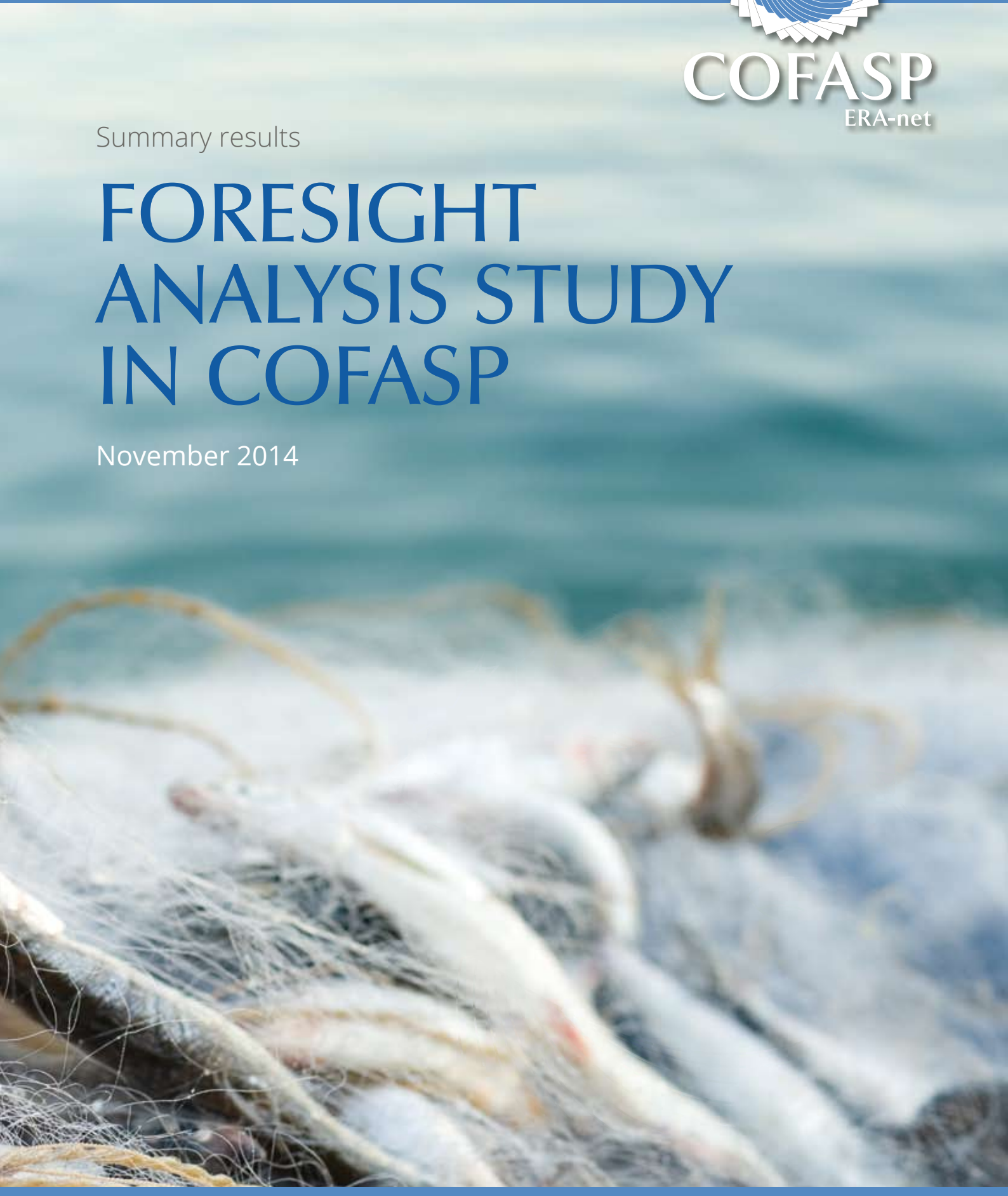
Cooperation in Fisheries,
Aquaculture and Seafood Processing

COFASP
ERA-net

Summary results

FORESIGHT ANALYSIS STUDY IN COFASP

November 2014

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THE PROJECT

The foresight study was implemented between September 2013 and June 2014 by the European Fisheries and Aquaculture Research Organisation (EFARO) as part of the FP7 Eranet COFASP. The aim of the study was to develop a research agenda defining the research required in the medium term (15 years) to enable a sustainable exploitation and farming and retailing of aquatic resources.

