

THE NOW PROJECT

LIVING RESOURCES AND HUMAN SOCIETIES AROUND THE NORTH

WATER IN THE THULE AREA, NW Greenland



A research project funded by the Velux Foundations and the Carlsberg Foundation

Final report 2014-2018, Including Annual Report 2017

PREFACE

This is the final report from the NOW Project running from 2014 to 2017. Previous reports covered 2014, 2015, and 2016. The present report includes activities in 2017, and a full list of publications and presentations throughout the project period.

As 2017 was the final year, the activities in the field were more limited than before, consisting of only two fieldworks, one by the biologists Anders Mosbech and Kasper Lambert Johansen, and one by anthropologist Kirsten Hastrup. They are described below. Another important activity was a major dissemination event in Nuuk in January 2017, where the collaborative GPS mapping project that was designed and implemented by biologists, anthropologists, and hunters 2015-2016, was presented. As will be seen below, it proved to be a major success and created a lot of interest among both politicians, managers, and the public.

If the field activities in 2017 were relatively limited, other activities were all the more expansive. First, two major international and interdisciplinary conferences on the North Water region were held in Copenhagen, of which more details are given below. Second, the publication activities truly took off on the basis of previous fieldworks and analyses, as seen in the list of publications.

We gratefully acknowledge the generous support from the Velux Foundations and the Carlsberg Foundation that enabled the research from 2014 to 2017. No less important were the inhabitants of Avanersuaq, who must be credited for their contribution to the success of the project, as collaborators, helpers, and not least patient partners in an ongoing conversation on life in the impressive high Arctic Landscape.

All reports are accessible at the project home page, NOW.ku.dk

Kirsten Hastrup, PI

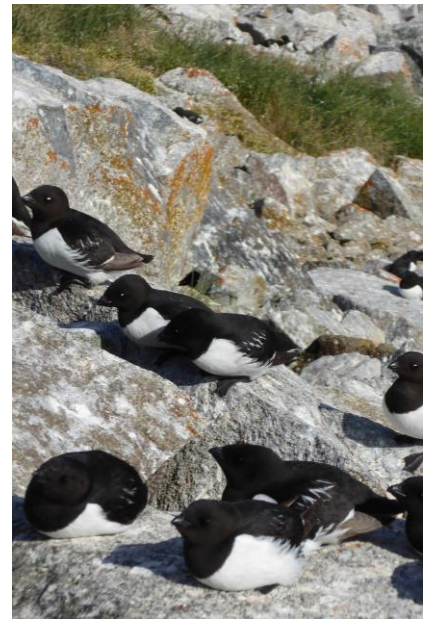
Bjarne Grønnow, co-PI

Anders Mosbech, co-PI

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1. MEMBERS OF THE RESEARCH TEAM

The list of researchers comprise people who have been active partners in the project throughout the period, as well as some who were engaged for a particular field season and/or particular analyses.

Anthropology

- *Kirsten Hastrup*, Professor, D. Phil., dr. scient. soc., Department of Anthropology, University of Copenhagen.
- *Janne K. Flora*, post doc. PhD, Department of Anthropology, University of Copenhagen; Now employed by Aarhus University, Department of Bioscience, to implement the *Piniariarneq* project in East-Greenland.
- *Astrid Oberborbeck Andersen*, post doc. PhD, Department of Anthropology, University of Copenhagen. Now employed by Aalborg University as assistant professor.
- *Asmus Gemmer Haastrup*, MA (thesis made in relation to the NOW project)

Archaeology / palaeo-zoology

- *Bjarne Grønnow*, Research professor, Dr. Phil, The National Museum of Denmark
- *Martin Appelt*, Senior researcher and Curator, PhD, The National Museum of Denmark
- *Jens Fog Jensen*, post doc, PhD, The National Museum of Denmark / The Museum of Natural History, University of Copenhagen
- *Anne Birgitte Gotfredsen*, post doc, PhD (palaeo-zoology), The Museum of Natural History, University of Copenhagen
- *Mikkel Myrup*, BA, curator, The Greenland National Museum and Archive.
- *Mikkel Sørensen*, PhD, associate professor, University of Copenhagen
- *Asta Mønsted*, PhD student, MA (thesis made in relation to the NOW-project)

Biology / Ecology

- *Anders Mosbech*, Senior researcher, PhD, Department of Bioscience, Aarhus University
- *Kasper Lambert Johansen*, Researcher, MA, Department of Bioscience, Aarhus University
- *Thomas Davidson*, PhD, Postdoc, Department of Bioscience, Aarhus University
- *Erik Jeppesen*, Professor, DSc, Department of Bioscience, Aarhus University
- *Ivan González-Bergonzoni*, PhD degree at AU, now at University of Uruguay and affiliated with Department of Bioscience, Aarhus University
- *Igor Eulaers*, received a PhD degree during the project, Department of Bioscience, Aarhus University, and University of Antwerp
- *Mads Peter Heide-Jørgensen*, Professor, dr. scient, Greenland Institute of Natural Resources.

- *Rune Dietz*, Professor, Dr.scient, Department of Bioscience, Aarhus University
- *Aili Labansen*, PhD student, Greenland Institute of Natural Resources and Department of Bioscience, Aarhus University
- *Torben Windirsch*, MSc (Thesis on the NOW peat core analysis), Alfred Wegener Institute, Germany

Logistic and Field assistance:

- *Mala Broberg*, Master student, Greenland Institute of Natural Resources
- *Frank Landkildehus*, Logistic specialist, Department of Bioscience, Aarhus University

Local field assistance, key persons:

Ole Kristensen, Savissivik; *Magnus Hansen*, Savissivik; *Mads Ole Kristiansen*, Qaanaaq; *Ilannguaq Hendriksen*, Siorapaluk; *Hans Jensen*, Qaanaaq; *Pauline Kristiansen*, Qaanaaq; *Kúlutana Kvist*, Qaanaaq; *Gideon Kristiansen*, Qaanaaq; *Kristian Eipe*, Qaanaaq; *Naimangitsoq Kristiansen*, Qaanaaq; *Niels Miunge*, Qaanaaq; *Mikeli Kristiansen*, Qaanaaq.

Hunters participating in the *Piniarineq* GPS-project :

Qillaq Danielsen, *Kristian Eipe*, *Markus Hansen*, *Ole Kristensen*, *Mads Ole Kristiansen*, *Mamarut Kristiansen*, *Najmanngitsoq Kristiansen*, *Kúlutana Kvist*, *Minik Larsen*, *Niels Miunge*, *Storm Odaq*, *Avigiaq Petersen*, *Aaqqiunnguaq Qaerngaaq*, *Ilannguaq Qaerngaaq*, *Thomas Qujaukitsoq*, *Tobias Simigaq*, and *Odaq Tivnaaq*.

2. PRESENTATION OF THE NOW PROJECT

The project has aimed at uncovering the dynamic relations between the living resources and the hunting societies of the Thule area in a long-term perspective. To make this possible, the research has integrated archaeological, biological, and anthropological perspectives is on the North Water (NOW) situated in northernmost Baffin Bay, being a so-called high Arctic oasis – a polynya – making life possible in an otherwise deep-frozen world.

The North Water polynya is created and maintained by a complex and delicate balance between meteorological and hydrographical conditions, which allows for a large production of phytoplankton at the basic level of the marine food chain. The production of primary biomass provides food and space for an abundance of living resources like seal, walrus, white whale, polar bear, and various seabird species higher up the food chain.

Apart from vegetal and animal life, the North Water has also made human life in an otherwise quite barren High Arctic landscape possible. Throughout 4.500 years the polynya has attracted people, migrating from Arctic Canada into Thule, and the rich animal life continues to be fundamental to the maritime hunting societies, not least the Inughuit in the Thule area, or Avanersuaq. From the early 19th century onwards, European whalers, who named this polynya *The North Water*, delighted in its riches. Later, Knud Rasmussen's famous Thule trading station benefited from a variety of resources from the NOW.

While constituting an oasis of open water, NOW is circumscribed by the sea ice during a substantial part of the year. Life by the polynya is premised as much by the presence of the ice and the ice edge, as by the open water. During the last decades the extent and volume of the sea ice in the Arctic Ocean have declined drastically in a seemingly irreversible process. This has had profound impacts on animal populations and on the communities facing severe instabilities in their resource base.

Thus, there was an urgent need to understand the dynamic relationships between the important marine game and bird populations and the human subsistence strategies in the polynya area. The project has combined biological, archaeological, and anthropological perspectives on these issues in both a contemporary and a long-term perspective. Concomitantly, it has contributed to fundamental research on the dynamics of High Arctic ecosystems and subsistence, and facilitate informed decision-making in times of drastic political, environmental, and social changes.

The project has had particular emphasis on three key-topics, all of them addressed from an integrated interdisciplinary perspective.

Resource spaces. Under this heading, the project has explored the resource spaces of selected marine mammals and birds – the living resources – and human hunting as a component of this ecosystem. The concept of ‘resource spaces’ describes the potential niches of animals and humans in the ecosystem, i.e. which resources are potentially within reach given behavioural and, concerning humans, technological and cultural constraints and potentials. High Arctic societies have applied different strategies to structure their hunting activities in space and time in order to create overlaps between the resource spaces of game and man, for instance ‘hot spots’ for walrus and narwhal hunting and bird catching.

Critical transitions. With its periodically rich and highly concentrated resources, the polynya was an important place at the ancient human gateway to Greenland. Archaeological research has documented that NOW has attracted people over a period of 4.500 years, but in a very uneven process, relative to the available resources and to the climatic conditions. In historical times, too, subsistence in Avanersuaq has undergone profound changes as a result of natural climate variation, population cycles, and impacts – for example from commercial hunting, trade, and pollution caused by global industrial development. The project has addressed such *critical transitions* in the human exploitation of living resources in the NOW with a view to identifying both the driving forces and the responses to critical changes.

Seasonal rhythms. The Arctic is strongly marked by seasonal variation, such as the dramatic shift between summer light and winter darkness. Light and darkness have a deep impact upon biological production, animal breeding and migratory patterns, and by implication also upon human life. The vast changes in annual temperature and in relative ice-cover are integrated elements in a deep-seated sense of seasonality in Inughuit social life, as is the seasonal availability of the various kinds of game, whether terrestrial, limnic or marine. Presently, the seasonal cycle around the NOW is drastically changing as far as the ice is concerned. From the hunters’ point of view the game seems to be increasingly ‘confused’, as the elements of the seasonal cycle are disjointed. The project poses the question of when the arrhythmic seasonality becomes critical for the sustainability of the resource spaces.

Working with interdisciplinary data.

Data collected in course of the NOW project, in the field as well as in the archives, were very heterogeneous: animal tracks, archaeological sites, lake and peat core sample locations, seabird colonies, GPS-recordings made by hunters, digital photos, satellite images, video footage etc. However, a common denominator was that all data derived from somewhere in the landscape, and through a spatial interface, data of very different types and different disciplinary origins could thus be investigated and compared within a common frame of reference. The creation of an integrated, spatial database (GIS database) therefore proved to be an important instrument in facilitating the interdisciplinary research strategy of the NOW project.

3. PROJECT RESULTS: A BROAD VIEW

The NOW Project started out with three key-topics that were each designed to include all three (main) disciplines, anthropology, archaeology, and biology. The idea was to use these topics as a common ground on which to build new knowledge, incorporating insights from diverse scientific practices. We have found that they fulfilled this purpose both in the field, where they directed our attention, and in the analysis, where they have allowed us to build distinct disciplinary results into comprehensive, collaborative publications, notably in a Special Issue of *AMBIO. Journal of the Human Environment* (cf. list of Publications below). The project results presented here are organized in relation to these key-topics; references in this section are solely to our own joint or individual publications, made on the basis of the NOW Project.

Key topic 1: Resource spaces

The notion of resource spaces works equally well for animals and humans, for present and past societies, and has served to integrate knowledge from all disciplines, each of them setting out from particular methods at determining the spatial ecology of particular species at various points of history and prehistory. Together, the studies enabled a mapping of living resources, hunting preferences, and their variance over time – as well as their absolute dependence on the North Water.

A primary example of this is the component of the NOW Project named *Piniariarnek* (Andersen et al 2017), a collaborative study between local hunters, anthropologists and biologists in which hunters collected annotated GPS-tracks of their hunting trips. The study mapped the resource spaces that hunters exploited over a full year and the many complexities that characterize the encounter between humans and animals, such as an area abundant with animals not necessarily corresponding with what one might expect to be an important hunting area from a purely economic perspective. Some preferred resource spaces may be located far away, and access to these may be taxing, costly, and possible only because of experience and accumulated knowledge from having “been there” (Flora and Andersen in press). Resource spaces therefore emerge through human engagement, and continue to persist for as long as they are used (Flora et al. 2018). Also, new resource spaces may suddenly appear or disappear, which may speak to fluctuations in animal migration, but also to the adaptive and flexible capacities of the hunters, who by embracing new economic opportunities – such as halibut fishing or tourism – find ways of exploiting new resources and spaces (e.g. Hastrup 2016b, 2016c).

By instrumenting and tracking walrus (Garde et al. 2018), little auks (Mosbech et al 2018) and common eiders (Mosbech in prep) new knowledge about important feeding areas, seasonal movements, and population delineations for these species has been produced. The data on animal movement has allowed us to study habitat selection in relation to e.g. depth, sea ice and marine productivity. These tracking studies

combined with tissue samples for stable isotope analysis result in deeper understanding of the spatial ecology of the hunted species, and the sensitivity to climate change. In turn, such fine-grained biological knowledge has fed into a comprehensive understanding of human movements in the landscape.

