European MARINE BOARD
Advancing Seas & Oceans Science

STAKEHOLDERS' CONSULTATION 2014

HORIZON 2020 SOCIETAL CHALLENGE 2

Food Security, Sustainable Agriculture, Marine, Maritime and Inland Water Research and the Bioeconomy

EMB submission date: 30 June 2014

Identifying the challenges

1) In the framework of the Horizon 2020 Societal Challenge 2, what are the most important specific challenges which require immediate actions in order to achieve smart, sustainable and inclusive growth?

The major challenges for Horizon 2020 Societal Challenge 2 include:

a) Oceans and Human Health:

Supporting both coordination and scientific actions to address the complex linkages between the marine environment and human health, informing maritime, environment, public health and innovation policy.

b) Marine Biodiversity:

Delivering knowledge of the extent and nature of biodiversity in European seas and oceans, its fundamental role in the functioning of marine ecosystems, and of the implications for humans of a changing biodiversity. Such knowledge is essential as baseline information for MSFD & GES, and underpinning the sustainability of blue growth priority areas (blue biotechnology, aquaculture, seabed mining, blue energy). It is crucial to close gaps in knowledge which could otherwise prove a major limiting factor in both economic and governance terms. This is particularly pertinent in the deep-sea where only 0.0001% has been sampled biologically.

c) Marine Microbial Ecology:

Understanding the nature (diversity) and role of marine microbial communities, their role in ecosystem functioning and the turnover of key elements essential for life.

d) Coherent Networks of Marine Protected Areas:

Providing a best practice framework for transnational collaboration in the planning, implementation and management of coherent networks of marine protected areas (MPAs), including those beyond national jurisdiction.

e) Sustainable Marine Biotechnology

Enhancing the knowledge base to support sustainability of actions in support of the EU Blue Growth strategy through a range of innovation actions across in support of marine biotechnology.

f) Sustainable European Aquaculture:

Providing scientific basis to achieve a thriving aquaculture industry in Europe, better able to supply the European and overseas seafood markets (increasing exports and reducing imports), provide a healthy and affordable seafood products the basis for a technologically advanced and profitable maritime industry. Actions for basic research should recognize that deep-sea aquaculture is an emerging economic activity driven by the increasing demand for aquaculture coupled with advances in technology.

2) What key research and innovation areas need to be addressed in order to tackle these specific challenges, and meet the specific objectives of Societal Challenge 2?

Knowledge is the key to unlocking the potential of aquatic living resources and matching economic opportunities with the best science and governance. Basic marine research is the first stage of the value chain for many marine economic activities of relevance e.g. aquaculture, marine biotechnology. In addition, the innovative application of science (e.g. habitat mapping of deep-sea ecosystems) and developing state-of-the-art technology for sample collection and data management are also key for achieving smart, sustainable and inclusive growth. The European Marine Board has recently completed a number of foresight activities in key research and innovation areas listed below. Scientific recommendations for addressing these in the context of societal challenges and opportunities can be found within each publication.

Oceans and Human Health

Please refer to European Marine Board position paper 19, Linking Oceans and Human Health: A Strategic Research Priority for Europe.

http://www.marineboard.eu/images/publications/Oceans%20and%20Human%20Health-214.pdf

Marine Biodiversity

Please refer to European Marine Board future science brief 1, Marine Biodiversity: A Science Roadmap for Europe.

http://www.marineboard.eu/images/publications/Marine%20Biodiversity-122.pdf

Marine Microbial Ecology

Please refer to European Marine Board position paper 17, Marine Microbial Ecology and its Role in Climate Change and Ecosystem Functioning.

http://www.marineboard.eu/images/publications/Microbial%20Diversity-117.pdf

Coherent Networks of MPAs

Please refer to European Marine Board position paper 18, Achieving Ecologically Coherent MPA Networks in Europe: Science Needs and Priorities.

http://www.marineboard.eu/images/publications/Marine%20Protected%20Areas-154.pdf

Marine Biotechnology

Please refer to European Marine Board position paper 15, Marine Biotechnology: A New Vision and Strategy for Europe.

http://www.marineboard.eu/images/publications/Marine%20Biotechnology-37.pdf

Aquaculture

Please refer to European Marine Board position paper 20, Navigating the Future IV, Chapter 5: Food from the sea (page 66).

http://www.marineboard.eu/images/publications/Navigating%20the%20Future%20IV-168.pdf

3) What are the key assumptions underpinning the development of these areas (research & innovation, demand side and consumer behaviour, citizens' and civil society's concerns and expectations)?

