Healthy and Productive Seas and Oceans

A Joint Programming Initiative to meet the Grand Challenge regarding European Seas and Oceans

Template to be submitted to the GPC for the meeting on the 4th of May 2010

Proposal
Healthy and Productive Seas and Oceans

Contents

Preamble ……..... 3

1. Theme for the Joint Programming Initiative …….. 4

2. Proposing GPC members …….. 7

3. Objectives …… 8

4. Research questions to be addressed …….. 9

4.1. Key features of the JPI…… 9

4.2. Pillars of the Oceans JPI……. 10

5. Preliminary suggestion of a governance structure..... 16

6. Added value, benefits and impact…….. 18

Joint Programming Initiative

Healthy and Productive Seas and Oceans

Europe can surely be characterized as "**blue**", with a 89 000 km coastline along two oceans and four seas: the **Atlantic and Arctic Oceans, the Baltic, the North Sea, the Mediterranean, and the Black Sea**, to which we should add immense overseas territories, as well as connections with inland water ways. This fact leaves its clear mark on its activities, its citizens, its economy and its climate.

Seas and Oceans provide indeed an essential part of our **wealth and well-being**. The fast growing global population will increasingly depend from marine food sources (including sustainable aquaculture) Moreover oceans and seas offers a large unexploited potential from underexplored marine biodiversity and marine renewable energy and play an crucial role in developing transport modalities en tourism activities, But oceans and seas are also under huge pressure from human activities and climate change. The **growing vulnerability** of coastal areas, increasingly crowded coastal waters, the key role of the oceans in the climate system and the continuous deterioration of the marine environment all call for a stronger focus on our oceans and seas.

Europe needs an **integrated knowledge base** that enables an integrated policy to make the most of marine resources in a sustainable way, while understanding and mitigating the impact of climate change on the marine environment and coastal areas.

1. Theme for the Joint Programming Initiative

Grand challenge - Understanding and mitigating the pressures on European Seas and Oceans to make the most of their resources

Economic and societal drivers

- The **maritime economy** accounts for as much as 5% of our economic activity. The EU's Marine Regions, with their strong connection to the sea, account for almost 40% of its GDP.

- The sea is a critical **source of food and energy**. European fisheries and aquaculture employ 0,7 million people and generates more than 30 billion Euros a year. Components derived from marine organisms through biotechnology are already being used in food, pharmaceutical, cosmetic and chemical industries. All together, these sectors provide the core activities of a strong marine bio-economy. Exploitation of oil and gas from the sea bottom and an increasing share of renewable ocean energy constitute a considerable part of Europe's energy consumption.

- **Maritime transport**, responsible for 90% of EU's external trade and 40% of its internal trade, is vital for its economy and even more for island states. Our 1200 ports are vital hubs for our economic activity, managing 3.5 billion tons of goods and 350 million passengers per year.

- **European tourism**, a substantial part of which takes place in coastal areas, accounts for 3 million jobs and 72 billion Euros of revenue per year. Almost one third of European population lives 50km of the coast and the value of living by the sea, while intangible, is high to many of us, as shown by the continuous growth of coastal tourism.

- The **unexploited potential** of the sea is even bigger, with still largely unknown resources. It is estimated that more than 90% of the marine biodiversity remains unexplored, offering a huge potential for discovery of new species and applications derived from biotechnologies, which is foreseen to generate a 10% annual growth for this sector. The deep seas, in particular, represent a new frontier for us. The recent discovery of cold coral reefs in the North Sea, of the same importance as the tropical ones, is just one outcome of this quest, almost as technologically challenging as space exploration.

- The potential for **marine energy** is still far from being realised. According to a 2009 study by the European Environment Agency, offshore, together with onshore, wind energy, could deliver competitively 2,600 Terawatt hours of energy in 2020, which represents up to 20% of the total demand for electricity in Europe. While the potential for competitive onshore wind is much bigger, social acceptance of large onshore wind farms might be a serious challenge, which explains why up to one third of future wind energy growth would have to be developed offshore. Wave, tidal and thermal energy could provide a substantial contribution to the renewable energy production of many European countries. Sea beds can strongly contribute to Europe's objectives of Carbon capture.

- Seas and Oceans also play a major role in the **regulation of the climate**. Not only does the sea act as a carbon sink limiting the global warming but global thermohaline circulation has a large impact on the Earth climate. Continuous monitoring and observation of the ocean system and its interaction with climate is crucial to the prediction of climate change and its consequences.

- Yet overfishing, pollution from industries and transport, discharge of nutrients, litter, together with the acidification of oceans resulting from climate change are dramatically affecting the marine environment, putting it **at risk from uncontrollable changes**.

- Sea level rise, coastal erosion and extreme events are threatening coastal settlements, forcing policy makers to reconsider the design of costly coastal defence. It has been estimated that the actual expenditure cost for **coastal protection** in Europe exceeds 1 billion Euros per year.

- **Climate change, overfishing and invasive species** transported with global trade are vectors of profound changes in marine ecosystems, with potentially considerable socio-economic consequences, like in the case of jelly fish invasions.

- The coastlines are getting ever more crowded being the preferred area for industrial activity connected to ports. Tourism, aquaculture, landing areas for fish catch, ocean energy installations and coastal villages and towns attract a growing population with all the consequences these activities have on the coastal and marine environment. Wind mills, off shore platforms, pipelines, motorways at sea and fish farms are all occupying more and more **marine space**. Activities under the surface like fishing, dredging and oil drilling disturb or damage marine ecosystems.

- The development in of these activities and the competition for limited coastal and marine space has a heavy **impact on marine ecosystems** and challenges the fragmented approach to the management of maritime affairs.

