Recommendations by EFARO
for the future FP 7 programs to be implemented at the EU level
in the field of fisheries and aquaculture

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1. Fisheries and Aquaculture Research

EFARO is the association of national fisheries and aquaculture research institutes involved in scientific policy support, related to the EC Common Fisheries Policy, the EC Strategy for Aquaculture and the EC Bird and Habitat Directive.

This kind of research has several focal points:

- Fisheries research
  - Fish stock assessment and protection
  - Fleet management
  - Fisheries economy
  - Socio-economic aspects on fisheries communities

- Aquaculture research
  - Development of sustainable techniques
  - Fish management: health and welfare
  - Feed
  - Diversification in produced species

- Seafood research
  - Food quality and safety
  - Consumers demands
  - Seafood processing
  - Food-chain optimising

- Environmental research
  - Marine living resources management (marine ecology)
  - Environmental impacts of fisheries
  - Environmental impacts of aquaculture
  - Coastal Zone Management

2. European Fisheries and Aquaculture Research

There is a long tradition of international joint fisheries research, under the auspices of ICES, based on interlinking national research programmes. Not all EU members are associated with ICES (North Atlantic Region, including Canada and USA). Similar, but no so strong enforced, programmes have been in place for the Mediterranean and the Baltic regions. In addition to the national programmes, the EC stimulated European joint fisheries and aquaculture research since FP 4, in order to support the European Common Fisheries Policy. In FP 4 and FP5 there were specific programmes (e.g. FAIR), accounting for 130 m€ (FP4) – 150 m€ (FP 5) in fisheries and aquaculture research programmes. In FP 6, the resources allocated for fisheries and aquaculture research has

been reduced to 60 m€, mainly in a special priority for Scientific Support in Fisheries Policies (SPP; Priority 8)) and some priority areas under the priorities 5 and 6 for Food Science Environmental Science. The Euopean Parliament decided in 2003 that additional resources were needed for the improvement of scientific support in fisheries policies at the European level.

In the draft FP7 programme, the whole complex of fisheries, aquaculture and seafood research is included in a broad context of agricultural research (Theme 2). The marine living resource and coastal zone management part should be included in the environmental science (Theme 6, but is not explicitly mentioned). The fish production and fish ecology research seems to be break-up into these two teams. Whereas the ecological approach in fish production as meant in the CFP and Bird and Habitat Directive requires more integration. The profit-planet-people baseline for sustainable economic development requires that socio-economic research be also integrated in this complex of R&D related to seafood production technology and marine living resource management. This is not mentioned explicitly in the draft FP 7 programme.

Our proposal to amend the text of the draft FP 7 programme is attached in Annex A of this document.

3. Trends in European Fisheries and Aquaculture Research

EFARO identifies the following trends in the need for fisheries and aquaculture research in Europe:

- Scientific basis of fisheries management related to stock recovery plans, avoiding discards, fleet-based management, regional fisheries management (RAC's) and avoiding overexploitation according to the Johannesburg Convention
- Ecosystem based approach in marine resource management, related to protection of Biodiversity (Rio declaration), Marine Protected Areas (MPA), coastal zone management (CZM) and the development of an integrated EU marine strategy.
- Triple-P bottom line for economic development, with a stronger view on socio-economic perspectives, related to revitalisation of fisheries dependent regions and transition of fish production-processing-trade-consumption chains (from fish to dish): a responsible, efficient and transparent consumer driven fish production.
- Develop and diversify aquaculture production in order to supply the demands for seafood where landings from fisheries become limited.
- A need for broader and more uniform data collection programmes, including ecological and economical data in addition to fish stock survey data, including also aquaculture production.

4. Priorities in Fisheries and Aquaculture Research

In the stakeholder consultation for the development of the FP 7 programme, EFARO has formulated the following priority actions, and recommended these to DG Fisheries & Maritime Affairs in December 2004.

Action 1- Improve scientific basis of fisheries management

Background: Current fish stock management systems need further development. The objective is to develop a holistic fisheries management approach focused on conservation and sustainable fisheries management. This requires methods to evaluate the function and efficiency of existing and alternative fisheries management systems taking into account the ecological, technical, socio-economical and political processes involved, i.e. from biological production to stakeholder acceptance of introduced management measures. This addresses also recreational fisheries. Understanding the interplay between these processes is a prerequisite for (i) the formulation and evaluation of management targets and harvest control rules in a multi-annual management framework, (ii) the successful implementation of new technical management measures and (iii) changes of entire management systems, e.g. from an output to an input control system.

