Goose staging in Vårsolbukta

First results from the field seasons 3.5.-16.6.2003 and 3.5.-18.6.2004

Christiane Hübner, UNIS (christiaane@unis.no)

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Project: Plant-herbivore interactions in an Arctic pre-breeding area for geese: effects of timing and intensity

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The results presented here are part of a PhD-project and are still unpublished. Thus, the data have to be considered as confidential. For permission to use these data please contact the author.

1 General conditions

Snow melt in 2004 was early compared to spring 2003 (Fig.1 and Fig.2a). Daily mean temperatures were slightly higher in 2004 (Fig.2b).

2 Goose staging

Daily goose counts were conducted in an area of about 2 km^2 around Camp Millar, from the southwest edge of Diabasbukta to approx. Camp Bell. The date of arrival of the first geese was similar in both years for all three goose species staging in Vårsolbukta (Fig. 3). Unfortunately, only few pink-footed geese (*Anser brachyrhynchus*) and light-bellied brent geese (*Branta hrota bernicla*) are marked with individual Darvic-rings and thus, detailed studies on migration timing can only be conducted in barnacle geese (*Branta leucopsis*). Currently, about 10% of the Svalbard barnacle goose population is marked with Darvic-rings (Griffin, pers. comm.).

Median arrival date for barnacle geese in Vårsolbukta was the 26^{th} of May in both years, whereas geese left Vårsolbukta three days earlier in 2004 than in 2003 (Table 1). Consistently, repetitive ring readings revealed a shorter mean staging time in 2004 compared to 2003 (Table 1). In both years, about half of the geese staged only one day in the area, whereas the other half stayed between 2-15 d (2003) and 2-9 d (2004).

Table 1. Average arrival and departure dates and staging times of barnacle geese in Vårsolbukta, Svalbard. Staging times in parantheses are means ± standard error for birds staying longer than one day.

Year	Median arrival	Median departure	Staging time
2003	26.5.	30.5.	3.9 ±0.3 d (6.6 ±0.4 d)
2004	26.5.	27.5.	2.5 ±0.2 d (4.6 ±0.3 d)

[1] see also Report of the field season in Vårsolbukta, 3.5. - 16.6. 2003 (Christiane Hübner, UNIS)

By dividing the sum of all daily goose counts with the mean staging time, the number of individual geese using Vårsolbukta as spring staging area can be estimated and results show that more than 20 % of the Svalbard barnacle goose population has been seen in Vårsolbukta in both years (Total population estimate: 27.000 geese; geese using Vårsolbukta during spring: 2003 - 5.332 geese, 2004 - 5.826 geese). In addition a considerable number of light-bellied brent geese and pink-footed geese stop over in this area (Fig.3). Thus, Vårsolbukta can be considered as an important spring staging site for the geese breeding in Svalbard.

3 Diet and body condition

To investigate food use, barnacle goose droppings were collected and analysed under the microscope. Plant particles in the droppings can be identified due to different epidermis cell structures. In both years, the main food was moss throughout the entire period. In 2004, grass content in the droppings increased in late May. To be able to judge the quality of the different food types, chemical analyses are being conducted (still in progress). However, another way of estimating the food availability and quality is to look at the change of body condition in individual geese. In geese, the shape of the abdomen is a good measure of fat reserves and, thus, their body condition (Fig.4). This method and can be used to estimate body condition without disturbing the geese.

Geese arrived with larger abdominal profiles (AP) in 2004 compared to 2003, which indicates that feeding conditions prior to Vårsolbukta were better in 2004. Females had generally larger APs as males both at arrival in and departure from Vårsolbukta. For females, the increase of fat reserves during their stay in Vårsolbukta was similar in both years, whereas males gained more fat reserves in 2004 (Fig.5). Males seem to be more sensitive to the environmental variation in the pre-breeding area than females, i.e. they can only deposit extra body fat stores when feeding conditions are good. One explanation for this difference between sexes can be the importance of female body condition for reproductive success in pairs. A male primarily should ensure good feeding conditions for its female, and only when conditions allow, refill its own body reserves as well. The role of body condition in males during breeding is still rather unclear, but there are indications that also male body condition plays an important role for reproductive success (Madsen, unpublished).

4 Migration schedule

In co-operation with Paul Shimmings in Helgeland, Jouke Prop at Diabasøya, Nordenskiöldkysten, and Maarten Loonen in Ny Ålesund, I compiled a preliminary migration schedule for the period between spring staging on the mainland (Helgeland) and the first egg laid in two breeding colonies in Svalbard (Diabasøya and Ny Ålesund).

