Papers presented at the conference and published elsewhere

Clausen, K.K. & Clausen, P. 2013. Earlier arctic springs cause phenological mismatch in long-distance migrants. *Oecologia* doi: 10.1007/s00442-013-2681-0.

Abstract: An uneven change in climate across the Northern Hemisphere might severely affect the phenology of migrating animals, and especially long-distance migrating birds relying on local climatic cues to regulate the timing of migration. We examine the forward displacement of spring in both staging areas and breeding grounds of one such population, the East Atlantic Light-bellied Brent Goose *Branta bernicla hrota*, and evaluate to what extent their migration has made a proportional response. On the breeding grounds in Svalbard the onset of spring advanced 2 weeks during the 24-year period, whereas no significant trend was found in the temperate staging areas. The timing of migration was constant throughout the study period, mirroring the static climatic conditions in the spring staging areas. These findings indicate a global warming-induced phenological mismatch in light-bellied brent geese, as these might arrive on their breeding grounds well beyond optimal breeding conditions. Our data indicated that productivity was negatively influenced by phenological delay and positively influenced by prolonged snow cover. We argue that both these effects might be representative of a negative influence of the growing phenological mismatch, because years with later thaw might partly offset the effects of increasingly earlier Svalbard springs. During the study period reproduction fell below annual mortality, and the population declined in recent years. The wider implications of these findings may extend to many migrating species, and highlight the urgent need to clarify how global change may influence cues and the associated timing of important life history activities.

Clausen, K.K., Stjernholm, M. & Clausen, P. 2013. Grazing management can counteract the impacts of climate change-induced sea level rise on salt marsh-dependent waterbirds. *Journal of Applied Ecology* 50: 528–537.

Abstract: Climate change-induced rises in sea level threaten to drastically reduce the areal extent of important salt marsh habitats for large numbers of waterfowl and waders. Furthermore, recent changes in management practice have rendered existent salt marshes unfavourable to many birds, as lack of grazing has induced an increase in high-sward communities on former good-quality marshes. Based on a high-resolution digital elevation model and two scenarios for projected rise in near-future sea levels, we employ an ArcMap allocation model to foresee the areal loss in salt marsh associated with these changes. In addition, we quantify the areal extent of inadequate salt marsh management in four EU Special Protection Areas for Birds, and demonstrate concurrent population dynamics in four species relying on managed habitats. We conclude by investigating potential compensation for climate change–induced salt marsh losses by means of more efficient management. Our models indicate that by the end of this century 15.3–43.6% of existent salt marshes will be flooded due to rising sea levels, and that inadequate managed salt marsh presently makes up around 51.1% of total marshes. Thus, re-establishing extensive areas of well-managed marshes might counterbalance the loss expected from rising sea levels

during the next century. In addition to positive effects on plant diversity, this will benefit energetically challenged herbivorous waterfowl such as Light-bellied Brent Geese *Branta bernicla hrota* L. and increase potential recovery of wader populations with unfavourable conservation status such as Black-tailed Godwit *Limosa limosa* L., dunlin *Calidris alpina* L. and Ruff *Philomachus pugnax* L. Implementing environmentally friendly management schemes based on extensive grazing (around 1 cow per hectare) is an important initiative to counteract the accelerating climate change-induced habitat loss in near-coastal areas across the globe, and to secure priority salt marsh habitats that support internationally important populations of breeding, wintering and staging waterfowl. However, this may only be a temporary solution that will have to be supplemented by increased reintegration with the sea and managed retreat of seawalls or near-coastal agricultural areas to effectively safeguard the future salt marsh biome.

Harrison, X.A., Tregenza, T., Inger, R., Colhoun, K., Dawson, D.A., Gudmundsson, G.A., Hodgson, D.J., Horsburgh, G.J., McElwaine, G. & Bearhop, S. 2010. Cultural inheritance drives site fidelity and migratory connectivity in a long-distance migrant. *Molecular Ecology* 19 (24): 5484–5496.

