

Preliminary observations on the nesting of Barnacle Geese in Spitsbergen

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An expedition was organized to study Barnacle Goose *Branta leucopsis* behaviour in Svalbard, with the aid of the Österreichische Akademie der Wissenschaften, Grünau, Austria and the Wildfowl Trust, England. The authors studied the breeding biology of the Barnacle Goose in the Gravsjoen area of the main island of Spitsbergen. The expedition was in Svalbard from 19th June to 23rd August, 1975 and observed geese located on the Nordenskiöldkysten from 25th June to 19th August. The use of the Björsethytta was given by the personnel at Isfjord Radio.

Methods

On 26th June, 1975, Barnacle Geese were still breeding on the inner and outer St Hansholmane islands. The inner island was readily accessible at low tide. A hide was set up there and manned on the evening of 28th June. The location of and approach to this hide disturbed some of the geese, so, after a few days, observations were interrupted. The hide was moved to a location where it was sufficiently separated from the geese with an approach and entry out of their view. Observations continued in the second hide until 12th July when all the observable Barnacle nests had hatched.

In total, ten 24-hour periods were spent in the hide and data was taken on 13 nests which could be seen from the hide, although more nests were present on the island. The hide had an internal volume of 1.5 m³. It was made of canvas and mounted on a wooden frame. Small windows faced 4 directions. Observations included recording male and female positions, activities and interactions with other geese.

After all the goslings had hatched, observations began from a hill overlooking the lakes of Gravsjoen and Oddvatne. The activities of the families and moulting flocks on the mainland were recorded with the aid of a telescope. Every week one member of the party went north and one went south along the coast to survey the numbers and locations of geese between Kapp Martin and Kapp Linne. This report contains primarily the results of our work during the nesting period.

In August, the expedition spent four days investigating the nest sites on both islands. The Barnacle Goose nests were identified and the distances between them were measured. The parameters for identification were: (1) the accumulated droppings around the nest and in the ganders' guarding positions, see below; (2) the kind of down present; (3) the kind of egg shell fragments present; (4) the shape of the nest cavities and the surrounding terrain; and (5) our previous observations on the islands.

Results

A total of 764 adult Barnacle Geese were found in this area. It included some 85 families which contained an average of 2.8 goslings. The proportion of unsuccessful or non-breeding geese was 78%.

We counted 24 nests on the inner island which had been used by Barnacle Geese in the spring of 1975. Figure 1 shows the inner island with the nest locations. The island was approximately 75 × 60 m and lay 250 m offshore. Its sides were rocky, 4–6 m in height. The surface was stony with rock outcrops. There was some vegetation but it did not become green until after the island had been deserted by the geese, there were also two small pools of fresh water. The Barnacle nests were often located among Eider *Somateria mollissima* nests, although each goose nest had at least a 2 m area without nests around it. On the outer island, 1,000 m from the coast, there were 23 nests. The two islands accounted for at most 40 of the 85 families seen.

Ebbinge & Ebbinge (in press) reported that 184 nest sites were occupied on islands off the Nordenskiöldkysten (including those described here) in 1975, so it is likely that all nesting was on islands in this area. In the very late season of 1964 there was no evidence of nesting in the same area (Norderhaug, Ogilvie & Taylor 1965) but Norderhaug (1970) reports 10–20 family groups plus 280 adults in 1965 and 5 breeding pairs in 1968. There were 21 nests on the inner island in 1974 (Boerman, Dijk & Spanje 1975).

