

ECOSYSTEM ASSESSMENT. HOW CAN RESEARCH SURVEYS CONTRIBUTE TO AN IMPROVED KNOWLEDGE BASE FOR FISHERIES MANAGEMENT?

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Introduction

Under an Ecosystem Approach to Fisheries (EAF), the scope of fisheries management broadens to include, among others, ecosystem effects of fishing and effects of the environment on fisheries and their target species. Broadening the scope of fisheries management also entails increased requirements as regards the scientific information needed for decision-making particularly as regards ecosystem structure and functioning and biological diversity. Likewise, there is also a need to identify key variables and processes in the ecosystems and to develop appropriate indicators through which the status of the ecosystem can be monitored in a simple and cost-effective manner.

While incomplete scientific information should not prevent managers from taking cost-effective action to prevent unsustainable fishing practices, consistent with the principles of the FAO Code of Conduct for Responsible Fishing (CCRF) and the related Ecosystem Approach to Fisheries (EAF) (FAO, 1995; 2003), decision-making can greatly improve its performance if informed by relevant scientific information.

Carefully planned scientific surveys can provide unique synoptic information on the state and the dynamics of the marine environment, to help address key environmental and resource issues to be dealt with under an EAF. These include, for example: monitoring the abundance and determining the spatial and seasonal/annual distribution of key target species; assessing the abundance and distribution of those species which, although not commercially important, may play a key role in the ecosystem structure and functioning; mapping biodiversity, bottom habitats and associated species; and studying the physical characteristics of water masses, with a view to understanding key

biological processes associated with them. Information from scientific surveys can also serve as complementary inputs to stock assessment models largely relying on fisheries-dependant data.

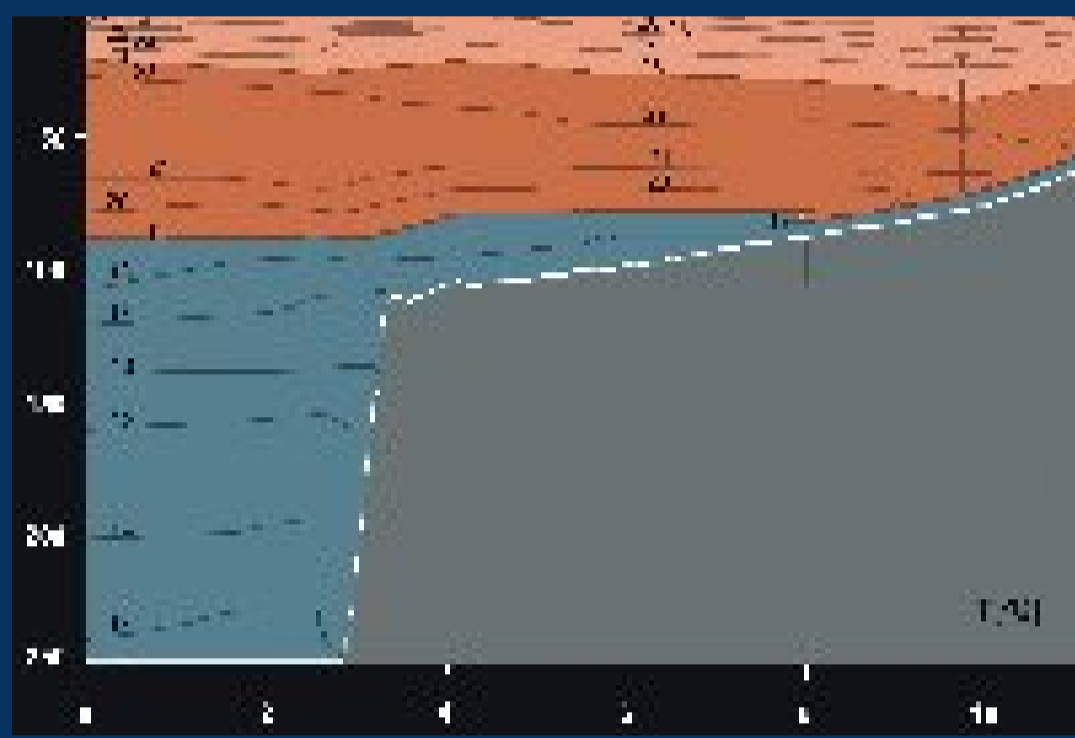
The EAF-Nansen Project

The Nansen Programme has carried out fisheries resources and environment surveys in developing countries since 1975. In 2006, the Norwegian Agency for Development Cooperation (Norad) approved a five-year follow-up project to the Nansen Programme (*Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries*) to be implemented by FAO, and with the expanded scope of contributing to improved fisheries management and the implementation of EAF.

