

SESSION 5: Ecosystem approaches to fisheries management

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INTRODUCTION

The Barents Sea, named after the Dutch explorer Willem Barents (1549-97) covers an area of about 1,4 million km², with water depths mainly between 200- and 500 m. Being a relatively shallow ocean and due to the inflow of warm and nutritious Atlantic water, the Barents Sea ecosystem has a very high productivity – as compared with other arctic ocean areas.

The first large scale exploitation of living marine resources of the Barents sea was the catch of marine mammals like whales, seals and walrus from the 17th century as well as cod that mainly was fished in coastal waters during the spawning migration. In the early 20th century, most of the large whale species were overexploited and there was also a strong exploitation pressure on the seal stocks. After World war II, there was a rapid development of offshore fishing operations in the Barents sea – not only for cod, but also for several other target species like haddock, redfish, Greenland halibut, polar cod, capelin and shrimp. Over the same period the exploitation of marine mammals was gradually reduced to zero or very low levels. At present the harvest of marine mammals is limited to the traditional Norwegian whaling for Minke whale in accordance with recommendations from the Scientific committee of the International whaling commission and Norwegian and Russian hunt for harp seals in accordance with recommendations from the International Council for Exploration of the Sea (ICES). ICES also provides quota recommendations for sustainable development of the Barents Sea fisheries on the different fish stocks mentioned above.

With a steady increase in fishing effort from the 1950-ies, driven by technological developments of fishing vessels and fishing methods, signs of over-exploitation of several stocks became apparent. The most dramatic case was that of the Norwegian spring spawning herring (spending the juvenile stage in the Barents Sea), with a total stock collapse in the late 1960-ies as a result of hard fishing pressure combined with adverse climatic conditions. Similar signs were also observed for other stocks – and in the late 1970-ies the first quota or Total Allowable Catch (TAC) was set for the Northeast arctic cod fishery – and later this was followed by TACs for most of the commercially harvested fish stocks in the Barents Sea. In addition, different technical measures have been introduced, mainly to protect juvenile fish, as regulations on mesh size, use of sorting grids, temporarily closed areas, by-catch limitations and different control and enforcement measures.

Since the introduction of Exclusive Economic Zones (EEZs), the management of the fisheries in the Barents Sea including decisions on TACs, different technical measures and development of harvest strategies have been conducted by the Joint Norwegian-Russian Fisheries Commission. Scientific advice - from ICES and directly from the scientific institutions in the two states is the basis for most management decisions made by the joint commission.

Scientific assessments of- and forecasts for the development of fish stocks are hampered with uncertainty and hence, management of fisheries is always based on decision making under uncertainty. Despite a series of advancements in scientific methodology during

the last decades, there is still a significant component of uncertainty linked to the scientific advice on fisheries management. The uncertainty is linked to the real harvest quantities of different species, but mainly to the great natural biomass fluctuations, which are characteristic for the Barents Sea ecosystem.

A main objective of an ecosystem approach to fisheries management is a more holistic approach to advice on management of ocean related human activities. For advice to fisheries management this means that incorporating data on ocean climate should reduce uncertainty of scientific recommendations for sustainable harvest levels, lower trophic level bio-production as well as species interactions on higher trophic levels in catch recommendations for target species.

For figures linked to this paper, see the corresponding power-point presentation given at the 10th Norwegian-Russian Symposium – that can be found on the compact disc enclosed in the Symposium proceedings.

ECOSYSTEM APPROACH TO FISHERIES MANAGEMENT

The concept of ecosystem approach to fisheries management is still being developed globally, with no clear definition of the concept. As marine ecosystems dynamics are very complicated the concept of ecosystem approach can also be made very complicated. However, to make it operational, it is necessary to simplify and focus the approach – which can be summarized in the following main elements:

- Improved advice for sustainable fisheries: Better knowledge and understanding of marine ecosystem dynamics – for improved advice to management for sustainable exploitation of living marine resources.
- Reduced ecosystem effects of fishing: Develop fish capture technology for reduced ecosystem effects of fishing. This means technology for aimed harvest of target species and sizes with least possible effects on other components of the ecosystem.
- Clean and healthy marine ecosystems: Develop indicators for “ecosystem health” – which can be monitored as basis for assessment and advice on ecosystem effects of fishing and other human activities related to the marine ecosystems. Important aspects will be the assessments of marine pollution and marine biodiversity with corresponding advice to secure clean and healthy oceans as a fundamental basis for marine life and food production.

