Commissioned by

HIGH LEVEL PANEL *for*
A SUSTAINABLE
OCEAN ECONOMY

BLUE PAPER

Summary for Decision-Makers

# The Ocean Genome:

## Conservation and the Fair, Equitable and Sustainable Use of Marine Genetic Resources

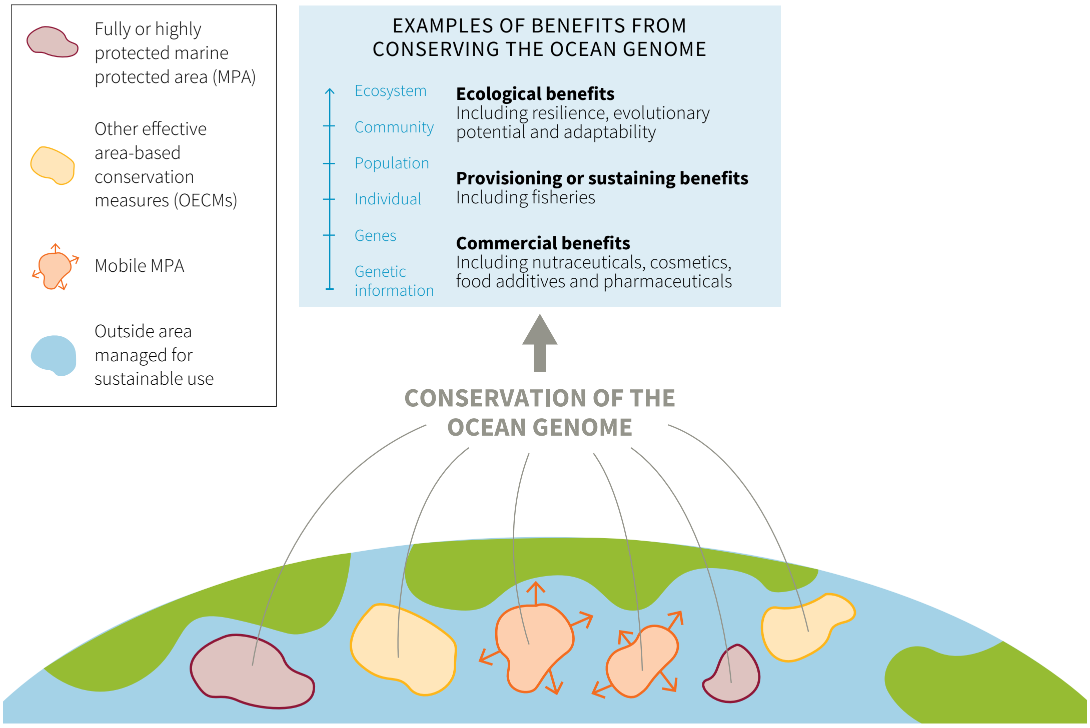
**The ocean is home to remarkable biodiversity.** Life has existed in the ocean for at least three times as long as on land, resulting in an abundance of unique genetic diversity that dwarfs the biodiversity found terrestrially.[1] For example, only 35 percent of major animal phyla—life forms that share common traits and contain the vast majority of species—are found on land, while 97 percent have been recorded in the ocean.[2]

**This new analysis commissioned by the High Level Panel for a Sustainable Ocean Economy[3] explores the current understanding of genetic diversity within the ocean, the benefits it provides in the context of a changing world and the threats posed to such diversity.** It identifies opportunities for improved conservation of the ocean genome and more sustainable and equitable use of these genetic resources.

**The ocean genome is the genetic material present in all marine biodiversity, including both the physical genes and the information they encode.** It is the foundation upon which all marine ecosystems and their functionality rest. It also determines the abundance and resilience of biological resources, including fisheries and aquaculture, which collectively form a pillar of global food security and human well-being (Figure 1).

**The ocean genome is threatened by overexploitation, habitat loss and degradation, pollution, impacts from a changing climate, invasive species and other pressures, as well as their cumulative effects**. By adopting United Nations Sustainable Development Goal 14, the international community has committed to protecting at least 10 percent of marine and coastal areas by 2020. However, only 2.5 percent of the ocean is currently considered highly or fully protected, and research suggests that at least 30 percent of representative marine ecosystems needs to be fully or highly protected to maintain a healthy, productive and resilient ocean.[4] Efforts should also be made to conserve the genetic diversity outside of marine protected areas (MPAs) through effective management that ensures the sustainable use of resources; prevents habitat degradation; and protects rare, threatened and endangered species, while respecting the rights of local fishing communities.