There are many ways to develop a research agenda. Very often experts are consulted to provide their view on the future. We applied a foresight method using scenarios, building a step by step analysis of the most important factors influencing the future, in our case in fisheries, aquaculture and food processing. A large group of stakeholders was involved in this process. In three workshops we looked at how the factors might develop in the future and what research is needed to support these developments. This leaflet gives you an overview of the project, the steps made and the research priorities that came out of the process.

STEPPING INTO THE FUTURE

The foresight process consisted of five logical steps. Starting point is the definition of the system and its subsystems after which for each of the subsystems the main drivers defining the future are described. Based on these drivers scenarios for the future are generated. The four constructed macro scenarios were the bases on which the research agenda was made.

STEP 1: THE SYSTEM

Considering all areas that would need to be covered, the world of fisheries, aquaculture and Seafood processing was divided into 7 areas or subsystem:

A. Policy: political objectives and legislation in a EU and national and regional context. Including political and policy changes and interaction of different levels.
B. Economics/ market: all aspects of the production distribution and consumption of goods and services. Demand vs. supply.
C. Value chain: chain of activities to deliver a valuable product or service for the market.
D. Resource use: the use of marine resources and the competition between different users.
E. Society: Societal trends, demographics, and developments, including values around the marine system.
F. Natural system: biological, physical, chemical environment of human marine activities. The natural system included all animals, interactions, sediments.
G. Knowledge: information, understanding, facts, technology or skills acquired through research, or experience or education. (Taking into account regional differences).

STEP 2: DRIVERS OF THE SYSTEM

Within the areas of the system we determined variables that are found to be key to the future development. These are the so called 'drivers' of the system (see figure below). For each driver we determined the most important indicators and how this driver has evolved over the past 20 years. Susequently for each driver a set of different hypotheses, or a number of "possible futures" were developed.

A.	**POLICY**
A1	Big issues: food security, energy, fresh water
A2	Food safety
A3	Conservation of resources
A4	Multi-level governance
A5	Regionalisation
A6	Stakeholder influence
A7	Political continuity
A8	Employment
B.	**ECONOMICS/MARKET**
B1	Economic climate
B2	Economic signature
B3	Globalization – competition BRICS
B4	Trading conditions and opportunities
B5	Access to capital (for business)
C.	**VALUE CHAIN**
C1	Consumer demand (user)
C2	Certification standards and traceability
C3	Valorisation of raw material and co-products
C4	Production costs
C5	Product development and marketing
D.	**RESOURCE USE**
D1	Environmental health status
D2	Access, user rights and alternatives
D3	Wants and needs for resources
D4	Technological advancement
E.	**SOCIETY**
E1	Demographics
E2	Population wealth
E3	Media and education (marine literacy)
E4	Regional differences
F.	**NATURAL SYSTEM**
F1	Physical and chemical forcing
F2	Species 'demographics'
F3	Resilience of the ecosystem
G.	**KNOWLEDGE**
G1	Funding
G2	Motive for generating knowledge
G3	Reliability of knowledge
G4	Access and openness of knowledge (IP)
G5	Uptake of knowledge and innovation capacity

STEP 3: MICRO-SCENARIOS

In this step we made stories by choosing one hypothesis per driver and matching them together with other hypotheses within the subsystem. A story like this is called a micro-scenario: a possible development of that subsystem. The micro scenarios are presented in the table below.

