



**CSA**  
**OCEANS**  
JPI Oceans support action

  
SEVENTH FRAMEWORK  
PROGRAMME

# Draft Implementation Plan

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#### **Disclaimer**

This draft Implementation Plan has been developed as a part of the CSA Oceans project, an FP7 Coordination and Support Action to support JPI Oceans in its implementation phase. This document is one of the main outputs from Work Package 1 and was produced with the best effort of CSA Oceans partners. The document is intended to serve as a menu for the Management Board to take forward actions. The document will be submitted to the Management Board of JPI Oceans who will decide whether to adopt it as their official Implementation Plan.

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## List of Acronyms

### JPI Oceans Terminology

**CSA Oceans**- A Framework Project 7 funded Concerted Support Action to support JPI Oceans in its start-up phase

**EXCOM**- Executive committee of JPI Oceans

**GPC**- The High Level Group for Joint Programming

**IPlan**- Implementation Plan

**IPR**- Intellectual Property Rights

**JPI**- Joint Programming Initiative

**JPI Oceans**- Joint Programming Initiative for Healthy and Productive Seas and Oceans

**KIC**- Knowledge and Innovation Community

**MB**- Management Board of JPI Oceans

**MTS**- Material Transfer Agreement

**SRIA**- Strategic Research and Innovation Agenda

**StAB**- Strategic Advisory Board

### Marine Policy Terminology

**BG16**- Blue Growth: Unlocking the potential of Seas and Oceans, a call for proposal under Horizon 2020.

**CBD**- Convention on Biological Diversity

**CFP**- Common Fisheries Policy

**EEA**- European Economic Area

**ERA**- European Research Area

**ERA-NET**- European Research Area Network

**GES**- Good Environmental Status

**H2020**- Horizon 2020

**ICZM**- Integrated Coastal Zone Management

**INSPIRE Directive**- Infrastructure for Spatial Information in the European Community

**MSFD**- Marine Strategy Framework Directive

**MSP**- Marine Spatial Planning

**MSY**- Maximum Sustainable Yield

**RFO**- Regional Fisheries Organisations

### Marine Science Terminology

**AUV**- Autonomous Underwater Vehicle

**HAB**- Harmful Algal Bloom

**PCB**- Polychlorinated biphenyl, a synthetic organic chemical compound of chlorine attached to biphenyl.

**ROV**- Remotely Operated Vehicle

**RV**- Research Vessel

**THC**- Thermohaline Circulation

## Implementation Principles

This draft Implementation Plan has been developed as a part of the CSA Oceans project, an FP7 Coordination and Support Action to support JPI Oceans in its implementation phase<sup>1</sup>. This document is one of the key deliverables of Work Package 1. It was produced with the best effort of CSA Oceans partners. This document will be submitted to the Management Board of JPI Oceans. The Management Board will decide whether or not to adopt it as the official JPI Oceans Implementation Plan. The document is intended to serve as a menu for the MB to choose actions on an annual or semi-annual basis. These selected actions will be published in a shorter and more detailed action plan e.g. JPI Oceans 2015-16 Operational Plan.

## Introduction

The JPI "Healthy and Productive Seas and Oceans", in short "JPI Oceans" is a joint programming initiative to align the marine and maritime research and innovation landscape in Europe. This draft Implementation Plan (IPlan) builds on the Strategic Research and Innovation Agenda (SRIA) and actions identified during the consultation. The SRIA and the IPlan take the vision and goals for JPI Oceans, agreed in 2011 by the JPI Oceans Member Countries, as their starting point:

1. Enabling knowledge based economy,
2. Ensuring good environmental status of the marine space,
3. Optimizing the response to climate change.

The purpose of this document, produced in the context of a CSA-project and with the best efforts of CSA partners, is to pull together in a coherent and succinct form the outline of the key fit for purpose actions, reflecting gaps in the ERA landscape identified during the consultation. The actions presented within each of the Strategic Areas provide a menu from which member countries can choose where they wish to cooperate in accordance with the principles of variable geometry. Based on the top-driven visions and goals of JPI Oceans, the actions proposed are a result of targeted discussions with stakeholders and the Strategic Advisory Board as to how they consider that JPI Oceans can add value in the ERA landscape.

## Joint Programming

The Joint Programming Initiative concept was introduced in 2008. The objective was to further align the European Research Area (ERA) by enabling multinational funding opportunities, better coordination, increase cost-efficiency and synergies and reduce fragmentation in European research policy. There are 9 other JPIs working in different research fields.

Variable geometry is the implementation of actions through voluntary participation of a group of partners, a term that has been introduced in the context of the European Research Area to enhance flexibility and a capability to implement measures by those most affected and/or committed.

## JPI Oceans Added Value

JPI Oceans seeks to add value by actions:

- Contributing to alignment through reducing fragmentation and unnecessary duplication;
- Planning common and flexible initiatives;
- Facilitating cooperation and forward looking activity;

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<sup>1</sup> [CSA Oceans \(Project: 314194\)](#)

- Establishing efficient mechanisms for interaction and knowledge transfer between producers and users of knowledge to better address grand challenges of our time.

JPI Oceans can add value by addressing bottlenecks and barriers where the Framework Programme and other ERA tools until now have proven to have shortcomings with respect to topics and tools. The need for a more coordinated approach in marine and maritime research is evident. International cooperation is a necessity in this field due to the interconnected and cross-cutting nature of the marine environment and marine eco-systems. In addition the field is very complex and involves diverse areas of knowledge, disciplines and sectors. The grand challenges of the oceans, therefore, cannot be solved by a single country and blue growth requires cross-sectoral cooperation. Responding to these challenges require an integrated and coherent long-term approach at European level and beyond.

### Consultation Consensus

The general consensus arising from the CSA Oceans consultation was that JPI Oceans could add value in the ERA landscape by taking into account the following factors when taking the SRIA forward in designing actions and identifying relevant fit-for-purpose tools:

- Calls for proposal are important but have limitations; societal issues require a long term approach, too short to embed PhDs, lack flexibility to make necessary adjustments; time from conception to realisation is too long in particular on emergencies
- Advances can be made in use of enabling technologies
- Oceans industry are too compartmentalised, synergies can be created
- Need to engage users and producers to ensure relevance and uptake
- Open access to data requires high-level/ policy decisions
- Lack of a specific budget for research and data collection
- Due to costs of monitoring there is a need for:
  - A Societally driven Monitoring strategy –
  - Advances in the use of models
  - Advance the development of devices and sensors
  - Dual science policy relevance
- No inherent mechanism for science cooperation when competence is at the level of Member States
- Research is needed for blue growth depending on stable framework conditions in the use of coasts, seas and oceans

### Advocating the importance of seas and oceans and Blue Growth in Europe

JPI Oceans has a role in advocating the importance of the seas and oceans, their contribution to growth, jobs and the blue economy as well as wider societal benefits, the threats to the marine environment and their role in climate regulation. JPI Oceans actions in the areas of science/policy interfaces will contribute through the gathering of evidence and case studies, by feeding into policy developments and informing key stakeholders and decision makers.

### Mobilising Member States

The JPI Oceans Implementation Plan will be driven by member states. As JPI Oceans responds to important policy needs, it is considered a high priority by the current member countries to ensure

that all European sea bordering countries can engage with and benefit from the initiative and ensure that current members have a strong buy in. This will require JPI MB/EXCOM/Secretariat advocacy and the demonstration of impact. As JPI Oceans moves into implementation, regional and global partnerships will be reinforced.

## Partnerships in Horizon 2020

To further foster the development the European Research Area JPI Oceans could provide a possible test case for new European Commission instruments as part of JPI Oceans' pilot actions. The European Commission's Blue Growth unit has observer status in the JPI Oceans Management Board and the close and good relationships between the various services of the European Commission and JPI Oceans will be further consolidated during the JPI Oceans implementation phase. Actions in this Implementation Plan will be implemented in cooperation with the European Commission, where it fits the purpose.

## Developing a CSA to Support Activities

The Horizon 2020 work programme for 2015 includes a call (BG16) for a new JPI Oceans Concerted support action (CSA). The CSA is expected to support the implementation of the SRIA of JPI Oceans by ensuring further alignment and convergence of national Research and Innovation activities and investments on marine research in line with the European Commission Recommendation of 2011<sup>2</sup>.

## Working with other JPIs

The Joint Programming concept is being implemented 9 other areas to address specific societal challenges. JPI Oceans would benefit from working at a strategic level with the other JPIs, such as sharing best practice, and at the level of actions, where there is a clear overlapping interest. The ongoing Joint Programming Initiatives are:

- [Alzheimer and other Neurodegenerative Diseases](#) (JPND)
- [Agriculture, Food Security and Climate Change](#) (FACCE)
- [A Healthy Diet for a Healthy Life](#)
- [Cultural Heritage and Global Change: A New Challenge for Europe](#)
- [Urban Europe - Global Urban Challenges, Joint European Solutions](#)
- [Connecting Climate Knowledge for Europe](#) (CliK'EU)
- [More Years, Better Lives - The Potential and Challenges of Demographic Change](#)
- [Antimicrobial Resistance- The Microbial Challenge - An Emerging Threat to Human Health](#)
- [Water Challenges for a Changing World](#)

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<sup>2</sup> [Commission Recommendation of 16.09.2011 on the research joint programming initiative "Healthy and Productive Seas and Oceans" \(2011/C 276/01\)](#)

## Towards an IPlan

In December 2014, JPI Oceans adopted its Strategic Research and Innovation Agenda (SRIA)<sup>3</sup>. The SRIA outlines ten areas of strategic priority. They were identified by an extensive consultation conducted by CSA Oceans and advice from the Strategic Advisory Board (StAB) of JPI Oceans. The approach ensure alignment between the views of both stakeholders and Member States.

These strategic areas are:

1. Exploring the deep seas.
2. Technology and sensor development.
3. Science support to coastal and maritime planning and management.
4. Linking oceans, human health and wellbeing.
5. Interdisciplinary research for Good Environmental Status.
6. Observing, modelling and predicting oceans state and processes.
7. Climate change impact on physical and biological ocean processes – Oceans circulation.
8. Effects of ocean acidification and warming on marine ecosystems.
9. Food security and safety driving innovation in a changing world.
10. Use of marine biological resources through development and application of biotechnology.

In the consultation three cross-cutting areas reflecting JPI Oceans vision, were identified as critical:

- Science-Policy
- Human Capacity Building
- Infrastructures: Shared Use and Common Procurement Strategies

Cross-cutting initiatives should be embedded within the actions of JPI Oceans, to enhance their impact.

The SRIA was developed through an interlinked combination of approaches. Starting with the agreed vision it has been built on the intersection of national (and regional where relevant) research agendas, an accumulation of many stakeholder agendas and a determination to converge the top-down driven vision with a bottom-up process to harmonize, align and create synergies and added value in the European Research Area related to oceans and seas. In this context, the development of the SRIA was a collective, shared and forward-looking exercise identifying and prioritizing directions for cross-cutting research, development and innovation challenges for our seas and oceans. In the process the JPI Secretariat gathered a vast collection of baseline information which will serve as a *'knowledge bank'* for later assessment and evaluation of whether JPI Oceans has contributed to the European Research Area, and if the initiative has had an aligning and value added impact in the long-term.

Key questions addressed in the consultation focused on:

- what are the key challenges in a 20-30 years perspective;
- current strategies and research activity and how JPI Oceans can add value through better use of national investment and resources. Specifically in regard to R&D and innovation, including human capacities and infrastructures.
- gaps and needs in the marine and maritime field, including; RTD, innovation, infrastructures, technologies, human capacities and science to policy;

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<sup>3</sup> JPI Oceans. (2015). Strategic Research and Innovation Agenda



- how to create synergies across Europe and internationally by interfacing with others

The consultation process involved:

- An extensive mapping exercise and desk based research
- A series of workshops during the summer of 2013 involving over 60 European and international stakeholder groups, organizations, networks, platforms and projects.
- An online open consultation
- A request to Research Funding Agencies (2013-2014), via questionnaire, to inform on their strategies and research priorities to look for areas of possible alignment, to identify the key challenges and opportunities and to gather information on functioning and mapping of: national RTD and innovation systems, science to policy mechanisms. This questionnaire was sent to the 20 JPI Oceans member countries and one observer country. In addition, the questionnaire was sent to 6 other European and non-European countries with coastal areas (Croatia, Cyprus, Greece, Israel, Latvia and Slovenia).

The JPI Oceans Strategic Advisory Board members have been actively engaged in a series of meetings and workshops to develop the themes and provide advice to member countries on the priorities, urgency and feasibility of the actions. In particular joint meetings of the StAB and the Management Board were particularly helpful in formulating the thematic priority areas for action. A first draft of the SRIA, with input of the stakeholders and Research Funding Agencies, was presented to the Strategic Advisory Board at its meeting in Oslo in March 2014. In a next phase the outcome of the stakeholder consultation was presented and discussed at a dedicated workshop in Madrid in July 2014. After this meeting, the StAB agreed to have individual reviewers for each of the strategic areas. Throughout July, August and September 2014 these individuals worked in close collaboration with the CSA Oceans consortium to further finalise the document. A similar process was then conducted with the Implementation Plan which was presented and commented upon by the StAB on a joint meeting with the Management Board in October 2014. In order to provide the Management Board with the necessary advice, the StAB also recommended ten actions which could be considered as priorities for JPI Oceans (Annex I).

The SRIA was endorsed at the Management Board meeting in December 2014, expressing that it provides a comprehensive basis to develop this Implementation Plan. In addition, a short version will be developed for political and communications purposes.

The Implementation Plan gives options for actions within each of the ten priority areas. The StAB has proposed one new action in Oceans and Human health and provided advice on certain actions and this is presented in Annex I as advice to the Management Board.

## Structure of JPI Oceans Documents

The development of JPI Oceans can be charted by the key documents it has published. The structure below shows hierarchy of agreed strategic decisions taken by the Management in the development of the JPI Oceans.

<b>Vision Document</b> 3 Goals 10 Objectives	During the preliminary phase of JPI Oceans, a common Vision Document was developed outlining the long-term goals and objectives of JPI Oceans. In September 2011 the Management Board adopted the Vision Document together with an overview of gaps to feed the Strategic Research and Innovation Agenda; an overview of the policy drivers for JPI Oceans; and a document expressing how JPI Oceans perceives its links to other JPIs.
<b>SRIA</b> 10 Strategic Areas 3 Cross-Cutting Areas	<p>The SRIA is a high level document which sets out the ten strategic areas JPI Oceans will act in order to align and add value in the ERA landscape. It draws on a long version which was developed by CSA Oceans.</p> <p>The JPI Oceans Management Board adopted the SRIA in December 2014.</p>
<b>Implementation Plan</b> 43 Actions 12 Cross-Cutting Initiatives	This Implementation Plan provides a long-term menu of action for the Management Board in the 10 strategic areas of JPI Oceans. It presents 43 actions and 12 cross-cutting initiatives, with fit for purpose tools, which could be taken forward by JPI Oceans both now and in the future.
<b>Operational Plan 2015-2016</b>	The Operational Plan will present the actions and activities that JPI Oceans will carry out in the next two years. This is a living document and will include new actions and ongoing activities. It will facilitate monitoring, evaluation and ensure feedback mechanisms to ensure that JPI Oceans is a learning and adaptive initiative.

### JPI Oceans as a learning initiative – reviews, forward looking activities and evaluation

Reviewing the SRIA of JPI Oceans will take place through a forward looking process as agreed upon by JPI Oceans Management Board. This *forward looking* activity will need to identify new and critical developments in the fields related to marine and maritime research and innovation in Europe, and to assess the relevance of these developments for the priorities of JPI Oceans. The forward looking process will also include a review and validation of the JPI Oceans goals and objectives and of the strategic priorities of the Strategic Research and Innovation Agenda. Forward looking processes can also relate to specific topics such as emerging issues, as undertaken in the JPI Oceans pilot action on microplastics.

When designing a targeted forward looking process, the JPI Oceans with its particularities<sup>4</sup> needs to be taken into account; hence a tailor-made two-pronged forward looking process could be a possible solution<sup>5</sup>.

The review and forward looking activities support the broader aim of JPI Oceans of being a learning process with continuous evolution. This will take place through monitoring and evaluation of the initiative, the actions and the partnership as such through a dedicated information system to secure the ability to conduct such *self-assessments*. As measurable objectives will be introduced from the design phase this will form an important basis to feed this process. The knowledge being obtained through these processes will be fed into the decision making process in which the Management Board is the key body. Hence, the strategy is to develop JPI Oceans *into a dynamic and learning initiative*, at the level of the actions being implemented.

Finally, *evaluations* will be needed at the level of JPI Oceans as a programme to assess if the initiative has a long-term alignment effect on strategy and policy level at the request of the Management Board and the Council through the mandate of GPC-ERAC.

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<sup>4</sup> [Deliverable 7.1 Foresight for JPI Oceans](#)

<sup>5</sup> D7.2 " A programmatic Foresight Process for JPI Oceans"

# Implementation Approach

## Development and Selection of Actions

The actions to be initiated in 2015 will be published in the first Operational Plan of JPI Oceans. The procedures for proposing new actions and modifying existing ones are outlined below.

By their nature, the Strategic Areas differ in scale and scope. As a result, the content of some of the Strategic Areas is greater than others which reflect the current knowledge and scale of the area as well as the scale of ambition.

During the Management Board meeting in December 2014, the members were asked to indicate their preliminary interest in the strategic areas. The Management Board expressed clear support for the strategic areas. The Strategic Advisory Board has advised the Management Board in particular in this early phase to focus on areas and actions of alignment which have a pan-European dimension, expressed through the number of countries signing up to it. Furthermore they have given advice on the relevance of actions seen from a strategic perspective (Annex 1).

The CSA Oceans project also identified existing “Key Players” in the Strategic Areas of JPI Oceans. This is a starting point and these are presented below, but it is important to note that this is not an exclusive list and should actively be expanded to include newly identified “Key Players” as the landscape of players evolves. Furthermore as the number of relevant initiatives and projects is considerable a selection had to be made; hence it is only a snapshot taken from the perspectives of initiatives and projects at that specific moment in time.

## Procedure for Launching an Action

JPI Oceans seeks to make use of a broad range of tools and pick those best fit for the purpose to implement its actions taking into account the feasibility, the impact and the time frames. These include national research funding, institutional investments, human resources, capacity building, existing infrastructure, structural funds, modelling, networking, and research alliances and combinations thereof. Countries may choose to fund new research or to participate through funding the coordination costs, use of infrastructure or creating open access to data or other forms of contributions considered useful in the joint action.

To initiate an action, one member country must take the lead and be supported by at least three others<sup>6</sup>. When a country decides to lead an action, it should first draft a plan outlining the aims and objectives of the action and tangible steps needed to achieve them. The plan must identify and propose how and when to bring together identified stakeholders in accordance with procedures adopted by the Management Board, stating that the user and producer shall be brought in from the design phase. The plan must also include views on potential coordination, fit for purpose tools, and propose criteria for success. The latter reflects the Council Conclusions that the evaluation criteria should already be embedded in the design of an action<sup>7</sup>. This plan will serve as basis for discussion and further development with the other Member countries. The lead country is encouraged to work closely with the Secretariat, which may be able to provide more detailed information from the CSA

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<sup>6</sup> [Terms of Reference for the Management Structure of the Joint Programming Initiative on Healthy and Productive Seas and Oceans](#)

<sup>7</sup> [Council conclusions concerning joint programming of research in Europe in response to major societal challenges](#)

Oceans' deliverables. To assist the lead country, CSA Oceans has developed a guidance document for developing an action<sup>8</sup>.

## Types of Measures

The measures foreseen within JPI Oceans can be divided into three categories:

- JPI Oceans Policy Measures
- JPI Oceans Structuring Actions
- Pilot Actions

### *JPI Oceans Policy Measures*

Policy measures are aimed at facilitating alignment and coordination at the strategic level of member states to further develop the European Research Area. These are the strategic processes of engagement, horizon scanning and information exchange between Member States and stakeholders that identify shared priorities. They may also establish the political preconditions and policy changes that lay the necessary foundations to initiate and implement Structuring Actions or pilot actions. They may also constitute independent actions for coordination and alignment at an intergovernmental level.