Oceans and Human Health

There has been growing recognition within the scientific community of the need for a more holistic approach to understanding the complex links between the seas and oceans on one hand, and human health and well-being on the other. Human exposure to marine-borne pathogens and chemical pollution pose significant threats to human health. At the same time, the seas provide numerous benefits to human health and well-being. Biotechnology is opening opportunities to exploit marine genetic resources and as understanding of the marine environment increases, so does our appreciation of its value and potential. Understanding this complexity can only be achieved with an interdisciplinary approach,

drawing from expertise across a diverse range of disciplines within natural, social and economic sciences, public health and medicine.

Marine Biodiversity

The seas and oceans, and the enormous diversity of life which they contain, are under threat from climate change, ocean acidification, and from numerous and increasing human impacts. In the past ten years, Europe has made significant progress in marine biodiversity research and knowledge generation owing to strong support, funding, and coordination of research effort. However, there is still a major knowledge deficit, for example in the deep-sea and many of the important programmes and initiatives which have driven this progress have now ended. While biodiversity policy has also advanced, Europe has failed to achieve the biodiversity targets it has set itself. To meet these targets, effective science-based decisions and management will be necessary. This requires good science, strong European research collaboration, enhanced observing and research capacities, and effective science-policy interfaces.

Marine Microbial Ecology

In today's marine ecosystems, microbes such as Bacteria, Archaea, viruses, fungi and protists (including microalgae), dominate the living biomass. Recent developments in molecular ecology, metagenomics and ecological modelling illustrate that microbes represent the most important biological group on Earth in terms of phylogenetic and functional diversity. In addition, interdisciplinary research has uncovered new and unexpected roles of microbes in the biogeochemical cycling of carbon, nitrogen, silica and iron and many other (trace) elements in our seas and oceans. Marine microorganisms produce the organic matter and oxygen required to sustain life and facilitate the storage, transport, and turnover of key biological elements. Thus, microorganisms are the foundation of life and are of critical importance to the habitability and sustainability of our planet.

Coherent Networks of MPAs

Networks of MPAs are perceived as an optimal way to safeguard biodiversity assets. Effective MPA network design considers scale, size and spacing, and definition and mapping of ecosystem components are an essential prerequisite for the management of MPAs. Within Europe this 'ecological mapping' has been undertaken at different spatial and temporal resolutions and often on a project basis, resulting in an incomplete and uneven coverage.

Connectivity and ecosystem-engineered habitats are identified as important research priorities for MPAs. Enforcement, surveillance and stakeholder participation are also integral to MPA success.

Demand for resources and advancements in technology are driving marine economic activities moving further offshore into the deep-sea e.g. seabed mining, aquaculture. This should be matched with the development of MPA networks in areas beyond national jurisdiction in the context of ecosystem-based marine spatial management.

Marine Biotechnology

European countries are facing difficult challenges that will shape our common future including a sustainable supply of food and energy and climate change. Marine Biotechnology can contribute towards meeting these challenges and to economic recovery and growth. As well as creating jobs it can contribute to the development of greener, smarter economies, central components of the new Europe 2020 Strategy 1. A strategy for marine biotechnology development in Europe is urgently needed to allow this potential to be realised. However, there is real need for transparent, independent knowledge to help inform the regulatory and licensing process for marine biotechnology activities, particularly in areas beyond national jurisdiction to meet increasing demand in bioprospecting activities further offshore.

Aquaculture

The EU Strategy for the Sustainable Development of European Aquaculture (EC COM(2002) 511 final) and the more recent Commission Communication on Aquaculture (EC COM(2009) 162 final), identify a number of challenges in building an economic and environmentally sustainable European aquaculture industry. The most recent EC Communication, Strategic Guidelines for the sustainable development of EU aquaculture (EC COM(2013) 229 final), estimates that each percentage point increase of current EU consumption produced internally through aquaculture could help create 3,000-4,000 new full-time jobs, explaining why aquaculture is one of the pillars of the EU Blue Growth strategy (EC COM(2012) 494 final).

