

## **Understanding Biodiversity in the Marine Realm in Support of the CBD: The GEO BON Marine Biodiversity Observation Network (MBON) and a Pilot Pole-to-Pole Effort**

In decision XII/1 the CBD CoP invited parties, indigenous and local communities and other relevant stakeholders to collaborate with GEO BON and other relevant organizations that contribute to building observing systems and to biodiversity monitoring, to address the priority needs identified by Parties related to biodiversity observations and monitoring. This document highlights work, in this regard, to design and implement a Thematic Marine Biodiversity Observation Network or Thematic MBON.

Several Aichi Targets focus on coastal ocean and marine ecosystems given the very significant ecosystem services that these provide to people around the world. These targets are difficult to achieve without a coordinated network of observing efforts across the biodiversity levels of the CBD, namely gene, species, and ecosystem. For example, it is difficult to know how coral reefs and other marine ecosystems are impacted by climate change, ocean acidification, or various anthropogenic pressures. Therefore it has been difficult to track and meet Aichi Targets 6, 10, 11, 14, and all the other targets that are relevant to coastal and marine ecosystems.

In the last few years, several projects have been established around the world focused on collecting biodiversity and biogeographic information. These programs should be linked to coordinate the methods required to identify and collect essential variables, to define and implement data archival standards, and to conduct the joint analyses required for regional and global biodiversity assessments.

For example, in the United States, the National Oceanic and Atmospheric Administration (NOAA), NASA, the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM), Shell Industry, and the Smithsonian Institution are funding demonstration projects coordinated to lay the foundation for a national network to monitor marine biodiversity at scales ranging from microbes to whales. These demonstration Marine Biodiversity Observation Networks or MBON have been established in the Florida Keys (Florida); Monterey Bay (California), the Santa Barbara Channel (California), and in the Chukchi Sea off Alaska. The Smithsonian Institution's Marine Global Earth Observatory (MarineGEO), directed by the Smithsonian's Tennenbaum Marine Observatories Network (TMON), has established research sites in Chesapeake Bay, Indian River Lagoon (Florida), Kaneohe Bay (Hawaii), the Mesoamerican Barrier Reef (Belize), and Bocas del Toro (Panama).

In Colombia, a program is being established in the Parque Nacional Natural Corales de Profundidad (PNN CPR), focused on mesophotic coral reefs in the Caribbean Sea. In Mexico, several marine biodiversity monitoring efforts are being carried out by the National Commission for Knowledge and Use of Biodiversity (CONABIO), and the Universidad Autonoma de Baja California.

Many other similar efforts exist from Australia to Europe, and from Asia to Africa.

This document requests support from the CBD to develop open, collaborative, integrated work through partnerships facilitated by the parties of the CBD and implemented within the

framework of the Group on Earth Observations (GEO) as a Thematic Marine Biodiversity Observation Network or Thematic MBON.

The Thematic MBON grows out of the priority activities of the Group on Earth Observations (GEO) Biodiversity Observation Network (BON) Working Group 5 (WG5) (GEO BON: <http://geobon.org/>). The Thematic MBON incorporates the biodiversity priorities of various GEO initiatives. It will incorporate and help focus WG5 products. Specifically, the effort includes the Global Marine Ecosystem Mapping effort (see Sayre<sup>1</sup> et al., 2015) led by the USGS and international scientists in collaboration with industry (ESRI). The thematic MBON will also contribute to the development and measurement of marine Essential Biodiversity Variables, and contribute methods and tools for a Marine BON in a Box.

It is important to coordinate such international efforts in biodiversity observation to help define management paradigms of biological resources, and to protect and sustain ecosystem services. The knowledge derived from such coordinated efforts is also needed to guide scientific and technical education and training, and public education and awareness. An important aspect of coordination is facilitating access to genetic resources on mutually agreed terms, recognizing sovereign rights of States over their natural resources.

Developing this knowledge requires the systematic collection of observation, scientific and technical cooperation, and biotechnology research. Results of research, development, and the commercial utilization of genetic resources may be shared in a fair and equitable way. This requires a framework for the fair and equitable sharing of benefits from biotechnology and addressing concerns related to the transfer, handling, and use of biodiversity information.

These CBD contracting Parties may benefit from **understanding which key organisms of ecological and management concern are in a marine ecosystem, how they relate to each other, and how they have been changing under different forcing**, be it natural or related to human pressures. Monitoring these changes will be important to understand changes in ecosystem services.

