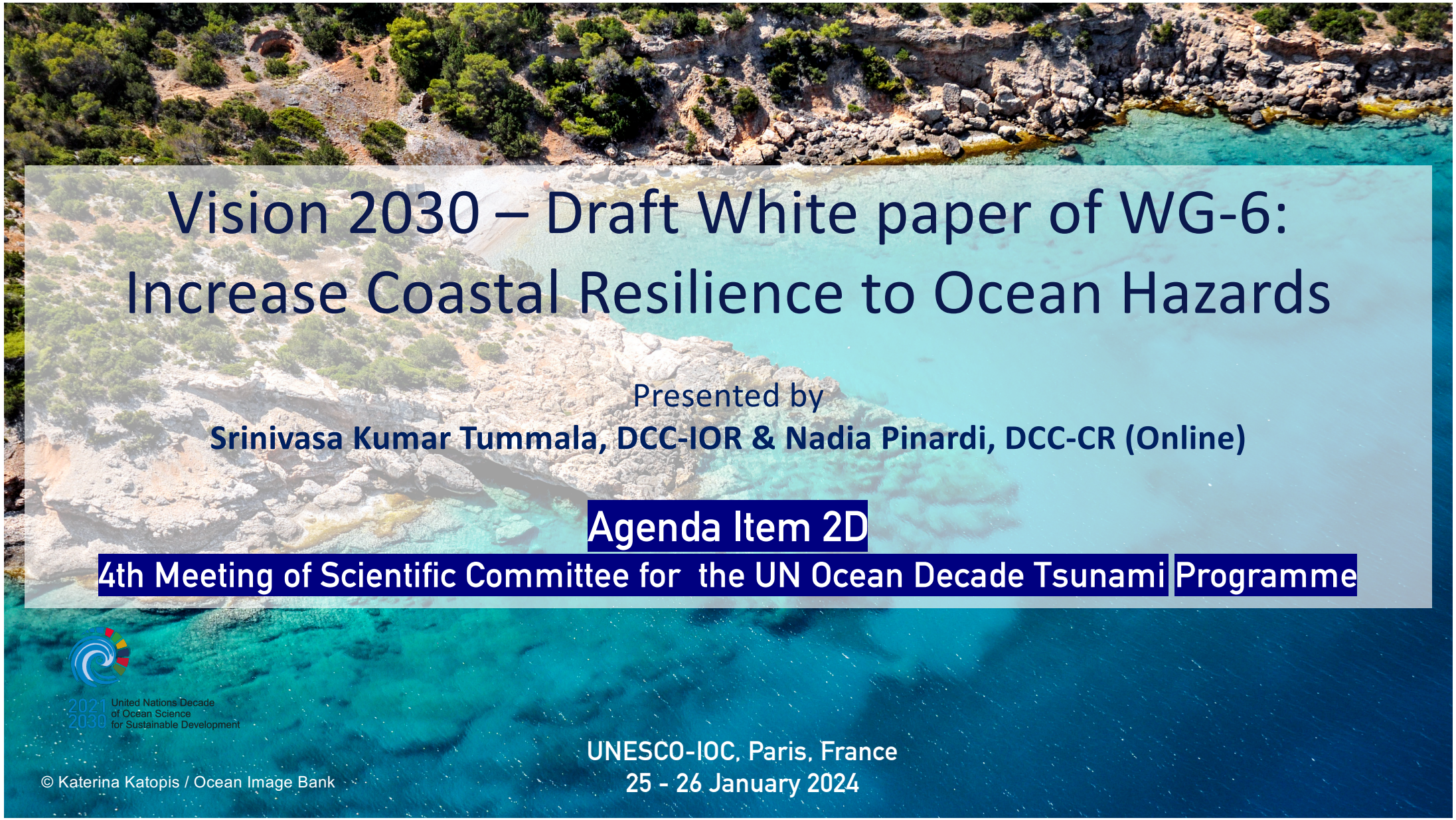


Vision 2030 – Draft White paper of WG-6: Increase Coastal Resilience to Ocean Hazards

