



The foraging ecology of Norwegian gannets

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The foraging ecology of the northern gannet *Morus bassanus* (Figure 1) breeding in two Norwegian colonies was studied in 2008 through a collaborative project between SEAPOP and CNRS (Centre National de la Recherche Scientifique), France. One of the aims was to uncover possible reasons for the negative population trend that was observed in a number of colonies in northern Norway over the last decade. Besides measuring the duration of foraging trips by observation, the project also put advanced technology into use by deploying GPS, Time-Depth Recorder (TDR) and Global Location Sensing (GLS) data-loggers on breeding birds.

Figure 1

In the Vesterålen area the northern gannet breeds on low islets normally along the outermost part of the coastline. This picture is taken at Ulvøyholmen, Vesterålen. (© 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 react to these activities, and to 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 northern 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 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 July 2008, we studied gannet foraging behaviour at two Norwegian colonies: Ulvøyholmen (Vesterålen) and Storstappen (Gjesvær, Finnmark) using three 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 Norwegian gannets in the Barents Sea, we also equipped 23 breeding adults with miniaturised GPS recorders for an average period of 24 hours at each colony. The birds were all rearing 2-5 week old chicks. The deployments were conducted during 3-9 July 2008 on Ulvøyholmen and during 15-27 July 2008 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 one-channel GPS data-loggers from Newbehavior (Technosmart, Rome, Italy) housed in waterproof and pressure tight, streamlined containers (95x48x24 mm) weighing 65 g, i.e. 2.2 % of adult body mass (see Grémillet et al. 2004 for details). Latitude and longitude (both with an accuracy of 10 m), and speed were recorded at 10 second intervals. In addition to the GPS data-loggers, 8 and 6 birds on Ulvøyholmen and Storstappen, respectively, were equipped with TDR (time depth recorders) data-loggers in order to study the diving activity during the foraging trips (data are being analyzed). The cylindrical TDR (G5 Data Storage Tag, 8 x 31 mm, mass 2.6 g, CEFAS Technology Ltd, U.K.) were set to record the temperature and depth every second, at an accuracy of 0.1 m.

Results

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. We recovered all the 23 GPS recorders deployed on gannets in each of the two colonies. Complete data sets were recorded for a total of 28 foraging trips from Storstappen and 35 from Ulvøyholmen. To minimize pseudo-replication problems, one trip per bird, randomly selected, was used for the analysis (see Table 1 for foraging characteristics).

Storstappen

The gannets from Storstappen foraged mainly in two different areas: north of the North Cape and to the west (beyond Hjelmsøya), quite far offshore in both cases (Figure 2). The birds generally foraged between 50 and 100 km offshore. The longest foraging trip lasted for 37 hours while the shortest was about 35 min. The mean path length travelled during foraging trips was 215 km ($SD=175$), with a mean maximum distance to the colony of 52 km ($SD=34$).

Table 1 Characteristics of foraging trips made by adult gannets during the chick-rearing period on Storstappen and Ulvøyholmen in July 2008. Information derived from GPS data-loggers.

Parameter	Storstappen (n=23)				Ulvøyholmen (n=23)			
	Mean	SD	Max	Min	Mean	SD	Max	Min
Foraging trip duration (h)	10.0	9.3	37.2	0.6	7.7	5.7	22.8	0.6
Foraging path length (km)	215	165	595	18	123	82	360	18
Max. distance to colony (km)	52	34	132	5	25	20	98	3
Flight speed at sea (km h ⁻¹)	49.8	4.0	55.3	41.6	45.9	3.7	50.8	38.1
Sinuosity of foraging path	0.97	0.06	1.13	0.84	0.95	0.09	1.11	0.75
Flight time (h)	4.3	3.4	11.5	0.3	2.8	1.8	6.9	0.3

