

## Theme Session on Fishers' Perceptions and Responses in Management Implementation (V)

### ICES CM 2005/V:01

#### The influence of management, market and fish stocks density on fishermen's foraging

Paul Marchal and Floor Quirijns

The properties of fishermen's foraging have been quantified, using Levy flights trajectories, for a selection of North Sea Dutch and French vessels, for which catch and effort data were collected on a haul-by-haul basis. These fleets have in recent years been subjected to severe constraints in terms of management (low TACs, days at sea limits, area closures), economics (low market prices for some of the target species), and stock abundance. The relative influence of these external constraints on the properties of fishermen's foraging have then been investigated using linear models. The results of this investigation contribute to provide better insights into the processes structuring fishermen's decision-making.

*Paul Marchal: IFREMER DOP/DHMMN, Responsable du Département Halieutique de Manche Mer du Nord, 150, Quai Gambetta, BP 699, FR-62321 Boulogne sur mer, France [tel: +33 321 99 56 16, fax: +33 321 99 56 01, e-mail: paul.marchal@ifremer.fr].*

### ICES CM 2005/V:02

#### MSY, bycatch and minimization to the "extent practicable"

Joseph E. Powers

Two goals of marine fisheries management in the United States are: 1) to achieve maximum sustainable yield and 2) to minimize bycatch "to the extent practicable." However, the determination of maximum sustainable yield is contingent upon the selectivity of the various fisheries involved and the mix of these fisheries that management desires. Several methods of computing maximum sustainable yield and associated parameters are compared. The methods make alternative assumptions as to the balance between targeting and bycatch fisheries. The methods were evaluated using a deterministic population simulation model. Additionally, spawning potential ratios computed with and without bycatch are compared so as to evaluate biological risk. While the choice of the method will largely be driven by socioeconomic factors, some implications to management are discussed. Perhaps, the most important implication is that before analysts can calculate maximum sustainable yield and associated parameters, management needs to define their desired mix of fishing and what "to the extent practicable" means.

Keywords: MSY and bycatch.

*Joseph E. Powers: Southeast Fisheries Science Center, National Marine Fisheries Service, National Oceanic*

*and Atmospheric Administration, 75 Virginia Beach Drive, Miami, FL 33149, USA [tel: +1 305 361 4295, fax: +1 305 361 4219, e-mail: joseph.powers@noaa.gov].*

### ICES CM 2005/V:03

#### Intended and unintended consequences: Fisher responses to bycatch reduction requirements in the Alaska groundfish fisheries

William A. Karp and Karl Haflinger

Bycatch of certain species, including Pacific halibut and several Pacific salmon species, is limited in the Alaska groundfish fisheries. Catch and bycatch in these fisheries is monitored at sea by observers. Fisheries for targeted demersal species often close prematurely when halibut bycatch limits are reached and vessels harvesting pollock may be required to relocate when salmon bycatch limits are reached in specific areas. Premature closures and mandatory relocation may be costly and provide incentives for implementation of innovative bycatch reduction measures. They also provide incentives for interference with observer sampling which results in under reporting of bycatch rates. We discuss both types of behavior and illustrate our perspective with two examples. The first involves industry-agency collaboration providing near real-time information on salmon bycatch rates to guide fleet avoidance of high bycatch areas; vessels targeting pollock are members of fishery cooperatives and response to salmon bycatch is governed by intercooperative contracts which ensure participation of all fleet members. The second considers evidence of observer sampling interference leading to underestimation of halibut bycatch rates, and the consequences of improved enforcement of regulations that prohibit interference with observer sampling. These include measures to discourage and detect sampling interference, and emulation of the successful salmon bycatch reduction measures employed in the pollock fishery.

*William A. Karp: NOAA Fisheries Service, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115, USA [tel: +1 206 526 4194, fax: +1 206 526 4066, e-mail: bill.karp@noaa.gov].*

### ICES CM 2005/V:04

#### Mind games: Cognitive mapping of fishers' knowledge and perceptions on the impacts of wind farms on fisheries

Steven Mackinson, Robert Brown, Jeroen van der Kooij, Hazel Curtis, Mike Myers, and Ross Leach

The development of offshore wind farms around the coasts of England and Wales could make a significant contribution to securing energy supplies for future generations. However, while knowledge of wind farm im-

pacts is developing all the time, there are still some uncertainties about the impacts of wind farms on the environment and specific industries whose activities may be affected by their development. Cognitive mapping was used as a tool in the dialogue between fishers and researchers in a study that investigates the socio-economic impacts and opportunities arising from wind farm developments. Cognitive mapping helped fishers to express their knowledge and perceptions of impacts in a structured way that facilitated a comprehensive and transparent understanding of the issues and concerns of fishers. Specific consideration of possible options to minimise the impacts of developments during construction and operation phases highlight the thought process behind fishers' adaptation to management actions.

Keywords: wind farm, knowledge, perception, adaptation.

*Steven Mackinson: CEFAS, Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk NR33 0HT, UK [tel: +44 1502 524 416, fax: +44 1502 513 865, e-mail: s.mackinson@cefas.co.uk].*

## **ICES CM 2005/V:05**

### **Comparison of collaborative fisheries research in New England and New Zealand**

John H. Annala and Laura T. Singer

Collaborative research between scientists and the fishing industry in New Zealand has been ongoing since at least the 1970s. Initially, collaboration was informal, often stimulated by the lack of suitable research platforms, e.g. research vessels, and originated spontaneously after meetings between fishermen and scientists. Collaboration became much more formalized following the introduction of cost recovery into New Zealand's fisheries in 1994 by which mechanism the fishing industry is levied for about 75% of the cost of fisheries research (depending on the fishery). The incentives provided by cost recovery led to more active and direct involvement by the fishing industry in fisheries research and subsequent management decision-making. In New England informal collaboration between scientists and fishermen has been ongoing in a limited number of fisheries since the 1970s as well. However, a much different route has been taken to foster more formal collaborations between scientists and fishermen since the late 1990s using federal funding through two different programs. One program, the Northeast Consortium, is administered at the University of New Hampshire, while the other, the Cooperative Research Partners Initiative, is administered by the Northeast Regional Office of the National Marine Fisheries Service. The purpose of both programs is twofold – (1) to bring scientists and fishermen together to conduct collaborative research on chartered commercial fishing vessels, and (2) to provide economic assistance to the commercial fishing industry through charter fees during a period of fishing restrictions and economic hardship. The origins and incentives of these two contrasting approaches to collaborative fisheries research, and the use

of the research outcomes in fisheries management, are analyzed and discussed.