Presented by

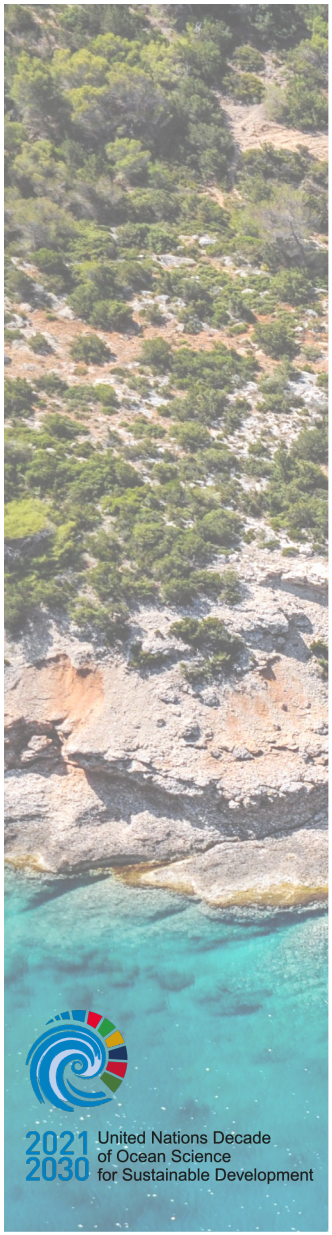
Srinivasa Kumar Tummala, DCC-IOR & Nadia Pinardi, DCC-CR (Online)

Agenda Item 2D

4th Meeting of Scientific Committee for the UN Ocean Decade Tsunami Programme

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

UNESCO-IOC, Paris, France
25 - 26 January 2024



Coastal Resilience?

Challenge 6 of the Ocean Decade aims at enhancing people-centered multi-hazard early warning services and adaptation planning for all geophysical, ecological, biological, weather, climate, and anthropogenic related ocean and coastal hazards, and mainstream **community preparedness and resilience** (Ocean Decade, 2023).

Coastal resilience is the capacity of the socioeconomic and natural systems in the coastal environment to cope with disturbances, induced by factors such as sea level rise, extreme events, and human impacts, by adapting whilst maintaining their essential functions

Vision 2030

Strong demand from Decade community to jointly **shape a common vision** and **design the 'science we need'** to enhance **collective impact and measure progress** to achievement of Ocean Decade Challenges.

- **What does success look like for this Ocean Decade Challenge at the end of the Decade?**
- **What milestones / targets do we need to achieve throughout the Decade to be on the path for success for this Challenge?**

