

## Preface

This book synthesizes the marine research that has been conducted in Young Sound, a High Arctic fjord in Northeast Greenland since 1994. The reason our work started was the growing evidence of dramatic changes in sea ice cover as evident from satellite images (Parkinson, 1992), model predictions of a future dramatic temperature increase in the Arctic (Hansen et al., 1988; Manabe & Stouffer, 1994) and the possibility of shut-down of the thermohaline circulation (Rahmstorf, 1995). All this would have a

profound influence on conditions in Greenland but would also greatly affect conditions in Northern Europe where the result might be a much colder future climate, despite the fact that it was becoming warmer globally. One of the areas where large changes in sea ice cover have occurred is off the coast of East Greenland. The area is difficult to work in due to the heavy sea ice conditions and ice drift. Here, large icebreakers are necessary platforms to perform measurements at sea. Even with icebreakers, however, it is often dif-

Preben Sørensen in our first “field laboratory” 1994.



Photo: Søren Rysgaard

difficult to obtain measurements on the inner parts of the shelf along East Greenland. The area is considered to be a sensitive indicator of climate change because of its contact with water masses from the Greenland Sea and direct meltwater flux from the Greenland Ice Sheet. Being a student, I did not have the means to hire an icebreaker. A childhood friend of mine was serving his military duty in Sirius, a Danish Military Division operating along East Greenland coast where it patrols the National Park area by dog sledge during winter. On one of his visits to Denmark, we discussed the possibility of a visit to the Daneborg area where the Patrol is located (74°N). Daneborg is situated close to a 100 km long fjord, Young Sound, which is in contact with the Greenland Ice Sheet and lies on the border between heavy sea ice conditions to the north and open-water conditions to the south, enabling supply by ship almost every year during the short summer season. Thus, this area was perfect for our studies – a relatively simple fjord in contact with the Ice Sheet and situated in a highly climate sensitive zone. In order to get up there I applied for financial support from the Carlsberg Foundation to cover the expenses for two persons and was granted the funds. We were lucky to get a lift with a military Twinotter plane and borrowed a small hut, “Sandodden” close to Daneborg during our stay in June–July 1994. We made a number of initial hydrographic, pelagic and benthic measurements in the area and had only brought a few boxes of equipment due to the limited space on the small plane. One of the surprising things was the high pelagic and benthic activity despite the sub-zero water temperatures. The oxygen penetration depth and oxygen consumption rates in the sediment were comparable with the temperate locality, Aarhus Bay, Denmark, and our initial work on designing special equipment for deeper profiling proved to be unnecessary. Staying in the area that summer, I realized that it would be the perfect place for integrated ecosystem studies and that we could greatly increase existing knowledge of High Arctic marine ecosystems by including diurnal, seasonal and interannual variability studies at a relatively low expense as compared with icebreaker activities. That summer, we also visited a former weather station “Kystens Perle” near Daneborg. It had served as weather station since World War II, but was closed down in 1975, as the new satellite system made many of these weather stations superfluous. As no one seemed to own the place,

we started to clean it up and repair it and saw that it could accommodate a quite large research team.

On return to Denmark, I applied for a larger research grant from the Danish National Research Councils to start up seasonal studies in this High Arctic fjord. The project “Nutrient dynamics in northeast Greenland waters and sediment” was funded for three years and after one year of preparation 15 scientists from different scientific disciplines worked together in Young Sound during 1996–97. During this work, detailed information on the seasonal variation in pelagic and benthic compartments was obtained.

When this “baseline” study was accomplished, we applied for financial support from the Danish Natural Science Research Council for the continuation of our work in the project: “Changes in Arctic Marine Production” (CAMP). This project was focused on the coupling between climate and the marine ecosystem and involved 30 scientists. The project only received half of the money we needed to fulfil the three-year program. Despite this, we decided to continue our research and hoped we would find the financial support along the line. Over the next 3 years several applications were made and thanks to the Danish Natural Science Research Council, the Carlsberg Foundation, the Danish Environmental Protection Agency, the Commission for Scientific Research in Greenland, the Frimodt-Heineken Foundation, the Torben and Alice Frimodt Foundation, the Bodil Pedersen Foundation and the Prince Joachim and Princess Alexandra Foundation we managed to complete the project with great success.

Alongside the research activities we started to repair the station “Kystens Perle” more thoroughly. Initially, we received support from the Danish Polar Centre (DPC), the Danish National Research Institute and the Military Division Sirius. During the field campaigns, logistic members from DPC, a carpenter and scientists continued to repair and rebuild the station into laboratories, kitchen, bedrooms etc. whenever they had time in between experiments. There was a fantastic team spirit and everyone worked for weeks without much sleep.

The CAMP project showed the need for tighter coupling between research in the marine and terrestrial environments. In 1995 a long-term monitoring network called “Zackenberg Ecological Research Operations” (ZERO) was established further inside the fjord to monitor atmospheric, hydrologic and



Photo: Søren Rysgaard

The research team in front of the former weather station “Kystens Perle” in June 1999.

terrestrial parameters. For example, the suspended matter discharge from the Zackenberg River was quantified and it became evident that this terrestrial material could be detected in our marine sediment traps. Furthermore, the freshwater discharge from rivers had a profound impact on the circulation in the fjord and the exchange with the Greenland Sea. Thus, tight cooperation with the terrestrial program was initiated and eventually resulted in the implementation of a long-term marine monitoring program “Marine-Basic” as an integrated part of the Zackenberg Basic monitoring program. MarineBasic has collected data since 2002. The work is financially supported by DANCEA (the Danish Cooperation for the Environment in the Arctic) under the Danish Ministry of the Environment. Furthermore, we received financial support from the Aage V. Jensen Charity Foundation to cover the expenses for a research boat and scientific equipment to start up the program. The latter

foundation also donated new housing facilities in Zackenberg/Daneborg.

I am very pleased that our research projects in Young Sound have now resulted in the implementation of a long-term marine monitoring program. Together with the monitoring programs in the terrestrial environment, it will provide important data on this remote region, from which very few data existed before 1994. Furthermore, time will show if our current understanding of this High Arctic ecosystem is adequate and if our predictions of future changes in the ecosystem is correct. Finally, I thank the number of scientists who have reviewed the individual chapters as well as the Greenland Institute of Natural Resources for providing funds for this publication.

Søren Rysgaard, Nuuk, October 2006