



**Scientific Advice Mechanism
High Level Group of Scientific Advisors**

**Food from the Ocean
Expert Workshop Report**

**Co-organised by the SAM secretariat and the Science Advice for Policy
by European Academies (SAPEA) consortium**

(14 September 2017, Brussels)

Food from the Ocean

Expert Workshop hosted by the High Level Group (HLG) of Scientific Advisors of the European Commission's Scientific Advice Mechanism (SAM)¹

14 September 2017, Berlaymont Building, Brussels

WORKSHOP REPORT²

Background

The first essential step towards the production of a Scientific Opinion by the High Level Group (HLG) of the Commission's Scientific Advice Mechanism (SAM), was the drafting of an evidence review report. This report was prepared by international working groups of the Science Advice for Policy by European Academies (SAPEA) consortium. Two independent working groups of 22 experts gathered and summarised the evidence on the question of "how to sustainably harvest more food from the ocean". The working groups covered a range of fields in the natural sciences, social sciences and the humanities.

The purpose of the workshop held on 14 September 2017 was to obtain expert assessment of the feasibility, cost and scaling implications of the evidence, possibilities and options outlined in the SAPEA evidence review report. The views of 14 invited experts were presented from the applied business, policy and citizen perspectives. They were discussed with a group of ten of the lead authors of the evidence review report. The aim was to help the High Level Group identify potential scientific-evidence based recommendations for its Scientific Opinion on the subject.

Workshop focus

The purpose of the workshop was to obtain expert assessment of the SAPEA evidence review report with a view to informing work on the SAM HLG Scientific Opinion. At the workshop, experts with knowledge and experience in business, policy and citizen/ consumer affairs discussed the suggestions and options mentioned in the report. The emphasis was put on feasibility, scaling, costing and options for sustainably harvesting more food from the oceans. For this purpose, the HLG posed questions that addressed the feasibility of potential actions³. The experts were provided with these questions and the draft report in advance of the workshop. They were also asked to take into consideration a description provided of the relevant policy context in the EU and internationally. Questions targeted each of the six workshop sessions, the final session focusing on areas of potential EU action.

¹ Co-organised by the SAM secretariat and the Science Advice for Policy by European Academies (SAPEA) consortium

² See workshop programme, expert briefing and list of participants in annex

³ These questions – see briefing annex - took into account the options from the scientific report.

Workshop Summary

Integrated perspective

In general, participants at the workshop agreed on the need for an integrated perspective that links the question of extracting more food from the oceans to broader issues of food security and nutrition and the difficult related trade-offs. For example, the potential of food from the ocean as a better source of micronutrients and lipids for undernourished populations than other foods is arguably more important than its value as a source of protein.

It was agreed that an integrated perspective on the topic is also needed to better understand existing synergies and intertwined challenges. For instance, the different ocean species interact with each other within ecosystems. It is, for example, simplistic in relation to fisheries or any other consideration to treat species separately.

Such interactions take place in a dynamic context of ecosystem change. They need to be taken into account when devising the regulatory system for different type of fisheries, or taking account of climate change, etc.

The relationship between small- and large-scale fisheries was touched upon, as well as the differences between the North and the South. It was also recalled that the majority of world fisheries are small-scale and not well-represented in the political and economic development agenda. Imbalances between developed and developing world are well-known.

Uncertainties

It was acknowledged that, in general, current knowledge in many areas of science relevant to food from the ocean is severely lacking. New evidence and understanding could change the perspective on what constitute sustainable solutions. In the meantime, some current scientific assessments are characterised by inherent *uncertainty* such as:

- the variable effect of climate change on each species and life stage (as with other ocean stressor⁴ impacts on marine ecosystems), resulting in changes at the base of the food web - e.g. ocean acidification impacts on molluscs
- the impacts of diseases and parasites on food-producing organisms
- the poor understanding of the effects of microplastics
- the effects of climate engineering (which, in any case, potentially only deals with part of the problem)

Environmental variables need to be considered in estimates of climate change, as currently they are not taken into account in determining Maximum Sustainable Yields (MSY). These variables include abiotic and lower trophic levels and fish density, age and environmentally-sensitive growth, mortality, and maturity (these three latter factors dependent on competition for limited resources).