Subsequent actions 2 to 4 and 6 address ecological, social, economical, control and communication aspects, and action 1 should integrate their findings. To facilitate this concept, an improved understanding of the dynamics of marine living resources and their exploitation is needed. Multi-species, multi-fleet and regional management tools should be developed to predict the multi-annual dynamics of fish stock and fisheries with sufficient precision, and at the same time generate information needed for adaptive changes in management at short time scales. Increased coherence between geographical dimensions has to be taken into account to increase the relevance of management scenarios.

Methods should:

- Include a variety of input and output based management mechanisms including both TACs, effort control, technical measures, longer-term capacity control and institutional adjustments.
- include aspects such as fishing technology, fishing practices, social impacts and economic drivers and a higher relevance of these inputs in relation to management measures and decision process.

Methods should furthermore:

- generate quantitative estimates of uncertainty in stock and fisheries assessments
- facilitate the use of multiple and semi-quantitative data from the industry, and
- allow for data poor situations, e.g. in deep-sea fisheries.

Action 2 - Prepare the implementation of ecosystem-based approach to fisheries management

Background: Move from traditional single species to ecosystem-based fisheries management where all components of the ecosystem (biological, chemical, and physical)

are considered as well as their interactions with human activities. Activities have to address the effect of changes (including global change) in ecosystems on marine living resources and their exploitation as well as the impact of exploitation on the structure and functioning of marine ecosystems.

Fisheries impacts on ecosystems directly by removal of targeted and by-catch species and by physical habitat degradation. Improving size and species selectivity of fishing gears and fishing fleets is a prerequisite to reduce unwanted by-catch, including marine mammals and sea birds. Mitigating habitat destruction by fishing operations requires impact assessment studies and technical innovation to reduce the damaging impact of fishing gear in use.

By targeting specific stock components, e.g. sizes or ages, fisheries alters the stock structure, life history traits and genetic structure of targeted and by-catch species, and ultimately alter the biodiversity of all these exploited ecosystems. Specifically alteration of the genetic composition may have irreversible effects on population dynamics of exploited species, a process that needs further investigation. Therefore the key issue is to determine which is the optimal state of the resources for given exploitation levels. Indirect ecosystem effects of fishing are alterations of food web structure by removing large quantities of predator and prey. Enhanced knowledge on intermediate and upper food web processes is required to disentangle the top-down effect of fisheries from the bottom-up effect of changes in the productivity of marine systems. In addition, contaminations that occur through the food web have to be characterized and assessed.

Existing time-series on ecosystem components should be analysed to generate and test the applicability of quantitative indicators of fisheries impacts, with emphasis on indicators and thresholds of the status of benthic communities, sensitive species and food web structure.
This will require bringing together marine ecologists, geneticists, fishery scientists and social scientists into integrated projects, aiming to develop an ecosystem approach to Management of Fisheries.[1] In this regard, *in situ* observations would need to be coupled with experimental ecology trials to assess the effects of some environmental factors on life traits of fish population.

Action 3 – Integrate social and economic dimensions into the CFP

Background: An integration of the social and economic dimensions into the CFP should take place both in relation to governance and impacts. In relation to governance there is a need to understand how the legitimacy and efficacy of the CFP can be improved through better linkages to coastal communities and regionalisation and how economic and market forces can enhance fisheries management (2). In this respect, the ways to optimise the

[1] The Policy basis of the "Ecosystem approach" to Fisheries Management. Eurogoos Publication N°21 September 2004.

[2] OECD, Recommendation of the Council on: The use of Economic Instruments in Promoting the Conservation and Sustainable use of Natural Resources. Endorsed by Environment ministers on 20.04.2004, adopted by the OECD Council on 21.04.2004.

fisheries production could not be independent from downstream production perspectives. In relation to impacts there is a need to enhance the understanding of the social and economic impacts of fisheries management both in relation to the industry, the local communities and in relation to national economies and the community. Promote multidisciplinary research aiming to merge ocean sciences, fisheries biology and social sciences will also require the integration of economic data in coherence with the data bases developed for stock management.

