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Report of the 1986 Meeting of Marine Environment and Ecosystems Subcommittee of CAFSAC

by

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Introduction

The Marine Environment and Ecosystems Subcommittee of CAFSAC met from November 03 to 05, 1986. The meeting consisted of 5 sessions, several of which were relevant to the interests of the NAFO Environmental Subcommittee.

Session I included two presentations on "Using Bioeconomics in Setting Quotas"; the first "Fisheries Investment with Imperfect Information; Effects of Parameter Uncertainty and Bayesian Updating" by Anthony Charles (St. Mary's University, Halifax, Nova Scotia), and the second "Setting Quotas in a Stochastic Fishery" by R.A. Myers (Science Branch, DFO, St. John's, Newfoundland).

In the discussions following the talks, it was pointed out that the potential drawback of these methods requiring extensive computer simulations was being lessened as computer hardware was more available. There was an agreement that the lack of easy-to-use software was now the major deterrent to implementing these methods. Such software could be produced but before it would be worthwhile, the uniform adherence to $F_{0.1}$ as the basis of management would have to be reconsidered. There was extensive discussion of this point. It led to the final recommendation: that MEES invite SSSS to join it in sponsoring a workshop to review alternatives to $F_{0.1}$ as bases for management advice. The workshop would focus on results from analysis of a small number of data sets - real or simulated - to investigate how advice based on management strategies other than $F_{0.1}$ would differ from advice provided under that regime.

The second session was entitled "Studies on Juveniles of Canadian Atlantic Fish Stocks", chaired by S. Akenhead. The specific objective of the session was to:

"Review of the present status of studies of juveniles. This session would include examination of SPA and survey data for evidence of the age by which year-class strength is determined. It could include studies of the distribution of juveniles relative to adults and of the problems of sampling and survey design for juveniles".

The session featured 15 presentations:

Dual Recruitment Provinces for juvenile Cod in S.W. Nova Scotia, by S.E. Campana (BIO, Dartmouth, N.S.).

Acoustic Detection of Small Fish in the Gulf of St. Lawrence North Shore,, by L. Dickie (BIO, Dartmouth, N.S.).

Preliminary Evidence of an Inshore Nursery Ground for Juvenile Pelagic Cod off S.W. Nova Scotia, by I. Suthers (Dalhousie University, Halifax, N.S.) and K.T. Frank (BIO, Dartmouth, N.S.).

Environmental Factors Influencing the Distribution and Abundance of juvenile Groundfish in S.W. Nova Scotia by J. Horne and S.E. Campana (BIO, Dartmouth, N.S.).

Local Variation in Length Distributions of Juvenile Haddock from the Scotian Shelf by J.S. Scott, (DFO, St. Andrews, N.B.).

Diel Variability in Trawl Catches of Juvenile and Adult Yellowtail (*Limanda ferruginea*) on the Grand Banks: Effect on Estimation of Numbers and Biomass for Resource Assessment, by S.J. Walsh, (DFO, St. John's, Newfoundland).

Validation of Acoustic Surveys of Juvenile Capelin by Aerial Surveys and Commercial Catch Rates by B.S. Nakashima (DFO, St. John's Newfoundland).

A methodology using SCUBA Transects for Assessing Inshore Juvenile Cod, by D. Keats (MUN, St. John's, Newfoundland).

Diel Vertical Distributions of Juvenile Gadoids in Thermally Stratified and Mixed Watermasses: Implications for Survey Design, by R.I. Perry and J.D. Neilson (DFO, St. Andrews, N.B.).

The contrast between Sputnik shrimp trawl and the standard otter trawl for Juvenile Greenland Halibut by W.R. Bowering (DFO, St. John's, Newfoundland).

Growth of Juvenile Pollock (*Pollachius virens*) from Tagging Along the Atlantic Coast of Nova Scotia, Canada, by D. Clay (DFO, Moncton, N.B.), P. Beck and P. Hurley (BIO, Dartmouth, N.S.).

Interactions of a Caligid Ectoparasite and Juvenile Gadoids on Georges Bank, by J.D. Neilson, R.I. Perry, J.S. Scott, and P. Valerio (DFO, St. Andrews, B.N.).

Methods used in sex determination, identification and preservation of 1 and 2 year old American plaice and yellowtail flounder, by S.J. Walsh, (DFO, St. John's, Newfoundland).

Predation by Atlantic cod on juvenile redfish on Flemish Cap, by G.R. Lilly, (DFO, St. John's, Newfoundland).

Major Oceanic Features in Relation to Early Life History Stages of the Short-Finned Squid, by R.W. Trites and T.W. Rowell (B.I.O., Dartmouth, N.S.).

Following a general discussion, a conclusion and several specific recommendations were agreed upon.

In conclusion, the session did not achieve its initial objective of evaluating the age at which year-class strength is determined. No one undertook certain parts of the suggested research-specifically looking at SPA results. Inadequate independent survey results, due to sampling difficulties, precluded progress in other areas. Given the inadequacies of current sampling programs for juveniles, the initial objective appears to be premature for virtually all marine fish species. The objective is still important, and these lines of research should be encouraged, however.

The following recommendations should improve the information obtained from such research.