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Vision 2030

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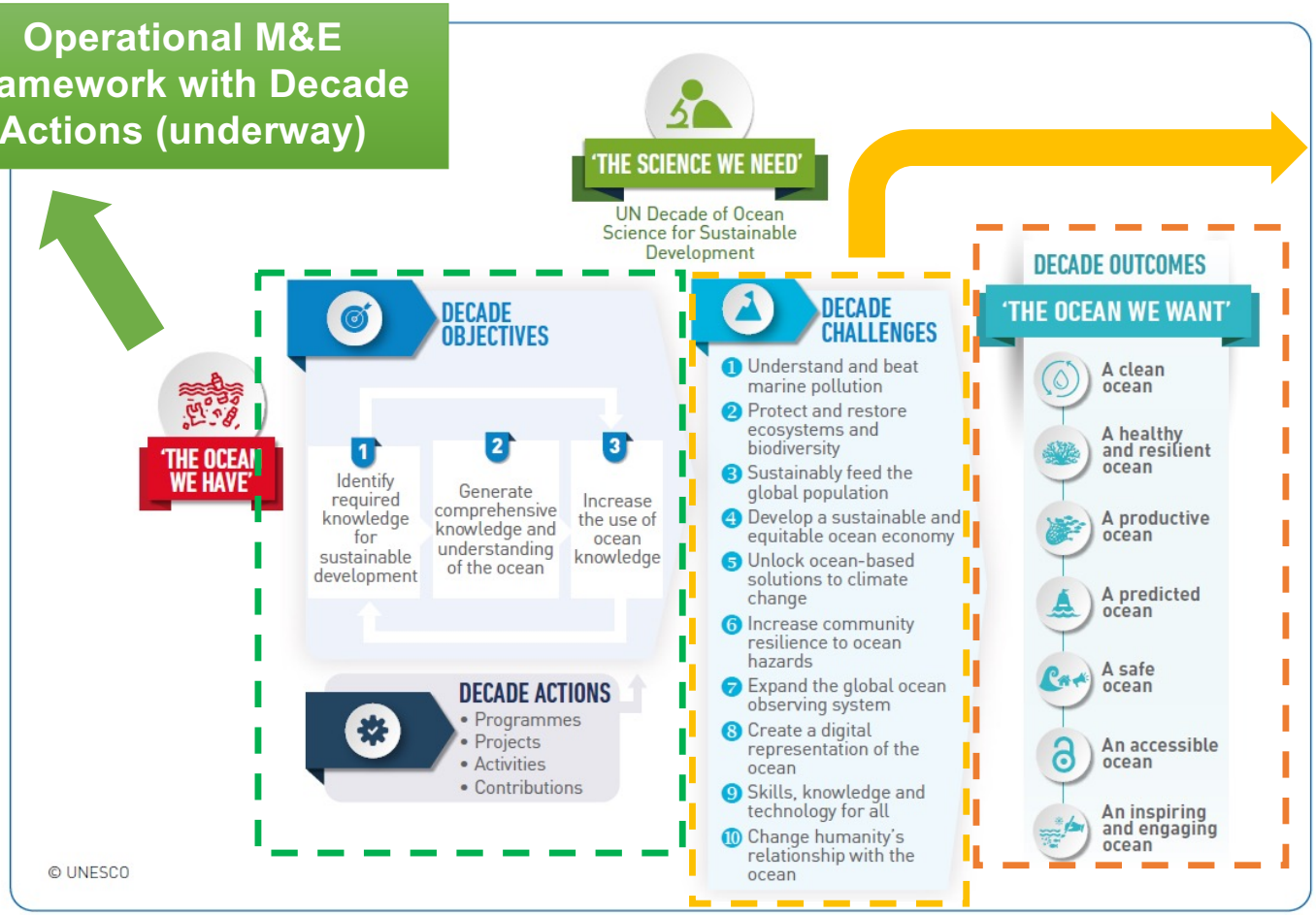
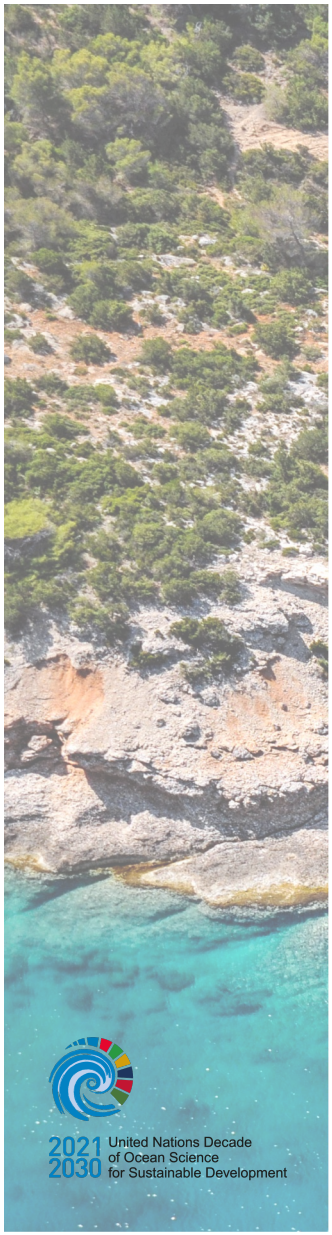
Operational M&E Framework with Decade Actions (underway)



Vision 2030 Process White papers to be presented at the Barcelona Conference

State of the Ocean Report (underway)



WG-6 Members

Co-chairs:

- **Nadia Pinardi** (Decade Collaborative Centre for Coastal Resilience, University of Bologna, Italy)
- **Srinivasa Kumar Tummala** (Decade Collaborative Centre for Indian Ocean Region, Indian National Centre for Ocean Information Services, India)

Members:

- Joseph Ansong (University of Ghana, Ghana)
- Alessandra Burgos (Oregon State University, United States)
- David Cabana (Helmholtz-Zentrum Hereon, Climate Service Center, Germany)
- Purificació Canals (MedPAN, Spain)
- Giovanni Coppini (Euro-Mediterranean Centre on Climate Change Foundation, Italy)
- Loreto Duffy-Mayers (Caribbean Alliance for Sustainable Tourism)
- Enrique Alvarez Fanjul (OceanPrediction Decade Collaborative Center, Mercator Ocean International, Fance)
- Mitchell Harley (UNSW Sydney, Australia)
- Juliet Hermes (South African Environmental Observation Network, National Research Foundation, South Africa)
- Jason Holt (National Oceanography Centre, UK)
- Dwikorita Karnawati (Indonesia Agency for Meteorology, Climatology and Geophysics, Indonesia)
- Hellen J. Kizenga (Institute of Marine Sciences, University of Dar es Salaam, Tanzania)
- Sunanda Manneela (Indian National Centre for Ocean Information Services, India)
- Iris Monnereau (Food and Agriculture Organization of the United Nations)
- Martina Müller (United Nations Office for Disaster Risk Reduction)
- Joel Kamdoum Ngueuko (Naturalia Environment, France)
- Antoine Queval (Alcatel Submarine Networks, France)
- Martin D. Smith (Nicholas School of the Environment, Duke University, United States)
- Andrea Valentini (Decade Collaborative Centre for Coastal Resilience, University of Bologna, Italy)

