

JPI
OCEANS



Strategy framework

2021-2025



STRATEGY FRAMEWORK

2021-2025

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1.0

Introduction

1.1 WHAT IS JPI OCEANS?

The Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans) is a pan-European intergovernmental platform that increases the efficiency and impact of research and innovation for sustainably healthy and productive seas and oceans.

JPI Oceans was created in 2011 by request of the Council of the European Union as one of 10 JPIs, each focusing on a major societal challenge. The original mandate of JPI Oceans refers to the Europe 2020 strategy's ambition to harness:



W (...) the contribution of EU maritime policies, among others, to achieve EU emissions reduction and biodiversity targets, address climate change adaptation, disaster prevention and response, more efficient use of resources and contribute to improving global food security.

 Member countries

 In negotiation

Figure 1: JPI Oceans membership covers all European sea basins with 18 member countries.



JPIs were established to further align the European Research Area (ERA) by enabling multinational funding opportunities, better coordination, increasing cost-efficiency and synergies, and reducing fragmentation in European research policy. Operating in the vast marine environment is challenging and costly. That is why marine and maritime research and innovation is a particularly worthwhile sector to obtain large-scale synergies among countries and align their strategic resource investments.

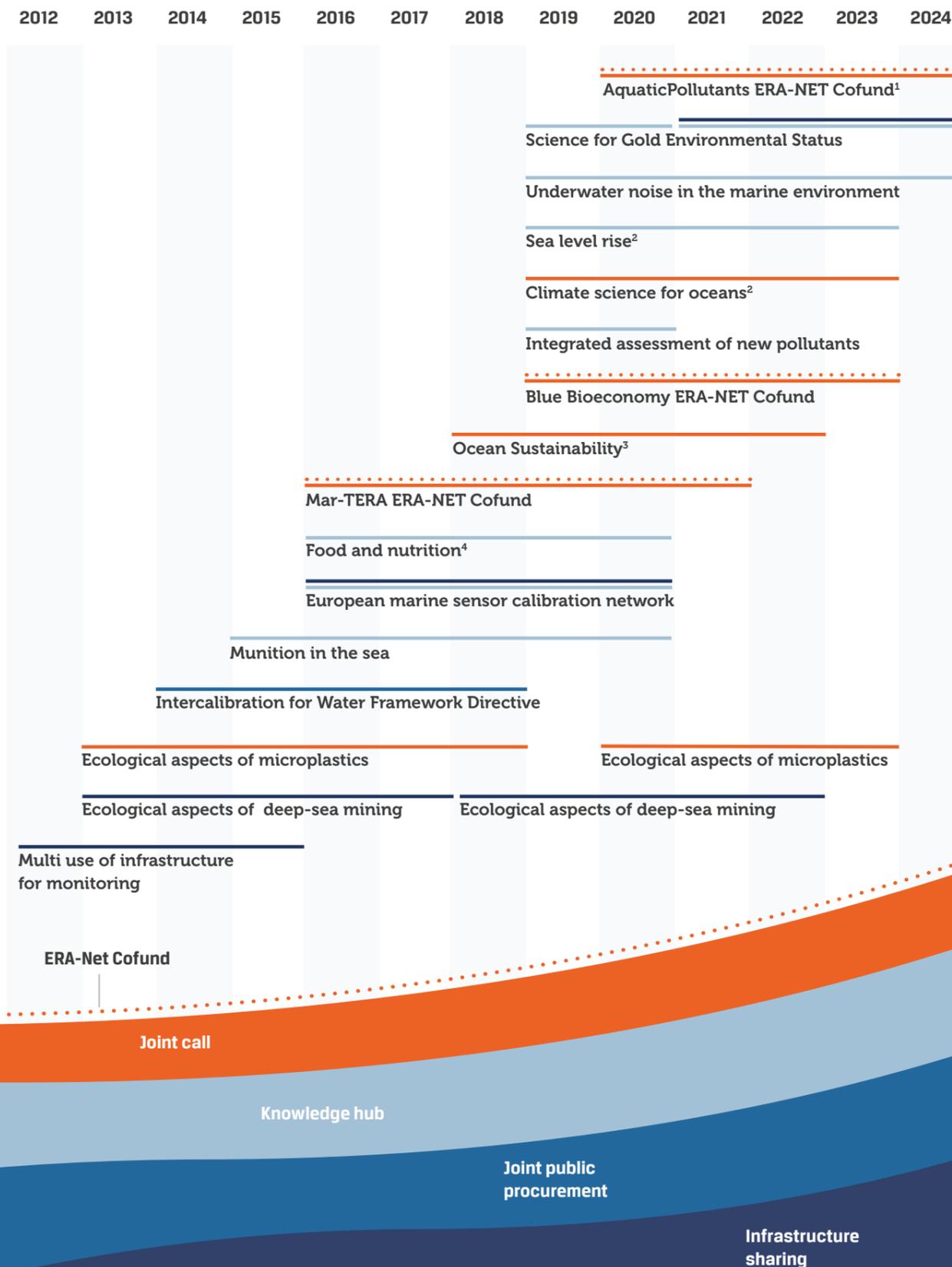
The Council recommended a set of actions through which JPI Oceans should pursue its mandate. These included identifying capacities and strategies for transnational activities, undertaking foresight exercises, developing joint calls for proposals, sharing and developing infrastructures, and developing efficient science-policy interfaces.

JPI Oceans is currently an intergovernmental partnership among 18 countries (Fig. 1), represented by governmental or national institutions such as ministries and funding agencies that develop, fund, and implement national research agendas and engage in international cooperation. It is governed by a Management Board composed of representatives from the Member and Associated Countries. These representatives have the authority to agree on Joint Action plans and funding initiatives across Europe.

Focused Joint Actions (Fig. 2) have been established as the central implementation mechanism of JPI Oceans' strategic agenda. Joint Actions address urgent or emerging topics that require knowledge and solutions to fulfil existing policy obligations.

Since 2018, JPI Oceans has been registered as a legal entity under Belgian law. This further consolidates the organisation's role in the European Research Area and reflects its increasing maturation. It is financed through member and partnership fees ensuring an equitable and stable basis to play a long-term, independent strategic role in the European and international landscape. Its operational hub is a secretariat located in Brussels. It facilitates strategic discussions, supports JPI Oceans' activities and fosters dialogue with stakeholders from science, industry and policy on European, Atlantic and global scale.

Figure 2: The suite of Joint Actions carried out by JPI Oceans, coloured according to the predominating tool(s) applied for their implementation (see chapter 5.2). Implementation tools subsumed under supporting activities were also applied to Joint Actions. Four Joint Actions are collaborations with (1) JPI Water and JPI Antimicrobial Resistance (2) JPI Climate, (3) Belmont Forum and Future Earth and (4) JPI Agriculture, Food Security and Climate Change (FACCE) and JPI Healthy Diet for a Healthy Life (HDHL). The Joint Actions are complemented by strategic engagements in Coordination and Support Actions and other European or international initiatives.



1.2 STRATEGIC ROLE OF JPI OCEANS

The distinctive role of JPI Oceans is that of an institutionalised, long-term intergovernmental platform with the ability to strategically prioritise and fund transnational research and innovation. This enables JPI Oceans to act as an efficient facilitator and implementer of research and innovation on marine and maritime challenges and opportunities.

National strategies and priorities are the main building blocks of JPI Oceans, also informed by the efforts of organisations specialised in assessments, foresight and knowledge gap analysis, and the specialist expertise and knowledge held in research performing institutions and organisations. JPI Oceans also serves as an umbrella for **cross-regional coordination of activities and exchange of experts, knowledge and best practices** between pan-European sea basin initiatives and their agendas.

Countries engage in and support JPI Oceans because they appreciate value additions to their national efforts in several ways. The interaction among countries through JPI Oceans has a mutual structuring effect on the marine and maritime strategic and funding landscapes in Europe. Strategic alignment is the basis for **increasing the value of national research and innovation investments** by implementing multi-national joint activities. JPI Oceans also ensures a level of independence that enables the pioneering of forward-looking, innovative research and innovation in areas of gradually emerging relevance.

To generate **impact through collaboration**, JPI Oceans builds on national capacities and networks in the participating countries and on engagement with policy and science-policy units in the European Union and global institutions like the United Nations (IOC, FAO, CBD, UNFCCC, UfM), OECD and others. As an intergovernmental partnership on research and innovation, JPI Oceans offers a platform for providing the European seas and oceans with an orchestrated voice in the marine and maritime arena and in the complementary relationship to the European Commission.



Photo credit: © VLIZ.

W JPI Oceans operates with a high level of flexibility. It allows countries to participate on a case-by-case basis according to their different priorities, needs and capacities.

To maximize the added value for participating countries, JPI Oceans operates with a high level of **flexibility**. It allows countries to participate on a case-by-case basis according to their different priorities, needs and capacities. Such flexibility and pragmatism also allow JPI Oceans to act fast when it comes to identifying emerging topics and implementing related actions, thus achieving quick outcomes.

Throughout its development, JPI Oceans has **worked closely with the European Commission**. The Commission is represented by DG Research and Innovation and DG MARE on the JPI Oceans Management Board as an institutional observer. The European Commission has granted JPI Oceans two Coordination and Support Actions and participated in co-funding three joint calls for a total of EUR 22.5 million. JPI Oceans aims to continue reinforcing EU actions, building on solid foundations partnering with the European Commission through Horizon Europe and beyond.

The **Horizon Europe Partnerships** between the European Union and Member States offers a format for continued collaboration with the European Commission. Several partnership topics demand a marine and maritime

perspective, such as those on a Safe and Sustainable Food System, Water security, Biodiversity, Waterborne transport, Circular bio-based solutions and others. They bear good potential for synergistic collaboration with JPI Oceans. However, most central to the scope of JPI Oceans is the new Partnership 'A climate neutral, sustainable and productive Blue Economy'. Accordingly, the JPI Oceans secretariat was instrumental in the preparation of a proposal for this Partnership. It offers a platform for the coming years to synergistically implement shared strategic ambitions of JPI Oceans and of this Partnership in the area of ocean productivity and Blue Economy (cf. chapter 4.2). JPI Oceans will further be able to carry forward the Partnership's legacy beyond its lifetime by implementing outstanding objectives or by adjusting intergovernmental collaborations to the Blue Economy needs as they evolve over time.

1.3 BUILDING ON SUCCESSES AND LEARNING

JPI Oceans can now build on a decade of experience (Fig. 3). The revised strategy for the years following 2020 is motivated by previous successes and intends to capitalise on best practices.

JPI Oceans has succeeded in establishing a network of actively participating countries that includes countries from all European sea basins, as well as international partners. In addition, generous resourcing was secured to maintain a strong secretariat and capacities to implement an increasingly diverse joint agenda. Several Joint Actions were established and demonstrated that the instrument is suitable for focusing capacities and resources on specific priorities. Among them, three Joint Actions on maritime technology, blue bioeconomy and aquatic pollutants were jointly developed and co-funded with the European Commission. They stand out as particularly broad and well-funded calls (Fig. 2).

Different Joint Actions were successful for different reasons. The Microplastics Joint Action built knowledge and momentum on an emerging topic before the issue received a lot of public and political attention. The MiningImpact Joint Action was exemplary in raising infrastructure sharing, including a research vessel, to a new level of European collaboration, amplifying credibility as well as public and political exposure. The Intercalibration Joint Action had a proven effect on threshold definitions in the EU Water Framework Directive. Joint Actions with

sister JPIs on Ocean & Climate, Aquatic Pollutants, and Food and Nutrition Security built bridges with experts and communities of crucial importance to develop solutions to cross-sectoral challenges.

