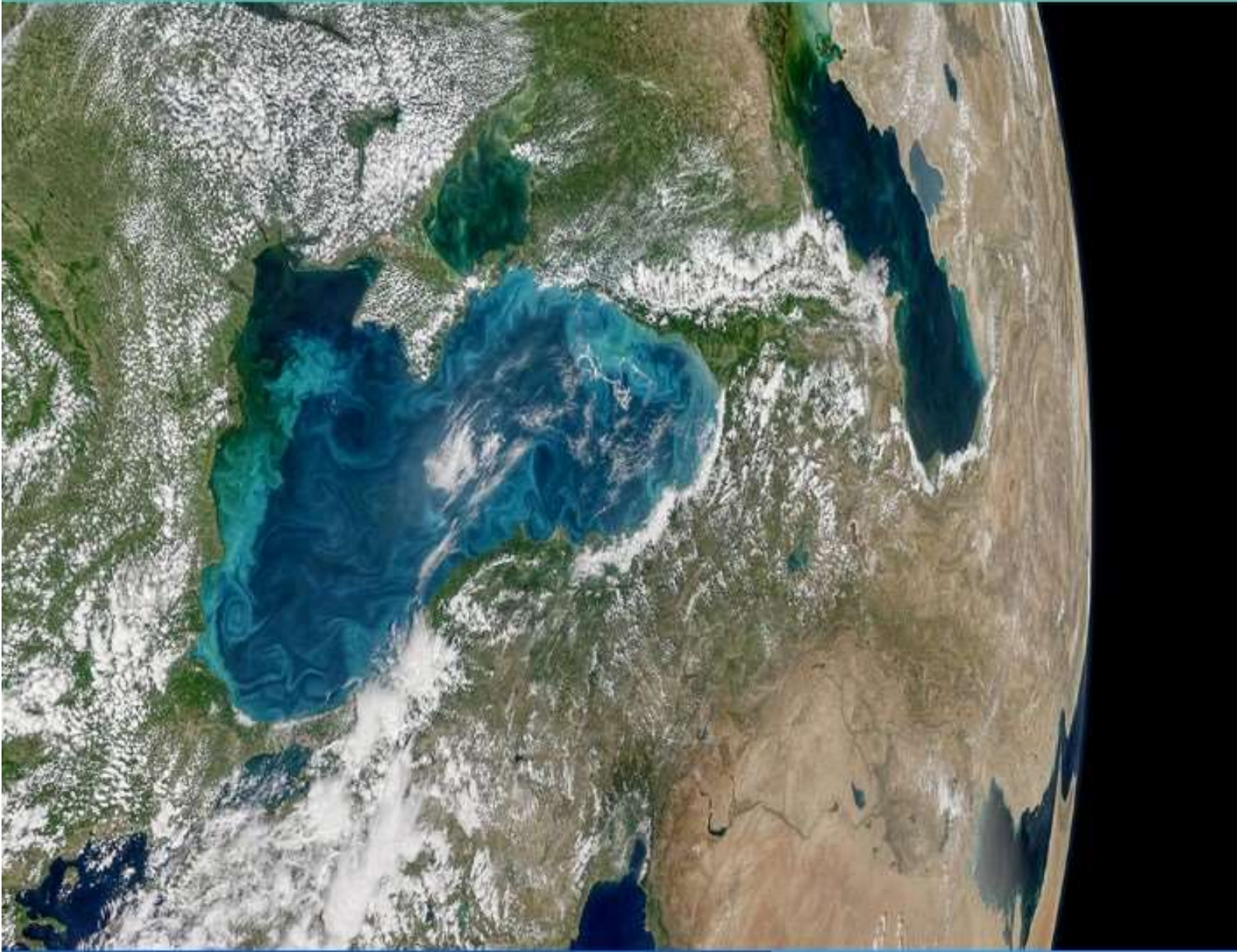


Coordination of Marine and Maritime Research and Innovation in the Black Sea

Black Sea CONNECT



D2.1 The Report on State of the art of Black Sea projects mapping and framework conditions



DELIVERABLE ID:	WP No 2/Del No 2/TASK No 2.1
DELIVERABLE TITLE:	The Report on State of the art of Black Sea projects mapping and framework conditions
RESPONSIBLE PARTNER:	UkrSCES
CONTRIBUTORS:	IO-BAS, GEOECOMAR, METU, NIMRD, RANEP, SIO-RAS, TSU, TUBITAK, UKRSCES, UST
TYPE	Report
DISSEMINATION LEVEL:	PU
FILE:	Black Sea CONNECT_D2_1
REVISION:	V1
DUE DATE OF DELIVERABLE:	Date 30/06/2020
ACTUAL SUBMISSION DATE:	Date 03/05/2023
CALL	H2020-BG-2018-2020 (Blue Growth) Coordination of marine and maritime research and innovation in the Black Sea
TOPIC	LC-BG-09-2019 Focus area: Building a low-carbon, climate-resilient future (LC)

Document History

REVISION	DATE	MODIFICATION	AUTHOR
0.1	29/06/2020	Document Creation	Viktor Komorin (UKRSCES) Oleksandr Neprokin, (UKRSCES) Karina Vishyakova, (UKRSCES) Pavel Goldin, (UKRSCES) Oleksandr Lepeshkin, (UKRSCES) Yulia Kotelnikova, (UKRSCES)
0.2	03/05/2023	Document Edit	Pavel Goldin (UKRSCES) Ezgi Sahin (METU) Pinar Uygurer (METU)

Classification

This document is:

Draft	
Final	x
Confidential	
Restricted	
Public	x



The activities of the Black Sea CONNECT Coordination and Support Action are funded by the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 860055.

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1. Executive Summary

The Report on State of the art of Black Sea projects mapping and framework conditions has been produced in the frame of Task 2.1 “Assessment of current R&I in the Black Sea” under the H2020 Black Sea CONNECT Project. It contains detailed and annotated materials for the opening chapter of the new Black Sea Strategic Research and Innovation Agenda (SRIA, 2019), and consecutively, the Implementation Plan.

Within the scope of this task; i) The status of the existing SRIAs including the Black Sea SRIA 2019 as a relevant basis for a new Research and Innovation Strategy in the Black Sea were reviewed ii) main R&I Areas were revised and the matrix of marine research projects conducted from 2015 to 2020 was analysed iii) outcomes were collated into summary graphs to identify needs and gaps. Analysis of gaps and research & innovation opportunities provided the necessary justifications and drivers for top-ranking R&I areas.

Version one of this deliverable was submitted in 2020. However, upon the comments of the reviewers and project officer received during the Black Sea CONNECT, the deliverable and the relevant raw data have been revised. The methodology is elaborated, and the duplications between the national and international projects have been removed as well as the duplications with the D3.1 Handbook of relevant Black Sea projects, initiatives and entities, including the modes of engagement. This version, however, still reflects the projects up until 2020 as D2.7 Revised Report on State of the Art of Black Sea projects mapping and framework conditions will cover updated projects and analysis.

Based on the outputs of D2.1 and D2.7, the Black Sea SRIA Implementation Plan will be designed to advance already existing progress on identified topics and less-addressed priority areas. In this deliverable the results show that National projects mostly focused on Living Marine Resources, Marine Pollution and Litter, Biodiversity and Operational Oceanography/Observing Systems and Monitoring projects; Multinational EU funded projects targeted Operational Oceanography/Observing Systems and Monitoring, Training & Technology Transfer, Tourism and Surrounding Economy, Socioeconomic & Policy Research and Biodiversity. Climate change was addressed as a secondary are. Additionally, it was also observed that emerging challenges are little addressed in monitoring programs: Bioinvasions, Deep Sea Ecosystems, Seas and Human Health.



2. Introduction

The Black Sea is a vital resource with vast potential to boost the societal value of the blue economy for its surrounding countries. Blue Growth has a great potential for the Black Sea countries and for Europe as a whole as it can be considered an instrument to promote stability and empower the coastal communities in the region (EC, 2014). The Black Sea, with its marine basin and coastal socioeconomic systems combined, can be considered a natural laboratory of global significance, for fundamental science, sustainability policy, and Blue Growth.

Improved knowledge and enhanced infrastructure together with better coordination and alignment of research and innovation efforts could both help to restore and maintain the resilience of the Black Sea ecosystem and enable sustainable exploitation of its natural resources. To this end, an Initiative has been supported by the EU to develop a joint research and innovation roadmap and guide national and EU-level policymakers. The Burgas Vision Paper was produced by the Initiative and published by the EC as the key framework document for a shared vision of a productive, healthy, resilient, sustainable, and better-valued Black Sea by 2030. It was prepared by experts from Black Sea coastal countries (Republic of Bulgaria, Georgia, Romania, the Russian Federation, the Republic of Turkey and Ukraine, as well as the Republic of Moldova), in cooperation with marine experts from leading European marine institutes and organisations, with the support of the European Commission and was launched during the European Maritime Day 2018 in Burgas, Bulgaria (May 2018). It addresses the key pillars on which a new Strategic Research and Innovation Agenda (SRIA) and its Implementation Plan can be built on, a direction which was further supported by the Ministerial Declaration towards a Common Maritime Agenda (2018) for the Black Sea, endorsed by all the Black Sea countries. According to these documents, the Black Sea Blue Growth Initiative has identified four main pillars in the Black Sea:

1. Addressing fundamental Black Sea research challenges (Black Sea Knowledge Bridge),
2. Developing products, solutions, and clusters underpinning Black Sea Blue Growth (Black Sea Blue Economy),
3. Building of critical support systems and innovative Infrastructures (Key Joint Infrastructure and Policy Enablers),
4. Education and capacity building (Empowered Citizens and Enhanced Blue Workforce).

The core contribution of the Black Sea CONNECT Coordination and Support Action is to scientifically, technically, and logistically support the Black Sea Blue Growth Initiative towards the implementation of the Burgas Vision Paper, with a view on boosting the Blue Economy in the region. Black Sea CONNECT will develop and promote a shared vision for a productive, healthy, resilient, sustainable, and better valued Black Sea.

The overall objective of the Action is to coordinate the development of the Black Sea Strategic Research and Innovation Agenda (SRIA), based on the defined principles in the Burgas Vision Paper and support the development of the Blue Growth in the Black Sea. The Black Sea SRIA and its Implementation Plan will guide stakeholders from academia, funding agencies, industry, policy, and society to address together with the fundamental Black Sea challenges, to promote blue growth and economic prosperity of the Black Sea region, to build critical support systems and innovative research infrastructure and to improve education and capacity building. The project will support the design of synergistic activities such as developing an operational network of funders, new transnational joint activities, and achieving the knowledge transfer of innovation to support blue economy. While doing this the project will support the policy direction set in the Burgas Vision Paper and it will link stakeholders, relevant initiatives, and institutions. While addressing the specific objectives, the



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crosscutting issues of the project will be integrating policy, industry, and research linking innovation to blue economy as well as promoting the alignment and convergence of national and international research and innovation activities and relevant initiatives and investments. The specific objectives are as follows:

- O1 Support the Black Sea Blue Growth Initiative to consolidate and update the SRIA
- O2 Develop the SRIA Implementation Plan
- O3 The establishment of an operational network for the Black Sea Region
- O4 Support the design and implementation of new transnational joint activities
- O5 Making the Black Sea visible through empowered Black Sea societies

An accountable and impactful SRIA Implementation Plan based on the key framework conditions to convert SRIA outputs into actions, will be developed together and with national research funders and key stakeholders concerned. The following are taken into account:

- The implementation strategy will be built on the concrete actions defined by the Black Sea Blue Growth Initiative
- The Plan will include mechanisms that will secure long-term sustainability of the SRIA Implementation Plan beyond the conclusion of the project.
- The Plan will also define, support and implement effective cooperation and funding mechanisms, tools to implement the actions through joint transnational activities.

In line with developing an accountable and impactful Black Sea SRIA in order to generate the text and content for the opening chapter of the SRIA, and consecutively, the Implementation Plan, “Assessment of current R&I in the Black Sea” task will detail and expand major challenges and opportunities for the Black Sea basin. Building on the past and ongoing work of the Black Sea Initiative, the task identifies the gaps, priorities, and research and innovation needs to construct a comprehensive document that the SRIA builds on. The task is enriched by the identification of key ecosystem services, pressures, and risks, and will enhance the opportunities mentioned in the Burgas Vision Paper. The key output of this task is an 'assessment document' which is regularly updated by the community as stakeholders will be engaged and national consultations progress.

3. Methodology

This deliverable aims to map the past and ongoing work of the Black Sea Initiative and identify the gaps, priorities, and research and innovation needs to construct a comprehensive document that the Black Sea SRIA builds on. An initial analysis as such was conducted during the development of the Black Sea SRIA in 2018. Under the Black Sea CONNECT CSA, which aims to update and further consolidate the Black Sea SRIA, this deliverable analyzes the marine-related projects in the Black Sea and the framework conditions. This deliverable will be updated with new data in the final year of the CSA (2023) to update the state of the arts of the Black Sea Projects and framework conditions.

During the SRIA development phase, eight workshops were held by the experts joining the Blue Growth Initiative for Research and Innovation in the Black Sea with the support of the European Commission. Initially, information on both national and international marine research projects was collected and analysed. Secondly, gaps and research and innovation opportunities together with the necessary justification and drivers from each Black Sea country were collated. Thirdly, regional and national boundary and framework conditions for the Research and Innovation needs and opportunities for successful implementation of an SRIA were



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identified. Based on the data generated and outcomes of these workshops, the experts of the Initiative drafted: i) a common vision, ii) challenges, iii) goals of the SRIA. These results were presented in the Burgas Vision Paper.

The matrixes and past project information were analysed and collated into summary graphs to identify needs and gaps. For this, sets of pre-defined area keywords were delivered to the expert group and they were asked to map national/international projects.

The aim of this deliverable is to revise and update this information to reflect the current trends in national and international projects of the Black Sea countries. Under this task and deliverable, lead UkrSCES has collected the bulk of data on marine-related projects from the CSA members in 2020. The CSA members were encouraged to consult their funding agencies, government bodies, universities, and other relevant authorities and databases to collect relevant national and international projects. Therefore, national datasets containing referenced and abstracted information on each project details were collected and summarized. Also, general information on budgets was included when accessible.

Another general approach was implemented for the field part of data collection: expert opinions were sought from the CSA partners and the relevant funding agencies and authorities that they referred to. The expert opinions of the CSA partners were collected to fit under the pre-defined main research and innovation areas which were defined at the time of the Black Sea SRIA development. These areas were identified by the experts of the Black Sea Blue Growth Initiative based on an analysis of the different sea-basin strategies and strategic agendas.

Also, public domains such as the EU's Cordis and the Black Sea Cross Border Cooperation databases were used to complement the input gathered from the CSA members.

The primary data collected during the initial steps were analysed in several steps. First, several checks were made to avoid duplications and unify the bulk of data. For avoiding duplication for multi-sided projects the parsimony procedure was applied. Regional international projects were assigned to the country where the coordinating institution was located. All the EU-funded multinational projects (including those funded by any EU agency such as the DG, EU Commission as a whole or partially funded by the EU and another entity or agency), mostly but not excluded, frames of FP7, H2020, ENI CBC, and also specially funded by DG ENV, DG MARE, DG NEAR, etc., were analyzed as EU projects except those focused on a single country of the region. Such procedures led to narrowing the analysis by targeting large-scale dedicated efforts consuming most of the researchers' time and allocated budgets and yielding primarily important results. Also, such an approach better highlighted the sources of interest driving research and innovation in the region. Interestingly, only a few external players were identified as funders of research projects in the region.

After the preliminary procedure, the content analysis was conducted by the team of reviewers. All the project abstracts, web sites and selected project reports were reviewed and classified by areas and subjects. The areas and goals were analyzed; primary and additional areas for each project were defined or re-identified if needed. For general statistics of this report only distribution by main (primary) area is presented; however, the narrative gap and opportunity analysis includes data on other areas and subjects summarized and specified per each project.



Based on the content analysis the key questions were addressed by the experts of the CSA based on the initial data of the SRIA development and the gap and opportunities analysis were finalized and presented as the narrative by each area. The input received through workshops and consultations in the process leading up to the SRIA development is updated and revised by the expert opinion of the CSA members.