Research and innovation will continue to be at the core of EU efforts to provide a basis for sustainable expansion of the sector, but also to make EU aquaculture production the most technologically advanced in the world.

Basic research remains fundamental to inform Environmental Impact Assessments (EIAs) that are required in the precursor stages of aquaculture and indeed wider blue growth economic activities and to underpin evidence-based decision making and ocean governance throughout the lifetime of an economic activity.

Tackling bottlenecks & gaps

4) What are the bottlenecks – in practices and research – in addressing these areas, and what are the inherent risks and uncertainties, and how could these be addressed?

- **Crossing disciplines**: Insufficient capacity for crossing disciplines to address complex societal challenges. Need much greater emphasis and implementation of effective trans- and inter-disciplinary research (e.g. within natural sciences and between natural sciences and social and economic sciences).
- **Knowledge management**: Drastically improved knowledge management requirements for EU-funded research projects. Insufficient effort on behalf of project consortia to deliver appropriate knowledge transfer actions to support policy/societal goals of project.

- **Open access to data and knowledge**: Remove barriers to access marine data in support of research and innovation (building on initiatives already underway).
- **Technology deficits**: Need to fast-track new sensor and platform technologies prohibiting progress towards integrated marine observing system in Europe. Biological monitoring is especially in need of technological innovation.
- **Citizen science:** There is a need to encourage and support the engagement of European citizens in data gathering, observations and experimental work in support of Horizon 2020 Societal Challenge 2 goals. Examples of successful citizen science programmes include the Jellywatch[1] initiative which is being implemented in ten Mediterranean countries.

5) Is there evidence for any major gap (knowledge, science and technology, markets, policies, competences, skills)?

Significant knowledge and implementation gaps are hampering progress across all of the thematic challenges outlined above. These are outlined in detail in the EMB papers referenced above. Some specific issues are highlighted below:

Oceans and Human Health

Key EU maritime, environmental and economic policies (e.g. Marine Strategy Framework Directive, EU biodiversity strategy) fail to take account of the complex relationships between marine environmental health or degradation and human health. The emerging metadiscipline of Oceans and Human Health can help to address these policy deficits.

Research in Oceans and Human Health (OHH) must be directed at elucidating key environmental processes, and providing a predictive capability for both biotic and abiotic environmental influences on human health, which only be achieved through the mobilization of interdisciplinary competencies and ensuring that the necessary scientific and technical capabilities are available.

Specific deficit is the limited amount of information or studies providing quantitative assessment of the disease burden and economic impact of marine-related human illness.

Marine Biodiversity

The fragmented approach to biodiversity science has left a legacy of poor coordination of knowledge and capacities. No quantitative assessment has been made of biodiversity status and trends in Europe. In particular we currently have very little information on the functioning of deep-sea ecosystems, how these systems evolved, or their resilience to human threats and natural pressures (European Marine Board (2013) Navigating the Future IV, chapter 8).

In general, biodiversity observations have been made and samples collected and curated in an uncoordinated way. A particular worry is that traditional taxonomy (based on

[1] http://www.ciesm.org/marine/programs/jellywatch.htm

morphology) is in serious decline. Historically a leader in this area, Europe has largely failed to transfer the extensive taxonomic knowledge it once possessed to a new generation of scientists.

Skills – Training Tomorrow's Marine Experts

The workforce for tomorrow's marine research, policy and industry sectors will be largely drawn from a pool of graduates currently receiving training in higher education institutions. European programmes and systems of training are, therefore, of the utmost importance. The challenging questions for marine sciences revolve around systems and their interactions, and addressing scenarios that include the role of people, economics and policies. Tackling climate change, understanding ecosystem function, managing sustainability: all of these require a much more extended mindset than was typical even a decade ago. The truly ambitious goal is to create synergies that will ultimately lead to a convergence in understanding which will help to facilitate workable solutions.

The EU Blue Growth initiative 1 is designed to develop and maximize the potential of Europe's oceans, seas and coasts and to support jobs and growth. The marine and maritime sectors that make up the "blue economy" could provide up to 7 million jobs in Europe by 2020. New jobs will be spread between expanding traditional sectors (e.g. maritime transport) and emerging sectors (e.g. deep sea mining). In order to facilitate this expansion, a skilled workforce will be required. Education and research are, therefore, central components of the blue growth strategy and it is recognized that training itself is part of the engine which drives innovation and technology development in maritime sectors.

