

Northern Fisheries

Newsletter from the Nordic Working Group on Fisheries Research – NAF

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The Mid-Atlantic Ridge Is Teeming with Life



Whales were observed in far larger numbers than expected along the Mid-Atlantic Ridge. Most numerous were various species of dolphins. The picture shows the common dolphin (*Delphinus delphis*). Photo: Leif Nøttestad

There are more top predators, whales and sea birds in the Atlantic Sea from Iceland to the Azores than expected. In this stretch of ocean which has been considered more or less a desert there are oases where food accumulates, catering for the needs of living creatures throughout the food chain. This is revealed by the project that covers whales and seabirds in the MAR-ECO expedition in the summer of 2004.

The distribution of whales and seabirds and their use of the mid-Atlantic Ridge (MAR) have only been sparsely mapped out before. But with the new and advanced equipment for observation, mapping and sampling which is available on the new Norwegian research vessel G.O.Sars, the observation of birds and

whales can be more extensive. Oceanographic and biological data were collected simultaneously, thus enabling the mapping of the ecological roles of whale and seabirds in this ecosystem.

It is evident that the area along the MAR is important for whale species that graze, migrate and even occasionally breed here. Furthermore, it is seen that the Ridge with its hydrographic flow attracts a large number of seabirds, even in the breeding period.

Many Dolphins

Altogether 1,433 whales were observed. About half (727) were various species of dolphins. 273 individuals in 28 schools were defined as common dolphin (*Delphinus delphis*). This

species was only observed south of the sub-polar front where the surface is warmer than 14 degrees. Another important dolphin species (*Lagernorhynchus acutus*) appeared only in areas where the water was colder than 11 degrees. 103 animals in seven schools were observed.

There were 50 observations of 83 sperm whales (*Physeter macrocephalus*). This large whale which dives as deep as 3,000 metres was registered all along the MAR with a concentration north of the Charlie Gibbs Fracture Zone (CGFZ), in the same area as sei whales.

The researchers also point out that it is especially surprising that there were so many observations of baleen whales. These are large whales

weighing up to 80-100 tonnes. When so many animals of this kind graze in the same area it is a sign of high levels of plankton in the sea.

85 sei whales (*Balaenoptera borealis*) were observed, for example. All were observed north of CGFZ. The observation area coincides with a local zone with the highest surface temperature and salinity and large quantities of zooplankton (especially small copepods) compared with the surrounding waters. Unlike the sperm whales that seem to prefer the seamounts of the MAR, most sei whales were registered above the steep slopes between the mounts.

20 finback whales (*Balaenoptera physalus*) were registered in 15 sightings. Seven animals were observed north of CGFZ, more were seen grazing on krill in the southern area of the MAR at the Faraday Fracture Zone (FFZ). Two of the four individual blue whales (*Balaenoptera musculus*) were registered in this area with high nutrient levels.

60 Per Cent Fulmar

It was no surprise that fulmars (*Fulmarus glacialis*) were predominant among bird observations with 1,009 out of a total of 1,714 individuals. Two species of shearwater, greater shearwater (*Puffinus gravis*) with 316 individuals and Cory's shearwater (*Calonectric diomedea*) with

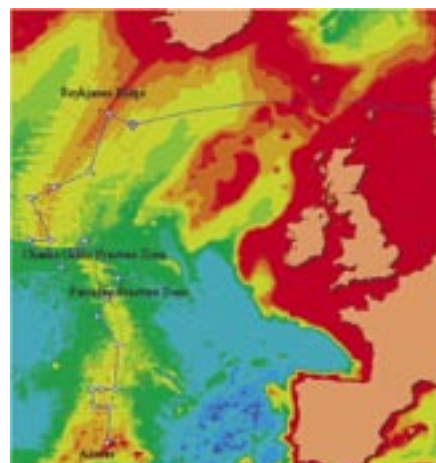
298 individuals are also common. The remaining 19 bird species had few individuals, from 12 and downwards to 1.

Fulmar is common north of 47 degrees north. Most of them were observed flying, not in flocks. The density was mostly less than one individual per square kilometres. Greater shearwater was only observed in the front area just north of CGFZ. The largest flock numbered 160 individuals. Cory's shearwater was much more dispersed with a small concentration at 45 degrees north where the surface temperature was 20 degrees. All individuals were further south than their cousin greater shearwater. The observations of Cory's shearwater often coincided with sightings of species of dolphin.

