Strengthening the links between European marine fisheries science and fisheries management

Future Demands for Fisheries Research

1. Introduction

The Danish Ministry for Food, Agriculture and Fisheries organised a symposium on Future Demands for Fisheries Research, as a member of MariFish. The aim of the symposium was to identify strategic research areas, required to support the development of fisheries management in Europe over the next ten years, in the context of the broader marine environment. The symposium addressed the developments in fisheries policy and management internationally, the future demands for scientific advice for fisheries management and strategic research to support the scientific advice. The MariFish Symposium on Future Demands for Fisheries research took place in Roskilde, Denmark in June 2007. The Symposium was attended by fisheries managers, scientists and stakeholders. Symposium program and participants list is shown in Appendix 1 and 2.

The symposium addressed

- How can research better facilitate fisheries management in the future?
- How can sustainability of marine fisheries be improved by more efficient interaction between management and research beyond traditional approaches?
- How climate changes to the marine environment affect fisheries management and the need for research and advice?
- How should research facilitate the implementation of an ecosystem approach to fisheries management?
- What research is needed in order to implement the commitment to maintain or restore stocks to levels that can produce the Maximum Sustainable Yield (MSY) by 2015 (WSSD (2002))?
- Can and should we develop management systems that give more responsibility to the fishing sector for management and control and is the sector ready to take on the responsibility? How can the incentives in fisheries be changed so that the fishing sector strives for sustainability rather than increased exploitation?

The presentations and workshops lead to recommendations for strategic research priorities related to these questions.

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2. Introduction to the MariFish project and work package 8

MariFish brings together European national funders of marine fisheries research to form an effective, working partnership. The total combined annual fisheries research budget of all partners amounts to approximately €160 million and represents a significant European research resource and body of scientific knowledge. To achieve this aim MariFish are in the process of undertaking the following activities from 2005-2010:

- Exchange information on current R&D/research programmes.
- Improve practices in the planning and procurement of research through shared knowledge.
- Identify existing regional, European and international collaboration.
- Enhance coordination between fisheries research and other disciplines.
- Compare and analyse national research programmes to identify areas of common interest, gaps and possible duplication.
- Develop and commission shared research programmes.
- Identify innovative, strategic research needs and develop a jointly funded programme.

Fishery management relies heavily on science; research makes a significant contribution to the translation of the Common Fisheries Policy, and other policy drivers. There is, therefore, a strong sense of overall purpose for fisheries research – that of providing a scientific basis for achieving sustainable fisheries management, set within the ecosystem-based principle.

To help MariFish achieve its many challenging goals the following statement of overall purpose has been adopted by the partners:

> "MariFish will focus on that research which provides evidence to managers for the development of strategies for sustainable fisheries, including links with aquaculture, set within the ecosystem based principle."

To ensure the overall objectives of MariFish are met the project has developed 8 work packages, which are all linked, please see more details at www.marifish.net. The symposium is linked with work package 8, which aim is to undertake a ten year forward-look exercise to identify strategic and innovative requirements for fisheries research to support the likely development of fisheries management over the next ten years.

3. Fisheries management and Ecosystem based management

European marine fish are managed by the Common Fisheries Policy (CFP) framework consisting of four pillars: conservation policy, structural policy, market policy and external issues. International conventions are also relevant to European fisheries management. The UN agreement on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (United Nations, 1995), the FAO Code of Conduct for Responsible Fisheries (FAO, 1995), the International Plan of Action for the Management of Fishing Capacity (FAO, 1999), International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (FAO,2001), International Plan of Action for sharks (FAO, 1999), the Habitats Directive (EEC, 1992) and the World Summit on Sustainable Development, Johannesburg (2002).

Research and science have a crucial role in the development of necessary tools for the operational and practical implementation of fisheries management. The overall objective of the CFP is to

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secure sustainable fisheries within an ecosystem approach. However the CFP has faced many challenges due to the decision-making process. Decision-makers are now questioning the present path and seeking management changes to improve the sustainability of fisheries within the Community.

Ecosystem based Management EBM
Fisheries management decisions have always faced uncertainty in science, the environment and the effectiveness of various management measures. An expansion of the scope for management to include extended ecosystem considerations will increase the uncertainty confronting policy decisions. The call for ecosystem-based approaches to fisheries management follows other, similarly far-reaching calls for changes to the basic approaches of fisheries management such as integrated cross-sectoral approaches, the precautionary approach and participation from a wide range of stakeholders.

