**Matrixes; Blue Growth Initiative for Research and Innovation in the Black Sea**

**Matrix A. Analysing gaps and research & innovation opportunities providing the necessary justification/drivers**

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| **R&I Area 1: Biodiversity** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | Shelf and Deep sea biodiversity is poorly studed |  | Functional diversity not addressed Implementation of operational techniques (remote sensors, biological sensors) to study biodiversity at adequate scale of natural variability |  |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.12.08 | Role of biodiversity in marine ecosystem functioning (BEF concept). Species adaptation to climatic changes. Diversity of some groups (microbes, viruses, fungi) is missing. Shelf and especially Deep sea biodiversity is poorly studied. | Understanding ecosystem functioning and services as a prerequisite for sustainable exploitation of resources and management | Application of advanced methodologies and techniques to study biodiversity (e.g. barcoding, Next Generation Sequencing (NGS) and –omics technologies).Implementation of operational techniques (remote sensors, biological sensors) to study biodiversity at adequate spatio-temporal scale of natural variability  Development of indicators for GES (implementation of WFD, MSFD) | The need to understand what means "the biodiversity is corresponding to GES", find new potential resources for blue technology, lacking expertise at national and regional scale |
| Georgia-  TSU  (Kakhaber Bilashvili)  2017.12.08 | Marine biodiversity studies has been conducted for a few years only within international projects. Gaps in assessing of biodiversity in marine ecosystem functioning. Species adaptation. Study of microbial diversity is carried out only for needs of sanitary control in limited areas of coastal waters. Long-term support of research projects and programmes on biodiversity. | National programmes for long term monitoring are at an initial stage of elaboration, only limited and sporadic studies are carried out basing on local funding. Adaptation of organisms and evaluation of this adaptation is missing. | At this stage, it is needed to provide more opportunities to reach the level of knowledge and experience gained by BS EU countries (namely Bulgaria and Romania) during the process of implementation of MSFD principles. More intensive targeted trainings, consultations, joint expeditions etc. are needed. | Recent joint scientific marine cruise carried out within internatioinal project EMBLAS I/II accelerated the process of preparation of ground for implementation of MSFD goals and approach. New opportunities appeared and become visible for mutual scientific work, intercalibration and standartisation of methodologies, established steady connection between international organisations, local authorities, state and scientific institutions, SME etc. The prompt promotional activitis (through social networks inter alia) helps to arise public awarness significantly. |
| Moldova IEG  (Tudor Castravet)  2018.01.22 | In addition to the marine protected areas there is a need for identification, design and application of new lacustrine protected areas in rivers deltas, lagunas and limans. | Protected areas are useful for the sustainable management of coastal/lacustrine resources, especially for the protection of biodiversity. | Sustainable use of the marine/coastal resources. | Ecosystem approach to management. |
| Russia  SIO\_RAS  (Tamara Shiganova)  2017.12.11 | The Black Sea species diversity comprises of the cold water boreal species and warm water species of the Mediterranean origin.  Now with climate warming important to identify alterations in the increased share of warm water and decreased share of cold water species among both native and non-native species diversity. | To figure out based on observations alterations in native species diversity and in their spatio-temporal distribution in the main systematic taxons.  Development of additional indicators for GES (implementation of WFD, MSFD) in changeable climatic conditions | The need to understand how climate change affected change in species diversity in pelagic and benthic communities.  To determine which species began abundant and which predominant | The need to identify how and in which areas and seasons the indexes of biodiversity are corresponding to GES" |
| Russia  SIO\_RAS  (Tamara Shiganova)  2018.03.25 | No current knowledge on changes of biodiversity under climate warming  There is no target species List, including 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 strong effect of Mediterranean flora and fauna; north western area (Bulgaria, Romania) under effect of fresh water input and brackish water species input, comparison with other coastal areas | Studied only for some separate area | To develop a list of non-native, cryptogenic and harmful native species in the Black Sea, as well as a list of "target species" that may impair or damage the environment, human health, property or resources in the Black Sea.  Need to have joint EC project  Development of indicators for GES (implementation of WFD, MSFD) |  |
| Turkey  METU-IMS  (Suleyman Tugrul)  2017.12.07 | Long-term changes in diatom and non diatom production, aboundance and spatial/temporal distributions in the NW shelf, estern basin and eastern basin. | Long-term changes in loads of nutrient, feeding the Black Sea with the N/P/Si ratios highly modified Si/N and N/P ratios in the late 1980’s and thus food chain in the Black Sea  Damming of major rivers reduced Si loads especially in the eastern basin, redusing dioatom/non-diatom ratios and their aboundances. These changes thus highly affected food chain 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 | Decreasing fish stocks need new plans/targets on the fisheries policy of each Black Sea country  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 |  |
| Turkey TUBITAK  2017.09.08 | Marine protected areas (MPA) in the region shall be defined to support saving biodiversity of BS. | There is not any MPA along BS coastal areas of Turkey. | Common MPA's determination methodology including same criterias shall be developed and applied for BS's coastal areas. |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Insufficient using of modern methods for estimating of biodiversity.  As a result – lacs in the data about species diversity, especially in the microscopic groups (microalgae, protysts, archean and bacteria, viruses), and lacs in the data about food webs and about functional diversity in the marine communities. | The 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 scenarios where collection of whole organisms is impractical or impossible on regular basis (deep sea). While the number of studies demonstrating successful eDNA detection has increased rapidly in recent years | Development Barcodes Data Base for Black Sea ecosystem  Assessment of biodiversity by eDNA and metagenomics methods | Data base of species barcodes for Black Sea allows use eDNA method in environmental monitoring. The work has been started during EMBLAS-II Project. |