The research vessel Dr. Fridtjof Nansen will be an important tool in the new Programme, complementary to other activities aimed at institutional strengthening and capacity-building for the implementation of EAF. Surveys will be carried out in collaboration with partners such as the five GEF-funded Large Marine Ecosystem Projects around Africa. The archive available from earlier surveys contains valuable and scientifically unique information that in many cases describe pristine conditions previous to fisheries development. These provide valuable benchmarks for the development of ecosystem indicators.

Ocean climate

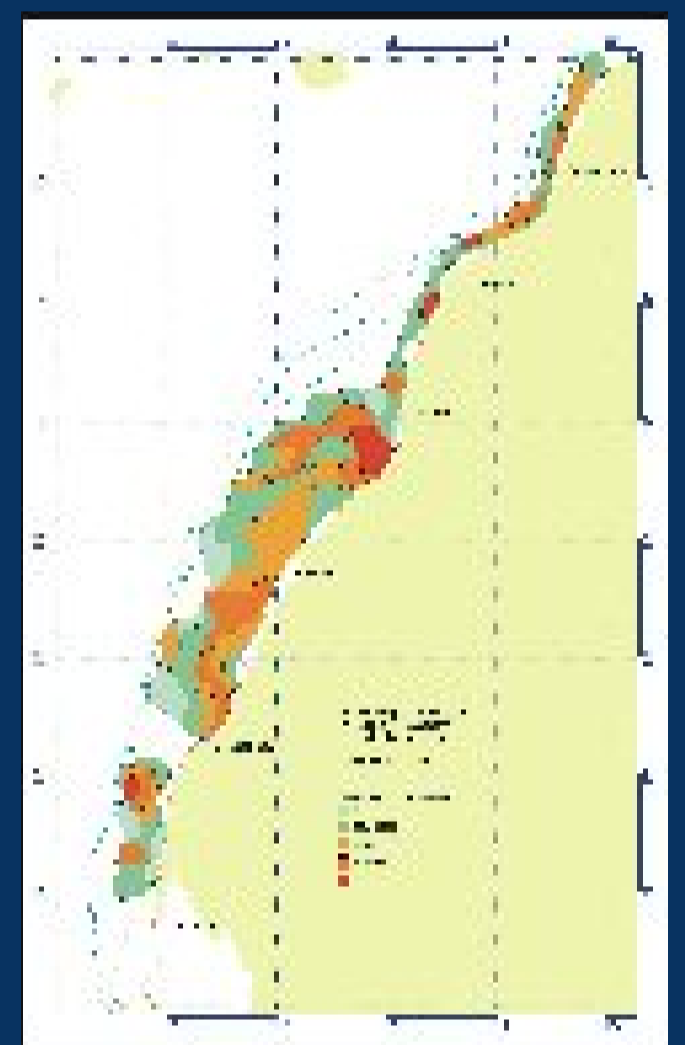
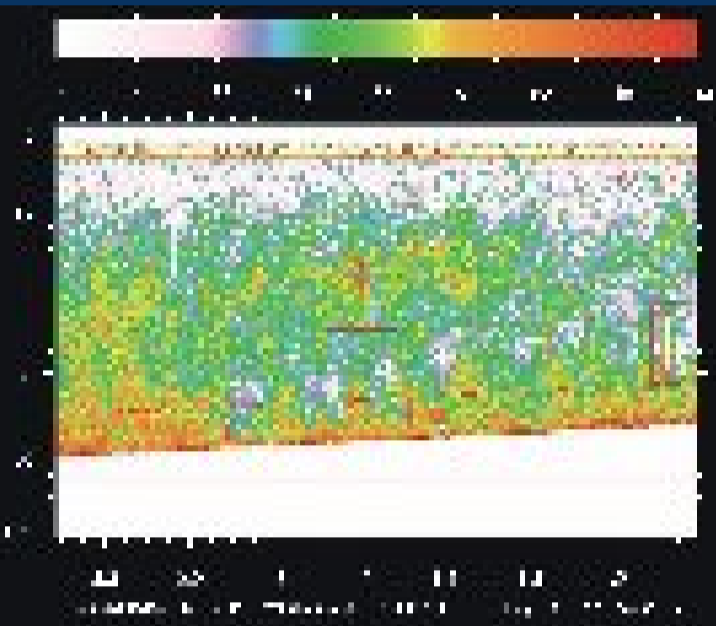
A vertically launched CTD-sonde and the surface salinograph provide information on temperature, salinity and oxygen used to produce vertical and horizontal profiles of the physical characteristics of the water masses. The Acoustic Doppler Current Profiler (ADCP) can record vertical profiles of currents in the ships track, while launched current meters record the time dynamics of the water currents in critical areas. Such information is useful in understanding the distribution and movements in fishery resources and other ecosystem components which can help in determining optimal management measures and approaches.



