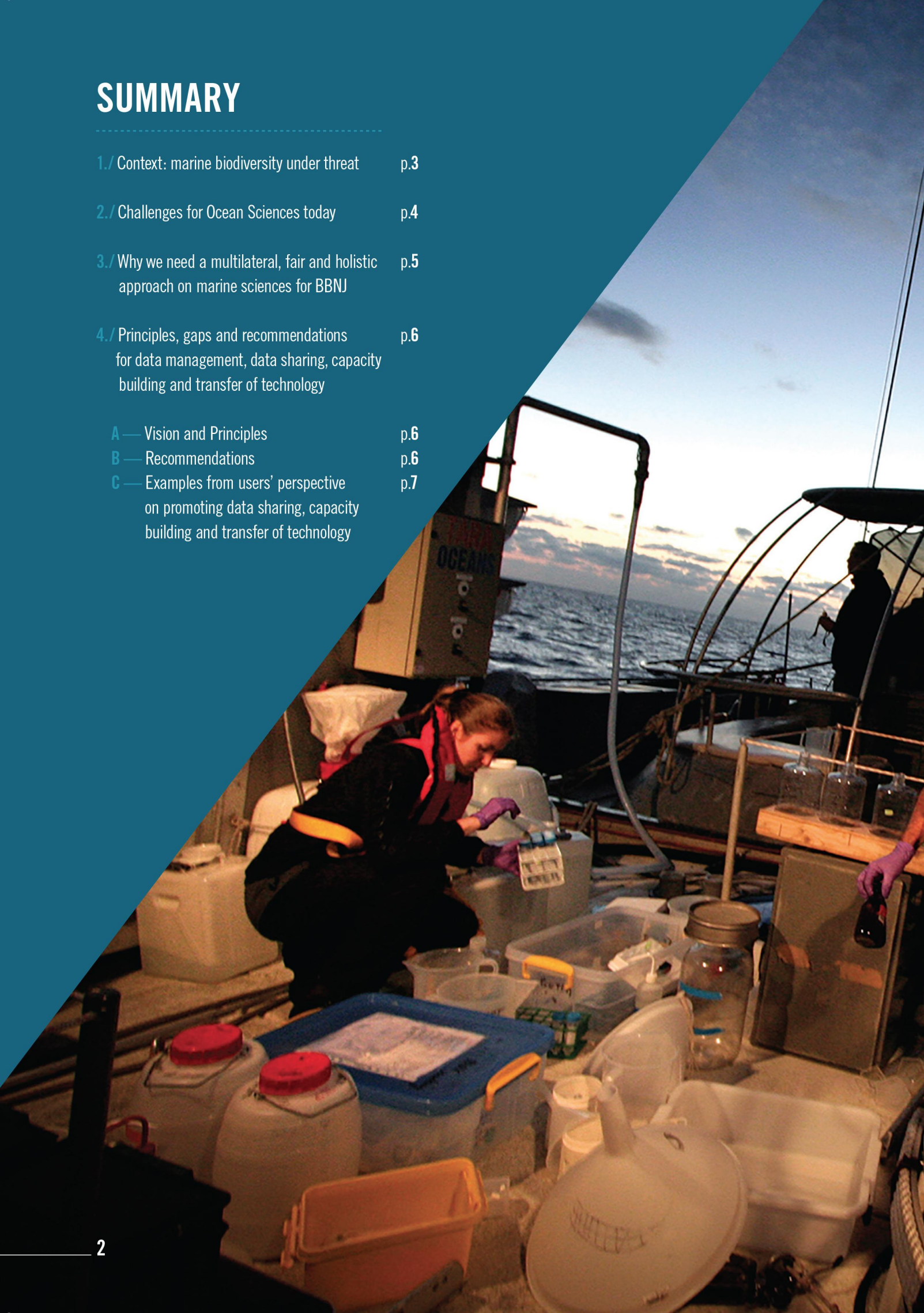


OCEAN SCIENCE IN AREAS BEYOND NATIONAL JURISDICTION: DATA SHARING, CAPACITY BUILDING AND TRANSFER OF TECHNOLOGY

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1./ CONTEXT: MARINE BIODIVERSITY UNDER THREAT

The current decade marks a period of important decisions within the United Nations system and regional processes related to governance of the ocean, with significant impacts on development issues. The effects of climate change on the ocean and the acceleration of marine biodiversity loss are now widely recognized, and their impact on territories and populations are more and more important. As assessed by different recent studies and by IPCC AR5 report, marine biodiversity is facing growing cumulative impacts from climate change and anthropogenic stressors, causing relevant changes in temperature, acidification and oxygen losses in the ocean. These impacts are not only affecting coastal areas, coral reefs and mangroves, but also are changing the physical, chemical and biological properties of the open ocean beyond national jurisdictions.

If we want to live with a healthy and productive ocean, we need to understand and predict those changes by promoting basic research at an international level. Therefore, Tara Expeditions Foundation is joining efforts to support the Ocean Science Decade proposed by IOC/UNESCO in 2017.



2./ CHALLENGES FOR OCEAN SCIENCES TODAY

95% OF OCEAN BIOMASS IS COMPOSED OF PLANKTON

It is widely accepted in the scientific community that the ocean is the most relevant ecosystem on our planet, supporting life, producing oxygen and regulating climate. But beyond the better-known climate and anthropogenic impacts on some coastal and more familiar species and habitats, it is essential to remember that the whole marine life, including all micro-organisms, is under threat with the rapid changes in temperature, oxygen concentration and pH. We must also keep in mind this contradiction: almost 95% of ocean biomass is composed of plankton organisms drifting in the oceans currents, however we know quite little about them. Planktonic life is essential for our planet and for humans, as it feeds fish and marine mammals and is the basis of the marine food chain. Fixing the extra heat produced by human activities and absorbing 50% of the terrestrial CO₂, plankton is also referred to as the lungs of our planet. Recent studies published on the Science magazine show that viruses, bacteria, unicellular photosynthetic organisms, protists and zooplankton, if studied as a whole integrated ecosystem, are the key to understand ocean biodiversity and how it works.

