

Theme Session R

ICES advice in a changing world!

ICES CM 2006/R:01

Understanding the mechanisms of stock recovery – EU Project UNCOVER will develop recovery strategies

Cornelius Hammer and Christian von Dorrien

Presently, a number of exploited fish stocks in European waters are at historically low levels and in danger of collapse. For many of these stocks, management advice from ICES has been a closure of the fishery.

In light of this situation, the purpose of UNCOVER is to develop recovery strategies for EU fish stocks which are outside of safe biological limits. In order to develop these recovery strategies, the principle objectives of UNCOVER are to 1) identify changes experienced during stock decline and their consequences for the prospects of stock recovery, 2) enhance the understanding of mechanisms of fish stock recovery, and 3) provide recommendations for the recovery of EU fish stocks, which are outside of safe biological limits. To fulfil these objectives, UNCOVER will, utilizing a multidisciplinary approach, synthesise and integrate relevant information from previous and ongoing research programmes to evaluate and develop strategies for the rebuilding of stocks. Findings will identify changes experienced during stock decline as well as key processes impacting upon the potential for stock recovery. Results will be integrated into a modelling framework in order to evaluate and develop management strategies incorporating biological and environmental factors as well as technical and socio-economic constraints. UNCOVER will investigate the failures and successes of previous stock recovery activities and will try to define optimal strategies for recovery plans for the future. Recovery strategies developed in UNCOVER will be area- and ecosystem-specific and tuned to key species and their fisheries in the Barents Sea, North Sea, Baltic Sea, and Bay of Biscay. UNCOVER is carried out with financial support from the Commission of the European Communities; it has started in March 2006 and will end in February 2010.

Keywords: stock recovery; recovery strategies; stock decline; management strategies.

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ICES CM 2006/R:02

The changing political environment – the global marine biodiversity agenda, fisheries science, and ICES advice

Jake Rice

Conservation Biology, focusing on conservation of biodiversity, protection of species at risk, etc., has thrived for over a quarter-century. However, until recently interest focused on terrestrial species and ecosystems. Biodiversity studies generally appeared in different journals and meetings than those read or attended by experts in marine sciences. Correspondingly, scientists engaged in ICES advisory work did not consider biodiversity as core business. A Mini-Symposium at the 2000 ASC produced three recommendations for increased ICES activity in biodiversity, but none were enacted. The Convention on Biological Diversity and subsequent WSSD commitments changed the policy environment substantially. Now countries are confronting commitments to halt the loss of biodiversity—including marine biodiversity—by 2010. Working Groups of the UN General Assembly are planning for periodic Global Marine Assessments and seeking a science basis for MPAs in areas beyond national jurisdiction. ICES states are beginning to establish networks of MPAs within EEZs, in accord with the EU Birds and Habitats Directives. All these initiatives have major implications for “classic” fisheries management, and for science advice provided by ICES. ICES is almost totally absent from discussions on the science foundations for biodiversity initiatives. In the absence of groups with the rigour of ICES, other groups, often with partisan views and less marine expertise, are filling the void. It may not be too late for ICES to exert scientific leadership in marine biodiversity. The paper will lay out the opportunities and benefits from ICES taking the biodiversity agenda seriously, and costs to ICES and member states of failure to do so.

Keywords: biodiversity, science advice, fisheries, ICES.

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ICES CM 2006/R:03

ICES advice and the ecosystem approach – how are we actually doing?

Jake Rice and Stuart Rogers

ICES has endorsed an ecosystem approach to its science and advice, and the major clients of ICES advice have also accepted an Ecosystem Approach as central to their business. To deliver more integrated advice, ICES has established an Advisory Committee on Ecosystems, re-organized its Advisory Reports to an ecosystem basis, and supported several expert groups which produced methods and tools to facilitate putting ecosystem considerations directly into analyses and advice, especially on fisheries. In 2006 WGRED and WGECO separately tabulated the uptake of ecosystem factors in fisheries assessments and management strategies produced by ICES. The paper will present these tabulations, which show that classic single-species assessments remain business-as-usual, and if ecosystem issues are considered at all, they are as add-ons. Both WGECO and WGRED make a number of recommendations to improve the situation. These recommendations will be presented and their feasibility discussed.

