|  |  |  |  |
| --- | --- | --- | --- |
| Pillar 1 - Addressing fundamental Black Sea research challenges | | | |
| Main Goal | **Action** | **Actor(s)** | **Milestones** |
| Developing innovative multi-disciplinary research, building on existing initiatives, including data sharing mechanisms that will generate the knowledge needed to increase ecosystems resilience | Research into innovative, integrated data sharing/observing system methodologies, (combining ecology and social data) using/building on on existing networks | Universities, Institutes, Black Sea Network, Ministries, Navy Oceanographic Offices, UNEP, Projects such as SeaDataCloud. | Short Term |
| Fill gaps in understanding the Black Sea ecosystem dynamics, biogeographic patterns, biodiversity, and ecosystem functions (including fishing resources) and potential impacts of aquaculture | National authorities, funding agencies, Black Sea Commission and its subsidiary bodies, FAO, EU, GFCM | Short/Medium Term |
| Develop the Regional/ specific to Black Sea Open Knowledge Base on multi-disciplinary research of the Black Sea and employing existing platforms | Universities, Black Sea Commission, Ministries, EU | Medium Term |
| Socio-economic research  focusing on coastal communities (including stakeholders) to understand how they drivers of marine environmental transformations single system - systems approach | BSEC, Research Institutes, Port authorities, municipalities, Union of Black Sea Municipalities, CPMR, Black Sea Network of NGOs, Maritime Clusters, National Statistical Institutes | Short/Medium Term |
| Interdisciplinary research on ecosystem function of deep part of the Black Sea including bottom sediments | Research Institutes, Offshore Industry, EU Research Institutions, Ministry Of Energy, Environment, Foreign Affairs, EU Bank Reconstruction and Development, UNDP, European Research Centers that has capacity for deep-sea research | Short Term |
| Develop novel Methodology on fast and better identification of non-native species and harmful invasive species | Research, maritime sector | Short Term |
| Preparation of joint calls to implement the themes. This must be put in connection with the other Pillars (to promote also innovation, make best use of present and future research facilities and run educational and training programmes | R&I Agencies, Ministries of Research, EU | Short Term |
| Increase ecosystem resilience knowledge, via an improved understanding of specific Black Sea features such as Rim current dynamics, mesoscale (fronts, eddies, vertical upwelling), suboxic zone anoxic layer in the Black Sea and its roles in nutrient fluxes, productivity and fisheries | Universities, Marine Institutes, Funding agencies, Space Agencies, Ministries | Short/Medium Term |
| Providing new knowledge to mitigate the impacts of global climate change and the multiple environmental and anthropogenic stressors in the Black Sea from land-sea interface to the deep basin. | Improved quantification of sources of natural and anthropogenic inputs across different Black Sea interfaces | All actors, DG Environment etc. | Short/Medium Term |
| Improved understanding of inputs from maritime activities | Ports, Maritime Agencies, Space Agencies, EU Safety Security at Sea,  Research Infrastructures | Short/Medium Term |
| Develop policy research on ICZM/MSP and on the interaction between land-based and sea-based activities and their impacts on coastal zones, both landward and seaward. | Black Sea Commission, Universities, Municipalities, NGOs | Medium/Long Term |
| Establish research on coastal hazards (erosion and geomorphological research and connections with climate change | Scientific Institutes, European Intuitions, Funding Agencies, municipalities, Ministries | Short/Medium Term |
| Understand the genesis and natural evolution of the Black Sea basin | Institutes, Global Institutes, IODP, IOC, Funding Agencies |  |
| Reveal the interactions between multiple stressors and marine ecosystems by developing novel evolutionary modelling and data analyses tools    Assess the relationship between biodiversity and ecosystem functioning under the influence of previously unprecedented combinations of multiple-stressors.    Demonstrate how adaptation and evolution may change ecosystem response to changing stressors (e.g. global warming, fisheries) with strong implications towards decreasing the uncertainty of climate models and key services the ecosystem provides. | National Institutes, European Research Centers, research infrastructures, global and regional observing systems | Short/Medium Term |

|  |  |  |  |
| --- | --- | --- | --- |
| Pillar 2 - Developing products, solutions and clusters underpinning Black Sea Blue Growth | | | |
| Main Goal | **Action** | **Actor(s)** | **Milestones** |
| Supporting marine and maritime research and innovation domains of all the Black Sea countries to create synergy, increase economic benefits, reduce hazards in service of prospering, resilient and empowered communities deriving interest from the Black Sea basin | Strengthen the synergy between science, industry and policymakers | Regional: BSEC, BSC etc.  National: line-ministries: -environment, transport/ communication, energy, education/science, fisheries, economy/sustainable development, tourism, industries, local authorities, NGOs, financial agencies. | Medium Term |