ECOSYSTEM APPROACH TO SCIENTIFIC ADVICE FOR MANAGEMENT OF THE BARENTS SEA FISHERIES

Status and basis for an ecosystem approach

An ecosystem approach does not represent something fundamentally new in marine and fisheries research. We do not start from scratch, but the ecosystem approach represents a new focus and direction for a more holistic and interdisciplinary way of understanding ecosystem dynamics and corresponding reductions of uncertainties in advice to fisheries management.

Jointly, IMR and PINRO have developed long time series for the main components of the Barents Sea ecosystem. One of the PINRO hydrographical sections (the Kola section) can be dated more than 100 years back and is among the oldest global marine data time series. In

addition there are other long time series on hydrography, plankton, fish and marine mammals that are important elements of a future ecosystem approach to management advice for the Barents Sea fisheries. Further, there are time series on species interactions – particularly on the diet of North-east arctic cod. Models exist both for single stock and multi-species assessments. In a global perspective, the capelin stock assessment is one of few where multispecies considerations are used in an operational way. For the Barents Sea fisheries there are numerous regulations to promote sustainable harvest of the living marine resources. The precautionary approach to fisheries management has been adopted for the management of the Barents Sea fisheries and management strategies for sustainable fisheries have been developed.

Improved advice for sustainable fisheries

Despite all existing knowledge about the Barents Sea ecosystem and development of management strategies for sustainable fisheries, the ecosystem approach calls for a considerable increase of data (in time and space) as well as integrated operational models that are able to include both quantified and not quantified ecosystem information in the assessments and advice for TAC decisions.

To obtain the necessary data input it will be important to develop new platforms for data collection. In addition to surveys with research vessels, data should be supplied from platforms like satellites, buoys and permanent installations for data collection. It will also be of high importance to develop the fishing fleet for data collection – either through scientific observers and / or direct data collection and reporting of catch-, biological and environmental data from the fishing fleets. The latter demands development of automatic and semi-automatic systems for data collection. In this context PINRO has for many years used observers on commercial fishing vessels to collect data for scientific purposes, while IMR recently has established a so called Reference fleet of fishing vessels reporting catch and biological data on an agreed format – for use in stock assessments.

In addition to increased data in time and space, there is a need for new systems for data handling and quality control as well as development of models that can incorporate ecosystem information in regular stock assessments. Over the past two decades, multi-species models aimed at optimizing the fisheries management have been developed for the Barents Sea ecosystem. MULTSPEC, AGGMULT and Bifrost are major multi-species models developed by IMR for the Barents Sea, and MSVPA and STOCOBAR have been developed by PINRO. To co-ordinate efforts in developing the multi-species models for the Barents Sea scientists from PINRO and IMR are working collaboratively in integrating the two models Bifrost and STOCOBAR.

For implementing the ecosystem approach to fisheries management, further improvement of assessment models and management schemes should be supplemented by modification of the overall system of data sampling and processing. Preference should be given to ecosystem surveys allowing comprehensive sampling, rather than single-species surveys.

Reduced ecosystem effects of fishing

An important aspect of the ecosystem approach is to harvest given TACs of certain target species and size with lowest possible by-catch of non target species, least possible effect on bottom habitats and in an energy effective manner to reduce fuel consumption and corresponding pollution per catch unit. Several measures have been introduced to mitigate unwanted by-catch in the Barents Sea fisheries. In the trawl fisheries for shrimp and groundfish, sorting grids to release by-catch of juvenile fish are mandatory. Another example

is the introduction of a bird-scaring device, which effectively reduces the by-catch of sea birds in the long-line fisheries. Still there are challenges to make most fishing gears more “ecosystem friendly” and research is needed such improvement. As a basis for this research – an evaluation of the total ecosystem effects of different fishing gears should be made.

Clean and healthy marine ecosystems

The oceans have for decades been recipients for pollution from different sources of land- and ocean related activities. In addition to natural substances in seawater, we have during the last decades experienced an increasing amount of pollutants like PCB, PAH, dioxine and heavy metals in the sea. These harmful substances are absorbed in the marine food chain and accumulated as they pass from lower to higher trophic levels. Although the Barents Sea is regarded as a relatively clean area, it is of utter importance to monitor the state of pollution and identify and advice against activities being main sources of pollution.

Research organization

Organizational approaches to ecosystem based fisheries management.

From 2003 IMR in understanding and co-operation with PINRO changed the survey program in the Barents Sea from pure single stock surveys to integrated multispecies and ecosystem-oriented surveys. The ecosystem approach has also inspired organization changes of the institutions. Thus, IMR reorganized in 2003/2004 from a thematic to an ecosystem based organization structure – where the thematic model with departments for marine resources and marine environment is replaced with ecosystem based advisory programs – for the Barents Sea, Norwegian and North Seas, the coastal zone and mariculture.