

## Project information

### Keywords

seabird, migration, habitat use, distribution, diversity, hotspots, climate, contaminants

### Project title

Seabird habitat use and migration strategies

### Year

2016

### Project leader

Børge Moe

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

(78.9N, 12.2E), (69.6N, 18.03E), (68.25N, 69.16E)

### Participants

Project participants and network partners.

Partners in Kongsfjorden and Brensholmen/Troms have been underlined. Also, Ehrich (skua field team in Yamal), Gilg (skua field team in Greenland) and van Bemmelen (phd connected to this project) are underlined.

From the Fram Centre and Norway: Hanssen (NINA), Sagerup (Akvaplan-NIVA), Ehrich (UIT), Herzke (NILU), Coulson (UNIS), Gabrielsen (NP), Strøm (NP), Descamps (NP), Bustnes (NINA), Anker-Nilssen (NINA), Systad (NINA), Dalsgaard-Christensen (NINA), Reiertsen (NINA), Erikstad (NINA), Bjørnliid (NTNU), Kilen (NTNU), Ask (NTNU), Skottene (NTNU), Fenstad (NTNU), Pelabon (NTNU), Bech (NTNU), Schultner (NTNU), Helberg (UiO)

International: France: Gilg (Univ Bourgogne), Chastel (CEBC CNRS), Tartu (CEBC CNRS), Angelier (CEBC CNRS), Goutte (CEBC CNRS), Blevin (CEBC CNRS), Fort (Univ. La Rochelle), Bustamante (Univ. La Rochelle), Boulmier (CEFE CNRS), Gremillet (CEFE CNRS), Ponchon (CEFE CNRS), Netherlands: van Bemmelen (Imares, Wageningen Univ), Tulp (IMARES, Wageningen Univ), Prop (Univ Groningen), Oudman (Univ Groningen), Biersma (Univ Groningen), Loonen (Univ Groningen). Denmark: Schmidt (Århus Univ), Hansen (Århus Univ), Mosbech (Århus Univ), Frederiksen (Århus Univ), Iceland: Jonsson (Univ Iceland), Gunnarsson (Univ Iceland), Russia: Sokolov, Sokolova (Russian Academy of Sciences, Gavriilo (Arctic & Antarctic Res Inst), Germany: Welcker (Bioconsult), Sittler (Univ Freiburg), Lang (Inst. für Tierökologie und Naturbildung), UK: Phillips (BAS), Bogdanova (CEH), Daunt (CEH), Harris (CEH), Wanless (CEH), US: Kitaysky (Univ Alaska Fairbanks). Canada: Gauthier, Robillard (Univ. Laval), Finland: Mäntylä (Univ Turku)

### Flagship

Fjord and Coast

### Funding Source

Fram Centre Flagship, Own funding, External funding and other funding

### Summary of Results

This project has provided important new knowledge about habitat use and migration strategies of arctic seabirds, with relevance for conservation management.

The project is focused on the fieldwork we do in Kongsfjorden and in Troms, and we take part in large-scale research networks to ensure multi-colony tracking at many Arctic and sub-Arctic locations.

One highlight is the scientific output, including one published paper, two papers in revision and two MSc thesis. The published paper (Hanssen et al. 2016) is part of the 'Kongsfjorden' special issue in Polar Biology. It reveals the migration strategies of Svalbard breeding common eiders and underlines implications for the bilateral conservation management by Norway and Iceland. The two papers 'in revision' have been re-submitted to Marine Ecology Progress Series and a special theme section about Individual Variation in Movement Strategies- a very relevant theme section for this project. Two MSc students in our project, H Kilen and N Bjørnliid, defended their thesis in June 2016 at NTNU.

Another highlight is the fieldwork, which has been successful. Especially, a breakthrough for Yamal, where they finally succeeded in recapturing long-tail skuas and recover tracking data from the geolocators. This has provided the first tracking data on Long-tail skuas from Russia, showing that they migrate through the Barents Sea and along the Norwegian coast instead of crossing the Eurasian continent

over land, to reach the wintering areas in the southern hemisphere. This project supplied the loggers and equipment for the field team in Yamal.