Making Best Use of European Marine Stations

An additional obstacle concerns the underutilization of coastal marine or oceanographic institutes as facilities for training activities, as traditionally these facilities have been largely engaged in research. However, some coastal labs also act as bases for student training and field courses. Several European coastal marine laboratories provide the opportunity and facilities for hosting students and visiting researchers. The Biological Institute Helgoland of the Alfred Wegener Institute in Germany, for example, supports some 100 visiting researchers and 700 training places each year. Where such important and unique services are provided by marine laboratories, particularly in support of graduate training, they should be protected and developed. To support this process, it may useful to provide a basis for improved networking and promotion of the training facilities at coastal marine laboratories at EU level.

Valuing Marine Ecosystem Goods and Benefits

Smart, sustainable and inclusive growth in Europe's 'blue' economy requires a holistic approach to evaluating proposed activities, encompassing biological, social and economic impacts so that society and policy makers have the ability to make more informed choices on activities that reflect and promote sustainable Blue Growth. The EMB working group, VALMARE[2] (Valuing Marine Ecosystems), is preparing a position paper to examine state of

[2] http://www.marineboard.eu/valuing-marine-ecosystems

the art and identify research priorities in the area. A review of evaluation methods for marine activities reveals shortcomings in the incorporation of current and projected societal value, including effects on human health, into environmental impact assessments. In order to proceed sustainably with Blue Growth initiatives, systems of evaluation need to be updated which have the ability to assign monetary and non-monetary values to an extended range of indirect ecosystem services and benefits. This is critical to underpin appropriate policy and planning aspects for blue growth activities such as marine biotechnology, aquaculture (and fisheries), and seabed mining.

Defining opportunities

6) What are the emerging opportunities for advances in the areas tackled by Societal Challenge 2, taking into account the EU position in research and innovation?

With blue growth sectors such as marine biotechnology, aquaculture and seabed mining expected to increase, there is the opportunity for Europe to become a world leader in knowledge production to address gaps, drive innovation and match socio-economic activity with ocean governance.

7) In which areas is the strongest potential to leverage innovation and, in particular, ensure the participation of industry including SMEs?

There is variation in understanding of the meaning of the term “innovation”. Most scientific research is, by nature, innovative. It is clear that marine research has a key role in delivering new products, processes and services that can deliver a direct economic impact, meeting the EU Blue Growth agenda. However, research must also address more fundamental questions in a way which may not deliver immediate economic gains, but which will form the basis for a much longer-term sustainable management of our seas and oceans. Thus, seas and oceans research can contribute to the development of not just a “smart economy” but, more importantly, can underpin our progress towards becoming a “smart society”, of which economy is just one - albeit important – component (EMB, Navigating the Future IV, 2013).

In the context of this questionnaire it is understood that innovation refers activities which contribute to expanding the EU maritime economy, creating economic opportunities and job creation, key goals of the Blue Growth strategy. In this case, research to support technology development, efficient operations, minimum environmental impact and new opportunities in the areas of marine biotechnology, aquaculture, ocean observing/forecasting, seabed mining, and renewable ocean energy will provide an important contribution to growth in these areas.

8) How could Horizon 2020 Societal Challenge 2 best contribute to EU policies, and leverage and complement Member States' efforts for growth and job creation?

Horizon 2020 Societal Challenge 2 contribute to EU policies by supporting both basic and applied research aimed at ensuring the expansion of economic activities in European (and non-European) marine waters is sustainable. The research goals included in the part of Societal Challenge 2 that deals with marine and maritime research should not only focus on

blue growth. Other important EU policies continue to require additional knowledge and advice from the scientific community. These include obviously the Marine Strategy Framework Directive (see key findings of the SU FP7 STAGES project, "Science and technology advancing governance on Good Environmental Status), the Water Framework Directive, the EU Biodiversity Strategy, the Common Fisheries Policy, the EU Aquaculture Strategy, the EU Climate and Energy Package, etc. There are important gaps in our knowledge preventing the successful implementation of these strategies and directives Societal Challenge 2 has a key role to play in addressing these gaps.

