

This stakeholder consultation is the response on behalf of an organization, the European Marine Board (EMB), based on one of its current activities of an expert working group “Submerged Landscape and Prehistory Research” (WG SUBLAND) endorsed by the EMB.

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#### Position of the European Marine Board

*The European Marine Board (EMB) is a pan-European forum for its member organizations to develop common priorities, to advance marine research and to bridge the gap between science and policy, in order to meet future marine science and societal challenges and opportunities. In 2014, EMB has 36 Member Organizations (MOs) comprised of national research funding and research performing organizations, including university networks, across Europe.*

During the last one million years, the European landmass was periodically fluctuating in area, sometimes making it 40%<sup>1</sup> 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. Cultural heritage assets are unique and are a major driver of societal cohesion, identity and well-being<sup>2</sup>. The Council of the European Union recently adopted conclusions on **cultural heritage as a strategic resource for a sustainable Europe**<sup>3</sup> and invited the European Commission to further support networking and promoting projects aimed at fostering sustainable management of cultural heritage.

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**.

In order to address the interdisciplinary nature of the subject, the European Marine Board launched an expert working group on submerged landscape and prehistoric research (WG SUBLAND)<sup>4</sup> (Sept. 2013 to Oct. 2014), gathering experts from the MOs of the EMB, Europae Archaeologiae Consilium/ European Archaeological Council (EAC) and a network established by the COST Action SPLASHCOS<sup>5</sup>. The Working Group will deliver its position paper in October 2014 with the main objectives of:

<sup>1</sup> For example, at the last glacial maximum (LGM), the European land area was increased by 3.2 million km<sup>2</sup>, with some places having a lowered sea level by about 120m-150m as a result.

<sup>2</sup> EU Council Decisions 2013/743/EU, OJ L347, 20.12.2013, p. 1022.

<sup>3</sup> 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.

<sup>4</sup> <http://www.marineboard.eu/submerged-landscapes> Flemming NC, Çağatay N, Chiocci FL, Galanidou N, Jöns H, Lericolais G, Missiaen T, Moore F, Rosentau A, Sakellariou D, Skar B, Stevenson A, Weerts H (*in prep.*) Land beneath the waves: Research strategies in submerged landscapes and sea level change--A joint geoscience-humanities research strategy for European Continental Shelf Prehistoric Research, Chu NC and McDonough N (Eds.) Position paper 21 of the European Marine Board, Ostend, Belgium.

<sup>5</sup> COST Action TD0902 (2009-2013) <http://www.splashcos.org/>

- Recognizing the importance of Continental Shelf Prehistoric Research and the implications for future climate change impact;
- Integrating 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;
- Highlighting this knowledge on prehistoric human-marine interaction;
- Formulating recommendations to foster processes with socio-economic benefits, e.g. Marine Spatial Planning (MSP), and to address societal challenges related to EC Climate Action (DG CLIMA) and Blue Growth (DG MARE).

Europe is amongst the world leaders in Continental Shelf Prehistoric Research, and we need to consolidate and expand that advantage.

*Please consider the following questions, citing any available evidence such as foresight and other assessments of research and innovation trends and market opportunities:*

1) What is the biggest challenge in the field concerned which requires immediate action under the next Work Programme? Which related innovation aspects could reach market deployment within 5-7 years?

**Continental Shelf Prehistoric Research** is a new trans-disciplinary domain **linking the analysis of climate/ sea level change, environmental conditions and the prehistoric archaeology** of people who lived and migrated on the ancient coastal plains. These records on the now submerged continental shelves can be preserved during seawater transgression.