Relevant Ocean and Coastal Hazards

The challenge in coastal resilience is devise information systems and practical methods to consider a complexity of hazards together with proper vulnerability and exposure information

Geophysical/Geological related

Tsunamis, Landslides, Subsidence, Volcanic eruptions, Coastal Erosion, Earthquakes

Biological

Algal Blooms, Invasive Species, Aquatic diseases, Nuisance blooms

Local Anthropogenic

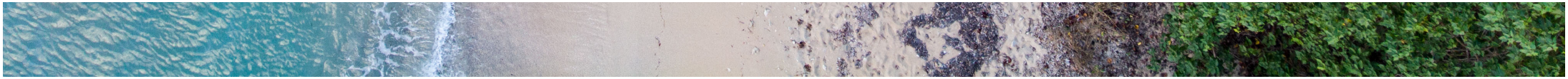
Urbanization pressures, Wastewater system, Marine Pollution, Chemical spills, Overfishing, Oil spills, nuclear waster, agricultural runoff, tourism pressures, political interference and corruption, maladaptive planning

Ecological

Wetland Degradation, acidification, de-oxygenation, loss of biodiversity, loss of seabed habitats, Coral bleaching, Eutrophication, connectivity

Ocean weather, hydrology and climate

sea-level rise, storm-surges, meteo-tsunami, coastal flooding, high waves and waves runup, currents, Marine Heat Waves, Glacial Melt, heavy rainfall, droughts, river discharge, Saltwater Intrusions



Coastal Resilience Components and Elements

Risk Assessment

- Multi-hazard evaluation frameworks
- Multi-level, multi-sector risk analysis
- Exposure and vulnerability analysis

Risk Reduction

- Monitoring, Forecasting and Early warning systems (multi-hazard)
- Warning Dissemination & Communication
- Preparedness & Response
- Sectoral medium to long term planning (zoning, infrastructure),
- Nature-based solutions,
- Digital twins

Governance/ Institutional/Social

- Marine and Maritime Spatial Planning
- Governance Framework
- Disaster recovery planning
- Equitable coastal resilience
- Government investments, financing and insurance
- Capacity building
- Corporate social responsibility

Current work in the Ocean Decade

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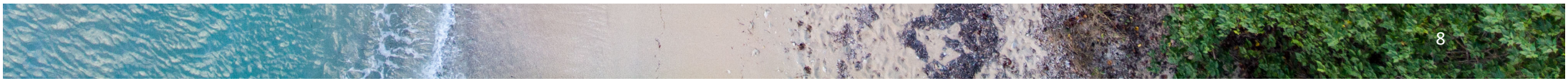
Decade Collaborative Centres dedicated to **Coastal Resilience and Ocean Predictions**, both contribute to the coordination of existing initiatives

As of November 2023, Challenge 6 is the focus of

- **4 Programmes**
  - Covering all ocean basins, but polar oceans are less represented at the Programme level
  - 3 Led by European-based institutions and One led by an Asia-based institution
- **24 Projects**
  - North Atlantic Ocean is the most represented, while the Southern Ocean is the least represented
  - Europe dominates in representation, while Africa, Small Island Developing States (SIDS) and Australia in the Pacific region lack both Projects and Programmes
- **6 Contributions** addressing specific components within the challenge



White paper: Decade outcomes for Challenge 6

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Emphasizes a holistic approach to resilience, considering hazards from both ocean and coastal perspectives

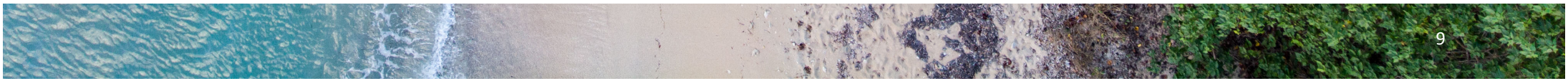
Outcome: safe ocean where life and livelihoods are protected from ocean-related hazards

1. Design 'people-centered' multi-hazard early warning systems

Some key characteristics of people-centered warning systems include a focus on stakeholder engagement and responsibility sharing, accessible communication supported by technological innovations, and institutional capacity building, including strong inter-agency collaboration

2. Design adaptation planning strategies to increase coastal resilience

Use the new data from the Ocean Decade to prepare updated plans and solutions also in view of the Marine Spatial Planning process.



