



TOPICS FOR RESEARCH

Project Report, August, 2008

REPORT 6



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This report does not necessarily reflect the view of the European Commission and in no way anticipates the Commission's future policy in this area

The FEUFAR Project

Background

The goal of the project is to define the research required in the medium term (here taken as 10 years), to permit exploitation and farming of aquatic resources set against the context of key challenges and risks for meeting sustainability requirements. The main output of the exercise will be a publication outlining key challenges, strategic options and the research needs of capture fisheries and aquaculture in European waters and in waters in which European fleets operate under bilateral or multilateral agreements. The project is expected to contribute to the development and subsequent implementation of a European Maritime Policy and to further strengthen the European marine research area through anticipation of research needs in the field of fisheries and aquaculture.

Research Methodology

Basically, the methodology consists of three steps: (i) describe the system, (ii) detect the driving forces in the system and, (iii) by constructing hypotheses about the driving forces, sketch potential scenarios for the future. These different scenarios will provide the basis for the identification of issues, from an economical, ecological, societal and managerial (governance) perspective, which may need attention or be the key challenges in future. Based on the analysis, some of the key future needs for research in capture fisheries and aquaculture will be identified.

Contributions

FEUFAR will seek the opinions of appropriate stakeholders, and the analysis will consider the possible implications of gradual or catastrophic climate change, new technologies, changes in societal values and organizational structures, globalization of markets for fish and other marine products, food security and health, and changes in management practices or fishing techniques.

Stakeholder participation and dissemination of results is fully integrated into the project. An expert committee consisting of representatives of the research and funding communities will assist in providing feedback into the analysis, and stakeholder groups will be invited to formal brainstorming activities during the course of the project. One forum will set up a stakeholder network of representatives of research, industry and management areas at a regional, European and international scale. A second will take the form of an expert workshop, including a broad selection of (representatives of) research and advisory organizations across Europe. The wider audience (including Regional Advisory Council representatives, and hence representing production, processing, societal, and environmental interests) will be invited and/or consulted in order to present draft findings and to generate educated feedback.

CONTACT

You can log on to our project website where you will find more information about the project, the results of the activities as they become available, and a discussion forum:

www.feufar.eu

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1 Preface

After defining the system's boundaries, documenting the drivers of the system and developing hypothesis of the drivers and formulating scenarios, the next step in the process is to set research priorities. The research priorities are developed from the perspective of the different scenarios.

As mentioned in report 1 (methodology) and report 6 (macro-scenarios) the scenarios are developed to provide different perspectives on how the future may look like. The purpose is to detect whether the research priorities under different circumstances will differ widely, and in fact by doing this develop a list of priorities addressing a range of challenges under different circumstances.

The 5 scenarios developed could be distinguished along 4 perspectives; scale of management, either regulating issues at a global/international scale or at a international-regional scale or even national-local scale; the main objective of production to be centred upon feeding people or mainly on conservation of the marine ecosystem; the extend to which society is based on environmental awareness and the main fabric of the governance system, be it free market or strict government planning and control.

A 2 day combined stakeholder and expert workshop was held in Heraklion, Greece on the 17 and 18th of June 2008. The aim of the workshop was to translate future scenarios of Fisheries and Aquaculture into research needs. In this report you will find a description of the research priorities as developed during the workshop. In addition you will find a short policy brief and a dissemination plan.

2 Research topics

2.1 Cross cutting themes

Three cross-cutting themes have been identified: issues of a generic interest affecting all sectors and themes. Implementing these cross-cutting themes is not so much a priority in research as much as a prerequisite to implement other more topical research issues. The cross cutting themes are:

1. Data collection and analysis
2. Risk management
3. Outreach

2.1.1 Data collection and analysis

Currently data on the socio-economic aspects for fisheries, aquaculture, recreational fisheries (costs, earnings, investments) and ecosystem goods and services are often not available. Even if the data are available these data are not available publicly nor are they continuously available, yet they are direly needed for the development and assessment of policies.

Next to the shear collection of the data, there is a research issue on building a 'knowledge base' (applied and fundamental research) to improve understanding of how systems (from individual animals, through population and ecosystem and from individual economic agents through to socio-economic communities) work. This knowledge base to be of an all embracing, inclusive and multi-disciplinary nature.

The data component of the knowledge base should be of good quality and accessible both to for research and for stakeholders.

