Het topje van de ijsberg

Boschman, Nienke; Hacquebord, Louwrens; Veluwenkamp, Jan Willem

Animal ecologists and the lure of the Arctic: a thirty year saga 1975–2005

R.H. Drent

GETTING A START

We learn at school that to have begun is half the job (*Dimidium facti qui coepit habet*) and to complete Horace's advice we should be bold but sensible. The Netherlands have long hosted the greatest concentration of avian migrants in the off season to be found in northern western Europe, and our work especially in the Wadden Sea kindled curiosity about events on the breeding grounds. Getting a start seemed however to pose insurmountable problems, especially since in those years the Russian Arctic where the majority of our wintering birds originate was to us a closed book. Luckily a determined and optimistic student relying on chance observations from a canoeing expedition to the coast of Western Spitsbergen decided to look for himself in 1975 (Ebbinge and Ebbinge-Dallmeijer, 1976). The discovery of accessible goose breeding sites indeed opened a vista of opportunity when resources were pooled with Dr Myrfyn Owen of the Wildfowl Trust. Linking with the 1977 Edgeøya Spitsbergen Expedition of the Arctic Centre a team of goose biologists undertook counts and observations on the Nordenskiöldkysten and managed to round up virtually the entire Barnacle Goose population on this tundra coast for marking. By using individually coded coloured leg rings that could be decoded at hundreds of meters distance the basis was laid for observation throughout the annual cycle, since this population winters on a reserve on the Solway (Scotland) facilitating close study. This project has continued down to the present day as a series of PhD students and their helpers have forged an unbroken chain in following the fates of these birds and their descendents.

These Arctic breeding geese are entirely dependent on plant food and their travels are hence closely tied to the local timing of peak abundance and quality of forage. The need to time events in the breeding area to enable the goslings to hatch at the appropriate moment to harvest fresh growth to cover their growth requirements, and at the same time ensure that the parents can renew their feathers before undertaking the return migration, leads to a compromise. In fact the parents must be on the spot long before plant growth in the Arctic is well underway, and they therefore follow a strategy of accumulating body stores further south and must endure many weeks of near starvation conditions during

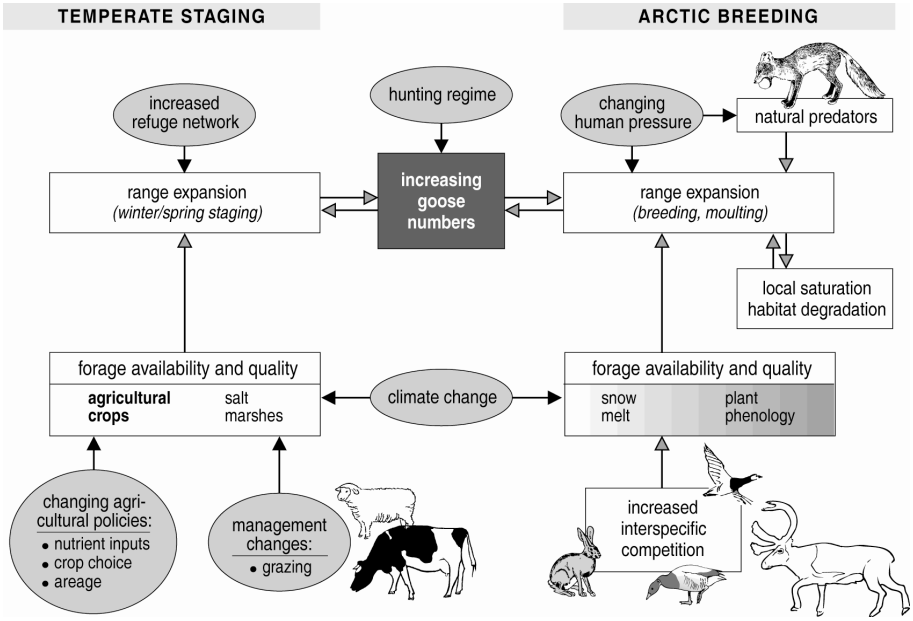

Figure 1 Energy balance of the breeding female Barnacle Goose of the Spitsbergen population throughout the annual cycle, depicted as a circular monthly calendar. The line connects the monthly estimates of the mean daily energy balance (kJ per day) in relation to the maintenence level (the 0-line). It will be noted that both at midwinter and during incubation the goose is in negative energy balance, and that during spring staging in Norway (May) and during the Arctic summer (July and again in September) the highest positive values for the year are reached. The inset shows the migratory flyway for this population that winters in Scotland (from Prop, 2004).