Areas of evolution and revision

The 2015-20 strategy had developed a set of ten broad priority areas. The revised strategy by contrast defines the thematic space and impact ambitions of JPI Oceans, complemented by a clearly outlined procedure on how to establish activities that contribute to our goals. This approach aligns with the JPI Oceans record of initiating activities related to agreed topics of shared national interest and of quickly mobilising implementation resources through voluntary commitments by participating countries. JPI Oceans has effectively operated without a committed resource pool to pursue a multi-year research and innovation plan, but by facilitating collaboration and engagement among participating countries. The capacity of JPI Oceans to act as first or early mover is ensured by maintaining a flexible and pragmatic design of Joint Actions with low bureaucratic thresholds. Increasing the creative space for topic development makes JPI Oceans even more agile, by avoiding overly specific and

JOINT ACTION EXAMPLE 1

ECOLOGICAL ASPECTS OF MICROPLASTICS CUTTING EDGE RESEARCH FOR A GLOBAL PROBLEM

Since 2014, 15 European countries and Brazil have committed 18.2 million Euro for research on the ecological aspects of microplastics in the marine environment under the framework of JPI Oceans. In an initial phase, four projects were funded. They focused on ecotoxicological effects of microplastics, the weathering of plastics, and baselines and standards for microplastics analyses in European waters. In a statement published in October 2015, the G7 Science Ministers acknowledged this work and called for actions and solutions to combat marine litter. In addition, the coordinators of the projects provided valuable input to the European Commission's Technical Group on Marine Litter. The latter supports and guides the implementation process of the Marine Strategy Framework Directive in close collaboration with EU member states.

Building on the results from the first transnational call "Ecological aspects of micro-plastics in the marine environment" and recent scientific findings, a second call was launched by 13 JPI Oceans member countries, Latvia and Brazil in November 2018. After evaluation, six new JPI Oceans projects were selected for funding to conduct research on sources of microplastics, methods for identifying smaller micro- and (nano-) plastics and monitoring their circulation in marine systems and the effects they have thereon.

Figure 3: Timeline outlining the development phases of JPI Oceans until today and into the future; with JPI Oceans' establishment, the co-design of the SRIA, large-scale implementation of R&I activities, broadening its organisational basis as an AISBL, and – now – anticipated upscaling of JPI Oceans Joint Actions and of collaborations with European and international partners and stakeholder organisations.



W JPI Oceans is setting itself up for closer collaboration over the coming years with EU initiatives, sea basins, overseas countries, sister JPIs, and other partners.

prescriptive priority areas which would bind attention and resources. In addition, opening up the proposition process for interesting topics to stakeholder input at the beginning of the Joint Action development harnesses the knowledge and creativity of external experts' diverse perspectives.

The design of JPI Oceans as an intergovernmental platform at the interface between science and policy ensures relevance of actions and efficient uptake of their outcomes. However, as most of JPI Oceans Joint Actions are still ongoing, their operational emphasis has so far been on their initiation. As more Joint Actions are maturing towards their concluding phase, JPI Oceans will give more attention to ensure impactful syntheses or other output is produced, tailored to target user groups and backed by communication and delivery campaigns.

As an interface organisation, JPI Oceans has already been a catalyst in communication and collaboration with partners across structural, geographical and sectoral boundaries. Following the formal transformation to a stand-alone, non-commercial legal entity, and the more recent commitment to contribute to interconnected cross-sectoral challenges like the United Nation's 2030 Agenda or the Marine Strategy Framework Directive (MSFD), JPI Oceans is setting itself up for closer collaboration over the coming years with EU initiatives, sea basins, overseas countries, sister JPIs, and other partners.

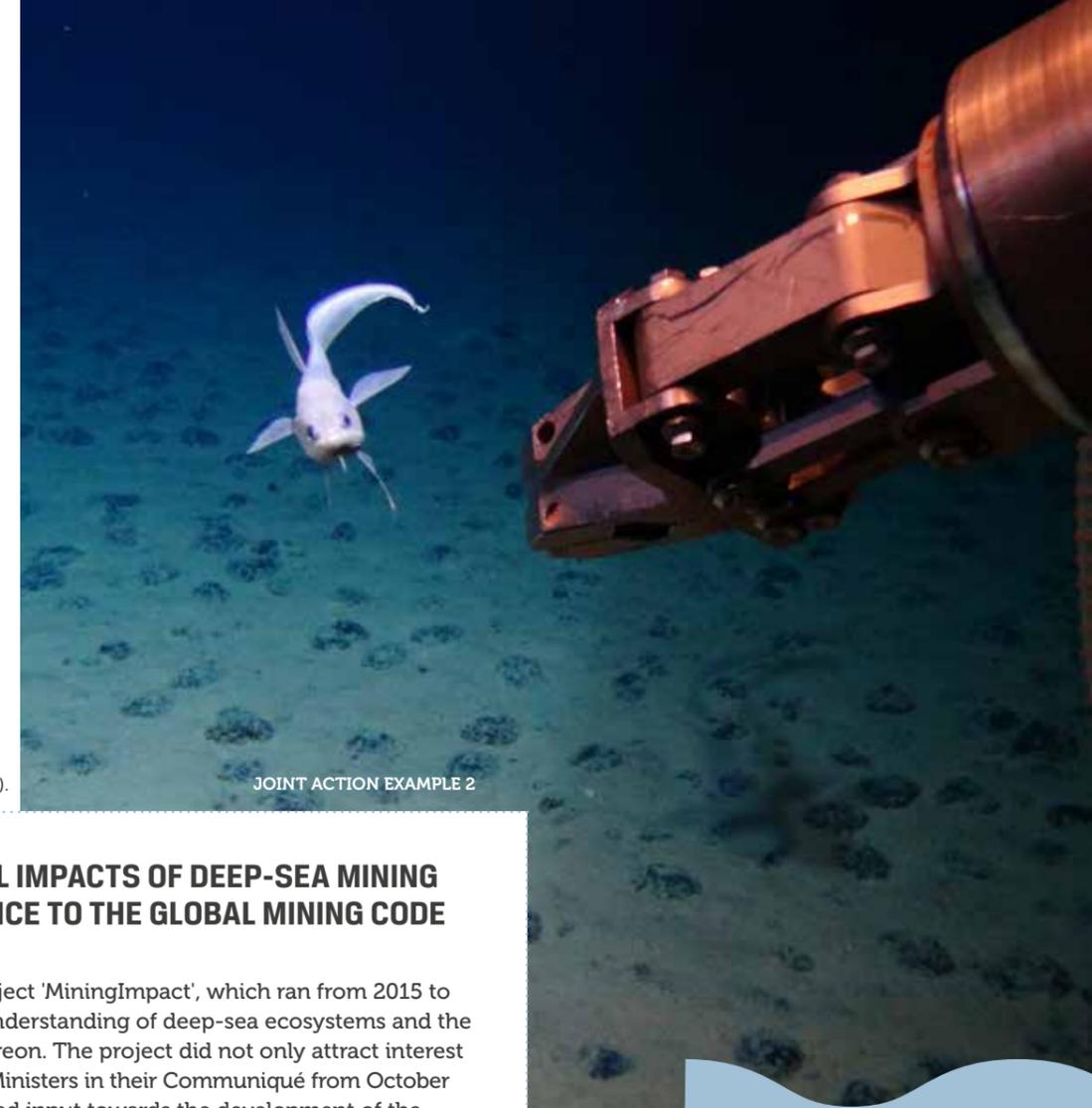


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ROV Team/GEOMAR (CC-BY 4.0).

JOINT ACTION EXAMPLE 2

ENVIRONMENTAL IMPACTS OF DEEP-SEA MINING A EUROPEAN VOICE TO THE GLOBAL MINING CODE

The first research project 'MiningImpact', which ran from 2015 to 2017, improved the understanding of deep-sea ecosystems and the impact of mining thereon. The project did not only attract interest from the G7 Science Ministers in their Communiqué from October 2015, but also delivered input towards the development of the international Mining Code. The latter is the set of regulations for the exploitation of polymetallic nodules in the deep seabed beyond the limits of national jurisdiction, which the International Seabed Authority (ISA) is currently negotiating.

The second project, 'MiningImpact 2' will be able to reduce existing knowledge gaps and uncertainties on the environmental impact of deep-sea mining of polymetallic nodules. The project will also specifically work towards policy recommendations and further contribute to the preparation of environmental impact assessments (EIAs) for future European deep-sea pilot mining tests requested by the ISA.

With these projects, JPI Oceans is generating and providing the necessary evidence base to underpin the development of the international governance framework for the exploitation of seabed resources that is currently being negotiated. By funding top-notch interdisciplinary science, JPI Oceans is giving the European science community a common voice in these global negotiations, ensuring that global policies are based on the best available scientific knowledge.



2.0 Strategic cornerstones

2.1 VISION AND MISSION

The following vision articulates at a high level what JPI Oceans ultimately wants to achieve. The mission describes the general approach to achieve it. The vision is further broken down into three strategic goals outlining tangible accomplishments.

Our vision

is to enable the transformation towards a sustainable blue economy whilst fostering the health and productivity of seas and oceans.

Our mission

is to facilitate the efficient provision of expert knowledge and innovative solutions to enable informed policy delivery and economic development that ensures sustainably healthy and productive seas and oceans.

The pursuit of the vision and mission is linked to an operational strategy with three complementary operational goals for the successful implementation of JPI Oceans' ambition and contribution to national and international policymaking and societal transformation (Fig. 4). Each operational goal is pursued with a few goal specific key approaches, described in the objectives for each of the operational goals.

2.2 OPERATIONAL GOALS AND OBJECTIVES

To reach the vision and mission and fulfil its strategic role, JPI Oceans strives to achieve three overarching operational goals, each of them pursued through several high-level objectives.

1st goal - Align priorities

Align national and international R&I agendas by identifying and jointly addressing marine and maritime issues of pan-European political and societal relevance.

Objectives:

- Engage countries in sharing their national priorities and in adopting jointly identified topics in their national agendas and strategies.
- Engage in international science-policy processes at regional, European and global levels to contribute to the development of underlying agendas and identify opportunities for their implementation.

2nd goal - Implement our agenda

Implement collaborative R&I in a way that maximises resource efficiency and transformational impact.

Objectives:

- Offer an attractive agenda, efficient implementation processes and clear value proposition for countries to develop and participate in Joint Actions.
- Involve stakeholders in the co-development of Joint Actions.
- Pursue opportunities for synergistic collaboration of JPI Oceans activities with regional, European and global initiatives.
- Seek co-funding opportunities with Horizon Europe and other champions of R&I support in both public and private spheres

3rd goal - Impact decision-making

Ensure that R&I outcomes contribute to relevant transformative policy and decision-making towards sustainable seas and oceans and a blue economy.

Objectives:

- Ensure uptake of R&I outcomes by creating ownership among member countries and experts from stakeholder groups through co-development of JPI Oceans activities and products.
- Ensure knowledge transfer to maximise update and impact of R&I at knowledge-generation and decision-making levels.
- Increase ocean literacy among key sectors of politics and society.

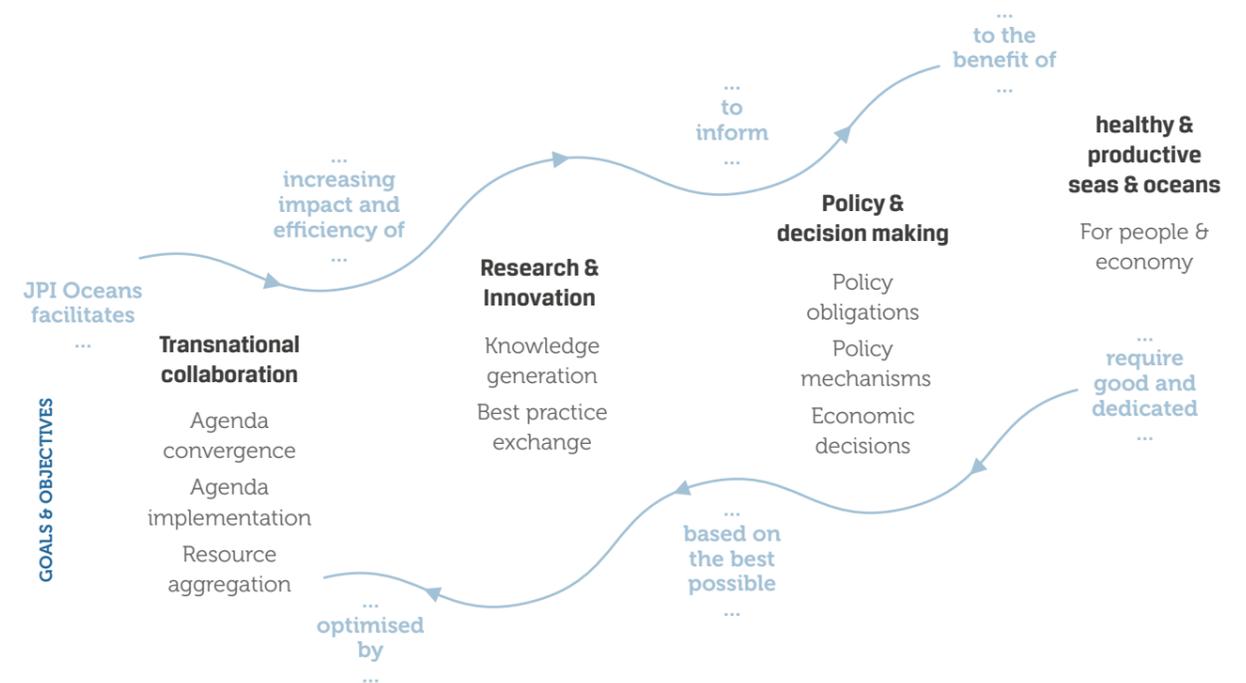


Figure 4: Illustration of the narrative underlying the strategic elements of JPI Oceans.