- Bio-economic modelling should be promoted to determine the economic consequences of envisaged management measures and to assess the efficiency of economic incentives to promote sustainable fisheries in longer-term. The likely geographical scale of these studies is regional, with substantial input from RAC's and stakeholder organisations.
- Within respect to social science, the institutional and societal aspects of the scientific advisory process, management formulation and implementation as well as enforcement and control processes and their impact on the functioning of fisheries management need to be studied. Secondly, social impact assessments need to be conducted before implementing major new fisheries management measures or change of entire management systems.
- The triple-P bottom line Profit-Planet-People has to be made operational for fish production chains.

Action 4 – Reinforce quality in data collection, control and monitoring

Background: Assess the validity of fisheries data reported and to make Vessel Monitoring Systems (VMS) and other automatic recording system (e.g. electronic logbooks) data useful for input and regional management, and enforcement of regulations. This includes (i) close cooperation with the fishing industry to ensure active participation and compliance, (ii) rapid processing and quality assurance of collected data on national level and (iii) transfer of data into operational international databases hosting the data at a sufficient temporally and spatially resolved level for close to real-time monitoring as well as ad-hoc and longer-term fisheries management, (iv) increase the confidence in the data collected through a better cooperation with the fishing industry.

Enhanced coordination of national fish and fisheries data collection and environmental monitoring programmes to lay the basis for an ecosystem approach to fisheries management and ensure optimal utilisation of resources in monitoring. Databases allowing linkage of fisheries and environmental data need to be designed and implemented in a sustainable way.

For both aquaculture and fishery products, in order to maintain the positive image of fisheries products, and to address the protection of the consumers, monitoring should also consider the quality and safety of fish products and enhance their traceability.

Action 5 – Support sustainable development of the aquaculture industry

Background: Implement the Strategy for Aquaculture development3, a strategy for the sustainable development of European aquaculture that calls for an increased support of

[3] COM(2002) 511 A Strategy For The Sustainable Development Of European aquaculture.

research as an essential step to support the sustainable development of the sector and to enable its integration in the coastal zone. There is a clear need for scientific support of EU-wide aquaculture aspects within the policy support areas of the Community Framework Programmes, like health and environmental issues – including cleaner technologies, new species, fish feed improvement, product quality and safety, and impact of genetic improvement on the aquaculture sector.

The thematic actions should be built on a total value chain approach including aspects of live fish traits and the impact this will have on harvesting operations, processing and the quality of the final consumer product. The following research topics should be given high priority:

+ In the field of rearing methods and technology
- Recirculation technologies to improve sustainability of fish production and fish health and product quality, including decreased water consumption and integrated systems.
- Use of probiotics and biosecurity protocols as means of reducing diseases and improving health conditions in live fish under farming conditions, leading to reduced application of antibiotics.

+ In the field of genetics
- Revisiting the traditional selective breeding schemes inherited from livestock, incorporating new genomic tools and addressing sustainability traits (food conversion efficiency, robustness, ability to metabolise vegetables, …).
- Use of proteomic studies on live aquaculture fish identifying how gene regulation is being impacted by feed components, husbandry practices or stress situations in the farming environment.
- Tools and method to evaluate genetic introgression and mixing from intentional or unintentional releases of farmed fish in the wild.
- Physiological implications of genetic improvement in relation to stress tolerance and welfare (e.g. maximising growth through efficient breeding schemes my have negative impact upon functional integrity of farmed fish).

+ In the field of nutrition and physiology
- Physiological impact of environmental changes on shellfish (reproduction, mortality, epizooty).
- Fish feed: Alternative ingredients to fish meal and fish oil in fish feed in respect of limited industrial fishery resources (e.g. sand eel) and securing fish health and functional integrity and performance, product quality and safety as well as environmental impact.
- Advanced studies on how specific lipid components, particularly of n-3 type, may influence live fish metabolism and the impact it could have on energy conversion and growth efficiency as monitored by protein and/or lipid metabolism.

+ In the field of the environmental interactions
- The development of integrated systems to minimize environmental impacts.

- Advanced and user-friendly numerical models to accurately determine the carrying and holding capacities of water bodies.