**Example Instruments:** Establishing joint priorities, setting up mutually agreed strategy processes

#### **Example Evaluation:**

- Does the action address necessary coordination mechanisms between partner countries?
- Does the action address coordination mechanisms between ministries, agencies and other institutions nationally?
- Does the action deploy effective governance and management structures and processes?

### *JPI Oceans Structuring Actions*

Structuring Actions are the specific activities to achieve the objectives of JPI Oceans. Structuring actions will also address emerging research areas by bringing the users and producers of knowledge together, address gaps and fragmentation, and provide dedicated initiatives to create an appropriate research and innovation landscape in Europe.

**Example Instruments:** Design and management of joint calls, joint public procurement, research alliances, knowledge hubs, networks of excellence, training, mobility, sharing infrastructure, access to data, feasibility studies, forward looking activities, emergency response, emerging issues.

#### **Example Evaluation:**

- The structuring actions will be evaluated depending on type actions, such as:
  - Research and innovation
  - Connectivity
  - Capacity building
  - Supporting actions
- They will be monitored and evaluated according to their specific objectives;

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<sup>8</sup> [CSA Oceans 2014 Proposal for procedures for design and management of joint actions](#)

- The monitoring and evaluation will be based on data bases, indicators and information collection that will be set up to support the various actions;
- The monitoring and evaluation will centre on the key categories of input, processes, outputs, outcomes and impacts.

### *JPI Oceans Pilot Actions*

Pilot actions provide a method to test experimental approaches on a smaller scale before full implementation. They have emerged as a way for JPI Oceans to launch activities early and to demonstrate the benefits of joint actions within the JPI framework.

Each of the pilot actions is developed with specific purposes or objectives in mind, and they will be carefully assessed according to these specific objectives. As each pilot action has its own objectives, evaluation criteria and indicators need to be developed accordingly.

The selection and launch of pilot actions will need to satisfy a number of criteria that have been set up for this specific purpose.

#### **Ongoing Pilot Actions:**

Each selected pilot actions may include one or more specific tools or instruments. Four pilot actions are currently underway to test specific aspects of the JPI Oceans process:

- **Ecological aspects of micro-plastics**
  - Aim: Testing the harmonisation of research methodologies and protocols for an emerging field and conducting a first joint call under the JPI Oceans framework.
- **Multi-use of infrastructure in the North Sea**
  - Aim: Testing the process of designing a cross-border integrated monitoring strategy, efficiencies in data gathering by covering two policies, competencies in different ministries.
- **WFD inter-calibration for coastal and transitional waters**
  - Aim: Testing a mechanism for joint funding from environmental authorities of nine member countries, surpassing the traditional models of joint calls, resulting in harmonisation and strengthening the scientific basis for cooperation.
- **Ecological aspects of deep-sea mining**
  - Aim: Joint use of research infrastructures and integrating national research activities in order to ultimately develop common European and international environmental standards.

These and other pilot actions will be used to shape subsequent measures and actions with a view to ensure implementation with highest possible impact.

#### *Relevance & impact*

- The pilot action explores and utilises synergies and complementarities between countries and/or capacities and/or scientific fields and/or science-industry-society to reach a common goal.
- The pilot action avoids unnecessary duplication of efforts by enhancing cooperation and/or coordination.
- The pilot action can potentially produces tangible outcomes within a time frame of 1-3 years.

#### *Added value for JPI Oceans*

- The pilot action tests new modes of operation to test tools and measures that can be put in use with higher efficiency than joint calls

- The pilot action tests modes of collaboration among countries for aligning national research programs, thereby contributing to an operational model for joint programming.
- The pilot action strengthens structures or processes that facilitate future collaboration of partners in JPI Oceans.

## Evaluating Active Actions

The long term and ambitious nature of JPI Oceans means that it is essential to conduct ongoing monitoring and evaluations of its actions to ensure they are being effectively implemented and producing the expected outcomes and impacts as well as to make beneficial adjustments. The CSA Oceans project has produced recommendations and guidelines to evaluating different kinds of actions<sup>9</sup>. While these reflect the state of affairs of JPI Oceans at this early stage, they will also be further developed and refined along with the progress of the JPI. For the evaluation approach embedded in the implementation plan, evaluation procedures at the level of actions will require a tailor made approach.

## Review of the Implementation Plan

The actions of JPI Oceans aim to deliver results which benefit the environment and society, both of which are constantly changing. To achieve these results, it is important to reflect on past actions and benefit from the experiences gained. The SRIA is a long term vision of where JPI Oceans seeks to add value, the Implementation Plan provides the flexibility to review existing actions and propose new ones. To achieve this, the Implementation Plan will be reviewed by the Management Board every second year. In addition, Management Board members, may at any time, request a review of the Implementation Plan in response to emerging issues.

## JPI Oceans Operational Plan

JPI Oceans will publish an Operational Plan in early 2015. It will present the actions which will be taken forward in the next two years and outline any ongoing activities. It will be based on the Implementation Plan but with a more specific and detailed agenda and it will identify specific partnerships which could be initiated. The Secretariat will facilitate this process and provide information from the consultation with stakeholders and Member States. If the Management Board agrees, the Operational Plan will be a living document to be updated and tabled at every Management Board meeting to review the progress of ongoing actions and to agree on new actions to be taken forward.

## Implementing strategic priorities and actions

This Implementation Plan consists of a portfolio of actions to be implemented under 10 strategic priorities as well as cross-cutting actions foreseen to support the overall implementation activities. This portfolio should be seen as a menu from which the above mentioned Operational Plan will be developed. The actions in the Implementation Plan are presented without any reference to the categories above, dividing JPI Oceans' actions into Structuring Actions, Pilot Actions and Policy Measures. However, the actions in the subsequent section are typically structuring and pilot actions making up the Implementation Plan, while Policy Measures refer to additional initiatives to be taken by the partnership to create and ensure effective framework conditions for the JPI. These are not always predefined, but likely to be identified through the implementation process. Hence, measures

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<sup>9</sup> JPI Oceans: Recommendations for selecting, evaluating and monitoring joint actions. Deliverable 2,6, CSA project, Brussels 2014.

on the partnership level to ensure alignment and coordination are deemed key to the JPI Oceans' success, but are not included in the Implementation Plan as such, they will however be captured in the operational plan.

## Long Term Platform for Information and Data Management

JPI Oceans will need to implement a long term data and information management system. This will create a legacy for the outcomes of each action and promote several principles of JPI Oceans including open access to data, long-term usability and innovative use of data for interdisciplinary studies.

There are multiple layers of users within JPI Oceans of information and data. Each user group has its own requirements which need to be considered. It is important that any management information system developed is as user friendly and intuitive as possible. It is also important to consider that the users engage with JPI Oceans through a multitude of systems using different hardware and software. These user groups are:

1. Internal Communications
  - This level needs to cover communications between the Management Board, Strategic Advisory Board and the Secretariat. The management information system needs to allow these users to share documents, plan joint meetings through calendars and effectively manage the actions of JPI Oceans.
2. Partners of JPI Oceans Joint Actions
  - The needs of this user group are similar to that of the Internal Communications, sharing documents and calendars. As actions progress, this group may also wish to share more complex data and this should also be considered. It is expected that this group of users will be formed of a number of individual project groups working on specific actions. This level will eventually feed into the group below as the actions generate outputs.
3. JPI Oceans Portal
  - This is the outward facing aspect of JPI Oceans. It is a tool for anyone to gain information on JPI Oceans, results of actions and data produced by the actions. It may be useful to work in partnership with existing open data initiatives and marine information portals.



## Potential Actions

### 1 Exploring the Deep-Sea

It is becoming more feasible to exploit deep-sea resources as a result of technological developments and economic conditions. They are identified as one of the five areas of high potential by the European Commission's Blue Growth strategy. However, deep-sea ecosystems are some of the most fragile and little understood on Earth. Actions in this area are by their very nature large and potentially expensive, it will be necessary to develop strong partnerships between different organisations in both the public and private sectors.

**JPI Oceans added value:** JPI Oceans could provide coordinated input and advice to relevant governance bodies, such as the International Seabed Authority. It could also assess the need to implement international legal requirements into the national laws of active member countries.

A large, coordinated effort is needed to undertake a high-resolution, multi-beam survey of the bathymetry and habitat distribution. A "Geological Survey of the Deep-Sea" would stimulate blue growth through sustainable exploitation of deep-sea minerals while ensuring the protection of sensitive ecosystems. This requires enhanced understanding of deep sea ecosystems, seabed and habitat mapping as well as observation infrastructures.

JPI Oceans could provide a forum to ensure that useful data is assembled, analysed and made publicly available.

**Key Players:** Black Sea Commission, CIESM, ECORD, EMODNET, EuroGeoSurveys, EuroMarine, European Marine Board, GOOS-DOOS, ICES, IOC-UNESCO, IODP, ISA, MAP-UNEP, national institutes, OneGeology, OSPAR, GEBCO program, IBPES,

#### Action 1.1: Map the Seabed and habitats in the deep ocean

**Objective:** Create a reference map of the deep-sea through international collaboration; designed for scientists, policymakers, industry, and society.

**Description:** The focus of the scientific community and industrial efforts on the deep-sea seabed is fragmented, as it is mostly confined to either specific areas of scientific interest, areas under licence for resource exploitation, or in areas related to claims of extended continental shelves.

JPI Oceans has the potential to undertake or become a partner in global initiatives to promote coherent partnerships between researcher consortia, industry and relevant public bodies. A multi-disciplinary action, on the scale of the Census of Marine Life or General Bathymetric Chart of the Oceans project, is needed on deep-sea resources. The aim would be to create a new, publically available, reference map of the world's oceans for scientists and industry.

If taken forward, the initiative should also consider if there are cost-benefits to be gained by combining seabed geosurvey and habitat mapping. This could for instance lead to the establishment of a European Atlantic Seabed Mapping Programme. The habitat mapping should be fine scaled to identify and locate habitats and improve our knowledge of deep-sea ecosystems. The mapping investments must be designed in a way which allows the outputs to be used to support evidence-based governance of deep sea resources hence facilitating considerations on the vulnerability and uniqueness of the habitats to governance bodies like the International Seabed Authority.

Furthermore special attention should be drawn to potential areas for harvesting and deep-sea mining.

**Proposed Tool:**

- Mapping is resource intensive and synergies can be created by a massive coordinated international effort as it requires a fleet of ships and autonomous vehicles. JPI Oceans could take initiative to lead or participate in a geological survey of the oceans (seabed and habitat mapping) on the global scale in cooperation with relevant international partners, scientific consortia and regulatory bodies.
- The first step should be to establish the framework; combining mapping of geology, resources and biodiversity, defining a geographic scope, identifying integrated study sites to focus relevant data collection as well as relevant infrastructures and their limitations.

### Action 1.2: Research on the environmental impacts of deep sea mining

**Objective:** Conduct interdisciplinary research into the impacts of deep sea mining on ecosystems. Produce advice for policy makers and the engineering community on the impacts of deep sea exploration (including oil, gas, methane hydrates, and minerals) as input to regulations for management options and more sustainable technological solutions.

**Description:** The environmental impacts of deep sea mining, including oil, gas and methane hydrates, are not well understood. To make informed decisions, policy makers must have up to date scientific information which takes into account the physical and biological nature of deep sea ecosystems.

Knowledge about the links between deep sea ecosystems and their significance for management is limited by the spatial and temporal nature of such systems; this makes the assessment of environmental impacts of deep sea mining and other deep sea activities (e.g. oil and gas exploitation) difficult. Research is needed to strengthen the basic knowledge about functioning of deep sea ecosystems and the process of connectivity in deep sea marine systems: i) habitats and their functional role in key areas, ii) mechanisms of transport and dissemination of larvae or of adult migration, including a better knowledge on deep sea currents, iii) the functioning of trophic networks and connectivity between different habitats population.

**Proposed Tool:**

- Build on outcome of the JPI Oceans pilot action on deep sea mining, strengthen research through joint calls, which also address the use of models and combine with foresight studies.
- Take into account the European Marine Boards working group (WG Deep-Sea) study on deep seas. This is due to report in autumn 2015 and the work is being undertaken under the auspices of GOOS-DOOS (GOOS deep ocean observing system).
- Inter-ministerial exchange (Economy - Environment - Research/Innovation) and discussion on future scope and envisaged intensity of deep-sea mining. Cooperation with and involvement of industry, technology and engineering community is needed at the appropriate stage. Any research investments need to provide recommendations on exploitation feasibility and criteria to relevant governance bodies.

## 2 Technology, Platforms and Sensor Development

Marine and maritime industries face a number of common challenges. Public-private partnerships across these sectors can promote blue growth, create employment and strengthen competitiveness by deliver breakthroughs on a range of enabling technologies including structures, platforms, new materials, sensors, and marine bionics.

By cooperating with partners across industry and science, JPI Oceans will furthermore help create the conditions required foster cutting edge design and innovative production methods as well as more efficient ocean observation systems.

### **JPI Oceans added value:**

JPI Oceans being long-term and cross-cutting in nature, offers an opportunity to develop cross-sectorial technological solution needed to overcome sectorial fragmentation needed to advance into seas and oceans. Any actions taken should be designed to secure strong cross-sectoral industry involvement and drive to ensure relevance and create critical mass.

The next generation of maritime technology will need to operate effectively in extreme environments. The advent of more autonomous systems requires more advanced e-infrastructures, cabled concepts for interfacing and land-based control systems. JPI Oceans can add value by engaging marine and maritime researchers together with engineers to test and validate technologies, develop standards, protocols as well as measures and rules for safety and environment (HSE). This will also contribute to more stable framework conditions for industry as scientific input will be embedded in the eco-designs and feed input to the policy frameworks.

The actions in this strategic area are designed to be undertaken in the order they are presented in. The first action will establish an Oceans Technology and Engineering Community (OTEC) which will be essential in coordinating and aligning the other actions. This hub will also be used as the basis for launching specific public-private partnerships. Actions 2 through 5 are related to specific marine and maritime technologies.

**Key Players:** EATIP, EFTP, ERA-MarineBiotech, EUROGOOS , EuroMarine, European Marine Board, Industry Associations, MARTEC, national institutes, OCEANERA-NET, SeaEurope, Waterborne

### **Action 2.1: Create a self-sustaining Oceans Technology and Engineering Community (OTEC)**

**Objective:** Foster a hub for marine and maritime engineering and research and blue industries from which joint actions and public-private partnerships in specific research areas can be launched. Maximise the effect of research investments and overcome fragmentation across industry sectors.

**Description:** The action will facilitate a broad partnership which is fundamental to obtain the critical mass needed to make advances into the oceans and to boost innovation and growth in maritime sectors and clusters. It will create the necessary framework needed to develop joint actions for specific technologies which are presented below. The approach of JPI Oceans can provide strong potential for impacts by leveraging industry and SME participation; hence creating critical mass and strengthening long-term EU competitiveness, blue growth and jobs.

This will be achieved by:

- Multiplying the resources by improving leverage and synergies with national programmes and focusing on areas which cannot effectively be addressed at national level;
- Mobilising resources to build scale and critical mass, attracting both senior marine and maritime researchers and developing PhD programs on fundamental areas by ensuring that this is embedded in actions taken as well as addressing and anticipating key trends;

This action requires a long term commitment to develop an oceans technology and engineering community through a systematic two-step approach. The first step will create alignment between the Member Countries of JPI Oceans and the second step will see the launch of specific public private partnerships to support the joint actions 2.2, 2.3, 2.4 and 2.5.

To address the fragmentation across Europe, JPI Oceans would first need to establish a viable community which could be used to launch joint actions. In the first instances, JPI Oceans could implement a broad horizon scanning exercise for a wide range of maritime activities, and develop a long-term research agenda, along the following major lines:

- Reducing the impact of maritime activities with the overall goal to move toward near-zero emissions of human activities at sea.
- (Bio)systems for vehicles and infrastructures chemical/physical emissions e.g. air/water pollutant, noise and vibration, etc.
- Infrastructures for economic and environmental sustainable extraction of renewable energy from sea. The action should also consider production, storage, conversion, transport and dispatch of energy deep sea.
- Sensor development, particularly biogeochemical sensors and intelligent sensor systems to measure emissions and technical advances to develop observing systems for biological processes as well as automated sensors for detection of harmful organisms and their toxins and physico-chemical parameter (T, pH,O<sub>2</sub>)
- Innovative, robust and reliable energy supply for autonomous marine technologies.
- Studies on the environmental effects of new fuels (biofuels, LNG, gas hydrates, etc.) and reducing the impacts of maritime activity.
- Monitoring systems of the environmental impact of waterborne commercial activities and developing integrated support systems to optimization and spatial planning management
- Safety, including classification rules and health, and environment standard requirements must be embedded in the innovation design such as the need for de-commissioning, recycling and re-use of structures. Sustainable marine vehicles and infrastructures at sea;
- Development of new concepts of Multi-Purpose Off-shore Platforms (MPOP).

JPI Oceans Public-private partnerships could be developed by a three pronged strategy:

- **Knowledge driven research:** PhD programs, research grants (split into early career and senior researchers and engineers), large projects with impact.
- **Research infrastructures:** Consolidate, improve, open access to large research infrastructures for marine and maritime science and technology.
- **Application driven research:** challenge prizes.

JPI Oceans Public-private partnerships should be built upon the active participation of relevant industries, institutes, universities and centres of excellence from within OTEC and should encourage strategic contributions from national ministries and top up contribution from the European

Commission . The initiatives should be concentrated around cross-sectorial technology areas identified within the actions below to be selected by industry and supported by science to ensure a concrete cooperation toward greener solutions and to reflect EUs growth strategy. Thus it should be considered a tool for the implementation of the Blue Growth Initiative in Europe.

A key task will be to develop and implement effective joint activities and instruments such as coordinated research and innovation initiatives. The initiative will require support across various ministries at national levels and cross-national public procurement for innovation to secure a concerted effort.

The key elements of the public-private partnership management are: (i) strong cross-sectorial industry representation; (ii) forward looking activities to align national agendas and to create new ideas for radical advances; (iii) funding made available nationally in the planning phase and topped up for cooperation in the long run; (iv) PPP should be largely self-sustained through participation to competitive calls for basic research and industrial engagements.

#### **Proposed Tools:**

To establish an OTEC, JPI Oceans should seek to align the approaches at a national level. This can then be built on at a European level to create a common hub for launching public-private partnerships to support the actions presented below.

- 1) Member Countries should identify potential clusters for research and technology. In cases where they do not exist, Member Countries could consider measures to stimulate their creation. As a second step Member Countries should consider long-term funding to create centres of excellence. To facilitate pan-European cooperation, Member Countries should agree on a national focal point through a call for expression of interest.
- 2) JPI Oceans could function as a hub for meetings between the relevant focal points. Technology platforms (e.g. WATERBORNE) could prove a useful first step for connecting to the relevant sectors and industries, bringing in the European dimension.
- 3) When building projects and collaborative activities, focal points should bring in relevant industry, businesses, and public authorities from the national level.
- 4) Build a collaborative area of public and private research to reach a critical mass, and where specific competences and infrastructures are shared to reach effective solutions and to facilitate shared use of infrastructures across Europe.
- 5) Member states should provide top-up funding to facilitate the cooperation and cater for capacity building. Where there is a gap in human capacities, JPI Oceans should integrate University Platforms to align educational programmes within the action.
- 6) Develop Public-Private Partnerships to address the specific research needs of actions 2.2,2.3,2.4 and 2.5.

### **Action 2.2: Technologies for maritime operations and platforms on the surface and in the deep sea**

**Objective:** Further develop maritime technologies to operate in remote and deep, harsh and cold environments.

**Description:** New structures and platforms at sea, such as stationary or floating platforms and peripheral structures, as well as platform development for new areas or seasonal redeployment, require enhanced knowledge and engineering. Issues remain to be solved such as:

- Marine Control Systems:
  - Stabilisation systems,
  - Docking,
  - Dynamic positioning,
- Mooring Technology
- Remote Operations:
  - Data transmission, E-infrastructure and telemetry for data transfer.
  - Remote control platforms and systems, including land based control.
- Safe and energy efficient handling of goods, storage and transfer operations of raw materials, goods and passengers to and from platforms and ships to land.
- Task specific vessel and platform design.
- Advances can be made in data simulation of potential accidents and spills and the environmental impacts.
- Deep-sea operations will require new ways of installing devices and equipment and a subsea value chain, management and monitoring of operations.
  - Subsea industrial activities need innovative riser systems for future harvesting of deep-sea resources.