	MICRO-SCENARIOS				
SUBSYSTEM	**1**	**2**	**3**	**4**	**5**
A. POLICY	Don't worry be happy	Rabbit in the headlights	Command and control	Europe in splendid isolation	
B. ECONOMICS/ MARKET	Too much monkey business	Money, money, money	China Syndrome	Electric Stone Age	
C. VALUE CHAIN	You can't always get what you want	Corporate suit	Consumer's Choice	Bric - a - Brac	
D. RESOURCE USE	Too good to be true	We need to talk	Anarchy	United we fail/ OK for some	Brave new world; after war
E. SOCIETY	Imagine	Gated communities	Push and Pull		
F. NATURAL SYSTEM	Life in a changing world	Changes towards the collapse	Strangers in the night	Adam and Eve	
G. KNOWLEDGE	Nirvana	The Winner takes it all	Copycat	Knowledge a public good	

STEP 4: MACRO-SCENARIO'S

Connecting the micro scenarios of the different subsystems resulted in the so called macro-scenarios: possible futures for the entire system. We developed 4 scenarios:

"It's not EU, it's me..."
The European project has failed. There is a permanent economic crisis with decreasing economic activities in Europe and a nationalistic political system with a shift to reactive "crisis management" with no cooperation among EU countries. As one consequence Europe will face a shortage in food production and as a result of competing use of the marine environment and its resources the marine ecosystem is in a poor environmental health status with reduced resilience and instable ecosystem communities. Demand for new knowledge and the ability to conduct research is low.

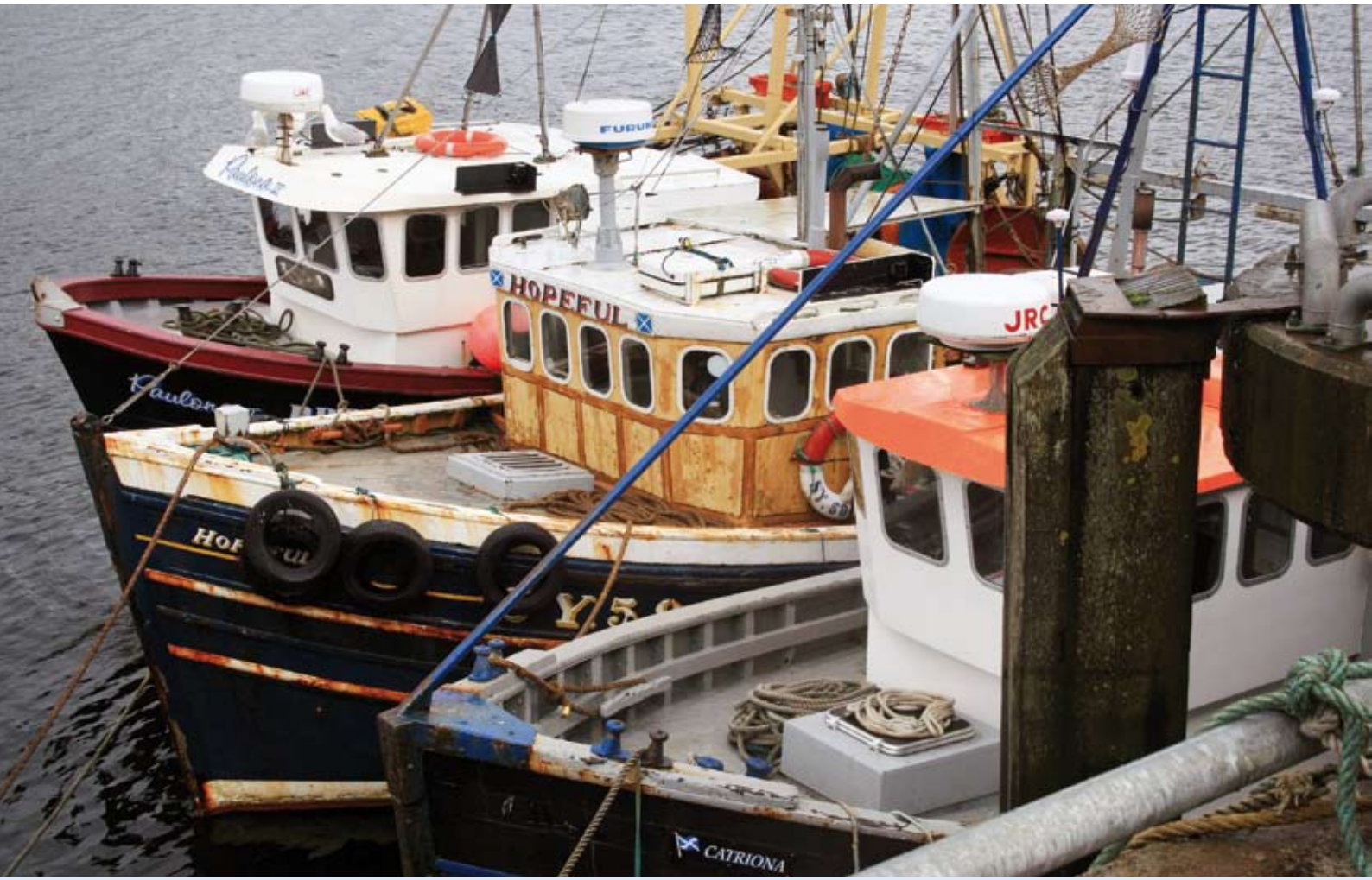
Fortress Europe... Not so splendid isolation
Europe closes its borders and restricts free movement of capital, people and goods. With no common market, member states take back responsibilities for economic and other social strategies with maximal resource exploitation and use of marine space at the top of the agenda. Although ecosystem health is generally good, it becomes increasingly challenged due to increased human impact. Research funding is almost exclusively by private funds demanding for IP rights.