laying and incubation. These relations are diagrammed in figure 1 and underline the conclusion that for these migrant herbivores successful breeding in the Arctic depends entirely on crucial stepping stones bridging the gap between wintering and nesting areas. At these sites the body fat depleted on the first leg of the migration can be replenished and protein stores laid down, so arrival and departure must be finely tuned to local timing of plant growth in the spring. The pattern described for the Spitsbergen breeding Barnacle Goose holds true for other geese and swans, and adequate protection of these 'hot spots' enroute is every bit as vital to survival of the populations concerned as are measures on the breeding and wintering grounds.

Of course our preoccupation with herbivore grazing in the Arctic led to watching the wild reindeer as well, and these proved to ingest goose droppings in times of scarcity. With their more efficient 'ruminant' digestive apparatus reindeer can extract nutrients by recycling the grass fragments originally

harvested by the geese, which in turn have the advantage in collecting minute but nutritious plant fragments (unavailable to reindeer with their large mouth parts). The long-term grazing impact of the year-round resident reindeer appears to enhance conditions for grasses as contrasted to the moss carpets that would otherwise invade and are thus allies to the geese that depend heavily on grasses during their summer stay. Following the pattern of most geese, our study species has increased over the past decades but despite this we have not substantiated any permanent damage so far to the plant resource as has been documented in some areas of Arctic Canada. There is some form of self-regulation at play here, as the increasing population of adult geese has resulted in a strong reduction in gosling production, most likely through food competition.

Cooperation with Norwegian Scientists

Although our solitary hut at Kapp Martin has been an irresistible magnet through the years we enjoyed cooperation with Norwegian scientists from the start and have profited greatly from the research facilities at Ny Ålesund. Here the essential back-up of laboratory facilities not only enabled greater sophistication in our goose work but paved the way towards a comparative study on the energetics of growth in terns. The Arctic Tern breeding locally near the research station offered the ideal yardstick to study climatic adaptation in contrasting the Spitsbergen findings with the data from the same and related species in the Netherlands. The most revealing comparison was offered when Marcel Klaassen was subsequently enabled to partake in an expedition to the Far South to include the Antarctic Tern in his PhD project (see fig. 2). Biologists from Groningen have not missed a field season at Ny Ålesund since 1989 and this has been an important training ground introducing students to the fascination of the Arctic (so far seven have gone on to their own PhD).

Arctic Russia and the East Atlantic Flyway

Despite the involvement in research in Arctic Spitsbergen we still found it tantalizing that the geese and swans we could study in the Netherlands in winter disappeared towards the northeast each spring for their five-month disappearance act. Personal contacts with the scientific community in Archangelsk initiated by Dr Jan Willem Veluwenkamp of the Arctic Centre brought the solution and the boundless hospitality of our Russian colleagues heralded a new chapter for the Dutch biologists. Our first task was to cooperate