- By addressing research topics that are cross-cutting in nature, this JPI will promote convergence between marine sciences, climate science and marine industries. It can also help promote convergence of technologies between different marine and maritime sectors (energy, transport, biotechnology, aquaculture, fisheries).

In short, our seas concentrate opportunities and environmental challenges of enormous dimensions and we have to provide our policy makers with the necessary knowledge base and tools to:

1) understand pressures from human activities and climate change on the marine environment with a view to mitigate their impact;
2) understand the interactions between climate and oceans to better predict and mitigate the harmful impacts of global warming;
3) further develop our maritime economy, particularly the promising fields of marine bio-economy and energy, while preserving the marine environment that is at the very source of this wealth.

This knowledge base is an integrated and coherent one centred on the marine environment, the ocean system and its interaction with climate and a set of core technologies needed to develop sustained and sustainable activities taking place in the marine environment.

It cannot be created by the RTD – efforts of a single country or region, instead the very complex nature of the marine system demands research coordination taking all the different aspects, e.g. different sectors, regions and disciplines, into consideration. Seas and oceans don't know political borders and confront Europe's different regions with common challenges. These will gain from a common knowledge base and benefit from the knowledge transfer a coordinated effort will bring about.

Marine research infrastructure used to generate data and knowledge are expensive and often of European dimension (like the ESFRI projects EURO-ARGO, EMSO, LIFEWATCH for the marine environment or EMBRC in the marine biotechnology field). This applies to research infrastructure in the field of marine energy and maritime offshore technologies as well. Coordinated efforts to develop and use this infrastructure can generate considerable synergies at European level. It is the pooling at European level of marine data and knowledge from different regional seas and sectors that will provide the necessary base to respond to the complex questions that we need to address.

In the area of marine environmental research there is already strong European cooperation and coordination through EU-funded initiatives like data sharing and ERA-nets. These activities prove that there is a strong willingness and ability to cooperate among European research communities.

Policy drivers

The **Action Plan for the EU Integrated Maritime Policy** (COM(2007) 575) pursues several objectives related to a sustainable and integrated management of maritime activities. It calls for a strong science base to support these objectives which is echoed in the **Marine and Maritime Research Strategy** (COM(2008)534..

The **Marine Strategy Framework Directive (MSFD** - Directive 2008/56/EC) provides a legal obligation to define a Good Environmental Status (GES) for all European regional seas by July 2012, and reach it by July 2020. The definition of the GES is a huge scientific challenge, which embraces – taking into account the needs of the marine systems – all kinds of pressures on the marine environment, some of which are poorly known (like litter, noise or invasive species). The MSFD is a strong political driver for a JPI in this field.

The MSFD also covers pressures on fish stocks. These latter are managed at EU level, in the framework of the **Common Fisheries Policy (CFP**), which is in the process of being reformed to ensure sustainability of EU fisheries. A key feature of the reformed CFP would be to move towards an ecosystem approach to fisheries, which requires a better knowledge of interactions between fishing and marine ecosystems. A JPI on "Healthy and Productive Seas" would be timely in that regard. Many pressures identified in the MSFD are related to the marine biodiversity. In fact, it is the first time that an EU legal instrument puts legal obligations to identify and mitigate pressures on biodiversity, in line with the Convention on Biodiversity (CBD) and the global commitment to reverse the decline of biodiversity. In that regard, the fact that 2010 is an international year for biodiversity makes it more relevant and timely to have this JPI.

The **UN** has launched a **global assessment for the marine environment**. This started with a so-called "assessment of assessments" which was adopted by the UN General Assembly in August 2009 and the decision to launch the global assessment, coordinated by UNEP and the IOC, is expected by the end of this year. There is therefore global drive to assess and mitigate the pressures on the marine environment and it is appropriate that Europe, which has been at the forefront of environmental policies takes the lead in this area.

Another global political driver is the continuous need to further improve the knowledge of **climate change and its impact**, particularly on coastal areas. A JPI on "Healthy and Productive Seas" will contribute strictly to respond to this need.

The **EU commitments to reduce CO2 emissions** by 20% and increase to 20% the share of electricity produced by renewables is also a driver to pursue research to boost offshore wind energy and other marine renewable energy sources.

Finally, the **EU's agenda 2020** puts a strong focus on the bio-economy as a key source of growth and jobs for the future. In that regard, our seas and oceans with their largely unexplored biodiversity provide a high potential field that would be developed in the framework of this JPI.

A list of the most relevant policy documents, communications and regulations that form the framework of this JPI is attached.

We therefore propose the Joint Programming Initiative on "Healthy and Productive Seas and Oceans" to address, in a coherent way, a set of issues of grand societal importance for Europe but also at global level.

2. Proposing GPC members

This proposal for a Joint Programming Initiative has been developed by a core group, consisting of Spain, Belgium and Norway.

The following countries have nominated a contact person to be part of the JPI-group:

Denmark, France, Ireland, Italy, Netherlands, Portugal, Turkey and United Kingdom.

Several stakeholders (European organisations, ETPs, RTOs, public authorities, etc.) have shown great interest in the proposal and their positions have formed a basis for the formulation of this proposal. It will be part of the governing boards' task to ensure that all relevant stakeholders will be consulted in the course of the JPI.

Process behind this JPI proposal
In developing the EU Integrated Maritime Policy, the Green Paper consultation prior to the adoption of the Blue Book in 2008, conducted a major consultation process (http://ec.europa.eu/maritimeaffairs/contrib_rc_en.html).

Altogether 480 responses came from MS, EU institutions, regions, industry sectors, research organizations and NGOs across Europe. 60-70 of these contributions where from scientific organization and an even larger number address how science and technology can underpin sustainable development and growth.

In addition to this the Maritime Days in Brussels (2008) and Rome (2009) have drawn together stakeholders from Europe. Again these have provided valuable input, addressing scientific and technological challenges across the marine and maritime issues.