Important ecosystem research

By means of existing and new data the future work on the whale and seabird project shall:

- Map the distribution of whale and seabird species along the MAR.
- Develop models for the link between zooplankton and seabirds (*Procellarii* species) along the MAR by means of underwater video profiles (UVP) and observations along the



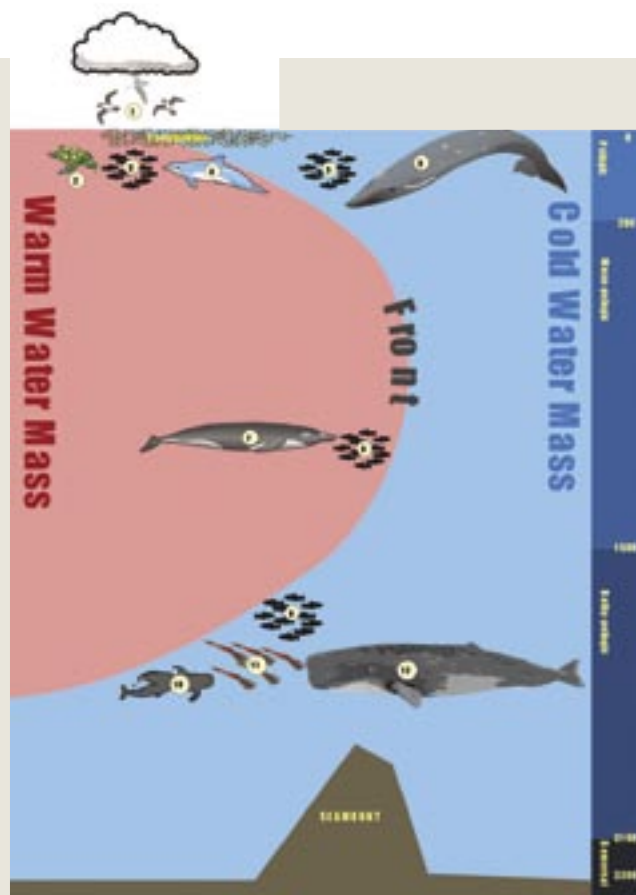
The route of the expedition from the Reykjanes ridge south of Iceland to the Azores. The areas around the fracture zones along MAR are marked.

transects. The basis will be a count of selected species of plankton in the upper 10 metres of the sea compared with the density of seabirds at the same stations.

- Find the most important areas ("hot spots") for whales along MAR by means of detailed acoustical data from selected parts of the transects. The density of whales and seabirds is to be compared with behavioural data.

The North Atlantic drift, the continuation of the Gulf Stream, creates a front system between cold and warm water. The stream crosses the Mid-Atlantic Ridge at the Charlie Gibbs Fracture Zone (CGFZ) halfway between Iceland and the Azores. The illustration shows a simplified example of the distribution of various animal groups within the front system between cold and warm water and seamounts.

The oceanic front and the precipitous topography is the main reason for the local proliferation and accumulation of zooplankton (*Calanus finmarchicus*) and krill in the pelagic waters from the surface and down to about 200 metres. Seabirds (1) and small fish species (3) eat plankton. In the warmer waters the turtles (2) are predators for small fish and jellyfish in the upper waters. Sei whales (*Balaenoptera borealis*) (6) and other baleen whales swim in both types of water and consume both zooplankton and shoal fish (5), whereas various species of dolphin (4) mainly hunt fish in different water depths. In the meso-pelagic zone from 200 to 1500 metres' depth, various species of fish (8) are eaten by deep diving sea mammals such as pilot whale (*Globicephela melas/macrorhynchus*) (7). Northern bottlenose whales (*Mesoplodon* spp) (10) also exploit the bathypelagic areas from 1500 metres where they hunt deep sea fish (9) and various types of squid (11). For the sperm whale (12) which dives deeper than any other whale, down to 300 metres, squid is also a favourite food.



