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INTRODUCTION

The **BLUEMED** Initiative offers a shared strategic framework for working towards a healthy, productive and resilient Mediterranean Sea that is better known and valued. It is designed to tap the full potential of the marine and maritime sectors, structuring transnational cooperation to create new 'blue' jobs and to improve social wellbeing, sustainable prosperity and the environmental status of the region and its surroundings.

Acknowledging the importance of developing a shared vision of the Mediterranean Sea as a common resource, to promote security, safety and prosperity of present and future generations, the Mediterranean countries are willing to coordinate and integrate efforts to implement the BLUEMED Initiative.

To ensure the flourishing of the blue economy and dignify the Mediterranean environment and its inhabitants, conflicting use of the Sea resource needs to be overcome, taking full account of extant anthropogenic impacts occurred over the last decades in total unawareness of the complexity and fragility of this ecosystem.

Joint efforts of Mediterranean countries, with the support of the European Commission, have been carried out since 2014 and resulted in the launch of the BLUEMED Strategic Research and Innovation Agenda (SRIA), calling for joint and aligned research and innovation strategies, programmes and activities on the Mediterranean Sea.

Synergies and complementarities among all the involved stakeholders will maximise existing and future opportunities and the use of the most appropriate instruments, thus structuring cooperation for advancing the Strategic Research and Innovation Agenda for Blue Growth in the Euro-Mediterranean Region. The BLUEMED Initiative supports and facilitates cooperation and coordination not only among EU Member States but among all the Mediterranean countries, in order to promote the alignment of programmes and pooling of resources and investments to address the challenges identified in the BLUEMED SRIA. Coordination with two relevant initiatives targeting the Mediterranean Basin at sub-regional level, namely the WESTMED – Towards a Sustainable Blue Economy Initiative for the Western Mediterranean, and the EUSAIR – European Strategy for Adriatic-Ionian Region, will enhance the efficiency of the actions, the investments in marine and maritime research, innovation and technology and will reduce fragmentation and duplication of efforts. At the same time, connection with the Regional Smart Specialization Strategies will enhance the Blue Growth perspective in the coastal/maritime and insular regions/countries.

The BLUEMED Strategic Research and Innovation Agenda (SRIA) is a living document designing a shared pattern to foster blue growth in the Mediterranean area. It targets multiple stakeholders and end-users, involving all relevant players in the consolidation process, national ministries, regional authorities, research organizations, research infrastructures, academia, the private sector, non-governmental and international organizations and the public, thus engaging the quadruple helix.

The BLUEMED SRIA addresses the crucial aspect of multilevel governance, bottom-up and horizontal (interregional and transnational), which must be taken into account when implementing its goals. The implementation plan will allow for different types of actions to be undertaken at different levels, with respect to geographical coverage, critical mass, joint funding, coordination of national/regional efforts or the use of EU instruments.

WHY BLUEMED

28 % of endemic species, 7.5% of the world's marine fauna and 18% of the world's marine flora in the 0.7% of the world's ocean area only
30 % of global sea-borne trade by volume
450 ports and terminals
A quarter of worldwide sea-borne oil traffic
World's second-largest market for cruise ships
A coastal population of 150 million that more than doubles during the tourist season
400 UNESCO sites
236 Marine Protected Areas
Unique culture as regard food and environmental healthy life stile

Among the seas of Europe, the Mediterranean has no match when it comes to biodiversity and the links between human activities and the environment. It is changing fast in response to both natural and anthropogenic pressures. Climate change, growing maritime traffic and pollution, overexploitation of fish stocks and invasions of alien species are among the stressors placing the region at risk. At the same time, the Mediterranean's unique features provide major local opportunities for blue growth and jobs, ranging from fisheries to tourism.

The region's geopolitical complexity may represent a constraint on implementing framework conditions favourable to blue economic growth. Joint efforts are required to successfully address present and future challenges. A global perspective, along with more vigorous transnational and international cooperation, is essential to implement effectively and efficiently tailored actions that are conducive to safe, secure and sustainable development for all.

THE PROCESS

The BLUEMED Initiative was set up in May 2014 in the framework of the European Strategy on Blue Growth. Technically, the process started with the endorsement of the BLUEMED Vision Document at the EU Competitiveness Council in December 2014. The work carried out by nine European countries (Cyprus, Croatia, France, Greece, Italy, Malta, Portugal, Slovenia and Spain) with the support of the European Commission, led in October 2015 to the signature of the Venice declaration on Mediterranean Sea Cooperation - Launching a Strategic Research Marine and Maritime Research and Innovation Agenda for Blue Growth, the BLUEMED SRIA. The Union for Mediterranean Declaration on the Blue Economy, inviting non-EU countries to join the BLUEMED Initiative, was adopted in November 2015.

The BLUEMED Coordination and Support Action, a project funded by the EC to support the BLUEMED Initiative, started in October 2016. As an operative tool, the project set up the

BLUEMED platforms on “Knowledge”, “Economy”, “Technology”, and “Policy”, four transversal thematic fora where country representatives, the National Pivots, meet and interact. Established to ensure broad consultation and constant dialogue at Mediterranean and national level, the platforms enhance virtuous relationships among different stakeholders to consolidate the SRIA towards the definition of the Implementation Plan.

In April 2017, the BLUEMED high-level conference “A Basin of Research and Innovation for sustainable growth” held in Malta marked a key milestone towards the endorsement, by UfM and EU Member States, of the Valletta Declaration on strengthening Euro-Mediterranean cooperation through Research and Innovation in May 2017.

Since February 2018, the Group of Senior Officials BLUEMED Working Group composed by delegates officially appointed by EU and non-EU countries is the BLUEMED Initiative steering body.

VISION

The geopolitical complexity of the Mediterranean area, whose countries from three different continents strongly depend on blue activities, challenges the sustainability of the marine environment. Multiple stakeholders with diverse and often contrasting interests compete for the use of the same resource and space.

In order to ensure a sustainable future, it is crucial to:

- reduce fragmentation and facilitate cooperation between people;
- engage EU and non-EU countries for a global Mediterranean Basin;
- foster innovative multidisciplinary research and innovation activities addressing the relevant Mediterranean challenges;
- coordinate planning and programming of relevant research and innovation activities;
- connect research investments and public policies at regional, national, European and Mediterranean level;
- provide knowledge-based support for the implementation of relevant policies;
- develop innovative marine-based technologies, methodologies and approaches with a view to boosting the sustainable economic growth of the European maritime sectors and the conservation and upgrading of the marine environment, resources and cultural heritage;
- advocate public understanding of the value of the blue economy;
- create an interoperable, fully integrated observing and forecasting system based on open data structures;
- train a new generation of scientists, professionals, technicians and entrepreneurs thus creating new and qualified ‘sea-based’ jobs.