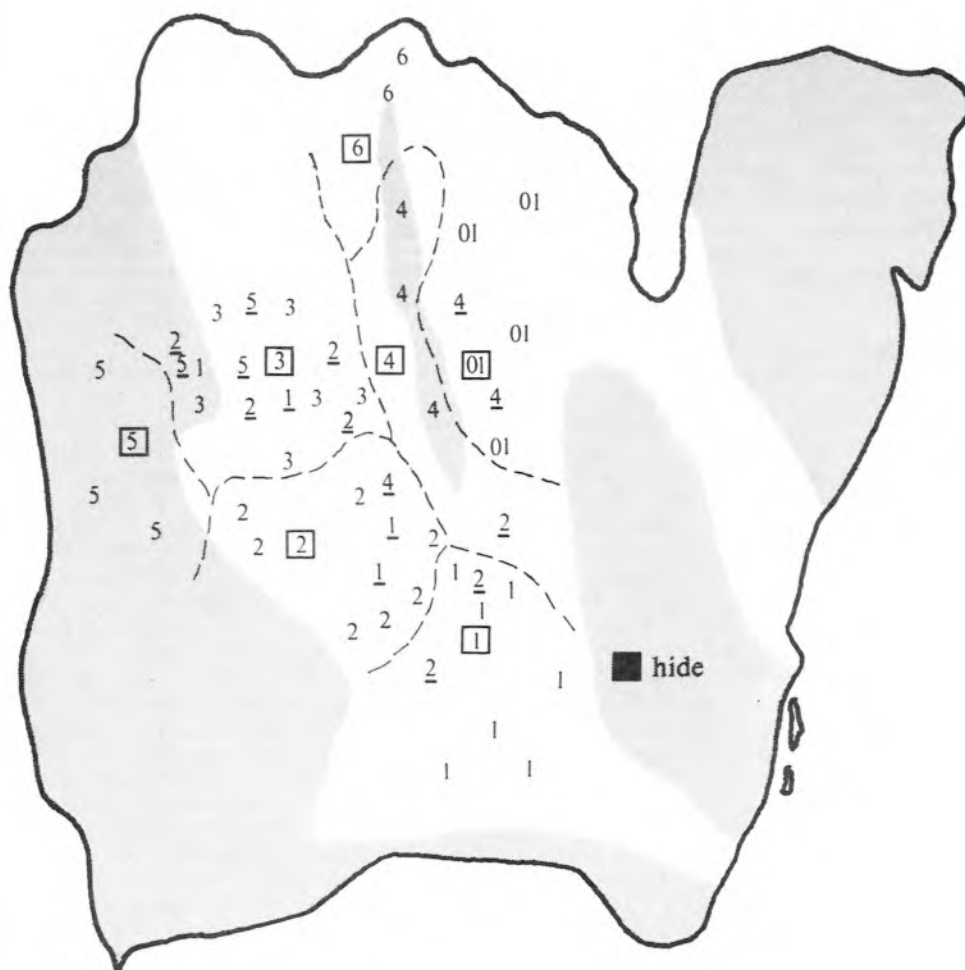


Figure 1. Sketch map of inner island showing nest sites (in squares), territory boundaries (dashed lines), and positions of fights (numbers) and grazing by males (underlined numbers). Shading indicates rock outcrops.

Nests on both islands were always found between or against rocks. The nest depressions were in general deeper than those of Eider nests although some Eiders brooded in old Barnacle sites. The nests were lined with down and contour feathers mixed with a little moss. Small bones and egg shells were often found under the layer of down. Some Eider feathers were present in every nest.

The guarding positions of the males were always traceable from large numbers of droppings at locations very near the nest. The droppings around two of the nests were extremely plentiful and had two distinct colours and drynesses which probably represented more than one year of use. By the beginning of August, 8 of the 47 nests in-

vestigated were overgrown with moss. Some were still filled with down while others were completely empty. This variation made it difficult to determine when and by which species the nests had been used.

The average distance between nests was 7.7 m when calculated from the three closest values for every nest. This separation was topographically dependent, and dependent on whether the sitting females were in view of each other. Nesting females in view of each other were separated by an average of 9.3 m, while out of view nests were at an average distance of 5.6 m. The difference was significant ($p < 0.002$, Mann-Whitney U Test).

The average clutch size observed was 3.3 (12 nests). 90% of the eggs which were

brooded to completion hatched. Two of the unhatched eggs were Eider duck eggs. This was not uncommon as at least five of the Barnacle Goose nests on the island contained Eider eggs. One family had a duckling among its goslings and one duck was seen with a gosling. The former survived at least three weeks whereas the latter was only seen once.

Nesting behaviour

Male

The males stayed close to the nest during incubation in certain guarding positions. They often had more than one position, but the most common was directly beside the female. The average distances from the nests for the males studies as listed in Table 1. The values are half-hour estimates of the males positions. The average for male 5 was much higher than that of other ganders but this may be normal individual variation.

The males defended certain areas around their nests from intruders. The defence areas did not impinge on those of the neighbouring nests unless the neighbouring male was absent. Attacks and threats were, in spite of these territories, situation and individually dependent. Males attacked some individuals farther away than others. Calling pairs were more prone to attack than silent pairs or an individual. Males attacked more readily after one encounter. Hatching and periods when the female left the nest also seemed to decrease the threshold of an attack. Neighbouring males did not normally attack each other. Nesting males could even wander about neighbouring territories without any aggressive reaction from the males defending them. Non-nesting geese were always driven away.