- Collect knowledge of and study the ecological role of whales and seabirds as top predators along the MAR. Data is based on the number of types of potential prey animals available, such as species of copepods, krill (*Euphausi-der*), squid and fish. It should be seen in the context of accumulations of whales and seabirds along the transects and data from the three points above.
- Calculate the number and dispersion of marine top predators compared with the oceanic conditions along the MAR. This is to be based on data from different depths with temperature profiles, salinity profiles, light profiles and the proliferation of whales and seabirds.

At an early stage of the research it is seen that certain areas stand out as surprisingly rich in nutrition. Especially in the front system water is forced up along the seamounts of the ridge. Local systems are formed with high levels of organic nutrition as a precondition for the presence of whales and seabirds. It has become evident, that ecosystem research in an unknown area and in the interface between several different disciplines helps produce new knowledge. ■

My time is up.

After three years as chairman of NAF I recently passed the chairman's gavel to my Danish colleague Helge Paulsen. Despite its limited means, NAF has since the start been successful in implementing common Nordic projects within fisheries research. Mar-Eco, which we present in this issue of Nordfiskeri, is one of twelve projects that NAF partly financed in 2005 – within different disciplines such as oceanography, marine biology, new resources, the development of new research methodology, management principles, fish health, economics and markets.

Together, the Nordic countries export more seafood than anybody else in the world. The Nordic fishing and aquaculture industries therefore face a twofold challenge: Ensuring sustainable development for a number of Nordic communities – whilst satisfying a large share of the global demand for seafood. In this respect, sustainability will continue to be a key concept throughout the value chain – in order to ensure clean and healthy aquatic ecosystems to supply safe seafood to the world market. The way fishing and aquaculture are practiced and the level of pol-

lution in seawater and freshwater directly affect the market for seafood today – seen in the light of environmental labelling and ever stricter limit values for pollutants in food products.

Research plays an important role in this field by producing relevant knowledge and guidance for sustainable use of resources, both in order to ensure a high and stable long-term yield from fisheries and aquaculture and to document the quality of Nordic seafood. An important link here would be the development of common Nordic indicators for sustainable development within all areas of the value chain, from clean and productive ecosystems to safe seafood and sustainable fishing communities in the Nordic countries.

I hope this can be obtained through a good Nordic dialogue within research, management, and policies in the fisheries sector. ■

Yours sincerely

Åsmund Bjørndal

MAR-ECO maps the entire mid-Atlantic Ridge

MAR-ECO is a multidisciplinary and international project with the objective of mapping out animal life along the northern part of the mid-Atlantic Ridge (MAR). 110 researchers and students from 16 nations around the North Atlantic participate in the exploration of this ocean area stretching from Iceland to the Azores. The project started in 2001 and will last until 2008 and is associated with the global programme Census of Marine Life (www.coml.org). MAR-ECO is managed by the Institute of Marine Research and the University of Bergen.

In the summer of 2004 there was a two-month long expedition along the underwater mountain chain. It was investigated down to almost 4000 metres by means of advanced technological equipment on the new Norwegian marine research vessel G.O.Sars. Altogether 55 researchers from 13 countries participated in the expedition and collected a great deal of fresh knowledge, amazing photographs, film and living organisms. Several of them unknown to science.

The deep ocean is the largest, but least well known environment for biological life. The seabed along the MAR is very undulating with deep valleys of 4000 metres, whereas the ridge itself has a lot of shallow volcanic mounts at just 600 – 1000 metres below the surface. There are often fast currents around the underwater seamounts, and nutritionally rich water accumulates. The currents near the surface are also often influenced by the topography in areas with such mounts. On the surface there are fronts between cold water from the north and warm and saline water from the south, which dominates in some areas and strongly affects the distribution of various animal species.

One of the topics of the investigation is to map the top predators, i.e. whales and seabirds that congregate around the mid-Atlantic Ridge. This project receives support from the Nordic Council of Ministers via the Nordic Working Group on Fisheries Research (NAF). The person in charge of the project is: Leif Nøttestad, the Institute of

Marine Research, Bergen, Norway (e-mail: leif.nottestad@imr.no). Other participants are: Henrik Skov, Denmark, Gisli Víkingsson, Iceland, Rui Prieto, Azores, Portugal, Erik Olsen, Norway, Mark Tasker, Great Britain, and Gordon Waring and Mike Vecchione, USA.