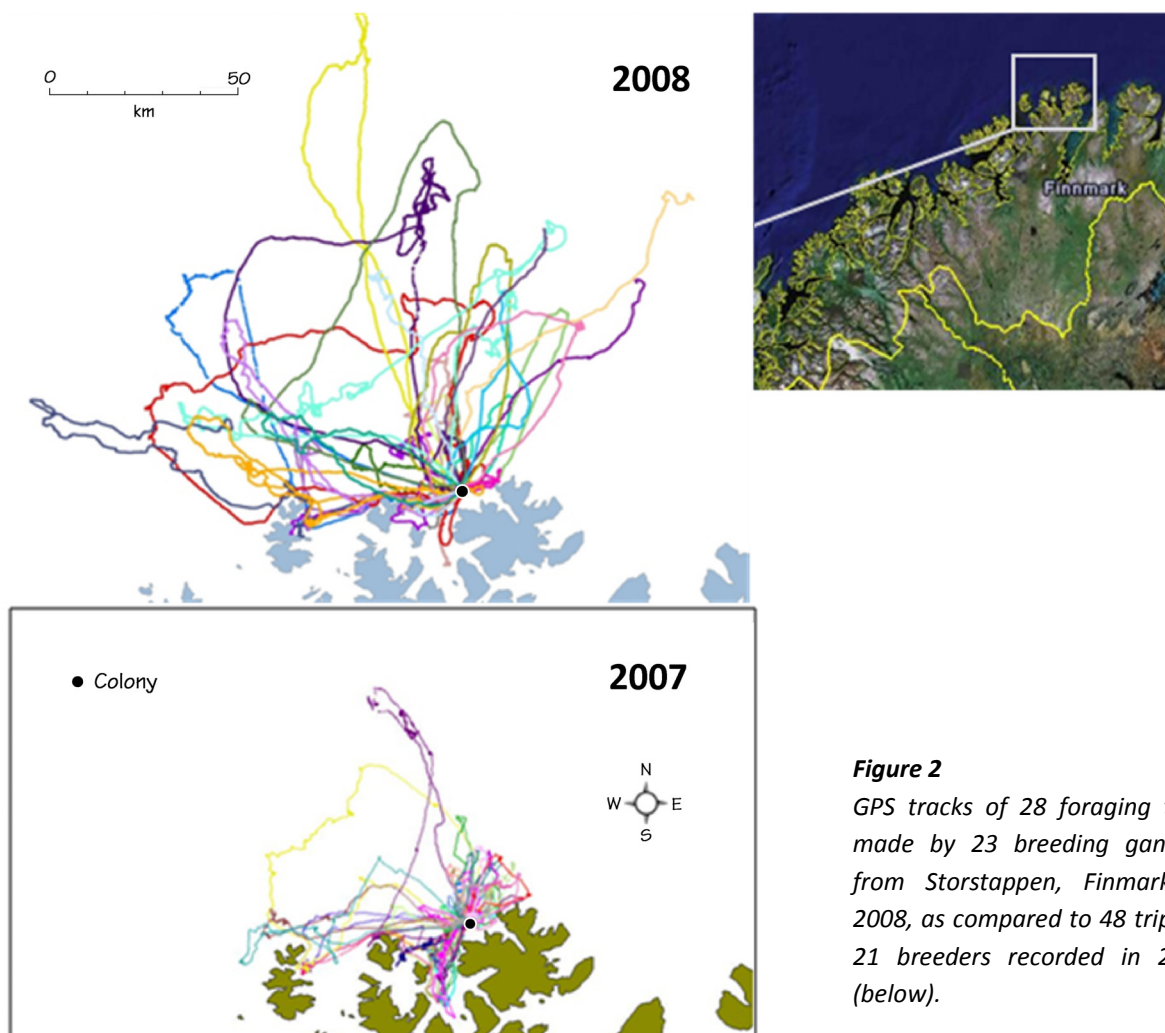


Figure 2

GPS tracks of 28 foraging trips made by 23 breeding gannets from Storstappen, Finnmark in 2008, as compared to 48 trips of 21 breeders recorded in 2007 (below).

Whereas the gannets in 2007 foraged within 20 km of the coast, mainly southwards to the Kobbefjorden area, northwest of the North Cape and to the west towards Hjelmsøya and Rolvsøya (see Figure 2 and details in Pettex et al. 2008), the mean foraging path lengths more than doubled between 2007 and 2008 (103 km vs 215 km), as did the foraging trip durations (5h vs 10h) and the maximum distance to the nest (22 km vs 52 km).

Using a sinuosity index (see Grémillet et al. 2004), positions associated with active feeding behaviour can be identified along the foraging trip. The relative densities of feeding positions in 2007 and 2008 are shown in figures 3a and 3b. Compared to 2007, birds in 2008 used the same northern and western areas in the vicinity of the colony but they generally travelled further offshore and intensively exploited an area located 100 km north-west of the colony.

