

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

Annual Report 2015

PREFACE

This second annual report from the NOW-project covers the calendar year 2015. The project started in July 2014 with a joint field-season, largely centred on the ship *Minna Martek* serving as a floating field-station for archaeologists, biologists and anthropologists alike (see last year's report). In 2015, the groups both split up and assembled in new ways, conducting both collaborative and individual fieldwork under the NOW-umbrella in large parts of the region. This will be expanded in the present report.

Apart from presenting the different studies conducted in the field, the report also contains some of the emerging results, as well as a list of presentations and publications that have come out of NOW during the year. Internal workshops and meetings have made it possible to see how the interdisciplinary cross-fertilization may change and refine the individual disciplinary perspectives.

We are grateful to the *Velux Foundations* and the *Carlsberg Foundation* for funding our project. By their generosity, these foundations made it possible not only to carry out a particular study, but also to experience the promise of interdisciplinary collaboration in a shared field. This report gives an impression of both disciplinary and collaborative efforts in 2015 and their perspective.

We also want to acknowledge the vital support received in the field. The anthropologists would like to thank the inhabitants of Qaanaaq for their hospitality and readiness to take on board 'passengers' in boats and on sledges. The biologists would also like to thank the community of Siorapaluk in particular for opening their doors and impart information on the hunt. The members of the archaeological and biological field crews of the NOW Project, 2015, wish to extend their warmest thanks to the staff at the Thule Air Base, in particular to liaison officer Kim Mikkelsen, base commander colonel Stuart A. Pettis, Tony Rønne Pedersen and Erland Søndergaard. The staff at the Knud Rasmussen Community Centre is likewise thanked for great hospitality. The biological team also wish to thank Chief officer Jørgen G. Bruun and second in command Morten Dastrup and the staff at Royal Danish Navy vessel Ejnar Mikkelsen for logistical support for the visit to *Kitsissut (Carey Islands)*.

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March 2016

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RESEARCH OBJECTIVES

The project investigates the dynamic relations between living resources and hunting societies of the Thule area in a long-term perspective. These relations are deeply affected by climatic conditions – subject to both minor and major changes over time. The focus is on the North Water (NOW), a High Arctic polynya situated in northernmost Baffin Bay, being the one and only reason why (and how) both people and animals may survive in this northernmost habitat on the globe. The polynya is circumscribed by ice for most of the year, and people have depended on the ice-cover for communication and hunting throughout the region.

This is what has now become a major challenge. The melting ice has hampered dog-sledging to the ice-edge and cut off stable communication between the settlements. The NOW-project responds to an urgent need to understand how the ecosystem develops and possibly breaks down, with a view also to changing human settlements and animal populations in the region, under the weight of changing ice-conditions. This calls for a close collaboration between anthropology, biology, and archaeology.

To make this collaboration practicable, we have identified three key-topics, *resource spaces*, *critical transitions*, and *seasonal rhythms*, serving as focal points for all three disciplines. These key-topics inform the field-reports below. (We refer readers to last year's report on the webpage for further general information on these.)

To handle the key-topics in practice, we initially identified four work packages to guide practical work on the ground. They are:

- a. Key Living Resources in the NOW: The Dynamics of a High Arctic Ecosystem*
- b. Human Settlement and Living Resources: Long Term Relations*
- c. Living in an Oasis: Drivers of Change*
- d. Walrus and Sea Birds: Human Impacts*

Again, we refer to last year's report and the webpage for details on the framework. The practical pursuit of the inherent objectives will transpire in the following reports, criss-crossing between disciplines and topics.

PRELIMINARY RESULTS

The following brief reports from field investigations in 2015 and the tentative analyses will provide readers with a first idea of the intricate nature of the North Water as a comprehensive ecosystem. By switching focus between present social life, animal movement and prehistoric settlement, the reports encircle the dynamic relations at play in the region.

During joint fieldwork in 2014, all participants had the privilege of actually sharing the field and beginning to understand the entanglements of long-term ecological processes, animal presence, and human settlement as we moved together in the landscape. In 2015, the shared field was visited by different groups of researchers at different times, enabling the groups to pursue more specific questions in depth.

Thus, the **Anthropologists** worked with hunters in various ways and places and were able to ascertain their sense of shifty seasons and the unpredictability of key-resources; notably by participating in the spring hunt on narwhal and walrus, respectively. Together with biologists, the anthropologists designed a GPS-tacking device, enabling the hunters to map their routes and game, and they also joined a walrus-tagging expedition with another biologist and a group of hunters, whose harpooning skills were needed. While biologists had done this many times before, the anthropologists could add a refined understanding of the hunters' perception of what they were doing and how it could potentially affect future hunting quotas.

Biologists also worked with little auks, monitoring their foraging routes out into the sea, and being able to show so far unknown patterns of movement to and from foraging places. Another issue is the human impact on the colonies in the long-term perspective. Parallel investigations were made in thick-billed murre colonies, where birds had lived without human disturbance. An extremely promising part of the seabird studies was the collection of more sediment samples from freshwater ecosystems, offering archives of past change in the form of lake sediment and peat deposits. The analysis of these samples will allow for an identification of the (prehistoric) arrival of birds, having left their imprint in the form of marine nutrients. A final biological project investigates the exposure to HG in wildlife and hunters in the region and the preliminary findings show how this exposure peaks during summer, when narwhal is hunted.

Archaeologists meanwhile charted and excavated two settlements in mid-district, Nuulliit and Uummannaq. The first one is a site of the early Thule Culture from the 13th century, and it yielded rich material for further analysis in terms of material deposits, holding a great potential for analysis of the tools and techniques used by the people, who were clearly living from the North Water's big animal populations. Faunal remains were also found, and will be analysed with a view to ascertaining prehistoric subsistence patterns on the edge of NOW. The second settlement scrutinized was Uummannaq, the original central

settlement in the Thule region, close to which the Thule Station was built in 1910. For the first time, both prehistoric and historical settlements were charted, and even mapped by drone, that will eventually become a baseline map for people in the region, who since 1953 are no longer able to actually live there, due to the Airbase.

All in all, this annual report offers present, historical, and prehistoric perspectives on the interdependence between living resources and human settlement in the NOW-region – and the challenges that the region is facing.

ANTHROPOLOGICAL ENGAGEMENTS

Kirsten Hastrup



Anthropological work in the region consisted of three months of fieldwork by Janne Flora and Astrid Andersen, mainly in and around Qaanaaq, but also including a brief stay in Savissivik, while Kirsten Hastrup spent three weeks following up on previous studies in Qaanaaq, this time focussing on the spring hunt from the sea-ice. Beyond the conspicuous seasonal activities, the anthropologists are always listening for the larger concerns of a community, whose immediate surroundings are subject to major environmental changes on the one hand and new political realities on the other – the latter implying restrictions on the hunt based on both international and national assessments. Thus, the horizon against which the small reports from the field given below by far outstretches the immediate surroundings.

For anthropologists to sense the world from within it so to speak, they must go along with the people they want to know. Evidently, there is a lot of conversation going on in the town or settlement, but in a community of hunters moving along with the people is essential for the understanding of the relationship between people and landscape and for sensing how far social and natural forms are mutually implicated in actual practice.

This year, 'moving along' got an extra dimension, in that a project of GPS-monitoring of hunters' movements was initiated – designed in close cooperation by members of the biological team and the anthropologists, and implemented by the anthropologists. This project is described below under a separate heading; here it suffices to note that it has allowed the hunters to map out their own routes and interests, also after the anthropologists had left. This gives new glimpses of what is locally deemed to be salient features and high

points of hunting life. It also bears witness to changing ice-edges and new seasonal rhythms, and thus addresses the larger ambitions of the NOW-project.

Anthropologists were also engaged in walrus-tagging with a biologist and local hunters; this demonstrates interdisciplinarity in actual practice. In this case, it centres on one of the salient species in the project, viz. the walrus, and points back also to the need for intense collaboration with the hunters. Again, this is described under a separate heading below.

The two first accounts of anthropological moves into the world of hunting serves to remind us about the actual lived life of people in the region, unfolding in close dialogue with a shifty nature. They also show some of the practical (social) implications of our three key topics: resource spaces, critical changes, and seasonal rhythms. The power of the North Water in shaping the regions rests with the fact that it is a resource space for multiple species, humans included. In the polynya, their individual feeding grounds overlap, creating a rich and variegated biotope, and allowing for an impressive food chain from phytoplankton to polar bear, with i.e. crustaceans, birds, seals, and people in between. What is happening now, with the warming of the sea and the opening of the ice, is that the resource spaces of the individual species no longer are as neatly overlapping as before. For the hunters, this means more difficult access to game, as will be gathered from the description of the walrus-hunt.

In more general terms, it means that the seasonal rhythms are becoming less certain. Seasonal rhythms format the everyday life of families through practices and meanings of food sharing, tasting, and eating; through peoples' experiences that become news and stories to tell; or a hunter's tasks and technologies that may be quickly adapted to rhythmic shifts and rearrangements. When resources cannot be taken for granted, and everything seems out of sync, the locals may face a critical transition, a point where old histories no longer seem valid, and social life must change direction. This does not necessarily signal doom or disaster. New resources may appear, such as the halibut in Kangerlussuaq, the fjord by Qaanaaq, and new generations may make their own moves towards a new kind of life based on both old and new possibilities. This is what the brief presentations from the field substantiate.

THE YOUNG NARWHAL-HUNTER: A FIRST CATCH

Kirsten Hastrup



While it has often been noted that the hunters in the Thule region are facing major challenges, given both environmental and political changes in Greenland, it bears remembering that social life goes on and contains moments of promise and pleasure. I shall relate such an instance from the spring hunt in 2015.

A hunter, with whom I had travelled in previous years, agreed to take me on his sledge to the ice edge along with his 16-year old son. On our way, a seal basking on the sea-ice close to a breathing hole was shot, and the sunshine made it quite pleasant to simply sit on the sledge and wait while the hunter approached the seal, against the wind and covered by the shooting sail.

We then pressed on towards the ice edge, where there was already a camp-site, with people waiting for the narwhals that came and went in various packs and did not give themselves up easily. There is a rule in the region that one must harpoon the whale before shooting it, so that it is already fastened by the harpoon line, before it is shot; this is to avoid wasting whales. They must also take them from kayaks, not motorboats, whose noise will scare the animals away, and skew the access to game in favour of families with access to powerful engines. In short it is all very traditional, but also very practical and sustainable.

We arrived at the camp and began waiting for narwhals along with the rest. During the day a number of packs came into the open water between the ice and the neighbouring island and the hunters descended into their kayaks but in vein. Most of them decided to move further out to enhance the opportunities in more open waters, but we remained. The men were alert, and suddenly the 16-year old came running past the

camp along the ice edge, silently, rapidly and in pursuit of a whale trying to get out of the impasse. I could only look as he sped along, jumping over a couple of ice floes, and finally managing to set the harpoon deep into the whale, and holding on to the line, until his father caught up with him and was able to actually shoot it, and to help fastening it properly. A floater was blown up and fastened to the animal, which was then steered back to the camp where more hunters soon congregated – having heard the shot – and helped dragging it ashore. For this they received part of the *mattak*, the skin and blubber that is a major delicacy and a rich repository of vitamins.



Floating the narwhal along the ice edge

This was the young man's first narwhal, and the congratulations, handshakes, and high-fives that he received, as did his father, were unending. The delight in his success spread, and it was to continue. Once the whale was cut up, and the meat and *mattak* silently distributed according to unspoken rules, we returned towards Qaanaaq, sitting on top of the spoils, covered by plastic and reindeer hides. Although it was around 4.30 in the morning before we arrived, people came down to the beach to congratulate the young man with his first narwhal. The rumour had already spread by the satellite phone in the camp (this is now part of the necessary gear, given the ice-conditions and new disaster patterns).

When, later in the morning, I told my hosts about the feat, they were extremely delighted and repeated again and again that this was a unique experience, and one they had never had. I was heartily congratulated for having been present and experienced a 'first catch'. The delight spread further quickly, and my impression was that the entire village talked about it, and about the fact that I had actually been there. I was stopped in mid track over the next few days and congratulated again. Needless to say, I was quite pleased myself, first by witnessing the successful hunt, and next by experiencing the wider ramifications of pride and pleasure that would unite the inhabitants in a festive atmosphere and in celebrating not only the young man, but the entire community of hunters. The fact that it was a young man for a moment stalled the sense of their 'dying out' – related to the fact that very few youngsters want to become hunters and choose instead to leave for 'the south' – being everywhere else in Greenland or even in Denmark.

While this is of course just an anecdote from the field, it does speak to the larger issue of unfolding histories, in two ways at least. The dominant narrative about the High Arctic now is one of catastrophe and cultural loss, owing to a mixture of colonial, climatic, and political threats. This is far too simplistic. After all, people are still there, and they do not live by cultural charters or preconceived roadmaps. The only constant in life up there has been the immanent changes and challenges that have alerted people to catch the moment, any moment of promise, such as the arrival of narwhals in the fjord and meeting the hunter ready.

Dragging the narwhal ashore



Since then the young man has continued educating himself to become a proper hunter, and has even sought to master the art of kayaking in the icy waters, which is certainly not for everybody. A lot of hope glues to him, defying the sense of doom and of the younger generations simply wanting to leave the region for (unknown) futures further south.

Rinsing the mattak



Quite apart from such boost of spirit, the story – along with other stories and actions in which one participates as anthropologist – also bears witness to the inherent difficulty of identifying *critical transitions* in the social world as such. People are always meeting the future halfway by their acting upon anticipation, and surely there will still be a lot of hunting going on in the region, even if (or when) the entire community cannot depend upon it. In the long-term perspective, life around the North Water has always been premised by changing conditions and entailed times of feast as well as times of famine.

During the 20th century, people experienced unprecedented stability, not least due to the establishment of the Thule Trading Station (1910), securing regular access to resources, such as guns and timber, and by introducing health care and education that went a long way to curb (if not erase) epidemics and to disseminate knowledge about life elsewhere. Some of the elderly people in Qaanaaq, having grown up in the 1930s and 1940s, remember this time as one of a 'good life'. It was severely disturbed, when in 1953, the Thule region was torn apart by the placement of the Thule Airbase in mid-district, and people living there at the Uummannaq settlement (see below in the archaeological report), were relocated. This was a critical transition, originating in the political domain, but with long-term consequences for access to resources and for seasonal travelling between the major settlements.

WALRUS HUNTING IN ETAH AND ANORITOOQ

Janne Flora and Astrid Oberborbeck Andersen



"Anoritoq has many things", Anoritoq June 2015.

