FEUFAR

THE FUTURE OF EUROPEAN FISHERIES AND AQUACULTURE RESEARCH

ANNEXES

Project Report, August, 2008 REPORT 7

Luc van Hoof, Wageningen *IMARES*, Project coordinator
Andy Payne, CEFAS
Audun Iversen, Fiskeriforskning
Chantal Cahu, Ifremer
George Tserpes, HCMR
John Pinnegar, CEFAS
Loïc Antoine, Ifremer
Maud Evrard, Marine Board
Véronique Lamblin, Futuribles

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

Funded by:

Table of Contents

1 Reactions to the draft report

2 List of Participants

Below you will find the list of people and organisations that have been involved in this exercise 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 or consumer organisations.

Name	*Organisation*
Burkhard Klein	AquaBiotech AG
Marieke Reuver	AquaTT
Adolfo Uriarte	AZTI
Esteban Puente	AZTI
Lorenzo Motos	AZTI
Mario Lopes dos Santos	CEC DGRTD
Corrado Piccinetti,	Chairperson of the Scientific Advisory Committee of GFCM
Frederic Briand	CIESM
Michel Goujan	CNPMSM
Karin Dubsky	Coast Watch Europe
Caroline Gamblin	Comité National des Pêches Maritimes et des Elevages Marins
Anthony J. Grehan	Department of Earth and Ocean Sciences, National University of Ireland,
Eric Lindebo	DGFISH
Evelina Sabatella	EAFE
Torgeir Edvardsen	EATP Secretary General
Stamatis VARSAMOS	EC DGMARE
Antoine DOSDAT	EFARO
Ana Olivert Amado	EP
Jan Willem Wijnstroom	European Anglers Alliance.
John Crudden	European Anglers Alliance.
Konstantinos Kalamantis	European Bureau for Conservation and Development
John Godfrey	European Consumers Organisation (BEUC)
Alistair Lane	Executive Director European Aquaculture Society
Courtney Hough	FEAP
Margreet van Vilsteren	FEAP
Ari Leskelä	Finnish Game and Fisheries Research Institute
Tapio Kiuru	Finnish Game and Fisheries Research Institute
Bettina Saier	Greenpeace International Representative
Dr. P. Divanach.	HCMR
Alexandros Karamanlidis	Hellenic Society for the Study & Protection Monk Seal
Gerd Hubold	ICES
Antoine DOSDAT	IFREMER
Jacqueline Pinez	IFREMER
Maurice Héral	IFREMER, MarinERA
H. van der Mheen	IMARES
Howard Browman	IMR
Ingolf Røttingen	IMR
Mark Vandeputte	INRA, AquaBreed
Heather Squires	Invest in Fish South West
Massimo Spagnolo	IREPA
Thomas Barbas	JRC
Dimitris Troiyanos	KEFALONIA FISHERIES S.A.
John Lock	MariFish
Charlotte B. Mogensen	MariFish and Head of section Development and Research Danish Ministry of Food, Agriculture and Fisheries
Dermot Hurst	Marine Institute
Niall McDonough	Marine Institute
Philip McGinnity	Marine Institute

Name	*Organisation*
Nina Hedlund	MarinERA (RCN, Norway)
Aurelien Carbonnière	MB
Zsigmond Jeney,	NACEE
Cécile Baulard	Nireus Aquaculture
Leonidas PAPAHARISIS	NIREUS AQUACULTURE S.A.
Kjell Maroni	Norwegian Seafood Federation
Mike Park	NSRAC
Nicki Holmyard	NSRAC
Jan Albert Blauw	NUTRECO
Gerard van Balsfoort	PFA & NVZ
Steve Karnicki	Polish institute for fisheries research
Selina Stead	President Elect European Aquaculture Society
Hazel Curtis	Seafish Scotland
Christine Absil	Seas at Risk
Benoit GUERIN	SWWRAC
Prof. Lorenzo Venzi	Università degli Studi della Tuscia
Dr. Lluis Tort	Universitat Autonoma de Barcelona

3 Long List research topics

SCENARIO:

Black Doomsday
Red Delicatessen
Blue Regionalism
Green Responsability
Violet 1984

