



## **I. Minimizing and Addressing ocean acidification, deoxygenation and ocean warming**

*What are the main challenges and opportunities related to minimizing and addressing ocean acidification, deoxygenation and ocean warming?*

Challenges are:

- (i) Raising awareness of the dangers of warming, deoxygenation and acidification in the ocean and how they act together.
- (ii) Conducting temperature, oxygen and carbonate system observations and monitoring at sufficient time and space resolution to provide mechanistic understanding of forcing consequences and enable realistic modeling of future change.
- (iii) Conducting biological observations and monitoring at comparable resolutions to the environmental data (in ii) to better understand the impacts and anticipate vulnerability.
- (iv) Tackling the complexity of interactions among climate drivers necessary to assess impacts and develop solutions to mitigate these impacts at depth.
- (v) Developing policy instruments that promote holistic, multi-stressor approaches and cover the entire ocean.

**Opportunities:** Address challenges in the context of the Decade for Ocean Science for Sustainable Development.

*What measures should be promoted to address current gaps and challenges related to minimizing and addressing ocean acidification, deoxygenation and ocean warming?*

- Acknowledge (i) the links between climate and biodiversity at CBD, UNFCCC, BBNJ discussions) (ii) the importance of seafloor- water column ecosystem interactions in the global regulation of OA and deoxygenation.
- Demonstrate common solutions to warming, acidification, deoxygenation.
- Integrate the global change marine science community across science domains
- Develop monitoring efforts in the context of GOOS/DOOS and the Essential Ocean Variables.
- Leverage existing long-term monitoring and paleo data; combine abiotic and biotic monitoring programs.
- Integrate studies at vulnerable sentinel sites to elucidate mechanism and improve prediction capacity
- Use biotic response to natural gradients in the ocean to understand the interaction of stressors in the field
- Identify relevant spatial and temporal scales in the manifestation of warming, oxygen decline and acidification, including short, high-impact events
- Expand SDG 14.3 to include warming and deoxygenation to recognize their interaction.



**Please, list examples of impactful existing partnerships related to minimizing and addressing ocean acidification, deoxygenation and ocean warming, especially scientific and technological innovation-based partnerships.**

**Please, add links to additional information**

For ocean deoxygenation see documents on these web sites

: <https://en.unesco.org/go2ne> and

<https://www.iucn.org/theme/marine-and-polar/our-work/climate-change-and-oceans/ocean-deoxygenation>

IPCC SROCC <https://www.ipcc.ch/srocc/>

<https://www.dosi-project.org/topics/climate-change/>

DOSI Policy Brief: <https://www.dosi-project.org/wp-content/uploads/053-DOSI-Deoxygenation-V9.pdf>

**FAO.** 2019. *Deep-ocean climate change impacts on habitat, fish and fisheries*, by Lisa Levin, Maria Baker, and Anthony Thompson (eds). FAO Fisheries and Aquaculture Technical Paper No. 638. Rome, FAO. 186 pp. Licence: CC BY-NC-SA 3.0 I

**Please, list key recommendations for minimizing and addressing ocean acidification, deoxygenation and ocean warming that could be discussed during this interactive dialogue.**

- Make carbon neutrality a target for all ocean industry and activities.
- Expand/enhance blue-carbon ecosystems
- Avoid ocean activities that impair biological carbon sequestration or release CO<sub>2</sub>, methane and N<sub>2</sub>O. Develop offshore wind and solar technologies to minimize adverse impacts
- Reduce nutrient inputs from land
- Stop oil and gas extraction from the seafloor
- Promote collaboration between scientists and industry to develop Carbon Dioxide Removal technologies including via bioinspiration
- Coordinate and extend ocean observing, particularly for deep ocean and biogeochemical/ecological processes, via the Deep Ocean Observing Strategy.
- Prioritize transfer of monitoring technology and technical knowledge to developing countries.
- Build climate into spatial planning and design of habitat protection and into environmental impact assessment.
- Promote climate conscious fisheries practices
- Develop mitigation and adaptation policy for areas beyond national jurisdiction



## **II. Enhancing the conservation and sustainable use of oceans and their resources by implementing international law, as reflected in the United Nations Convention on the Law of the Sea**

*What are the main challenges and opportunities related to enhancing the conservation and sustainable use of oceans and their resources by implementing international law, as reflected in the United Nations Convention on the Law of the Sea?*

Challenges:

The separation (silo) of responsibilities into different management sectors (climate, fisheries, minerals, shipping, biodiversity agencies) in areas beyond national jurisdiction. This creates areas of conflict, overlapping, or divergent interests (e.g., among fisheries and mining sectors).

Lack of climate-responsibility for the 60% of the ocean in areas beyond national jurisdiction. There is no NDC addressing mitigation and adaptation for more than half the ocean which falls in ABNJ.

Dumping regulations/conventions allow terrestrial waste inputs to the ocean via pipe.

Enforcement difficulties in vast, remote areas

[Lack of climate projections at sufficient resolution to characterize most seafloor areas](#)

Limited baseline knowledge and understanding of most deep-ocean ecosystems, . compounded by slow growth and potentially long recovery times of many deep-sea organisms.