Therefore, this report first gives an overview of the existing SRIA's and their strategic goals/objectives/areas which were used to define 24 main R&I areas under which the Black Sea marine projects and framework conditions were analysed. An analysis of the existing SRIA's also helps to put the Black Sea SRIA into the broader context of the marine strategic agendas. Following that, Black Sea marine projects that took place from 2015-2020 are analysed under the 24 R&I categories country by country. Lastly, the expert opinions on the framework conditions were presented.

It is important to note that this deliverable will be revised and finalized at the end of the Black Sea CSA with the most up-to-date state of art of Black Sea projects and framework conditions. This report will feed into the development of the Black Sea SRIA Implementation Plan which will be one of the main outputs of the Black Sea CONNECT CSA.

4. The basis for a new Research and Innovation Strategy in the Black Sea

This section will briefly investigate the status of the existing SRIA's in different sea basins including the Black Sea SRIA 2018 as a relevant basis for a new Research and Innovation Strategy in the Black Sea were reviewed. Mapping out the existing SRIA's will enable to underline the Black Sea SRIA in a broader context of sea-basin strategies and relevant agendas as the methodologies, processes, and mechanisms of the existing SRIA's were benefited during the development of the Black Sea SRIA.

4.1 Black Sea SRIA 2018

In 2017, an Initiative was launched and supported by the European Commission (EC) to develop a joint research and innovation agenda and guide national and EU-level policymakers named as, 'The Blue Growth Initiative for Research and Innovation in the Black Sea'. As highlighted in the Burgas Vision Paper, this expert working group is consisted of experts from Black Sea coastal countries, (Republic of Bulgaria, Georgia, Romania, the Russian Federation, the Republic of Turkey and Ukraine, as well as the Republic of Moldova), in cooperation with marine experts from leading European marine institutes and organisations, with the support of the European Commission. They produced the Burgas Vision Paper [1] the key framework document for a shared vision of a productive, healthy, resilient, sustainable, and better-valued Black Sea by 2030. The paper was launched during the European Maritime Day 2018 in Burgas, Bulgaria (May 2018). It addresses the key pillars on which a new Black Sea Strategic Research and Innovation Agenda (SRIA) can be built on. This process was further supported by the Ministerial Declaration towards a Common Maritime Agenda [2] (2018) for the Black Sea, endorsed by the same Black Sea countries. Eight workshops were held by the experts joining the Blue Growth Initiative for Research and Innovation in the Black Sea with the support of the European Commission (EC). Initially, information on both national and international marine research projects were collected and analysed. Secondly, gaps and research and innovation opportunities together with the necessary justification and drivers from each Black Sea country were collated. Thirdly, regional and national boundary and framework conditions for the Research and Innovation needs and opportunities for successful implementation of SRIA were identified. Based on the data generated and outcomes of these workshops, the experts of the Initiative drafted: i) common vision, ii) challenges, iii) goals of the Black Sea SRIA. These results were presented in the Burgas Vision Paper.



The SRIA has been developed on the already agreed goals as stated in the Burgas Vision Paper to address the related challenges (Fig.4.1).



Fig. 4.1. - Steps taken to develop the Burgas Vision paper

The Initiative has identified four main pillars on which a new set of research and innovation actions can be developed:

Pillar 1 - Addressing fundamental Black Sea research challenges - Black Sea Knowledge Bridge

- MG1** Developing innovative multi-disciplinary research, building on existing initiatives, including data sharing mechanisms that will generate the knowledge needed to increase ecosystems resilience.
- MG2** Providing new knowledge to mitigate the impacts of global climate change and the multiple environmental and anthropogenic stressors in the Black Sea from land-sea interface to the deep basin.

Pillar 2 - Developing products, solutions and clusters underpinning Black Sea Blue Growth - Black Sea Blue Economy

- MG1** Supporting marine and maritime research and innovation domains of all the Black Sea countries to create synergy, increase economic benefits, reduce hazards in service of prospering, resilient and empowered communities deriving interest from the Black Sea basin.
- MG2** Creating incentives for maritime innovation in existing and new, emerging blue economy sectors.

Pillar 3 - Building of critical support systems and innovative Infrastructures - Key Joint Infrastructure and Policy Enablers.

- MG1** Developing smart, integrated observing and monitoring systems in support of addressing scientific and socioeconomic challenges of the Black Sea, towards governance for a sustainable ecosystem, mitigation of climate change impacts, and accurate forecasting for adaptive management.
- MG2** Advancing a harmonised set of working methodologies, standards and procedures on all aspects of coastal and marine research.
- MG3** Developing new marine based technologies by benefiting from the fourth industrial revolution for the Black Sea to promote safe and sustainable economic growth of the marine and maritime sectors, the conservation and valorisation of marine cultural heritage.
- MG4** Mechanisms to create, support and promote start-ups oriented towards the circular and blue economy in the Black Sea region

Pillar 4 - Education and capacity building - Empowered Citizens and Enhanced Blue Workforce

- MG1** Supporting formal and informal learning, education, training and use of knowledge and technologies for established and emerging marine and maritime jobs.



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MG2	Empowering ocean-engaged citizens contributing to a clean, plastic free, healthy and productive Black Sea.
MG3	Contributing to enhanced science policy dialogue in formulating coastal and marine policies and programmes.

Fig. 4.1.b – Black Sea SRIA Pillars and Main Goals (MG)

Each main goal further breakdown to concrete actions which are not included in this report. More details on the specific actions can be found on the Black Sea SRIA. [3]

There will be three overarching considerations throughout the SRIA:

1. First, the pillars support developing and adopting innovative, fit-for-purpose observation and data sharing systems (combining ecology and social data) building on existing networks.
2. Second, the actions are designed to benefit primarily from co-funding and co-programming mechanisms and bodies at the national, transnational, and international level.
3. Third, the Black Sea SRIA will be updated on a regular basis in dialogue and in close link with relevant national and research stakeholders and further clarifications and revisions will be made as needed.

A key output of the SRIA is to help identify national-level priorities to contribute to the development of national Blue Growth agendas. Furthermore, the actions proposed in the SRIA and their implementation will be generating scientific knowledge. Such new knowledge includes better ecosystem assessments, forecasts and management, as well as an understanding of the vulnerabilities of the ecosystem. Knowledge is the key element towards science-based and well-informed decision-making. Such policymaking paves the way to a sustainable blue economy.

Under Black Sea CONNECT CSA, the Black Sea SRIA will be updated twice in the course of the action. With rounds of national consultations to be conducted with broad national stakeholders, input to the Black Sea SRIA will be gathered and included in the upcoming updates. The stakeholders will be also asked to prioritize the actions of the Black Sea SRIA, to reveal what are the most urgent priorities at the country and region level.

As of March 2021, the first update of the Black Sea SRIA was submitted to the EC services as a result of the first round of national consultations that took place in September-October 2020. Over 600 stakeholders were reached with the consultations and substantial input to the Black Sea SRIA has been gathered with new action suggestions. As mentioned earlier, this input will be used to develop the Black Sea SRIA updates and its Implementation Plan.

4.2 Experience of other existing SRIAs

4.2.1 BLUEMED SRIA

The BLUEMED Strategic Research and Innovation Agenda (BLUEMED 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.



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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 which was presented at the EU Competitiveness Council in December 2014 by the Italian Presidency of the EU.

Following that, 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 (BLUEMED CSA), a project funded under Horizon 2020 by the European Commission 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 Union for Mediterranean 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 (BLUEMED GSO) composed by delegates officially appointed by EU and non-EU countries is the BLUEMED Initiative steering body. (BlueMed SRIA, 2018) [3]

Vision and objectives

Based on 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, the vision for a sustainable future on the Mediterranean area, is set 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.

The experts decided that this vision should be done by

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

Methodology and Implementation

BLUEMED Initiative has identified 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 which also highlights cross-cutting themes. The BLUEMED SRIA further lays out goals and actions under each pillar. Further breakdown of the actions can be found in the BLUEMED SRIA.

BLUEMED SRIA Challenges	
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 and offshore resources
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
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	A1. Open data, open science, open innovation.
	A2. International Cooperation and Coordinated Transboundary Networks.
	A3. Interaction between scientists, stakeholders, policy and decision makers, civil society.
	A4. Building capacity, blue skills and blue professionals.
	A5. Promoting and implementing strategies and action plans.



Fig. 4.2.1 – BLUEMED SRIA Challenges

In this section, the methodology that is followed for the prioritization of these goals is presented. The selection method is rigid enough to allow comparable results and flexible enough to allow countries to give their national perspective (priorities can change on social, geographical, economic reasons, etc.).

At national level:

Step 1: all countries scored all SRIA goals from 1 to 10 based on 4 criteria (scientific, economic, techno and policy impact at Med level) and they classified goals between short/long term.

Step 2: all countries generated a top10 list of priority goals based on step 1 and the following 10 criteria proposed by Italy (CNR):

1. Goal clearly in the field of research & innovation;
2. Goal addresses an issue which is relevant for the Mediterranean Sea;
3. A realistic action plan can be established for the next years (favour g/a that could be developed in the short term);
4. Possibility to have a leverage effect (convergence of the BLUEMED priorities with other strategies, e.g. Regions);
5. Expected impact in terms of economic development, jobs, well-being of citizens, etc.;
6. Gaps and risks;
7. Required conditions (infrastructures, human resources, possibility of funding, etc.);
8. The 'across-pillar' added value;
9. Goal clearly filling a gap;
10. Goal not overlapping with existing initiatives/projects.

Step 3: national exercises and a comprehensive matrix of results have been distributed to CSA coordinator, Work Package leaders and Platforms Coordinators.;

Step 4: Final conclusions are communicated to the BLUEMED GSO G for their analysis, agreement and validation of priorities.

With this methodology, BLUEMED SRIA has been updated 2 times (First release in 2015, First Update in 2017 and the second update in 2018). Based on the prioritisation work conducted by the countries and BLUEMED GSOs comments and guidance, the BLUEMED Preliminary Implementation Plan focusing on the selected priorities + the pilot «Towards a healthy plastic-free Mediterranean Sea» has been drafted in June 2020.

4.2.2 BONUS SRA & SRIA

BONUS, the policy-driven and solution-orientated joint Baltic Sea research and development programme (www.bonusportal.org), was established by the Decision 862/2010/EU of the European Parliament and the Council in September 2010, under Article 185 of the Treaty on the Functioning of the European Union (TFEU) within the EU 7th Framework Programme for Research and Technological Development. The leading Baltic Sea research and innovation funders of the EU member states Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden are the BONUS members implementing the programme and in addition the Russian Federation participates in BONUS through bilateral agreements. BONUS aims to generate knowledge to overcome the major environmental challenges faced by the Baltic Sea ecosystem by integrating research



activities within the region into a durable, cooperative, interdisciplinary, and focused transnational programme. ([Leijonmalm et al., 2017](#)) [5]

In support of sustainable development and ecosystem-based management of the Baltic Sea region, the HELCOM Baltic Sea Action Plan and the EU Marine Strategy Framework Directive and other European, regional and national coastal and marine environmental policies and plans, BONUS:

- issues calls on ecosystem research and innovation for the scientific community and SMEs
- funds projects of high excellence and relevance 1) to produce knowledge, scientific evidence, and innovation solutions needed by policymakers and 2) to engage end-users and the society in the knowledge-based governance of the fragile Baltic Sea. ([BONUS Programme, 2010-2017](#)) [6]

The main aim of BONUS is to develop, generate and disseminate knowledge and expertise to resolve the 11 challenges defined in the Strategic Research Agenda (SRA) to ensure the future sustainable use of the Baltic Sea ecosystem. The SRA addresses and defines five main strategic objectives, which are translated into 19 problem-oriented research themes. They form the programme's overall framework and provide the basis for the calls for research proposals. Whilst most of the challenges are generic and cross-cutting in nature, some (e.g. «Planning of the use of marine space», «Making fisheries management effective», and «Achieving safe maritime traffic») are more focused and sector-specific

BONUS Strategic Objectives	
SO 1	Understanding the Baltic Sea ecosystem structure and functioning
SO 2	Meeting the multifaceted challenges in linking the Baltic Sea with its coast and catchment area
SO 3	Enhancing sustainable use of coastal and marine goods and services of the Baltic Sea
SO 4	Improving the capabilities of the society to respond to the current and future challenges directed to the Baltic Sea region
SO 5	Developing improved and innovative observation and data management systems, tools and methodologies for marine information needs in the Baltic Sea region

Fig. 4.2.2. a – BONUS SRA Strategic Objectives

BONUS SRA Challenges	
1	Evaluating and developing relevant policies and collective governance
2	Adapting to a sustainable way of living
3	Adapting to the effects of climate change
4	Restoring Good Environmental Status (GES) of the Baltic Sea and its coasts
5	Mitigating eutrophication that affects today nearly the entire Baltic Sea
6	Achieving sustainable and safe use of the exploited coastal and marine ecosystem goods and services
7	Planning of the use of marine space that fulfills the intensifying and diversifying needs of society
8	Making fisheries management effective in order to secure the stability of the ecosystem and reproduction capacity of the Baltic Sea fish stocks
9	Achieving safe maritime traffic imposing no risks to the environment
10	Minimising the environmental threat from increasingly diversified use of chemicals and new materials
11	Creating cost-efficient environmental information systems

Fig. 4.2.2. b – BONUS SRA Challenges



The activities of the Black Sea CONNECT Coordination and Support Action are funded by the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 860055.

The implementation of the joint Baltic Sea and North Sea programme builds on the structures and procedures developed in implementing BONUS, the joint Baltic Sea research and development programme, implemented under Article 185 of the TFEU during 2010-2017. The proposed new programme is expected to become operational in late 2017 and continue for six years, with the first call opening in early 2018 and the last one in 2021.

The main programmatic document of the programme – its strategic research and innovation agenda (SRIA) will set and justify the strategic directions and at the same time outline the planned implementation and identify the work programme. Such a coherent, single-document approach allows streamlining the structure of the programme, in particular towards its potential beneficiaries and stakeholders, while making systematic updates based on stakeholder consultations, programme reviews, and project outcomes fast and easy.

The programme's SRIA will be based on the initial research and innovation needs identified in part B of this document and intensive stakeholder consultations during 2016-2017 and thereafter updated in an iterative process (1-2 times during the implementation period). The SRIA will underpin the policy- and industry-driven character of the whole programme. Broad and inclusive consultation with the academic communities and enterprises of the participating states and the relevant transnational research and innovation initiatives and frameworks (e.g. ICES, European Marine Board, relevant ERA-NETs, Joint Technology Initiatives and Joint Programming Initiatives) as well as a profound and wide-reaching engagement of key stakeholders and end-users will secure programme's far-reaching ambition and capacity to boost swift progress beyond the current state-of-the-art.

Transnational collaborative research and innovation projects will be the main instrument for the implementation of the proposed programme. In its calls for proposals, the programme will prioritise to a high degree the demand for research integrating natural, technological and social sciences and addressing multi-sector marine governance issues.

To facilitate innovation, a collaboration between actors along the entire value chain is necessary. Therefore, the proposed programme will implement actions that stimulate this collaboration, e.g. by enabling common tackling of challenges and exploitation of opportunities, thus realizing the maximum innovative potential. Innovation projects led by enterprises are specifically encouraged and supported. A new model of joint actions will be developed, involving different parts of the innovation chain. The aim of the model is to create new knowledge and solve specific challenges towards commercializing of the potential solutions via proof of concept, leading to commercial endeavors and feedback into the experimental phase.

4.2.3 BANOS SRIA

The Baltic and North Strategic Research and Innovation Agenda (BANOS SRIA) drafting team, consisting of 27 marine experts, have coordinated and prepared the thematic parts of the SRIA under the three strategic objectives together with the BANOS CSA coordination team, BONUS EEIG (*this is the dedicated implementing structure of BONUS, the joint Baltic Sea research and development programme, www.bonusportal.org*). The interdisciplinary drafting team members have contributed to the SRIA draft development for Strategic Orientation Workshop (SOW) according to their respective spheres of expertise and competencies ranging from sustainable ecosystem management approaches and land-sea interconnections to the development of new blue innovation and marine social economics. All parts of the SRIA are prepared with the key aim of the



future BANOS programme in mind, which is, once launched, to satisfy knowledge needs for the coming decade and beyond.

