



Key-site monitoring in Røst in 2008

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All existing long-term data series on seabird population trends, survival rates, reproductive performance and diets in the Røst archipelago were updated in 2008 following well-established, standardised procedures (Table 1) but, as in 2007, some sample sizes were severely limited by very poor breeding conditions for many species.

Table 1 Key population parameters (SE, n) of seabirds in Røst in 2008. Population change is the numeric change in size of the breeding population registered between 2007 and 2008 on the basis of plot counts (p) or total censuses (t). The main kittiwake colony is on Vedøya (ca. 9,300 pairs in 2008), whereas that on Kårøya is a relatively small (519 pairs) population nesting on buildings. For each species, the listed survival estimate was derived from basic model(s) that fitted the data set best (i.e. those with $\Delta QAICc < 2$ when adjusting for median $c\text{-hat}$).

Species	Population change	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Fulmar	+ 258.3% ^p				
Cormorant	+ 25.0% ^t			Clutch size ¹	2.78 (0.10, 115)
Shag	- 5.8% ^p	2002-08 (6)	85.4% (1.5, 343)	Clutch size ^{2,3}	2.06 (0.03, 566)
Eider	No data			Clutch size	4.24 (0.18, 41)
Great skua ⁴	0.0% ^t			Breeding success	0.00 (0.00, 3)
Common gull				Clutch size ²	2.52 (0.15, 25)
Herring gull				Clutch size ²	2.24 (0.15, 29)
Great black-b. gull				Clutch size ²	2.20 (0.09, 65)
Kittiwake					
Vedøya	- 9.0% ^{p5}			Large chicks/nest ⁵	0.00 (n=345)
Kårøya	+ 15.7% ^t	2003-08 (5)	87.3% (2.0, 183)	Clutch size/pair	1.34 (0.08, 98)
				Large chicks/pair	0.46 (0.06, 83)
				Large chicks/nest ⁶	0.18 (n=519)
Arctic tern	No breeding			No breeding	
Common guillemot	+ 166.7% ^p	No estimate yet possible ⁷		No data (poor breeding success)	
Razorbill	+ 216.7% ^p				
Puffin	- 10.2% ^p	2006-07 (1)	84.3% (7.2, 452)	Hatching success	0.00 (n=63) ⁸
Black guillemot	+ 44.4% ^{p9}	1997-08 (11)	88.0% (1.7, 86)	Clutch size	1.66 (0.09, 29)
				Large chicks/clutch	0.75 (0.11, 16) ¹⁰

1) Minimum estimate from counts made on 17 June, when some clutches were still incomplete while others had relatively large chicks; **2)** Excluding empty nests; **3)** On 1 July; estimated by linear regression of mean values for eight different counts between 19 June and 27 July, **4)** Three breeding pairs as in 2007; **5)** Based on total counts in study plots; **6)** Based on total counts; **7)** Monitoring of survival rates was initiated in 2005 by the colour-ringing of 69 adults, 22 of which were re-sighted in 2006, but the birds abandoned the study plot early in both 2007 and 2008 due to very poor conditions for breeding; **8)** All eggs were abandoned before hatching; **9)** Maximum number of individuals on a resting site close to the colony, as monitored by time-lapse photography; **10)** See text for details of estimation.

For the puffin, various other aspects of their breeding performance (not listed in the table) were also monitored in the traditional way. As usual, the fieldwork was divided into two periods: 5.5-15.5 and 10.6-10.8. The main tasks during the first period were, as always, the standardised monitoring of puffin breeding numbers (cf. Anker-Nilssen & Røstad 1993) and body condition just prior to egg-laying, and setup of the automatic time-lapse camera for registering attendance patterns of puffins every hour throughout the rest of the season. Maintenance of the field station has also extra attention during the May visit. This year we started preparations for a full renovation of the housing facilities on Hernyken, which is planned for 2009. A more extensive report with results for all species covered by the monitoring in Røst up to and including 2005 is given by Anker-Nilssen & Aarvak (2006). As brief reports for subsequent years are included in the SEAPOP annual reports, the more extensive reports for Røst will be updated less frequently.

Another bad season for pelagic species

The population status for many species remained poor in 2008. The seemingly huge increases for fulmar, common guillemot and razorbill (Table 1) between 2007 and 2008 are all explained by the extremely few birds present in the monitoring plots in 2007, and for all three species 2008 was still the second poorest year in terms of breeding numbers. The populations of puffins on Hernyken and kittiwakes on Vedøy dropped by 9% and 10%, respectively, to levels corresponding to only 30% and 37% of their numbers when monitoring started in 1979. If the monitoring plots are representative of the whole colony, this new record low for kittiwake indicates the total population on Vedøy is now only 9,300 pairs. The drop for puffins was the first in six years, and implies that more than half of the 24% increase in 2002-07 was lost. The total population estimate of 425,400 apparently occupied puffin burrows in Røst in 2008 is only 11% higher than the all-time low in 2002. The poor status of these five offshore-feeding species strongly indicates that food supply in pelagic areas within reach of the colony has been inadequate for many years.