Keywords: ecosystem approach, science advice, fisheries science, stock assessments, ICES.

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Theory on functioning of the Barents Sea ecosystem: fishery and oceanographic aspects

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A successful management of the marine ecosystem resources depends on understanding the principles and specificity of its functioning. The intermediate location of the Barents Sea between the Arctic and boreal oceanic systems determines the presence of the extensive frontal zones. It is generally accepted that owing to this peculiarity the Barents Sea is rich in various species of commercial marine organisms. A theory on the functioning of the Barents Sea ecosystem, developed on the basis of analysis of a considerable amount of retrospective data on oceanography and fishery, is presented. Results published earlier (Titov, 2001) and investigations of recent years testify that at the transition from the cold to the warm climatic conditions on the shelf of the Barents Sea, the frontal zones in the pelagic and then in the bottom layers become sharpened. Correspondingly, the conditions formed are favourable at first for the pelagic fish species (capelin) and then for the demersal ones (cod). These relationships correspond with the geographical

areas of distribution of fish species. Catch statistics for capelin and cod summarized for the recent decades show that concentrations of these species occur at the frontal zones in pelagic and bottom layers, correspondingly. On the basis of these data the main ideas of the theory on the functioning of the Barents Sea ecosystem were formulated: temporal variations of some characteristics of the Barents Sea ecosystem correspond to spatial peculiarities of their localization; climatic changes influence the abundance of cod and capelin by modification of frontal zone parameters; the abundance of cod and capelin is directly dependent on the quality of the environmental conditions for these populations in general. The theoretical assessment of consequences of the global climate change for the populations of cod and capelin in the Barents Sea is presented.

Keywords: Barents Sea, capelin, cod, frontal zone, marine ecosystem, theory.

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Harvest control rules and changing productivity: the working example of North Sea herring

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North Sea herring is managed by the EU and Norway through a harvest control rule where the target fishing mortalities are changed if the estimated SSB falls below a trigger biomass level (1.3 million tonnes). This management agreement was adopted in December 1997, and last amended in November 2004. The management agreement includes target fishing mortalities for both adult and juvenile fish. Initial studies to test the robustness of the rule assumed a stable state of productivity, with stochastic variability in recruitment.

Recruitment in North Sea herring has been successively poor for the last 4 year classes (2002, 2003, 2004, and 2005). This sustained sequence of reduced recruitment has not been observed before at current levels of stock biomass. According to a recent ICES study group (SGRECVAP) this serial poor recruitment has been caused by an increase in the mortality of the larvae over the first winter, and was not due to overexploitation of the stock. Thus, at least in the short term, the productivity of North Sea herring has changed, whilst the management agreement currently has not. As the agreement is primarily based on target fishing mortalities, changes in productivity should not undermine the management agreement; however, because the trigger points are based on biomass, they may no longer be optimum for sustainable exploitation.

In 2006, the ICES advice changed to account for the changes in the productivity of North Sea herring. Projected catches and SSBs were estimated assuming a shift in recruitment from the average of the last 25 years (since the stock recovered from collapse) to the average of the last four years to reflect the more recent low levels. The management agreement however, does not respond immediately to this advice about lower productivity, as the agreement decisions are triggered by the current state of the stock, not the projected state. This process is precautionary in the case of recovery, the regime under which the rule was developed, but has the opposite effect in the situation of sustained projected decline. In addition to the less than optimal biomass trigger points the agreement (amended in 2004) also now includes a maximum change in TAC rule, with a limit of 15% change per year, which apparently conflicts with the need to respond swiftly to changes in productivity of the stock in the presence of sustained decline.