⁴ acidification, pollution, changing ocean currents, stratification, sea-level rise, etc.

In order to avoid old-fashioned single stock assessments, there are alternative approaches to determining fishing yield, which include ecosystem functioning such as Bpa (biomass precautionary approach reference point), which can be implemented almost rightaway. Bpa is already a standard approach for short-lived species and does not require MSY estimates. It was also pointed out that there is much on-going research supporting the so-called balanced harvesting approach, though there is not yet an adequate body of evidence on its effects – be they benefits or otherwise.

It was also noted that there is a large uncertainty in the potential for growth in the exploitation of new (i.e. up-to-now unexploited) species – some also noting that invasive species or species change under climate change could be utilized.

A significant uncertainty was seen in relation to the suitability of institutional systems into which fisheries management and practices can be locked and which may become obsolete or inapplicable as a result of climate change. In essence, if you need to capture what is in your waters rather than what used to be there, there is need for radical change in fisheries management and practices.

Re-direction of reduction fisheries

The potential for re-direction of reduction fish to human consumption was seen as depending on multiple factors, such as human preferences, market dynamics etc. The demand for fishmeal e.g. in emerging markets such as China and nutritional strategies in different countries may play an important role.

Bycatch

The complexity and variation between the situations in different geographical areas led to recognition of the need for a case-by-case assessment of selective fishing gear and management systems for reducing bycatch. Mechanisms for decreasing bycatch and collateral damage may need to be adjusted to specific areas and species (potentially banning fishing gear that is less selective in specific cases).

While there was agreement on the need to eliminate discards, as also legislated for under the discard ban, there was acknowledgement that enforcement remains challenging and compliance is virtually impossible to control.

Some participants noted the need for increased knowledge and to take consequent action regarding:

- the level of waste from harvested production of wild stocks
- the need for better data
- independent control methodologies for traceability and labelling (on which EU law is already strong)
- Incentives to limit fishing waste (bycatch/discard) and eventually use discards, in line with the current commitments to the circular economy.

With regard to some of these issues, it was suggested that the EU data collection framework could be used.

New species

In general, given some of the considerations (including social concerns relating to coastal systems) on how mechanisms for more food from the ocean could be developed or extended, the harvesting of macroalgae and molluscs (oysters, mussels) that extract food from the sea seemed one of the most easily controllable and possible to increase in the shorter term. It may also be possible to combine with relatively labour-intensive, employment-focused options. However, it was also noted that harmful algae blooms that seem to increase with climate change could have large negative effects on shellfish production and that macroalgae may contain heavy metals.

With regard to mesopelagic fish, fundamental knowledge gaps and technical shortcomings raised doubts about their short-term potential to increase food from the sea. Knowledge is also still sparse on their nutritional composition, processing, and potential challenges.

For zooplankton, it was agreed that additional harvesting was both unclear and uncertain. There is no clarity on what sustainable level of harvesting could be, as such populations are both difficult to survey, have low density and high costs of extraction (and are therefore uneconomic).

Mariculture

The potential of mariculture – the farming of fish, crustaceans, molluscs, sea plants, algae, and other aquatic marine organisms under controlled conditions – was emphasised. It is considered to be a relatively underdeveloped sector yet could have the largest capacity to increase the supply of food. Salmon farming, for example, is now a net producer of fish meal and fish oil. However, challenges exist, such as grains or other resources going into mariculture feed that competes with human food, along with competing uses of coastal areas.

The high potential of open sea mariculture was recognised though largely seen as requiring substantial investment and only manageable over a long timescale. One participant pointed out that technologies for the open sea farming of fish and shrimp have become well established in some places in the last few years. Such open or deep sea farming and fishing were also seen as needing clear regulatory frameworks and the means to implement these for food and ocean ecosystem security.

An important obstacle to aquaculture is public acceptance. A widespread view that wild catch is “better” than aquaculture products remains dominant in Europe. The benefits of aquaculture need to be promoted among consumers.

