A master's thesis that will make a difference

- do your master's study in Greenland

Greenland Institute of Natural Resources

Collaboration

The Greenland Institute of Natural Resources (GINR) has a long history of collaboration with researchers from Danish and international universities, and students will be assigned supervisors from both GINR and their own institution.

Photos

Peter Schmidt Mikkelsen, Carsten Egevang, Thomas Juul-Pedersen, Kristine Arendt, Lene Kielsen Holm, Dorte Haubjerg Søgaard, Søren Rysgaard, Mikkel Lund, AnnDorte Burmeister, GINR

The Greenland Institute of Natural Resources

GINR is situated in the capital of Greenland, Nuuk, in the Southwestern part of the country (www.natur.gl). GINR offers high quality research facilities and the opportunity to work with experienced and enthusiastic researchers working with Arctic science on a daily basis.

The Greenland Institute of Natural Research (right) and the University of Greenland (left)

Research

GINR integrates research in natural, technological, and social sciences to understand the effects of natural variability and climate change on Arctic ecosystems and society.
Research focus on marine ecology such as fish, shellfish, marine mammals, marine productivity, seasonality and the fate of the primary production in marine ecosystem, biogeochemical cycling and sea ice processes as well as land-based resources such as land mammals and vegetation.
Research is carried out in collaboration with international institutions and includes:

- Biology of species and their interactions
- Distribution of populations – through tagging, satellite tracking and genetic analysis, and surveys
- Mapping of food availability – by satellite imagery, vegetation and plankton analyses, and stomach content analyses
- Ecological interactions
- Oceanic hydrography, ocean currents, and sea ice – by satellite imagery and measurements of physical, biological and chemical parameters
- Melting of the Greenland Ice Sheet and freshwater flux into the sea – through measurements and photography
- Analyses of logbooks from hunting, bycatches and sample measurements
- Experiments with instrument technology, enclosures etc.
- Interview surveys of fishermen and hunters.

Staff

GINR employs a permanent staff of about 50 people, 30 of whom are researchers and technical administrative staff and crew members on the Institute's research vessels. For further information see www.natur.gl.

Facilities

GINR has 2800 m^2 of modern office and laboratory facilities, 850 m^2 of guest accommodation and a 400 m^2 boathouse in Nuuk, as well as permanent field stations in Kobbefjord (near Nuuk) and Young Sound (in NE Greenland). The Institute has an annex with a large multi-room, which is used for meetings and seminars. Furthermore, the annex contains 5 flats and 8 rooms for visiting researchers and workshops.
GINR owns two research vessels: R/V Sanna and R/V Pâmiut and 5 motorboats and dingeys, used for transportation, fieldwork in the fjords around Nuuk and the regular monitoring programs in Greenland.

R/V Sanna

Working as a master student at GINR

Modern laboratories and Arctic biology in your backyard gives you the opportunity to put theory into practice. We have a wide range of expertises in Arctic research, and offer you the chance to explore your area of interest alongside international specialists. If you have other ideas than the projects descibed here, contact Dorte H. Søgaard Doso@natur.gl

Master's thesis subjects

Variation in microbial activity and community structure between Greenland fjords

Project start: **2015**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources in Greenland.**

Two or three master students have the opportunity to work with marine microbial activity at the Greenland Institute of Natural Resource.

The Greenland coastline is characterized by fjord systems. These semi-enclosed marine ecosystems show high biological differences, still the degree of variability and what drives this variation remain largely unknown. Bacteria and planktonic organisms are the foundation of the marine food web, thus it is important to understand how and why these communities differ between fjords. We therefore propose three complementary projects, which aim to describe differences in these essential food web components in three Greenland fjord ecosystems.

A. *Phytoplankton productivity and species composition in three Greenlandic fjord systems (regional scale variation)*.

Phytoplankton is the key primary producers converting incoming sunlight to organic material, thereby sustaining the marine food web. This sub-project is a study of the differences in biomass, productivity and species composition of phytoplankton communities in three fjord systems. This study would also look at differences in bathymetry and hydrography between the fjords, and work to identify what environmental drivers induces the biological variability.