HOW

1. Identify needs of marine and maritime communities and align relevant programmes;
2. Increase the accessibility of opportunities, funding and facilities;
3. Develop joint actions by aligning, planning and programming research and innovation activities at multiple level;
4. Engage different stakeholders;
5. Fine-tune data, knowledge, capacities and projects;
6. Maximise leverage effects of research investments and their influence on public policy;
7. Raise awareness on the impacts to the Mediterranean that have been caused by a not-sustainable economic growth on land and at sea.

KEY CHALLENGES

BLUEMED identifies a set of challenges under three pillars, (i) 'key enabling knowledge', (ii) 'key sectoral enablers', and (iii) 'enabling technology and capacity creation' characterized by tight horizontal synergies deemed necessary for sketching economy-driven trajectories. It also highlights cross-cutting themes.

Key enabling knowledge for the Mediterranean >> Knowledge enablers

- A. Mediterranean Sea ecosystems: characterize present dynamics, services, resources, vulnerability and resilience to natural and anthropogenic pressures
- B. Mediterranean Sea: forecast changes of the basin under climate and anthropogenic pressures and develop services in the field of sustainable adaptation to climate change and plans for mitigation
- C. Hazards and protection of coastal areas and open sea in the Mediterranean
- D. Innovative blue growth trajectories: biotechnologies, food, and the deep sea resources

Key sectoral enablers in the Mediterranean >> Economy enablers

- A. Innovative businesses based on marine bio-resources in the Mediterranean
- B. Ecosystem-based management of Mediterranean aquaculture and fisheries
- C. Sustainable tourism and cultural heritage in the Mediterranean
- D. Maritime clusters in the Mediterranean
- E. Governance of maritime space and marine resources in the Mediterranean

Enabling technology and capacity creation for the Mediterranean >> Technology enablers

- A. Smart, greener and safer maritime transport and facilities in the Mediterranean
- B. Observing systems and operational oceanography capacities in the Mediterranean
- C. Innovative offshore industrial platforms including marine renewable energy and co-use
- D. Marine and coastal natural and cultural heritage in the Mediterranean: discovering, protecting and valuing

Cross-cutting enablers for Blu Jobs and Blue Growth

KNOWLEDGE ENABLERS

CHALLENGE A. Mediterranean Sea ecosystems: characterize present dynamics, services, resources, vulnerability and resilience to natural and anthropogenic pressures	
GOAL	ACTION
A1. Understanding the functioning of the Mediterranean Sea ecosystem	A1.1 Develop theoretical and operational tools for data analytics towards an end-to-end conceptual and numerical model
	A1.2 Identify the origin of invasive or alien species (including bacteria) and the routes of invasions, the environmental conditions conducive to invasions and their main effects and impacts on local habitats, species and ecosystems and study natural connectivity patterns from basin open boundaries and commercial maritime routes
	A1.3 Assess inputs from atmosphere-land-sea nexus and the effects of natural events and historical and ongoing anthropogenic pressures leading to change in marine and coastal ecosystems
	A1.4 Fill gaps in understanding the Mediterranean Sea dynamics, biogeographic patterns, biodiversity, and ecosystem functions (including fishing resources) using novel monitoring, e.g. satellite, marine drones, molecular/genetic tools to develop new end-to-end models forecasting the carrying capacity of the Mediterranean ecosystems
	A1.5 Identify the services supported and the management scales (e.g. regional inter-boundary) towards sustainable exploitation of resources
	A1.6 Describe the deep sea “landscape”, mapping the topography of seabed, characterizing the geomorphology and substrate types, identifying geo-habitats and sensitive habitats, with an open access inventory of their biodiversity, as well as essential fish habitats and anthropogenic alterations for sustainable exploitation and preservation of deep sea resources
A2. Understanding Pollution Impacts, Mitigation, and Remediation in the Mediterranean Sea	A2.1 Develop coastal and marine potential hazard/pollution sources maps (exploiting Earth Observations and linking to pollutant dispersion models) to identify hot spots and areas that are particularly exposed to the impact of multiple stressors and propose possible solutions
	A2.2 Implement coordination/cooperation schemes and comparable risk assessment procedures (integrating biological and chemical techniques) of the effects of multiple anthropogenic pressures at different depths, including deep-sea areas
	A2.3 Conduct in situ measurements and develop modelling tools to understand the distribution, intensity and sources of underwater noise, as well as its effect on marine species
	A2.4 Measure and identify emerging chemical compounds (e.g. pharmaceuticals, synthetic drugs) from terrestrial sources, determining

CHALLENGE A. Mediterranean Sea ecosystems: characterize present dynamics, services, resources, vulnerability and resilience to natural and anthropogenic pressures	
GOAL	ACTION
	contaminant dispersal in all marine matrices; characterize sources, pathways and effects on marine ecosystems; develop early warning tools
	A2.5 Define distribution, concentration and provenance (when possible) of all forms of garbage at sea (including plastic and microplastic debris) at the sea surface, within the water column, the sea floor and the coastal-estuarine environments; rise awareness through literacy and citizen-science initiatives
	<p>A2.6 Explore and propose solutions to reduce the input of pollutants from atmosphere, land and sea:</p> <ul style="list-style-type: none"> - Obtain marine ecotoxicological data for contaminants in marine waters and sediments, at different levels of biological organization. Develop environmental criteria (baseline and thresholds) for alert/intervention and early warning tools (e.g. using novel biomarkers) - Develop and test (bio)remediation measures in diverse areas, considering re-use and recycling of hazardous materials to promote sustainable redevelopment of aquatic contaminated sites - Develop new generation techniques for identification of molecules; in situ sensors for a large-scale view of their distribution; mechanisms of transfer and bio-magnification and modeling of the food web - Identify sources of chemical pollution from sunken ship wrecks and containers thrown at sea, inventory of critical hazards and risk assessment of leak impacts in space and time Identify possible genetic pollution from aquaculture animals to natural populations and effects to the ecosystem - Improve wastewater treatment processes and recycling to prevent the impact of pollution in coastal areas