The design and running of the Baltic and North Sea Coordination and Support Action (BANOS CSA) organized SOW is based on the model developed and used in the ongoing BONUS Art. 185, the predecessor of the future BANOS programme as planned in the BANOS CSA. As envisaged in the BANOS CSA Description of Action (DoA), the SOW is the central stakeholder consultation event culminating the process of developing the Strategic Research and Innovation Agenda (SRIA) of the future, joint Baltic and North Sea Research and Innovation Programme (BANOS) ([The strategic orientation workshop report BANOS](#), 2020) [7]

The Draft of The Baltic and North Strategic Research and Innovation Agenda has been prepared in the run-up to the Strategic Orientation Workshop (SOW) organized by the Baltic and North Sea Coordination and Support Action (BANOS CSA) on 31 March – 2 April 2020 in Leiden, The Netherlands to serve foremost achieving the aims set for the SOW.

The defined scope of the future Baltic and North Sea Research and Innovation Programme (BANOS), as planned in the BANOS CSA, together with the mapped national and transnational research and innovation priorities form the backbone of the SRIA and encompasses three strategic objectives:

	Strategic Objectives
Healthy Seas and Coasts	A.1: A resilient marine ecosystem
	A.2: Seamless governance linking land, coast and sea
	A.3: Digital Ocean - Competent ecosystem modelling, assessments and forecasting
	A.4: Efficient techniques for environmental monitoring
Sustainable Blue Economy	B.1: Sustainable resource management of marine global commons
	B.2: Understanding the value of ecosystem goods and services
	B.3: Smart Seas - technological solutions for sustainable, circular and bio-base blue economy
Human Wellbeing	C.1: Safe food and feed
	C.2: Safe and accessible coast

Fig. 4.2.3 – BANOS Strategic Objectives

A precondition for achieving these objectives, as well as the nine specific objectives and a core of 31 research and innovation themes grouped under these objectives, is the ecosystem-based management approach.

In addition, three attributes describing the scope of BANOS include:

- 1) the close connection to the ecosystem,
- 2) dependence on climate impact and
- 3) geographic relevance to the Baltic Sea and North Sea regions. ([BANOS SRIA](#), 2020) [8]

Finally, after incorporating the SOW contributions to the BANOS SRIA, it will be published by the end of 2020/early 2021. Also, from thereon, it will maintain the character of a 'living document' entailing regular updates driven by the challenging and dynamic policy landscape and scientific and eco-technological advances of the years to come



4.2.4 SEAS-ERA – Black Sea SRA

The FP7 SEAS ERA project (2010-2014) is a network of European marine research funding organisations (RFOs) located along the European seaboard in the Atlantic, Mediterranean and Black Sea. The SEAS-ERA partnership maintains close contacts with the Baltic Sea RFOs through the EU BONUS project. [9]

The principle aims of the SEAS-ERA network are to improve co-operation between national competitive marine research funding programmes, to facilitate better co-operation in addressing shared opportunities and challenges, to ensure better use of existing resources and capacities, to bridge identified gaps, to avoid duplication, to jointly fund strategic projects of mutual interest and in doing so, contribute to the sustainable development of the marine resource and progress the establishment of the marine component of the European Research Area (ERA).

SEAS-ERA Black Sea Strategic Areas

Basic Research and New Knowledge

Applied Research - Science supporting Society and Economy

Critical Supports/ Infrastructure needs

Fig. 4.2.4 – SEAS-ERA Strategic Areas

4.2.5 JPI OCEANS SRIA

The Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans) is an intergovernmental platform that strives to increase the impact of national investments in marine and maritime research and innovation.

Vision and Objectives

By joining forces, JPI Oceans focuses on long-term collaboration between the EU Member States, Associated Countries, and international partners. The platform provides its member countries with a shared voice, strategic agenda, and action plan to address complex ocean-related societal challenges that cannot be solved at the national level.

Methodology and Implementation

JPI Oceans adds to the value of national research and innovation investments by aligning national priorities and implementing joint actions. This is achieved by:

- planning and launching joint calls for transnational research and innovation projects
- sharing research infrastructures and resources
- enhancing science-policy cooperation with stakeholder involvement to translate science into policy
- initiating new forms of collaboration between projects and scientists
- strategic community building, disseminating and communicating research results to support their exploitation and facilitating mutual learning

In supporting research and innovation JPI Oceans is helping to ensure society has better knowledge of the seas and oceans, and the potential for sustainable blue growth and jobs whilst also addressing the challenges of climate change and human impact on the ocean.

The strategy of JPI Oceans is defined by its Strategic Research and Innovation Agenda (JPI SRIA) which was published in May 2015. The SRIA presents ten Strategic Areas, developed and agreed by JPI Oceans (with the support of CSA Oceans) as strategic priorities for marine and maritime research in Europe. [10]



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JPI Oceans Strategic Areas	
1	Exploring Deep Sea Resources
2	Technology and Sensor Developments
3	Science Support to Coastal and Maritime Planning and Management
4	Linking Oceans, Human Health and Wellbeing
5	Interdisciplinary Research for Good Environmental Status
6	Observing, Modelling and Predicting Oceans State and Processes
7	Climate Change Impact on Physical and Biological Ocean Processes
8	Effects of Ocean Acidification on Marine Ecosystems
9	Food Security and Safety Driving Innovation in a Changing World
10	Use of Marine Biological Resources through Development and Application of Biotechnology
Cross-cutting Issues	
1	Science-Policy Interface
2	Human Capacity Building
3	Infrastructures

Fig. 4.2.5 – JPI Oceans Strategic Areas and Cross-cutting Issues

Each strategic area and cross-cutting issue further break downs to concrete actions which are not included in this report. More details on the specific actions can be found on the JPI SRIA.

The JPI SRIA was developed through the CSA Oceans which helped to collect substantial input. The consultation process involved:

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



4.2.6 Conclusion

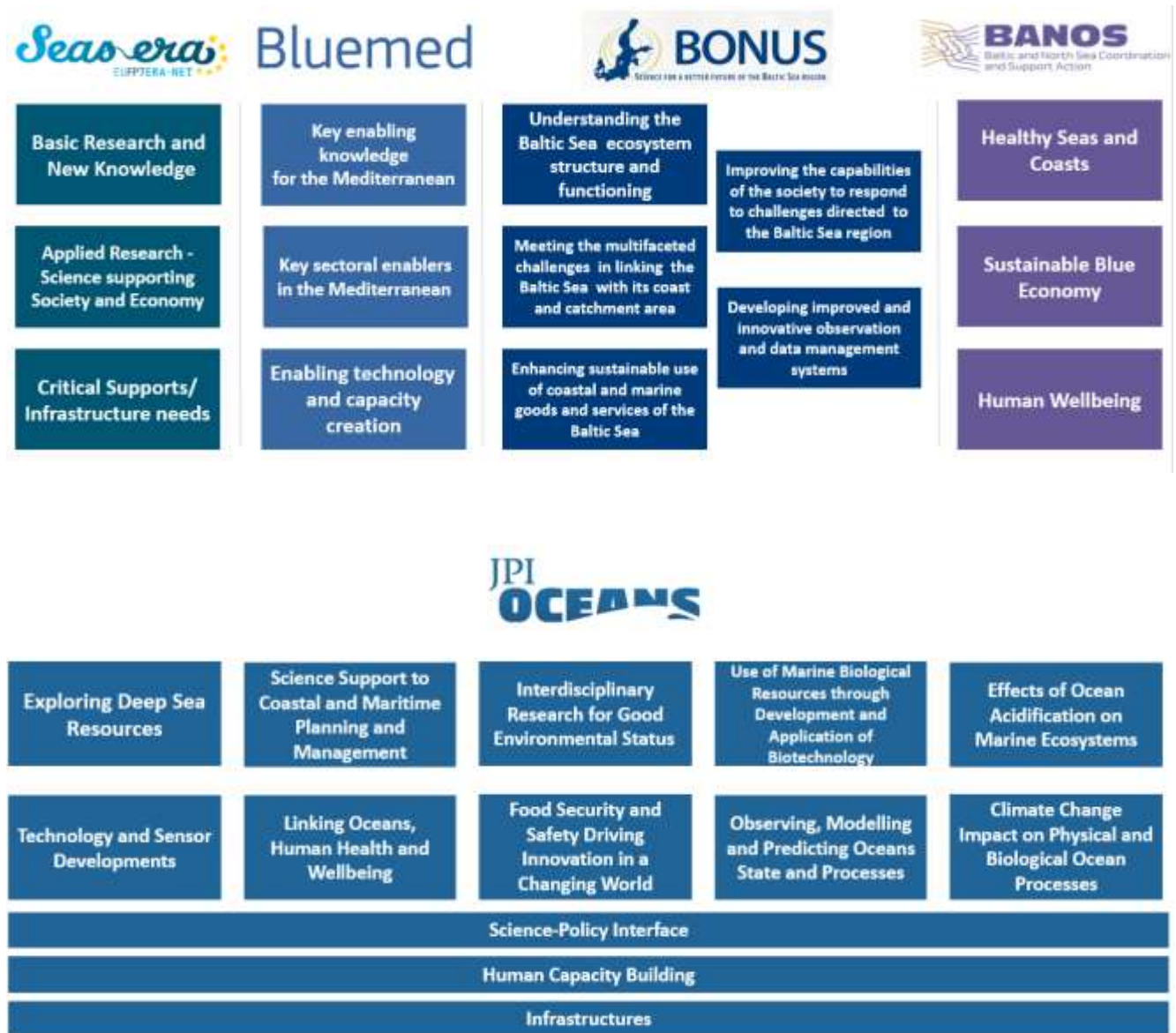


Fig. 4.2.6 - Existing Strategic Agendas

In the previous sub-sections, existing SRIA’s and their processes were briefly mentioned. For the sake of the report, a general overview has been provided on the different SRIA’s to put the Black Sea SRIA in context. Additionally, the abovementioned SRIA’s presented a good opportunity to provide know-how for the development of the Black Sea SRIA and its components during the initial phases of the Black Sea SRIA. A thorough analysis of the existing SRIAs’ strategic objectives, challenges, and actions helped the experts of the Black Sea Blue Growth initiative to lay out the basis of the main priority Research and Innovation (R&I) areas and framework conditions (See section 3 and 5). Based on these categories, In the next section, these areas will be investigated more in detail.

Comparison between Strategic Agendas

When these 5 strategic documents (JPI, Black Sea, BlueMed and Baltic Sea BONUS and BANOS), four major observations can be noted:



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- While the SEAS-ERA projects (applied for Atlantic and Black Sea), BLUEMED and BANOS follow three-pillar strategy outlines (i.e. basic science – applied science – infrastructure), BONUS follows a five-stage strategy outline tailored towards management challenges, and JPI Ocean’s strategy is based on more specifically oriented areas.
- In the SEAS-ERA project and BLUEMED SRIAs applied research – science focusing on both conservation of existing resources & capacities and but also on sustainable development- is in the forefront. Especially the BlueMed SRIA seems to give more emphasis on the H2020/Blue Growth vision. In the BONUS SRA, however, the protection of existing resources & capacities is emphasized. Still, a Blue Growth vision is set for the Baltic area but the management challenges need to be addressed first.
- How the different strategies tackled with the ‘coastal’ zone can be different among the SRIAs. In the Black Sea and BlueMed Integrated Coastal Zone Management (ICZM), Maritime Spatial Planning (MSP) and Marine Protected Areas (MPA) are usually evaluated under one ‘theme’, while in BONUS SRA these subjects are treated as separated research themes. This clearly means more potential calls for coastal management in the Baltic Sea that lies at the heart of the BONUS approach.
- Blue Growth sectors such as harvesting the oceans non-living resources: Sustainable mineral, oil and gas extraction from coastal and offshore areas takes place in both the SEAS-ERA project and BLUEMED, however, BONUS does not focus on multi-purpose offshore platforms and its products.



5. Main R&I Areas

Within the scope of development of Black Sea SRIA, past projects were analysed to identify needs and gaps during eight workshops held in 2016 – 2018. A set of pre-defined main R&I Areas were identified based on the existing SRIAs by the expert working group of the Blue Growth Initiative for Research and Innovation and they were asked to map national/international projects under the identified R&I areas. As mentioned earlier, these areas were identified after an analysis of the existing SRIA's. At the time of this report, these areas are still found to be relevant and therefore the Black Sea marine projects and framework conditions were collected under these areas. These areas are the following.

R&I Area 1: Biodiversity

R&I Area 2: Biological Invasions

R&I Area 3: Catchment-Sea Interaction

R&I Area 4: Climate Change & Impacts

R&I Area 5: Cultural Heritage

R&I Area 6: Deep-Sea Ecosystems

R&I Area 7. Ecosystem Multiple Stressors

R&I Area 8: Eutrophication and Deoxygenation

R&I Area 9: Interconnections of Basins

R&I Area 10: Marine Ecosystem Services

R&I Area 11: Marine Pollution and Litter

R&I Area 12. Marine and Coastal Hazards

R&I Area 13: Seas and Human Health

R&I Area 14: Blue Biotechnology

R&I Area 15: Deep Sea Mining, Oil and Gas Sustainable Exploitation

R&I Area 16: Living Marine Resources

R&I Area 17: Tourism and Surrounding Economy

R&I Area 18: Marine Renewable Energy

R&I Area 19: Maritime Transport

R&I Area 20: MSP, ICZM

R&I Area 21: Operational Oceanography/Observing Systems and Monitoring

R&I Area 22: Socioeconomic & Policy Research

R&I Area 23: Training & Technology Transfer

R&I Area 24: Other/Multiple Areas

Under the Black Sea CONNECT CSA Black Sea project database has been updated to identify the gaps, priorities, and research and innovation needs and define the current state of the art and framework conditions in the Black Sea with the same methodology. The expert group consisting of the CSA was asked to map national/international projects according to these pre-defined areas and if projects cover different R&I areas or more than one main area.

Updated Black Sea Projects given in following chapter and analysis of gaps and research & innovation opportunities providing the necessary justification/drivers for top-ranking R&I area will be discussed in chapter 7.



6. Matrix of marine research projects

The matrix of marine research projects fulfilled was analyzed for the period covering 2015-2020. Outcomes were collated into summary graphs to identify needs and gaps. As a result, the different focus of national-funded and EU-funded projects was revealed, as shown below.

6.1 Black Sea Countries

Bulgaria

The total number of projects in Bulgaria – 60 projects.

The top five-ranked research and innovation areas that have been funded in Bulgaria within the last 5 years (2015-2020) are:

- 1) Living Marine Resources (fishery, aquaculture, etc.)
- 2) Operational Oceanography/Observing Systems and Monitoring
- 3) Biodiversity
- 4) Training & Technology Transfer
- 5) MSP, ICZM; Marine and Coastal Hazards



Figure 6.1.a –Number of marine research and innovation projects targeting the Black Sea in Bulgaria

Other than these five top-ranking areas, national support to emerging fields such as Cultural Heritage and Renewable Energy must also be noted. A lack of support to ecosystem services, stressors and an emerging sector of biotech is also noteworthy and points to future implementation opportunities.