9) What types of cross-cutting and trans-disciplinary activities would best tackle these challenges/opportunities based on the first experience of Focus Areas such as Blue Growth or Sustainable Food Security[3]?

All of the priority areas identified in question 1 above will require an interdisciplinary response and could benefit from cross-cutting research calls. For the purpose of this questionnaire, we will focus on one area for which a cross-cutting approach, which addresses the goals of several of the other Horizon 2020 Societal Challenges, will be essential. This area is oceans and human health.

The interconnections between human health and wellbeing, on the one hand, and the seas and oceans on the other, are becoming increasingly important in light of rapidly growing coastal populations and climate change. Europe can achieve significant public health benefits through a better understanding of highly complex marine environment and human health interactions.

"Oceans and Human Health" (OHH) represents a relatively new and integrative research field, drawing from expertise across the natural, social and economic sciences, including public health and medicine. A beneficial step-change in scientific understanding, evidence-based policy, public awareness and human behaviour is possible through:

• coordinated interdisciplinary research;

• building OHH communities and capacities;

• engaging with stakeholders; and

• managing effective knowledge transfer and science policy interfaces.

To achieve these policy-relevant goals will require a major integrated research effort. In the context of Horizon 2020 societal challenges, this will require a cross-cutting approach, combining the resources of Societal Challenges:

1. Health, demographic change and well-being;

[3] Horizon 2020 Work Programme 2014-2015 on Societal Challenge "Food Security, Sustainable Agriculture and Forestry, Marine and Maritime and Inland Water Research and the Bioeconomy" http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-food_en.pdf

2. Food security, sustainable agriculture, marine and maritime research and the bioeconomy;

5. Climate action, resource efficiency and raw materials; and

6. Inclusive innovative and secure societies.

It is proposed that a cross-cutting call, with input from these societal challenges, based on the FP7 Ocean of Tomorrow model, would be highly effective to deliver a major boost to advance the knowledge on oceans and human health linkages and build an interdisciplinary OHH community in Europe. In addition, OHH is also a field with high potential for transatlantic cooperation (particularly with the U.S.A. which has a strong OHH capacity), in line with the goals of the Galway Statement.

Output and impacts

10) What type of output could be foreseen and what could the impacts (on science and technology, innovation, economy, environment and society) be based on your identification of priority areas for action? What would success look like? How would you measure it?

a) Oceans and Human Health:

A comprehensive and interdisciplinary Oceans and Human Health research programme in Europe has the capacity, in the medium term (5-7 years), to deliver:

- Greater understanding of the causes of human illness associated with marine environmental causes and reduction on the burden of human disease arising from marine environmental causes;
- Improvement in our understanding of the potential public health benefits from marine and coastal ecosystems;
- Improved citizen awareness of risks and benefits and hence social/behavioural changes that can optimise the public health implications of our relationship with the sea. This can ultimately reduce disease burden and reduce economic impact (health costs, reduced days at work etc.);
- Concrete support for evidence-based maritime, environmental, health and economic policies which take account of oceans and human health interactions;
- Increased capacity to anticipate new threats to public health before they become serious.
- Much improved interdisciplinary collaboration and the establishment of a truly interdisciplinary Oceans and Human Health science and stakeholder community in Europe, leading to greater efficiency in knowledge generation and transfer.

b) Marine Biodiversity:

Knowledge: Improved knowledge and understanding of marine biodiversity, future scenarios of change, associated impacts, risks and opportunities

Policy and Management: More effective maritime policy-making, science-based marine management and ocean stewardship supported by decision making tools.

Education and Awareness: More informed decision makers and general public with greater awareness of marine biodiversity issues, societal benefits, risks and opportunities.

Leadership: Europe maintains its global leadership in marine biodiversity research delivering excellent science and training opportunities.

c) Marine Microbial Ecology:

Specific outputs and benefits arising from a coordinated and well supported European research programme on marine microbial diversity:

- A set of community-agreed standards and technologies for (automatic) sampling and data acquisition (lab protocols), storage and exchange of data to reach a new level of interoperability and data integration across disciplines;
- Innovative software approaches for quality management, data processing, data integration, accessibility and visualisation;
- Ecosystem models for selected sites in the marine system to provide a predictive understanding of the contributions of functional microbial biodiversity to marine ecosystems functioning, with a special focus on the role of microbes in climate change and the effect of climate change on microbial communities;
- Delivery of new biocatalytic processes, enzymes, biosynthetic pathways and bioactive compounds for use in biotechnological applications.
- An innovative legal framework and model contracts for the protection and sustainable use of marine genetic resources;