CHALLENGE B. Mediterranean Sea: forecast changes of the basin under climate and anthropogenic pressures and develop services in the field of sustainable adaptation to climate change and plans for mitigation	
GOAL	ACTION
B1. Forecasting the Mediterranean Sea dynamics and climate	B1.1 Sustain and improve ocean observing systems for physical, biogeochemical, and ecosystem parameters by expanding their scope and establishing quality assurance in order to improve modeling and forecasting of system dynamics, and estimates of trends and indicators
	B1.2 Provide numerical modelling, forecasting, indicators to identify diverse trends as well as abrupt shifts in the Mediterranean environmental conditions supported by long-term monitoring, considering land-sea-air interaction processes, with a focus on coastal dynamics
	B1.3 Improve the understanding of the hydrodynamics interaction of the Mediterranean Sea with the Atlantic Ocean
	B1.4 Implement downscaling models of climate change for the Mediterranean Sea and sub-basins; assess the impacts on marine ecosystems and their resources, from regional to local scales
B2. Preparing to climate change and define adaptation/mitigation measures	B2.1 Make a comprehensive assessment of climate and anthropogenic related risks and opportunities in the Mediterranean Sea ecosystem and human environment from the coastal zone to the deep ocean, including extreme climate events, acidification, sea level rise, flooding and invasive species
	B2.2 Develop, enhance and deliver user-friendly tools for disseminating climate information related to Mediterranean atmosphere, coastal and deep ocean areas
	B2.3 Climate Change and Blue Growth: Develop climate adaptation strategies
	B2.4 Identify how activities, such as water use, can accelerate and enhance impacts of climate change through increased coastal subsidence, salt wedge penetration and ultimately increased flooding risks and desertification
	B2.5 Launch a pan-Mediterranean program on coastal fresh water reserves: quantification of reservoirs, state of the water (quality, contaminants, depth beneath surface), level of exploitation and frames for sustainable use of this good. Promote innovative desalinization practices in areas with lack of fresh water minimizing negative impacts on shallow marine ecosystems

CHALLENGE C. Hazards and protection of coastal areas and open sea in the Mediterranean	
GOAL	ACTION
C1. Reducing the coastal risk of disasters and their effects	C1.1 Define geological features located nearshore and offshore (slides, volcanoes, fault, diapirs, mud volcanoes, fluid escape features, sand boils and seismicity) potentially generating geo-hazards that cause risk to coastal and offshore infrastructures and population
	C1.2 Improve assessment and knowledge sharing on the recurrence of marine geo-hazards, from paleo records (inferred paleo seismicity, recurrence of sediment failure, historical volcanic activity), through deep coring/drilling accompanied by mechanical characterization of submarine terrains (sediments or rocks)
	C1.3 Implement high-resolution swath bathymetry mapping and geophysical surveys to reveal detailed morphology of the seafloor, locate active geological features and study the morphological land and sea floor changes to build predictive models
	C1.4 Fill gaps in understanding coastal morphodynamics at regional and local level including a focus on coastal erosion and on anthropogenically induced erosion processes (e.g. erosion due to maritime transport in near-shore areas next to ports, especially those close to natural protected areas)
	C1.5 Develop operational observing platforms and decision matrices to address natural marine disasters such as tsunami events, coastal slides, storms, while assessing and controlling progressive coastal and geological processes such as erosion, habitat destruction, landslides
	C1.6 Study coastal urbanization trends and related pressures to improve protection of coastline ecosystems
	C1.7 Identify the risks introduced by anthropogenic features such as ports, oil terminals, offshore platforms and map the relevant information defining possible mitigation scenarios
C2. Protecting Maritime Cultural Heritage	C2.1 Exploit large-scale seabed mapping databases to locate shipwrecks, as well as drowned building remains, pavements (e.g. roman centuriation) or infrastructures, and target areas for high-resolution seabed mapping
	C2.2 Explore and protect underwater natural and cultural heritage through a multidisciplinary approaches, combining efforts from national programmes for stocktaking

CHALLENGE D. Innovative blue growth trajectories: biotechnologies, food, and the deep sea resources	
GOAL	ACTION
D1. Exploring the potential of blue-biotech	D1.1 Infer and analyze metabolic pathways of marine organisms with biotech and bioremediation potential
	D1.2 Explore the potential of genetically modified organisms, within the constraints imposed by precautionary principles, to produce metabolites useful for nutraceuticals, biofuel and pharmacology as well as bioremediation
	D1.3 Develop individual base, mechanistic models of simulating the biology of model species; carry on -omics and -metaomics analyses with a bioprospecting purpose
	D1.4 Analyze and enhance defense strategies against pathogens and parasites of marine organisms
	D1.5 Find solutions for culturing marine extremophiles with biotech potential
	D1.6 Develop tools for characterization of unknown genes of marine organisms
	D1.7 Characterize signaling and interactions among marine organisms to consider in the set-up of artificial systems
D2. Support solutions for sustainable food production	D2.1 Identify marine biota as a new source of protein for human consumption
	D2.2 Characterize ecological niches of target species to improve their preservation and reduce the number of extinctions
	D2.3 Increase knowledge on biological and ecological aspects of habitat-forming species
	D2.4 Develop Mediterranean aquaculture: new management tools, ecosystem-based approach, tackling pathogens; develop conceptual models for Integrated Multi Trophic aquaculture (IMTA)
D3. Exploiting the Deep Sea	D3.1 Improve knowledge base for sustainable exploitation of shelf to deep-sea biotic and abiotic resources, including sand borrowing sites , mining for minerals and ore deposits and identifying molecules of potential industrial interest

ECONOMY ENABLERS

CHALLENGE A. Innovative businesses based on marine bio-resources in the Mediterranean	
GOAL	ACTION
A1. Developing new methodologies and tools	A1.1 Evaluate the means necessary to promote engineering and new business models based on new robust micro-algae species and other microbial communities and strains for biorefinery schemes, including aquaculture feeding and for greening the chemical and agroindustry
	A1.2 Develop biotechnological chains on an industrial scale to boost biotechnological applications and patent deposits such as in the health, cosmetics and food sector
	A1.3 Analyze and asses the exploitation potential of newly discovered invertebrates for human consumption, biomedicine or ecosystem engineering considering the economic viability and technological sustainability
	A1.4 Optimize cultivation and metabolic/production using omics techniques of known and new marine microbial species as well as their industrial up-scale, complying with relevant regulations
	A1.5 Develop methodologies to quantify the socio-economic value of natural bio-assets
A2. Generating new products and services	A2.1 Evaluate the potential reuse of marine litter and potential development of products
	A2.2 Develop methods and tools to sustainably exploit and extract submarine bio-resources
	A2.3 Develop biomaterials to replace non-environmentally friendly materials especially in the Sea
	A2.4 Promote new market opportunities for Mediterranean-labelled products from marine bio-resources
	A2.5 Promote aggregation of companies and investors from key sectors to increase Mediterranean competitiveness on a global scale