Late June, while in Qaanaaq, we were invited to join two hunters on a hunting expedition to Inglefield Land. They were in search of walrus and, if the opportunity arose, polar bear too, both of which they believed could be found in the northern area of the North Water during this time of year. They were not sure of course, since the movements of these species in recent years have eluded and surprised even the most experienced of hunters. Knowing of our participation in the biological walrus tagging mission some weeks earlier (see below), the hunters were keen to show us what they referred to as 'a real hunt'. We set off by dog sleds in

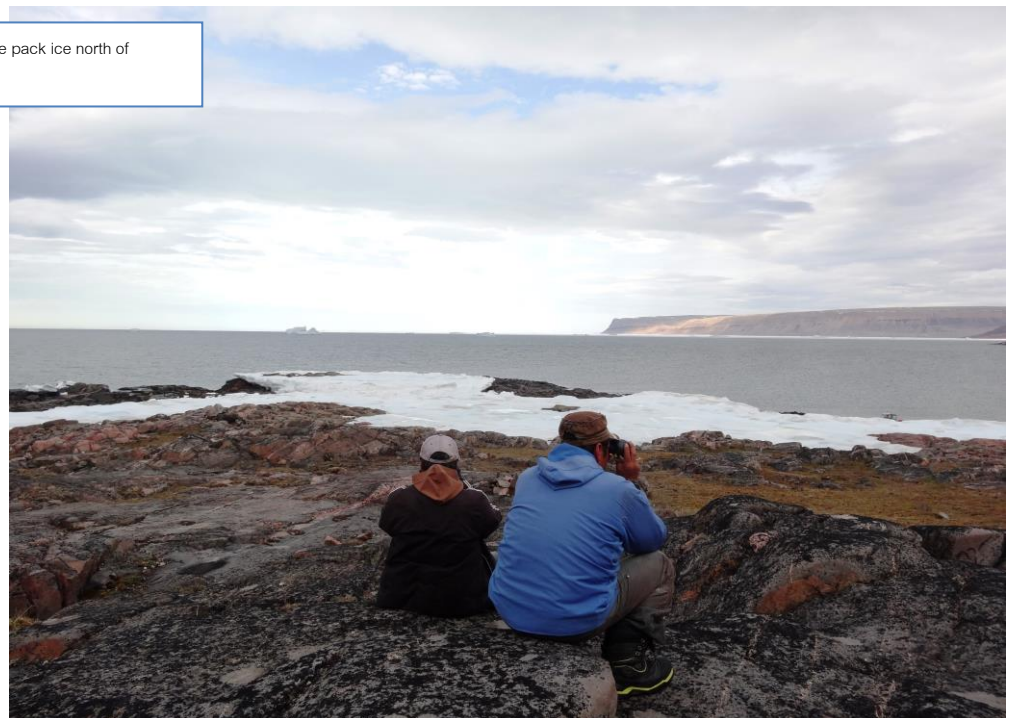
two teams, making sure to keep ample distance from each other due to the insecure sea ice that would actually break up only a few days later. Navigating through and across cracks in the ice we made it to the boat several hours later. It had been transported by sled to Siorartooq. Leaving the dogs here, fed, close to fresh water, and in the company of several other dog teams, we continued northwards by boat. The younger hunter, whose boat it was, though seasoned, was not as well travelled in this area as the older hunter, and as we boated through the polar summer night, scouting for walrus and polar bear, the older hunter would point to places, name them, or relay his experiences and memories from that place. He would instruct the younger hunter when to be cautious of reefs, when to speed up, slow down, and which fiords to examine more closely. This was clearly a situation in which knowledge and experience was being passed from one hunter to the next, from one generation to the next.



Approaching Etah, in the early morning, two walrus suddenly emerged through the waves close to the boat. The hunters quickly switched places, the older hunter took the steering and the younger readied himself with rifle and harpoon on deck. Pursuing them for a while, trying to get a good aim, the boat suddenly stopped and turned around. "Our walrus is further north" said the younger hunter, gesturing northwards with his arm. Landing the right size walrus at the right time, and not just any walrus, he underscored, is not a trivial matter, but requires the kind of knowledge that has been learned and passed through experience for generations. We slept through the late morning by the ice that still covered the fjord outside Etah, found a lookout post, and scouted for walrus. There were none and we continued northwards. Little islands off the coast, here and elsewhere in the area take their name after walrus body parts. The steep slopes along the coast were dotted with grazing caribou reindeer and muskoxen. Throughout, eider ducks that were nesting on the islands would fly in pairs across the water. We scouted for polar bears and walrus. But saw none. We would stop periodically, anchor the boat, and climb ashore to get a look-out.

We had it on good authority that this was an area rich on animal life; a resource space. As the older hunter confirmed that if you sit still, for long enough in this northern landscape, you will see more animals than anywhere else. Yet, there was a sense in which the resources available and unavailable destabilized this notion. Caribou, muskoxen and eider ducks were all there in plenty, but the hunting season was closed on these animals, and they were out of bounds. In their high concentration and accessibility, they remained inaccessible. The animals, that at this time of year could be said to define this area as a resource space for humans, remained to be seen. And to frustrate matters further, the hunting season for walrus and polar bear too, would draw to a close within a few brief days. At the rate night and day had already morphed together and would no longer dictate when we slept and when we were awake, or which calendar day it was, this deadline seemed only hours away. There was a slippage in the seasonal rhythms of the movement of walrus, calendars, hunting restrictions, and our journey, all made visible through a resource space that in some senses were shrinking, and in others growing. Occasionally, one of the hunters would point to the landmass across the water to their old hunting grounds, now also inaccessible due to national borders, and half-joke in wonder whether the animals had gone to Canada. We pitched a tent on one of the islands in the Taserartalik area. Once nesting season is over, this area would be full of boats, tents pitched, families on holiday. Just waiting for the clock to strike midnight, so they could rummage through the abandoned nests to harvest the last un-hatched eggs of the season. For now, these islands belonged to the eider ducks, except for an uninhabited corner, which is where we overnighted.

Patience. Scouting for walrus on the pack ice north of Inglefield Land. June 2015.



Walrus is one of the prime resources in the NOW area. Walrus meat is recognized as the best dog food, followed by the bearded seal. Their meat protects the dogs' paws and keeps their furs in good condition. For humans too, walrus is food. But since dogs take first priority in this matter, walrus meat for human

consumption is increasingly becoming a rare delicacy enjoyed mainly at times of celebration. Hunting restrictions and quotas limit the number of walrus a hunter can catch on a given trip, and how many can be caught throughout a season. Coupled with the strenuous effort it is to travel to these hunting grounds, which is possible only because the hunters can afford to lay out and maintain depots of petrol along the coast, makes the success of walrus hunting depend on careful planning. Returning empty handed is not an option, even if one walrus will never be enough to feed a team of dogs for a whole winter.

'Our walrus' did indeed turn out to be further north. We spent the following long day, or evening, boating to the north side of Anoritoq, where we went ashore and the hunters scouted northwards towards the pack ice, hoping to see walrus. A polar bear walked in the far distance. We trekked to the old settlement of Anoritoq where legend has it that a woman who had waited for her polar bear son to return home, had petrified, waiting in vain. She now stands as an upright rose-tinted granite stone, offerings placed neatly around her, and a faint darkened spot where some hunters, in order to ensure good polar bear hunting, would sometimes (or some time ago) 'feed her blubber'.

Hauling the walrus onshore, Inglefield Land, June 2015.



The hunters guided us through the old Thule winter dwellings. Though no longer inhabited, this place is still clearly used, and remains as an important place that binds together different kinds of histories and activities: of people who once lived here, of legends that continue to live long after the place has become uninhabited; for the two hunters with two anthropologists in tow who were soon to spot a herd of walrus basking on the pack ice; and for people in Qaanaaq for whom Anoritoq remains as a much desired place to visit; though many never have.

We approached the walrus quietly. As we neared the pack ice, the older took over the steering ice the younger hunter grabbed his harpoon and rifle. He disembarked and quickly jumped onto the ice from where he harpooned one male walrus and quickly delivered a precise shot. There was much relief. The dogs had food. Now began the arduous task of hauling the walrus onto land, flensing, and packing the boat. Because the younger hunter owned the boat and had landed the walrus, he was assigned the head. They shared the rest, lengthways. The stomach contents, mainly mussels, a delicacy were studied and sampled, and the older hunter noted that he could only see two of the three kinds of mussels walrus feed on. Flippers, ribs, back, all stacked into a neat pile of meat. They worked quickly and before long the entire carcass was transformed from having been a walrus, into food. Some for the dogs. Some for humans, delicacies with different tastes that required different kinds of preparation. The inedible parts were left for the tide to take, since, the younger hunter asserted, "the other animals have to eat too." We boiled the heart for dinner, or breakfast, shortly before bedtime, early in the morning.

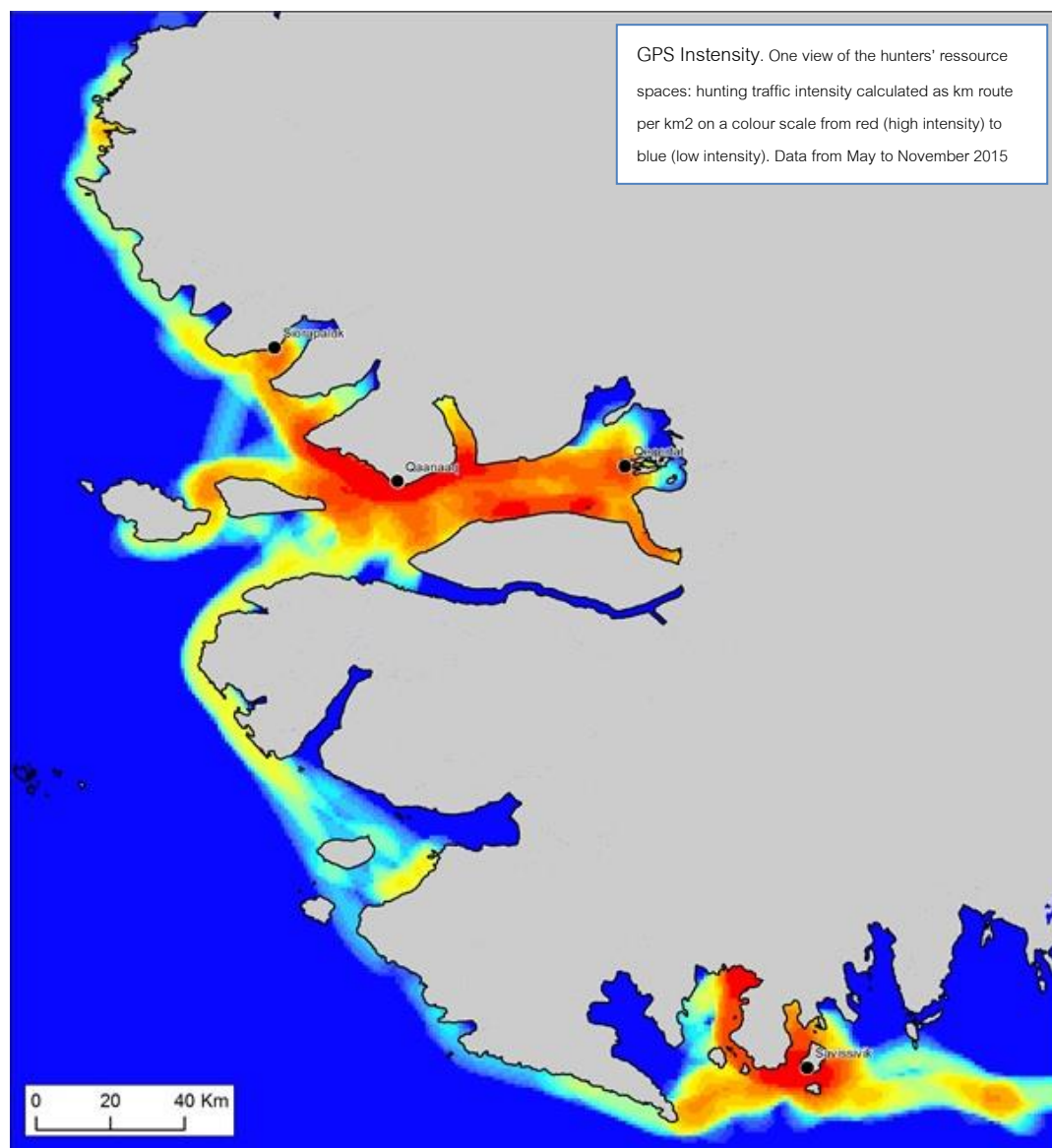
To lighten the load of our return journey the next day, the hunters sewed up two of the flippers into neat parcels that could be preserved under a heap of rocks in the island until they would return later in summer to collect eggs. Upon returning to Siorartooq, they did the same. This time with the offal, but using the same technique of stitching and burying under rocks, where it will ferment. These *ungerlaaq* are for human consumption and are typically enjoyed at special occasions. As they placed their stitches carefully into to their *ungerlaaq*, the hunters speculated when they might be ready, and on which occasions they would be eaten. The younger hunter thought his would be eaten at his mother's birthday in midwinter. But due to the warmer weather conditions it was ready already for his daughter's first day at school a couple of months later.

The 'real hunt' that the hunters were keen to reveal to us was about knowledge and practice in a landscape where seasonal rhythms are shifting and at odds with calendars and available resources. The search and hunt for walrus during spring is thus an endeavour that consolidates careful planning with intuition in ways that allow hunters to move through, and to, distanced resource spaces, and continue to ascribe knowledge, history, and meaning to an otherwise fragmenting landscape.

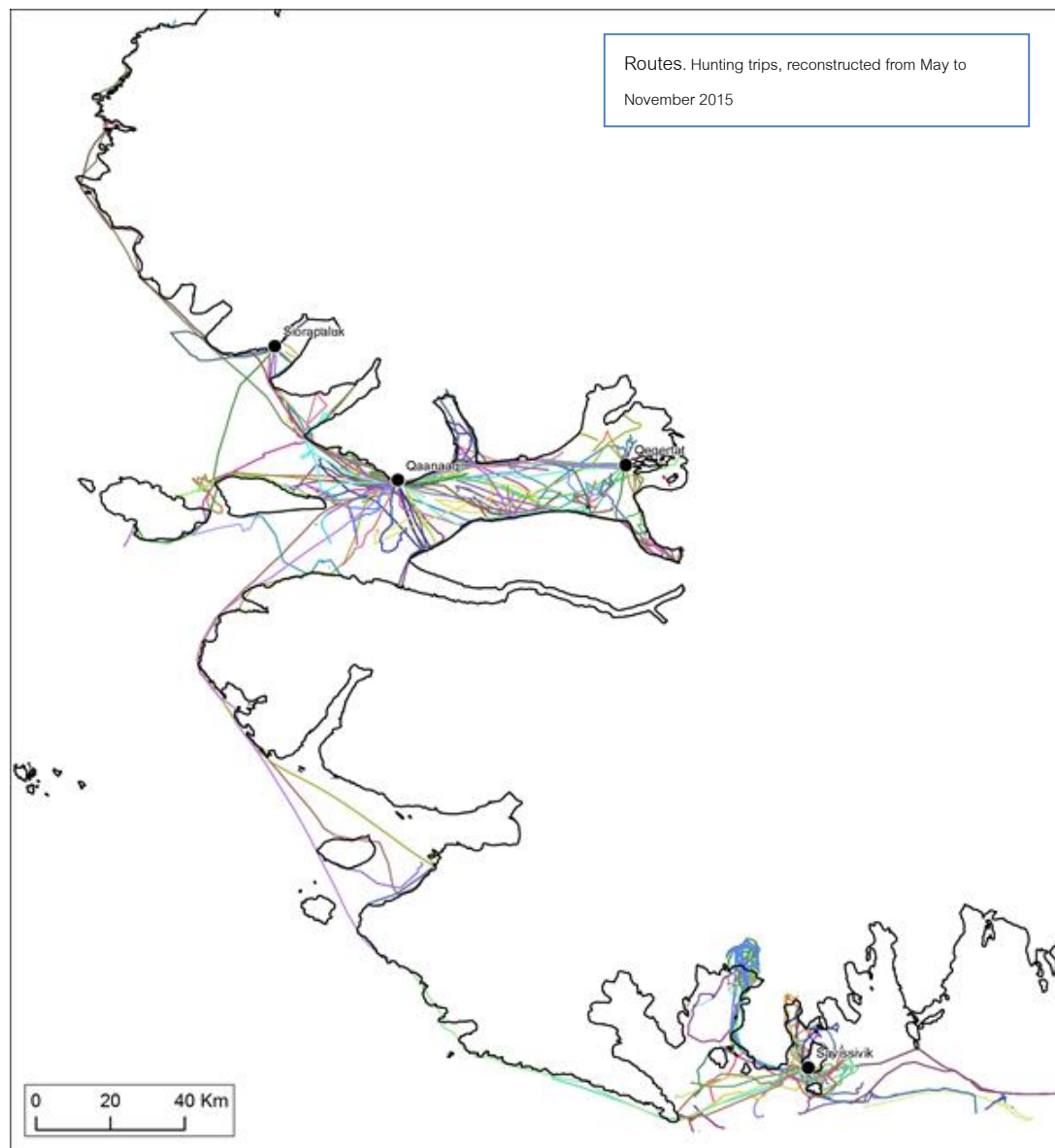
PINIARIARNEQ: MAPPING RESOURCE SPACES AND SEASONAL RHYTHMS IN THE NORTH WATER

Janne Flora, Astrid Oberborbeck Andersen, Anders Mosbech, Mads Peter Heide-Jørgensen, and Kasper Lambert Johansen.