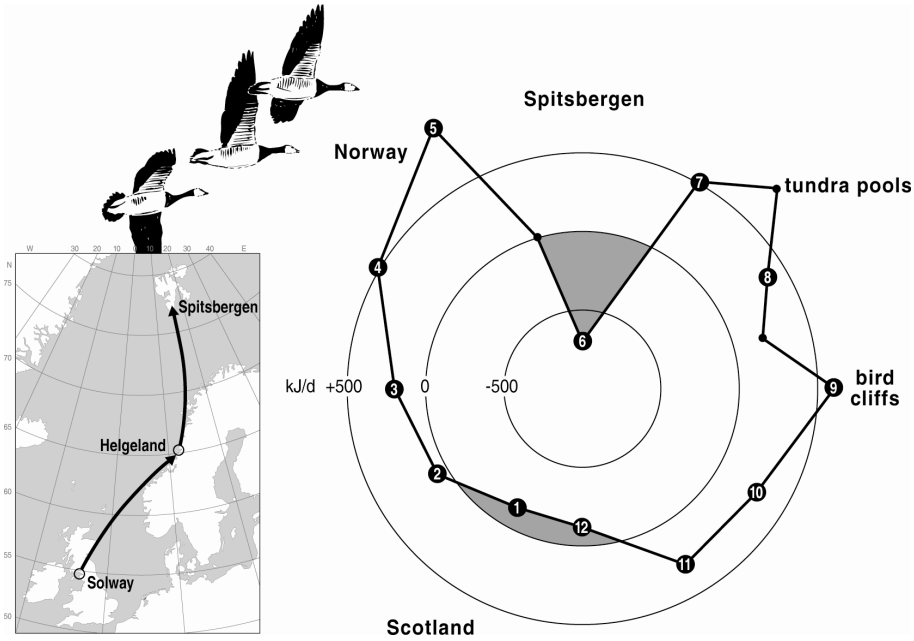

Figure 2 Comparison of costs of thermoregulation of the chick tern throughout development (Etr) in the Arctic Tern at Spitsbergen (SP), the same species in the Netherlands (NL), the Common Tern in the Netherlands, and the Antarctic Tern studied at King George Island. The hatched bloc shows the contribution towards thermoregulation provided by the parents (brooding) and demonstrates how large this subsidy is for the extreme polar environments (from Klaassen, 1992).

in aerial survey work of the White Sea region in 1993 to locate concentrations of Bewick's Swan and the Brent and Barnacle Geese that we knew must pass through this arm on their way to the Arctic coast. Results exceeded our expectations and an estuarine lagoon sheltering behind Mud'Yug Island near Archangelsk promised ideal observational opportunities. In following spring seasons we joined hands with our Russian colleagues to ensure we were encamped on the snowbound nearby islands to study the staging phase well before the first waterfowl arrived. By employing satellite telemetry we were able to track both Bewick's Swan and Dark-bellied Brent Geese from their wintering quarters in north-western Europe. Findings from this new technique confirmed that the White Sea localities we were studying were indeed among the first resting places for these long-distance migrants after departing from the Wadden Sea (geese) or Baltic region (swans). The uninterrupted flight of the brent geese averaged slightly in excess of one thousand kilometers before descending to rest, drink and feed (in that order!) a feat of 14–19 hours of sustained flight. For

the geese the White Sea represented a critical a half-way house enroute to their breeding grounds on the Taimyr Peninsula of Siberia. The Bewick's Swans we were watching were much closer to their nesting area on the Pechora delta but in both cases the concentrations we had located centred on rich supplies of specific forage plants. The geese were feeding on sea grasses (*Zostera*) appearing beneath the ice and the swans were grubbing for tubercles of pondweed (Potomageton) buried in the mud ever since growth had ceased the previous summer. This expeditionary work was followed up by experimental work on the pondweed, plants from the White Sea being grown in cultures at the Limnological Centre of the Netherlands Ecology Institute (Nieuwersluis).

Meanwhile a major research effort was being mounted in the Pechora delta by Dr Mennobart van Eerden and his team at RIZA (Institute for Inland Water Management, Lelystad) in cooperation with biologists from the Komi Scientific Centre with headquarters at Syktyvkar. Intensive studies on the Bewick's Swans soon involved the combined forces of the three Dutch groups (Groningen University, RIZA and NIOO (the Netherlands Ecological Instituut)) with the Russian colleagues as well as members of the Wildfowl Trust (UK) now under their new name of Wetlands and Waterfowl Trust (WWT). The final chapter in this work on the Arctic coast of Russia started in 2000 when the Barnacle Goose was added to the arsenal. This species has long been known to breed on Vaigach Island (south of Novaya Zemlya) and winter in north-western Europe (mainly Netherlands and coastal Germany). During the past twenty years the Barnacle Goose has undergone range expansion not only in the Russian Arctic but even more spectacular has been the colonisation of islands in Sweden and Estonia originally used only as stepping stones during migration. More recently breeding colonies have even become established in the traditional wintering area (Netherlands). These geese thus offered a unique opportunity to study how migratory routes and schedules are shaped by individual histories, and to this end a marking programme at three breeding areas (Russia, Sweden and the new colonies in the Netherlands) has been instituted. For the Russian site we decided to concentrate on a newly established coastal colony at an abandoned fishing station (Tobseda) that can be reached by helicopter from Naryan Mar.