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| **R&I Area 2: Biological Invasions** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | No targeted study about the biological invasiosn. Studies are carried out through other projects which have the element of invasive species in the work plan (biodiversity). A lot of work has been published because of these activities. Pathways should be studied and should be commonly addressed. Alterations of ecosystem functions, because of invasive species have to be studied. Management plans of invasive species, especially in fisheries, is needed with emphasis on prevention control | Development of robust indicators (species specific) for GES. Cooperation with all the countries at basin scale |  | Eventual management of the invasive species - prevention control |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.12.08 | No targeted systematic study of biological invasions at all levels of species diversity. Pathways of invasions not commonly addressed; poor understanding of alterations of ecosystem functions, because of invasive species. | Management plans, with emphasis on prevention control of new invasions | Combination of molecular techniques and traditional monitoring of invasive species for proper species identity 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. | Development of robust indicators (species specific) for GES. Concerted actions among all the countries at basin scale to control/prevent new invasions. |
| Russia  SIO\_RAS  (Tamara Shiganova)  2017.12.11 | Since 1950s the Black Sea became recipient basin and the main region donor for the Sea of Azov and the Caspian Sea non-native species invasions.  Among them the most aggressive invader was ctenophore *M.leidyi* for all these basins. Effect on these seas ecosystem and fishery were tremendous in all seas.  After arrival ctenophore *Beroe ovata*, which grazed on *Mnemiopsis leidyi*, its effect on the Black Sea ecosystem decreased. But there is still effect and these two ctenophores became the main drivers of pelagic ecosystem now and their interactions determine state of pelagic ecosystem.  Study the main factors, which control both invaders populations are important issue.  During last decades with climate warming pathways of species invasions have been changed. Warm water species and even subtropical ones began to arrive with ballast waters and penetrate via Bosporus in the Black Sea. Some of them established in higher temperature conditions.  Among them there are two Indo-Pacific fish species – “Lessepsian” migrants *Sphyraena pinguis* and *poisonous Lapocephalus sceleratus.* On these harmful fish should be paid special attention. | Most of non-native species arrived with ballast waters. Information on species establishment should be studied and measures to stop these pathways should be implemented.  Measures of the Black Sea countries on prevention via other pathway species arrival and control all of new invasions should be developed.  Special observations on occurrence of two Indo-Pacific fish species – “Lessepsian” migrants *Sphyraena pinguis* andpoisonous *Lapocephalus sceleratus* should be performed, particularly in the southern (Turkish) and western Black Sea. | To collect information on all established invasive species and the new records.  Application of advanced methodologies and techniques to study invaders and their pathways including barcoding should be implemented. | Development of joint actions of the Black Sea countries to control/prevent new invasions at basin scale. |
| Russia  SIO\_RAS  (Tamara Shiganova)  2018.03.25 | 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 effect invasive species both benic and pelagic ones on the bentic and pelagic communities  No current list of the most harmful species in the Black Sea  Not enough DNA barcoding study of  wide disperced invasive spesies  Warnings concerning ballast water uptake in certain areas and measures under regulation |  | Need to have projects on invasive species to monitoring developments and studies in basin scale |  |
| Turkey TUBITAK  2017.09.08 | An effective ballast water management plan shall be defined at regional level. | BS suffers from invasive species transported by ballast waters. | Investigation on ballast water management at regional level shall be supported. |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | There are no usable methods for the rapid detection of new invasive species |  | Improving the new modern methods, based on the DNA-barcoding of aborigines and invasion species |  |

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| **R&I Area 3: Catchment-Sea Interaction** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva  2017.12.08 | Lack of up-to-date regional scale assessment of catchment area inputs to the Black Sea | Evaluation of impacts on the Black Sea ecosystem | Development of catchment area -sea coupled hydrological and biogeochemical models | Scenarios for management |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2018.03.10 | 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 implementation of instruments such as MSP, ICZM and IRBM and correlate governance progress with indicators characterising state of the sea, coasts and catchments. | Development and harmonisation of implementation progress and state of the environment indicators across catchments, coastal zones and marine-maritime domains. | Certain advancement 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](http://www.blacksea-commission.org/Downloads/Black_Sea_ICZM_Guideline/Black_Sea_ICZM_Guideline.pdf)), but no similar instruments for tracking MSP and IRBM progress available yet. |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2018.03.10 | Need for innovative instruments to integrate various sea, coast and catchment observing systems within 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. | 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. | Implementations experience available by UNEP/GRID-Geneva to demonstrate Data Cube tools in Black Sea areas, such as in Georgia (also covering part of neighbouring Turkey) and in Moldova, showing great potential both landward and Seward tools. |
| Moldova IEG  (Tudor Castravet)  2018.01.22 | Water, chemicals and sediments linkages and mutual close and distant interactions between the rivers catchments and the sea are not sufficiency known. | Need for assessing the feedback between the marine and continental environments. | Development of catchment area - sea hydrological and biogeochemical models. | Need for scenarios for management in under conditions of environmental change. |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Lack of data about real population sizes and structure, and impact of catching on the population sizes and structure for commercial species;  Lack of real date about rare species undermined by the commercial exploitation |  | Independent of commercial fishing control catches$  International study of the possibility of restoring the populations undermined by the fishery (sturgeons, gullies) |  |

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| **R&I Area 4: Climate Change & Impacts** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | Scenarios for climate change in order to assess the impacts is scarce. Long term measurements and observations are missing. Assessment of impacts of climate change in biodiversity, especially in coastal ecosystems. Carbon sequstration measurements in the deep waters is missing |  | The risks and the adaptation of policies to sea level rise. Potential changes (because of climate changes) in thermohaline circulation. Accidification. Study the vulnerability of the coastal zone and adaptations to climate change. | 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). |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.12.08 | Scenarios for climate driven changes in order to assess the impacts is scarce. | Assessment of impacts of climate change on biodiversity, hydrology and biogeochemical processes. Carbon sequstration measurements in the deep waters | Climate induced alterations in thermohaline circulation, accidification, sea level rise, erosion and flooding. Study the vulnerability of the coastal zone andadaptations to climate change. Exploring the recent technological developments (real-time data from Argo floats, satelite measurements etc). | Risk assessment and early warning scenarious including assessment of socio-economic impacts for adaptive management. |
| Russia  SIO\_RAS  (Tamara Shiganova)  2017.12.11 | Main drivers: inclrease of SST, SLR, decrease of SSS, changes in surface circulation, disintegration of CIL, Shoaling of oxic/anoxic bounadry,Gelatinous species both native and non-native blooms |  | Joint observations in frame of national and EC projects |  |
| Turkey MEDCOAST  (Erdal Ozhan)  2017.12.07 | Quantification of consequences/impacts of climate change. Like intensity and severity of storms, coastal (especially beach) erosion, vulnerability of protected areas and human settlements. | Very few national and regional studies exist. | Tailored research programs |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Very lack of knowledge of 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 need the influence of climate change on the dynamics of the hydrogen sulphide layer, impact of climate change on the development of seasonal hypoxia on the shelf, and impact of climate change on potential bio-invasions (new niches for allies) and narrowing niches of aboriginal species. | Exposure relates to the influences or stimuli that impact on a system. In this study, exposure is a measure of the predicted changes in the climate for 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 sulphide 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. | 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 - climate change-related extreme weather events, for example, storms, blooms etc. |

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| **R&I Area 5: Cultural Heritage** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Moldova IEG  (Tudor Castravet)  2018.01.22 | Incipient and yet weak cultural cooperation and protection of the cultural heritage in the Black Sea Region. |  | New mechanisms of cooperation should be applied to capitalize the cultural heritage around the Black Sea. | A common management policy should be developed and applied via a coordination network. |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Mapping of cultural heritage is non uniform and incomplete | Uniform of the cultural resources mapping would be useful for understanding the presence of cultural resources in the Black Sea region | International project to uniform and incomplete mapping of cultural heritage in the Black Sea region | The results would uniform to avoid and minimize impacts to cultural heritage |

