Consultation of Stakeholders on Potential Priorities for Research and Innovation in the 2018-2020 Work Programme of Horizon 2020 Societal Challenge 5 'Climate Action, Environment, Resource Efficiency and Raw Materials'

This stakeholder consultation is the response on behalf of the European Marine Board (EMB) based on several of its recent activities on climate change (OCNexus), deep sea (WG DeepSea), underwater cultural heritage (WG SUBLAND) and citizen science (WG Citizen Science).

The European Marine Board (EMB) has for many years provided foresight and recommendations on emerging marine science topics and needs and associated societal challenges and opportunities, for example in Navigating the Future IV (EMB, 2013)[1]. Societal Challenge 5 is an important instrument to boost European competitiveness while promoting the research and innovation solutions that ensure that economic growth is matched with sustainability.

The Societal Challenge sub-programmes in Horizon 2020 provide a hugely important opportunity for European and international collaboration to address some of the most complex challenges around sustainable ocean development, climate change and Blue Growth. In this consultation response, the EMB emphasizes the importance of further support for integrated ocean research to contribute to the knowledge base necessary to underpin effective solutions across a range of established and emerging societal challenges.

Questions:

1) What are the challenges in the areas of Societal Challenges 5 'Climate action, environment, resource efficiency and raw materials' that require action under the Work Programme 2018-2020? Would they require an integrated approach across the Horizon 2020 Societal Challenges and Leadership in Enabling and Industrial Technologies?

The ocean is our planetary life support system and harbours an enormous and largely undiscovered biodiversity. It is also an important driver for Europe's economy, supporting a maritime economy worth €500m per year in gross value added and 5.4 million blue jobs. In 2014 the European Commission published a Communication on Innovation in the Blue Economy[2]. The Communication promotes specific elements of the 2012 EU Blue Growth strategy which identified key strategic actions to underpin the future development of Europe's maritime economy and set an ambitious target of creating 1.6 million additional blue jobs across a number of growth areas. There is an opportunity for the Societal Challenge 5 2018-2020 Work Programme to much more effectively address an environment that covers 70% of the earth's surface, provides the vast majority of the planet's biosphere, and is largely unexplored and poorly understood.

[1] Navigating the Future IV (2013) http://marineboard.eu/file/18/download?token=QescBTo6
[2] EC COM(2014, 254 final/2) Innovation in the Blue Economy: realizing the potential of our seas and oceans for jobs and growth. http://cor.europa.eu/en/activities/stakeholders/Documents/COM(2014)254%20final.pdf

The Ocean-Climate Nexus

The European Marine Board calls for greater representation in the 2018-2020 Work Programme of Societal Challenge 5, of the important role of the ocean in the climate system, its role in buffering the effects of climate change and the significant impacts that climate change and ocean acidification are having on marine ecosystems. The ocean absorbs a significant portion of the excess heat from global warming and exports carbon to the deep ocean. It is the anchor of the water cycle and provides a range of ecosystem goods and services that we are often unaware of and have limited means to evaluate quantitatively. Climate change affects all regions and sectors. Knowledge of the complex processes underlying the ocean's variability is critical for an assessment of the interactions within the ocean-climate-human nexus.

An integrated approach across the Societal Challenges will be particularly important to address these issues. Research and innovation actions linking ocean and climate, marine ecosystem goods and services, food security and the bioeconomy (Societal Challenge 2), and the implications of climate change for human health and wellbeing (Societal Challenge 1) will be crucial to provide answers to complex multi-disciplinary questions and solutions in support of sustainable ocean development and Blue Growth.

The European Marine Board has, over the years, addressed multiple climate research challenges and delivered recommendations through its expert work groups and open forum[3]. In October 2015 at the European Parliament[4], the ocean science communities of Europe and the North America, through the combined voices of the ***European Marine Board and the US Consortium for Ocean Leadership jointly issued a Consensus Statement[5] calling for recognition of the ocean in climate actions and support for long-term ocean-climate research and observation programmes.***

The Consensus Statement set out some of the key challenges for unravelling the links between ocean and climate and the most important research priorities that can help provide answers and support an evidence-based societal response to climate change. Advanced ocean observing is imperative to underpin this effort; we need to identify and plug temporal, spatial and parameter gaps and to optimize the use of advanced models. By committing the appropriate scale of international investments to ocean observation and research, a significant leap is possible towards understanding the patterns of change. This is crucial to inform political decisions on approaches for mitigation and adaptation to climate change.