The moral high ground
This future scenario envisages a sophisticated, well organized and well controlled recreational and artisanal/small-scale harvesting regime. Persuaded by the public, the EU takes the lead on taking a stand and developing a policy on how to harvest marine animals in a sustainable and low impact way. Besides that consumers are very critical on ethical principles and public awareness about preserving the environment and carefully using the ecosystem services has led civil society groups consisting of both environmental groups and small scale fisheries groups to have a big influence on this. Together, they see the benefits of preserving the environment. Knowledge is a public good and there is public access to ecosystem information.

EUtopia
After the prolonged crisis of the first decennia of the second millennium the world economy, and of Europa, has veered back and is flourishing. EU policies and national policies fully align in the strive for enabling prosperity. Consumers drive developments in the fish produce and seafood market. The stable population with a richer middle class is focussing on health issues and the demand for seafood produce increases. There is an increase in number species as a result of climate change but a decline in 'traditional species', yet, the net effect on ecosystem services and benefits are positive, resulting in even more productive ecosystems. People have a strong sense of self-responsibility, well-educated with knowledge and awareness of the sea. Fixing the main challenges for society is considered to be a public affair.

STEP 5: RESEARCH PRIORITIES

In the last step we identified the uncertainties, challenges and opportunities that research may answer for the four scenarios. The research priorities that are described in the next part of this leaflet are the result of this last step.



RESEARCH AGENDA

MARINE SCIENCE IN GENERAL

The use of Europe's seas and oceans will intensify. Partly as a result of an increase of traditional uses of the sea and an increased relocation of land-based uses towards the sea. Partly an increased use in a search for new ways to explore the richness of the seas and oceans. This leads to the following research topics.

Optimal use of the seas: what is the optimal sustainable use of our seas and oceans with increased possibilities of using available resources in novel ways and using novel ways to extract and use marine resources. This question has a bearing on the development of an overarching system of marine spatial planning (also see section on Governance).

