



The year-round spatial ecology of Norwegian gannets

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The spatial ecology of the gannet *Morus bassanus* breeding in two Norwegian colonies was studied in 2009 through a collaborative project between SEAPOP and CNRS (Centre National de la Recherche Scientifique, France). One of the aims was to conduct a multi-year survey on foraging ecology in an attempt to explain a negative population trend observed in a number of colonies in northern Norway and to investigate movements outside the breeding season. Besides measuring the duration of foraging trips by observation, the project also put advanced technology into use by deploying GPS and Global Location Sensing (GLS) data-loggers on breeding birds.



Figure 1

Pairs of gannets use much time to decorate their nest, and remains from the fishing industry are often used as nest material, sometimes with fatal consequences as birds might be entangled. (© E. Pettex)

General background and aim of the project

Many seabird populations are increasingly impacted or threatened by human activities such as fisheries, oil exploration, ship traffic and accumulation of deleterious pollutants. From a management point of view, as well as from the perspective of the general public, it is essential to understand how seabirds are spatially distributed throughout their annual cycle and how they are affected by both human activities and concurrent environmental changes in the marine environment.

Recent studies have documented that some Norwegian seabird species are currently under threat (e.g. Barrett et al. 2006, Lorentsen & Christensen-Dalsgaard 2009). Among them is the gannet which, after a remarkable increase in numbers after their establishment as a nesting species in Norway in the 1940s, has experienced a considerable decrease in numbers in the Lofoten - Vesterålen area (Barrett et al. 2006, Lorentsen & Christensen-Dalsgaard 2009).

In this project we studied the foraging ecology and winter ecology of gannets from two different colonies (Ulvøyholmen, Vesterålen and Storstappen, Finnmark) to gain a better understanding of factors influencing their current population trends.

Methods

Foraging ecology

In June and July 2009, we studied gannet foraging behaviour at two Norwegian colonies: Ulvøyholmen (Vesterålen) and Storstappen (Gjesvær, Finnmark) using two complementary approaches.

First, we conducted an attendance survey, recording foraging trip durations for 20 breeding pairs. Continuous observations performed from 40 m distance with a spotting scope (30X Leica Televid 77) lasted 24 hours. For each nest, we recorded the time of arrival and departure for both parents. These data were used to calculate foraging trip duration and time spent by the parents together on the nest (data analyses are currently in progress).

Second, in order to study in detail foraging trip duration, foraging range and foraging areas of the gannets, we also equipped 25 and 19 breeding adults at Ulvøyholmen and Storstappen, respectively, with miniaturised GPS recorders for a period of 1 to 6 days at each colony. The birds were all rearing 2-5 week old chicks. The deployments were conducted on 29 June - 10 July 2009 on Ulvøyholmen and 16 - 28 July 2009 on Storstappen. One of the pair members at a nest was caught when both partners were sitting together. The mate always stayed at the nest to guard the chick during the handling. We used "GiPSy 2" model GPS data-loggers from TechnoSmArt (Rome, Italy) housed in a waterproof shrink tubing (120x55x40 mm; mass 50 g, i.e. 1.6% of adult body mass), sealed by flame. Latitude and longitude (both with an accuracy of 4.2 m), and speed was recorded at 1 second intervals.

Interbreeding movements

In 2008, we deployed 15 cylindrical GLS archival tags from Lotek (LAT 2500, 8x35 mm, mass 3.5 g) on each colony to record adults' movements between breeding seasons. The tags were, among others, set to record time of sunset and sunrise each day and sea surface temperature every day. The GLS were attached to a Darvic type ring on the leg. Data were downloaded from 18 recovered tags during the 2009 field season, nine from each colony. They will provide information on the migration routes for birds during the interbreeding season and their time budgets (flying, resting at sea and/or diving activity) over the year (analyses in progress).

Results

Foraging ecology

As foraging trips were relatively short, both parents spent a substantial time together at the nest in all colonies, and chicks were never left alone.

Storstappen

We recovered 14 GPS-loggers from gannets on Storstappen with complete data recorded for 120 foraging trips in 2009. To minimize pseudo-replication problems, one randomly selected trip per bird was used for the analysis. Significant differences in foraging characteristics were observed between 2007 and 2008, and between 2007 and 2009 (Table 1). During the two last breeding seasons, gannets from Storstappen made longer foraging trips than in 2007, although the maximum distance from the nest was still relatively short for this highly mobile top predator.

Table 1 Characteristics (means \pm 1 SE) of foraging trips made by 21, 23 and 14 adult gannets during the chick-rearing period on Storstappen, Finnmark in July 2007, 2008 and 2009 respectively. Information derived from GPS data-loggers. The differences between 2007 and 2008 are significant, as are also the differences between 2007 and 2009.