The need to adopt an ecosystem-based approach for fisheries management is a priority, as a part of the CFP and indicated by the now developing European Marine Thematic Strategy which aims to give additional protection to the European marine environment. There are significant challenges here for fisheries science - understanding the impact of fishing on the marine environment, assisting in the development of alternative management measures, and how to monitor recovery, through the development of appropriate indicators. The inclusion of ecosystem considerations in fisheries management implies two changes with extensive institutional repercussions: the uncertainties about states and outcomes rise dramatically and a multiplicity of new stakeholders, interests and objectives must be accommodated in the management institutions.

4. Presentations

(The power point presentations can be found on MariFish website ww.marifish.net)

4. 1 Scientific input to fisheries management

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A range of new policy directions sets new requirements for the scientific support for the Common Fisheries Policy. These include a move from a tactical to a strategic approach, from avoiding disaster to doing something good, from predictive to adaptive management and from top-down micromanagement to industry initiative within limits. Examples on initiatives requiring new types of scientific support are the development of management plans, the implementation of an ecosystem approach and the development of results-based management as inherent in the new discards policy.

These new requirements also mean that the way research is conducted must increasingly be interdisciplinary, integrating sector issues with the environmental and social context and that there is a need to develop research in cooperation with the industry. The complexity of issues and the emphasis on stakeholder participation also means that research based advice should be delivered in a more exploratory manner than is presently the case.

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The 7th Framework Programme will make calls for research which underpins the longer term needs for research to support advice ranging from basic understandings of marine ecosystems and societal drivers for fisheries to fisheries interactions with the ecosystems, societal outcomes and governance for fisheries management.

4. 2 New Zealand fisheries; How research underpins existing management and priorities for the future

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New Zealand has the world's fourth largest Exclusive Economic Zone but its fisheries are only moderately productive, with total annual catches of around 600,000 tonnes. About ninety percent of total production is exported, with a value of approximately NZ$ 1.1 billion (equivalent to about 550 million Euro). The aquaculture industry produces an additional NZ$240 million in exports. There are also important recreational and customary Maori fisheries.

Since 1986, major commercial fisheries have been managed using Individual Transferable Quotas. Currently, 96 species (divided into 618 management units) are managed by ITQs . The industry receives no direct subsidies and pays approximately NZ$30 million towards the government's costs of managing commercial fisheries, including research and enforcement. Total annual expenditure on fisheries and aquatic environment research is approximately NZ$40 million, of which about NZ$20 million is purchased by the Ministry of Fisheries. Relatively small but increasing proportions of the research purchased by the Ministry are for non-commercial research and aquatic environment research. The Ministry does not undertake research itself but purchases research from a range of government and private research providers.

For more than ten years the Ministry has operated planning processes for both research planning and stock assessment that involve extensive interaction with stakeholders. The first step in the research planning process is 13 planning groups, each focusing on a group of fisheries or a theme, such as non-commercial fisheries or stock assessment methods. Each group comprises scientists and fishery managers from the Ministry, research providers, and stakeholder representatives (commercial, customary, environmental, and recreational), including scientists employed by stakeholder organisations. The groups discuss, evaluate and recommend proposed future research activity in respect of relevant fisheries or themes.

Recommendations from all the groups are then considered by the Research Coordinating Committee, which comprises similar membership as the planning groups but often at a more senior level. It develops prioritised recommendations for future research activities across all fisheries. The Ministry reviews these recommendations against other non-research priorities and consults with stakeholders on the Ministry's proposed services (including research) for the following year. Thus, the process includes three formal consultations with stakeholders. The stock assessment process is very similar and involves the same participants.

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These consultative processes are important components of New Zealand's fisheries management and most participants consider the processes valuable. Advantages include:

- An open process with good documentation and improved transparency.
- Involvement by stakeholders is important for co-management, and leads to better understanding by stakeholders of stock assessments and research needs.
- Input from stakeholders and contestability of assessments leads to better assessments.
- There is a clearer rationale for research and research planning responds to issues raised in assessments.

There are a number of potential concerns with the processes. These may result in modifications over time:

- The processes are expensive and require a significant time commitment by Ministry staff and stakeholders; there is a lag between identifying research needs and purchasing research.
- Lack of funding for effective participation by non-industry groups.
- Environmental concerns about undue industry influence.
- Industry concerns at their lack of influence on research for which costs are recovered from the industry and the potential for inappropriate influence by research providers.
- A consensus approach in working groups can limit reporting of different views.