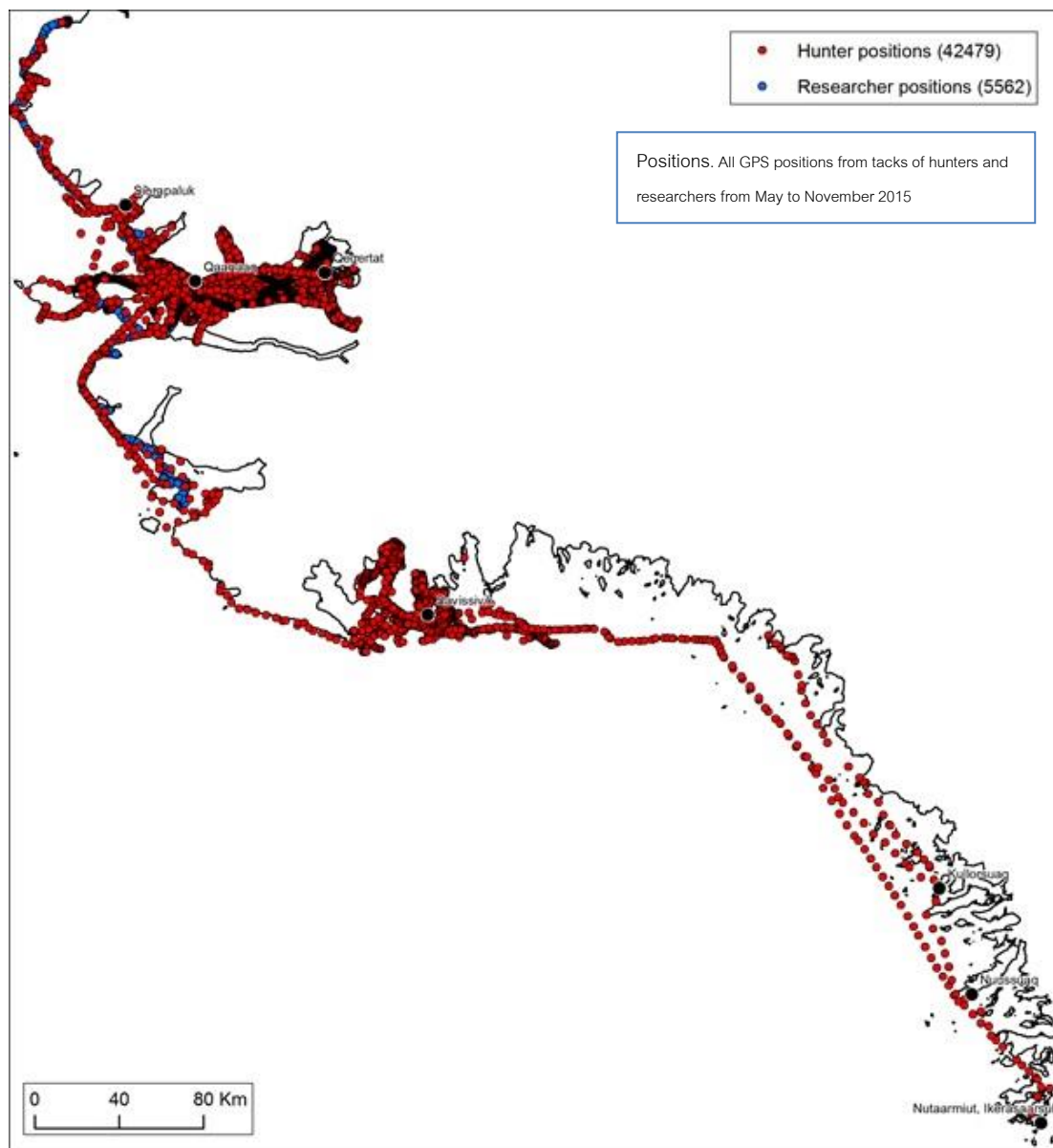
Concept development and method design. Inspired by the experiences from the first NOW expedition during summer 2014, we developed an interdisciplinary method for mapping the seasonal rhythms and resource spaces of the hunters in the North Water area. Based on Cybertracker, a freeware tool for developing icon-based GPS tracking and data recording systems for handheld devices, we designed and installed 'Piniariarneq' (Hunting trip) on 22 handheld Garmin Monterra GPS devices. Piniariarneq is designed to automatically track routes of travel. The software also allows hunters to record animals they observe and harvest, and to capture anything else they find relevant and interesting on their hunting trips through photograph and video - all automatically geotagged.



Implementation in the field. In May 2015, during a three-month fieldtrip in Avanersuaq, Piniariarnek was introduced to hunters from Qaanaaq, Savissivik and Siorapaluk. The research initiative was met with great interest and curiosity, and eventually endorsed by the local hunters' association, KNAPP. Receiving this as a tool they had use for themselves in their own recording of the distribution of game animals, 19 hunters in Qaanaaq and Savissivik enthusiastically agreed to track their hunting trips over a 12-months period. Through one technology, this collaborative method brings together groups with different interests and positions in relation to use and management of living resources. Furthermore, Piniariarnek breaks with traditional top-down research relations, in that the hunters not only partake in the gathering of data, and in the analysis. They are also co-owners of the data. From the beginning, Piniariarnek has generated unique and surprising results. This is the first time that the space use of hunters in Avanersuaq can be quantified through their own mapping of routes, and observed and harvested resources. The hunters' qualitative documentation of their trips through photography and film adds an additional view to the maps, making them multi-dimensional.

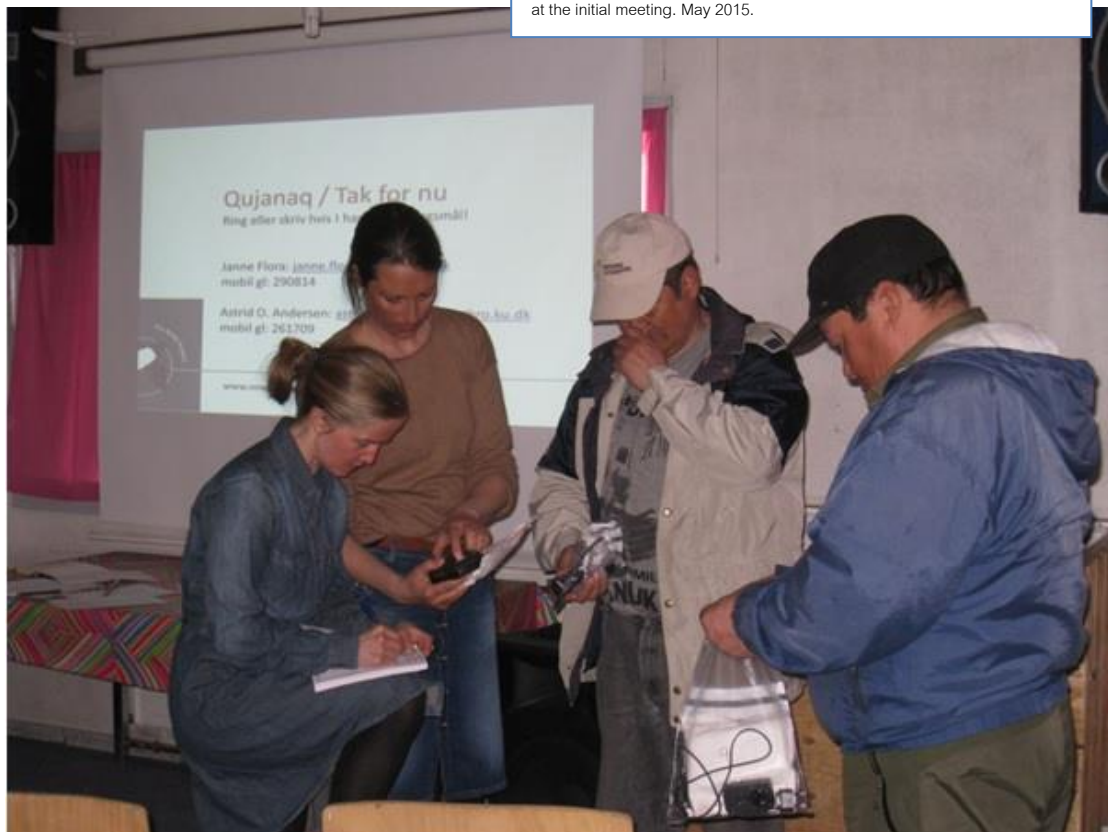


Prospects and perspectives. With the help of a local assistant, this 12 month pilot project will be completed in May 2016. Hereafter data analysis will commence. However it is already apparent from the preliminary results, that this entirely new way of recording and describing resource spaces in Avanersuaq (and Greenland more broadly) is relevant for all the disciplines of the NOW project in terms of scientific method and results. The analysis of the multi-layered data: maps, tracks, sightings, photographs, video, make visible complex ecological and social processes in a changing landscape. We can now relate the land use of hunters to the distribution and movements of game, and understand the seasonal changes in relation to how hunters travel. The results also reveal the deeply social nature of travel and hunting, attachment to old previously settled places, and thus also a nature which is not just a resource space, but also a social and lived landscape.





Hunter and his son who is an aspiring hunter at the ice edge. The hunter registers his son's 'first catch' of narwhal. May 2015.



Astrid O Andersen og Janne Flora hand out GPSs to two hunters Qaanaaq at the initial meeting. May 2015.

TAGGING AND TRACKING OF WALRUSES IN THE NORTH WATER

Mads Peter Heide-Jørgensen, Janne Flora, Astrid Oberborbeck Andersen

Background. Walruses are found year-round in the North Water and are also present for most of the year along the eastern part of Smith Sound where the modern human occupation is concentrated today. During summer months walruses are however known to be absent from the eastern part of Smith Sound and it has been speculated that the walruses leave Smith Sound in late spring and undertake large-scale counter clockwise migrations in Baffin Bay until they return to Smith Sound in early fall. More recently it has been proposed that walruses in Smith Sound belong to a population that extends widely into the Canadian High Arctic and is separated from walruses occurring further south in West Greenland and along the east coast of Baffin Island. One novel approach for direct monitoring of the daily travels by walruses is satellite tracking of individual walruses.

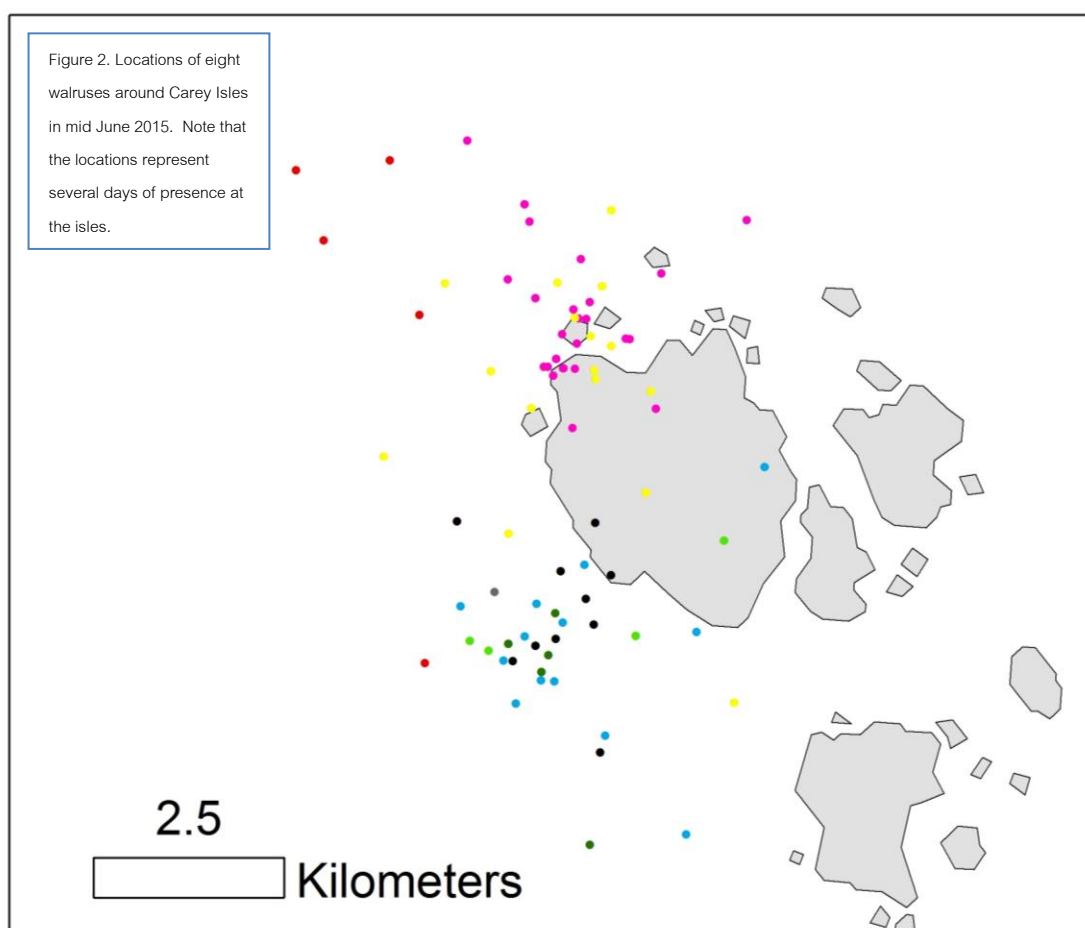


Figure 1. Satellite transmitter mounted on hunters harpoon (top) and tagging of two walrus in a small iceberg (below).

In this study we instrumented walruses with satellite-linked radio transmitters in the eastern part of Smith Sound to study their westward dispersal during spring and summer. Walruses that are hauled out on land can be immobilized and instrumented with tusk-mounted tags that will last for a long time on the animal. Immobilization is, however, not an option for walruses on ice as they may enter the water and drown.

Walrus in Smith Sound are not known to have terrestrial haul-outs, at least not in modern time, and our instrumentations were therefore restricted to remote deployments of tags with hand-held harpoons on animals in water or hauled-out on sea ice.

Methods. During May–June 2015, 21 walrus were instrumented with satellite-linked transmitters in the Wolstenholme Fjord. The tags consisted of an external transmitter part and an internal anchor (Fig. 1). The transmitter was mounted on a flexible base plate that could turn around the anchoring part. Tag design varied slightly over the course of the study but the transmitters were either SPOT5, MK10 or SPLASH tags (Wildlife Computers, Redmond, USA) The anchor consisted of a 6 mm stainless steel rod with a sharp harpoon head that penetrated the skin of the walrus and was equipped with barbs to delay the migration out through the skin. The opposite external part of the anchor had a cylindrical plug used for holding the tag during the deployment. The tip of the traditional harpoons used for harpooning whales and walrus was modified to hold the tag until the anchor was embedded under the skin (Fig. 1). The handheld harpoons were used for deploying the tags.