Due to the expensive nature of structures, infrastructures, simulators and the need to couple activities with the new generation of scientists and engineers actions taken in this area requires a long term approach. The initiative should be worked out in very close cooperation with industry to ensure relevance, and bringing in technological and engineering institutes, universities and centres of excellence in Europe

**Proposed Tool:**

- Calls and/or top-up funding to be provided from within each of the participating countries to facilitate the cooperation and support capacity building.
- To take this action forward, JPI Oceans should organise workshops to develop hubs within the areas above. For each of these research areas the following steps will be taken.
  - Call for an expression of interest from countries.
  - Establish a hub to host expert (from research and industry) workshops to develop a roadmap to advice on actions to be taken.

**Action 2.3: Materials and nano-technology**

**Objective:** Develop new innovative, functional, intelligent and resilient traditional materials such as advance steel grade and aluminum. Develop solutions to avoid biofouling and corrosion being impediments to marine and maritime operations and observations. High temperature systems and corrosive fluids in the deep sea resource reservoirs will require new materials and active heating solutions. Furthermore as industries advance into deeper, harsher and more vulnerable seas there is a need for materials to cope with these environment as well as issues such as corrosion.

**Description:** Research and development is needed for new, reliable and functional materials, to ensure environmentally friendly, economical and safer solutions for the oceans industries and marine activities. Specific advances in materials to tackle the harsh conditions in the Arctic and the pressures and temperatures in deep seas need to be made as industry moves into these areas. Due to the vulnerability in the use of new materials in the marine environment research shall aim to understand the long term behaviour and degradation of materials under realistic maritime

environmental conditions to better correlate calculations and simulation techniques for design with accelerated lab tests and real life performance. This development shall be accompanied by life cycle cost and environmental impact assessment of novel materials.

Due to the expensive nature of structures, infrastructures, simulators and the need to couple activities with the new generation of scientists and engineers actions taken in this area requires a long term approach. The initiative should be worked out in very close cooperation with industry to ensure relevance, and bringing in technological and engineering institutes, universities and centres of excellence in Europe.

**Proposed Tool:**

- Calls and/or top-up funding to be provided from within each of the participating countries to facilitate the cooperation and support capacity building.

To take this action forward, JPI Oceans should organise workshops to develop a hub. To achieve this, the following steps will be taken:

- Call for an expression of interest from countries.
- Establish a hub to host expert (from research and industry) workshops to develop a roadmap to advice on actions to be taken.

## Action 2.4: Cross-cutting nature inspired design

**Objective:** Develop new materials, structures and functional principles by learning from and "tested" by nature.

**Description:** The knowledge of marine ecosystems and species recently increased significantly, but due to economic realities and a lack of knowledge exchange between marine sciences and maritime technologies, biomimicry strategies and solutions need to be advanced. Biomimicry and bionics embrace the idea of learning from nature and adapting designs from nature to solve modern problems. Only a limited number of projects have looked into this area of science and technology. Long-term testing, advanced design methods and methods for efficient production of bionic solutions at a technical scale are largely missing.

The aim of this interdisciplinary research is to systematically investigate the potentials of mimicking natural marine systems. Learning from nature as well as the latest developments in material sciences and production technologies shall pave the way for a more efficient and sustainable adaptation of natural solutions in technical products. The development should be accompanied by an analysis of the economic potential and the expected impact of biomimicry solutions; not only for a specific technical problem, but also on marine eco-systems at larger scale and over the entire life cycle of the technical solutions. Due to the expensive nature of structures, infrastructures, simulators and the need to couple activities with the new generation of scientists and engineers actions taken in this area requires a long term approach. The initiative should be worked out in very close cooperation with industry to ensure relevance, and bringing in technological and engineering institutes, universities and centres of excellence in Europe.

**Proposed Tool:**

- Calls and/or top-up funding to be provided from within each of the participating countries to facilitate the cooperation and support capacity building

To take this action forward, JPI Oceans should organise workshops to develop a hub. To achieve this, the following steps will be taken:

- Call for an expression of interest from countries.
- Establish a hub to host expert (from research and industry) workshops to develop a roadmap to advice on actions to be taken.

### Action 2.5: Improving performance of fixed and mobile platforms

**Objective:** Improve the performance of platforms and data transmission for monitoring, observations, and basic science.

**Description:** There is a need to improve the performance of fixed and mobile platforms in order to strengthen their capabilities of providing long-term series of data, real-time data transmission and exploring deeper or remote areas.

This action should work towards improving underwater and other vehicles/platforms capacities for monitoring, surveying and sampling. This includes:

- Power systems for increased autonomy.
- Biosensors capable of performing analytical tests and producing results within minutes rather than hours or days at affordable prices.
- A new generation of miniaturised sensors.
- Further R&D is required to improve underwater communications to implement in a more efficient and sustainable manner the interventions described above.
- Development of new platforms to monitor several parameters simultaneously, such as condition monitoring of offshore structures or environmental conditions.

In order to increase safety, it is important to improve accurate navigation by improving underwater communication and developing more accurate models of underwater vehicles. This will also save costs.

Due to the expensive nature of structures, infrastructures, simulators and the need to couple activities with the new generation of scientists and engineers actions taken in this area requires a long term approach. The initiative should be worked out in very close cooperation with industry to ensure relevance, and bringing in technological and engineering institutes, universities and centres of excellence in Europe.

#### **Proposed Tool:**

- Calls and/or top-up funding to be provided from within each of the participating countries to facilitate the cooperation and support capacity building.
- To take this action forward, JPI Oceans should organise workshops to develop hubs within the following areas: Models, Sensors, Underwater Communications and Energy. For each of these research areas the following steps will be taken.
  - Call for an expression of interest from countries.
  - Establish a hub to host expert (from research and industry) workshops to develop a roadmap to advice on actions to be taken.



### 3 Coastal and maritime planning and management to advance sustainable blue growth

Industries are increasingly competing for maritime space, hence good planning and management is fundamental to enhance sustainable growth in the maritime sectors. It is a prerequisite in promoting investments, growth and jobs and legal certainty, predictability and transparency will reduce costs for investors and operators and reduce conflicts between sectors both spatial and temporal. Planning and management at the same time must assure an optimal combination of growth and sustainability. European coastal areas are under increasing pressures from pollution, climate change and intensive used by humans. Rapidly increasing demand for maritime space will only add to existing pressures. Agreed standards for assessment of activities are essential for effective management and planning. Stability is essential to achieve sustainable blue growth.

The actions in this area follow a logical order of progression. They have the potential deliver high impact at low cost. The first step will be to create a forum for practitioners of coastal observation and establish a mechanism to provide policy-relevant knowledge. The next phase will be to develop a common strategy which identifies priorities across Europe. Finally, develop management options for policymakers to adapt to climate change and minimize human impacts.

#### **JPI Oceans added value:**

JPI Oceans can add value by developing a coherent and integrated strategy for the exchange of knowledge on coastal zone management. It can provide a platform to implement marine spatial planning thereby supporting blue growth and job creation.

JPI Oceans could facilitate the development of new frameworks for management which combine ecosystem and resource utilisation models. This would allow different planning options to be holistically assessed, both in space and time.

JPI Oceans could align multidisciplinary research efforts which aim to provide climate change adaptation strategies, sustainable management of human activities, and reducing impacts. It should focus on cross-border areas where cooperation between countries is needed to ensure effective governance.

The actions taken need to involve relevant local management authorities to ensure that knowledge and best practice is shared and used to design action plans. They should also foster cooperation within the scientific community to align scientific efforts and investments. Finally industry sectors must be involved to ensure that their needs are catered for as users of space.

**Key Players:** Black Sea Commission, BONUS, CIESM, COFASP, EFARO, EUROGOOS, EuroMarine, HELCOM, ICES, IPBES, JRC, MAP-UNEP IOC-UNESCO, Marine Board, OSPAR, EMODnet

#### **Action 3.1: Build an efficient interdisciplinary scientific community for policy-relevant knowledge**

**Objective:** Establish a long term network of relevant institutions, coastal laboratories and universities involved in ICZM and MSP. Share knowledge, develop best practices, deliver standard tools and methods, to facilitate management and planning, coordinate activities and provide advice to policy makers and managers.

**Description:** Understanding coastal and marine ecosystems goods and services and their environmental, economic and social value is essential in moving towards an ecosystems-based

approach and develop a sustainable maritime economy. It requires a qualitatively and quantitatively knowledge of the marine and coastal ecological processes in the context of global change. With this aim, it is necessary to develop methods of economic and social valuation of biodiversity and coastal areas to provide tools for proper preservation and protection measures.

Developing a trans-national network of scientific institutions responsible for providing advice to policy-needs, related to spatial planning (MSP, CFP, MSFD), could be a first step towards a common and coherent approach. Such a network would support data sharing initiatives, avoid duplication and fill knowledge gaps to create a better understanding of coastal and shelf areas. They could address the important question of how to measure cumulative pressures and impacts.

The first step would be to compile the available information for the targeted area. The management of this data will require a harmonised pan-European effort to support science for management and planning, building on existing initiatives like EMODnet. An integrated European monitoring strategy would ensure a more coherent approach to the current and future needs. A truly holistic approach requires biological, chemical and physical models, high resolution bathymetry, and indicators to assess the combined effect of human activities and climate change on the marine system.

The outcome of this action would be to produce standard tools for management and planning. This would make use of databases and information portals to share practice. Tools should be developed to give policy makers the ability to manage the marine environment in an integrated and sustainable way. Cooperation should include the planning and coordination of surveys to avoid duplication, including calibration of monitoring protocols.

**Proposed Tool:** Implementation tools will be used in the following order of steps

- Step 1: Interested Member Countries will propose experts to take part in a JPI Oceans working group to identify the current barriers of creating interdisciplinary scientific advice marine spatial planning.
- Step 2: The working group will develop a roadmap for where JPI Oceans can add value. This will be done in collaboration with relevant stakeholders using tools such as workshops and stakeholder events.

### Action 3.2: Develop and implement an integrated monitoring strategy for coastal observation

**Objective:** Pave the way towards an integrated, long-term platform for European coastal monitoring, identify data gaps, propose actions to cover the gaps and also look at the coordination necessary at national and EU level to optimise monitoring of coastal areas.

**Description:** A common strategy for sustained long-term monitoring of human impacts and climate change in coastal areas is needed to support sustainable blue growth and respond to MSP and Integrated Coastal Zone Management. The strategy will clearly define specific questions needed to be addressed and state what information and data is necessary. A monitoring network in key geographical sites will need to address gaps in spatial and temporal data needed to capture highly dynamic pressures and impacts on ecosystems

The strategy should establish long-term monitoring plans and measures to assess the impact of management. It will be necessary to develop improved and innovative observation and data sharing management systems, tools and methodologies for marine information needs and monitoring of the

coastal environment and offshore areas<sup>10</sup>. The focus will be on delivering end-to-end solutions, building on what is already in place in terms of data acquisition systems, data management systems and systems for delivery of services.

The strategy should integrate different tools such as communication platforms (between different sectors, science, citizens and policy makers and how to involve these) to analyse conflicts and synergies between various activities in coastal zones.

Expert Groups on coastal monitoring could be set up at European level by JPI Oceans (as part of the EOOS strategy). The strategy will allow continuous updating of a repository of cross-sectorial information and EU-wide database for MSP and ICZM (see action 1). In addition it will have to be developed in close coordination with the proposed action 6 under 4.6 in order to ensure dual use of infrastructure servicing both policy needs for monitoring (focus of this action) and infrastructure needs for science being the purpose of the action under strategic area 4.6.

**Proposed Tool:** Implementation tools will be used in the following order of steps

- Step 1: Member Countries interested in this action will put in place a national process to identify a limited number of relevant national experts, who are involved in coastal monitoring and national institutions with infrastructures for coastal monitoring.
- Step 2: these candidates will form a pan-European group. Their task will be to propose solutions and a plan for easy access to marine and maritime research infrastructure (to update the infrastructure database developed in CSA Oceans) and relevant platforms and networks in coastal and offshore areas.
- Step 3: They will furthermore identify infrastructure gaps such as the need for tailor made sensors addressed in strategic area 2.

### Action 3.3: Enhance research on the land-sea interface by increasing the role of integrated models

**Objective:** Develop knowledge and modelling tools specifically focused on the region between land and sea; enabling policy makers to make coordinated decisions. It will aim at developing options to adapt to climate change and manage sustainably human activities and minimise their impacts.

**Description:** JPI Oceans could launch a transnational and multidisciplinary initiative to align investments and develop knowledge and tools for the implementation of MSP and ICZM. It will integrate both MSP and ICZM approaches at the interface between land and sea. One area already identified is the interface between the coastal zone and estuaries and intertidal regions. This action should be focussed on cross-border areas, where cooperation between countries is needed to ensure good governance. Areas sensitive to climate change should be identified and prioritised across Europe. The action should make use of existing numerical models but also develop new methods which combine marine ecosystems with economic dynamics. All activities in this action should be based on a multi-disciplinary approach to enhance predictive capabilities and the development of new services based on user requirements.

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<sup>10</sup> Deliverable 5.2

**Proposed Tool:**

- Step 1: Member Countries will identify potential researchers and experts willing to participate in this action.
- Step 2: JPI Oceans should organise a pan-European seminar to share experiences of using new integrated models, and propose development options. This would be attended by researchers and experts from different fields; including planners, modellers, socio-economists as well as involve relevant conventions, organisations and stakeholders. Based on the outcome of the seminar a series of workshops will be organised by JPI Oceans. The objective of these workshops is for experts to work more in detail on possible approaches for the improvement of existing integrated models requiring fresh money.

## 4 Linking oceans, human health and wellbeing

There has been a growing recognition that oceans, human health and wellbeing are interlinked and that we are only beginning to understand the complex relationship of risks and benefits. The close association between environment and health is well-established but has focused largely on the terrestrial environment, while taking little account of the role of the seas and oceans.

In this area, JPI Oceans will work in collaboration with ongoing initiatives and build on the existing work, particularly the European Marine Boards Position Paper on linking oceans and human health<sup>11</sup>.

### **JPI Oceans added value**

JPI Oceans can provide a coordination framework to establish a network of European centres of excellence for oceans and human health. The role of JPI Oceans will be to promote interdisciplinary networking for knowledge transfer among scientific communities, economic sectors, and public administrations.

**Key Players:** Black Sea Commission, BONUS, CIESM, EFARO, ERA-MarineBiotech, EuroMarine, HELCOM, ICES, IOC-UNESCO, MAP-UNESCO, OSPAR, European Marine Board

### **Action 4.1: Ocean health benefits and risks**

**Objective:** Feed input to policy advice and decisions to cater for health benefits and reduce health risks.

**Description:** The action will foster the necessary connections between marine, environmental, biomedical, health, economic and social sciences; it will also facilitate a dialogue between relevant stakeholders. The action is in line with the vision of JPI Oceans to address issues at the intersection between the marine environment, climate change and the maritime economy and human activities. The action will build on the scientific output from other strategic areas of JPI Ocean such as Food Security and Safety (9); Biotechnology (10); and Interdisciplinary Research for Good Environmental Status (5).

The action will create a long-term institutional framework to address the challenges and opportunities of oceans and human through an integrated approach. This will support the capacity for Europe to conduct interdisciplinary and collaborative research to address the complex but important links between the marine environment and human health and wellbeing.

**Proposed Tool:** In following order:

- Step 1: Promote interdisciplinary networking and knowledge transfer through a call for interest at a national level and identification of relevant institutions from the scientific community, economic sectors of our society and public administration; ensuring the active participation of the Health community (public health, epidemiology, medicine etc.) who are currently traditionally less engaged.
- Step 2: Develop an interdisciplinary, transnational oceans and human health community in Europe. Identify areas of synergies, specialization and gaps. Member states should provide

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<sup>11</sup> [European Marine Board. 2013. Position Paper 19: Linking Oceans and Human Health](#)

seed money to start the process, with funding at national and European level for the international cooperation.

#### Action 4.2: First step towards developing a networking of Centers of Excellence

A call for proposals with three main axes should be considered to identify the institutions involved in this area. The call should focus on interdisciplinary research in this area:

1. Understanding the public health burden from human interactions with the ocean;
2. Investigating the processes involved in the transport and transmission of toxins (biogenic) and toxicants (man-made) from the marine environment to humans;
3. Exploring the benefits to human wellbeing of interacting with coastal and marine environments.

Further information on this action is to be found in the input by StAB Appendix.

## 5 Interdisciplinary Research for Good Environmental Status

Despite the significant progress of the Marine Strategy Framework Directive (MSFD), there is currently no shared EU-wide agreement on how to define Good Environmental Status (GES).

### **JPI Oceans added value**

In order to develop a common understanding of GES, JPI Oceans could conduct research and promote the exchange of knowledge and best practices between members with a view to harmonising assessments and monitoring human activity.

JPI Oceans could also facilitate the coordination of institutions and existing research efforts/networks that work at national and regional levels on the implementation of MSFD. In addition it could support multi-disciplinary capacity building of researchers to better address assessment of the ecosystem and the impact of multiple pressures, including modelling skills.

JPI Oceans could act as a flexible hub for scientists to address, urgencies, emergencies and disasters inside and outside the EU by putting in place temporary panels of experts to assess the issue and propose solutions. Such a flexible system could also be used to coordinate requests and offers for assistance from the EU 28 and the three European Economic Area (EEA) countries.

**Key Players:** Black Sea Commission, BONUS, CIESM, COFASP, EFARO, EuroMarine, European Marine Board, HELCOM, IBPES, ICES, IOC-UNESCO, IPCC, OSPAR, UNEP-MAP, JRC, EDA

### **Action 5.1: Integrate research on the pressures of pollution on the marine environment**

**Objective:** Implementation of an integrated European strategy for monitoring by defining scientific and technical parameters and monitoring protocols for GES indicators and procedures for regular updates to the strategy to capture issues relating to emerging threats and pollutants. Building on existing European initiatives and organisations, implementation of the strategy will advise policy makers. Implementing networks of cooperation across the national level to exchange practice and share capacities.

**Description:** The long term ecological risks associated with pollution, including dumped munitions, in the marine environment is a major concern. For many pollutants, there is limited information on their distribution, behaviour, and impacts and there is a need to trace pathways of chemicals from the environment to their sources to enable appropriate action (monitoring strategies). This will also require the development of new sensors, being the objective of Strategic Area 2.

The potential risks from polluted seafood on human health are a major concern and challenges that calls for a coordinated European action for analysing undesirables in seafood (collaboration 4.4). These include dioxins, PCBs, heavy metals, in the case of farmed fish it also makes reference to therapeutic agents, illegal substances.

JPI Oceans add value by acting as a hub for scientific information exchange in cooperation with Regional Sea Conventions, (e.g. on science and research needs and exchange of expertise and

knowledge related to the implementation of MSFD requirements) and inform Member States on future research needs. As part of this the MSFD CIS Project Coordination Group (PCG) of DG ENV could be used to discuss common priorities. Agreement on research needs will also facilitate cooperation between ministries of environment and research for co-design of projects. Exchange between JPI Oceans and the PCG and/or Marine Strategy Coordination Group is also indispensable to ensure that research results are provided at the right time to influence the MSFD programs of measures.

Coordination between different national laboratories can be strengthened. This will help a network to exchange practice and align activities between and will help organise the analysis of different types of pollutants, according to their capacities. Not all centres have the capacities (human and technical equipment) to conduct an integrated and comprehensive assessment of all present and emerging pollution, hence synergies can be created. The network should improve and strengthen intercalibration exercises, building on the existing ones, and optimise analytical methods and develop standard methods for analysis. The network cooperation could lead to harmonised public procurements for acquisition of new and more sensitive equipment.

**Proposed Tool:**

- Set up an incentive based multidisciplinary panel of experts to develop of integrated models to assess the impact of increasing pressures on the GES.
- Develop a comprehensive database on human pressures and environmental data on GES which can be used in models to assess cumulative impacts on the marine environment.
  - Step 1: define the areas to be addressed and the data needed to test integrated models.
  - Step 2: the panel of experts would work on the development of integrated models using the data to feed the models.
- Create a network of marine laboratories involved in the MSFD working group on GES and specialised in marine pollution,

## Action 5.2: A flexible expert system to address emergency issues

**Objective:** Act as a hub to allow scientists to inform on urgencies or emerging issues at sea to secure rapid advice from science to policy on risk assessment and possible technological and innovative solutions to deal with these events on a case by case basis.