For the migration leg from Helgeland to Vårsolbukta, individual departure dates from Helgeland were compared with the arrival dates in Vårsolbukta for the same birds (Fig.6). The dates of departure from Helgeland have to be treated as estimates with a certainty of ± 4 d[2], since the area the observers had to cover each day is large and geese may have stayed some days longer without being detected. The mean time used for this leg of migration was 13.1 d and 12 d for 2003 and 2004, respectively (Fig.7), and exceeds the actual time needed for a direct flight between the two locations by at least 10-11 days. Early departing birds used on average 6-7 days longer than late departing birds (Fig.6), indicating that late departing geese can compensate their delay by arriving earlier in Vårsolbukta.

These results indicate strongly that the geese use additional staging areas on their way north (Fig.7). One possible candidate for such an area is Hyttevik, north of Hornsund. However, no systematic counts and ring readings have been conducted in this area in the important period of barnacle goose migration.

A similar pattern is seen on the next leg of migration from Vårsolbukta to the breeding colonies (Fig.8). In Ny Ålesund, dutch researchers observe the local breeding colony on a yearly basis.

[2]calculated by the difference of recorded mean departure for ringed birds and mass departure of all birds in Helgeland

Nevertheless, egg laying dates for individual geese could only be recorded for 2003, since the high predation pressure by Arctic fox and polar bear resulted in a total nesting failure in 2004. However, in 2004 another dutch research team camped close to Diabasøya and thus, for this year egg laying dates for the colony breeding on this island could be used. Also for this last leg before arrival at the breeding colony, the geese seem to use much longer time for migration than needed for actual flight time (NÅ: 16.1d, DØ:5.2d, Fig.7) and late departing individuals use less time for the travel to catch up with their tight reproductive schedule. Here again, there are indications that geese use additional staging sites on their way (Fig.7).

In summary, the time schedule is generally very similar between years, wheras it varies considerably between individual geese. Thus, the long time needed for migration, the high individual variability and the short staging time in Vårsolbukta point to a migration strategy of using several short stop-overs on different locations in a flexible way depending on environmental conditions and individual decisions. This effects directly management decisions on Svalbard, since it seems that the barnacle geese depend on many locations, rather than on few major sites during pre-breeding. The consequences of a loss of one or several of those staging sites can not be foreseen and further studies are necessary to confirm the above speculations.

5 Other observations

In addition to the daily goose counts, we recorded the number of reindeers in the area (Fig. 9). However, these numbers are minimum counts, since we did not search the area thoroughly for reindeers. During the entire period up to 50 % of all counted reindeers were spotted high up in the bird cliff. There were no newborn calves in the area.

We frequently got visited by two Arctic foxes, most probably a pair, which had a den in the area. During a later stay in end of July, we observed at least three young Arctic foxes playing on the plain north of Camp Millar.
During the whole period in Vårsolbukta we saw no sign of polar bears.
For observations of other birds see Table 2.

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Big thanks for putting the Governors cabin at Camp Millar at our disposal!

Table 2. Additional observations of birds during spring 2004 in Vårsolbukta, Svalbard

Species			**Date**	**Remarks**
Black guillemot	Teist	*Cepphus grylle*	9.5.	2 indiv.
Common eider	Ærfugl	*Somateria mollissima*	9.5.	1. sighting, 6 pairs
Golden Plover	Heilo	*Pluvialis apricaria*	20.5.	1 indiv.
Purple sandpiper	Fjæreplytt	*Calidris maritima*	21.5.	1. sighting, 1 indiv.
Purple sandpiper	Fjæreplytt	*Calidris maritima*	22.5.	> 5 indiv.
Great skua	storjo	*Stercorarius skua*	22.5	1. sighting, 3 indiv.
Arctic skua	tyvjo	*Stercorarius parasiticus*	27.5.	1. sighting, 1 indiv.
Cackling goose	'Liten kanadagås'	*Branta hutchinsii*	2.6.	1 indiv.*
Greater black-backed gull	Svartbakk	*Larus marinus*	8.6.	1. sighting, 1 indiv.