3.1 GLOBAL

Several global agreements provide a socio-political framework for the oceans and seas sector. The resulting global agendas are therefore highly relevant to JPI Oceans and are reflected in the revised strategy and scope. By participating in JPI Oceans, countries can contribute to and shape international processes, e.g. the UN Decade of Ocean Science, and international agreements.

The United Nations 2030 Agenda provides the most comprehensive and interconnected framework with 17 goals for sustainable environmental, societal and economic development. **Sustainable Development Goal (SDG) 14**, dedicated to the conservation and sustainable use of oceans, seas and marine resources, calls for sustainable fisheries, curbing pollution and acidification, the protection of marine and coastal ecosystems, and implementation of protection measures such as international laws and protected areas, among others. Other SDGs, particularly those addressing climate (SDG 13), land ecosystems (SDG 15), consumption & production (SDG 12), economic wellbeing (SDG 8), nutrition (SDG 2), and health (SDG 3), also chiefly depend on inclusion of direct effects or indirect linkages of marine and maritime factors.

Other highly relevant political agreements under the auspices of the United Nations include the **Paris Climate Agreement**, the **Aichi Biodiversity Targets**, and the **Sendai Framework for Disaster Risk Reduction**. Their area-specific foci complement the 2030 Agenda in the fields of climate mitigation, biodiversity protection, and disaster risk reduction and provide additional motivation and direction for JPI Oceans' design of scope and agenda.

All these UN agreements cut across several sectors of the Earth system, including oceans and seas. As a global mechanism for efforts from an ocean-perspective, the UN has called for a decade specifically dedicated to ocean science for sustainable development. The Science Action Plan of the **UN Decade of Ocean Science for Sustainable Development** is based on major societal needs that require the ocean to be clean, healthy, resilient, productive, predicted, safe, accessible and inspiring, all of which are attributes that JPI Oceans generally adheres to. The Decade may also create significant momentum for underlying ocean infrastructures such as ocean monitoring and observation, data sharing and access, and ocean literacy.

3.0

Policy Context



The report of the **Organisation for Economic Co-operation and Development (OECD) 'The Ocean Economy in 2030'** (OECD, 2016) states that economic activity in the ocean is expanding rapidly but that an important constraint on its development is the current deterioration of ocean health. The report puts forward a set of recommendations to enhance sustainable development of the ocean economy. One of these is aimed at fostering greater international cooperation in maritime science and technology, to stimulate innovation and strengthen the sustainable development of the ocean economy. Another recommendation is to strengthen integrated ocean management.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) released its Global Assessment Report on Biodiversity and Ecosystem Services in 2019. It outlines that about 66% of the marine environment has been significantly altered by human actions. The Intergovernmental Panel on Climate Change (IPCC) Special Report on the Ocean and Cryosphere (2019) highlights the urgency of prioritizing timely, ambitious and coordinated action to address unprecedented and enduring changes in the ocean and cryosphere. Both processes are a source of agenda information, and targets for knowledge generated within JPI Oceans activities.

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The Science Action Plan of the UN Decade is based on major societal needs that require the ocean to be clean, healthy, resilient, productive, predicted, safe, accessible and inspiring, all of which are attributes that JPI Oceans generally adheres to.

Photo credit:
Erlend Astad Lorentzen /
Havforskningsinstituttet.

3.2 EUROPEAN

The European Union is developing and releasing regulatory documents on all central areas relevant to JPI Oceans, addressing maritime matters, blue growth, protection of climate and environment, and the organisation of European research and innovation. With these regulations, EU Member States are giving themselves a common policy framework partly echoing global policies and obligations.

While not all documents are legally binding, they remain associated with widely shared and synchronised obligations to establish enforcement and implementation measures for EU decisions, and to generally put legal frameworks into practice. This often requires knowledge, experience, innovation, coordination and new infrastructure. Here, joint programming can serve as the most efficient mechanism to streamline national efforts across Europe by coordinating initiatives, sharing costs, aligning agendas, pooling expertise and exchanging results.

The core European legislative piece for JPI Oceans is arguably the **Integrated Maritime Policy (IMP)** (Fig. 5, next page). It sets the EU level framework by providing a more coherent approach to marine and maritime issues, as well as increased coordination between different policy areas relating to Europe's oceans and seas. Its implementation strategy foresaw the need to partner with the member states through the establishment of a platform such as JPI Oceans.

The Marine Strategy Framework Directive (MSFD) is the environmental pillar of IMP, due to its integrated approach of demanding Good Environmental Status (GES) for the ocean and seas across all sectors. Its implementation requires

systemic understanding, identification of criteria and thresholds, tailored monitoring and observation, and assessment of effective measures. This poses complex and costly challenges for countries, and the objective to achieve GES by the original 2020 target has not been achieved. Accordingly, achieving the MSFD goals is a major driver for JPI Oceans in its strategic prioritisation and an important motivation for countries to undertake Joint Actions.

Other European legislation pieces address specific marine and maritime areas that JPI Oceans considers strategic to its agenda setting, such as legislation on spatial planning, biodiversity, blue growth, fisheries, sustainable food systems, blue energy, maritime transport and climate neutrality. The 9th Framework Programme **Horizon Europe** for the term 2021-27 constitutes an agenda rich in opportunities for partnering, collaboration and complementarity. In 2019, the European Commission presented the **European Green Deal** – a roadmap to make the EU's economy sustainable. The Green Deal and associated components such as the Farm to Fork Strategy, Climate Law and Zero Pollution ambition aim to make Europe climate neutral by 2050 and provide a roadmap with actions to boost the efficient use of resources by moving to a clean, circular economy and revert biodiversity loss and cut pollution, all relevant for JPI Oceans' work going forward.

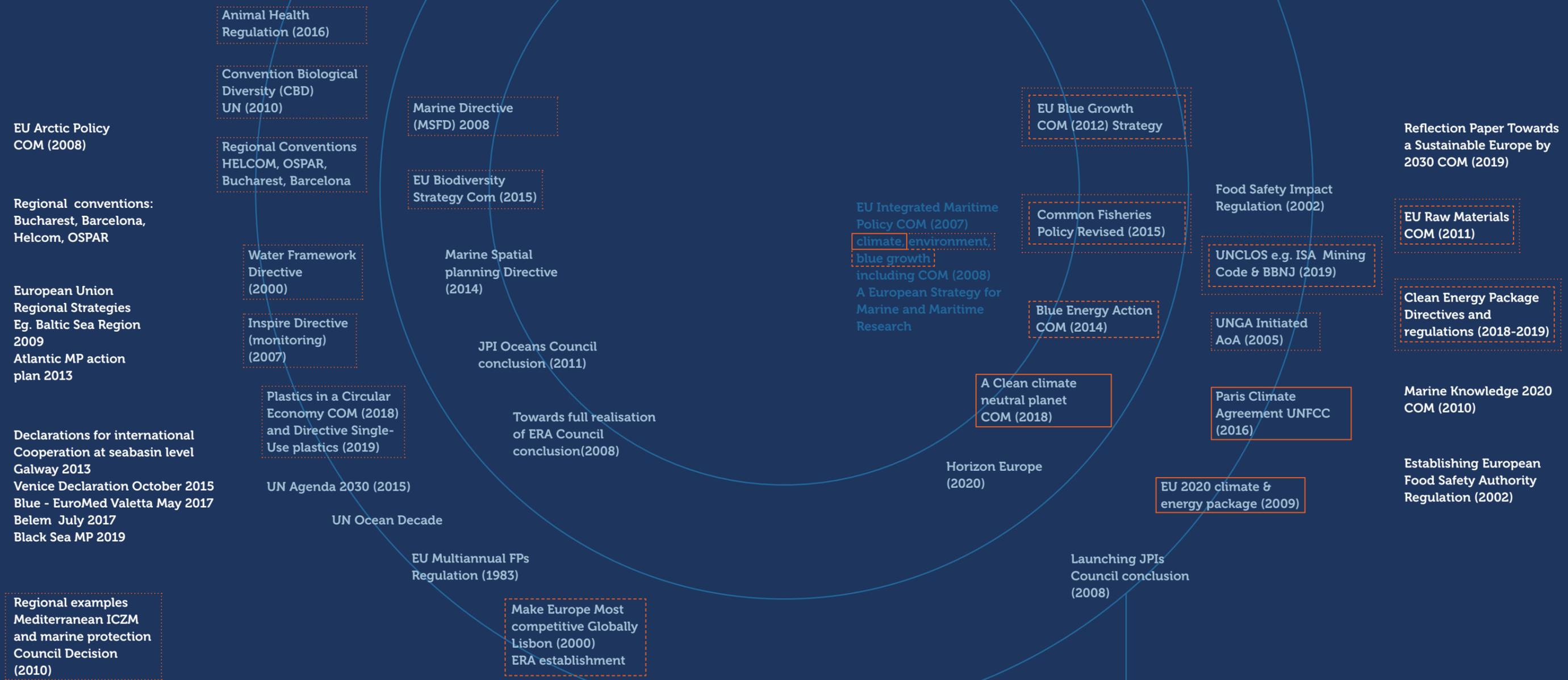


Figure 5: Map of policy drivers at EU and global level. They are arranged in tiers of increasing relevance for JPI Oceans towards the centre of the circle and colour coded when associated with one of the areas climate, environment, or blue economy.

- Climate-related policy driver
- Environment-related policy driver
- Blue growth-related policy driver

3.3 REGIONAL

At the regional sea basin level, the European countries have adopted legally binding conventions for the protection of the marine environment as part of the regional seas conventions and action plans framework. The four European regional seas conventions are the Helsinki Convention (HELCOM) in the Baltic Sea, the Barcelona Convention (UNEP-MAP) in the Mediterranean Sea, the Bucharest Convention in the Black Sea and the OSPAR Convention in the North East Atlantic Ocean, including the North Sea.

In addition to these legally binding conventions, the regional European ocean and sea basins have established platforms for **agenda setting** and strategic coordination of research and innovation: Atlantic Ocean Research Alliance (AORA) and All AtlaNtic Cooperation for Ocean Research and innovation (AANChOR) for the Atlantic Ocean, BONUS and BANOS for the Baltic and the North Sea, BlueMed for the Mediterranean Sea and Black Sea CONNECT for the Black Sea. These groups are of great value for engaging various stakeholders in discussions and activities of regional scope and in addressing sea-basin specific challenges.

W Regional platforms actively engage local partners in two ways. They allow local partners to set the agenda and they strategically coordinate research and innovation.