Keywords: herring, changing productivity, North Sea harvest control rule, advice.

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ICES CM 2006/R:07

Links between OSPAR and ICES

Lisette Enserink, Paddy Walker, and Andrea Weiss

The links between OSPAR and ICES are long-standing. OSPAR is an important client of ICES and submits annual and fast-track requests. The prime areas of interaction are data management and advice. The advice requests cover monitoring guidelines for water, sediment and biota, toxicological indicators of environmental health, and the development of EcoQOs (Ecological Quality Objectives). Requests for advice from OSPAR are primarily dealt with by ACME and ACE. Member countries provide ICES with monitoring data from the OSPAR programmes JAMP (Joint Assessment and Monitoring Programme) and CEMP (Co-ordinated Environmental Monitoring Programme), which ICES then provides to OSPAR.

This paper will present an overview of the most recent requests for advice and how these have been implemented by OSPAR. It will also review the current agreements between ICES and OSPAR and their strengths and shortcomings. The paper will conclude by exploring the requests that OSPAR might make to ICES in the future in the light of new developments in marine policy and how ICES might be best equipped to deal with them.

Keywords: OSPAR, EcoQO, marine policy, monitoring, JAMP, CEMP.

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ICES scientific advice as a basis for negotiating the fisheries management decisions

R. Aps, L. Kell, H. Lassen, and I. Liiv

ICES scientific advice constitutes the important common element of the stakeholders' knowledge base, enabling them to generate valid arguments in the course of argumentative dialogues to resolve the fisheries-related interest conflicts. ICES scientific advice serves as the common ground for the generation of proposals, justifications, assertions, and challenges in accordance with the stakeholders' dialogue game protocol. However, the main focus is on the biological objective of sustainable fisheries while the socio-economic objective is often not clearly formulated or sufficiently understood. It is therefore more difficult in discussions to challenge proposals, justifications, and assertions related to the socio-economic objective, and consequently the stakeholders tend to attribute more importance to the socio-economic objective. ICES scientific advice, as an element of the stakeholders' knowledge base needs to be supplemented with transparent input of the desired advice based on socio-economic objectives. It is important to challenge the socio-economic justifications for setting the TAC in excess of scientific advice, and the belief that the agreed TAC on any of the stocks concerned may to a certain extent exceed ICES scientific advice with low risk of serious or irreversible harm to fishery resources. To narrow this gap, the minimum regret approach is used to find the optimal order of the stakeholders' preferences, aiming to strike the balance between biological and the socio-economic objectives, and to reconcile each individual stakeholder's preference with the optimal preference of all the stakeholders.

Keywords: scientific advice, fisheries negotiations, argumentative dialogues, minimum regret approach.

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Effort management for mixed fisheries in EU waters: a viable alternative for failing TAC management?

Niels Daan and Adriaan D. Rijnsdorp

We argue that the failure of fisheries management to constrain exploitation rates in mixed fisheries is directly

related to TACs constraining total reported landings rather than total catches of individual species. In practice, output control in these fisheries has undermined the scientific basis of stock assessment, because information on the total removals, essential input of any assessment model, is lacking. After 20 years of experience with the Common Fisheries Policy and its advisory system, it seems an illusion to expect future improvements in the stocks, unless the EU is prepared to consider fundamental changes in the control system. Direct input control provides such an option, but may also have unwanted side effects. We compare the advantages and disadvantages of the present TAC system and a Total Allowable Effort (TAE) system that is designed to maintain the concept of relative stability among the national fishing industries through fixed quota shares, one of the pillars of the political agreement. We also describe a dual system that allows for building up experience with TAE management under a TAC system and for an evaluation of its potential drawbacks. For the advisory system, accepting this approach would mean a paradigm shift in the collection of relevant information, which may be used to trace some of the uncertainty in the present catch forecasts.

Keywords: assessment uncertainty, TAC and effort management, partial fishing mortality.