*What measures should be promoted to address current gaps and challenges related to enhancing the conservation and sustainable use of oceans and their resources by implementing international law, as reflected in the United Nations Convention in the Law of the Sea?*

Development of economic models evaluating how ecosystem services will change in the future

Convene special report or workshop to incentivize raising conservation and restoration awareness and increasing mitigation ambitions.

Support training and capacity development to create a network of experts that could cover relevant scientific knowledge and develop monitoring strategies in areas in needs of impact assessment or marine spatial planning design

Support ocean literacy to raise public awareness of the impact of human activities on the marine environment beyond the shore, down to the seabed within EEZ and in the high seas and deep seas.

Please, list examples of impactful existing partnerships related to enhancing the conservation and sustainable use of oceans and their resources by implementing international law, as reflected in the United



Nations Convention in the Law of the Sea, especially scientific and technological innovation-based partnerships.

**Deep Ocean Stewardship Initiative:** DOSI is a scientific network that seeks to integrate science, technology, policy, law and economics to advise on ecosystem-based management of resource use in the deep ocean and strategies to maintain the integrity of deep-ocean ecosystems within and beyond national jurisdictions. DOSI is currently comprised of over 700 experts from 45 countries.

**Deep Ocean Observing Strategy:** A group of scientific networks that addresses deep ocean observations to address scientific and societal needs, in service of sustainability.

*Please, add links to additional information*

[www.dosi-project.org](http://www.dosi-project.org) (see minerals, fisheries, genetic resources, BBNJ, [climate change](#) working groups)  
[www.deepoceanobserving.org](http://www.deepoceanobserving.org)

*Please, list key recommendations for enhancing the conservation and sustainable use of oceans and their resources by implementing international law, as reflected in the United Nations Convention in the Law of the Sea that could be discussed during this interactive dialogue.*

Create compatibility of international protections/protected areas (APEI, VMEs, PSSI, MPA, World heritage sites), including the creation of more protections in areas beyond national jurisdiction.

Promote more collaboration between global ocean management sectors.

Promote the success of BBNJ treaty negotiations.

Promote open data access and FAIR principles.

Acknowledge the need to integrate warming, deoxygenation and acidification changes in the establishment of reference states (i.e. baseline projection) and in the designation of APEI in EIA.

Integrate the monitoring of climate stressors (temperature, oxygen, pH and POC) in environmental impacts monitoring plans

Ensure a rigorous Mining Code is put in place and ample baseline knowledge is collected so informed decisions can be made, prior to the transition from exploration to exploitation of

Appoint a scientific committee to manage the EIA process for all extractive activities in areas beyond national jurisdiction.



### **III. Increasing scientific knowledge and developing research capacity and transfer of marine technology**

*What are the main challenges and opportunities related to increasing scientific knowledge and developing research capacity and transfer of marine technology?*

**Challenges:**

Many countries lack the appropriate tools and funding needed for marine research, especially deep-ocean research, and lack an understanding of areas beyond national jurisdiction and associated life.

Conducting research in areas representative of the variety of ecosystems threatened by human and climate impacts across ocean basins.

**Opportunities:** Promote basic research and international collaboration to address combined impacts of warming, oxygen loss and acidification on ocean ecosystems; develop model marine ecosystems with long-term monitoring to understand stressor impacts on functioning.

Promote the FAIR principles for findable, accessible, interoperable, and reusable data. Develop training around data best practices.

The Decade for Ocean Science offers an opportunity for unprecedented generation and sharing of scientific knowledge.

Maximize and use new knowledge gained from science generated for developing industries (e.g., deep-seabed mining).

*What measures should be promoted to address current gaps and challenges related to increasing scientific knowledge and developing research capacity and transfer of marine technology?*

Develop projects that ensure paid opportunities for training and/or transfer of technology to the country indefinitely.

Support programs to develop low-tech instrumentation for deep-sea research and ecological monitoring as a transformative step, particularly in deep-sea areas within EEZ accessible with smaller vessels. It will allow training and implementation by a much larger community of scientists around the globe, particularly in island states.

Promote open data access and FAIR principles.



*Please, list examples of impactful existing partnerships related to increasing scientific knowledge and developing research capacity and transfer of marine technology.*

- Nekton Mission
- Deep-Sea Biology Society
- Deep-Ocean Stewardship Initiative
- Deep Ocean Observing strategy
- [InterRidge \(working groups, visiting grants and cruise bursaries\)](#)

***Please, add links to additional information***

*Please, list key recommendations for increasing scientific knowledge and developing research capacity and transfer of marine technology that could be discussed during this interactive dialogue.*

Develop an international funding body that supports collaborative research, in particular for developing countries that do not have access to national science funding agencies.

Develop shared facilities such as moorings, ships, observatories (along the lines of the international space station) that multiple countries can contribute to and share data openly.

Develop and implement 'cutting edge' technologies that can close observational gaps in biogeochemical and biological observations (e.g., regarding communities and ecosystem functions in the deep pelagic and at the seafloor).

Focus and strengthen concerted efforts to assess the potential and limitations of eDNA observations in order to gain the required knowledge to make this an operational component of biological observing.

End the practice of parachute marine science; promote serious collaboration and engagement with developing countries.

Improve coordination of ocean observing activities, particularly for the deep ocean.