Finally, the project has contributed to a conservation management process, led by Birdlife international, which has resulted in a proposal to OSPAR for a marine protected area (MPA) in the Mid Atlantic, based on analysis of tracking data of many marine species.

#### Master and PhD-students involved in the project

Two MSc students defended their these at NTNU in June 2016. Heidi Kilen and Nora Bjørnliid

One current MSc student. Emily Hill (NTNU)

One phd student connected to the project. Rob van Bemmelen (Univ Wageningen, IMARES)

#### For the Management

- 1) Most Arctic seabird migrate far from breeding grounds. They depend on safe flyways and the safeguarding of wintering areas on large spatial scales. Coordinated international conservation measures are important to ensure ocean health from local to global scale
- 2) Norway and Iceland host winter population of Svalbard eiders, and they share the conservation responsibility for this population.
- 3) The Norwegian coast/waters is flyway for large populations from Russia
- 4) Migration strategy relates to exposure of contaminants for seabirds

#### Published Results/Planned Publications

##### Core publications:

Hanssen, S.A, G.W. Gabrielsen, J.O. Bustnes, V.S. Bråthen, E. Skottene, A.A. Fenstad., H. Strøm, V. Bakken, R.A. Phillips, B. Moe (2016) Migration strategies of common eiders from Svalbard: Implications for bilateral conservation management. *Polar Biology* DOI 10.1007/s00300-016-1908-z

van Bemmelen, R., B. Moe, S. A. Hanssen, N. M. Schmidt, J. Hansen, J. Lang, B. Sittler, L. Bollache, I. Tulp, R. Klaassen & O. Gilg (2016) Consistency and flexibility in non-breeding movement patterns in a long-distance migratory seabird, the Long-tailed Skua. *Marine Ecology Progress Series* (in revision)

Bogdanova, M. I., A. Butler, S. Wanless, B. Moe, T. Anker-Nilssen, M. Frederiksen, T. Boulinier, L. S. Chivers, S. Christensen-Dalsgaard, S. Descamps, M. P. Harris, M. Newell, B. Olsen, R. A. Phillips, D. Shaw, H. Steen, H. Strøm, T. L. Thórarinnsson & F. Daunt (2016) Multi-colony tracking reveals spatio-temporal variation in carry-over effects between breeding success and winter movements in a pelagic seabird. *Marine Ecology Progress Series* (in revision)

##### MSc theses:

Kilen, Heidi (2016) How Does Spring Migration and Day Length Affect the Diving Ecology of a Capital Breeder Wintering at High Latitudes? MSc thesis, NTNU Trondheim

Bjørnliid, Nora (2016) Repeatability and Flexibility in the Migration Strategies of an Arctic Seabird. MSc thesis, NTNU Trondheim

##### Symposium:

van Bemmelen, Rob; Moe, Børge; Hanssen, Sveinn Are; Schmidt, Niels M.; Gilg, Olivier. Consistency of migration routes in a long-distance migratory seabird, the Long-tailed Skua. *Animal Movement International symposium. Bridging the Gap Between Modelling and Tracking Data*, Lund University 16-02-2016 - 17-02- 2016

##### Other scientific publications with relevance for the flagship project:

Merkel, Benjamin; Phillips, Richard A.; Descamps, Sébastien; Yoccoz, Nigel Gilles; Moe, Børge; Strøm, Hallvard. (2016) A probabilistic algorithm to process geolocation data. *Movement Ecology* 4:26 DOI: 10.1186/s40462-016-0091-8

Blévin, Pierre; Angelier, Frédéric; Tartu, Sabrina; Ruault, Stéphanie; Bustamante, Paco; Herzke, Dorte; Moe, Børge; Bech, Claus; Gabrielsen, Geir W.; Bustnes, Jan Ove; Chastel, Olivier (2016) Exposure to oxychlordane is associated with shorter telomeres in arctic breeding kittiwakes. *Science of the Total Environment*, 563-564: 125-130

Bustnes, Jan Ove; Bårdsen, Bård-Jørgen; Moe, Børge; Herzke, Dorte; Hanssen, Sveinn Are; Sagerup, Kjetil; Bech, Claus; Nordstad, Tore; Chastel, Olivier; Tartu, Sabrina; Gabrielsen, Geir W. (2016) Temporal variation in circulating concentrations of organochlorine pollutants in a pelagic seabird breeding in the high arctic. *Environmental Toxicology and Chemistry* 2016 doi: 10.1002/etc.3560