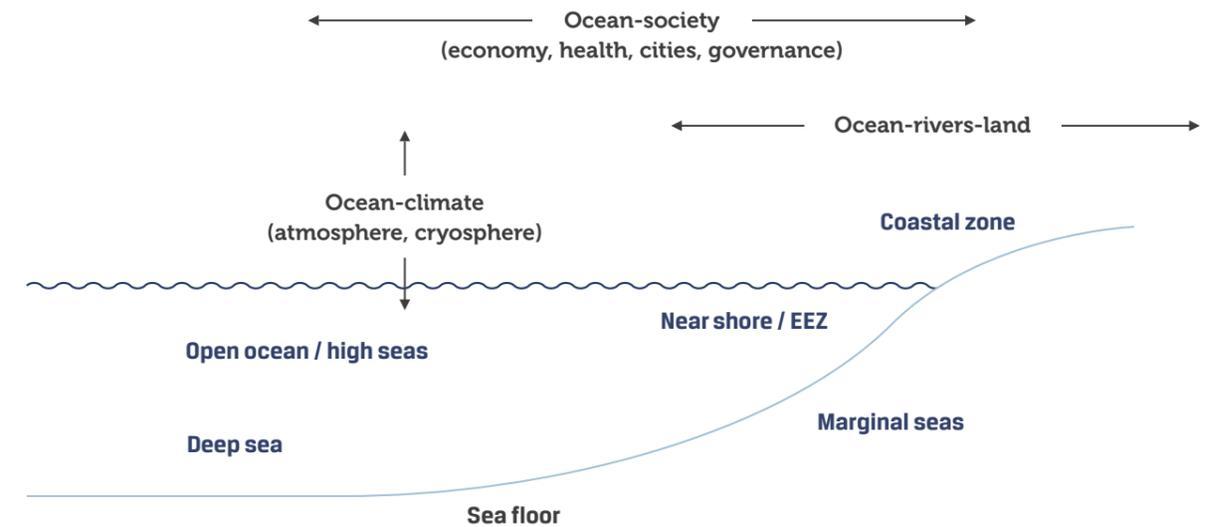
3.4 NATIONAL

National strategies, agendas and resources are the building blocks of JPI Oceans. Their origins can vary between countries, e.g. coming from one dedicated national ministry or R&I funder, from an inter-ministerial process or from national coordination by a reference group of the main national actors. When significant convergence between the national priorities of several participating countries is identified, these priorities can be aligned into Joint Actions and pursued in pan-European collaboration, adding value that goes beyond national capacities.

In return, the joint programming process of JPI Oceans also holds the potential and ambition to enrich national strategies and coordination by inspiring the **national adoption of emerging topics** of transnational attention, encouraging the development of integrated national marine and maritime strategies and generally incentivising cross-ministerial and cross-institutional conversation within members countries.

W National strategies, agendas and resources are the building blocks of JPI Oceans. Significant convergence between the national priorities can be aligned into Joint Actions.





DOMAINS

Figure 6: Schematic of the central marine and maritime domains addressed by JPI Oceans (in bold) and the interfaces with other domains which JPI Oceans can address in collaboration with external partners (in italics).

In its full name, JPI Oceans refers to seas and oceans as its domains of main concern. While we often use the term "oceans" in a broader inclusive sense, the narrow definition relates to the open part of the ocean with a relatively uninhibited connection among the major ocean basins. Sea basins, on the other hand, are characterised by partial hydrographic isolation, which often leads to a more pronounced impact of anthropogenic pressure compared to open ocean regions. Maritime Europe is characterised by sea basins more than any other part of the world, calling for common and coordinated scientific and political approaches among different marginal sea basins.

Socio-economic and environmental domains that JPI Oceans implicitly also considers central to its scope include the coastal zone, small islands and the sea floor with all their resources, ecological niches, economic activities, political constellations, and specific legal conditions (Fig. 6). To adequately conduct R&I on such interconnected complex systems, JPI Oceans speaks to a wide scope of expertise that includes natural and social sciences, but can also reach out to the humanities, engineering, law, economy and finance.

To solve many of the marine and maritime challenges, it is essential to go beyond the core domains of JPI Oceans. The key to a comprehensive grasp of interconnected problems and their effective solution often lies at the interfaces with the climate system, with the land including inland waters and upstream activities, and with societies including economic practices and coastal and inland management (Fig. 6). JPI Oceans aims to increasingly address these domain interfaces in collaboration with suitable partners, such as sister JPis, Horizon Europe partnerships, NGO partners, among others.

4.0

Scope

GEOGRAPHIC SCOPE

The geographic focus of JPI Oceans is on those Seas (Black Sea, Mediterranean, Baltic and North Sea) and Oceans (Atlantic and Arctic) with extensive coastlines and exclusive economic zones of European countries. However, this does not exclude activities in regions of the Pacific, Indian, and Southern Oceans, should these be of relevance to European interests. For example, research under the deep-sea mining impact Joint Action is carried out in the North Pacific because that is where the claims for the exploration of industrial mining techniques are located. Research in the Ocean-Climate call is carried out in the subtropical Atlantic given that ocean-atmosphere processes at low latitudes strongly influence European weather and climate, as well as climate prediction accuracy for Europe and elsewhere.

THEMATIC SCOPE

The thematic space of JPI Oceans presented in this document is developed on the basis of the ten thematic areas and three cross-cutting themes of the SRIA 2015-2020. The areas and themes were assessed for their continued timeliness and completeness. They were moderately modified to align with the latest priorities and framings in the field of marine and maritime R&I. The resulting revised 12 areas were then arranged in a continuous framing (Fig. 7) of ocean requirements with the three interconnected priority areas (1) Ocean Health, (2) Ocean Productivity, and (3) Ocean Stewardship & Governance. This moderate repositioning of the strategic areas reduces their distinctness in favour of reflecting openness towards systemic approaches to ocean challenges, such as looking at cumulative effects of pollutants, at multiple impacts of climate change, or at observation and technology developments for environmental improvements.

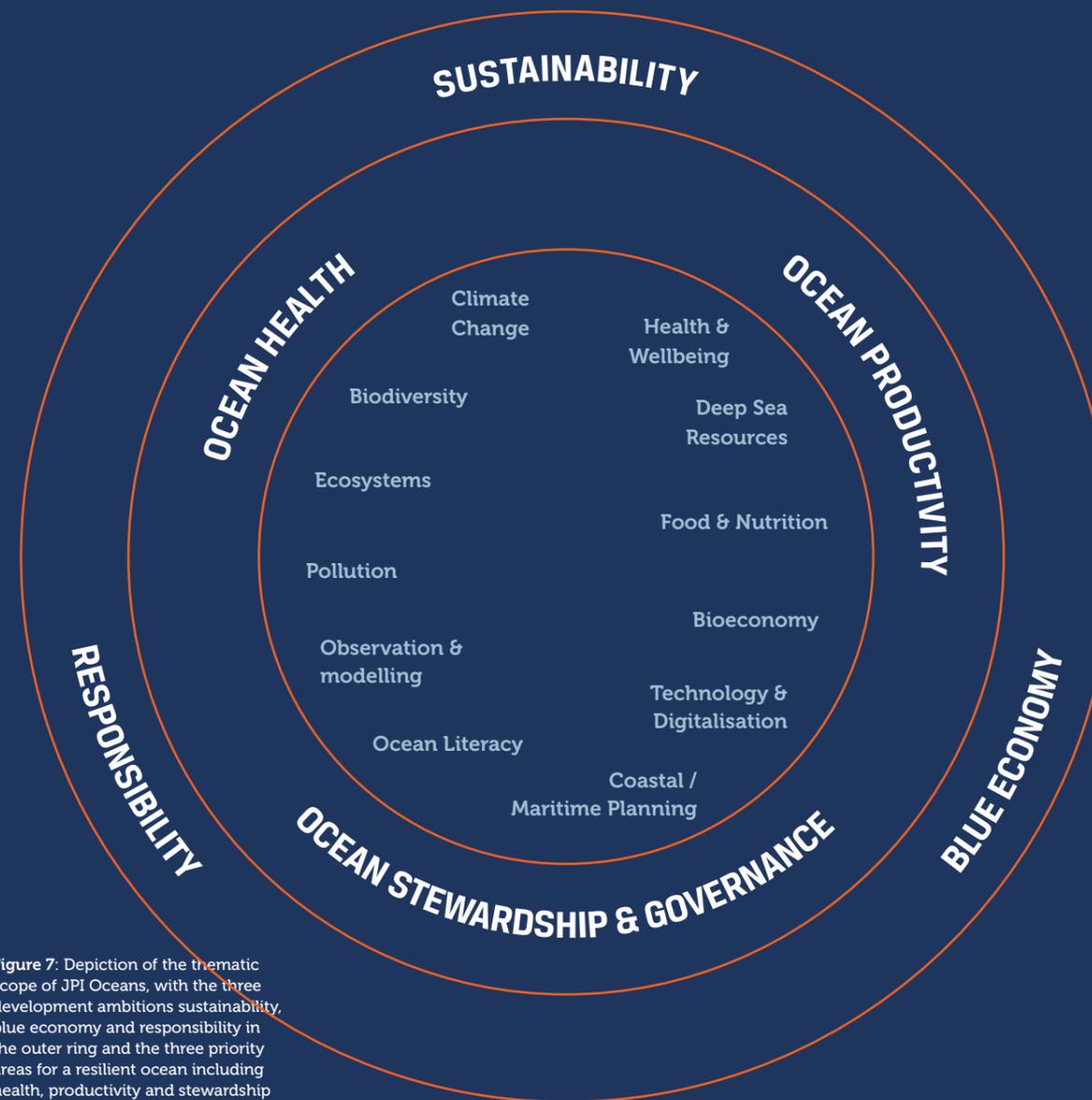


Figure 7: Depiction of the thematic scope of JPI Oceans, with the three development ambitions sustainability, blue economy and responsibility in the outer ring and the three priority areas for a resilient ocean including health, productivity and stewardship & governance in the middle ring. The centre details the kind of topics of interest that adhere to the higher-level framing.

JPI Oceans is an effective platform to align national and regional research strategies and investments but does not have a dedicated programme budget. The revised strategy was therefore designed as an open thematic space. This offers the flexibility to harness converging national interests that contribute to meeting the goals and challenges that lie within the scope of JPI Oceans through long-term structuring investments and commitments. This mode of operation can complement time-bound programmes with a fixed budget, such as the EU Framework Programmes.

The open thematic scope (Fig. 7) with a clearly formulated ambition but no fixed delivery plan on specific priorities also generates leeway for JPI Oceans to adapt and react to challenges and opportunities that emerge over the course of the strategy period. This reinforces JPI Oceans' agility in the landscape of R&I enablers, i.e. to act as first or early mover and to mobilize resources relatively quickly through voluntary commitments of its members.

4.1 OCEAN HEALTH

Environmental integrity has become a concern among European societies, an important element of political discourse and a consideration for economic development. The ambition to protect ocean health is embedded in this thinking.

A healthy ocean will provide a rich basis for sustained economic activities and people's wellbeing. People's drivers to protect ocean health thus range from economic interest to ethical responsibility. Sustainable development across all socioeconomic sectors is promoted as the United Nations 2030 Agenda. It explicitly includes the marine realm and offers guidance to address ocean health in connection with other Sustainable Development Goals. At the individual or sectoral level, Responsible Research and Innovation has emerged as an approach that appeals to all stakeholders of Research and Innovation to take responsibility for ensuring solutions that are societally inclusive and ecologically sustainable.

Societal Importance

The rapid expansion of new ocean industries, alongside the growth prospects of traditional industries, puts increasing pressures on the oceanic environment. These increasing anthropogenic pressures are intertwined with the historical and current threats and pressures from land-based sources. The impact of the latter most intensely affects coastal areas but is not limited to them, as the global spread of ocean plastics pollution illustrates. On the other hand, ocean warming and ocean

acidification, two connected effects of rising greenhouse gas levels, have a global impact on the oceans independent of the emission hotspots.

The entirety of marine ecosystem services depends on ocean health. They offer a rich capital that can support a long-term, thriving blue economy and human wellbeing. However, ocean health is threatened today by intensifying human activities on land and in waters, resulting in chemical, biological and physical forms of pollution, in habitat destruction and ecosystem disturbance, and damage to coastal and seafloor integrity. The exact extent to which ecosystem services are impaired or what the critical causes among multiple pressures are and how to best protect or recover ocean health are, however, in many cases unclear.