CHALLENGE B. Ecosystem-based management of Mediterranean aquaculture and fisheries	
GOAL	ACTION
B1. Develop optimal fishing strategies, technologies and practices	B1.1 Introduce new/adapt fishing gear and detection technologies to reduce discards and by-catch, fuel consumption, and direct impact on seabed (like abrasion, that smoothens the roughness reducing biodiversity, and ghost fishing)
	B1.2 Develop best methods to integrate the use of by-products and by-catch from fisheries and aquaculture in the production chain
	B1.3 Develop innovative technologies, appropriate monitoring, assessment and governance regimes for sustainable management of fisheries, especially the small-scale ones, use lessons learned, take into account socioeconomic and ecosystem considerations, in line with the Common Fisheries Policy and the General Fisheries Commission (GFCM) for the Mediterranean decisions, and in the view of Maritime Spatial Planning Directive
	B1.4 Develop innovative and efficient maritime surveillance systems for the fisheries, considering local needs and practices
B2. Develop optimal aquaculture strategies, technologies and practices	B2.1 Develop innovative solutions adapted to present economic and ecological exploitation constraints for offshore aquaculture
	B2.2 Define methods to reduce fishmeal/fishoil use in the aquaculture industry
	B2.3 Develop and implement effective processes using robots and automation to improve husbandry, biosecurity, control escapes, towards economic sustainability
	B2.4 Develop aquaculture practices adapted to multipurpose maritime facilities (e.g. bioremediation, biomass production not for humans consumption, ...)
	B2.5 Foster studies to support non-carnivorous species aquaculture, reducing thus the demand for fishmeal.
	B2.6 Study and evaluate the best processes to adapt and diversify aquaculture activities (species and systems) and capacities in a changing environment

CHALLENGE C. Sustainable tourism and cultural heritage in the Mediterranean	
GOAL	ACTION
C1. Linking tourism, tourists and environment	C1.1 Promote synergies between tourism and other productive activities (e.g. fishing tourism, marine mammals watching, aquaculture and tourism), encouraging networking with other

CHALLENGE C. Sustainable tourism and cultural heritage in the Mediterranean	
GOAL	ACTION
	economic sectors (agriculture, crafts, culture, fishing, etc.) and between destinations in order to enlarge the tourism product offer
	C1.2 Design solutions to increase sustainability, adaptability and resilience of coastal infrastructures
	C1.3 Develop new quality tourism products fostered by Marine Protected Areas, green transportation (biking, hiking, bird watching, canoeing)
	C1.4 Establish tools to promote an integrated approach to distribute tourist fluxes to coastal areas and inland
	C1.5 Develop economic strategies to use tourism as a vehicle to educate people through a “Lifelong learning” approach, implementing new interactive tools and multi-devices based on modern technologies that respond to the growing demand for more experience-based and active holiday, increasing at the same time the responsible fruition and the preservation of the tangible and intangible heritage (including under water)
	C1.6 Expand opportunities offered by a sustainable cruise tourism to favour up market and targets, high quality and tailor made services and to strengthen the relationship with cruise companies and intermediaries
	C1.7 Develop monitoring and evaluation systems of the fluxes of tourism (economic, social and environmental) to support an efficient management of tourism flows and impacts leading to an effective governance of tourism growth
	C1.8 Implement evaluation measures and methods to address the development of a greener and sustainable tourism industry
C2. Increase the economic impact of the Mediterranean natural and cultural heritage	C2.1 Create a sustainable and integrated range of tourist services, e.g. scuba diving circuits and recreational/artisanal fisheries sustainably exploiting the Mediterranean’s cultural heritage
	C2.2 Take advantage of retrieved data and information to create a Virtual Museum of Mediterranean Submarine Archaeology
	C2.3 Promote the knowledge of ancient traditions like the artisanal practices of salt extraction in Mediterranean lagoons, drying fish techniques (Bottarga eggs, tuna flesh preservation, ...)
	C2.4 Launch a “tourists through history” initiative showing in a given touristic area the ancient maps digitized and compared to

CHALLENGE C. Sustainable tourism and cultural heritage in the Mediterranean	
GOAL	ACTION
	modern ones documenting how a particular stretch of coast has evolved through climate change and anthropogenic pressure
	C2.5 Promote the digitalization of tourism practices and innovative products (e.g. smart moorings, serious games, augmented reality, scripting on smartphone, underwater trails...) to develop citizen science services and participative and “savoir-faire” tourism

CHALLENGE D. Maritime clusters in the Mediterranean	
GOAL	ACTION
D1. From traditional maritime economic to blue growth activities	D1.1 Establish strategies to encourage and facilitate cluster development in the Mediterranean area, particularly addressing innovative green technologies, through cooperation between local small and medium enterprises, large companies, scientific institutes and innovative players
	D1.2 Promote public-private partnerships to overcome the obstacles to the flourishing of new activities e.g. in emerging markets, such as, offshore wind, mineral resources in the high seas, biotechnologies, coastal ecological engineering, satellite data services ... through federation of actors research/industry, increasing visibility, international representation
	D1.3 Develop economic studies to identify the specialization of different areas and regional clusters and highlight more productive and sustainable activities
	D1.4 Establish innovative methodologies to assess the impacts of different programmes and actions on the evolution of maritime sectors and economy
D2. Mediterranean Blue start-ups	D2.1 Favour incubators and connect startups, investors, accelerators, entrepreneurs, corporate networks, universities for increasing innovative blue ecosystems