Users and stakeholders

Upstream stakeholders

Collect observations and produce analysis and forecast:

- Research
- Op. centres
- Business
- Indigenous and local communities
- NGOs
- National defence org.

Intermediate stakeholders

Knowledgeable users that customize products for specific needs:

- Research
- Business
- NGOs
- National Defense Organizations

Downstream stakeholders

Use information for risk reduction and governance:

- Gov/Public authorities
- Coast Guards/Civil prot.
- Indigenous and local communities
- Education institutions
- Media/Opinion Leaders
- General Public

Preliminary User Needs for Coastal Resilience Components

➢ Priority Issues

- **Vital Role of Observations:** Observations are essential inputs for early warning systems, especially in predicting high-impact weather and ocean hazards within a few days
- **Global Data Sharing:** Early warning systems depend on countries freely sharing data globally, using advanced computing centers for processing
- **Crucial Datasets for Warnings:** these datasets are a suitable combination of past information (observations) and predictions by numerical modelling or AI
- **Adaptation Planning Data:** Adapting to climate change requires downscaling climate scenarios and carry out impact modeling

➢ Annex 3: Priority Data Sets

Thematic data set	Variables
Meteorological Data	Real-time weather data from both instruments and numerical models, including temperature, humidity, wind speed, and wind direction, precipitation and atmospheric pressure.
Seismic and Geophysical Data	Earthquake data from seismometers, strong motion accelerometers to detect seismic activity, Global Navigation Satellite System (GNSS) data to monitor ground deformation due to earthquake, volcanic activity, landslide etc.
Hydrological Data	River discharge for water levels and flow rates from gauges and from hydrological modelling, and soil moisture data to assess landslides and flooding risk. Dissolved chemicals in water and their loading, sediment mass balance at the river-estuary interface with the coastal ocean.
Oceanographic Data	Sea level data to monitor for potential tsunamis, Sea level from in situ, satellite and numerical models for storm surges, wave buoy data and numerical model outputs for high-waves and swells etc., sea temperature and salinity, and marine current data from satellite, in situ and numerical oceanographic models to track heat anomalies and transport of pollutants and sediments. Biogeochemical variables from satellite, in situ and numerical models including phytoplankton, PH, oxygen, dissolved and particulate chemical species.
Human activities	Population density and distribution data, Vulnerability and exposure data, Vessel traffic density, Marine Protected Area domain extension and number, aquaculture and mariculture sites, fishing intensity, housing stock, transportation, energy, public safety, wastewater treatment, and educational infrastructure.
Seabed habitat Data	Seagrass meadows, mangroves, and coral covers.
Bathymetry, terrain and geological data	Digital elevation model data combining terrain and bathymetry, seabed sediment grain size, substrate classification and sedimentation rates, submerged landscapes.
Climate downscaled scenarios	Downscaled IPCC climate scenarios for all hydrological, meteorological, ecosystem and oceanographic thematic variables listed above.
Human health	Water quality monitoring to detect microbial contamination, monitoring for pollutants such as heavy metals, pesticides, and industrial chemicals, harmful algal blooms monitoring, mosquito and tick surveillance, monitoring and reporting of waterborne, foodborne, and other communicable diseases in coastal communities