2.1.2 Risk management

Risks and uncertainties occur throughout the production and ecosystem on different scales and impacts varying between impact of climate change, invasive species, pathogens, HABs through to uncertainties in stock assessments and policy impact.

Risk analysis is to be a basic component of impact assessments of polices as well as the basis for the development of policies. At present the meaningful development of uncertainty and risks into ecosystem management is at its infancy.

The research topic to address is the development of a framework that enables inclusion of risk and uncertainty in policy development and assessment throughout fisheries, aquaculture and the ecosystem.

2.1.3 Outreach

Under a number of research issues the need for demonstration and promotion is identified. This entails not so much the scientific development of communication techniques and messages but the application for specific messages.

Areas that can easily be identified lay in the field of health effects of fish consumption, promotion of sea food and in general the communication of the results of scientific research to the wider public in a way and format apt for the target group.

2.2 Fisheries

2.2.1 Gear and operational technology

- Making gears more efficient and able to mitigate bycatch and discards, limit ecosystem impacts and improve selectivity (with better survival of escaping resources)
- Improving fuel efficiency by, for example, the development of new technologies and more use of passive gears, and enhanced ship and propulsion design

2.2.2 Management and governance

- More development of multi-annual and multispecies management models and approaches, taking cognizance of trophic relationships and ecosystem health, and addressing uncertainty in a clearly understandable manner
- Further research into the socio-economics of the fishing communities, including issues such as ownership of resources and co-management
- Develop monitoring and enforcement technology beyond the current VMS
- Artificial habitat creation and better understanding of fish behaviour, including further tag-recapture and DST (Data-storage tags).

2.2.3 Valorisation of currently underused components of the catch

2.2.4 Basic research on populations of lower trophic level resources

2.3 Aquaculture

2.3.1 Research on new species

Considering the market saturation of sea bass, sea bream and salmon that has resulted in low prices, research on new species is needed. Diversification based on each region's characteristics and the consumer's choice. Research on species biology (e.g. reproduction, larval stages, fish health and welfare). Research on low trophic level species, including bivalves.

2.3.2 Research on the development of offshore cage technologies

Associated to renewable energy resources. Research on life cycle analysis for the whole system. Study of risk aspects (insurance, theft). Considering the high competition for the use of coastal areas development of offshore technologies is highly required.

2.3.3 Alternative food for the farmed resources

Replacement (as much as possible) of fish meal and fish oil. Development of strains able to grow on diets with lower protein content and lower omega 3 level.

2.3.4 Species enhancement

Through selective breeding, hybrid, triploid. Research on GMO to understand if and how species can be improved by this technique, for example to make herbivorous species with higher omega 3 content related to consumer demand for healthy product.

2.3.5 Spatial consideration

Considering the high competition for the use of coastal areas research is needed to define priorities.

2.3.6 Research on the environmental impact of aquaculture activities

Taking into account that this the main criticism, research is needed to evaluate and reduce the negative impacts of aquaculture on the environment and other uses of the coastal zone (nutrients loads, use of energy, escapees, chemicals, diseases, aesthetics).

2.3.7 Aquaculture for other purposes than food production

Production of constituents and molecules for medicine, cosmetics. Culture of species (e.g. algae) to eliminate pollution from certain depth zones. Culture of species used as pollution indicators.

2.3.8 Improvement of the present technologies for inshore aquaculture

Net cages represented around 99% of the present production. Recirculated system has good potential for some regions but research are needed to improve fish growth in this system.

2.4 Ecosystem approach to management

2.4.1 Climate Change

2 separate topics: (1) understanding impacts, (2) adaptation by fisheries and aquaculture sectors

- address combined effects of anthropogenic activities and climate change on stocks (distribution, behaviour, growth, food-webs), habitats (carrying capacity, hydrodynamics, oxygen depletion, food availability etc.). Knock-on effects for higher predators (birds, mammals). Fishing increases susceptibility to climate change (occasional poor year classes), climate change reduces productivity of some 'traditional' stocks (increases productivity in others) [some EU projects already, e.g. RECLAIM]
- how will fisheries and aquaculture be affected and how will they need to adapt ('relative stability' rules in CFP, 'adaptive boundaries of MPAs, new target species, new fishing gears, new species in aquaculture, deeper cages) [very poorly researched]
- Introduced and invasive species (which can become established because of changed environmental conditions). New opportunities as well as challenges. [very poorly researched]

2.4.2 MPAs and habitat enhancement

- Understanding the effect of MPAs (established for conservation, fisheries other reasons), their benefits and socio-economic implications (biodiversity, resilience of the ecosystem, 'spillover' effects, trophic cascades, effect of fishing effort displacement)
- Habitat enhancement – through MPAs and artificial reefs etc. Methods, tools, monitoring, siting methodologies. Creation of artificial areas for natural recruitment (to enhance productivity), and to increase artisanal and recreational benefits.

