

## Theme Session O

### Governmental quality and risk management

---

ICES CM 2008/O:01

---

#### ICES approach to EAFM: implications for adaptive environmental management institutions

Doug Wilson

The institutions, knowledge, and techniques needed for the ecosystem approach to fisheries management (EAFM) are still very much in development. The problem is an essentially technical challenge, in which the ecosystem is seen as a big machine that needs to be properly maintained. The first thing we need to do is to diagnose its problems and then we can decide who needs to do what to fix them. The alternative is to start by seeing the problem as an essentially social dilemma. The question then becomes how people who see problems are able to initiate a decision-making process to learn about and then effectively respond to those problems. The first approach is the initial response of most natural scientists, but when they begin to deal with the issue practically the social dilemmas quickly emerge. Based on a long series of sociological interviews and the observation of meetings, this paper traces how these two paradigms have played themselves out within ICES. ICES has gone through a reorganization driven to a large extent by the demands of the ecosystem approach. It has become more spatial, and to some degree more qualitative, rather than purely statistical in its basic approach to management. ICES has also self-consciously remade itself into a learning organization through broad institutional changes, rather than simply a group that collates the knowledge of individual scientists. The lessons ICES has learned in this process are valuable for fisheries and other arenas of science-based policy.

Keywords: sociology, EAFM, institutional analysis.

Contact author: Doug Wilson, Innovative Fisheries Management, An Aalborg University Research Centre, North Sea Research Park, PO Box 104, Willemoesvej 2, Hirtshals 9850, Denmark [tel: +45 96 25 87 39 ex 272, fax: +45 98 94 48 33, e-mail: dw@ifm.dk].

---

ICES CM 2008/O:02

---

#### Risk analysis framework for the cost benefit analysis and strategic fishery management

Naman Sharma and Dan Lane

This paper investigates the requirements for integrated decision-making for fisheries described as system. Founded on the principles of decision analysis developed within the field of management science, it provides the requisite methodology for improved decision support and risk assessment and management. A system model is proposed for the fisheries system that takes into account the multiple criteria of the marine ecosystem, including biological sustainability, economic viability, social stability, and administrative efficiency. This decision support system integrates traditional biological stock assessment methods with operational management considerations, and a scientific approach to decision-making. An illustrative case study based on the cod fishery in NAFO division 4TVn is used to demonstrate the proposed methodology.

Keywords: integrated fishery system analysis, economic, social, biological and administrative impacts, risk management, risk analysis.

Contact author: Naman Sharma, School of Management, University of Ottawa, Ottawa, Ontario K1N 6N5 [tel: +1 613 562 5800 ex 2035, fax: +1 613 562 5164, e-mail: sharma@management.uOttawa.ca].

---

ICES CM 2008/O:03

---

#### Insurance mechanisms to mediate economic risks in marine fisheries

J. D. Mumford, A. W. Leach, and L. Kell

Uncertainty affects the behaviour of fishers and fishery regulators in a way that adversely affects the sustainability of fish stocks and fishery income and productivity. In agriculture there has been a long history of using levy funds and insurance schemes to create private and mutual funds to mediate economic risks to growers resulting from environmental variability and quarantine risks. In the USA, federal government continues to underwrite funds (collected by private insurers) used to protect contributors from the effects of extreme weather and pest and disease losses. In Europe, mutual funds such as Kartoffelafgiftsfonden in Denmark and Potatopol in the Netherlands have adopted different approaches to mediate risks from exotic potato diseases. For fisheries, insurance may provide a tool to address uncertainty in a way that would help both the fishing industry and regulators achieve objectives of sustainability, income security, and productivity. Through the use of probabilistic estimates of future catches and the risk of depletion across

various scenarios for a herring-type and a cod-type stock (using the FLR framework), we investigate how joint government and industry participation in creating funds may encourage increased protection of fisheries, and compliance and enforcement for fishery regulation. The paper also explores how fund exposure may be reduced by the application of reinsurance from private insurers for high cost but low probability events, such as total fishery collapse. Although insurance may be a partial solution to unsatisfactory fishery management and fishing performance, the potential drawbacks in the application of this novel approach are also discussed.

Keywords: uncertainty, risk, insurance, sustainability, management.

Contact author: J. D. Mumford, Centre for Environmental Policy, Imperial College London, Silwood Park, Buckhurst Road, Ascot SL5 7PY, UK [tel. +44 (0)207 594 2206, fax: +44 (0)207 594 2308, e-mail: j.mumford@imperial.ac.uk].