Improved Sustainable Management of Existing Fisheries

It was noted that although there is a broad consensus in the scientific literature on the merits of rights-based management and on the negative effects of subsidies, there is also a widely-recognised need to reconcile and integrate both social aims and efficiency considerations in the careful design and application of specific fisheries policies and management measures.

Specific measures mentioned included:

- removing harmful subsidies, whilst potentially replacing some with investment grants or other incentives
- tailoring quota systems (for instance, trading efficiency for community development in community-based quotas or Territorial Use Rights in Fisheries - TURFs), buy-back of quotas and other approaches - the aim here, as a matter of food security and sustainability of stocks and fishing activity at each location over the long term,⁵ would be to avoid: 1. fishers or fishing communities having to lease from others outside and 2. fishing at high levels only to get and maintain quotas
- tax reduction or grants
- incubators for young cost-effective companies, in particular in aquaculture/mariculture.

Regulator's tool box

The need for a “regulator’s tool box” was stressed, including the role of the juridical system. Social licence is crucial but not the only way to manage concerns.

The harmonization of standards, quality and traceability was deemed essential, in relation to both the licensing of aquaculture firms and the establishment worldwide of a fair and level competitive playing field.

As the farming of multiple species is desirable from a sustainability perspective, but is difficult in terms of licensing and management, there may be a need for the mainstreaming of licensing requirements in this sector, including farming permits for molluscs/macroalgae.

Specific actions and identification of best practices may be needed in relation to minimizing the use of chemicals in some cases; improving vaccines; improving the understanding of pathogen transmission mechanisms; etc. - with an eye to achieving an integrated way of reviewing/ assessing risks and developing regulation.

Certification and eco-labelling were seen as useful systems of social licence that are external to the regulatory system.

Other points noted:

- the need to check perverse incentives and to stifle illegal fishing
- complex difficulties with regard to areas of the world that have a lack of political will and control of fishing activities
- The potential role of up-to-date technology available for surveillance and control via satellite.
- The possible use of MPAs to protect habitats and rebuild stocks.

Coastal engineering was little discussed but was acknowledged as being technically feasible and with economic potential.

⁵ Here, documents such as the code of conduct for responsible fisheries, right to food guidelines, voluntary guidelines on the responsible governance of tenure of land, fisheries and forests were mentioned by one participant.

Extending good examples/best practice

In relation to uncertainties and variations between systems and preconditions, the potential for reviewing and extending (via new platforms and fora) appropriate best-practice examples across Europe and worldwide was underlined, e.g.:

- The use of closed and open fishing areas
- Emulating Norwegian aquaculture practices and regulation
- Non-European examples of integrated multi-trophic aquaculture
- Alternative feed development approaches (including e.g. the potential of food waste, insect-based systems).

It was also emphasised that educating and informing people is essential to help bring about behaviour change in what we are prepared to eat. Noted in this regard was the disconnect between those in the developing world who have little choice in what they eat and the fact that when they become richer, they consume more land-produced protein, thus making it meaningless to deal with "food from ocean" separately from the rest of the food system.

Other remarks

With relevance to the further development of the SAPEA evidence review report, participants also emphasised the need to clarify specific assessments of landings; trends in landings; trends in the usage of fish for non-food purposes; the level of overfishing; the level of stocks with adequate assessment (in relation to MSY, for example); the extent of zooplankton additional harvesting; and current risk assessment of microplastics - both more broadly in relation to the literature, and with regard to assessment in specific sources.

It was also noted that the report might benefit from distinguishing between the Mediterranean and the Atlantic, due to large differences between the fisheries situation; and clarifying where the focus is placed on the EU and where on global production.

Some specific sources were also mentioned, such as FAO data and a cod fisheries policy report on performance of the CFP in the Atlantic and Mediterranean. It was also suggested to look further into harm-based regulatory approaches.

PROGRAMME

Workshop Chair

Professor Carina Keskitalo, Member of the High-Level Group & Chair of the Food from the Ocean Steering Group.