A total breeding failure among the population of kittiwakes in the main colony at Vedøy was documented for the second time on record (Table 1). Because those breeding out of reach of white-tailed eagles on buildings at Kårøy also did worse than ever (see below), there is no doubt poor food conditions were the main reason for the failure. A small collection of food regurgitations from chicks and adults indicated an extremely varied diet, including gadoids (32-47 mm long), pipefish, glacier lanternfish (43-63 mm), sandeel, several heads of large (ca 26 cm) herring (most likely long-line bait) as well as a crab leg and some invertebrate worms (possibly Nematoda) (Figure 1). The other fish was probably mackerel *Scomber scombrus*, which agrees well with our numerous observations of schools of (perhaps 10-20 cm long) mackerel immediately offshore to the southwest of Røst this summer. Interestingly, while the positive relationship between kittiwake breeding success and the abundance of first-year herring continues to explain the performance of kittiwakes breeding on buildings, its significance for those breeding at Vedøy disappeared since the time when eagle numbers in Røst boomed in 1997 and have since remained high (Anker-Nilssen & Aarvak 2009).

In the kittiwake colony nesting on buildings on Kårøy, only one of the 62 individually monitored kittiwake pairs produced two fledglings, and this exceptional pair succeeded simply because one of their chicks went astray and was adopted and raised by a neighbouring pair. The same thing

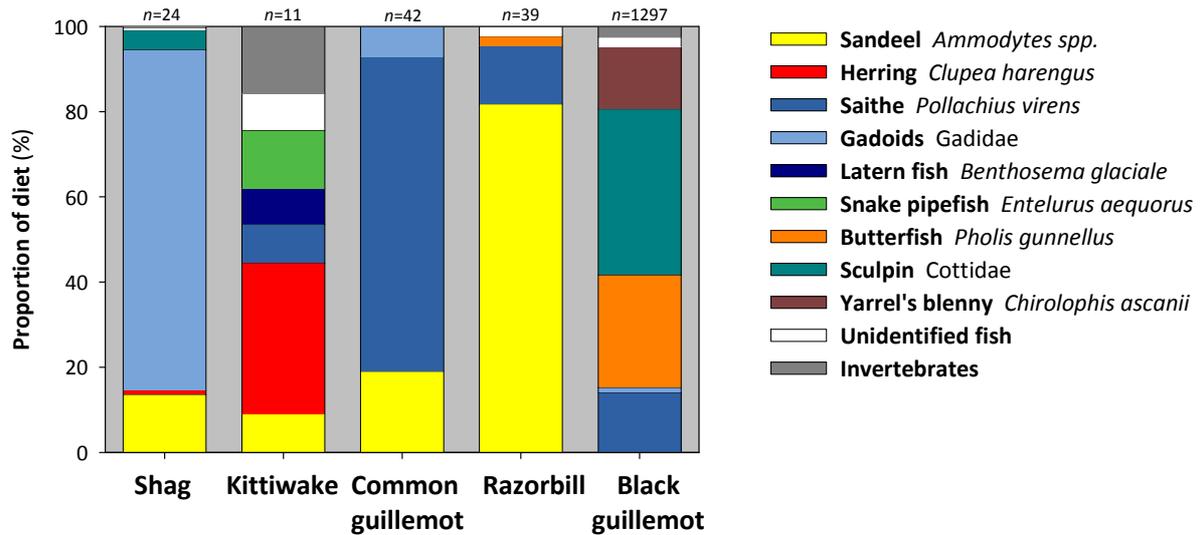


Figure 1

Diet composition of five different seabird species in Røst in 2008. Numbers of food loads examined are indicated above each bar. Data for shag (pellets from adults only) and kittiwake (regurgitations from 5 adults and 6 chicks) are presented by mass, whereas data for the auks are based on observations of food loads intended for chicks and presented by frequency of occurrence.

happened in 2007, involving exactly the same pairs! Although clutch size and breeding success was 14% and 13% lower (respectively) than in 2007, the mean hatching date on buildings in 2008 was 13 June ($n=44$), exactly one week earlier than in 2007 ($n=45$). The hatching period spanned more than a month from 26 May to 28 June, and actually continued three days into the fledging period (first chick fledged on 25 June).