Establish temporary panels of experts selected for their excellence and experience in past emergencies. This action will allow member states to exchange good practice and consider future cooperation on the emergencies identified.

**Description:** There are currently no systems in place to address and solve disasters caused by pollution, especially when the pollutant is outside the jurisdiction of an existing monitoring programme like dumped munitions as a proposed issue by StAB. Proactively responding to these issues is costly, but inaction is likely to be more expensive in the long term.

JPI Oceans is well placed to establish a flexible, international contingency system based on excellent science. This would give scientific experts a platform to highlight urgencies or emerging issues at sea.

Act as a door to address and develop innovative procedures and protocols to deal with emerging issues at different temporal scales and to guarantee advice to ensure rapid and efficient responses. It is important that these temporary panels operate under the Chatham House Rule to ensure that



important, yet politically controversial issues can be raised as scientists identify issues which are a cause of alarm. The action will build on the experience from the JPI Oceans pilot action on micro plastic when developing procedures and mandate.

**Proposed Tool:** Implementation will take place in the following order:

- Step 1: Develop a portal for scientists to provide information on potential threats or changes in the marine environment which could require further investigation.
- Step 2: identify relevant experts and possibly complimented with studies on the issue and be a checkpoint to consider whether Member countries agree to pursue the issue
- Step 3: if Member Countries choose to take issues forward, experts will be selected for their expertise and relevant agencies will be identified to participate in these temporary panels.

### Action 5.3: Address the effects of eutrophication and harmful algae blooms (HAB) on marine ecosystems, maritime economy and human health

**Objective:** Address gaps in knowledge relating to HABs which have the potential to harm human health and the blue bio-economy.

**Description:** Eutrophication, caused by an increased nutrient load from terrestrial sources, is a major problem in many European coastal areas. It can lead to changes in species composition, loss of biodiversity, ecosystem degradation, hypoxia, anoxia and harmful algal blooms (HAB). As a result, eutrophication is also a major threat to economic activities and human health.

There are still gaps in our understanding of the causes and effects of HABs, particularly in relation to climate change and increased human activity. To assess the links between HABs, climate change and human impacts it is necessary to determine the combined effect of short-term decadal-scale climate variation and anthropogenic pressures.

Long term databases of HAB events should be integrated with environmental and climate change prediction models in European waters. It may also be useful to establish common data standards across Europe. It is necessary to improve the current modelling tools to increase the reliability of toxic algal bloom forecast. These can be used to adopt management measures to minimise the social and economic impact on fisheries, aquaculture (Strategic Area 9), tourism, and human health.

**Proposed Tool:** Launch calls for proposals to fill scientific gaps, possibly engaging structural funds, and taking into account tool 1 and tool 2 defined for Action 1 of this strategic area.

### Action 5.4: Setting up a research network to address current barriers to a common understanding and coherent assessment of GES in European waters

**Objective:** Implement and test sensitivity of GES indicators and set realistic targets.

**Description:** Establishing accurate and reliable indicators for cumulative human impacts requires a coherent, pan-European approach through the coordination of national and regional activities in the implementation of MSFD.

JPI Oceans could support cooperative research across Europe through sharing and exchanging of knowledge, infrastructures, data, and best practices to identify and overcome the scientific needs to understand and assess GES. This could be done by establishing a network of institutes to share experience, knowledge and data and identify new research needs. This should be complimentary to

what is available through the Working Group on Good Environmental Status. To secure this and avoid duplication, a platform should be formed between this network and Regional Sea Conventions in cooperation with the JRC MSFD Competence Centre; this will ensure a continuous exchange and cooperation.

There is a need to standardise indicators to understand the impacts of natural and anthropogenic changes to the marine environment across Europe. Where indicators are not currently effective, it may be necessary to develop more suitable and coherent criteria. This is particularly relevant when deciding indicators for biodiversity.

Further research to develop methodologies to assess and monitor biodiversity should bring together and build upon existing approaches for thematic assessments conducted in the framework of the Regional Conventions. Assessment criteria should take into account regional differences and recognise the interactions between geographic divisions.

Additional support for modelling could enable the adoption of common targets in some areas. This may require human capacity building to enable researchers to develop integrated models to test indicators. Targeted research is needed to address how GES indicators can be affected by climate change. This is useful both for providing feedback to climate scientists and distinguishing between different forms of human impacts.

JPI Oceans could develop a platform for information exchange on a continuous basis in cooperation with Regional Sea Conventions. This action will contribute to the development and also to the implementation of an integrated European strategy for monitoring, defining scientific and technical contents and monitoring protocols for indicators of GES.

**Proposed Tool:**

- Launch calls for proposals.
- Seed money for networking. The JPI member organisations may be well placed to signpost experts to take part in the JRC MSFD competence centre expert groups.

## 6 Observing, modelling and predicting ocean state and processes

Sustained long-term observations are required to understand the interactions between the marine environment, climate change and human activities. Physical, chemical, biological, ecological, and geological data need to be combined to form a holistic understanding of hazards, risks and changes in the marine environment. Observations require a range of infrastructures, which are expensive to develop, operate, maintain and upgrade.

### **JPI Oceans added value**

JPI Oceans, in cooperation with relevant organisations, offers a unique opportunity to develop a European Oceans Observing System (EOOS). As a long-term mechanism, it can provide a strategic monitoring strategy which is fit for purpose and which utilises shared infrastructures for science and monitoring needs.

**Key Players:** , Barcelona Convention, Black Sea Commission Bucharest, BONUS, CIESM, Copernicus, Donet in Japan, EFARO, EMBRC, EMECO, EMODnet, EMODNET, EMSO, EUROARGO, EuroGeo Surveys, EUROGOOS, EuroMarine, GEOSS, Helcom HELCOM, i-Marine, ICES, ICOS, IMOS in Australia, INSPIRE Directive, IOOS, LIFEWATCH, My Ocean, MyOcean, NEMO, Neptune in Canada, ODIP, OOI the USA, OSPAR, Ospar, PRACE, ROOS, SEADATANET, SIOS, WISE-Marine

### **Action 6.1: Support the set-up of the EOOS concept**

**Objective:** Enable fully operational and sustained systems that deliver cost efficient solutions, high quality observations and data. Support leading scientific research and improve the evidence used to inform environmental policy and management. Allow member countries to fulfil research and monitoring obligations by facilitating complimentary uses of observation systems.

**Description:** There is a need for an overarching coordination of research and monitoring capabilities and European / regional networks of infrastructures. This should allow the identification of relevant gaps and priorities to address the environmental and societal challenges taking into account the technology state of the art.

#### **Proposed Tool:**

As a first step engage a dialog with EuroGOOS and other relevant initiatives/ networks to investigate towards the establishment an EOOS strategic board for the Development of a strategic vision of the European Ocean Observing System. The intention of the Board should be to design tools and mechanisms which would allow integration of existing European oceans observation and monitoring capacities which are important to enable a number of JPI Oceans objectives.

### **Action 6.2: Foster the development of observing technologies (see also strategic area 4.2)**

**Objective:** Develop a long-term plan for integrated technologies which are needed to create better ocean observation systems.

**Description:** As part of the EOOS strategy, JPI Oceans could set up a multidisciplinary EOOS working group to identify monitoring needs and provide an overview, guidance, and advice on technological solutions as well as propose new ways of cooperation to address scientific questions and monitoring needs. This activity would benefit from collaboration between public and private sectors for the development of technologies and to find ways of cooperation between industry and research centres to optimize the use of private platforms for monitoring (e.g. opportunity vessels).

**Proposed Tool:** JPI Oceans could, through this working group of experts, establish a programme that aims to:

- Support the technology development for design and deployment of more efficient and cost effective *in situ* observing systems;
- Support technology for the development of cabled sea-floor stations;
- Build on existing initiatives which use voluntary fishing vessels, commercial vessels and platforms and, consider how to expand it to collect more in situ environmental data.

### Action 6.3: Provide access to marine data, ensuring harmonization and standardization of protocols

**Objective:** Promote common standards, propose innovative solutions and open access to data as well as harmonization of data requirements in particular related to MSFD.

**Description:** JPI Oceans could work towards the harmonisation of data requirements for the descriptors in the framework of the Marine Strategy Framework Directive (MSFD), maritime spatial planning (MSP) and existing regional sea conventions (HELCOM, OSPAR, Barcelona, Bucharest).

**Proposed Tool:** JPI Oceans can add value to data acquired nationally by drafting EOOS data guidance to:

- Encourage the further development of a world-class network of marine data centers using common standards;
- Foster a truly open access data policy (e.g. by proposing an overall JPI Oceans agreement for data free exchanges between all marine data providers) to ensure that all collected data becomes known and available to all stakeholders, and safeguarded for further use by long-term stewardship of the data.

### Action 6.4: Support e-infrastructures for computing, modelling and (including early warning systems and provision of services to end users)

**Objective:** Improve prediction on future evolution of marine environment.

**Description:** JPI Oceans could work towards the development of new modelling tools to specifically address inter-disciplinary prediction and complex environments (e.g. coastal marine hazard tracking integrating ecosystems, climate and economics). Integrated models should be based on the ecosystem approach, and aim to improve high resolution prediction of the future evolution of marine ecosystems under different scenarios.

**Proposed Tool:** Actions taken by JPI Oceans could include:

- Launch calls for improving and fostering access to existing high performing computing facilities to run models which combine several ocean related components of the earth system to work together or separately;
- Establishing a JPI Oceans position towards H2020 international calls, notably e-infrastructures calls through the “Research Data Alliance”;
- Reducing the levels of uncertainty for predicting within the ecosystem approach and responding to policy needs in ocean monitoring by organizing a number of workshops.

## Action 6.5: International cooperation on infrastructures for global ocean observation

**Objective:** Provide a framework to link an EOOS with international counterparts to promote a truly global integration of existing marine infrastructures.

**Description:** Global Ocean Observations are paramount for the sustainable management of the oceans at global scale. Observing systems and marine data centres are key infrastructures and international cooperation in this domain is essential to fully address the goals of JPI Oceans.

The information continuously provided by ocean observation networks, within GOOS, enables a better ability to assess and predict the state of the global ocean.

**Proposed Tool:** Actions taken by JPI Oceans could include:

- Enable the exchange of best practices in the design, instrumentation, management and governance between different Regional Ocean Observing Systems, from the coast to the deep ocean through an expert group or workshops;
- In cooperation with other, promote greater involvement of the EC-EU countries in driving the expansion of GOOS into the biogeochemical and biology/ecosystems domain and organize workshops as a starting point as a contribution to the overall GOOS vision on long-term observations;
- Standardise protocols and methods in data treatment at international level;
- Promote specialised observing systems to other regions globally.

## Action 6.6: Integrate societal needs in coordination of research and monitoring

**Objective:** Develop a monitoring strategy embedded in EOOS responding to science and policy dual uses and needs. Identify data and infrastructure gaps and which observations (and associated infrastructures) are essential to sustain at a pan-European level

**Description:** It is important that ocean observations meet societal needs. Given the high proportion of science budgets spent on collecting data, the co-design of research and monitoring infrastructure, services and data collection and usage is needed. In this way, key infrastructures and gaps in monitoring to service policy and science can be identified and the necessary level of data resolution, both spatially and temporally, can be defined to accommodate its multipurpose use. Monitoring could also be better supported and complemented by models.

Climate change, ocean acidification and pollution are typically identified as the most pressing issues in the next 20-30 years. JPI Oceans could develop a coherent and integrated monitoring strategy for Europe to increase cooperation between institutions and countries, resulting in more efficient monitoring. Monitoring should be interdisciplinary to maximize the potential of existing infrastructure.

**Proposed Tool:**

JPI Oceans can help develop a European monitoring strategy objectives to be pursued through workshops, networks, working groups, conferences, seminars, embedded within EOOS, to respond to cross-sectorial current and future policy needs. Such a strategy would address several systemic issues (see also Strategic Area 3) and the need to ensure dual uses of infrastructure for the purpose of monitoring needs and infrastructure needs to support societal driven science and addressing:

- Sharing of best practises to encourage a coordinated and common use of infrastructures at regional level for data acquisition and marine monitoring, including coordinating

measures, facilitating the agreement of protocols and data sharing and common sets of symbols for maps of activities in marine space;

- Facilitating regional assessment of monitoring programmes;
- Common responsibilities / spatial gaps to be addressed in coast zones, seas and oceans;
- Mapping data collection programmes at national, sub regional and regional level with the aim to increase coordination and address the differing approaches to data collection, quality control and accessibility;
- Propose a pan-European, flexible, network of monitoring infrastructures with real-time data provision (see section on infrastructure) where available such data (salinity, temperature, oxygen, and fluorescence) as well as data which are important for tracking environmental changes and analysis of time series such as biological data.

## 7 Climate change impact on physical and biological ocean processes – Oceans circulation

Climate change is a global threat which will impact the natural environment, economies and wellbeing of humankind. There is a need for continuous monitoring and surveying to understand the processes and feedback mechanisms between the ocean, atmosphere and cryosphere systems, both on a global and regional scales, and provide evidence from long-term, quality-controlled datasets and process-based understanding.

### **JPI Oceans added value:**

Responding to these challenges requires a global approach, through which JPI Oceans can add value at a pan-European level. Financial support for permanent infrastructure should not depend on normal grant funding, which is usually short term and therefore it does not secure the long term support needed to observe climate change related changes. JPI Oceans can add value by taking into account the focus of other ongoing activities within Horizon 2020.

JPI Oceans could take a specific responsibility for driving the initiative on biogeochemistry within the remit of GOOS as the US and Australia are coordinating *physics* and *biology* respectively as expressed in 4.6 Action 5).

**Key Players:** AMT, Black Sea Commission, BONUS, CIESM, CLIVAR, COFASP, ECORD, EMBRC, EMECO, EMODNET, EUROARGO, EUROGOOS, EuroMarine, European Marine Board, GEOSS, GOOS, HELCOM, IBPES, ICES, IGBP, IOC-UNESCO, IODP, MAP-UNEP EFARO, MARS, OSPAR, POGO, RAPIDWATCH, ROOS

### **Action 7.1: Impacts of climate change on ocean circulation and effects on pelagic ecosystems and ecosystem dynamics**

**Objective:** Develop the understanding of how climate changes affect the pelagic ecosystem, including primary production, biogeochemical processes, trophic webs interactions and distribution, abundance of marine organisms, changes in biodiversity and the spread of invasive species.

**Description:** This action attempts to ascertain how climate change and climate variability in the North Atlantic and remote regions is affecting the main ocean currents in North East Atlantic. It will monitor changes in the upwelling along the eastern boundary system of the western Iberian coast and the western African coast and research how these changes affect the pelagic ecosystem, spread and distribution of marine organisms, trophic web interactions and distributions, changes in biodiversity and spread of invasive species. Current oceanographic models do not integrate climate scenarios on sub-regional or local scales.

### **Proposed Tool:**

- JPI Oceans should organize a workshop with experts brought to the table by Member Countries tasked to inform on actions to be taken in order to improve the reliability of models and their spatial resolution.
- These models will need to be supported by Member Countries investing in long-term monitoring efforts at the same spatial and temporal scales.
- Seed money will be required for institutions to cooperate and coordinate of big, national, infrastructures and remote sensing.

- Fund targeted studies to bring in expertise of universities and other marine research centers in order to complement the work developed by national institutes.
- Establish a long-term forum for researchers to strengthen cooperation and exchange knowledge. The aim is to discuss the current situation and propose new ideas to better understand the impacts of climate change on physical and biological ocean processes and the consequences it may have on marine ecosystems and the economy. Given the international nature of this issue, the forum should be open to international researchers.
- Relevant European and international organizations could be invited by JPI Oceans to participate in the organization of symposiums advised upon by the forum.
- Fund short-term exchanges of early career researchers to conduct research in the field of climate change impacts on marine ecosystems, promoting excellence in this area.
  - Member countries could launch a call for expression of interest of centres willing to host the researchers and the need to focus on and focussed experimental research.
  - Each participating country should cover the expenses of their national researchers through competitive calls.

### Action 7.2: Long-term monitoring of thermohaline circulation

**Objective:** Establish a long-term monitoring programme to follow changes in the thermohaline circulation (THC) and deep water mass formation processes. Use the data to validate models showing slowdown and shutdown of the THC in the next 100 years.

**Description:** The action will focus on the components of the thermohaline circulation and identify drivers and thresholds leading to weakening/collapse in the North Atlantic and the Mediterranean and the changes in physical and biogeochemical variables, mass formation, temperatures and freshwater input from ice melting. It will also seek to develop better models of predicting future changes to the system and the potential for cooling and sea level rise in Western Europe.

Long-term monitoring of the THC requires a strong political commitment. It also requires a strong cooperation between research institutions involved in the monitoring of the deep ocean and an oversight strategy to align different efforts.

New climate-ocean-land models are needed to predict future changes to the thermohaline circulation with a high degree of confidence. Research and modelling on how these changes will affect biogeochemistry of the deep ocean is also needed. Modelling needs to be complemented with data from autonomous systems, fixed point observatories and oceanographic surveys; key sites should be identified in the North Atlantic and the Mediterranean. The research should be interdisciplinary in nature and involve teams of scientists from across Europe and other countries bordering the Atlantic Ocean.

**Proposed Tool:**

- Assess the availability of long-term funding to study the THC and to identify if there are gaps or opportunities for expanding cooperation within existing projects, such as RAPIDWATCH.
- Fund research gaps and new models.



### Action 7.3: Understand past environmental changes in connection to climate variability

**Objective:** Enhance knowledge on how and why climate has changed historically and understand the associated environmental impacts.

**Description:** Understanding past climate change is key to predicting future scenarios. Historical and paleo data, ocean observing and forecasting systems should be integrated to provide better indicators of past, current and future environmental status. Long sediment coring and alternative methods and approaches are necessary to cover key gaps in our knowledge of ocean response to climate change and its environmental impacts and productivity. The use of data obtained from pre-measurement sources helps refine models and distinguish background variability.

**Proposed Tool:** Call for proposals to conduct multidisciplinary scientific studies: use of historical and present data, increased observations, use of cores and mapping of records and interpretation of archaeological registers and geophysical evidence.

## 8 Effects of ocean acidification and warming on marine ecosystems

Ocean warming and acidification are global processes caused by increase of atmospheric concentrations of CO<sub>2</sub> and other greenhouse gases. These pressures require long-term aligned research as well as a long-term concerted monitoring effort; hence JPI Oceans offers a platform from which to coordinate these efforts.

JPI Oceans will build on the work of short term initiatives, such as EPOCA, to create a long term continuity in this area.

### **JPI Oceans add value**

JPI Oceans can add value by providing both a large geographical coverage and a long-term strategy towards the issues surrounding ocean acidification and warming on marine ecosystems and productivity.

**Key Players:** Black Sea Commission, BONUS, CIESM, EMBRC, EUROGOOS, EuroMarine, European Marine Board, GCOS, GOOS, HELCOM, IBPES, ICES, IGBP, IOC-UNESCO, IPCC, networks, OA-ICC, OSPAR, ROOS, UNEP-MAP

### **Action 8.1: Monitoring the effects of acidification and warming**

**Objective:** Strengthen our knowledge of the combined effects of warming and acidification on marine ecosystems and determine "tipping points" for different regions

**Description:** The action will address the effects of ocean acidification in combination with ocean warming, including the increasing stratification of the water column, on other physical, as well as on chemical and biological processes. In particular the action is aims to:

- Understand the effects of ocean acidification and warming on the biological productivity and microbial processes in the water column;
- Improve the ability to predict the knock-on effects of altered productivity throughout marine ecosystems;
- Investigate and develop models to predict the effects of warming on the stratification of the water column and the effects on vertical nutrient supply;
- Understand the effects of ocean acidification and warming on the chemical properties of seawater and on biogeochemical cycles. It will address the effects of warming and acidification on the ocean-atmosphere exchange of substances.