Variable	2007 (n=21)	2008 (n=23)	2009 (n=14)
Trip duration (h)	5.3 \pm 1.0	10.9 \pm 2.0	13.2 \pm 0.3
Total length (km)	103 \pm 18	229 \pm 33	175 \pm 7
Max. distance (km)	22 \pm 4	56 \pm 7	49 \pm 2

In 2009, the gannets foraged mainly southwards to the Kobbefjorden area, northwest of the North Cape and to the west (towards Hjelmsøya and Rolvsøya), as they did during both previous years (see details in Pettex et al. 2009), but several birds also travelled to Kamøyfjorden and towards Porsangerfjorden (Figure 2).

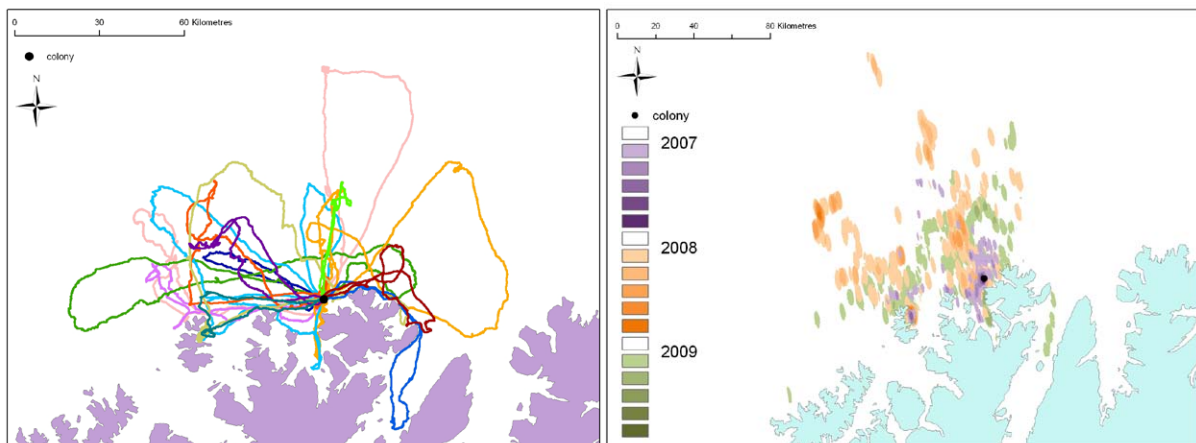


Figure 2

Examples of foraging trips made by 14 breeding gannets from Storstappen, Finnmark in 2009 (left) and relative densities of GPS positions associated with active foraging activity during trips made by gannets from Storstappen in July 2007, 2008 and 2009 (right).

The birds generally foraged between 40 and 80 km offshore. One bird foraged at a distance of 132 km from the colony. The longest foraging trip lasted for 17 hours while the shortest was about 30 min. The mean path length travelled during foraging trips was 175 km ($SE=7$), with a mean maximum distance to the colony of 49 km ($SE=2$).

Using a sinuosity index (see Grémillet et al. 2004), positions associated to active feeding behaviour can be identified along the foraging trip. The relative densities of such feeding positions in 2007, 2008 and 2009 are shown in Figure 2. In 2009, birds foraged in the same areas as in 2008, but they ignored the most distant grounds to the north and west of the colony. They exploited several new areas (Porsangerfjorden and north of the North Cape) and travelled significantly farther than in 2007.

Ulvøyholmen

We recovered 20 GPS-loggers from gannets on Ulvøyholmen. Complete data sets were recorded for a total of 107 foraging trips. To minimize pseudo-replication problems, one randomly selected trip per bird was used for the analysis. No significant difference can be observed between the foraging trips of 2008 and 2009, although the total length of the path tends to be higher in 2008 (Table 2).

Table 2. Characteristics (means \pm 1 SE) of foraging trips made by 23 and 20 adult gannets during the chick-rearing period on Ulvøyholmen, Nordland in July 2008 and 2009 respectively. Information derived from GPS data-loggers. The differences between the two years are not significant.

Variable	2008 (n=23)	2009 (n=20)
Trip duration (h)	7.7 \pm 1.0	6.1 \pm 0.7
Total length (km)	123 \pm 13	84 \pm 11
Max. distance (km)	25 \pm 3	19 \pm 2