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Assessing the potential effect of management scenarios for anchovy fishery of the Bay of Biscay using ISIS-Fish simulation tool

Sigrid Lehuta, P. Petitgas, and S. Mahévas

Despite the regulation of the Bay of Biscay anchovy (*Engraulis encrasicolus*, L. 1758) fishery by TACs, the stock recently dropped below the precautionary biomass level (B_{pa}). The biological characteristics of the Bay of Biscay anchovy, such as high growth and mortality rates, early reproduction and short life span, explain that the population largely depends on annual recruitment (Borja *et al.*, 1998) and thus on the environmental conditions. Since there is currently no reliable recruitment indicator, long-term management measures seem to be more relevant than annual TACs. The spatially and seasonally explicit simulation tool ISIS-fish was used to assess the impact of different management scenarios, such as marine protected areas, on the stock and fisheries dynamics of anchovy. The population and exploitation models underlying ISIS-Fish were parametrised using commercial data (logbooks and fishers interviews) and scientific data. Because of the uncertainty of many parameters, sensibility analyses were performed to quantify their impact on the output results. Finally, a statistical simulation design was built to assess the effects of the different management scenarios, including fishers' reaction to management measures. These results show that ISIS-Fish

can constitute a useful tool for the analysis of stock recovery plans. The specific application to pelagic fish has promoted improvements to the simulation software which need to be pursued.

Keywords: fishery management, simulation tool, data integration, restoration plans, anchovy, Bay of Biscay, ISIS-Fish, sensitivity analysis, experimental design.

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Environmental fisheries interactions in management advice

Brian J. Rothschild

Management involves making decisions that control production. In fisheries these decisions usually involve setting the magnitude of fishing mortality. Determining the appropriate magnitude of fishing mortality depends upon the development of criteria to determine the appropriate level of fishing mortality. These criteria are generally based upon past observations that relate fishing mortality to productivity, to stock size, and to recruitment. In this paper we study the relationships between spawning stock biomass, and recruitment and fishing mortality. We find that fishing mortality is not a good predictor of either recruitment or spawning stock biomass. We explore environmental variability as a reason for this counterintuitive result. We further consider how these results impact various management-related concepts such as “overfishing” and stock “rebuilding.”

Keywords: management, fishing mortality, overfishing.

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ICES CM 2006/R:12

From technical and scientific advice to integrated assessments – evolution of co-operation between HELCOM and ICES

Anne Christine Brusendorff and J.-M. Leppänen

HELCOM, the Baltic Sea Marine Environment Protection Commission, and ICES have had close cooperation since the establishment of HELCOM in 1974.

ICES has acted as a technical adviser in developing data reporting forms, quality assurance, and methodological manuals for environmental monitoring coordinated by HELCOM. HELCOM has a standing request to ICES for

supporting the two joint steering groups on quality assurance on biological and chemical measurements, the first one being also participated by OSPAR.

In addition to the standing request, HELCOM has made special requests to ICES dealing with various scientific aspects, such as assessing the state of the commercial fish stocks, populations of harbour porpoises and seals in the Baltic Sea, habitat mapping supporting the activities of especially the HELCOM Working Groups on Monitoring and Assessment (HELCOM MONAS) and Nature Protection and Biodiversity (HELCOM HABITAT).

ICES is acting as the data manager to HELCOM's oceanographic and biological community data.

Carrying out the GEF/World Bank-funded Baltic Sea Regional Project has been a major cooperation effort by HELCOM and ICES and has transferred several scientific requests by HELCOM into the core programme of ICES.

Implementation of the Ecosystem Approach and the HELCOM Baltic Sea Action Plan could start a new phase in cooperation between the two organisations. HELCOM, as the bridge between science and policy making and ICES as an international science organisation could enhance their cooperation in integrated assessment of the Baltic Sea marine environment and biodiversity.

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Other fish to fry, or how to reach sustainable fishery in the North Sea during a period of climate change?