B. *Bacterial productivity, bacterial respiration and bacterial growth efficiency in three Greenlandic fjord systems (regional scale variation).*

Bacteria perform two major functions in the transformation of organic material: 1) they produce new bacterial biomass (bacterial production) and 2) they respire organic carbon to inorganic carbon (bacterial respiration).
Bacterial growth efficiency is define as the amount of new bacterial bio-mass carbon produced per. unit of organic carbon substrate utilized and is a good way to relate bacterial production and respiration. We still lack

knowledge about bacterial production, bacterial respiration and bacterial growth efficiency in Greenlandic fjord systems, and this limits our ability to understand the role of bacteria in these systems. Thus, this sub-project would look at the difference in bacterial production, bacterial respiration and bacterial growth efficiency in three Greenlandic fjords, and work to identify what drivers induces the biological variability.

C. *The air- sea CO_2 uptake in three Greenlandic fjord systems (regional scale variations).*

During the last 100 years anthropogenic activities have increased atmospheric levels of CO_2. Approximately 50% of the anthropogenic CO_2 emissions have been absorbed by the oceans. Thus, the oceans play an important role in reducing the effects of anthropogenic CO_2 emissions. However, basic knowledge is still needed about whether or not coastal fjord systems in Greenland are a net source or a net sink of atmospheric CO_2. This sub-project would look at the difference in air-sea CO_2 uptake in three Greenlandic fjords, and work to identify what drivers induces the variability.

Please contact Thomas Juul-Pedersen Thpe@natur.gl, Dorte H Søgaard Doso@natur.gl and John Mortensen Jomo@natur.gl for further information.

Fieldwork in Greenland

Seasonal patterns of micro and meso-zooplankton in a sub-Arctic fjord

Project start: **Any time**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources primarily in Nuuk.**

One master student has the opportunity to work with micro and meso-zooplankton at the Greenland Institute of Natural Resource.

Micro-zooplankton and the small size groups of copepods have been shown to be important during spring and summer in the subarctic fjord Godthåbsfjord.

This study will describe seasonal variation in carbon turnover and species composition of the small size groups of zooplankton. The work will be based on *in situ* field measurements and laboratory experiments of the collected organisms. The study will be based on data collected in the monitoring program Marine Basic Nuuk and the student will be an active part of field campaigns (see www.nuuk-basic.dk).

Please contact Kristine Arendt Krar@natur.gl and Thomas Juul-Pedersen Thpe@natur.gl for further information.

Microsetella norvegica

Vertical migration of zoo-plankton

Project start: **Winter 2015**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources primarily in the bottom of the Godthåbsfjord in Greenland.**

One master student has the opportunity to work with zoo-plankton at the Greenland Institute of Natural Resource.

In the subarctic fjord Godthåbsfjord krill has been shown to be an important grazer on the primary producers. Krill is furthermore an important prey item for fish, marine mammals and birds like little auk that has their winter feeding areas near the fjord. Oceanographic measurements with ADCP show vertical migrations of plankton organisms during winter and spring in Godthåbsfjord.

In this study we want to make a detailed description of the daily pattern in vertical migration of krill and other zoo-plankton organisms. The study will focus on *in situ* net sampling of zoo-plankton organisms on a cruise in Godthåbsfjord and compare this to previous ADCP measurements.

Please contact Kristine Arendt Krar@natur.gl and John Mortensen Jomo@natur.gl for further information.

Fieldwork with miknet on R/V Sanna in Godthåbsfjord

Hydrographic study of the outer sill region of Godthåbsfjord

Project start: **Any time**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources primarily in the Godthåbsfjord in Greenland.**

One master student (in oceanography or equivalent) has the opportunity to work with hydrography at the Greenland Institute of Natural Resource.