Keywords: collaborative research, incentives, research outcomes, fisheries management.

*John H. Annala: Gulf of Maine Research Institute, 350 Commercial Street, Portland, Maine 04101, USA [tel: +1 207 772 2321, fax: +1 207 772 6855, e-mail: jannala@gmri.org].*

## **ICES CM 2005/V:06**

### **Information collected on Scottish commercial fishing gear and its use in fisheries management**

Dick Ferro and Rob Kynoch

Fisheries Research Services have been gathering information on the specifications of Scottish commercial fishing gears for 5 years. Three categories of data have been collected to serve distinct purposes. First, skippers have been asked to provide the specification of those gear features which affect selectivity. This information not only indicates how closely the commercial fleet adheres to the legal requirements defined by technical conservation measures but also gives an insight into skippers' decisions to change their gear in response to legislation change. Given suitable selectivity models, this type of data can also be used to estimate past and present gear selectivity as well as the potential effect of further legislative changes in the future. Secondly, information is collected to monitor gear types in use. The aim is to identify major gear developments where new designs with possibly greater fishing power are being introduced. Thirdly, a greater understanding of the relation between fishing effort and fishing mortality is essential if effort control is to be a major element in future fisheries management. Any analysis involving the collection of fishing effort data has to identify the significant component fleets in a fishery. In recent effort studies, surveys have been carried out to ground-truth the national data on fishing gears at vessel level and then to help to identify typical fishing gears used by each fleet component. The paper will describe these data categories briefly and give examples of the use to which they can be put by fisheries managers.

Keywords: fishing gear, commercial usage, management.

*R. S. T. Ferro: FRS Marine Laboratory, PO Box 101, 375 Victoria Road, Aberdeen AB11 9DB, UK [tel: +44 1224 876 544, fax: +44 1224 295 511, e-mail: ferro@marlab.ac.uk].*

## ICES CM 2005/V:07

### **Commitment to salmon: using Bayesian modelling to create a sustainable fisheries management tool based on commitment of fishermen**

Päivi Haapasaari, Timo P. Karjalainen, and Kalle Reinikainen

Finland's goal in the Salmon Action Plan program of IBSFC is to restore salmon stocks of Bothnian Bay rivers. As part of a research program of the Academy of Finland, the multidisciplinary Bireme-SAP project is working for this goal. A sociological viewpoint is involved to open the black box of the fisher's role in the restoring process. Our task has been to find out fishers' perceptions of salmon stocks, of rebuilding the stocks and of the management issues, and to model these with Bayesian networks. The method was chosen to model the restoration process interdisciplinary, by merging social aspects with biological factors. Understanding the fishers' point of view makes it easier to cope with uncertainty in fisheries management. From the beginning "commitment" has been emphasized as the crucial point leading to consensus between different actors around salmon. Commitment means finding the best ways to increase the probability of successful restoration, so that the process has the fishers' approval. How should salmon fishing be restricted? How to improve commitment? Would commitment mean reducing catches? These and other questions have been modelled with Bayesian networks. The most important research material in building the network has been key-actor interviews and a questionnaire to 1000 fishers. Bayesian belief networks seem to be an effective representation of knowledge for reasoning under uncertainty, but the method has been applied especially in natural sciences. In social sciences this approach is less used, and we had to create our network almost with no examples. Despite some problems our experiences are promising.

Keywords: salmon stock restoration, Bayesian belief networks, commitment, social sciences, fisheries management, fishers' perceptions.

*Päivi Haapasaari: Faculty of Education, P.O. Box 2000, FIN-90014 University of Oulu, Finland [tel: +358-8-553 3629, fax: +358-8-553 3600, e-mail: paivi.haapasaari@oulu.fi].*

## ICES CM 2005/V:08

### **Fishers' perception on local support to the fishing activity and attitudes towards a new management regime**

Cristina Pita

The continuous fisheries collapse and the fact that over-exploitation is a global concern lead to a successive implementation of alternative mechanisms of management. To determine how a future fisheries management plan

will affect coastal communities with traditional links to fishing is of great importance given the fact that any new management approach will directly affect the local economy and welfare of these communities. The aim of the present work was to investigate the fishers' perception on the support given by the government, the local community, and the tourist industry (the main economic activity in the area) to the fishing activity, as well as the fisher's willingness for occupational or geographical mobility as a reaction to a new management regime. For this purpose questionnaires were undertaken on a typical coastal community highly dependent on fisheries from the south of Portugal. Results show that the general perception amongst fishers is that the fishing industry is supported and valued by the local people and the tourist industry, but not by the government. Results also show that, although the fisheries sector presents a declining trend, most fishers do not consider leaving the fishing activity. In fact, fishers are more willing to change to another area to remain fishing than to change jobs within the area.

Keywords: fishers, attitudes, mobility.

*Cristina Pita: University of Aberdeen, School of Biological Sciences, Cruickshank Building, St Machar Drive, Aberdeen AB24 3UU, Scotland, United Kingdom [e-mail: c.pita@abdn.ac.uk].*

## ICES CM 2005/V:09 – Poster

### **A multidisciplinary study of discarding in North Sea fisheries**

T. L. Catchpole, T. S. Gray, and C. L. J. Frid

A multidisciplinary approach combining natural and social scientific data was used to provide a holistic view of the practice of discarding in the North Sea. The research comprised of (a) a documentary analysis of discarding in the North Sea; and (b) a case study of one fishery in the North Sea, the English *Nephrops* fishery. The study enabled the identification of the fundamental causes of discarding, the factors that prevent discard reduction and the best means of achieving discard reduction objectives.