With **increasing offshore activities** and initiatives such as the EC Blue Growth policy<sup>6</sup> and European sea basins action plans<sup>7</sup>, it is both timely and crucial to recognize Continental Shelf Prehistoric Research in order to mitigate damage from exploitation, increase site prediction and discovery through technological advancement and reduce the uncertainties of offshore operators due to site discovery by collaborating with industrial stakeholders. In this way, the management of cultural heritage assets will become more efficient and sustainable. The European Marine Board, through its Working Group SUBLAND, identifies the following challenges which require immediate action under the next Work Programme that will reach market deployment by 2020:

- I. **Training and Education** to prospect underwater cultural heritage: Continental Shelf Prehistoric Research requires a continued structure with educational and training supports, and interaction with other relevant research communities<sup>8</sup>. This is in line with the target of the Erasmus+ *Knowledge Alliance*<sup>9</sup> to boost innovation and stimulate the flow and exchange of knowledge between higher education and enterprises. This will also encourage *Capacity Building* and *Sector Skill Alliance* to tackle skill gaps for sustainable development.
- II. **Access to technology and data**: Research infrastructure use in cultural heritage management was highlighted at the last International Conference on Research Infrastructure (ICRI, Athens; April

<sup>6</sup> EC COM(2014) 254/2 (13.5.2014) [http://ec.europa.eu/maritimeaffairs/policy/blue\\_growth/](http://ec.europa.eu/maritimeaffairs/policy/blue_growth/)

<sup>7</sup> EC COM(2013) 279 (13.5.2013) [http://ec.europa.eu/maritimeaffairs/policy/sea\\_basins/atlantic\\_ocean/index\\_en.htm](http://ec.europa.eu/maritimeaffairs/policy/sea_basins/atlantic_ocean/index_en.htm)

<sup>8</sup> For example: palaeoclimatology, climate modeling, geophysical engineering, geochemistry and genetics.

<sup>9</sup> EU OJ L347, 20.12.2013, p. 58. Erasmus+ : [http://ec.europa.eu/programmes/erasmus-plus/index\\_en.htm](http://ec.europa.eu/programmes/erasmus-plus/index_en.htm)

2014)<sup>10</sup>. Most of the relevant offshore prospecting technology has been developed and managed by the marine science community and offshore industries. It is strongly encouraged that this infrastructure and technology expertise is shared. Likewise, long-term restructuring and access to data with no commercial value is required to develop datasets at European level. EMODnet<sup>11</sup>, part of the EU's open data initiative, aims to make marine data more accessible, interoperable and useful to end-users. The community of Continental Shelf Prehistoric Research recommends that underwater archaeological data be included in such data initiatives. It is only through open access to data and technology that the required inter-disciplinary integration of both the marine science community and offshore industries will be achieved.

- III. **Industrial partnership** for a coordinated collaboration and technology advancement: It is an important challenge to promote collaboration between offshore industries, cultural heritage agencies and research institutes to excel research and to reduce the cost and complexity of enforcing conditions of licensing. The discovery of submerged prehistoric sites requires improved technology, such as acoustic systems, diving tools and the application of remotely operated vehicles (ROVs). By teaming up with industrial stakeholders through public-private partnerships, further technology development can be stimulated.
- IV. **Multi-stakeholder mechanism**: Operational costs can be kept to a minimum by combining the initial surveys necessary for Continental Shelf Prehistoric Research with those already required for environmental assessment. The logical and administrative links between ecosystem management, nature-based solutions, and cultural heritage have been recommended in the SC5 Advisory Group report<sup>12</sup>. Governance with a multi-stakeholder model from environmental, industrial and academic sectors will improve the efficiency of site management.

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

Underwater cultural heritage has always held the public's interest, with a number of TV programs and frequent articles in the popular press. The media attraction of underwater cultural heritage demonstrates citizens' interest in the history of human societies. Supporting Continental Shelf Prehistoric Research directly reflects modern society's expectations in answering questions about early human migrations, origins of seafaring, exploitation of marine resources and response to sea level change. Already over 2,500 submerged prehistoric sites have been catalogued in European seas, mostly dating from 5,000-20,000 years old, with a few in the range 20,000 to 300,000 years old. Organic archaeological materials can be found underwater which are seldom found in dry-land sites of the same age. Seabed prehistory is a substantial part of European cultural heritage, and is covered by treaties and international agreements. The development of Continental Shelf Prehistoric Research will integrate areas in Social Sciences and Humanities (SSH).