---

#### ICES CM 2008/O:04

### **Ecosystem management as a new mode in fishery management: linking fishers' and scientists' knowledge**

Maiken Bjørkan

Based mainly on scientific advice, the knowledge base of fishery management is criticized for being too limited, and it is now widely acknowledged that there is a need to address how to integrate local knowledge and to facilitate knowledge exchange between scientists and fishers. This paper looks at the issue of local knowledge in relation to the understanding, legitimization, and mobilization of fishers' ecological knowledge (FEK), and its interaction with scientific ecological knowledge (ScEK), within the context of the fishery management discourse. Here, I am particularly interested in the construction of arenas in which fishers are employed as knowledge providers on a regular basis. The Norwegian Coastal Reference Fleet (CRF) is an example of such cooperation where fishers participate in research with, for instance, sample collection and first-hand ecological knowledge, and will be used as a case study. This new relationship presents scientists with some questions, such as how can they be sure that the fishers follow the scientific standards, and do the data collected from the CRF have the same quality as the data collected from the scientists? Simply put: can they trust the data collected by fishers? This challenge is related to the general mistrust between the groups, as well as to the visions of science as knowledge that has to be disentangled and autonomous from the social. Importantly, I investigate whether the CRF is a move towards ecosystem management.

Keywords: ecosystem management, knowledge, trust, reference fleet.

Contact author: Maiken Bjørkan, MaReMa, The Norwegian College of Fishery Science, 9037 Breivika, Tromsø, Norway [tel: +47 93088577, fax: +47 93 08 85 77, e-mail: maiken.bjorkan@nfh.uit.no].

---

#### ICES CM 2008/O:05

### **Robust management, risk, and the ecosystem approach to fisheries**

Anthony Charles

Robust management focuses on achieving reasonable success in meeting societal objectives, even given limited understanding of the fishery and an imperfect capacity to control exploitation. Such robustness typically implies creating an adaptive portfolio of mutually reinforcing management tools. This can be seen as a form of risk management, in that risk is reduced through structural design measures that shift fishery management to become more "robust" to the structural uncertainty that pervades fishery systems (as manifested in model, implementation, and institutional uncertainty). Moving towards a focus on robust management and risk management must be a key element of fishery governance in the context of the emerging ecosystem approach to fisheries (EAF) if we are to meet its goals of ecosystem health, sustainable resource use, and human well-being. This presentation draws on recent analysis of the human dimensions of the EAF to highlight links to robust management and risk. The discussion will include consideration of (i) boundaries, scale, and scope, (ii) policy, legal, institutional, social, and economic factors relevant to the EAF, (iii) internal incentives and institutional arrangements that can affect the adoption of EAF management, and (iv) risk-inducing distributional implications among stakeholders, inter-temporally and across spatial scales.

Keywords: robust management, risk management, adaptive management, ecosystem approach to fisheries, structural uncertainty.

Contact author: Anthony Charles, Management Science/Environmental Studies, Saint Mary's University, Halifax, Nova Scotia, Canada B3H 3C3 [e-mail: tony.charles@smu.ca].

---

**ICES CM 2008/O:06**

---

**Fisheries management systems and risk perception among fishers in Iceland, Faroe Islands, UK, and Greece**

Ingi Runar Edvardsson, Diana Tingley, Johann Asmundsson, Alexis J. Conides, and Dennis Holm

This paper draws on the results of a European Union project (PRONE) looking at how perceptions of risk affect divergent categories of stakeholders involved in the fishing industry. These stakeholders are grouped together in five main categories: the fishing industry, fishers, governments and regulators, consumers and scientists. The PRONE Project analyses each of these categories using a mental modelling method in four countries: Iceland, UK, Faroe Islands, and Greece. This paper focuses on fishery management systems and their impact on risk perception among fishers in the four countries. The main question to be addressed is whether regulatory fishery management in the European Community and Iceland based upon total allowable catches (TACs) and individual transferable quotas (ITQs) leads to different perceptions of risk among inshore and offshore fishers compared with in the Faroe Islands, where management is based upon effort control, and the Mediterranean, which has no quota system. In particular, risks related to fish stocks, economic factors, scientific knowledge, and climate change are analysed.

Keywords: fisheries management systems, risk management, fishermen.

Contact author: Ingi Runar Edvardsson, University of Akureyri, Iceland [e-mail: ire@unak.is].

---

**ICES CM 2008/O:07**

---

**Stability of international fishery agreements using precautionary bioeconomic harvesting strategies**

Mika Rahikainen, Marko Lindroos, and Veijo Kaitala

Open access drives fisheries to inefficient harvest rates and ultimately to stock collapse. International agreements are often necessary to exclude open access because many fish resources are spread across national boundaries and international waters. In fishery economics, game theory is a common tool for analysing the strategic interactions of different countries. The point is that all countries would be better off cooperating (i.e. complying with agreement) than non-cooperating. We parameterized an age-structured bioeconomic model for the North Sea herring fishery to analyse the economic impact of harvest control rule (HCR) on this fishery. The trigger points, linked to spawning-stock biomass and fishing mortality rate ceiling, of the current HCR can be regarded as strategic bioeconomic reference points that operationalize the precautionary approach. Applying the precautionary approach by the grand coalition through HCR adds net present value to the fishery compared with the case when only  $F$  is optimized. However, it does not pay off for a partial coalition to apply HCR if the outside player does not comply with it and harvests using an optimal fixed fishing mortality rate. The coalition structure and the fishing costs have an impact on the optimal fishing strategies of the countries. The grand coalition is stable only when low fishing costs are assumed. If fishing costs are identical among countries, there will be incentive for free riding and a multinational fishing agreement is never stable. However, HCR has the potential to stabilize multilateral fishing agreements if fishing costs are high.