The European Marine Board stands ready to work across borders and disciplines towards a greater understanding of the ocean-climate nexus and to communicate scientific knowledge to support ocean stewardship and measures to understand, mitigate and adapt to global change.

[3] http://www.marineboard.eu/ocean-climate-nexus/library-0
[4] https://vimeo.com/146752220
[5] http://www.marineboard.eu/ocean-climate-nexus/consensus-statement

Sustainable Management of Deep Sea Resources

Deep-sea environments provide us with ecosystem goods and services that we are often unaware of. Some ecosystem services are quantifiable and have a direct market value. These include the provision of food through fisheries, marine-derived bioactive compounds, and oil, gas and mineral resources. However, the ocean also provides a broad range of ecosystem services that cannot be valued directly. Climate regulation, carbon sequestration, oxygen production and waste remediation are unseen services but essential for planetary health and human wellbeing.

Blue growth goes deep

A key role of Horizon 2020 Societal Challenges is to target emerging issues. There is currently a rapid development of interest to access ocean resources in deeper waters beyond the continental shelf. This includes established industries such as fisheries, and oil and gas production, which are moving operations deeper than ever before. In addition, emerging activities such as deep-sea mining, blue biotechnology and the development of renewable energy schemes, identified as priority areas by the EU Blue Growth Strategy, are the subject of major interest from both the private sector and some national governments.

However, we lack adequate legal and policy frameworks to regulate access to and utilization of deep-sea resources - both living and non-living - in areas beyond national jurisdiction (ABNJ). These economic opportunities also present specific challenges which will depend on the scale of the activities, the size and biological characteristics of the ecosystems impacted, and the trade-offs in terms of economic benefit compared to alternative strategies, e.g. recycling of rare earth elements.

A call from industry for fundamental deep-sea research

In a deep-sea stakeholder consultation (103 responses from 16 countries) carried out by the EMB in 2015, **95% of respondents, including industry, reported fundamental deep-sea research as the highest priority for informing future activities in the deep sea**. A key knowledge gap identified by many stakeholders was the need for baseline knowledge on biodiversity and ecology, ecosystem functioning and connectivity, spatial and temporal variation in deep-sea ecosystems and resilience of deep-sea species to pressures. Long-term monitoring and sampling of fauna and the surrounding environment was seen as an integral part of impact monitoring. There was also a call for further mapping of the seabed, including habitat mapping, together with the pooling of bathymetry and related data into publicly-available data centres (EMB Position Paper 22 & Policy Brief 2, 2015)[6].

[6] http://www.marineboard.eu/deep-sea-research

Coastal Tourism and Sea-Level Rise – Underwater Cultural Heritage

Coastal tourism is the largest sector in the European maritime economy and ***developing public interest around the discoveries of ancient human settlement remains[7] found in coastal seas has enormous potential to both tourism and awareness of how our ancestors adapted to sea level rise***.

Cultural heritage assets are unique and are a major driver of societal cohesion, identity and well-being[8]. The Council of the European Union adopted conclusions on cultural heritage as a strategic resource for a sustainable Europe[9] and Horizon 2020 expert group reported[10] that "*Innovative use of cultural heritage can make to a smarter, more inclusive and more sustainable Europe now and in the future.*"

With increasing offshore economic activities, these submerged historical records are under threat. The European Marine Board recognizes the importance of **Continental Shelf Prehistoric Research**, a new trans-disciplinary domain **linking the analysis of climate/ sea level change, environmental conditions and prehistoric archaeology**. Supporting the Continental Shelf Prehistoric Research will contribute to a solid knowledge base to safeguarding the submerged cultural heritage in Europe's shallow shelf seas (EMB Position Paper 21 & EMB Policy Brief 1, 2014)[11].

