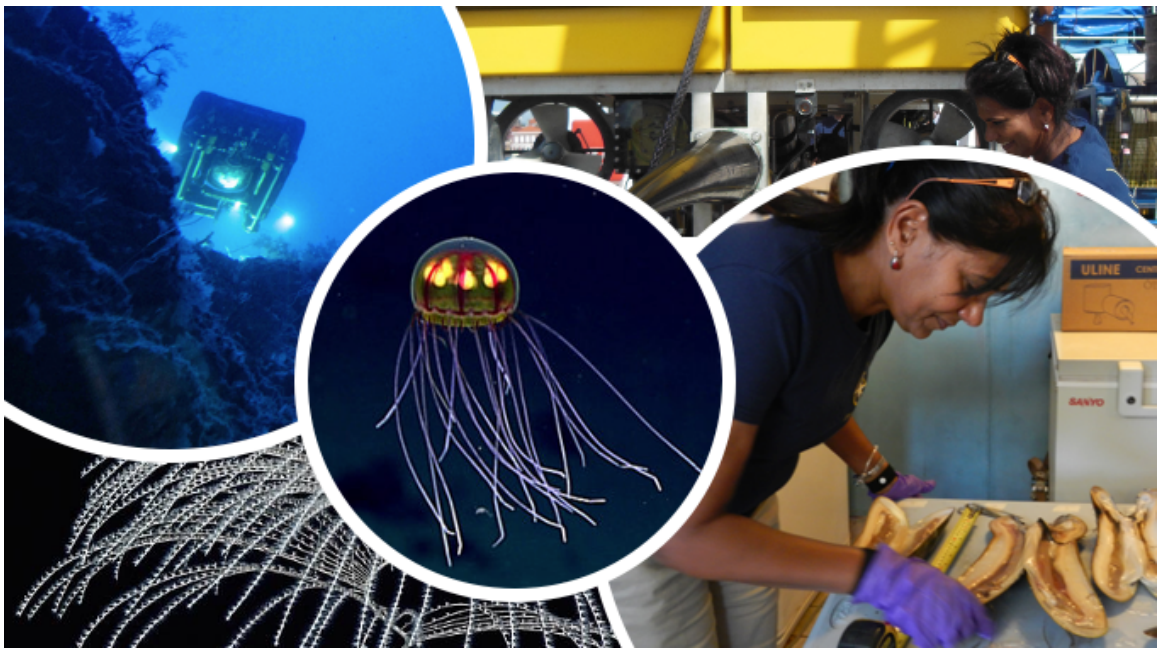
Science in Small Island Developing States

Capacity Challenges and Options relating to Marine Genetic Resources of Areas Beyond National Jurisdiction

Summary for policymakers



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This document summarises the report titled "Science in Small Island Developing States - Capacity Challenges and Options relating to Marine Genetic Resources of Areas Beyond National Jurisdiction". The report examines the challenges facing SIDS to access and use marine genetic resources from ABNJ and identifies options for the BBNJ agreement to address the scientific and technological needs of SIDS in this regard.

1. Small Island Developing States (SIDS) as "Large Ocean States" are closely connected to ocean areas beyond national jurisdiction (ABNJ).

A healthy ocean is vital for SIDS to survive and thrive, as marine resources support lives and livelihoods of SIDS, providing the basis for blue economies and thus supporting economic prosperity, social wellbeing, and environmental sustainability for future generations. However, although SIDS' have strong **ecological, economic and cultural connections** with ABNJ (through ocean currents, movement of species, cultures and proximity with deep and open ocean ecosystems of SIDS' Exclusive Economic Zones, EEZs) they face **capacity constraints**, including with respect to science, technology and innovation, that hinder their ability to access, study and utilise marine biodiversity of ABNJ and to benefit equitably from the use of marine genetic resources (MGR).

2. The development of a new international legally binding instrument for the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ agreement), under the United Nations Convention on the Law of the Sea is of particular importance to SIDS.

As specified in the United Nations General Assembly Resolution 72/249, the negotiations for the BBNJ agreement encompass (i) marine genetic resources, including questions on the sharing of benefits; (ii) measures such as area-based management tools, including marine protected areas; (iii) environmental impact assessments; and (iv) capacity-building and the transfer of marine technology. Key **benefits from MGR** include: building scientific and technical capacity of collaborators; increased knowledge of biodiversity in the ocean and resulting capacity for management/conservation; building biorepositories of local species for potential future analysis; improved understanding of the value of marine biodiversity; access to, or provision of, equipment, technology and facilities; and funds to support collaboration. Benefit-sharing is expected to support the conservation and sustainable use of biodiversity under the BBNJ agreement, and to **promote scientific research as well as capacity building**.