Georgia

The total number of projects of Georgia – 12 projects

The top-ranked five research and innovation areas that have been supported in Georgia within the last 5 years (2015-2020) are:

- 1) Tourism and Surrounding Economy
- 2) Socioeconomic & Policy Research
- 3) Cultural Heritage
- 4) Maritime Transport
- 5) Socioeconomic & Policy Research

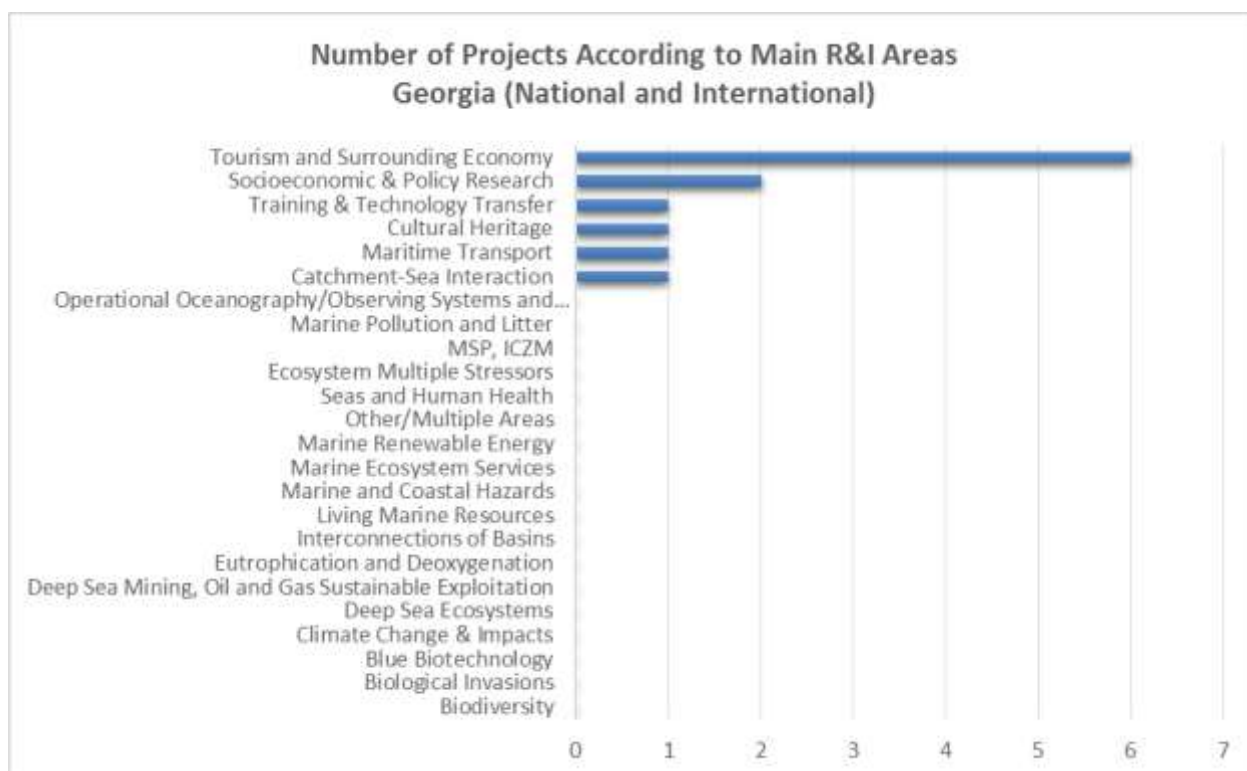


Figure 6.1.b –Number of marine research and innovation projects targeting the Black Sea in Georgia

In the Georgian national funding landscape high support to Tourism-related projects comes under attention and reflects a country strategy. More scientific areas such as ecosystem services, deep sea or biodiversity are under-funded. Similar to Bulgaria, a baseline support to the area of cultural heritage is noteworthy. Obviously, the overall small number of projects does not include Georgian participation in multinational projects funded and directed by the EU and coded as European for the aims of this report.



Moldova

The Total number of projects of Republic of Moldova – 4 projects

The top-ranked five research and innovation areas that have been supported in Moldova within the last 5 years (2015-2020) are:

- 1) Marine Pollution and Litter
- 2) Marine and Coastal Hazards
- 3) Other/Multiple Areas

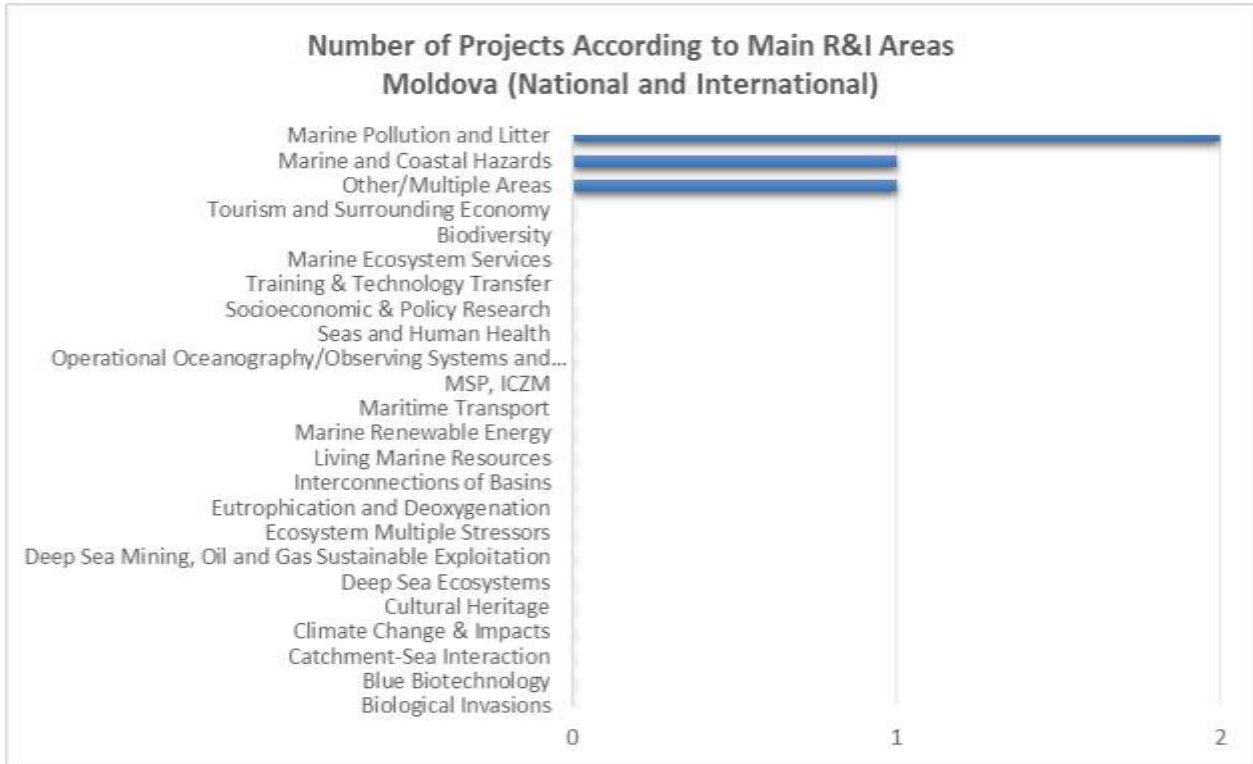


Figure 6.1.c - Number of marine research and innovation projects targeting the Black Sea in the Republic of Moldova

Connected to the Black Sea mainly through rivers, there is an emphasis on pollution/litter and coastal hazards related projects in Moldova emphasizing the land-sea connection in this country. Obviously, the overall small number of projects does not include Moldovan participation in multinational projects funded and directed by the EU and coded as European for the aims of this report.



Romania

The total number of projects of Romania – 85 projects

The top-ranked five research and innovation areas that have been supported in Romania within the last 5 years (2015-2020) are:

- 1) Deep-sea mining, Oil and Gas Sustainable Exploitation
- 2) Biodiversity
- 3) Other/Multiple Areas
- 4) MSP, ICZM
- 5) Operational Oceanography/Observing Systems and Monitoring



Figure 6.1.d - Number of marine research and innovation projects targeting the Black Sea in Romania

Romania overall reported a high number of projects for the given period and the diversity of areas. There is a clear focus of national projects on deep-sea mining, oil and gas sustainable exploitation. Also, similar to Bulgaria, focus on classical areas such as biodiversity and operational oceanography is evident in the top five. Another well addressed area similar to Bulgaria is the MSP, ICZM. The role of emerging areas such as ecosystem multiple stressors, marine ecosystem services, coastal hazards, blue biotech, is seen. Deep sea research and biological invasions found to be underfunded.



Turkey

The total number of projects of Turkey – 113 projects

Top-ranked five research and innovation areas that have been supported in Turkey within the last 5 years (2015-2020) are;

- 1) Living Marine Resources (fishery, aquaculture, etc.)
- 2) Biodiversity
- 3) Marine Pollution and Litter
- 4) Operational Oceanography/Observing Systems and Monitoring
- 5) Blue Biotechnology

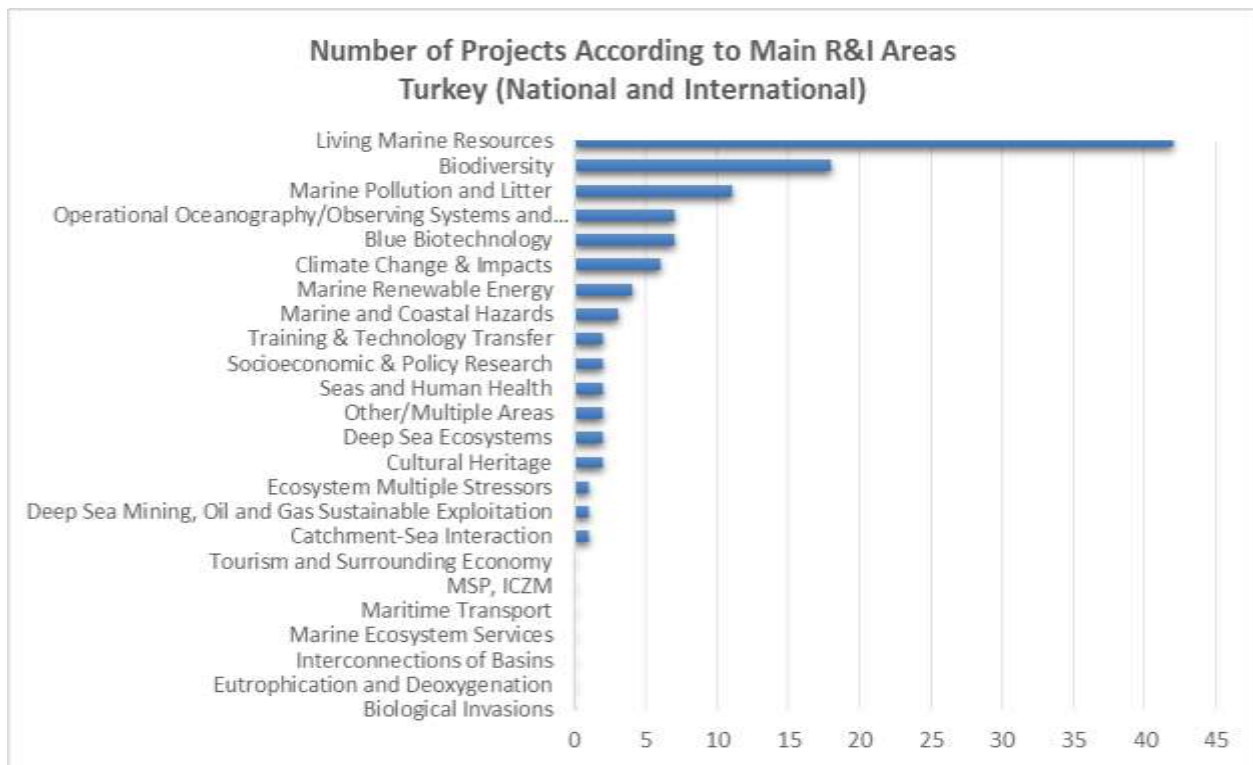


Figure 6.1.e - Number of marine research and innovation projects targeting the Black Sea in Turkey

Turkey reported the largest number of projects in the region and the subject diversity of the projects was also large. Living Marine Resources is an obviously leading area with the highest priority. Notable support to emerging fields such as blue biotech, climate change and marine renewable energy suggests that novel ideas on these have been attracting funding. Funding to some social areas, such as tourism or MSP, was missing pointing out to their underfunded state.



Ukraine

The total number of projects of Ukraine – 50 projects

Top-ranked five research and innovation areas that have been supported in Ukraine within the last 5 years (2015-2020) are;

- 1) Biodiversity
- 2) Marine Pollution and Litter
- 3) Operational Oceanography/Observing Systems and Monitoring
- 4) Other/Multiple Areas
- 5) Catchment-Sea Interaction

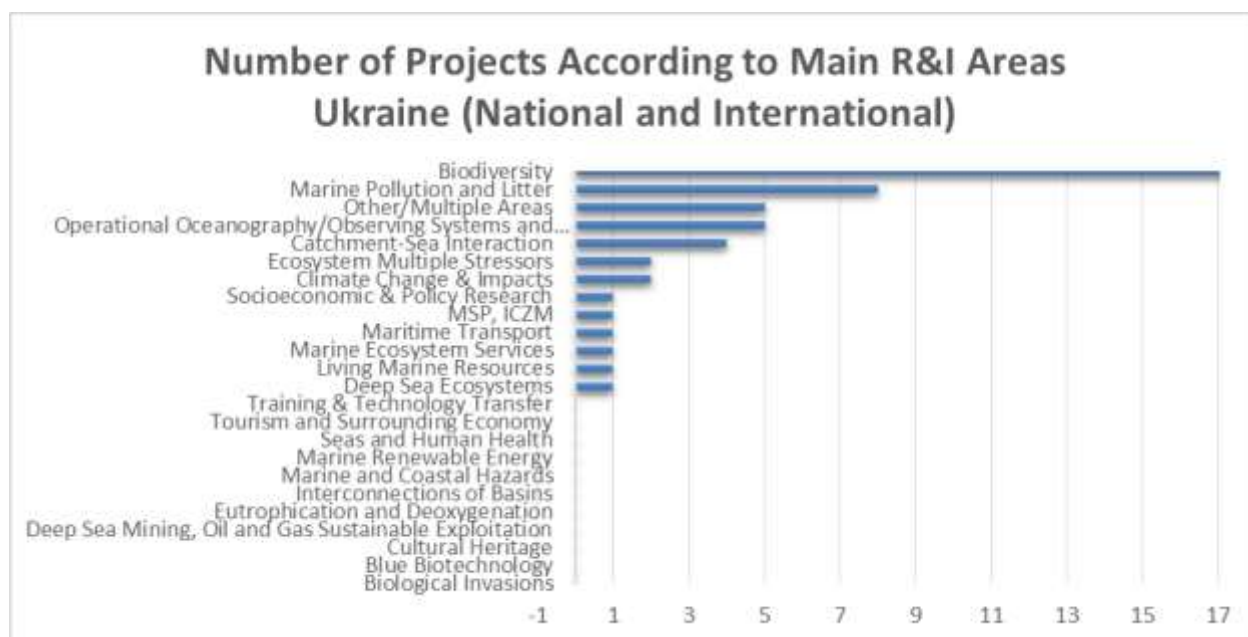


Figure 6.1.f - Number of marine research and innovation projects targeting the Black Sea in Ukraine

In Ukraine, biodiversity research is by far the most supported subject followed by marine pollution research and operational oceanography. Catchment-sea interaction is another natural area of interest, given several major river basins in the country. Emerging topics such as marine renewable energy, blue biotech, and coastal hazards are underfunded. Equally poorly supported is the research of living marine resources, unlike in other countries.