Abstract: Cultural transmission is thought to be a mechanism by which migratory animals settle into habitats, but little evidence exists in wild populations because of the difficulty of following individuals over successive generations and wide geographical distances. Cultural inheritance of migration routes represents a mechanism whereby geographical isolation can arise between separate groups and could constrain individuals to potentially suboptimal sites within their range. Conversely, adopting the parental migratory route in adult life, rather than dispersing randomly, may increase an individual's reproductive success because that strategy has already been proven to allow successful breeding. We combined a pedigree of related Light-bellied Brent Geese (*Branta bernicla hrota*) with 6 years of observations of marked birds to calculate the dispersal distances of adult offspring from their parents in both Ireland and Iceland. In both countries, the majority of offspring were found to recruit into or near their parental sites, indicating migratory connectivity in the flyway. Despite this kin structure, we found no evidence of genetic differentiation using genotype data from 1,127 individuals across 15 microsatellite loci. We suggest that the existence of migratory connectivity of subpopulations is far more common than previous research indicates and that cultural information may play an important role in structuring reproductive isolation among them.

Inger, R., Harrison, X.A., Ruxton, G.D., Newton, J., Colhoun, K., Gudmundsson, G.A., McElwaine, G., Pickford, M., Hodgson, D. & Stuart Bearhop, S. 2010. Carry-Over Effects Reveal Reproductive Costs in a Long Distance Migrant. *Journal of Animal Ecology* 79 (5): 974–982.

Abstract: It has been known for some time that the consequences of "decisions" made at one point in an animal's life may not always be borne immediately. For example, numerous studies have demonstrated the trade-off between current and future breeding success across multiple taxa. It is becoming increasingly clear that such processes may also operate among seasons, such that the conditions experienced at one point in the annual cycle may have significant downstream impacts, or 'carry-over effects', and this is particularly evident among

migratory species. We might therefore predict that certain combinations of reproductive and migratory strategy could lead to profound carry-over effects. However, the extent to which these phenomena might generate variation in fitness within a population is unclear. Here, we investigate how winter habitat selection in a long-distance migrant, with extended parental care (the Light-bellied Grent Goose) is influenced by parental status and how this has a counterintuitive effect on subsequent breeding success. Dominant individuals and groups generally monopolize the best quality resources. In the case of geese, families are dominant; however, our findings highlight a hidden cost to raising a family. Stable isotope analysis demonstrates that later in the non-breeding season, adults with families utilize lower quality resources than non-breeders. This is probably caused by parents being constrained in habitat choice by the lower foraging efficiency of their juveniles. Consequently, parental adults end the winter in poorer condition than non-breeders. We further demonstrate that parents in one year are less likely than expected to breed again in the next year and suggest that this is caused by conditions during the non-breeding period being carried over into the breeding season. In conclusion, we demonstrate previously hidden costs to raising a family, which are likely to be important in terms of life-history evolution.

Kahanpää, L. & Kellomäki, E. 2013. Lemmings and Lesser White-fronted Geese in Norway. *Goose Bulletin* 16: 16–20.

Abstract: The lemming years of 2010 and 2011 provided plenty of easy food for small predators in northern Norway allowing the Lesser White-fronted Geese to breed in peace. As a result the long-term high of 13 broods with an average of 3.4 goslings each was counted in August 2011 in the Valdak marshes, the traditional autumn migration gathering area. One year later, the return to reality was abrupt with only 3 broods totalling 12 young. Also most of the previous years' young birds were absent.

Kondratyev, A., Zaynagutdinova, E. & Kruckenberg, H. 2013. Barnacle Goose *Branta leucopsis* abundance on Kolguev Island – current status and history of population growth. *Wildfowl* 63: 56–71.

Abstract: Barnacle Geese first colonised the Russian arctic island of Kolguev in the early 1980s, since when their numbers have steadily grown. Initial colonies were founded on fox-free coastal sand spits, but by the mid-1990s large colonies (> 5,000 breeding pairs) had become established in the Peschanka River delta, reaching 45,000 breeding pairs by the mid-2000s. Subsequently, numerous new smaller colonies (mean ± s.d. = 12 ± 6 nesting pairs, range = 1–54, n = 18 colonies) started to increase in numbers in the central part of the island, initially associated with *c.* 30% of all known Peregrine Falcon *Falco peregrinus* nests in the study area. The overall population size and number of inland colonies continued to grow, and by 2011–2012 all 24 known Peregrine Falcon nests had Barnacle Goose colonies (mean colony size = 54 ± 40 pairs, range = 1–133, n = 13 colonies). White-fronted Geese *Anser albifrons* and Tundra Bean Geese *Anser fabalis rossicus* formerly recorded nesting in dense colonies around Peregrine Falcon nests no longer did so, apparently having been expelled from core areas by the earlier nesting and more aggressive Barnacle Geese. The hatching success of Barnacle Geese nesting in the open sedge-moss bogs of central Kolguev (first occupied in 2011–2012) was no different to those associating with Peregrine Falcons (73% and 75%