+ In the field of product quality

- Identification of biochemical markers that can be used for predicting final product safety, texture, yield and eating quality, including modification induced when processing the product.
- Identification of bioaccumulation pathways of potentially toxic compounds (toxins, heavy metals, organic contaminants) and their detoxification processes (e.g. algal toxins in shellfish).

Action 6 - Interactive communication with stakeholders and the public

Background: Create more effective systems to improve dialogue with stakeholders and society at large regarding fisheries and aquaculture management, to incorporate the views of the industry, the citizens and the consumers of the harvested marine resources as basis for policy decisions. This can include new mechanisms for developing and delivering scientific advice, expertise, and results of performance evaluations to both the stakeholders and the public.

New ways, possibly in connection with NGOs, for delivering this information can be developed.

ANNEX A

EFARO proposal to amend the FP-7 programme (in red)

THEME 2. Food, agriculture, fisheries and biotechnology

Objective

Building a European *Knowledge Based Bio-Economy*[12] by bringing together science, industry and other stakeholders to support European policies and to exploit new and emerging research opportunities that address social and economic challenges: the growing demand for safer, healthier and higher quality food and for sustainable use and production of renewable bioresources; the increasing risk of epizootic and zoonotic diseases and food related disorders; threats to the sustainability and security of agricultural (including aquacultural) and fisheries production resulting in particular from climate change; and the increasing demand for high quality food, taking into account animal welfare and rural contexts.

Rationale

Innovations and advancement of knowledge in the sustainable management, production and use of biological terrestrial and aquatic resources (micro-organism, plants, animals), will provide the basis for new, sustainable, eco-efficient and competitive products for agriculture, fisheries, food, health, forest based and related industries**.** In line with the European strategy on life sciences and biotechnology[13], this will help increase the competitiveness of European biotechnology and food companies, in particular high tech SMEs, while improving social welfare and well-being. Research into the safety of food and feed chains (including natural trophic chains), diet related diseases, food choices and the impact of food and nutrition on health will help to fight food related disorders (e.g. obesity, allergies), chemical contamination and infectious diseases (e.g. transmissible spongiform encephalopathies, avian-flu), while making important contributions to the implementation of existing and the formulation of future policies and regulations in the area of public, animal and plant health and consumer protection.

The diversity of the European industries in these areas, while being one of its strengths and an opportunity, leads to fragmented approaches to similar problems. These are better addressed by increased collaboration and sharing of expertise, for example on new methodologies, processes and standards that result from changing EU legislation.

Several European Technology Platforms contribute in setting common research priorities, in fields such as plant genomics and biotechnology, forestry and forest based industries, global animal health, farm animal breeding, food and industrial biotechnology. The research will also provide the knowledge base needed to support[14]: the Common Agricultural Policy; agriculture and trade issues; food safety regulations; Community animal health, disease control and welfare standards; and the Common Fisheries Policy reform aiming to provide sustainable development of fishing and aquaculture. A flexible response to new policy needs is also foreseen, in particular with respect to new social or economic trends.

Activities

• **Sustainable production and management of biological resources from land, forest, and aquatic environments**: Enabling research, including 'omics' technologies, such as genomics, proteomics, metabolomics, systems biology and converging technologies for micro-organisms, plants and animals, including exploitation of their biodiversity; improved crops and production systems, including organic farming, quality production schemes and GMO impacts; sustainable, competitive and multifunctional agriculture, and forestry; rural and coastal development; animal welfare, breeding and production; plant health; sustainable and competitive fisheries and aquaculture; infectious diseases in animals, including zoonoses; safe disposal of animal waste; conservation, management and exploitation of living aquatic resources, developing the tools needed by policy makers and other actors in agriculture and rural development (landscape, land management practices, coastal zone management, etc.).

• **"Fork to farm, fish to dish": Food, health and well being**: Consumer, societal, industrial and health aspects of food and feed, including behavioural and cognitive sciences; nutrition, diet related diseases and disorders, including obesity; innovative food and feed processing technologies (including packaging); improved quality and safety, both chemical and microbiological, of food, beverage and feed; integrity (and control) of the food chain; environmental impacts on and of terrestrial and aquatic food/feed chains; total food chain concept (including seafood); traceability.