This requires a monitoring programme with particular focus on key geographical areas where changes are occurring more rapidly and which are particularly sensitive to climate change. The action should define the essential variables to be monitored to improve our understanding of the impacts of ocean warming and acidification on marine ecosystems and establish common monitoring protocols and methods. This will require a concerted effort across European countries and cooperation with regional and international organizations. Cooperation with third countries may be important to address the problem in some specific areas or regions. Better links between science and the development of local policy on risk assessment are essential.

**Proposed Tool:** This action should be taken forward by funding a network taken forward by a 2-steps approach. A steering committee should be set up to develop a programme of activities to be conducted by the network.

- Step 1: Member countries launch a call for expressions of interest of institutions to form a long term networks, participation to be assessed by the country to be involved
- Step 2: Fund the establishment a pan-European long term network of relevant institutions, centres and universities involved in this topic. Share knowledge, develop best practices, coordinate activities, standardise measures and provide advice to policy makers and managers and needs to be supported by an infrastructure network for data collection.
- Step 3: Establish a monitoring programme.

## Action 8.2: Combine modelling and experimental research to understand cumulative impacts of stressors on marine ecosystems

**Objective:** Establish a pan-European network to ensure critical mass and a long-term approach to deal with the effect of acidification and warming on the marine environment. Provide sound scientific advice to policy makers on these impacts.

**Description:** There are currently no pan-European networks in place to look at cumulative pressures on the marine environment. This action will need to cooperate with the networks in Action 8.1. The network will develop and improve models and experimental work to predict:

- The combined effects of ocean warming and acidification on marine pelagic and shallow benthic ecosystems;
- Uncertainty of the impacts combined of acidification and warming on the carbon cycle and the cycles of other key elements and processes such as ocean hypoxia;
- A better understanding of the relationship between and combined impacts of climate change and human pressures;

The network will improve the methods, models protocols and standardising measurements to reduce the uncertainty of projections on the carbon cycle in regional seas which will provide policy makers with better advice.

### **Proposed Tool:**

- Fund the establishment of a long-term network of research institutions across Europe to coordinate monitoring and research activities on cumulative pressures. This does not exist at the moment and the issue requires long-term cooperation building on national constellations and agreement on identifying and agreeing on one national centre to be the contact point. The network will;
  - organise expert workshops, training modules, conducting inter-calibration exercises; provide access facilities and other infrastructures to conduct research.
  - develop a common database and new models
  - National calls to support this action for individual national researchers to participate in workshops and meetings conducted by the network
- Launch calls for multidisciplinary research (biologists, physicists, chemists, experimentalists and modellers).

### Action 8.3: Understand the effects of acidification and warming on deep sea ecosystems

**Objective:** Improve our knowledge on the impact of acidification and warming on vulnerable deep sea habitats and their biodiversity to support development of sustainable management measures and assessing climate risks in marine protected areas.

**Description:** At an EU level, the impact of acidification and warming on deep sea ecosystems is not understood. A small number of projects have addressed the issue, but not in great depth. The knowledge gaps are mostly due to a lack of long term data. More knowledge is needed to assess the impact of climate change on vulnerable ecosystems, biodiversity sensitivity, tolerance and adaptability in species in a fluctuating environment, to support the development of suitable management measures.

**Proposed Tool:**

Launch calls for proposals to strengthen:

- the knowledge base of biodiversity and the physical and chemical environments, structure, regulation and functioning of ecosystem,
- data gathering for baselines,
- new tools such as integrated models,
- identify needs for new sensors (possibly use of omics, genetic and molecular tools relating to deep sea organisms being the objective of strategic area 2
- models to assess climate change effects based on best available scenarios.

## 9 Food security and safety driving innovation in a changing world

The global population increases drives the need for more food. According to the FAO food supply will have to increase with 60% by 2050, compared to today, to meet demands in view of an expected population of 9 billion<sup>12</sup>. Rising demand is driving innovation in fish capture and fish production. Moreover, environmental pollutants from nearby and remote anthropogenic sources are introduced, dispersed and accumulated in seafood through trophic transfer, which pose a risk for human health.

### **JPI Oceans added value:**

JPI Oceans can add value by integrating fisheries and aquaculture research with omics, environmental and socio-economic research. It could establish a framework to bring together scientist from different disciplines to respond to these complex challenges.

JPI Oceans can develop partnerships with organisations such as the International Council of the Exploration of the Sea (ICES) and their network of government research institutes, which focus intently on the applications of the MSFD and CFP directives. JPI Oceans is a long-term instrument in the European landscape that can add value and synergies across the member countries by putting together a research programme by aligning efforts to cover existing data gaps needed for a sound understanding of the food security challenge in cooperation with the European Commission within an ERA-NET Cofund.

**Key Players:** Black Sea Commission, BONUS, CIESM, COFASP, EATIP, EFARO, EMBRC, EUROGOOS, EuroMarine, European Marine Board, FAO, HELCOM, IBPES, ICES, IOC-UNESCO, IPCC, OSPAR, regional conventions, Regional Fisheries Organizations, ROOS, SCAR-FISH, UNEP-MAP

### Action 9.1: Projecting climate change effects on ecosystem structure, function and productivity

**Objective:** Understand the cumulated impacts of climate change on food-web structures and species interactions including regime shifts.

**Description:** The accumulated impacts of climate change on the marine environment will lead to changes in ocean currents, seawater temperature and productivity in the photic layer of specific ocean areas. This could potentially trigger changes in the food-web structures and species interactions including regime shifts. As a further consequence of these impacts, species will change their distributional ranges, thus affecting the centres of production and the access of fishing fleets to these. It has already been observed that some stocks have moved northwards and this has created political tension between some countries and the EU relating to catch quotas. Sharing of widely distributed stocks with climate induced changes in abundance will require future work and should be based on universally accepted scientific data. Coordinated research is required to understand the consequences of a range of impacts of climate change on marine productivity, with a view of projecting marine fish production potential at European and sub-European scales. The development of ecosystem models will be necessary to disentangle the effects of climate change from those due to fisheries exploitation, and to assess the economic impact of climate change on the fisheries sector. Long term research is needed in this field to elucidate the direct and indirect effects of climate change on fish ecology, physiology and population's dynamics.

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<sup>12</sup> "How to Feed the World in 2050" discussion paper (2009) High-level Expert Forum of FAO.

**Proposed Tool:** Launch calls for coordinated long-term research network(s) to ensure widely accepted scientific data, ecosystem models disentangling effect of climate change from fisheries exploitation and economic impacts assessments.

## Action 9.2: Technological developments to enhance aquaculture productivity and yield

**Objective:** Stimulate blue growth and jobs through technological developments in aquaculture production.

**Description:** To achieve growth in aquaculture productivity in Europe, four elements need to be researched in a coordinated fashion. Firstly, research on alternative feeds needs to recognise the limits to fishmeal and fish oil production and the need to extract protein from alternative sources. Secondly, further research is needed to adapt farmed organisms to be resilient to environmental changes. Research into omics, molecular technologies and biotech solutions to identify robust phenotypes for breeding species more resistant to diseases is needed. The use of DNA sequencing will assist in development of stock baselines, and this needs to take into account the spatial dimension and distribution of vital phases of commercial species. Thirdly, research must be conducted to identify expected changes in coastline dynamics to expand European aquaculture industries. Finally, research is needed to promote and expand innovative use of by-products or aquaculture waste recycling. Integrated Multi-Trophic Aquaculture (IMTA) and waste recycling would promote a more sustainable industry which has fewer impacts on the environment.

### Proposed Tool:

Funding for research on:

- Alternative feeds, and research based on DNA sequencing brood stock, new species and stock baselines adapted to climate change impacts.
- Expanding aquaculture requiring technologies (multi-use platforms (see priority area 24.2) and understanding of coastline dynamics.
- Recycling and IMTA.

Provide funds and seed money for:

- Strengthening common European platforms in the field of “omics” research (incl. typically sequencing platforms, microarray, 2D-gel electrophoresis, GC-MS + crystallography, electronic microscope, diffract meter), with associated bioinformatics and e-infrastructures, and the development of centres for systems biology and synthetic genomics, recognising that Marine Biology research & valorisation draws from a wide range of multi-disciplinary outputs and tools;
- Integrating genomic information with environmental, socio-ecological and other biological data;
- Integrating aquaculture with "omics" technology to identify robust/resistant phenotypes for sustainable growth and breeding + microbes and novel pharmaceuticals.

Support modelling capabilities: mainstream biodiversity- genetic variation - into earth observation systems to enable predictive capacities of biodiversity dynamics and resultant impacts on ecosystem services;

### Action 9.3: Interactions between marine aquaculture and fisheries and land-based food production

**Objective:** Maximise sustainable food production and support management policy by looking for further interactions between marine fisheries, aquaculture and land-based food production

**Description:** Fishmeal is a high protein product produced from small pelagic fish and as a by-product of fish processing and partial replacement by using soymeal. Increase in fishmeal and soymeal prices is reflecting the limits to fishmeal production and the increased competition such as from biofuels. The globalised markets for fishmeal are capable of adding enormous pressures on local resources and resulting in sequential exploitation. The interactions between marine fisheries, aquaculture and land-based food production need to be considered in terms of maximising production while ensuring environmental protection at all scales.

Secondly, as part of this action, investments in governance research, including global governance principles, should take place. Equally, efficient disaster risk management and adaptation in aquaculture and fisheries needs science-based risk assessments to support policy. This requires taking into account the accumulated pressures on changing climate risk patterns, extreme events and human induced disasters. In order to respond to these changes we need to enhance the ability to downscale these risk assessment impacts from the global to the local level. Actions in this area have to be taken in close cooperation with organisations such as ICES, regional conventions and FAO, EFARO, universities and institutes within the European Marine Board and IPCC to deliver timely results relating to science and policy needs in this area.

**Proposed Tool:** Research/calls on governance and global governance principles, efficient science-based disaster risk management to support policy requiring a scientifically integrated approach and development of different scenarios.

### Action 9.4: Health of food webs

**Objective:** Develop a better understanding health of food webs with competing claims and pressures from human activities and how it impacts fisheries and aquaculture. Impacts of indirect factors, such as physical degradation, environmental pollution, alternative uses of the marine environment, fisheries management strategies, or fisheries-induced evolution, on marine food production systems

**Description:** It is often the case that fishing activity takes place alongside other industrial activity at sea such as energy generation, transport and tourism. These activities not only compete for space, but also interfere with each other through the release of contaminants, which can affect both the health of food webs and of the humans relying on them, or through the physical damage to essential habitats. More holistic ecosystem-based management practices are evolving to balance the needs of the different industries. In the context of food security, it is necessary to monitor and assess the consequences of policies and management strategies on the social, economic and environmental aspects and the effect of environmental deterioration due to human activities, changes in food webs and biodiversity on the supply of food from the sea.

**Proposed Tool:** Calls for proposals, data sharing, sharing of best practice on different management measures.

## Action 9.5: New models and data needs to ensure sustainable fisheries and a GES of populations of commercial fish species

**Objective:** Enhance our knowledge to apply the concept of MSY

**Description:** One of the objectives of the CFP is to achieve a maximum sustainable yield (MSY) of the exploited fish stocks. However, there are still important data and knowledge gaps to apply the MSY concept to the management of mixed fisheries.

The MSFD Descriptor 3 requires an ecosystem approach to fisheries management, which has traditionally been on a stock-by-stock basis. Knowledge and data available on fish stock is often limited and in many cases data is very poor and there can be large differences of coverage between regions. Increasing the frequency and geographical coverage of the current fishing surveys is needed to obtain more information to reduce the uncertainty in stock assessments; this should be complimented by fish stock models.

The ecosystem approach for management of fisheries needs to consider the social, economic and environmental factors equally. This implies the development of management strategies that use different sources of advice and it will require the development of bio-economic and socio-economic fishery models.

**Proposed Tool:** research/calls, new models and a more comprehensive information and database on species interactions on food webs (including non-edible species) and population dynamics

## Action 9.6: Address the effects of eutrophication and HABs on human activities

**Objective:** Vulnerable to HABs requiring enhanced understanding to secure the blue bio-economy as well as human health improving our knowledgebase on impacts of harmful effects of HABs and eutrophication on fisheries, aquaculture and shellfish production and improve practice in aquaculture production itself

**Description:** Eutrophication and harmful algal blooms (HABs) are a major concern in coastal areas and particularly for some sectors of the maritime economy and also due to the harmful effects on human health.

One of the sectors more affected by HABs is aquaculture. At the same time, bad practice in aquaculture itself can lead itself to eutrophication which may also promote toxic algal blooms. It is necessary to better characterize the impacts of aquaculture on coastal areas and ecosystems, and also to evaluate risks associated with HABs events that could affect the sustainability of aquaculture. This requires continuous monitoring of phytoplankton assemblages, nutrient supply and oceanographic dynamics in aquaculture sites and other areas potentially affected by eutrophication and HABs. Such monitoring could benefit from pan-European networking to share best practice, agree on standards and indicators to monitor.

The information collected through monitoring can be complemented by measures to foster integration of the already available information on HABs and fish killing events in European waters, facilitate communication with related international research and promote the engagement of end users to draw prevention and mitigation plans.

**Proposed Tool:**

Fund: Monitoring programs, networks and conduct evaluation and research on risk-assessment



### Action 9.7: Impacts of fisheries on marine ecosystems

**Objective:** Research to support governance on how fishing activities interact with and impact on marine ecosystems, and reduce impacts through new technological solutions

**Description:** Fisheries impacts on ecosystems remain as one of most relevant concerns within human pressures. The reform of the Common Fisheries Policy (CFP) aims to make fisheries more sustainable by implementing an ecosystem approach to avoid overfishing and minimise the impact of fisheries activities on the marine environment.

There are important knowledge gaps on how fishing activities interact with and impact on marine ecosystems, from physical damage to biodiversity changes. It is important to improve the knowledge of the role of different exploited species in the ecosystem and also to know how fishing activities affect the connectivity between ecosystems (including vulnerable deep-sea ecosystems), and how impacts on a particular area may affect neighbouring ecosystems. This knowledge on impacts is also needed to develop new approaches, technologies and devices to reduce the impact of fishing activities on the marine environment.

**Proposed Tool:** Research/Calls, development of models, mapping to support CFP and MSY, develop a knowledge grid of fishing impacts

### Action 9.8: Social and economic consequences of changes in marine food production

**Objective:** To more accurately predict possible changes in seafood production over the next decades and the socio-economic impact of these changes for Europe. Propose tools and innovative solutions to industry and contribute to the economic sustainability of fisheries and aquaculture in Europe.

**Description:** Fisheries and aquaculture provide both food and create job opportunities in many parts of Europe. However, changes in fish stocks as a result of overfishing or environmental change can be extremely damaging to fishing communities. There is an urgent need to try and anticipate such changes to allow policy makers to implement management plans and limit damage.

**Proposed Tool:**

Establish a multi-disciplinary pan-European expert working group to meet 2-3 times a year, covering all European sea basins to discuss on the changes in marine food production and its socio-economic implications. Such a group should analyse existing knowledge and develop possible future scenarios for marine food production and expected changes as a consequence of climate change, acidification and human pressures (including fisheries activity). The group WG could focus its activity on key areas or case studies for which all relevant data exists, to test models under different scenarios and make improvements needed to enhance predictions. Representatives of relevant European organizations and expert groups would be invited to the meetings of the WG, though these organizations will have to cover the cost of their participation in the activities of the WG.

### Action 9.9: Promote infrastructures in aquaculture

**Objective:** Promote infrastructure to support blue growth and jobs in the aquaculture sector

**Description:** Based on existing initiatives, JPI Oceans offers a flexible mechanism to develop synergies between the public research community and the private sector.

**Proposed Tool:**

Provide seed money at the level of interested Member Countries to:

- Develop a long-term network of aquaculture research infrastructures to strengthen research in automation and enhance the design and operation of marine biological production and harvesting systems.
- Develop a European network of top class experimental facilities, improving transnational access, and coordination and integration of national aquaculture infrastructures should be supported. It should cover all types of EU environments, systems and species that can meet current and emerging research needs or industry needs.

## 10 Use of marine biological resources through development and application of biotechnology

The twenty-first century has been called the “century of the gene”<sup>13</sup> and biotechnology is a key driver for the development of the new bio-economy.

### **JPI Oceans added value:**

JPI Oceans could help foster the marine bio-economy including bio-discovery for new products and services. It offers the opportunity to conduct actions which would organise and coordinate necessary efforts in this field, including the Marine Biotech ERA-NET. Where the Marine Biotech ERA-NET has a mandate to create research oriented initiatives and propose directions for developments, JPI Oceans could act as a bridge between various sectors and help develop adequate frameworks for steps towards the Blue Growth goals.

JPI Oceans can add value as a R&D infrastructure and platforms will be needed to support further leaps in marine bio-technology and to improve access to and development of these resources.

JPI Oceans is well placed to top-up institutional cooperation in this area, thereby creating a robust and sustained biotechnological community in cooperation with existing initiatives. JPI Oceans and its member states, having access to major seagoing platforms, observatories and networks of stations, are well placed to ensure that databases such as the UNESCO-IOC/IODE Oceans biogeographic Information systems can remain up to date.

**Key Players:** CBD, CIESM, ELIXIR, EMBRC, ERA Marine Biotech, EuroMarine, European Marine Board, GEO BON, IBPES, ICES, IOC-UNESCO, IODE, LIFEWATCH, OBIS, WORMS

### Action 10.1: Biotechnology and bio-discovery - Exploitation of genetic resources for sustainable blue growth

**Objective:** Identify genetic resources biotechnology which is of commercial interest.

**Description:** Valuation of biological resources can be developed through the application of biotechnologies to marine bio-discovery activities. Exploration of biodiversity is needed to identify compounds of commercial interest, especially in extremophile habitats. Bio-prospecting is resource-intensive; it requires joint research efforts, clear rules on access and benefit sharing, ownership and environmental responsibility. Sustainable use of living marine resources requires a long-term (20-30 years) approach to technology investments. There is also a need to develop new methods and protocols for marine genetic prospecting and marine bio discovery for industrial use, thus requiring close cooperation between marine labs, universities and industry in the support activities.

This action will establish a MSY for the use of marine bio-resources to avoid overexploitation and assess the impact and risks from exploiting marine biodiversity. Better Intellectual Property Rights (IPR) frameworks are needed to support blue growth in this area. This includes frameworks for material transfer agreements (MTAs) to enhance cooperation across countries in the fields of biodiversity and genetic resources. Development of sustainable techniques to culture marine

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<sup>13</sup> The EuroMarine concept (2010) Integration of European marine research networks of excellence - EuroMarine.

organisms with the purpose of providing natural products for commercial use will be needed to reduce the risk to marine ecosystem.

To advance in this field, there needs to be a better understanding of the innovative uses of marine products and bioactive compounds. In addition the utilization of marine biomass in well-developed bio-refinery processes will need new biotechnological tools and methods and a multidisciplinary approach. Multi-stream marine bio-refineries are needed, focusing on the use of all possible products from marine resources, creating new jobs.

**Proposed Tools:**

- Joint calls,
- Seed money to develop methods and protocols for prospecting and risk assessments,
- Studies and workshops investigating IPR frameworks
- Commercial assessment with industries, through brokerage events to identify uses and stimulate development of marine bio-refineries.

### Action 10.2: Taxonomic and genomic knowledge on biological resources needed for policy

**Objective:** Enhance knowledge of taxonomy and genomics to support marine to provide policy advice for Blue Growth and GES.

**Description:** This action will include genome bioinformatics and computational biology, sequence and structure analysis, molecular evolution and omics technologies. These have been and still are key enablers to make advances in the biotechnological field. There is an urgent need to make a genetic footprint of marine species.

It is necessary to improve high-throughput technologies for early warning (biomarkers) and diagnosis of marine ecosystems health and its impairment due to chemical pollution, as well as to increase the effort in the methodologies for the integration between biological and chemical data.

**Proposed Tool:** Funding capacity building in bioinformatics, omics and high-throughput technologies for diagnostic of pollution

### Action 10.3: Organismal models, collections, databases to support marine research and blue growth

**Objective:** Explore potential roles and features for adaptation in micro-organisms to underpin bio discovery

**Description:** There is a need to develop new organism models to understand basic biological, ecological and evolutionary processes which underpin the discovery of biotechnology and biomedicine.