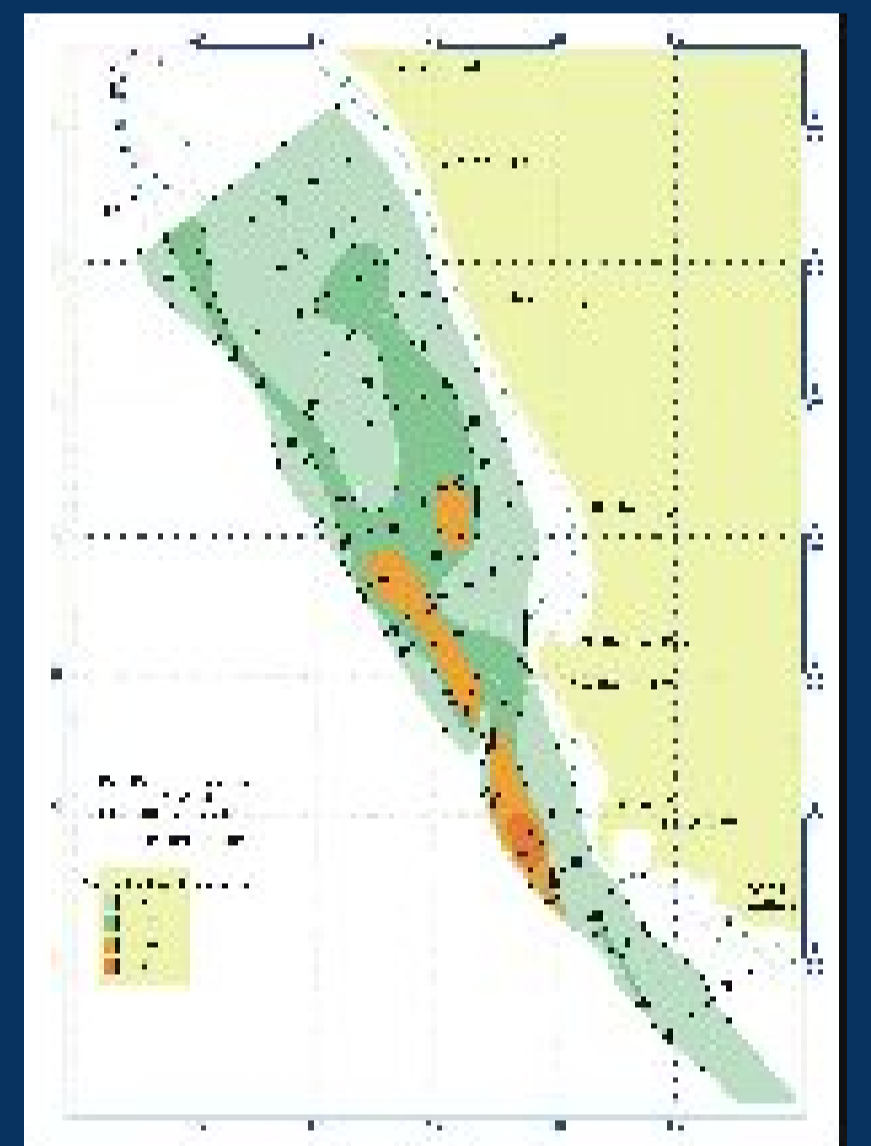
Monitoring of pelagic resources



Acoustic densities are split into species or species groups based on information on the characteristics of the acoustic traces on echograms combined with trawl samples, and plotted in distribution maps, providing abundance estimates, also by size groups.



Monitoring of demersal resources



Information on species composition, distribution and abundance of demersal species in the survey area is obtained using a calibrated fine meshed bottom trawl following a statistical sampling programme. Length and biological samples can provide information on size groups, sex or maturity stages.

If a time series of surveys is available, the natural fluctuations of recruitment and the effects of fishing on the fishable part of the stock can be assessed.