In preparing for the template all this material has been thoroughly analyzed. We have targeted key scientific topics related to research, science and technology, which we have considered to be most appropriate and relevant for the JPI. We have searched for areas where we see strong possibilities for synergies and added value by joining forces across our boarders. Likewise we have specifically targeted areas of specific relevance to address and solve the grand challenges. This is echoed in the objectives and actions in the proposal.

3. Objectives

Healthy and Productive Seas and Oceans in Europe as the basis for a thriving European maritime economy – we must take the right decisions to preserve the marine environment and facilitate the development of its huge potential, thus serving the European societies and their welfare. When dealing with such complex systems, it is crucial that decision making is informed by sound scientific knowledge, provided by the European research community.

The marine system and its services represent a complex inter-disciplinary area that has rather been addressed in a fragmented way. The result of this fragmented approach is observed as degraded ecosystems, overfished fish stocks, polluted waters, conflicts and competition regarding the use of resources and coastal and marine space, to name some of the issues listed above.

However, our knowledge about interlinkages between ecology, climate and economy now makes it clear that a new approach is needed to address the system in a more holistic way. We must assess the impact of human activities on the marine system, and indicate new paths for a sustainable utilisation of marine resources while protecting the environment. We also need to predict the impact of climate change on the marine environment and coastal areas, with a view to mitigate it and ensure security at the coastal rims. What is needed, though, is a joint effort to combine expertise, resources and the stakeholders' input to create the necessary knowledge base.

Objectives

The main goal of this JPI is to maximise in a sustainable way the benefits that Europe's societies will draw from seas and oceans, as an important economic basis in terms of jobs, services, products and social welfare, while mitigating the negative impacts of climate change. To reach the main goal, we need:

1. a more complete scientific base about the marine system, both related to oceanographical and biological knowledge, as well as the impact of human activities on the whole system including biotic and abiotic components. Monitoring of the oceans, seas, the coasts as well as their sources of pollution like rivers should be a joint endeavour.

2. a more complete scientific knowledge base about the interactions between oceans and climate as well as a better prediction and management of the impact of climate change (particularly on sea level rise, coastal erosion, extreme events and marine ecosystems).

3. to unlock the potential for new products and services that lie in our marine resources. Initiate and facilitate the discovery and investigation of both biological and abiotic resources and enable the development of technology necessary to fulfil their potential, particularly in the areas of the marine bio-economy and marine energy.

These 3 objectives are inter-linked and should be developed in a coordinated way.

4. Research issues being addressed

4.1. Key features of this JPI

Integration and convergence

A holistic and integrated effort demands a structure that takes the interdisciplinary nature of the challenges into account. In order to be able to provide for evidence based policy making and ensure the sharing of knowledge, the JPI should consist of three pillars. However, the interfaces for knowledge transfer between them are of crucial importance since they are closely inter-linked.

For instance, the development of marine renewable energy requires convergence between energy industries, oceanography which can determine the safest and most promising areas for their development, and traditional maritime industries which can service and build offshore installations. Similarly innovation in marine biotechnology requires convergence between genetics and marine environment and biology since gene expression depends of the environment where marine organisms develop. Understanding the pressures on the marine environment also requires convergences between marine environment, socio-economic and climate sciences, since human activities and climate change have a combined impact on marine resources, like in the case of jellyfish.

European and regional seas dimension

Europe's four seas (Black, Mediterranean, Baltic and North Sea) and two oceans (Arctic and Atlantic Ocean) have common features but certainly also different ones. The challenges can differ considerably due to climate factors, pollution grades, ecosystem characteristics, different stress factors, etc. There are also very pronounced variations among the different marine areas, estuaries, ports, coast types, etc. that are to be considered. However the key processes (e.g. eutrophication, overfishing, invasive species, pollution by contaminants or litter, impact of noise) follow similar patterns and can be approached through similar models or research. It is therefore crucial that all the three pillars of the JPI have a European and a regional seas dimension, with an adequate articulation between the two to make the most of synergies at EU level, while taking into account regional specificities.

Building on the existing initiatives

The vast area of marine and maritime sciences is subject of many RTD-activities, at EU- (FP, ERA-Nets, BONUS,…), international, national and regional levels. These activities have to be taken into account regarding the JPI's pillars.