### 3) What is the output that could be foreseen, what could the impact be, what would success look like, and what are the opportunities for international linkages?

Continental Shelf Prehistoric Research will contribute to the social awareness of such a research discipline. The discoveries will add to local museum collections, boosting coastal tourism. The sea level

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<sup>10</sup> <http://www.icri2014.eu/>

<sup>11</sup> European Marine Observation and Data Network (EMODnet) <http://www.emodnet.eu/>

<sup>12</sup> First Report of the Horizon 2020 Advisory Group for Societal Challenge 5: 'Climate Action, Environment, Resource Efficiency and Raw Materials'

changes and human interactions implied from this research will contribute to the understanding of future impacts from climate change. Endangered prehistoric sites will be preserved and cultural heritage management improved.

The European research community involved in Continental Shelf Prehistoric Research, a topic supported by multi-national and international organizations, is very active and increasing. However, the structure is still informal and transitory. With a new coordinated research effort at European level, the potential for new discoveries and benefits from international linkages would be vast. For example, the International Union of Quaternary Research<sup>13</sup> (INQUA) and the International Geoscience Programme<sup>14</sup> (IGCP) have, for decades, recognized and occasionally supported the human/hominin dimension in Quaternary/Pleistocene research, including the role of the continental shelf, but not including the direct study of submerged sites. Similarly, major international conference series occasionally hold a session on continental shelf submerged sites, such as the World Archaeological Congress<sup>15</sup> (WAC-6, Ireland, 2008). The UNESCO Office for Underwater Cultural Heritage recognizes the importance of the prehistoric continental shelf, and organized a Scientific Colloquium (Brussels, 2011)<sup>16</sup> on factors impacting underwater cultural heritage. Europe has been a leader in Continental Shelf Prehistoric Research, and we need to consolidate and expand that advantage to encompass an international dimension.

#### 4) Which are the bottlenecks in addressing these areas, and what are the inherent risks and uncertainties, and how could these be addressed?

We identify the bottlenecks in three perspectives: data and technology support, cross-disciplinary awareness and management.

##### **Support (data and technology)**

- Insufficient availability of high resolution seabed mapping;
- Requirement for new software to convert bathymetry and sediment data into reconstructed palaeo-terrain and landscapes;
- Necessity for novel methodologies for remote operated site confirmation, possibly through geochemical or DNA-based techniques;
- Lack of availability of ship time.

*These could be addressed following the recommendations of bullets I, II and III in Question 1.*

##### **Knowledge & awareness**

Lack of mutual understanding between disciplines: for example, archaeologists lack of familiarity with modern acoustic technology and engineers and geologists not appreciating the needs of archaeologists.

*These could be addressed following the recommendations of bullets I, II and IV in Question 1.*

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<sup>13</sup> INQUA <http://www.inqua.org/>

<sup>14</sup> Launched in 1972 and originally termed as "International Geological Correlation Programme," is a cooperative enterprise of UNESCO and the International Union of Geological Sciences (IUGS). <http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/international-geoscience-programme/>

<sup>15</sup> WAC: <http://www.worldarchaeologicalcongress.org/>; WAC-6: [http://www.worldarchaeologicalcongress.org/site/wacpress\\_20.php](http://www.worldarchaeologicalcongress.org/site/wacpress_20.php)

<sup>16</sup> <http://www.unesco.org/new/en/culture/themes/underwater-cultural-heritage/dynamic-content-single-view/news/international-scientific-colloquium-on-the-factors-impacting-underwater-cultural-heritage-at-the-royal-library-of-belgium/#.USAzAih-hSI>

### Management

The biggest risk is mismanagement. Poor training and lack of access to available technology and data will lead to difficulties in multidisciplinary surveys at a shared operational cost. Lack of such alliance effort will unfortunately result in prehistoric sites being destroyed by human activities (e.g. industrial operators) or natural disasters (e.g. storms).