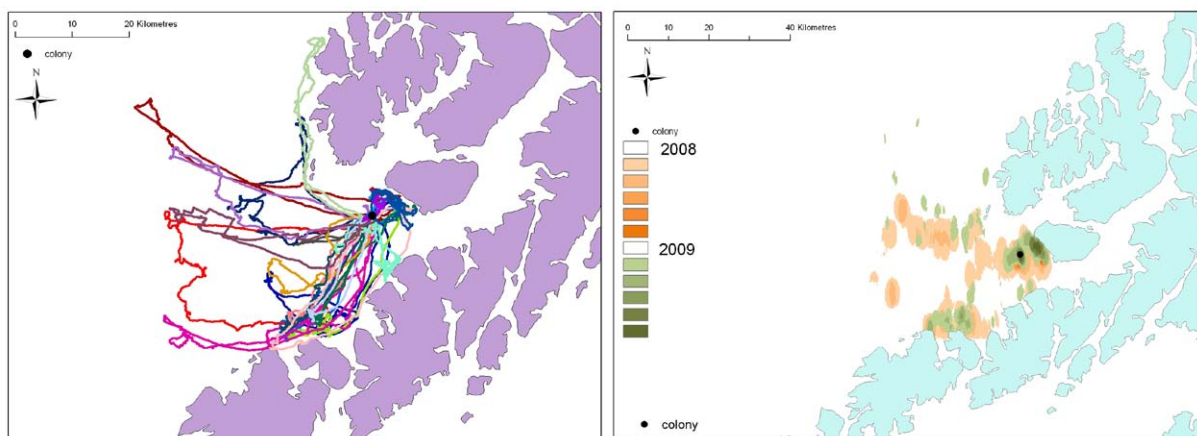


Figure 3

Examples of foraging trips made by 20 breeding gannets from Ulvøyholmen, Vesterålen in 2009 (left) and relative densities of GPS positions associated with active foraging activity during trips made by gannets from Ulvøyholmen in July 2008 and 2009 (right).

Foraging trips were relatively short and most of the birds foraged along the southwest coast of Hadseløya or while travelling south towards the northern coast of Austvågøy and Vestvågøy in Lofoten. Several birds also foraged offshore to the west (Figure 3). Foraged areas in 2009 were very similar to those of 2008.

Densities of positions associated to feeding activity (Figure 3) show that birds fished both years mainly off Hadseløya, near the village of Melbu. Birds did not travel far offshore during the study period, but foraging positions in 2009 were more concentrated than in 2008.

Interbreeding movements

Of the 15 adults equipped with GLS-loggers on Ulvøyholmen in 2008, 11 were resighted in 2009. Nine were retrieved, one bird was caught but had lost the GLS, and one bird escaped all attempts of capture. On Storstappen, 12 of the 15 GLS-equipped birds were seen, and 9 retrieved. In total, 18 GLS's provided data about the interbreeding movements of Norwegian gannets.

All GLS's contained usable data although batteries had lasted only 3 to 6 months (the GLS's were replaced by the manufacturer and new ones were deployed in 2009). To date, analyses are still in progress, but raw data obtained from the Lotek algorithm indicate that most birds spent the winter in the North Sea and in the English Channel. One bird travelled further south, along the Mauritanian coast (Capo Blanco).

Conclusions

The results from this three-year study indicate that the gannets from both Storstappen and Ulvøyholmen foraged in restricted areas. Over the study period, the gannets show plasticity in their foraging behaviour. In both colonies, high fidelity to foraging sites can be observed but gannets also exploited new areas from one year to the next. Annual variability is more conspicuous on Storstappen than on Ulvøyholmen where gannets seemed to forage in highly predictable areas, in the vicinity of the colony. Considering their relatively low foraging effort, the gannets seem to benefit from readily available resources near both breeding sites. If the availability of prey has been constant over the last decade, we can reasonably assume that food-limitation could not be responsible for the negative population trend observed in the Lofoten/Vesterålen area.

Preliminary results from the interbreeding movement study indicate that the adult gannets of both colonies migrate to the North Sea area in winter.

References

Barrett, R.T., Lorentsen, S.-H. & Anker-Nilssen, T. 2006. The status of breeding seabirds in mainland Norway. **Atlantic Seabirds 8**: 97-126.

Grémillet, D., Dell’Omo, G., Ryan, P.G., Peters, G., Ropert-Coudert, Y. & Weeks, S. 2004. Offshore diplomacy, or how seabirds mitigate intra-specific competition : a case study based on GPS tracking of cape gannets from neighbouring breeding sites. **Marine Ecology Progress Series 268**: 265-279.

Lorentsen S.-H. & Christensen-Dalsgaard, S. 2009. The national monitoring programme for seabirds. Results up to and including the 2008 breeding season. **NINA Rapport 439**, 53 pp.

Pettex, E., Lorentsen, S.-H., Barrett, R.T. & Grémillet, D. 2008. The foraging ecology of Norwegian gannets. Pp. 26-31 in Anker-Nilssen, T. (ed.): SEAPOP studies in the Barents and Norwegian Seas in 2007. **NINA Report 363**.

Pettex, E., Lorentsen, S.-H., Barrett, R.T. & Grémillet, D. 2009. The foraging ecology of Norwegian gannets. **SEAPOP Short report 6-2009**.

Cover photo: Breeding adult gannets, as this bird at Ulvøyholmen, did not seem to bother about the tiny GPS data-logger that was attached to their tail feathers,. (© E. Pettex)

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