The technological capability and biochemistry competences to have access to marine bio-resources and the identification of their products have to be strengthened; there is a need to develop infrastructure, databases, e-infrastructures, methods, programs and demonstrators to support this. Existing databases need to draw on a large team of taxonomists to ensure that the data are of high quality and it is essential that this work is coordinated to avoid duplication and fragmentation.

**Proposed Tools:**

- Joint calls and investment in innovative strain cultivation strategies and platform for high-throughput microbial cultivation, and develop new model organisms,
- Seed money to develop and ensure coordinated use of infrastructures, databases, e-infrastructures, methods, models, programs and demonstrators
- Increase capacities amongst others in taxonomy.

### Action 10.4: Coordinated efforts along the value chain from marine biomass to markets

**Objective:** Coordinated efforts along the value chain from marine biomass to markets to reduce the EUs dependency on imports of biomass

**Description:** Marine biodiversity offers a vast potential to develop new products with a wide range of applications ranging over pharmaceuticals, nutraceuticals, enzymes, dyes, cosmetics, biopolymers, feeds for aquaculture and new materials. Aquaculture of micro- and macro-algae can provide biofuels and products with a wide range of applications. Special attention should be paid to the delivery of marine biomass for multi-stream bio-refinery purposes. Major sources are macro- and microalgae, where suitable technology is being developed, but also other high volume organisms are being developed for aquaculture. Markets are expanding dramatically, and the exploitation of marine biomass may contribute substantially to reduce the imports of biomass to the EU, thus improving the European bio-economy, hence research should be market driven.

**Proposed Tool:**

Launch market driven multidisciplinary calls for proposals engaging biomass producers, technology providers and supported by marine scientists.

### Action 10.5: Promote infrastructures for marine bio-technology

**Objective:** Establish a partnership of virtual centres of marine bio-technology infrastructures to enable growth and jobs.

**Description:** Based on existing initiatives, JPI Oceans offers a flexible mechanism to develop cooperation between public research communities and the private sector. The development of a long-term network of biotechnology research infrastructures would strengthen the design and operation of marine biological production and harvesting systems by creating a critical mass.

This action will develop a European biotechnology research infrastructure vision and be based on existing initiatives like the ERA Marine Biotech and EMBRC.

**Proposed Tool:**

Capitalise on the knowledge and experience gained in different member-states for further optimization of nationally-based projects, cooperative initiatives and fund:

- Establishment of a European marine biotechnology institute or centre, at least virtual, through a permanent secretariat and network with key nodes.
- Development of a global biological research infrastructure vision to contribute to European capacities for a leading edge research in marine biology and biodiversity including those related to microbes and novel pharmaceuticals; databases, methods and programs for genome bioinformatics and computational biology, sequence and structure analysis, and molecular evolution; integration of classical methods of observational ecology with those of “omics” and numerical models.

## Cross-Cutting Initiatives

The cross-cutting initiatives are designed to be imbedded within the actions presented in the Strategic Areas where relevant (More information, see Chapter 1).

### Science-Policy Interface

Policy makers rely on high quality scientific information to support evidence-based policy decisions; this is especially true for marine and maritime areas. The challenge for the scientific community is to transfer reliable, robust and impartial scientific evidence into the complex policy arena. In the context of JPI Oceans, **science-policy** has two meanings. Being driven by policy makers, JPI Oceans must ensure that any scientific research carried out as part of a joint programming activity is effectively communicated to relevant policy mechanisms. Secondly, JPI Oceans is in a position to improve and add value to existing science-policy mechanisms.

#### Initiative 1: Better and faster use of existing knowledge from different disciplines

There is a wealth of scientific knowledge available throughout Europe on many different aspects of the marine environment. The challenge is how to make this knowledge easily visible and available to policy makers.

JPI Oceans could:

- Help stimulate work toward the integration of high performance computing, data analytics and visualisation facilities that make best use of all marine data, rapidly turning data into evidence for policy. While initiatives already exist, there is a lack of focus across both geographically and between scientific disciplines.
- Act as a clearing house and establish a repository of information of key activities and people in the marine and maritime science-policy interfaces. To make most use of the existing capacity this could include information from Member States, European and at an international level.

#### Initiative 2: Specific actions in relation to the implementation of the MSFD

The MSFD is currently one of the main policy drivers for the marine environment in Europe. Its implementation requires scientific knowledge from a range of disciplines to be used in a holistic way. While individual Member States have the responsibility of setting their own parameters, the requirement for comparability is crucial to the success of the policy at a European level.

JPI Oceans could facilitate sharing best practice and encourage cooperation between researchers, policy makers and regional science management organisations. Working with existing organisations, harmonized approaches and better coordination may be achieved.

#### Initiative 3: Stimulate Co-design of research programmes and science based policy at Pan-European Level

Co-design should be the core principle on which JPI Oceans establishes activities. It has the potential to create specific research activities that are designed from the start with specific societal or policy drivers in mind.

JPI Oceans could develop innovative approaches to coordination between Member States, based on the principles of co-designed research programmes, dual-use infrastructure for research and monitoring (see section on infrastructure), and greater data sharing.

#### Initiative 4: Signpost experts to relevant policy requirements

While scientists are often willing to engage in science-policy activities, it is sometimes the case that they are unaware of how to engage in the process. JPI Oceans could address this in several ways. It could provide capacity building to enable more effective engagement. JPI Oceans could establish a signposting mechanism to provide scientists with the opportunity to engage in relevant science-policy. It could also address the lack of recognition of scientists engaging in policy activities.

#### Initiative 5: Raise awareness of ocean issues to stakeholders, policy makers and general public

Promoting a healthy relationship between society and the ocean depends upon a sense of stewardship in the public and among policy makers. This requires education and engagement across society and could be supported by JPI Oceans in a number of ways, including:

- Providing a platform to discuss current ocean issues and speak with a unified marine/maritime voice to the EU. To convey research outputs to EU decision making bodies (EP, EC) which will promote a sustainable blue economy at the highest levels of policy;
- Providing a platform for research funders to identify the key issues and challenges that need to be addressed and communicated to the highest policy level;
- Coordination of foresight research (a) to avoid duplication and (b) to identify the best processes to put forward fit for purpose solutions.

### Human Capacity Building

Boosting capacity is essential to solve societal problems. The current ERA-net tools are too short to effectively invest in education such as PhDs. As a long term strategy, JPI Oceans is well placed create a strategy to ensure that capacity building is translated into actions.

#### Initiative 1: Training and education

JPI Oceans could develop funding opportunities for training and education within its actions. In particular, all long-term activities should support a dedicated PhD programme and training for scientists and technicians. JPI Oceans must ensure that human capacity building is coordinated with other initiatives.

As an intermediate step could be to fund projects for training in specific emerging issues in marine sciences. A structured initiative on human resources development should be aligned with the needs of marine and maritime sectors. It should take into account the need to bridge the gap between education/training and the labour market and actively promote the attractiveness of marine and maritime jobs.

#### Initiative 2: Jointly recognised educational modules

JPI Oceans could establish a portal to provide educational material for marine and maritime study. This could include: young scientists' tools, long-range training programmes, vocational education and training; doctoral and postgraduate grant information, joint training, teaching and exchange programmes, summer courses, master classes, international and collaborative research projects,



courses and networking for technicians. Action could also be taken to ensure that these are appropriate for different countries. Where relevant, JPI Oceans could establish University Platforms to cooperate on this initiative.

### Initiative 3: Develop science-policy capacities

JPI Oceans can take action to develop science-policy capacities through internal and external training and guidelines to help researchers transfer knowledge to policy. It could offer secondment opportunities to the JPI Secretariat and key policy bodies on European level, user workshops and training modules for communicating science to the media.

It could encourage participation in working groups, advisory bodies and workshops directly linked to international organizations and bodies responsible for providing scientific evidence to support policies. Some organisations have a permanent interface with policy bodies, allowing for active involvement between science and policy. In some cases a platform for scientists and policy makers has been set up in the framework of a project with the specific objective to compile current knowledge at regional level for implementation of ICZM.

### Initiative 4: Launch a Knowledge and Innovation Community (KIC)

JPI Oceans could promote the development of a Knowledge and Innovation Community in cooperation with the European Institute of Innovation and Technology (EIT). Such a community on marine and maritime fields of expertise would be based on strategic cooperation between a number of universities and research centres and a strong link with industry. Working towards a KIC would involve a proposal in accordance the EIT rules and would therefore benefit from EU-level funding. In addition it will add value by integrating education and entrepreneurship with research and innovation.

## Infrastructure: Shared Use and Common Procurement Strategies

The shared use of research infrastructures is typically a cross-cutting issue which would benefit from the new cooperation mechanism offered in the framework of JPI Oceans. A high political commitment and dialogue between the relevant authorities is required to ensure sustainable and cost-effective observing systems: JPI Oceans offers a platform for such a dialogue to develop common procurement strategies and associated business plans. These can be adapted for the optimal use of costly infrastructures, by bringing together relevant authorities, users and producers.

### Initiative 1: Development of a common vision for marine research infrastructure shared use and access

Cross-border access at European level is usually intended to offer the best suited infrastructures to EU scientists. This contributes to the optimal use of existing infrastructures. The trans-national access opportunities offered by various Framework Programmes projects are welcomed by scientists, but are limited in size and ambition.

The development of a common vision and actions for marine research infrastructure use and access in the framework of JPI Oceans would ensure cost effective coordination between science, monitoring needs and research infrastructure support. Depending on the research needs, shared use of infrastructure could be addressed either at regional scale, at pan-European level or even with the two dimensions combined for an optimal efficiency.

When appropriate, it may be effective to establish public-private partnerships. The shared use and access issue is particularly important in the field of research vessels, autonomous observing systems, marine laboratory coastal stations, experimental facilities for research in aquaculture and land-based facilities for ocean engineering. Not to mention the marine data issue which needs a shared vision of the e-infrastructures needed and will facilitate accessing and knowledge sharing, as well as agreements at Member State level for more data exchange and access.

### Initiative 2: Set-up common procurement strategies, develop common business plan

JPI Oceans can overcome the unconnected nature of decisions relating to larger investments in the field of research and monitoring infrastructures. This action would help to streamline and harmonise national infrastructures roadmaps. Developing common procurement strategies and business models would harness economies of scale, shared investment risk, standardisation and interoperability.

This action is particularly important in the field of research vessels. There is a need for strategic reassessment and coordination at European level of the oceanographic vessels as part of a broader European approach to marine research infrastructures. JPI Oceans could coordinate this assessment with member countries, the European Commission and existing initiatives.

Longer term public-private partnerships can be developed in the framework of JPI Oceans. Public-private partnerships are already in operation in Europe within the marine research communities, mainly regarding operation of robotic vehicles. Industry cooperates closely with governments and research institutes in the design and development of new RVs, ROVs and AUVs.

### Initiative 3: Strengthen land-based facilities and develop *in situ* testing sites for ocean engineering, shipbuilding, ocean energy, sub-sea technologies and instrumentation

Land-based testing sites allow marine technology to be tested under a range of conditions before being deployed into the ocean. Facilities include deep wave basins and wave flumes, water circulation canals, hyperbaric tanks, shock and vibration generators, climatic rooms, calibration laboratories.

These facilities are essential in developing technology for the deep-sea, monitoring and many types of ocean engineering projects. Joint actions at European level can make real progress to:

- Facilitate trans-national access to facilities to establish a European network of infrastructures;
- Support the design and development of new sub-sea technologies and common prototypes for both research and commercial uses with the maritime community;
- Develop a shared and clear vision for *in situ* testing site development.

# Annex I: Selected actions JPI Oceans Strategic Advisory Board

## 21 October 2014

### Introduction

The actions listed below were selected by the Strategic Advisory Board of JPI Oceans during their meeting on 21 October as priority actions for JPI Oceans. These were selected (in some cases adapted) from the 52 actions listed in the draft Implementation Plan sent to the Strategic Advisory Board in advance of the meeting.

During the meeting the StAB agreed that it would be impossible to select only 1-3 actions with high impact as a priority for JPI Oceans, as was asked by the Management Board. However the board agreed that they will assess all actions and attempt to select one action per strategic action which could be considered a priority for JPI Oceans. A list of the selected actions can be found below in addition to a short description of the scope of the actions and the possible implementation options. The text on the description and implementation options was made in cooperation with the StAB members who volunteered to review the text.

It should be noted that the action “Research on the environmental impact of deep-sea mining” was also identified as a priority action for the StAB. However, the StAB agreed that the action was already covered by the running pilot action “[Ecomining](#)”.

### Strategic area 2: Technology and sensor developments

#### Action: Materials, biomimetics and bionics

The proposed action has two focus areas:

- A. The **qualification of materials** (structural materials, coatings etc.) for new applications under **extreme environmental conditions** e.g. in the offshore energy sector, the exploitation of marine resources and in maritime transport, and
- B. The **development of new materials**, structures and functional principles by learning from nature (bionics and biomimetics)

New applications for maritime technologies in extreme environments (deep sea, sea bed, arctic) require new material properties and functions which need to be reliable (safe), efficient (economically feasible) and environmental friendly (with respect to their carbon footprint and their interaction with marine eco-systems) over their entire life cycle. Latest developments in material sciences (e.g. smart- and nano-materials) bear potentials for maritime operations, but their long term properties in extreme environments are currently not sufficiently known. To overcome this situation, modeling techniques and laboratory tests – usually applied in material development need to be complemented by long term and real life tests. Those tests can usually not be implemented in the frame of traditional research projects, as they are too expensive and/or too long lasting. Tests of new materials under extreme real life conditions are needed to validate and tune numerical models and accelerated lab tests, to ensure the reliability of those materials and to develop corresponding rules and legislation.

Nature has a much longer experience of “operating” under extreme environmental conditions at sea and the “solutions” developed by nature are often more efficient, reliable and environmentally

friendly than “human made technologies”. The second line of actions shall therefore aim to learn from natural strategies to cope with extreme environments and adopt them to improve maritime technologies. This applies for structural materials as well as protection mechanisms against ageing and fouling. Research shall also aim to adopt natural mechanisms for the “creation” of natural solutions for a more efficient and environmentally friendly production of technological solutions and for natural renewal and cleaning solutions to make technologies more long lasting and reliable.

#### Implementation Options:

- **Structuring measures:**
  - o **Focus area A. and B.:** joint calls between the BLUE GROWTH priority, environment and NMP in H2020 to maintain the necessary budget for a large scale and long term (5 years) project;
  - o **Focus area A.:** EU, national or regional (InterReg, BONUS) support for long term testing of new materials for marine environments using existing research infrastructure, such as the SMARTBAY in Ireland or FIDO in Germany; potentially financed by the research infrastructure program in H2020
  - o **Focus area A.:** support for rule and legislation development within the European programme for standard development
  - o **Focus area B.:** Smaller project calls under a follow-up of ERA-NET MARTEC (COFUND MARTEC under BLUE GROWTH)?
  
- **Cooperation Requirements:** The topic requires a close cooperation between marine scientists and their corresponding research infrastructure and maritime technologies (e.g. the Waterborne WG on BLUE GROWTH). In medium term, this cooperation could be implemented in a PPP on the Exploitation and Protection of Oceans by Maritime Technologies under H2020.
  
- **Risks:** Lacking involvement of material developers, maritime technology developers and the industry related to the exploitation of oceanic resources will lead to an insufficient impact and market uptake of the research. The involvement of marine environmental experts is needed to protect the environment and marine eco-systems and allow for a sustainable operation. In particular item a) requires resources and time, which are not available in any of the individual funding mechanisms existing to date.
  
- **Science-Policy Interface:** Research shall take future developments of rules (e.g. IMO, class rules) and legislation into account and feed back the knowledge gained into new rules and legislation. This should primarily be implemented by the member states and their involvement in IMO, MARPOL and SOLAS.

#### Action: Sensor development for autonomous operation

The action aims to develop new sensors to monitor physical, chemical and biological parameters by integrating knowledge on marine environmental research, nanomaterials, electronics, biotechnology and ICT. This should include the miniaturization and improvement of power systems of both platforms and sensors to increase their autonomy. The action will also examine the adaptation and design of

fixed and mobile platforms to enable better interaction, long-term series of data, real-time data transmission and the exploration of deep and remote areas.

**Implementation options** (first start input by the Secretariat):

- **Structuring measures:**
  - o **Research and innovation:** A flexible industry driven research programme based on a joint approach between marine scientist and engineers.
- **Supporting actions:** feasibility study

## Strategic area 3: Science support to coastal and maritime planning and management

### Action: Enhance research on the land-sea interface by increasing the role of integrated models

JPI Oceans will launch a transnational and multidisciplinary initiative to align investments and develop knowledge and modelling tools specifically focused on the interface region between land and sea, an area affected by drivers and activities regulated by often uncoordinated policy and policy objectives. Integrated modelling tools are expected to assist implementation of both Marine Spatial Planning (MSP) and Integrated Coastal Zone Management (ICZM) approaches. Emphasis will be on developing options to adapt to climate change and manage the increasing volume and nature of human activities while minimising their impacts. Efforts must include the collection of coherent measurements at the land/sea interface, i.e. within the catchment through estuarine and intertidal regions into the marine environment. The initiative should focus on cross-border areas across Europe, including areas especially sensitive to climate change, where cooperation between countries is needed to ensure the governance.

The action should mainly provide better baseline information for coherent implementation of policy and lead to better governance and use of existing and new numerical models. The combination of land-based and marine ecosystem models and economic dynamics models is expected to develop new services based on user requirements.

**Implementation options:**

- **Structuring measures:**
  - o **Research and innovation:** joint funding calls, engaging structural funds;
  - o **Connectivity:** research alliances, knowledge hubs, networks of people, mutual opening of programs, interaction with existing ERA-nets or BONUS, establishment of ERA-Net Cofund;
  - o **Capacity building:** mobility of human resources, accessing/sharing marine infrastructures, procedures/agreements for transnational access and sharing of infrastructures, access to data;
  - o **Supporting actions:** impact assessments, workshops, foresight,
- **Required cooperations or exchange:** The JPI Oceans action should add value to and build further in an integrated way on

- Example of SEASERA project EMOSEM (joint funding from Belgium, France and Portugal)
  - HELCOM steered or used projects who's development on this issue is more advanced than for the North Sea, see also TARGREV project and new BONUS project SOIL2SEA (which still has too limited involvement of socio-economic sciences). The right novel question to ask and solve would be for example: How do you design a social and economic model to define a cost-efficient nutrient reduction?
  - JRC modelling initiatives (see FATE and impact of pollutants in terrestrial and aquatic ecosystems) at European scale (so no local resolution included here) presented also for example at OSPAR meetings.
  - ICES initiatives on integrated ecosystem modelling and integrated ecosystem assessments in ICES regional seas.
  - National project examples (LUSI in BE, ....)
- **Risks:** potential overlap needs to be verified with Interreg programs or launched EC calls (exchange needed on the focus of the work carried out which will likely not be on integrating models for the other programs)
  - **Science-Policy Interface considerations:** Politically the issues are addressed through various directives:
    - Integrated Coastal Zone Management
    - Nitrates Directive & Urban Waste Water Treatment Directive
    - WFD & Marine Strategy Framework Directive (MSFD) (EC, 2008) addressing Good Environmental Status,
    - Shellfish Directive focusing on shellfish growth quality conditions in the EU coastal waters
    - Bathing Water Quality Directive

## Strategic area 4: Linking oceans, human health and wellbeing

### Action: Interdisciplinary research on ocean and human health issues risks and benefits

Securing human health by reducing the burden of disease and improving the quality of the global environment are two grand challenges which top the policy agenda of governments worldwide. The close association between environment and health is now well-established at least for terrestrial environments; there is however a growing recognition that the marine environment and human health and wellbeing are interlinked in ways we are only beginning to understand. The effects can be classified in terms of both risks and benefits. Three main axes should be considered to address truly interdisciplinary research in this area:

4. Understanding the public health burden from human interactions with the ocean;
5. Investigating the processes involved in the transport and transmission of toxins (biogenic) and toxicants (man-made) from the marine environment to humans;

6. Exploring the benefits to human wellbeing of interacting with coastal and marine environments.

The first axis focuses on the range of negative consequences for human health (including loss of life) arising from coastal and marine ecosystems that are changed, damaged or degraded as a result of natural disasters or human exploitation. The second axis needs to advance our understanding of the physical, chemical and biological processes involved in the transport, transfer, degradation and effects of toxic chemicals and their degradation products, pathogenic organisms and toxic metabolites through the marine environment to humans. This includes the impact of consumption of contaminated sea-food or toxins produced by the phytoplankton species involved in harmful algal blooms (HABs) which can lead to a range of chronic and acute symptoms. A sufficient predictive capability for both biotic and abiotic environmental influences on human health and well-being can only be developed with expertise from a diverse range of disciplines across natural, social and economic sciences, including public health and medicine.

