

ICES Annual Science Conference (2001) and the 89th Statutory Meeting: Observer's Report:

The 2001 Annual Science Conference (ASC) of ICES (International Council for the Exploration of the Sea) was held in Oslo, Norway from 26-30 September 2001. The conference was opened by the Norwegian Crownprince Haakan.

Chile was accepted as observer to ICES. There were more than 500 marine scientists present from Member and observer Countries of ICES. In addition there were observers from other international organisations.

The open lecture was given by the former Norwegian ambassador Mr. Thorvald. Stoltenberg on "Our Common Future: A Political perspective on the Ocean and related Issues". Three invited speaker gave a talk at the meeting. Finn Bergesen jr (Norway) Director General for the Confederation of Norwegian Business and Industry talked on "Knowledge requirements in the development of fisheries and mariculture". He concluded that there is a need for political independent advice on which to build management and that this advisory process should include science, management and the industry. Coleen L. Moloney (South Africa) talked on "Ecosystem studies and fisheries management: the Benguela experience", describing a formal research partnership that were established among government departments, universities and museums in South Africa. She described how the studies conducted to understand the Southern Benguela upwelling region in order to understand and integrate understanding of the upwelling ecosystem, with one of the objectives being improving fisheries management. She also described how this program has enabled a productive partnership between academic researchers and fisheries managers. The third invited speaker, Stephen J. Hall from Australia talked on "Fisheries Management from an Ecosystem Perspective: how do we get there from here?". In his talk he focused on the transition from a single-species framework for fisheries management towards one that incorporates the wider considerations required of an ecosystem-based framework.

The conference was structured 15 theme sessions highlighting topics of current scientific interest. With respect to fisheries management, the sessions of particular interest were:

1. Theme Session on The Life History, Dynamics and Exploitation of Living Marine Resources: Advances in Knowledge and Methodology

This Session attracted more than 50 contributions which were organised into six sub-sessions. These were

Spawning adults and larvae studies. Chair: Olav Sigurd Kjesbu

Crustaceans. Chair: Julian Addison

Molluscs. Chair: Pauline Kamermans

General fish studies. Chair: Jens Christian Holst

Methodologies. Chair: Julian Addison

Marine Mammals. Chair: Christina Lockyer

Many felt that it was important to strengthen recommendations on what ICES should advise and investigate. It was emphasised that there must be more information

gathered on species that may become targets of fisheries in the future, so that management advice based on generic harvesting models could be in place before exploitation began. A particularly important model component is knowledge on age/size at sexual maturity. One example was on anglerfish, which was originally a discarded by-catch, but had now become a valuable if dwindling commercial fishery where the mature fish appeared to have disappeared.

2. Theme Session on The Response of Cephalopod Populations and Fisheries to Changing Environment and Ecosystems

Co-Conveners: Ronald K. O'Dor, Uwe Piatkowski, and Graham J. Pierce

Cephalopods pass through pelagic and (often) benthic phases - but go through them very quickly. They may be among the fastest responding biological indicators to pick up anomalies (c.f. W session which identified large scale physical oceanographic changes - reflected in cephalopods). However, this may mean that we cannot predict abundance trends very far ahead - i.e. they are indicator species and there are limits to what can be done with prediction.

Several models presented included satellite-derived temperature, which is potentially available for near-real-time forecasting. Satellite data can also be used for novel applications such as tracking the locations of night fishing jugging boats.

3. The Stock Structure of Atlantic Cod: State of the Art

Co-Conveners: Svein-Erik Fevolden (Norway), Daniel Ruzzante (Denmark), Tom Cross (Ireland) and Anna Danielsdóttir (Iceland)

Cod exhibit population structuring at geographic scales that are relevant for fisheries science and management. Several studies with mtDNA RFLP do not show structure within geographic regions, however this is likely a reflection of the technique's low power rather than of real lack of structure.

It was shown that it is possible to use archived otoliths for examining long term temporal genetic composition of cod complexes. This approach is likely to provide insight into potential sources for population recovery in depressed stocks

Studies that use a combination of genetic with morphometric markers and or meristic markers are needed.

4. Developing Salmon Conservation Limits – Recent Progress and Reviews (M)

Convener: Niall O'Maoileidigh (Ireland)

With regard to a suggestion for a future session on “Interactions between aquaculture and wild fisheries”, it was concluded that a full symposium should be developed between ICES and NASCO to complement a number of symposia (notably in 1994 and 1997), which have published significant proceedings. The Symposium could also

be opened to a broader mariculture and marine fisheries audience to provide a wide scope for papers and participation.