New Zealand also allows for information generated by stakeholder-purchased research to be used in official assessments, although the systems by which it is used in assessments are not well developed. The industry undertakes a range of research projects including fine scale catch effort data collection, acoustic surveys, and development of devices to reduce impacts on protected species. Advantages of such research include:

- Increased stakeholder buy-in to research and management.
- Potential for increased cost effectiveness, efficiency, and innovative research.

Potential concerns include:

- The need for explicit standards and strict monitoring to ensure integrity and quality of research.
- Increased variety of research methods requires additional coordination with MFish-purchased research.
- Stakeholder expectations about the usefulness of information may be unrealistic.

Recovery of government costs for research on commercial fisheries is an important part of New Zealand fisheries management. Advantages include:

- Costs of research to support activities resulting in private benefit are not borne by the taxpayer.
- Allows total value of the fishery to be considered in management.
- Incentives to ensure good links between research and management objectives, and justification of proposed research.
- Strong focus on cost-effective research methods.

Potential concerns with cost recovery for research include:

- Ongoing debates about what research should be cost-recovered.
- Administrative complexities.
- Strong industry incentives to reduce research costs.
- Debate on the scientific merits of research can be clouded by cost considerations.

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- Interpretation of the precautionary approach (i.e., the management response when information is poor) is important.

There is currently a move to implement objectives-based management in New Zealand fisheries. It is based on standards to ensure government obligations are met, and fisheries plans setting out how value for stakeholders from each fishery can be maximised within the standards. The move to objectives-based management is likely to have significant effects on research requirements, including:

- Increased focus on evaluating a range of potential multi-year harvest strategies, including options for research and other services.
- Evaluation of fisheries against standards – those set by the government and those required to achieve environmental certification.
- An increased focus on socio-economic research and research on the impacts of fishing on benthic habitats and on the broader aquatic environment.
- An increased focus on managing to specified levels of risk, involving trade offs between allowable harvest levels and the precision of stock assessment levels.

4. 3 Stakeholder involvement and future demands for fisheries research

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The current management system we have to manage fisheries is not working in every case, although it is important to recognise that in many cases the system does appear to be working, as there are healthy stocks in many parts of the world and even in the waters subject to the management rules of the Common Fisheries Policy. However achieving all stocks in a healthy condition and ending all overexploitation that exists is not occurring. The last review of the Common Fisheries Policy (CFP) concluded, that one of the major institutional failures of the CFP was the lack of stakeholder engagement. And the route taken to address this inadequacy was the formation of the Regional Advisory Councils (RACs), ensuring stakeholder engagement, of which the Pelagic is one.

Management has favoured output as the goal around which policy goals have been devised. Reliance on biological predictions has helped conceal the fact that the ultimate objective of fishing is an economic one. The pelagic RAC want to see the implementation of long term management plans that help to secure sustainable stocks and at the same time enable economically viable catching and processing industries to supply the global demand for fish. One of the major difficulties inherent in managing small pelagic fisheries is the large and unpredictable fluctuation in recruitment that can occur illustrated by the history of Atlanto Scandian herring and North Sea herring fishery.

The fishing industry needs good science to have a viable long term future. Not only to enable the setting of TACs and quotas and to help explain environmental changes, but also to meet the

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increasingly stringent requirements of the consumer. The consumer is increasingly looking to the retail sector to provide the safeguards associated with social and corporate responsibility. Sustainability sells products. And increasingly accreditation of fish products will require scientific sanction thereby ensuring that science is no longer just for the benefit of scientists or the fishermen, but that it underpins the entire supply chain. Science, good science is no longer an option or even a luxury. It is now firmly at the heart of what is needed to have to do what we do best; catch and sell fish.

4.4 Fisheries Management in Canada And Future Priorites: Traditional Relationships in a Complex, Changing and Uncertain Environment

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The relationship between fisheries management and science has become more complex and more challenging over recent years as the policy, legal and governance contexts for fisheries management has become more complex.

On environmental policy, we have moved from a fisheries stock focused approach with the objective of maximum sustainable yield to an approach with multiple objectives based on the precautionary approach, ecosystem based management, and industry economic viability. At the same time, the legal context has constrained traditional approaches in Canada with new Species at Risk Legislation, Oceans Legislation, Court decisions, and international agreements – all of which prescribe certain approaches or measures in different circumstances. And to make things more challenging, the actual governance system for the management of fisheries has become flatter and more complex with fishers, other jurisdictions (Provinces and Territories), Aboriginal groups, NGO's and others increasingly seeking a greater say in decision making.