Workshop programme

0830-0900 Coffee on arrival

0900 – 0945 Opening Session

09:00 Welcome and introduction
Professor Carina Keskitalo

09:05 SAM overview
Dr Johannes Klumpers, Head of the SAM Unit, European Commission

09:10 SAPEA overview
Professor Sierd Cloetingh, President of Academia Europaea

09:15 Overall commentary on the SAPEA report, with 5-minute Questions & Answers

Keynote speaker:

Professor Manuel Barange, Director of the Fisheries and Aquaculture Policy and Resources Division at the Food and Agriculture Organisation, Rome

0940 – 1240 Working Group 1 Natural Sciences

09:40 Introduction by Professor Dag Aksnes, Chair of SAPEA Working Group 1, University of Bergen, Norway

Session 1: Sustainable harvesting of wild populations

09:45 Overview of relevant areas in the report by Professor Michael St John, National Institute of Aquatic Resources, Technical University of Denmark

10:00 Response by Dr Philippe Cury, Directeur du Centre de Recherche Halieutique Méditerranéenne et Tropicale, France

10:10 Response by Dr Henrik Sparholt, Scientist/Advisor & Nordic Marine Think Tank, Denmark

10:20 Response by Dr Luis Lopez Abellan, Director of the Oceanographic Centre of Canarias, Tenerife, Spain

10:30 Discussion

10:50-11:05 Coffee break

Session 2: Sustainable mariculture

11:05 Overview of relevant areas in the report by Professor Yngvar Olsen, Norwegian University of Science and Technology
 11:15 Response by Stephanie Rakels, Investment Manager, Aqua-Spark, Netherlands (*by proxy*)
 11:25 Response by Dr Santiago Cabaleiro, Director of the Galician Aquaculture Technology Centre, Spain
 11:35 Discussion

Session 3: Uncertainties and future trajectories of production

11:55 Overview of relevant areas in the report by Professor Daniela Schmidt, University of Bristol, UK
 12:05 Response by Dr Katja Frieler, Potsdam Institute for Climate Impact Research, Germany (*by proxy*)
 12:15 Response by Dr Gro-Ingunn Hemre, Director of Research, National Institute of Nutrition and Seafood Research, Norway
 12:25 Discussion

12:40-13:15 Lunch

13:15-16:05 Working Group 2 Social Sciences and Humanities

13:15 Introduction by Professor Poul Holm, Chair of SAPEA Working Group 2, Trinity College Dublin, Ireland

Session 4: Markets, economics and innovation

13:20 Overview of relevant areas in the report by Professor Dr Martin Quaas, Kiel University, Germany
 13:30 Response by Michael Keatinge, Director of Fisheries Development and Training Services, Irish Sea Fisheries Board, Ireland
 13:40 Response by Courtney Hough, General Secretary, FEAP – Federation of European Aquaculture Production Industry, Belgium
 13:50 Discussion

Session 5: Social licence and governance

14:10 Overview of relevant areas in the report by Dr Gesche Krause, Alfred Wegener Institute, Germany
 14:20 Response by Dr Susan Steele, Chair, Sea Fisheries Protection Authority, Ireland
 14:30 Response by Dr David Agnew, Science and Standards Director, Marine Stewardship Council, UK
 14:40 Discussion

15:00-15:15 Coffee break

Session 6: The role of the EU

15:15 Overview of the SAM document on the relevant policy context (Appendix III to the briefing document) by James Gavigan, SAM Unit, European Commission

15:25 Response by Prof Ragnar Arnason, University of Iceland

15:35 Response by Dr Maria Jose Barragan Paladines, Leibniz Centre for Tropical Marine Research, Germany

15:45 Discussion

16:05-16:30 Summary and close

Professors Carina Keskitalo and Sierd Cloetingh

16:05 Summary of discussions and next steps

16:30 Close

BRIEFING AND QUESTIONS FOR INVITED EXPERT DISCUSSANTS

The purpose of this expert workshop is to assess feasibility, cost and scaling implications of the evidence, possibilities and options for sustainably harvesting more food from the oceans outlined in the draft SAPEA report. Under the auspices of the High Level Group of scientific advisors, invited expert discussants will present their views on the draft SAPEA report from a downstream applied (business, policy and citizen) perspective in discussion with the expert authors of the SAPEA report. This should help the High Level Group to identify the main elements of the Scientific Opinion it will deliver to the Commission on the subject.

