

## Project information

### Keywords

habitat use, migration, top predators, seabirds, marine ecology

### Project title

Seabird habitat use and migration strategies

### Year

2015

### Project leader

Børge Moe

### Participants

## Project participants and network partners

**From the Fram Centre and Norway:** Sagerup (Akvaplan-NIVA), Ehrlich (UIT), Barrett (UIT), Herzke (NILU), Coulson (UNIS), Gabrielsen (NP), Strøm (NP), Descamps (NP), Hanssen (NINA), 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), Boulinier (CEFE CNRS), Gremillet (CEFE CNRS), Ponchon (CEFE CNRS), Netherlands: van Bemmelen (Imares), Tulp (IMARES), 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), Russia: Gavrilov (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).

### Flagship

Fjord and Coast

### Funding Source

Fram Centre Flagship

Own funding: 'Egenforskning'

External funding and other funding

### Summary of Results

This project has provided important new knowledge about habitat use and migration strategies of seven arctic seabird species (common eiders, kittiwakes, long-tailed skuas, glaucous gulls, arctic skuas, little auks, lesser black-backed gulls), results that have relevance for conservation management. All the work has been part of large-scale research networks to ensure multi-colony tracking at many Arctic and sub-Arctic locations.

One highlight is the number of presentations held at the 2<sup>nd</sup> World Seabird Conference in Cape Town (Oct 2015). We held 4 presentations of which habitat use and migration strategies were the core issues (Moe et al., Hanssen et al., van Bemmelen et al. and Bogdanova et al.). All presentations focus on new results on arctic skuas, long-tailed skuas and kittiwakes about a) consistency of individual migration strategies b) migratory connectivity c) carry-over effects d) early life migration strategies and habitat exploration and e) consequences of migration strategies on uptake of contaminants. We aim for publishing these results in 2016.

Among our publications in 2015, Hanssen et al. is the most important one for this project. It demonstrates that within the breeding population of common eiders in Svalbard there are two different migration strategies, one part of the population migrates south east and winter in Iceland and the other migrates south and winter in Norway. Hence, it provides key information for conservation management, demonstrating shared responsibility between Iceland and Norway for the winter population of Svalbard breeding common eiders.

### For the Management

The findings are highly relevant for management.

The project reveals

a) different scales of which management has to be applied, from local to global, to ensure healthy seabird habitats. E.g. Hanssen et al. 2015 reveals that two countries share the management responsibility of the Svalbard winter population of common eiders.

b) sensitive marine hotspots, both in terms of migratory corridors, staging areas and wintering areas.

c) overlap with potential anthropogenic threats. Especially the role of exposure to POPs and proximity to sources.

d) breeding origin of seabirds distributed in different marine sectors. Hence, accidents or perturbations in a given sector can be linked to consequences on different seabird populations –often breeding far away from the given marine sector.

#### Published Results/Planned Publications

##### 2015:

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 (2015) Migration strategies of common eiders from Svalbard: Implications for bilateral conservation management. *Polar Biology* (in review)

Harris, M.P., S. Wanless, M. Ballasteros, B. Moe, F. Daunt & K.E. Erikstad (2015) Geolocators reveal an unsuspected moulting area for Isle of May Common Guillemots *Uria aalge*. *Bird Study/Ringing & Migration* 10.1080/00063657.2015.1006164

Fenstad A.A., B.M. Jenssen, K.M. Gabrielsen, M. Öst, K. Jaatinen, J.O. Bustnes, S.A. Hanssen, B. Moe, D. Herzke & Å. Krøkje (2015) POP levels and the importance of source proximity in Baltic and Svalbard breeding common eiders. *Environmental Toxicology and Chemistry*, in press, DOI: 10.1002/etc.330