5. Case Studies in the Systems Analysis of Fisheries Management (N)

Co-Conveners: Jon G. Sutinen, Daniel E. Lane, and Brian Rothschild

This session showed a variety of approaches to systems analysis ranging from biological structures and processes relevant to fisheries management to discussions of the relevant processes to be incorporated in building fisheries systems models for sustainable fisheries. A particular interesting paper presented the New Zealand adaptive management system.

6. Application of Mark-Recapture Experiments to Stock Assessment

Co-Conveners: John Bratley (Canada), Noel Cadigan (Canada), and Adriaan Rijnsdorp (Netherlands)

A general theme that arose in this Session was the need to account for tagging mortality, tag loss, and reporting rates when interpreting the results from tagging studies. If no understanding exists about these quantities then tagging programmes may not provide information that is directly useful for stock size estimation. However, such programs may provide useful indices of stock size and information on migration rates.

Data storage tags can provide excellent information about fish behaviour and should be used simultaneously with traditional tags. Cost benefit analyses would be useful in this regard as DST's are expensive but they are becoming cheaper and smaller. DST's could be combined with high-reward tags to estimate reporting rates. DST's are most useful in regions with extensive hydrographic data and can provide new insights into fish movement.

7. The Quality and Precision of Basic Data Underlying Fish Stock Assessment and Implications for Fisheries Management Advice

Co-Conveners: Martin Pastoors (Netherlands) and John Simmonds (UK)

Contributions were grouped into three themes:

- Dealing with uncertainty in catch at age data.
- Survey indices: how much and where to sample
- Effects of uncertainty in basic data on stock assessments

Dealing with uncertainty in catch at age data.

Six papers were presented on precision of catch age data, examining the influence of both sampling and age estimation. One paper provided an excellent methodology for estimating the precision of catch at age from the fishery using a bayesian hierarchical

model. The issues of errors in age estimation were highlighted and in particular a method of using otolith weight as an estimator of age was proposed. Another contribution highlighted the necessity to reduce bias rather than to improving precision. In the discussion the accuracy of total level of landings was raised as a crucial issue in the estimation of catch at age. Assumptions that this is measured without error can rarely be regarded as reasonable. Investigations of sampling requirements need to include cost as well as precision. Inclusion of discard data was mentioned as a potentially important or crucial element of the total catch estimation process.

Survey indices: how much and where to sample?

Nine papers were presented on the issue of survey data both addressing the methods of collecting survey data as methods to provide indices.

Two papers looked at the effort allocation on surveys in the Barents Sea. The studies concluded that reducing trawling time and increasing the number of trawls and distributing these throughout the survey area would be advantageous. The same conclusion on area allocation was also supported. A paper on survey effort allocation for the Mackerel and Horse Mackerel egg survey concluded that it would be beneficial to reduce sampling in low abundance areas and increase sampling in high abundance areas, thereby reducing the inter-sample distances in these areas.

In the discussion it was considered that reducing trawling time may not be generally applicable and also dependent on the objective of the survey. Where the trawl is believed to sample the fish distribution independently of fish behaviour, short trawls would be applicable. However, if the trawl is operating by herding in front of the gear, catches may be related to the duration of the trawl. It was suggested that the dark turbid waters in the Barents Sea in winter may have an impact on fish behaviour which makes shorter trawls suitable.

Effects of uncertainty in basic data on stock assessments

Eight papers addressed the effects of uncertainty in basic data on stock assessments and management advice. Two papers focussed on the effects of mean weights and maturity at age. Another focussed on the time of spawning which could be used as an indicator of spawning potential. The likely consequences of age reading errors on the management advice for Baltic cod was also explored. This suggested that the implications for management advice were relatively small. Three papers were presented as the outcome of a EU funded research project. These papers evaluated the influence of uncertainties in the catch at age data and associated variables on the management advice for North Sea herring, cod and plaice. When a commercial CPUE tuning index is used, the assessment is more sensitive to the uncertainties in the basic data. When only the uncertainties in the catch at age data are taken into account, the assessment models tend to be robust to the levels of uncertainty.

The discussion focussed on the robustness or insensitive nature of the assessment models. In general the process of averaging will reduce variance. It was concluded that it was important to use multiple assessment models so as to investigate some of

the uncertainties associated with the structural model assumptions. It was suggested that the assessment models used could be over-parameterised.