CHALLENGE E. Governance of maritime space and marine resources in the Mediterranean	
GOAL	ACTION
E1. Strengthen synergies among science, industry, policy-makers and society	E1.1 Develop participatory approaches to take decisions by improving the dialogue with civil society, considering its importance (e.g. awareness, inputs, transparency, participation, consensus and support) and its specific technicalities (e.g. engagement at local level, language, ambassadors)
	E1.2 Support Maritime Spatial Planning and Integrated Coastal Zone Management through research on multi-level governance and management of multi-stakeholder processes, improving the dialogue with civil society
	E1.3 Take full consideration of long-lasting effects of historical human interventions on coastal systems ranging including river diversions, digging of canals, construction of hard structures for coastal defence, landfills with toxic materials and spread pollution through time (now buried in sediment column)
	E1.4 Provide scenarios of environmental change, investigating the impacts on biodiversity and nature's benefits to people, of alternative socioeconomic development pathways, policy options and blue growth scenarios
E2. Effective maritime spatial planning in the Mediterranean	E2.1 Improve the knowledge on the land-sea nexus to properly address planning, considering co-existence of coast and sea uses and environmental objectives; particular emphasis should be placed on substantially improving the connection between marine traffic with port location/activities and the main supply chains on land (train and free-way networks as well as water ways where appropriate)
	E2.2 Develop coastal ecological engineering solutions and measures taking into account also pressures derived from economical drivers on land
	E2.3 Define and study approaches and tools to identify the trade-offs between ecological dynamics and socio-economic needs, taking into account marine ecosystems goods and services and their environmental, economic and social value, in order to inform and improve adaptive planning and management scenarios
	E2.4 Use integrated decision tools to select appropriate sites for offshore installations, to ensure that they meet energy and environmental requirements

CHALLENGE E. Governance of maritime space and marine resources in the Mediterranean	
GOAL	ACTION
	E2.5 Address transboundary maritime spatial planning issues to understand problems and opportunities (social, economic, environmental) related to the establishment of new maritime zones (Exclusive Economic Zones - EEZ and/or other <i>minoris generis zones</i>) and strengthen knowledge on environmental pressures across borders
	E2.6 Develop tools/software to assess the cumulative impacts of human activities, including the role of land-based stressors, to ensure an eco-sustainable exploitation of marine resources, considering social and economic aspects
	E2.7 Promote innovative technologies and services for a sustainable management and resulting protection of coastal areas from coastal erosion, flooding and pollution
	E2.8 Implement managing solutions and conservation plans, including networks of Marine Protected Areas and their surroundings, for coastal to deep-sea ecosystems, taking into account their relationship with natural and anthropogenic changes (such as artificial reefs) in the environment while ensuring and promoting ecosystems services; best practices on adaptation and resilience
	E2.9 Develop best practices for deep-sea adaptive management based on open data from diverse stakeholders and a common/shared and long-term vision
E3. Promote the role of Marine Renewable Energies (MRE) in the energy transition phase	E3.1 Develop tools to evaluate and select optimal zones for the implementation of MREs farms with a multi-criteria approach (e.g. wind, currents, energy potential, characteristics of seabed, interaction with other marine activities, environmental impacts, ...) also evaluating the possible re-use of some of the oil and gas platforms that are about to be decommissioned
	E3.2 Develop large demonstration projects to sustain commercial MREs development, including Floating Offshore Wind Turbine which is particularly relevant in the Mediterranean

TECHNOLOGY ENABLERS

CHALLENGE A. Smart, greener and safer maritime transport and facilities in the Mediterranean	
GOAL	ACTION
A1. Greening vessels, facilities and services	A1.1 Implement multidisciplinary integrated methodologies to evaluate the impact of ships and harbours on the environment at transnational level, in the light of the specific characteristics of the Mediterranean basin
	A1.2 Develop new vessel concepts, <i>i.e.</i> flexible, modular and high efficient ships, using new materials (e.g. high strength, lightweight, smart, ...) and advanced design and production techniques, with lower manufacturing, construction, installation and decommissioning costs from the perspective of the circular economy
	A1.3 Low emission alternative fuels: support the design of LNG-fuelled ships and appropriate inland, coastal and offshore infrastructures, and the research on biofuels
	A1.4 Exploit new technologies and tools to monitor pollution from ships on route and in harbours
	A1.5 Towards shipping electrification: support research on cold ironing from renewable resources, batteries and fuel cells in particular for fishing boats
	A1.6 Design and develop innovative green infrastructure solutions to improve the sustainability of ports, with special reference to energy efficiency and externalities related to the surrounding built environment
A2. Safer maritime transport	A2.1 Develop a new generation of Decision Support System tools and low-cost expendable instruments for emergency response to marine pollution and oil-spills from accidents, including analysis of the state of damaged platforms, carriers, and shipwrecks and managing on-board emergency situations
	A2.2 Develop ship detection and classification tools to interpret satellite images (relying on European Maritime Safety Agency as data provider)
	A2.3 Develop innovative technologies for safer vessels, with real-time structural monitoring, the ability to navigate in sub-optimal conditions (safe return to port) and the ships' continued capacity to sail. Operate in extreme environmental situations (resilient ships) and sensitive areas, which may involve using the European Global Navigation Satellite System

CHALLENGE A. Smart, greener and safer maritime transport and facilities in the Mediterranean	
GOAL	ACTION
	A2.4 Boost technology to speed up corpse identification and recovery in case of disasters at sea
	A2.5 Develop innovative ship inspection technologies, such as drone and augmented reality also to reduce illegal practices (fraud fishing, discharge at sea of containers with toxic content along navigation routes)
A3. Connected and automated transport	A3.1 Towards autonomous ships and digital shipping (i.e. from sensors and Internet of Things, to big data analytics)

CHALLENGE B. Observing systems and operational oceanography capacities in the Mediterranean	
GOAL	ACTION
B1. Towards an observing system of systems	B1.1 Develop technologies towards an integrated Mediterranean observing system, capitalizing on existing networks and consortia, including European Strategy Forum on Research Infrastructures, and national/regional/local infrastructures, in line with the overall European contribution to global observing systems, such as in the Common Information Sharing Environment (CISE) approach
	B1.2 Support long term and long-time series observing systems for climate change impact evaluation
	B1.3 Implement ICT, Big Data Analysis and Cloud Services Platforms to take advantage of multi-sectoral data management and sharing opportunities for the Mediterranean
	B1.4 Standardize and expand coastline monitoring systems across the Mediterranean region to maintain updated data and information on erosion phenomena and coastal risks (e.g. monitor coastal dunes, wetlands, coastal forest and underwater meadows, coral and coralligenous colonies)
	B1.5 Develop appropriate systems to foster Citizen Science initiatives and protocols to complement environmental and ecosystem monitoring
	B1.6 Ship of opportunity to improve environmental monitoring (sea state, wave height, traffic, visible pollution such as garbage patches, and early detection of disasters such as oil spills)
B2. Tailor-made sensors and platforms	B2.1 Develop Autonomous Unmanned Vehicles and related infrastructure to extend actions on deep sea environments - for different types of operations minimizing the presence or cost of support vessels and ensuring minimal environmental impact.
	B2.2 Develop submarine networks using sensors fibre optic arrays also for deep sea observatories, to monitor geohazards (gas seepage or venting, slope instability, submarine volcanoes, earthquakes) measuring ground acceleration, gas emissions, earthquakes in all water depths including the deep sea
	B2.3 Use state-of-the-art knowledge and infrastructure/sensors (AUV, USV, UAS, gliders with novel sensors, etc.) to improve monitoring of, particles flux, energy and mass transfer rates and processes

