken by common guillemots has fluctuated but declined overall. Therefore, 2005 was unusual in that a high percentage of sandeels were recorded. The low sample size of fish collected in 2005 means that this figure should be treated with caution.

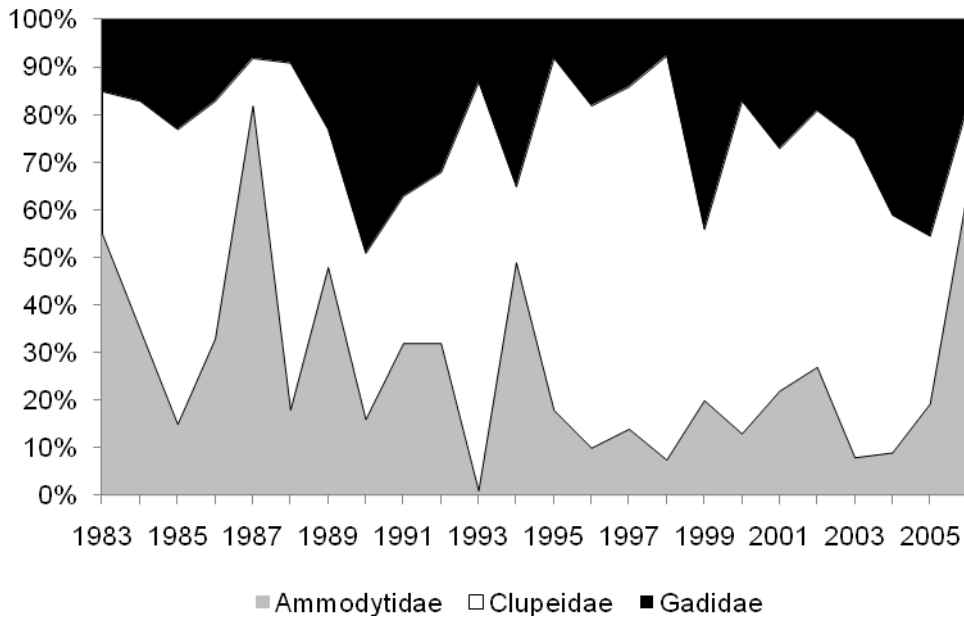


Figure 10. Proportion of fish species taken by common guillemots on Canna 1982-2005.

Other seabirds

Nine food samples were collected from regurgitations of both adult and chick black-legged kittiwakes, of which six contained remains of small gadoids (one of which also contained a 15mm shrimp), two contained 0-group sandeels and one a small Clupeidae. One of the gadoids was identified as a *Trisopterus* sp. No regurgitations were obtained from young European shags.

9 References

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10 Appendices

Appendix 1. Common guillemot chick weights

Weights in grammes									
241	290	275	300	261	216	256	262	240	259
214	211	232	185	203	265	233	207	270	227
238	226	220	213	202	245	271	245	239	245

Note: Weights taken only from chicks with a wing length of >60mm. Mean weight was 239.7g.

Appendix 2. Diet samples

Common guillemot

Details are given of the size (mm) of fish caught by adult guillemots on Canna in 2005.

Sprats: 2 measured

<i>Length</i>	110	111
No. of fish	1	1

Sandeels: 7 measured

<i>Length</i>	122	130	135	160	205
No. of fish	1	2	1	2	1

Whiting: 2 measured

<i>Length</i>	71	93
No. of fish	1	1