Fenstad, Anette; Bustnes, Jan Ove; Bingham, Christopher George; Öst, Markus; Jaatinen, Kim; Moe, Børge; Hanssen, Sveinn Are; Moody, A. John; Gabrielsen, Kristin Møller; Herzke, Dorte; Lierhagen, Syverin; Jenssen, Bjørn Munro; Krøkje, Åse. (2016) DNA double-strand breaks in incubating female common eiders (*Somateria mollissima*): Comparison between a low and a high polluted area. *Environmental Research*, 151: 297-303

Fenstad, Anette; Bustnes, Jan Ove; Lierhagen, Syverin; Gabrielsen, Kristin M.; Öst, Markus; Jaatinen, Kim; Hanssen, Sveinn Are; Moe, Børge; Jenssen, Bjørn Munro; Krøkje, Åse (2016) Blood and feather concentrations of toxic elements in a Baltic and an Arctic seabird population. *Marine Pollution Bulletin* doi: 10.1016/j.marpolbul.2016.10.034

Fenstad, Anette; Jenssen, Bjørn Munro; Gabrielsen, Kristin M.; Öst, Markus; Jaatinen, Kim; Bustnes, Jan Ove; Hanssen, Sveinn Are; Moe, Børge; Herzke, Dorte; Krøkje, Åse (2016). Persistent organic pollutant levels and the importance of source proximity in Baltic and Svalbard breeding common eider. *Environmental Toxicology and Chemistry*, 35: 1526-1533

Fenstad, Anette; Moody, A. John; Öst, Markus; Jaatinen, Kim; Bustnes, Jan Ove; Moe, Børge; Hanssen, Sveinn Are; Gabrielsen, Kristin Møller; Herzke, Dorte; Lierhagen, Syverin; Jenssen, Bjørn Munro; Krøkje, Åse. (2016) Antioxidant Responses in Relation to Persistent Organic Pollutants and Metals in a Low- and a High-Exposure Population of Seabirds. *Environmental Science and Technology*, 50: 4817-4825

Tartu, Sabrina; Bustamante, Paco; Angelier, Frédéric; Lendvai, Adam Z.; Moe, Børge; Blévin, Pierre; Bech, Claus; Gabrielsen, Geir W.; Bustnes, Jan Ove; Chastel, Olivier (2016) Mercury exposure, stress and prolactin secretion in an Arctic seabird: an experimental study. *Functional Ecology*, 30: 596-604

Publication with contribution to another flagship project:

Burr, Z.M., Ø. Varpe, T. Anker-Nilssen, K.E. Erikstad, S. Descamps, R.T. Barrett, C. Bech, S. Christensen-Dalsgaard, S-H. Lorentsen, B. Moe, T.K. Reiertsen & H. Strøm (2015) Later at higher latitudes: large-scale variability in seabird breeding timing and synchronicity. *Ecosphere* 7 (5). DOI: 10.1002/ecs2.1283

Publications before 2016 has been reported in the previous annual reports.

## Communicated Results

### Education:

Lectures at UNIS by GW Gabrielsen (AB-201, AB-202, AB-203)

Lectures at UIT by SA Hanssen (Marine top predators BIO 3506) and GW Gabrielsen (Bio 3003)

Guest lecture at Byåsen Skole by B Moe (Dyreliv i Arktis og Antarktis. Fagtema Arktis og Antarktis)

### Popular science, publications:

Hanssen, Sveinn Are; Moe, Børge. Migrasjon hos sjøfugl, en logger-revolusjon. *Ottar* 2016 (309) s. 12-16

Strøm, Hallvard; Descamps, Sébastien; Ekker, Morten; Fauchald, Per; Moe, Børge. Storskala kartlegging av sjøfuglenes arealbruk

Workshops:

Moe, Børge; Strøm, Hallvard. Large-scale tracking of seabirds in the Barents, Norwegian and North Sea (SEATRACK). BirdLife International initiative to identify high seas MPAs in NE Atlantic; Reykjavik Workshop 2016-06-02

Hanssen, Sveinn Are; Moe, Børge. Bio-transport of contaminants in skuas. Avitox workshop, Chizé France 2016-05-19 - 2016-05-20

Hanssen, Sveinn Are; Skottene, Elise; Bustnes, Jan Ove; Herzke, Dorte; Moe, Børge. Contaminant loads in relation to wintering area and breeding habitat in the Arctic Skua. National Wildlife Research Centre Seminar, Carleton University, Ottawa; 2016-10-08 - 2016-10-08

Moe, Børge.