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| **R&I Area 6: Deep Sea Ecosystems** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | Functioning of Deep Marine Ecosystems in the Black Sea is not really known. The experience in Bulgaria is that there are some studies mainly in Geological surveys and through the EU projects some biologcal and biodiveristy studies have been carried out. We missed the processes in the deep waters. 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 sequastration in deep waters is also missing. Marine resources in the deep waters is not really registered. There are only very few studies that allow to discover the morphology of the bottom. Specific habitats that support specific biodiversity and ecosystem functions such as mud volcanos, gas seepages are very poorly studed. |  | Biogeochemical cycle in the deep waters is unkown and should be studied. Microbial food web, carbon sequestration and particle deposition in the deep is not known. Research especially with marine mamals. |  |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.12.08 | Knowledge of Deep Marine Ecosystem is limited. There are some studies mainly from Geological surveys and focused on paleonthological aspects. 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 sequastration in deep waters is also missing. |  | Biogeochemical cycle in the deep waters, Microbial food web, carbon sequestration and particle deposition in the deep. Research of specific habitats that support specific biodiversity and ecosystem functions such as mud volcanos, gas seepages. | Functioning of Deep Marine Ecosystems in the Black Sea as an unique environment and potential resourse (oxic-anoxic interphase, H2S environment) |
| Russia  SIO\_RAS  (Tamara Shiganova)  2018.03.25 | Not enough knowladge on habitats which were assessed as threatened in categories Critically  Endangered, Endangered and Vulnerable |  | Need to assess threatened habitats in categories Critically  Endangered, Endangered and Vulnerable | to develop measures for support the conservation  of marine habitats. |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Gaps instudy 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 deep part of the Black Sea; the role of anaerobic zones in biogeochemical cycle of organic and inorganic substances. | The Вlack Sea is the largest meromictic basin on the planet. Its uniquely characteristic feature is the presence of relatively thin surface layer of aerobic water and a powerful hydrogen sulphide 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 at al., 1993) conducted an analysis of the entire historical dataset on the distribution of hydrogen sulphide 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 sulphide 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 result of climatic changes. | International complex seasonal expeditions to investigate 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 | 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 central part of the Black Sea to assessment of topography of the border of the H2S zone would show influence all these factors. |

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| **R&I Area 7: Ecosystem Multiple Stressors** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Gaps in mathematical models for assessment and forecast of the effect of the complex of multiple stressors on marine ecosystem, related to uncertainty of model results | 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 state of the ecosystem or its components (C. Piroddi et al, 2015). Most of the model-derived indicators compiled in the catalogue 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. | Development of the mathimatical 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). |

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| **R&I Area 8: Eutrophication and Deoxygenation** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Turkey  METU-IMS  (Suleyman Tugrul)  2017.12.07 | Limited historical and systematic data sets on bio-chemical properties of the open and coastal Southern Black Sea  Therefore, long-term impacts of enhanced eutrophication on the basic bio-chemical 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 riversfeeding the Black Sea with the modified N/P/Si ratios have altered the coastal and open sea bio-chemical properties, dameced the entire marine ecosystem,  Moreover, dam constructionson the major/regional rivers have reduced Si inputs to the Sea especially in the eastern basin, reducing dioatom/non-diatom ratios and their aboundances. These changes thus highly affected 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 | 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 tolls are needed to assess basin wide natura 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 diotom consuming food-web. |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | 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. |  | Creation of a special monitoring system for deep-water hydrogen sulphide, predictive models of the dynamics of deep-water hydrogen sulphide.  Creation of models of seasonal hypoxia development taking into account 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 |  |

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| **R&I Area 9: Interconnections of Basins** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Russia  SIO\_RAS  (Tamara Shiganova)  2017.12.11 | Effect of the Black Sea invaders on the Mediterranean.  Mediterranezation of the Black Sea with climate warming |  |  |  |
| Russia  SIO\_RAS  (Tamara Shiganova)  2018.03.25 | Not enough research on dispersal invasive species between the Black and Mediterranean due to climate change |  |  |  |
| Turkey  METU-IMS  (Suleyman Tugrul)  2017.12.07 | 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. | For the Marmara Region Envionmental 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) | 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 |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | 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 not known, while this influence is significant (due to water exchange between the seas, and due to mass seasonal migrations of fish and marine mammals) |  | Creation of models of mutual influence of the Black and Azov Seas |  |

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| **R&I Area 10: Marine Ecosystem Services** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | There are no methods of calculating the value of ecosystem services adapted to the conditions of the Black Sea |  | Development of modern models that allow us to quantify the value of the Black Sea ecosystem services |  |

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| **R&I Area 11: Marine Pollution and Litter** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | Impacts and biological effects of pollutants are scarce. In Bulgaria we have only a one year assessmen of pollutants sensu MSFD and WFD, but only in the coastal and partly in the 12 mile zone, but we lack capacity (human expertise and equipment) for pollutants and marine litter analysis (especially microplastics). |  |  |  |
| Georgia-  TSU  (Kakhaber Bilashvili)  2017.12.08 | The problem of pollution of the coastal areas with solid waste has essentially become aggravated in Georgia in recent years. There is no national corresponding monitoring programme yet. Observations on regular base began few years ago within international project (EU/EC funded project EMBLAS) discharges. | Descriptor 10 (properties and quantities of marine litter) of MSFD considers the survey of marine litter in four spheres of marine environment: on the beaches, on the seafloor, on the water surface, in the biota. At present regular observations are initiated in regard of beach and riverine litter. Data | According to the initial results, we can conclude that the litter on the surveyed sections of beaches is generated from land-based sources. They do not contain elements that could occur in the sea from ships, or could be related to fishing. Solid waste, including wood is transported by rivers into the sea. The rivers need to be under special and intesive monitoring. In Sarpi coastal area the highway represents the main source of waste due to the permanent traffic jam on the border (transboundary impact). Elaboration of new guiding manuals (including microplastics) and applications are provided by leading european institutions (e.g. JRC). |  |
| Georgia  IJTSU  (Kakhaber Bilashvili)  2018.01.21 | The problem of pollution of the coastal areas with solid waste has essentially become aggravated in Georgia in recent years. There is no national corresponding monitoring programme yet. Observations on regular base began few years ago within EU/EC funded project EMBLAS. | Descriptor 10 (properties and quantities of marine litter) of MSFD considers the survey of marine litter in four environment: on the beaches, on the seafloor, on the water surface, in the biota. | It is of great impotance to create the national subprogramme, basing on complex approach including field observations, chemical analysis of the samples (especially on microplastics and its pathways in trophic chain) , working on rising of public awarness etc.  At present regular observations are initiated in regard of beach and riverine litter. Obtained data are trasferred in real time mode and stored to RIMELL data base. |  |
| Russia  SIO\_RAS  (Tamara Shiganova)  2018.03.25 | No transboundary study of oil pollution threatens the Black Sea coastal ecosystems and the levels of pollution particularly river mouths.  No comprehensive study toxic substances such as pesticides and heavy metals Another major problem have to be studied is the discharge of insufficiently treated sewage waters, which results in microbiological contamination and poses a threat to public health |  |  |  |
| Turkey  METU-IMS  (Ahmet Kideys)  2017.12.11 | Which media and biota members should be sampled for better monitoring? Is it sea surface, water column, sediment and/or biota? What areas should be given priority? This are not known. | In order to understand the efficiency of measures taken, a sound monitoring program is important and hence a clarification of which medium is best for monitoring is needed. | Dedicated studies on these media and biota members (different species of candidate invertebrates –e.g. the mussel Mytilus, fish etc. should be investigated specific to the different regions, considering European level monitoring program within the framework of MSFD. | Although these types of studies are increasing, most of such studies are fragmented and hence a European level coordination would be important to come up with better. |
| Turkey  METU-IMS  (Ahmet Kideys)  2017.12.11 | Investigating temporal trends in sediment samples. | The levels of microplastics from dynamic environment changes a lot and hence it is often difficult to make meaningful evaluations on the trends of microplastics in marine environment. | Investigation of temporal trends in sediment of different regions (inshore-offshore, river mouth-other, populated-non-populated etc) should be studied to understand the distribution pattern of microplastics with respect to water dynamics in longer term periods. | Such studies are very rare from the literature. |
| Turkey  METU-IMS  (Ahmet Kideys)  2017.12.11 | Levels of nanoplastics in marine environment | Nanoplastics could be transferred from the digestive system into other organs organisms and human. | Determination of nanoplastics are difficult in biota and some new techniques should be developed. | It is very important to investigate the toxicological effects of nanoplastics in especially aquaculture species and human. |
| Turkey  METU-IMS  (Ahmet Kideys)  2017.12.11 | Bacterial and fungal decomposition of microplastics | Removal of existing micsroplastics is important from the marine systems. | There are a wide range of needs/opportunities on this respect. | Such studies are not undertaken conclusively. |
| Turkey TUBITAK  2017.09.08 | Common methodology for analysis for marine monitoring is lack in regional level in BS. Monitoring of dangerous substances and measures taken for those substances are very limited in BS region and shall be harmonized. Significant legal, politic and technical gaps in marine litter management in coastal areas. The pollutant loads sourced from point and diffused sources are not defined regularly. |  | Investigation on marime litter pollution and dangerous substances and definition of measures necessary for protection of BS are strictly required in the region. To evaluate existing pressures and effectiveness of the measures taken, pollutant loads shall be monitored regularly. |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | No estimates, counts and monitoring of marine litter,  Especially does not examine the role microplastics |  | Development of a system for monitoring the amount and composition of marine litter in the Black Sea, and its removal by river flow.  Deep studies of the effect of microplastics on living organisms of the Black Sea |  |