Keywords: risk management, harvest control rule, precautionary approach, game theory, fisheries agreement, North Sea herring.

Contact author: Mika Rahikainen, Fisheries and Environmental Management Group (FEM), Department of Economics and Management, University of Helsinki, PO Box 27, FIN-00014 University of Helsinki, Finland [tel. +358 9 191 58443, e-mail mika.rahikainen@helsinki.fi].

---

**ICES CM 2008/O:08**

---

**A quest for management objectives—case study on the Barents Sea capelin**

Ingolf Røttingen and Sigurd Tjelmeland

The Barents Sea capelin is a short-lived Arctic pelagic species and a shared Norwegian–Russian stock. Although the management objectives for Barents Sea capelin have not been explicitly stated, they seem to be to maximize the long-term yield, while ensuring that there is enough capelin available as food for cod. Within Norway there are several stakeholder groups. These groups differ in their views of how the capelin resource should be utilized. Broadly speaking, the views range from coastal fishers who argue that the main objective should be no capelin fishery in order to maximize cod availability (cod follows and feeds on the capelin migrating to the spawning areas near the coast), to the deep-sea fishers who tend to argue for a maximization of the output (value) of the fishery. The aim of the present paper is to systematize and identify core elements in the views of the stakeholder groups in an ecological and economic context, and suggest how communication and dialogue between stakeholders, fishery scientists, and managing authorities can take place in order to obtain a consensus of how to best utilize this stock in a long-term view. From a background

of the biological knowledge base of the capelin, further emphasis is put on the role of the scientists in transforming a possible consensus view into an operational harvest control rule.

Keywords: short-lived pelagic species, management objectives, stakeholder views, harvest control rules.

Contact author: Ingolf Rottingen, Institute of Marine Research, PO Box 1870, Nordnes, N-5817 Bergen, Norway [tel: +47 5523 8404, fax: +47 5523 8531, e-mail [ingolf@imr.no](mailto:ingolf@imr.no)].

---

## ICES CM 2008/O:09

### Value of information and value of control in fishery management: North Sea herring as an example

Samu Mäntyniemi, Sakari Kuikka, Mika Rahikainen, Laurence Kell, and Veijo Kaitala

In this paper we take a decision theoretic approach to fishery management using a Bayesian approach to integrate the uncertainty about stock dynamics and current stock status. We express management objectives in the form of a utility function. The value of new information, possibly resulting in new control measures, is high if the information is expected to help in differentiating between the expected consequences of alternative management actions. Conversely, the value of new information, and that of related new control measures, is low if there is already high certainty about the state and dynamics of the stock and/or if there is only a small difference between the utilities attached to different potential outcomes of the alternative management action. The approach can therefore help when deciding about the allocation of resources between obtaining new information and improving management actions. The value of new information will be evaluated to obtain more precise predictions of recruitment and possibly also to conduct different combinations of scientific surveys in the future. The value of control is measured by the added value of being able to control an uncertain variable. In the case of herring, such a variable could be the natural mortality of herring, which could be controlled by controlling the fishery of species that feed on young herring.

Keywords: decision analysis, Bayesian statistics, uncertainty, stock-recruitment, scientific survey.

Contact author: Samu Mäntyniemi, Fisheries and Environmental Management Group (FEM), Department of Biological and Environmental Sciences, PO Box 65, FIN-00014, University of Helsinki, Finland [tel: +358 9 191 58710, fax: +358 9 191 58257, e-mail: [samu.mantyniemi@helsinki.fi](mailto:samu.mantyniemi@helsinki.fi)].

---

## ICES CM 2008/O:10

### Running simulation designs to assess the sensitivity of management measures to fishers' reactions

Stéphanie Mahévas, Sigrid Lehuta, Hervé Monod, and Youen Vermard

Fisheries management requires quantitative diagnosis of the impact of management measures. It has been argued that not taking into account fishers' reaction to management measures could lead to unreliable predictions of management impact on the fisheries. ISIS-Fish is a flexible simulation tool for fisheries dynamics to assess the impact of fishing regulations on the dynamic of the fishery. This model is time discrete, spatially explicit, and fishers' behaviour is described within its fleet dynamics model. As soon as ISIS-Fish is parameterized, running simulations is rather easy and following it without any rigorous approach that takes into account parameters and processes uncertainty could lead to incorrect interpretation of results. We provided a guideline for simulation tools, mainly based on simulation designs: performing (i) a numerical exploration to point out sensible parameters of the model and (ii) an uncertainty analysis to build confidence intervals on outputs. We reviewed some simulation practises commonly used to address these two issues. Elasticity analysis (changing one input at a time) is the widely used approach in fishery modelling but it is nevertheless not appropriate to explore complex models because no interaction between inputs can be assessed. We recommended performing a global sensitivity analysis using simulation designs and linear regression models. A simulation design defines a set of scenarios, each corresponding to a combination of inputs (parameters or processes) values. Outputs of all scenarios are then analysed using statistical models, first to estimate sensitivity coefficients for both parameters and interactions between parameters and second to estimate confidence intervals on outputs according to variations in inputs.