Similarly, the archaeological studies have resulted in a deeper insight into the dynamic relations between humans and living resources around the North Water in a long time perspective, complementing the anthropological studies of contemporary resource spaces and the hunting economy. The distribution, character, and seasonality of settlements reflect human resource spaces around the polynya. Archaeological records from earlier excavations are relatively rich, and new investigations could therefore be selective and point directly towards issues of particular concern for the NOW project. This consisted of reconnaissance and test excavations in the Savissivik, Cape York Peninsula and Wolstenholme Fjord areas. Investigations concentrated on the Thule Culture/Historic Inughuit (c. 1250 AD to present). The discovery of a Late Dorset Culture site (c. 650 – 1300 AD) on the island, Sallegg (Bushnan Island), far south of the hitherto known range, showed that the resource space of this Palaeo-Eskimo culture included the northern Melville Bay (Sørensen and Grønnow 2014).

The surveys of the NOW Project were supplemented by more detailed investigations as the two national museums (in Greenland and Denmark, respectively) joined forces in conducting advanced surveys of the largest and most complex pre-historic and historic sites in the area, Nuullit, Ummannaq, and Inersussat, by means of drones. This resulted in a unique documentation of large-scale aggregation camps aimed at exploitation of certain living resources like walrus. Data from the surveys were combined with historical records covering the time of the Thule Station Period (1910 – 1953) until present (Grønnow 2016).

Analyses of these data have shown how the resource spaces of the Inughuit hunting society have changed considerably through time, shaped by an interplay between the spatial and seasonal distribution of the game on the one side and accessibility, hunting technologies, subsistence strategies and political/economical frames around the Inughuit society on the other side. By going back in time via historical and archaeological sources, our joint research has demonstrated that the Inughuit society has always been remarkably dynamic due to its flexible approach to both environmental and political opportunities, and to changes within either (Flora et al 2018).

Key topic 2: Critical transitions

A number of research components from all disciplines contributed to the study of the dynamic history of the North Water socio-ecological system. While changes in both ecosystems and societies may be gradual, it has been evident in our analysis that major shifts have occurred in the North Water area at different times. In a concluding paper in the AMBIO special issue (Jeppesen et al 2018), we identify and discuss possible relations between “fast” transformations in an ecosystem and decisive historical “events” that substantially changed the trajectories of human societies living around the North Water in the past. We did find, however,

that the notion of 'critical transition' was not easy to use across the disciplines, so we generally replaced it with 'rapid transformation', which allowed for integrating the current, rapid changes in the region, without pre-empting the issue of whether it was 'critical' or not in the long term.

We extracted sediment cores from lake and peat deposits at several places in the region and used these 'landscape archives' to track long-term patterns in the dynamics of the seabird populations (Davidson et al 2018). Radiocarbon dates show that the thick-billed murre (*Uria lomvia*) and the common eider (*Somateria mollissima*) have been present for at least 5500 cal. years. The first recorded arrival of the little auk (*Alle alle*) was around 4400 cal. years bp at Annikitsok, with arrival at Qeqertaq (Salve Ø) colony dated to 3600 cal. years bp. Concentrations of cadmium and phosphorus (both abundant in little auk guano) in the lake and peat cores suggest that there was a period of large variation in bird numbers between 2500 and 1500 cal. years bp. The little auk arrival times show a strong accord with past periods of colder climate and with some aspects of human settlement in the area. This study is the first to investigate the long-term patterns in the presence, absence, and abundance of seabird colonies in the NOW across multiple locations and to provide direct evidence of the timing of the onset of colony formation of three of the key sea bird species the region. The data, particularly when synthesised, provide indirect evidence on the state, or 'strength' of the NOW polynya through time. Some remarkable correlations between cold periods, bird arrival and in numbers, inferred polynya condition, and major human demographic events are evident. Thus, we know that humans entered at approximately the same time as the little auks, and now we understand that they were equally attracted to the North Water, making the High Arctic habitable throughout the year.

The historical, archaeological and zoo-archaeological research focused on human subsistence economy, resource utilization and impacts of external cultural contacts during two selected transitional periods: Early Thule (The Ruin Island phase, c. 1250 – 1450 AD) and the Thule Station Period (1910-1953). The investigations at the Early Thule culture site, Nuulliit, in the outer Wolstenholme Fjord included a drone-based survey and excavation of an activity area in front of a *qassi* (a men's house), where preservation conditions were excellent. The excavation resulted in a quite unique find material, including faunal remains (bones, baleen, ivory etc.). The zoo-archaeological analyses throw new light on this important phase in the early Thule culture, when exploitation of marine big game, in particular bowhead whale and walrus, formed the basis of human life at the North Water (Gotfredsen et al 2018). Subsequently, critical changes in subsistence economy, settlement patterns and social organization took place, coinciding with the onset of the Little Ice Age in the 15th century by the end of the Ruin Island phase, when hunting of large whales ceased. The archaeological finds from the Nuulliit excavations provide spectacular information on the use of non-living resource (Mønsted 2016; Grønnow et al in press). Analyses of artefacts and waste from work and repair processes throw new light on the raw material and the technology used during this Early Thule phase. Cultural connections far beyond the North Water are indicated by quantities of meteoric iron pieces at the site – a raw material only found in the southern Thule region and in great demand in the Canadian Arctic – and by iron objects of Norse origin.

Significant transformations in Inughuit society took place in the Thule Station Period. Bringing historical studies of the detailed records from that period in dialogue with an anthropological attention to historical and contemporary events and relations shows the profound impact of Knud Rasmussen's trading station on settlement patterns and economy (Grønnow 2016). It led to new settlement concentrations, changes in the yearly hunting cycles, and new 'cash crop' strategies aimed at fur trade. Conversations between anthropologists and some of the elderly people in the region revealed a sense of this period being generally very 'good'; a sense of security prevailed. At an analytical level, the sense of a new degree of security is backed by the unpacking of the commercial and political drivers that changed the opportunities of hunting livelihoods in significant ways (Hastrup et al. 2018c). Our research has also contributed to a deeper understanding of the critical transition triggered by the establishment of the Thule Air Base, the closing of the Uummannaq (Old Thule) settlement in 1953 and the ensuing forced relocation of people (Hastrup 2015; Hastrup in press d).

Through the new anthropological studies we have learned that what marks a transition as critical to the people inhabiting the North Water region, gets articulated in many different ways. The present transitions in focus are climatic, i.e. changing conditions of sea ice and inland ice, warmer temperatures, as well as political and economic changes, such as the closing of a fish factory and the opportunity to obtain cash for catches. Some transitions are articulated in a register of loss and longing (Flora in press); in the loss of sovereignty in terms of making decisions about how certain species can be hunted (Andersen et al. 2018); of hunting areas in Ellesmere Island; sledge routes; or settlements that have been closed down. These are closely connected to memories and a remembered landscape in which social life, places, and hunting grounds once central to everyday life, are now rarely visited. They may also be connected to the loss of significant materials that have been taken away, such as the meteorites taken by Robert Peary and Knud Rasmussen; events that sometimes resurface in new guises, when unknown groups of scientists arrive to the region – as we experienced in our first (joint) fieldwork in 2014. Longing may also be connected to imagined possibilities and futures, where new opportunities, such as tourism, mining, jobs, or a greater sense of regional autonomy, may reshape the sense of community.

Focusing on recent pressures and transitions in the socio-ecological system we have analysed the interactions of climate, socio-economy, and global mercury pollution (Dietz et al 2018), using a cross-disciplinary approach combining mercury (Hg) analysis of harvested species, catch statistics, and historical and anthropological perspectives. Previous ways of evaluating temporal contaminant trends in Arctic wildlife and Inuit food items have focused on monitoring with regular time intervals a few "essential" species of importance to the hunting communities. The present study has, for the first time, estimated seasonal and long-term temporal change of Hg entering an Arctic community, i.e., Avanersuaq, based on a 20-year record of hunting trends as well as an evaluation of the Hg content in a large number of important hunted foods. The results of this study describe the main sources of Hg from the hunt as well as the seasonal exposure of

hunters. The study shows that the narwhal meat is the most important source for the exposure of hunters, and reveals a number of climate related as well as cultural and socio-economic changes affecting the diet composition, and thus the invisible threat of Hg exposure in the Inuit population. This study documents a violation of the provisional tolerably yearly intake of Hg, on average by a factor of 11 (range 7–15) over the last 20 years as well as the provisional tolerably monthly intake by a factor of 6 (range 2–16), and raises health concerns (see also Hastrup 2016f).

In sum, the many new insights gained by the efforts of the NOW Project show that ecosystem and societal transformations are occurring at multiple scales simultaneously, and with varying temporality, paces or rhythms (Hastrup et al. 2018c). Some are long term and slow transitions, other are historically punctual, in that they happen once, if with cascading effects. The trajectories of these effects can often be traced in the natural and the societal parts of the ecosystem. The challenge in defining a critical transition is not only one of disciplinary definition, but also about the scale and perspective of an event. To hunters and their families, changes in hunting regulations, or the establishment of a fish factory, may be experienced as a critical transition to the same degree as long term shifting ice and climate conditions. The first are historically punctual and political, the last slow and irreversible; this suggests that it is difficult to disentangle strictly biological findings from archaeological and anthropological ones. Thus, the need for new modes of making the disciplines enter into dialogue in different constellations is urgent. Our own work towards this has shown that the North Water ecosystem, including human society, extends beyond the geographical boundaries of the area, and that effects and impacts travel to and from the NOW area, making it hard to determine what is internal and what is external to the ecosystem.

Key-topic 3: Seasonal rhythms

The Arctic in general is strongly influenced by seasonal rhythms of light, ice-cover, and presence or absence of particular animals. The current changes in annual temperature and sea-ice deeply affect the hunting pattern, given that the 'seasons' are now increasingly discordant, as it were. The *Piniariarneq* project mentioned above, in which hunters were supplied with GPS-devices, allowed them to track their hunting routes, document their catch, and anything else they found relevant and important, during one full year. Each season brings about its own resources, activities, social organization, and travel, as was revealed in the GPS material through the eyes of the hunters themselves. The shortening of the season of landfast sea ice where hunters travel by dog-sledge, has extended the open water season, and made possible for long distance hunting trips by motorboat to be completed over relatively short period. The seasonal changes, coupled with new technologies therefore, have changed the rhythms with which hunters engage with the landscape. The *Piniariarneq* project also revealed marked changes in landscape use, according to the seasons; autumn being concentrated very closely to the inhabited areas, while summer was characterised by extensive landscape use.

Seasonal rhythms, however, not only concern the rhythmic changes between winter and summer, the return or disappearance of ice, or the presence or absence of particular animals. Seasonal rhythms are also social rhythms, implying that 'natural' changes give rise to changes in social and family rhythms, in ways that impact upon the everyday life in the whole community. The return of the little auk in spring marks the beginning of a new rhythm, after which the little auk from Savissivik may find their way to dinner tables Qaanaaq, or where the elderly can become self-sufficient, as they always have been in this season (Mosbech et al 2018). For many families during summer, hunting is a social activity that involves the entire family. In the process, knowledge and history intricate to hunting and the landscape is maintained and passed on to the next generation, and allowing a rhythm to continue long term. The sharing of meat between peers in a hunting or working alliance likewise may change year upon year, and so may also the wider dispersal and sale of food among community members outside of immediate hunting networks. One of the significant observations from anthropological fieldwork relates to new patterns of *selling* meat and blubber (within and beyond the region, and made possible because of new infrastructure and new technologies), contributing to an undermining of the 'community' through new and more porous boundaries, which entail a gradual impoverishment of some families and not least of the elderly people, who are no longer part of a socially ingrained system of *sharing*.

As part of the interdisciplinary efforts of the NOW Project, anthropologists joined a biologist and five hunters from Qaanaaq on a walrus tagging mission to Uummannap Kangerlua (Wolstenholme Fiord) in spring 2015 (Andersen et al. 2015). The purpose of instrumenting walruses with satellite-linked transmitters was to analyse how the increasingly ice-free areas around the North Water are affecting migration time and routes of walruses between Greenland and Canada (Heide-Jørgensen et al. 2017). Anthropologists joined the mission to learn how hunters use the landscape and value different species, especially walrus. Another aim was to study the different kinds of skills and expertise (of hunters and biologists) that go into a successful production of biological knowledge, and to analyse how and when the different ways of knowing and valuing walrus overlap, and when tensions between them arise. Through these studies, new knowledge about walrus wintering and seasonal migration patterns has been generated, and it has been concluded that many different values and interests are tied to walruses, depending on the perspective that one follows (management, biology, community). These findings make it evident that the walrus is an important agent in both social and biological networks, a fact which ought to be considered when assessing sustainability and sustainable resource utilisation as concepts to be used in management (Andersen et al. 2018).

The manifestly changing rhythms are not simply owed to the new climatic variations but also, for instance, to access to new motorized boats of considerable power, thanks to a political decision (in Nuuk) to subsidize the hunters given their plight in the volatile environment, allowing them to hunt farther away and in relatively packed ice, once the fast ice has broken. This is an example of a political change in Greenland, related also to new Danish and international territorial interests in the region, suddenly making human habitation in the far

North a major national and political asset. Thus, seasonality is made and sustained through many agents, climatic, social, political, human and animal.

'Seasons' as such are equally made through social events: a first catch, a celebration that requires a specific catch, preparation of meat and meal, the arrival of little auks that announce a new season, and makes certain places significant and irresistible to return to. In other words, *seasonal rhythms* are as much social as they are natural, when seen from the point of view of people, depending on living resources.



Fig. 3.1 Full moon in Qaanaaq, October 2017. Photo: Kirsten Hastrup

4. BIOLOGICAL FIELDWORK 2017

A: Common eiders and little auks - *By Kasper Lambert Johansen, Anders Mosbech & Christian Sonne*

In 2017, the seabird team of the NOW Project had a field campaign in the southern part of the Thule district. The main purpose was to instrument common eiders with satellite tracking devices to gain insight into their movement patterns and foraging behaviour - a study in spatial ecology much like the walrus and little auk tracking conducted in 2014 and 2015. The tracking study of eiders was postponed to 2017 due the development time of special satellite tracking units with integrated pressure sensors capable of recording diving activity. Another goal of the fieldwork was to collect photos from time-lapse photo monitoring boxes installed in little auk and thick-billed murre colonies in 2014 and 2015, and, if possible, collect more samples of the zooplankton that little auks bring in from the sea to feed their chicks.