Figure 1 shows the location of attacks, territory boundaries, and grazing areas

between 5th and 11th July. More than one attack in the same place is only represented once. Apparently, no grazing territories existed for the males although the defended territories were quite distinct. If a nesting female walked or grazed outside her territory, she was immediately attacked by the neighbouring male. This situation twice led to one male attacking another, yet the attacks did not last long nor have an obvious victor. After one of these fights the two males assumed sleeping postures one metre apart, on opposite sides of the territorial boundary.

The male also attacked potential predators in his territory. The predators seen were Glaucous Gulls *Larus hyperboreus*, Greater Black-backed Gulls *L. marinus*, Arctic Skuas *Stercorarius parasiticus*, and Great Skuas *Catharacta skua*. The latter two species were occasional visitors to the island whereas the gulls were always present. Gulls did not take any eggs or goslings in the presence of the goose pair but they took ducklings and eggs in the presence of Eider ducks. Perching gulls could stand within 4 m of most goose nests without being attacked. The gulls even ravaged neighbouring Eider nests and abandoned Barnacle nests without eliciting an attack from the onlooking male. If, however, a gull glided low over a male's territory, it was usually threatened. Skuas rarely perched on the island. They normally glided over it looking for prey. As a result, they were more often threatened by the male. No Arctic Foxes *Alopex lagopus* were seen on the island even though it was occasionally connected with the mainland at low tide.

Table 2 lists the percentages of time the males spent grazing and on nest pauses, or effectively, the time they spent away from their guarding positions. A nest pause is defined here as flying away from the island, leaving the nesting area completely. The

Table 1. Average guarding distance of males from nest.

Male	1	2	3	5	7	8	Mean
Distance in metres	0.98	0.83	0.91	2.4	0.95	0.78	1.14

Table 2. Percentage of time spent on pauses or grazing.

Male	01	1	2	3	5	7	8	Mean
% Time on pauses and grazing	10.3	34.3	22	17.1	33	13	9	21.4
Female								
% Time on pauses	3.9	7.6	2.6	2.9	9.2	3.5	5.4	5.2

grazing discussed occurred only on the island.

The males took pauses at irregular intervals. The pauses were usually preceded by pre-flight motions including head-shaking, stretched necks, moaning and wing flapping. The time between pauses varied from 30 minutes to 14 hours. The average percent of time grazing and on pauses was 21.4%. The length of the pauses varied from 5 to 135 minutes. Every gander took both long and short pauses. The pauses were spread out over the whole day. There were no obvious daily rhythms but the daily percentages were constant for each gander until the eggs had hatched. The percentages decreased in every case shortly before or at hatching. The sitting goose did not respond when the gander flew away and only called occasionally upon his return even though the male always called with her at that time.

The direction of flight was recorded whenever possible when males took pauses or returned. Each gander had 4–8 recordings. The direction was the same for every observation on each individual male. Males were often seen flying away or returning together with a neighbouring male. Table 3 shows this tendency as the percent of take offs or landings which the male took with other males.

Table 3. Coincidence of male pauses.

Male	1	2	3	5	7	8
No. of pauses	30	13	15	11	14	22
% simultaneous departures or returns	16.7	27	20	18	22	9

Female

The females continued to repair and build their nests into the last stages of incubation. Because of the short duration of egg turning movements they were often missed, but one female watched for 4 days turned the eggs regularly every 100–140 min. The orientations of the sitting geese were recorded at half-hour intervals. Changes in position occurred throughout the day. The longest observed period between changes was 3 hours and the shortest 8 minutes.

When taking a nest pause the female covered the nest over with down and flew off towards the mainland leaving the male to guard the nest. Pauses varied from 12 to 120 minutes in duration and were taken several times a day. The direction of departure was constant for every goose and paralleled the male departure in every pair except one.

Percentages of time on pauses are listed in Table 2. The values varied considerably between females, yet each individual maintained constant daily values over the observation time.

Pauses of neighbouring geese often occurred within a few minutes of each other, and pauses were usually taken in the same period of the day. Figure 3 shows the average percent of time on pauses against the time of day and the average temperature. The percentages represent averages obtained from the values of geese 1, 2, 3, 5, and 01. Temperature and pauses do not appear to be closely related.