We applied this approach to the Anchovy fishery of the Bay of Biscay and assessed the impact of several hypotheses of fishers' reaction to fishing access regulation (TAC and MPA). We used hierarchical statistical models fitted to anchovy biomass and catch provided by a factorial fractional design coupled with a Latin hypercube to integrate the uncertainty of sensible model parameters. We derived conclusions on the robustness of management measures to fishers' reactions and parameter uncertainty.

Keywords: simulation tool, sensitivity, uncertainty, simulation designs, ISIS-Fish.

Contact author: Stéphanie Mahévas, Ifremer, Department of Ecology and Models for fishery science, Center of Nantes, Rue de l'Île d'Yeu, BP 21105-44311 Nantes, Cedex 3, France [e-mail: [Stephanie.Mahevas@ifremer.fr](mailto:Stephanie.Mahevas@ifremer.fr)].

---

**ICES CM 2008/O:11**

---

**Risk perception, communication, and trust: the provision and use of fishery science in the Faroe Islands, Greece, Iceland, and UK**

Diana Tingley, Ingi Runar Edvardsson, Johann Asmundsson, Alexis J. Conides, Dennis Holm, and Gurpreet Padda

This paper presents the findings of risk perception and communication research conducted in relation to the provision and use of fishery science in the distinct and diverse fishery management systems of four European countries: Faroe Islands, Iceland, Greece, and the UK. Fishery science forms one of the major information bases upon which fishery management decisions are made (e.g. in relation to total allowable catches, individual effort and/or catch quotas, fishery closures, technical measures, etc.). However, the implementation success of these management decisions may be influenced by stakeholder perceptions of the quality of the science process, confidence in results, the way in which science results are used in the management decision-making process and, finally, the extent to which the organizations producing the science are trusted. Risk perceptions were examined in each country in relation to the provision and use of fishery science for a range of stakeholder groups: fishers (inshore and offshore), fishers' representatives, non-governmental organizations, fishery managers/government, and scientists. Risk grids were developed to identify major differences in perceptions between groups. The linked issues of risk communication and trust were also analysed using a qualitative research methodology.

Keywords: fisheries science, risk communication, risk perception, trust.

Contact author: Diana Tingley, University of Portsmouth, UK [e-mail: [diana.tingley@port.ac.uk](mailto:diana.tingley@port.ac.uk)].

---

**ICES CM 2008/O:12**

---

**Assessing the meaning of collaboration: how stakeholders define cooperative fisheries research**

Teresa R. Johnson

This paper considers the question: How do fishery stakeholders perceive science conducted in collaboration with non-scientists, such as in cooperative fishery research? This question is examined in the northeastern USA, where significant opportunities for industry–science cooperative research have emerged over the last decade in response to poor public perceptions of fishery science and management and escalating scientific information needs. This analysis utilizes the social science method known as discourse analysis, and presents storylines that have emerged around the topic of cooperative fishery research. Data for this analysis were collected from May 2003 to November 2006 and include interviews, observations, and a review of key documents. Data were entered into a QSR-N6 database and were coded inductively for emergent storylines and patterns. In addition to presenting and analysing the storylines, this paper identifies several factors as being critical for ensuring the legitimacy of cooperative fishery research and generally improving stakeholder perceptions of science and management.

Keywords: cooperative research, fishery science, northeast US.

Contact author: Teresa R. Johnson, Department of Human Ecology, Rutgers University, 55 Dudley Road, New Brunswick, NJ 08901, USA [tel: +1 732 932 9153 359, fax: +1 732 932 8887, e-mail: [tjohnson@aesop.rutgers.edu](mailto:tjohnson@aesop.rutgers.edu)].

---

**ICES CM 2008/O:13**

---

**Risk management within an RFMO—the case of Greenland halibut and NAFO**

David C. M. Miller and Peter A. Shelton

In 2003, NAFO Fisheries Commission established a 15-year rebuilding plan for Greenland halibut, a valuable straddling stock off the east coast of Canada, following a period of declining biomass and increasing fishing mortality. The rebuilding plan was, however, *ad hoc*, developed without consultation with NAFO Scientific Council, and has been strongly criticized for being risk-prone and inconsistent with the precautionary approach. This criticism has been borne out by subsequent assessments of the stock that have shown that fishing mortality increased under the rebuilding plan to over 2.5 times  $F_{\max}$  and four times  $F_{0.1}$ . The development of the rebuilding plan reflects how NAFO has traditionally worked—mainly behind closed doors, making selective use of scientific advice and arriving at decisions on total allowable catches (TACs) and other regulations through a process that is not always transparent. At the NAFO meeting in 2005 a renewed commitment was made to rebuild the Greenland halibut stock based on scientific principles and the precautionary approach. This encouraged NAFO Scientific Council to form a study group to evaluate rebuilding options for the stock using a management strategy evaluation approach, utilizing the open-source FLR environment. This is a transparent approach, necessitating involvement from all stakeholders, which aims to find rebuilding strategies that are robust to risk and uncertainty. We report on progress of the study group, describing how a wiki was used to encourage participation and how a review meeting in Vigo in

February 2008, which included scientists, fishery managers, and industry, has been instrumental in guiding the approach.