Fig. 4.1. To the left, the field camp on Manson Islands in Wolstenholme Fjord. To the right, a common eider caught in a nest trap fabricated from chicken wire. Photo: Kasper Lambert Johansen.

A team of four flew into Thule Air Base (TAB) on July 17th and established camp on the largest of the Manson Islands in Wolstenholme Fjord (Fig. 4.1). Usually around 4000 eiders breed on this island (Burnham et al. 2012). However, a fox was present on the island in 2017 and only few eiders were breeding. Nevertheless, 10 female common eiders were caught and instrumented with satellite transmitters, surgically implanted in the abdominal cavity by the veterinarian of the field team. After a week, the veterinarian and his assistant flew back, whereas the two remaining team members were picked up in motorboats at TAB by occupational hunters Ole Kristensen and Markus Hansen from Savissivik. In route to Savissivik, the little auk colony at Qoororsuaq was visited and photos from two monitoring boxes were successfully collected and the boxes refurbished with new batteries and cameras. Muskox hair, bone and horn samples were also collected. In Savissivik, photos were collected from the photo monitoring box installed in the little auk colony in 2014, and

the box was refurbished. Further, little auk chick meal samples were collected from birds caught in the colony. The last two team members flew back from TAB on August 2nd.

Common eider - Preliminary results

The Thule district is a very important breeding area for the common eider. Here, an estimated 25.000-30.000 pairs breed every summer, corresponding to approx. 30 – 50 % of the West Greenland breeding population (Burnham et al. 2012; Flemming Merkel pers. com.). However, common eiders from Thule have never been tracked before, so our field effort has generated completely new knowledge on the post-breeding habitat use, migratory behaviour, and population delineation of these birds. We focussed our tracking on eiders in Wolstenholme Fjord, where > 2/3 of the Thule district eiders breed.

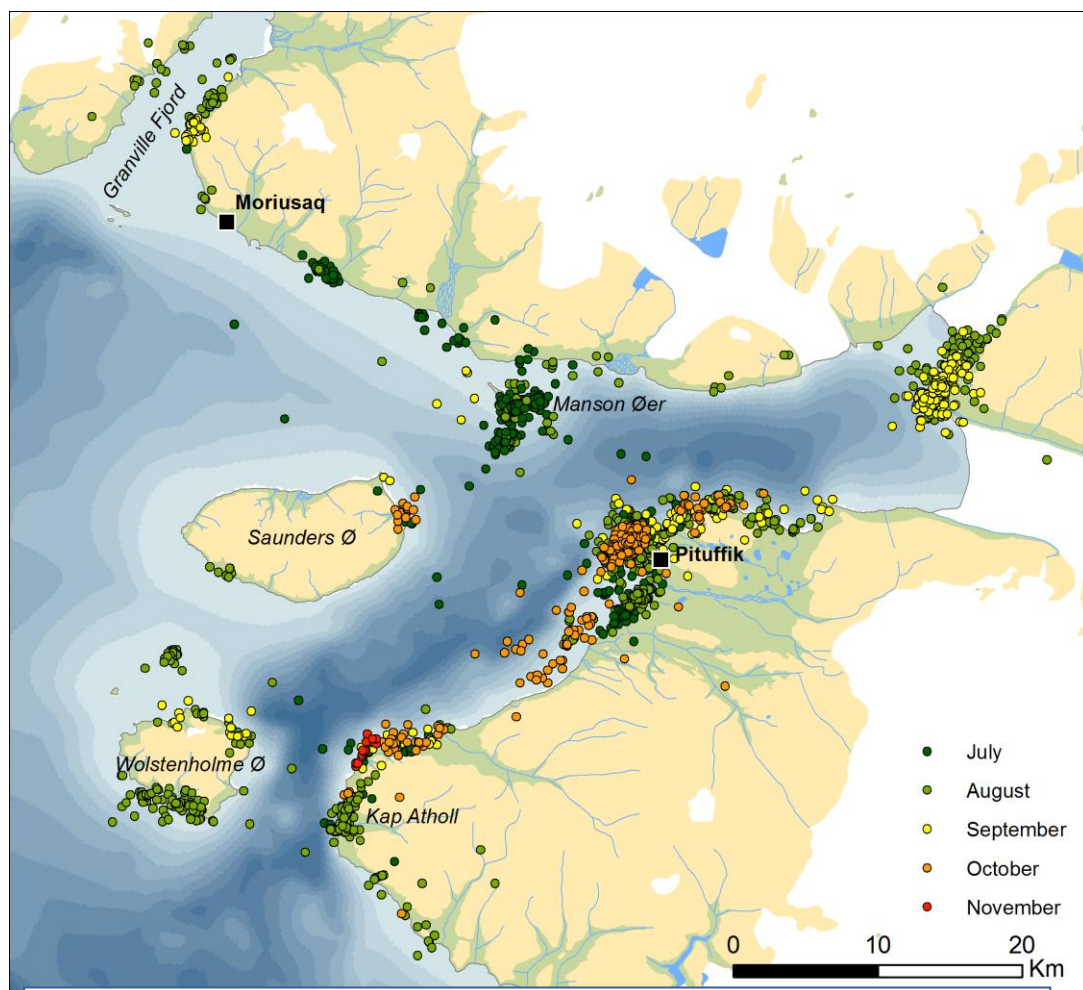


Fig. 4.2. Locations from ten common eiders, which were tracked from the breeding colony on Manson Øer. Locations are color-coded according to month.

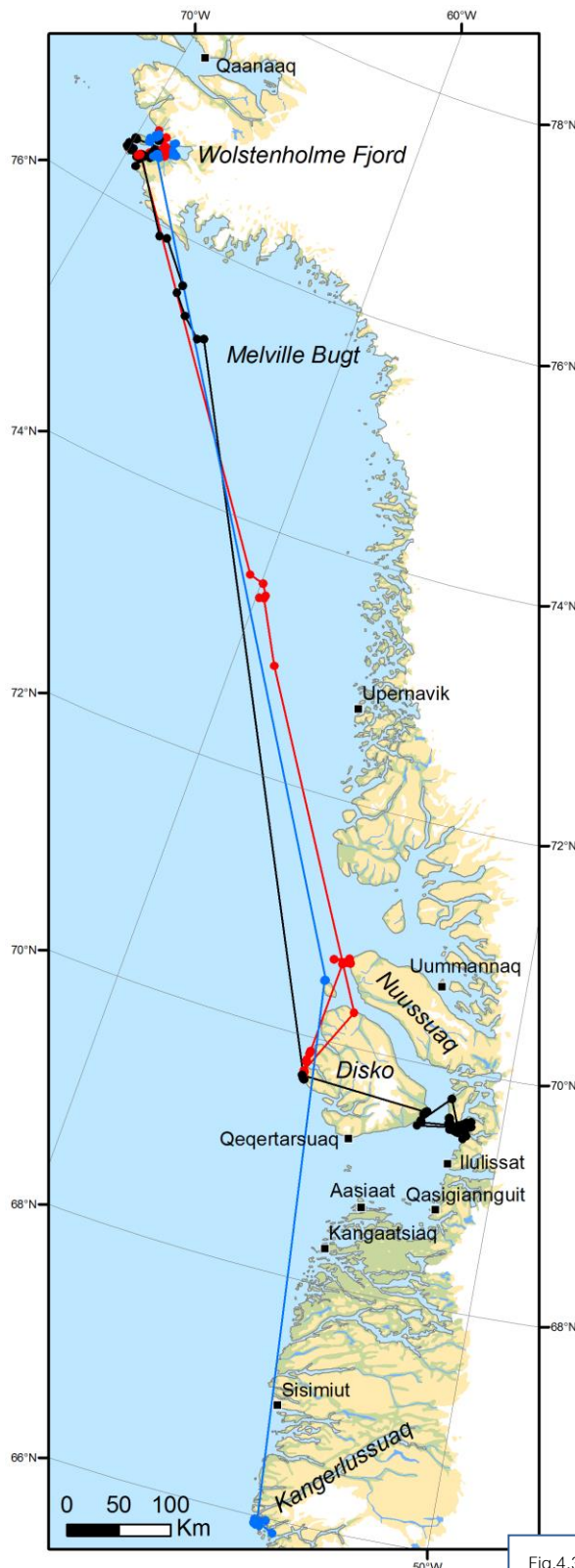


Fig.4.3. Autumn migration of three common eiders tracked from the Manson Islands breeding colony.

After completing the breeding season in late July, the tracked eiders stayed in Wolstenholme Fjord until mid-October/early-November, when the sea ice started to form (Fig. 4.2). They primarily stayed in shallow (< 50 m of depth) sheltered areas along the coasts, and concentrations were observed around Pituffik (TAB), Kap Atholl, Wolstenholme Ø, the very bottom of Wolstenholme Fjord, and at the mouth of Granville Fjord. The area around Pituffik seems to be of particular importance as almost all of the tracked birds spent time there at some point during the post-breeding period. We have not yet analysed the diving data of the birds, which will give more information on what they are doing in the post-breeding staging areas, and, in particular, help define important foraging grounds as opposed to areas simply used for resting. However, it is well known that flocks (crèches) of female eiders herd the chicks to such areas soon after hatching. Here the chicks feed and grow, and eventually develop flight feathers. The females moult their flight feathers and are also flightless for some time. Feeding in the post-breeding staging areas is also crucial for building up sufficient energy reserves for the autumn migration. Thus, in all, the identified post-breeding staging areas are critically important for the birds and vulnerable to disturbance.

However, with the recent human de-population of Wolstenholme Fjord (approx. 40 inhabitants in 1998; 0 by the close of 2010; excluding TAB personnel), and its limited use for hunting today (as witnessed by the

Piniariarneq project), the fjord in many ways provides a sanctuary for the eiders, just as it seemingly does for the walrus during spring (as observed during the walrus tagging). To what extent the eiders may be impacted by the proposed titanium-mining project in shallow waters off Moriusaq remains to be assessed, but in this connection, analyses of our tracking data may also prove important.

For three of the instrumented eiders, we were able to track the autumn migration (Fig. 4.3). They left Wolstenholme Fjord on 14/10, 31/10 and 4/11 and arrived in the Disko Bay area, approx. 850 km to the south, on 18/10, 7/11 and 6/11, respectively. One eider continued south to the mouth of Kangerlussuaq (Søndre Strømfjord) more than 1300 km from the breeding colony on Manson Islands. This suggests that the common eider breeding population from Thule primarily winters in the Southwest Greenland Open Water Area, and not in Canadian Waters. The ice free Southwest Greenland Open Water Area is an important wintering for many seabirds, including approx. 0.5 mill. common eiders (Merkel et al 2002). However, the migratory connectivity between Thule breeding population and Southwest Greenland wintering population represents new knowledge, and is important for assessing population trends in both areas. Thus, the recent growth of the Thule common eider breeding population (> 5 fold increase from 1997/98 – 2009; Burnham et al. 2012) may well be related to the stricter hunting regulation imposed in the wintering area in Southwest Greenland since 2001. However, the aforementioned human de-population of Wolstenholme Fjord, taking place during the same period, may also play a part.

Little auk

The time-lapse photo monitoring boxes installed in little auk colonies have been very successful and give information on the phenology and the attendance pattern of the birds, which is reflecting the foraging behaviour and related to the oceanographic conditions. In total 17.183 photos were collected in 2017. In the Qoororsuaq colony, the photos covered the tail end of the 2015 breeding season, and the complete breeding season of 2016, in two different study plots. In Savissivik, the photos covered the end of the 2014 breeding season, and complete breeding seasons of 2015 and 2016 (Fig. 4.4).

Fig. 4.4. To the left, download of photos from the time-lapse photo-monitoring box installed in the little auk colony at Savissivik Island. On the same occasion, little auks were caught for sampling of the zooplankton that they bring in from the sea to feed their chicks (to the right). Photo: Kasper Lambert Johansen.



Currently, the birds have been counted in all photos from Qoororsuaq, and the analyses of the data from this locality are almost complete. A scientific paper is in preparation, which combines the newly retrieved data with earlier data (breeding seasons 2010-14), to examine general patterns and year-to-year variation in little auk colony attendance patterns and numbers. Besides contributing with completely new knowledge on little auk breeding behaviour, we hope that this paper may provide part of the methodological basis for a community-based ecosystem-monitoring program in the future. The idea is to use little auk colony attendance patterns revealed from time-lapse photography, and samples of marine zooplankton from little auk chick meals, as a means of tracking changes in the marine ecosystem in response to e.g. climate change. The deployment camera boxes, retrieval of photos, servicing of the equipment, sampling of little auk chick meals, and potentially also analyses of photo data, can be undertaken by, or in close collaboration with, local stakeholders, serving to better root scientific knowledge production in the local communities of region.

References

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Nesting Common Eider (*Somateria mollissima*) Population Quintuples in Northwest Greenland. *Arctic* 65(4): 456-464.
- Merkel, F, A. Mosbech, D. Boertmann & L. Grøndahl (2002):
Winter seabird distribution and abundance off south-western Greenland, 1999. *Polar Research* 21(1): 17-36.

B: Contaminant-mercury work – *By Rune Dietz, Igor Eulaers, Anders Mosbech, Thomas Alexander Davidson, Janne Flora and collaborators.*

While there was no new fieldwork in 2017 on contaminants, it was the year when the analysis of previously assembled materials was concluded. Contaminant related work has previously been reported in detail in the annual reports from 2015 and 2016. In brief, the NOW project was acknowledged for support for the article published by Dietz et al. (2015), as well as the Bachelor students Dramshøj and Jørgensen (2016) and the Master student Najbjerg (2017).