Tartu, S., P. Bustamante, F. Angelier, Á.Z. Lendvai, B. Moe, P. Blévin, C. Bech, G.W. Gabrielsen, J.O. Bustnes, O. Chastel (2015) Mercury exposure, stress and prolactin secretion in an Arctic seabird: an experimental study. *Functional Ecology* 08/2015; DOI:10.1111/1365-2435.12534

Prop, J., J. Aars, B.-J. Bårdsen, S.A. Hanssen, C. Bech, S. Bourgeon, J. de Fouw, G.W. Gabrielsen, J. Lang, E. Noreen, T. Oudman, B. Sittler, L. Stempniewicz, I. Tombre, E. Wolters & B. Moe (2015) Climate change and the increasing role of polar bears on bird populations. *Frontiers in Ecology and Evolution* doi: 10.3389/fevo.2015.00033

Goutte, A., C. Barbraud, D. Herzke, P. Bustamante, F. Angelier, S. Tartu, C. Clément-Chastel, B. Moe, C. Bech, G.W. Gabrielsen, J.O. Bustnes & O. Chastel (2015) Survival rate and breeding outputs in a high Arctic seabird exposed to legacy persistent organic pollutants and mercury. *Environmental Pollution* 200: 1-9

Andersson, M., P. Waldek, S.A. Hanssen & B. Moe (2015) Female sociality and kin discrimination in brood parasitism: unrelated females fight over egg-laying. *Behavioral Ecology* doi:10.1093/beheco/arv007

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* (in press)

##### MSc thesis 2015:

Skottene (2015) Migration Patterns Affect Element Concentrations in an Arctic Seabird. MSc thesis at Department of Biology, NTNU

Ask (2015) Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs) Affect the Thyroid Hormone System, Body Condition, and Body Mass in Two Arctic Seabird Species MSc thesis at Department of Biology, NTNU

##### 2014:

Dabert, M., S.J. Coulson, D.J. Gwiazdowicz, B. Moe, S.A. Hanssen, E.M. Biersma, H. E. Pilskog & J. Dabert (2014) Differences in speciation progress in feather mites (Analgidae) inhabiting the same host: The case of *Zachvatkinia* and *Alloptes* living on arctic and long-tailed skuas. *Experimental and Applied Acarology* doi: 10.1007/s10493-014-9856-1

Wynn, R.; D. Brown, G. Thomas, C. Holt, S.A. Hanssen, O. Gilg, B. Moe (2014) Spring migration routes of Long-tailed Skuas around and across the UK – results of observational and tracking data. *British Birds* 107: 220-228

Reiertsen, T.K., K.E. Erikstad, T. Anker-Nilssen, R.T. Barrett, T. Boulinier, M. Frederiksen, J. González-Solís, D. Gremillet, D. Johns, B. Moe, A. Ponchon, M. Skern-Mauritzen, H. Sandvik, N.G. Yoccoz (2014) Prey density in non-breeding areas affects adult survival of Black-legged kittiwakes *Rissa tridactyla* *Marine Ecology Progress Series* 509: 289–302.

Schultner J., B. Moe, O. Chastel, C. Bech, A.S. Kitaysky (2014a) Migration and stress during reproduction govern telomere dynamics in a seabird. *Biology Letters* 10: 20130889

Goutte, A., F. Angelier, C. Bech, C. Clément-Chastel, G. Dell'Omo, G.W. Gabrielsen, A. Lendvai, B. Moe, E. Noreen, D. Pinaud, S. Tartu, O. Chastel (2014) Annual variation in the timing of breeding, pre-breeding foraging areas and stress hormones levels in an Arctic

population of Black-legged kittiwake. *Marine Ecology Progress Series* 496: 233-247

Schultner, J., B. Moe, O. Chastel, S. Tartu, C. Bech, A.S. Kitaysky (2014b) Experimental evidence for corticosterone as a mediator of carry-over effects between breeding and migration. *Marine Ecology Progress Series* 496: 125-133

Tartu, S., F. Angelier, J.O. Bustnes, B. Moe, S.A. Hanssen, D. Herzke, G.W. Gabrielsen, N. Verboven, J. Verreault, P. Labadie, H. Budzinski, J.C. Wingfield & O. Chastel (2014) Polychlorinated biphenyl exposure and corticosterone levels in seven polar seabird species. *Environmental Pollution* 197: 173-180.