Five hunters from Qaanaaq participated in the tagging effort and were responsible both for travels to and from the walrus grounds as well as the deployment of tags. Walrus were observed either from promontories, icebergs or from the three boats that were used for searching the walrus grounds. Most

walrus were tagged from the boats while they were resting on sea ice but in some cases walrus in the water could also be tagged. Occasionally walrus were located far into the ice and if possible tagging was done by walking across the ice to the animals. Sex of walrus was determined visually on a subset of animals based on tusk growth and presence of calves. Positions of the walrus were obtained from the Argos satellite data processing system with Kalman filtering algorithm, and accuracy of locations was assessed by Argos location codes (LC) 3–0, A and B.

Preliminary findings. All walrus with functioning tags abandoned the Greenland side of the North Water in mid June. Three walrus entered Lancaster Sound and followed a track close to the southern shore of Devon Island. Two walrus reached as far west as the west coast of Devon Island. The remaining walrus either stayed on the east coast of Ellesmere Island or entered Jones Sound. Of particular interest is the observation that more than 60% of the tagged walrus visited Carey Isles and apparently spend many days at the islands (Fig. 2). This may suggest that walrus have a terrestrial haul-out site on the Carey Isles and if true this would be the only remaining terrestrial haul-out in West Greenland.

Travel distance per hour was calculated and showed that the mean hourly travel distance of the 16 walrus was 2.3 km (SD 1.7) and an ANCOVA (with day and time as covariate, $r^2=0.09$) revealed no significant (estimated at 5% level) difference between the individual walrus (Tukeys post hoc tests) and no significant effect of date on the travel speed ($p>0.06$).

The results from the 2015 field campaign and tracking of walrus will be combined with results from similar tagging of walrus in 2010-2013 covering three other areas of the North Water (Etah, North and South of Kiatak) to a combined description of the dispersal patterns of walrus during summer from the four concentration areas in North Greenland.

SEABIRD RESOURCE SPACES, POPULATION HISTORY AND POTENTIAL HUMAN IMPACT

Anders Mosbech, Kasper L. Johansen, Aili Labansen & Daniel Spelling Clausen



WP 1. Key living resources in the NOW: The Dynamics of a High Arctic Ecosystem

WP 2. Human Settlement and Living Resources

WP 4. Walrus and Seabirds: Human Impacts

In terms of numbers, the North Water Polynya is the most important breeding area of seabirds in Greenland, and it is the only region where the thick-billed murre population seems to thrive. In the NOW project we study how the seabirds depend on the sea by tracking seabirds to foraging areas, by recording seabird feeding behaviour with data-loggers and by studying seabird diet. In the colony areas we study how seabird droppings fertilize terrestrial and freshwater environments and how indicators of the historical nutrient input from seabirds is telling the story of the seabird populations (see the paleo-record team section), which may have been impacted by climate changes as well as human utilization for thousands of years.

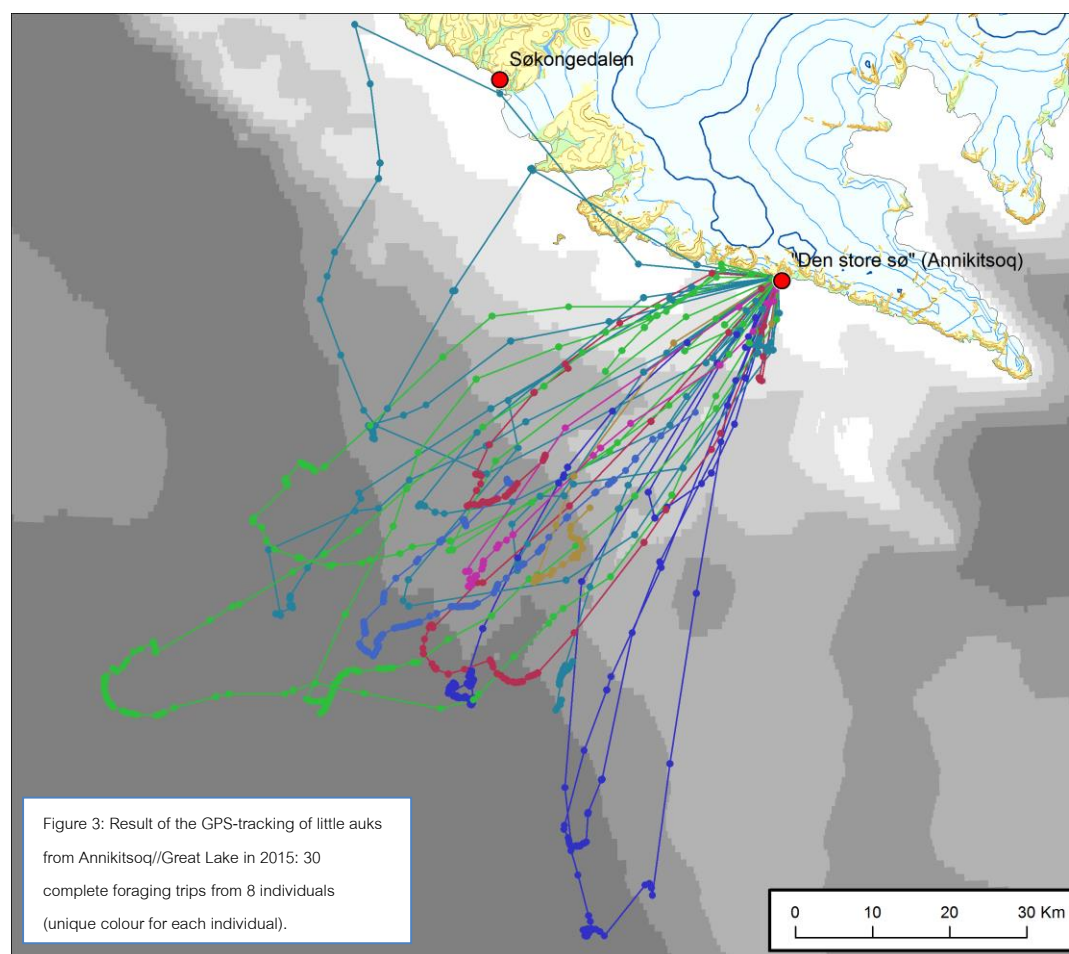
A project focusing on potential impact of human disturbance in thick-billed murre colonies in West Greenland has an important component in the North Water Polynya, because here the behaviour of undisturbed birds can be studied for comparison.

Field studies in 2015. Two field teams worked with seabirds in the NOW area in 2015. One team focused on little auks, eiders and paleo-records and visited a number of sites, while another team focused on thick-billed murre behaviour at Kisissut (Carey Islands), the most remote and undisturbed colony in Greenland. This was made possible by the Royal Danish Navy vessel Ejnar Mikkelsen, serving as a tremendous logistical platform and enabling us to use the remote Kisissut as a study site (Fig. 1).



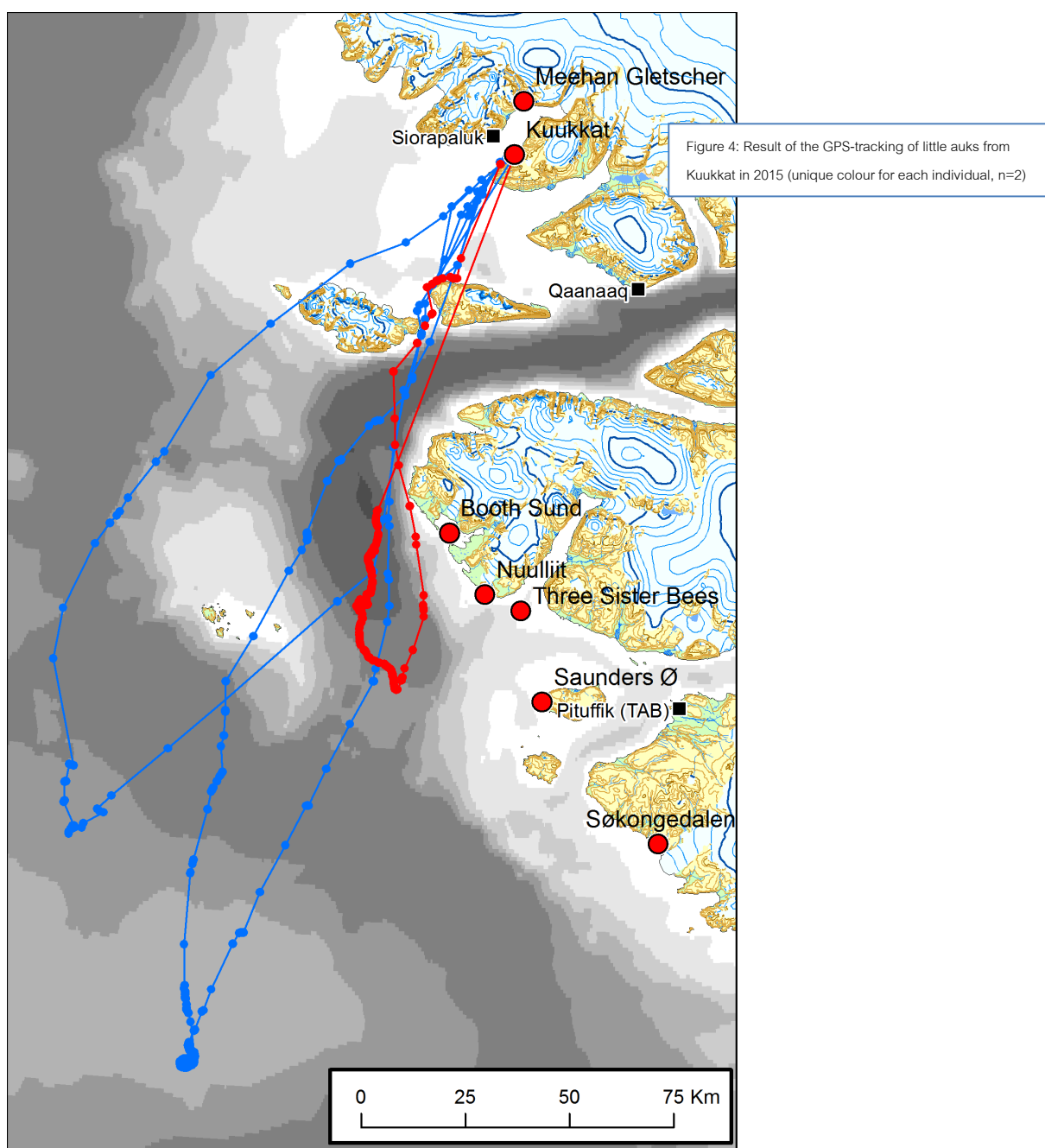
Studies of little auk and common eiders. Between July 22 and August 13 2015 a seabird team embarked on joint fieldwork with the freshwater and paleo-record team and visited a number of different sites in the central and northern part of the NOW investigation area (Fig. 2). From a basecamp along with archaeological team at Nuullit in Wolstenstenholme Fjord, the large common eider colonies at Three Sister Bess and Booth Sound were surveyed, and the thick-billed murre colony at Saunders Island was visited. At all these sites, cores of perma-frozen peat was successfully extracted, which will hopefully add the paleo-history of two additional seabird species to the project. Like the little auk, the common eider and the thick-billed murre have constituted important resources to human societies over time, but their resilience to

human exploitation is very different from that of the little auk. Feeding primarily on mollusc and other benthic invertebrates (eider) and fish (murre) they are also likely to respond differently to ecosystem changes over time than the planktivorous little auk, potentially adding new dimensions to the study of history of the NOW. As in 2014, the primary focus was on the huge little auk colonies. Qoororssuaq/"Søkongedalen" was visited briefly to collect and redeploy year-round photo monitoring cameras, and to extract a peat core. At Annikitsoq/"The Great Lake" on the Cape York peninsula, 9 GPS-loggers were deployed on little auks and gave exceptional data on foraging patterns (Fig. 3).

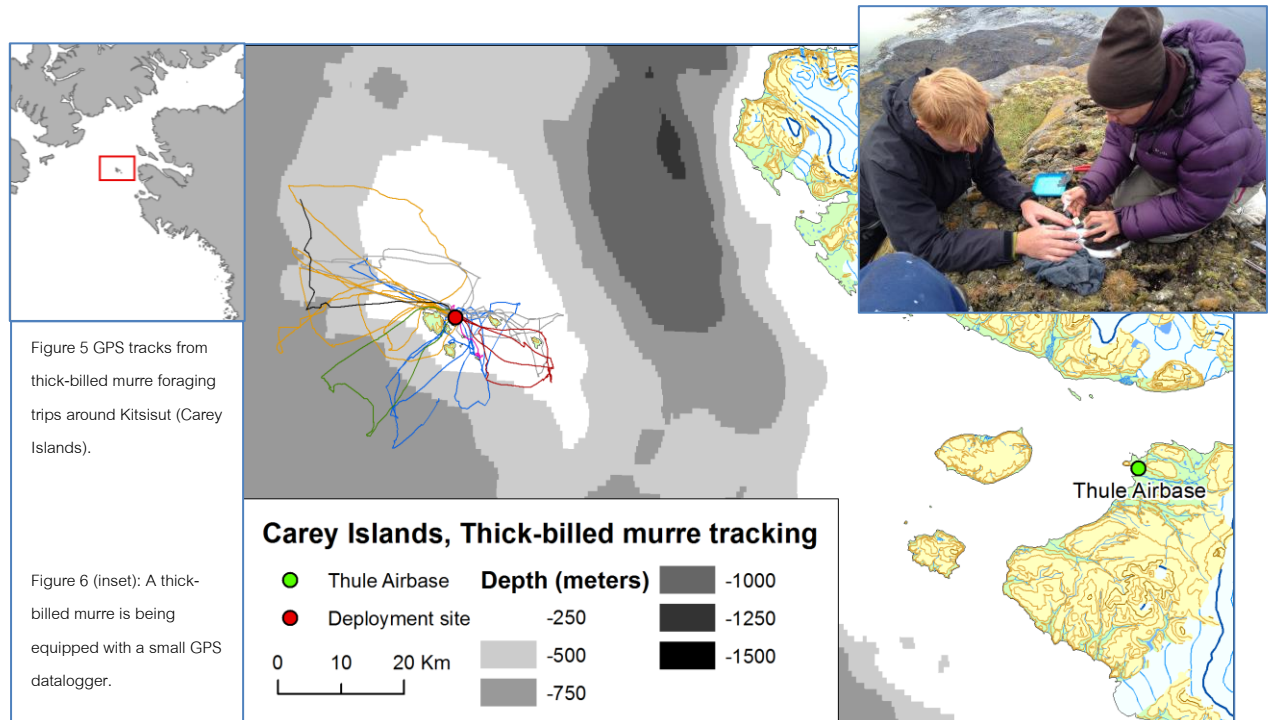


21 samples of food brought in by adult birds for their chicks were collected and a transect of the plots was established to measure the input of nutrients by bird droppings. Also, time-lapse photo monitoring was conducted to establish the diurnal rhythm of the colony and weather data, essential for interpreting the foraging patterns of the birds, were collected. These activities were strictly coordinated with the freshwater and paleo-record team, which, at the same site, extracted peat and lake sediment cores to gain data on the history of the colony, and sampled freshwater systems and terrestrial biota to assess the impact of the birds due to their transport of marine derived nutrients. The GPS-tracking of little auks from Annikitsoq was coordinated with a seabird and oceanographic survey conducted by DCE and GINR from the Royal Danish Navy vessel Ejnar Mikkelsen (description in Danish <http://bios.au.dk/aktuelt/vis/artikel/kortlaegning-af-foelsomme-omraader-langs-groenlands-vestkyst-fortsætter-1/>). This coordination meant that systematic

seabird transect counting, zooplankton sampling and oceanographic investigations were synoptically performed along a transect cutting through the primary foraging areas as revealed by the GPS-tracking. To gain equivalent data from a more northern position along the North Water, many of the investigations done at Annikitoq were repeated in a little auk colony at Kuukkat close to Siorapaluk. Here 9 GPS-loggers were deployed, 12 food samples were collected and photo monitoring was conducted, while the freshwater and paleo-record team extracted peat cores and collected water samples. At Kuukkat, we unfortunately only received data from 2 of the 9 birds instrumented with GPS-loggers, probably due to the breeding season almost being over at the time of deployment. However, the tracks of these two individuals reveals new insight into the poorly understood late breeding/early post-breeding behaviour of little auks (Fig. 4).