Overall Black Sea countries national and international projects – 324

Top-ranked five research and innovation areas that have been conducted in Black Sea countries (except the multinational EU projects) within the last 5 years are:

- 1) Living Marine Resources (fishery, aquaculture, etc.)
- 2) Biodiversity
- 3) Marine Pollution and Litter
- 4) Operational Oceanography/Observing Systems and Monitoring
- 5) Other/Multiple Areas

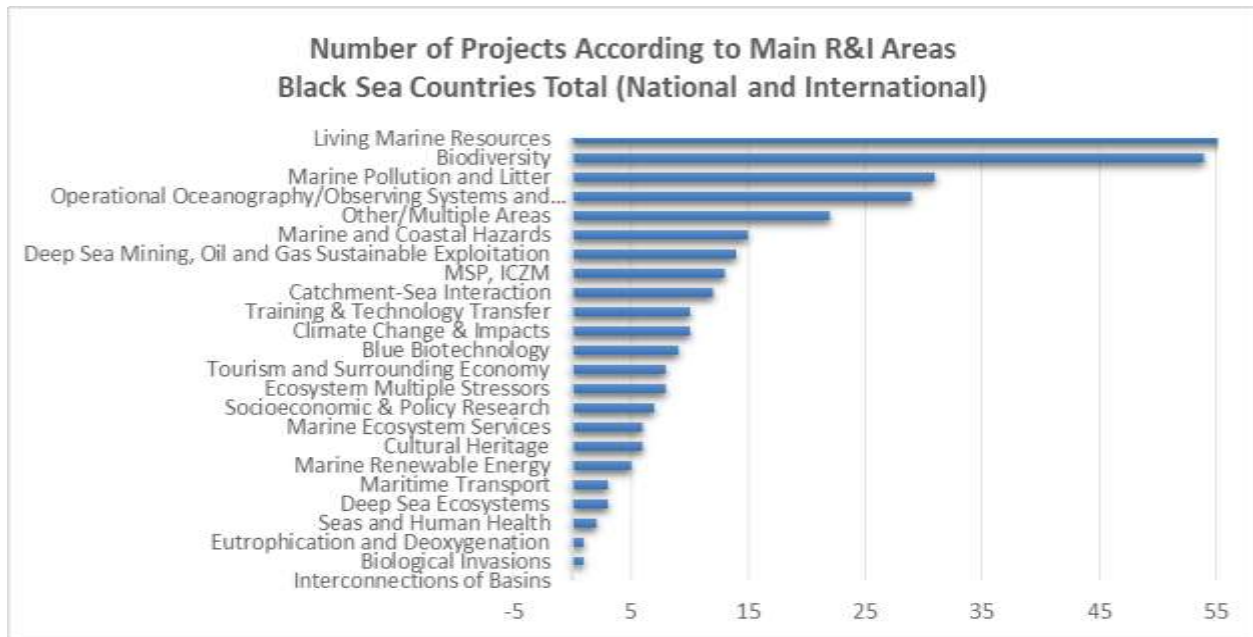


Figure 6.1.g - Number of overall national and international marine research and innovation projects conducted in Black Sea countries (except the multinational EU projects)

Interestingly, distribution of secondary (or additional) R&I areas identified per each multidisciplinary project (when applicable) was highly similar to the distribution of main areas. Further details are provided under the gaps and R&I opportunities analysis (Section 7).



6.2 European Union Projects

In addition to the 324 regional (mostly national) projects, the number of multinational EU-funded projects is 102. The R&I areas of the EU Projects were reviewed according to the Project's descriptions (also included in the table) from the CORDIS (<https://cordis.europa.eu/>) and Black Sea Cross Border Cooperation (<https://blacksea-cbc.net/>).

The top five research and innovation areas that have been funded by European Commission under FP7, H2020, and Black Sea Cross Border Cooperation programmes within the last 5 years (2015-2020) are:

- 1) Operational Oceanography/Observing Systems and Monitoring
- 2) Training & Technology Transfer
- 3) Marine Pollution and Litter
- 4) Tourism and Surrounding Economy
- 5) Socioeconomic & Policy Research; Biodiversity

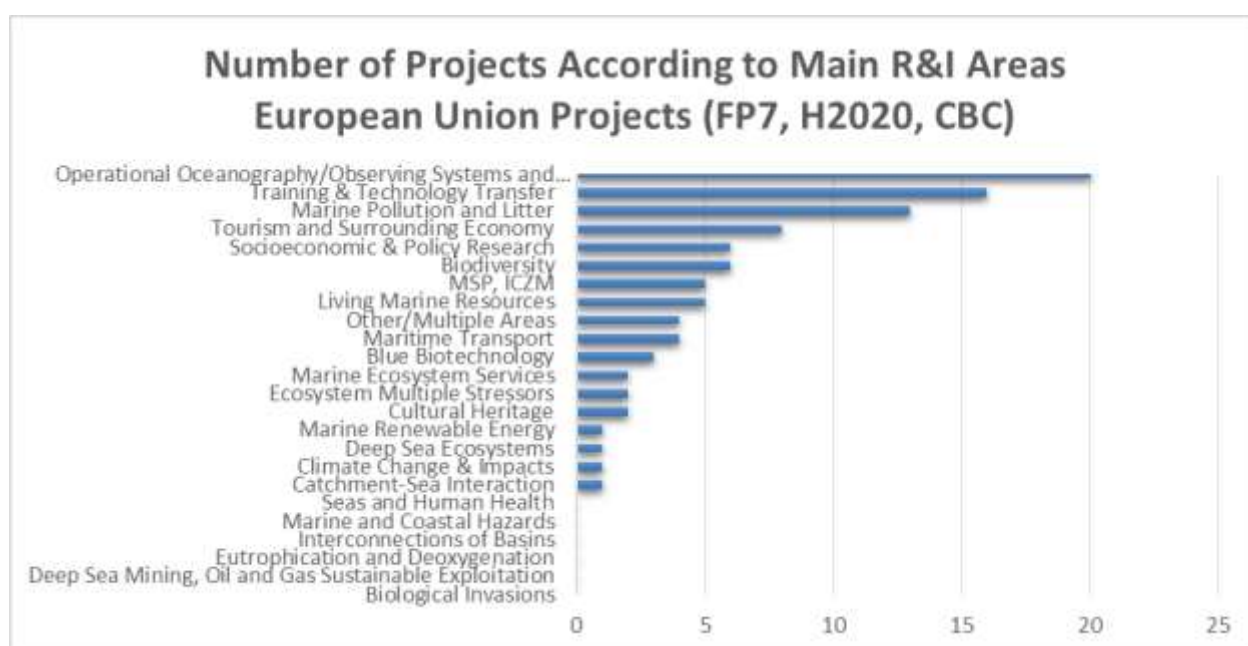


Figure 6.2 - Number of EU-funded marine research and innovation projects targeting the Black Sea

6.3 Overview of the Black Sea projects according to main R&I areas

Overall, while the national projects mostly focused on Living Marine Resources, Marine Pollution and Litter, Biodiversity and Operational Oceanography/Observing Systems and Monitoring projects; the EU-funded projects have targeted a slightly different set of priorities such as Operational Oceanography/Observing Systems and Monitoring, Training & Technology Transfer, Tourism and Surrounding Economy, Socioeconomic & Policy Research and Biodiversity. Also, climate change and interconnection of basins were addressed as secondary areas in several EU projects. The EU-funded, international projects, by their very consortium-based nature, have been able to pool different expertise and therefore were able to tackle issues such as socioeconomics and policy and capacity building/technology transfer. However, in all funding streams, there was a gap in terms of support to emerging R&I areas. More funding is needed both at the national and EU level for projects and programmes tackling areas such as Biological Invasions, Deep Sea Ecosystems, Marine Ecosystem Services, Human Seas and Health among many others.



In the next section, gaps and R&I opportunities are scrutinized under the 24 pre-defined main R&I areas which will explain why some areas are underfunded.

7. Analysis of Gaps and R&I Opportunities

During the analysis following criteria for gaps identification in the R&I areas were used:

- Lack of notions and definitions in the identified area, which are in use in the region
- Lack of projects in the identified area
- Lack of progress (growth in project number and funding) in the identified area

The criteria for R&I Needs/Opportunities were:

- Contribution to goals and objectives identified by the Burgas Declaration, Black Sea Agenda, SRIA declarations, MSFD, WFD
- Relevance to national and regional agenda and development priorities
- Addressing global challenges and cutting-edge innovations

7.1 R&I Area 1: Biodiversity

Lack of follow up in monitoring effort, most of the monitoring programs are limited to short-term projects

Experts stated that projects concerning the Biodiversity area are generally limited to time frames of 1-4 years, with several exceptions of 5-7-year activities or they are low funded.

- **R&I Needs/Opportunities:** planning follow-up sustainable mid-term (7 and 7+ years) monitoring programs, capacity building at the national level in each country of the region.
- **Justification:** MSFD cycles provide a 7-year time framework, and monitoring programs should cover at least a full MSFD cycle.

The modest level of basin-wide cooperation in monitoring programs, differences in national approaches and methodologies

- **R&I Needs/Opportunities:** enhancing basin-wide cooperation, common monitoring effort, harmonizing national methodologies.
- **Justification:** Provisions by MSFD, Descriptor 1: setting up compatible targets, indicators, thresholds measurements.

Lack of integration with other R&I Areas: Bioinvasions, Deep Sea Ecosystems, Catchment-Sea Interaction, Climate Change, Seas and Human Health.

Emerging challenges are insufficiently addressed in monitoring programs, boundary ecosystems are often left aside the monitoring effort, and deep-sea biodiversity is rarely covered by monitoring effort.

Meanwhile, climate change and warming water lead to a decline of cold-water species within both native and non-native species diversity.

No current knowledge on changes of biodiversity under climate warming.

There is no target species List, including a review of the target species criteria for the Black Sea.

No comprehensive study of joint Black Sea countries on comparison of change biodiversity in coastal areas in different areas: such as Turkish area under the strong effect of Mediterranean flora and fauna; north western area (Bulgaria, Romania) under the effect of fresh water input and brackish water species input, comparison with other coastal areas.

No dedicated passive acoustic underwater monitoring is conducted in the region.



- **R&I Needs/Opportunities:** Enhancing the use of operational techniques (remote sensors, biological sensors) to study biodiversity at an adequate scale of natural variability and to figure out changes in native species diversity and in their spatial and temporal distribution.
Listing non-native, cryptogenic, and harmful native species in the Black Sea, as well as species that may pose a hazard is necessary.
Passive acoustic underwater monitoring is of special importance for detecting marine mammals.
- **Justification:** Equally complete coverage of all the biodiversity is a necessary prerequisite for its assessment. There is a need to identify how and in which areas and seasons the GES is to be assessed. Updating indicators for GES (provisions by WFD, MSFD) in changeable climatic conditions is important during each implementation cycle. The use of remote sensing showed its effectiveness.

Insufficient use of modern methods for estimating of biodiversity. As a result, the diversity of some groups is underestimated, especially in the microscopic groups (microalgae, fungi, protists, archaean and bacteria, viruses), and functional diversity is poorly addressed (Biodiversity – ecosystem functioning, BEF concept). Only three projects, of which only one is ongoing, declared metagenomics or eDNA research within their scope.

- **R&I Needs/Opportunities:** Application of advanced methodologies and techniques to study biodiversity (e.g. barcoding, Next Generation Sequencing (NGS) and –omic technologies).
Development Barcodes Data Base for Black Sea ecosystem.
Assessment of biodiversity by eDNA and metagenomics.
Understanding ecosystem functioning is a prerequisite for sustainable management.
- **Justification:** Rapidly expanding study of eDNA and metagenomics (+ metatranscriptomics) has generated unprecedented ability to detect species and conduct genetic analyses for conservation, management, and research, particularly in the deep-sea. Database of species barcodes for the Black Sea allows using eDNA in environmental monitoring.

Long-term changes in diatom and non-diatom production, abundance, and spatiotemporal distributions need special monitoring.

Long-term changes in loads of nutrients, feeding the Black Sea with the N/P/Si ratios highly modified Si/N and N/P ratios in the late 1980s and thus food web in the Black Sea. Damming of major rivers reduced Si loads especially in the eastern basin, reducing diatom/non-diatom ratios and their abundances. These changes affected food webs and major commercial fish stock. Enhanced eutrophication reduced the thickness of oxygenated zone and thus enlarged SOZ in the deep basin, leading to less space for zoo-plankton, pelagic and demersal fishes.

- **R&I Needs/Opportunities:** Long-term climatic changes and enhanced DON+DIN, TP inputs demand basin wide planning to increase Si/N ratio in the BS surface waters, keep over 7-10 especially during the spring bloom period on the rim currents should be addressed.

Marine protected areas (MPA) in the region shall be greatly expanded and, in some areas, established from scratch. In addition to the marine protected areas, there is a need for establishing new PAs in estuarine areas and coastal wetlands.

Most of the PAs in the region are onshore based that is far below the requirements by international agreements (i.e., CBD).

- **R&I Needs/Opportunities:** Common basin-wide methodology for creating MPAs including a common set of criteria shall be developed and applied for the BS marine and coastal areas. All the legal instruments



should be applied for creating legally protected areas, including international and transboundary reserves: the Habitats Directive, the Bern Convention (Emerald Network), the Convention on Biodiversity (EBSA Areas).

- **Justification:** Marine and coastal areas are the best preserved and most vulnerable ecosystems across the region, at present affected by climate change, developing economies, and construction. Many of them require urgent action, as provisioned by a few commonly recognized international agreements.

Lack of long-term archival and use of data.

- **R&I Needs/Opportunities:** Particular effort and funding should be focused on digitizing data and collections, creating repositories of digital data and materials, sharing backup of unique materials (e.g., paratypes), and use of long-term data for monitoring.
- **Justification:** A few institutions lost their collections, primary paper databases, and documentation during recent years due to reorganization or fire. Meanwhile, only a few institutions of the region contribute to the GBIF and other worldwide recognized digital repositories.

7.2 R&I Area 2: Biological Invasions

Lack of dedicated monitoring of biological invasions, their pathways and effect on ecosystems, and absence of management plans by species.

Invasive alien species are the major agents in the Black Sea ecosystem shaping its dynamics. In recent years, alien ctenophores *Mnemiopsis leidyi* and *Beroe ovata* are the main drivers of pelagic ecosystem, but their interactions are not studied in depth. The rapana whelk *Rapana venosa* severely affects benthic communities. With climate changes, warm water species invade the Black Sea. Among them there are two harmful fish species, “Lessepsian” migrants *Sphyræna pinguis* and poisonous *Lapocephalus sceleratus*.

- **R&I Needs/Opportunities:** Development of joint actions of the Black Sea countries to control/prevent new invasions at a basin-wide scale. Concerted basin-wide actions to control/prevent new invasions. Bioinvasion pathways, alterations of ecosystem functions should be studied and commonly addressed. Management plans for invasive species, especially in fisheries, including ad hoc and emergency plans, are needed with emphasis on control. Development of economic incentives for control of the rapana whelk is appreciated.
- **Justification:** The development of robust species-specific indicators for GES assessment is required under the MSFD provisions.

Outdated methods of monitoring of invasive species, lack of environmental and climate change perspective in bioinvasions studies.

No summarized current comprehensive knowledge on the total structure of invasive including cryptogenic species and their vectors and pathways of invasion. Not enough studies on the effect of invasive species on the benthic and pelagic communities. No current list of the most harmful species in the Black Sea. Not enough DNA barcoding study of wide dispersed invasive species. Warnings concerning ballast water uptake in certain areas and measures under regulation.

- **R&I Needs/Opportunities:** Information on all the present invasive species and the new records should be summarized and basin-wide shared. Application of advanced methodologies and techniques based on the DNA-barcoding of native and alien species to study invaders and their pathways including barcoding should be implemented. Improving the new modern methods, combination of molecular techniques, and traditional monitoring of invasive



species for species identification and origin. Studies on life cycle, multiple impacts, and development of options for combating negative effects and alternatively make use of positive effects if any.

Special observations on the occurrence of two Indo-Pacific fish species – “Lessepsian” migrants *Sphyraena pinguis* and poisonous *Lapocephalus sceleratus* should be performed, particularly in the southern (Turkish) and western Black Sea.

- **Justification:** Development of robust species-specific indicators for GES assessment is required under the MSFD provisions.

Lack of effective ballast water management plans at the regional level.

Most of the non-native species historically arrived with ballast waters.

- **R&I Needs/Opportunities:** Investigation on ballast water management at the regional level shall be supported.

An effective ballast water management plan shall be defined at the regional level and adopted by countries. Measures of controlling all the new invasions should be developed.

- **Justification:** Management of invasive alien species is essential for maintaining biosafety at the regional level.

7.3 R&I Area 3: Catchment-Sea Interaction

Lack of up-to-date regional-scale assessment of catchment area inputs to the Black Sea.

- **R&I Needs/Opportunities:** Development of catchment area-sea coupled hydrological and biogeochemical models. Extension of knowledge and experience gained in Danube-Black Sea research onto the regional level.
- **Justification:** Catchment-sea interaction research is the necessary prerequisite for coastal and estuarine management.

Need to develop and integrate tools to observe progress with governance action with the progress achieved in the state of the environments in the sea, coasts, and catchments with the Black Sea Basin.

There is a need to observe progress with the implementation of instruments such as MSP, ICZM, and IRBM and correlate governance progress with indicators characterizing the state of the sea, coasts, and catchments.

- **R&I Needs/Opportunities:** Development and harmonization of implementation progress and state of the environment indicators across catchments, coastal zones, and marine-maritime domains.
- **Justification:** Certain advancements achieved in defining ICZM progress and state of the coast indicators in the Black Sea region based on EU experience (see needs and progress documented in approved [Guideline on ICZM in the Black Sea](#)), but no similar instruments for tracking MSP and IRBM progress available yet.