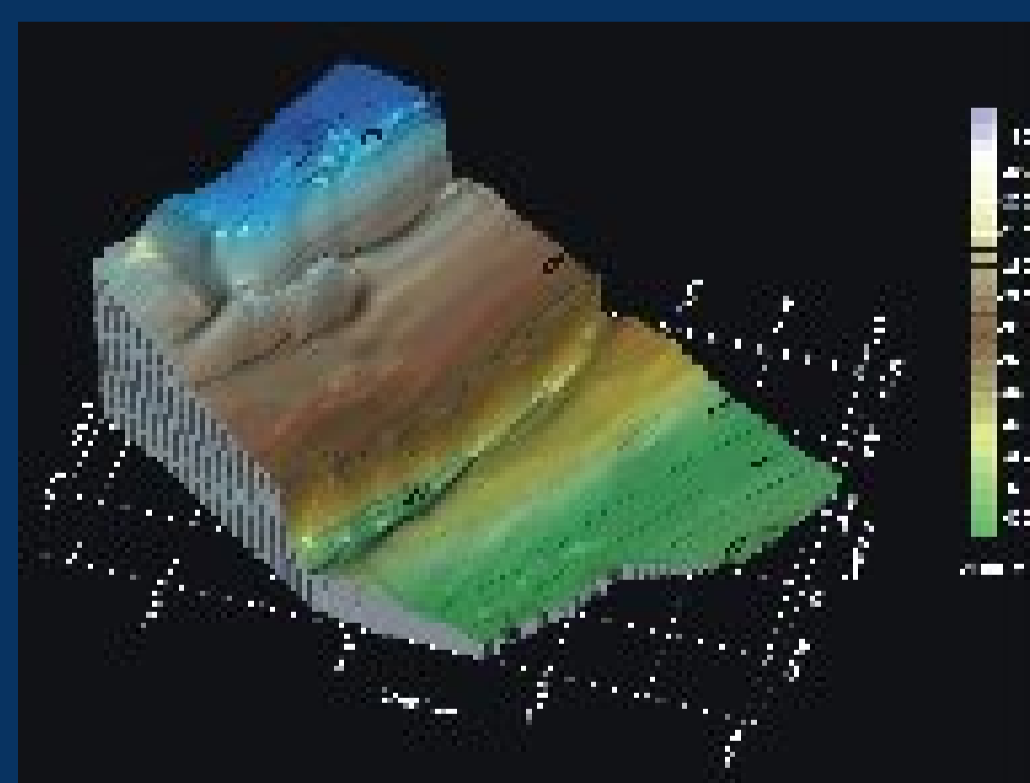
Plankton and nutrients



Phytoplankton is collected from water bottles attached to the CTD. Fluorometers attached to the CTD and to the surface salinograph, give indices of abundance in vertical and horizontal profiles. Grand scale distribution of phytoplankton from satellites monitoring sea-colour is linked to *in situ* data. Zooplankton is sampled by nets, controlled to open and close at determined depths.

Spatial and temporal trends in plankton abundance and distribution can provide important information of relevance to fish: their early life stages, the availability of food, changes in the eco-system and other factors which can potentially assist management within EAF.

Bottom topography & Habitat mapping



Information on bottom topography from the acoustic system combined with hydrographic data provide a better understanding of fish migration, critical habitats for fish and effects from marine pollution. This information is of relevance for setting up spatial management units e.g. Marine Protected Areas (MPAs).



Benthos



The grab provides information on sediment type, benthos fauna and the level of pollution around potential sources, such as oil platforms or industrial outlets. Indices of the epibenthic fauna can also be recorded by traces of such material in the bottom trawl. Visual observation methods from camera mounted frames and towed platforms give information on effects of trawling or natural disasters on the bottom fauna.

Conclusions

Consistent with the objectives of conventional fisheries management, scientific surveys in the past have mainly provided information on target stocks. Abundance estimates have been used either to tune stock assessment models, or more directly to produce biomass abundance trends to guide fisheries management.

Under an ecosystem approach, the scope of data collection and research through surveys broadens. The relevance of the information that can be obtained through surveys increases as this may be the only platform for obtaining key ecosystem data and information.

Ecosystem surveys provide synoptic information on the state of the marine ecosystem, and if a time series is established, natural and manmade ecosystem changes can be monitored, and useful indicators developed to inform fisheries management. Surveys can be designed to develop baseline studies needed for assessing long-term effects of fishing and the possible impacts of climate change on the marine environment and on fishery resources, an area so far largely unknown.

Scientific surveys provide a unique opportunity to collect key information that can be used directly or indirectly for decision-making and to collect data sets from which subsets can be drawn for more specific studies.

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