All of this serves to make fisheries management more complex and less predictable than it was in the past. Whereas science advice in the past was focused largely on stock biomass and productivity, science is now being asked to provide advice, information and analysis on stock interactions and predation, on spawning practices, on sensitive areas and the effect of various gear technologies on their effect o benthic communities, on the effect of the increasing number of invasive species in the ecosystem, and on changing ocean conditions and their potential effect on stock dynamics now and in the future. And in providing this advice, to be effective, it has to be accessible and meaningful not just to fisheries managers, but to multiple stakeholders.

With static resources over the past decade, scientists have struggled to find ways to respond to these new queries and to still to provide basic stock status advice that continues to be and will continue to be the core scientific requirement for taking fisheries management decisions.

This state of affairs has the challenged the ability of fisheries managers to provide advice to Ministers for decisions on quota and other measures and it has stretched the capacity to scientists

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to respond to the growing array of information requests that are now considered necessary to taking responsible decisions.

To help us to address this, Canada has worked on a Resource Management Sustainable Development Framework to clarify fisheries management policy, legal, and governance frameworks and a fisheries assessment tool to support these frameworks. We have also developed a 5 year strategic science research agenda for the department in an attempt to consider the questions that fisheries management (and other marine science clients) have and will have in the future. We are also seeking to reposition departmental science and fisheries management in the developing environment where are all of the key decisions and the crucial information for those decisions are no longer only in government.

At the end of the day, we believe that the ability for fisheries management and science to work together to respond effectively to this developing set of circumstances is crucial to successful fisheries management and to the future of the resource.

4. 5 Integration of ecosystem considerations into future fisheries management

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Numerous policy commitments call for the adoption of an Ecosystem Approach to Fisheries (EAF). The current management challenge is to move towards effective implementation of an EAF. In practice, implementation requires the development of a management system that can deliver both fisheries and environmental objectives. The presentation considersthe types of scientific research that are needed to support implementation. This is based on the recognition that EAF requires that environmental issues formerly dealt with on an ad-hoc basis are treated as a central issue in management, that objectives relating to both fisheries and ecosystem concerns will be part of the management system, that there will be potentially more conflicts from trying to meet multiple objectives and that there will likely be a move towards treating fishing on a par with other sectoral activities. At present, the main issues that must be addressed when moving towards an EAF are excessive capacity, incompatible objectives, changing societal perspectives, the prioritization of fishing impacts (what matters) and the development of mitigation measures and incentives. Dealing with excessive capacity and changing societal perspectives is mainly a management issue that requires limited additional scientific input, but managers will need new research inputs to address the other issues. In relation to objectives, such research could usefully include:

(1) the development of analytical tools and decision support tables to describe explicitly the tradeoffs between fisheries and environmental objectives,
(2) the development and testing of operational objectives for fishery and environmental management (at the RAC area scale) and,

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(3) the development and testing of tools for reconciling incompatible objectives at the sub-RAC area scale (e.g. spatial planning). In relation to the prioritization of fishing impacts, it is necessary (1) to understand how effectively single-species management might support an ecosystem approach and which environmental issues will remain if MSY is achieved, (2) to identify those management methods that most effectively minimize the risk of undesirable changes in marine ecosystems, (3) to determine the minimum requirements for data to support an effective ecosystem approach and to ask whether more can be achieved with cheaper and more easily collected pressure data (e.g. VMS records) and,
(4) to develop indicators and reference points and the supporting data collection procedures to support an EAF. In relation to mitigation measures and incentives, it is necessary (1) to develop and assess the impacts of incentive schemes that might promote environmentally responsible fishing (ERF), (2) to develop methods for assessing and reporting on the impacts of fisheries and comparing their environmental "footprints", (3) to develop gears to reduce the environmental impact of fishing and to assess their benefits in conjunction with other management tools, (4) to develop and assess methods of EIA and SEA that might be applied to fisheries,
(5) to develop spatially based management systems that integrate with those developed by other (non-fisheries) sectors and,
(6) to develop methods for assessing and consistently documenting the "track records" of fisheries. The last issue is likely to become important when identifying areas where fisheries have a precedent to operate within a spatial planning system.

5. Discussions

The discussion of the presentations ranged widely and provided a strong basis for the workshop recommendations to follow. A critical point was that fisheries science needs to both change and lead the fishery management system to a greater extent by responding to new challenges and developing new tools. It was noted that the fishery science system has not kept up with the changing needs of policy-makers. Calls for ecosystem-based advice, advice on multispecies management strategies and new types of management measures such as area based management are too often met with somewhat negative responses from the scientists. Some of the inability to respond to requests for new, more complex advice results from a lack of data of sufficient resolution and extent to address emerging problems. There was substantial agreement that data collection and management systems (e.g. data archiving and data sharing) need to be improved as rapidly as possible to take advantage of new technology as well as to respond to the need for more complex advice. This includes the need to address data access concerns as well as improving the quality of fisheries data. There is an urgent need to obtain comprehensive, accessible data on catches, that both are species and area specific to a much greater degree than under the present system.