* associated with barnacle geese

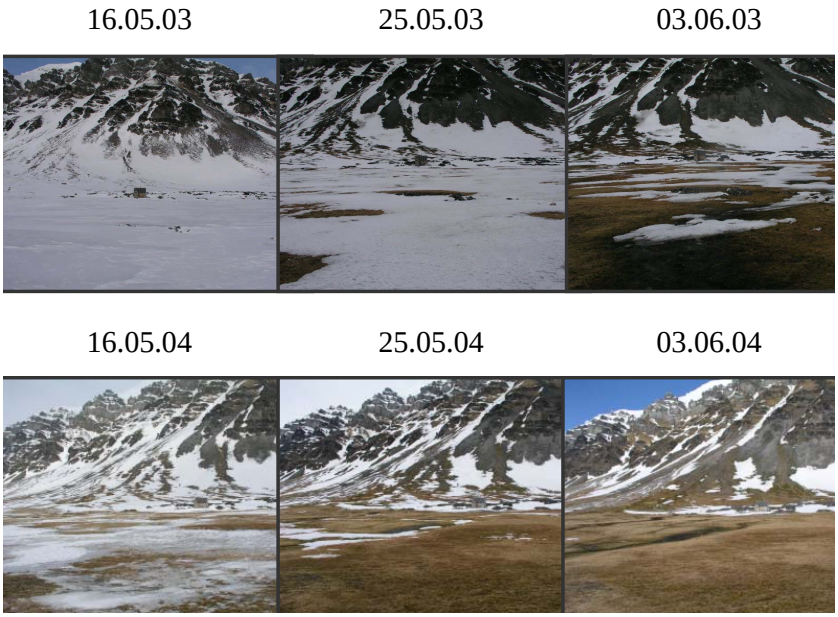

Figure 1. Amount of snow cover in Vårsolbukta, Svalbard, during two subsequent spring seasons.

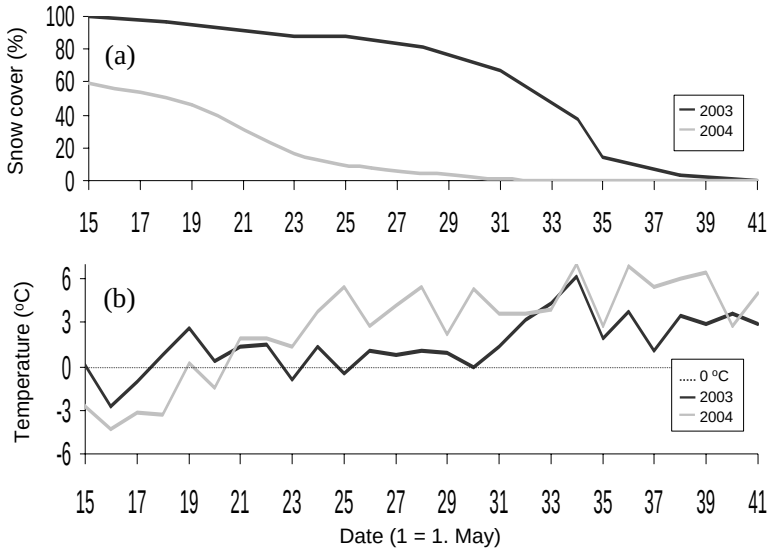

Figure 2. Snowmelt and daily mean temperature in Vårsolbukta, Svalbard.

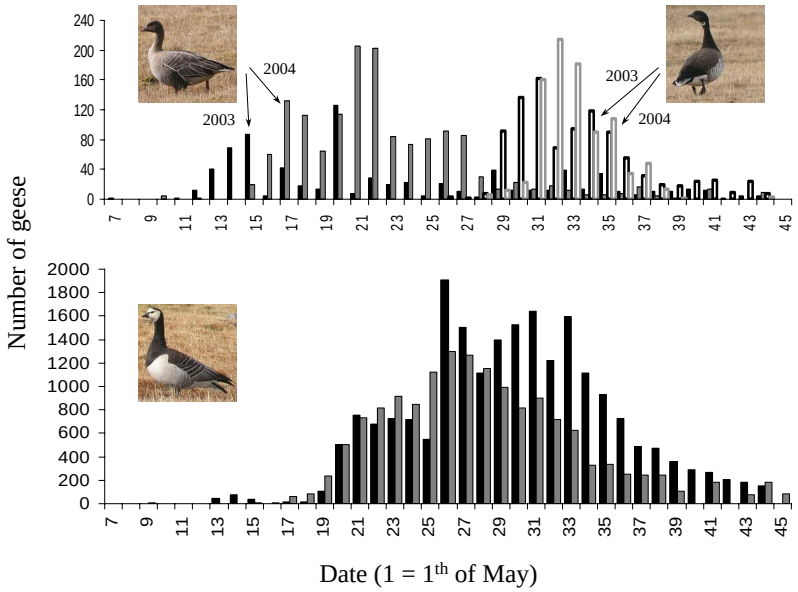

Figure 3. Number of geese in 2003 (black columns) and 2004 (grey columns). The upper graph shows data for pink-footed geese and brent geese, whereas the lower graph shows data for barnacle geese. Note that the scale of the y-axis differs between the two graphs.