The fishermen's immediate individual objectives and the different views held by fishermen and fisheries scientists on the consequences of discarding were identified as the main factors inhibiting discard reduction. A discard reduction framework to aid the management of discards is proposed. The framework provides a means to assess the discard reduction needs of individual fisheries within the context of other fisheries and environmental objectives. The tools that are required to reduce discarding are categorised as either technical or incentive-based. A strategy to increase the level of incentive to that which is required to introduce effective discard reduction measures is presented. The strategy includes formulating quantified discard reduction targets at the stock level, consultation with fishermen on the benefits to discard reduction, and the development of direct economic incentives.

Keywords: discarding, incentive, North Sea, fishermen.

T. L. Catchpole: School of Marine Science and Technology, University of Newcastle-upon-Tyne, Dove Marine Laboratory, Cullercoats, North Shields NE30 4PZ, UK [tel: +44 1912 524 850, e-mail: t.l.catchpole@ncl.ac.uk, tomcatchpole@hotmail.com].

## ICES CM 2005/V:10

### A retrospective analysis of technical creeping: trends, determinant factors and effects

Paul Marchal, Benoît Caillart, Ole Eigaard, Olivier Guyader, Ane Iriondo, Fanny Le Fur, Jacques Sacchi, and Marina Santurtun

Face-to-face interviews have been undertaken to identify the main changes in gear and vessel technology, which have improved the fishing efficiency of a number of Basque, Danish, and French fleets, over the past 15 years. For a selection of these fleets, it has also been investigated what the drivers of these changes have been, and the extent to which these changes have been translated into fishing efficiency. The drivers under consideration include management constraints, economic expectations, and the influence fishermen exert on each other. Fishing efficiency has been evaluated for each of the main stocks being harvested (North Sea cod and plaice, Bay of Biscay *Nephrops*, and Northern hake), and also for the landings value of the mixed fisheries.

Paul Marchal: IFREMER DOP/DHMMN, Responsable du Département Halieutique de Manche Mer du Nord, 150, Quai Gambetta, BP 699, FR-62321 Boulogne sur mer, France [tel: (+33) 321 99 56 16, fax: (+33) 321 99 56 01, e-mail: paul.marchal@ifremer.fr].

## ICES CM 2005/V:11 – Withdrawn

## ICES CM 2005/V:12

### Harmful blooms of cyanobacteria: A threat to fishermen's livelihood in the Baltic Sea?

Jari-Pekka Pääkkönen, Miina Karjalainen, Maiju Lehtiniemi, Jonna Engström-Öst, and Markku Viitasalo

Harmful algal blooms of hepatotoxic cyanobacteria, *Nodularia spumigena*, are common between July and September in the Baltic Sea. In optimal weather conditions, as in the summers of 1997 and 2002, massive blooms may occur in most regions of the Baltic Sea, covering thousands of square kilometers. *N. spumigena* has been shown to cause various deleterious effects on Baltic organisms, including Baltic fish. The blooms may also interfere with normal fishing practises, such as using nets and trawls, and cause a decline in fishermen's summertime incomes. However, the influence of blue-green algae on Baltic fisheries has not previously been studied. As a part of a larger research project investigating ecological and socioeconomic effects of the Baltic cyanobacteria, a questionnaire was sent to professional fishermen on the Finnish coastline. The fishermen were asked:

(1) if and how algal blooms have affected their fishing methods, catch, and revenue, (2) which areas and fish species they consider to be affected, and (3) where do they get the information about the blooms, and how do they modify their fishing practises during blooms. The results to be presented reveal area-, species-, and gear-specific effects of blue-greens, and suggest that blooms of cyanobacteria may pose a severe threat to Baltic summertime fisheries. In general, fishermen were very concerned about the current state of the Baltic Sea, and the future of their own profession.

Keywords: HAB, cyanobacteria, *Nodularia spumigena*, fisheries, Baltic Sea.

Jari-Pekka Pääkkönen: Finnish Institute of Marine Research, P.O. Box 33, FIN-00931, Finland [tel: +358 961 394 409, fax: +358 961 394 493, e-mail: jari.paakkonen@fimr.fi].

## ICES CM 2005/V:13

### Economic analysis of marine reserve creation: an agent-based simulation model

Mette Termansen and Alberto Ansuategi

Recently marine biologists and economists have shown increased interest in promoting marine protected areas as a possible insurance policy to help sustain marine ecosystems and possibly even over the long run increase harvest levels. Some interesting work has come out of expanding the spatial representation of traditional models by introducing a two-patch environment, with one patch representing the fishing ground and the other the reserve. A particularly interesting paper following this approach is Sanchirico and Wilen (2001), *JEEM* 42, 257–276 (SW hereafter). SW analyze whether setting aside areas is likely to produce fishery benefits as well as conservation benefits, and under which conditions this would hold. This paper takes SW's approach as a baseline for further analysis. The model is set up as an agent-based simulation model and it deviates from SW with respect to four aspects: (1) it expands the spatial representation of the sea from the two-patch environment set up by SW to a (100.100) grid; (2) fishermen are modelled as spatially and temporally short-sighted agents; (3) it considers transitional dynamics; and (4) exit from the fishery is based on the individual fisherman's past economic performance and entry to the fishery is based on aggregate profits in the industry. Preliminary results show that marine reserve creation (1) increases aggregate biomass, (2) does not seem to improve economic performance of fishermen, even with parameter settings that support a "win-win" outcome in SW's paper, and (3) makes cycles more drastic.

Keywords: marine reserves, agent-based models.