Preliminary User Needs for Coastal Resilience Components

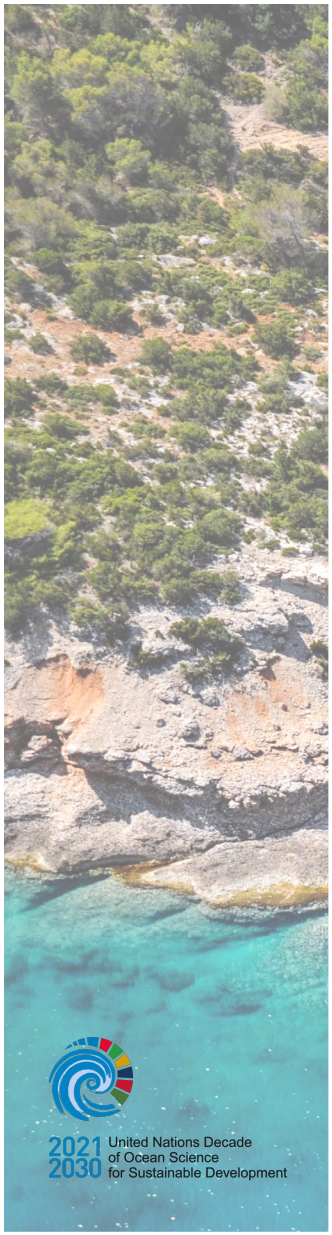
➢ Knowledge generation and sharing

- **Systematic Risk Knowledge Building:** Building risk knowledge relies on collecting data systematically and communicating **region-specific hazards** and vulnerabilities to communities
- **Obstacles Due to Deficient Knowledge:** Lack of disaster risk knowledge, attributed to factors like limited data, interdisciplinary gaps, and insufficient research, poses obstacles to creating resilient communities
- **Initiatives for Enhanced Risk Knowledge:** Primary initiatives involve investing in interdisciplinary research, leading to innovative tools for data analytics, risk mapping, and accessible repositories.
- **Dissemination:** training programs are essential. Examples include initiatives such as the WMO Global Multi-hazard Alert System (GMAS), the UNESCO-IOC International Tsunami Information Center (ITIC) training program, and the Ocean Teacher Global Academy (OTGA) of UNESCO-IOC.

Preliminary User Needs for Coastal Resilience Components

➢ Infrastructure requirements for early warning systems

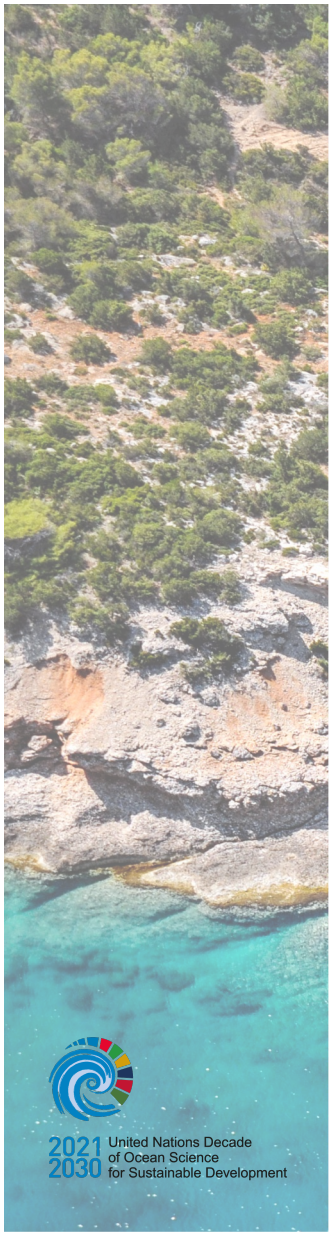
- **Optimal Global Monitoring Network:** To boost coastal resilience to ocean hazards, establish a diverse global observing network with computational facilities for forecasting and climate downscaling.
- **Improved Data Management:** Tackle challenges of ocean hazards by enhancing data sharing infrastructure, adopting best practices, and maintaining effective data management.
- **Technological Adoption:** Utilize technologies like the Common Alert Protocol (CAP), establish standard communication formats (especially for diverse abilities), and use broadcast and social media for widespread dissemination.
- **Infrastructure Details:** Detailed requirements for coastal resilience in dealing with different ocean hazards are listed in **Annex 4**.



Preliminary User Needs for Coastal Resilience Components

➢ Partnerships and resources

- **Collaborative Approach for Resilience:** Boosting coastal resilience involves partnerships at various levels, following SDG 17. Collaboration with entities like Decade Collaborative Centres (DCC) provides global insights.
- **National Engagement:** Crucial collaboration nationally includes Early Warning Centers, academia, and emergency managers. Partnerships with government, non-profit organizations, private companies, and communities create a comprehensive strategy.
- **Community Involvement:** Initiatives like the Fisherman Field School Program engage local communities actively. Practices such as the Tsunami Ready Recognition program enhance community awareness and preparedness.
- **Holistic Partnerships:** Collaborative Ocean Acidification (OA) Action Plans and partnerships with organizations like FAO, UNEP, UNDP, WWF contribute to a comprehensive approach. Detailed requirements are outlined in **Annex 4**.