Analytical activities

All the Hg data obtained under the NOW project were summarized with other new Arctic contaminant and effect data and compiled in an extensive AMAP Assessment: “An assessment of the biological effects of organohalogen and mercury exposure in Arctic wildlife and fish” which has been completed, reviewed and resubmitted and accepted for publication (Dietz et al. in press). The assessment report is planned to be published in a scientific journal namely Science of the Total Environment where an agreement has been made with the chief editor Adrian Covaci (Dietz et al. in prep). The results were also presented as abstracts and oral presentations at AMAP International Conference on Arctic Science: Bringing Knowledge to Action in Reston USA, 24-27 April, 2017 and at the Arctic Change 2017 Conference in Quebec City, 11-15 December, 2017. (Dietz et al 2017 b, 2017c). Finally the results form the base of a separate 1.5 hour session at the Arctic Biodiversity Congress in Rovaniemi, Finland, October 2018.

In addition, the obtained mercury data from the different seabird and seal species will be combined with the generated stable CN isotope data in a paper that is underway (Eulaers et al in prep.), focussing on the trophic dynamics of mercury in the NOW.

Mercury analyses on Inuit shavings were finished at the metal laboratory of Aarhus University. The results were presented both at the NOW Symposium at the Royal Danish Academy of Sciences and Letters, 8-10 may 2017 and at the North Water Polynya Conference held at the Scandic Hotel during 22.-24 November 2017 (Dietz 2017d 2017e), together with results presented in Dietz et al. (2017a, 2018a,b). Moreover, an article on the seasonal mercury exposure of the NOW Inuit verified by seasonal hair samplings is underway as well (Dietz et al. in prep.). The new cross-disciplinary human exposure studies from the NOW area were based on the extensive Piniarnek data, which allowed for a new method to establish a unique mercury influx budget model for Arctic Societies, as well as on new temporal and seasonal patterns verified by year-round beard hair monitoring of people from the NOW area. This new way of modelling Hg exposure in Arctic Inuit from the NOW project has been expanded to cover also Iltoqqortoormiit and Nuuk under a new programme called MEREX-1 (financed by the DANCEA Programme under the Danish Ministry of Environment). A report/draft article will be concluded by ultimo march 2018. Based on these results and Human Health studies an additional project has been submitted for MEREX-2, where the method will be verified from human

blood and hair Hg data from hunters by pairing data on hunted wildlife and Hg exposure from the individuals and their family members. Results from both projects will acknowledge the NOW project and the funding bodies in the upcoming papers.

In addition to biota analyses, the Aarhus University metal lab carried out sediment and peat core analysis for a wide range of elements. Mercury analysis from the higher resolution sediment cores, which cover a shorter period (last few hundred years), was terminated and results were presented by Davidson et al. (2017a, 2017b) as well as published by Davidson et al (2018). However, more information is available, which will be used in a number of papers in preparation by Davidson, Dietz, Eulaers and others.

Overall the contaminant related information is being used in invited presentations and teaching at Aarhus University, University of Copenhagen, Denmark's Technical University, DIS Copenhagen as well as UNIS, Svalbard.

Collaboration with other projects:

Related effect issues:

Results on effects of mercury exposure on internal organs of narwhals from the NOW and Ittoqqortoormiit regions was terminated and published by Sonne et al. (2018), acknowledging the NOW programme. Histological examination of renal tissues presented four types of glomerular lesions and two tubular lesions. Hepatic tissues exhibited three portal lesions and two parenchymal. All 12 lesions were found in adult whales from the NOW area while eight were present in adult whales from North East Greenland. Six lesions were detected in sub-adults from North East Greenland and four in sub-adults from North West Greenland. In conclusion, the prevalence of histological changes and mercury levels were the highest in adults and therefore both age and metal are important factors to include when evaluating liver and kidney lesions in narwhals.

Diseases and contaminants in NOW

Results obtained by Andersen-Ranberg et al. (2018) showed morphometric, molecular and histopathologic liver infection generated by liver flukes in ringed seals linked to heavy metal data including mercury from the NOW area. This information is of importance for human consumption in relation to potential zoonotic transfer of these parasites to Inuit inhabiting the NOW area.

ARCTOX collaboration

Additional seabird mercury data from the NOW area from matrices not covered by NOW (blood and feathers) were obtained by the LIENSs institute, France. These results were included within a large programme called ARCTOX, a pan-Arctic programme on mercury contamination of seabirds and marine food webs. Preliminary results were presented at the 13th International Biennial Mercury Conference ICMGP (Providence, Rhode Island 16-21 July 2017), at the international conference "High Altitudes meet High

Latitudes: Globalizing Polar Issues", Crans-Montana, Switzerland 11-12 September 2017) and at the "Environmental Science in the Arctic Context" seminar organized within the Finnish chairmanship of the Arctic Council (Fort et al. 2017a,b,c). Regarding NOW samples, these will be included within ARCTOX in order to map Hg in seabirds and marine ecosystems throughout the Arctic. For this, blood and feather samples collected from glaucous gull, black-legged kittiwake, little auk, thick-billed murre, common eider and northern fulmar have already been analysed for total-Hg and stable C and N isotopes. These data will be combined to other sites and species sampled from 2015 to 2017 (19 species, 59 sites and >6,000 samples).

In terms of publication, the plan is to have (1) a complete Arctic paper combining all blood samples under ARCTOX from 2015 to 2017 to map Hg in Arctic ecosystems (Fort et al in prep. a). (2) a second paper is planned using feather data to investigate contamination: during the non-breeding season for the exposure of seabirds. Questions addressed in this second paper are what is the role played by the non-Arctic wintering period on the mercury contamination of birds, where are birds exposed to Hg, and how do different migratory/wintering strategies affect bird exposure to Hg. The paper is planned for 2018 as well. (Albert et al in prep. b).

Finally, a temporal aspect based on glaucous gull, thick-billed murre and black guillemot liver samples collected since early 80's in Northwest and East Greenland will be investigated. These results are quite interesting with clear trends, especially in gulls (Fort et al. in prep c). Stable isotope methods have recently become available to discriminate if these trends are explained by a change in bird diet or a change in environmental contamination. The trends we have for Hg reveal a re-increase of levels since ca. 2010 in gulls. Braune et al. (2016) have reported similar trends for Canada.

5. ANTHROPOLOGICAL FIELDWORK 2017

By Kirsten Hastrup

The final anthropological fieldwork in the region was short, lasting from 26 September to 13 October, hemmed in by the weekly flights in and out of the town. It was centred on Qaanaaq, where the level of activity was very high, at least during the second week and until departure. The sun was close to setting for four months, and the last opportunities for bigger game had to be pursued. Part of the first week was sadly still due to a couple of tragic deaths that affected everybody; but soon life went back to normal, and the remaining light had to be exploited while it was still possible to use the motorboats on the open sea – increasingly hampered by layers of thin ice as the days went by, and by drifting ice floes that would soon freeze together.

The reindeer hunt was still on; it had been relatively successful this year but was ending, and the hunters concentrated on some last (and unsuccessful) campaigns for narwhals that were still in the fjord – but leaving. Seals were the main game, shot with rifles from the motor-boats, the size of which testifies to subsidies from the government – given that dog-sledging is no longer reliable in the autumn, and often not until January.



Fig. 5.1 Looking in vain for a narwhale and getting seals.

Photo: Kirsten Hastrup

The kayak in the picture indicates that narwhal was hoped for; as always narwhal must be taken with harpoon and from kayak, to avoid simple slaughter and potential loss. Seals were what the hunters got, however, serving both as human and dog feed. Beluga whales were just arriving, according to the hunters, and they hoped to get some before darkness descended upon them.

One of the concerns this autumn was the presence of wolves in the region, closing in upon the inhabited places, and allegedly pushing muskoxen towards the nearest fjords, as well as reindeer, that were not always as abundant and accessible as this year. Many conversations centred on the (potential) game, testifying to the predominant concern: The success of the hunt. This again underscores the fact that in spite of new fishing opportunities (halibut) and of an overall decreasing access to game, the dominant parameter of self-identification remains the hunt.



Fig. 5.2 Seal-hunters in Qaanaaq, October 2017. Note the new ice that will close the small lagoon that is their harbour in a matter of weeks. Photo: Kirsten Hastrup.

On a more general note, in spite of both local tragedies and a tenuous hunting success in the late autumn, the hunters are remarkably optimistic. Partly due to the success of the Piniariarneq project (see below) the hunters now feel that they have finally got the ear of the authorities and that these will support their staying in the region. Politicians from Nuuk had come visiting for the first time ever within living memory. While before – that is some years back in similar conversations with the anthropologist – the hunting families had felt ridiculed by the politicians and just asked to move south, if they could not make a living in the far North, now they were not only heard but even encouraged to stay – and were subsidized to make it possible. The

subsidies were mainly for bigger motorboats with stronger engines by which they could travel much further and through rougher waters than in the older and far smaller ones. This in some ways compensated for the fact that the sea-ice was un-negotiable for an increasing period of the year, preventing the conventional dog-sledge hunts.

No doubt, there are also 'territorial' interests in the new political sentiment; given the intensifying international interest in the Arctic seas, national habitation in the region is something to hold on to.

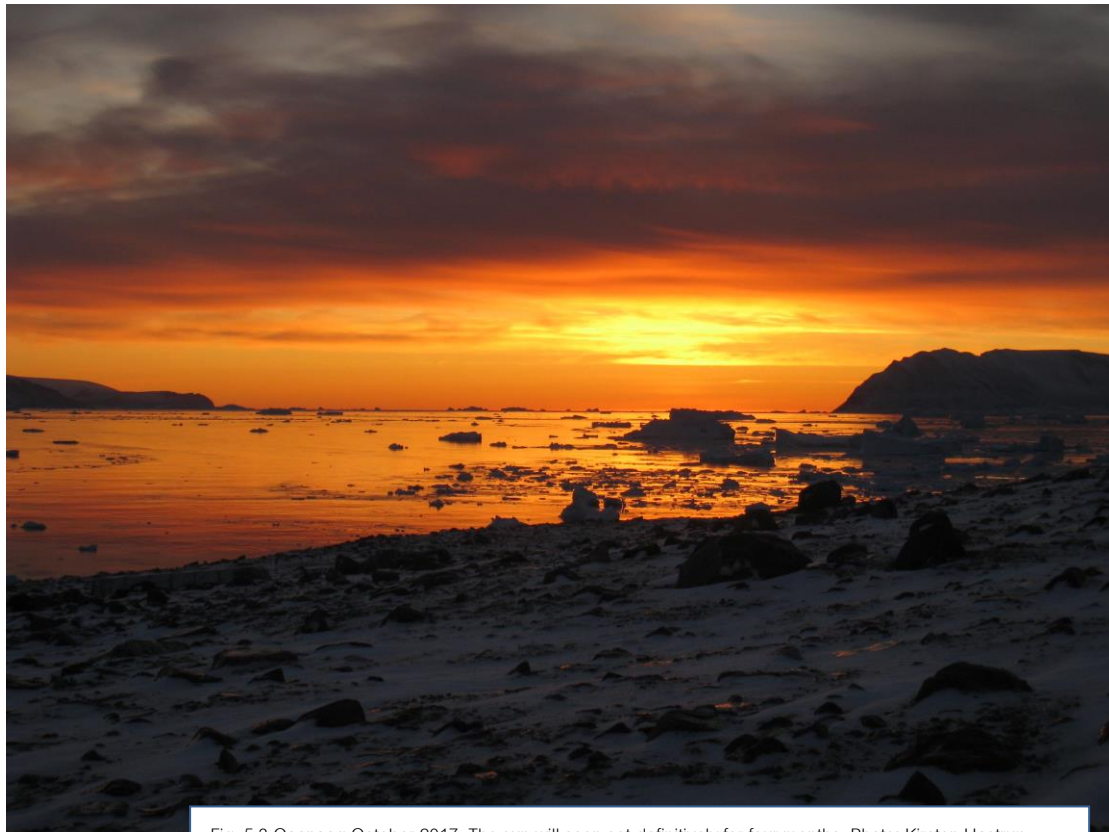


Fig. 5.3 Qaanaaq October 2017. The sun will soon set definitively for four months. Photo: Kirsten Hastrup

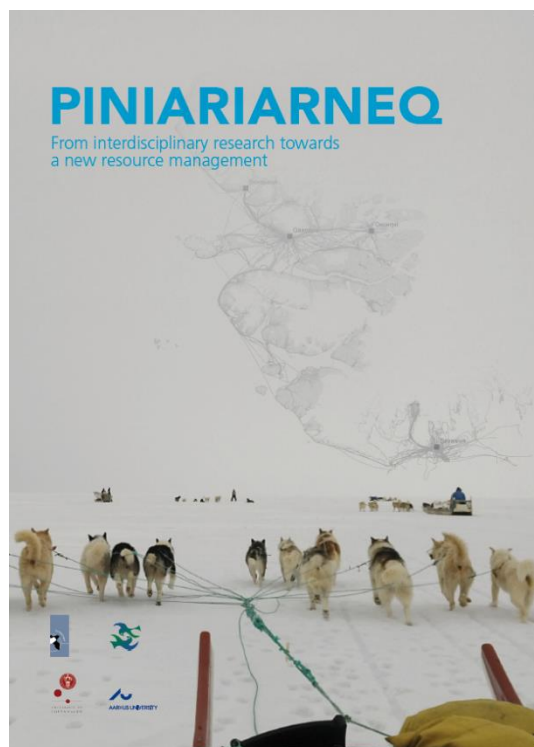
The arrival of yet another film-crew, wanting to stage a narwhal hunt for want of the real thing and generally expecting people to comply with their wishes, proved the point that had been voiced during previous fieldwork that film-crews know far too little about the real world in which the hunters live, and which they allegedly want to 'document'. It also proved the point that people are not adverse to an extra income, but they prefer to keep a personal distance and call it business – verging on 'dirty'. Going with the hunters in their boats, meeting and talking with them on the beach when cutting up seals, visiting women preparing skins and making mittens or cushions, being invited to a couple of birthdays, and conversing with many different people, including the vicar and some youngsters, convinced me that while the challenging times are acknowledged, people are nothing if not resilient and surprisingly optimistic.