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| **R&I Area 12: Marine and Coastal Hazards** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Georgia  IJTSU  (Kakhaber Bilashvili)  2018.01.21 | The main problem of the coastal zone is a beach erosion, coursed 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 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 influence the volumes of river’s load discharges. | 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 sells with corresponding calculation of sediment balance, used, as a base for refulation of beaches under danger). This should help to use existing funds to be used more effectively. | There are number of successful case studies in this field, that can be renewed and include in the process of preservation of stability of beaches. |
| Moldova  IEG  (Tudor Castravet)  2018.01.22 | Cliffs protection and management is equally important. | Geomorphologic hazards (erosion, subsidance, landslides) | Research programs, training opportunities, monitoring programs |  |
| Turkey MEDCOAST  (Erdal Ozhan)  2017.12.07 | Beach protection and management | Beach erosion | Tailored research programs, training opportunities |  |
| Turkey  MoTMC,  DG of Maritime and Inland Water Regulation  2018.03.23 | Projects on oil pollution arising from ships | Oil-polluted shoreline cleanup | Research programs, training opportunities and voluntary based monitoring programs in order to increase the capacity for oil-polluted shoreline cleanup. |  |

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| **R&I Area 13: Seas and Human Health** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.12.08 | Effective management of wastewater effluent is missing, even if there is an advance in upgrading and new WWTP building. An underestimated threat at basin scale is the presence of potentially toxic phytoplankton species, the impacts of phytoplankton blooms on human health. Thre are single cases (Turkey) of beach closure related to the proliferation of toxic jellies. |  | Threre is a need of targeted research of phytoplankton and other species outbreakes on human health even if they originally are of local scale. Application of new methods for species identity (genomics) and monitoring ( remote sensing, drons, argo buys etc) | Addressing this problem is also of economic importance (beach closure), aquaculture bans, human health hazards |
| Moldova  IEG  (Tudor Castravet)  2018.01.22 | Seafood quality management system shall be established along Black Sea coastal areas (molluscs, crustaceans, fish). | Especially on-line public information system should be provided. |  |  |
| Turkey TUBITAK  2017.09.08 | Effective bathing water management system shall be established along BS coastal areas. | The desalination process involves a lot of wastewater whch poses a significant discharge problem both in terms of volume and high salt concentration. The adverse effects of brine are being increasingly recognized, especially on vulnerable sea species such as seagrasses due to their stenohaline characteristics. Posidonia Oceanica is especially sensitive to increases in salinity levels. Brine from seawater desalination facilities, can produce diebacks across large areas in their vicinity. Especialy online public information system should be provided for bathing water for public health. | Need for brine production avoidance/closing the loop of water in the desalination sector. Bathing water quality monitoring and dissemination of results to the public research studies shall be supported by regional programmes. |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Lack of knowledge about toxic species in the phytoplankton and its blooms, and about pathogenic bacteria in the seawaters. |  | Development 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. |  |

**2. KEY SECTORAL ENABLERS IN THE BLACK SEA**

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| **R&I Area 14: Blue Biotechnology** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.12.08 | Very few studies and Projects, only at EU level. |  | Biotechnological applications for the sustainable exploitation of marine biological resources, including prokaryotes protists and algae | The huge potential of marine biological diversity, especially of prokaroytic and protistan 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 |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Lacs in the knowledge of the genetic diversity of deep sea anaerobic prokaryotes, which have large potential for the future biotechnology development | 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 | Using metagenomics and metatranscriptomics methods for the understanding genetic diversity of deep sea microbial communities |  |

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| **R&I Area 15: Deep Sea Mining, Oil and Gas Sustainable Exploitation** | | | | |
|  | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | Very little is known of the oil and gas deposits albeit the few exploration initiatives. | Recent pilot research show the potential to explore H2S as a resourse for alternative energy, as well as the gas hydrates. | Concept to explore alternative resourses of the deep sea is missing along with a strategy for environmental protection. | Potential for new alternative resources |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.12.08 | Very little is known of the oil and gas exploration research in BG waters and Black Sea EEZ, albeit the few exploration initiatives. In the Black Sea recent pilot research show the potential to explore H2S as a resourse for alternative energy, as well as the gas hydrates. |  | Concept to explore alternative resourses of the deep sea is missing along with a strategy for environmental protection. | Potential for new alternative resources |
| Georgia-  TSU  (Kakhaber Bilashvili)  2017.12.08 | An interest on governamental level exists. In recent years "ANADARKO Petroleum Corporation" (US) has been carried out works in Georgian territorial area, but for the reason of unsufficient funding operations were stopped. |  | At present, preliminary negotiatioins are conducted with the leading EU and US companies. In the case of reaching some agreements it is intended to anounce a call for tendering of licensed lots. |  |
| Turkey  METU-IMS  (Devrim Tezcan)  2017.12.09 | In the Turkish EEZ of the Black Sea, Turkish Petroleum Company has been exploring hydrocarbon resources with the support of universities. However as the information are confidential, the access to the data is very limited. |  | There is a huge hydrocarbon exploration capacity in Turkey (Two 3D seismic vessels, plans to buy a drillship) |  |