respectively). During brood rearing and moulting, Barnacle Geese share feeding habitats with other goose species. Should their numbers continue to grow on the island, further overgrazing of foraging habitats may increase competition between Barnacle Geese and White-fronted Geese for food, both in brood-rearing and in moulting habitats.

Kowallik, C. & Koffijberg, K. 2013. Does every goose count? Pitfalls of surveying breeding geese in urban areas. *Wildfowl* 63: 90–106.

Abstract: The size of local breeding populations of Greylag Geese *Anser anser* and Canada Geese *Branta canadensis* at a suburban site in Northrhine-Westphalia, Germany, was assessed between 2010 and 2012 using four different methods: nest surveys, counts of territorial pairs and two types of brood counts. For both species, nest surveys generated the highest estimate of breeding numbers. Geese recorded as territorial pairs made up 50–75% of the apparent nesting pairs (73% of all nesting Greylag Geese and 60% of all nesting Canada Geese in an area surveyed extensively in 2011). Numbers of broods recorded never exceeded 50% of the number of apparent nesting pairs. Moreover, the number of broods observed was heavily dependent on fieldwork intensity, with most broods found during highly frequent (twice-weekly) counts that allowed effective monitoring of the fate of individual broods, even without using individual marking. When broods are monitored less frequently, one has to rely on the maximum number of broods observed simultaneously in determining the number of pairs with young, which in our study represented only 10–25% of the apparent nesting number. Although nest counts may provide the highest estimate of breeding goose abundance, they may be impractical or undesirable (*e.g.* because of disturbance to other breeding birds). In such cases, territorial pair assessments may be the preferred method, if separation of breeding and non-breeding birds is not made too conservatively. For instance, only those birds that obviously behave as non-breeders, by leaving the nesting areas to feed on nearby agricultural fields during daytime, should be excluded from breeding numbers. Although counts of the total number of broods can contribute to measures of reproductive success, they can considerably underestimate the number of goose breeding pairs.

Nilsson, L., Follestad, A., Guillemain, M., Schricke, V. & Voslamber, B. 2013. France as a staging and wintering area for Greylag Geese *Anser anser*. *Wildfowl* 63: 24–39.

Abstract: France is traditionally a staging area for Greylag Geese *Anser anser* migrating from northwest Europe to wintering sites in Spain, though increasing numbers have wintered in France over the last three decades. This paper considers sightings within France of neck-banded individuals marked elsewhere in Europe since the 1980s, to determine the origin of Greylag Geese staging and now wintering in the country. The geese included in this study were all caught in summer during the annual moult, either as family groups or in non-breeding flocks. Most sightings of neck-banded geese were from western France, and most birds identified were from breeding areas in the Nordic countries or to a lesser extent in the Netherlands. The Lac du Der area in northeast France was found to be a wintering area for an introduced population of Greylags established southwest of Stockholm in Sweden, and the geese wintering on the Camargue in southern France were recruited mainly from central Europe. Numbers wintering in France have increased in line with the general increase in

the European Greylag Goose population, whereas numbers on passage in France have not increased in the same way, possibly due to a northward shift in the winter distribution of Greylags across Europe. The numbers wintering in France are, however, still small compared to other areas along the flyway.

Nolet, B.A., Silke Bauer, S., Kokorev, Y.I., Popov, I.Y. & Ebbinge, B.S. 2013. Faltering lemming cycles reduce productivity and population size of a migratory Arctic goose species. *Journal of Animal Ecology* 82: 804–813.