The third axis would contribute to the increasing research evidence on the health promoting and wellbeing benefits for people interacting with the coastal and marine environment (referred to as “Blue Gym”).<sup>14</sup> During the last decade, there has been a significant investment in multi-disciplinary oceans and human health research programmes in the USA. Europe can similarly benefit from the development of a holistic and coherent transnational oceans and human health research effort, involving leading scientists from across Europe.

#### Implementation options:

- **Policy measures:** Ensuring cooperation between agencies/Ministries responsible for funding health and environment/marine research to address key interdisciplinary questions.
- **Structuring measures:**
  - o **Research and innovation:** joint calls, Horizon 2020 topics and engaging structural funds;
  - o **Connectivity:** Specific initiative to develop an interdisciplinary, transnational oceans and human health community in Europe;
  - o **Capacity building:** Human capacities: Develop dedicated graduate training programmes in oceans and human health; Development of one or more OHH Centres of Excellence.
  - o **Supporting actions:** feasibility study, impact assessments, workshops, foresight, emergencies, emerging issues.
- **Risks:** Key risk is the inability to ensure participation of the Health community (public health, epidemiology, medicine etc.) who are currently less engaged. A possible barrier but also a possible opportunity
- **Science-Policy Interface considerations:** Politically the issues are addressed through various directives and actions such as:

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<sup>14</sup> Bowen et al., 2006; Fleming et al., 2006; Fleming and Laws, 2006; Walsh et al., 2008; Bowen et al., 2014.

- Marine Strategy Framework Directive (MSFD) (EC, 2008) addressing Good Environmental Status.
- Common Fisheries Policy (CFP) on seafood,
- Shellfish Directive focusing on shellfish growth quality conditions in the EU coastal waters
- Bathing Water Quality Directive, focusing on water quality and pathogens.
- However we fail to address the issue of oceans, human health and wellbeing effectively through an interdisciplinary and holistic approach. This failure implies that we lack accurate datasets to detect chemical/material pollutants, biogenic toxins and human pathogens and improved testing for seafood and water quality and safety as well as understanding the patterns and extent of natural dispersion of sewage, agricultural effluents and industrial waste.

## Strategic area 5: Interdisciplinary Research for Good Environmental Status

### Action: Build a flexible expert system to address emergency issues

Rapid and radical degradation of the world' seas and oceans is triggering increasing calls for more effective approaches to protect, maintain and restore marine ecosystems. A number of potentially high risk sources of pollution are not considered within the framework of classical monitoring programmes (e.g. leakage or release from remaining oil in wrecks, discharge of contaminants from petrochemical or nuclear plants, engine room effluent discharges, dumped munitions and radioactive substances, as well as remobilisation of pollutants from historical dumping sites at sea, etc.). In the event of worst-case scenarios, with a simultaneous and rapid release of toxic compounds (i.e. radioactivity) to the marine environment, epidemiological consequences would be massive and highly challenging to manage.

Emergency preparedness programs shall enable emergency personnel to rapidly identify, evaluate, and react to a wide spectrum of emergencies, including those arising from the massive release of toxic compounds which, according to their nature, might affect human health directly (*i.e.* radioactive compounds) or through the trophic chain (metals, organic compounds etc.).

Solid scientific approaches and risk assessments for how to handle and remediate this pollution source are needed. These actions, though typically adopted at local or, in a few cases, regional scale, need cross-border cooperation, in order to exchange best practices, frontier and basic research and capture the benefits from past experiences, emerging science and technology opportunities.

JPI Oceans is well placed to establish topic related panel(s) to feed into international flexible contingency systems, allowing scientific experts to inform on urgencies or emerging issues at sea and provide scientific information on and possible technological and innovative solutions to deal with the situation. Handling these issues in a proactive efficient way is costly, but not taking action is likely to be even more expensive in the long term.



### Implementation options:

- **Policy measures:** The integration of safety, security, and emergency preparedness is essential to applying marine management's primary mission of protecting public health and safety. Suitable strategies shall be based on modular cross-ministry national efforts under the coordination of an International Board (IntB), reporting to National Ministries of Foreign Affairs. The IntB can be regarded as a "cross-JPIs platform" where EMSA would have a seat. The IntB shall provide advice and assistance to international organizations and JPI Oceans countries to develop effective regulatory measures and enforce rigorous safety standards. The IntB shall facilitate those international activities that are mandated by EU law or international treaties and conventions (*i.e.* the International Atomic Agency, the Nuclear Energy Agency). Other activities shall be taken forward through regulatory and research cooperation agreements or on a voluntary basis.
  
- **Structuring measures:**
  - o **Research and innovation:** At the beginning, joint calls and/or public procurement shall enable multidisciplinary research efforts (*i.e.* integrating the chemistry of the environment, public health patterns, features and history of industrial activities etc.) towards a preliminary mapping of the state of art context. In addition structural funds can be engaged as well. In some specific cases (*i.e.* IMO ballast water program), actions might relate to previous efforts. Further joint calls shall tackle intervention strategies, with a focus on the best available practices and technologies.
  - o **Connectivity:** research alliances, knowledge hubs (including those with diplomatic implications), networks of people, network of bilateral agreements, mutual opening of programs, interaction with existing ERA-nets or BONUS, establishment of ERA-Net Cofund. Interactions should go along with medium to long term joint research programs that shall facilitate information exchange, periodic analysis, and joint data collection activities.
  - o **Capacity building:** training, mobility of human resources, accessing/sharing marine infrastructures, procedures/agreements for transnational access and sharing of infrastructures, access to data; IntB shall also provide opportunity to citizens to learn and be heard by means of meetings open to the public, media resources, fact sheets and brochures.
  - o **Supporting actions:** Feasibility studies and use of risk analysis methods to support decision making throughout the regulatory process. Performance analyses for waste disposal and decommissioning, shall evaluate the potential releases of toxic compounds (*i.e.* radioactivity) into the environment, and assess the resultant doses to demonstrate whether a disposal facility has met its objectives. Review and assessment of regulatory proposals shall guarantee correct advice by means of final reports that will be addressed, through the IntB, to the Ministries of Foreign Affairs or national protection agencies.
  
- **Required cooperations or exchange:**

The IntB shall participate with international organisations dealing with risks / emergency and safety issues: e.g. the International Nuclear Regulators Association (INRA), the International Atomic Agency (IAEA), the Nuclear Energy Agency (NEA) and, more in general, the

Organization for Economic Corporation and Development (OECD). More direct cross links shall be foreseen with the European Maritime Safety Agency (EMSA) and the International Maritime Security Organisation (IMO) to coordinate actions on a synergic basis. The IntB shall also develop ad hoc bilateral agreements at various scale to facilitate information exchange arrangements and joint intervention plans. This can also be considered with regards to assistance to less-developed countries in their attempts to prevent accidents and to develop and improve their regulatory capabilities and safety infrastructure.

- **Risks:** Potential overlap needs to be verified, particularly with IMO (i.e. the ballast water management convention and related programs), EMSA and national coast guards. Risk management plans and procedures for disasters, which are established at national level, should be fine-tuned which specific scientific expertise and overall plans. This requires important coordination steps integrating different sectors (including diplomacy).
- **Science-Policy Interface considerations:**  
Science to policy interfaces will intervene at different steps and will especially focus on rules and guidance development issues (including standards and new protocols), and assessment of performance (as a support to inspections).

## Strategic area 6: Observing, modelling and predicting ocean state and processes

### Action: Support e-infrastructures for computing, modelling and forecasting (including early warning systems and provision of services to end users)

In the era of climate change, efforts towards observing, modelling and predicting ocean state and functioning are of paramount importance. JPI Oceans takes cognisance of the enhanced national and European efforts to develop observation technologies, coordinate observation networks and harmonize protocols. Further integration is required to develop modelling approaches that address inter-disciplinary prediction in complex environments (e.g. coastal & marine hazard tracking, integrating ecosystems, climate and economics). This will take into account the ecosystem approach, and needs improvements in high resolution prediction of the future evolution of marine ecosystems under different scenarios. JPI Oceans role in this objective should focus on improving and fostering access to existing high performing computing facilities (e.g. PRACE), to ocean modelling frameworks, allowing several ocean related components of the earth system to work together or separately (e.g. NEMO ) and to forecasting capacities (e.g. My Ocean). In addition JPI Oceans should set up a common view on H2020 international calls, notably on e-infrastructures calls on the “Research Data Alliance”. In general, the e-infrastructure support should be aimed at reducing the level of uncertainty in prediction within the ecosystem approach and respond to policy needs in ocean monitoring.

#### Implementation options:

- **Structuring measures:**
  - o **Research and innovation:** joint calls for European infrastructure facilities, joint public procurement, engaging structural funds;

- **Connectivity:** research alliances, knowledge hubs, networks of people, mutual opening of programs, interaction with existing ERA-nets or BONUS, establishment of ERA-Net Cofund;
  - **Capacity building:** training, accessing/sharing marine infrastructures, procedures/agreements for transnational access and sharing of infrastructures, access to data;
  - **Supporting actions:** foresight exercises, emerging issues.
- **Risks:** Essential to activate initiatives in coordination with research calls that would make use of the e-infrastructure, to avoid having the e-infrastructure without activity research (e.g. idling infrastructure).

## Strategic area 7: Climate change impact on physical and biological ocean processes – Oceans circulation

### Action: Impacts of climate change on surface ocean circulation and effects on pelagic ecosystems and ecosystem dynamics

This action is specifically targeted to ascertain how climate change and climate variability in the Arctic and North Atlantic oceans and regional seas is affecting the ocean currents, including changes in temperature and salinity leading to changes in the Gulf Stream, Thermohaline circulation, North Atlantic Drift, Azores, Canary and Iberian Currents, including changes in upwelling and downwelling intensities and geographical locations. This activity is about coordinated monitoring of ocean physics and on how these changes affect pelagic ecosystems, including primary production, biogeochemical processes, trophic web interactions, abundance and distribution of marine organisms and resources, changes in biodiversity and the spread of invasive species.

The reliability and spatial resolution of the current oceanographic models need to be improved to develop and integrate more modern scenario and risk modelling of climate change on sub-regional and local scales, supported by a long-term monitoring effort at the proper spatial and temporal scales. This requires a strong coordination of existing big infrastructures, such as research vessels, autonomous and fixed observing systems (such as Argo floats, gliders, moorings, etc.) and remote sensing to provide information on several physical, chemical and biological key ocean variables (such as SST, chlorophyll, winds, altimetry, etc.) with a wide spatial and temporal coverage.

#### Implementation options:

- **Structuring measures:**
  - **Research and innovation:** joint coordination calls, joint public procurement, engaging structural funds under single research agendas;
  - **Connectivity:** research alliances,, mutual opening of programs, interaction with existing ERA-nets or BONUS, establishment of ERA-Net Cofund, establishment of integrated knowledge hubs;

- **Capacity building:** training, mobility of human resources, accessing/sharing marine infrastructures, procedures/agreements for transnational access and sharing of infrastructures, access to data;
  - **Supporting actions:** implementation workshops, foresight exercises, assessment of emerging issues.
  - **Required cooperations or exchange:** Involvement of national institutes and research centres in monitoring key essential variables, and expertise of universities and other marine research centers to complement the work through more targeted studies within this action. Coordination with Canadian and American initiatives would be desirable.
- **Risks:** Lack of coordination across the European landscape may result in oversampling certain regions or processes to the detriment of others. Risk would include loss of partnership in regions not supported by the actions.

## Strategic area 8: Effects of ocean acidification and warming on marine ecosystems

### Action: Monitoring the variability and combined effects of acidification and warming on the upper ocean layer

Ocean Acidification (OA), often referred to as the other CO<sub>2</sub> problem, has been recognized as one of the major challenges for marine ecosystems in coming decades. This has resulted in a number of national and European efforts to investigate the impacts of OA on individuals and communities. However, monitoring of OA across the European regions, from estuaries and coasts to open ocean, and its relationship with warming, remains largely underdeveloped. This action will aim at contributing to existing research efforts on the effects of ocean acidification, de-oxygenation and warming, with strengthened monitoring efforts on the variability and trends in these parameters in under-sampled areas, with common methods and protocols. Monitoring should include overarching research on the consequences of trends for the structure and functioning of ecosystems, such as increasing stratification of the water column and associated consequences.

In particular the action is aimed at providing a baseline of variability and change in OA and warming across regions, identifying tipping points and thresholds for these regions. In addition the actions aims at understanding the effects of OA and warming on the vertical nutrient supply and on the resulting biological productivity and microbial processes in the water column. Work needs to be coordinated with national and European research on the knock-on effects of altered productivity throughout marine ecosystems (e.g. biodiversity, composition and abundance of planktonic communities and the effect on higher trophic levels) and on the effects on the chemical properties of seawater, on biogeochemical cycles and on the ocean-atmosphere exchange and absorption of important gases and substances. This programme should particularly focus on key areas where changes are occurring more rapidly (e.g. the Arctic), where variability is larger (e.g. estuaries and coasts) as well as on areas particularly sensitive to climate change (e.g. the Mediterranean).

#### Implementation options:

- **Policy measures:** inclusion of this activity in national and European monitoring requirements

- **Structuring measures:**
  - o **Research and innovation:** joint calls, joint public procurement, engaging structural funds;
  - o **Connectivity:** research alliances, knowledge hubs, networks of people, network of bilateral agreements, mutual opening of programs, establishment of ERA-Net Cofund;
  - o **Capacity building:** training, accessing/sharing marine infrastructures, procedures/agreements for transnational access and sharing of infrastructures, access to data;
  - o **Supporting actions:** feasibility study, impact assessments, workshops, foresight,...
  
- **Required cooperations or exchange:** The action requires a concerted effort across European countries (involving national institutions, universities and other research centres) and also the cooperation with regional and international organizations (e.g. ICES, OSPAR, IOC, networks) to build on the current efforts of the international community. Cooperation with third countries may be important to address the problem in some specific areas or regions.  
 The programme should be supported by an infrastructure network (see Strategic area 7, Action 7) to efficiently collect the data from in situ monitoring of research vessels, underwater vehicles, autonomous monitoring platforms (drifters, gliders, etc.) and fixed stations (both in the water column and the sea bottom). The data should be complemented, particularly for the processes in the upper layers, with satellite data. This infrastructure network should also provide facilities to conduct experiments needed to understand single and combined impacts of ocean warming and acidification on organisms and ecosystems.
  
- **Science-Policy Interface considerations:** Better links between science and the development of local policy on risk assessment are essential.

## Strategic area 9: Food security and safety driving innovation in a changing world

### Action: Interactions between marine aquaculture and fisheries and land-based food production

Ensuring sufficient and healthy food for a world in excess of 9 billion humans has been widely recognised as one of the largest challenges of the 21<sup>st</sup> century. With less than 5% of the total food production, the oceans are targeted as providing opportunities for growth and development of food systems. Aquaculture is the fastest growing food production system, and currently relies excessively on capture fisheries as feeds, in the form of fishmeal and fish oil. Partial replacement of fishmeal in carnivorous aquaculture has been achieved using land-based soymeal. The price increases of both reflect the limits to fishmeal production and the increased competition for soymeal from other evolving markets such as biofuels. JPI Oceans recognises that the challenges in this initiative include the development of more efficient aquaculture production less reliant on fishmeal and the development of global governance policies and principles to set common objectives for the use of globalised food commodities. Equally, the development of efficient science-based disaster risk

management and adaptation in aquaculture and fisheries needs to ensure the oceans increase their footprint in securing food in the future.

#### Implementation options:

- **Policy measures:** Support for the development of governance discourses and measures that holistically address all food production systems.
  
- **Structuring measures:**
  - o **Research and innovation:** joint interdisciplinary research calls between natural, social sciences and the humanities., engaging structural funds;
  - o **Connectivity:** research alliances, knowledge hubs, networks of people, network of bilateral agreements, mutual opening of programs, establishment of ERA-Net Cofund;
  - o **Capacity building:** mobility of human resources, access to data;
  - o **Supporting actions:** feasibility studies, workshops, foresight.
  
- **Required cooperations or exchange:** Actions in this area have to be taken in close cooperation with organisations such as ICES, regional conventions, and FAO to deliver timely results relating to science and policy needs in this area
  
- **Risks:** What kind of risks would be there in the further preparation of the activity: potential overlaps, lack of involvement of key stakeholders, etc.? As a truly social challenge this requires integration across disciplines which are generally accessing funding from different sources and mechanisms.

## Strategic area 10. Use of marine biological resources through development and application of biotechnology

### Action: Coordinated Efforts along the Value Chain from Marine Genetic Resources to Markets for sustainable Blue Growth

Joint effort for valorisation of biological resources is needed to make the application of biotechnologies and marine bio-discovery activities a success. Bio-prospecting is resource-intensive and one of the reasons is the administration burden of the new EU regulation on access and benefit sharing which entered into force in October 2014. The regulation will oblige users (such as the feed and food industry, the pharmaceutical and cosmetics industry and researchers) to exercise due diligence to ascertain that genetic resources and associated traditional knowledge which they utilise have been accessed in accordance with the applicable legal requirements, and that the benefits are fairly and equitably shared in accordance with mutually agreed terms. Every member state will designate one or more competent authorities responsible for the application of the regulation. The competent authorities will, inter alia, carry out checks to verify users' compliance with their obligations. In order to counteract any constraints having implications on marine biotech research a long-term strategy is needed to organise the suitable structures and an agenda to enable countries to efficiently protect and share data and samples, and create an open and successful research landscape in marine biotechnology.

Another important issue (not addressed by the ERA-NET Marine Biotech) is the need for a secured and sustainable access to marine biomass. This requires the development of new demonstrators to upscale the culture of marine biomass (algae, bacteria, sponges etc). It could also be focused on the improvement of existing demonstrators/facilities in order to facilitate international access and support the up-scaling process from the lab to the industry (feasibility studies and proof of concept).

**Implementation options:**

- **Fit-for-purpose financing tool:** Horizon 2020 – ERA-Net COFUND call
- **Required cooperations or exchange:** an exchange with the Marine Biotech ERA-Net.
- **Science-Policy Interface considerations:** Better IPR frameworks are needed. This includes frameworks for material transfer agreements (MTAs) to enhance cooperation across countries in the fields of biodiversity and genetic resources.

## Annex II: Deliverables from the FP7 Concerted Support Action

CSA Oceans is an EU FP7 project which facilitated the implementation of JPI Oceans in its start-up phase. The project was launched on 1 September 2012. The Deliverables of CSA Oceans have been instrumental in developing the Strategic Research and Innovation Agenda and the Implementation Plan.

