DOSI
DEEP-OCEAN STEWARDSHIP INITIATIVE

POLICYBRIEF
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Accessing and Sharing Benefits from Marine Genetic Resources from Areas Beyond National Jurisdiction: Building on Best Practices in the Scientific Community

Best-practice approaches to marine scientific research already enable benefit-sharing from marine genetic resources (MGR) by providing open and facilitated access to data and samples, including long-term curation, data management, and knowledge exchange. Sample and data repositories are critical to reproducible science and advancing knowledge in support of the conservation and sustainable use of biodiversity beyond national jurisdiction (BBNJ). A BBNJ agreement could streamline and strengthen best-practice approaches, enhancing transparency and accessibility.

Fig 1

Fig 2

Fig 1&2 Sample sorting and archiving in the Discovery Collections. Photos, National Oceanography Centre, Southampton, UK

Deep-sea scientific research and sharing benefits are linked

Sampling the deep sea, particularly in areas beyond national jurisdiction (ABNJ), is technically challenging and costly. Access to samples and data from ABNJ is therefore critical for the deep-sea research community. Numerous initiatives already ensure wide availability of data and samples resulting from marine scientific research, for the purposes of improving knowledge of the deep-sea environment. These initiatives are key to sharing benefits from MGR.

What are MGR samples and data?

Noting the definitional challenges associated with MGR (DOSI, 2019), **MGR samples could encompass a wide range of sample types** –from whole organisms to environmental samples of water or sediments that may contain organisms – that are preserved to allow 'utilisation' of a MGR. (i.e. 'conducting research and development on the genetic/and or biochemical composition of genetic resources', CBD, 1992). **MGR data could encompass all information associated with or extracted from a physical MGR sample, including any associated genetic sequence data,** from an unprocessed genetic sequence, to an identification of a gene – i.e. a wide range of data types.

MGR data also includes the following information about a sample: current identification (taxonomy); current location and storage method; occurrence data (where, when and how the sample was collected); associated environmental data; and derived sample data (e.g. tissues and extractions isolated from the sample). To safeguard the scientific value of a sample, **all data (from taxonomic and occurrence information to any downstream genetic analysis) must be integrated and linked to the MGR sample.**

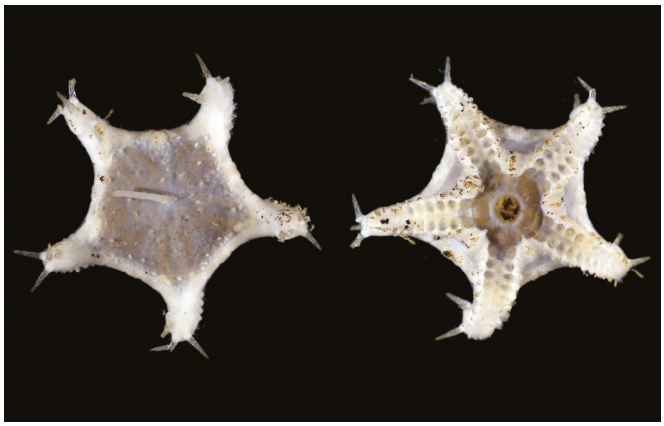

Fig 3 Echinodermata from the Central Pacific, collected from a seafloor benthic sample.
image by A. Glover, T. Dahlgren, H. Wiklund

Current scientific practice: From cruise to sample collection to data repository

MGR samples and data are collected from the deep-sea environment during a cruise. Such cruises require months of advance planning, often through international collaboration. Institutes, governments, and philanthropists manage the ships that conduct these cruises. Scientists typically register cruise information with the flag state, and log the data and sample collection information in relevant national repositories. However, practices vary with regards to sharing information on marine scientific research activities, including those involving biological sampling. Furthermore, no central global cruise registry currently exists to facilitate information sharing.