The current Barnacle Goose programme has been the focus of a Dutch-Russian cooperation including biologists from Moscow, first at the newly discovered staging sites on the Kanin Peninsula bordering the White Sea, and since 2002 centred at the Tobseda nesting colony. Three PhD students (one from Moscow State University, two from Groningen University) are pursuing complementary lines and plans for the 2005 season are in place. Here again

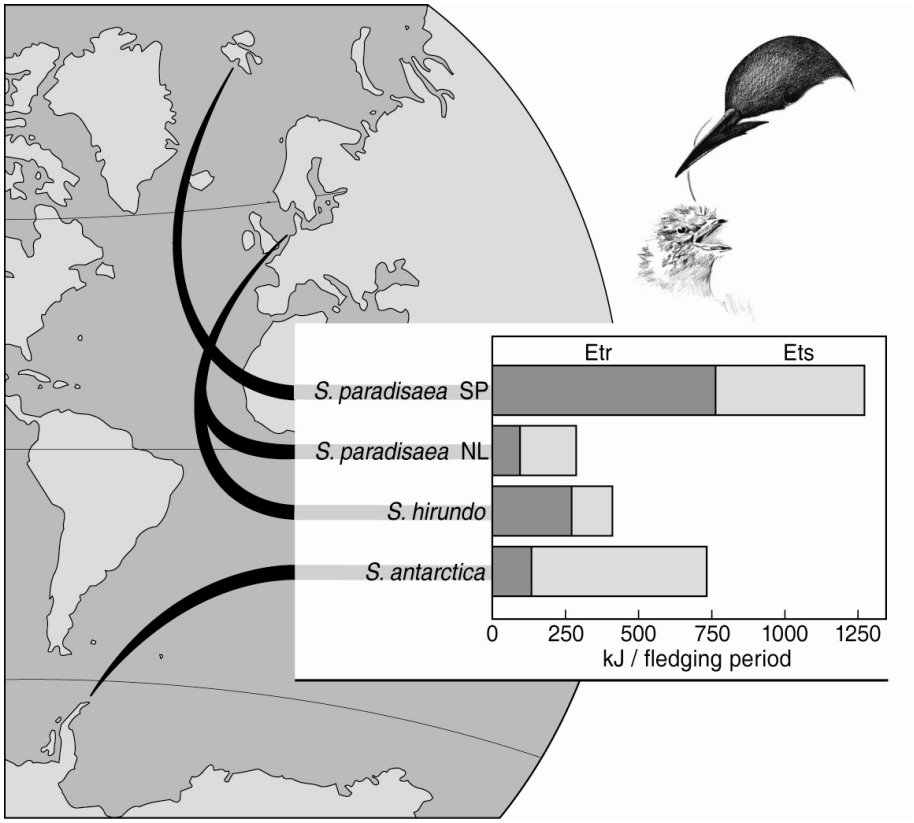

Figure 3 Overview of factors acting both during wintering and breeding known to influence goose populations: note the impact of modern agriculture and refuge establishment in the temperate zone, hunting traditionally heavy during migration, and how changed relations between lowered human presence at Arctic sites interacts with natural predators (polar bears, polar fox) in limiting breeding success. Interspecific competition with other herbivores in the North include wild (Spitsbergen) and domestic (Russia) reindeer. Climate change may lead to a mismatch between travel schedule and timing of peak forage plant quality and abundance (from Jefferies et al., 2005).

tracking techniques are employed to discover the staging sites and timing used during migration. In addition to satellite telemetry intended to provide a record on a sample of 16 breeding females throughout the year, tiny geolocaters have been applied to the legring of 50 geese. These locaters record times of sunrise and sunset on a chip and providing the bird can be recaptured subsequently extracting the data provides a map of the past whereabouts, excluding periods above the Arctic circle in summer when the continuous daylight obviates the plotting system. Results so far are encouraging and supplemented by visual

observation by a team of amateurs during the winter months will provide insights into the annual routine that so far have been beyond our reach, and we are looking forward to renewing contact with our birds at the colony next season. Our goose studies are part of the overall research program in the Pechora region coordinated by RIZA and this provides a rich background of biological inventory and habitat mapping supported by remote sensing methods of great value to our own work.