As the SBSTTA 20 plans its agenda on marine and coastal biodiversity issues, including marine spatial planning, ecologically or biologically significant marine areas (EBSAs), impacts of marine debris and climate change, and wild resource management, CBD contracting Parties may benefit from and support an effort to coordinate the standardization of methods, collection, and archiving of regional marine biodiversity observations, and associated capacity building efforts through a concerted international Marine Biodiversity Observation Network, or MBON. MBON is envisioned as the key pillar of GEO BON for the entire marine realm. As a collaboration, particularly with Blue Planet (GEO's overarching marine task, <http://www.oceansandsociety.org/>) and the Global Ocean Observing System (GOOS; <http://www.ioc-goos.org/>), it ensures coordination and sharing among the intertwined disciplines and other initiatives involved. The project members are also engaged in other activities, such as the Global Ocean Observing System (GOOS) Biological-Ecological Panel which seeks to

---

<sup>1</sup> Sayre, R., Wright, D., Aniello, P., Breyer, S., Cribbs, D., Frye, C. Vaughan R, Van Esch B, Stephens D, Harris P, Macmillan-Lawler M, Basher Z, Costello, M., Finkbeiner M, Monaco M, Goodin K, Guinotte J, Morgan L, Halpin P. 2015. "Mapping EMUs (Ecological Marine Units)—the creation of a global GIS of distinct marine environments to support marine spatial planning, management and conservation". GEOHAB 2015, Marine Geological and Biological Habitat Mapping, May 3-8, Salvador Bahia Brazil: 21.

establish Essential Ocean Variables based on regional and country needs. MBON is also working hand in hand with the IOC/UNESCO I-OBIS. We will seek close engagement with Future Earth and the IPBES.

## **The MBON Concept**

To improve our ability to monitor, interpret, and forecast change, and to provide the scientific information that supports marine living resource management, a coordinated system to collect biodiversity observations is needed. For this purpose, a Thematic Marine Biodiversity Observation Network, or MBON, is being formulated within the context of GEO BON.

Composed of regional networks, the MBON is an important tool to translate biological observations into a socio-economic context. It simplifies the complex relationship between biodiversity, organism abundance, system productivity, and ecosystem services. A successful MBON is fundamental to (1) provide baselines of biodiversity useful to users in science, industry, and policy and management, and (2) to improve each country's capacity to forecast impacts due to human activities, climate change, invasive species and harmful algal blooms (e.g. red tides) on ecosystem services and to respond to them.

## **Major benefits of the MBON**

The MBON offers many benefits to contracting parties and users of marine resources. For, example, the information generated by the MBON will:

- Expand our knowledge of biodiversity and its services with the purpose of improving management of human activities that impact these services.
- Coordinate separate individual monitoring and science programs focused on various aspects of marine biology and biodiversity to optimize productivity.
- Provide mechanisms to share data, experiences, knowledge, and protocols to understand species and the status and trends of ecosystem services.
- Increase understanding of physical and biological connectivity, including distributions and movements of migratory species across jurisdictions.
- Refine and adjust methods to collect information to properly document resources and to share innovative technologies and methods developed for the observation of marine biodiversity (e.g. remote sensing and genetic methods) that allow decision making based on scientific information.
- Amplify the effect of national investments in living marine resource surveys to a regional and global scale using the network, and simultaneously maintain the flexibility to manage resources locally and even regionally.
- Minimize the high costs of data management and of improving access to information.
- Provide the framework for a country to establish the baselines needed to evaluate status and critical trends in future biodiversity and living marine resource assessments. In turn, improve the capacity to detect and discriminate between changes caused by natural and/or anthropogenic factors and effectively respond to them.

## Phase 1: A Pole to Pole MBON

Changes in marine biodiversity are being documented along every coast from pole to pole. To facilitate effective decision making it is important to understand these changes and their implications. Implementing a global marine biodiversity observation network will require identifying and bringing together numerous partners and ongoing programs, identifying gaps, and coordinating to address priorities, standards, and a common set of practical observations (such as Essential Biodiversity Variables). A pilot effort may help highlight some of the challenges. The GEO BON WG5 proposes to organize regional groups that are willing and ready to network first, and then link these into a global network using the framework of the CBD/SBSTTA and the Ocean Biogeographic Information System (I-OBIS: [www.iobis.org](http://www.iobis.org)) coordinated by the UNESCO Intergovernmental Oceanographic Commission (IOC) (OBIS: [www.iobis.org](http://www.iobis.org)).

As a first component of the global system envisioned, GEO BON proposes a “Pole-to-Pole MBON in the Americas”, building on existing MBON pilots started last year. This would be a regional effort to monitor and document the changes in marine biodiversity occurring along the coasts of the Americas and from the Arctic to Patagonia and to Antarctica and inform effective and timely responses. In parallel, we will work with GEO BON and I-OBIS to identify programs in other continents that can be joined into a network.

In parallel through the framework of the GEO BON and with guidance and collaboration of the CBD contracting parties, MBON is interested in developing similar regional networks that link with Africa, Asia, Europe, and Oceania, from the Arctic to the Antarctic.

The vision is to develop the framework with the Pole to Pole MBON in the Americas pilot, to (1) connect and consolidate existing observing programs along the coasts of the Americas, (2) integrate surveys on species distribution, movement, habitat, and genetic material, (3) develop a community of practice and foster collaboration on science and sharing of data, and (4) share infrastructure (e.g. for sample data management, product visualization, analysis and synthesis).