INVESTING IN BASIC RESEARCH, CAPACITIES AND TECHNOLOGY TO UNDERSTAND URGENT ISSUES

While the world's climate is changing rapidly, it is especially important to better understand the biodiversity of plankton, its dynamics and adaptability, the strength and resilience of this ecosystem and how it copes with physicochemical changes in oceanic water masses. We have known for many years, for instance, that climate change is threatening ocean biodiversity with the new and cumulative climate impacts – issues also associated with anthropogenic pollution and overfishing. But, despite the needs, we are not investing enough in basic research, capacities and technology to

understand and act on these and other urgent issues. Here is a terrible paradox: the more the ocean is under threat, the less we are supporting knowledge production to predict and prevent future impacts.

NEW TECHNOLOGIES FOR OCEAN AND OUR FUTURE

For the world of science, the recent United Nations Ocean conference to follow up the SDGs process and the definitions under the BBNJ negotiation comes at a timely point: it coincides with major transformations, opening up very promising perspectives on genome analysis applied to marine biodiversity for monitoring species and climate evolution; The development of new technologies for vessel monitoring, using much more accurate satellite images to tackle illegal fishing; The development of robotics, with drones and submarine craft always more efficient to help us not only to exploit but also to understand and preserve the ecosystems including the deepest ones.

BIG DATA SHARING FOR A NEW AND INCLUSIVE KNOWLEDGE

At every scale, these are still largely unknown, though we are now seeing a deep transformation in marine sciences with the quick development of new technologies like Next Generation Sequencing, Big Data analysis, bioinformatics and bioimaging. These will transform the way we see the ocean, in the same way that genetics transformed medicine and cancer prevention. In addition, at its 43rd Session in Nairobi, Kenya, the IPCC Panel decided to prepare a special report on climate change and the oceans and the cryosphere, giving the ocean much needed attention in the climate sphere. From a basic research perspective, in addition to finance and resource provision, we need to go beyond silos and build transdisciplinary international programs using the best available and more disruptive science.