| Develop mechanism of integrated management based on circle ‘data – plan – management – monitoring’ in order to achieve Good Environmental Status |  |  |
| Create and/or reinforce existing inter-sectorial arrangements, i.e. between BSEC and BSC, line-ministries |  |  |
| Increase industry/academia programs/projects |  |  |
| Define geological features located near shore and offshore, their evolution through time and their realizing factors potentially generating geo-hazards that cause risk to coastal and offshore infrastructures and population |  |  |
| Promoting the circular economy principles and incentives among the businesses and infrastructure providers |  |  |
| Foster joint initiatives and translational actions, roadmap for joint proposals |  |  |
| Creating incentives for maritime innovation in existing sectors such as transport, fisheries and tourism and development of emergent blue economy sectors | Energy – establishing of renewable energy sectors such as offshore wind and tapping the potential of sustainable gas hydrates exploration |  | Short/Medium Term (Mapping/State-of-play)  Medium Term  (Science and industry) |
| Marine food – developing sustainable fisheries and high-tech aquaculture including multi-platform use | Science and fisheries bodies/enterprises | Medium Term |
| Biotechnology – deriving high-value novel products from organisms inhabiting unique habitats of the Black Sea   * Identifying the Black Sea invertebrate and primitive vertebrate biodiversity using DNA bar-coding technique. * If necessary creating new barcode gene/genes for better resolution. * Working on their stem cell and regeneration potential using whole body regeneration experiments, siRNA and CRISPR techniques. | Science and industry | Medium/Long Term |
| Promote synergies between tourism and other productive activities (e.g. fishing tourism, marine mammals watching, aquaculture and tourism) |  |  |
| Development of second generation of biofuel reactors (using algae as raw material) as plans to control and reduce the effects of algal blooms |  |  |
| Dedicated basin-scale programs for the safe and sustainable exploration, prospecting and exploitation of the natural resources, mainly gas-hydrates |  |  |
| Program to harness the marine energy (waves, currents), especially in synergy with coastal protection plans |  |  |
| Development of a revolutionary navigation system, with ships promoting carbon efficiency, and with safety measures well incorporated |  |  |
| Abiotic Marine Resources – mapping and understanding the value of abiotic marine resources, sustainable exploitation means with no major negative impact assessment (e.g. material for beach artificial nourishment, etc.). |  |  |
| Sustainable and green maritime shipping |  |  |
| Development of mechanisms for joint work academia and industry in funding schemes that promote innovation at the basin scale but also respect the principles of public funding  - open data vs. competitiveness principle of private companies  - IPR differences in the Black Sea Basin countries – and means to reach agreements and collaboration plans |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Pillar 3: Building of critical support systems and innovative Infrastructures | | | |
| Main Goal | **Action** | **Actor(s)** | **Milestones** |
| Development of smart observing and monitoring systems and assessment frameworks towards governance for a sustainable ecosystem, mitigation of climate change impact, and accurate forecasting for adaptive management | Develop a network of dedicated Marine Research Infrastructures at the Black Sea basin-scale, building on existing European and international initiatives (EMSO, DANUBIUS-RI, EURO ARGO – as RIs, GOOS and IOC international initiatives). |  |  |
| Produce and make available compatible high-quality data sets (from all aspects of coastal and marine research e.g. biology, geology, physics, chemistry etc) at the Black Sea basin scale. |  |  |
| Adopt data sharing principles and best practices (FAIR: Findable, Accessible, Interoperable, Reproducible) particularly for time-series data |  |  |
| Establish an updated monitoring and forecasting (modelling) infrastructure network at Black Sea scale |  |  |
| Promote technology development and innovation |  |  |
| Implementation of existing best practices and latest achievements in science and technology to develop a harmonized set of working methodologies, standards and procedures on all aspects of coastal and marine research (provision of compatible data, information and knowledge at the sea-basin level) | Provide harmonized outputs from monitoring and research infrastructures to coastal/marine plans/assessment frameworks for e.g. ICZM and MSP for decision and policy makers, such as the Black Sea Commission and national decision makers |  |  |
| Establish common MSP methodology at national and regional levels e.g. through transboundary pilot schemes and common methodology for the Black Sea Basin |  |  |
| Developing new marine based technologies by harnessing the fourth industrial revolution for the Black Sea to promote safe and sustainable economic growth of the marine and maritime sectors, the conservation and valorisation of marine cultural heritage | Identify of key technologies and innovations required for the Black Sea monitoring and research |  |  |
| Identify solution providers and best practices for development and use of key marine technologies and ICT |  |  |