Alberto Ansuategi: *Facultad de CC. Económicas, Avda. Lehendakari Agirre 83, ES-48015 Bilbao, Spain [tel: +34-94-601 3824, fax: +34-94-601 3891, e-mail: alberto.ansuategi@ehu.es].*

## ICES CM 2005/V:14

### Evaluating the impacts of bycatch on implementation uncertainty and the definition of reference points

Murdoch McAllister

Uncertainty over future bycatch levels, the success of measures to control bycatch, and the potential effects of bycatch on management procedure performance are common manifestations of implementation uncertainty. A management procedure may fail if bycatch is ignored, underestimated, or if assumptions about how bycatch impacts a population are incorrect. Assumptions about bycatch and its relationship to population dynamics can strongly impact definitions of reference points of a target fish stock. Nonetheless, little attention has been devoted to modelling the potential impacts of bycatch assumptions on management performance and reference point definition. This paper illustrates how alternative assumptions about bycatch can impact maximum sustainable yield (MSY)-based reference points and management performance using an age-structured population dynamics model for Gulf of Mexico red snapper (*Lutjanus campechanus*). Variations in how bycatch is treated in the MSY computation and in assumptions about when in the early life history density dependence occurs affect several aspects. Stock biomass at MSY varies from about 9 to 37% of unfished stock size. MSY varies from about 3 million to 173 million pounds. The abundance relative to  $B_{MSY}$  varies from overfished to underfished. Optimal stock rebuilding policies vary from reducing TAC by about half to relying only on drops in shrimp trawling effort. Recommendations are provided for how MSY reference points should be defined and management procedures evaluated in the face of uncertainty over future bycatch and its relationship to population dynamics.

Keywords: implementation uncertainty, bycatch, fisheries management reference points.

*Murdoch McAllister: Imperial College, Division of Biology, RSM Building, Prince Consort Road, London SW7 2BP, UK [tel: +44 207 594 9330, fax: +44 207 589 5319, e-mail: m.mcallister@imperial.ac.uk].*

## ICES CM 2005/V:15 – Withdrawn

## ICES CM 2005/V:16

### Mechanisms and evaluation indicators in fisheries management

Fernando González-Laxe

The search for mechanisms that regulate fisheries and can guarantee a high level of compliance in the short term has become one of the first tasks of policymakers.

The priority lies in finding the control of the different variables in order to achieve two immediate aims: a) the conservation of resources (sustainability) and b) the profitability of the exploitations (competitiveness). That is, the pursuit of biological and economic references.

Subsequently, the mechanisms of fishing regulation focused on the control of inputs and outputs; that is, on the set of variables that had an influence on fishing exploitation and could be object of control and handling.

After, the OECD (1997) determined a set of technical variables to be taken into consideration, such as fishing effort and intensity, the minimum and advisable size of vessels, fishing gears and species; fishing grounds and temporary, territorial and specific prohibitions, etc. This way, the OECD established recommendations that allowed a certain control on fishing activities in a “theoretical way”.

The introduction of systems of ex-post evaluation has contributed to attracting attention to the different trial and error methods. The main example of this is the one that refers to the analysis of the Common Fishery Policy (CFP) and the subsequent assessment of its proposals carried out in the course of the last fifteen years, with reference to both fishing resources and stocks, and the fishing capacities.

The references to the use of the concepts of maximum sustainable yield (MSY), maximum stable economic yield (MSE), and maximum social yield (MSS) have been part of the first experiences with regard to the evaluation of fishing policies and mechanisms of regulation.

More recently, the establishment of reference points, objective points, and limit reference points has meant an important progress in the management mechanisms, since these points help to conform techniques that allow to develop exploitation regimes based on the precautionary principle. The guaranteed percentages and implementation rate will become the irrefutable evidence of the consistency of these methods.

This paper focuses on the combination of other basic elements that help to determine the priority criteria of fishing regulation.

Taking the existence of a juxtaposition of instruments linked to environmental, economic, and social aspects as a starting point, it is obvious that there is an important presence of conflicts and difficulties when it comes to implementing the mechanisms of fishing regulation; the so-called “triangle of paradigms”.

It is not easy to combine the conservation paradigm (which delimits the sustainability of resources), the rationalisation paradigm (which guarantees the economic efficiency in terms of maximisation of the fish stocks), and the social/community paradigm (which guarantees the community welfare). The reasons why this combination is difficult can be summarised as follows: a) there is

a contradiction among the different objectives, and the coordination of actions is not taken into account; and b) there are neither mechanisms that consult the sector or demand its participation, nor mechanisms to access the fishing grounds.

This paper insists on classifying the mechanism of regulation in five big areas:

- a) access to the fishery (considered basic as it eliminates the uncertainty and clarifies who the users are, which reduces the conflicts);
- b) resource management and sustainability (which refer to the criteria of the regulation of fishing intensity);
- c) mechanisms that regulate fishing capacity (these mechanisms must adapt to structural changes, technical progress and changes in demand and consumption habits in a permanent way);
- d) mobilisation of economic funds (which take into account incentives, subsidies and public aids, which are very determinant factors in the industrial and traditional fisheries); and
- e) participation of the productive agents in the decision-making process (with a down-up system, as well as with the assumption of responsibilities).

As a result, this paper suggests focusing on the components of the model, the coordination of actions, and the existing scopes and instruments regarding the mechanisms of fishery management.