Need for innovative instruments to integrate various sea, coast, and catchment observing systems within a common user-friendly intuitive operational environment.

There are various separate systems created for separate geographical domains such as sea (e.g. JRC marine data observation systems including the Black Sea), coasts, and catchments (e.g. FP7 enviroGRIDS Black Sea Catchment Observation System). Certainly, there is a need to integrate marine, coastal, and catchment observation systems.

- **R&I Needs/Opportunities:** Implement innovative Data Cube technology for integration of Earth Observation across sea, coast and catchment domains of the Black Sea, providing easy to apply toolsets.



- **Justification:** Implementations experience available by UNEP/GRID-Geneva to demonstrate Data Cube tools in Black Sea areas, such as in Georgia (also covering part of neighboring Turkey) and in Moldova, showing great potential for both landward and Seward tools.

Water, chemicals, and sediments linkages and mutual close and distant interactions between the rivers' catchments and the sea are not sufficiently known.

Need for assessing the feedback between the marine and continental environments.

- **R&I Needs/Opportunities:** Development of catchment area - sea hydrological and biogeochemical models.
- **Justification:** Need for scenarios for management in under conditions of environmental change.

Large uncertainties in load estimations.

- **R&I Needs/Opportunities:** Integration of marine-coastal and river basin observatories. Catchment-sea coupled biogeochemical and ecosystem model. Scenarios for management ICZM / MSP considering land-sea interaction. Indicators for catchment-sea interaction.

7.4 R&I Area 4: Climate Change & Impacts

Scenarios for climate change in order to assess the impacts are scarce, whereas direct climate-related drivers are multiple and complex. Long-term measurements and observations are missing. Assessment of impacts of climate change in biodiversity, especially in coastal ecosystems. Carbon sequestration measurements in the deep waters are missing.

Despite the growing bulk of evidence from the region, rapid climate change has no many multiple and complex short-term consequences that many of which are hard to be assessed.

- **R&I Needs/Opportunities:** The risks and the adaptation of policies to sea-level rise. Potential changes (because of climate changes) in thermohaline circulation and acidification. Study of the vulnerability of the coastal zone and adaptations to climate change.
Study the vulnerability of the coastal zone and adaptations to climate change.
Exploring the recent technological developments (real-time data from Argo floats, satellite measurements, etc.).
- **Justification:** Combination of the (operational) prediction of the sea level and the erosion and flooding of coastal areas, the economic-social-environmental impacts, and their treatment, while optimizing its real-time measurements of meteorological-oceanographic parameters by combined use spot measuring devices and satellite (coastal satellite oceanography).
Risk assessment and early warning scenarios including assessment of socio-economic impacts for adaptive management.
Climate-induced alterations in the thermohaline circulation, acidification, sea-level rise, erosion, and flooding.

Lack of assessment of consequences/impacts of climate change: intensity and severity of storms, coastal (especially beach) erosion, vulnerability of protected areas, and human settlements.

- **R&I Needs/Opportunities:** Assessment of climate change-related extreme weather events, for example, storms, blooms, etc.

Lack of knowledge on risk index, exposure, sensitivity, and adaptive capacity of the Black Sea environment by Climate Change & Impacts. Downscaled spatial maps of climate changes (temperature, rainfall, evaporation, wind, sea level) for the Black Sea region.



Special attention needs the influence of climate change on the dynamics of the hydrogen sulfide layer, impact of climate change on the development of seasonal hypoxia on the shelf, and the impact of climate change on potential bio invasions and narrowing niches of native species.

Exposure relates to the influences or stimuli that impact on a system. This is a measure of the predicted changes in the climate by the year 2050. Sensitivity reflects the responsiveness of a system to climatic influences and the degree to which changes in climate might affect that system in its current form. Sensitive systems are highly responsive to climate and can be significantly affected by small climate changes. Adaptive capacity - The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. It is shown that the upper boundary of the hydrogen sulfide layer has risen in recent decades; It is important to understand how dangerous this phenomenon is due to climate change. Climate change creates potential ecological niches for invasions of other species, and at the same time it narrows niches of endemic species of "Ponto-Caspian" origin, it is necessary to learn to predict these processes.

- **R&I Needs/Opportunities:** Assessment of exposure, sensitivity, and adaptive capacity by using the mathematical models of the Black Sea ecosystems.
Development of new methodologies and methods – risk index; risk analysis; adaptation capacity; tools for multi-disciplinary research.
Development of predictive models of climate influence on the ecosystem of the Black Sea.
Research for combining various types of information as well as for assessment of economic damage.

7.5 R&I Area 5: Cultural Heritage

Incipient and yet weak cultural cooperation and protection of the cultural heritage in the Black Sea Region.

Absence of region-wide projects and lack of national sea-related projects in most of countries.

- **R&I Needs/Opportunities:** New mechanisms of cooperation should be applied to capitalize the cultural heritage around the Black Sea.
- **Justification:** A common management policy should be developed and applied via a coordination network.

Mapping of cultural heritage is non-uniform and incomplete.

Integrated mapping of cultural heritage would be useful for understanding the presence of cultural resources in the Black Sea region.

- **R&I Needs/Opportunities:** International project for integrated mapping of cultural heritage in the Black Sea region focusing on (but not limited to) traditional knowledge, nature, and sea-related practices and lifestyle, uniqueness of minorities, and local practices.
Technology, robotics, and observatories to track and explore underwater heritage.
Dedicated transboundary and national effort on conservation of traditional knowledge, local genetic diversity of cultural plants and domestic animal farming and breeding, traditions of sustainable fisheries.
Strengthening historical and biosphere reserves (including transboundary sites), conservation of cultural heritage in rural regions, rewilding initiatives.
- **Justification:** Integrated mapping and conservation of cultural heritage sites and practices will be beneficial for blue economy and the development of sustainable tourism and MSP in the region. Reserving cultural and biosphere sites is important for sustainable blue growth.



7.6 R&I Area 6: Deep-Sea Ecosystems

The functioning of Deep Marine Ecosystems in the Black Sea is not really known. Specific habitats that support specific biodiversity and ecosystem functions such as mud volcanos, gas seepages are very poorly studied. Seafloor morphology is largely uncharted.

There are some studies mainly in Geological surveys in some countries, namely Bulgaria, and through the EU projects some biological and biodiversity studies have been carried out. The processes in the deep waters are under-studied. With the deployment of Argo profilers some recent information on physical and some chemical parameters (on-line data) are available, but still missing biochemical measurements. Carbon sequestration in deep waters is also missing. There are only very few studies that allow discovering the morphology of the seafloor.

- **R&I Needs/Opportunities:** Biogeochemical cycle in the deep waters is unknown and should be studied. Microbial food web, carbon sequestration, and particle deposition in the deep. Research on marine mammal falls is promising. Research of specific habitats that support specific biodiversity and ecosystem functions such as mud volcanos, gas seepages. Integrated geological studies of coastal and marine regions are appreciated. Progress in coastal and marine geology worth to be assessed in the frames of this area.
- **Justification:** Functioning of Deep Marine Ecosystems in the Black Sea as a unique environment and potential resource (oxic-anoxic interphase, H₂S environment).

Not enough knowledge on habitats that were assessed as threatened in categories Critically Endangered, Endangered and Vulnerable

- **R&I Needs/Opportunities:** Need to assess threatened habitats in categories Critically Endangered, Endangered, and Vulnerable.
- **Justification:** to develop measures for supporting the conservation of marine habitats.

Gaps in studies of the H₂S-zone of deep-sea: spatial-temporal distribution of H₂S in the water column and factors influenced on it; the balance of H₂S in the deep part of the Black Sea; the role of anaerobic zones in the biogeochemical cycle of organic and inorganic substances.

The Black Sea is the largest meromictic basin on the planet. Its uniquely characteristic feature is the presence of a relatively thin surface layer of aerobic water and a powerful hydrogen sulfide zone (H₂S-zone), which is located at depths of more 90-160 m and covers about 87% of the volume of the sea. A. A. Bezborodov and V. N. Eremeev (Bezborodov et al., 1993) [11] conducted an analysis of the entire historical dataset on the distribution of hydrogen sulfide in Black sea waters, which confirmed the absence of a unidirectional trend of the depth of the upper boundary of the anaerobic waters. It has been shown that the spatial and temporal variability of the position of this boundary is primarily determined by synoptic and seasonal variations of the hydrological structure of waters of the sea. The question of the rhythmicity of the oscillations and constant unidirectional change trend depth remains controversial. Over the last 20 years, the hydrogen sulfide layer has experienced 20-25 meters rise that can be explained by complex factors, such as the excessive influx of allochthonous organic matter or changes in hydrologic structure as a result of climatic changes.

- **R&I Needs/Opportunities:** International complex seasonal expeditions to investigate the central part of the Black Sea. Development of a special international system for deep-water hydrogen sulfide monitoring, including automatic methods (ARGO-buoys), and forecasting models of deep-water hydrogen sulfide dynamics.



- **Justification:** Aerobic and anaerobic ecosystems stably coexisted in the Black sea around 7,500 years. However, there is unidirectional and noncyclic influence on the ecosystem of the Black sea, such factors as water withdrawal and seasonal redistribution of river runoff; pollution of coastal waters; climate change. International complex seasonal expeditions in the central part of the Black Sea to the assessment of topography of the border of the H2S zone would show influence all these factors.

Gas hydrates information only recently emerging. Gaps in gaining insight into origin and behaviour of methane in marine environment under global climate warming and the role of methane ecological change.

- **R&I Needs/Opportunities:** Investigating the potential of the Black Sea methane degassing as geohazards to offshore eco- and geosystems.

7.7 R&I Area 7: Ecosystem Multiple Stressors

Gaps in mathematical models for assessment and forecast of the effect of the complex of multiple stressors on marine ecosystem related to the uncertainty of model results. The result of 'synergistic impact of eutrophication, fisheries, biological invasion and climate change on the ecosystem' on blue economy is not studied.

Ecological models are currently one of the strongest approaches used to predicting and understanding the consequences of anthropogenic and climate-driven changes in the marine environment. Inclusion of biodiversity components indicated in the MSFD in ecological models is highly heterogeneous. The traditional focus of marine ecosystem modelling, driven mainly by the wide-spread use of low trophic level models related to the bottom-up forcing of production, and in parallel, motivated by fisheries-oriented policies and conservation interests in particular species. All available EU models have been used to address at least one pressure or its impact on the state of the ecosystem or its components (C. Piroddi et al, 2015) [12]. Most of the model-derived indicators compiled in the catalog are state indicators, meaning that they inform on the condition of the ecosystem, its components, or its functioning while reflecting the impacts of multiple pressures in the environment.

The majority do not provide a direct measure of the pressures affecting the system, so they can only indirectly be associated to the pressures mentioned above. And despite strong scientific evidence for the overall cause-effect relationships between many of these pressures and the state of the ecosystem, the identification, and quantification of the pressures cannot be achieved through these indicators.

- **R&I Needs/Opportunities:** Development of the mathematical model of Black Sea for more robust assessments and forecasts of the effect of the complex of multiple stressors on marine ecosystem. Improvement the existing models with regards to species diversity, spatial resolution for selected species and for better description of the direct effect of anthropogenic pressures on ecosystems. Integrating the two mechanisms into ecological modelling: statistical and mechanistic (i.e. multispecies and biogeochemical models). Marine system models are indeed becoming increasingly complex and sophisticated, but far too little attention has been paid to model errors and the extent to which model outputs actually relate to ecosystem processes. Further developments on this would produce more robust assessments and forecasts and therefore more reliable indicators by integrating the two mechanisms into ecological modelling: statistical and mechanistic, i.e. multispecies and biogeochemical models (C. Piroddi et al, 2015).

Ecosystem multiple stressors studies should be further extended to include the final impact on the Blue Economy services. New generation ecosystem models' studies can be used to explore the synergistic impact of multiple stressors.



- **Justification:** Marine system models are indeed becoming increasingly complex and sophisticated, but far too little attention has been paid to model errors and the extent to which model outputs actually relate to ecosystem processes. Further developments on this would produce more robust assessments and forecasts and therefore more reliable indicators by integrating the two mechanisms into ecological modelling: statistical and mechanistic, i.e. multispecies and biogeochemical models (C. Piroddi et al, 2015).

7.8 R&I Area 8: Eutrophication and Deoxygenation

Limited historical and systematic data sets on biochemical properties of the open and coastal Southern Black Sea. Therefore, the long-term impacts of enhanced eutrophication on the basic biochemical properties/vertical features have not been well understood.

No systematic monthly/seasonal monitoring programmes have yet implemented to fully assess medium and long-term ecological changes in the shelf, coastal and open Black Sea ecosystem due to both climatic and human-induced impacts.

Enhanced nutrient loads by the major rivers feeding the Black Sea with the modified N/P/Si ratios have altered the coastal and open sea biochemical properties, damaged the entire marine ecosystem. Moreover, dam constructions on the major/regional rivers have reduced Si inputs to the Sea especially in the eastern basin, reducing diatom/non-diatom ratios and their abundances. These changes thus highly affected the food chain and major commercial fish stocks.

Enhanced eutrophication changed food chain, enhanced POM production and export to the halocline depths reduced the thickness of oxygenated zone and thus enlarged SOZ in the deep basin halocline, leading to less oxygenated space for zoo-plankton, pelagic and demersal fishes.

R&I Needs/Opportunities: Assessments of “good environment condition” limits for the direct and indirect eutrophication indicators in the Black Sea. For this goal the reachable reference ecological conditions of the BS must be determined based on limited historical, new observations and model simulations, then the total nutrient inputs, their major sources.

Novel tools are needed to assess basin-wide nature and human-induced nutrient and organic matter inputs to BS. This tool must be coupled to the Black Sea ecosystem models for the estimation of tolerable GES targets in the Black Sea.

Impact Assessment of enhanced nutrient inputs and changes in N/P/Si ratios in the inputs and surface waters on both chemical and major biological properties of BS and also on the BS commercial fisheries feeding on diatom consuming food-web.

The dynamics and mechanisms of formation of deep-water hydrogen sulphide are not sufficiently studied. The mechanisms for the development of seasonal hypoxia on the shelf are generally known, but there are still no precise forecasting models and no operational monitoring is carried out. The role of the outflow of the Danube and other rivers in the eutrophication of the Black Sea shelf is not clear enough, as a consequence, comprehensive measures to reduce this impact have not been developed. At present, there are no dedicated projects for monitoring of eutrophication and hypoxia, and the latest international project in the list ended in 2012. Now these phenomena are studied only as sections in large-scale monitoring efforts.

- **R&I Needs/Opportunities:** Creation of a special monitoring system for deep-water hydrogen sulfide, predictive models of the dynamics of deep-water hydrogen sulfide.
- **Justification:** Creation of models of seasonal hypoxia development considering the influence of climate and river runoff, creation of an international system of operative monitoring of eutrophication and



hypoxia, including monitoring of the river runoff of the Danube and other large rivers of the Black Sea basin.

Eutrophication and hypoxia regularly lead to mass mortality of biota and it is a potential strong hazard for aquaculture and other blue economy industries. Dedicated monitoring of these phenomena is critically important in the blue growth context.

7.9 R&I Area 9: Interconnections of Basins

Modest development of Black Sea-Mediterranean studies in a macroregional context.

Several integrative BS-Med projects, mainly doing with some aspects of biodiversity and bioinvasions, were identified.

- **R&I Needs/Opportunities:** Macroregional Black Sea-Mediterranean initiatives in all the areas are highly appreciated.
- **Justification:** Black Sea-Mediterranean region is regarded as a single research and management unit from many perspectives. However, when taken separately, the Black Sea falls out from global research schemes, and it hinders overall progress in Black Sea studies.

Long-term changes in the nutrient and TOC contents of NW shelf waters reaching the Bosphorus region and flowing into the Marmara basin.

About %35-50 of primary production and oxygen deficiency developed in the Marmara Lower layer is off Black Sea origin.