Workshop focus – practicality of the draft SAPEA Evidence Review Report suggestions and options⁶

The purpose of the workshop is to provide critique by the wider expert community of the evidence review report and related information, so that that work can begin on the scientific opinion that is aimed to inform European policymakers. At the workshop, experts with competence, knowledge and experience in business, policy and citizen/ consumer affairs should discuss the suggestions and options in the draft SAPEA report in terms of feasibility, scaling, costing and other such practical considerations. In so doing, they should also take consider the potential for action under EU competences.

In other words, the workshop should help bridge from the evidence review stage to the drafting of the scientific opinion which is to support relevant policy development work in the European Commission. It should help to identify the scientific evidence that is more likely to have practical implications on timescales that are relevant for EU policy development.

The critique and input from invited experts should primarily take the form of a reality-check of the scientific evidence in the report. It should explicitly comment on the feasibility, practicality or applicability, and quantification of the possible increases in the sustainable harvesting of food from the ocean that the evidence suggests, in terms of:

- a) Is what the evidence puts forward really feasible?
- b) If so, at what scale is it feasible (lab, pilot, demonstration, full commercial) and within what timeframe?
- c) What issues affect scalability to application at full potential and what are the financial/ investment considerations that need to be borne in mind (if not already factored into the evidence presented)?
- d) Are there important trade-offs as well as competing territorial/geographical factors to consider?
- e) Could part of what is potentially on offer from a scientific evidence perspective be more feasible and desirable than the rest and what might have to be done in all such alternative options to increase the sustainable harvesting of food from the ocean?
- f) What is the potential size of the effect – e.g. in terms of changes in the percentage of food extracted from the ocean or other more pertinent metrics?

⁶ in business/ policy/ citizen terms

Detailed questions per workshop session

Based on the draft SAPEA report, a number of **more detailed questions** (below) have been drawn up as part of this briefing. These are based on indications in the report of potential areas for practical development. While the questions may be difficult to answer, they should be seen as important considerations to direct the discussion. Your comments are thus especially invited in the directions indicated by these questions and in light of your expertise. In so doing, please offer potential responses or at least comment on the various factors that may impact on feasibility, time scale or similar, even if the questions themselves may be too broad or thorough to answer completely.

N.B. Thus, in preparing their remarks ahead of the workshop, discussants are asked to pay specific attention to the questions below in so far as they relate to their area of competence and also the specific workshop session in which they will speak, in order to keep the discussion focused on practical and applied considerations.

The discussants can also identify **other questions** related to feasibility, scaling or costing aspects on the basis of their reading of the draft SAPEA report and this briefing, and which they think they should address in their remarks. In such cases, please as discussant signal these other questions in advance **when submitting the outline (e.g. powerpoint) for your intended remarks ahead of the workshop.**

As your expertise may extend to several of the sessions, it would be very valuable if you can also summarise your comments in writing to us (no later than a week after the workshop). This would be very much appreciated – it will ensure that we have best understood your concerns and views in spite of the limited time at the workshop itself.

Session 1: Sustainable harvesting of wild populations:*Capture fisheries:*

- What is the possibility to allow fish to realize their growth potential and contribute to the next generation), i.e. functionally capturing larger/mature fish compared to today?
- What are the possibilities to develop and implement requirements for selective fishing gear to reduce bycatch and gentle fishing gear that increases the survival of the discarded bycatch, as well as development and implementation of management systems aimed at reducing bycatches? Limitations, extent of redirection possible, time scale, instruments?
- What are the possibilities to develop and implement capacities to store (on vessels), deliver and process discards and offal, and what is their suitability for feed ingredients further down the value chain (i.e. food safety regulatory issues)? Limitations, extent of redirection possible, time scale, instruments?
- What are the possibilities to develop and implement the redirection of reduction fisheries (i.e. catches reduced to fishmeal and oil for use in processed feed or put to other uses such as direct feed, bait fish, pet food, or fertilizer) towards direct human consumption? Extent of redirection possible? Time scale?
- How could bycatch be better taken care of in relation to the CFP as well as more broadly – how do we keep the benefits of the current system whilst utilizing bycatch?