Sustained observations along two pole to pole transects, one along the continental margin of the Pacific Ocean and the other along the continental margin of the Atlantic Ocean, will provide many benefits to the countries of the region. In addition to those already mentioned, benefits specific to the American continent include better understanding the impacts of El Niño and variations in rainfall and temperature on biodiversity and ecosystem services like fisheries, or how resilient ecological connected “biomes” may be.

An important capability would be to serve as an early warning system for changes in species composition. This includes monitoring for invasive species. It also includes providing observations to improve assessments on change of range expansions and contractions for species given environmental or biological disturbance.

The resulting integrated picture of what is happening to marine biodiversity will provide marine resource managers and policymakers with information to consider solutions to problems caused by human activities and **allow each country to address Aichi targets** and U.N. Sustainable Development Goal 14, which require marine biodiversity conservation.

## **Some concrete steps to define and implement the Pole-to-Pole MBON in the Americas:**

- Host a dedicated, in-person meeting of international mission agencies and scientists to:
  - Outline country needs in biodiversity observation;
  - Define scientific objectives and strategy to address operational problems. Scope and align what is needed, what is possible, what might be fundable, what is already happening and what could be adapted;
  - Define minimum / essential variables for each country/region (i.e. contribute to defining Ocean Essential Biodiversity Variables (EBVs for the Ocean). This requires defining concrete products and a timeframe for deliverables;
  - Outcome: establishment and definition of the Essential Ocean Variables (EOVs) along with a candidate list of indicators/protocols that would be acceptable as measurements for those variables.
- Inform about the benefits of an MBON;
- Define capacity building needs and develop targeted programs with BON in a BOX, engaging other national and international programs (GEO, GOOS, IOC/UNESCO, NOAA IOOS, NASA, etc.). Define contributions to a marine BON in a Box (a GEO BON framework to provide tools to help countries set up a biodiversity observation network).
  - Plan methods/training workshops to facilitate standardization and comparison of methods, and inter-calibration of observations;
- Plan and hold dedicated meetings between relevant national and international agencies on data organization, archiving, and sharing and use policies, perhaps jointly with CBD and IPBES. An objective would be to explore what data can be made openly available to facilitate regional assessments, following the model of international weather forecasting agencies.
- Use the MBON US Demonstration projects and the Smithsonian Tennenbaum Marine Observatories Network (TMON) as sources of experience and platforms for capacity building in the Americas.
- Identify candidate MBON sites and an overall coordination and governance structure during 2016
- Formal establishment of a global network in 2017 with partnerships from other regions.
- *Define a pilot demonstration implementation phase over a 5 to 10-year period.*

## **Connections to other initiatives and networks: Building on Existing Activities**

The MBON Pole to Pole in the Americas activity will benefit from other initiatives in the region. It will be built upon existing observing systems, but to accomplish this will require resources to support national research efforts and to link these into a network. The GEOSS in the Americas (AmeriGEOSS) and GEO BON, through its Marine Ecosystem Change Working Group (WG5) are committed to facilitating the link of international activities to implement the Pole to Pole project.

One goal is to develop an understanding of different standards for field data collections. The effort involves international metadata and data archival programs such as the I-OBIS/UNESCO IOC, the World Register of Marine Species (WoRMS) and Marine Regions. OBIS is an open, international database that allows users to search over 1,000 databases and 40 million marine biodiversity records from all of the world's oceans provided freely by a collaborative network of

hundreds of scientific institutions worldwide connected through national, regional and thematic OBIS nodes. WoRMS is an authoritative taxonomic reference list that assists in the organization of names, including synonyms, of marine organisms. The WoRMS open-access database integrates over a hundred global, regional, and thematic species databases controlled by more than 200 world-leading taxonomists. Marine Regions is a standard list of marine georeferenced place names, boundaries and areas. The GEO BON Marine Ecosystem Change Working Group and MBON, jointly with the GOOS Biology and Ecosystems Panel, have begun work on a list of core variables (Essential Ocean Variables and Essential Biodiversity Variables) to help prioritize future observations based on the societal need and the capabilities of present observation systems.

Similarly, MBON, as one of the pillars of GEO BON, requires the observation infrastructure and human capacity developed under the GEO Blue Planet, and strengthening the relationship with groups like AmeriGEOSS, the GOOS Biology and Ecosystems Panel, the International Council for Science's Committee on Data for Science and Technology (CODATA), and the GEO Data Sharing Working Group.

Coastal nations would benefit from international, systematic efforts to understand how marine resources may change in response to larger-scale forcing in the ocean and on land. These lead to shifts in large-scale ecosystem baselines. The aggregation of local observation systems into a global Marine Biodiversity Observation Network will address many dependencies of society on marine natural resources and their biodiversity and allow for the power to detect, understand and predict changes in marine biodiversity at a scale unachievable by any one program or country. Understanding how biodiversity and these related services are changing is essential for effective management for the sustainable use of resources. The GEO BON collaborative Marine BON concept is designed to fill these gaps and to find solutions to some of the problems that these changes have generated in our society.

The Thematic MBON community requests the support from the CBD and its contracting parties to obtain the financial support needed to enable this global biodiversity observation facility, to serve the need of the IPBES and the CBD.