CHALLENGE B. Observing systems and operational oceanography capacities in the Mediterranean	
GOAL	ACTION
	B2.4 Develop new products relevant for monitoring the global change of the Mediterranean Sea: horizontal and vertical hydrodynamic circulation, T increase, pH reduction, changing biogeochemical cycles, trophic levels and abrupt regime shifts in marine communities
	B2.5 Support R&D on eco-acoustics to assess the overall health of the ecosystem
B3. Security and safety services and technologies in the Mediterranean supporting the Blue Growth	B3.1 Integrate the Information Communication Technologies-ICT (Big Data, IOT-connected objects, Deep Learning, etc.) in the development of observing systems to deliver high-tech products and services for traditional and emerging sectors such as fisheries, aquaculture, MRE, etc.
	B3.2 Develop new cybersecurity-based solutions for securing data and communications in complex and critical maritime systems such as ports and vessels (positioning systems, communication systems, access control systems, ...)
	B3.3 Design and implement new on-board systems for security of passengers and crew, based on the integration of multi-sensorial surveillance and monitoring technologies (biometry, computer vision systems, radar,..) supervised by ICT architectures
	B3.4 Develop integrated solutions based on autonomous and unmanned (marine and air) drones/robots for surveillance around the vessel and in port areas, enhanced by advanced (surface and underwater) target detection and tracking systems
	B3.5 Develop advanced Alert Management Systems able to provide an continuously updated situational awareness about the safety and security conditions of a vessel and improve crisis management
	B3.6 Develop advanced space systems (optical, radar) for sea monitoring and surveillance exploiting Copernicus and new satellite constellations, as well as the future opportunities offered by geostationary platforms for continuous observation
	B3.7 Smart data fusion of terrestrial and Automatic Identification System data for improved Vessel Tracking
	B3.8 Develop systems for security of ports based on the integration of sensing technologies from multi-observational platforms

CHALLENGE B. Observing systems and operational oceanography capacities in the Mediterranean	
GOAL	ACTION
	(airborne, drones, on-ground, surface water and underwater) for the control of the persons and goods (containers, vehicles, ...)

CHALLENGE C. Innovative offshore industrial platforms including marine renewable energy and co-use	
GOAL	ACTION
C1. Changing the rationale: one platform, multiple uses and activities	C1.1 Develop offshore fixed and mobile infrastructure for the purpose of environmental monitoring from the coast to the high seas, including surface weather conditions, water column and seabed monitoring
	C1.2 Develop Platforms' Multi-Criteria Analysis (MCA) tools allowing to assess different technological options from safety, social, economic and environmental points of view, and regulatory framework at all stages of development from construction to decommissioning, addressing risk analysis (safety and security) during their lifecycle
	C1.3 Autonomous operations to support aquaculture, desalination, services of yachts in platforms
C2. Increase the fraction of installed marine renewable energy power plants	C2.1 Develop site characterization tools and methods with spatialized information, measurement and modeling of extreme events (including sea state) and characterization of sedimentary transport
	C2.2 Identify and strengthen potential synergies between coastal and offshore energy infrastructures and other activities/threats (e.g. aquaculture, protected areas, coastal erosion prevention, etc.)
	C2.3 Develop technology design tools for MRE: impact of biofouling on components, behavior of structures/components in fatigue, innovative monitoring strategies, anchoring
	C2.4 Tool development farm architecture and integration with electric networks, energy storage (Hydrogen, ...)
	C2.5 Environmental and socio-economic impacts: Develop digital tools to characterize and analyze interactions between all stakeholders and the environment, habitat modification, characterization and modeling of biofouling, contextualization of impacts related to MRE

CHALLENGE C. Innovative offshore industrial platforms including marine renewable energy and co-use	
GOAL	ACTION
	C2.6 Develop appropriate methods to manage and exploit bio-resources in the vicinity of MREs plants
	C2.7 Study and improve the acceptability of MRE projects through an enhanced knowledge of their environmental interactions and a thorough multidisciplinary evaluation including socio-economic dimension

CHALLENGE D. Marine and coastal natural and cultural heritage in the Mediterranean: discovering, protecting and valuing	
GOAL	ACTION
D1. Technology solutions for the Mediterranean natural and cultural heritage	D1.1 Develop systems for monitoring of cultural heritage in coastal areas (underwater or partially emerged assets), based on the integration of multi-sensing and multi-observation platforms (satellite, ROV, UAV, on-ground, underwater)
	D1.2 Assimilation of sensed data in advanced modelling for the definition of mitigation actions against climate change and multi-risk scenarios
	D1.3 Technologies and innovations to strengthen sustainable development policies, more efficient use of natural resources and cultural heritage in coastal and marine areas such as: <ul style="list-style-type: none"> - 3D virtual diving with applications for smartphones, for the promotion of natural and cultural heritage; - Ecological engineering: artificial reefs for diving sites, underwater trails, preservation of biodiversity; - Eco-yachting: ecological moorings
	D1.4 Promote innovative devices for and approaches to limit coastal erosion and pollution and to favour beach stabilization
	D1.5 Blue marinas with nature-based solutions. Design and develop innovative integrated solutions using clean technologies to improve the sustainability and management of infrastructures
	D1.6 Develop a strategy focusing on new ICT technologies and services for sustainable tourism (integrating coast and inland waterways) to de-seasonalise and differentiate tourism products
	D1.7 Marine litter: development and testing of new marine litter removal techniques (sea bottom removal, floating litter removal,

CHALLENGE D. Marine and coastal natural and cultural heritage in the Mediterranean: discovering, protecting and valuing	
GOAL	ACTION
	fishing-for-litter good practices). Include citizen science approach when appropriate

CROSS-CUTTING ENABLERS

A number of key cross-cutting actions are needed to assure effectiveness of Knowledge, Economy and Technology actions and their transfer into Blue Growth sectors and value chains. Most of these cross-cutting actions are policy driven and require policy decisions for their implementation.