Another important point in the discussion was the development of new models for fisheries ecosystems that would allow greater exploration of management scenarios beyond simple single species assessments of population dynamics. This includes spatially explicit models (ecological footprint analysis) that can consider the impacts on target and non-target species as well as habitat and can be used to project likely impacts of management policies in the medium term.

Based on the presentations there were a substantial discussions of the need to shift toward a focus on strategic outcome based management rather than input and tactical studies. This means, in effect, defining conservation goals and limits and strategies to achieve these goals, leaving tactics

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to the fishing sector, rather than designing technical measures to achieve conservation and constantly trying to catch up with the changing tactics and efficiency of the sector. In order to do this, the conservation goals need to be defined in sufficient detail to be clearly enforceable by region, for example. It also means that the burden of proof of management efficacy changes from justifying management tactics to clarifying strategy and challenging the fishing sector to ensure their tactics can attain the conservation goals.

Participants from the fishing sector indicated that there was a significant change in perspective among some fishermen toward the desire for stability in catches rather than maximum catches. This was particularly notable for the pelagic fisheries where many stocks are at sustainable levels, while for other fisheries in need of rebuilding. This change in perspective implies that scientific advice may be needed to address variability more directly rather than yield maximisation.

6. Reflections

Dr. Andrew A. Rosenberg and Mr. Mogens Schou were invited to provide reflections on the presentations.

6.1 Reflections by Prof. Andrew A. Rosenberg, University of New Hampshire

The presentations in this conference provided some fascinating perspectives on new directions for fisheries science. In particular, I noted with interest the following observations:

- Fisheries science is now in the position of needing to catch up with management. Some management initiatives are seeking new direction while the scientific advice has been slow to respond to these new challenges.
- There have been a series of new principles developed for management including the Precautionary Approach, Ecosystem-based Management, Objective-based management and area management and the interconnections between these have not always been made as clear as they should be.
- Given the ever increasing complications of management systems it is essential to move from a tactical approach to management to a strategic approach to management, from single sector to cross-sectoral approaches and from management based on prediction to management based upon adaptation.
- For much of the industry, and for management as well, stability in a fishery is more important than maximizing yield.
- The management system must be integrated across government and stakeholder groups, including cooperative research.
- As cross-sectoral approaches are developed a system for identifying and resolving trade-ffs between objectives (yield vs stability, one species versus another, fisheries versus other uses of the marine environment).

My comments are with respect to three of these issues, objective-based approaches, cooperative research and the implementation of ecosystem-based management.

To establish an objective-based system of management it is necessary to reframe the scientific advice such that management can set the limits or constraints within which industry operates. This creates a sustainability or conservation space and allows the tactics for fishing to be determined by the industry as long as the limits are respected. The intention is to move beyond the current

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system of trying to control fishing tactics in a never-ending spiral where management is trying to catch up with industry with respect to fishing methods, data and conservation (e.g. recruitment based fisheries and the problems of recovering stocks after overfishing has occurred). Scientific advice needs to focus on what these limits or constraints should be in terms of exploitation rates, non-target stocks, ecosystem effects and so forth, as well as the data requirements to estimate and monitor the limits.

Cooperative research can be a vital tool for expanding the science program. The two principal features of cooperative research are that it brings fishermen knowledge into the sampling and science framework and it enables high resolution high frequency sampling to occur in a way that research cruises can never do. The most critical cooperative research is to bring fisheries data from vessels to the scientists and managers accurately and in real time, accurately geo-located. These data are fundamental and our data systems are still shockingly poor, in large part but not entirely because of the lack of cooperation from industry. The second priority is to research those new scientific questions that critically depend upon high intensity sample, not to re-study questions that have been largely answered in hopes of getting a different result. Technical expertise of fishermen can be crucial in answering these emerging questions.

Ecosystem-based management is cross-sectoral and must be thought of in the context of ecosystem change due to climate, fishing and other factors. It is essential to develop models of ecosystems that can fully estimate the cumulative impacts of various human activities on the marine environment, and evaluate the trade-ffs resulting from different mixes of activities. To do this, real-time, high resolution data is needed, not just the traditional fisheries data with all the restrictions on confidentiality. Marine ecosystems are a public trust resource and the data on activities in the marine environment should be widely accessible.