Already several EU projects on this topic (MPAs) [PROTECT & EMPAFISH] but will become a high profile issue (as a result of Habitats Directive). 'Spill-over' benefits and socio-economic cost-benefits still controversial.

2.4.3 Coastal Zone Management

Often combined with MPAs by groups

- Tools for spatial planning (GIS etc.). Matching particular activities to the most suitable locations.
- Analyses of VMS satellite data (Vessel Monitoring System) – distribution of fishing effort (by different gear types) etc.
- Impact analyses (methods) for different activities in the coastal zone.
- Interaction between fisheries and aquaculture (for space)

2.4.4 Modelling ecosystems

Important to understand ecosystem dynamics including implications of aquaculture and fisheries for other ecosystem components.

- Will require multispecies and ecosystem modelling approaches (to establish indirect predator-prey effects, e.g. on other fish species, seabirds, mammals etc.)

- Modelling to assess the potential impact of introduced species

Need to reduce uncertainty in models and to communicate levels of confidence

Currently many models have been developed but data to parameterise the models is lacking and they have never been used operationally for management [some existing EU projects e.g. BECAUSE]

Other issues highlighted

- Marine pollution control (oil and chemicals, e.g. from aquaculture, but also litter etc. from fisheries) - response and understanding of impacts
- Carrying capacity models for mollusc [and fin-fish] culture in the natural environment?
- Data management and integration methods (common databases, GIS, habitat maps etc.). Improved accessibility among all EU countries

Important ecosystem issues missing

- Nutrient enrichment of oligotrophic waters by aquaculture (research on impacts, and potential mitigation measures, standards/thresholds etc.)
- Impacts of particular fishing gears on non-target animals (benthos, seabirds, cetaceans, turtles, deepwater corals) – modelling and observational research.
- Escapement of aquaculture fish (genetic implications for wild stock etc.)
- Lost fishing gear (ghost fishing) – impacts, and mitigation research (some already funded)
- Ecosystem impacts in countries where EU has bilateral fisheries agreements (e.g. West Africa, south Atlantic, south Pacific)

2.5 Consumer preference and market development.

2.5.1 Product development from fish

A. Food

- I. Demand from customers
- II. Research in additional and new products
- III. Research on food processing to improve/maintain taste, texture et.c
- IV. Food technology (Proper technology needed to support developments of safe and diversified food products from fishing and aquaculture)
- V. New types of food
- VI. Develop products for niche markets, both local and global
- VII. From waste to taste: New products from bi-products
- VIII. Growth and competitiveness

B. Non food

- I. Elements of marine functional and healthy foods (Priority for nutrition)
- II. Bio prospecting to bring out ingredients from both fish and non-fish marine resources, algae, plants etc
- III. Bio-technology science: new and novel uses of compounds
- IV. New products and by-products of fisheries and aquaculture, including ingredients for functional food and pharmaceuticals.

2.5.2 Consumer health (as a basis for fisheries research in general)

- I. Document beneficial health effect of seafood (from medical research)
- II. Knowledge of health benefits of farmed fish (new feeding) and shellfish
- III. Detecting components beneficial to human health
- IV. Functional food – producing new components with health beneficial effects
- V. Study combined effects of pollutants
- VI. Quality control technologies (freshness, pathogens or contaminants contents, for breeding) that are cheap and quick (automation)
- VII. Competitiveness and food safety (?)
- VIII. Awareness of consumer, public health
- IX. Development of low-cost, healthy products/increase demand among poor consumers

2.5.3 Traceability

Traceability is important for several purposes, to assure consumers, to document sustainable harvesting, to document origin, to document all sources of input, days since catch et.c. On the technical side, the further development of standards, procedures and systems is needed. The focus on traceability is moving towards the business side, seeking new applications to ensure competitiveness of European producers.