Godthåbsfjord is one of the largest tidewater outlet fjords in Greenland and subjected to intense research. Bottom water renewal of the fjord is mainly controlled by the intensity of mixing in the outer sill region due to fortnightly variations in tidal amplitude. Oceanographic measurements with CTDs in the outer sill region show high frequency variation on semi-diurnal scales, whereas the bottom water show a distinct 14 days signal during dense inflow events.

In this study we want to describe hydrography and verify the 14 days tidal pattern in the outer sill region of Godthåbsfjord. The study will focus on *in situ* CTD sampling on a number of short day cruises in Godthåbsfjord near Nuuk and compare this to previous CTD measurements in the region.

Please contact John Mortensen Jomo@natur.gl and Thomas Juul-Pedersen Thpe@natur.gl for further information.

The Godthåbsfjord in autumn

The biological and abiotic processes in a glacier influenced subarctic sea ice

Project start: **January 2015**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources primarily in the bottom of the Godthåbsfjord.**

One or two master student has the opportunity to work with microbial processes in sea ice at the Greenland Institute of Natural Resources.

Sea ice provides a low-temperature habitat for diverse communities of micro-organisms including bacteria and heterotrophic- (e.g. flagellates and ciliates) and autotrophic protists (e.g. diatoms). Organisms incorporated into sea ice are challenged with changes in space, light availability, salinity, nutrients, dissolved inorganic carbon (TCO_2), O_2 concentration, temperature and pH. Especially light availability within the sea ice has a major influence on the sea ice algal biomass and production.

Main focus will be on describing the seasonal dynamics of major pathways of the carbon cycle in the sea ice, e.g. primary production, bacterial production and abiotic processes e.g. $CaCO_3$ production, TA and TCO_2. A seasonal carbon budget can be produced and we are able to estimate the potential air-ice-sea water flux of CO_2.

Please contact Dorte H. Søgaard doso@natur.gl for further information.

Sea ice fieldwork in Young Sound in NE Greenland

Seasonal measurements of bacterial production, bacterial respiration and bacterial growth efficiency and cell size in subarctic sea ice

Project start: **January 2015**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources primarily on sea ice in Malene Bight near Nuuk.**

One or two master students have the opportunity to work with bacteria in sea ice at the Greenland Institute of Natural Resources.

Bacterial production in Arctic sea ice has been measured since 1990, to our knowledge, in less than 10 studies. Furthermore, studies of the bacterial growth dynamics in sea ice are a relative new field of investigation.

In general bacteria perform two major functions in the transformation of organic material: 1) they produce new bacterial biomass (bacterial production) and 2) they respire organic carbon to inorganic carbon (bacterial respiration).

Bacterial growth efficiency is defined as the amount of new bacterial biomass carbon produced per unit of organic carbon substrate utilized and this relates bacterial production and respiration.

We still lack knowledge about bacterial production, bacterial respiration, bacterial growth efficiency and bacterial cell size in Arctic sea ice, and this limits our ability to understand the role of bacteria in this system.

The main objective of this study is to assess the seasonal dynamic of the bacterial productivity, growth efficiency, respiration, cell size and bacterial biomass in subarctic sea ice.

Please contact Dorte H. Søgaard doso@natur.gl for further information.

Sea ice fieldwork in Young Sound in NE Greenland

Intertidal ecology as indicator of climate impacts in Greenland

Project start: **Anytime**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources in Greenland.**

Master students have the opportunity to work with marine invertebrates in the intertidal zone in Greenland.

Species composition in the rocky intertidal zone in the Arctic is strongly affected by physical stressors, and less by biological interactions. Extreme air temperatures is a critical parameter, which is expected to affect several life history traits of benthic invertebrates, such as foraging, growth, mortality and reproduction, and ultimately determine the northern distribution limits of species.

Therefore, the intertidal is regarded a sensitive indicator habitat for biological effects of climate changes in the Arctic.

However, little is known about species-specific responses to physical stressors in Arctic marine invertebrates, and this knowledge is crucial for being able to document and understand climate-related differences in species composition and habitat ecology.

Greenland Institute of Natural Resources (GINR) offers the opportunity to address such questions in a combination of field work and experimental studies in Nuuk, Greenland.