Keywords: fisheries management, risk, management strategy evaluation, FLR.

Contact author: Peter Shelton, Fisheries and Oceans Canada, PO Box 5667, St John's, NL, Canada A1C 5X1 [tel: +1 709 772 2341, fax: +1 709 772 2001, e-mail: sheltonp@dfo-mpo.gc.ca].

---

#### ICES CM 2008/O:14

### Untangling probability concepts in qualitative risk evaluations

Gottfried Pestal

Improved fishery management requires consistent and transparent risk evaluations, but qualitative judgements are usually necessary to bridge the gap from theory to implementation and from technical details to broader communication. Recent fishery applications of qualitative risk evaluation illustrate the potential benefits and highlight methodological inconsistencies resulting from the particular setting of each case study. These inconsistencies need to be untangled using fundamental probability concepts to identify those aspects that are most relevant to the decision setting. Only then can appropriate qualitative approximations be developed. Qualitative risk evaluations need to distinguish between evaluating discrete events or ranges of outcomes. For a discrete event, such as the risk associated with the breach of a hydroelectric dam, quantitative risk assessments consider the severity of each possible outcome and the probability or frequency of each outcome. The qualitative approximation for this is the traditional risk matrix, categorizing outcomes on two scales: unlikely/infrequent to likely/frequent and negligible to severe. Uncertainty can be incorporated by specifying ranges along each scale (e.g. event is either unlikely or moderately likely). However, most fishery decisions deal with a continuous range of possible outcomes, and qualitative approximations need to reflect the shape of the probability distribution, effectively moving towards Bayesian degrees of belief. For example, risk evaluations of conservation units for Fraser River sockeye salmon (*Oncorhynchus nerka*) incorporate the two dimensions of severity (i.e. judging current status) and uncertainty (i.e. judging quality of information) to delineate five distinct risk categories, each with specific implications for stock assessment.

Keywords: risk, qualitative approximation, Bayesian.

Contact author: Gottfried Pestal, SOLV Consulting Ltd., BC, Canada [e-mail: gpestal@solv.ca].

---

#### ICES CM 2008/O:15

### Stakeholders' participation in fisheries management: fishers' perceptions of involvement

Cristina Pita, Graham Pierce, and Ioannis Theodossiou

Fishers' attitudes play a critical role in the likely success of a fishery management measure and, ultimately, for any management regime to achieve success cooperation from the fishing industry is essential. Stakeholder involvement is a key factor in providing for better management, contributing to an increase in the legitimacy of a measure and therefore the likelihood of compliance. The European Commission identified the lack of stakeholder involvement as one of the major weaknesses of the Common Fisheries Policy (CFP), recognizing that this fact clearly undermined its legitimacy. Thus, the 2002 Reform of the CFP, in order to improve its system of governance, aimed at involving stakeholder in a more open, flexible, and transparent form. Considering this intent, the present document aimed at gauging fishers' perceptions of involvement in management. In order to achieve this, a survey was conducted on the participants in the inshore commercial fishery from the Highlands of Scotland, UK. The survey was carried out through face-to-face interviews and logistic models created in order to identify which variables influence fishers' perceptions and attitudes. The present analysis concluded that, five years subsequent to the reform of the CFP, the vast majority of fishers perceive that they are not well represented in local fishery management and that government bodies (local, national, and EU) do not support or value the fishing industry. To add to this general dissatisfaction, the majority of fishers are also not pleased with the current fishery management regime.

Keywords: fishers, attitudes, perceptions, management, involvement, participation.

Contact author: Cristina Pita, Business School, Department of Economics, University of Aberdeen, Edward Wright Building, Dunbar Street, Aberdeen AB24 3QY, Scotland, UK [e-mail: c.pita@abdn.ac.uk].

---

#### ICES CM 2008/O:16

### Public participation and risk communication: lessons for fisheries

Bonnie J. McCay

Several decades of research on risk perception and effective communication have pointed to the importance of public participation. Most of this research has been focused on health risks from environmental pollutants. This paper summarizes the major lessons that have come out of this work that can be applied to the somewhat different case of risks of loss or decline of fish resources. Among those lessons are (i) the need for effective and genuine user-group participation early in the decision-making process; (ii) need to recognize and respect fundamental differences in risk perception and evaluation, and the cultural models that lie behind them; and (iii) limitations therefore of the “deficit” model that assumes that members of user-groups or the public simply lack accurate information.