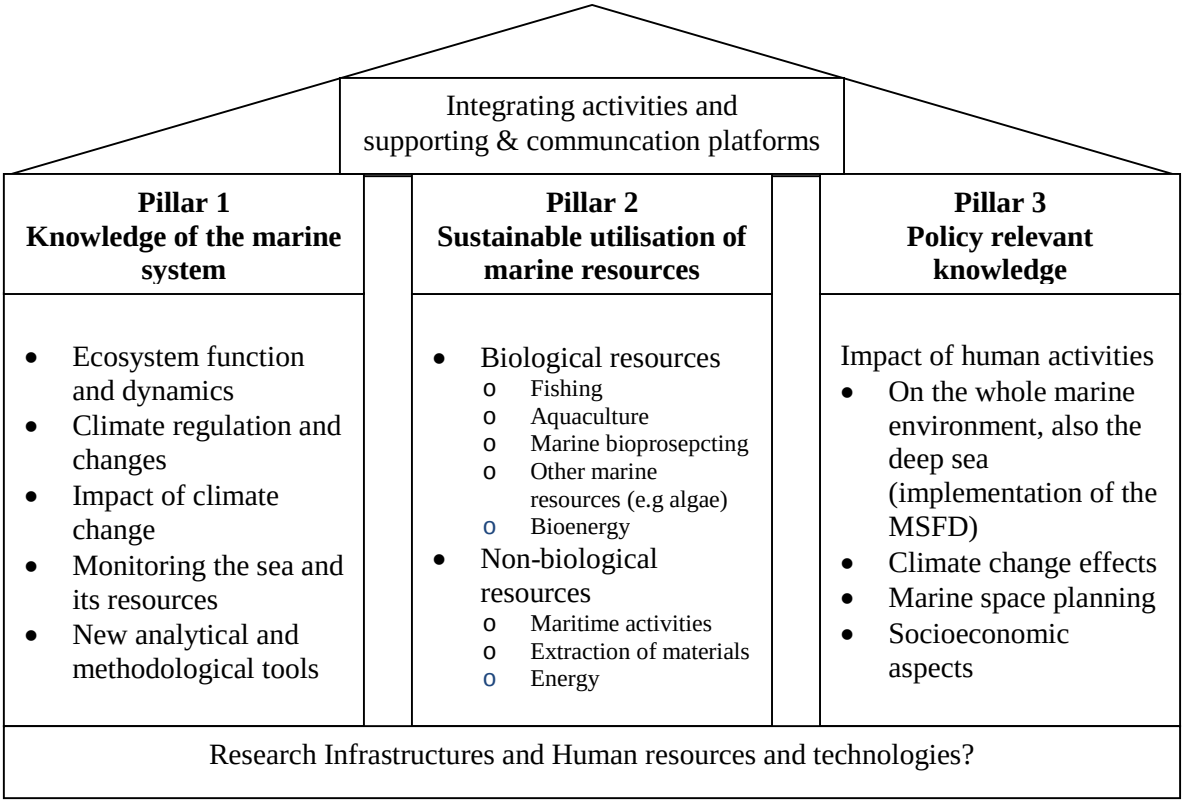
Over the last years we have seen that many stakeholders have formed associations, e.g. in European Technology Platforms, business associations, research communities, and NGOs. These groups will be consulted and their inputs taken into consideration during the whole lifetime of the JPI.

Similarly initiatives have developed in the field of marine research and data infrastructure, although often in a fragmented way.

The JPI initiative will act as a catalyst to fill key knowledge gaps and provoke convergence between initiatives, with a view to produce the necessary integrated knowledge that is needed by policy makers to ensure an integrated an sustainable development of sea-based activities.

4.2. The pillars of the Oceans JPI

The research questions to be addressed in this JPI are of a very broad nature and demands a well structured and approach that also enables an efficient implementation. A systematic structure, built on three pillars and a cross cutting dimension is suggested.



Presentation of the 3 pillars of the JPI "Oceans". The areas regarding research infrastructures, human resources and possibly technologies will be of cross cutting character.

Description of the 3 pillars and the cross cutting activities:

Pillar 1: Knowledge of the marine system

This research area will represent the important pillar of knowledge of the nature of the marine system, comprising both biotic and abiotic components. It provides a foundation that is necessary to develop the other pillars since sea-related activities must be developed following an ecosystem based approach, taking into account climate change as major vector of change.

Relevant research areas:

- Understand better the functioning of marine ecosystems and their dynamics in time and space, biogeochemical fluxes and the dynamics of the food web, including the microbial systems.

- The oceans' role as climate regulators, and the impact of a changing climate on this function. Likewise the effects of climate change on the seas, oceans and coastal zone need to be addressed.

- Do we have the climate models necessary to predict regional and ecosystem changes, and particularly to downscale the global climate models to the sub-regional seas? What consequences does this have on the management of coastal areas (coastal defences, ports, offshore structures…)?

- Are we able to combine climate with ecosystems and food web models to improve predictions of ecosystems evolutions in relation to anthropogenic pressures and climate change (e.g. invasive species like jelly fish or algal blooms)? Can new developments of biotechnological tools and methodology improve our understanding of microbiobial processes and functioning of marine ecosystems at different levels and scale.

- Knowledge necessary to define and move towards Good Environmental Status of European Seas and Oceans as required by the Marine Strategy Framework Directive?

- What does it need to integrate ecological, socioeconomic and practical requirements for the development, management and monitoring of a coherent network of Marine Protected Areas in European marine waters to protect key ecosystems and species to conserve biodiversity?

- Can we develop marine sensors connected to intelligent IT systems to monitor the marine environment and guide policy makers in the decision making process?

Pillar 2: Sustainable utilisation of marine resources

The benefits from our activities are invaluable and we have to expect increased demand for services from our seas and oceans due to population growth and modern lifestyle. We therefore have to explore new opportunities to create values, always taking the vulnerability of the marine system into account. This is the theme of the second research area, which can be divided into 3 subareas.

There are a number of European Technology Platforms established in the relevant areas which have elaborated visions and strategic research agendas. Some of these topics are addressed in EU-, national and regional research activities or are themes of ERA-Nets. The JPI – activities will of course take these outputs and needs into account.

The research to be conducted will not duplicate research conducted under different thematic programs. It will focus on those cross-cutting aspects, which are not properly covered under any of these programs.

a. Biological resources

Key questions in this subarea are:

- How can we meet the increasing demand for fish and seafood, while moving towards an ecosystem based approach in these two sectors?
  - With a growing world population and a general rise in demand for marine food, we have to find sustainable ways to expand the supply. How can that be achieved?
  - Which role can wild catch play, how can we ensure its sustainability and stop destructive fishing practices? Can fisheries benefit from shipbuilding technologies to construct safer and more sustainable fishing vessels?
  - How can we enhance the share of aquaculture in a sustainable way? Can marine biotechnology help develop new and sustainable sources of feed by moving lower

in the trophic chain? Can aquaculture benefit from offshore technologies and industries to move its production offshore? Seafood related aspects will have to be addressed in cross-cutting RTD-efforts in the field of health and nutrition.