## Figure 1: Examples of Benefits from Conserving the Ocean Genome




*Note: This figure depicts a portfolio approach for conserving the ocean genome and its associated benefits. Effective conservation hinges on using multiple tools, including area-based conservation measures such as fully and highly protected MPAs that provide the greatest protection from the impacts of extractive and destructive activities. Coupling these with effective management of sustainable use can ensure wide-ranging benefits that are ecological, sustaining, provisioning and commercial.*

*Source: Developed by authors. Designed by J. Lokrantz/Azote.*

**Advances in sequencing technologies and bioinformatics have enabled a better understanding of the ocean genome, which in turn is enabling exploration.** These new insights are supporting advancements in conservation planning and management and the designation of MPAs, as well as commercial biotechnology applications as diverse as anticancer treatments, cosmetics and industrial enzymes. At the same time, the environmental, social and ethical risks arising from using existing and new biotechnologies such as CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) remain under-investigated and poorly known, especially in marine environments.

**As awareness of the value of the ocean genome has grown, so too has the complexity of the international and national legal, institutional and ethical contexts that govern it.** The complexity in governance of the ocean genome is linked to many factors: its conceptual broadness, a mismatch between ecological and political boundaries in the ocean, the diversity of threats eroding genetic diversity and the mix of commercial and noncommercial uses of the ocean genome. Some of these gaps are on the agenda of a two-year intergovernmental conference launched in 2018 by a United Nations General Assembly resolution. The aim of the conference is to negotiate a new legally binding international instrument on the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction (BBNJ).

**Despite the significant value derived from the ocean genome, efforts to conserve, sustainably use and equitably share monetary and non-monetary benefits are challenged by the following:**

**The fragmented ocean governance landscape:** The ocean has been divided into multiple jurisdictional spaces. As such, the current ocean governance landscape is a complex patchwork of diverse institutions and legal regimes. Consequently, issues of conservation and equitable use of the ocean genome are dealt with in a fragmented and incoherent manner. Some of these gaps are on the agenda of the BBNJ negotiations.

**Gaps in scientific understanding:** Despite rapid technological progress enabling exploration of marine life at a genetic level, vast gaps in knowledge remain. For instance, most marine species may remain undescribed,[5] a large fraction of predicted genes from marine prokaryotes cannot be assigned functions[6] and the functions of some 90 percent of genetic sequences collected from viruses remain unknown.[7]

**Asymmetrical capacity to access and share the benefits of research and use of marine genetic resources:** The considerable costs involved in marine bioprospecting research, alongside the advanced technologies and expertise required to conduct such research, have meant that most commercial activity associated with the ocean genome has been undertaken by high-income countries, especially in the deep sea. However, sampling is often conducted in low- or middle-income countries, which—due to severe financial, technological and capacity limitations—are often unable to undertake marine research themselves or access and use the rapidly growing databases of genetic sequence data.

## Eight Opportunities for Action to Ensure the Conservation and Sustainable and Equitable Use of the Ocean Genome

**The ocean genome is the foundation upon which all marine ecosystems rest and is integrally linked to the existence of all life on Earth, including humanity.** A healthy ocean genome requires implementing international and national legal measures that ensure that a delicate balance between conservation and sustainable use is achieved through incentives for research and development as well as equitable technology diffusion and benefit sharing. **Taking the actions below will ensure that the ocean genome is conserved and used in a sustainable, fair and equitable manner that is critical for a sustainable ocean economy.**

| 1. PROTECT MARINE GENETIC DIVERSITY AS PART OF CONSERVATION MEASURES AND MONITOR OUTCOMES: |
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| Protect at least 30 percent of the ocean in implemented and fully or highly protected marine protected areas (MPAs). |
| Conserve genetic diversity outside of MPAs. |
| Mainstream genetic monitoring into sector-specific management plans and international mechanisms. |
| Use strategic environmental assessments to manage conflicting uses and guide planning. |
| Incorporate marine genetic diversity into the design and management of conservation measures. |
| Report on the conservation and use of marine genetic diversity in national biodiversity strategies and action plans. |