Various qualitative observations strongly indicated that also the populations of fulmar and common guillemots nesting on open ledges experienced yet another total breeding failure. The reproduction of these species is not monitored, but many of the common guillemots breeding in sheltered areas left the colony before normal and few chicks were seen alive. However, a few common guillemots and some (more) razorbills probably succeeded in fledging their chicks, most likely because of access to some saithe and what seemed to be greater sandeel *Hyperoplus lanceolatus*, but with a striking difference in importance between the two species (Figure 1).

The progress of the puffin season

Again, the problems for pelagic species were well illustrated by the colony attendance of adult puffins. The automatic time-lapse monitoring showed that virtually no birds visited the colony between 22 May and 25 June, i.e. throughout the main incubation period (Figure 2). This extreme event was paralleled by the fact that not only did unusually few of the inspected nests contain an egg but, with one exception, all eggs found were ice cold and none were proven to hatch. The only exceptions from this suggestion of a total breeding failure throughout the colony were the two observations of puffins with food loads, one (on 12 June) carrying a single snake pipefish *Entelurus aequoreus*, the other (on 3 July) with a load of what looked like very small sandeels (Figure 3).

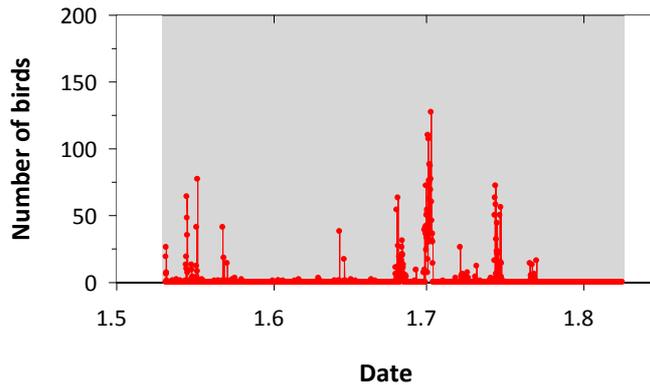


Figure 2

Colony attendance of puffins in a study plot on Herynken in 2008. Corresponding results for the five preceding years are presented in last year's report (Anker-Nilssen & Aarvak 2008). The results were derived from counting birds on digital pictures taken every hour by an automatic time-lapse camera.



Figure 3

Photo collage of one of only two puffins seen carrying a food load in Røst in 2008. This bird was seen on 3 July and seemed to carry mainly small post-larval sandeels. (© T. Anker-Nilssen)

An equally complete hatching failure has only been documented once before for puffins, in the same colony in 1995 (Anker-Nilssen & Brøseth 1998). This is the 13th total breeding failure for puffins in Røst since 1964. In addition are five seasons when only 1-10% of the chicks fledged (Lid 1981, Anker-Nilssen & Aarvak 2006).

Fortunately for the monitoring of survival rates, many adults visited the colony on a few occasions in late June and first half of July (Figure 2). However, the mean number of birds sitting in the photo plot between early May and early August (1.75, $SE=0.20$, $n=2153$) was very similar to that in 2007 (1.65, $SE=0.18$, $n=2178$), but only 10% of that in the record year of 2006 (17.78, $SE=0.68$, $n=2115$) and about half of that in the other good year (2004: 3.70, $SE=0.16$, $n=2157$) for which we have directly comparable data.

The puffin is the only species that is monitored in early May. Because both 2002 and 2004 were successful breeding seasons, some four- and six-year-old birds were expected to settle as first-time breeders. Thus, the drop in breeding numbers was not foreseen and could indicate that the potential recruits had not yet appeared or decided to postpone breeding by another year, e.g. because food conditions were inadequate in the pre-breeding season. Nevertheless, the body mass of 25 adults

captured in the colony on 9-14 May (470.6 g, $SE=8.0$) was only about 1% below the average level for that time of year (474.6 g, $SE=4.65$, $n=16$ years). It is therefore unlikely that an unusually large proportion of established breeders had not yet visited their burrows.

Problems also for inshore-feeding species

For black guillemots, which are currently counted hourly when resting on a small islet close to the colony using an automatic time-lapse technique (Anker-Nilssen 2007), a tendency for increased non-breeding combined with a very low breeding success (Table 1) could be expected to have a 'positive' effect on the monitoring results. Indeed, the evening peaks in numbers of resting adults in the late incubation and early chick rearing periods were clearly higher in 2008 than in the two preceding years, as was also the later increase in numbers towards the end of the chick period (Figure 4). Not surprisingly, this was paralleled by a marked decrease between 2007 and 2008 in the number of nests containing egg(s) or chick(s) in the colony. Thus, it is likely that the apparent 44% increase in the maximum number of black guillemots counted from the monitoring pictures (Table 1) actually reflected a negative trend for this population.