A.P. Oost and P. Walker

During the twenty-first century climate may change in a still largely unknown way. Climate change may influence the rate of sea-level rise, wind climate (storminess), air and water temperatures and precipitation and river run-off. A non-exhaustive summary is given of possible changes for fish and shellfish to be anticipated for the North Sea and—as an example—the adjacent tidal flat area of the Wadden Sea, due to climate change.

A first qualitative appraisal shows that all the changes brought about by climate change may influence directly or indirectly (via changes in the food-web) the fish and shellfish populations in an often profound, but partly still unknown way. In the short term, temperature rise is expected to be the major cause for changes in the fish and shellfish populations. In the longer run, also sea-level rise and wind climate may exert considerable influence. River run-off and precipitation are thought to exert only a minor influence.

The question arises how fishery may plan on such an uncertain future. The best way is probably one which takes into account the trends of 1) average development of relevant physical parameters; 2) its annual variability, 3) the timing of the variation, and 4) the reaction of biota to these changes. Since the North Sea is a relatively shallow shelf sea, experiencing strong variability, it is expected to be not so much the changes in average development or the annual variability that are the most important, but rather the shifts in the timing of the annual variation. Hence, research and management should focus on these shifts and the reaction of the ecosystem.

Keywords: climate change, annual variation, management.

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The illusion of MSY

Laurence Thomas Kell and Jean-Marc Fromentin

An important driver for the future European fisheries policy is the World Summit on Sustainable Development, under which the EU is committed to maintain or restore stocks to levels that can produce Maximum Sustainable Yield (MSY) by 2015. The main value of MSY is that it combines biological and economic concepts (i.e. biomass and yield) into a single point, providing a common reference that can be used to assess the current and desired status of a stock.

However, this is also its main weakness; since fisheries are one of the most complex systems to understand and manage because of the mix of biological, ecological, economic, and social processes that are all dynamic and further interact with each other. Therefore MSY cannot be, in many cases, a robust objective in the face of uncertainty (i.e. due to the natural stochasticity in biological and economic processes) as it is a simplistic measure. For example, natural variability can mask the effects of exploitation, for example initial overexploitation is not detectable until it is severe and often irreversible. Exploitation, even at moderate levels, further induces complex and important modifications in population resistance and resilience through, e.g. changes in habitat, population structure, genetic diversity, or trophic interactions. Also, the short-term gain can result in a lack of interest in sustainability and the huge variety and complexity of systems makes it difficult to generalise. In this paper we review the various factors related to sustainability and illustrate their importance by reference to selected case studies conducted by the EU project FEMS (Framework for the Evaluation of Management Strategies).

Keywords: Maximum Sustainable Yield, MSY, sustainability.

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ICES CM 2006/R:15 – Poster

Sea scallop, *Placopecten magellanicus*, mass mortality in the Nantucket Lightship Marine Protected Area of Georges Bank

Kevin D. E. Stokesbury, Bradley P. Harris, Michael C. Marino II, and Jacob I. Nogueira

We observed a mass mortality of sea scallops, *Placopecten magellanicus*, in the Nantucket Lightship Marine Protected Area on Georges Bank, USA between 2004 and 2005. The entire population of sea scallops in this area, covering 3951 km², declined by 35% while half the

scallops in the dense aggregation located in the northeast corner (504 km²) died. The scallops that perished were large, ranging from 110 to 180 mm shell height. Only 8% of this decline was explained by fishing mortality. Synergistic effects of senescence, parasitism of shell borers and prokaryotic infection are likely leading factors causing the NLCA scallop mass mortality. This loss is equivalent to approximately 7015 mt (15.3 million lbs) of harvestable scallop meat, worth about US\$ 134 million (ex-vessel), while fishing pressure remained focused in open areas where sea scallops were smaller and less plentiful.

Keywords: Georges Bank, Sea scallop, *Placopecten magellanicus*, mass mortality.

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