6. DISSEMINATION OF THE *PINIARIARNEQ* PROJECT:

By Janne Flora, Astrid Oberborbeck Andersen, Kasper Lambert Johansen

Piniariarneq: From interdisciplinary research towards a new resource management

Having successfully concluded and disseminated the 13-month *Piniariarneq* GPS-project in Qaanaaq and Savissivik in 2016, the scientists and hunters who collaborated in the project began exploring the relevance and avenues for dissemination beyond the scientific realm: to the public and stakeholders in spatial planning and management of living resources in Greenland. We envisaged that the richness of the *Piniariarneq* dataset, which consisted of both qualitative and quantitative data (routes from hunting trips, recordings of catches and observations of animals, video footage, photographs, and written notes), would appeal to the general public as well as to scientists and policy makers in Greenland. More specifically, we wanted to convey the uniqueness of the method and approach to interdisciplinary collaboration, as well as explore the



place of the method in new forms of collaboration between hunters, scientists, and policy makers in Greenlandic ecosystem management.

Having secured funding for such activities from The Ministry of Higher Education and Research, Open Funds (Udlodningsmidler), in 2016, we proceeded to organize activities in Nuuk in January 2017. Joining us were five hunters and collaborators on the GPS project from Thule, the principal investigators of the NOW project, as well as Mads Peter Heide-Jørgensen from the Greenlandic Institute of Natural Resources. Our activities intersected with the dissemination activities of the NOW project at the University of Greenland, which took place during the same period.

More than thirty participants from the Greenlandic Government, Greenlandic research council, Greenland Institute of Natural Resources, the Greenlandic association for fishermen and hunters, University of Greenland, WWF Greenland, and the Inuit Circumpolar Council (ICC), attended our meeting at Hotel Hans Egede. All collaborators - anthropologists, biologists, and hunters - presented results and perspectives from the project. This was followed by an open discussion on the potentials of using our GPS method as a tool for integrative knowledge production in resource management and spatial planning.

A public presentation of the GPS project was also held at the cultural centre *Katuaq*, as part of the seminar series “Meet a researcher” hosted by the Department of Culture, Research and Church. The presentation was extremely well attended. Anthropologists, biologists and hunters presented experiences and findings from the collaboration, which was followed by a discussion and a screening of the 26-minute short film, *Piniariarneq*, produced from video footage recorded by the hunters with the GPSes. A dedicated presentation was also held at the Greenland Institute of Natural Resources, as the method could prove highly relevant for their work.



Fig. 6.1 Stakeholder meeting at Hotel Hans Egede

Aside from the attention that *Piniariarneq* had already received in 2016 by Videnskab.dk, our 2017 activities were widely covered by the local and national press in Greenland. KNR (Greenland National Broadcasting) screened the *Piniariarneq* film; and participants from the project were interviewed for a slot on the Nuuk TV evening news.

Impact and prospect of Piniariarneq

The *Piniariarneq* project has delivered GIS data to the Pikiilasorsuaq Commision's (ICC) interactive atlas of the North Water polynya, which contributes to a better understanding of human use of the North Water on the Canadian as well as the Greenlandic side:

<https://panda.maps.arcgis.com/apps/MapSeries/index.html?appid=8c2ab42be1ad4bab961d7fe88b279456>

One of our primary objectives with the *Piniariarneq* report (Andersen et al. 2017), and the dissemination activities in Nuuk, was to pave the way for the project to become more than a pilot study and be integrated into the toolbox of methods to support local involvement in knowledge production for spatial planning, ecosystem monitoring and management of living resources. To that end, the impact has been considerable. One of the strengths of the method is its ability to bring together and integrate various forms of knowledge into maps, and thus bridge the conceptual and geographical distances between different knowledge forms and regimes. It is a testament to this that several of the collaborators see scope in using the method for mapping important human use areas to inform spatial planning and as part of long-term ecosystem monitoring; and that hunters' and fishers' associations from other parts of Greenland have expressed interest in the approach. More concretely, the method has just been incorporated in a new project in East Greenland. Here, 20 hunters from Ittoqqortoormiit and Tasiilaq currently use an updated version of *Piniariarneq* GPS app to document important hunting and wildlife concentration areas, so that these areas may be taken into account in a new oil spill sensitivity atlas being prepared for Southeast Greenland as part the Greenland Government oil spill response.



Fig. 6.2 Public presentation in the cultural centre Katuaq



7. PRESENTING THE NOW-PROJECT IN NUUK

In relation to the presentation of the Piniariarneq project, there was an opportunity to also present the entire NOW-project to the public in Nuuk and students at the University of Greenland (Ilisimatusarfik). Hosted by our collaboration partner, The Greenland National Museum and Archive, the two hour evening event included popular presentations by researchers from the disciplines contributing to the NOW-project, biology, anthropology and history/archaeology. The talks were well received, the discussions lively, and the event added to the awareness in Nuuk of the living conditions and culture of the Inughuit in the 'periphery' of the political and economic centres of modern Greenland.



Fig. 7.1 Bjarne Grønnow introducing the NOW Project to the public in Nuuk. Photo: Astrid Oberborbeck

8: INTERNATIONAL SYMPOSIUM - MAY 2017

The North Water:

The Entanglement of Ice, Animals, and People in a High Arctic Oasis

The symposium was held in and sponsored by the Royal Danish Academy of Sciences and Letters, and took place 8-10 May 2017. The aim was explicitly to present the results of the NOW-project, and have them discussed with international peers before the final publications. Below, programme and participants:

Monday, 8 May

13.00: Presentation of the NOW-project and the Programme for the Symposium (Kirsten Hastrup).

13.15 -14.45: **The North Water in History: From 19th Century Exploration to 21st Century Science**

- *Kirsten Hastrup*, Department of Anthropology, University of Copenhagen. Presentation: "Discovering the North Water – and Meeting New People".
- *Sverker Sörlin*, Kungliga Tekniska Högskolan, Stockholm. Presentation: The making of the 'Arctic' through scientific practices.
- *Anders Mosbech, Tom Christensen*, Department of Bioscience, University of Aarhus, and *Mads Peter Heide-Jørgensen*, Greenland Institute of Natural Resources. Presentation: "The Ecological Significance of the North Water in Contemporary International Perspective"

14.45-15.30: *Coffee break*

15.30–17.00: ***The North Water in Geological, Palaeo-Ecological, and Archaeological 'Archives'***

- *Steffen M. Olsen*, Danish Meteorological Institute. Presentation: "Arctic oceanography and the melting ice-cover".
- *Sofia Ribeiro and Naja Mikkelsen*, Geological Survey of Denmark and Greenland. Presentation: "Sea Ice and Primary Productivity Changes in the Inglefield Bredning – NOW Region During the Past 4000 Years Based on Multiproxy Analyses of Marine Sediment Records".
- *Thomas Davidson*, Department of Bioscience, University of Aarhus. Presentation: "Greening the High Arctic: When and How have seabirds Transformed Fresh Waters of the North Water Polynya".

17.00-19.30: *The National Museum* (Exhibit and buffet)



Fig. 8.1 Asta Mønsted enlightening participants in the symposium on a boy's dress with ca. 80 amulets, brought to the National Museum by Knud Rasmussen's 5 Thule-expedition. Photo: Astrid Oberborbeck Andersen.

Tuesday, 9 May

9.00-10.30: *Living Resources in Biological and Glaciological Perspective: Key Species in the Polynya*

- *Kasper L. Johansen and Anders Mosbech*, Dept. of Bioscience, University of Aarhus. Presentation: "The Little Auk as Ecosystem Engineer".
- *Eva Garde*, Greenlandic Institute of Natural Resources. Presentation: "The Walrus in Smith Sound."
- *Anne Birgitte Gotfredsen*, The Natural History Museum of University of Copenhagen. Presentation: "Subsistence and Processing of Animal Resources at Nuulliit".

10.30-10.45: *Coffee Break*

10.45-12.15: *Living Resources in a Human Perspective: The Volatility of the Hunt*

- *Mark Nuttall*, Ilisimatusarfik and Department of Anthropology, University of Alberta. Presentation: "Hunting, Animals, Ice, and Seismic Lines: Encounters with the More than Human in Melville Bay".
- *Martin Appelt*, The National Museum of Denmark. Presentation: "Animal Presence and Human Identity in Prehistoric Artefacts and Dresses from the Avanersuaq Region".
- *Janne Flora*, Department of Anthropology, University of Copenhagen. Presentation: "Making a Proper Meal in Avanersuaq: Mixing Social Relations, Landscape, and Memory".

12.15-13.00: *Lunch*

13.00-14.30: *Patterns of Human Settlement and Mobility in the Long-Term*

- *Geneviève LeMoine*, Peary-Macmillan Arctic Museum, Bowdoin College (with John Darwent, Christyann Darwent, and Hans Lange). Presentation: "Living in Inglefield Land: 4500 Years of Settlement Strategies at the Northern Limit of the North Water".
- *Asta Mønsted, Martin Appelt, Bjarne Grønnow*, The National Museum of Denmark. Presentation: "Pioneering Inuit at the North Water: The Flow of Resources through the Early Thule Site, Nuulliit".
- *Bjarne Grønnow, Martin Appelt, Asta Mønsted, Anne Birgitte Gottfredsen, Jens Fog Jensen*. Presentation: "Long Term Dynamics of Inuit Settlement and Subsistence around The North Water".

14.30-15.00: *Coffee break*

15.00-16.30: *The Thule Settlement: From Regional Centre to Forbidden Land*

- *Mikkel Myrup*, The National Museum of Greenland, and *Bjarne Grønnow*, The National Museum of Denmark. Presentation: "Historical Focal Sites in the Present: Archaeological and Topographical Documentation of Uummannaq and Inersussat".
- *Kristian Hvidtfelt Nielsen*, Centre for Science Studies, University of Aarhus. Presentation: "Camp Century".
- *Kirsten Hastrup*, Department of Anthropology, University of Copenhagen. Presentation: "Foreign Invasions: Life in a Ruined landscape".

16.30-17.30: *Beer and film on the 3rd floor*

19.00: *Conference dinner*

Fig. 8.2 Participants gathered for the screening of a film based on the Piniariarnek project in the roof-auditorium of the Royal Danish Academy of Sciences and Letters. Note the 'other' audience on the wall, in the huge glass mosaic by the artist Erik A. Frandsen. Photo: Astrid Oberborbeck Andersen



Wednesday, 10 May

9.00-10.30: *Collaborative experiments of mapping*

- *Erik W. Born*, *The Greenland Institute of Natural Resources*. Presentation: "Polar Bears: Both sides NOW".
- *Claudio Aporta*, Department of Anthropology, Dalhousie University, Halifax. Presentation: "From Knowledge to Data: Challenges and Opportunities for Integrating Inuit Perspectives in Marine Spatial Planning".
- *Astrid O. Andersen*, *Janne Flora*, Department of Anthropology, University of Copenhagen, and *Kasper L. Johansen*, Department of Bioscience, University of Aarhus. Presentation: "Piniariarnek: GPS-Tracking of Hunting Practices around the North Water".

10.30-12.15: *Emerging Challenges: The Oasis at Peril?*

- *Rune Dietz*, Department of Bioscience, University of Aarhus. Presentation: "The Contamination of the North Water".
- *Erik Jeppesen*, Department of Bioscience, University of Aarhus. Presentation: "Tipping Points in the Ecosystem".
- *Maribeth Murray*, Arctic Institute of North America, University of Calgary. Presentation: "The Northwater Polynya: A Comparative Observational Perspective on the Significance of Polynyas for Understanding Human-Environment Interaction Past and Present".

12.15-13.00: *Lunch*

13.00-14.00: *Theoretical adventures and bold suggestions:*

Short comments and suggestions for future theorizing of the interplay between ice, animals and people, given by appointed discussants

Discussants:

Alistair Paterson, Department of Archaeology, University of Western Australia.

Mikkel Sørensen, The Saxo-Institute, University of Copenhagen.

Sebastian Wetterich, Alfred Wegener Institute, Hemholtz Centre for Polar and Marine Research, Potsdam.

David Boertmann, Department of Bioscience, University of Aarhus

14.00-14.30: *Publication plans and farewell*

9. INTERNATIONAL CONFERENCE

International North Water Conference, Copenhagen 22-24 November 2017.

The purpose of the conference was to bring together scientists working on issues related to the North Water Polynya Region to present the most recent research and to discuss status, trends and the future of the North Water Polynya as well as future research needs. The target audience of the conference was natural scientists. The conference was open for stakeholders as well, and included an outreach session and a panel debate with representation of local hunters, The ICC North Water Commission, and managers from government administrations (Canada, Greenland and Denmark). The conference had 87 participants including 22 from Greenland, 15 from Canada and 6 from USA. Following the conference, a conference report on status and trends will be published for a wider audience.

See home page <http://conferences.au.dk/nw/>

Wednesday, 22nd November

- 09:45-09:50 Official opening of the NOW conference by *Anders Mosbech*
- 09:50-09:55 Welcome by the Canadian ambassador *Emi Furuya*
- 09:55-10:10 *Anders Mosbech* Introduction to the NOW Polynya Conference

Physical oceanography and Holocene changes. Session chair: Eva Friis Møller

- *Søren Rysgaard* (key note speaker): – Climate change, carbon cycling and air-sea exchange
- *C.J. Mundy* (key note speaker) – The North Water Polynya sea ice environment – a review of physical processes and biological implications.
- *Dany Dumont* – The North Water ice bridge shape and life cycle variability and its impact on the physical oceanography
- *Till Soya Rasmussen* – The representation of the North Water in coupled ocean and sea ice models.
- *Steffen M. Olsen* – Winter stratification of the High Arctic Inglefield Fjord 2011-2017

Lunch

Session chair: David Boertmann

- *Sofia Ribeiro* (Key note speaker) – Sea ice conditions and primary productivity in the North Water Polynya – the past 4000 years

- *Audrey Limoges* – Late Holocene changes in primary production and sea-surface conditions in the North Water Polynya
- *Thomas A. Davidson* – Greening the high Arctic: When and how have seabirds transformed the fresh waters of the NOW Polynya?
- *Martin Appelt, Bjarne Grønnow & Kirsten Hastrup* – Historical and archaeological records as proxies for the dynamics of the North Water ecosystem.