*Fernando González-Laxe: Instituto Universitario de Estudios Marítimos, Universidade da Coruña, Campus Elviña, ES-15071 A Coruña, Spain [tel: +34.981.16700 (ext 2571), e-mail: laxe@udc.es].*

## **ICES CM 2005/V:17**

### **Ecological aspects on co-management of coastal fish resources in Sweden**

J. Modin, T. Aho, L. Píriz, M. Sköld, and H. Svedäng

Integrated co-management implies that fishermen and other stakeholders should be included in the management process. This study compares three current co-management projects in Swedish coastal waters. The aim is to discuss implications of local co-management on ecosystem-based management. The projects differ in stakeholder participation, level of co-operation, involvement of authorities, and resource focus. One project involves a local trawl fishery for vendace (*Coregonus albula*) in the northernmost part of the Gulf of Bothnia, the Bothnian Bay. Management decisions have partly been delegated to the concerned fishermen who annually agree on fishing restrictions (effort, no-take zones). Another project concerns fishermen who trawl for northern shrimp (*Pandalus borealis*) in a marine protected area in the northern archipelago of Skagerrak. The fishermen, scientists, and regional and local authorities have agreed on a management plan for a sustainable fishery and nature conservation. The plan includes restrictions on gear

and access to ecologically sensitive areas. The fishery has been certified for a Swedish consumption label and the fishermen have participated in a marine ecology course arranged by university scientists. These projects are contrasted with an owner-based co-management project in the Baltic, where the prime goal has been to harmonise gear restrictions and allocation of fishing rights to non-owners. The various approaches for co-management, the objectives and participation are compared and the potential implications for fish resource management are discussed.

**Keywords:** integrated coastal management, fisheries management, coastal ecosystem, ecosystem approach, resource allocation.

*Johan Modin: Institute of Coastal Research, National Board of Fisheries, P.O. Box 109, SE-74071 Öregrund, Sweden [tel: +46-173-46 463, e-mail: johan.modin@fiskeriverket.se].*

## **ICES CM 2005/V:18 – Poster**

### **Uncertainty in the determination of biomass reference points for North Sea plaice: The influence of assumptions about discards, weight, maturity and stock-recruitment relationships**

Sarah B. M. Kraak, Loes J. Bolle, and Adriaan D. Rijnsdorp

Many exploited stocks are managed with regard to reference points. The limit biomass ( $B_{lim}$ ) is defined as the spawning stock biomass (SSB) below which recruitment is impaired or stock dynamics are unknown. Management harvest rules are designed such that  $B_{lim}$  should be avoided, usually referring to the precautionary reference point  $B_{pa}$ .  $B_{lim}$  is determined through inspection of the historic relation between recruitment and the parental SSB. However, our perception of the historic number of recruits, through the stock assessment, is influenced by our assumptions on true catch numbers, e.g. discards. Similarly, our perception of the historic SSB is influenced by our assumptions on fish weight and fish maturity. Different assumptions may change the shape of the stock-recruit relationship. Furthermore, decadal changes in the abiotic and biotic environment (regime shifts) may influence the recruitment potential of the spawning stock. We investigated the influence of assumptions about discards, fish weights, maturity, and the choice of the reference period with regard to possible decadal changes in the environment on the determination of  $B_{lim}$  of North Sea plaice. The different assumptions indeed changed the shape of the stock-recruit relationship, and led to different  $B_{lim}$  reference points. In some cases  $B_{lim}$  was close to the lowest observed SSB, in other cases recruitment seemed to have been impaired at observed larger SSBs. We conclude that the determination of  $B_{lim}$  is surrounded by uncertainty, perhaps necessitating a more conservative  $B_{pa}$ .

Keywords: North Sea plaice, uncertainty, reference points, limit biomass, discards, maturity, weight, stock-recruitment, regime shifts.

*Sarah B. M. Kraak: Netherlands Institute for Fisheries Research, P.O. Box 68, NL-1970 AB IJmuiden, The Netherlands [tel: +31 255 564 783, fax: +31 255 564 644, e-mail: sarah.kraak@wur.nl].*

## CM ICES 2005/V:19

### Experience-based knowledge and fisheries management in the Mweru-Luapula system, Zambia

Cyprian Kapasa, Isaac Malasha, and Doug Wilson

This paper reports the sociological findings in relation to hypotheses about the nature of fisheries experience-based knowledge (EBK) and its implications for management. The first hypothesis was that a body of knowledge exists that can be described as the EBK of the fishers in the Mweru-Luapula system. A very high degree of consensus was found, not only about simple factual observations but in opinions about simple causal relationships as well. A series of hypotheses were examined about patterns in how this body of knowledge was shared among the different fishing groups. This was carried out through a consensus analysis, a semi-quantitative anthropological technique that measures the degree of consensus and also generates a score of agreement with the consensus. The hypotheses examined were that fishers' EBK scores would be affected by: A) the particular gears; B) the number of different types of gears; C) the amount of experience. Support was found for the first two hypotheses, but not for the third. Finally, opinions about management were related to the various gear and geographical groups. This analysis found a group of fishers who are committed to fisher-based management and who share many attitudes that are congruent with the latest biological information on the management of the Mweru-Luapula. They are the group with the highest EBK and who would be a valuable resource for the sort of ecosystem-based monitoring that these authors are promoting. The problem is that they are the ones using illegal gears that are considered, with little biological justification, to be 'destructive'.

*Douglas Wilson: Institute for Fisheries, Management (IFM), North Sea Centre, P.O. Box 104, DK-9850 Hirtshals, Denmark [e-mail: dw@ifm.dk].*

## ICES CM 2005/V:20

### Evaluating fisheries management advice for some North Sea stocks: is bias inversely related to stock size?

Martin Pastoors

Biological scientific advice is often used as an input to fisheries management of commercially exploited fish stocks. The quality of that advice is often debated in public discourses but is much less often formally evaluated.

We looked at the scientific advice provided by the International Council for the Exploration of the Sea (ICES) for some North Sea stocks (cod, haddock, plaice, and sole) over the period 1985–2002 in order to assess the quality of the scientific advice. We compared the predicted landings from the scientific advice with the realized landings in the fishery and also evaluated the estimates of fishing mortality and spawning stock biomass in predictions and in the most recent stock assessments. We found that for a number of North Sea stocks there has been a strong tendency to overestimate stock sizes and underestimate fishing mortality during the 1990s. For some stocks, the bias appeared to be negatively correlated with stock size. Implications of these findings are discussed in terms of the quality of the scientific advice in fisheries management.