Abstract: The huge changes in population sizes of Arctic-nesting geese offer a great opportunity to study population limitation in migratory animals. In geese, population limitation seems to have shifted from wintering to summering grounds. There, in the Arctic, climate is rapidly changing, and this may impact reproductive performance, and perhaps population size of geese, both directly (*e.g.* by changes in snow melt) or indirectly (*e.g.* by changes in trophic interactions). Dark-bellied Brent Geese (*Branta bernicla bernicla* L.) increased 20-fold since the 1950s. Its reproduction fluctuates strongly in concert with the 3-year lemming cycle. An earlier analysis, covering the growth period until 1988, did not find evidence for density dependence, but thereafter the population levelled off and even decreased. The question is whether this is caused by changes in lemming cycles, population density or other factors like carry-over effects. Breeding success was derived from proportions of juveniles. We used an information-theoretical approach to investigate which environmental factors best explained the variation in breeding success over nearly 50 years (1960–2008). We subsequently combined GLM predictions of breeding success with published survival estimates to project the population trajectory since 1991 (year of maximum population size). In this way, we separated the effects of lemming abundance and population density on population development. Breeding success was mainly dependent on lemming abundance, the onset of spring at the breeding grounds, and the population size of Brent Goose. No evidence was found for carry-over effects (i.e. effects of conditions at main spring staging site). Negative density dependence was operating at a population size above *c.* 200,000 individuals, but the levelling off of the population could be explained by faltering lemming cycles alone. Lemmings have long been known to affect population productivity of Arctic-nesting migratory birds and, more recently, possibly population dynamics of resident bird species, but this is the first evidence for effects of lemming abundance on population size of a migratory bird species. Why lemming cycles are faltering in the last two decades is unclear, but this may be associated with changes in winter climate at Taimyr Peninsula (Siberia).

Rosenfeld, S.B. 2009. *The Pattern of Summer Feeding Ecology of Geese in the Russian Arctic.* KMK, Moscow, Russia. [In Russian.]

Rosenfeld, S.B. & Syroechkovski Jr., E.E. 1998. The diet of brent geese in the Russian tundra during the breeding period. *Casarca* 4: 96–119. [In Russian with English summary.]

Abstract: Feeding ecology and diet of the Brent Goose were studied in 6 different areas of the Russian Arctic in 1993–98. Different parts of the breeding range of the Dark-bellied Brent were studied: the core zone of the breeding range on the islands of the Kara Sea and the Taimyr coast, the marginal part of the range in the inner areas of Taimyr, and the eastern edge of the range at the Anabar Bay. Feeding of Black Brant was observed in a typical site in the colony in the north of the

Lena Delta. Data on feeding of Atlantic Brent from Spitsbergen and Black Brant from Alaska were used for comparison. Food composition was studied in the laboratory by the dropping analysis following M. Owen's (1975) method adapted to the tundra zone by us (Rozenfeld 1997). Additional visual observations of feeding birds, especially pulli, were made. We have compared the diet of 7 different Brent Goose populations during the breeding period and of pulli in four locations. In the Brent Goose diet, 38 species of vascular plants are found regularly and about 15 species occasionally. They belong to the following six main groups: *Poaceae/ Juncaceae*, *Cyperaceae*, *Fabaceae/ Polygonaceae/Asteraceae*, *Salicaceae* and *Equisetaceae*. The role of mosses is negligible and only in Spitsbergen they play significant role, most likely due to poor composition of plant communities. If M. Owen's method is used, the role of mosses could be overestimated (Derksen *et al.* 1993), but we have avoided this problem by modification of dropping processing. The role of insects in food of the Brent Geese, and particularly pulli, is high in comparison with other geese. Animal food cannot be considered to be eaten by mistake. The role of insects increases northwards and can make up to 6% of food items consumed by pulli. The review of animal food ingested by the Brent Geese is presented to show that they are the most invertebrate-eating species among all geese. In all study areas, the basic food of geese (grasses and sedges) was related to availability of the most common plants in the surroundings of the breeding site. In High Arctic, Brents utilized more plant species, because of the shortage of their favourite food. Brents were forced to eat any food items they could find. Two different types of diet with prevalence of *Poaceae/Juncaceae* and *Cyperaceae* are characteristic of the Brent Geese during the nesting period. The first type is typical for geese in all study areas in Taimyr including polar deserts of the Kara Sea islands and inland tundra with relatively reach vegetation. The second type was observed in geese inhabiting flat marshy islands in the Anabar Bay and the Lena Delta. Different subspecies of the Dark-bellied Brent and Black Brant were breeding in very similar landscapes and had almost similar diet. These data as well as observations from Alaska show that Brent geese easily adapt their feeding requirements to the plant communities of their habitats. The coastal islands of such type are the most widespread breeding habitats of the Black Brants in Asian tundra we can assume that the diet with high share of sedges, which is more typical for the larger *Anser* geese, is common for most of the Asian Black Brants. The Brent Geese can use only small parts of the plants, so after plants have grown taller geese can switch to the younger plants or change the species. Shifts from early vegetating species (sedges) to late vegetating ones (grasses) can be easily observed during June-July. Data from the north-western Taimyr shows that the Brent Geese prefer *Poaceae/Juncaceae* to other plants throughout the season and that they select this group of plants when they can. The Brent geese have to use less preferred sedges which are more available after arrival in June but later through the season the increase of use of *Poaceae/Juncaceae* can be clearly seen. Diet of 1–10 days old pulli is more similar in all study sites then of adult birds. Even in high arctic Taimyr and Lena Delta pulli had nearly similar diets with dominating of *Poaceae/ Juncaceae* numerous *Fabaceae/Polygonaceae/ Asteraceae* and very little role of *Cyperacea*. Diet of Brent geese pulli differs with diets of