- I. Traceability for competitiveness and product diversification
- II. Traceability methodologies (efficient, cheap and quick)
- III. Focus on anti-fraud measures to protect food quality and european consumers
- IV. Assurance for origin and quality
- V. Research on traceability: DNA technology for stock identification (origin of the fish) and anti-fraud purpose
- VI. Fast analysis techniques to check quality (pollutants, contaminants, pathogens) and freshness of the product
- VII. Bio accumulation of spatial based pollutants and contaminants

2.5.4 Certification and branding (labelling):

- I. What to label, which level to label (what do consumers need and want of information)
- II. Research for effective labelling systems, including health, fish welfare, origin, treatment.
- III. Research on standards

2.6 Socio-economics and Governance

2.6.1 Socio-economic analysis & impact assessment

In the area of socio-economic analysis it was identified that there is a clear need for implementing general socio-economic studies, provided a sound data base is established and available, and have impact assessments be executed. So far too little attention has been rendered in developing these analyses. Urgent attention is needed to provide proper scientific support to policies and to include stakeholder knowledge in the discourse.

This entails rather standard and continuous research into the economics of activities of harvesting marine resources (i.e. fishing, aquaculture, recreational fisheries) to maximize efficiency and production as well as into more specific issues such as:

- Socio economic structure and effects of activities within sustainable ecosystem management
- Socio-economics of the coastal zones and coastal communities (alternative uses of the coasts and resources and alternative employment)
- The development of socio-economic tools to gather views of stakeholders (e.g. 'mind-mapping' techniques) and promote understanding among different 'users'.

More specific issues to be addressed in the short run are support to policy development and assessment of policies in the following areas:

- Socio economic analysis of the impact of:
 - consequences of subsidies and taxes
 - effects of new management tools such as for example
 - the potential socio-economic benefits to local communities of some form of co-management systems
 - the effects of MPA's as strict no-take zones or limited take zones
 - Mitigation of social effects of employment destruction in coastal communities

2.6.2 Governance

Addressing governance issues has already become a rather standard feature in marine research, dealing with cases of multiple stakes and stakeholders and integration of domains in integrated management tool development such as the ecosystem approach to marine management. In fact, the focus is already there in several policy documents; issue to address is a further need for operationalisation.

A major area of further research in this light is the further bringing together the triangle of stakeholders, management and scientific support to policy. Areas to be addressed lay in the domain of:

- Development of innovative, adaptive, context specific (regional) management tools and systems based on inclusion of stakeholders and geared at the creation and acceptance of shared knowledge. This rather wide topic embraces:
- Development of stakeholder – science partnerships and the accommodation of local knowledge and observations in the development of analytical tools.
- Addressing the issue of multiple uses and users for example the aquaculture-fisheries-recreational fisheries uses in terms of spatial planning and socio-economic and environmental impact

The above is related to the more general development of new management tools and the further application of newly developed management instruments. This includes:

- The further development and implementation of integrated coastal zone management, including optimization of use of instruments such as MPAs, optimal spatial location of activities and conflict resolution techniques.

- The search for more efficient and (cost) effective methods of management and enforcement through enlarged legitimacy and compliance through for example co-management arrangements, co-creation in policy development and multi-stakeholder evaluation of impact assessment.

3 Policy Brief

The FEUFAR project (the Future of Fisheries and Aquaculture Research) aimed at developing a research agenda defining the research required in the medium term (10 years), to enable a sustainable exploitation and farming of aquatic resources. The process of foresight analysis utilised had two main features. On the one hand the research agenda was developed based on the development of a series of scenarios. These scenarios have been built step by step on an analysis of the main determinants of fisheries and aquaculture.

On the other hand in all steps of the process peer experts and stakeholders have been involved. This results in a research agenda that is logically argued and based on an analysis of stakeholders and experts beyond the project team. Hence the priorities described in the research agenda have both a scientific analytical basis and societal reference.

5 main areas of priority research have been identified:

- Fisheries
- Aquaculture
- Ecosystem approach to marine resource management
- Consumer preference and Market development
- Socio-economics and Governance

In addition three cross cutting themes have been developed:

- Data collection and analysis
- Risk management
- Outreach and extension services

In these priorities are embedded the future need for strategic fisheries and aquaculture research. Next to providing scenarios based on current trends and the requirement of sustainable production, the priorities represent strategic issues of future policy and research.