Keywords: fisheries management, stock assessment, evaluation, retrospective error, recruitment, TAC, *Gadus morhua*, *Pleuronectes platessa*, *Solea solea*, cod, haddock, plaice, sole.

*Martin Pastoors: Netherlands Institute for Fisheries Research (RIVO), The Netherlands [e-mail: martin.pastoors@wur.nl].*

## ICES CM 2005/V:21 – Withdrawn

## ICES CM 2005/V:22

### Possible stakeholder conflicts in quota-regulated fisheries

Thorolfur Matthiasson

Fishery economists and fishery scientists have forcefully argued that access to fisheries has to be restricted so as to increase stock size, harvest, and/or profitability compared to what would be the results of free access. Fisheries economists have pointed out that management by Individual Transferable Quotas (ITQs for short) fare better than other systems of management considered. It is the purpose of this paper to ask what kind of resource stewardship would best serve different stakeholders in an ITQ fishery. The stakeholders in focus are quota holders, non-quota-holding fishing firms (skippers), and (an imaginary) Ministry of Industry. It is shown, utilizing a simple model, that non-quota holding fish firms would argue for smaller steady-state size of the fish stock than would quota holding firms. Fishery managers may find themselves in the line of fire between the two. The final outcome may well be decided by the political weight of either group.

*Thorolfur Matthiasson: Faculty of Economics and Business Administration, The University of Iceland, Odda v/Sturlugotu, IS-101 Reykjavik, Iceland [e-mail: totimatt@hi.is].*

## ICES CM 2005/V:23

### Resolving conflicts in selecting a programme of fisheries science investigation

Kate Johnson, Mark Baine, Climis Davos, Joanna Henley, and Jonathan Side

Investigation and illumination of the underlying conflicts within a community of fishers and fisheries scientists provided the context for the case study supporting this paper. The Orkney archipelago in Scotland relies heavily on the marine environment for the wellbeing of its communities. This investigation goes beyond the conventional relationship between scientists and fishers and places fishers in a position to identify a programme of scientific research for the benefit of their fishery. Participatory techniques are used to: (a) establish a collective research agenda of high priority subjects; (b) identify groups of statistically similar research priorities; and (c) assess attitudes towards other stakeholders' potential reaction to their research agenda. Special attention is given to the dissemination of results.

Key findings include a reluctance of fishers to participate in meetings, but a high level of participation through completion of questionnaires (in excess of 50%) after a high level of personal contact by the research team. Partly reflecting the determination of those few who attended the meetings is the finding of the hostility they expressed towards fisheries science and research, while a notably less hostile view was expressed in the returned confidential questionnaires. Cluster analysis identified four groups of fishers expressing differing priorities for four possible research programmes. A lesson for policy-makers is the nature of the approach to gain the benefit of the fishing community's participation into research policy decisions. Determined individuals in public forums may not reflect majority opinions and other avenues of participation might be more reflective of conflict management potential.

Keywords: participation, conflict, fisheries science.

*Kate Johnson: International Centre for Island Technology, Heriot-Watt University, Old Academy, Back Road, Stromness, Orkney KW16 3AW, Scotland, UK [tel: +44 1856 850 605, fax: +44 1856 851 349, e-mail: k.johnson@hw.ac.uk].*

## ICES CM 2005/V:24

### Simulation designs to compare management scenarios using ISIS-Fish V2.0: application to a demersal mixed fishery in the Bay of Biscay

Stéphanie Mahévas and Dominique Pelletier

We developed ISIS-Fish V2.0, a simulation tool aimed at evaluating the impact of spatial and seasonal management measures on the dynamics of mixed fisheries. ISIS-Fish V2.0 is generic software that elaborates on the previous version by explicitly considering and modeling the

short-term economics dynamics of mixed fisheries. Effort allocation may be altered through fishers' behaviors, which depend on economic conditions, management options implemented, and other factors influencing fishers' decisions. Economic conditions are modeled through short-term cost and revenues. Decision rules and other endogenous behaviors may be modeled through a Script language that is integrated in ISIS-Fish V2.0.

Statistical simulation designs coupled to linear models are defined to run simulations and quantify the impact of management scenarios on fishery dynamics.

An application of ISIS-Fish V2.0 to a demersal mixed fishery of the Bay of Biscay is proposed. This fishery is actually managed through mono-specific-TAC, minimum-landing sizes, mesh size, and fishing ban for large boats within the 12-mile area. All these management measures are inefficient to protect the main target species, *Nephrops*, hake, anglerfish, and megrim. For several years, spatial closures of the *Nephrops* area and the hake nursery have been envisaged. We propose to assess this management measure and to compare it to traditional ones.

Keywords: simulation tool, statistical simulation design, fishers' behavior, bio-economical model.

*Stéphanie Mahévas: Departement EMH/IFREMER, Rue de l'Île d'Yeu, BP 21105, FR-44311 Nantes Cedex 03, France [tel: +33 240 374 181, fax: +33 240 374 075, e-mail: Stephanie.mahevas@ifremer.fr].*

## ICES CM 2005/V:25

### Can the technical regulatory measures restore the local fish stocks? Case study of the perch (*Perca fluviatilis* L.) stocks in the Riga Bay and the western-Estonian Archipelago

Leili Järv, Ahto Järvik, and Tiit Raid

The opening of the European market for Estonian perch caused a rapid increase in effort and catches in the perch fishery. However, after some years the catches and CPUE began to decrease. Furthermore, the older age groups disappeared from the age structure of catches. Despite the absence of the analytical stock assessment of perch, the annual overexploitation of most of the local perch stocks could be clearly defined in the early to mid-1990s.