Discussion

Coffee

Marine productivity and food web studies. Session chair: Mark Mallory

- *Louis Fortier (Key note speaker)* – The winter ecosystem: A gap in our understanding of the North Water.
- *Igor Eulaers* – The use of ecogeochemical tracers to quantify food web dynamics in the North Water region.
- *Douglas Causey* – Evidence for increasingly rapid destabilization of coastal Arctic food-webs.
- *Jean-Éric Tremblay* – Is the North Water still a biologically productive oasis?
- *Eva Friis Møller* – Why is the North Water Polynya Region such an important breeding area for little auks?
- *Mathieu LeBlanc* – Importance in the timing of the North Water (NOW) Polynya formation for polar cod *Boreogadus saida* and its zooplankton.
- *Jakob Thyrning* – Identifying climatic drivers of range expansion of a boreal species into the North Water.

Discussion

Posters, drinks and snacks (In the Lobby)

- *Natascha Kumar* – Climate and environmental change over the past 4000 years in a High Arctic polynya – a biomarker approach.
- *Karl Brix Zinglensen* – Update and detailing of the IBCAO bathymetry model over Greenland

Astrid Oberborbeck Andersen – Introduction to the *Piniariarneq* project (In the auditorium)

Piniariarneq – movie

Questions and discussion with participation of the hunter *Mads Ole Kristiansen*

Tapas and more drinks (In the Lobby)



Fig. 9.1. Kasper Lambert Johansen presenting the Piniariarneq project, showing the intensity of activity in particular areas. Photo: Astrid Oberborbeck Andersen

Thursday, 23rd November

Populations of Marine mammals, birds and fish. Session chair: Flemming Merkel

- *Mads Peter Heide-Jørgensen* (Key note speaker) – Overview of the populations and assessing sustainability of current use of living resources and new potentials.
- *Rikke Guldberg Hansen* – A comparison of the abundance and distribution of marine mammals wintering in the North Water Polynya and the North East Water Polynya – Is it NOW or NEW?
- *Eva Garde* – The Walrus in Smith Sound.
- *Anders Mosbech* – Little auk and thick-billed murre in the NOW Polynya.
- *Kurt K. Burnham* – Status of peregrine falcon and gyrfalcon populations in northwest Greenland.
- *Jesper Boje* – Fisheries in the northern Baffin Bay and its future potential
- *Kasper Lambert Johansen* – The Piniariarneq Project: Inughuit hunters map their important hunting areas.
- *Mads Ole Kristiansen* – The Piniariarneq project: Comments from the hunters.
- *Parnuna Egede* – Interactive atlas of Inuit knowledge on the Pikialasorsuaq ecosystem, and past and present use of living resources

Lunch

Human stressors. *Session chair:* Parnuna Egede

- *David Boertmann* (Key note speaker): – Anthropogenic stressors in the NOW – today and in the future.
- *Mette Frost* – Modelling oil spill trajectories in Melville Bay and the North Water Polynya.
- *Line A. Kyhn* – Seismic surveys in Baffin Bay and the Greenland regulation.
- *Rune Dietz* (Key note speaker): – How the traditional lifestyle and diet in the Northwater region are challenged by long-range pollution.
- *Jennifer Burnham* – Status of mercury concentration in twenty-four bird species in northwest Greenland.
- *Erin Keenan* – Tools for Marine Conservation Planning in the Eastern Canadian Arctic

Discussion

Round table discussion on the future of the North Water - identification of the most urgent research questions for informing and planning for the future. Session chair and facilitator: Anders Mosbech

15:00-15:10	<i>Anders Mosbech</i> : The future of the NOW, research questions – introduction to the round table discussion
15:10-15:20	<i>Kuupik Kleist</i> (Pikialasorsuaq Commission)
15:20-15:25	<i>Karen Motzfeldt</i> (Ministry of Nature and Environment, Naalakkersuisut, Greenland)
15:25-15:30	<i>Lisbeth Ølgaard</i> (Ministry of Environment and Food, Denmark)
15:30-15:35	<i>Vicki Sahanatien</i> (Nunavut Wildlife Management Board)
15:35-15:40	<i>David Lee</i> (Nunavut Tunngavik Inc.)
15:40-15:45	<i>Joel Ingram</i> (Oceans Program Central and Arctic Region, Fisheries and Oceans Canada)
15:45-15:50	<i>Olennguaq Kristensen</i> (President in Savissivik, Association of Fishers and Hunters in Greenland, KNAPK)
15:50-15:55	<i>Mads Ole Kristiansen</i> (President in Qaanaaq, Association of Fishers and Hunters in Greenland KNAPK)
16:00-17:00	Round table discussion with scientists and stakeholders
17:00-17:10	<i>Anders Mosbech</i> , Round-up and closure

Banquet (19:00- 01:00)

Friday 24rd November

Workshop on Research coordination and planning

Come, join and share your plans and ideas for future Projects in the NOW. Focus will be on research needs, and the potential for scientific and logistic synergy in the region at large. Introduction from *Søren Rysgaard*, *Mark Mallory* and others.

Farewell and Departure



Fig. 9.1 From the round table discussion. Photo: Astrid Oberborbeck Andersen

10. PUBLICATIONS & DISSEMINATION

The publications are many and varied, and we want to highlight our special issue of *Ambio. A Journal of the Human Environment*, vol. 47 (2), 2018 ed. by K. Hastrup, A. Mosbech and B. Grønnow, entitled *The North Water Polynya: A High Arctic Oasis under Transformation* (open access). It is a truly interdisciplinary issue of which we are proud, because it fulfils our ambition to collaborate in publication as well as in the field. The individual articles are listed by their first author in the list below.

We also want to draw attention to the previous *Annual Reports* (2014, 2015, 2016), where fieldwork activities and emerging analytical results are presented (see www.NOW.ku.dk).

Publications 2014:

Sørensen, M. & Grønnow, B.

2014: På sporet af de første grønlændere i Melville Bugt – en beretning om en arkæologisk opdagelse under NOW-projektets feltarbejde, sommeren 2014. - *Tidsskriftet Grønland*, Vol. 4: 228 – 241.

Hastrup, K.

2014: Nordvandet. Levende ressourcer og samfundsliv i Thule-regionen. Villum Fonden # Velux Fonden. *Årsskrift 2014*.

Publications 2015 :

Andersen, A. O., J.K. Flora & M.P. Heide-Jørgensen.

2015. Aaverparpaggiit: et tværfagligt møde om hvalrosser. *Tidsskriftet Grønland* 4/2015, pp. 225-236.

Appelt, M., Jens, J.F. M., Myrup, M., Haack, H., Sørensen, M. & Taube, M.

2015: The Cultural History of the Innaanganeq/Cape York Meteorite. Greenland National Museum & Archives, Technical Report 2015, 92 pp.

Grønnow, B.; Sørensen, M. & Gotfredsen, A. B.

2015. Arkæologiske og arkæo-zoologiske registreringer i Kap York-området, NOW Projektet, 2014. SILA – Arktisk Center ved Etnografisk Samling, Nationalmuseet, *Feltrapport 35*: 72 pp.

Hastrup, K.

2015: *Thule på tidens rand*. København: Lindhardt og Ringhof (495 pages).

Jensen, J.F., Appelt, M., Myrup, M., Haack, H. & Taube, M.

2015: Himmelsk og jordisk jern i Grønlands forhistorie - ny teknologi og gamle problemer. *Nationalmuseets Arbejdsmark*, pp. 116-131.

Publications 2016 :

Grønnow, B.; Appelt, M.; Gotfredsen, A. B. and Myrup, M.

2016: Arkæologiske og arkæo-zoologiske undersøgelser på bopladserne Nuulliit og Uummanaq (Avanersuaq) – en del af NOW Projektet, 2015. SILA-Arktisk Center ved Etnografisk Samling, Nationalmuseet, *Feltrapport* 37: 119 pp.

Grønnow, B.

2016: Living at a High Arctic Polynya: Inughuit Settlement and Subsistence around the North Water during the Thule Station Period, 1910–53. *Arctic* 69, Suppl.1:1-15.

Hastrup, K.

2016a: 'Knud Rasmussen: Explorer, Ethnographer, and Narrator'. In Igor Krupnik, ed. *Early Inuit Studies. Themes and Transitions, 1850s–1980s*. Washington DC: Smithsonian Institution Scholarly Press, pp. 111-136.

2016b: A History of Climate Change: Inughuit Responses to Changing Ice Conditions in North-West Greenland, *Climatic Change*, (0) 2016: 1-12. DOI 10.1007/s10584-016-1628-y

2016c: Climate Knowledge: Assemblage, Anticipation, Action'. In Susan A. Crate and Mark Nuttall, eds. *Anthropology and Climate Change. Coming of Age*, London and New York: Routledge (35-57).

2016d: The North Water. Life on the Ice Edge in the High Arctic. In K. Hastrup and F. Hastrup, eds. *Waterworlds: Anthropology in Fluid Environments*. Oxford and New York: Berghahn, pp. 279-299.

2016e: Feltarbejde i Thule. Sammenfiltringen af steder, folk og fortællinger. *Tidsskrift for Kulturstudier* 2016, 1: 62-79.

2016f: Global Food Security: A Grand Challenge of the Present Times.' In L. Jørgensen, N. Lynnerup, A. Løkke og H. Balslev eds. *Food, Population and Health: Global Patterns and Challenges*. Copenhagen: The Royal Danish Academy of Sciences and Letters. *Scientia Danica. Series H. Humanistica*, 4, vol 7, pp. 161-168.

2016g: Nordvandet. Et levende spisekammer i Thuleregionen, Nordvestgrønland.' *Carlsbergfondets Årsskrift 2016*. København: Carlsbergfondet (64-72).

Hastrup, K., J. Flora and A. O. Andersen.

2016: 'Moving Facts in an Arctic Field: The Expedition as Anthropological Method.' *Ethnography*. (0) 2016: 1-19.

Hastrup, K., A. M. Rieffestahl and A. Olsen

2016: 'Food Security. Changing Health Concerns in the Global North.' Wiley's *Companion to the Anthropology of Environmental Health*, ed. Merrill Singer. Hoboken, N.J.: Wiley and Son (257-280).

Publications 2017-18 :

Andersen, AO, JK Flora, KL Johansen, MP Heide-Jørgensen & A Mosbech

2017: *Piniariarneq: From interdisciplinary research towards a new resource management*. University of Copenhagen.

- Andersen-Ranberg E, Lehnert K, Leifsson PS, Dietz R, Andersen S, Siebert U, Measures L, Sonne C,
2018: Morphometric, molecular and histopathologic description of hepatic infection by *Orthosplanchnus arcticus* (Trematoda: Digenea: Brachycladiidae) in ringed seals (*Pusa hispida*) from Northwest Greenland. *Polar Biology*, in press.
- Christensen, T, A Mosbech, KL Johansen, D Boertmann, DS Clausen, T Boye & F Ugarte
2017: *Nordvandet; Økologi, sårbarhed og mulig fremtidig forvaltning*, Notat fra DCE - Nationalt Center for Miljø og Energi og Grønlands Naturinstitut 45 s.
- Clausen, DS, A Mosbech, D Boertmann, KL Johansen, J Nymand, S Potter & M Myrup
2016: *Environmental oil spill sensitivity atlas for the Northwest Greenland (75°-77° N) coastal zone*. Scientific Report from DCE – Danish Centre for Environment and Energy, No. 196.
- Davidson, TA, S Wetterich, KL Johansen, B Grønnow, T Windirsch, E Jeppesen, J Syväranta, J Olsen, I González-Bergonzoni, A Strunk, NK Larsen, H Meyer, J Søndergaard, R Dietz, I Eulaers & A Mosbech
2018: The history of seabird colonies and the North Water ecosystem: Contributions from palaeoecological and archaeo evidence. *Ambio*.
- Dietz, R, A Mosbech & I Eulaers
2017: Fangststyr ved Nordvandet og den globale kviksølvforurening. *Tidsskriftet Grønland*, bind 65, nr. 1, s. 26-36.
- Dietz, R, A Mosbech, J Flora & I Eulaers
2018: Interactions of climate, socio-economics, and global mercury pollution in the North Water. *Ambio*.
- Dietz, R, I Eulaers, JP Desforbes, S Wilson, C Sonne, RJ Letcher, E Andersen Ranberg, BD Barst, N Basu, JO Bustnes, J Bytingsvik, TM Ciesielski, PE Drevnick, GW Gabrielsen, A Haarr, K Hylland, BM Jenssen, E Kruemmel, M Levin, MA McKinney, DCG Muir, J Provencher, J Staffansson, FF Rigét & S Tartu
in review: An assessment of the biological effects of organohalogen and mercury exposure in Arctic wildlife and fish. *AMAP Assessment 2017: Mercury*. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.
- Dietz, R, K Gustavson, C Sonne, JP Desforbes, F Rigét, V Pavlova, M McKinney, R. Letcher
2015: Physiologically-based pharmacokinetic modelling of immune, re-productive and carcinogenic effects from contaminant exposure in polar bears (*Ursus maritimus*) across the Arctic. *Environmental Research* 140, pp. 45–55.
- Elliott, KH, JF Linnebjerg, C Burke, AJ Gaston, A Mosbech, M Frederiksen & F. Merkel
2017: Variation in Growth Drives the Duration of Parental Care: A Test of Ydenberg's Model. *The American Naturalist*, vol. 189, no. 5.
- Flora, J. and A. O. Andersen,
2017: Whose Track Is It Anyway?: An Anthropological Perspective on Collaboration with Biologists and Hunters in Thule, Northwest Greenland. *Collaborative Anthropologies*, vol 9 (1-2) : 2016-17 : 79-116.