- **Marine biodiversity for future wealth creation**: Marine organisms, both large, small and microbes represent a nearly inexhaustible source of bioactive compounds and novel materials which we only are starting to understand and investigate (bioprospecting). How can we explore novel products and processes applicable in medicine, material science, industry, nutrition and other areas? How can we promote the necessary convergences between genetics and marine environment / biology sciences? What mechanisms can help promote innovation in this crucial sector for our future economic development?

- How can we utilise algae's' ability to produce **biomass for energy** production? Which other pathways to generate energy can we study (e.g. anaerobic microbes)?

b. Non-biological resources

The area of **maritime technologies** contains research related to shipping, ports, safety, vessel design, interoperability, platform construction, extraction of hydrocarbons, dredging, and many more. There will be a whole range of questions that have to be addressed, among these,

- What is necessary to achieve greener and more efficient transport and ports (with regard to energy efficiency, emissions, pollution, transport of invasive species and recycling)?
- Which ecosystem-friendly methods can we develop to improve the techniques of dredging, e.g. turn the concept of "dredging with nature" into a reality?
- Inter-disciplinary research and cooperation needed to boost eco-innovations?
- Can we use existing marine platforms for research in different scientific and cross cutting areas?

Extraction of abiotic materials

- Which new mineral resources can we benefit from? Environmental friendly ways to exploit mineral resources? Inter-disciplinary research involving socio-economy is needed to respond to these questions.
- Where and how can sand and gravel be extracted without having long term damaging effects on the environment?

Energy from the sea

- How can we increase Europe's energy security from marine sources?
- What does it need to advance ocean energy technologies, like off shore wind, tidal and wave energy? We need to boost the convergence between the energy technologies and the maritime / offshore technologies to make energy devices work in the marine environment. We also need to boost integration between energy related knowledge and oceanography knowledge to optimise location of energy devices and safety.
- What are the effects of wind parks or other installations at sea on the environment and other maritime activities?

Carbon storage

- Can the technologies be improved? Can we improve the monitoring of pilot sites and the models to predict long term behaviour of captured Carbon dioxide?
- Related safety and environmental questions.

Pillar 3: Policy relevant knowledge

The challenge of excessive and inconsiderate utilisation of our seas and oceans can only be met with measures that discourage illegal or risky human activities, ensure that their impact on the environment is within acceptable boundaries, and develop new activities in a sustainable way.

Since the main goal of this JPI can only be reached if European policy makers are enabled to take decisions based on a scientific knowledge base, it is necessary to make this information easily accessible and visible. This is a very challenging task since scientific knowledge is not directly geared towards societal and policy needs. Even when it is so, it remains challenging to turn scientific knowledge into knowledge and tools usable by policy makers. Therefore a dedicated area of this JPI will focus on policy relevant knowledge.

This third pillar concerns mainly the interface between human activities / climate change and the management of their effects, positive or negative, on the seas and oceans.

Themes under this heading will comprise scientific knowledge of the impact of the exploitation and utilisation of marine resources, as well as of climate change to help policy makers optimise the mitigation of their harmful effects.

a. Given the extensive range of pressures covered by the MSFD and its objective of reaching GES of the seas, a substantial part of this work will consist in providing policy makers with **knowledge and tools relevant to the implementation of Good Environmental Status**:

    - What are the best indicators of Good Environmental Status (GES) of European Seas and Oceans as required by the Marine Strategy Framework Directive?
    - Can we understand the links between the 11 pressures identified in the Marine Strategy Framework Directive and develop subsequently integrated sets of indicators taking into account the interactions between different pressures?
    - Assessment and protection of marine biodiversity
    - Sustainable management of our fish stocks
    - Science base for the design and management of (networks of) Marine Protected Areas
    - Anthropogenic and climate impact on deep sea ecosystems
    - Knowledge for a sustainable management of marine ecosystems, including in the deep sea,
    - Link with land based activities, tolerance limits of run off from land, sewage, chemical waste, dumping – cross-cutting activities to be organised with relevant RTD-programmes, e.g. on agriculture
    - Socioeconomic aspects of pressures on marine ecosystems, including ecosystems services
    - Foresight studies

b. A second policy relevant knowledge stream is related to **the management of coastal and marine space**. The ever increasing development of coastal and marine activities has created both competition for a limited space and a dramatic impact on the marine environment. Tourism with its benefit and impact represents an important area. There is a need to provide policy makers with knowledge and tools to optimise the development and the location of these activities in a way that takes into account their impacts on the ecosystems.

Attempts to promote Integrated Coastal Zone Management (ICZM) have had a limited success, mainly because they lacked the integrated science base that could have made them more successful. Marine Spatial Planning is also being promoted but with limited scientific support .At the same time, it is widely recognised that the management of the coastal zones cannot be separated from that of the marine system. Models developed by scientists tend to bring them together in Integrated Coastal Ocean Management Systems.

Issues to be developed are in particular:

- What is the knowledge base necessary to develop ICZM and MSP?
- How can we ensure that ICZM and MSP take into account the preservation of ecosystems (the GES of the seas)?
- Can we develop tools usable by policy makers to promote ICZM and MSP?
- Training and communication schemes??

c. A third policy relevant area regards the **mitigation of climate change impact on coastal areas** and in particular:
   - Improved prediction of seal level rise, coastal erosion and risks related to extreme events, with a view to optimise coastal defence
   - Improved knowledge and prediction of extreme events and mechanical pressures on offshore structures to optimise their design

Cross cutting programme activities:

1. Research Infrastructures

Marine research infrastructure is an essential base and a pre-requisite to develop the necessary knowledge. These infrastructures are often expensive and of European dimension. ESFRI has, for instance, many marine infrastructure projects but they are being developed without an overall vision that would ensure that they respond optimally to societal and policy needs in relation to our seas.

The following table gives an overview of main types of marine research infrastructure relevant for this Joint Programming Initiative[1].