- **R&I Needs/Opportunities:** For the Marmara Region Environmental Management, seasonal and annual variability in the organic+inorganic nutrient loads of western BS inflow to the Marmara Sea is needed, together with their temporal variations in their major sources (mainly the Danube).
- **Justification:** These data sets are essential for the reliable calculations of Marmara TN and TP budgets and to assess the amounts of the current levels of particulate organic matter produced by human impacts in the Marmara region.

The Azov Sea is not included in most of the Black Sea research programs, as a result, its impact on the Black Sea ecosystem is unknown, while this influence is significant (due to water exchange between the seas, and due to mass seasonal migrations of fish and marine mammals).

The Azov Sea differs in salinity and production from the Black Sea. Meanwhile, it is a critical habitat for many animal populations living in the Black Sea.

- **R&I Needs/Opportunities:** Creation of models of mutual influence of the Black and Azov Seas.
- **Justification:** Including the Sea of Azov and the Kerch Strait into monitoring framework allows for modelling processes in the entire Black Sea, while its excluding is an essential source of bias.

7.10 R&I Area 10: Marine Ecosystem Services

There is no basin-wide assessment of the ecosystem services. Lack of projects: there are only few projects related to specific areas mainly focused on Romania.

- **R&I Needs/Opportunities:** Basin-wide extending national expertise: identifying the services common to all the Black Sea basin; efforts to assess the ecosystem services are necessary.
- **Justification:** Filling gaps in accordance to Short/Medium Term Goals of SRIA Agenda.

There are no methods of value estimation for ecosystem services adapted to the conditions of the Black Sea.



- **R&I Needs/Opportunities:** Basin-wide extending national expertise. Development of modern models that allow quantifying the value of the Black Sea ecosystem services.
- **Justification:** Development of advanced models addressed to the global challenges.

7.11 R&I Area 11: Marine Pollution and Litter

Common methodology for analysis for marine monitoring is lacking. Significant legal, political and technical gaps in marine litter management in coastal areas. The pollutant loads sourced from point and diffused sources are not defined regularly.

Despite a great and growing number of projects (especially targeting marine litter during the latest years), only ca. 30% are conducted at the international level, with concerted effort.

- **R&I Needs/Opportunities:** Sharing knowledge, methodology and practices, networking and capacity building at the basin-wide level.
Impacts and biological effects of pollutants are scarce. This requires experiments in a broad spectrum of organisms.
To evaluate existing pressures and the effectiveness of the measures taken, pollutant loads shall be monitored regularly.

No comprehensive studies of estimates, role, and decomposition of microplastics, pharmaceuticals, nanopollutants, e-wastes in the biota and marine environment as a whole. Lack of projects: a few projects (Romania; EU) related to microplastic studies.

- **R&I Needs/Opportunities:** Deep research of the effect of microplastics, pharmaceuticals, nanopollutants, e-wastes on living organisms of the Black Sea.
- **Justification:** Studies addressed to the global challenges and are important across the entire ecosystem, since microplastics can affect detrimentally on the environment and biota.

Absence of underwater noise monitoring. Lack of projects: a few pilot studies only in Bulgaria.

- **R&I Needs/Opportunities:** Development of the underwater noise monitoring programmes.
- **Justification:** To implement one of the MSFD Descriptors D11: Energy incl. Underwater Noise.

7.12 R&I Area 12. Marine and Coastal Hazards

The main problem of the coastal zone is beach erosion, caused by lack of beach-forming material. Within the borders of Georgia, the Black Sea littoral is divided into eight independent dynamic coastal systems (or littoral cells) identifiable as separate alongshore flows. On the background of the climate changes and interimpact of two environments – sea and land, the territory is constantly being assimilated with a rapid rate for agriculture, industry and civil accommodation. The anthropogenic loading on the natural environment too much exceeds the potential of sustainability of natural landscapes which results in the sharp disorder of ecological balance developed for a thousand years. For instance, continuing construction of hydropower stations on the rivers drastically influences the volumes of river's load discharges.

- **R&I Needs/Opportunities:** To implement innovative methods of beach restoration, basing on the knowledge gained in previous years (e.g. taking into consideration and account, results of the earlier research that revealed existing littoral cells with corresponding calculation of sediment balance, used, as a base for regulation of beaches under danger). This should help to use existing funds to be used more effectively.
- **Justification:** There are a number of successful case studies in this field, that can be renewed and include in the process of preservation of stability of beaches.



Cliffs protection and management are equally important. Geomorphologic hazards (erosion, subsidence, landslides).

- **R&I Needs/Opportunities:** Research programs, training opportunities, monitoring programs.

Beach protection and management. Beach erosion.

- **R&I Needs/Opportunities:** Tailored research programs, training opportunities.

Projects on oil pollution arising from ships. Oil-polluted shoreline clean-up.

- **R&I Needs/Opportunities:** Research programs, training opportunities and voluntary-based monitoring programs in order to increase the capacity for oil-polluted shoreline clean-up.

Lack of extensive research related to the effects of degassing in The Black Sea: Where are the most hazardous areas of degassing located in the Black Sea? Is the Black Sea methane a triggering factor in geohazards and ecological change? How and in what way degassing of the Black Sea can be harmful to offshore infrastructures and ecosystems under global climate warming? In-deep study of sea bottom geology - Coastal processes.

- **R&I Needs/Opportunities:** Research programs or projects related to the effects of degassing in the Black Sea: investigating the potential of the Black Sea degassing as an indicator of the perspective of geological prospecting on the shelf: study eco- and geosystems; infrastructure navigation. The program is associated with the protection of the coastal zone.

7.13 R&I Area 13: Seas and Human Health

Effective management of wastewater effluent is missing, even if there is an advance in upgrading and new WWTP building. Lack of knowledge about toxic species in the phytoplankton and its blooms and about pathogenic bacteria in the seawaters, and their impact on human health. No seafood (mollusks, crustaceans, fish) quality management system along Black Sea coastal areas. Potentially toxic phytoplankton species, the impacts of phytoplankton blooms on human health. Effective bathing/swimming water management system shall be established along BS coastal areas. Pathogens in marine environment.

A lack of projects both on the national and regional scale. There are single cases (Turkey) of beach closure related to the proliferation of toxic jellies. Marine life mortality, epizootic events of unknown cause.

- **R&I Needs/Opportunities:** Applying One Health concept in the sea research and management. Dedicated research of phytoplankton and other toxic species outbreaks. Introducing modern methods of monitoring of toxic species in the phytoplankton and its blooms, and distribution of pathogenic bacteria in the seawaters, based on the “smart buys”, DNA-barcoding methods and DNA-arrays. Seafood quality management system shall be established. Especially, on-line public information system should be provided. Bathing/swimming water quality monitoring and dissemination of results to the public research studies shall be supported by regional programmes.
- **Justification:** Addressing this problem is also of economic importance (beach closure), aquaculture bans, human health hazards.



7.14 R&I Area 14: Blue Biotechnology

Lacking national funding towards Blue Biotech and other emerging Blue Growth sectors. General modest development of Blue Biotech in the region.

Projects listing Blue Biotech as a priority, involving the Black Sea region, are generally conducted at the EU level for ten years. They cover microbial products, algae, solid waste of fish processing. Meanwhile, there are only a few national initiatives, and most of them are limited by fish processing or farming. There is an absence of basin-wide and transboundary projects in the Blue Biotech.

- **R&I Needs/Opportunities:** Biotechnological applications for the sustainable exploitation of all the marine biological resources, including prokaryotes, protists, and algae.
R&I projects of all the levels are needed to discover the ways to sustainably benefit from Black Sea biological resources, including prokaryotes protists and algae, by biotechnology applications.
- **Justification:** The huge potential of marine biological diversity, especially of prokaryotic and protist microorganisms, for biotechnological applications remains so far largely unexploited. By using the appropriate modern technological developments important applications in the area of bioprospecting (production of pharmaceuticals, bioactive substances, etc.) can be achieved. See new OECD report on Blue Biotech.

Lack in knowledge of genetic diversity of deep-sea anaerobic prokaryotes, which have large potential for the future biotechnology development.

- **R&I Needs/Opportunities:** Using metagenomics and metatranscriptomics methods for the understanding genetic diversity of deep-sea microbial communities.
- **Justification:** A unique worldwide number of anaerobic and extremophilic microorganisms suggests the presence of a significant number of unexplained genes that are potentially of interest for the creation of new microbial biotechnologies or improvements to existing ones.

7.15 R&I Area 15: Deep Sea Mining, Oil and Gas Sustainable Exploitation

Scenarios for climate change in order to assess the impacts are scarce, whereas direct climate-related drivers are multiple and complex. Long-term measurements and observations are missing. Assessment of impacts of climate change in biodiversity, especially in coastal ecosystems. Carbon sequestration measurements in the deep waters are missing.

Despite the growing bulk of evidence from the region, rapid climate change has no many multiple and complex short-term consequences that many of which are hard to be assessed.

- **R&I Needs/Opportunities:** The risks and the adaptation of policies to sea-level rise. Potential changes (because of climate changes) in thermohaline circulation and acidification. Study of vulnerability of the coastal zone and adaptations to climate change.
Study the vulnerability of the coastal zone and adaptations to climate change.
Exploring the recent technological developments (real-time data from Argo floats, satellite measurements etc.).
- **Justification:** Combination of the (operational) prediction of the sea level and the erosion and flooding of coastal areas, the economic-social-environmental impacts and their treatment, while optimizing its real-time measurements of meteorological-oceanographic parameters by combined use spot measuring devices and satellite (coastal satellite oceanography).
Risk assessment and early warning scenarios including assessment of socio-economic impacts for adaptive management.
Climate induced alterations in thermohaline circulation, acidification, sea-level rise, erosion and flooding.



Lack of assessment of consequences/impacts of climate change: intensity and severity of storms, coastal (especially beach) erosion, vulnerability of protected areas and human settlements.

- **R&I Needs/Opportunities:** Assessment of climate change-related extreme weather events, for example, storms, blooms etc.

Lack of knowledge on risk index, exposure, sensitivity and adaptive capacity of the Black Sea environment by Climate Change & Impacts.

Downscaled spatial maps of climate changes (temperature, rainfall, evaporation, wind, sea level) for the Black Sea region.

Special attention needs the influence of climate change on the dynamics of the hydrogen sulfide layer, impact of climate change on the development of seasonal hypoxia on the shelf, and impact of climate change on potential bioinvasions and narrowing niches of native species.

Exposure relates to the influences or stimuli that impact on a system. This is a measure of the predicted changes in the climate by the year 2050. Sensitivity reflects the responsiveness of a system to climatic influences, and the degree to which changes in climate might affect that system in its current form. Sensitive systems are highly responsive to climate and can be significantly affected by small climate changes. Adaptive capacity - The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. It is shown that the upper boundary of the hydrogen sulfide layer has risen in recent decades; it is important to understand how dangerous this phenomenon is due to climate change. Climate change creates potential ecological niches for invasions of other species, and at the same time it narrows niches of endemic species of "Ponto-Caspian" origin, it is necessary to learn to predict these processes.

- **R&I Needs/Opportunities:** Assess of exposure, sensitivity and adaptive capacity by using the mathematical models of the Black Sea ecosystems.
Development of new methodologies and methods – risk index; risk analysis; adaptation capacity; tools for multi-disciplinary research.
Development of predictive models of climate influence on the ecosystem of the Black Sea.
Research for combining various types of information as well as for assessment of economic damage.

7.16 R&I Area 16: Living Marine Resources

Monitoring and transparency lacking in Black Sea fisheries effort and landings data. Biased data on abundance and population structure.

Imperfect systems of data collection in commercial sector, multiple gaps in monitoring of fisheries, and a large sector of illegal unregulated and unreported catches.

- **R&I Needs/Opportunities:** Piloting Black Sea VMS data sharing under Global Fishing Watch, combined with remotely sensed and artificial intelligence methodologies. Use of questionnaire and market surveys (synergy with the GFCM methodologies) as independent landings proxies.
Since natural populations of a number of species are significantly undermined, it is necessary to orient aquaculture to the renewal of natural populations (sturgeon, turbot).
Decreasing fish stocks need new plans/targets on the fisheries policy of each Black Sea country.
- **Justification:** Recent progress in fishing activity tracking such as Global Fishing Watch could be piloted for the Black Sea contributing into improved monitoring and regulation of this declining sector.



The exploitation of many stocks continues to be beyond the levels they can sustain, while the status of a large number of stocks cannot be fully assessed due to poor data. Habitat destruction and the depletion of key predator and prey species and consequent food web effects are of concern and poorly understood.

Lack of knowledge on over-exploitation of many stocks, poor data, and consequent food web effects, link between the fisheries resources and the lower trophic levels and environmental drivers to promote an ecosystem approach to fisheries management.

Mariculture is a growing activity, which needs careful management to minimize potential impacts.

Implementation of the principles of a Common Fishery policy for the Black Sea based on trans-boundary collaboration.

- **R&I Needs/Opportunities:** Design innovative research programmes with new implementation tools across different scientific fields (acoustics, new engineering solutions for mariculture).

The link between the fisheries resources and the lower trophic levels and environmental drivers to promote an ecosystem approach to fisheries management.

Development of adequate models. Explore the potential of marine protected areas as a useful tool for the sustainable management of marine resources, especially for the protection of nursery grounds and biodiversity hot spot areas.

Pilot studies of new species for mariculture.

- **Justification:** A need to address the gap between the natural and the social and economic sciences, in order to meet the scientific requirements for the implementation of the ecosystem approach coping with adequate management and governance systems.

Overexploitation of fishery resources, that is, the exploitation of commercial fish stock over safe biological limits. There is no effective control mechanism. Absence of systematic long-term monitoring of the south eastern Black Sea anchovy fish stock in the Economic Exclusive Zone (EEZ) of Georgia. The lack of availability of reliable and accurate measures of the capacity and overcapacity of the fleet provides policymakers with useful tools to avoid rent dissipation of fishermen and/or the overexploitation of anchovy stocks.

Insufficient efforts to study the impact of ecologically competed organisms (e.g. invasive species) on small pelagic fish. Absence of effective methodological tools for assessment of degrees of overexploitation.

- **R&I Needs/Opportunities:** Inclusion of non-governmental bodies (e.g. NGO-s) can help to strengthen the control on exploitation of the fish stocks.
- **Justification:** There are a number of valuable scientific studies on the topic that gives an opportunity to improve the management ability by implementing scientific findings into the practice of managing authorities.

Overcapacity should be considered by policymakers for the bioeconomic sustainability of the Georgian anchovy fishery. A fishing capacity management framework must be implemented to reduce the fishing capacity if it exceeds the TAC limit, or the MSY when the TAC is not set appropriately. In effect, overcapacity is an important fishing problem given that it results in the dissipation of fishermen's rent and in the overexploitation of fish stocks when the fishing output is not limited or is not set properly. The above situation justifies the need to provide scientifically validated and accurate measures of fishing capacity and overcapacity to identify and avoid the structural problem of overcapacity.

Living resources of deltas, lagunas and limans are essential for local communities.



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The Ecosystem Approach to Management is a key management principle to facilitate sustainable development in its three dimensions, namely, environmental protection, social equity and cohesion and economic prosperity.

- **R&I Needs/Opportunities:** Absence of effective methodological tools for assessment of degrees of overexploitation.
- **Justification:** Local communities are traditionally dependent on local resources.

Not enough knowledge on the implications of climate change to fishery in the Black and Mediterranean seas. Not enough study effect non-native species on commercially important marine living resources eutrophication, over-fishing and habitats loss/damage.

Commercially important marine living resources have been greatly affected by non-native species introductions, eutrophication, over-fishing and habitats loss/damage.

- **R&I Needs/Opportunities:** To develop a methodology to assess risks and vulnerabilities of fisheries to climate change, non-native species introduction, eutrophication in the Black Sea.

7.17 R&I Area 17: Tourism and Surrounding Economy

Undeveloped air and marine transport between neighboring territories. The seasonality of tourism on the Black sea. The duration of touristic season is quite short.

Only a few projects related to development and impacts of tourism in Black Sea region.

- **R&I Needs/Opportunities:** Capitalization of expertise, capacity building: developing creative environmental-friendly paradigm shaping tourism as a part of blue growth. Overall need for the share of tourism and projections as a part of Blue Economy.
- **Justification:** Coastal and marine tourism is an important component of the growing, sustainable Blue Economy.