The EMB expert working group recommended to:

- Recognize the importance of Continental Shelf Prehistoric Research and the implications for future climate change impact;
- Integrate interdisciplinary knowledge in underwater research, especially in relation to prehistoric social change, and propose a way ahead for collaborative multidisciplinary research, including improved technology, training and funding resources;
- Highlight knowledge on prehistoric human-marine interaction;
- Federate a multi-stakeholder mechanism for a sustainable offshore exploitation[12] and to foster processes with socio-economic benefits, such as Marine Spatial Planning (MSP), and to address societal challenges related to Climate Action and Blue Growth.

[7] During the last one million years, the European landmass was periodically fluctuating in area, sometimes making it 40% larger than at present due to the global volumes of water locked up in ice caps. This now submerged landmass holds valuable information on the long-term history of human settlements during several episodes of migration, abandonment and reoccupation, which shaped the European landscape, the environment and its population.
[8] EU Council Decisions 2013/743/EU, OJ L347, 20.12.2013, p. 1022.
[9] EU Council Conclusions on cultural heritage as a strategic resource for a sustainable Europe at Education, Youth, Culture and Sport Council meeting, Brussels, 20 May 2014.
[10] Horizon 2020 expert group report "Getting cultural heritage to work for Europe"
[11] http://marineboard.eu/continental-shelf-prehistoric-research-wg-subland
[12] http://www.marineboard.eu/sites/marineboard.eu/files/public/EMD%20WS20_Report_EMB.pdf

2) What is the output/impact that could be foreseen? Which innovation aspects could reach (market) deployment within 5-7 years?

No response included - see above.

3) Which gaps (in science and technology, innovation, markets, policy, financing and governance, regulation etc.) and potential game changers, including the role of the public sector in accelerating changes, need to be taken into account?

No response included - see above.

4) Which areas could benefit from integration of horizontal aspects such as social sciences and humanities, responsible research and innovation, gender aspects, international cooperation?

Issues such as ocean-climate nexus, deep sea research and submerged prehistoric research could benefit from the international collaboration and collaboration with social science and humanities. Because most of the ocean lies beyond the jurisdiction of individual nations and the high cost of building and operating infrastructures, coordinated international collaborations are essential. Since prehistoric time, human has long relationship with the ocean and society's understanding of "the ocean's influence on us and our influence on the ocean[13]" is key to bringing research and innovation activities to another dimension.

Engaging with Citizens – Citizen Science

The European Marine Board has been advocating the importance of citizen awareness of the ocean since 2012 and is a partner to a SC2 Blue Growth project on Ocean Literacy 'Sea Change'[14]. In addition, the EMB has recently established a citizen science expert working group to promote the involvement of new actors in citizen science in order to advance marine research. Key benefits of citizen science include enhancing monitoring capability, empowering citizens and increasing environmental awareness. In the case of marine science, citizen science initiatives are particularly important to create awareness of the challenges facing the ocean as well as increasing ocean literacy.

The process of studying and understanding the best ways to develop, implement, and evaluate citizen science is still considered a relatively new field. To successfully design and operate long-lasting future citizen science initiatives, the integration of social sciences and humanities and adoption of best practices in responsible research and innovation is essential. The EMB's citizen science expert working group will reflect this in their recommendations on best practice for incorporating citizen science into

[13] http://www.seachangeproject.eu/images/SEACHANGE/Media_Centre/SeaChange_OceanLiteracyBooklet.pdf
[14] www.seachangeproject.eu

marine research projects, including best practice in engaging with and maintaining citizen engagement as well as outlining requirements to support marine citizen science in the future.

5) In view of the recent evolution of the socio-economic and policy context, what are the emerging priorities for Societal Challenge 5?

1. Understanding the links between the ocean, climate and human well-being
2. Generating multi-disciplinary baseline knowledge of the deep sea to:
    - Underpin sustainable exploitation of deep-sea resources;
    - Develop a appropriate targets and indicators to underpin a framework for maintaining Good Environmental Status in the deep sea;
    - Support for advanced and integrated ocean governance.
3. Support research and innovation to discover, curate and safeguard Europe's unique underwater cultural heritage as a high-value tourism product in line with Blue Growth strategic goals.

Further details on all three priorities are provided in the response to Question 1.

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About European Marine Board

The European Marine Board is Europe's foremost think tank for marine science policy. The EMB is a partnership of major national marine science institutes, research funding agencies and national network of universities. In 2016, the EMB has 35 member organizations from 18 countries.

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