Value of use of the seas: in order to strive for an optimal sustainable use of the seas it is important to be able to put a value to existing and potential future ecosystem goods and services. Related to this is the question of costing the impact of activities on the marine ecosystem and incorporate these costs into the production costs in the value chain. Together with non-economic values this analysis will provide a basis for a societal cost-benefit analysis of different activities, especially in a world with increased competition for marine resources, especially space. This in turn will provide important input into marine spatial planning.

ENVIRONMENT

In general continued basic research into the state and functioning of ecosystems is required. In addition there are general challenges to be addressed in order to achieve sustainable use of Europe's seas and oceans.

Low impact products: a general challenge to all uses of the marine environment is to develop products and production techniques that not only reduce direct impact on the marine resources directly exploited, but are produced with the lowest impact possible on the marine ecosystem, including its associated carbon footprint.

Sustainable use strategies: combined with a strive for low impact products there is a need to devise holistic strategies at the level of Large Marine Ecosystems for sustainable production. This will include a definition of ecosystem and environmental boundaries, setting up strategies for marine resource use and prevention and mitigation measures.

This will require a methodology in which impacts of a multitude of activities can be determined at the appropriate ecosystem geographical and time scale. An example of such a methodology can be **the modelling and risk assessment** of disease and pathogen distribution in wild populations and aquaculture systems; develop prevention and treatment systems. Another example can be to devise a methodology that considers **species adaptation to ecosystem change** and the ecosystem impact considerations of the restoration of certain species.

FISHERIES

A challenge in the exploitation of fish stocks will be the balance between stock and ecosystem status and the exploitation of marine resources.

Monitoring and Management: for the appropriate management of the ecosystem it will remain necessary to develop long term integrated management plans for resource use. Especially in the field of fisheries this will require models that can reliably predict the dynamics of ecosystems and activities undertaken in the ecosystem. In addition, it will require user-friendly monitoring programs or techniques that result in reliable assessments of exploited marine resources/populations which clearly assess the impact of (alternative) fishery management programs on sustainable use of shared resources. The development and use of technology to improve monitoring and surveillance will be required in addition to continued improvements in monitoring and data collection.

Adaptation strategies: the fisheries sector is con-fronted with a multitude of challenges that will require an adaptation of prior used (fishing) strategies. As result of ***ecosystem change***, how can fishers adapt vessel types and equipment to make a fit with the new dynamic circumstances? In addition, how can fishing fleets respond to a ***societal call*** to develop low impact fishing methods, such as eco-friendly powered vessels, low impact fishing gear. And in the light of ***market demand*** how can the entire harvest of vessels, including by-catch and discards be appropriately managed and used.

Data use: in order to provide a basis for management of resources and the development of the industry's fishing and management strategy it is necessary to develop technology and methodology that will allow effective and accepted obtaining and using fishery-independent data and commercial data from industry, especially in small-scale fisheries.

Recreational Fisheries: a major challenge is the potential and role of developing recreational fisheries and other recreational uses of the sea e.g. tourism. How do these activities relate to other commercial use of marine space and resources and how does competition between alternative uses of resources develop.

AQUACULTURE

The role of aquaculture will remain important over the next decades. Challenges to the sector are found in the production system and its effect on the wider environment and in using the potential of new modes of production.

Market demand: noting consumer demand and production costs across all modes of aquaculture production, a main challenge remains to be the species that can be cost effectively produced and meet market demand. In this there are several challenges being posed to the sector; which species and production techniques can serve a high-value novel niche market? In case of multiple potential aquaculture species, how could a diversified production scheme look like? And how can aquaculture producers operate in a market characterized by multiple high-value products?

Organic aquaculture: related to market demand is the special case of organic aquaculture. Main questions related to this issue centre on developing the system, using the potentials for herbivore species, sources of feed, plant aquaculture, bivalves (shellfish). Main challenge is to lower the production costs relative to conventional methods.