The overexploitation was first observed in Pärnu Bay (Northeastern Gulf of Riga) and the need for technical regulatory measures became clear. In 1992, the mesh size limit in gill nets was increased from 76 mm to 96 mm. That made it practically impossible to catch perch with these gears. For the following 4–5 years a total ban on fishery in the last ten days of every month and a minimum landing size of 19 cm for perch was implemented. From 1997 the decreasing of perch catches stopped and the slow increase of catch and CPUE in

Pärnu Bay could be observed. At present, the perch stock is probably restored in Pärnu Bay.

In other areas of the Riga Bay and in the Archipelago Sea the implementation of the regulatory measures mentioned above began only in 1999. As a result, the local perch stocks have been for a long time in depression and the restoration is not yet observed.

The experience obtained with the Pärnu Bay perch stock shows that the implementation of the working technical regulatory measures at the proper time can avoid the depletion of fish stocks that are under high fishing pressure, and make the restoration of overexploited stocks faster, even if the TAC regulation is missing.

Keywords: perch, fishing effort, overexploitation, stock restoration, technical regulatory measures.

*Leili Järv: Estonian Marine Institute, University of Tartu, Mäealuse 10A, EE-12618 Tallinn, Estonia [tel: +372 671 8962, fax: +372 671 8900, e-mail: leili@ness.sea.ee].*

### **ICES CM 2005/V:26**

#### **International Baltic Sea Fisheries Commission – A case study in multi-agent negotiations**

Robert Aps, H. Lassen, and W. Ranke

The International Baltic Sea Fisheries Commission (IBSFC), the regional fisheries organization responsible for rational exploitation of Baltic shared fishery resources was established in 1973, pursuant to the Gdansk Convention, with a view to preserving and increasing the living resources of the Baltic Sea and the Belts and obtaining the optimum yield, and, in particular, to expanding and coordinating studies towards these ends. A multi-agent management decision negotiation framework (negotiation protocol, negotiation issues, and reasoning model) related to the package-deal and zero-sum game schemes was used to describe and analyze the management decision uncertainty related to (1) yearly negotiations on the total allowable catches (TAC-s) for the Baltic cod, herring, sprat, and salmon, (2) re-allocation of the Baltic cod and herring fishing possibilities, and (3) conflict resolution mechanisms applied by IBSFC. The possibilities to increase participation of the fishing industry in the management decision process with the aims: (1) to improve the fisher's perception of the management decisions and responses to management implementation, and (2) to decrease uncertainty associated with the fisher's adaptations or lack of compliance are discussed in terms of negotiating positions of the stakeholders involved into multi-agent negotiations under the IBSFC frames.

Keywords: multi-agent negotiations, package-deal, zero-sum game, fisher's compliance.

*Robert Aps: Estonian Marine Institute, University of Tartu, 10A Mäealuse Str., EE-12618 Tallinn, Estonia*

*[tel: +372 506 2597, fax: +372 671 8900, e-mail: robert.aps@ut.ee].*

### **ICES CM 2005/V:27**

#### **Interdisciplinary modelling through probabilistic networks: impact of fishermen's commitment on the management of wild Baltic salmon stocks**

Catherine G. J. Michielsens, S. Kuikka, P. Haapasaari, S. Kulmala, A. Romakkaniemi, and J. Erkinaro

Till now the restoration of potential wild Atlantic salmon populations has known relatively little success. In order to increase the probability of success, it is necessary to examine the possible factors that are currently limiting the rehabilitation of these salmon stocks and which remedial management measures can be taken. Management measures however, do not directly affect the salmon populations. Instead they are targeted at the fishermen. The impact of management measures on the fish stocks is therefore dependent on the reaction or commitment of fishermen to the management measures. The commitment of the fishermen, however, is quite uncertain. A probabilistic net has been constructed to look at the impact of fishermen's commitment on the fish stocks. This net combines biological information on the wild Baltic salmon stocks with socio-economic information from the fishermen. Low commitment of fishermen will decrease the impact of management actions on the fish stock. In order to select appropriate management measures to increase the probability of successful rehabilitation of potential salmon rivers, information on the fishermen's reaction to different management measures is needed. Larger uncertainty about the fishermen's commitment to different management actions will result in a lower control over the system.

Keywords: fisheries management, commitment, interdisciplinary, Bayesian network.

*Catherine G. J. Michielsens: Finnish Game and Fisheries Research Institute, Viikinkaari 4, P.O. Box 2, FIN-00791 Helsinki, Finland [tel: +358 205 751 357, fax: +358 205 751 201, e-mail: catherine.michielsens@rktl.fi].*

### **ICES CM 2005/V:28**

#### **Small-scale fishers perceptions about fisheries governance and other stakeholder groups**

Pekka Salmi

Small-scale fishing is a livelihood characterised by a long history of adapting to changes in the social and natural environment. Fishing forms often a part in the rural pluriactivity: the fisher households combine different sources of income and develop various fishing strategies for coping with the changes. Although the income from fishing is not as high as in larger fishing enterprises, small-scale fishing is often important for the em-

ployment, economy, and culture of rural coastal communities. The diversity and complexity of the livelihood forms a special challenge for fisheries governance, which, at the central level, has typically concentrated on managing larger fishing units.

This paper is based on results from an EU-funded project (AQCESS), which studied aquaculture and coastal economic and social sustainability in a multidisciplinary way. The empirical material comprises personal interviews conducted with commercial fishers and other stakeholders in the Finnish study area, Archipelago Sea Region, SW Finland. In this area fishing has a long tradition as a source of income combined with agriculture and shipping, but along with the modernization of the society the coping strategies have changed and diversified. The paper will draw special attention to the fishers' perceptions about different decision-making institutions and stakeholder groups and discuss options for developing the governance of small-scale fisheries.

Keywords: small-scale fishers, governance, fisheries authorities, water owners, Archipelago Sea Region.