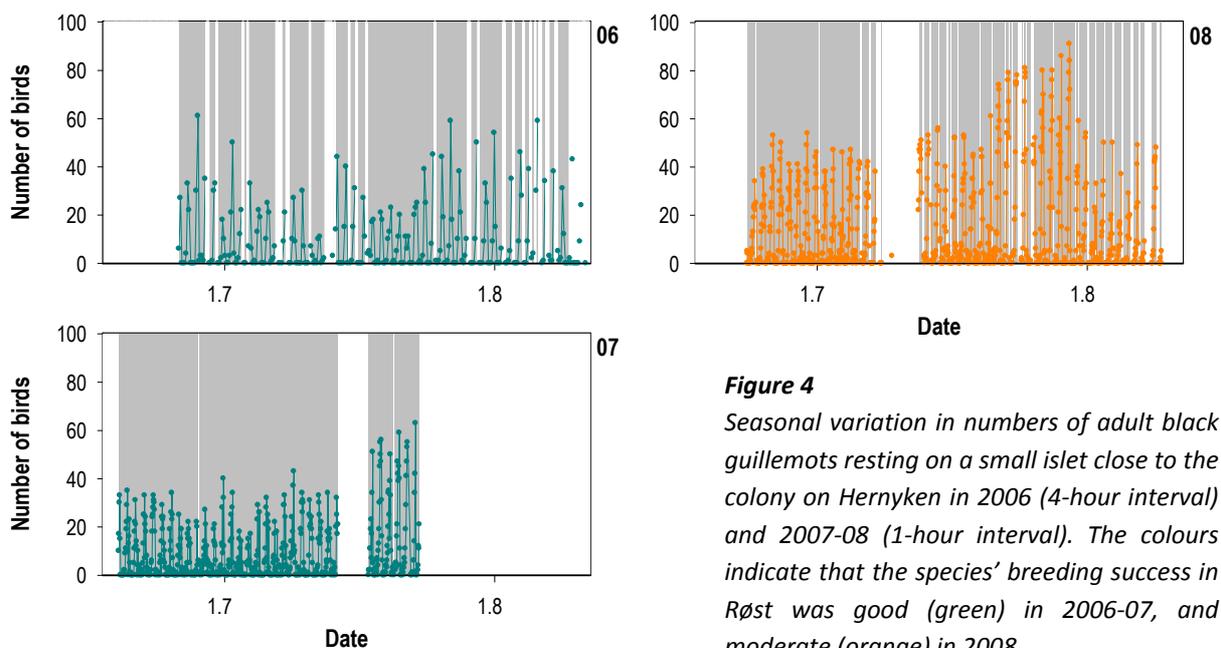


Figure 4

Seasonal variation in numbers of adult black guillemots resting on a small islet close to the colony on Heryken in 2006 (4-hour interval) and 2007-08 (1-hour interval). The colours indicate that the species' breeding success in Røst was good (green) in 2006-07, and moderate (orange) in 2008.

The calculation of the record low breeding success for black guillemot in 2008 includes eight nests in which clutch and brood size were unknown, but where the adults' continued feeding activity indicated they contained at least one chick late in the chick period. The assumption that each of these nests produced one large chick was used in the estimate only because no other nest of the species inspected this season contained more than one reasonably large chick, and because the eight other nests only produced only four large chicks (0.5 per nest). The low proportion of (first-year) saithe in the chick diet in 2007 and 2008 (15.9 and 14.0%, respectively), might reflect poorer recruitment of 0-group saithe into the kelp forest than in most other years.

The low clutch size of shags indicated poor abundance of 1-year-old saithe or alternative prey early in the season. Also, the mean brood size decreased gradually as the season progressed to about 1.7 in late July. This is about the same level as in 2007 (cf. Figure 3.1.17 of Anker-Nilssen & Aarvak 2008), indicating overall breeding success was similar in the two years. Thus, the survival of shag chicks was probably somewhat better in 2008 than in 2007. Unusual foraging behaviour of the species suggested that this was linked to an uncommon food source. Almost on a daily basis we observed several hundred adults foraging inshore in long belts that moved rapidly as (the temporarily unsuccessful?) individuals from the back were flying over the other birds and landing in front of the line where they immediately started to dive. Unfortunately, we never succeeded in identifying the prey they were chasing, but the results of the pellet samples (Figure 1) suggest that it was greater sandeel. Additional support comes from the size of sandeel otoliths in the shag pellets (indicating a mean fish length of at least 160.2 mm, $SE=6.9$, $n=31$) and the radical shift in the diet of razorbills, from 91% saithe in 2007 to 82% greater sandeel in 2008. Even though the razorbill is considered to be a pelagic species, it is often seen foraging in inshore waters within the Røst archipelago.