- 1) Studies of the basic biology of juvenile fish should be encouraged. The current state of knowledge of the basic biology of many marine species is inadequate to even design effective surveys of juveniles, let alone apply information on the distribution and abundance of juvenile fish to management problems.
- 2) If a survey for juvenile fish is to be conducted, the following factors should be considered explicitly in the survey design: A-Pattern of diel migration, B-Potential for Gear Avoidance, C-Habitat preferences, and suitability of gear for the area, D-The advantages of surveying the pelagic vs. demersal stage of the juveniles given the purpose of the study, E-The expected pattern of dispersal during the pelagic or demersal stage.
- 3) Applications of hydro-acoustic techniques to surveys of juvenile fish are providing promising results. This work should be encouraged. Areas which deserve special attention include application of the methods to a variety of species, particularly during the pelagic phase, and problems of calibration. MEES recognizes the need for close collaboration with SSSS when considering hydroacoustics.
- 4) The use of non-standard gears for surveys of juvenile fish should be explored in some specialized contexts. Such gears include (but are not restricted to) diving and collection of predators.
- 5) From Bowering's paper, the SPUTNIK shrimp trawl survey appears to provide useful information on year-class strengths of Greenland Halibut several years prior to recruitment to the fishery. This data base, and similar ones if they exist, should be examined further, particularly with regard to information on other species. The strengths and weakness of this gear as a survey tool for young fish should be investigated systematically.

The third session was a presentation of a proposal for a Scotian Shelf Modelling Project. The purpose of the session was to inform and raise the interest of MEES in the project. The objectives of the project, and an outline of the emphases and initial approach of the project were presented and discussed at length. The discussion shifted to consideration of the value of holistic ecosystem modelling, and appropriate relationships of the proposed project to existing work in the area, such as the Fish Ecology Project. The discussion resulted in two conclusions:

- 1) The Scotian Shelf modelling project seems a understandable development from the state of holistic ecosystem modelling currently underway in Atlantic Canada.
- 2) The work of the Fisheries Ecology Project would be appropriate for presentation at a future meeting of MEES.

Session IV consisted of a meeting of the MEES Core Membership and other interested staff of the region, to discuss areas of future activity of the Subcommittee. Areas noted as currently receiving little attention from MEES, and otherwise having only tenuous links to the CAFSAC Advisory process included; the state and dynamics of the marine environment, habitat research and habitat management issues, and how human activities affect the marine (and freshwater) environments. No specific conclusions or recommendations were adopted, but discussions during session V indicated broad support for an annual consideration of the state of the physical environment and of the state of anthropogenic effects on aquatic ecosystems.

The concluding session V had 3 components. The first was the report of a Working Group established consequent to a recommendation of the 1985 MEES session on Environment and Recruitment. The Working Group was to identify appropriate statistical methods for analyses of the original data available to Sutcliffe and to redo his analyses using these methods.

R.A. Myers and K. Drinkwater conducted the work. They first reported analyses recommended for use when researchers are trying to relate time series of data on fish populations and on environmental variation. These were:

- 1) There must be an absolute separation between exploratory and confirmatory analysis in order to minimize Type II errors. This can be achieved by one of three methods: (i) an exploratory analysis can be published and then at a later date these predictions can be tested when new independent data are available; (ii) the data can be randomly split into two portions, the first of which is used for exploratory analysis and the second can be used to evaluate significance; or (iii) a priori hypotheses can be tested without initial exploratory analysis.
- 2) If possible, general hypotheses should be tested by combining significance levels from several independent tests of an hypothesis on several stocks.
- 3) Time series methods should be used for the analysis of time series data sets. In particular Box-Jenkins time series analysis is usually preferable for an exploratory analysis.

It was felt that difficulties inherent the original Sutcliffe data, including the use of catch rather than catch-per-unit effort, precluded useful returns for reanalysis of those data. Rather Myers presented the results of the further investigation of the predictive power of the relationships reported by Sutcliffe.

When the 9 to 14 years of new catch data were considered for the stocks analyzed in Sutcliffe's earlier work, predictive power of the earlier relationships was generally weak. Utility of environmentally-based predictions were also tested. Overall, the mean deviations of the predicted catch based on environmental regressions were similar to predictions based on the long term means but were higher than deviations from predictions using catch data a few years previous. Environmentally-based predictions of landings for invertebrate stocks were generally more accurate than those for fish stocks.

The second report was from the Cod-Capelin Working Group, established in the Newfoundland Region in response to another recommendation from the 1985 MEES meeting. The Working Group had identified four major lines of inquiry which had potential to provide insights into management implications of interactions of the two species. These are:

- 1) Analysis of the existing data base of cod body parts.
- 2) Analyses of existing data on migration of cod and capelin, including relevant oceanographic data.

- 3) Analysis of survey data bases on large-scale patterns of distribution and abundance of cod and capelin over space and time.
- 4) Quantification of how much impact, if any, the capelin fishery has on capelin stocks..

Action on 1 and 2 are expected in 1987.

The other components of Session V led to the adoption of the specific recommendations included in this report. Copies of the full MEES Subcommittee report can be obtained from the CAFSAC office. Individual scientists can be contacted directly for copies of their contributions to the sessions.

Plans for the 1987 MEES meeting are underway. Progress reports on work done in response to recommendations of previous meetings will be reviewed and new directions considered. New sessions are planned on 3 themes, as well:

- 1) The Value of Holistic Ecosystem Modelling to Fisheries Management.
- 2) Scientific Justification for Capelin Management Strategies.
- 3) Approaches to quantifying the relationships between oceanographic data (particularly temperature) and research survey and catch rate data sets.

The latter two sessions are in response to specific requests from CAFSAC. The session on quantifying relationships between oceanographic and fish population data sets is thought to be especially timely, given the NAFO special session for 1988. The MEES session, by focusing on identifying biologically and statistically valid approaches to the problem will lay a firm foundation for work to be conducted and then presented at the NAFO Session.