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| **R&I Area 16: Living Marine Resources (fishery, aquaculture, etc.)** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | 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 understaood. Mariculture is a growing activity, which needs careful management to minimise potential impacts. | Implementation of the principles of a Common Fishery policy for the Black Sea based on trans-boundary collaboration. | Design innovative research programmes with new implementation tools across different scientific fields (acoustics, new engeneering solutions for mariculture)  Link between the fisheries resources and the lower trohic levels and environmental drivers to promote an ecosystem approach to fisheries management.  Development of adequate models. Explore the potential of marine protected areas as an usefull 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 | 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. |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.12.08 |  | Implementation of the principles of a Common Fishery policy for the Black Sea based on trans-boundary collaboration |  | We 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 to management. |
| Georgia-  TSU  (Kakhaber Bilashvili)  2017.12.08 | Overexploitation of fishery resources, that is, the exploitation of commercial fish stock over safe biological limits. There is no effective control mechanism. Absence of sistematic long term monitoring of the southeastern 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. | Absence of sistematic long term monitoring of the southeastern 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. | Unsufficient 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. Inclusion of non-governamental bodies (e.g. NGO-s) can help to strengthen the control on exploitation of the fish stocks. | There are 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 taken into account 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 fish-ing capacity and overcapacity to identify and avoid the structural problem of overcapacity. |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2018.03.10 | Research, data and transparency is lacking in Black Sea fisheries effort and catch landings. | Overexploitation of fishery resources and insufficient national and regional efforts to address the issue through data collection and sharing. | Share openly VMS data, combined with remotely sensed and artificial intelligence methodologies to detect fishing activities and sharing all results with the public via Black Sea pilot scheme of fishing activity detection. | 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. |
| Moldova IEG (Tudor Castravet)  2018.01.22 | Living resources of deltas, lagunas and limans are essential for local communities. | 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. | Absence of effective methodological tools for assessment of degrees of overexploitation. | Local communities are traditionally dependent on local resources |
| Russia  SIO\_RAS  (Tamara Shiganova)  2018.03.25 | 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 | To develop methodology to assess risks and vulnerabilities of fisheries to climate change, non-native species introduction, eutrophication in the Black Sea |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi) | Lack of data about real population sizes and structure, and impact of catching on the population sizes and structure for commercial species;  Lack of real date about rare species undermined by the commercial exploitation |  | For accurate assessment of reserves, new methods of accounting are needed (independent of commercial fishing, scientific fishing, acoustics, DNA methods, population genetics)  Since natural populations of a number of species are significantly undermined, it is necessary to orient aquaculture to the renewal of natural populations (sturgeon, kalkan) |  |

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| **R&I Area 17: Tourism and Surrounding Economy** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Georgia-  TSU  (Kakhaber Bilashvili)  2017.12.08 | Economic development of the world's maritime nations, including Georgia is directly related to the touristic resources of the Black Sea. It shoud be underlined that in coastal territories the medical, health-improving and cognitive recreational zones are overlapped. In number of areas touristic infrastructure is not developed enough to satisfy modern requirements of touristic industry. The duration of touristic season is quite short. Marine touristic cruises is not developed. | Careful approach is needed to ensure that tourism is sustainable and does not exceed the carrying capacity of its environment or deplete natural tourist attractions. This is particularly important in countries, where tourism is a new phenomenon, and the environment is still relatively undisturbed. | Urbanisation process and creation of touristic infrastructure needs more control from authorities, juridical regulations should, also, be sharpened. Modern experiens of international touristic spots should be implemented to prolong duration of touristic season. Recently new initiatives appeared in the marine cruise segment, in particular, to establish cruise route between Odessa and Georgian ports. . |  |
| Moldova  IEG  (Tudor Castravet)  2018.01.22 | Only few projects related to development and impacts of tourism in Black Sea Region. | Is needed to ensure that tourism is sustainable and does not exceed the carrying capacity of its environment. | Developing touristic networks, including infrastructure, on buffer zones and by zonal types. | Most tourists come from the neighbouring regions and countries. |
| Russia  EDIRC  (Sergev  Kovalev)  2017.12.08 | The seasonality of tourism on the Black sea. Undeveloped of cruise and yacht tourism on the North coast, its infrastructure and related business - ship repair, supply of spare parts, bunkering, etc. Undeveloped air and marine transport between neighbouring territories. Uneven development of the production and processing of agricultural and fish products. Weak navigation support approaches to ports, information visits and mooring in the ports, information about events. | To develop a program to reduce the tourism seasonality by development of event tourism and MICE segment, all-season infrastructure of recreation and sport activity, health tourism, entertainment segment, cruise and yacht tourism infrastructure. To develop the programme of promoting national tourist destinations, and its integration to Mediterranean programmes. To create a virtual service about the tourist potential of the region, with the information about the features of the approaches to the ports (video), interactive booking system of mooring, customs and border procedures, information on events, weather, etc. | Analysis of possibilities and needs for the development of event tourism and MICE segment, all-season infrastructure of active recreation and entertainment, infrastructure and related services for cruise and yacht tourism. Analysis of the related legislation of the countries surrounding the Black and Azov seas with the development of proposals for its convergence, the optimization of border and customs procedures. The analysis of existing regional information and navigation systems with the elaborating of proposals on introduction of similar systems in the Black sea. | Regional and related national programs for the development of all-season leisure, yacht and cruise tourism, appropriate infrastructure, related services, information and legislative support. |
| Turkey MEDCOAST  (Erdal Ozhan)  2017.12.07 | Tourism in Black Sea countries should be different than what is offered by the Med countries. | Shorter tourism period and suitability for sun and sea tourism. |  |  |
| Turkey, MoTMC,  DG of Merchant Marine  2018.03.23 | Lack of sustainable cruise tourism services in the Black Sea | The number of passenger transport and cruise activities in the Black Sea is decreasing | Economic sustainability and availability of cruise tourism voyages in the Black Sea ports and İstanbul can be researched in terms of ports of call, suitable ship capacity and passenger potential |  |

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| **R&I Area 18: Marine Renewable Energy** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | There are few studies in BG on the problem of renewable energy from the sea, such as wave energy, gas hydrates, H2S, but they are in a very early (scientific) stage. | We need to work in connection with industry in order to define the way that new technologies could help getting the energy without destroying the marine envrionment. |  | Energy resources based on new technologies. Industry involvment and cutting edge research. |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | The potential of the renewable energy sources of the Black Sea has not been studied or evaluated  Technologies for the use of renewable energy sources for the Black Sea have not been optimized |  | Evaluation and mappingof the renewable energy sources in the Black Sea.  Optimization of the renewable energy technologies for the Black Sea conditions. |  |

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| **R&I Area 19: Maritime Transport** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | There is lack of data in terms of NOxs emissions of ship trafic, also assessment of the effects of various ship trafic impacts on the ecosystem, as one of the major vector of biological invasions and a prevention policy. The BWM Convention will enter into force on 8 September 2017, but its effective impementation will need more time. |  | Research for an envelope of operational and policy measures and practices can provide a sustainable framework for shipping (and for all related actions). | The impact of such a research can be massive for all involved stakeholders in the area of interest; for example for the shipping community, the ports, the refineries and fuel providers, the local residents etc |