Studies of thick-billed murre at Kitsissut (Carey Islands). Isbjørneø is part of the island group Kitsissut (Carey-øer) about 50 km off the nearest mainland. The island group houses the most undisturbed colonies of thick-billed murre (TBM) in Greenland, and there has never been carried out research on these birds - apart from photo counts. Most of the colonies are located on Isbjørneø, and a team of three researchers conducted studies here from July 31 to August 9.



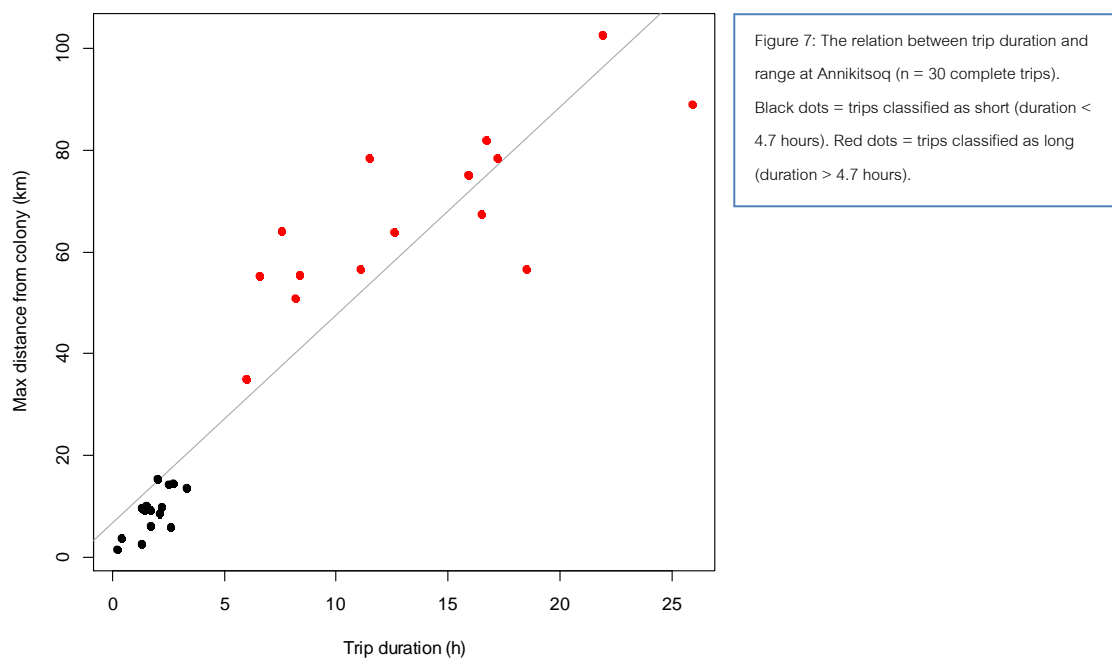
The main purpose of the field campaign was to carry out disturbance studies of TBM, to be compared with similar studies from other TBM colonies in Greenland. The island turned out to have good opportunities for observing and catching TBM from several sub colonies. The disturbance studies included video recording of the response of birds under different disturbance scenarios, which included playback of motorboat sounds and firing a rifle at various distances from the colony.

The team also deployed 9 GPS loggers, and was able retrieve 7 of them after approximately 24 hours to reveal foraging areas. The Thick-billed murres primarily foraged in areas west and southwest of the islands (Fig. 5 and 6).

While working at Kitsissut all the colonies of the island group were systematically photographed to provide basis for an estimate of the size of the breeding population. Ejnar Mikkelsen provided a platform for this survey.

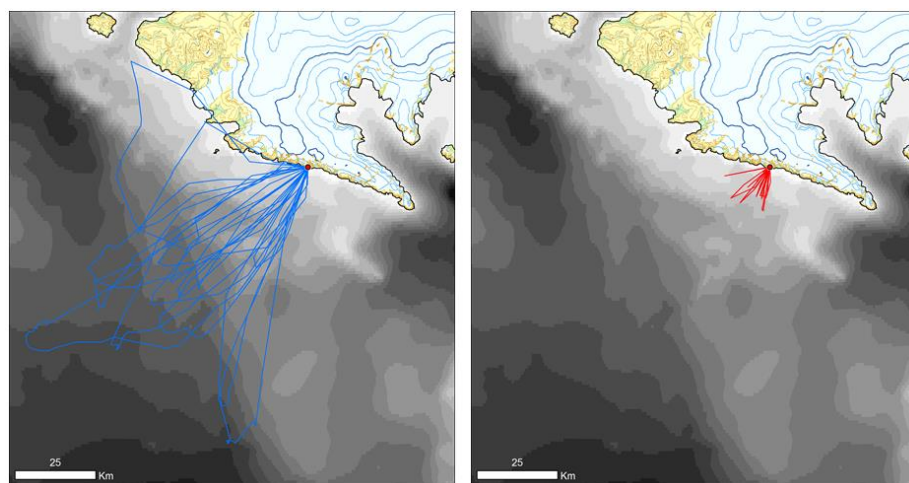
Saunders Island was visited on the way to and from Kitsissut to retrieve dataloggers from TBM deployed in the 2014 field season. The team was able to retrieve 6 out of 10 loggers, and re-deployed 5 of the loggers again.

Analysis in progress. Analysis of data from GPS-tracking of little auks is currently progressing rapidly. At Savissivik, we have found $\delta^{15}\text{N}$ in benthic algae in freshwater systems to be strongly correlated with overflight intensity of little auks, modelled on basis of the GPS tracking data from 2014. Along with a host of other analyses conducted by the freshwater and paleo-record team, this serves to highlight the nature of the massive impact that the little auks have on the freshwater and terrestrial ecosystems of the NOW area via their transport of marine nutrients, and a joint publication on the subject is under preparation.



Through analyses of the duration and range of foraging trips we have found that the little auks of NOW have a bi-modal foraging strategy. At Annikitsok, they very consistently alternate between short foraging trips with a duration of approx. 2 hours and a range of approx. 9 km, and long foraging trips with duration of approx. 13 hours and a range of approx. 65 km (fig. 7).

Figure 8: Map of long (blue) and short (red) foraging trips, illustrating the two very different areas used by the little auks. Trips are classified as long or short on the basis of a duration of more or less than 4.7 hours respectively (see fig. 7).



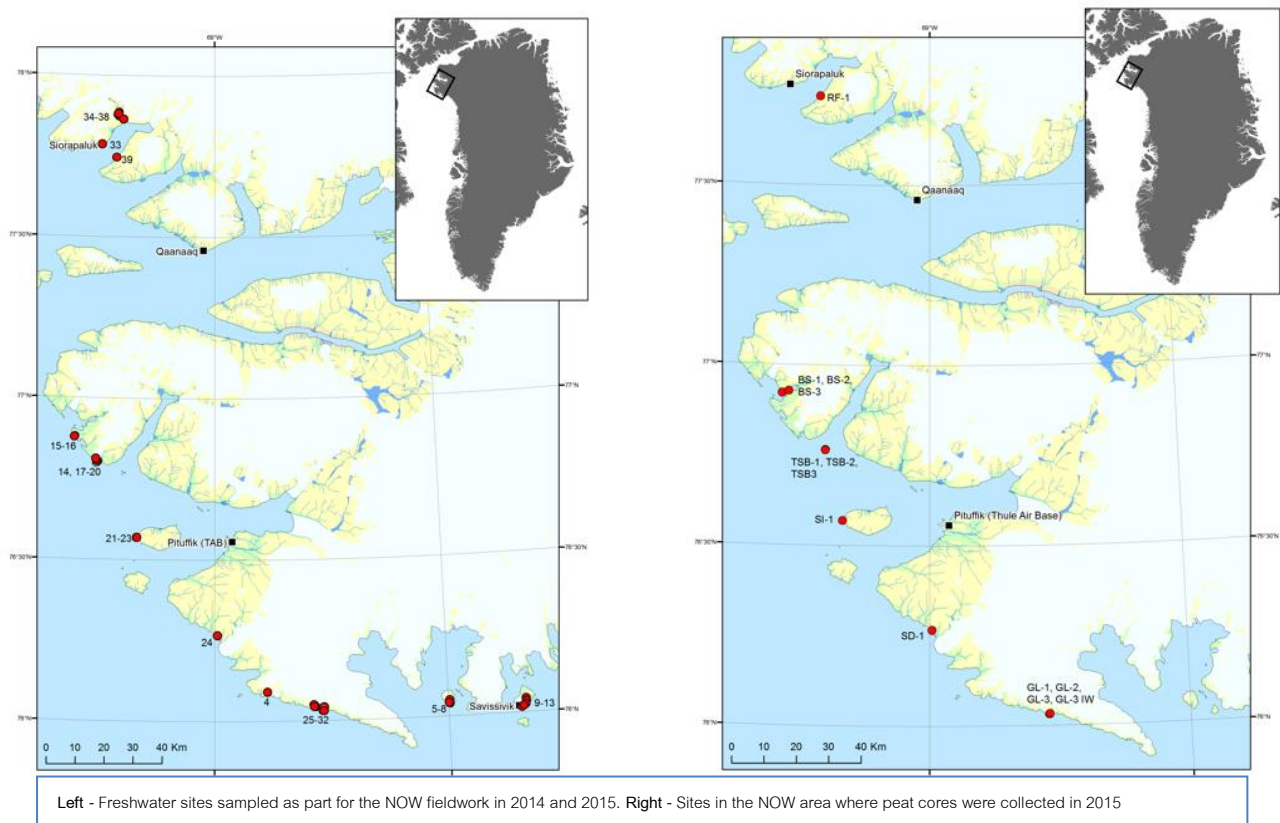
Bi-modal central place foraging is primarily known from Procellariiformes and is thought to have evolved as a response to poor foraging conditions in vicinity of the breeding colony. According to the theory, short trips serve to maintain a high feeding rate of chicks, but result in a negative energy balance for adults. Thus, adults regularly need to embark on longer foraging trips to more productive feeding grounds in order to regain their own energy reserves. While bi-modal foraging has previously been demonstrated for the much smaller breeding population of little auks along the Greenland Sea (Welcker et al. 2009), we were surprised to find it in the NOW, which we had hypothesized to constitute an optimal foraging area. Bi-modal foraging in little auks has previously only been studied on the basis of recording when individually marked birds depart from and return to the breeding site, or by the use of time-depth recorders, which do record diving but do not record geographic coordinates. Thus, our GPS tracking is the first time that little auk bi-modal foraging is put on a map. The results are quite intriguing in the sense that the little auks of NOW clearly exploit two very different habitats or resource spaces: an area on the shelf very close to the colony and a distant foraging area, seemingly associated with the shelf break (fig. 8). Further analyses will focus on what variables determine the locations of these different foraging areas.

FRESHWATER SEDIMENT CORES AND PEAT DEPOSITS. REPORT FROM THE PALAEO-RECORD TEAM

Thomas Davidson

WP2 Human Settlement and Living Resources: Long Term Relations.

2015 saw second successful field season with a range of samples collected from modern freshwater ecosystems and archives of past change collected in the form of both lake sediments and peat deposits.



1. The first aspect of this work is investigating how these arctic fresh waters are fuelled by marine derived nutrients.

In 2015 we samples 26 systems (5 lakes, 17 streams and 4 ponds) with a good range of impact from bird colonies. Samples of water chemistry, primary producer biomass and the stable isotopic composition of organisms from across the food web have already been analysed. The data show that the proximity of bird colonies has a massive effect on the productivity and biodiversity of freshwater systems. A paper is currently in preparation examining these data.

2. Lake sediment cores were collected in Nuullit, lake NOW14, in an area not currently influenced by seabirds and from a lake, strongly impacted by seabirds, on the Cape York Peninsula (NOW25). The cores have been split and NOW25 shows a marked change from very light to dark sediments at a depth of around 150 cm in the core. This almost certainly represents the point at which the bird colony was established in the catchment (see image). This builds on the work of 2014 meaning we have collected two long cores from lakes within a catchment impacted by



birds, going back to a pre-bird period. In addition we have collected cores from two lakes outside of the bird-effected catchments to investigate how ecosystems vary in the absence of birds.

Along with the sediment cores collected in 2014, these cores will be dated using ^{14}C on terrestrial macrofossils picked from the cores. Isotope analysis of ^{13}C and ^{15}N will be carried out on these cores.

Results from the lake cores collected in 2014 show that the $\delta^{15}\text{N}$ signal shows unequivocally that the shift from light to dark sediments is the result of a massive increase in marine derived nutrients. Other analysis ongoing and planned will characterise changes in primary production over time at lakes with and without bird colonies in the catchments. In addition we will explore other means of inferring past bird density such as fecal sterols, heavy metal analysis (e.g. Cadmium). We will also analyse sediments to track change in mercury (Hg) concentrations both within and without areas affected by bird colonies.

3. In addition to the archive of environmental change held in lake sediments we also collected a number of peat deposits in 2015. This increased the area where investigations into the past bird populations could be performed to also include areas where lakes are not present. A total of 12 peat cores or exposure samples were collected at 6 locations (see maps above).

The peat cores were split in the climate chamber (-10 Celsius) and analysis of a range of parameters of the organic matter is ongoing. These analyses include: Total Organic Carbon (TOC) content, Total Carbon (TC) content, Total Nitrogen (TN) content, Stable carbon isotopes ($\delta^{13}\text{C}$) of TOC, $\delta^{15}\text{N}$ of organic content. Furthermore we will analyse characteristics of ground ice, using stable water isotopes ($\delta^{18}\text{O}$, δD) of ice-wedge ice and Stable water isotopes and also ($\delta^{18}\text{O}$, δD) of segregation and pore ice.

Section of a 172cm sediment core taken from the Great Lake (site NOW23). The transition from light sediment to dark is the point where a little auk colony became established in the catchment.

ANTHROPOGENIC EXPOSURE OF HG IN WILDLIFE AND HUNTERS IN THE NORTH WATER

By Rune Dietz, Igor Eulaers, Mala Broberg, Gert Mulvad and Anders Mosbech

WP 3. Living in an Oasis: Drivers of Change

The wildlife and hunters in the Northwater (NOW) have the highest mercury load across the Arctic, while their exposure to persistent organic pollutants is much lower than in East Greenland. The NOW project will shed further light on mercury exposure over historical and archaeological time-scales and compared to other regions.

Fieldwork 2015. During the field work in the Northwater in 2015 we obtained samples from more than 200 specimens of narwhals (*Monodon monoceros*) and marine birds, such as black guillemot (*Cephus grylle*), Brünnich's guillemot (*Uria lomvia*), little auk (*Alle alle*), common eider (*Somateria mollissima*), northern fulmar (*Fulmarus glacialis*), glaucous gull (*Larus hyperboreus*) and Black-legged kittiwake (*Rissa tridactyla*), fish, amongst which arctic char (*Salvelinus alpinus*) and sculpins (*Cottoidea*), and blue mussel (*Mytilus edulis*).

More than 130 seabirds were obtained from 7 seabird species sampled under a permit from the Greenland Self Government.