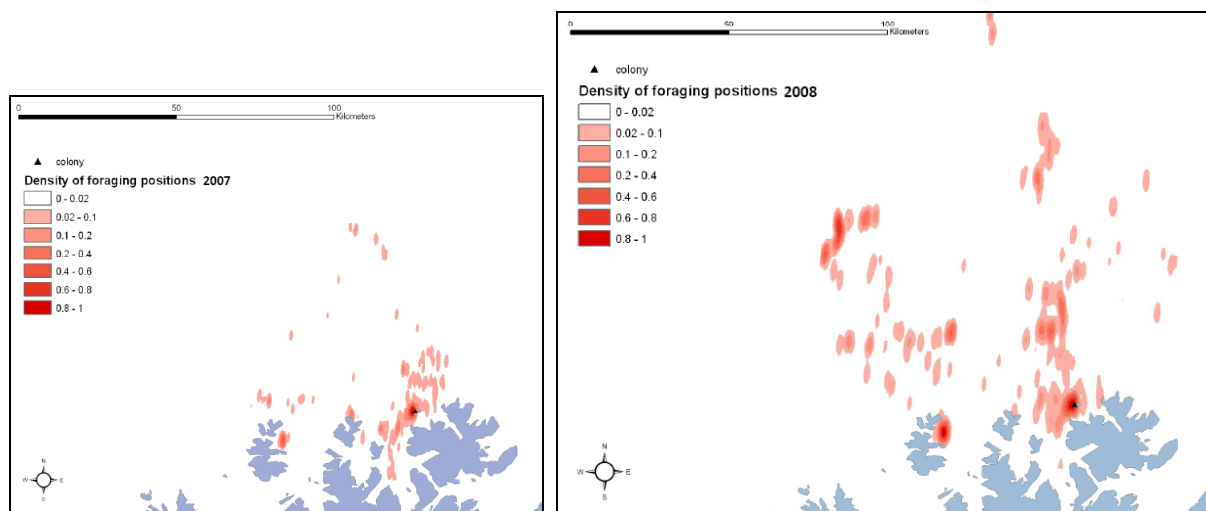


Figure 3

Relative densities of GPS positions associated with active foraging activity of breeding northern gannets on foraging trips from Storstappen in July 2007 (left, 21 adults) and July 2008 (right, 23 adults).

Ulvøholmen

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. Only one bird foraged far north along the west coast of Andøya (Figure 4). Densities of positions associated to feeding activity (Figure 5) show that birds fished mainly off Hadseløya, near the village of Melbu. Birds did not travel far offshore during the study period.

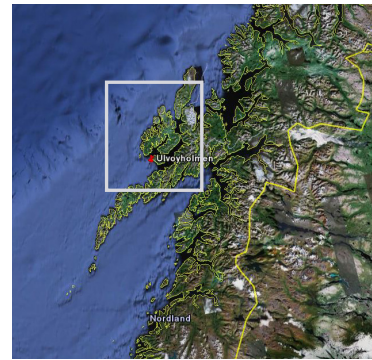
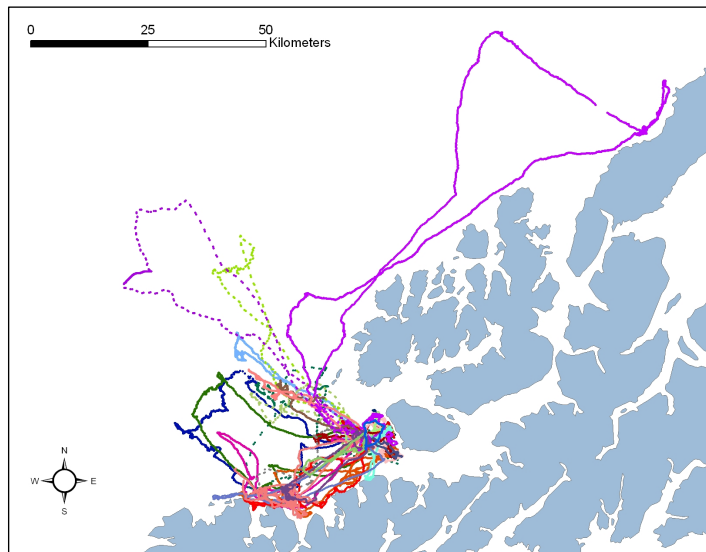


Figure 4

GPS tracks recorded during 35 foraging trips by 23 breeding gannets from Ulvøyholmen, Vesterålen in 2008.

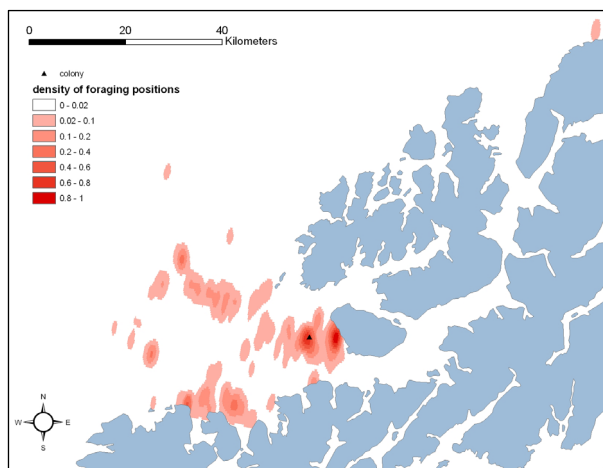


Figure 5

Relative densities of GPS positions associated with active foraging activity during trips made by 23 northern gannets from Ulvøyholmen in July 2008.

Conclusions

Preliminary results show that the northern gannets from both Storstappen and Ulvøyholmen foraged in restricted areas.

In 2008, the birds from Storstappen doubled their foraging effort and foraged farther offshore than in 2007. The gannets visited the same areas near the Storstappen colony but extended their foraging trips. The Storstappen gannets showed feeding site fidelity but also the ability to forage in new areas, e.g. if food resources are limited in the direct neighbourhood of the breeding site.

The Ulvøyholmen gannets foraged mainly along the south Vesterålen and north Lofoten coasts. New deployment of loggers on both colonies in 2009 will provide extra information on the foraging flexibility of gannets from these two colonies and will provide an indication of food availability within the feeding range of the colonies.

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Cover photo:

Gannets breeding at Ulvøyholmen, North Norway. (© E. Pettex)

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