- Flora, J, KL Johansen, B Grønnow, AO Andersen & A Mosbech
2018: Present and past dynamics of Inughuit resource spaces. *Ambio*.
- Garde, E., R.G. Hansen, K. Zinglarsen, S. Ditlevsen, M.P. Heide-Jørgensen.
2018: Diving and foraging characteristics of walrus in Smith Sound. *Journal of Experimental Biology* 500: 89-99.
- Gonzalez Bergonzoni, I, KL Johansen, A Mosbech, F Landkildehus, E Jeppesen & TA Davidson
2017: Small birds, big effects: the little auk (Alle alle) transforms high Arctic ecosystems. *Royal Society of London. Proceedings B. Biological Sciences* 284
- Gotfredsen, A.B., Appelt, M. & Hastrup, K.
2018: Walrus history around the North Water: Human-animal relations in a long-term perspective. In: K. Hastrup, B. Grønnow & A. Mosbech (eds.). The North Water Polynya: A High Arctic Oasis under Transformation. *Ambio*, special issue: 47 (2).
- Grønnow, B.; Appelt, M.; Gotfredsen, A. B. and Myrup, M.
2017: Arkæologiske og arkæo-zoologiske undersøgelser på Inersussat (Appat/Saunders Ø) og andre bopladser i Wolstenholme Fjord, Avanersuaq. NOW Projektet, 2016. SILA – Arktisk Center ved Ethnografisk Samling, Nationalmuseet, *Feltrapport* 38: 86 pp.
- Grønnow, B.& Myrup, M.
2017: Droner og Fortidsminder i Grønland – en ny teknologi i arkæologiens tjeneste. – *Tidsskriftet Grønland* 3, 2017: 242 – 253.
- Hastrup, K.
2017: The Viability of a High Arctic Hunting Community: A Historical in Marc Brightman and Jerome Lewis, eds. *The Anthropology of Sustainability: Beyond Development and Progress*, New York: Palgrave Macmillan (145-164)
2018: Collaborative Moments. Expanding the Anthropological Field through Cross-Disciplinary Practice'. *Ethnos*, Vol. 83 (2): 316-334.
- Hastrup, K., B. Grønnow & A. Mosbech
2018a: Preface. *Ambio*.
2018b: Introducing the North Water: Histories of exploration, ice dynamics, living resources, and human settlement in the Thule Region. *Ambio*.
- Hastrup, K, A.O. Andersen, B. Grønnow, M.P. Heide-Jørgensen
2018c: Life around the North Water Ecosystem: Natural and social drivers of change over a millenium. *Ambio*.
- Heide-Jørgensen, MP, J Flora, AO Andersen, REA Stewart, NH Nielsen, RG Hansen
2017: Walrus Movements in Smith Sound: A Canada–Greenland Shared Stock. *Arctic* 70, 3, p. 308-18.
- Heide-Jørgensen, MP, MHS Sinding, NH Nielsen, A Rosing-Asvid, RG Hansen.
2016: Large numbers of marine mammals winter in the North Water Polynya. *Polar Biology*, Vol 39(1), pp 1-10.

- Jeppesen, E., M Appelt, K Hastrup, B Grønnow, A Mosbech, JP Smol, & TA Davidson
 2018: Living in an oasis: Rapid transformations, resilience, and resistance in the North Water Area societies and ecosystems. *Ambio*.
- Mercier, F, A Mosbech, T Christensen, D Boertmann, T Boye & J Rice
 2017: The Northern Baffin Bay Ecoregion. *Natural Marine World Heritage in the Arctic Ocean, Report of an expert workshop and review process*. IUCN, Gland, p. 78-85
- Møller E, KL Johansen, M Agersted, F Rigét, D Clausen, J Larsen, P Lyngs, A Middelbo & A Mosbech.
 In rev: Spatio-temporal linkages among phytoplankton, zooplankton and little auks in Eastern Smith Sound and Northern Baffin Bay. *Marine Ecology Progress Series*.
- Mosbech, A & KL Johansen
 2017: Om Nordvandet og NOW-projektet. *Tidsskriftet Grønland*, bind 2017/1, nr. 65, s. 11-12.
- Mosbech, A, KL Johansen, TA Davidson & P Lyngs
 2017: Søkongerne ved Nordvandet – en lille fugl med en stor økologisk betydning. *Tidsskriftet Grønland*, bind 2017/1, nr. 65, s. 13-25.
- Mosbech, A, KL Johansen, TA Davidson, M Appelt, B Grønnow, C Cuyler, P Lyngs & J Flora
 2018: On the crucial importance of a small bird: The ecosystem services of the little auk (Alle alle) population in Northwest Greenland in a long-term perspective. *Ambio*.
- Mosbech, A, P Lyngs & KL Johansen
 2017: Estimating little auk (Alle alle) breeding density and chick-feeding rate using video surveillance. *Polar Research* 36, 1.
- Spears, BM, L Carvalho, MN Futter, L May, SJ Thackeray, R Adrian, DG Angeler, SJ Burthe, TA Davidson, F Daunt, AS Gsell, DO Hessen, H Moorhouse, H Huser, SC Ives, ABG Janssen, EB Mackay, M. Søndergaard & E Jeppesen
 2016: Ecological instability in lakes: a predictable condition? *Environmental Science & Technology* 50 (7): 3285–3286.
- Sonne C, Leifsson PS, Søndergaard J, Dietz R.
 2018: Hepatic and renal histology and mercury concentrations of North West and North East Greenland narwhals (*Monodon monoceros*), *Journal of Toxicology and Environmental Health Part A*, 81: 202-211.

In press:

Flora, J.

In press: *Wandering Spirits: Longing and Loneliness in Greenland*. Chicago: University of Chicago Press.

Flora, J. and A. O. Andersen,

In press: Taking Note: a kaleidoscopic view on two, or three, modes of fieldnoting. *Qualitative Research*.

Grønnow, B.; Andersen, A.O; Appelt, M.; Flora, J., Hastrup, K.; Johansen, K.J. and Mosbech, A.

In press: *En arktisk oase - NOW Projektet i Thule*. Nationalmuseets Arbejdsmark 2018.

Hastrup, K.

In press a: Dogs among Others: Inughuit Companions in Northwest Greenland. *Dogs in the North*, Robert P. Wishart, Rob Losey, P. Loovers, eds. London and New York: Routledge.

In press b: The Historicity of Health. Environmental Hazards and Epidemics in Northwest Greenland. *Journal of Cross-Cultural Research*.

In press c: Thule as Frontier: Commons, Contested Resources, and Contact Zones in the Big North. In *The Making of Northern Resource Frontiers*, M. Lien and F. Hastrup, eds. Special issue of *Anthropological Journal of European Culture*.

In press d: A Community on the Brink of Extinction? Ecological Crises and Ruined Landscapes in Northwest Greenland. In A. B. Stensrud and T. Hylland Eriksen, eds. *Ecological Crises in an Overheated World*; London: Pluto Press.

Lissner, J., Høye, T.T., Mosbech, A. & Johansen, K.L.

In press: First record of *Oreoneta eskimopoint* Saaristo & Marusik, 2004 (Araneae, Linyphiidae) from Greenland. *Norwegian Journal of Entomology* 65, 1–6.

Dissertations

Dramshøj, LS & N Bøgeløv Jørgensen

2016: *Bioaccumulation of mercury in narwhals (Monodon monoceros) and the health threat it poses to Inuit population*. Bachelor Thesis, University of Copenhagen and Aarhus University. 36 pp. Main Supervisor: Morten Tange Olsen, Co-Supervisors: Rune Dietz, Igor Eulaers. Defended 18 July 2016.

Najbjerg, L

2017: *Are temporal changes in ringed seal (Pusa hispida) blubber thickness related to climate change and hunting?* Masters Thesis, Aarhus University and University of Copenhagen. 42 pp. Main Supervisor: Rune Dietz, Co-Supervisors: Christian Sonne, Igor Eulaers, Peter Holm. Defended 27 February 2017.

Haastrup, A.G.

2017: *Appanqannlia? Ingen Lomvie? En analyse af forskellige vidensformer om lomvien og bæredygtighedstanker i Grønland*. Master's thesis, Dept. of Anthropology. University of

Copenhagen, 103pp. Main Supervisor, K. Hastrup; co-supervisors: A.O. Andersen, J. K. Flora. Defended Sept. 2017

Mønsted, A.

2016: Mandshuset på Nuulliit. Etnografisk-arkæologisk analyse af et qassi i det nordlige Grønland. Master Thesis, SAXO Institute, University of Copenhagen: 90 pp. Defended Oct. 2016.

Dissemination

Scientific Presentations

- Andersen, AO 2016. *Walrus in Anthropological Perspective*. Presentation given at Walrus Research Day, Copenhagen, 28 Nov. 2016.
- Andersen, AO 2017. Introducing the screening of the movie “Piniariarnek”. North Water Polynya Conference, Copenhagen, 22-14 Nov. 2017.
- Andersen, AO., J Flora & 2015. *Living resources: disturbing the animate-inanimate divide*. Conference panel organized and chaired at the Annual Meeting of the American Anthropology Association, Denver, 18 – 22 Nov. 2015.
- Andersen, AO 2015. *How to kill a little auk. Tracking life and after-life trajectories of birds in Northwest Greenland*. Annual Meeting of the American Anthropology Association, Denver, 18 – 22 Nov. 2015.
- Andersen, AO 2016. *Puzzling pieces and situated urgencies of climate change and capitalism in the High Arctic. Stories from Qaanaaq*. Paper presented on workshop: Climate Change and Capitalism: Inequality and Justice in an Overheated World, Oslo, 25-27 April 2016.
- Andersen, AO, JK Flora, & KL Johansen 2017. *Piniariarnek: GPS-Tracking of Hunting Practices around the North Water*. Presentation at the conference The North Water: The Entanglement of Ice, Animals, and People in a High-Arctic Oasis. The Royal Danish Academy of Sciences, Copenhagen, 8-10 May 2017.
- Boertmann, D., T. Christensen, & KL Johansen 2017. *Anthropogenic stressors in the NOW, today and in the future*. Presentation at the North Water Polynya Conference, Copenhagen, 22-24 Nov. 2017.
- Davidson, TA & E Jeppesen 2015. Attended a workshop hosted by CEH in Edinburgh entitled 'Detecting critical transitions in lakes'.
- Davidson, TA 2015. Invited speaker at the first meeting of PAGES (Past Global Changes) working group on Aquatic transitions. Nottingham, UK.
- Davidson, TA 2017. *Greening the High Arctic: When and How Have Sea-Birds Transformed Fresh Waters of the North Water Polynya*. Presentation at the conference The North Water: The Entanglement of Ice, Animals, and People in a High-Arctic Oasis. The Royal Danish Academy of Sciences, Copenhagen, 8-10 May 2017.
- Davidson, TA, I Gonzales-Bergonzoni, KL Johansen, S Wetterich, H Meyer, T Windirsch, E Jeppesen, J Olsen, F Landkildehus, A Strunk, R Dietz, I Eulaers, NK Larsen & A Mosbech 2017. *Greening the high Arctic: When and how have seabirds transformed the fresh waters of the NOW Polynya*. Presentation at the North Water Polynya Conference, Copenhagen, 22-24 Nov. 2017.
- Davidson, TA, I González-Bergonzoni, KL Johansen, A Mosbech, E Jeppesen 2016. *Small birds, big effects: the little auk transforms high arctic ecosystems*. Presentation at Arctic Research Centre, Annual meeting, Sandbjerg, Nov 23rd, 2016

- Dietz R & Sonne C, 2018. Narwhals and the global Mercury issue. Book contribution to a Book, "Revealing an Arctic Legend" issued in connection with a 2017 Narwhal Exhibit at the Smithsonian Institute.
- Dietz, R 2017. *The Contamination of the North Water*. Presentation at the conference The North Water: The Entanglement of Ice, Animals, and People in a High-Arctic Oasis. The Royal Danish Academy of Sciences, Copenhagen, 8-10 May 2017.
- Dietz R, Eulaers I, Desforges JP, Wilson S, Sonne C, Letcher RJ, Andersen-Ranberg E, Barst BD, Basu N, Bustnes JO, Bytingsvik J, Ciesielski TM, Drevnick PE, Gabrielsen GW, Haarr A, Hylland K, Jenssen BM, Kruemmel E, Levin M, McKinney MA, Muir DCG, Provencher J, Staffansson J, Rigét FF, Tartu S 2017c. An assessment of the biological effects of organohalogen and mercury exposure in Arctic wildlife and fish. Arctic Change Conference, Quebec City, 11-15 December, 2017.
- Dietz R, Eulaers I, Desforges JP, Wilson S, Sonne C, Letcher RJ, Andersen-Ranberg E, Barst BD, Basu N, Bustnes JO, Bytingsvik J, Ciesielski TM, Drevnick PE, Gabrielsen GW, Haarr A, Hylland K, Jenssen BM, Kruemmel E, Levin M, McKinney MA, Muir DCG, Provencher J, Staffansson J, Rigét FF, Tartu S 2017b. An assessment of the biological effects of organohalogen and mercury exposure in Arctic wildlife and fish. Reston AMAP International Conference on Arctic Science: Bringing Knowledge to Action, Reston USA, 24-27 April, 2017.
- Flora, J. On the strong taste of change in a northwest Greenlandic Landscape. Annual Meeting of the American Anthropology Association, Denver, 18 – 22 Nov. 2015.
- Flora, J. No great hunter without a wife. International Conference on Gender Shifts and Resource Politics in the Arctic. Uppsala University, 22 Feb. 2017
- Flora, J. How to make a proper meal in Avanersuaq. The North Water: The Entanglement of Ice, Animals, and People in a High-Arctic Oasis. Now-Symposium. The Royal Danish Academy of Sciences, Copenhagen, 8-10 May 2017.
- Flora, J, & AO Andersen. The sea ice as a site for multiple economies in Qaanaaq. Eleventh Conference on Hunting and Gathering Societies, Vienna, 11 Sep. 2015.
- Fort J, Helgason H, Amálineau F, Anker-Nielssen T Bustnes J-O, Danielsen, J, escamps S, Dietz R, Elliot K, Erikstad K, Ezhov, A, Gavrilov M, Gilchrist G, Gilg O, Grémillet D, Hansen E, Hanssen S, Helberg M, Huffeldt N, Jónsson J, Kitaysky A. Langseth M, Leclaire S, Thorarinsson T, Lorentsen S-H, Lorentzen E, Mallory M, Merkel F, Moe B, Montevecchi W, Mosbech A, Olsen B, Pratte I, Provencher J, Ragnarsdóttir S, Reirsen T, Robertson G, Sagerup K, Strøm H, Systad G, Tertitski G, Thompson P, Hallgrímsson G, Tolmacheva E, Will A, Wojczulanis-Jakubas K, Bustamante P 2017. Spatial ecotoxicology: tracking large scale mercury contamination of the avian community in a changing Arctic. Abstract and spoken presentation. High Altitudes meet High Latitudes: Globalizing Polar Issues, Crans-Montana, Switzerland 11-12 September 2017.