Preliminary User Needs for Coastal Resilience Components

➢ Capacity development and exchange needs

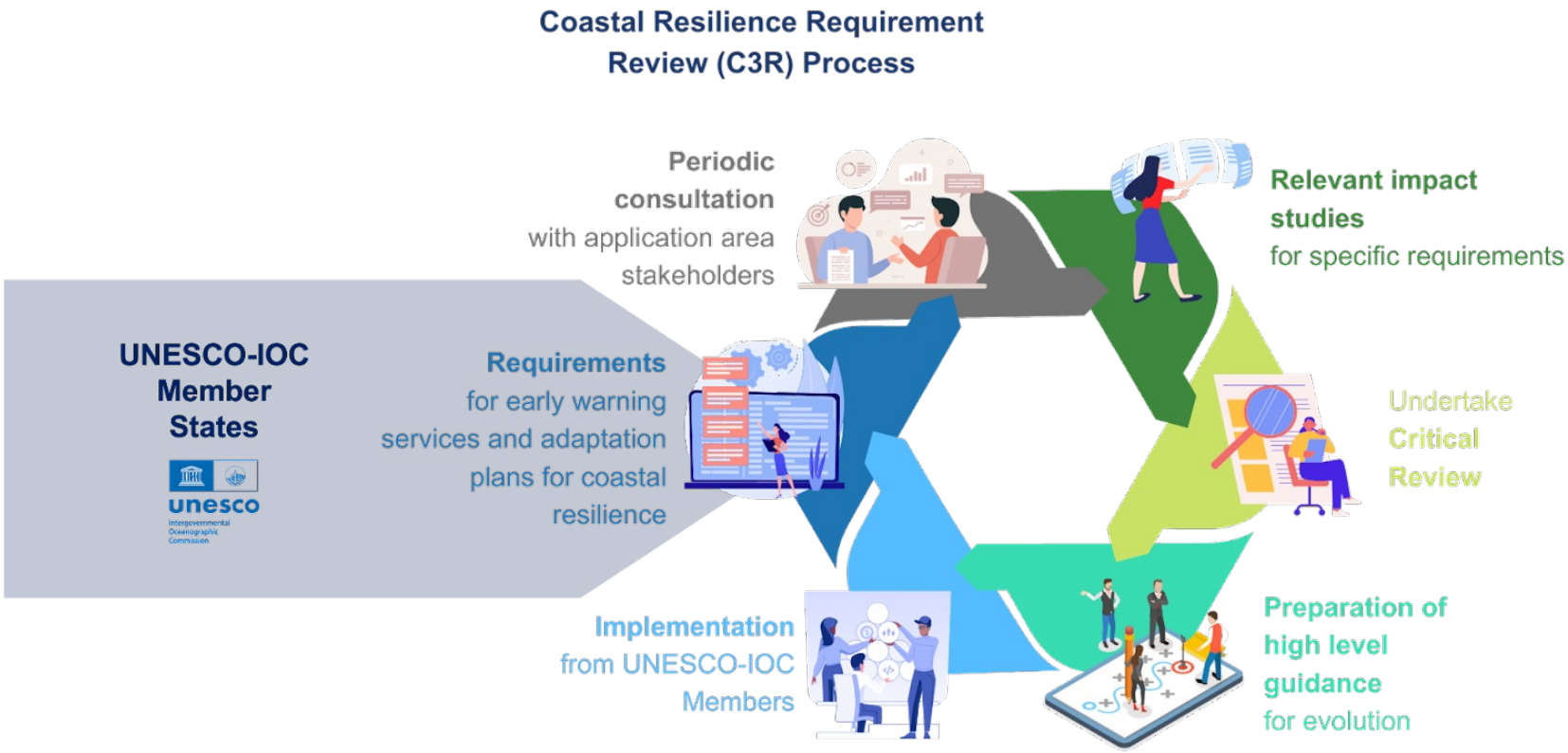
- **Challenges in Risk Understanding:** Effective monitoring and forecasting alone don't guarantee community understanding and appropriate response to warnings. Public awareness and preparedness empower individuals to protect themselves and adapt to growing risks.
- **Local Capacity-Building:** Communities need initiatives that build their capacity to understand, prepare for, and respond to ocean hazards**.**
- **UNESCO-IOC's Role:** UNESCO-IOC assists Member States with marine environment management through networks and a new Capacity Development Strategy (IOC-CD, 2023). Programs like the IOC Ocean Decade Tsunami Programme aim for resilient communities by 2030.
- **Collaborations:** Collaboration among scientists, policymakers, and practitioners is vital for a collective understanding of coastal resilience. Partnerships with organizations like FAO, UNEP, UNDP contribute to a holistic approach in various scientific fields.