Males and females did not take pauses simultaneously so the nest was not left unguarded. The male often called when the female arrived or left although the female never answered. The intent to take a pause was only recognizable by the goose standing up, covering the nest with down and flying away. If the male was grazing at a distance he came over to the nest and remained there until the female returned.

When the female arrived, the male bent down towards the nest. The female then approached the nest and resumed sitting. The female's approach to the nest was always preceded by the male making this motion. The males were usually by the nests when

the females arrived but four occasions were observed when the male was not there because of some disturbance. In those cases the returning female stood a few metres from the nest instead of going directly to it and did not resume sitting until the male had first approached the nest. One female flew away again and the nest was quickly destroyed by gulls.

After approaching the nest, the female slid into the nest from the edge and went through a directional rotation of about 360° in three or four shifts. The entire rotation ended with a stretching movement where the wings were slightly raised and the neck curved. This stretching was similar to the hollowing movement of Greylag Geese *Anser anser*. The procedure varied little between geese and pauses.

In the male's absence, neighbouring males

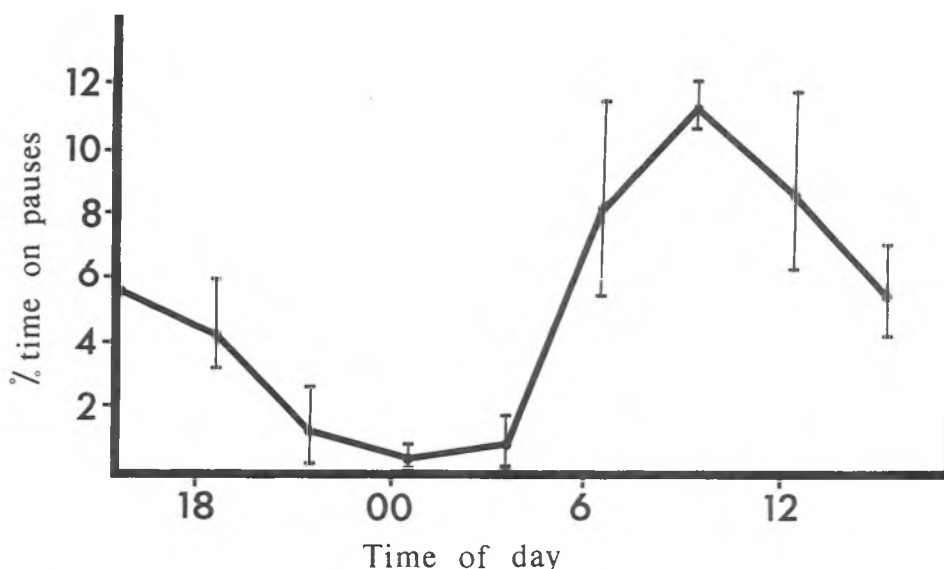


Figure 2. Average per cent of time on nest pauses by geese 1, 2, 3, 5, and 01.

usually chased non-nesting geese away. When they did not, the goose defended the nest by drawing her head back and calling without leaving her sitting position on the nest, even when attacked by another goose. If a neighbouring male came near a sitting female in her mate's absence, she did not react this way.

Hatching

Some of the data collected on hatching is listed in Table 4. Because close inspection of the nests was impossible, the time of complete hatching was used. It represents the moment goslings were seen under the female when she stood to arrange the nest. The eggs could have been pipped up to 24 hours before this.

Hatching took place between 4th and 11th July. The eggs in each nest normally hatched within a 3 to 6-hour time range; however in two nests an egg did not hatch with the others. One female abandoned the egg after

23 hours when the male and goslings began to wander about the island. The egg was eaten within half an hour of the goose's leaving the nest.

In one nest an egg was hatched 25 hours after the others. The male had already begun grazing with the goslings. The female left the nest to graze shortly after the last gosling had hatched. This gosling was not able to leave the nest at that time so the male came back to the nest and stayed there until the gosling could walk, while the goose and the other goslings grazed. This perhaps paralleled guarding of the nest during female nest pauses.

The males remained closer to the nest and their pauses became shorter at hatching. The average amount of time grazing and on pauses (see Table 1) for all males decreased from 22.3% four days before hatching to 10.95% on the day before hatching. Female nest pauses stopped between 12 and 24 hours before hatching. The goose rarely changed her sitting position and sat with

Table 4. Hatching data.