Harp seals (*Pagophilus groenlandicus*), hooded seals (*Cystophora cristata*) and bearded seals (*Erignathus barbatus*) were hard to obtain as hunting focus was on the narwhals during August. An agreement has been made with Canadian colleagues to obtain the samples from their sampling further south as these animals migrate to the NOW area later during the summer period. Mercury (Hg) and other elements will be analyzed at the Aarhus University lab in Roskilde in 2016. The obtained Hg data will be compared to previous sampling in the areas, historic samples and samples elsewhere in Greenland and elsewhere in the Arctic.



Upper panel: The samples we collected 31 years ago (left: Massana Kristiansen flensing a narwhal at the ice edge together with his sons, including Mamarut) will be compared to the samples collected in 2015 a.o. (Right: Mamarut Kristiansen flensing another narwhal now the same age as his father in 1984).

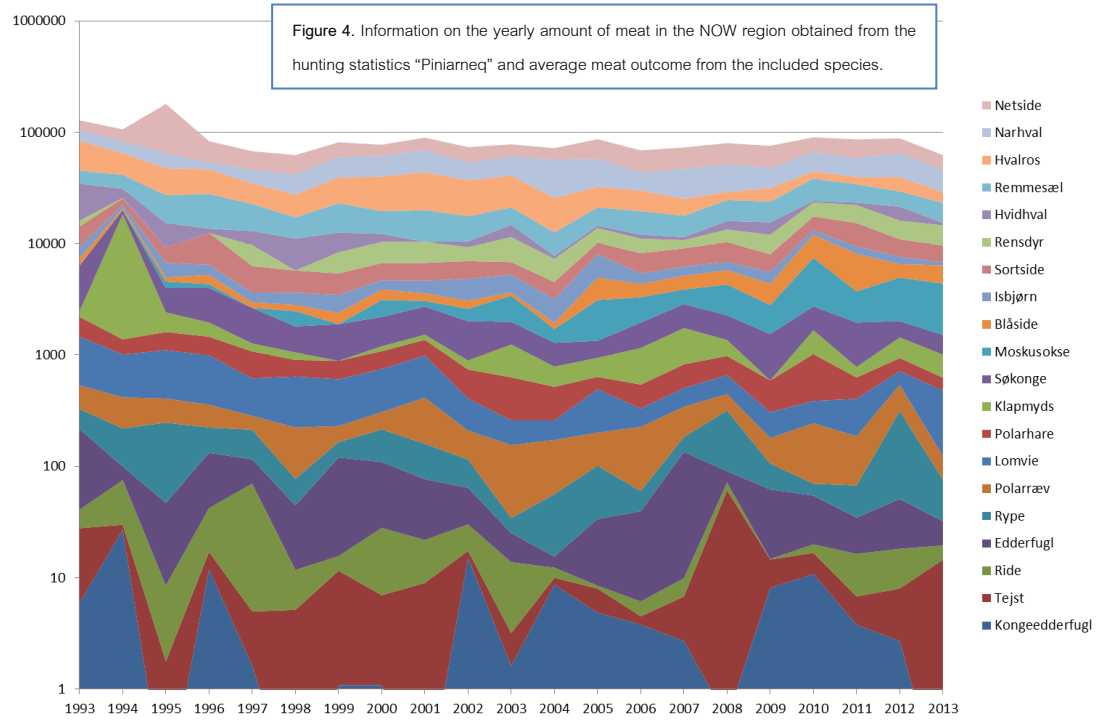
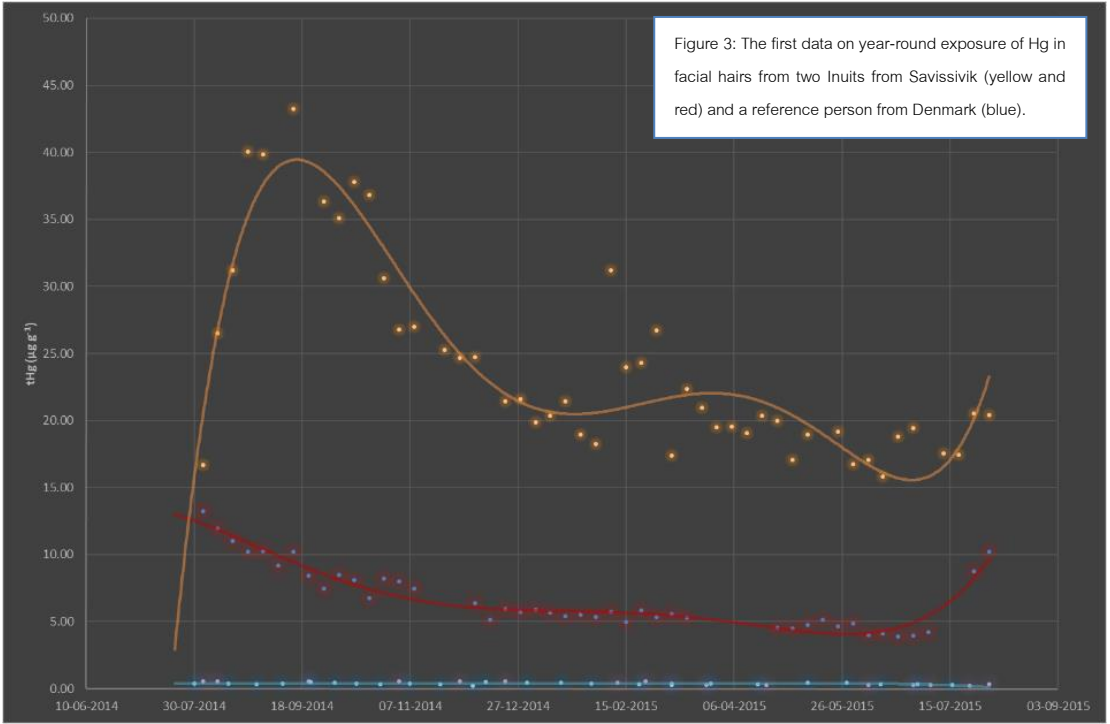
Lower panel: A month later 25 narwhals were sampled in Ittoqqortoormiit as part of the Dancea research programme "Unexpected". These samples provide a unique possibility to compare with the NOW sampling as well as previous samplings for contaminants, histopathology, and genetics a.o.

The recent available data as well as those obtained during the NOW project will likewise be used for human expose modelling, which will be verified using samples collected non-invasively year-round, such as facial hair from the Inuit hunters.

Data from ringed seals (*Pusa hispida*) and polar bears (*Ursus maritimus*) will be available from Aarhus University, who on regular basis collect and analyze these species as part of the Arctic Monitoring and Assessment Programme (AMAP). Samples from species not obtained in 2015, including muskox (*Ovibos moschatus*), walrus (*Odobenus rosmarus*), bearded seal, and king eider (*Somateria spectabilis*), are planned to be collected in 2016.

Study of human Hg exposure. Also in 2015 we started a second year-round study of the human Hg exposure, which we initiated in Savissivik in 2014. We have established cooperation with the hunters who shave their beard once per week and write down a description of their food intake. The beard is analyzed for Hg and this method gives a unique description of the human exposure without the need to take human blood samples. Together this provides a new and unique monitoring tool to study seasonal patterns of Hg exposure.

Samples obtained from beards in 2014 – 2015 were analyzed for Hg in 2015 (*Figure 3*) and additional sampling from the Qaanaaq area was initiated in 2015 and will continue until summer 2016 where these will be analyzed. The initial analyses shows a much higher Hg exposure in the NOW area compared to Denmark (up to a 100-fold). It also documents a higher exposure during summer where narwhals are hunted and ingested and the net excretion during the rest of the year following the high Hg intake during summer.



Information on the local hunting bag was obtained from the Greenland Self Government hunting statistics ("*Piniarneq*"). This information allows for calculation of the seasonal amount of meat obtained from the hunt in the NOW area (*Figure 4*).

Most of the obtained narwhals were caught in front of the glaciers near Qeqertat in head of Inglefield Bredning (Kangerlussuaq).



Future work. The present day food intake and contaminant loads will be compared to samples and information that the archaeologists collect during their excavations. Our investigations have so far documented an up to 20 fold increase in the mercury loads in polar bear, beluga (*Delphinapterus leucas*), narwhal and birds of prey since preindustrial times (prior to 1850). The plan is also to make a mercury mass balance model over the human exposure over the last decades within the NOW and relate these to historic exposure.

ARCHAEOLOGICAL AND ARCHAEO-ZOOLOGICAL INVESTIGATIONS

Bjarne Grønnow, Martin Appelt, Jens Fog Jensen, Asta Mønsted, Anne Birgitte Gotfredsen, and Mikkel Myrup



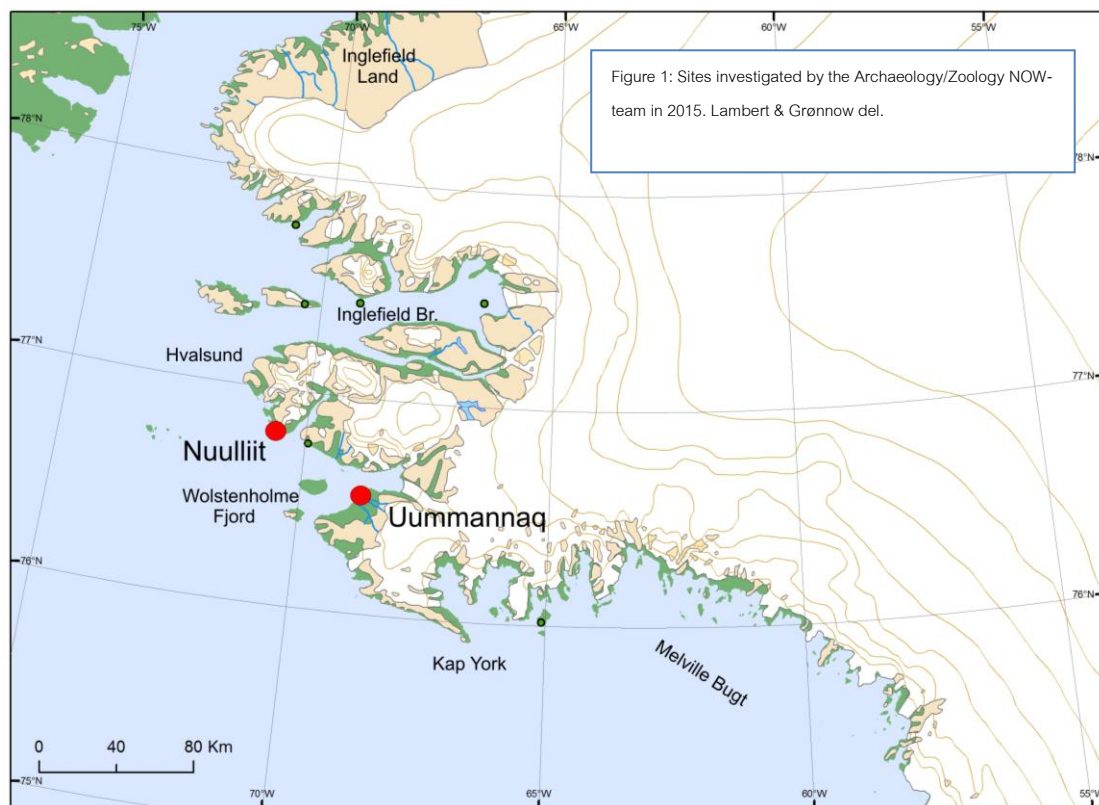
Archaeological excavations were carried out at the Nuulliit and Uummannaq settlements in mid-district (figure 1). The house ruins of both sites were excavated by Erik Holtved in the 1930s and 40s, but only artefacts and no fauna material were collected back then. The NOW-project, and its comprehensive perspective made it pertinent to revisit these key sites and re-assess the potential for archaeological and archaeo-zoological data that could provide a deeper knowledge about life on the edge of the North Water in a long time perspective.

Fieldwork. The field crew reached Thule Air Base (TAB) July 9th, where the Danish liaison officer, Kim Mikkelsen, welcomed us. On July 11th the crew did an oral presentation on the NOW Project at the Knud Rasmussen Community Centre. The talk was attended by HM Queen Margrethe II, Base commander Colonel Stuart A. Pettis, and other VIP's of the TAB. While at TAB the crew went to Dundas and gained an overview of the features and topography of the nearby historic Inughuit settlement at Uummannaq. By permission from the TAB authorities we surveyed the site by means of the e-bee drone of the NOW Project.

The boat of Danish Arctic Contractors, 'Blue Jay', took the team and its gear to Nuulliit, about 80 km west northwest of TAB, on July 14th. We made a short reconnaissance on Hoppner Næs, the northern spit of the Booth Sund, but decided to concentrate on the 'classical' site at Nuulliit hoping that some midden layers with organic materials were preserved and left untouched by Holtved in 1946.

Investigations at Nuulliit took place in the period July 15th – August 2nd. The activities included excavations, registration of prehistoric features on the entire Nuulliit Peninsula, registration of features and faunal material on the historically/recently used part of the site, and surveys and air photos by means of drones.

August 3rd the crew was picked up by 'Blue Jay' and returned to TAB after a most rewarding time at Nuulliit. Back at TAB the crew gave a talk about the investigations at Nuulliit and the NOW Project in general at the Community Centre. About 30 members of staff attended the talk and they showed great interest in our research.



Due to bad weather conditions it was decided to skip investigations at Saunders Ø. Instead, we set up camp at the Uummannaq site, where we worked from August 6th to 10th. The last days on TAB were used to handle logistics and finds. The field crew was back in Copenhagen on August 13th.

The Nuulliit Site

The Nuulliit site is situated on a peninsula in the north-westernmost part of the Wolstenholme Fjord, some 20 kilometres southeast of Booth Sound, and about 55 kilometres WNW of TAB. The peninsula split in two, i.e. a western and an eastern spit. The Inuit/Inughuit, as well as the pre-Inuit, archaeological remains are mainly found in five concentrations (Figure 2):

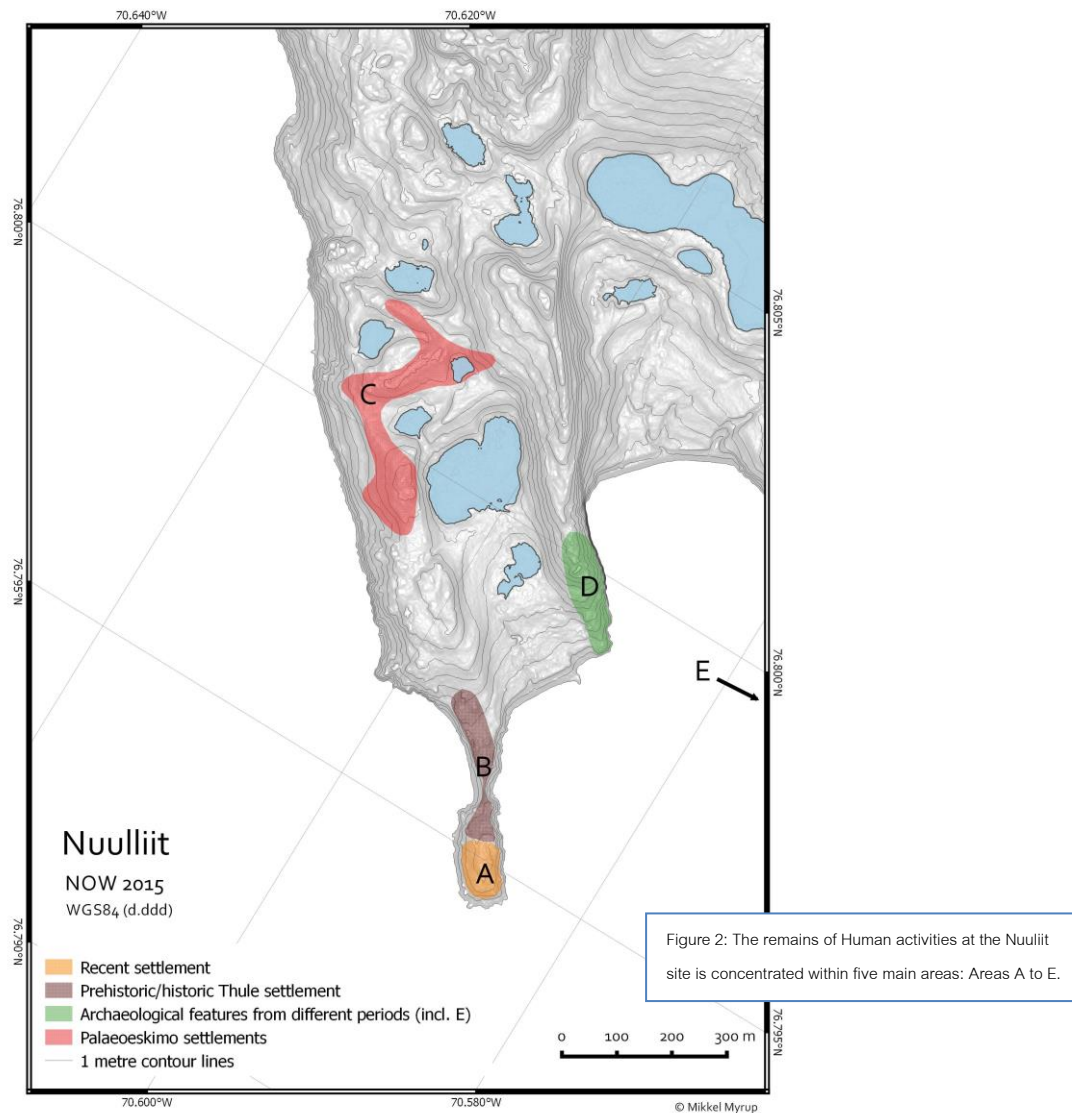


Figure 2: The remains of Human activities at the Nuulliit site is concentrated within five main areas: Areas A to E.