I. Marine Environment / Climate Change	**II. Support to Innovation / the new maritime economy**
Marine environment and climate: ✓ In situ observation of the sea column (floats, gliders…) ✓ In situ observation of the sea beds (multi-use seabed observatories) ✓ Oceanographic vessels …	**Marine bio-economy** ✓ Marine biotechnologies (genetic / environmental databanks…) ✓ Aquaculture (pilot sites…) **Marine renewable energy** ✓ Wind, wave, tidal, thermal (test pilot sites)
ESFRI related projects: EURO-ARGO, EMSO, SIAOS, AURORA BOREALIS…	ESFRI related projects: EMBRC, ECCSEL
Data & information infrastructures - Sensors – IT Systems	

For instance, the development of GMES marine core services responding to policy needs, requires a convergence between different sources of marine data (from satellite, in the sea surface and column, in

[1] This voluntarily leaves aside satellites, which provide measures on sea surface, but are being dealt with in other frameworks.

the seabed, biological, chemical and physical data… etc.), but also an integration of data coming from different seas. This necessitates an improvement of the access to and integration of scattered data.

With regard to oceanographic vessels, efforts have been pursued to improve the pooling and sharing of capacities at European level but there are important gaps and challenges in some areas. Oceanographic vessels are, among other utilisations, necessary for the mapping of European seabeds, which is also crucial for the development of the whole marine scientific knowledge base.

Infrastructure for the monitoring of the marine environment is often being developed and used separately from marine research infrastructure, while both would benefit from stronger convergence.

Issues to be covered are in particular:

- An improved access to and pooling of marine data coming from different sources and regions;
- An improved convergence between different marine research infrastructure projects, with a view to ensure that they respond better to societal and policy needs;
- A coordinated effort to develop over the long term the most critical marine research infrastructure projects and fill the key gaps;
- A coordinated effort to undertake over the long term a complete mapping of European seabeds

2. Human Resources

This JPI should also look at the need to ensure that enough people deal with marine and maritime topics and provide them with the knowledge and expertise needed. The measures suggested and partly implemented through the ERA-imitative "Mobility and careers" should act as framework for the formulation of questions.

The complexity of the marine and maritime field as well as the pressing issues forces us to find answers to questions like

- How do we engage the "best brains" to solve the crucial issues?
- How can we stimulate recruitment to marine / maritime research careers?
- How do we increase gender equality?
- How can we develop regional clusters, choose to build research infrastructure and establish Centres of Excellence in areas that otherwise would not be attractive for young recruits?

- How can we increase visibility of the marine issues and reach common understanding among researchers, business communities, politicians and the general public in order to rise our youth's interest to work in this field?

- The need for people with interdisciplinary skills is rising steadily. How can we increase their recruitment and educate them effectively? How can we involve the marine and maritime sectors in this.

5. Preliminary suggestions of a governing structure

The complexity of this JPI demands a governance structure that ensures that both the regional dimensions and the convergence and integration aspects are taken into account. Only then will the main goals be reachable.
We suggest therefore the following:

Management Board (MB)

Decision making body, comprised of at least one representative of each MS with sufficient authority to commit funds for the JPI theme. The MB is open to new participants. The MB assesses applications of new members and decides or recommends changes in membership. The MB should have overall responsibility of the JPI and should in detail:

- Develop the strategic orientation of the JPI taking the regional dimensions into account
- Operational aspects
- Implement guidelines for Framework Conditions for the specific JPI
- Oversee the implementation of its activities.
- Coordinating overarching Integrating activities and supporting & communcation platforms

The MB comprises a President, a Vice-president, and members.
The MB would adopt the Term of Reference and the composition of the other boards.

Executive Board (EB)

The EB is the executive body of the JPI and is comprised of a limited number of members (about 20% of MS involved in the JPI). The EB is responsible for implementing:

- Decisions taken by the MB.
- Instruments specific for the JPI theme.
- SRA.

It comprises a President, a Vice-president, a Secretary and members.

Programme Boards (PB)

The Programmes (P1 to P3) are assigned one to each pillar of the JPI. These programs might consider not only RD activities but also mobility and training activities, disseminations activities and others. Each programme would be managed by a program manager and a program manager assistant.

Advisory Bodies

Scientific Advisory Board (SAB The SAB is comprised of academia/industry stakeholders conducting research in the relevant area (about 15 members). It helps to develop the Strategic Research Agenda (SRA), and to organize the evaluation procedures. It comprises a President, a Vice-president and members.