- Fort J, Helgason H, Amálineau F, Anker-Nielssen T Bustnes J-O, Danielsen, J, Descamps S, *Dietz R*, Elliot K, Erikstad K, Ezhov, A, Gavrilov M, Gilchrist G, Gilg O, Grémillet D, Hansen E, Hanssen S, Helberg M, Huffeldt N, Jónsson J, Kitaysky A. Langseth M, Leclaire S, Thorarinsson T, Lorentsen S-H, Lorentzen E, Mallory M, Merkel F, Moe B, Montevecchi W, *Mosbech A*, Olsen B, Pratte I, Provencher J, Ragnarsdóttir S, Reirsen T, Robertson G, Sagerup K, Strøm H, Systad G, Tertitski G, Thompson P, Hallgrímsson G, Tolmacheva E, Will A, Wojczulanis-Jakubas K, Bustamante P 2017. ARCTOX: A Pan-Arctic sampling network to track Mercury contamination across Arctic marine food webs. RO-069. Abstract and spoken presentation. International Biennial Mercury Conference ICMGP, Providence, Rhode Island 16-21 July 2017.
- González-Bergonzoni, I, KL Johansen, A Mosbech, E Jeppesen & TA Davidson 2016. *Seabird effects in the high arctic in space and time*. Presentation at Lake Group meeting, Bioscience Aarhus University, December 2016
- Gotfredsen, A.B. 2017. "Subsistence and Processing of Animal Resources at Nuulliit". International NOW-symposium, May 2017.
- Gotfredsen, A. B. 2017. "Marine mammal exploitation from a diachronic perspective" Presentation to the 23rd Annual Conference of the European Association of Archaeologists (EAA), Maastricht 30 August – 3 September 2017.
- Hastrup, K. J. Flora and A.O. Andersen, 2015. A presentation of the NOW Project on a workshop 'Stitching together heterogeneous data worlds'. Departments of Anthropology and Sociology, University of Copenhagen, January.
- Hastrup, K. 2015. *The Viability of a High Arctic Hunting Community: A Historical Perspective*; to the international Conference on Anthropological visions of sustainable futures organized by Marc Brightman and Jerome Lewis, University College London (February).
- Hastrup, K. 2015. *Collaborative Moments: Interdisciplinary Experimentation in the Field* at The Anthropological Mega-Seminar, Sandbjerg, August 24-26,
- Hastrup, K. 2015. Key-note address to the 33 Nordic Ethnology and Folklore Conference, Copenhagen: *Comprehending Thule: The Co-Constitution of Peoples, Places and Stories*. August.
- Hastrup, K. 2015. Keynote: *The Heritage of Hunters: Living with Climate Change in the High Arctic*, at the Heritage Seminar, Aarhus University, August.
- Hastrup; K. 2015) *Anthropology in Fluid Environments: The Elusiveness of Place in the High Arctic*, Invited Lecture at Princeton University (4 October).
- Hastrup, K. 2015. *A Permanent State of Extinction? The Case of the Thule People of North West Greenland*, Invited lecture at University of Pennsylvania (October 5).
- Hastrup, K. 2016. *Thule as Frontier. Contested Resources in the High Arctic*. Institut d'Études Avancées, Paris. (15 November)
- Hastrup, K. 2016. presented *Vital Materials in the High Arctic: An analysis of Agentive Assemblages in a Hunting Community*. Laboratoire d'Anthropologie Sociale, Collège de France, Paris (23 November).

- Hastrup, K. 2016. *Living Resources and Human Societies around The North Water in the Thule Area* for all students and colleagues at 'Institutets Dag', Department of Anthropology, University of Copenhagen. (8 June)
- Hastrup, K. 2016. *Thule på tidens rand: Antropologisk arbejde i et ubegribeligt landskab*, to the Royal Danish Academy of Sciences and Letters (28 April).
- Hastrup, K. 2016. *New Materials and Ancient Resources in the Thule Region: The Precarious life of High Arctic Hunters*; workshop 'Climate Change and Capitalism: Inequality and Justice in an Overheated World', University of Oslo. 25 April
- Hastrup, K. 2017. *The End of Nature? Natural Agents on the Edge of Human Worlds*. Presentation at the University of Bologna, 23 March 2016.
- Hastrup, K. 2017. *Arctic Nostalgia. Towards an Ecology of Non-Scalable Socialities?* Conference on *Ecological Nostalgias*: Université Libre de Bruxelles, June 2017
- Hastrup, K. 2017. *Discovering the North Water – and Meeting New People*, presentation to the NOW-symposium, 8 May.
- Hastrup, K. 2017. *Foreign Invasions: Life in a Ruined landscape*, presentation to the NOW-symposium, 9 May.
- Hastrup, K. 2017, *Methodological Challenges in Changing Landscapes: Materiality, Vitality, and Affect*. University of Vienna, 3. November.
- Hastrup, K. 2018. *Provoking Landscapes: Materiality, Vitality, and Affect in the High Arctic*. University of Stockholm, 14 March, 2018.
- Hastrup, K. 2018: *The Arctic as a Human Frontier: The Case of Thule, Northwest Greenland*. Nordiska Museet, Stockholm, 15 March 2018.
- Jeppesen, E 2017. *Tipping Points in the Ecosystem*. Presentation at the conference The North Water: The Entanglement of Ice, Animals, and People in a High-Arctic Oasis. The Royal Danish Academy of Sciences, Copenhagen, 8-10 May 2017.
- Johansen, KL & A Mosbech 2017. *The Little Auk as Ecosystem Engineer*. Presentation at the conference The North Water: The Entanglement of Ice, Animals, and People in a High-Arctic Oasis. The Royal Danish Academy of Sciences, Copenhagen, 8-10 May 2017
- Johansen, KL, JK Flora, AO Andersen, MP Heide-Jørgensen & A Mosbech 2017. *The Piniariameq Project: Inughuit hunters map their important hunting areas*. Presentation at the North Water Polynya Conference, Copenhagen, 22-24 Nov. 2017.
- Møller, EF, MD Agersted, KL Johansen, FF Riget & A Mosbech 2017. *Why is the North Water Polynya Region such an important breeding area for little auks?* Presentation at the North Water Polynya Conference, Copenhagen, 22-24 Nov. 2017.
- Mosbech, A 2016. *Arctic Change, the Global and the Local Greenland Environmental Perspective*. Presentation at European Science Open Forum, Manchester July 2016.

- Mosbech, A, KL Johansen, C Cuyler, M Frederiksen, JF Linnebjerg, P Lyngs & FR Merkel 2017. *Little auk and thick-billed murre in the NOW Polynya*. Presentation at the North Water Polynya Conference, Copenhagen, 22-24 Nov. 2017
- Mosbech, A, KL Johansen, EF Møller & P Lyngs 2016. *Foraging strategy of little auks during chick rearing in northwest Greenland*. Presentation at the 13th International Seabird Group Conference, Edinburgh September 2016.
- Mosbech, A, KL Johansen, P Lyngs, TA Davidson, E Jeppesen, B Grønnow, M Appelt, R Dietz, AO Andersen & J Flora 2015. *The little auk population at the North Water Polynya. How palaeohistory, archaeology and anthropology adds new dimensions to the ecology of a high arctic seabird*. Presentation at the 2nd World Seabird Conference, Cape Town, South Africa, 26/10/2015 - 30/10/2015.
- Mosbech, A, T Christensen & MP Heide-Jørgensen 2017. *The Ecological Significance of the North Water in Contemporary International Perspective*. Presentation at the conference The North Water: The Entanglement of Ice, Animals, and People in a High-Arctic Oasis. The Royal Danish Academy of Sciences, Copenhagen, 8-10 May 2017.

Public dissemination:

- "Søkongefangst". One-room exhibition created by researchers of the NOW Project and exhibited at the National Museum of Denmark, in joint venture with the national museums of Greenland. March 3, 2015.
- KL Johansen & A Mosbech. *Søkongen – en lille fugl med en stor betydning*. Presentation at Veluxfonden's årsudflugt, 8 Sep. 2017, Statens Naturhistoriske Museum, Copenhagen.
- J Flora, AO Andersen & KL Johansen hosted a dialogue meeting between researchers, hunters and stakeholders in the management of Greenland's living resources at Hotel Hans Egede, Nuuk, 24 Jan 2017, and presented results from the *Piniariarneq*-project.
- Flora, J. AO Andersen & KL Johansen gave a talk about the *Piniariarneq*-project at the Greenland Institute of Natural Resources, Nuuk, 25 Jan 2017.
- J Flora & AO Andersen gave a Science Talk: "Tracking Hunting Routes in Thule" at the Knud Rasmussen Community Center, Thule Air Base, Pituffik, Northwest Greenland, 19. May 2016.
- J Flora og AO Andersen gave a talk about the interdisciplinary work of the NOW Project: *Nordvandet set gennem hinandens øjne: tværfaglighed i antropologisk perspektiv*, at the lecture event "Fangere og fangst dyr omkring Nordvandet: det tværfaglige NOW-Projekt", at Ilisimatusarfik (University of Greenland), Nuuk, 25 Jan 2017.
- K. Hastrup, Bjarne Grønnow and Kasper Lambert Johansen presented the NOW-project and some of its results at the annual meeting of the Velux Foundations, 8 September 2017.
- A Mosbech & KL Johansen gave the talk "*Søkongerne i Nordvandet: en lille fugl med stor økologisk betydning*" at the lecture event "*Fangere og fangst dyr omkring Nordvandet: det tværfaglige NOW-Projekt*" at Ilisimatusarfik (University of Greenland), Nuuk, 25 Jan 2017.

- MP Heide-Jørgensen gave the talk "*Fangst og fangstdyrene omkring Nordvandet*" at the lecture event "*Fangere og fangst dyr omkring Nordvandet: det tværfaglige NOW-Projekt*" at Ilisimatusarfik (University of Greenland), Nuuk, 25 Jan 2017.
- A Mosbech gave a talk about the North Water Polynya and the NOW project during the event "At gå på fangst" at the culture house Katuaq, Nuuk, 26 Jan 2017.
- J. Flora, AO Andersen & KL Johansen gave a talk about the Piniriarneq-project during the event "At gå på fangst" at the culture house Katuaq, Nuuk, 26 Jan 2017.

Film:

PINIARIARNEQ (produced by AO Andersen and J. Flora). Shortfilm and result of the GPS tracking project Piniriarneq has been screened the following places and dates:

- Dialogue meeting between researchers, hunters and stakeholders in the management of Greenland's living resources, Hotel Hans Egede, Nuuk, 24 Jan 2017.
- "At gå på fangst" dissemination activity at the culture house Katuaq, Nuuk, 26 Jan 2017.
- Greenlandic National Television, KNR. February 2017
- Arctic Day, Ethnographic Exploratory, Copenhagen, 3 May 2017
- Symposium: The North Water: The Entanglement of Ice, Animals, and People in a High-Arctic Oasis. The Royal Danish Academy of Sciences, Copenhagen, 8-10 May 2017
- North Water Polynya Conference, Copenhagen, 22-24 Nov. 2017.

Popular articles about the little auk ecosystem impact (in Danish):

<https://videnskab.dk/naturvidenskab/lille-fugls-afkoering-har-kaempe-effekt-paa-groenlands-natur>

<http://knr.gl/da/nyheder/s%C3%B8kongernes-aff%C3%B8ring-farver-nordgr%C3%B8nland-gr>

<http://scitech.au.dk/om-science-and-technology/aktuelt/nyheder/vis/artikel/soekongen-en-lille-fugl-med-stor-effekt-i-arktisk/>

<http://sermitsiaq.ag/soekongens-klatter-goer-groenland-groent-frodigt>

Popular articles:

<http://sciencenordic.com/tiny-bird%E2%80%99s-poo-has-tremendous-impact-greenland%E2%80%99s-nature>

<http://arctic.au.dk/news-and-events/news/show/artikel/the-little-auk-a-major-engineer/>

<http://www.asp-net.org/content/little-auk-major-engineer#>

<http://www.earthtimes.org/nature/auks-transform-arctic-ecosystems/3002/>

<https://freshwaterblog.net/2017/02/15/small-birds-big-effects-the-little-auk-transforms-high-arctic-ecosystems/>

Article about The NOW-Project in the journal Polarfronten: "[Oasen i isen](#)".

https://issuu.com/polarfronten/docs/polarfronten_2_2015

Article about the GPS project in Danish Videnskab.dk (May 22nd 2016): "Forskningsprojekt bygger bro mellem forskere og grønlandske fangere" <http://videnskab.dk/miljo-naturvidenskab/forskningsprojekt-bygger-bro-mellem-forskere-og-gronlandske-fangere>

Article about the GPS project in Greenlandic Sermitsiaq A.G. (May 24th 2016): "Fangere og forskere samarbejder i Qaanaaq" <http://sermitsiaq.ag/fangere-forskere-samarbejder-i-qaanaaq>