*Contact author: Bonnie J. McCay, Department of Human Ecology, School of Environmental and Biological Sciences, George H. Cook Campus, Rutgers the State University, 55 Dudley Road, New Brunswick, NJ 08901, USA [tel: +1 732 932 9153 ext. 314, e-mail: mccay@aesop.rutgers.edu, http://humanecology.rutgers.edu/].*

## ICES CM 2008/O:17

### **Fisheries governance: issues of legitimacy and accountability**

Jan van Tatenhove

Fisheries policy is confronted with new challenges, such as an increased involvement of stakeholders and the integration of several levels of policy-making. To understand new methods of stakeholder participation and processes of multilevel policy-making we introduce in this paper a governance framework. Governance refers to the sharing of policy-making competencies in a system of negotiation between nested governance at several tiers (supranational, national, regional, and local) on the one hand and state actors, market parties, and civil society organizations on the other. Governance emphasizes both processes of policy-making (policy), the institutional setting in which policy-making takes place (polity), and the activities and decisions of politicians, policy-makers, and other involved actors (politics). New institutional arrangements have emerged in the advisory and management process in fisheries policy. Examples of innovative governance arrangements are: co-management systems, rights-based management, Regional Advisory Councils, and marine protected areas. In general, these initiatives show increased involvement of stakeholders, and the sharing of power, management, and decision-making responsibilities. Changes in the institutional setting of fisheries policies, the coexistence of traditional and innovative forms of stakeholder involvement, and the institutionalization of new fishery governance arrangements will affect issues of legitimacy and accountability. The second part of the paper focuses on issues of legitimacy and accountability in fishery governance. In general, legitimacy refers to whether people accept the rules of the political system, the reflection of the interests of participants in the formulation of policy (input legitimacy), or the capacity of political systems to resolve problems (output legitimacy). In political science the traditional dilemma between input and output legitimacy is how to increase, for example, the effectiveness of policy without limiting participation and popular consent, by increasing the transparency and accountability of procedures (throughput legitimacy). Accountability refers to the relationship between an actor and a forum, in which the actor has an obligation to explain and justify his or her conduct, the forum can pose questions and pass judgement, and the actor may face consequences.

*Contact author: Jan P. M. van Tatenhove, Wageningen University, Department of Social Sciences, Environmental Policy, PO Box 6130, 6700 EW Wageningen, The Netherlands [tel: + 31 317 482447, fax: +31 317 483990, e-mail: Jan.vantatenhove@wur.nl].*

## ICES CM 2008/O:18

### Poster

### **Well-managed fisheries: can we learn from experience to define best practices?**

Howard Powles, L. Scott Parsons, and Dan Lane

Studies of success in fishery management to define best practices are surprisingly uncommon. Defining “success” in fishery management, reviewing examples of successful fishery management, and using the results to outline best practices could help to foster a positive approach to addressing the challenges. Results from a literature review, a workshop to define “success”, and a symposium to present and discuss examples of successful fishery management will be presented and feedback on conclusions sought. Available literature and other information on best practices in fishery management can be grouped into five categories: textbooks and manuals, compilations (symposia, workshops, volumes of collected papers), articles and reviews, case studies, and certification programmes. Much of the literature on best practice reflects the disciplinary interests of the authors, with earlier publications giving more attention to biological aspects of management than to economic and social aspects, and the increasing interest in the past decade in user rights, governance mechanisms, and a broader ecological approach to resource conservation and management. Good fishery management requires multiple issues to be addressed, and a “sustainability” framework including ecological, economic, social, and institutional elements may be useful for judging success. The key elements of success in fishery management identified to date include a formal conservation framework based on knowledge of biological (ecological) limits; a predictable user rights regime; clearly defined and agreed objectives; strong

institutions and governance structures, with clearly defined roles and responsibilities and scope for full participation by users; and the ability to adapt to unforeseen challenges.

Keywords: fishery management; best practices.

Contact author: Howard Powles, C-FOAM Research Cluster, Telfer School of Management, University of Ottawa, 53 Lortie Street, Gatineau (Québec), Canada J9H 4G6 [tel: +1 819 684 7730, fax: +1 819 684 7730, e-mail: powlesh@sympatico.ca].

---

ICES ASC 2008/O:19      Poster

---

**Incorporating and explaining the variation in biological processes to improve the management of fish stocks**

G. J. Piet, R. van Hal, G. J. Oskarsson, C. Rockmann, and C. L. J. Scott

Four biological processes or characteristics that determine the population dynamics of fish are distinguished: recruitment, growth, condition, and maturity. For different stocks of plaice, cod, and herring we explore how the variation in these processes affects the perception of the status of the stock. Extrinsic drivers explain (part of) the variation in population dynamics. We also show how knowledge of the relationship with extrinsic drivers may help in improving the management of these stocks.

Keywords: growth, condition, maturity, recruitment, extrinsic driver.

Contact author: G. J. Piet, Wageningen IMARES, PO Box 68, 1970 AB IJmuiden, The Netherlands [tel: +31 (0)317 87188, fax: +31 (0)317 87326, e-mail: gerjan.piet@wur.nl].