Fisheries

- Efficient fisheries (efficient fleet, low cost, engines and hulls, fishing in deep waters, gears, electronics to find the fish, safety etc.)
- Technological development for efficient fishing selective gear
- Technological development, e.g. gear, artificial habitat, to maximize sustainability and productivity in a region
- Environmental and welfare friendly technology (avoid: genetic pollution, disease transmission, nutrient discharge)
- Develop control systems
    - Boxes, satellites, enforcement,
    - Data bases and data communication intranet
- Access to data / results:
    - transparent, free
    - Accessible to managers – development of models for management
    - Accessible to stakeholders
- Transformation of the sector:
    - high fuel price, low stock, increased monitoring and control (incl. market control re. traceability, identification)
    - Traditional fisheries to disappear
    - Socio economics survey – reconversion of fishermen
- Lower trophic level fish and shellfish (e.g. zooplankton, krill) therefore research on populations and recruitment, role in natural food-webs to ensure does not have knock-on effects.
- Fishing gear selectivity – huge need for more selective gears, to eliminate bycath – particularly in trawl fisheries and to improve size selectivity (to avoid undersized fish)
- Need to make sure that fish which 'escape' from selective nets, survive. Also nets which release cetaceans, seals and seabirds. Lots of research into gear technology. Also gears that mitigate damage to catch from predators (e.g. seals and cormorants).
- Cleaner fuel for fishing boats (so less polluting) also more fuel efficient boats. (More responsible in terms of environmental impacts) – less fuel consuming. [not from biofuels??]
- Assessment models that take into account uncertainty and communicate level of confidence.
- Multispecies fisheries models (including predator prey interactions) also technical interactions and ecosystem effects/implications. Implementation and parameterization.
- Different tools for fisheries management (e.g. multispecies TACs). Tools need to sociologically acceptable as well as ecologically – clear understanding of socio-economic implications of management actions. Acceptable tools to achieve MSY.

Aquaculture

- Aquaculture technology (new products, hybrid species, nutrition science, new resources for fish feed, minimize use of antibiotics, offshore/inshore aquaculture, GMOs as future solution, sea ranching and restocking
- Transport and refrigeration technologies (globalization)
- Development of deep-culture cage technology to mitigate loss of culturable species through surface warming
- Site selection for off shore mollusc production
- Integrated onshore technology development for aquaculture

- Environmental and welfare friendly technology (avoid: genetic pollution, disease transmission, nutrient discharge)
- Retention of broodstock production within a region
- New (regional) species identification for each specific region
- Domestication of different species, according to location
- Breeding selectivity (genetic profiles; appearance; growth rate; body constituents [omega 3], etc) of endemics, but also of potentially valuable and useful exotics
- Basic research on early life stages (especially nekto-benthic and settlement phases)
- Basic research on biology, ecology and physiology of local endemic species
- Establishment of successful local fish/shellfish breeding centres
- New species (aquaculture)
- Sourcing and producing an adequate and suitable feed supply for aquaculture
- Non-fish feed alternatives
- Improve production efficiency (filter feeders, growth, genetics, quality, control, etc for aquaculture)
- Maximize health components (through feeding, selection, breeding, hybrids, triploid, etc) for aquaculture
- GM eg for increasing the health benefits of fresh water or herbivore fish
- Vaccines
- Research into multi-trophic/focus aquaculture (including semi-enclosed and onshore systems)
- Climate (change) and regional (endemic and exotic) species, for selection purposes
- Research into sterility as a means of enhancing growth and mitigating problems associated with escapement of cultured material
- Research into best growth rates so that value of output is enhanced
- Feed: Need for new raw material
    - To produce more;
    - To produce functional food;
    - To enhance taste of product.
- Species identification (incl. genetics for selection) for mass protein production
    - "Easy" to find new species to grow, BUT
    - Difficult to sell them on market.
- Need for infrastructures to scale up results from lab/aquarium level to industry level

- Valorisation of fish waste:
    - Technologies available BUT
    - Logistics / scale issue - few quantities vs large scale processing system
- Substitutes and replacement for fish meal, also better food conversion efficiencies. Need to develop technologies to use proteins from farming (on land) to feed to fish in aquaculture. [Currently a ban on some meat proteins]. (but some socio-economic side-effects for other sectors)
- Other more efficient species which have higher conversion efficiency (e.g. meagre) rather than high-trophic level seabass and seabream. Requires quite a lot of development work.
- Sustainable ways to utilise fish-meal/oil in the the natural environment.
- Research into far-offshore aqauculture technologies (big farms, open water). Also processing offshore? New cage technologies etc. New technologies to deal with wastes and outputs, transportation of fish to coast, monitoring techniques. Environmental impact assessment.
- Research into sighting of facilities. Finding places where aquaculture facilities will not conflict with other users. Environmental impact assessment.
- Not sustainable and efficient to move aquaculture onshore, uses a lot of water and energy. Would be very polluting. [SCENARIO IS WRONG]. But depends on species – might happen for species such as shrimps, using heated water from power stations etc. (making most of by-products).
- Making aquaculture facilities more energy-efficient, e.g. use of renewable energy (wind, tidal, waves).