*Pekka Salmi: Finnish Game and Fisheries Research Institute, Saimaa Fisheries Research, Laasalantie 9, FIN-58175 Enonkoski, Finland [tel: +358 205 751 623, fax: +358 205 751 609, e-mail: pekka.salmi@rktl.fi]*

## ICES CM 2005/V:29

### Governance of the Baltic salmon fishery – Fishers' views

Juhani Salmi and Pekka Salmi

The states around the Baltic Sea have regulated commercial salmon fishery with an emphasis on protecting the wild salmon stocks. In Finland the measures have been motivated also by securing catches for fishing tourism in the rivers. The divergent interests have aroused conflicts between commercial Baltic salmon fishers and northern tourism industry and have become a heated issue not only in fisheries policy, but also in the regional policy by the state. Typically, the national decisions concerning the Finnish salmon fisheries policy have been made on an *ad hoc* basis, without extensive planning or participation by the user groups. In addition to the central state authorities, fisheries research has a strong impact and has been tightly involved in the planning stage.

In this paper we study the perspectives and problems presented by Finnish salmon fishers concerning the management of Baltic salmon fisheries. We also discuss fishers' adaptation strategies to the changing circumstances. The empirical material comprises face-to-face interviews with commercial fishers. After introducing the governance system in salmon fishery we analyse fishers' preferences concerning different means of regulation. On the basis of the empirical material and various other sources, highlighting e.g. the river fisheries perspectives, we discuss the options of moving towards more sustainable Baltic salmon fisheries governance.

Keywords: commercial fishers, river anglers, tourism industry, fisheries governance, authorities, Baltic salmon.

*Juhani Salmi: Finnish Game and Fisheries Research Institute, Reposaari Unit, Konttorikatu 1, FIN-28900 Pori, Finland [tel: + 358 205 751 895, fax: + 358 205 751 895, e-mail: juhani.salmi@rktl.fi].*

## ICES CM 2005/V:30

### The payoffs from marine reserves in a stochastic environment: shocks, rents and resilience

R. Quentin Grafton and Tom Kompas

The paper analyses the economic payoffs from marine reserves using a stochastic optimal control model with a jump-diffusion process. The results show that even if the reserve and harvested populations face the same negative shocks, harvesting is optimal, the population is persistent and with no uncertainty over current stock size, a reserve can increase resource rents. Using data from the North Pacific halibut and the Northern cod fishery we demonstrate that the more the payoffs from a reserve, and also optimum reserve size, increase the larger is the magnitude of the negative shock, the greater its frequency, and the larger its relative impact on the harvested population. The results show that with a stochastic environment an optimal-sized marine reserve can generate a triple payoff that (a) raises the resource rent even when harvesting is 'optimal', (b) decreases the recovery time for the biomass to return to its former state and smooths fishers' harvests and resource rents, and (c) lowers the chance of a catastrophic collapse following a negative shock.

Keywords: optimal control, uncertainty, rents, resilience.

*R. Quentin Grafton: Asia Pacific School of Economics and Government (APSEG), Room 215, JG Crawford Building (Bldg 13), Ellery Crescent, The Australian National University, Canberra, ACT 0200, Australia.*

## ICES CM 2005/V:31

### Applying Bayesian modeling to social sciences: methodological perspective

Kalle Reinikainen, Timo P. Karjalainen, and Päivi Haapasaaari

Bayesian belief networks have been applied especially in natural sciences, as a representation of knowledge for reasoning under uncertainty. We apply Bayesian modeling to social sciences in the Bireme-SAP fisheries management research project, which works for the restoration of the salmon stocks of Bothnian bay rivers in Finland. Our task is to model fishers' perceptions of the management issues, using Bayesian belief networks. The aim is to link the social model with the biological model in order to find the best ways to increase the probability of successful salmon restoration. In our presentation we shall introduce our concept for applying Bayesian methods to social sciences. The first phase of Bayesian mod-

eling is building up the model structure, in which a lot of knowledge from the field is needed. Our approach to this is key-person interviews and the process of Grounded Theory, the outcome of which is a mind map describing the interrelationships of the social network under research. The mind map is then developed into the model structure. The next step is collecting the data to the conditional probability tables of the model. Our way to do this is by a structured questionnaire. The distributions of the questionnaire are then estimated to get the probability values. On the whole, applying Bayesian methods to social sciences requires a wide methodological triangulation. The model has to be seen as a particularistic representation of reality, but anyhow it can be a useful tool for policymaking at a more common level.

Keywords: interdisciplinary modeling, social sciences, Bayesian belief networks, Grounded Theory.

*Kalle Reinikainen: Faculty of Education, University of Oulu, P.O. Box 2000, FIN-90014, Finland [tel: +358-8-553 3455, fax: +358-8-553 3600, e-mail: kalle.reinikainen@oulu.fi].*

## **ICES CM 2005/V:32**

### **Involving fishers in the development of a fisheries ecosystem plan**

O. A. L. Paramor, J. L. Hatchard, K. H. Mikalsen, T. S. Gray, C. L. Scott, and C. L. J. Frid

An ecosystem-based fisheries management plan for the North Sea was developed using input from fishers and other stakeholders. Stakeholders were interviewed at the start of the process to determine what they wanted out of the North Sea ecosystem and which management tools they preferred. Scientists and modellers then investigated the level and types of management required to achieve these ecosystem states. These results were presented back to stakeholders for comments and feedback before the North Sea fisheries ecosystem plan was finalised. The management tools preferred by fishers were technical measures, effort control, and protected areas. Quotas were thought to encourage discarding which they considered a serious threat to the health of the ecosystem. This presentation will provide information on fishers' perceptions of these management tools and how they thought these could be best implemented.

Keywords: ecosystem, stakeholders, fishers, North Sea, fisheries management.

*O. A. L. Paramor: Dove Marine Laboratory, School of Marine Science and Technology, University of Newcastle upon Tyne, Cullercoats, North Shields NE30 4PZ, UK [tel: +44 191 252 4850, fax: +44 191 252 1054, e-mail: O.A.L.Paramor@newcastle.ac.uk].*