---

ICES CM 2008/O:20      Poster

---

**Ranking the relative status of exploited marine ecosystems using multiple ecological indicators on states and trends**

Marta Coll, Lynne J. Shannon, Yunne-Jai Shin, Alida Bundy, Dawit Yemane, Jae-Bong Lee, Jason Link, Kerim Aydin, Didier Jouffre, Maria Fatima Borges, Henn Ojaveer, Pierre Labrosse, and Sergio Neira

How do the impacts of fishing on marine ecosystems compare around the world? Here we present a comparative approach to analyse the impacts of fishing on a range of ecosystems using a suite of readily understood ecosystem indicators, based on the work of the Eur-Oceans working group. The aim of this work is (i) to rank a set of ecosystems according to the extent of fishing impacts by testing different methods, (ii) to evaluate this ranking when considering conservation goals, and (iii) to compare the ranking of ecosystems on a multivariate basis and with previous comparative approaches. First, ecosystem current states are compared by examining the mean values of these indicators in recent years. Second, trends of indicators are compared with expected trends over time. Slopes of the trends and their significance are assessed across ecosystems using short time-series of data previously standardized. The ecosystems are then ranked according to sub-categories of indicators addressing three ecological goals: (i) biodiversity conservation, (ii) ecosystem stability and resistance to perturbation, and (iii) preservation of trophic structure and resource quality. A way of combining these ranks by weighting the selected indicators is proposed, taking into account potential overlaps in indicators in response to fishing and that some indicators do not provide additional information. Results allow the classification of ecosystems into moderate to highly affected categories and show improving or deteriorating trends. Similarities and differences between ecosystems are further explored using multivariate analyses and testing of explanatory factors.

Keywords: comparative approach, indicators, fishing impacts, ecosystem states and trends, ranking techniques.

Contact author: Marta Coll, Dalhousie University, Biology Department, 1355 Oxford Street, Halifax, Nova Scotia, Canada B3H 4J1 [e-mail: martacoll@dal.ca, martacoll@yahoo.com].

---

ICES CM 2008/O:21      Poster

---

**The current situation and possible ways for sustainable development of the small-scale fishery in Estonian coastal sea**

A. Järvi and T. Raid

Fishery has been one of the most important economic activities for the inhabitants of the coastal villages of Estonia for centuries. However, since the mid-1990s the efficiency of the coastal fishery as well as the number of professional fishers has declined significantly because of recent overexploitation of many local fish stocks and the lack of a reasonable management strategy. This has resulted in serious social problems, such as a large proportion of part-time employees among coastal habitants and a decrease of local population, making it difficult for coastal communities to survive. In 2006–2007 an Estonian–Finnish INTERREG IIIA

project was carried out and in 2008 some additional studies were performed using a bottom-up strategy (participatory governance) with the participation of representatives from coastal communities with the aim of finding a conceptual strategy for the development of the Estonian coastal fishery. A SWOT analysis of the outcome of the interviews with the professional fishers by regions was performed. It was found that in principle, survival of a sustainable small-scale fishery and of coastal villages is possible if a integrated coastal area management strategy could be implemented and supported at the level of the government, county authorities, and municipalities.

Keywords: Estonia, coastal fishery, sustainable development.

Contact author: Ahto Järvi, Estonian Maritime Academy, Mustakivi tee 25, 13 912 Tallinn, Estonia [tel: (372) 6442280, fax: (372) 6460334, e-mail: ahto.jarvik@gmail.com].

## ICES CM 2008/O:22

### **IndiSeas: a global comparison of ecosystem indicators across fished marine ecosystems**

Alida Bundy, Yunne-Jai Shin, Lynne Shannon, Marie-Joëlle Rochet, Marta Coll, and Philippe Cury

There has been a strong global move towards the ecosystem approach to fisheries (EAF). To make progress towards implementing the EAF, carefully selected and appropriate indicators are required to translate ecosystem impacts and changes into management and policy measures that can be assessed for their effectiveness. The scientific community grappling with the EAF is challenged to provide a generic set of synthetic indicators to accurately reflect the effects of fisheries on marine ecosystems, to facilitate effective communication of these effects, and to promote sound management practices. Building on the work of SCOR/IOC Working Group on "Quantitative Ecosystem Indicators" (2004), a working group was established under the auspices of the EUROCEANS European NoE (Network of Excellence), to look at "EAF Indicators: a comparative approach across ecosystems". A suite of ecosystem indicators were chosen after careful consideration of several criteria, including ecological meaning, availability and cost of data, sensitivity to fishing pressure, and comprehension to the general public. These indicators were assembled for 22 fished ecosystems, representing tropical, temperate, high-latitude, and upwelling systems. The results of comparative analyses were synthesized to inform the public and fishery managers of relative states and recent trends in the world's fished marine ecosystems. Using the comparative approach, a web-based "dashboard" composed of these ecosystem indicators has been developed, reporting results of various statistical and analytical techniques employed to evaluate the exploitation status of marine ecosystems in a comparative framework and to guide fishery management in each ecosystem.