CHALLENGE A. Cross-cutting enablers for Blue Jobs and Blue Growth	
GOAL	ACTION
A1. Open data, open science, open innovation	A1.1 Promote and regulate transparency with regard to the results of research conducted or 'owned' by public/private companies and institutions, and public authorities, and take action to make them more readily available to the society
	A1.2 Create a "Blue Cloud" for Marine data accumulation (e.g. oceanographic, bioptical, genomics) at Mediterranean level
	A1.3 Support planning and management activities by improving access to marine data (connecting to the Blue Cloud) and including economic, social and environmental information
	A1.4 Promote standardization and interoperability of technological solutions with specific reference to the maritime field with innovate "guides to the use" explaining what diverse sets of data are available
	A1.5 Create a common disclosure and data sharing policy on Maritime Cultural Heritage including the preservation of ancient cartography and its digitization and translation into GIS georeferenced mapping systems
A2. International Cooperation and Coordinated Transboundary Networks	A2.1 Promote appropriate investments, homogeneous legislation and capacity building throughout the Mediterranean, together with a sound sense of ownership in order to ensure full participation from all stakeholders
	A2.2 Promote Maritime Domain Awareness through a strategic framework based on voluntary contributions provided within flexible and inclusive institutionalized structures
	A2.3 Establish a coordinated network of marine institutes, universities, stations, observatories and public and private companies
	A2.4 Promote transnational pilot studies to develop and implement methodologies and practices
	A2.5 Improve coordination and cooperation among Member States and non-EU countries to achieve the Good Environmental Status by developing standard methodologies to implement the

CHALLENGE A. Cross-cutting enablers for Blue Jobs and Blue Growth	
GOAL	ACTION
	Marine Strategy Framework Directive and the UNEP-MAP Ecosystem Approach in shared waters
	A2.6 Establish a network for collaboration between marine and archaeological institutions to share data, locate shipwrecks and target areas for high-resolution seabed mapping
	A2.7 Implement coordinated methods and approach, to achieve a dedicated science-to-policy network on hazards in the Mediterranean
	A2.8 Develop new concepts and protocols with private companies and maritime operators to maximize the use of infrastructure, ships and platforms for scientific and environmental monitoring, safety and security purposes
A3. Interaction between scientists, stakeholders, policy and decision makers, civil society	A3.1 Enhance awareness at both civil and political levels that the degradation of the marine environment presents crucial security challenges in terms of disruption of national economies, displacement of people, degeneration of national identities, loss of lives
	A3.2 Include citizens' science in monitoring and sampling strategies while increasing awareness on the biases intrinsically related to citizen's science, which is hindered for example beyond the visible horizon or in dark deep water
	A3.3 Coordinated approach addressing coastal management and conservation of anthropogenic villages/ecosystems involving local communities
A4. Building capacity, blue skills and blue professionals	A4.1 Develop a network of training research centres to train new professionals on sampling, recording and working at marine level for environmental, engineering and scientific studies
	A4.2 Develop an electronic platform for e-mentoring of young start-uppers in blue growth acting like a virtual incubator to create a lively ecosystem of entrepreneurs of innovation
	A4.3 Co-develop training courses and knowledge exchange activities to improve the level of institutional, technical and human capacities at national level for the implementation of Maritime Spatial Planning and Maritime Governance
	A4.5 Create a Mediterranean training centre to carry out projects for safety in oil & gas offshore operations, including environmental risk and new technologies

CHALLENGE A. Cross-cutting enablers for Blue Jobs and Blue Growth	
GOAL	ACTION
	A4.6 Develop new modalities of security operators training exploiting the opportunities offered by the augmented reality techniques
	A4.7 Exploit new digital technologies for training purposes, solutions based on Virtual Reality or Augmented Reality
	A4.8 Promote capacity building to increase resilience to disasters of Mediterranean countries
	A4.9 Train a new generation of marine technicians/scientists to conduct research on the protection of the marine cultural heritage
	A5.1 Analyse socio-economic and geopolitical dynamics of the Mediterranean area as the context/ constraint to implement the actions above and shared policies
A5. Promoting and implementing strategies and action plans	A5.2 Promote Circular Economy associated to the sea and to coastal development and analyse solutions for implementing circular economy procedures
	A5.3 Support the social part of de-contamination activities (plastic strategy) and the policy part by implementing the MFSD in Med
	A5.4 Develop environmental decision support modelling systems to sustain policy strategies, including adaptation and mitigation, for preserving the socioeconomic and environmental sustainability of marine species and habitats
	A5.5 Review and harmonize the action plans of the MED countries on hazards and protection of coastal areas
	A5.6 Develop adaptive strategies for events, even of low recurrence but potentially devastating, preparing people for such a possibility, including impact scenarios
	A5.7 Develop economic strategies to test and promote safe natural products of marine origin
	A5.8 Reduce administrative costs, promoting investments in best technologies to support sustainable aquaculture

CHALLENGE A. Cross-cutting enablers for Blue Jobs and Blue Growth	
GOAL	ACTION
	A5.9 Carry out marketing campaigns to raise awareness among consumers to improve the image of Mediterranean aquaculture products and to enhance the related economic value
	A5.10 Improve transport systems for smart, safe mobility in coastal zones, lagoons and restricted areas
	A5.11 Provide incentives for the use of Vessel Monitoring Systems (VMS)
	A5.12 Create the legislative, technological and infrastructural conditions to promote a highly connected and automated sea transportation system to improve safety and efficiency of shipping
	A5.13 Review and reinforce policies dedicated to the maritime security to achieve relevant sustainability goals and socio-economic advantages
	A5.14 Define a strategic plan and an action priority schema for maritime security supporting the Blue Growth and critical infrastructures monitoring
	A5.16 Support to legal controls on littering and waste abandonment on river beds, unprotected shores and offshore
	A5.17 Change of legislation to facilitate fishing boats that bring ashore chemical containers, weapons/bombs or other undefined and potentially harmful material found offshore (in most countries today these boats risk to remain sequestered for weeks in port with major damage to the workers and owners)



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POLICY RELEVANCE AND EXPECTED IMPACTS

The BLUEMED SRIA is a policy-driven agenda whose developments are expected to inform, influence, and support the implementation and evolving processes of a wide range of international and EU policy instruments, i.e. general (“Blue Frame”), macro-regional, sectoral and environmental. The following table presents an overview of such relevance for each challenge of Knowledge, Economy and Technology enablers. The cross-cutting enablers are considered *per se* as policy actions.