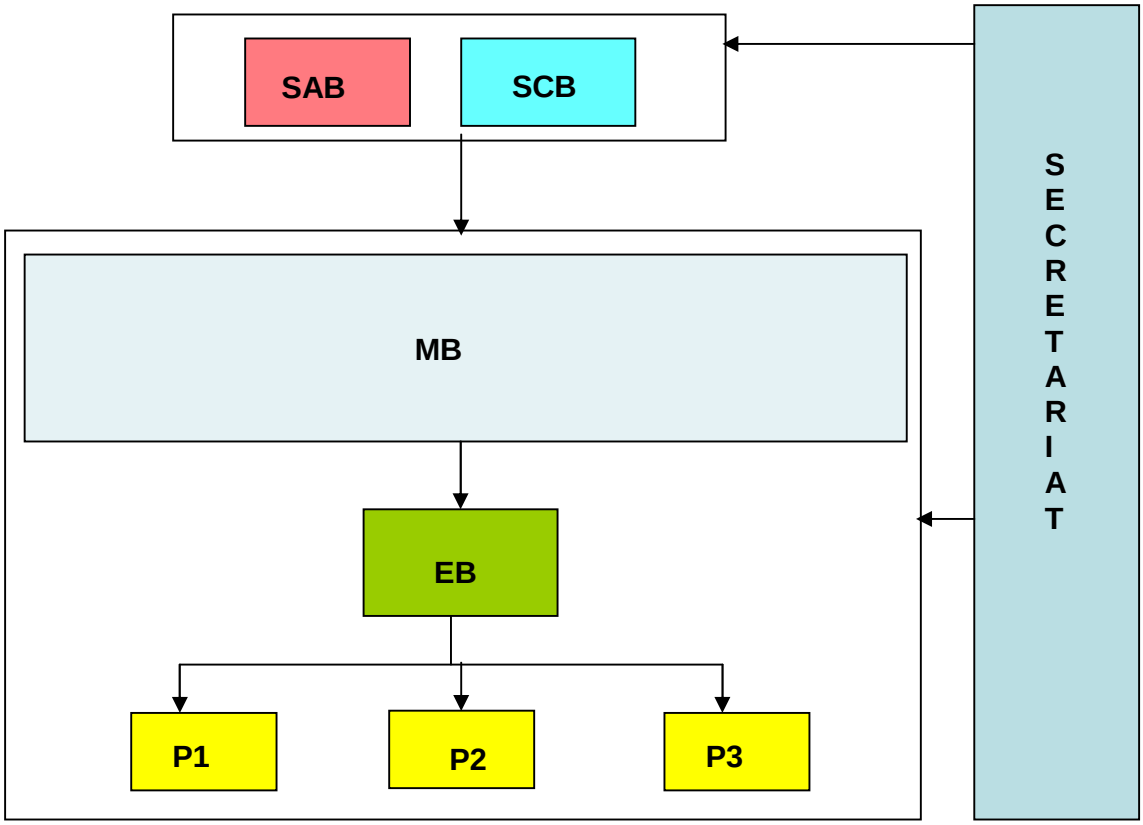
Stakeholders Consultative Board (SCB)
The SCB is comprised of additional advisory boards composed by different stakeholders (technological platforms, social platforms, etc.).

Administrative bodies

Secretariat.

It is the “back office support” to the JPI bodies taking care of the administrative implementation of JPI internal instruments.

The secretariat ensures that all decisions taken by the governing bodies are appropriately implemented, guarantees the necessary flow of information among all participants, assigns and distributes the resources, organizes the meetings, supports in the preparation of the SRA, prepares all the documentation necessary to run the JPI, etc.



P 1
Knowledge of the marine system
P 2
Sustainable utilisation of marine resources
P 3
Policy relevant knowledge

6. Added value, benefits and impact

Added value and Impact on European Research in this area

► **Promoting integration between different sea-related scientific disciplines**

Most of research taking place at EU and national level covers specific thematic areas, which makes it difficult to address the challenges identified above that are cross-cutting in nature. There is little cooperation between technological platforms related to the sea, like the Waterborne Technology Platform, the European Aquaculture Technology and Innovation platforms and platforms in the field of energy.

It also offer the opportuninty to plan integrated long term research activites (in a LTER – framework or in other context fostering integration of research activities).

These convergences are conducive to innovation in the different areas. They are in fact indispensable to meet in particular the challenge of developing the marine bio-economy and marine renewable energy.

► **Synergies at EU level and within regional seas**

There are essentially two ERA-NETs related to marine research: MARIFISH (regarding fisheries) and SEASERA (which replaces MARINERA and a few other marine ERA-NETs) An ERA-Net on marine biotechnology is under development. However they cover essentially marine research (i.e. the marine system) and do not make the link with maritime industries and technologies, marine biotechnology… etc.

This JPI initiative will offer a framework to make this link and boost synergies at EU level to deal with complex cross-cutting issues like "dredging with nature", marine biotechnology and biodiversity, offshore marine energy development, marine space planning… etc.

It will also recognise the specificities and integration of regional seas (Baltic, North Sea, Atlantic, Mediterranean, Black Sea) and boost cooperation between them. By spreading good cooperation practices acquired in some regional seas, it can help promote further integration in other regional seas.

► **Coherence and value added in the development of research infrastructure**

Big marine research infrastructure projects of EU dimension, like those identified in ESFRI, are costly, difficult to finance and developed in a fragmented way. This JPI will give a unique opportunity to:

- ✓ agree on a coordinated European Framework for their progressive development and provide for an adequate governance framework when appropriate;
- ✓ ensure that they are developed in a way that meets key societal and policy needs, like for instance the definition and monitoring of the GES of the seas;
- ✓ ensure a convergence between different infrastructure projects so that they contribute to key European projects like the GMES marine core services;

Similarly, the mapping of EU seabeds is a long and costly exercise, but with huge potential benefits in terms of identifying resources, ecologically valuable areas and optimising the spacing of some activities. There are potentially important synergies at EU level by pooling scarce technical and human resources available for the completion of seabed mapping. There are also obvious synergies for the mapping of seabed areas at the boundaries between different countries. A coordinated European plan to complete the mapping of Europe's seabeds is a request of the European marine scientific community and this JPI offers a unique opportunity to complete it.

► **Better pooling and access to data and information. (This is obvious but often overlooked)**

Marine data are often acquired and used in different contexts, e.g. for environmental monitoring purposes, for scientific research purposes, or else for the development of offshore economic activities. They remain fragmented sets of data, whose acquisition is sometimes duplicated. A coordinated approach to marine data acquisition and sharing can generate considerable savings and improve access to data for all stakeholders, scientists, environment managers, maritime industries.

It has been estimated by the European Commission that a coordinated policy of better pooling and sharing of marine data could generate 300 million Euros of savings per year, and new services with a 100 million Euros value per year.

Socio-economic impact and benefits

► **Optimised and coherent implementation of the MSFD**

The implementation of the Marine Strategy Framework Directive will be a very challenging and potentially costly process for Europe. There will be monitoring costs related to the GES criteria and indicators as well as the cost of the actions implemented to reach the GES in relation to the 11 pressures identified.