Technology development: there is a continued demand for improved recirculation facilities and research into multi-trophic aquaculture/ agriculture/hydroponics (i.e. both directions: sea-land and land-sea) and off-shore Multi Trophic Aquaculture. In order to devise these systems a better understanding of the potential of Multi Trophic Aquaculture systems is required. In addition, the potential health issues of IMTA components should be addressed. In addition, the identification of potential species, sources of feed, water treatment technology and increases in water/feed efficiency should be addressed.

SEAFOOD PROCESSING

The main challenge in the seafood processing industry was found in addressing an increased need to more rapidly adjust to changes in production and demand.

Towards more flexible production units: with a production sector with a more diverse (and more sea-sonal) production and a European market characterised by multiple market segments (high-value (non-bulk) products, next to bulk ingredients market) there will be a strive away from single-species production plants towards more small-scale and multi-purpose processing units. Research into developing these small-scale and multi-purpose processing units is required.

Maximise processing efficiency: there is an increased strive to fully use all of the harvested fish produce, be it from aquaculture or wild capture fisheries. On the one hand this implies maximisation of the filet yield. But on the other hand it also entails optimising the use for fish meal and oil coming from the remains from fish processing (from trimmings) and the use of all co-products for high value products for feed, food, pharmaceuticals and cosmetics.

New products and new production technologies: in addition to optimising the use of the fish harvest there is also the need to develop production technologies for new resources such as seaweed and algae such as the production of biodegradable packaging (from seaweed). In addition there is a need to overall reduce waste and environmental impacts in processing.

Species enhancement: as for the potential use and enhancement of species, starting point has to be addressing the issue of aquatic animal health and welfare. In addition research into GM (genetically modified) feed use and fish genetic strains with low environmental risk will be addressed. Species adaptation to ecosystem change will have to be taken into account. Some aspects can be addressed through coordinated breeding programmes.

VALUE CHAIN

The main challenge in the value chain can be found in achieving integration over the distinct links on the production chain form primary production to consumption.

Increased sustainable efficiency: a generic challenge to the fisheries, aquaculture and processing sectors lies in a search to increase efficiency of vessels and gears, of aquaculture production (e.g. feed conversion ratio, time to slaughter) and in seafood processing which at the same time reduces impact on the ecosystem and makes the most efficient use of harvested resources. The entire value chain will have to adapt to this principle of 'more with less', especially new technology/techniques in the processing sector will have to be developed to adjust to changes in raw materials (e.g. species, size).

Setting standards: a major concern is the development of methods to ensure that seafood products meet appropriate standards for health and safety. This includes both setting of health and safety standards as well as devising systems such as labelling, to communicate produce attributes. This will include the identification of threats to food safety along the supply chain, compared to thresholds for safe human consumption, and to develop programme/standards to prevent threats from entering the supply chain.

Information in the value chain: communication of attributes of produce along the value chain across the individual producers towards the final consumer is very important. One of the issues that needs to be addressed is: how can labelling and standardization be organized in the value chain towards a multitude of consumer groups and markets? Steps towards these can be taken by looking into Best practice for certification and labelling and into the development of EIDs (electronic identification documents) providing relevant information along the value chain operators and final consumers.

GOVERNANCE

The main challenge in governance is devising a governance set up that addresses the major challenges put to society in such a way that all relevant actors in the production process and value chain participate in the management of marine resources.

Control: a main issue is the establishment, in a dynamic world and a permanently changing ecosystem, of a framework for management to ensure resource use (including pollution) to stay within identified and agreed upon limits. This will include the question of which incentives could be used to ensure compliance of the industry and which technology could be further developed to support this (e.g. effort controls, VMS, CCTV).

Licence to produce: increasingly producers need to acquire a licence to produce: a public consent to the industry to exploit the marine environment. Obtaining this licence to produce pertains on the one hand the provisioning of (science based) information on primary production and across all steps in the production chain. On the other hand it would require insights in the public attitudes towards marine production and communication between producers, consumers and citizens.

Participation: With a growing complexity of the management challenge at Europe's seas and oceans there is an increased need for Marine Spatial Planning and Monitoring and Evaluation of the use of marine resources. The effective implementation of this calls for the development of a platform for stakeholders to increase participation/input in decision-making and evaluation processes.