The scenarios developed could be distinguished along 4 perspectives; scale of management, either regulating issues at a global/international scale or at a international-regional scale or even national-local scale; the main objective of production to be centred upon feeding people or mainly on conservation of the marine ecosystem; the extend to which society is based on environmental awareness and the main fabric of the governance system, be it free market or strict government planning and control.

Fisheries, aquaculture and their management are by their very nature an international issue as fish stocks are a common pool resource (be it present in capture fisheries, the environment in which aquaculture is taking place or as resource for aquaculture production) present across national boundaries. In addition, the fabric of fisheries and aquaculture policy is such that national policies are highly determined by the EU Common Fisheries Policy and such forums as the International Council for the Exploration of the Seas and the Regional Advisory Councils such as those for the North Sea, Pelagic, Baltic and Mediterranean.

The results of the project form starting point for a discussion on the political priorities and the funding of relevant research. As such the presented research priority agenda above does not present a clear break of trend with most present day research programmes. Indeed still research is required in order to further develop sustainable fisheries and aquaculture practices in a world with an ever increasing demand for fish and fish products, against a back drop of climate change and rapidly expanding international fish trade.

This implies that a lot of topics mentioned above do already have a reflection in current national and international research programmes. However, what becomes clear in the analysis is that although attention is already given to fisheries and aquaculture topics, total effort in these fields of research should rather be on the increase than on the decline.

In addition, especially in the fields of management and governance the scenarios present a pressing need for the development of integrated multi-disciplinary and multi-stakeholder tools in order to address (spatial) planning and prioritisation issues. And when tools are developed they are in urgent need of being operationalised.

Also pivotal in the entire research effort has to be an understanding of the position of the consumer and their preferences next to incorporating an understanding of societal view on the sustainable utilisation of marine resources. Utilisation and conservation of marine resources in a sustainable way requires a sustainable management system balancing ecological, environmental and societal aspects. Non of the research priorities presented above can be taken up in isolation, but should be considered integrated with the other aspects.

4 Dissemination

The methodology applied in this foresight analysis hinges on a participatory process involving people and organisations either as expert in the field of fisheries and aquaculture or as stakeholders from the fishing and aquaculture industry and their representative organisations, environmental NGOs and consumer organisations. Hence every step in this process has been discussed with a relevant group of participants. This implies that the results are based on an analysis fed by expertise in the project team, other experts acting as peers to the process and representatives of relevant parts of the stakeholder community.

Throughout the project lifespan the results have been communicated to relevant stakeholders through information made available on the project website (www.feufar.eu) and by sharing and discussing the information during the workshops. In total a series of 5 workshops have been held.

On the project website information is available on the back ground of the project and the foresight methodology used. In addition all project reports and reports of the workshops are available on line.

The website also features a discussion platform. However, experiences with the discussion platform show that this tool is not being used.

At the start of the project a leaflet has been prepared detailing the purpose and scope of the project and providing information on how to obtain more information on the project and how to get involved in the process. This leaflet was send to the wider fisheries and aquaculture community.

During the course of the project the aim, methodology and progress has been presented at a large number of meetings and fora. In fact one can see that the FEUFAR project is widely known and the results are eagerly awaited.

The progress of the project has had a permanent position on the agenda of EGFARO and ESF-Marine Board. The project has been presented during the CONSENSUS event in Ostend, Belgium.

For the coming period the following publications, presentations and activities are envisaged. The draft report will be send to experts and stakeholders for comments. These comments will be listed in an annex to the final report.

The results of the project are used to draft a simple leaflet presenting an overview of the project and its process and methodology and the final outcome: a research agenda.

In addition to the executive summary in this report a more extended summary is drafted, giving the project in a nutshell. This latter has been chosen to be implemented since the core of the foresight analysis hinges on a series of logical steps (from system description and drivers via micro and macro scenarios to research topics) that cannot be presented in detail in the executive summary, yet there is a need for a more short version of the project process and results then the entire final report.

The process and results will be presented on invitation to the EC DGMARE, the EP commission on fisheries and EC DGRTD programming committee for FP7. The results can be presented to the dedicated Marine ERANETS. In addition EFARO and ESF-Marine Board envisage the implementation of an event to present the results of the project.

The website (www.feufar.eu) will be made available for a longer period of time to ensure that the documents remain accessible.

The members of the project team will be available to present the process and results on request to any party interested.

It is under discussion whether it is worthwhile to utilise the FEUFAR experiences to publish peer reviewed articles. In addition it is being considered to document the experiences in the project by way of publication of a book.