Unexploited & under exploited species:

- Today's biological and technical constraints for harvesting more zooplankton and mesopelagic fish include lack of harvesting methodology with sufficiently low energy costs for harvesting, in particular, for organism sizes smaller than krill, and the fact that fishing bans and precautionary approaches that are applied in order not to reduce the outcome of traditional fisheries and avoid risk of changing ecosystem functioning. To what extent could fit-for-purpose harvesting methods be developed and deployed?
- Industrial mechanised harvesting of macroalgae as it has so far been implemented is relatively small compared to global macroalgae cultivation and has had negative impacts on the shore ecosystem (harvesting or killing also other species of plants or animals than those targeted or resulting in disease risks). Improved technologies and management would be needed for increased mechanised harvesting. To what extent might this be possible, and on what time scale? What is the level of cost and industrial interest in this type issue?

Session 2: Sustainable mariculture:

- Increasing macroalgae and mollusc production is already underway and “might be increased from a biological point of view”. However, water quality in coastal areas is sometimes insufficient, and farming may have negative effects on wild shellfish populations. With regard to the slower expansion of fish and crustaceans (mainly shrimp) in “feeding mariculture”, the report notes that “[t]he more complex production technology required, the higher production costs and the market situation are more likely explanations for the slower development of these groups”. Additionally, future expansion requires new sources of fish oils to satisfy the feed requirements of these groups. Can quicker expansion possibilities in these areas be realised and if so how?
- There are many potential impacts of increased mariculture. These include: competition for space in coastal areas; the lack of offshore production techniques (e.g. structures to allow seaweed to survive in open-ocean conditions); insufficient seed quality and related risks regarding maintenance of native genetic resources (e.g. to limit disease and also consider use of non-native genotypes currently often prohibited in seaweed aquaculture to avoid invasive species risks, and provide selective breeding programmes; also farm escapees as a potential threat to genetic diversity of native populations); health risks due to alginates binding e.g. heavy metal, lack of low-cost, high efficiency harvesting systems; varying nutritional content seasonally, and food acceptability; and environmental concerns related to release of organic material and pharmaceutical products. These may in particular have strong environmental footprint in poorly regulated mariculture in locations with poor water renewal. To what extent can issues such as these be managed, and through what systems or instruments?

Session 3: Uncertainty and future trajectories:

- Within the scope of potential variation in future climate change as projected – how can we be certain not to overfish?
- What may the costing, possibility for scaling, time scale, and feasibility be of proposed measures? What could the future trajectories of production be?

Session 4: Governance instruments and implementation: the legislative context

- In the report, it is suggested that effective catch restrictions need be put in place by the regulating authorities. What are the potentials and limitations for this? What related management measures could be envisaged?
- It is also suggested that direct subsidies for marine food production should be used with caution, as they can have detrimental indirect effects. Today, there is a broad consensus among scientists that subsidies for wild capture fisheries should be abandoned completely. How could any such transition be managed?
- On the other hand, tailored taxation, meaning a tax (or fee) on fish catches, could be an appropriate instrument to increase the efficiency and yields of fisheries, in particular if it is appropriately delineated according to the structure of fish populations. Taxes may be an appropriate regulation instrument when they are applied to increase the private costs of actions that harm the marine environment – such as over-exploitation of marine resources, but also marine pollution. Taxing the use of nutrients that eventually end up in marine environments may help keeping the oceans in a productive state with respect to food resources. Which sort of tax instruments could be used for this, and how could their effectiveness be measured?
- It is suggested that for activities that benefit the natural environment, remuneration payments may also be appropriate. Specifically, it could make economic sense to remunerate (not subsidise) the water purification service of farming filter feeders. To what extent and using what instruments could such measures be undertaken, and how would such a measure be assessed?
- There may be a case to subsidise research and technology development in the various sectors of marine food production. Which ones in particular and in what way could such measures be targeted?
- It is suggested that greening payments could play a limited role in promoting sustainable fishing in terms of the implementation of the discard ban. Subsidies that would facilitate the purchase of new gear that allows for the better separation of target species from other species that are not being targeted but that have high survivability rates, could be beneficial as long as the gear that is supposed to be replaced is also permanently removed at the same time. In terms of mariculture, some form of green payment system could be developed. Similar to the greening of the CAP, this would act as compensation for the additional environmental benefits that are produced as a result of improved but more expensive marine farming approaches. To what extent and using what instruments could such measures be undertaken, and how would such a measure be assessed?