| Development of tailor-made technologies where appropriate |  |  |
| Support the development of coherent basin-scale programmes for the discovery and valorisation of the common cultural heritage and history (coastal ancient to modern archaeological sites, wrecks, etc.) |  |  |
| Mechanisms to create, support and promote start-ups oriented towards the circular and blue economy in the Black Sea region | Establish Open Transnational Service and Access initiatives to research infrastructures and networks (e.g. TNA, VA, SA) |  |  |
| Define common open data and infrastructure access rules between all Black Sea countries to support the creation and promotion of start-ups oriented towards Blue Growth |  |  |
| Support development of marine and maritime clusters in the Black Sea to promote start – up Blue Growth activities in the region |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Pillar 4: Education and capacity building | | | |
| Main Goal | **Action** | **Actor(s)** | **Milestones** |
| Supporting formal and informal learning, education, training and utilization and transfer of technologies and knowledge for established and new marine and maritime jobs | Establish consortia of Universities / Marine Education Centers to develop new programs and coordinate existing ones (syllabus and curricula) to support and implement priorities defined in SRIA | Universities, Training Organizations, regional and national authorities/government | Short Term |
| Introduce training/re-training of specialists in Integrated Coastal & Marine Management for various levels of education | Ministries of Education/ Research, Universities, Training Organizations/private sector | Short Term |
| Nurture a Black Sea cultural / scientific identity, through dedicated education and work stage programmes in all fields of research and Blue Economy | Ministries of Education/Research, Universities, Training Organizations/Private sector | Short Term |
| Design and implement:   * Dedicated Master, PhD and postdoctoral Programmes for future researchers and professionals in all fields of Blue Growth; create a distributed marine graduate school; * Life-long learning programmes | Universities, Training Organizations/private sector, government departments | Short Term |
| Facilitate the best use of existing infrastructures (including those for education and research). | Ministries of Education, Universities, Training Organizations, responsible for infrastructures | Short Term |
| Promoting digital literacy (e.g. e-learning environments) as an essential component of education in all fields of Blue Growth. | Universities, Training Organizations, public and private training centres | Short Term |
| Promote mentoring and training for new start-ups (e.g. entrepreneurship, etc) in blue economy at local/regional levels. | Universities, Training Organizations, Business Community | Short Term |
| Promoting educational and vocational youth mobility related to the blue economy among the countries in the Region | Supporting students and graduates to gain practices and undergo apprenticeships at businesses and institutions active in blue economy | Universities, Training Organizations,  Business Community | Short Term |
| Promoting young researchers to start or widen their research with elements of the blue economy | Universities, Training Organizations | Short Term |
| Create/Raise awareness on Erasmus+, Marie-Curie Sklodowska type and other mobility programs (e.g.; EURAXESS portal, etc.) | National ERASMUS+ Secretariats , Horizon 2020 contact points, Universities, Training Organizations | Short Term |
| Empowering ocean-engaged citizens and policy makers, contributing to a clean, plastic free, healthy and productive Black Sea | Promote awareness about importance and relevance of the coast and sea through targeted events and campaigns | Universities, Training Organizations, Business Community, Local Authorities, NGOs | Short Term |
| Facilitate the exchange of best practices to promote environmentally friendly attitudes and behaviours | Universities, Training Organizations, Business Community, Local Authorities, NGOs | Short Term |
| Implement Citizen Science in the Blue Growth of the Black Sea | Universities, Training Organizations, Business Community, Local Authorities, NGOs, Social Media and communication specialists, Parent and consumer associations, sport clubs etc. | Short Term |
| Contributing to enhanced science policy dialogue in formulating costal and marine policies and programs | Train policy and decision makers as regards marine and coastal zone environment issues | Ministries of Education, Universities, Training Organizations | Short Term |
| Support joint regional/national training/awareness raising/outreach activities towards the implementation of Marine and Maritime EU and national policies | Universities, Training Organizations | Short Term |
| Celebrate the importance of the Black Sea basin and organize various events as ocean days/marine research nights to promote the Black Sea basin | Universities, Training Organizations, Business Community, Local Authorities, NGOs | Short Term |
| Launch initiatives such as Black Sea Ambassadors, brand this initiative around the Black Sea Basin | Universities, Training Organizations, Business Community, Local Authorities, NGOs, social media and communication specialists | Short Term |