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Research & Innovation Opportunities

To increase efficiency in the conservation and restoration of marine environmental health across Europe, the EU has implemented the Marine Strategy Framework Directive (MSFD). It aims to achieve Good **Environmental Status (GES)** in the EU's marine waters and to preserve the resource base which marine-related economic and social activities depend on. Eleven qualitative descriptors outline what GES means in practice, when achieved. Descriptors range from preventing harm from waste and litter to minimising eutrophication and keeping contaminants and energy emissions below pollution levels to maintaining biodiversity.

Improvement of the description of Good Environmental Status as a whole requires an integrated approach to assessing any maritime activity or protection measure, to ensure synergies between descriptors are maximised and trade-offs minimised. Achieving Good Environmental Status requires a solid **understanding of the structure, function, and connectivity of marine ecosystems**. Research on the functional links that connect marine ecosystems and between physical processes and the biological environment is fundamental for understanding the ecosystem services provided by the ocean and the potential for restoration of habitats

and their associated ecosystem services.

With regard to the application and interpretation of **ecosystem service assessments**, the scientific and regulatory communities still lack consensus, resulting in an incoherent operational framework. Different terminologies and methodologies are used to assess, value and map eco-system services and ecosystem service bundles. One opportunity for improvement would be a better integration of natural and social sciences into ecosystem service assessment frameworks to combine monetary and non-monetary valuations. Other opportunities lie in a better understanding of interactions among different ecosystem services and the underlying ecosystem functioning.

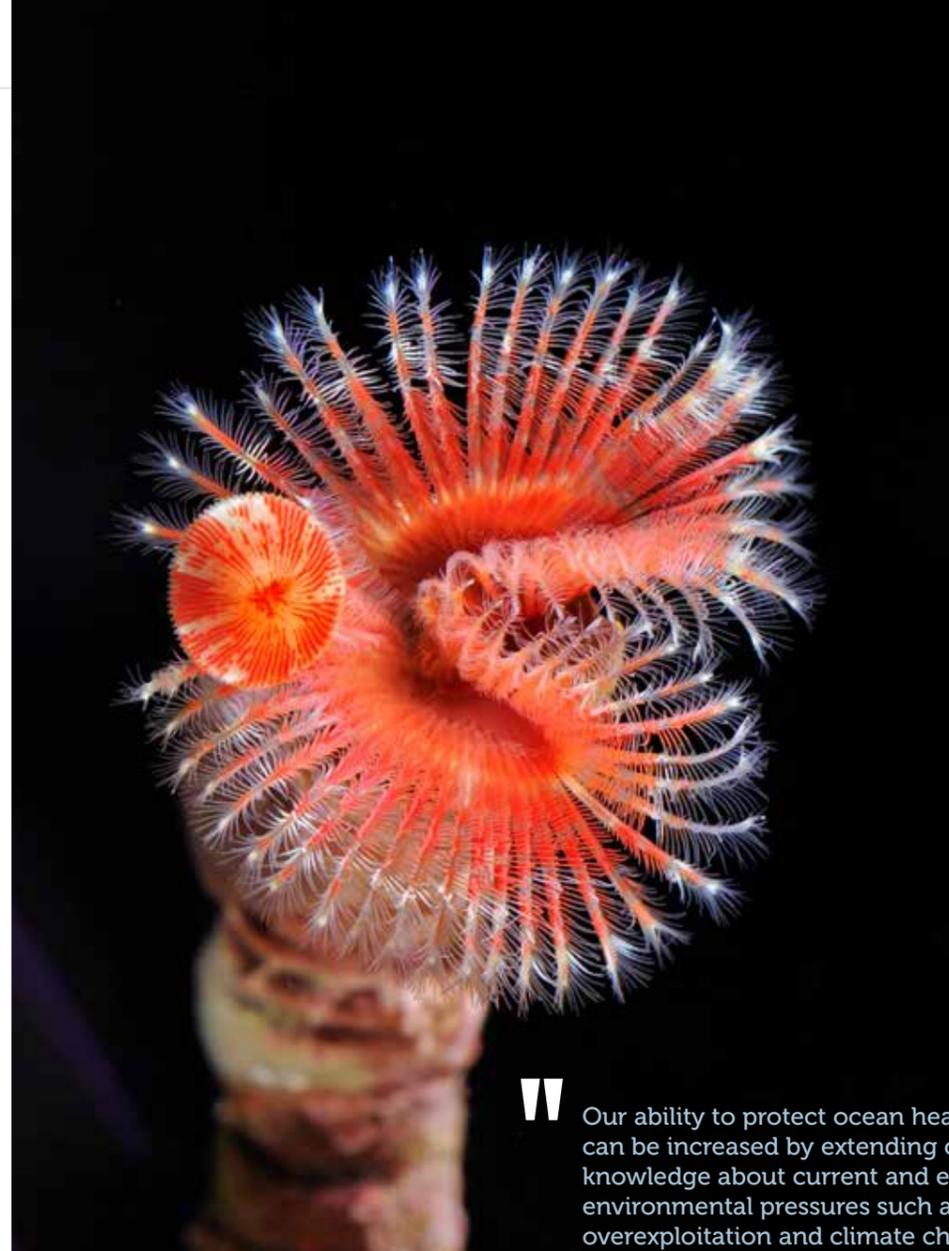
One of the European Green Deal's main targets is to have a major impact in halting **biodiversity** decline and restoring ecosystems. In that context, knowledge on status and trends, the causes and consequences of biodiversity loss and degradation of ecosystem services is crucial to substantiate cost-effective measures and management options.

Our ability to protect ocean health can be increased by extending our knowledge about **current and emerging environmental pressures** such as **pollution, overexploitation and climate change** and their impacts across longer timescales, broader geographic scales and all essential ecosystem components. Further key advancements can come from improving the tools to assess the environmental impact of pressures and the efficiency and socioeconomic impact of measures to reduce or eliminate them. This is even more essential in the context of **cumulative effects assessments** where interactions between multiple activities, pressures and ecosystem components are investigated in a systemic way. The complexity in understanding synergistic, antagonistic and additive cumulative effects, and the ways for managing the causal human activities and pressures, requires a new level of systemic research. This can, for instance, take the form of the development and validation of models, to better understand and predict cumulative effects on species and habitats.

The research community is paying growing and emerging attention to underwater **noise** emissions as a form of **pollution** dominantly generated by maritime activities. Noise is now recognised as an impact on marine populations' health and biological productivity. Concerns about acoustic pollution of the marine environment are therefore directing scientific interest to a better understanding of the problem and possible solutions, with relevance for national and international regulatory frameworks and the blue economy.

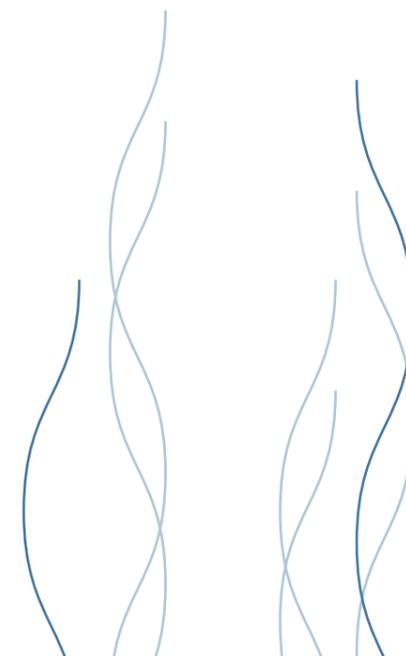
Anthropogenic greenhouse gas emissions into the atmosphere add global-scale pressures on the marine environment. The ocean has taken up ca. 90% of the excess heat from global warming, 30% of the emitted carbon dioxide (CO₂), and basically all the water from melting continental ice. **Ocean warming, ocean acidification, sea level rise and oxygen loss** put multiple pressures on ocean health and the communities that rely on predictable climate change effects, productive ecosystems, biological resources, or safe coastal areas, infrastructures, and hinterlands. It will be necessary to strengthen knowledge and develop innovative approaches to enable informed societal transformation that responds effectively to the multiple challenges of climate change to the oceans.

Major breakthroughs in research and innovation will be required to reach the mitigation targets of the Paris Climate Agreement to which the European countries have committed. Reducing uncertainties of **climate-ocean interactions** and the ocean's buffering capacity for heat and CO₂ absorption call for more progress on observations and coupled modelling. Decarbonising our ocean economy and infrastructures requires the development of innovative carbon-neutral options in sectors like maritime energy production and transport. In addition, meeting the challenge of "negative emissions", i.e. carbon removal from the atmosphere, requires innovative research into "blue carbon", ecologically viable carbon sequestration options in the world's ocean and by coastal ecosystems. Both decarbonisation and carbon removal offer wide fields for research and innovation from basic science to commercial applications.



“ Our ability to protect ocean health can be increased by extending our knowledge about current and emerging environmental pressures such as **pollution, overexploitation and climate change** and their impacts across longer timescales, broader geographic scales and all essential ecosystem components

The IPCC Special Report on the Ocean and Cryosphere (2019) stated that observed and projected changes will present us with major adaptation challenges. In the **Arctic**, positive feedback mechanisms between warming and ice loss have contributed to an amplified surface air temperature increase at twice the rate compared to the global average. These changes will result in an Arctic Ocean free of sea ice during summers during the second half of the 21st century and bring many ocean and cryosphere-dependent communities to the limits of their adaptive capacities. Research and innovation must deliver towards more effective adaptation measures for strengthening the resilience of coastlines, coastal communities, and exposed ecosystems, while also contributing to efforts that limit global warming and atmospheric greenhouse gas concentrations to keep changes manageable for adaptation.



4.2 OCEAN PRODUCTIVITY

Ocean productivity is the aggregate of the ecosystem goods and services that the ocean provides for the wellbeing of people and socio-economies. Productive seas and oceans deliver the capital that sustains the ocean economy. To ensure humanity can continuously and increasingly benefit from marine resources, a knowledge-based approach that integrates ambition for ecological sustainability with blue economic development is pivotal.

Societal Importance

There is an enormous potential for healthy and sustainable seas and oceans to deliver innovation, value creation and employment. Furthermore, their role in addressing global challenges such as energy security, healthy environment, climate change and sustainable food systems provision is substantial. In 2018, the EU Blue Economy directly employed close to 5 million people, generated around €750 billion in turnover and €218 billion in gross value added. By 2030, the OECD report "The Ocean Economy in 2030" stated that ocean-based industries have the potential to double in size by 2030 compared to 2010, outperforming the growth of the global economy. These snapshots highlight the ocean's importance for the current and future European economy.

Beneath the optimistic development prospects for the ocean economy lie complex systems of overlapping activities, often competing for limited space and resources. Citizens' growing awareness of environmental sustainability and societal equity requires economic sectors to merit their social licence to operate in the maritime space in order to thrive in the long term. These interconnected challenges can be met but require the best possible basis of broadly co-designed knowledge, information and data.

W Ocean-based industries have the potential to double in size by 2030 compared to 2010, outperforming the growth of the global economy.

Photo credit:
Andrey Armyagov
Shutterstock.

The sustainable use of aquatic biological resources, subsumed under the term Blue Bioeconomy, is expanding into innovative fields of research and commercial applications. Traditionally, the Blue Bioeconomy was largely limited to fisheries and aquaculture. More recent innovations and prospects encompass new products and services in areas that include food, feed, chemistry, biomaterials, health and cosmetics.