Although the cormorant bred in higher numbers than ever recorded and had the highest clutch size in June since monitoring was initiated in 2002 (Table 1, range of annual means 2.14-2.78), this changed markedly before 11 July when we revisited the colonies and succeeded in ringing 59 chicks only. Very few (if any) chicks had fledged by this time, but 27 (23%) of the 115 nests had disappeared since our first visit and active brood size had dropped to only 0.96 per original nest (1.25 per active nest). The problem was apparent in both colonies occupied this year, and strongly indicated food conditions were not optimal. Many food pellets were collected but have not yet been analysed.

Also the eider had a record high clutch size (Table 1, range of annual means 2.93-4.24), but we have no other quantitative information on its breeding performance.

The clutch sizes of the three *Larus* gulls were not very different from those in the two preceding years, but very few pairs succeeded in raising any young. A small colony of 15 pairs of great black-backed gulls that had a mean clutch size of 2.40 ($SE=0.22$) eggs on 13 June, had no eggs and only 0.87 ($SE=0.22$) chicks alive per nest on 9 July. Most of the chicks died long before the age of fledging.

Figure 5

It had to happen, sooner or later, and it most certainly will happen again. Nevertheless, on 9 May 2008 we were excited to find on Herynken the fresh remains of an adult puffin carrying the ring *STAT.VILT.ÅS NORWAY 56705*. This bird, which had been killed by a raven (or possibly a large falcon) only a few hours earlier, now holds the world record for the highest known age reached by a puffin. The files documented it was ringed only meters away as a fledgling on 8 August 1967, thus it was almost 41 years old when it met its destiny!



Survival of adults

The estimates of adult survival for the four species monitored for 4-17 years were updated with data from 2008. With no covariates included in the analyses, survival rates have varied significantly between years only for the puffin, in which an estimated 84.3% survived from the good breeding season of 2006 to the poor breeding season of 2007 (a reliable estimate for last year's survival cannot be calculated because recapture rate also varies between years). This is the third poorest survival on record for this population so far. Survival was at its maximum in the first four years of the study (1990-94; 94.3-97.1% p.a.) but varied between 81.2% and 93.4% with a mean of 88.2% p.a. over the next 13 years (1994-2007). This makes the extreme longevity of some birds even more remarkable, as when we happily could re-claim the world age record for puffins (Figure 5).

Using the same data sets for Røst and three colonies in the UK as Harris et al. (2005), Grosbois et al. (*in press*) showed that 67% of the inter-annual variance in adult survival of puffins is accounted for by a global spatial scale component, indicating there is substantial synchrony among colonies. The local sea surface temperature (SST) at each colony accounted for 40% of the global scale component, but also for an equally large fraction of the local scale component. SST thus acted at the same time to synchronize and desynchronize survival rates, but the analysis also suggested some other unknown environmental factor(s) acted as synchronizing agents.

For shag, kittiwake and black guillemot the addition of an extra year of data had only minor effects on survival estimates. In all three cases the best model was one with constant survival rate over the monitoring period, but for both shag and black guillemot the recapture rates varied between years.

Faithful auks

In cooperation with scientists at the Natural History Museum, University of Oslo, we investigated the rate of extra-pair paternity (EPP) among 38 family groups of puffins and 32 family groups of black guillemots (Anker-Nilssen et al. 2008 and *in press*). The study was based on mainly blood samples collected in Røst in two (2003-04; puffin) and eight (2000-07; black guillemot) different years, and analysed using a combination of four and three polymorphic microsatellite markers, respectively. As no cases of EPP were documented, the factual rates of EPP in these populations were probably no higher than 7.6% of the young puffins and 6.2% of the young (and 8.9% of the broods of) black guillemots (upper 95% confidence limits of the zero estimates). Besides adding to our understanding of the behavioural ecology of auks, where low or no rates of EPP have also been documented for three of the four other Atlantic species, this knowledge is valuable when predicting the viability and resilience of auk populations.

Faithful people

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Cover photo:

For the last decade, the only common guillemots that occasionally succeed in raising their chick in Røst are those breeding in shelter and out of reach of white-tailed eagles (© T. Anker-Nilssen)

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