The Arctic Anchor of Shorebird Flyways

Although an ideal starting point for our work on geese, Spitsbergen with its very limited presence of breeding shorebirds could not satisfy our need to obtain a view from 'the top of the world' on the bird community numerically dominant in our Wadden Sea during late summer and autumn. The contacts resulting from our Arctic work did however facilitate undertaking joint expeditions to the High Arctic of Canada and more recently Greenland where the key species of our Wadden system could be studied. Work on nesting shorebirds in coastal Siberia has again relied on close cooperation with Russian colleagues but the dispersed nature of the nesting habits of these birds precludes a focus on population dynamics as in the waterfowl. Instead the ecophysiology of chick growth and parental energetics have formed the theme of these studies performed under the stress of constant presence of the Arctic Fox, a better nest finder than even the most experienced biologist. In comparison to the waterfowl the migratory flyways of the shorebirds span an even greater geographical area and this work has deservedly emphasized expeditionary work to the tropical wintering areas (South America, Africa, Australia and New Zealand) often at remote localities. Always local biologists have been forthcoming to give aid and this work also includes a vital training aspect. In distinction to the plant-oriented work when studying the feeding ecology of the waterfowl, the shorebird niche involves intensive work on the benthic invertebrates these birds glean from the mudflats during low water. The major cooperating institute for this work is the Royal Netherlands Institute for Sea Research (Texel) underlined by joint appointment of the key researchers.

Acknowledgements

Our debt to the facilitating function of the Arctic Centre over the years has been recorded above, and as everyone involved in expeditions knows there is always a shortage of funds and we acknowledge the Groninger Universiteitsfonds,

Pieter Langenhuys Fonds, Gratama Fonds, Schuuring-Poppinga Fonds, European Science Foundation, Nato Science Panel, Royal Society of London, Royal Netherlands Academy of Arts and Sciences, Netherlands Arctic Program of the Netherlands Organisation for Scientific Research, British Ornithologists' Union, Deutsche Ornithologen Gesellschaft, The Wildfowl Trust, Committee of Environment Protection and Natural Resources of Archangelsk Region, Bird Ringing Centre of the Russian Academy of Sciences, Danish Environmental Research Institute, Norsk Polarinstitutt, University of Lund, Royal Netherlands Institute for Sea Research and Groningen University.

SAMENVATTING

Sinds 1975 trekken Groninger biologen achter ganzen, zwanen en steltlopers de Arctis in. In samenwerking met Deense, Noorse, Canadese, Engelse en Russische biologen heeft het werk een focus gekregen in langlopende volgstudies aan individueel gemerkte vogels. Waarnemingen worden ondersteund door gebruik van miniradio's en satellietzenders om de dynamiek van deze lange afstandstrekkers in beeld te brengen. Op cruciale momenten hebben contacten via het Arctisch Centrum nieuwe mogelijkheden voor onderzoek geschapen, eerst op Spitsbergen en later aan de arctische kust van de Russische Federatie.

REFERENCES

Ebbinge, B.S. and Ebbinge-Dallmeijer, D. 1976. Barnacle Geese (Branta leucopsis) in the Arctic summer: a reconnaissance trip to Svalbard. *Norsk Polarinstitutt Årbok* 1975:119–138.

Klaassen, M.R.J. 1992. The naïve proficient: Metabolic responses of chicks to problems of climate and food availability. Diss. University of Groningen.

Prop, J. 2004. *Food finding: On the trail to successful reproduction in migratory geese*. Diss. University of Groningen.

Jefferies, R.L., Drent, R.H. en Bakker, JP. 2005. Connecting arctic and temperate wetlands: reciprocal influences between migratory water birds, land use and available habitat in response to global change. In Verhoeven, J.T.A. et al., red. *Wetlands.* Heidelberg.