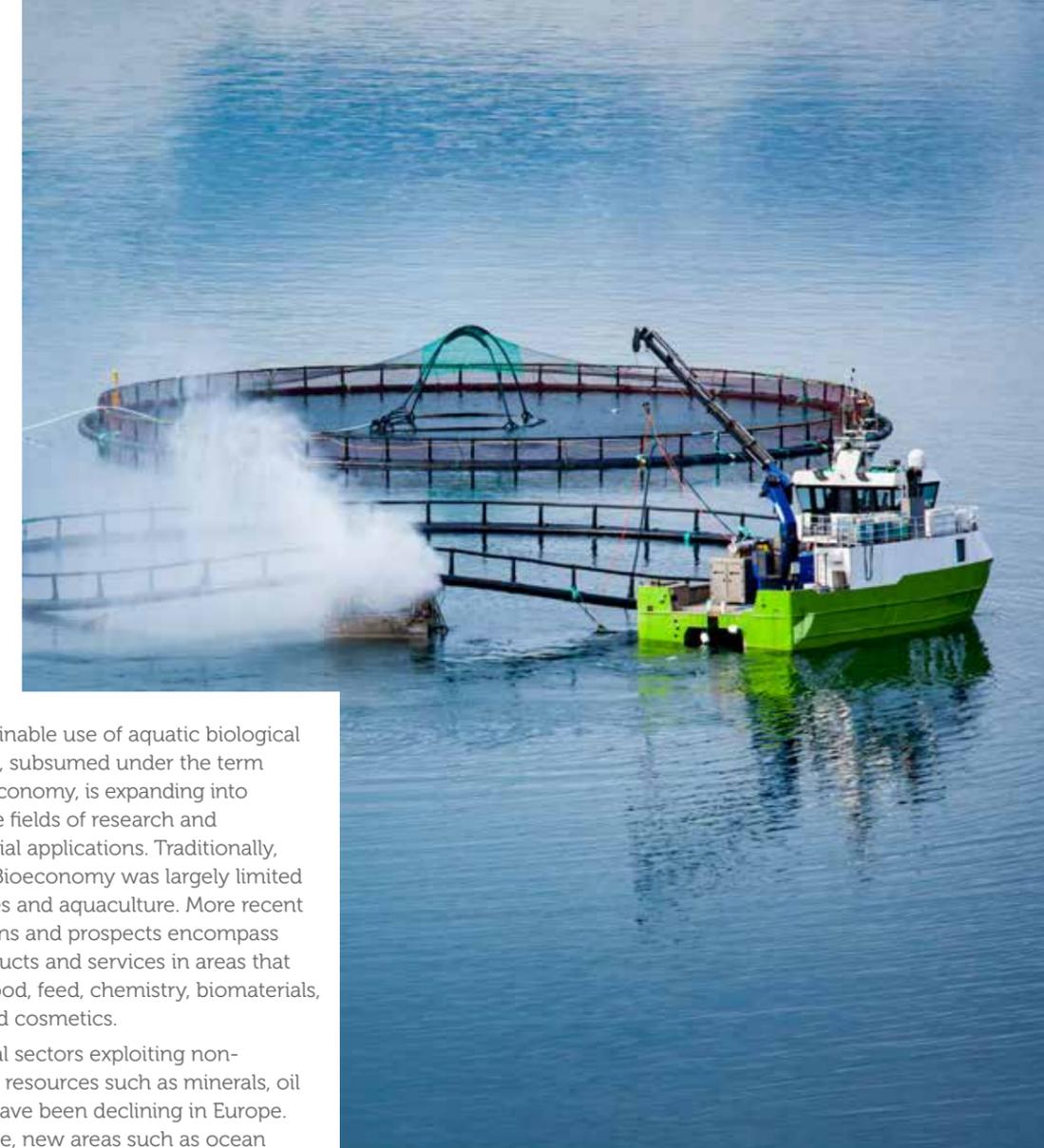
Traditional sectors exploiting non-biological resources such as minerals, oil and gas have been declining in Europe. Meanwhile, new areas such as ocean energy, particularly offshore wind, have experienced strong growth. As Europe transitions towards a carbon-neutral economy, demands and opportunities to upscale and innovate ocean energy will further increase. In addition, mining of rare metals for technological applications offer potential for new economic activity. Technological innovations, e.g. in the deep sea, or environmental changes like a reduction of sea ice in the polar regions will expand our ability to reach previously unexploited areas of the ocean.

Research & Innovation Opportunities

Underpinning the European approach to developing the **Blue Economy** is the principle of sustainability, i.e. adopting responsibility on a cross-generational time scale to maintain ocean integrity and productivity to the benefit of societal

wellbeing and cohesion. It is crucial to understand the natural and social systems related to the marine environment and the possible effects of ocean change on ocean productivity, enabling policymakers, businesses and citizens to base their decisions on scientific evidence.

JPI Oceans' approach is to ensure that the ocean's productivity can be sustainably utilised. Reducing the impact of existing economic activities and ensuring that emerging activities do not repeat past counterproductive mistakes is the benchmark of this approach. Science can not only **inform policymaking**, but also assist **individual decision-making** to enable citizens to contribute to the sustainability of ocean economies through individual choices, e.g. through dietary choices, purchases or holiday destinations.



Traditional sectors such as **fishing** and **tourism** are already on the verge of eroding their own business capital by overexploiting seafood stocks or damaging the environment in tourism hotspots. At the same time, these well-understood sectors offer demonstrated opportunities and innovative potential for reducing their ecological impact, e.g. by transforming them into circular economy practices such as closed-loop **aquaculture** designs and further develop offshore and low- and multi-trophic aquaculture.

Challenges in overfishing, pollution from aquaculture and the development of new marine-based products require solutions to ensure that **aquatic living resources** are used and managed in a sustainable way, enabling these sectors to continue growing without adverse effects. The last decade has seen a steady increase of interest in **deep-sea resources** to secure mankind's future demands in raw materials. This requires a knowledge-informed discourse on the trade-offs between environmental risks and development opportunities and the establishment of good governance for existing and emerging activities.

W Traditional sectors such as fishing and tourism are already on the verge of eroding their own business capital by overexploiting seafood stocks or damaging the environment in tourism hotspots.

Understanding the impacts of new activities in extreme environments such as deep-sea mining, offshore energy, aquaculture, and the move into polar regions, will provide decision-makers with a knowledge base to develop evidence- and **knowledge-based policies and regulatory frameworks**. If insufficiently regulated, the expansion of economic activity into new spaces of high growth potential would likely cause irreversible ecological damage to some of the most pristine yet most fragile ecosystems on the planet, such as the deep sea or polar waters. Monitoring the impacts of economic activity, exploring possibilities for responsible exploitation and assessing effective protective measures can be R&I contributions to new sustainable practices.

Ocean productivity contributes substantially to **food and nutrition security**, providing essential macro- and micro-nutrients for people's diets. Overfishing and harmful marine aquaculture practices are still a concern across Europe, amplified by a desire to increase the production of food from the sea to meet future demands. Diversification, value creation for less exploited ocean products, and technological developments will be key to meeting the challenge of ensuring food, feed and nutrient security.



Understanding Ocean Productivity requires a **systemic approach**. This applies to all sectors as nothing within the ocean occurs in isolation from other phenomena. New opportunities for efficiency and sustainability gains lie in viewing the role of food from the ocean in the context of whole food systems from "farm to fork", e.g. by considering overlaps with land-based systems in the area of feed or by optimising the production of food from the sea to ensuring that the overall nutritional needs and choices of consumers can be met.

Other opportunities for synergies between land and sea-based production lie in the application of **biotechnology**. With a growing awareness of the potential of marine **microbiomes**, biotechnology will continue to underpin developments in understanding the oceans and exploiting them sustainably. Microorganisms represent 70-90% of the marine biomass, including bacteria, viruses, fungi and some algae. Their genetic material is a rich source for industrial products and medical applications. They may hold the key to solutions related to human health, pharmaceutical cures, climate change and ocean pollution. Marine organisms generally provide rich chemical diversity for the drug development pipeline. Although most drugs are still derived from terrestrial sources, more than 34,000 molecules of pharmaceutical or cosmetic interest have been discovered in the marine environment. With 50 to >90% of marine species still undescribed by science, the marine environment offers a vast resource for the development of drugs to combat diseases.



Technology can help meet the challenges we face, both in reducing the ecological impact of activities and in unlocking and enabling new activities and blue economic developments. Advancements in areas such as robotics and artificial intelligence offer great potential but will require ongoing efforts in their development and application in the ocean environment. The application of sensors, robotics and automation can increase the safety of operations and provide more cost-effective alternatives to manned operations. The sector can build on technologies that are already applied in non-marine settings and could lead to significant blue economic advances. The maritime application of information and communication technologies such as artificial intelligence, automation and distributed ledgers in fisheries and aquaculture could increase transparency, traceability and trust in the sustainability of marine resources utilisation.



Seas and oceans have a proven effect on human health and wellbeing in ways we are only beginning to understand, with opportunities for coastal enterprises and communities.

A long-term approach to **cross-sectorial technological cooperation** is required. In particular, new applications for maritime technologies in extreme environments (deep sea, seabed, Arctic) require new material properties and functions. These must be reliable, safe, efficient, economically feasible, and environmentally friendly over their entire life cycle. First investigations e.g. in the fields of structures, drag reducing coatings or propulsion have shown the immense potential of marine bionics, i.e. adapting solutions from nature to technical solutions. Cross-cutting **technological synergies** may be generated through transversal R&I investments and programming, for example, advanced computational methods for multidisciplinary design analysis and optimization, autonomous vehicle development, robotics, advanced materials, additive manufacturing, predictive analysis and artificial intelligence. Such innovations will offer new business prospects and at the same time increase our technological capacity for effective stewardship for ocean health and productivity.

The **service sector** represents the biggest economic activities related to ocean and seas. In Europe, coastal tourism alone employs nearly twice as many people as all other ocean economy sectors combined. It thus contributes to the economic wellbeing of coastal communities and to physical and mental health through recreation. Sustaining this sector and its natural capital and cultural and historical heritage requires that sustainable blue tourism is promoted and innovative approaches with educational potential such as aqua tourism are explored. Another maritime and coastal service sector with large potential is that of eco-engineering, both as a scientific discipline and as an industry that combines economic growth with marine sustainability. Finally, seas and oceans have a proven effect on **human health** and wellbeing in ways we are only beginning to understand, with opportunities for coastal enterprises and communities. The Seas, Oceans and Public Health in Europe (SOPHIE) project highlighted examples of therapies that improve mental health through exercise near the sea. The physical health benefits of water-based recreation were estimated to be worth approximately £176 million per year in England alone.

4.3 OCEAN STEWARDSHIP & GOVERNANCE

To ensure both ocean health and productivity while economically benefitting from their services, requires responsible management of human interaction with the ocean, seas and coasts. This includes various forms of ocean stewardship and good governance and requires fit-for-purpose tools (including methodologies and approaches) that are based on the best available science and technology. Key tools for successful ocean stewardship and governance include a broad range of different elements such as technology development and digitalisation; observation, monitoring and modelling; coastal and maritime planning; and ocean literacy and capacity building. Advancing capacities in all these areas requires the mobilisation and transfer of expertise from multiple disciplines and sectors.

Societal Importance

In response to the increased pressures on and use of the ocean, greater attention is currently being paid to the governance and stewardship of the ocean. The world population is estimated to increase from 7.7 billion in 2019 to 8.5 billion people in 2030. This demographic change alone will already add economic and recreational activity at sea which could induce growing pressures on the marine environment.

Increased awareness and political attention towards ocean stewardship have led to national and regional initiatives to conserve and sustainably manage the ocean within national jurisdictions. In addition, state representatives from around the world have gathered at the UN for a series of meetings between 2018 and early 2020 to discuss and decide on the

first conservation treaty for the High Seas. In parallel, deliberations are taking place at the International Seabed Authority to regulate the prospection, exploration and exploitation of marine minerals in the so-called "Mining Code". In the context of this increased focus on ocean governance and stewardship, scientific support for the ecosystem-based governance of the ocean is pivotal.

An integrated, holistic and ecosystem-based approach to the management of the seas and oceans is key to securing both their health and productivity. Good planning and governance therefore become increasingly fundamental to reduce conflicts between competing interests, protect environmental health, and promote a productive and sustainable blue economy.

Spatial planning is an important instrument to achieve this. In this respect, the OECD recommends promoting innovation in governance structures, processes and stakeholder engagement to render integrated ocean management more effective, more efficient and more inclusive.