7.18 R&I Area 18: Marine Renewable Energy

The potential of the renewable energy sources from the Black Sea, such as wave energy, gas hydrates, H2S has not been studied or evaluated.

Lack of projects: there are few studies of sources of renewable energy (gas hydrates and wave energy), but mostly they are at the initial research stage.

- **R&I Needs/Opportunities:** Industry – research - stakeholder partnership.
- **Justification:** Energy resources based on new technologies are addressing global challenges and cutting-edge innovations.

Spatial planning is missing to locate potential marine renewable energy infrastructure in the Black Sea. Environmental impact assessment of marine renewable energy is missing. New technologies have not been introduced in the regions.

Absence of related projects.

- **R&I Needs/Opportunities:** Evaluation and mapping of the renewable energy sources in the Black Sea. Optimization of the renewable energy technologies for the Black Sea conditions.
- **Justification:** Energy resources based on new technologies are addressing global challenges and cutting-edge innovations. Source: COCONET wind atlas.

Lack of research related to Offshore Wind Farms (OWF) installing and impact.

A single project (COCONET) was related to the issue.



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- **R&I Needs/Opportunities:** Comprehensive research of the OWF installing and impact on biota and habitats, with providing guidelines on sustainable use.
- **Justification:** Provisions and guidelines by the Bird and Habitats Directives, CMS (Bonn) Convention, AEWA, EUROBATS, ACCOBAMS Agreements addressing environment-friendly practices OWF should follow.

7.19 R&I Area 19: Maritime Transport

Emissions from marine traffic. Impact of increasing shipping on the environment.

The BWM Convention will enter into force on 8 September 2017, but its effective implementation will need more time.

- **R&I Needs/Opportunities:** Operational and policy measures and practices can provide a sustainable framework for shipping (and for all related actions).
- **Justification:** Region-based integrated control mechanisms should be developed.

Impact of COVID-2019.

Maritime transport fell by 70% during 2020, then was deeply affected by Russia's war against Ukraine (which time frames go beyond this report) and its current composition and recovery rate are to be studied.

- **R&I Needs/Opportunities:** *Ad hoc* task force should be created for providing expertise at emergencies.

7.20 R&I Area 20: MSP, ICZM

National planning initiatives may have different priorities and methodological approaches. This will create difficulties for the development of common Azov and Black sea MSP.

- **R&I Needs/Opportunities:** Need for joint MSP, ICZM conference/forum for the Black Sea
Analyze national legislations in terms of goals, principles, lists and formats of the input and output MSP data layers and to develop recommendations for their convergence.
- **Justification:** MEDCOAST ICZM conferences are long established as major biannual conferences in the Med and Black Sea regions.
If organized consecutively with MEDCOAST, Black Sea Conference Series of the BSC could provide opportunities for the annual gathering for ICZM and MSP practitioners.

MSP practice and methods undeveloped in non-EU Black Sea countries, only emerging in EU countries (RO, BG) through EU supported initiatives.

MSP experience, methodology, and funding are lacking in non-EU Black Sea countries, limiting prospects for MSP at area-specific, national, and common Black Sea Basin level.

- **R&I Needs/Opportunities:** Establish common MSP methodology at national and regional levels e.g. through transboundary pilot schemes and a common methodology for the Black Sea Basin.
- **Justification:** There is a need to extend EU experience with MSP into non-EU littoral countries and in harmonization with EU member Black Sea countries.

No SEA expertise and framework exists for the assessment of MSP strategic impacts.

MSPs under development in EU- Member littorals countries and potential pilot schemes in non-EU countries and ultimately the Black Sea Basin wide MSP would require assessment of strategic impacts.

- **R&I Needs/Opportunities:** Develop compact, comprehensive and commonly agreed SEA guidelines for area-specific (sub-national), national, as well as the Black Sea Basin-wide regional MSPs.
Capacity building at national levels.



- **Justification:** SEA is mandatory in some countries and not required statutorily in other Black Sea countries. Challenge would be to provide a common SEA framework for eventual MSPs at all levels of application (sub-national, national basin).

Despite quite rich experience with ICZM in the Black Sea region, there is a need for innovative research on methodologies in support of the implementation at sub-national, national and regional levels.

Black Sea Commission in 2016 approved [Guideline on ICZM in the Black Sea](#), which provides a roadmap for implementation and requires multifaceted support including ICZM research and innovation.

- **R&I Needs/Opportunities:** Provide for interdisciplinary scientific research on ICZM and on the interaction between land-based and sea-based activities and their impacts on coastal zones, both landward and seaward.
- **Justification:** The purpose of this research would be to further knowledge of ICZM, to contribute to public information, to facilitate public and private decision-making, and overall support in the implementation of ICZM at all applicable levels.

7.21 R&I Area 21: Operational Oceanography/Observing Systems and Monitoring

The absence of systematic monitoring in the shelf and open sea. No harmonized monitoring programmes on the regional level.

No integration in the sea, coast, and catchment observing systems.

Lack of permanently updated real-time information regarding the marine environmental conditions in the absence of modern technology for *in-situ* monitoring (e.g. remote sensors, gliders, HF-radars, etc.)

Limited spatial and temporal coverage of ARGO floats (only dozen of floats, no buoys on the shelf area of the Black Sea), ferrybox and other automatic oceanographic monitoring systems.

The lack of biogeochemical components measurements through the operational oceanography platforms.

Limited systematic data are available on BS chemical inputs to the Marmara upper layer and Bosphorus under flow regime.

Limited operational data on catchment, river inputs, shelf processes and their time variation.

A small number of the regional scale projects (such as Copernicus) and follow-ups.

Low involvement in Euro-Argo ERIC and similar initiatives of the Black Sea riparian countries.

- **R&I Needs/Opportunities:** Integrated and coordinated effort at Black Sea scale through the use of several operational oceanography platforms (moorings, profilers, ferry boxes, gliders, ships of opportunity). Implement innovative Data Cube technology for integration of Earth Observation across sea, coast and catchment domains of the Black Sea, providing easy to apply toolsets. Strengthening participation in the system Euro-Argo floats network and JCOMM. Trainings for specialists to operate with modern and innovative technologies. Building of multi-platform integrated observatories for recording a variety of parameters in different space and time scales. Increased availability of biogeochemical parameters will provide a solid background for the evaluation and further development of the existing ecosystem numerical models. Need for innovative instruments to integrate various sea, coast and catchment observing systems.



Develop Black-Sea tailored operational platforms and biogeochemical sensors for energy-relevant substances (methane, H₂S).

- **Justification:** Investment at EU level as this effort exceeds national capabilities. The process of implementation of MSFD approach need to strengthen capacity of operational observation infrastructure on a regional level, taking into consideration existing international conventions and documents (e.g. Convention of Protection of Black Sea from Pollution, Black Sea strategic action plan; Black Sea Integrated Monitoring and Assessment Program (BSIMAP for 2017-2022)).

7.22 R&I Area 22: Socioeconomic & Policy Research

Absence of efficient cooperation between the socio-economic and environmental science.

Policies need to be developed based on results from indicators for the WFD and MSFD.

Targets for achieving the GES are missing.

Lack of crisis management, emergency action plans, and emergency response.

The present-day crisis showed the extreme vulnerability of regional development and challenges which remain unsolved.

- **R&I Needs/Opportunities:** Research in support of policies and the society.
Training/awareness of the regions of the country on the potential of the marine environment.
Implementation of the MSFD needs to be addressed with new incentives for research. Involvement of different groups of stakeholders from the beginning.
Think tanks, emergency task forces providing integrated expertise should be established and supported.
- **Justification:** Implementation of the MSFD needs to be addressed with new incentives for research.

7.23 R&I Area 23: Training & Technology Transfer

Lack of permanent MSP, Blue economy, and other training and capacity building facilities in the Black Sea region.

The difference in the level of training of specialists in the sectors of Blue economy leads to difficulties in their interaction, the quality of their work and services.

Poverty, limited travel ability, lack of investment in tech.

Very few training opportunities in different sectors of R&I in the Black Sea region. e.g. experience with ICZM MEDCOAST training series, which educated numerous managerial and decision-making capacity in the region could serve as an excellent model for MSP.

- **R&I Needs/Opportunities:** Transfer aquaculture technology from the Mediterranean to the Black Sea.
Transfer of renewable energy technologies from Northern to the Black Sea.
To coordinate the training of specialists of related specialties; use the exchange of students and teachers programs.
More intensive targeted trainings, consultations, joint expeditions.
Create new training modules to train the wider Blue Economy workforce.
- **Justification:** Training is a critical element both for research capacity and management. Capacity building and Technology transfer are needed in almost all fields of research for the whole Black Sea in order to achieve a better understanding of the Black Sea ecosystem and implement scientifically based adequate management strategies. Facilitating the training and technology transfer are needed to accelerate the implementation of MSFD and WFD.



Under-utilized potential of aquaculture, especially of offshore aquaculture.

The potential of the renewed energy of the Black Sea is not used at all.

- **R&I Needs/Opportunities:** The lack of projects of Technology transfer from different regions. Transfer aquaculture technology from the Mediterranean to the Black Sea. Transfer of renewable energy technologies from Northern to the Black Sea.
- **Justification:** Addressing global challenges and cutting-edge innovations it is extremely important to study the experience of countries that have succeeded in a particular area of R&I.

8. Conclusion

Overall, it can be deduced that the priorities for project-funding differ from the national level to the European level. Lacking underlying infrastructure (observing and monitoring systems e.g.) especially at the Black Sea basin, relevant marine-related policies, implementing instruments, and regional cooperation are some of the more frequently quoted as reasons for the under-developed R&I areas.

In this deliverable the results show that National projects mostly focused on Living Marine Resources, Marine Pollution and Litter, Biodiversity and Operational Oceanography/Observing Systems and Monitoring projects; Multinational EU funded projects targeted Operational Oceanography/Observing Systems and Monitoring, Training & Technology Transfer, Tourism and Surrounding Economy, Socioeconomic & Policy Research and Biodiversity. Climate change was addressed as a secondary are. Additionally, it was also observed that emerging challenges are little addressed in monitoring programs: Bioinvasions, Deep Sea Ecosystems, Seas and Human Health.

To address these problems, Black Sea CONNECT CSA specifically is tasked to gather significant key players from initiatives, projects, research infrastructures and group them in a network that supports and enhances the information exchange and fosters scientific cooperation. The CSA will create the platform that will enable alignment of potential funding, including funding for research-industry partnerships. For this aim, Black Sea CONNECT has already identified relevant regional entities (BSC, BSEC, GFCM, and more) and actors at the proposal stage and engage them throughout the implementation phase. For more effective alignment of key actors and players for stronger research and innovation domains in the Black Sea region, the Black Sea CONNECT CSA has a dedicated report to map relevant Black Sea projects, initiatives, and entities, including the modes of engagement which will be updated twice within the life cycle of the project.

This deliverable presents an initial assessment of the state of the art of the Black Sea projects in the broader context. Further analysis will be made and the document will be finalized in the final year of the Black Sea CONNECT CSA under D2.7 and this document will provide input for setting the priorities of the Black Sea SRIA Implementation Plan. The Implementation Plan will advance already existing progress on identified topics and to less-addressed priority areas.



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Glossary/List of Acronyms

DEFINITION	ACRONYM
BALTIC AND NORTH SEA RESEARCH AND INNOVATION PROGRAMME	BANOS
BLACK SEA COMMISSION	BSC
BLACK SEA CONNECT COORDINATION AND SUPPORT ACTION	CSA, Action
ORGANIZATION OF THE BLACK SEA ECONOMIC COOPERATION	BSEC
BLACK SEA UNIVERSITY NETWORK	BSUN
COPERNICUS MARINE ENVIRONMENT MONITORING SERVICE	CMEMS
THE EUROPEAN EARTH OBSERVATION PROGRAMME	Copernicus
CONFERENCE OF PERIPHERAL MARITIME REGIONS	CPMR
COORDINATION AND SUPPORT ACTION	CSA
INTERNATIONAL CENTRE FOR ADVANCED STUDIES ON RIVER-SEA SYSTEMS	DANUBIUS-RI
EUROPEAN COMMISSION	EC
THE EUROPEAN MARINE OBSERVATION AND DATA NETWORK	EMODNET
EUROPEAN MARINE SCIENCE EDUCATORS ASSOCIATION	EMSEA
EUROPEAN MULTIDISCIPLINARY SEAFLOOR AND WATER COLUMN OBSERVATORY - EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM	EMSO-ERIC
EUROPEAN STRATEGY FORUM ON RESEARCH INFRASTRUCTURES	ESFRI
EUROPEAN UNION	EU
EUROPEAN CONTRIBUTION TO THE ARGO PROGRAMME	EURO ARGO - ERIC RI
NEW OPERATIONAL STEPS TOWARDS AN ALLIANCE OF EUROPEAN RESEARCH FLEETS	EUROFLEETS
EUROPEAN GLOBAL OCEAN OBSERVING SYSTEM	EuroGOOS
FOOD AND AGRICULTURE ORGANIZATION	FAO
GOOD ENVIRONMENTAL STATUS	GES
GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN	GFCM
GLOBAL OCEAN OBSERVING SYSTEM	GOOS
NETWORK OF ENVIRONMENTAL HYDRAULIC INSTITUTES IN EUROPE	Hydralab
INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA	ICES
INFORMATION AND COMMUNICATION TECHNOLOGIES	ICT
INTEGRATED COASTAL ZONE MANAGEMENT	ICZM
INTERNATIONAL MARITIME ORGANIZATION	IMO
INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION OF UNESCO	IOC-UNESCO
INTERNATIONAL OCEAN DISCOVERY PROGRAM	IODP
JOINT EUROPEAN RESEARCH INFRASTRUCTURE NETWORK FOR COASTAL OBSERVATORIES	JERICO
JOINT PROGRAMMING INITIATIVES	JPI
MEDITERRANEAN COASTAL FOUNDATION	MEDCOAST
MARINE PROTECTED AREAS	MPAs
MARINE RESEARCH INFRASTRUCTURES	MRIs
MARITIME SPATIAL PLANNING	MSP
MARINE STRATEGY FRAMEWORK DIRECTIVE	MSFD
NON-GOVERNMENTAL ORGANIZATIONS	NGOs
FURTHER DEVELOPING THE PAN-EUROPEAN INFRASTRUCTURE FOR MARINE AND OCEAN DATA MANAGEMENT	SeaDataCloud
PAN-EUROPEAN INFRASTRUCTURE FOR OCEAN & MARINE DATA MANAGEMENT	SeaDataNet
SMALL AND MEDIUM-SIZED ENTERPRISES	SMEs
STRATEGIC RESEARCH AND INNOVATION AGENDA	SRIA
UNITED NATIONS DEVELOPMENT PROGRAMME	UNDP
UNITED NATIONS ENVIRONMENT PROGRAMME	UNEP



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Partner Abbreviations

NO	CONSORTIUM MEMBERS	TYPE	SHORT NAME	COUNTRY
1	Middle East Technical University - Institute of Marine Sciences (Coord.)	University, Research Institute	METU	Turkey
2	Organization of the Black Sea Economic Cooperation	Intergovernmental Organization	BSEC	Turkey
3	The National Institute for Research and Development of Marine Geology and Geoecology	Research Institute	GEOECOMAR	Romania
4	Institutul National de Cercetare-Dezvoltare Marina "Grigore Antipa"	Research Institute	INCDM	Romania
5	Bulgarian Academy of Sciences Institute of Oceanology	Research Institute	IO-BAS	Bulgaria
6	The Scientific and Technological Research Council of Turkey	Governmental Research and Funding Agency	TUBITAK	Turkey
7	Institut Français de Recherche pour l'Exploitation de la Mer	Research Institute	IFREMER	France
8	Helmholtz-Zentrum Geesthacht Zentrum für Material- und Küstenforschung GmbH, also representing the German Marine Research Consortium KDM	Consortium of Research Institutes	HZG	Germany
9	Ukrainian scientific Centre of Ecology of Sea	Research Institute	UkrSCES	Ukraine
10	Tiraspol State University	University, Research Institute	UST	Moldova
11	Ivane Javakhishvili Tbilisi State University	University, Research Institute	TSU	Georgia
12	Secretariat of the Black Sea University Network	Non-governmental Organization	BSUN	Romania



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