All of these issues require a different kind of scientific advice from traditional fisheries science. Broad ecosystem analyses will be needed more than annual stock assessments. Long term advice becomes more important than short-term advice. Modelling of management scenarios for whole ecosystems rather than just each individual fishery will be needed, and data must be accessible across sectors at a high level of resolution. The future of fisheries science will follow these principles in my view.

6.2 Reflections by Mogens Schou, Advisor on fisheries and aquaculture to the Danish Minister

Being a fisheries manager in the ministry, my problem is, that I don't pay the fishermen – and I don't hire them or fire them. In the end I don't manage them even if this has been the conception of the Common Fisheries Policy for 25 years.

Fishermen have their own management plan. Sometimes they don't seem to understand the deeper meaning behind our management and sometimes they don't believe that the stock forecast made more than a year ago is still correct.

What we do is trying to manage the resource with the fisherman as the contestant of our skill and method in doing so.

How do we make fishermen comply? We don't – let us tell fishermen the share of the stock they can take, and ask them to manage themselves and prove that their management complies with this simple condition.

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They must optimize and document their fishery. Science becomes the servant of optimal production within a simple restriction, just as it has been in the steel industry and other energy and raw-material using industries, where use of input relative to output has improved beyond imagination.

Science must facilitate the process: Challenge existing management paradigms – don't just criticize levels of outtakes. And prove concrete management methods in participatory research method with concrete fleets. Do it together with your colleagues within behavioural sciences and the new technologies.

Perhaps then I can then focus on policy and administrative issues, as I thought would be my destiny, when I entered public service.

7. Reports of Working Groups

(The power point presentations can be found on MariFish website ww.marifish.net)

7.1 Report of Working Group 1

Chairs: Kevin Stringer's and Iain Macsween
Rapporteur: Helen Shaw

Research for future management
Future research topics identified by the group included a wide range of topics. Ecosystems and trophic levels (food webs and predator-prey interactions) were considered a priority because they will provide insight into how changes to the distribution and abundance of one species (through human impact and climate change) may affect other species.

Interdisciplinary research (socio-economic and institutional analysis) was also recognised to be important to improve understanding on the drivers behind fishers' behaviour. This will allow managers to develop management strategies that take into account the possible impact of policies on fishers' behaviour. Other topics included the consumer to ocean/ocean to plate approach (considering marketing and processing of fishery products), ecolabelling and certification (to maximise the return on catch), marine spatial planning and development of reliable carbon footprints.

Management
Participants agreed that in future there should be increased collaboration – particularly to investigate larger scale questions e.g. climate change, a more regional approach considering multiple objectives and flatter governance. Scientists should be more closely involved with policy makers and have a dialogue in the early stages of discussions with stakeholders, with the RACs identified as a good example of a meeting that would benefit from increased participation of scientists.

Objectives
There is a need for improved communication of research to all stakeholders including policy-makers and public. There should be easier ways of accessing the research that has already been carried and how the results feed into policy. Data management was regarded as a vital issue and

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the EC would be devoting funding to develop this issue further. It was also suggested that there is a need to address the shortage of scientists via postgraduate scholarships and also doctorate level work. One option for bringing social scientists, economists and biological scientists together would be to fund scholars to participate in working groups, and award scholarships that encourage collaboration between the 3 groups.

Data
It was recognised that there should be increased data availability – for example the widespread use of electronic log books and increased industry involvement. This could also be achieved if countries shared existing data and collaborated closely when planning research so that data was compatible between countries where possible.

7.2 Report of Working Group 2

Chairs: Poul Degnbol and Jonathan Peacey
Rapporteur: Véronique Lamblin

An ideal view is that research for fishery management should be inclusive taking into account not only global ecosystem and environmental considerations including other marine activities impacting ecosystems and economics.

Research should be more proactive by allowing innovative proposals for fishery management. Research for fishery management should become more linked to operationalization for a better understanding and share of the objectives among stakeholders and mainly to adapt the diversity of the different locations in terms of ecosystems and activities.

This new management system should take into account:
1) ecosystem requirements or the acceptable limits for the ecosystems,
2) other marine activities (oil, aquaculture, renewable energy) and their impacts in terms of space, environment and economy,
3) economic optimization for fisheries,
4) trade off among activities in terms of environmental impacts and economics.