In conclusion, it was pointed out that currently ICES has successfully coordinated a series of surveys and a strong recommendation was put forward to set up an ICES Group to coordinate the collection of commercial catch data. This Group should also look at the methodology to obtain raised numbers at age.

8. Catchability and Abundance Indicators – the Influence of Environment and Fish Behaviour

Co-conveners: Pierre Fréon (France) and Dankert Skagen (Norway) Rapporteur: François Gerlotto (France)

Technological improvement (acoustics, electronic tags, sensors on gears, statistical tools) in recent years have allowed substantial improvement in the knowledge of factors responsible for biases and errors in abundance estimates related to fish behaviour and environmental factors. Such studies have to continue in the future but at the same time there is a need to improve ways to incorporate this knowledge into stock assessment methods. This can be achieved either by improving data collection (survey design, gears, commercial sampling scheme, etc.), correcting indices when post-processing data (GLM, GAM, etc.) or modifying the final assessment models.

9. What Information Does Ecosystem Management Need from Ecologists and Gear Technologists to Assess Ecosystem Effects of Fishing and Implement Policies?

Co-Conveners: Dick Ferro (UK), Karel Essink (Netherlands), and Jake C. Rice (Canada)

This Theme Session consisted of nine contributed papers, one of which was not presented. There was a consistent thread throughout all the presentations; that the scientific community is rapidly increasing its ability to collect information about marine ecosystems and make that information available widely. The Session included a presentation of a conceptual/theoretical framework for evaluating environmental effects of fishing practices on benthos, as well as several technological advances for detecting and measuring those effects. The technologies included underwater video, acoustic monitoring, and experimental research programmes of multiple sorts. The Session also included a contribution that applied GIS methods to quantifying the distribution of fishing effort in space and time. Progress on by-catch reduction was also reported. In addition, a proposal was made for a 10-year project, at an extremely large scale, to combine information for diverse sources, including fisheries, research monitoring, climate and meteorology, and social-economic sources, in data bases usable by both the research and management communities. All the contributions illustrated that just as interest in managing human activities in an ecosystem context is increasing, our abilities to work as scientists in that larger ecosystem context are also increasing.

10. Eutrophication, for better or for worse: Can it be controlled?

Co-convenors: Lars Føyn (Norway) Eugeniusz Andrulowicz (Poland) and Victor N. de Jonge (Netherlands)

Eutrophication depends on light, nutrient input and water residence time.

Point sources can be controlled, while diffuse sources could be controlled but it is less easy to do so.

Water residence time cannot be controlled. Thus depending on this a more rapid or less rapid system response can be expected (e.g. the North Sea compared with the Baltic Sea).

Regionally there has been success in controlling eutrophication (Oslofjord, Ems Estuary).

Further investigations are needed to monitor and understand changes in distribution of nutrients as a basis for development of eutrophic situations. The variations in the phosphate content in the Barents Sea are examples where it is not clear if the increase in phosphate is caused by intrusion of nutrient rich Pacific-water or may be an indication of a human-induced change. It is also of importance to be aware of the fact that different water masses do have different amount of nutrients, and concentrations that are looked upon as anthropogenic influences in some areas will be the normal no influenced values for other areas.

Because eutrophication is dealing with nutrients and the available amounts of nutrients are essential for biological production and, ultimately, fish production, a more detailed study into the scientific aspects of eutrophication and its ecological relationship might be of value.

11. Use and Information Content of Ecosystem Metrics and Reference Points

Co-convenors: Ronald Lanfers (Netherlands) and Jake Rice (Canada)

Several papers reviewed frameworks for developing or evaluating metrics, and illustrated their uses. Although the frameworks differed in detail, all gave attention to overall communication characteristics of metrics, to their reliability as indicators of change, and to the need for a tight linkage between the metric and the thing(s) about which decisions are being made. Diverse perspectives were offered with regard to whether comprehensiveness of metrics was actually a desirable property or not, but it is certainly an important consideration. Papers which applied such frameworks to a variety of metrics generally suggested that some and possibly many candidate metrics might not be particularly useful, at least in a management context. It was also suggested that ecosystem models need further development, if they are to be able to provide metrics of the status of ecosystems in an integrative way.