Ecosystem approach to management

- Benefits from alternative marine energy production
- Environmental and welfare friendly technology (avoid: genetic pollution, disease transmission, nutrient discharge)
- dynamics of invasive species
- The link between aquaculture activity and enhanced wild stocks in the area, especially in oligotrophic waters
- Research to increase productivity of marine areas e.g. artificial reefs
- Measuring the health of the marine environment and ecosystems
- Monitoring and measuring consequences of ecosystem destruction
- Research on decontamination from molluscs
- Creation of artificial areas for natural recruitment and perhaps MPAs or marine enhanced areas
- Enhancement of rivers and artificial reefs, for example, in a low-tech manner as well as through high-tech methods
- International transport: monitoring to avoid pollution and invasive species
- Research into the optimal siting of MPAs so that value can accrue to artisanal and recreational activities too
- Broader scale tag-recapture studies to understand migration issues better (DSTs and traditional tags)
- Prediction – mathematical models:
  - aquaculture requires an healthy environment, e.g. avoid HAB
  - Reduce aquaculture impact on environment (pollution – waste, escapees)
- Aquaculture on land:
  - Protection of marine environment BUT
  - Space issue
  - Energy issue
- MPAs
- Ecosystem approach
  - understanding of ecosystems, of trophic levels of food chain
- How to make sure that fisheries and aquaculture are integrated in coastal zone, and with other users (tourism, energy production, transport) – i.e. spatial planning methodologies/tools (GIS systems, mapping activities) . Planning and impact analyses in the coastal zone. Which activity is most appropriate for each location. Knock on impacts for infrastructure. MPAs (for various purposes)
- Implications of climate change, how will ecosystems adapt. How will fisheries and aquaculture need to adapt? Needs good models and research.
- How to build 'knowledge base' (applied and fundamental research) to improve understanding of how system (individual animal, population, ecosystem) works. Needs to be as wide and multi-disciplinary as possible. How to share knowledge and data.

Consumer/market

- New fish products from fish waste
- Alternative marine ingredients, including use of discards
- Maximize protein output (fisheries)
- Ingredients for functional food and pharmaceuticals/nutraceuticals: from algae, marine plants etc
- Research in Processing for additional and new products
- Product development and diversification, including optimal use of all product, including waste
- Traceability as a way to assure consumers
- Research on traceability
- Traceability issues, even down to small areas – DNA technologies for identification and anti-fraud purposes and for broodstock identification
- Health benefits of molluscs
- Effects of pollution (mercury etc)

- Research on food processing, to improve/maintain taste, texture etc.
- Low cost healthy products
- Increase demand for healthy sea products (including poor consumers)
- Demonstrate/promote health effects
- Long term health benefits (including GM, public financed)
- Effective labeling systems: health, fish welfare, origin, treatment
- Research on branding/marketing
- Local certification schemes for consumers
- Development of niche products for global markets
- Genetics for identification purposes - fish to carry its own information
  - Traceability (product origin) for consumers,
  - avoid fraud for managers.

- Need for new technologies – fast analysis techniques to check quality (chemical residuals), freshness of the product
- Bio-prospecting – from within the waste materials of fishing and aquaculture and oceans (also new organisms). Bio-technology science, new and novel uses of compounds.
- Use of fish by-products. Huge quantities currently thrown away. Need to research new ways of using fish waste, e.g. use trimmings from human consumption fisheries to produce fish meal (also bio-diesel, pharmaceuticals etc.).

Socioeconomics and governance

- Lobbying international agreements
- Assess impact of recreational fisheries
- Research for light form of monitoring and enforcement
- Research new methods for fisheries management
- Socio economics and governance research for tools for integrated coastal management including tourism and sports fishing
- Mitigate social effects of employment destruction in coastal communities
- Basic research
- Asses consequences of subsidy cuts
- Data access
- User rights and governance (including recreational fisheries) for fisheries
- Aquaculture (ashore, at sea) vs. MPAs. A multi-stakeholder evaluation to produce the best strategy
- Training, extension, demonstration (aquaculture)
- MPAs – full no-take, vs. partial no-take
- Mitigating ecological damage from intensive aquaculture through, for example, the establishment of carbon credit systems
- Optimal use of MPAs (protected spawning stock, protected recruitment, recreational activities)
- Research into the potential socio-economic benefits to local communities of some form of co-management systems
- The economics of fishing, to maximize efficiency and production
- Investigating at a regional scale the co-principles of sustainable aquaculture/sustainable fisheries, and their interactions
- How to make sure that fisheries and aquaculture are integrated in coastal zone, and with other users (tourism, energy production, transport) – i.e. spatial planning methodologies/tools (GIS systems, mapping activities) . Planning and impact analyses in the coastal zone. Which activity is most appropriate for each location. Knock on impacts for infrastructure. MPAs (for various purposes)
- Data from recreational fisheries (level of catch) – currently very little information on scale of activity and catches. Also import as will be able to buy up quotas. Recreational sector part of management process (and subject to controls). Research on economic scale (benefits for coastal economies) and environmental impacts. Cost-benefit analysis.

- Under this scenario fishermen are part of data collection process. Data is reliable and trustworthy – fishermen happy to collaborate with scientists. Tools for gathering views , systems for collecting and processing the data (informatics development) – data freely available and distributed to science community.
- International cooperation in research – added value from international researchers working together, different perspectives. Wide dissemination of results and data.
- International co-operation (fishing partnership, trade, use of raw materials). Socio-economic approaches into sustainable management tools/techniques. Responsibility for impacts in 'partner' countries (e.g. EU bilateral agreements). Ethical standards (fisheries and aquaculture).
- Socio-economic tools to gather views of stakeholders (e.g. 'mind-mapping' techniques). To promote understanding among different 'users' etc.
    - Risk of introduced/invasive species and pathogens (as a result of climate change and shipping). Needs research on impacts (sometimes opportunities), mitigation measures.