These objectives should become spatially explicit for operationality and a clear understanding for industry. Defining new objectives has to be done through experiment at regional or local level. An organisation similar to RACs but involving other activities (energy, recreational fisheries, aquaculture etc.) and other scientific disciplines could be set up for this purpose.

Governance and political economy could help :
- explaining the process, purpose, long term plan of the different stakeholders to take stakeholder's concerns into account for setting up new objectives and a new management system,
- solve transboundary issues for cooperation and data exchanges,
- find new market developments for fisheries,
- achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).

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Ecosystem management would require research:

- to find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with "footprints" (allowing trade off),
- to understand stock diversity, fish behaviour and genetics,
- to understand spatial processes of stock structure and diversity (impact of climate change also),
- to determine what is the best space size or geographical boundaries for ecosystem objectives.

Management instruments raise research questions about:

- socio-economical impacts of new management tools based on environmental objectives,
- institutional capacity of managing results if management responsability is given to fishermen.

7.3 Report of Working Group 3

Chair: Simon Jennings
Rapporteur: Andrea Leedale and Charlotte B. Mogensen

Future Management
The group thought it was important that managers specified and agreed upon objectives, thus supporting the move from reactive to adaptive management (learning by doing). Options and their consequences should be assessed by scientists to help managers understand the trade-offs between objectives.

Management objectives are to be achieved within the Common Fisheries Policy and the EU Marine Strategy (for 2021). An intersectoral approach to fishery management that accounts for linkages with the EU Marine Strategy and the work of HELCOM and OSPAR are needed. Supporting science would need to be presented in such a way that it can support the decision making process in relation to both fisheries and environmental objectives.

Research for future management
The European Commission's proposed actions to reduce discarding were discussed in detail. There was a need to instigate cooperative research that would ensure better industry uptake of technological changes to gears, perhaps using the European Fisheries Fund as incentive. The approach could be at European (MariFish) or individual Member State level, depending on the fishery and gears used.

Specific research questions include:

- How to enforce the discard ban or incentivise compliance.
- What are the effects of changing patterns of discarding e.g. Nephrops fisheries may be enhanced by discards.
- What are the effects of discarding on the ecosystem?

Another important issue was considered to be the assessment of the relative environmental impacts of different fishing methods. This could be formalised as an environmental impact assessment or ecological footprint analysis.

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In relation to climate change the group discussed the need to develop a suite of climate scenarios and predicted outcomes for fish stocks and food web structure It was also important to directly incorporate climatic effects into the existing stock assessment models Potential climate effects on contaminants and their ecological impacts was also rated as an important area of research. To participants also identified the importance of socio-economic research which would focus on the way in which the fishing industry adapted to environmental variation.

Data

The development of ecological sensitivity maps and measures of the impacts of different fishing gears were regarded as necessary, to help develop environmental (fishing) impact assessment. Such information could be used to compile maps that would help with the planning of fishing and other offshore activities.

The new data collection regulation (DCR), where ecosystem data collection will be mandatory, could also provide the data needed to further develop maps of sensitivity or impact and to determine the ecological footprint of fisheries. The trade-offs between impacts on the ecosystem could then be described by scientists, to give managers a picture of how different management scenarios would affect the ecosystem and the availability of resources. Habitat and sensitivity maps would also contribute to implementation of the EU marine Strategy – and work funded outside DCR might be combined with fishery information to give a broader picture of the ecosystem and ecosystem impacts.

8. Symposium recommendations

Following the presentations of the reports of the working groups the recommendations for future research were discussed. The short and long term management recommendations range from specific research in reducing discards and developing habitat maps to the development of “virtual” institutions to develop adaptive advice. Clearly, the linkage between these topics are the major issues of ecosystem-based approaches, comprehensive data systems and improved ecosystem modelling capabilities.

Bycatch and discard:

- Gear Technology
- Acceptable levels of discard
- Incentives for fishermen
- Real time closures

Habitat maps:

- Methods for developing maps
- Impact assessments

Trade-offs:

- Multiple species – effects
- Sociological analysis of decision making process.
- Climate aspects (stock assessments, multiple species models).
- Contaminants (effects on fish popultations, food webs and climate interaction).

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- Behavioural responses of fishermen.
- Impact assessments and footprint analysis.
- Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers' behaviour.

Governance and political economy:

- Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not followed and to take stakeholder's concerns into account for setting up new objectives and a new management system.
- Solve transboundary issues for cooperation and data exchanges.
- Find new market developements for fisheries.
- Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).
- Consumer to ocean/ocean to plate.
- Ecolabelling and certification.
- Spatial planning and carbon footprints.