young Red-breasted Geese and Bean Geese. The influence of Brent Geese on tundra vegetation was never estimated. In the high arctic in polar desert habitats (Russki Island and other islands in the Kara Sea) Brent in good breeding year can eat 90% of all available vegetation above the ground. Luckily Dark-bellied Brent have 3 year cycle in breeding so they normally do not stay in summer on the islands next year after peak breeding and give the vegetation communities chance "to rest". If Brent Geese will try to breed on the high arctic every year they will be likely faced with problem of absence of available food. Taking into account that about half of all breeding pairs of Dark-bellied Brent are breeding on the high arctic islands of Kara Sea the importance of vegetation as potential regulation factor could be high. We suggest that the role of vegetation of high arctic islands in regulating the proportion of young in the Brent population should be precisely studied.

Rozenfeld, S.B., Dmitriev, A.E., Bulteau, V. & Vangeluwe, D. 2012. Rare Anatidae on the northeastern Gydan: results of the 2012 summer survey. *Casarca* 15 (2): 15–22. [In Russian with English summary.]

Abstract: Five colonies of the Red-breasted Goose *Branta ruficollis* (23 nests) were found on the 415-km survey route along the Mongocheyakha River in the central part of the Gydan Peninsula in the period between 6 and 26 July 2012. Four to 7 pairs nested in each colony. A total of 67 adult Red-breasted Geese were encountered, 25 of them moulting. The average clutch size was 3.5 ± 0.5 eggs (n = 8); average brood size was 4.8 ± 1.0 goslings (n = 6). No nesting Bewick's Swans *Cygnus c. bewickii* were found in the study area. Only 30 non-breeding swans were counted along 415-m water route with no young birds among them. An additional 220-km aerial survey was performed on 26 July: 62 adults and four immatures were encountered; 10 pairs were accompanied by broods. The average brood size was 1.6 ± 0.2 cygnets (n = 10).

Rozenfeld, S., Timoshenko, A. & Vilkov, V. 2012. The results of goose counts on the North-Kazakhstan stopover site in autumn 2012. *Casarca* 15 (2): 164–176. [In Russian with English summary.]

The geese were counted on the lakes and their vicinities by two teams in the period between 25 September and 16 October 2012 in Northern Kazakhstan. The dates of counts were chosen in accordance with the data obtained from the transmitter-tagged birds. The total amount of geese was estimated on the basis of early morning counts. Data on specific composition of the flocks and age ratios were collected in daytime and evening. For more detailed information we made photos of each flock (n = 3875). To avoid overestimation because of the local movements of geese, the team members and rangers were in close contact with each other over the entire survey period. The geese were counted every 3–4 days on the lakes with the large congregations. Data on the specific composition of the flocks and age ratio in each species were collected on the peak of migration and analyzed with the use of photographs made during the counts (n = 1764). Since the majority of lakes was dry, and also due to very strict protective measures taken by the game husbandries, almost all migrating geese were encountered only on five groups of lakes. In October 2012, we counted 835,700 White-fronted, 111,200 Greylag, 150,500 Red-breasted, and 30,600 Lesser White-fronted Geese. The proportions of the immature birds in 1,764 flocks were 54.5, 69.8, 46.5, and

43.6 %, respectively. Our data suggest underestimation of the populations of the Red-breasted and Lesser White-fronted Geese on the wintering grounds and possibly reflect the efficiency of the protective measures taken in Kazakhstan and Russia in the last two years.

van der Jeugd, H. 2013. Survival and dispersal in a newly-founded temperate Barnacle Goose *Branta leucopsis* population. *Wildfowl* 63: 72–89.