Identification of new and cross-cutting technologies and solutions to boost blue growth, 2014 [View](#)

Improving Science-Policy Interfaces: Recommendations for JPI Oceans 2014 [View](#)

Mapping and preliminary analysis of infrastructures, observation - data and human capacity building 2014 [View](#)

Mapping and preliminary analysis of policy needs for evidence 2014 [View](#)

Mapping of maritime research and innovation strategies and funding 2014 [View](#)

Needs and gaps analysis in marine sciences to feed the SRIA 2014 [View](#)

Needs and gaps in infrastructure and human capacity building to feed the SRIA 2014 [View](#)

Proposal for procedures for design and management of joint actions 2014 [View](#)

A programmatic foresight process for JPI Oceans 2013 [View](#)

Communication plan JPI Oceans 2013 [View](#)

Update the JPI Oceans Early gap analysis 2013 [View](#)

Foresight for JPI Oceans - Definition and review of relevant processes 2012 [View](#)

Strategic Research and Innovation Agenda



## Annex III: Stakeholders Invited to take part in CSA Workshops

<b>United Nations Organisations and Expert Groups /International Organizations</b>	
GOP	Global Partnership for Oceans
IBPES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IHO	International Hydrographic Organization
POGO	Partnership for Observation of the Global Oceans
SCAR	Scientific Committee for Antarctic Research
SCOR	Scientific Council for Oceanographic Research
PICES	North Pacific Marine Science Organizations
WIOMSA	Western Indian Ocean marine Science Association
CARTAGENA CONV	Convention for the protection & development of the marine environment in the wider caribbean region
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change (UNESCO)
WMO	World Meteorological Organization
<b>Policy and Regional Conventions/Advisory bodies</b>	
ACFA	Advisory Committee on Fisheries and Aquaculture
BARCELONA CONV/MAP-UNEP	Barcelona convention
Black Sea Commission	Bucharest Convention - The Black Sea Commission
GCFM (FAO)	General Fisheries Commission for the Mediterranean
HELCOM	Helsinki Commission
OSPAR	Oslo/Paris convention for the Protection of the Marine Environment of the North-East Atlantic
SCAR Fish	Standing Committee on Agricultural Research (SCAR)
STEF	Scientific, Technical and Economic Committee for Fisheries
UNEP/MAP-MEDPOL	Programme for the Assessment and Control of Marine Pollution in the Mediterranean Region
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CECAF	Fishery Committee for the Eastern Central Atlantic
CPS	Secretariat of the Pacific Community
NAFO	North Atlantic Fisheries Commission
PROE/SPREP	Secretariat of the Pacific Regional Environment Programme (SPREP)

<b>European Union Institutions</b>	
DG MARE	Directorate General for Maritime Affairs and Fisheries
DG ENV	Directorate-General Environment
DG RTD	Directorate-General for Research and Innovation
DG ENTR	Directorate-General Enterprise and Industry
EEA	European Environment Agency
JRC	Joint Research Centre
EMSA	European Maritime Safety Agency
EFSA	European Food Safety Authority
EFCA	European Fisheries Control Agency
<b>ERA activities (ERA-NETs, Art 185)</b>	
Biodiversa ERA-NET	Cooperation and shared strategies for biodiversity research programmes in Europe
BONUS EEIG	Baltic Organisations Network for Funding Science
BS ERA-NET	Networking on science and technology in the Black Sea region
COFASP ERA-NET	Strengthening cooperation in European research on sustainable exploitation of marine resources in the seafood chains - ERA-NET
Marine Biotech CSA	CSA (Coordinating) in Marine Biotechnology
MARTECII	ERA NET - Maritime Technologies II
SEAS-ERA	Towards Integrated Marine Research Strategy and Programmes
Susfood	ERA NET on SUSTainable FOOD production and consumption
<b>European Scientific Organizations and Associations</b>	
CIESM	The Mediterranean Science Commission
ICES	International Council for the Exploration of the Sea
European Marine Board	European Marine Board
EFARO	European Fisheries and Aquaculture Research Organisation
ECORD	European Consortium for Ocean Research Drilling
MARS	European Network of Marine Research Institutes and Stations
EUROMARINE	Integrating of European Marine Research Networks of Excellence
EMECO	European Marine Ecosystem Observatory
EAS	European Aquaculture Society
European Polar Board	European Polar Board
<b>International Programmes</b>	
CLIOTOP	International Programme on Climate Change impact on top predators
DIVERSITAS	DIVERSITAS an International research programme of biodiversity science

ESSP (Future Earth)	Earth Systems Science Partnertship
GCOS	Global Climate Observing System
GEO BON	Group on Earth Observations Biodiversity Observation Network
GEOHAB	International programme of Harmful Algae
GEOSS	Global Earth Observation System of Systems
GLOSS	Global Sea Level Observing System
GOOS	Global Ocean Observations Systems
ICRI	International Coral Reef Initiative
IGBP	International Geosphere-Biosphere Programme
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
IOCCP	The International Ocean Carbon Coordination Project (IOCCP)
IPBES	International Programme Biodiversity and Ecosystems Value
SOLAS	Surface Ocean - Lower Atmosphere Study
WCRP	World Climate Research Programme (CLIVAR)
<b>Infrastructure Initiatives and Organizations</b>	
AQUAEXCEL	Aquaculture infrastructures for excellence in European fish research
ASSEMBLE	European Network of Marine Research Institutes and Stations
Black Sea GOOS	Black Sea Global Ocean Observing System
BOOS	Baltic Operational Oceanographic System
COOPEUS	
Copernicus	The European Earth Observation Programme
EMBRC	European Marine Biological Resource Centre
EMSO	European Multidisciplinary Seafloor Observatory
ERVO	European Research Vessel Operators
EUROFLEETS II	FP7 funded infrastructure project - Towards an Alliance of European Research Fleets
EUROGOOS	European Global Ocean Observing System
EuroMarine	FP7 coordination and support action designed to bring together the three FP6 marine Networks of Excellence (NoE) communities; EUR-OCEANS, MarBEF and Marine Genomics Europe
EuroSites	FP7 Collaborative Project forming an integrated European network of nine deep-ocean (>1000m) observatories
EUSEAMAP	Mapping European seabed habitats
GROOM	Gliders for Research, Ocean Observation and Management
HYDRALAB IV	Hydraulic and ice engineering research infrastructures
IBIROOS	Ireland-Biscay-Iberia Regional Operational Oceanographic System
I-MARINE	Data e-infrastructure Initiative for Fisheries Management and Conversation of Marine Living Resources
JERICO	TOWARDS A JOINT EUROPEAN RESEARCH INFRASTRUCTURE NETWORK FOR COASTAL OBSERVATORIES - FP7 funded

	project
LIFEWATCH	e-Science European Infrastructure for Biodiversity and Ecosystem Research
MARINET	Marine Renewables Infrastructure Network
MESOAQUA	Network of leading MESOcosm facilities to advance the studies of future AQUAtic ecosystems from the Arctic to the Mediterranean FP7 funded project
MODEG-EMODNET	Marine Observation and Data Expert Group (European Marine Observation and Data Network-EMODNET expertgroup)
MONGOOS	Mediterranean Global Ocean Observing System
MyOcean	FP7 funded project under the Global Monitoring for Environment and Security
NOOS	North-West Shelf Operational Oceanographic System
ODIP	
OFEG	
SEADATANET II	PAN-EUROPEAN INFRASTRUCTURE FOR OCEAN & MARINE DATA MANAGEMENT
SIDERI	Strengthening International Dimension of Euro-Argo Research Infrastructure
SIOS	Svalbard Integrated Arctic Earth Observing System
UPGRADE BS SCENE	Up-grade Black Sea Scientific Network
Wise marine	European data and information management system for the marine environment
<b>Technology platforms/Industry, Innovation &amp; Economic Associations</b>	
AIPCE-CEP	European Fish Processors Association - European Federation of National Organisations of Importers and porters of Fish
CESA	Community of European Shipyards' Association
DCNS	
ECMAR	European Council for Maritime Applied R&D
ECSA	European Community Shipowners' Association
EIP Raw Materials	European Innovation Partnership Raw Materials
EMEC	European Marine Equipment Council
ENMC	European Network of Maritime Clusters
EOEA	European Ocean Energy Association
EuDA	European Dredging Association
EURACS	European Association for Classification Societies
EURMIG	EU Recreational Marine Industry Group
EUROGIF	European Oil and Gas Innovation Forum
EWEA	European Wind Energy Association
FEAP	Federation of European Aquaculture Producers
OGP	International Organization of Oil and Gas Producers
EATIP	European Aquaculture Technology and innovation Platform
EFTP	European Fisheries Technology Platform

EuMaT	European Technology Platform for Advanced Engineering Materials and Technologies
Integral Satcom Initiative ISI	European Technology Platform on Satellite Communications
TPWind	European Wind Energy Technology Platform
Waterborne	Waterborne Technology Platform
<b>Organisations to contact individually by videoconference</b>	
OECD	Organisation for Economic Co-operation and Development
WOC	World Ocean Council
TAFTIE	European Network of Innovation Agencies
CPMR	Conference of Peripheral Maritime Regions
EurOCEAN	European Centre for Information on Marine Science and Technology
<b>EU FP7 Collaborative projects</b>	
AQUAMED	The future of research on aquaculture in the Mediterranean Region
CLAMER	Climate Change and European Marine Ecosystem Research
COCONET	Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential
COEXIST	Integration of aquaculture and fisheries in the coastal zone
COMFISH	Strengthening the impact of fisheries related research through dissemination, communication and technology transfer
CoralFISH	
DEEPFISHMAN	Deep Sea Fisheries Management
DS <sup>3</sup> F	The Deep Sea & Sub-Seafloor Frontier
EMAR2RES	Support action to initiate cooperation between the communities of European MARine and MARitime REsearch and Science
EUROBASINS	Basin-scale Analysis, Synthesis and Integration
FISHPOPTRACE	Fish population structure and traceability
HERMIONE	Hotspot ecosystem research and Man's impact on European seas
KNOWSEAS	The Knowledge-based Sustainable Management for Europe's Seas
LIFECYCLE	Building a biological knowledge-base on fish lifecycles for competitive, sustainable European aquaculture
MARCOM+	Towards and Integrated Marine and Maritime. Science Community
MAREX	Exploring Marine Resources for Bioactive Compounds: From Discovery to Sustainable Production and Industrial Applications
MARINE TT	European Marine Knowledge Transfer and Uptake of Results
MEdSeA	

MEECE	Marine Ecosystems Evolution in a Changing Environment
MG4U	Marine Genomics for Users
MYFISH	Maximising yield of fisheries while balancing ecosystem, economic and social concerns
NACLIM	
PERSEUS	Policy-orientated marine Environmental Research for the Southern European Seas
STAGES	Science and Technology Advancing Governance of Good Environmental Status
THOR	Thermohaline Overturning – at Risk?
VECTORS	Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors

## Annex IV: Members of JPI Oceans Management Board and StAB

The Management Board is chaired by Caron Montgomery, Lourdes Armesto is Vice-Chair.

The Management Board is composed of the following members:

Management Board		
Country	Organisation	Name
<b>BELGIUM</b>	Belgian Federal Science Policy Office (BELSPO)	Contact: Frank Monteny Contact: David Cox
	Flemish Government, Department Economy Science and Innovation (EWI)	Contact: Dirk Van Melkebeke Contact: Gert Verreet
	Fonds National de la Recherche Scientifique (FNRS)	Contact: Freia Van Hee
<b>DENMARK</b>	National Institute of Aquatic Resources (DTU-DTU Aqua)	Contact: Torger Børresen
	Danish Agency for Science, Technology and Innovation (DASTI)	Contact: Susanne E. Hede Contact: Floor ten Hoopen
<b>ESTONIA</b>	Ministry of the Environment of the Estonian Republic	Contact: Silver Vahtra
	University of Tartu; Estonian Marine Institute (EMI)	Contact: Henn Ojaveer
	Ministry of Agriculture	Contact: Eve Külmallik
	University of Tartu; Institute of Ecology and Earth Sciences	Contact: Kalle Olli
<b>FINLAND</b>	Finnish Environment Institute (FEI/SYKE)	Contact: Mari Walls
	Academy of Finland, Research Council for Biosciences and Environment	Contact: Kyösti Lempa
<b>FRANCE</b>	French Research Institute for Exploitation of the Sea (IFREMER)	Contact: François Jacq Contact: Gilles Lericolais
	French National Research Agency (ANR)	Contact: Maurice Heral Contact: Patrick Monfray
<b>GERMANY</b>	German Federal Ministry of Education and Research (BMBF)	Contact: Christian Alecke
	German Federal Ministry of	Contact: Wiebke Rüdts von

	Food, Agriculture and Consumer Protection	Collenberg Contact: Hartmut Stalb
	Research Centre Jülich (JÜLICH)	Contact: Joachim Harms
<b>GREECE</b>	Hellenic Centre for Marine Research (HCMR)	Contact: Evangelos Papathanassiou
	Ministry of development; General Secretariat for Research and Technology (GSRT)	Contact: Chrysoula Diamanti
<b>ICELAND</b>	Marine Research Institute Iceland (MRI)	Contact: Johann Sigurjonsson
	Icelandic Centre for Research (RANNIS)	Contact: Sigurdur Björnsson
<b>IRELAND</b>	Marine Institute Ireland (MI)	Contact: John Evans Contact: Peter Heffernan
<b>ITALY</b>	National Institute of Oceanography and Experimental Geophysics (OGS)	Contact: Angelo Camerlenghi
	Italian Ministry of Infrastructure and Transport, Directorate of Maritime Transport and Inland Waterways	Contact: Enrico Maria Pujia
	Italian Consortium for Managing research Activities Venice Lagoon (CORILA)	Contact: Pierpaolo Campostrini
	National Research Council of Italy, Marine Technology Research Institute (INSEAN-CNR)	Contact: Emilio Fortunato Campana
<b>LITHUANIA</b>	Ministry of the Environment of the Republic of Lithuania (AM)	Contact: Dalius Krinickas Contact: Viktorija Vaškevičienė
	Research Council of Lithuania	Contact: Brigita Serafinavičiūtė Contact: Audrius Žvikas
<b>MALTA</b>	University of Malta, Physical Oceanography Unit (UM)	Contact: Alan Deidun
<b>NETHERLANDS</b>	Ministry of Economic Affairs, Agriculture and Innovation (EL&I)	Contact: Ino Ostendorf Contact: J.M. Dalhuisen
	Netherlands Organisation for Scientific Research (NWO) on behalf of the Ministry of Education, Culture and Science	Contact: Josef F. Stuefer Contact: Bernard Westerop
<b>NORWAY</b>	Research Council of Norway	Contact: Christina Abildgaard



	(RCN) Norwegian Ministry of Fisheries and Coastal Affairs	Contact: Kristin Elisabeth Thorud Contact: Arne Benjaminsen Contact: Jartrud Steinsli
<b>POLAND</b>	Polish Academy of Sciences; Institute of Hydroengineering (IBW PAN)	Contact: Grzegorz Różyński
<b>PORTUGAL</b>	Portuguese National Funding Agency for Science, Research and Technology (FCT) Portuguese Institute of Ocean and Atmosphere (IPMA)	Contact: Alexandre Fernandes Contact: Nuno Lourenço
<b>ROMANIA</b>	National Authority for Scientific Research, Directorate for European Integration and International Cooperation University of Bucharest, Faculty of Geology and Geophysics	Contact: Viorel Vulturescu Contact: Viorel Gh. Ungureanu
<b>SPAIN</b>	Spanish Ministry of Economy and Competiveness (MINECO)	Contact: Lourdes Armesto
<b>SWEDEN</b>	Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) Swedish Agency for Marine and Water Management (HaV)	Contact: Lisa Almesjö Contact: Anna Jöborn
<b>TURKEY</b>	Tübitak Marmara Research Center	Contact: Cinar Oner
<b>UNITED KINGDOM</b>	Department for Environment, Food and Rural Affairs (DEFRA) National Environmental Research Council (NERC)	Contact: Caron Montgomery Contact: Ed Hill

The Strategic Advisory Board is chaired by Peter Herzig (Chair), Manuel Barange (Vice-Chair).

The Strategic Advisory Board consists of the following individuals from science, industry, public authorities and civil society, appointed in a personal capacity:

Strategic Advisory Board	
Name	Organisation
Manuel Barange	Plymouth Marine Laboratory (PML)
Catherine Boyen	Centre National de la Recherche Scientifique; Station Biologique de Roscoff (CNRS-SBR)
René P.A. Dekeling	Ministry of Infrastructure and the Environment - Directorate-general for Spatial Development and Water Affairs
Laura Giuliano	International Council for the Exploration of the Mediterranean Sea (CIESM)
Arturo González Romero	INNOVAMAR
Peter Herzig	Helmholtz Centre for Ocean Research Kiel (GEOMAR)
Jørn Krog	County Governor of Sør-Trøndelag
Karin Lochte	Alfred Wegener Institute for Polar- and Marine Research (AWI)
Niall McDonough	European Marine Board (ESF-EMB)
Jean-Francois Minster	TOTAL
Sigve Nordrum	Aker BioMarine Antarctic
Sevcan Çolpan Polat Beken	Scientific and Technological Research Council of Turkey (TÜBİTAK)
Eeva-Liisa Poutanen	Ministry of the Environment of Finland
Frank Roland	Centre of Maritime Technologies e.V. (CMT)
Yvonne Shields	Commissioners of Irish Lights
Nils Christian Stenseth	University of Oslo, Centre for Ecological and Evolutionary Synthesis (UiO-CEES)
Wendy Watson-Wright	UNESCO; Intergovernmental Oceanographic Commission (IOC)

John Lock and Gert Verreet stepped down from the Strategic Advisory Board in 2013 and 2014 respectively.

## Annex V: International Organisations and Initiatives

AMT- Atlantic Meridional Transect

Black Sea Commission

BONUS- The joint Baltic Sea research and development programme

CIESM- The Mediterranean Science Commission

CLIVAR- Climate and Ocean: Variability, Predictability and Change

COFASP- Cooperation in Fisheries, Aquaculture and Seafood Processing

Copernicus- European Programme for the establishment of a European capacity for Earth Observation

Donet- Dense Oceanfloor Network System for Earthquakes and Tsunamis

EATIP- European Aquaculture Technology and Innovation Platform

ECORD- European Consortium for Ocean Research Drilling

EDA- European Defence Agency

EFARO- European Fisheries and Aquaculture Research Organisation

EFTP- European Fisheries Technology Platform

EIT- European Institute of Innovation and Technology

ELIXIR- A Distributed Life Sciences Research Infrastructure Supporting Innovation in Marine Sciences

EMBRC- European Marine Biological Resource Centre

EMECO- European Marine Ecosystem Observatory

EMODNET- European Marine Observation and Data Network

EMSO- European Multidisciplinary Seafloor and water column Observatory

EOOS- European Ocean Observation System

EURO-ARGO- European Contribution to the Argo Programme

EuroGeoSurveys- Association of the European Geological Surveys

EUROGOOS- European Global Ocean Observation System

FAO- Food and Agriculture Organisation of the United Nations

GCOS- Global Climate Observing System

GEBCO program- General Bathymetric Chart of the Oceans

GEO BON- The Group on Earth Observations Biodiversity Observation Network

GEOSS- Global Earth Observation System of Systems

GOOS- Global Ocean Observation System

HELCOM- The Baltic Marine Environment Protection Commission

ICES- International Council for the Exploration of the Sea

ICOS- Integrated Carbon Observation System

IGBP- International Geosphere-Biosphere Programme

i-Marine- Data e-Infrastructure Initiative for Fisheries Management and Conservation of Marine Living Resources

IMO- International Maritime Organisation

IMOS- Integrated Marine Observation System

IMTA- Integrated Multi-Trophic Aquaculture

IOC-UNESCO- International Oceanographic Commission of the United Nations

IODE- International Oceanographic Data and Information Exchange

IODP- International Ocean Discovery Programme

IOOS- Integrated Ocean Observation System

IPBES- Intergovernmental Platform on Biodiversity & Ecosystem Services

IPCC- International Panel on Climate Change

JRC- Joint Research Council

MARCOM+- Towards an Integrated Marine and Maritime Science Community

MARS- Marine Autonomous and Robotic Systems

MARTEC- An ERA-NET on maritime technologies

NEMO- Nucleus for European Modelling of the Ocean

OA-ICC- Ocean Acidification International Coordination Centre

OBIS- Ocean Biogeographic Information System

ODIP- Ocean Data Interoperability Platform

OneGeology- an international initiative of the geological surveys of the world.

OOI- Ocean Observatories Initiative

OSPAR- Convention for the Protection of the Marine Environment of the North-East Atlantic

POGO- Partnership for Observation of the Global Oceans

PRACE- Partnership for Advance Computing in Europe

ROOS- Regional Ocean Observing System

SCAR-FISH- Standing Committee on Agricultural Research Strategic Working Group on Fisheries and Aquaculture

SEADATANET- a standardized system for managing the large and diverse data sets collected by the oceanographic fleets and the automatic observation systems

SeaEurope- Ships and Maritime Equipment Association

SIOS- Svalbard Integrated Arctic Earth Observing System

THC- Thermohaline Circulation

UNEP-MAP- United Nations Environment Programme Mediterranean Action Plan for the Barcelona Convention

Waterborne- a forum where all stakeholders from the waterborne sector (sea & inland) define and share a common Vision and a Strategic Research Agenda

WISE- Water Information System for Europe

WORMS- World Register of Marine Species