- Similar to wild fishing, subsidies and grants have been employed for decades to compensate for the high level of risks in the start-up of aquaculture farms, again with the aim of overall production growth. Reorienting these payments toward green payments for innovation in reducing waste from the production process and for compensating producers for employing more expensive feed that uses less marine resources in its composition could be an objective. Alternatively, reduction in tax liabilities for those operators who move to more sustainable forms of mariculture is an option that could also be explored rather than green payments. To what extent and using what instruments could such measures be undertaken, and how is such a measure assessed (amongst participants)?
- It is suggested that it may be relevant to review possibilities for Integrated Coastal Zone Management (ICZM) or regionalization of marine governance in relation to EU MSP. Any comments on this? Regarding protection, sizes of the protected reserve zones could also be considered. Any comments on this?

Session 5: Market governance measures, social license and innovation:

- Regarding instruments for social license, large food corporations play a decisive role in determining the sourcing and provisioning of the food market and must develop further their public responsibility for sustainable marine foods. Established instruments (such as EIA and certification, for instance) along with new instruments may be important here. What instruments could be brought to bear, and how/ towards what could they best be targeted?
- With regard to innovation issues, it has been identified that less intensive mariculture struggles with its productivity compared to alternative proteins. There is consensus among the experts that the appropriate approach for facilitating start-up investments is to set up clear, transparent, and harmonized regulation and rules according to which an aquaculture firm will get licensed, and which presently vary widely between states. In the case of advancing offshore multi-use in a spatially efficient way, certain preconditions need to be fulfilled and streamlined to reduce the risk for offshore entrepreneurs. For example, there is a need to clarify the working tasks and location of marine installations, but also the overall regulatory conditions (e.g. determination of working rules) and allocation of responsibilities, as well as commercial arrangements or actuarial regulations and questions of ownership and liability in the EEZ. Any comments on the potential to develop such a process and appropriate instruments to do so?

Session 6: The role of the EU:

- In which of the areas in the EU policy context could the EU best act in order to help foster increased sustainable harvesting of food from the oceans?
- The introduction to the draft SAPEA report refers to the satisfaction of global demand for the medium to long-term (30+ years). But which among the options and possibilities discussed has potential for increasing the amount of food harvested from the ocean in the meantime, and which would lend themselves to policy action or change now? (Given that +30 years takes us beyond 2047 - i.e. more than a whole generation from now and six or seven electoral cycles and Commission terms)?
- With regard to coordination with broader social aims such as employment, to what extent and in conjunction with what types of policies may labour-intensive forms of harvesting, so called “technological subsidiarity”, be possible?
- The report notes that opportunities also exist for restoration and enhancement of coastal marine ecosystems, e.g. through the development of breakwaters, sea walls and other man-made structures along coastlines which is increasing worldwide to sustain commercial, residential and tourist activities as well as for protection from coastal erosion and sea level rise. Any suggestion on how such measures could be developed in conjunction across various policy areas, and through what instruments?

LIST OF EXPERT CONTRIBUTORS AND OTHER ATTENDEES

Expert Contributors

Carina H. Keskitalo is Professor of Political Science at the Department of Geography and Economic History at Umeå University. She is also strategic research leader at the Department of Forest Resource Management, Swedish University of Agricultural Sciences, Umeå, Sweden. She is a Member of the Scientific Advice Mechanism (SAM) High-Level Group and Chair of the Food from the Ocean Coordination Group.