Research & Innovation Opportunities

Understanding and predicting changes to the ocean environment is important for all sectors that operate within its space. Services, such as climate projection and weather forecasting, rely on a deep understanding of ocean processes. The accuracy of such **ocean information services** in the short, medium and long term has a direct impact on economic activity and is crucial to ensure sustainable Blue Growth. It requires continuous and sustained development of our capabilities and capacities of ocean **observation, monitoring** and numerical **modelling**. Information services and risk assessments also need to address hazards of low probability but potential high impact such as geohazards related to earthquakes, landslides and resulting tsunamis. Evidence-based management and decision-making requires high-quality scientific information. This poses a challenge to the scientific community to **transfer reliable, robust and impartial evidence** into complex arenas of discourse and decision-making among agents in the policy arena, business and civil society. This challenge can be addressed with **research on stakeholder engagement and co-management methodologies** for enhanced marine resources management.

Turning scientific insight into decisions, action, change or even fundamental transformation requires understanding not only of ecosystems, technological innovations, or the toxicity of pollutants, but also of the interconnected political, commercial, social, behavioural and cultural dimensions of managing and using the marine areas and their resources. This calls for active involvement of researchers from diverse backgrounds including social science, psychology, policy, history and economy. Expanding our capacities and methodologies for identifying and analysing **interest and power relationships**, and our abilities to **model scenarios** and **predict societal outcome**, is therefore an essential element for successful science-society-policy interaction, offering immense opportunities for sustainable development.

W Services, such as climate projection and weather forecasting, rely on a deep understanding of ocean processes.



Photo credit:
Jan Dierking/GEOMAR.

Spatial planning in coastal or open marine areas, or for maritime economic development, offers concrete applications for integrating expertise on governance, legal issues, marine systems and maritime operations. With the expansion of the ocean economy, industries are increasingly competing for ocean space. A productive and sustainable blue economy requires agreed standards for assessing various human activities and industries, according to the principles of sustainable development. **Maritime Spatial Planning (MSP)** initiatives are therefore growing worldwide, increasing the need for science to support MSP elaboration and implementation for effective actions towards the sustainable development of the oceans. Transdisciplinary research engaging multiple scientific disciplines, industry, business, society and policymakers is needed to integrate environmental concerns into the planning of multi-industrial activities in coastal and marine areas and to meet related governance needs (MSP, CFP, MSFD, WFD).

To achieve the ambition of a healthy and productive ocean it is further key to raise individual **awareness about the interconnection between people and the ocean**. Notwithstanding increased campaigning and attention in politics and popular media, overall there is still not enough understanding of the impact the ocean has on citizens' wellbeing and daily lives. A way to increase appreciation for the ocean, and thus the capacity for stewardship for its protection and sustainable management, is to **foster an ocean literate society** through the exploration of educational, curricular, participatory, artistic, cultural, media, and other, more innovative avenues.

Meanwhile, **capacity** is also needed at the specialist level. This includes the next generation of experts, i.e. early career researchers and professionals as the future leaders and changemakers, but also established experts with limited access to high-level scientific education and professional development, and researchers needing to expand their core expertise in the direction of emerging fields. Through its model of international **collaboration, exchange** of people and information, and **sharing of facilities and infrastructures**, JPI Oceans is well placed to expand its capacity to advance impact.



5.0

Implementation

5.1 JOINT ACTIONS

The central implementation mechanism of JPI Oceans is that of Joint Actions. They are formed around topics that fall under JPI Oceans' thematic scope and contribute to its goals. They are supported by the interest and commitment of several member or associated countries under the leadership of one or co-leadership of several member countries and have developed a concept for implementation, including plans for resourcing, outcomes and impact.

A Joint Action is developed based on shared thematic priorities of at least four committing Member or Associated Countries. The topic is examined in a co-design process across relevant stakeholder domains including relevant experts from participating countries and resulting in a concept paper that describes the planned implementation elements, outcomes and policy impact. The approved Joint Action is implemented using the tools that are best suited to achieve the ambitions with the resources, cash and in kind, that participating countries commit to. A Joint Action is concluded after a multiannual implementation phase with delivery of products and outcomes and an evaluation to improve and optimise. A follow-up cycle can be considered based on R&I demand and continued country commitment.

5.2 IMPLEMENTATION TOOLS

JPI Oceans uses a range of tools in the implementation of its Joint Actions (Fig. 8)

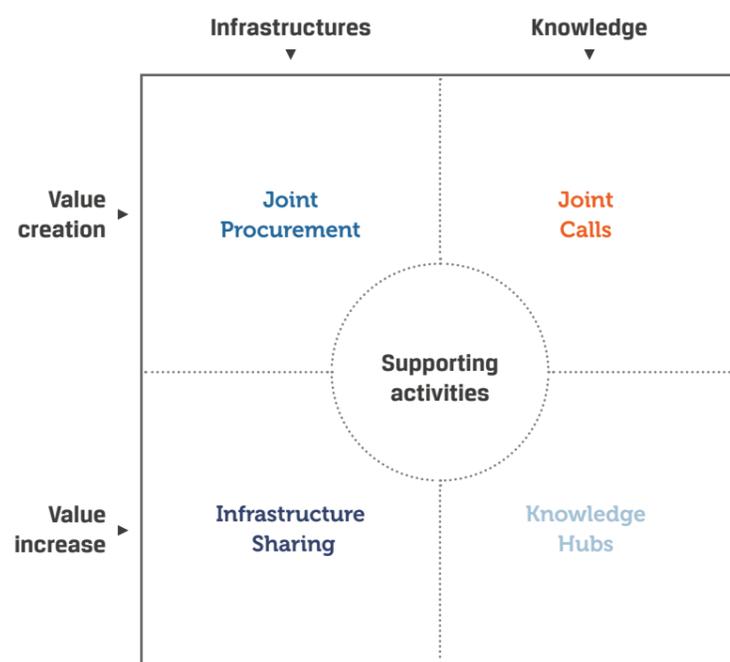


Figure 8: Quadrant diagram illustrating the specific target areas of each of the 5 implementation tools in the field that covers different forms of value addition (from increase to new creation) for the key groups of assets of R&I, namely infrastructures and knowledge.

Joint Calls for project proposals

Joint calls for R&I proposals are JPI Oceans' primary implementation tools for filling identified knowledge gaps. Joint calls among participating countries have the benefit that they can be undertaken speedily, allow a flexible combination of cash and in-kind contributions, and align with planned or running national activities. Joint calls co-funded by the European Commission require longer preparation but usually leverage a larger volume of funds and increase the number of countries participating (Fig. 9).

Infrastructure sharing

Infrastructure sharing is based on making the most of existing and often costly national infrastructures. It can free up capacities for use towards specific jointly agreed priorities and is therefore an effective tool to add significant value to investments that have already been undertaken. As the large majority of marine and maritime infrastructure is owned and operated by JPI Oceans member countries, internal assessments have rated the shared use of infrastructure as "high impact – low cost" with large potential for expansion.



* With Belmont Forum and Future Earth
 ** With JPI Climate
 *** With Water JPI and JPI AMR

Figure 9: Resources mobilised through the twelve joint calls of JPI Oceans and its partners (Belmont Forum, JPI Climate, MarTERA, BlueBio and AquaticPollutants) amount to EUR 165.6 million national funding plus EUR 22.5 million co-funding from the European Commission.

Knowledge hubs

Knowledge hubs are well-balanced expert networks with the goal of delivering specific products in a focused way. Products depend on the identified user needs but can consist of e.g. recommendations, syntheses, data compilations, calibration exercises or scientific assessments. Knowledge hubs are an effective bundling tool in situations with ample but dispersed knowledge and abundant but disconnected activities on a topic of interest. Knowledge Hubs consist of selected experts from the participating countries, covering a defined area and spread of expertise. The participating countries nominate experts and support (in kind or cash) their engagement.

Joint public procurement

Joint Public Procurement is a financial instrument for contracting authorities from different countries fostering joint procurements. By aggregating their resources, public procurers increase their buyer power, may hence

obtain better contractual conditions and have a stronger instrument for orienting the market. Therefore, joint public procurement can increase the effectiveness of public procurement procedures while sharing the risk linked to the procurement notably of innovative solutions.

Supporting activities

Supporting activities exist in different shapes and forms. Their strategic purpose is to prepare new Joint Actions. They can help shape and sharpen next steps of more costly actions, potentially increasing chances of relevant results and good uptake. Foresight and backcasting exercises can be used to prepare potential calls and seek collaboration with sectors outside traditional oceans research and technology communities. Bibliometric studies provide a useful quality check ensuring that scientists in the forefront are invited to the hubs/networks.

5.3 IMPLEMENTATION PRINCIPLES

VARIABLE GEOMETRY

To implement its activities, JPI Oceans builds on the principle of variable geometry. Participating countries decide on a case-by-case basis in which Joint Actions to participate and which contributions to provide. Applying this principle allows JPI Oceans to maximise the range of funding opportunities and other instruments available for research, human resources, infrastructure and innovation at regional, national and European level.

CO-DESIGN OF STRATEGY AND ACTIVITIES

Given the agile nature and broad scope of the Strategy Framework, co-design is key to successfully developing timely activities and achieve the envisioned impact. The Strategy Framework itself is a product of co-design across countries, disciplines and sectors, enriched by the feedback and engagement from diverse stakeholders, intended to strengthen the relevance and impact of the strategy framework and its implementation.

In scoping new Joint Actions, co-design permits to experiment with and combine different sets of knowledge. Co-designing with end-users enables their participation in idea generation and concept development in the Joint Actions whose final goal is to provide knowledge or solutions to these same users. In the face of complex environmental, political and technological issues which these Joint Actions are addressing, it will be crucial to involve stakeholders and end-users (policymakers, industry, civil society and citizens).

OPEN SCIENCE

Science is evolving; research results, practices and resources are opening up and going beyond a limited access publication-based model, to a new open environment in which research data and digital research tools are freely available. The Roadmap for the UN Decade of Ocean Science for Sustainable Development (2021–2030) highlights access to scientific knowledge and information as a prerequisite for the transformation of the scientific and technical capacity of ocean stakeholders globally, so that all can participate in, and benefit from, developments in ocean science and technology.

This orientation towards 'Open Science', the practice of science in such a way that others can collaborate and contribute, enables reuse, redistribution and reproduction of the research and its underlying data and methods. In line with the Decade's focus on a "transparent ocean", information and data generated in activities implemented by JPI Oceans shall be made available to the scientific and other user communities complying with the FAIR Principles for scientific data management and stewardship.

W Science is evolving; research results, practices and resources are opening up and going to a new open environment in which research data and digital research tools are freely available.



Figure 10: Illustration of JPI Oceans' approach to knowledge transfer and open science with three main recipients of knowledge transfer and associated approaches.

KNOWLEDGE TRANSFER

The focus on opening up data and information is also key to enabling the effective transfer of knowledge across different disciplines and sectors. Figure 10 outlines the processes by which R&I knowledge is exchanged and taken up among scientists, by citizens and policymakers, and by industry and business in general.

JOINT ACTION EXAMPLE 3

KNOWLEDGE TRANSFER CALL FOR AQUATIC POLLUTANTS

In a pilot activity, the three Joint Programming Initiatives (JPIs) on Water, Oceans and Antimicrobial Resistance (AMR) launched a joint call for knowledge transfer of research on Aquatic Pollutants as part of the Aquatic Pollutants ERA-Net Cofund. The call will complement a joint call for research and innovation projects on risks posed to human health and the environment by pollutants and pathogens present in water resources. The objective is to realize a better and wider dissemination, develop new innovative methods to support the transfer of research and the uptake of results into the public and administrative sector, policy, industry or economy. With the knowledge transfer call the three JPIs hope to achieve a greater impact and increase the awareness of project outcomes.