• **Life sciences and biotechnology for sustainable non-food products and processes**: Improved crops, feed-stocks, marine products and biomass (including marine resources) for energy, environment, and high added value products such as materials and chemicals, including novel farming systems, bio-processes and bio-refinery concepts; bio-catalysis; forestry and forest based products and processes; environmental remediation (e.g. after accidental pollution) and cleaner processing.

• **Profit – Planet – People principle** in sustainable and responsible food production, including revitalisation of farmers or fisheries communities and regions.

THEME 6. Environment (including Climate Change)

Objective

Sustainable management of the environment and its resources through advancing our knowledge on the interactions between the biosphere, ecosystems and human activities, and developing new technologies, tools and services, in order to address in an integrated way global environmental issues. Emphasis will be put on prediction of climate, ecological, earth and ocean systems changes; on tools and technologies for monitoring, prevention and mitigation of pressures and risks in all environments including on health, as well as for the conservation of the natural and man-made environment.

Rationale

Environmental problems go beyond national frontiers and require a coordinated approach at a pan-European and often global level. Earth's natural resources and the man-made environment are under intense pressures from growing population, urbanisation, continuous expansion of the agriculture and fisheries, transport and energy sectors, as well as climate variability and warming at local, regional and global scales. Europe needs to engage in a new sustainable relationship with the environment while improving competitiveness and strengthening European industry. EU-wide cooperation is needed to attain critical mass given the scale, scope and high level of complexity of environmental research. It facilitates common planning, the use of connected and inter-operable databases, and the development of coherent and large scale observation and forecasting systems.

Research is needed at EU level for the implementation of international commitments such as the Kyoto protocol, the UN Convention on Biological Diversity, the objectives of the World Summit on Sustainable Development 2002, including the EU Water Initiative, and contributions to the Intergovernmental Panel on Climate Change and the Earth Observation initiative. In addition there are significant research needs arising from existing and emerging EU level policies, the implementation of the 6th Environmental Action Plan and associated thematic strategies, the action plans on Environmental Technologies and Environment and Health, and Directives such as the Water Framework.

The EU needs to strengthen its position in world markets for environmental technologies. Such technologies help deliver sustainable growth providing eco-efficient solutions to environmental problems at different scales and protecting our cultural heritage. Environmental requirements act as a stimulus for innovation and can provide business opportunities. European Technology Platforms on water supply and sanitation and on sustainable chemistry confirm the need for EU level action and their research agendas are taken into consideration in the activities below. Other Platforms (e.g. on Construction and

on Forestry) partially deal with environmental technology issues and are taken into consideration as well.

A series of activities are listed below many of which are directly relevant to policy needs. However, additional support may be provided to new policy needs that emerge, for example relating to sustainability impact assessments of EU policies (e.g. environmental aspects of agricultural and fisheries policies, integrated coastal zone management); the follow up of the post-Kyoto action on Climate Change; and new environmental policies such as in maritime policy, standards and regulations.

Activities

• Climate change, pollution and risks

– *Pressures on environment and climate:* Functioning of climate and the earth system; adaptation and mitigation measures; pollution in air, soil and water; changes in atmospheric composition and water cycle; interactions between climate, land surface and the ocean; and impacts on biodiversity and ecosystems.

– *Environment and health:* Interaction of environmental stressors with human health including identification of sources, links to indoor environment, and impact and emerging risk factors; integrated risk assessment methods for toxic substances including alternatives to animal testing; quantification and cost-benefit analysis of environmental health risks and indicators for prevention strategies.

– *Natural hazards:* Improve prediction and integrated hazards- vulnerability - and risks assessments for disasters related to geological hazards (such as earthquakes, volcanoes, tsunamis) and climate (such as storms and floods); develop early warning systems and improve prevention and mitigation strategies.

• Sustainable Management of Resources

– *Conservation and sustainable management of natural and man-made resources*: ecosystems; water resources management; waste management and prevention; protection and management of biodiversity, soil protection, seabed and coastal areas protection, approaches against desertification and land degradation; forest management; sustainable management and planning of urban environment, data management and information services; assessment and foresight relating to natural processes.

– *Evolution of marine environments*: Impacts of human activities on the marine environment and its living and non-living resources; pollution and eutrophication in regional seas and coastal areas; deep sea ecosystems; assessment of marine biodiversity trends, of ecosystem processes and of ocean circulation; seabed geology.