Seabird habitat use and migration strategies. Fjord & kyst flaggskip, årsmøte 2016, Sommarøy; 2016-10-04 - 2016-10-05

Media:

FORSKNING.NO, 23-07-2016. Moe B. Bird migration- from myths to applied ecology (Fugletrekket fra myter til anvendt kunnskap). Blogg contribution.

FORSKNING.NO, 12-07-2016. Hanssen SA, Moe B. A territorial globetrotter with a bad reputation (En hjemmekjær globetrotter med frynsete rykte). Blogg contribution.

FORSKNING.NO, 23-06-2016. Hanssen SA. She starves during 25 days, he doesn't care! (Hun sulter i 25 dager, han bryr seg ikke!). Blogg contribution

SEAPOP.NO 2016-01-05. News item based on our paper in Marine Ecology Progress Series MEPS (Goutte et al. 2014).

NEWSDEEPLY.COM, 2016-05-18. Hymann R. Waning sea ice threatens fragile arctic food web (B Moe is among the interviewed scientists).

Interdisciplinary Cooperation

The project has benefitted from cooperation between researchers from different disciplines. The listed papers mainly belong to the following disciplines: Distributions/diversity, migration, ecology, climate change biology and ecotoxicology.

## Budget in accordance to results

The 400k funding from the Fram Centre has played an important role for financing fieldwork, equipment, tracking analyses and for writing papers, and has thus given us the opportunity to take an active role in the large-scale network of collaborators. The project also benefitted from external funding (Seatrack, Arctic Field Grant/NFR, Statens kartverk and Svalbard Miljøvernfond) as well as a use of own research hours (egenforskning). The Fram Centre funding has been crucial for obtaining these external funds. This project is linked to huge research networks, involving many researchers and costly field work and analytical work. Its large-scale success has depended on external funding for the field activities of project partners (e.g. extensive field operations in Russia, Greenland and other Norwegian colonies).

Most of the 400k has been allocated to our fieldwork in Kongsfjorden (Svalbard) and Brensholmen (Troms), equipment and tracking analyses, and resources available for writing papers. The funding of this project has been important for our role in 3 of the papers (Hanssen et al. 2016, van Bemmelen et al 2016, Bogdanova et al. 2016), with Hanssen et al. (2016) and van Bemmelen et al. (2016) being the most important ones. Furthermore, the funding has also been crucial for the MSc student to take part in this project, and the two MSc theses completed this year. For the other papers the main funding has come from other sources, but they are relevant for the project.

Money allocated to Fram Centre partners within the project:

70k was allocated to NPI and costs at the Sverdrup Station in Ny-Ålesund.

30k was allocated to Sagerup/Akvaplan NIVA for field work contribution in Ny-Ålesund, and approximately 15k was allocated to cost/equipment for Ehrlich (UIT) for field work in Yamal.

Could results from the project be subject for any commercial utilization

No

Conclusions

a) The project has established a strong basis for further work. We have a long-term perspective and will further develop the project to focus on climate effects on migratory strategies and habitat use in arctic seabirds, along with consequences of exposure to contaminants. The project has provided a unique basis for assessing inter-annual as well as inter- and intra-individual variation habitat use, since we now have obtained several years of data from the same individuals and population, in a wide collaborative network. This project is now also linked to SEATRACK (funding from the Ministry of Climate and Environment (KLD), Ministry of Foreign Affairs (UD) and the oil industry (NOROG), a large-scale tracking program of seabirds in Norway, Russia, UK, the Faroes and Iceland.

b) The development of small-sized electronic tags has been a prerequisite for the project. However, there is a constant need for further decreasing the size, increasing the battery life and increasing the precision of the electronic tracking tags.