Science-policy dialogue

One of the drivers to reinforce the current science-policy dialogue is the transition towards ecosystem-based management of the marine environment. As a result, there is an increasing need to transfer scientific evidence into the policy arena in a timely manner and in a context and language which is accessible either to managers or policymakers. As reflected in its third operational goal, JPI Oceans intends to impact decision-making and ensure that the R&I outcomes of the Joint Actions contribute to relevant transformative policies towards healthy seas and oceans and sustainable practices in the blue economy. In facilitating this science-policy dialogue, JPI Oceans can build on its co-design process and engagement with policy and science-policy units in the European Union and global institutions like the United Nations, the International Seabed Authority, OECD and others. Operationally JPI Oceans will ensure, with support from knowledge brokers, that impactful syntheses or other outputs are produced, tailored towards user groups and backed by communication and delivery campaigns.

Science-business dialogue

The excellence of Europe's scientific research is widely acknowledged. However, the high-quality knowledge is not efficiently transferred into marketable innovations. This recognised deficiency has been coined 'The European paradox'. There are wide ranging policy options to overcome this paradox, from the support of technology transfer through incentive schemes to training programmes, networking activities and collective roadmapping and foresight exercises.

Science-society dialogue

A growing recognition of the importance of ocean conservation presents marine and maritime sciences with an excellent opportunity to raise awareness about the interconnection between people and the ocean and thus maximize the impact of current ocean literacy activities. As a founding member of the EU4Ocean coalition JPI Oceans will reinforce its outreach efforts, build partnerships and join forces to deliver a more coordinated approach to ocean literacy activities in Europe. With the OECD forecasting marine tourism to expand even faster than international tourism as a whole a strong communication and education campaign could develop new collaborations ensuring that the ocean literacy principles are well known among ocean recreationists and marine tourists.

W Operationally JPI Oceans will ensure, with support from knowledge brokers, that impactful syntheses or other outputs are produced, tailored towards user groups and backed by communication and delivery campaigns..



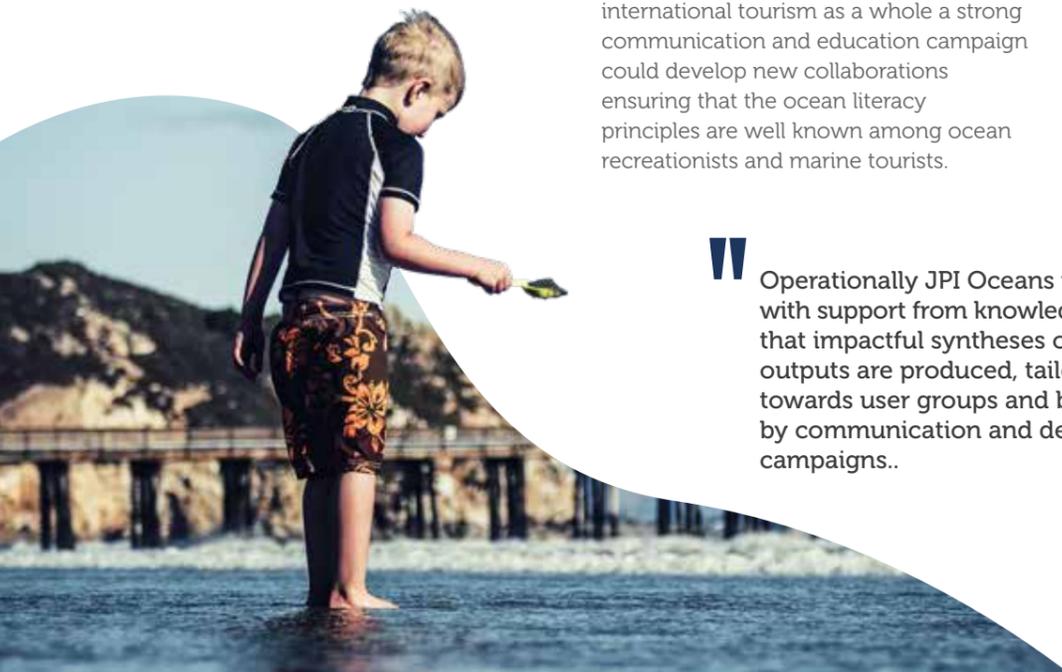
Photo credit: Plastic World - Estefanía Pereira Pinto.

CASE STUDY: OCEAN LITERACY

JPI Oceans microplastics projects provided input to the travelling exhibition 'Ocean Plastics Lab'. The exhibition reached over 50,000 visitors in Italy, Belgium, the USA, Canada and Germany.

The exhibition, designed as a hands-on science lab, invited visitors to assume the role of scientists and explore the extent and impact of plastics in the ocean in four shipping containers. It has travelled to various locations worldwide, inviting the public to engage with scientific work carried out around the world. JPI Oceans projects had provided expert input to the design of the installations showcased in each of the shipping containers. In doing so, they informed citizens about the most relevant aspects of microplastics pollution in the marine environment. The JPI Oceans projects were also involved in three public events organised at the Brussels exhibition tour stop to discuss what science and society are doing to understand the problem and what options are available to solve it.

The Ocean Plastics Lab was initiated by the German Federal Ministry of Education and Research together with the German Marine Research Consortium (KDM), supported by the European Commission and international partners from politics and science.



COLLABORATION WITH EXTERNAL PARTNERS

Europe

In 2018, the European Commission adopted its proposal for Horizon Europe, the 9th EU Framework Programme for Research and Innovation, operational from 2021 onwards. For the first time, an overall policy approach for all kinds of partnerships, from ERA-NETs to JTIs, FET Flagships and even the EIT/KICs has been developed and uniformly labelled 'European Partnerships'. For JPI Oceans, the new European Partnership 'A climate neutral, sustainable and productive Blue Economy' is of particular importance (see 1.2 Strategic role of JPI Oceans). Accordingly, JPI Oceans was invited to take part in the preparatory and implementation phase of the new Partnership.

Synergies at the interface with shipping are sought through cooperation with the partnership on zero-emission waterborne transport coordinated by the Waterborne Technology Platform (TP). Other partnership topics that demand a marine and maritime perspective, such as those on a Safe and Sustainable Food System, Water security, Biodiversity, and Circular bio-based solutions and others also bear good potential for valuable contributions by JPI Oceans.

JPI Oceans has further identified the **Horizon Europe Mission** on Healthy oceans, seas, coastal and inland waters as a major logical venue for close engagement and opportunities for value addition. Specifically for connecting research infrastructures across Europe, the new **European Strategy Forum on Research Infrastructures** (ESFRI) Roadmap planned for 2021, will support the efficient implementation of JPI Oceans vision. Likewise, increased integration and consolidation of Europe's ocean observing capacities will be a core task of JPI Oceans within the context of the **European Ocean Observing System** (EOOS).

In recent years, JPI Oceans increased its cooperation with **other Joint Programming Initiatives**, launching a joint call with JPI Climate, setting up an ERA-Net Cofund on aquatic pollutants with the Water JPI and the JPI on Antimicrobial Resistance and building a strategic consortium with FACCE and HDHL JPIs for collaboration on food system subjects. JPI Oceans aspires to continue this close cooperation with its sister-JPIs and explore further collaboration opportunities.

At the level of **European regional sea basins** platforms for strategic coordination and agenda setting are the BANOS initiative for the Baltic and the North Sea, the BlueMed initiative for the Mediterranean, and Black Sea CONNECT for the Black Sea. In the case of shared priorities and demand for agenda implementation across several or all sea basins, the value-adding paradigm of JPI Oceans is particularly relevant. Challenges of joint concern can usually be addressed more efficiently through collaboration and sharing of resources. Most JPI Oceans member countries are in fact also involved in one or several regional sea basin groups, thus enabling JPI Oceans to act as efficient moderator and facilitator for cross-regional collaboration, which will accordingly remain a major partnering offer of JPI Oceans.

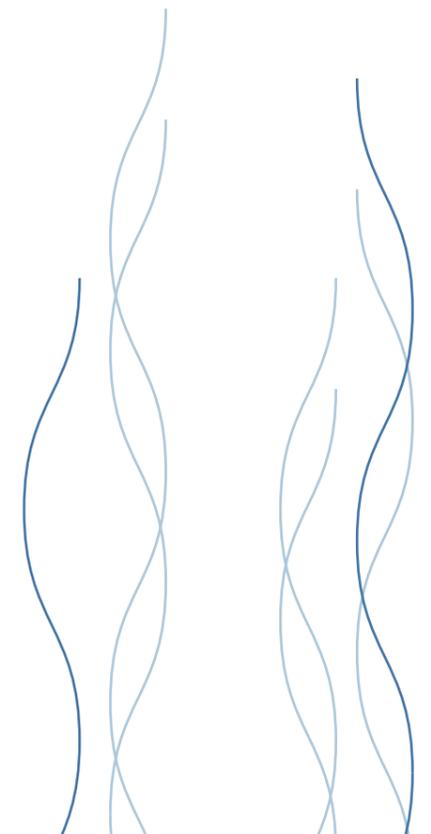
Regional initiatives and policies often address the need for involvement, inclusion and coordination with **neighbouring, non-European countries** (e.g. Mediterranean and Black Sea regions). JPI Oceans intends to facilitate this process by implementing the concept of Science Diplomacy for the promotion of marine and maritime career skill development and knowledge exchange for a more sustainable use of regional sea basins.

Cooperation beyond Europe

It is JPI Oceans' ambition to both play a strategic role and be a key facilitator for its participating countries with parties across the world sharing JPI Oceans' vision and strategic objectives. International cooperation builds on the joint responsibility for seas and oceans as global "commons" under the **UN Convention on the Law of the Sea**. As well as common actions to observe and protect the ocean in the longer term the rationale for cooperating may be driven by the need to take short-term actions, such as in responding to emergencies, or situations that require the mobilisation of expertise and infrastructure on a grand scale. Through its actions, JPI Oceans can also play a strategic role in **ocean advocacy**, raising and addressing ocean issues to the level of the international political arena.

In recent years, **G7 countries** have increasingly added ocean matters to their agendas. Topics included coastal resilience, marine litter including plastics, sustainable fisheries, deep-sea mining, maritime security, the Law of the Sea, ocean observation and open science. Four G7 countries are JPI Oceans members (France, Germany, Italy, United Kingdom). Through these countries, JPI Oceans informed the prioritisation process based on its Joint Action outcomes (in particular on plastics and deep-sea mining). The G7 process thus continues to offer an important pathway for JPI Oceans and its participating countries to inform global-scale political prioritisation and contribute to their pursuit.

In 2017, the **United Nations proclaimed a Decade of Ocean Science for Sustainable Development (2021-2030)**. The goal is to support efforts to reverse the cycle of decline in ocean health and gather ocean stakeholders worldwide behind a common framework that will ensure ocean science can fully support countries in creating improved conditions for sustainable development of the ocean. The target decade from 2021-2030 aligns with the implementation period of the JPI Oceans strategy at hand. This offers opportunities to reinforce each other's agenda. It also offers the opportunity for JPI Oceans to help with the implementation of the Decade's ambitions by organising European R&I contributions, connections and leadership.





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The year 2017 also saw the launch of the **Belém statement**, a joint Declaration on Atlantic Ocean Research and Innovation Cooperation between the European Union, Brazil and South Africa. The statement followed the **Galway statement** for the North Atlantic cooperation, signed in 2013, and reflected a new move to an integrated approach to research and development across the whole Atlantic Ocean. JPI Oceans is a partner in the All Atlantic Ocean Initiative, the main instrument supporting the implementation of the Belém Statement. On the operational level this collaboration also translates into concrete activities. In its last joint call on microplastics in the marine environment, JPI Oceans, in cooperation with Brazil, aimed to promote European and transatlantic research cooperation on the issue, and contribute to the implementation of the Belém Statement as well as G7, G20 and UN aims of reducing (micro-) plastic pollution in the ocean.

Established in 2009, the **Belmont Forum** is a global partnership of funding organisations, and regional consortia committed to the advancement of transdisciplinary science. In 2018, the Belmont Forum, JPI Oceans and Future Earth joined forces and launched a call for proposals on Transdisciplinary Research for Ocean Sustainability. The call resulted in the agreement to award 13 international consortia of researchers and stakeholders funding over a period of four years. With an overlapping membership with the Belmont Forum, JPI Oceans will seek further collaboration on marine and maritime topics.

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