Please contact Martin E. Blicher mabl@natur.gl for further information.

Fieldwork in the intertidal zone in Greenland

Greenlandic Communities, Ice and Living Resources

Project start: **Summer 2014**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources primarily in North Greenland (Uummannaq-Upernavik - Qaanaaq)**

One student has the opportunity to work with Greenlandic communities, ice and living resources at the Greenland Institute of Natural Resources.

The ICE-ARC project is a new EU project funded for 2014 – 2018 under the FP7 program. The project aims to understand and quantify the multiple stressors involved in the change in the Arctic marine environment.

Particular focus is on the rapid retreat and collapse of the Arctic sea ice cover and to assess the climatic (ice, ocean, atmosphere and ecosystem), economic and social impacts of these stressors on regional and global scales. GCRC will be involved in unraveling the impacts of climate change on the Greenlandic society (indigenous people) through community-based participatory research.

We will need an assisting student with ethnological interest and skills for this project. Since the work includes interviews with local knowledge holders, students must be able to communicate fluently in Greenlandic. Further information on the project: www.natur.gl/en/climate-research-centre/climate-and-society/

Please contact Lene Kielsen Holm Leho@natur.gl.

Fieldwork at a traditional campsite in the Nuuk area in Greenland

Vegetation and lakes in West Greenland

Project start: **Anytime**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources in Kobbefjord near Nuuk.**

Two or more master students have the opportunity to work with terrestrial and limnic ecology at the Greenland Institute of Natural Resources.

The institute has a research facility 20 km south of Nuuk, where the Nuuk Basic program (www.nuuk-basic.dk) since 2008 has been monitoring an array of parameters related to the vegetation's response to a changing environment. The program also includes measurements of a number of lake parameters.

We have several opportunities for doing a master thesis with these data as baseline information and as a starting point for further research.

Please contact Josephine Nymand Jony@natur.gl for further information.

Fieldwork in Kobbefjord in Greenland

Potential shifts in distribution of fish in response to a temperature increased

Project start: **1 of June 2014 or 2015**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources in Greenland**

One or two master students have the opportunity to work with fish at the Greenland Institute of Natural Resources.

From 1996-1999 a sharp increase in summer bottom temperature of approx. 2°C was observed in West Greenland. It has previously been demonstrated, that this had a significant effect on growth of Greenland halibut (Sünksen et al. 2009), but no studies have been done focusing on possible changes in the distribution of species across the ecosystem.

All fish species caught in yearly bottom trawl surveys on the West Greenland shelf are measured and weighed. Based on these data it is possible to calculate a Centre of Gravity for each species, and subsequently, if this Centre of Gravity shifts as a result of temperature changes. This also applies for other entities such as specific ecological groups.

The study includes a 2-3 week fieldsurvey onboard GINRs vessel, R/V Pâmiut. Travel and living expenses are covered.

Please contact Rasmus Hedeholm rahe@natur.gl for further information.

GINRs research vessel, R/V Pâmiut

Length weight relationship of the Northern shrimp Pandalus borealis based on developmental stages, sex, densities, temperatures and depths

Project start: **1 of June 2014 or 2015**
Project setup: **You will be working with a team from The Greenland Institute of Natural Resources in Greenland**

One or two master students have the opportunity to work with shrimps at the Greenland Institute of Natural Resources.

Northern shrimp (Pandalus borealis) is the most important fishing resources in Greenland and accounts for more than 50% of the export income. The shrimp is a protandric hermaphrodite with circumpolar distribution in the northern hemisphere, born as a male and changing to females stages being 4 – 7 years.

The physical as well as the biological environment is believed to have a major influence on pandalid shrimp populations. Estimated weights at length are believed to be consistent over years, however in recent years (2008-2013) seem to have heavier shrimps in the intermediate lengths, 15 and 20 mm. The mean weight of both sexes has decreased over the 24-year history of the survey, by, on average, 81 mg/yr for females and 26 mg/yr for males.