Of course, the implementation of the directive also comes with considerable benefits in terms of sustainability of sea-related activities, ecosystem services… etc. It remains however that a good knowledge base regarding human pressures on the marine environment can help optimise the definition of the GES indicators, develop efficient monitoring techniques and optimise the actions needed to reach GES of the seas. This can potentially result in considerable savings for all countries concerned.

Incidently, it can also promote the development of a new industry for the monitoring of the marine environment based on remote sensors, and smart IT systems that turn raw data into knowledge usable by policy makers. Given the global dimension of the marine environment challenge, it is an opportunity for the EU to take the lead in such new developments and develop a know-how that it can then export abroad.

► **Sustainable development of fisheries, aquaculture, maritime transport**

The fishing sector in the EU suffers considerably from overfishing and destructive fishing practices. It has a lot to gain from research that will help it move towards an ecosystem based approach and sustainability.

Similarly aquaculture development in Europe is limited by access to space and sustainability considerations. While it has been growing globally at an average annual rate of 8%, it has almost stagnated in Europe over the past years (with the exception of Norway). A stronger knowledge base would allow to move aquaculture towards environmental and feed sustainability. It could also address the access to space by helping move aquaculture offshore, e.g. in multi-use offshore platforms. It can therefore help unleash the potential of this promising sector.

► **Boost the development of marine renewable energy**

The development of marine renewable energy till 2020 will come essentially from offshore wind. This JPI will help ensure that it takes place in an optimal way, by promoting the necessary convergences between the energy industry and oceanographers to identify sites for offshore parks with highest potential, safest to manage and to service. It will also boost the cooperation between the energy

industry and the shipbuilding industry to ensure that this latter delivers the necessary means to accompany the development of this offshore wind industry. It will in this way contribute to offer new opportunities to the shipbuilding industry.

This JPI will also provide policy makers with tools to optimise marine space allocation for different marine activities and ensure that space for marine renewable energy is maximised, while taking into account other needs and impact on marine ecosystems.

Finally, it will provide a strong boost to the development of other sources of marine renewable energy, like wave energy. The potential worldwide wave energy contribution to the electricity market is estimated to be of the order of 2,000 TWh/year, about 10% of the world electricity consumption. For some member states, on the Atlantic coast, wave energy can contribute an even bigger part of their electricity consumption. By addressing the key technological challenges, promoting the right cross-thematic cooperations and providing for test sites, this JPI can play a significant role in turning the potential of wave energy into a reality.

► **Boost the development of marine biotechnology**

An OECD study (**The Bioeconomy to 2030: designing a policy agenda**) suggests that biotechnology could contribute to 2.7% of the GDP of OECD countries in 2030, with the largest economic contribution of biotechnology in industry and in primary production, followed by health applications. The economic contribution of biotechnology could be even greater in developing countries, due to the importance of primary production and industry in their economies.

The discovery of new marine organisms represents yearly an average of about 1,400 new species worldwide, and Europe is at the forefront of this process. Yet it is estimated that more than 90% of the marine biodiversity remains unexplored and the potential for discovery of new species and applications derived from biotechnologies is considerable. Molecules derived from marine organisms through biotechnology have applications in food, pharmaceutical, cosmetic and chemical industries. Marine biotechnology can also contribute to biofuel production through micro-algae, with much faster growth-rates than terrestrial crops and a much higher yield of oil per acre.

This JPI will contribute to these crucial developments by pursuing the exploration of the seas, and improving our knowledge of the biological and natural processes that allow the rich marine biodiversity to flourish, particularly in some areas of the deep seas. The promotion, within ESFRI, of a European Marine Biological Resource Centre, offering direct access to the different marine ecosystems in European coastal waters, and aligning genomic and environmental research within a single research infrastructure would also contribute to this objective by providing access to presently unknown biological mechanisms which can in turn be used for biomedicine or for biotechnologies.

► **Optimise the cost of climate change mitigation**

Marine research infrastructure that provide information on the marine environment will also help improve predictions of climate change and its impacts on marine ecosystems and coastal areas. There are many ways in which a better understanding and prediction of the impact of climate change can provide benefits to the society.

The knowledge of the impact of climate change on the Arctic melting is crucial to design reasonable scenarios on potential economic developments taking place in this area, with respect to fisheries, energy exploitation and transport. The Northern route would, for instance, reduce the length for transport from China to Northern Europe by one-third but all these developments also carry considerable risks for the environment. It will allow policy makers to take the appropriate measures to ensure that such developments remain sustainable.

In another area, it has been estimated that the expenditure costs of coastal protection in Europe exceeds 1 billion Euros and that a narrowing of the prediction of sea level rise in different areas, thanks to better data in continuous series, could help save up to 100 million Euros per year.

Finally a better understanding of climate change impact is crucial for fisheries, where scientists must be able to distinguish changes in fish stocks induced by (over-)fishing from those induced by climate change. Poor diagnosis in this field can lead to mismanagement of fisheries. Fine knowledge of climate change can also have an impact on the location of fish farms to optimise the physico-chemical conditions for fish growth.

Contact persons for the JPI

Mrs. Kari Balke Øiseth
Director General
Department of Research
Ministry of Education and Research
P.O. Box 8119 Dep
0030 Oslo, Norway

Office phone: +47 22 24 74 60
Cell phone: +47 90 51 85 37
E-mail: boi@kd.dep.no

Mr. Simen Ensby
Director for international cooperation
The Research Council of Norway
P.B. 2700 St. Hanshaugen
0131 Oslo, Norway

Office phone: +47 22 03 74 07
Cell phone: +47 92 88 61 55
E-mail: sen@rcn.no