Ecosystem management would require research:

- To find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with "footprints" (allowing trade-off).
- To understand stock diversity, fish behaviour and genetics.
- To understand spatial processes of stock structure and diversity (impact of climate change).
- To determine what is the best space size or geographical boundaries for ecosystem objectives.
- Ecosystems and trophic levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY.

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9. Summary

The challenge for the EU is to move from the current position towards sustainable fisheries and for policy makers to deliver a coherent and coordinated program for sustainable fisheries. To achieve adaptive fisheries management there is a need for researchers to develop scenarios for different management options, to move the advisory system from predictive to adaptive management. Managers must have access to a wider range of options provided by scientists. Scientists need to either choose to simplify uncertainty or choose to describe the implications of the uncertainty, which involves tradeoffs. Researchers need to help define the indicators for monitoring the impact of management measures on an ecosystem basis as well as identify the “experiments” that need to be done to improve knowledge of sustainability. Ecosystem management requires research to find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with “footprints” (allowing trade-off).

Changing the data collection, management and access system is an essential component of improving research and advice. This will require a major effort by policy-makers, scientists and the fisheries sector, to obtain and make accessible comprehensive data on marine ecosystems.

The importance of getting stakeholder and consumer buy-in is significant. Transparency, in the form of involving several parties with different interests in the “consultancy” relationship, seems to be the way to gain the advantages of by-ins from industry and other stakeholders to management.

The unnecessary bycatch and subsequent discarding associated with fisheries is a key issue, affecting the image, productivity and efficiency of the sector. In this area there is particular scope to work with the catching sector to develop and implement a sectoral plan of action to significantly reduce the environmental and resource impacts associated with fishing.

The MariFish steering group will decide upon strategic priorities on the basis of the symposium recommendations for a jointly funded research programme in 2008. MariFish steering group partners will identify priorities for research for possible joint Member State funding on the basis of the recommendations.

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Appendix 1

Future Demands for Fisheries Research

Symposium Invitation

Roskilde, Denmark: 7–8 June 2007

MariFish is pleased to announce its symposium on Future Demands for Fisheries Research hosted by the Danish Ministry for Food, Agriculture and Fisheries.

The purpose of this symposium is to identify the strategic research that will be required to support the development of fisheries management within Europe over the next ten years, especially within the context of the management of broader marine activities.

The symposium will address the likely developments in fisheries policy and management within the next decade, the associated demands for scientific advice on fisheries management and the strategic research required to provide this advice.

Themes to be addressed

- How can future research better facilitate fisheries management?
- How can we improve the sustainability of marine fisheries by more efficient interaction between management and research – are we held back by traditional thinking?
- Changes in marine environment. How do climatic induced changes to the marine environment affect fisheries management and the needs for research and advice?
  - Ecosystem approach to fisheries management. How to implement the ecosystem approach to fisheries management?
  - Maximum sustainable yield. How to implement the commitment to maintain or restore stocks to levels that can produce the MSY by 2015?
  - Responsibility of the sector in fisheries management, monitoring and control. Can and should we develop management systems that give more responsibility to the fishing sector and is the sector ready to take on the responsibility?

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- Harmonisation or regionalisation. Is there a conflict between harmonisation of management measures and the adoption of measures to regional differences?

Keynote speakers

- Jonathan Peacey, Ministry of Fisheries, New Zealand
- Kevin Stringer, Fisheries and Oceans, CanadaIain MacSween, Pelagic RAC
- Poul Degnbol, Directorate-General for Fisheries and Maritime Affairs, European Commission
- Simon Jennings, The Centre for Environment, Fisheries and Aquaculture Science, UK

Workshop discussions on likely developments in fisheries management and demands for research and advice will take place on the second day of the symposium facilitated by keynote speakers.

Expected outcome

As a result of the presentations and workgroup exercises, we will formulate recommendations for strategic research priorities. The recommendations will be considered by the MariFish partners when planning future collaborative research projects.

Who will benefit from attending?

- Fisheries Directors
- Representatives from the fishing sector
- Leading scientists
- MariFish partners
- Representatives from the EU, OSPAR, HELCOM, Regional Fisheries Management Organisations, ICES

Programme

Opening: 7th June at 12:00
Closing: 8th June at 16:00

Venue

Hotel Prindsen, Roskilde, Denmark

www.prindsen.dk/

Registration

Participation is free and by invitation only. To receive the agenda and travel details, please register before 15th April by email to: koordination@dffe.dk

For further information, see:
www.marifish.net

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Appendix 2

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