Area A) The recent settlement (used until the early 1990s)

This sub-rectangular area on the point of the western spit covers about 150 x 50 metres. Most of the grass-covered flat area is littered with settlement remains. The features were documented and tentatively recorded as belonging to one of three phases; "the Moriussaq-phase" (the 1950s onwards), "the sub-recent phase" (historic, but older than the 1950s), and "the old-phase" (i.e. prehistoric). A partly burnt-down hunter's lodge is situated at the southernmost part of the area. The area around the lodge is littered with debris of its use during the last 30 years or so. Generally Area A is dominated by three types of features; 28 caches (primarily meat-caches), 25 tentrings, and numerous hollows in the area where the dogs were tied up.

In order to record the faunal material lying *in situ* on the soil surface a recording method developed during the GeoArk-project in Northeast Greenland (Gottfredsen 2010: 178) was applied. The animal bones were GPS positioned, alternatively spatially related to an archaeological feature, quickly recorded on registration sheets and photographed. Walrus jaw bones collected for further analysis in laboratory was GPS positioned prior to sampling. The time depth of surface finds is very difficult to control and therefore the taphonomic

state, e.g. weathering and corrosion degree of the bone surface, whether it was covered with lichens, etc. was recorded for each bone. The GPS positions and the photos were taken by MM and AM, whereas the bones were recorded and described by ABG.

Area B) The prehistoric/historic Thule settlement (Holtved 1954)

Practically all features in Area B was excavated by Holtved and his team in 1946. The area was surveyed by Holtved and divided into two 'ruin concentrations', Group I and Group II. At the time of Holtved Group II a couple of the winter houses were still in use, but else the morphology of the ruins and Holtved's finds show that generally the site was occupied during the early part of the Thule culture. With its more than 50 ruins Nuulliit Area B is the largest known early Thule site.

During the field season 2015 we made notes on the erosion of the ruins of the area, and the present erosion banks on both the eastern and western side of the site was measured by precision GPS for comparison with Holtved's survey.

We tested for organic preservation through several test pits (spade holes) in vegetated areas in front of many of the ruins of winter houses, but only a couple of the tests showed positive results.

However, as described below, the area in front of Holtved's Ruin 30 was identified as containing well preserved artefacts and waste materials of bone etc., and accordingly we concentrated our investigations in this area.

Area C) The pre-Inuit settlements ('Old Nuulliit')

This area was surveyed by Eigil Knuth and he excavated practically all features. Information on this part of the site, baptized by Knuth 'Old Nuulliit', can be found in Sørensen 2010. Here it suffices to say that tent rings from Independence I, Pre Dorset and Late Dorset are found on the site, reflecting the quite complex cultural sequence of the Avanersuaq area. In 2015 we measured the position of Knuth's different features in Area C with precision GPS.

Area D) The archaeological features from different periods

The low ridge is located some 300 metres east-northeast of the spit upon which the main settlement is located. On July 25th and 26th 2015 we recorded 64 human-made structures along an area of approximately 300 x 50-150 metres of the ridge, which raises from ca. three to 18 metres above sea level (brief descriptions, positions by handheld GPS, photograph). Holtved surveyed the area in 1946 and among others recorded a set of kayak-supports and two small possible graves. He also excavated the inside of two winter houses of the Kap Kent Type (48 and 49, Holtved 1954). Knuth partly excavated a third winter house (51, Holtved 1954) (Sørensen 2010).

The two-day survey in 2015 resulted in the recording of 62 structures. Additional structures would probably have been found if more time was invested. The southern, lower part of the ridge is dominated by the four winter houses of Kap Kent type, mentioned above, and a number of mostly recent caches.

Area E) The archaeological features from different periods, southern part of the eastern spit

The features are mostly distributed along the southern and eastern part of the spit. The recording was limited to a three-hour photo and GPS survey, and we may thus have overlooked a number of features. The 23 recorded features are: 15 meat-caches, two cairns, two tent-rings, one shelter ruin, one probable fox-trap, a box-hearth and one wall-like feature of unknown function. The eastern spit was probably only used sporadically. A few features were prehistoric, while the main use of the area dates to the last hundred years.

Figure 3: Excavation in progress in front of Ruin 30 at the southern part of the western spit at Nuulliit..



Excavations at Nuulliit

Initially, we tested the preservation conditions in front of the Cape Kent ruins situated north of the main dwelling area (Holtved 1954: 10). The result was negative, and consequently we tested the remainder of the site by digging several small test pits (spade holes) placed in front of almost 60 turf-built winter houses on the southern part of the site. Only a few areas were covered by turf layers and at these places the layers were generally quite acid. Accordingly, almost no organic matter was traced.

However, in front of Holtved's Ruin 30, several well preserved seal bones and whale bone fragments covered by 20 cm of turf were located, and it was decided to excavate a few 50 by 50 cm units in the area. This was situated in front of the entrance passage of Ruin 30, which Holtved interpreted as a *qassi* (mens' house) dating to the Ruin Island Phase of the Thule Culture. The preservation conditions were excellent and the units were relatively rich in bones, ivory and other finds. Thus, we expanded our investigation, and ultimately we excavated an area of 6 by 6 meter covering a large part of the activity and midden area in front of the *qassi* (Figure 3).

The units were carefully excavated by means of trowels, all artefacts and waste materials as well as bones were collected by unit, and the excavated soil was tested by unit with metal detector (Figure 4) in order to locate metal pieces, which were very hard to discover and see by the naked eye as they mostly consisted of tiny rusty flakes.

Concentrations of waste from the working of soap stone and baleen were recorded separately, and two 6 meter long sections were measured and described, one parallel to the entrance passage and one perpendicular to it. Moreover, a detailed documentation of Ruin 30 was made by means of the drone and precision GPS. The distribution of metal pieces in front of Ruin 30 is shown as an example of the potential of the spatial analyses of artefacts and waste, which can be made, when the registration of the total material is completed (Figure 5).



Figure 6: Martin Appelt searching for metal objects in excavated soil from a ¼ square meter unit from excavation Area A in front of Ruin 30.



Figure 7: One of the iron artefacts in front of the men's house (Ruin 30) at Nuulliit found by means of a metal detector. The object is a tiny ring from a horse chain mail.

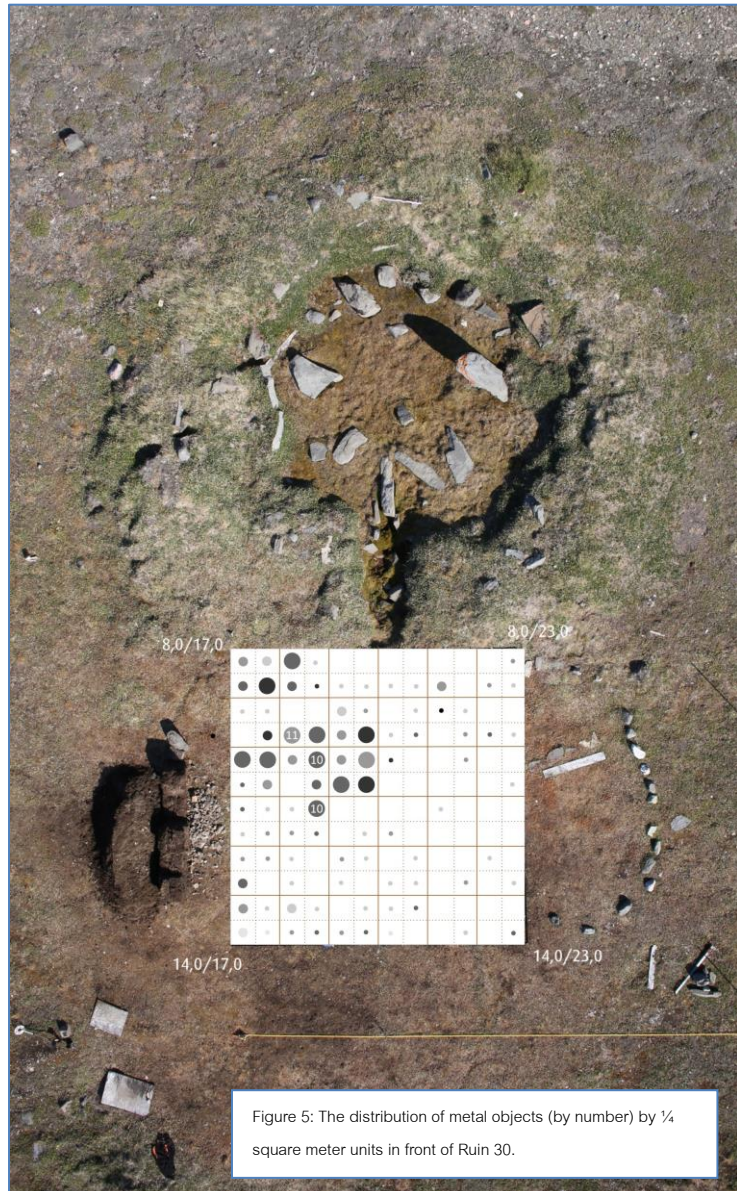


Figure 5: The distribution of metal objects (by number) by ¼ square meter units in front of Ruin 30.

A small, 2 by 2 meter area was excavated close to the erosion bank in front of Holtved's ruins 53/54 following the same principles. The preservation conditions for organic material were not optimal, but importantly a harpoon head for hunting of large whales was uncovered here (Figure 8).

Figure 8: Harpoon head of walrus ivory for hunting large whales, found in excavation area B in front of Ruins 53/54.



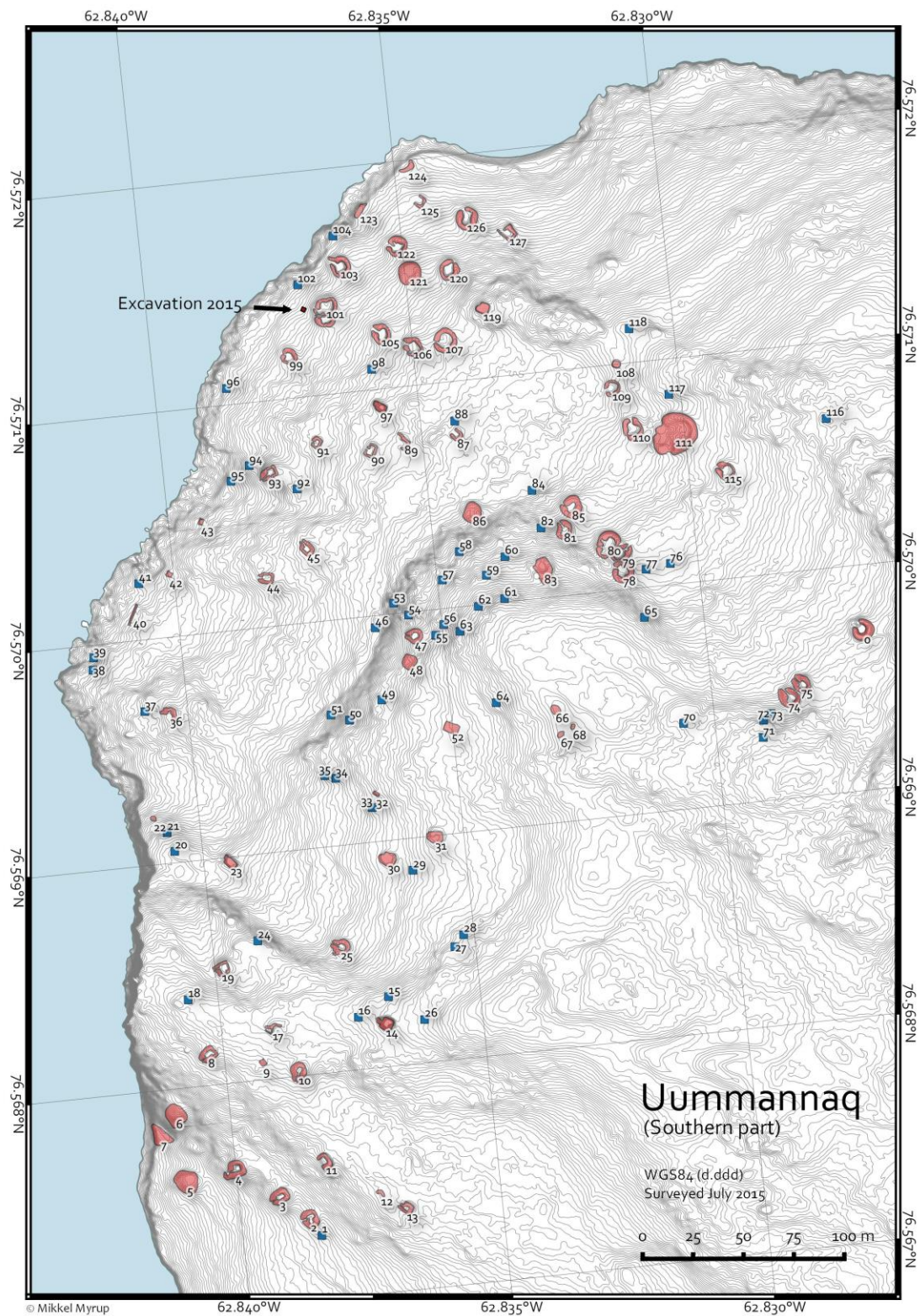
Survey with drones of Nuulliit

The 2015 field season was the second year that drones were applied to provide more precise means of documenting the archaeological sites, i.e. map generation and high-resolution photo and video documentation. The eBee system was used, as in the previous season, to generate high-resolution maps and digital 3D models of the visited archaeological sites. The eBee system and the differential GPS proved to be a powerful combination yielding documentation of high quality. The rotor-powered drone, was useful in obtaining high resolution images, stills and video, but the system revealed some rather substantial vulnerabilities related to single pilot flying and the relative complex routine of operations. Thus the S1000+ rotor ended its days crashing while recording video film at Nuulliit. Because of the complexity of this system, combined with weight and volume, the decision of abandoning it has been made, and a lighter and more simple drone will be purchased for the coming field season. All in all the 2015 season taught us some valuable lessons concerning the use of fixed wing and rotor drones and despite the mishaps there is no doubt about the advantages of utilising these types of systems.