Preliminary User Needs for Coastal Resilience Components

➢ Technology and innovation solutions

- **Technology for Resilience:** Advanced sensors, satellites, and AI/ML is vital for early warnings against ocean hazards, following F.A.I.R. principles. Numerical modeling and Digital Twin Frameworks improve forecasting.
- **Climate-Resilient Infrastructure:** Mix grey and green infrastructure with smart technologies for climate resilience. Innovations in sand mobilization, sustainable aquaculture, and waste management contribute to overall resilience.
- **Renewable Energy Integration:** Include offshore wind and wave energy for sustainable power solutions. Resilient microgrids ensure continuous power during and after hazards.
- **Effective Communication with ICT:** Use emerging ICT technologies, such as cellphone apps, for efficient early warnings, especially in vulnerable communities. Detailed technology requirements are listed in **Annex 4**.

The Coastal Resilience Requirement Review Process



The indicators need to be fine-tuned according to the goals and objectives during each periodic assessment of the Coastal Resilience Requirement Review process

The Coastal Resilience Requirement Review Process

Characterize relevant Coastal Stakeholder Groups

1) Coastal Cities and Ports,
2) Delta and Estuaries
3) Small Islands
4) Transitional coastal waters and
5) Iced coastlines

Establish a Coastal Resilience Requirement Review (C3R) process

1) Urban planning, infrastructure
2) Ecosystem preservation, water management, and infrastructure resilience
3) Adaptive strategies, sustainable development, and community engagement
4) Conservation and protection actions, nature-based solutions and sustainable food production
5) Coastal erosion, loss of biodiversity and changes in economic activities

Plan Periodic Consultation Mechanisms

1) Key indicators of resilience specific to each typology of coastal environment
2) Aligning these indicators with relevant SDGs targets/indicators
3) Establishing regular consultations to gather feedback, assess progress, and adapt strategies based on evolving needs and challenges

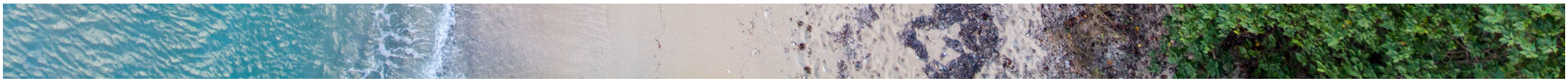
Indicators to track the achievements

Metrics offer a comprehensive perspective on the advancements made in the Coastal Resilience Requirement Review

- Indicators that demonstrate the improvement of knowledge related to the identification and comprehension of coastal multi-hazard, encompassing cascading effects
- Indicators for best practices in data sharing for early warning systems
- Indicators of the advancement in best practices and standards for risk reduction
- Indicators of successful capacity building and educational practices
- Indicators reflecting the successful development of international partnerships
- Indicators of changes in institutional and legislative frameworks supporting coastal resilience

Importance and Relevance to Sustainable Development Goals (SDGs) and other Challenges

- Enhancing coastal resilience brings numerous benefits, aligning with most of the SDG targets.
- Coastal resilience aligns most strongly with ***Goal 13*** "Climate Action" and all its targets
- ***Goal 14*** "Conserve and sustainably use the oceans, seas, and marine resources for sustainable development" is expected to be positively impacted
- Challenge 6 will also support the ***Goal 17*** through the design of responsive, inclusive, participatory, and representative risk management and decision-making across national boundaries
- ***Current SDGs lack a comprehensive acknowledgment of targets associated with coastal resilience.***
- The assessment and readiness for coastal risks should be more systematically incorporated into the sustainable development agenda.



Importance and Relevance to Sustainable Development Goals (SDGs) and other Challenges

- Challenge 6 is linked to all Decade challenges. Improving early warnings helps alert communities about pollutants (Challenge 1) and safeguards coastal ecosystems (Challenge 2)
- Timely alerts enhance sea safety, supporting fishing communities and sustainable practices (Challenge 3). Early warnings impact the sustainability of ocean economic activities (Challenge 4).
- Knowing the Ocean-climate connection (Challenge 5) informs climate adaptation planning and warnings about changing coastal conditions.
- Challenges 6 and 7 work together, providing a foundation for effective early warnings and contributing to high-fidelity modeling (Challenge 8). Capacity development (Challenge 9) enhances awareness for adaptive measures and a sustainable relationship with the ocean (Challenge 10).

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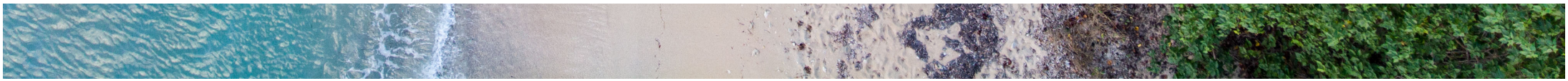

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Working Group 6
Increase Community Resilience to Ocean Hazards

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