Abstract: Survival rates and dispersal were studied in a newly-founded temperate Barnacle Goose *Branta leucopsis* population in the Netherlands using marked individuals. Birds were ringed at three localities: two in the Delta area in the southwest of the Netherlands and one in Fryslân in the north. Annual survival decreased during 2004–2012 from *c.* 95% to *c.* 75%, probably due to an increase in hunting pressure introduced to reduce the size of the population and its damage to agricultural crops. A decrease in survival should lead to a decline in numbers in the population, but this was not apparent from the summer counts. Natal dispersal was high: 56% of males attempted to breed > 10 km from their natal site, and 38% at > 100 km from their natal area. In females, these figures were 30% and 24%, respectively. A substantial number of male Barnacle Geese most probably emigrate to the large population that breeds along the shores of the Barents Sea, and the Dutch Barnacle Goose population currently is a source, from which restocking of the Barent's Sea population takes place. Breeding dispersal was low. Disturbance of colonies may influence dispersal as birds from one colony disturbed by foxes showed remarkably high natal and breeding dispersal.

Vangeluwe, D., Rozenfeld, S.B., Dmitriev, A.E., Bulteau, V. 2012. Preliminary results from GPS remote tracking of Red-breasted Geese (Branta ruficollis) from Gydan Peninsula (Russia) breeding grounds. *Casarca* 15 (2): 64–69. [In English with Russian summary.]

Abstract. Ten Red-breasted Geese were tagged on the breeding grounds along the Mongocheyaha River on the northeastern Gydan Peninsula of Russia (see Rozenfeld *et al.* 2012 for complete details) between 8–21 July 2012. The efficiency of the transmitters (and the system) used was less than optimal. The data received were highly precise, and the system was very easy to use. But the unreliability of the transmitters is a concern, only four of the 10 having transmitted so far, and all four having transmitted only intermittently. It could be that the transmitters were, and are now, out of the GSM network range and will begin to transmit both historical and current data upon arrival in more populated places, such as Romania and Bulgaria. Two failed breeders amongst the tagged female Red-breasted Geese both headed east to moult on the Taimyr. In contrast, the tagged males moulted near their nesting colony. A 35-day moulting period was determined, which does not agree with the 15–20 days given by Hunter (2005).The phenology of post-breeding migration was as follows. In early September, after having moulted on Western Taimyr, one of the tracked Red-breasted females was located in the Ob Estuary, and heading south. A male that had moulted on the Gydan was still on the Gydan tundra on 12/09. Meanwhile, by 11/09, another goose had already reached the mid-Siberian stopover, where she staged for at least 13 days. Kazakhstan was reached by one female on 23/09 and by the other on 29/09. In early October, both males were still on stopovers in Russia, 930 km and 660 km north of the Kazakh

sites. In Kazakhstan another period of refuelling of at least 13 days was recorded. Interestingly, the female concerned moved around the area to a very limited extent for five days following her arrival. She may have been exhausted from her long fl ight to this location. Stopovers were located in Siberia for three Red-breasted Geese. All these sites were situated along the course of the Ob, and two of the geese stopped just 30 km apart, but at an interval of 10 days. The Kazakh sites were at the same latitude (53.7°N and 53.9°N) but at a difference of 2° longitude (62.9°E *versus* 64.9°E). A minimum average speed of 68.3 km/h can be calculated for the direct flight by #18 between central Siberia and Northern Kazakhstan. This flight speed is exceptional and needs to be further analysed in light of meteorological data, particularly wind speed and orientation. It shows that Red-breasted Geese may have the capacity to make only one, lengthy, stop between their native tundra and the Kazakh steppe.

Photograph: Catching Light-bellied Brent Geese by cannon-net, at a spring staging site in Denmark, by Kevin Clausen.