Nest	No. of eggs	No. of goslings	Hatching time (hr)	First departure after hatching (hr)	Final departure after hatching (hr)
1	4	4	25	<3	3
2	3	3	6	19.5	22.5
5	5	5	6	27.5	23
7	4	4	4	20.5	30
8	3	2	3	26	28

wings partially open. Both parents used a warning call in cases of danger after the onset of hatching. The call resembled the *Jammerlaut* of Greylag Geese (Fischer 1963). It had not been heard during the incubation period.

All the families returned at least once to the nest before leaving the island for the mainland. The only island departures seen occurred 6 and 17 hours after the families had first left the nest. They left the island by walking to the surrounding cliff where the adults flew down from ledge to ledge and the goslings tumbled after them. After reaching the sea, the families swam north or south along the coast instead of going directly ashore. Both departures were at low tide.

Discussion

The large number of nests and geese found during the study supports the reported increase in the Svalbard Barnacle Goose population and the wintering population at Caelaverock, which had risen from 3,200 in 1970 to 6,000 in 1975. (Norderhaug 1970, Owen & Campbell 1974).

From the hatching dates of 4th–11th July and assuming a 24-day incubation period, the beginning of incubation must have been between 12th and 18th June. Data concerning the onset of laying in Spitsbergen is scanty but these dates are later than 1st–5th June which was reported by Løvenskiold (1963).

It is probable that all the geese in this area were colony breeders. This could be a result of species affinity or the lack of proper nesting sites. Isolated nests have been reported by Løvenskiold (1963), among others, yet none was found in our study area.

The geese studied nested together with Eider Ducks on the two St Hansholmane. Neither bird nested on the island near the mouth of the Gravsjoen even though the terrain was quite similar and it was only a few hundred metres away. Only Pink-footed Geese *Anser brachyrhynchus* nested on this island. The cause was perhaps the island's being so close to the shore that the two were connected at low tide. This made it easily accessible to foxes which according to Løvenskiold (1963) hinder Barnacle and Eider nesting as they cannot defend a nest against foxes whereas Pink-footed geese can. Other factors besides geotype seem to support colony formation. Mutual defence of nests and the nesting area was an advantage. This was accomplished by the existence of defence territories and the inhibition of

fighting between nesting ganders.

During nesting, the male primarily chased non-nesting geese and predators away from his territory. He guarded the nest closely during the female's nest pauses and initiated her return to the nest after them. The need for male's presence perhaps insured the safety of the goose from predators and neighbouring males while she settled in to the nest, although it apparently caused the pre-emption of two nests.

The goose was attacked when away from the nest but still on the island, so consequently she could not graze there easily. As a result all her grazing was done away from the island. Grazing territories have been reported for Pink-footed Geese, Ross's Geese *Anser rossii* and Canada Geese *Branta canadensis*.

Pink-footed Geese maintained an average of 15.4 m between nests (Inglis 1976), the Ross's Geese, 4.57 m, (Ryder 1972) and Canada Geese (Vermeer 1970) averaged 13.4 m in the most crowded colonies. The nesting geese in these colonies usually grazed in the areas around the nests. Both the male and female utilized these areas to graze and the female's pauses were taken in the male's company.

A toleration of neighbouring Pink-footed males was reported by Inglis (1976) in the form of less intensive attacks and threats. He also reported no harassment of incubating females by neighbouring males as had been reported for Canada Geese (Ryder 1976).

Barnacle Geese had been principally cliff breeding geese until recently when they began to utilize islands as nesting localities (Norderhaug 1970). The absence of grazing territories might be a result of this, as cliff breeding geese have no choice but to leave the nesting area to graze. The guarding of the nest during female pauses is then advantageous.

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Summary

The behaviour of a colony of Barnacle Geese *Branta leucopsis* in Svalbard was observed during the last 10 days of incubation. The interactions between neighbouring geese in the nesting area during our observations can be summarized as follows:

1. Males defended certain areas around their nests and defended areas were contiguous.
2. Neighbouring males rarely attacked or

threatened each other. They even tolerated certain other males, grazing inside their defended areas.

3. Neighbouring females were not tolerated by males in their territories whereas sitting females were not attacked on their nests in

the absence of their mates and showed little alarm when neighbouring males came near the nest.

The females were away from the nest for 5% of the time, most often between 07.00 and 13.00 hours.

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A family of Barnacle Geese *Branta leucopsis* at Slimbridge. (Philippa Scott).