MGR samples collected during cruises are usually archived in biorepositories, including museums. Biodiversity science depends on such archives[1]. Even in the absence of any current legal requirements to archive samples, scientists have improved sample management practices in recent years, increasingly recognising the importance of sample archiving. **Sample collections serve as key agents of benefit-sharing,** as recognised in the Nagoya Protocol. Benefit-sharing for ABNJ can be supported through commitment to long-term curation and data management for collections. However, significant **logistical, technical and financial implications** must be addressed to make such collections more widely available.

Open access is best practice. Museums and biorepositories, open access publications, and databases already enable some access to MGR samples and data. The established practice for genetic data is publication in open access databases, such as **GenBank**. The open access database Ocean Biogeographic Information System (**OBIS**) publishes information about sample collection location, and therefore species occurrence. The World Register of Marine Species (**WoRMS**) publishes and incorporates taxonomic information. However, barriers to open access remain (resource constraints, datasets in formats that limit accessibility or data published in non-open access papers). **Data transparency encourages good data management.** Publishing datasets is a key mechanism to increase data accessibility and encourage best-practice.

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[1] *Amon, D., Baker, M., Harden-Davies, H., Hilario, A., Levin, L., (2018) Deep Sea Fundamentals. Deep Ocean Stewardship Initiative (DOSI) Policy Brief*

Strengthening access, sharing and transparency for MGR samples and data: options for the BBNJ agreement

The BBNJ agreement can facilitate the sharing of benefits from MGR of ABNJ and enhance international cooperation in marine scientific research, streamlining, strengthening, and improving visibility of scientific best practices.

Possible measures include:

(i) Creating a global online registry of research cruises and samples, enhancing knowledge exchange.

(ii) Recognising the important role and needs of collections for current and future use.

(iii) Recognising the crucial role of common data standards and standardisation frameworks. Data should be open and FAIR (Findable, Accessible, Interoperable and Reusable).

(iiii) Supporting existing data systems and appropriate tools and resources for sharing data and information, which may include a clearinghouse mechanism.

(v) Building cooperation and collaboration, including through national and global networks.

(vi) Ensuring a common understanding of terms, including scientific interpretations of legal definitions (in light of challenges experienced with the Nagoya Protocol).

Fig 3 21 species of Mollusca from the Central Pacific recently described with molecular and morphological data.
Image by A. Glover, T. Dahlgren, H. Wiklund

Thinking ahead: safeguarding scientific value

Management of MGR samples and data currently takes place in an open access arena, so any benefit-sharing regime must maintain open sharing of MGR from ABNJ, while building solutions to ensure access for all countries. This objective underlines the need to promote, and embed into protocols, a system of best-practices for data and sample management by the scientific community. To advance knowledge, enable reproducible science and support the conservation and sustainable use of BBNJ, the maintenance of sample and data repositories is needed. However, the maintenance of such facilities carries cost implications that must be considered to ensure long-term effective benefit-sharing. The elements are in place to build an effective agreement for access to MGR from ABNJ that supports both science and society.

References & Suggested Reading:

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2. Gjerde, K., Boteler, B., Durussel, C., Rochette, J., Unger, S., Wright, G. (2018) Conservation and Sustainable Use of Marine Biodiversity in Areas Beyond National Jurisdiction: Options for Underpinning a Strong Global BBNJ Agreement through Regional and Sectoral Governance, STRONG High Seas Project. doi:10.2312/iass.2018.015
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ABOUT DOSI

The Deep-Ocean Stewardship Initiative 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 jurisdiction.

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Fig 4 *Aboard research vessel en route to the Clarion Clipperton Zone, Central Pacific.*
Image by A. Glover, T. Dahlgren

Fig 5 *Sponge and shrimp at Monhs Treasure, on the Arctic Mid Ocean Ridge. 2700 m depth.*
Image courtesy of MarMine/Ramirez-Llodra, Norway

Fig 6 *Bryozoa growing on polymetallic nodule from the sea floor,*
Image by A. Glover, T. Dahlgren, H. Wiklund

Fig 7 *Sediment samples from Atacama Trench at 7742 metres depth.*
Image courtesy of Eulogio Soto, Universidad de Valparaiso, Chile


Fig 4


Fig 5


Fig 6


Fig 7