#### 2013:

O. Gilg, B. Moe, S.A. Hanssen, N.M. Schmidt, B. Sittler, J. Hansen, J. Reneerkens, B. Sabard, O. Chastel, J. Moreau, R.A. Phillips, T. Oudman, E. Biersma, A.A. Fenstad, J. Lang & L. Bollache (2013) Trans-Equatorial Migration Routes, Staging Sites and Wintering Areas of a High-Arctic Avian Predator: the Long-tailed Skua (*Stercorarius longicaudus*) *PLOS One* 8(5): e64614

Bustnes, J.O., B. Moe, Helberg, M., & R.A. Phillips (2013) Rapid long-distance migration in Norwegian Lesser Black-backed Gulls along the eastern flyway. *IBIS* 155: 402–406

J. Fort, B. Moe, H. Strøm, D. Grémillet, J. Welcker, J. Schultner, K. Jerstad, K.A. Johansen, R.A. Phillips, A. Mosbech (2013) Multi-colony tracking reveals potential threats to little auks wintering in the North Atlantic from marine pollution and shrinking sea-ice cover. *Diversity and Distributions* 19: 1322–1332

Hanssen, S.A., B. Moe, B.-J. Bårdsen, F. Hanssen, G.W. Gabrielsen (2013) A natural anti-predation experiment: Predator control and reduced sea ice increases colony size in a long-lived duck. *Ecology and Evolution* 3: 3554-3564, doi: 10.1002/ece3.735

#### 2012:

Frederiksen, M., B. Moe, F. Daunt et al. (2012) Multi-colony tracking reveals the non-breeding distribution of a pelagic seabird on an ocean basin scale. *Diversity and Distributions* 18: 530-542

#### Communicated Results

##### Users:

Seatrack start-up meeting with funders, 13 Jan 2015, Tromsø

Two presentations by B Moe

#### Conferences:

2nd World Seabird Conference, 26-30 Oct 2015, Cape Town, South Africa

Five presentations: Moe et al. Hanssen et al, van Bemmelen et al, Bogdanova et al, Tartu et al.

#### Press:

Many news reports in 2015, including

SCIENCE, <http://news.sciencemag.org/climate/2015/03/polar-bears-turn-seabirds-sustenance>

NATURE, <http://www.nature.com/nature/journal/v519/n7541/full/519008d.html>

FORSKNING.NO, <http://forskning.no/klima-rovdyr-evolusjon-arktis/2015/04/isbjornen-bytter-diett-fra-kjott-til-egg>

##### Education:

The results have been used in lectures at UNIS (AB-201, AB-202, AB-203) and UiT (Bio-3003, Bio 3506) by GW Gabrielsen and Sveinn Are Hanssen.

Two MSc students (Skottene, Ask) have completed their thesis (see publication list above)

#### 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, Avitox) as well as a use of own research hours (egenforskning). This project is a huge cooperation, 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 Greenland and other Norwegian colonies).

Most of the 400k has been allocated to our fieldwork in Ny-Ålesund (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. 2015, Fenstad et al. 2015, Harris et al. 2015), with Hanssen et al. (2015) being the most important one. 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:

100k was allocated to NPI and costs at the Sverdrup Station in Ny-Ålesund. 28k was allocated to Sagerup/Akvaplan NIVA for field work contribution in Ny-Ålesund, and approximately 20k 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

If Yes

No, but the results may have major implications for management and industry (e.g. oil industry, fisheries, shipping)

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 the Environment (MD), Barents 2020/Ministry of Foreign Affairs (UD) and the oil industry), a large-scale tracking program of seabirds in Norway, Russia, UK 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.