News from the MAR-ECO expedition is put out on www.mar-eco.no on an ongoing basis. The project on the top predators has already been communicated through newspapers, radio and TV. The expedition was followed by a TV-crew, who produced a one-hour documentary broadcast on the Norwegian television, NRK1 on Christmas Day 2004. The programme will also be shown on other Nordic and international channels. The leaders of MAR-ECO have set great store by publicizing the work. On the 11th November 2004 the project leader Odd Aksel Bergstad received the Research Council of Norway 2004 prize for outstanding research communication. ■

“The Norwegian Sea Ecosystem”

Edited by Hein Rune Skjoldal et al

The Norwegian “Institute of Marine Research” conducted the project “Mare Cognitum” on the ecosystem of the Norwegian Sea between 1993 and 2001 together with researchers from other institutions in Norway, Iceland and the Faroe Islands. The aim was to change the status of the Norwegian Sea from a “mare incognitum” – the unknown sea, to a mare cognitum – a sea that we know. More specifically the purpose was to “identify and quantify the most important factors and mechanisms that lead to variation in the ecosystem in the Nordic seas, with the purpose of being able to predict fluctuations in sea climate, production and fish stocks”. The project has cost more than NOK 200m, and until now more than 60 scientific publications and more than 200 symposium and meeting presentations have been produced.

“The Norwegian Sea Ecosystem” presents the status quo of our knowledge of the ecosystem of the Norwegian Sea based in part on the results of the Mare Cognitum project. The book contains a total of 559 pages divided into 20 chapters, which are written mainly by the staff of the Institute of Marine Research. The first chapters give an introduction to the ecosystem of the Norwegian Sea and the hydrographic and climatic conditions. The book then goes through the biological taxonomy. It starts with plant and zooplankton and goes on to the most important fish species such as herring, blue whiting, mesopelagic fish, mackerel and salmon. The review of the animal groups finishes with three chapters on squid, mammals and birds. The book finishes with three chapters on “Feed network and trophic interactions”, “Variability in climate and ecosystems” and “Management of pelagic fisheries in the Norwegian Sea”.

“The Norwegian Sea Ecosystem” is an amazing and fascinating mixture of scientific review, text book in marine biology and “Illustrated Science”. The book presents a heavy, hard-to-access material in an exciting way, also for non-specialists. It is richly illustrated with many pictures and graphic illustrations. An extensive use of text boxes with in-depth explanations and small anecdotes makes it possible to focus on a specific subject without interfering with the whole. This helps make the book readable and interesting.

The editorial group behind the book has made a major effort to make it educational and logical in its construction. And they have been successful, for example through a brief introduction to ecosystems and food chains in the second chapter of the book complemented by in-depth cover in chapter 17. These chapters are written by the chief editor of the book and interlink successfully.

Somewhat more problematic is the editing of the chapters written by others. Here it seems that the authors have had a very free hand to decide on the content. The result is that parts of the content might be better placed in another context, and there are minor discrepancies. For example, a large section of the phytoplankton chapter describes the physical conditions, which would fall more naturally in the oceanography chapter and, to mention a detail, two chapters both have a text box with size classification of plankton. In one, plankton in the interval 20-200µm is described as “net plankton” whereas in the other one it is described as “micro-plankton”. The detailed description of selected animal groups means that other groups of organisms are hardly men-



tioned. That is the case of micro-organisms which are very important for the transformation in the ecosystem and large fish groups, such as other species of codfish and flatfish. Unfortunately, the authors have chosen not to take a closer look at the prospects of changes in the ecosystem as a function of climate changes and overfishing. This is a pity. Both because the possibility of predicting future changes is one of the main arguments for this important work, and because the question is of significance to all of us.

“The Norwegian Sea Ecosystem” is a fount of knowledge that can be recommended to everyone with an interest in nature and the sea. It is just a pity that the editors have been so modest as to not print the title on the back of the book so that it could be located quickly on the book shelf. ■



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Nordic cooperation on fisheries research
The Nordic Working Group for Fisheries Research (NAF) co-ordinates joint research projects, takes the initiative to improve Nordic research cooperation, finds

suitable areas for Nordic cooperation, and evaluates the technical content of applications for support for research projects.

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