Keywords: ecosystem indicators, comparative trends, ecosystem approach to fisheries.

Contact author: Alida Bundy, Fisheries and Oceans, Canada, Bedford Institute of Oceanography, PO Box 1006, Dartmouth, NS, Canada B2Y 4A2 [tel: +1 902 426 8353, fax: +1 902 426 1506, e-mail: bundya@mar.dfo-mpo.gc.ca].

## ICES CM 2008/O:23

### Poster

### **From optimization to collaboration: developing escapement strategies for Fraser River sockeye salmon (*Oncorhynchus nerka*)**

Gottfried P. Pestal

The Fraser River Sockeye Spawning Initiative (FRSSI) has been a six-year process to develop new guidelines for setting annual escapement and exploitation targets for Fraser sockeye stocks. In 2003 Fisheries and Oceans Canada (DFO) committed to reviewing the rebuilding plan which had been in place since 1987, and established a collaborative planning process for incorporating new information and emerging policies. The technical groundwork was laid through the development of a simulation model which was refined over three years and six workshops, leading up to an intensive two-year planning exercise focused on capturing participants' preferences and exploring trade-offs among alternative escapement strategies. This phased approach helped participants with diverse backgrounds work through the substantial learning curve associated with bringing complex technical analyses into a public process. Workshops became increasingly useful to DFO and participants because of their consistent structure and relatively stable attendance. The technical team benefited from the regular feedback provided by participants, who brought broader perspectives to the initial scoping of the initiative and patiently pushed for a more communications-focused approach to model development. FRSSI was able to develop and implement fundamental changes in management strategy for this complex fishery setting, switching from a fixed escapement target to a mortality rate target that varies with abundance and accounts for en-route and prespawn losses, and removing the requirement to stay above brood year escapement to account for fluctuating productivity.

Keywords: escapement strategy, collaborative development, Fraser River, sockeye salmon.

Contact author: Gottfried P. Pestal, SOLV Consulting Ltd., Unit 60607 RPO Granville Park, Vancouver, BC, Canada V6H 4B9 [tel: +1 604 420 1528, fax: +1 420 1527, e-mail: gpestal@solv.ca].

---

**ICES 2008/O:24 Poster**

---

**The role of regional fishery bodies in North Atlantic fisheries**

Katharina Jantzen

The scope of fishery management has changed during the last decades from a centralized to a decentralized approach. It requires cooperation between the different actors in fisheries, coming from the economic, ecological, and social or rather political arena according to the sustainability approach. Thus, marine resources have to be allocated in a way that satisfies the needs of fish industries and individual fishers with respect to environmental protection and conservation issues. Regional fishery bodies are significant for the management of resource allocations. According to their functions they develop management measures or give scientific advice for the sustainable use of aquatic resources with special attention to the management of high seas fisheries. This poster deals with the history of two of the most important regional fishery bodies of the North Atlantic: (i) the Northwest Atlantic Fisheries Organization (NAFO) and (ii) the International Council for the Exploration of the Sea (ICES). In the fisheries history of the North Atlantic, the memberships of these bodies have played an important role in the development of sustainable fisheries of different fishing nations. It is therefore important to look at the interrelations between members and regional fishery bodies and their influence on fishing nations. As it is not possible to consider all members, the poster concentrates on the Newfoundland and Icelandic fisheries after the exclusive economic zone declaration in 1977, and focuses on the quota system and the question of which fishery gained most.

Keywords: regional fishery bodies, North Atlantic fisheries, quota management.

Contact author: Katharina Jantzen (GLOMAR, University of Bremen, Germany): German Maritime Museum, Hans-Scharoun-Platz 1, 27568 Bremerhaven, Germany [tel: +49 471 4820763, fax: +49 471 4820755, e-mail: jantzen@dsm.museum].

---

**ICES CM 2008/O:25 Poster**

---

**Including ecological impacts of fishing gears in marine and fisheries management decisions in Canada**

Susanna D. Fuller, Jennifer Ford, Candace Picco, Lance Morgan, Chih-Fan Tsao, Ratana Chuengpagdee, and Dorthea Hangaard

The different impacts of fishing gears on benthic habitats and bycatch species have not, to date, been explicitly considered in fishery management decisions in Canada. We used data from Fisheries and Oceans Canada, an extensive literature review, and input from fishers and scientists to describe the habitat and bycatch impacts of ten commonly used fishing gears in Canada. We also surveyed fishers, scientists, fishery managers, and marine conservation professionals and discovered a very high level of agreement among these groups about the severity of these ecological impacts. Information on the severity of impacts from fishing is needed to implement the precautionary approach, ecosystem-based management, and to develop risk-averse management strategies. We discuss how our assessment informs the existing and proposed fishery management policies and programmes in Canada.

Keywords: fishing gears, habitat, bycatch, fisheries management, spatial management.

Contact author: Jennifer Ford, Ecology Action Centre, Canada [tel: +1 902 446 4840, e-mail: jenford@ecologyaction.ca].