*These could be addressed following the recommendations of bullets I, III and IV in Question 1.*

#### 5) Which gaps (science and technology, market, policy) and potential game changers, including the role of the public sector in accelerating changes, need to be taken into account?

The gaps for Continental Shelf Prehistoric Research exist in knowledge (e.g. time and location of the recorded sites and trans-disciplinary awareness) and policy (e.g. a coordinated and sustainable structure through which relevant stakeholders can liaise), as noted in previous sections. However, besides recognizing the value of protecting seabed prehistoric sites, it is important for authorities to develop systematic procedures, e.g. from identification, assessment, survey and protection to excavation. A comprehensive governance mechanism plays an important role in supporting such activities that sometimes take place at national boundaries. The procedures to oversee these activities at European level are necessary to ensure compliance with existing treaties and legislations.

#### 6) In which areas is the strongest potential to leverage the EU knowledge base for innovation and, in particular, ensure the participation of industry and SMEs? What is the best balance between bottom-up activities and support to key industrial roadmaps?

Cultural heritage assets, recognized for their contribution to sustainable growth and job creation, are subject to damage from human activities (e.g. offshore operation) and natural disasters (e.g. climate change induced storms). Europe possesses strong potential from its knowledge resources for prevention of such damage occurring, if coordinated mechanisms and knowledge alliances are established.

Direct interactions between high-profile industry representatives and researchers proved very fruitful, as demonstrated in the SPLASHCOS Esbjerg Meeting<sup>17</sup>. The community has recognized that for Continental Shelf Prehistoric Research, it is important to engage in dialogue with the fishing industry (by reporting by-catch) and to develop voluntary codes of practice with aggregate dredging companies. Such initiatives should be supported from regional to pan-European level.

Offshore industries usually start projects with intensive geological and geophysical surveys for information, which may also be a fundamental requirement for reconstruction of submerged landscapes in high resolution. Drilled cores from these investigations may allow additional geochemical, palynological or microfossil analyses and dating, that produce important data about local landscape and sea level history. There are already examples of fruitful cooperation in Europe between the marine industry and research on submerged landscapes, such as the Doggerland project that integrated datasets from marine industries for modelling the prehistoric landscape<sup>18</sup>. Such cooperation also contributes to a better understanding by industry managers to the scientific interests of submerged landscape research.

<sup>17</sup> SPLASHCOS Esbjerg Meeting (14-16 March 2013) <http://www.splashcos.org/events/splashcos-esbjerg-meeting>

<sup>18</sup> Gaffney V, Fitch S and Smith D (2009) Europe's lost world: the rediscovery of Doggerland. CBA research report 1955

7) Which areas have the most potential to support integrated activities, in particular across the societal challenges and applying key enabling technologies in the societal challenges and vice versa: and cross-cutting activities such as social sciences and humanities, responsible research and innovation including gender aspects, and climate and sustainable development? Which types of interdisciplinary activities will be supported?

Sea level rise is one of the most direct manifestations of a warming climate and is highlighted as one of the key research priorities by the European Marine Board<sup>19</sup>. Continental Shelf Prehistoric Research, a new trans-disciplinary domain that links sea level change with prehistoric human activities, has the potential to address one of the most pressing societal challenges via studying the past, and calibrating models of past climatic events. As stated previously, this research requires an integrated effort from diverse academic disciplines, cultural heritages, and industries. The trans-border nature of Continental Shelf Prehistoric Research usually falls outside the national research agenda and tends to be divided across EU research themes. It is therefore important that a solution-oriented R&I programme in the spirit of Horizon 2020 addresses this topic.

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<sup>19</sup> European Marine Board (2013) Position Paper 20, Navigating the Future IV, Chapter 2; CLAMER-EMB report (2011) Synthesis of European Research on the Effects of Climate Change on Marine Environments. <http://www.marineboard.eu/publications>