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| **R&I Area 20: MSP, ICZM** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | Information is fragmented the implementation of the Directive in Bulgaria is a positive action. |  |  |  |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2017.12.07 | 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 is lacking in non-EU Black Sea countries, limiting prospects for MSP at area specific, national and common Black See Basin level. | Establish common MSP methodology at national and regional levels e.g. through transboundary pilot schemes and common methodology for the Black Sea Basin. | There is a need to extend EU experience with MSP into non-EU littoral countries and in harmonisation with EU member Black Sea countries. |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2017.12.07 | No SEA expertise and framework exists for assessment of MSP strategic impacts. | MSPs under development in EU- Member littorals countries and potential pilot schemes in non-EU countries and ultimately Black Sea Basin wide MSP would require assessment of strategic impacts. | Develop compact, comprehensive and commonly agreed SEA guidelines for area-specific (sub-national), national, as well as the Black Sea Basin-wide regional MSPs. | SEA is mandatory in some countries and not required statutorily in other Black Sea countries. Challenge would be to provide common SEA framework for eventual MSPs at all levels of application (sub-national, national basin). |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2017.12.11 | 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 is lacking in non-EU Black Sea countries, limiting prospects for MSP at area specific, national and common Black See Basin level. | Establish common MSP methodology at national and regional levels e.g. through transboundary pilot schemes and common methodology for the Black Sea Basin. | There is a need to extend EU experience with MSP into non-EU littoral countries and in harmonisation with EU member Black Sea countries. |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2017.12.11 | No SEA expertise and framework exists for assessment of MSP strategic impacts. | MSPs under development in EU- Member littorals countries and potential pilot schemes in non-EU countries and ultimately Black Sea Basin wide MSP would require assessment of strategic impacts. | Develop compact, comprehensive and commonly agreed SEA guidelines for area-specific (sub-national), national, as well as the Black Sea Basin-wide regional MSPs. | SEA is mandatory in some countries and not required statutorily in other Black Sea countries. Challenge would be to provide common SEA framework for eventual MSPs at all levels of application (sub-national, national, basin). |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2017.12.11 | Lack of Black Sea wide conference or forum in support of research in MSP. | There is a need of regularly functioning international conference series promoting research aspects MSP in the Black Sea. | Establish policy research in MSP as the separate theme or integrated with ICZM within the framework of the Black Sea Scientific Conferences organised biannually by the Black Sea Commission, complemented by the MSP thematic promoted by biannual Medcoast ICZM conference series. | Medcost ICZM conferences are long established as major biannual conference in the Med and Black Sea regions.  If organised consecutively with Medcoast, Black Sea Conference Series of the BSC could provide opportunities for annual gathering for ICZM and MSP practitioners. |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2017.12.11 | 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](http://www.blacksea-commission.org/Downloads/Black_Sea_ICZM_Guideline/Black_Sea_ICZM_Guideline.pdf), which provides roadmap for implementation and requires multifaceted support including with ICZM research and innovation. | 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. | 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. |
| Russia  EDIRC  (Sergev  Kovalev)  2017.12.08 | National MSP's have different priorities and methodological approaches. This will create difficulties for the development of common Azov and Black sea MSP | To establish a working group to analyse the national legislation on MSP and to develop proposals for convergence of their priorities, methodological approaches, the list and formats of the sources and the outputs of MSP. | It is necessary to analyse 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. The establishment of MSP Working group, the discussions on peculiarities of national legislations in the field of MSP and the development of the recommendations for their convergence. | National programs to improve the ecology of the sea and of the sea uses, programs of the development of the Blue economy and of the creation of conditions for comfortable living and recreation on the coastal areas should be developed in the frame of common goals and priorities in order to increase opportunities for the entire Black Sea MSP. The creation of the international MSP Working group, discussions on the specific of national legislations facilitate the development of recommendations for their convergence. |
| Turkey MEDCOAST  (Erdal Ozhan)  2017.12.07 | There are not much opportunities for research in both Integrated Coastal Management (ICM) and MSP. The main gaps in both issues are capacity building (national and regional) and regional collaboration. | The capacities (institutional and human resources) for ICM and MSP in majority of the BS countries are not adequately developed. Opportunities for regional exchange of experience in ICM and MSP are scarce. | University degree programs in Integrated Coastal and Marine Management (including MSP) would be valuable. Tailored training programs similar to MEDCOAST Institute would help capacity building in human resources. Networking at regional level among de-centralized institutions of BS countries, creation of experience sharing opportunities (joint projects, regional conferences) would help. |  |
| Turkey  METU-IMS  (Devrim Tezcan)  2017.12.09 | There is no MSP application in Turkey.  Along to the Turkish coast of the BS, a few cities have ICZ plans, but they should be combine with MSP. | EC Maritime Affairs: 2021 is the deadline for the establishment of maritime spatial plans | A MSP regulation compatible with the other countries in the Black Sea is needed.  Opptn:  METU is supported to prepare a pilot MSP project to provide info to the ministries for the regulation. |  |