Note: Marine microbial ecology is one of the priority areas for transatlantic research identified in the Galway statement.

d) Coherent Networks of Marine Protected Areas:

Greater coherence between regions and Members States (and associated countries) in the planning, establishment, monitoring and management of networks of MPAs in EU waters. This can contribute substantially towards achieving GES and towards meeting member state and EU targets with respect to the Convention of Biological Diversity (Aichi target 11 which states that, *"…by 2020, at least 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected area and effective area-based conservation measures, and integrated into the wider landscapes and seascapes.")*

e) Sustainable Marine Biotechnology

Vision for marine biotechnology in Europe by 2020:

By 2020, an organized, integrated and globally competitive European Marine Biotechnology sector will apply, in a sustainable and ethical manner, advanced tools to provide a significant contribution towards addressing key societal challenges in the areas of food and energy security, development of novel drugs and treatments for human and animal health, industrial materials and processes and the sustainable use and management of the seas and oceans.

Specific indicators of success will include;

- Up to 10 leads on prospective drugs (e.g. antibiotics)
- A much closer interaction between industry and academia (e.g. through successful public-private partnership initiatives) overcoming the disparity in motivation and time-scales.
- A supportive and beneficial legal and policy framework to safeguard IP and ownership for EU researchers and SMEs utilizing marine genetic resources from both within EEZ and ABNJ. This includes addressing the deficit in advice and information to the marine biotechnology community on current discussions and developments regarding the implementation of Marine Scientific Research (MSR) under UNCLOS and access and benefit sharing arising from use of MGRs from waters in another jurisdiction or ABNJ.

f) Sustainable European aquaculture:

a. Increased production and gross added value for EU aquaculture sector (on 2010 levels of 1.26 million tonnes and €3.1bn, respectively).
b. Reduction in reliance on imported aquaculture products from outside the EU.
c. Diversified and healthy seafood for consumers

Production of new, diverse aquaculture species and implementation of breeding programmes that utilize the latest developments in genetics and genomics to enhance management, performance, disease and parasite resistance, flesh and nutrient quality and welfare traits of farmed species under changing environmental conditions.

Much improved technical and economic feasibility for the cultivation of a range of marine algae species with commercial potential (food and biotechnology applications). Recognition of the emerging areas of Deep-sea aquaculture utilizing autonomous, un-tethered submerged culture/ranching cages.

d. Reduced environmental impact of aquaculture

Major reduction in the use and release of various pollutants and veterinary medicines (e.g. through development of improved vaccines for endemic diseases), and the loss of ‘escapee’ organisms.

Advances the development of innovative feeds and dietary ingredients that further reduce reliance of the finfish farming sector on marine fish-meal, fish-oil and feedstuffs that can be directly consumed by humans.

Development of improved management tools based on the ecosystem approach to minimize the impact of aquaculture activity on water quality, ecosystem health and other coastal zone users.

e. Reduction in pathogens and diseases

Prevention, eradication and control of infectious aquatic pathogens and diseases, not only affecting currently cultivated species/biota but also to foresee and address emerging and prospective disease challenges involving the cultivation of new species/biota. A much improved understanding of the relationship between immune gene, genomic and proteomic expression.

Better vaccine and drug delivery methods, particularly oral delivery systems.

f. Introduction of new non-food products and related production lines

Achievement of significant added value to aquaculture products and by-products through development of non-food uses, including better separation of bio-products, efficient waste transformation and improved biomass conversion. Also, advanced use of new/unexploited species for novel non-food products and services.

g. Improved rearing system technologies

Significant increase in the technical and economic viability of systems for production in onshore recirculation systems, seafood detoxification, offshore (deep water) aquaculture and integrated multi-trophic aquaculture. Advances in these technologies will be crucial to allow aquaculture to grow in the context of ever-increasing spatial competition in coastal areas.

h. Europe as a world-leading exporter of technology and best-practice

European aquaculture SMEs and professionals providing advice and consultancy on efficient aquaculture methods, rearing systems, disease treatment, waste management, processing and packaging and marketing of aquaculture products.