It is the time to build cross-cutting, open and collaborative research engines, databases and scientific programs. Decision makers have a strong responsibility to strengthen ocean science, enabling future science-based conservation and adaptation actions.



3./ WHY WE NEED AN INTERNATIONAL, FAIR AND HOLISTIC APPROACH ON MARINE SCIENCES FOR BBNJ

Representing around 95% of the life in the ocean, much more than fish, coral reefs or coastal species, plankton and microorganisms are drifting in the open ocean. Understanding ocean biodiversity thus requires a transdisciplinary and holistic approach, based on international research programs, with mandate to sample and analyses data from areas beyond national jurisdictions. At this crucial moment of negotiations for an Implementing Agreement for the High Seas biodiversity governance, the scientific issues set out in the document on the table of negotiators will be significant; It will be necessary to define the status of what is considered as Marine Genetic Resources for research (and not for commercial exploitation), as well as the mechanisms of supervision and funding of research in the High Seas.

More broadly, the Implementing Agreement (IA) for BBNJ can be considered as an opportunity to go forward on a common and open database accessible to all, with multidisciplinary and integrated genomics, meta-genomics, environmental, taxonomic and imaging datasets. The IA negotiations, as applied to the High Seas, can also be taken as an opportunity to go beyond national surveys to develop scientific cooperation programs at regional and international level. Concretely, experience shows that regional and multilateral projects – such as programs promoted by IOC/ UNESCO - are more likely to promote transfer of technology and concrete scientific training including post-doctoral grants to developing countries.

4./ PRINCIPLES, GAPS AND RECOMMENDATIONS FOR DATA MANAGEMENT, DATA SHARING, CAPACITY BUILDING AND TRANSFER OF TECHNOLOGY

A — VISION AND PRINCIPLES

Considering that promotion of marine scientific cooperation is defined under UNCLOS in paragraph 242; Considering that publication and dissemination of information and knowledge is defined under paragraph 244; And considering that data sharing, capacity building, and transfer of technology are also defined in paragraph 244 and under Articles 269, 271, 278, 279:

The Tara Expeditions Foundation recommends seizing this opportunity of the BBNJ Implementing Agreement to strengthen marine research. Decisions from the preparatory conference should set the stage for a fair, equitable and pragmatic vision on research and Marine Genetic Resources, allowing scientists to go forward on the knowledge production and understanding of the marine biodiversity and global ocean changes. Under the coordination of the Tara Expeditions Foundation scientific advisory board, we set up some recommendations, based on the following principles:

- **OPEN DATA and data sharing for all research in ABNJ**, following the general idea of the High Seas as a share resource;
- **Priority to collaborative international scientific cooperation:** Ensuring data sharing, data access, transfer of technology and capacity building, as non-monetary benefit sharing
- **Promoting Equity and solidarity:** Supporting the creation of a benefit sharing mechanism, in a form of a trust fund, to foster science infrastructure in developing and least developed countries.

B — RECOMMENDATIONS

On the Status for Basic Research in ABNJs:

Scientific research programs in areas beyond national jurisdictions demand long term ship cruises and are costly ope-

rations. For this reason, and to avoid inequality on access to data, it should be a priority in the Implementing Agreement and future regime to give provisions for such international scientific programs, with national, regional and multilateral funding.

The research programs should be consistent with the principle of the High Seas as a shared resource, and based on Open Access to Data, transfer of technology and capacity building mechanisms. Nevertheless, to foster and not undermine international programs and funding, we recommend either a “declarative” or “notification procedure” on permits and sampling authorizations for basic research in ABNJs. From user’s perspective, there is a risk to go to a too bureaucratic international framework for marine research that could hinder the development of basic science in the High Seas, exactly in the moment when we strongly need it to predict and prevent ocean global changes.