The Uummannaq site

Field work at Uummannaq included a topographical survey of the site by means of the e-bee drone and precision GPS. All man-made features at the site were documented, described and pinpointed by means of precision GPS. A large number of features were photographed, as well. A preliminary result of the survey is

presented on Figure 9. The map will be elaborated and it will be attempted to fit the 1916-survey of Uummannaq by Lauge Koch and Peter Freuchen to the modern topographical map based on our 'ground check' of this one century old, but quite informative map. (The map was located by Peter Dawes among Koch's archival materials).



The site was tested for preservation of organic matter by excavating several small test pits (spade holes) in front of all 'Holtved's ruins'. Based on the results of the test pits, we investigated a small area (2 x 2 meter) in front of Ruin 5, where some organic material including faunal material was preserved in a partly permanently frozen turf layer. This excavation yielded a limited faunal material and few organic artefacts, which probably date to a post-Ruin Island Phase. Among the finds were a Late Dorset harpoon head.

Laboratory work 2015. The find materials from the summer's excavations at the Nuulliit and Uummannaq settlements (see below) were registered and prepared for conservation. The finds are temporarily stored at the Department of Conservation at the National Museum before they following analyses are returned to the Greenland National Museum and Archive.

The finds from the Nuulliit site were made in a 6 by 6 meter excavation area in front of Ruin 30 (Holtved 1954: 38-40), which is interpreted as a men's house (*qass*). Due to dense turf layers covering the culture layer and permafrost close to the front wall of the dwelling a rich and variegated material of organic as well as inorganic matter was uncovered. All finds add to the interpretation of the area in front of the dwelling as being a workshop area, where tools were repaired and 're-cycled', as well as an area where waste from work processes inside the men's house were dumped following cleaning of the house floor.



Figure 10 The archaeological finds from the Nuulliit site are registered, measured, photographed and prepared for conservation at the Department of Conservation of the National Museum.

The artefacts were described, measured, drawn, and photographed (Figure 10). The finds include fragments of more than twenty different tool categories (e.g. adze heads, mattock heads, snow knives, bows and arrowheads, harpoon heads, lance heads, lamps, knives, wedges, scrapers, and figurines). Interestingly, more than 200 iron flakes and tool fragments were found due to our use of metal detector. Almost all iron pieces are from meteoric iron, but the morphology of at least three pieces reveals that they are of Norse origin (rings from chain mail (Figure 7) and boat rivet plate). In total about 105 objects are registered as artefacts and fragments thereof, but when waste products from production of tools from ivory and bone (narwhal- and walrus tusks, whale bones) and soapstone are included, the total find material must be counted in thousands. Lists covering the complete material are currently being processed.

A few finds from one of the Cape Kent ruins at Nuulliit (including a sledge shoe and a soap stone lamp) was brought back to the National Museum by Jørgen Meldgaard in 1992. Registration of these objects was

included in our laboratory work. From the small 2 by 2 meter excavation in front of Ruin 5 at the Uummannaq site (Holtved 1944) seven objects of organic material as well as a few pieces of worked iron and copper was uncovered.

The faunal material retrieved from the excavations on Nuulliit and Uummannaq was cleaned, dried under controlled conditions and subsequently analysed by the use of the comparative collection at the Natural History Museum of Denmark. By now, approximately half of the Nuulliit assemblage (more than 6,000 fragments) has been analysed producing a species list of at least nine mammalian and six avian species. The ringed seal was the most frequent species, as counted by bone fragments, followed by walrus and bearded seal whereas caribou, polar fox and arctic hare occurred in trace amounts. Birds such as Brünnich's guillemot, little auk, northern fulmar and eider ducks were exploited too. Notably, and due to the meticulous excavation technique applied, a very large amount of waste materials from production processes (*débitage*) and blanks of walrus tusk as well as a smaller amount of narwhal tusk and blanks and flakes from whale bone were collected and recorded. Also contributing to the raw material for tool production a large number of relatively large baleen fragments from bowhead whale were identified. The faunal material from Holtved Ruin 30 is the largest and most well-preserved material retrieved from an activity area associated with a men's house from the North Water and offers possibilities for a large number of detailed analyses.

Future steps of the laboratory work include selection of materials for radiocarbon analyses, typological and spatial analyses, metal analyses and classification of waste from work processes and work traces.

Analytical work 2015. In order to establish a historical frame of reference in relation to prehistoric as well as contemporary subsistence and settlement patterns around the North Water, data from the period of the Thule Station (1910 – 1953) was compiled. Quite detailed information from the study area, Avanersuaq, exists from that period: geographical positions and descriptions of the hunting grounds, the accessible game, the sledge routes, seasonal rhythms, the positions and sizes of the winter sites, demography, and long term settlement patterns of individual hunting families. Supplemented with the results of the surveys of the 2014-season it is possible to establish a high quality dataset useful for comparative studies across time in the Avanersuaq area.

Data on early Thule Culture settlement in the Avanersuaq area was compiled as well. Finds from investigations in the 1930s and 40s by Holtved (1944; 1954), by McCullough & Schledermann in the 1980s (McCullough 1989), and by the ILAP-team (LeMoine & Darwent 2010) formed the basis of a survey of geographical positions, radiocarbon and typological dates, as well as architecture and find materials of all Thule sites of the Ruin Island Phase around the North Water (dating to c. 1200 – 1400 AD). Based on finds of Norse objects, a well-defined chronological horizon of the Ruin Island phase of the Thule Culture was identified and in combination with data from the faunal material on these sites it is possible to establish a model of the earliest Thule settlement and subsistence patterns in the area.

Further comparative information has been compiled from the pre-Inuit use of Avanersuaq (approx. 2500 BC – 1320 AD). Early data was collected through Holtved's excavations (1944), and later archaeological fieldwork was done by Eigil Knuth during four field seasons at the Nuulliit site (1958, 1960, 1975, and 1990) (compiled and analysed in Sørensen 2010), by Schledermann during the 1980s (1990), by the 'Man, Culture and Environment'-project team in the late 1990s (Appelt & Gulløv 1999), and by the Inglefield Land Archaeological Project (ILAP) (LeMoine & Darwent 2010).

Alongside the laboratory work with excavated and surface collected faunal material of the 2015 campaign, information on archaeo-zoological assemblages from the Avanersuaq as well as the Canadian area was compiled (e.g., Darwent & Foin 2010; Johansen 2013). Archaeo-zoological data on the species distribution, the demographic distribution of the game animals combined with butchery patterns, seen in a historical and ethnographic frame, will further elucidate prehistoric seasonal rhythm and subsistence patterns. Especially the Nuulliit assemblage from Holtved ruin 30 contemporary with the Illuminerssuit house at Kap Seddon (Grønnow and Meldgaard 1980) gives optimal opportunities for comparative studies of early Thule settlers across regions with differing environmental conditions. A number of surface collected walrus jaw bones from the historic/recent area of Nuulliit were measured with a digital calliper in order to get an estimated size of the animals and thus the sex distribution of the walrus catch, hence contributing further to our knowledge on hunting strategies practiced during the historic use of Nuulliit.

Based on the archaeological and archaeo-zoological analyses carried out in 2015 we are now able to contribute with a long-term perspective on the contemporary subsistence strategies recorded by the anthropologists of the NOW Project.

Conclusion. 2015 was a very productive 'archaeological year' for the NOW Project. The archaeological field work concentrated on excavations and thorough surveys of two key sites in the study area: Nuulliit and Uummanaq. In particular the excavation of a 6 x 6 meter area in front of Ruin 30 (a *qassi*/men's house) at Nuulliit yielded a rich and informative find material from the Ruin Island Phase of the Thule Culture, probably from the 13th century AD. This material holds a great potential for studies of the utilization of raw materials (ivory, baleen, soap stone, and iron) including techniques used for repair and re-cycling of tools by the first Thule immigrants. Our excavations yield, for the first time in Greenland, information on the spatial distribution of activities in front of a *qassi*. In combination with information from earlier investigations the artefacts and faunal materials from the 2015-season also contribute to a description of the subsistence/settlement pattern of the early Thule Culture in the North Water region, which can be compared with parallel patterns from other periods. This way, the archaeological and archaeo-zoological investigations add a long-term perspective to a central research topic of the NOW Project.

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“SØKONGEFANGST” — A PRISM

Astrid Oberborbeck Andersen & Martin Appelt

On March 3, 2015 the NOW-Project, in joint venture with the Danish National Museum, opened a one-room exhibition entitled “Søkongefangst” (Catch of Little Auks).

The exhibition placed at its centre the little auk and the different skills and technologies that humans – hunters of the High Arctic and scientists of the NOW-project – use to catch the little bird for varying purposes.

Through the display of items related to little auks, the projection of videos, sounds, and texts, an atmosphere was generated; the visitor stepped into a multi-media Arctic exhibit-scape. The things were not simply placed in the exhibition; they related to one another and connected in different ways: an *ipoq* (hunter's 'racket') next to a noose-carpet used by biologists; stuffed little auks (from the zoological museum next to the video of a Greenlandic woman chewing and preparing little auk skin for the crafting of a clothing, little auk bones neatly placed in boxes next to a piece of child's clothing made of little auks, and donated to the National Museum in 1920 by Navarana Freuchen.



Navarana

af Peter Freuchen, I al frimodighed, Erindringer 1, Westermann, København 1953

”Da Navarana var lille, havde hun oplevet frygtelige dage. En af polarnattens sagaer var udspillet for hendes øjne. Hun boede med sine forældre på Salve Øen, da en af de forfærdelige epidemier, der kan udrydde hele bopladser hos eskimoerne, ramte dem. Da den havde raset ud - og under denne foregik gruopvækkende ting - var kun Navarana og hendes mor Kasaluk og en lille bror på tre år levende. De havde ikke noget mad og måtte dræbe deres hunde for at få noget at spise. Da hundene var fortærede, spiste de, hvad de kunne undvære af klæder og skindremme og den slags. Den lille dreng diede stadig sin mor; men i sin vanvittige sult bed han den ene brystvorte af hende. Derefter hængte moderen ham, mens Navarana så på det. Hun fortalte mig dog, at det var værre at se på moderens sorg og fortvivelse end på den døde, lille dreng, som ikke rørte sig mere.”

“Søkongefangst” brought together

items and moving images from different moments in time, and different scientific disciplines – the exhibition created a **meshwork**, or site, where different disciplinary scientific and hunter practices connect, and a little auk network could be unfolded by the museum visitor.

When studying the history of Avanersuaq one soon comes to realise that the basic component is the ever more entangled network of individuals. Individuals that defy a single frame of time or geography and constantly seem to be touching upon the lives of every other individual of their time – and beyond. The depicted piece of clothing is one of 12 pieces donated to the National Museum in 1920 by Navarana Freuchen when living on Enehøje on western Lolland, and only about half a year before she died on the way back to Thule. The tiny anorak is made of 36 skins of little auks and probably fits a two-year old. The preparing of the skins would have been a substantial work as would the delicate needlework that joint the delicate skins together with its trimming of polar bear and thin-sliced seal skin. The National Museum's protocols do not let us know why Navarana donated the pieces, and generally not much has been written about her outside what we know from her husband. It may perhaps have been made for and used by her son?

“Søkongefangst” portrayed aspects of ecological relations and living resources in the North Water area, *and* it portrayed aspects of scientific engagement with the region. As such, the exhibition was a form of communication and dissemination of the activities of the NOW-project, a dialogical outreach to the wider public.

Further, the exhibition was in itself an **interdisciplinary materialization**, stimulating joint analysis and publication. It is the intention of members of the NOW-project to further explore and develop this form of **cross-disciplinary prismatic analysis** and exhibition.

“Søkongefangst” was on exhibit until the middle of April 2015 in the Danish National Museum.

PRESENTATIONS BY NOW-MEMBERS, 2015

In January 2016, Bjarne Grønnow participated in the symposium "Arctic Crashes: Human, Climate and Habitat Agency in the Eastern Arctic and North Atlantic", at the Arctic Studies Center, Dept. of Anthropology, National Museum of Natural History, Smithsonian Institution in Washington DC. Paper: Critical Transitions. Humans and Resources in High Arctic Greenland

In December 2015, researchers from the NOW-Project gathered in Magleås Kursuscenter for two days, to present and engage with preliminary research results across the disciplinary fields.

In December 2015 Erik Jeppesen and Thomas Davidson attended a workshop hosted by CEH in Edinburgh entitled 'Detecting critical transitions in lakes'.

In November 2015, Janne Flora and Astrid O. Andersen participated in the Annual Meeting of the American Anthropology Association in Denver. They organized a panel entitled "Living Resources. Disturbing the Animate - Inanimate Divide", and each gave a paper:

Janne Flora: On the Strong Taste of Change in a Northwest Greenlandic Landscape

Astrid O. Andersen: How to Kill a Little Auk. Tracking Life and after-Life Trajectories of Birds in Northwest Greenland

In November, Kirsten Hastrup presented 'Thule på tidens rand' to the Royal Danish Geographical Society.

In November, during a short fieldwork in Qaanaaq, Janne Flora and Astrid O. Andersen held a presentation about the NOW-project at Piareersarfik, the centre for adult schooling.

In October 2015, Anders Mosbech participated in the World Seabird Conference in Cape Town.

Paper: 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.

Authors: Anders Mosbech, Kasper Johansen, Peter Lyngs, Thomas Davidson, Erik Jeppesen, Bjarne Grønnow, Martin Appelt, Rune Dietz, Astrid Andersen and Janne Flora

October 1, 2015, Kirsten Hastrup presented 'Anthropology in Fluid Environments: The Elusiveness of Place in the High Arctic', as Invited Lecture at Princeton University.

October 5, 2015, Kirsten Hastrup presented 'A Permanent State of Extinction? The Case of the Thule People of North West Greenland', as Invited lecture at University of Pennsylvania.

In September, 2015, Bjarne Grønnow participated in the conference 'Forging of cultures in the Circumpolar North - a comparative perspective', University of Aarhus, Arctic Research Centre, with the paper: Instability and Isolation: High Arctic Settlement Patterns in a Long Term Perspective

In September 2015, Kirsten Hastrup gave a keynote lecture: 'The Heritage of Hunters: Living with Climate Change in the High Arctic', at the *Heritage Seminar*, Aarhus University.

In September 2015, Janne Flora and Astrid O. Andersen participated in the Eleventh Conference on Hunting and Gathering Societies, in Vienna. They presented a co-authored paper: The sea ice as a site for multiple economies in Qaanaaq

In August 2015, Kirsten Hastrup gave a key-note address to the 33 Nordic Ethnology and Folklore Conference, Copenhagen: 'Comprehending Thule: The Co-Constitution of Peoples, Places and Stories'.

On August 24-26, Kirsten Hastrup presented 'Collaborative Moments: Interdisciplinary Experimentation in the Field' at The Anthropological Mega-Seminar, Sandbjerg.

In April 2015 Thomas Davidson was an invited speaker at the first meeting of PAGES (Past Global Changes) working group on Aquatic transitions. Nottingham, UK.

In February 2015, Kirsten Hastrup presented '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.

In January 2015, K. Hastrup, J. Flora and A.O. Andersen gave a presentation about the NOW Project on a workshop 'Stitching together heterogeneous data worlds'. Departments of Anthropology and Sociology, University of Copenhagen

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