Johannes Klumpers is a European Commission official heading the Scientific Advice Mechanism Unit (SAM). After several years of industrial research in Sweden, he joined the EC Directorate-General for Research & Innovation in 1998 and has worked there on a large variety of topics, from renewable raw materials to gender, science in society, finance and budget and occupies his current post since its establishment in October 2015.

Sierd A.P.L. Cloetingh is Professor of Earth Sciences at Utrecht University. He is President of the Academia Europaea and since 2017 president of the COST Association. Academia Europaea is the Lead Academy on behalf of SAPEA in the Food from the Oceans project.

Manuel Barange is the Director of the Fisheries and Aquaculture Policy and Resources Division at the Food and Agriculture Organisation, Rome, Italy and also an Honorary Fellow at the Plymouth Marine Laboratory and an Honorary Professor at the College of Life and Environmental Sciences, University of Exeter, UK.

Dag L Aksnes is Professor in the Theoretical Ecology Group, Institute of Biology, University of Bergen and Chair of Working Group 1 (natural sciences).

Michael St John is Professor at the National Institute of Aquatic Resources, Technical University of Denmark and a member of Working Group 1 (natural sciences).

Philippe Cury is a senior scientist at IRD (Institut de Recherche pour le Développement). He is the Director of the CRH (Centre de Recherche Halieutique Méditerranéenne et Tropicale) based in Sète France, and of the UMR-EME 212 IRD-Ifremer and University Montpellier 2.

Henrik Sparholt was Deputy Head of the Advisory Programme at ICES (International Council for the Exploration of the Sea) and had significant involvement in the Ecolknows project, improving fisheries assessment methods by integrating new sources of biological knowledge.

Luis López Abellán is Director of the Oceanographic Centre of the Canaries from the IEO (Instituto Español de Oceanografía) in Tenerife.

Yngvar Olsen is Professor in the Department of Biology, NTNU (Norwegian University of Science and Technology) and a member of Working Group 1 (natural sciences).

Stephanie Rakels is Investment Manager at Aqua-Spark, a global investment fund based in the Netherlands that makes investments in sustainable aquaculture businesses that generate investment returns, while creating positive social and environmental impact.

Santiago Cabaleiro is the Director of the Galician Aquaculture Technology Centre CETGA and also General Manager of Cluster of Aquaculture companies of Galicia.

Daniela Schmidt is Professor in Palaeobiology at the University of Bristol and is a member of Working Group 1 (natural sciences).

Katja Frieler is Deputy Chair, Climate Impacts and Vulnerabilities, Potsdam Institute for Climate Impact Research.

Gro-Ingunn Hemre is Director of Research, NIFES, the National Institute of Nutrition and Seafood Research in Norway.

Poul Holm is Professor of Environmental History, Trinity College Dublin, and Chair of Working Group 2 (social sciences and humanities).

Martin Quaas is Professor of Environmental, Resource, and Ecological Economics at Kiel University and a member of Working Group 2 (social sciences and humanities).

Michael Keatinge heads up the Fisheries Development Division, encompassing Fleet Development, Fisheries Services, Marine Technical and Fisheries Development at BIM, Ireland's Seafood Development Agency.

Courtney Hough is General Secretary at EATIP (European Aquaculture Technology & Innovation Platform) and FEAP (Federation of European Aquaculture Producers).

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James P. Gavigan has been an official of the European Commission (EC) since 1990. He joined the EC's Scientific Advice Mechanism (SAM) unit in Brussels in September 2016. Previous positions include: Head of Science, Technology and Innovation at the EU's Delegation to the US and Head of the European Research Area Policy Unit.

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Matthias Kaiser is Director of the Centre for the Study of the Sciences and Humanities at the University of Bergen and is a member of Working Group 2.

Jann Martinsohn is Team Leader & Sector Head who works in close collaboration with the Head of Unit of JRC.D.2 – Sustainable Resources - Water and Marine Resources, manages the activities of the staff within the fisheries and aquaculture group of the Maritime Affairs Unit and leads its projects.

Other Attendees

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