On Access and Traceability:

Today, ocean science made sufficient progress on satellite and remote sensors to reasonably consider the feasibility of an international clearing house mechanism that will be able to clear and monitor research vessels in ABNJ, based on mandatory notification procedure. It is essential to create a mechanism to identify and make a difference with commercial vessels on procedures.

On Benefit Sharing, capacity building and transfer of technology:

From a research perspective, we recommend an integrated vision on non-monetary benefit sharing including transfer of technology, knowledge sharing and capacity building. Acknowledging the huge technological and knowledge gaps in research fields such as DNA sequencing, meta-genomics and BIG DATA analyses, it is essential to provide funding and international framework for capacity building in developing countries. Today, unfortunately only a few countries are equipped with research institutes and infrastructures able to participate in excellence programs using sequencing and DNA genomics on ex-situ Marine Genetic Resources analyses.



C — EXAMPLES FROM USERS' PERSPECTIVE ON PROMOTING DATA SHARING, CAPACITY BUILDING AND TRANSFER OF TECHNOLOGY

Following the groundbreaking Tara Oceans publications in Science (May 22, 2015), the Tara Oceans consortium has been developing a database which today is the biggest and more complete open dataset for marine biodiversity.

The example of the Tara Oceans consortium is encouraging: within 5 years a scientific team designed an ambitious, long-term infrastructure of open access archives with online platforms for access to data: On the genomics side, the systematic validated sequencing methodologies used provide extensive data that are deeply integrated, through the sample identification system, with data from the environmental and imaging approaches.

For access and data sharing, web services can be put in place to use the samples registries and navigate the infrastructure. Exploring the Tara Oceans and other BIG DATA multi-domains datasets require innovative bioinformatics tools, cloud computing, and next generation global ocean modeling. Although many bioinformatics and modeling tools are emerging, there is a pressing need to develop new interfaces enabling scientists to exploit the full potential of an integrated big data knowledge base, in particular to further our understanding of interactions and the evolutionary trajectories of ocean life. It is important to reaffirm that all samples from the Tara programs are collected respecting the international criteria and National laws and made available in open access platforms, as we recommend for all basic research in ABNJ.

Post-doctorants, PHDs, Workshops and trainings

Parallel to the data management and data access issues,

Tara Expeditions Foundation is developing a capacity building and transfer of technology program with developing countries in South America, Africa and the Pacific region. Concretely, a program supported by the **French Facility for Global Environment (FFEM)** is today funding several post-doctoral students and regional workshops to involve southern countries in the existing consortium Tara Oceans. The training of post-doctoral researchers is taking place in the framework of an interdisciplinary and international research using the global holistic data from the Tara Oceans expedition. It creates the perfect opportunity to launch the development of an international and interdisciplinary scientific cooperation in oceanic ecosystems study.

Towards a Decade for Ocean Sciences

Based on the experience from what we see from the field – or from the lab - scientists working on ocean resources should be more encouraged to innovate, to go beyond classical silos of marine research, to explore new technologies and new shared tools crossing physical observation with biological parameters, bioimaging, bioinformatics and modelling. Facing an increasing global change and its impacts on ocean, the scientific community working on basic sciences for the ocean is more than ever welcome to the policy arena in this important period for ocean governance definitions. We need more bridges with decisions makers and a strong scientific community to understand and monitor ecosystem evolutions, biodiversity changes, species depletion and migrations.

For the common interest of the planet and mankind, we support the proposal of a decade for ocean sciences!

DNA sequences: ENA <http://www.ebi.ac.uk/ena>

Images: EuBI <http://www.eurobioimaging.eu/>

Environmental data: PANGAEA <http://www.pangaea.de>

Open access principles ensuring that its knowledge base remains FAIR (Findable, Accessible, Interoperable and Reusable; Wilkinson et al. 2016) to all.



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