Many of the presentations, though, provided encouraging results with individual metrics, including ones using species life history characteristics, occurrence and distribution of rare species, and integrative multivariate analyses. For the benthic component of marine ecosystems, evidence and arguments were provided that metrics of habitat status, with some supporting population metrics, would be necessary and could be informative. In the longer term ecological context some trophic metrics

were also brought forward for consideration. The Session also included a presentation on a model and visualization tool for exploring complex questions about fisheries management in a multispecies context, and presenting the results in very clear and readily usable way for communication and decision-making.

12. Ecosystem Change in the Baltic

Co-Conveners: Sture Hansson (Sweden), Brian MacKenzie (Denmark), Ilppo Vuorinen, (Finland), Tiit Raid (Estonia)

Summary of presentations

The presentations offered a varied view of the problems of the Baltic, with effects of anthropogenic impacts from pollution and fisheries coupled with the effects of long and short-term natural variation. As different scientists turned the kaleidoscope, new angles were highlighted. An overview discussed changes and human impacts over the last 60 years. The international characteristics of our inland sea become obvious from several papers that reported on results from European Union (EU) projects, in which scientists from non-EU countries have also been involved.

The Baltic Sea has three strongly interacting commercial fish species (herring, sprat and cod). These were often in focus. The tight trophic couplings among the three, and how they are influenced by their abiotic environment was discussed in several contributions. Another presentation extended the analysis to include biotic and abiotic effects on long-term zooplankton dynamics. Being a brackish environment with a pronounced stratification, salinity and oxygen conditions are very important to many species, in particular cod and sprat. Because of these strong effects, the importance of understanding water movements is obvious. Physical factors, however, also have other impacts on the marine ecosystem, with upwelling as a key mechanism for transportation of nutrients into the euphotic zone. One presentation described a mathematical model, which predicted where upwelling and downwelling areas are likely be found. These results were generally supported by remote sensing data.

Coastal fish communities are rather similar around the Baltic. This is particularly interesting as most coastal species are relatively sedentary, and hence population changes in one place do not necessarily influence populations in other areas. Comparisons between areas can thus help to understand the mechanisms that influence these species. Changes occur in different species in relation to eutrophication, climate, intensive fisheries and hydrographic conditions. These coastal, sedentary species can be contrasted to some populations of herring, which perform feeding migrations into areas outside the Baltic. This can be clearly shown by their parasite burden.

13. Growth and Condition in Gadoid Stocks and Implications for Sustainable Management

Co-conveners : Lawrence Buckley (USA), Jean-Denis Dutil (Canada) and Tara Marshall (Norway)

Gadoid stocks live in very diverse environments and exhibit a wide spectrum of responses to biotic and abiotic factors. The session illustrated that the full extent of variability in growth, condition and reproductive parameters can only be recognized by comparisons among stocks. The rapid development and application of novel approaches and the focus on cod in national and international programs are providing new insights into the processes affecting growth, survival, recruitment and production. However, integration of the many different studies will require synthesis of results across life-history stages and stocks. In particular, the diverse data sets should be compiled in common or compatible formats and models linking the different life stages developed. Research survey sampling practices should be modified to provide the basic data (e.g. maturity and fecundity, liver, somatic and gonads weights) needed to set reliable biological reference points and to make improve medium term projections of stock biomass and production.

14. Transport Processes in the North Atlantic

The 2001 Theme Session focused on vertical and horizontal transport processes of importance for the ecosystem and the transport and fate of contaminants.

15. Sustainable Development and Conservation of Natural Resources of the Coastal Zone (Y)

Josianne G. Støttrup, (Denmark) and Poul Degnbol, (Denmark)

Issues that were discussed at the session include

- Defining objectives for coastal management:
- Who defines the objectives?
- Are different stakeholders' objectives compatible and how are they mediated in the management process?
- How are objectives relating to conservation and exploitation balanced, especially as stakeholder groups with a conservation interest may be more prominent in coastal areas.
- Management setup:
- Authority is generally divided between local and national government according to area or sector and coordination is difficult
- The legal framework is generally a patchwork of sector or area based regulatory instruments, which do not easily lend themselves to integrated management or may counteract integration.
- Implementation of participatory (involving stakeholders) approaches is necessary but also difficult.

Tools :

- MPA's are promising but possibly complex/diverse. Outside boundary effects have not been unequivocally demonstrated within the US experience.
- Experiences from tools used for spatial planning in the terrestrial domain can be utilised in the marine area, including mapping tools.