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| **R&I Area 21: Operational Oceanography/Observing Systems and Monitoring** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Turkey  METU-IMS  (Suleyman Tugrul)  2017.12.07 | Limited systematic data are available on BS chemical inputs to the Marmara upper layer and Bosphorus under flowregime to estimate their impacts and contributios to the Marmara nutrient and organic matter budgets as well as the ventilation of BS suboxic/anoxic waters and water exchange rates in the Boshorus | For the estimation of Marmara N, P, TOC budgets and assess long-term trends in the natural (Black Sea/Marmara exchange fluxes) and land-based inputs, the reliable data on the BS inputs are essential. | New observation systems should be deployed in the Boshorus Exits and at least monthly monitoring in the exit regions and along the Bosphorus are needed |  |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | Recently there is an advance of operational oceanography in Black Sea (Black Sea GOOS) and Black Sea Argofloats as a component of the global initiatives. Through several projects a number of Argo floats have been deployed, in some countries ferrybox system are in operation, but their spatial and temporal coverage are limmited. The image analysis techniques are still not efficient especially for biochemical assessments due to the lack of unified algorythms (although this is a field of recent very active research). While the aquisition of on-line data of physical and dynamic parameters marked a substantial progress, generating data on the biochemical properties of the ecosystem are lagging behind. Biogeochemical measurements through the operational oceanography platforms are rare | The Black Sea open sea marine ecosystem is largely driven by the position of the halocline and the CIL that govern the productivity of the water column. Although the general patterns are known the role of the quasipermanent gyres are largely not studied. The absence of systematic monitoring in the shelf and open sea results to the lack of information regarding the seasonal and interannual variability of important processes, such as the intermediate or deep water formation that affect the hydrodynamic regime of the entire basin. Furthermore, the lack of systematic real-time information regarding the marine environmental conditions affects the skill of the existing basin-scale forecasting products, such as the Copernicus MCS Black Sea hydrodynamic forecasting service. The lack of biogeochemical component in the recorded processes imposes a serious gap in the understanding of the water column processes, since the recorded physical parameters cannot be linked with the ecosystem functioning.There is a lack of capacity for ecosystem modelling. | Integrated and coordinated effort at Black Sea scale through the use of several operational oceanography platforms (moorings, profilers, ferry boxes, gliders, ships of opportunity). 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. | Investment at EU level as this effort exceeds national capabilities. Only at such level the observation of large scales within the Black Sea is possible. Strengthening the biogeochemical component of the operational oceanography infrastructure in the Black sea will provide for the crutial linking of the different water column processes and give a clear picture of the long-term effects of the climate change in the marine environment |
| Bulgaria  IO-BAS  (Snejana Moncheva) – 2017.12.08 | Recently there is an advance of operational oceanography in Black Sea (Black Sea GOOS) and Black Sea Argofloats as a component of the global initiatives. Through several projects a number of Argo floats have been deployed, in some countries ferrybox system are in operation, but their spatial and temporal coverage are limmited. The image analysis techniques are still not efficient especially for biochemical assessments due to the lack of unified algorythms (although this is a field of recent very active research). While the aquisition of on-line data of physical and dynamic parameters marked a substantial progress, generating data on the biochemical properties of the ecosystem are lagging behind. Biogeochemical measurements through the operational oceanography platforms are rare | The Black Sea open sea marine ecosystem is largely driven by the position of the halocline and the CIL that govern the productivity of the water column. Although the general patterns are known the role of the quasipermanent gyres are largely not studied. The absence of systematic monitoring in the shelf and open sea results in the lack of information regarding the seasonal and interannual variability of important processes, such as the intermediate or deep water formation that affect the hydrodynamic regime of the entire basin. Furthermore, the lack of systematic real-time information regarding the marine environmental conditions affects the skill of the existing basin-scale forecasting products, such as the Copernicus MCS Black Sea hydrodynamic forecasting service. The lack of biogeochemical component in the recorded processes imposes a serious gap in the understanding of the water column processes, since the recorded physical parameters cannot be linked with the ecosystem functioning.There is a lack of capacity for ecosystem modeling. | Integrated and coordinated effort at Black Sea scale through the use of several operational oceanography platforms (moorings, profilers, ferry boxes, gliders, ships of opportunity). 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. | Strengthening the biogeochemical component of the operational oceanography infrastructure in the Black sea will provide for the crutial linking of the different water column processes and give a clear picture of the long-term effects of the climate change in the marine environment and contribute for sound evidence based adaptive management |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2017.12.11 | To facilitating the regular observation of the state and evolution of coastal zones, the Black Sea region and coastal countries need to set out process of regional and national inventories of coastal data in agreed format. | Recently approved [Guideline on ICZM in the Black Sea](http://www.blacksea-commission.org/Downloads/Black_Sea_ICZM_Guideline/Black_Sea_ICZM_Guideline.pdf) identifies need in coastal observation and monitoring mechanisms and networks as one of the key action areas in the region. | The Black Sea region and countries to make use of and strengthen existing appropriate mechanisms for monitoring and observation, or create new ones if necessary. To prepare and regularly update national inventories of coastal zones, covering information on resources and activities, as well as on institutions, legislation and planning that may influence coastal zones. | Purpose of these measures taken by the Black Sea countries would be to improve governance systems, as well as to ensure public access to the information derived from monitoring and observation mechanisms and networks. |
| Georgia  IJTSU  (Kakhaber Bilashvili)  2018.01.21 | The state of infrastructure is not sufficient to meet the requirements of MSFD to lead not only routine, but including non-traditional measurements, such as contamination of biota and sediments, marine litter, noise, habitats mapping, etc. Important part of the Infrastructure are the marine stations and platforms. In Georgia there are none. | There are two main sources of oceanographic data in Georgia, as follow: data collected under the state funded National Environmental Agency (NEA) of the Ministry of Environmental Protection of Georgia, which is a leading holder of marine data and acting on partly commercial base.  NEA is carrying out from 2006 permanent monitoring of the Black Sea environment with the frequency from 2 to 4 sampling per year (number of stations from 3 to 5 and number of parameters from 10 to 12 , Surface/ 20 m Depth). More permanent observational (presumebly, coastal) modules/stations are under implementation.  Another source of data are scientific projects (e.g. PERSEUS, SDN 1/2/3, EMODNET1/2/3, Data Ingestion and EMBLAS), funded by external donors (e.g.EU FP, UNDP etc.). The data from projects are mainly preserved by three organizations. Those are: NEA, IODE/IOC Associate Data Unit - ADU at Tbilisi State University and S/R Firm GAMMA Ltd. All of them operate the special servers for data management, are the part of SeaDataNet productive system and acting under the SeaDataNet License.  All data is available on SeaDataNet portals transformed in CDI ODV files.  Recently (from 2015), joint observations on Marine litter (beach, riverrine, floating) has been carried out by Tbilisi State University and S/R firm GAMMA (within project EMBLAS). | The process of gradual implementation of MSFD approach need to strengthen capacity of operational observation infrastructure. Elaboration of national monitoring prgrammes, which is under way, presumably, should force governamental monitoring organizations to take steps due.  Beside that, there are number of scientific institutions, which perform observations or collect Black Sea data. Private organizations, which have also capacities for monitoring, are not included into the monitoring process, though have in possession equipment and vessels.  The regional forecasting system is based on a high-resolution 3-D regional prognostic model of the Black Sea dynamics developed at the Institute of Geophysics (TSU-IG, Georgia). The regional prognostic model with 1 km grid step, which is based on a primitive equation system of ocean hydrothermodynamics in hydrostatic approximation, is nested in the basin-scale model (BSM) of the Black Sea dynamics of Marine Hydrophysical Institute (MHI, Sevastopol) with 5 km grid step. Numerical algorithm is based on the splitting method applying with respect to physical processes and geometrical variables. | Concerning the implementation of requirements of EU-Georgia Association Agreement (see Annex XXVI – Environment), the main guiding document regarding the marine environment is The Marine Strategy Framework Directive – MSFD which came into force on July 15, 2008. One from the priorities of the new European strategy is dissemination of the activities set in the Directive on regional and sub-regional level (including the Black Sea region), taking into consideration existing international conventions and documents ( e.g. Convention of Protection of Black Sea from Pollution, Black Sea strategic action plan, 1996, renewed in 2002; Black Sea Integrated Monitoring and Assessment Program (BSIMAP for 2017-2022) was adopted at the regular meeting of the Black Sea Commission in October, 2016“.  Following the European model of the development of economics and employment the government of Georgia issued - “Social-economic strategy of development of Georgia- Georgia 2020”, where main principles of “Blue Economics” and its marine component “Blue Growth” were shared, including the necessity of integration of educational and research processes and activities, based on innovations. |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2018.03.10 | Need for innovative instruments to integrate various sea, coast and catchment observing systems within common user-friendly intuitive operational environment.  (NB: same as provided above under **R&I Area 3: Catchment-Coast-Sea Interaction**) | 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. | 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. | Implementations experience available by UNEP/GRID-Geneva to demonstrate Data Cube tools in Black Sea areas, such as in Georgia (also covering part of neighbouring Turkey) and in Moldova, showing great potential both landward and Seward tools. |
| Georgia Institute of Geophysics (Demur Demetrashvili)  2018.03.10 | In conditions of increasing anthropogenic load development and improvement of the coastal forecasting system for the Georgian coastal area is very important and actual. At present coastal forecasting system based on a high-resolution regional model of the Black Sea dynamics and 2D and 3D impurity’s transport models is developed but forecast of wind driven surface waves is missing. Besides, we need very high-resolution forecasting subsystem for Batumi-Poti-Anaklia coastal zone, which undergo more intensive anthropogenic load. | Black Sea plays a role of a transport corridor for transportation of oil and other products from the East to the West. Through the  Georgian sector of the Black Sea passes the international transport corridor TRACECA (Transport Corridor Europe-Caucasus-Asia) and in the coming years more intensive transportation is expected. This year the construction of the Deep Sea Port of Anaklia begins in the Georgian coastal zone, which would become the largest port in the eastern part of the Black Sea.  The port of Anaklia would significantly increase the Black Sea transport function and, accordingly, an anthropogenic pressure on the Georgian sector of the Black Sea. It is obvious that this fact creates a serious threats to the sea ecosystem. | Nowadays the coastal forecasting system, which is one of the parts of the Black Sea basin-scale nowcasting/forecasting,  Provides 3 days’ forecast of main hydrophysical fields – the current, temperature and salinity with 1 km spacing in the Georgian sector of the Black Sea and surrounding water area, but in accidental situations also the forecast of spreading oil and other polluting substances.  Further improvement of the forecasting system is connected with inclusion into the system the model of forecast of wind-induced surface waves.  In addition, there is needed to develop a new very high-resolution coastal forecasting system for Batumi-Poti-Anaklia coastal area (with grid steps 200-250 m), which would be a part of the already existing forecasting system. | The forecasting system could provide input not only into the monitoring and research, but could serve as strong forecasting backbone for the Joint Maritime Operations Centre of Georgia based at Supsa and into the wider safety and security network of the Black Sea countries. |
| Turkey MEDCOAST  (Erdal Ozhan)  2017.12.07 | Very few measurements of wind waves along the BS coast, improved operational wave forecasting | Reliable wave forecasting and climate data are needed for almost all sectors of Blue Economy, including marine transportation, fisheries, cruise tourism | A coordinated system of continuous wave measurements at selected locations along the BS coast. This could be a regional project. Networking and collaboration among the meteorological offices of the BS countries. |  |
| Turkey  METU-IMS  (Devrim Tezcan)  2017.12.09 | Common cruises are needed | Recent open sea data are insufficient | METU is planning to perform several cruises in the Turkish EEZ of the Black Sea using Scanfish to get high resolution continuous | The other countries can perform cruises at the same periods. |
| Turkey  METU-IMS  (Devrim Tezcan)  2017.12.09 | Continuous fixed monitoring systems | Only a few mooring systems exist in the Black Sea. | METU is planning to deploy an oceanographic / meterological mooring system on the shelf off the Sinop Peninsula  Needs: But more mooring system are needed to monitor all  -  Turkish Met Office is planning to deploy 5 meteorological buoys along the coast of the Turkey. | METU has the experience to deploy and maintain the mooring systems |
| Turkey  METU-IMS  (Devrim Tezcan)  2017.12.09 | Time Series | To monitor the chemical and biological parameters | METU supports some local institutes in Black Sea to make time series measurements but a larger support mechanism is needed to perform time series. |  |
| Turkey TUBITAK  2017.09.08 | Harmonized monitoring programs including similar frequency, parameters (hydromorphological, biological, chemical, and phsicochemical), environmental quality standards, matrices and analysis methods shall be defined in the level of BS Region. | Evaluation of pollution monitoring results in the regional level is very challanging issue because of the different type of data from diffent BS countries. | Definition of effective marine monitoring strategy and programme at the regional level is reqired. |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | There is no system of operative oceanography, there are no online databases, there are almost no ferry-boxes and other automatic oceanographic monitoring systems |  | Development of the ferry box network.  Creation of an international database of operational oceanography of the Black Sea (Black Sea GOOS).  Creation of special ARGO buoys for monitoring the dynamics of deep hydrogen sulphide.  Development of smart buoys network (including eutrophication and hypoxia determining in the operational mode) in the coastal areas of the Black Sea. |  |