No study has been done focusing on which parameters caused differences in length – weight relationships (e.g. effects of fishery pressure, density, temperature or depths).

A large dataset covering a time series from, 1998-2013 is available for this study. The study also includes 2 – 3 week field work onboard the GIRNs vessel, R/V Pâmiut. Travel and living expenses are covered.

Please contact AnnDorte Burmeister Anbu@natur.gl for further information.

Bottom trawl, R/V Pâmiut

Student life

Getting to Nuuk

You can use your local travel agency or the internet when booking the flight. There are two operators of flights to Nuuk: www.airgreenland.dk and www.icelandair.dk. The travel time from Copenhagen is about 5.5 hours.

Arrival in Nuuk

To get from the airport to the student housing in the annex or in Nuuk you have to take a taxi . Phone numbers: +299 321321 or +299 363636.

About Nuuk

Nuuk is the capital of Greenland with about 16200 inhabitants. Nuuk is located on Greenland's west coast and is called an open water city, which means that you can sail to the city year round. Nuuk is located south of the Arctic Circle.

There is a cultural center in Nuuk, Katuaq. Katuaq stage events of different cultural character of Greenland and foreign artists, exhibitions, concerts, theater, etc. Furthermore, there is also a cinema in katuaq showing the latest movies and a café.

It is possible to go skiing in Nuuk both cross country and alpine for further information see www.skilift.gl.

There exists a golf club in Nuuk with a 9 hole course. There is a beautiful swimming pool, Malik, who has won an international prize for architecture.

During summer fishing and hiking in the mountains are possible.

Student housing, Biologstationen

Accommodation

The student housing is located in the annex at GINR or in Nuuk town, about 4 km from GINR. The housing facilities are limited but for further information please contact booking@natur.gl.

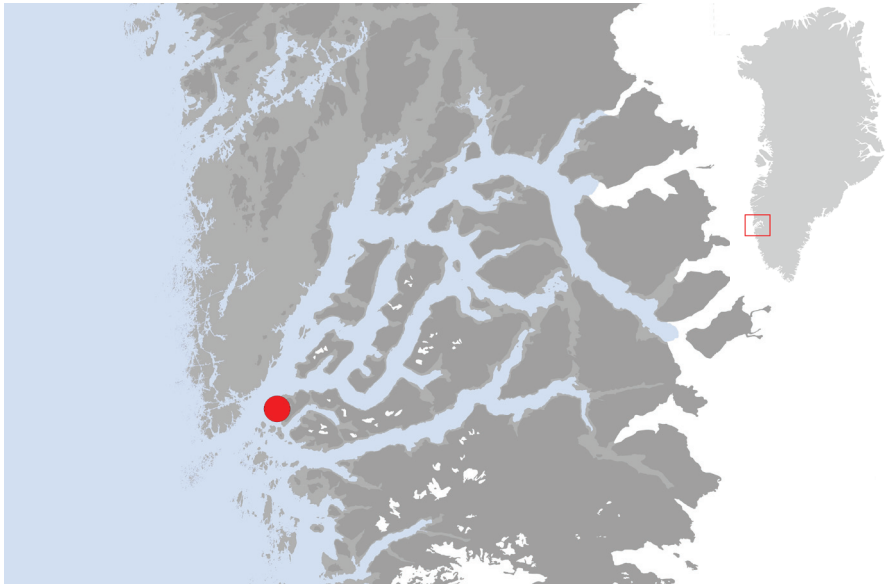
The monthly rent per 1st January 2014 is DK 1500,-. A room is 8 – 12 square meters. There is internet connection in all rooms. You share bathroom with 2-5 other students.

You will also share kitchen and living room with other students. The kitchen and living room is fully equipped with refrigerator, stove , TV etc.

Living expenses

The cost of living in Greenland is almost the same as in Denmark.

All travel expenses to and from Nuuk must be paid by the student. It is possible to apply for grants to finance the travel expenses ask your supervisors for more information.



Greenland map with a marking of the Godthåbsfjord area. Detailed map of the fjord system with the location of Nuuk marked in red.