	Strategic Blue Frame & Governance	Macro-Regional Frameworks				Sectoral Policies							Environmental Policies		
		EU Cohesion and Neighborhood Policy (ENP)	Barcelona Convention	EUS AIR	WEST MED	Transport	Energy	Fisheries & Aquaculture	Food	Bioeconomy	Tourism and UCH	Security and Surveillance	Pollution	Biodiversity	Climate
KNOWLEDGE Pillar															
CHALLENGE A. Mediterranean Sea ecosystems: characterize present dynamics, services, resources, vulnerability and resilience to natural and anthropogenic pressures															
<i>GOAL A1. Understanding the functioning of the Mediterranean Sea ecosystem</i>															
<i>GOAL A2. Understanding Pollution Impacts, Mitigation, and Remediation in the Mediterranean Sea</i>															
<i>GOAL A3. Promoting sustainable exploitation of biotic and abiotic resources</i>															

	Strategic Blue Frame & Governance	Macro-Regional Frameworks				Sectoral Policies							Environmental Policies		
		EU Cohesion and Neighborhood Policy (ENP)	Barcelona Convention	EUS AIR	WEST MED	Transport	Energy	Fisheries & Aquaculture	Food	Bioeconomy	Tourism and UCH	Security and Surveillance	Pollution	Biodiversity	Climate
CHALLENGE B. Forecast changes of the Mediterranean basin under climate and anthropogenic pressures and develop plans for sustainable adaptation to climate change and mitigation of its effects															
<i>GOAL B1. Forecasting the Mediterranean Sea dynamics and climate</i>															
<i>GOAL B2. Preparing to climate change and define adaptation/mitigation measures</i>															
CHALLENGE C. Hazards and protection of coastal areas and open sea in the Mediterranean															
<i>GOAL C1. Reducing the coastal risk of disasters and their effects</i>															
<i>GOAL C2. Protecting Maritime Cultural Heritage</i>															
CHALLENGE D. Innovative blue growth trajectories															
<i>GOAL D1. Exploring the potential of blue-biotech</i>															
<i>GOAL D2. Support solutions for sustainable food production</i>															
<i>GOAL D3 Exploiting the Deep Sea</i>															
ECONOMY Pillar															
CHALLENGE A. Innovative businesses based on marine bio-resources in the Mediterranean															

	Strategic Blue Frame & Governance	Macro-Regional Frameworks				Sectoral Policies							Environmental Policies		
		EU Cohesion and Neighborhood Policy (ENP)	Barcelona Convention	EUS AIR	WEST MED	Transport	Energy	Fisheries & Aquaculture	Food	Bioeconomy	Tourism and UCH	Security and Surveillance	Pollution	Biodiversity	Climate
<i>GOAL A1. Developing new technologies and tools</i>															
<i>GOAL A2. Generating new products and services</i>															
CHALLENGE B. Ecosystem-based management of Mediterranean aquaculture and fisheries															
<i>GOAL B1. Develop optimal fishing strategies, technologies and practices</i>															
<i>GOAL B2. Develop optimal aquaculture strategies, technologies and practices</i>															
CHALLENGE C. Sustainable tourism and cultural heritage in the Mediterranean															
<i>GOAL C1. Linking tourism, tourists and environment</i>															
<i>GOAL C2. Increase the economic impact of the Mediterranean natural and cultural heritage</i>															
CHALLENGE D. Maritime clusters in the Mediterranean															
<i>GOAL D1. From traditional maritime economic to blue growth activities</i>															
<i>GOAL D2. Mediterranean Blue start-ups</i>															
CHALLENGE E. Governance of maritime space and marine resources in the Mediterranean															
<i>GOAL E1. Strengthen synergies among science, industry, policymakers and society</i>															
<i>GOAL E2. Effective maritime spatial planning in the Mediterranean</i>															

	Strategic Blue Frame & Governance	Macro-Regional Frameworks				Sectoral Policies							Environmental Policies		
		EU Cohesion and Neighborhood Policy (ENP)	Barcelona Convention	EUS AIR	WEST MED	Transport	Energy	Fisheries & Aquaculture	Food	Bioeconomy	Tourism and UCH	Security and Surveillance	Pollution	Biodiversity	Climate
<i>GOAL E3. Promote Marine Renewable Energies' role in the energy transition phase</i>															
TECHNOLOGY Pillar															
CHALLENGE A. Smart, greener and safer maritime transport and facilities in the Mediterranean															
<i>GOAL A1. Greening vessels, facilities and services</i>															
<i>GOAL A2. Safer maritime transport in the Mediterranean</i>															
<i>GOAL A3. Connected and automated transport</i>															
CHALLENGE B. Observing systems and operational oceanography capacities in the Mediterranean															
<i>GOAL B1. Towards an observing system of systems</i>															
<i>GOAL B2. Tailor-made sensors and platforms</i>															
<i>GOAL B3. Security and safety services and technologies in the Mediterranean supporting the Blue Growth</i>															
CHALLENGE C. Innovative offshore industrial platforms including marine renewable energy and co-use															
<i>GOAL C1. Changing the rationale: one platform, multiple uses and activities</i>															
<i>GOAL C2. Increase the fraction of installed marine renewable energy power plants</i>															
<i>GOAL C3. Train for blue offshore professionals</i>															

	Strategic Blue Frame & Governance	Macro-Regional Frameworks				Sectoral Policies							Environmental Policies		
		EU Cohesion and Neighborhood Policy (ENP)	Barcelona Convention	EUS AIR	WEST MED	Transport	Energy	Fisheries & Aquaculture	Food	Bioeconomy	Tourism and UCH	Security and Surveillance	Pollution	Biodiversity	Climate
CHALLENGE D. Marine and coastal natural and cultural heritage in the Mediterranean: discovering, protecting and valuing															
<i>GOAL D1. Technology solutions for the Mediterranean's natural and cultural heritage</i>															



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