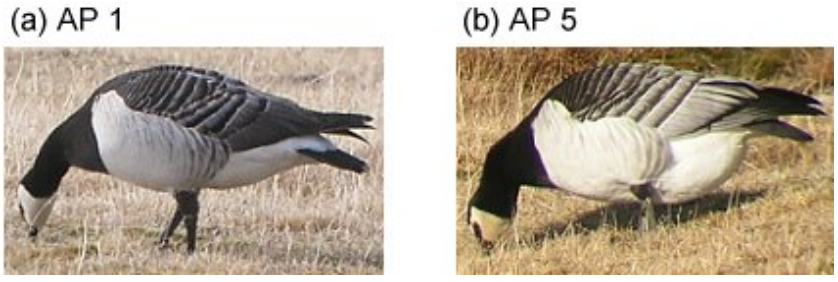

Figure 4. Abdominal profiles (AP) in barnacle geese. The scale reaches from 0-7. (a) AP 1 represents a goose in low body condition, whereas (b) AP 5 shows a goose in good body condition.

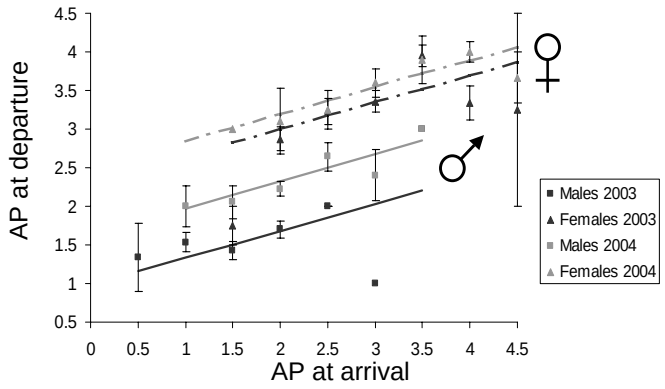

Figure 5. Abdominal profiles (AP) at departure in relation to AP at arrival for barnacle geese in Vårsolbukta, Svalbard. Means ± standard errrors (dots) and predicted values (lines) are shown.

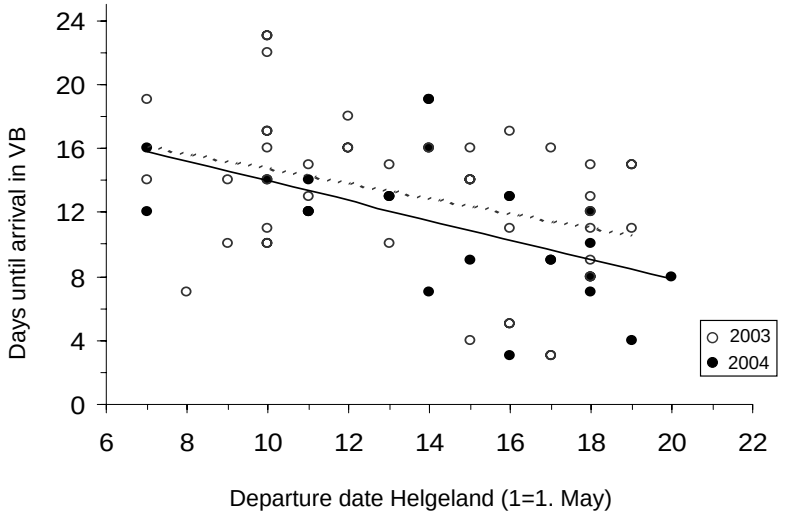

Figure 6. Migration leg between Helgeland on mainland Norway and Vårsolbukta, Svalbard for barnacle geese. The dashed line indicates 'time zero' for the individual geese departing from Helgeland. The arrows show the time elapsed between departure in Helgeland and arrival in Vårsolbukta of early and late departing geese.