ORGANISATION OF RESEARCH AND FUNDING

The financing and organisation of research will over time depend on the relative priority given to (marine) research, the availability of funding from either public or private sources and the organisational level at which science will be organised. Below some tendencies are presented. Research can be organised at three levels: at the level of the individual Member State, at the central EU level and at the regional level. With increased regionalisation towards the regional seas this regional level is expected to become of more importance, for example through the development of regional research financing structures such as ERAnets.

In line with this development it seems logic that increasingly investments in major research infrastructures are not financed at the Member State level but at a more central level, such as the regional sea level. In addition to this, transfer and extension of knowledge can be organised at a more central level in dedicated centres of transfer of excellence.

Always a balance has to be struck between public and private funding of research and ways in which the two can cooperate. Noting the need for data sharing and making commercial data more widely available for research a cooperation between science and producer organisations, with clear mandates tools to share performance data and market intelligence should be developed.

New to this way of financing is the possible development of micro-financing (private and public opportunities): local initiatives to address local problems. This form of addressing problems will allow for high levels of local participation and addressing the problems identified by local residents.
In addition a balance should be struck between short-term oriented research programs focussing on market and applied science (e.g. development of high-value products/niche markets) and more long term research programs focussing on a shared understanding of long-term ecosystem dynamics.

Cooperation in Fisheries, Aquaculture and Seafood Processing

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ABOUT COFASP

COFASP is an ERA-NET. The objective of the ERA-NET scheme is to develop and strengthen the coordination of national and regional research programmes. COFASP was created to directly address actions envisaged within fisheries, aquaculture and seafood. It started in 2013 under the KBBE theme in FP7, and is part of the Europe 2020 strategy, which recognises bioeconomy as an important part of the strategy.

COFASP Partners

- DASTI - Danish Agency for Science, Technology and Innovation, Ministry of Science, Tehcnology and Innovation Denmark
- CNR - National Research Council Italy
- ICES - International Council for the Exploration of the Sea Denmark
- Tecnalia-AZTI Fundacion Azti/Azti Fundazioa Spain
- BMELV - Federal Ministry of Food, Agriculture and Consumer Protection Germany
- BLE - Federal Office for Agriculture and Food Germany
- DLO - Stichting Dienst Landbouwkundig Onderzoek, Wageningen University and Research Center Netherlands
- RANNIS - The icelandic Centre for Research Iceland
- Ifremer - French Research Institute for Exploitation of the Sea France
- UEFISCDI - Executive Agency for Higher Education, Research, Development and Innovation Funding Romania
- RCN - The Research Council of Norway Norway
- ANR - The French National Research Agency France
- DEFRA - The Secretary of State for Environment, Food and Rural Affairs United Kingdom
- Scottish Ministers - The Scottish Ministers Acting Though Marine Scotland United Kingdom
- IEO - Instituto Español de Oceanografia Spain
- HCMR - Hellenic Centre for Marine Research Greece
- GSRT - Geniki Grammatia Erevnas Kai Technologias, Ypourgio Paidias, Dia Viou Mathisis & Thriskevmaton Greece
- FCT - The Foundation for Science and Technology, Ministry of Education and Science Portugal
- Marine Institute - Marine Institute Ireland
- FGFRI - Game and Fisheries Research Finland
- DAFA - Danish AgriFish Agency, Ministry of Food, Agriculture and Fisheries of Denmark Denmark
- EV ILVO - Eigen Vermogen van het Instituut voor Landbouw en Visserijonderzoek Belgium
- DTU Aqua - Technical University of Denmark Denmark
- MATIS - Matís ltd. Iceland
- ISPRA - The Institute for Environmental Protection and Research Italy
- GDAR - General Directorate for Agricultural Research and Policy Turkey

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SEVENTH FRAMEWORK PROGRAMME

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