| 2. SUPPORT GREATER EQUITY IN GENOMICS RESEARCH AND COMMERCIALISATION: |
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| Give adequate attention to marine science capacity building, information exchange, collaboration and appropriate technology transfer and raise new and additional funding to support such initiatives. |
| Build these components into international and national research policies, plans and programmes. |

| 3. PROMOTE RESPONSIBLE AND INCLUSIVE RESEARCH AND INNOVATION IN MARINE GENOMICS RESEARCH: |
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| Support a transparent, interactive process by which societal actors, innovators and scientists become mutually and socially responsive to each other with a view to the ethical acceptability, environmental sustainability and societal desirability of the innovation process and its marketable products. |
| Provide incentives for research that are targeted toward important but underfunded objectives with a focus on lower-income countries, the most marginalised and vulnerable communities, women and environmental concerns. |
| Develop communication tools to improve linkages among societal actors. |

| 4. EMBED CONSERVATION OF THE OCEAN GENOME WITHIN RESEARCH AND COMMERCIALISATION, INCLUDING THROUGH BENEFIT-SHARING MECHANISMS AND AGREEMENTS: |
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| Develop a global, multilateral benefit-sharing mechanism for the fair and equitable use of marine genetic resources beyond national jurisdictions. |
| Enhance the legal, technical and administrative capacity of low- and middle-income countries to secure equitable benefits, including for relevant local communities and indigenous peoples. |
| Facilitate benefit-sharing agreements within territorial waters focused on conservation and sustainable and equitable use. |
| Require those seeking research funding to explain the potential conservation, sustainability and equity applications and benefits of their research. |
| **5. ENSURE THAT INTELLECTUAL PROPERTY NORMS ACROSS COMMERCIAL AND NONCOMMERCIAL SECTORS SUPPORT A SUSTAINABLE AND EQUITABLE OCEAN ECONOMY:** |
| Modify procedural aspects of international patent law to require disclosure of the biological and geographical origins of genetic material across all associated commercial and noncommercial activities. |
| Require disclosure of origin across the research and development pipeline including in storage, publications and prior to commercialisation. |
| **6. INCREASE FINANCIAL AND POLITICAL SUPPORT TO IMPROVE KNOWLEDGE OF THE OCEAN GENOME:** |
| Build support for integrative taxonomic research as well as research on the functional biology of the ocean. |
| Support research needed for genetic monitoring as part of existing environmental assessments. |
| Prioritise the allocation of resources to help build scientific capacity. |
| **7. COMPREHENSIVELY ASSESS THE RISKS AND BENEFITS OF TRANSGENIC MARINE ORGANISMS AS WELL AS THE USE OF NEW MOLECULAR ENGINEERING TECHNOLOGIES IN THE MARINE ENVIRONMENT:** |
| Initiate a multi-actor deliberative process to develop principles and debate approaches for whether and how genetic technologies should be used in the marine environment. |
| **8. STRENGTHEN THE ROLE OF PHILANTHROPY IN PROVIDING INFRASTRUCTURE AND FUNDING FOR MARINE SCIENCE:** |
| Establish a network to better coordinate privately funded initiatives and align their priorities with those of states that are acquiring knowledge for societal needs. |
| Encourage financial supporters of ocean science, including philanthropies, to sign a 'Declaration for Coordinated Ocean Action'. |

## The High Level Panel for a Sustainable Ocean Economy

Established in September 2018, the High Level Panel for a Sustainable Ocean Economy (HLP) is a unique initiative of 14 serving heads of government committed to catalysing bold, pragmatic solutions for ocean health and wealth that support the Sustainable Development Goals (SDGs) and build a better future for people and the planet. The Panel consists of the heads of government from Australia, Canada, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Kenya, Mexico, Namibia, Norway, Palau, and Portugal, and is supported by an Expert Group, Advisory Network, and Secretariat that assist with analytical work, communications and stakeholder engagement. The Secretariat is based at World Resources Institute.

The report that this brief summarises was prepared in support of the work of the HLP. The arguments, findings, and recommendations made in the report represent the views of the authors only. This Blue Paper is an independent input to the HLP process and does not represent the thinking of the HLP, Sherpas or Secretariat.

For more information, including the full report, visit **www.oceanpanel.org**

Endnotes


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