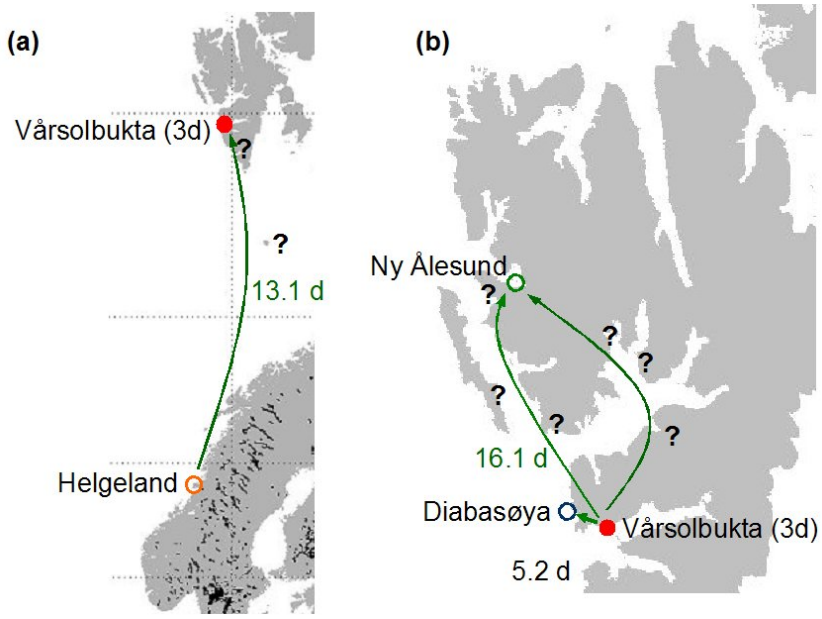

Figure 7. Summary of the migration schedule for barnacle geese breeding on Svalbard. Question marks indicate possible staging sites.

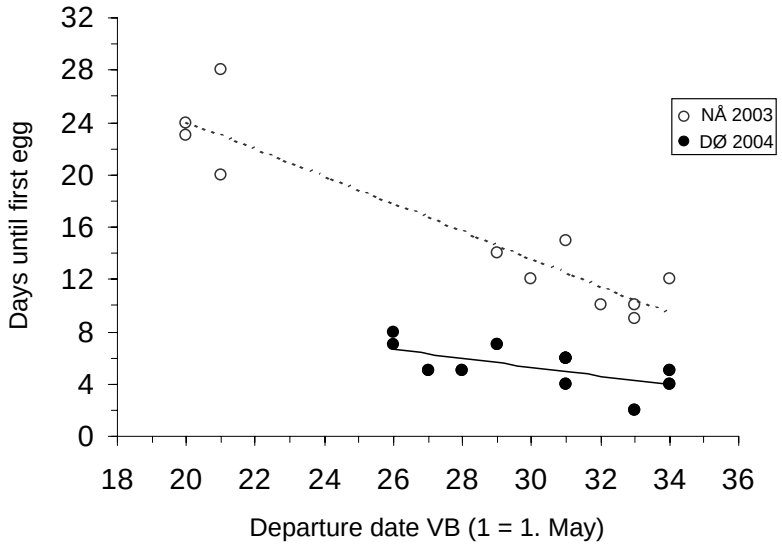

Figure 8. Migration leg between Vårsolbukta and two breeding colonies for barnacle geese, Svalbard. DØ: Diabasøya, NÅ: Ny Ålesund. The dashed line indicates 'time zero' for the individual geese departing from Vårsolbukta. The arrows show the time elapsed between departure in Vårsolbukta and the date of egg laying, i.e. when the first egg is laid, for early and late departing geese.

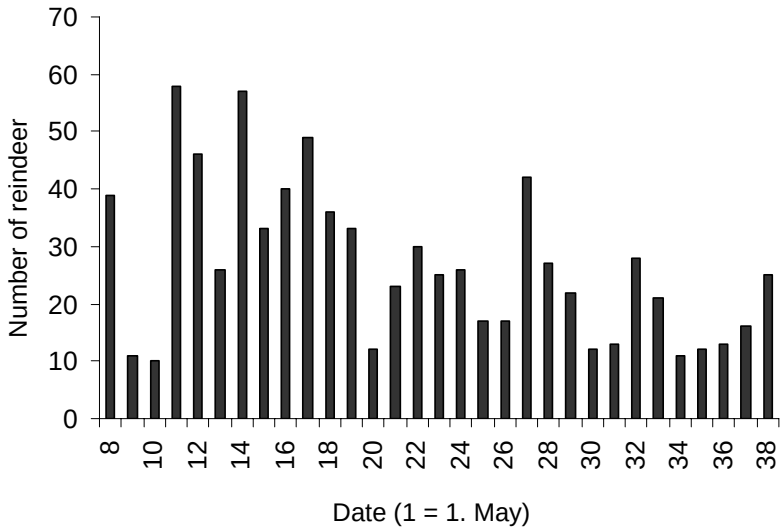

Figure 9. Crude number of reindeers in Vårsolbukta in spring 2004, assessed during daily goose counts