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| **R&I Area 22: Socioeconomic & Policy Research** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 | Policies need to be developed based on results from idicators for the WFD and MSFD. Targets for achieving the GES are missing as well as an efficien cooperation between the socio-economic and environmental science. |  | Design of Integrated monitoring system by combining traditional monitoring, observing systems and models. 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. |  |

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| **R&I Area 23: Training & Technology Transfer** | | | | |
|  | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Bulgaria  IO-BAS  (Snejana Moncheva)  2017.09.02 |  |  | Training is critical elemet both for research capacity and management. Capacity Building and Technology transfer is needed in Bulgaria but also for the whole Black Sea In almost all fields of research in order to achieve a better understanding of the Black Sea ecosystem and implement scientifically based adequate management strategies. |  |
| Georgia-  TSU  (Kakhaber Bilashvili)  2017.12.08 |  |  | More intensive targeted trainings, consultations, joint expeditions etc. are needed to accelerate process of preparation of ground for implementation of MSFD and WFD. Besides state monitoring and authorised bodies, trainings should cover personnel from universities, institutons, NGO, SME, as well. |  |
| Georgia  ICZM National Focal Point  (Mamuka GVILAVA)  2017.12.11 | Lack of permanent MSP training and capacity building facility in the Black Sea region. | Experience with ICZM Medcoast training series, which educated numerous managerial and decision-making capacity in the region could serve excellent model for MSP. | Need in regional MSP training facility, utilising experience existing in the region. | Medcoast first edition of training in MSP with EU supports complements its ICZM capacity. |
| Russia  EDIRC  (Sergev  Kovalev)  2017.12.08 | 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. | Mutual improvement of training programs in applied sciences and professions by investigation of training programs of the participating countries, their expert evaluation and recommendations for improvements, creating the "ideal model" of coordinated national and transnational training programs for different specialities. | To coordinate the training of specialists of related specialties; use the exchange of students and teachers programs. To establish a unified minimum requirements for the training programs for specialists of similar professions and minimum requirements for their certification. | Regional program for the coordination of educational process of training specialists in applied science and professions, development of recommendations and proposals on the possibility of their mutual recognition. |
| Turkey MEDCOAST  (Erdal Ozhan)  2017.12.07 | Very few training opportunities in several sectors of Blue economy. Thoughts provided for ICM and MSP applies to this area as well. | Similar to MSP, ICZM R&D Area.  De-centralized networking would help technology transfer. | Similar to MSP, ICZM R&D Area |  |
| Ukraine  (Viktor Komorin & Evgen Dykyi)  2018.01.29 | Under-utilized potential of aquaculture, especially of the offshore aquaculture.  The potential of the renewed energy of the Black Sea is not used at all. |  | Transfer aquaculture technology from Mediterranean to Black Sea.  Transfer of renewable energy technologies from Northern to Black Sea. |  |
| **R&I Area 24: Other/Multiple areas** | | | | |
| **Country** | **Identified Gaps** | **Justification** | **R&I Needs/Opportunities** | **Justification** |
| Russia  EDIRC  (Sergev  Kovalev)  2017.12.08 | Implementation of national programmes for the development of the Blue economy, compiled without influence of neighboring countries can lead to excessive ecological load on the Black sea. | To develop a Strategic environmental assessment for the whole of the Black sea taking into account the development of Blue economy of coastal countries | Mutual coordination and correlation of programs of the Blue Growth of the Black sea coastal countries. To elaborate a criteria and appropriate parameters (indicators) of the ecological status of the sea waters | The program of monitoring of human activities and pressures, the environmental health of the Black sea and development of recommendations on mutual improvement of national programes for the development of the Blue economy |