3. Science and technology relating to MGRs can be used for biodiversity conservation and biodiscovery.

Scientific research and development involving the genetic properties of marine organisms can be utilized for a range of purposes including the conservation and sustainable use of biodiversity and, potentially, the development and commercialization of biotechnology (Figure 1). In **conservation**, genomics is an increasingly important aspect of research efforts to understand marine biodiversity (e.g. species composition, distribution and population connectivity), **monitor ocean**

health and inform management (including fisheries management, environmental impact assessments and area-based management tools). For example, the analysis of 'environmental DNA' (eDNA – the genetic residue left behind by organisms in the marine environment) can be used to assess ecosystem health and to identify the presence of **invasive or threatened species**. Furthermore, technologies using real-time gene-sequencing can support law enforcement efforts by accurately identifying species, such as endangered species in **illegal wildlife trade** (e.g. shark fins and rays) or mislabeled seafood. The natural adaptations of marine organisms (e.g. to various levels of temperature, pressure or chemical concentration) can also indirectly inspire, or be directly used in research and development.

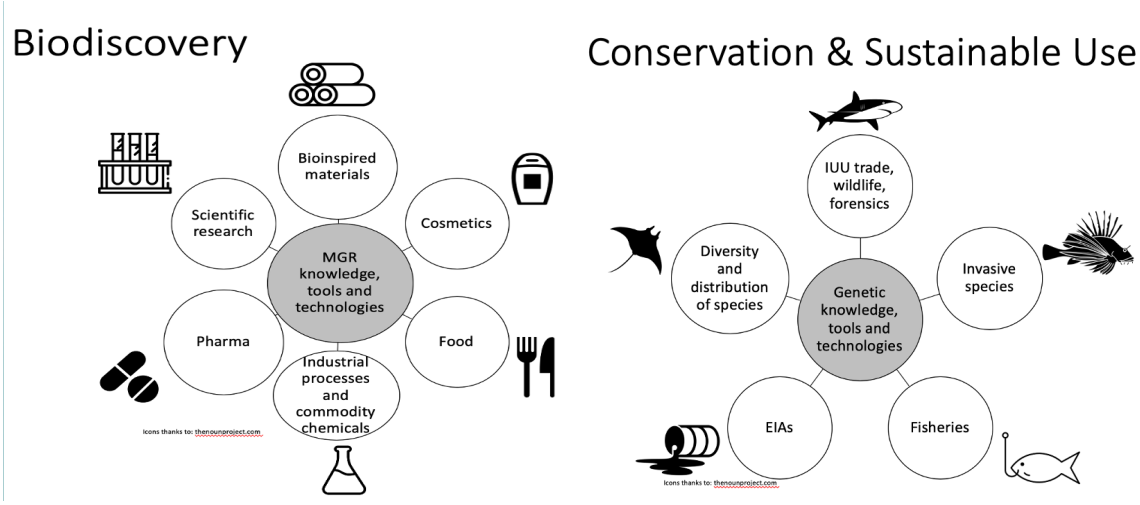

Figure 1. Genetic knowledge, tools and technologies can be used in applications for conservation and sustainable use of biodiversity and for biodiscovery.

'Biodiscovery' applications can use or recreate molecules (e.g. natural products or enzymes) produced by marine organisms to develop new products such as **commodity chemicals, industrial enzymes, cosmetics, nutraceuticals, and pharmaceuticals**.Research and development processes require various forms of **human, technical, financial and scientific investment** as well as legal, policy and regulatory capacities. There are different entry points into MGR development, from basic facilities to the state of the art. The options for SIDS likely depend on current capacities, technologies, skills and budgets.

4. Several SIDS have scientific and technological capacity relevant to MGRs – but constraints remain with respect to MGRs of ABNJ

Almost all SIDS already have some institutional basis for ocean science, such as one or more **university or research institutions**, though there is wide variation between SIDS. Some are small, others are larger with sophisticated facilities spread over several universities and research institutes, including some with dedicated focus on marine biodiscovery, biotechnology or genomics.

Illustrative examples provided in the report include:

- **international partnerships enabling deep-sea biodiversity research** in SIDS, including in Cabo Verde, Cook Islands, Grenada, Kiribati, Netherlands Antilles, Palau, Seychelles, Trinidad and Tobago and Vanuatu;
- **marine biodiscovery and biotechnology research initiatives and degree programs** in Barbados, Fiji, Jamaica, Mauritius, Papua New Guinea, Seychelles, Singapore and Solomon Islands;
- **marine biodiversity research activities and degree programs** involving genetic research in Bahamas, Barbados, Belize, Fiji, Maldives, and Trinidad and Tobago;
- **small-medium enterprises** specializing in marine biodiscovery in Mauritius and Jamaica.

Constraints and capacity building experiences offer lessons learned:

Ocean areas *within* national jurisdiction

Ocean areas within national jurisdiction represent a pressing priority for SIDS capacity because most lack the capacity to fully investigate their own—often very large—EEZs. Building SIDS capacity to undertake and utilise ocean science with respect to ABNJ could also be usefully applied **within the EEZ**. Supporting SIDS to develop **research and innovation agendas** that not only considers the BBNJ agreement but also the priority needs relating to—and connectivity with—national EEZs could help to identify synergies for capacity building.

We need capacity to better understand our EEZ, and we could then use that to better engage with ABNJ.

Human capacity

Training, retaining, and sustaining scientists, and inspiring the next generation of leading ocean stewards, scientists and innovators is critical. **Human capacity** can built through training, education and mentoring, through university courses and international fellowship programs. Local leaders are important to cultivate confidence in early- and mid-career scientists, to support them in professional development.

International cooperation is really important for training, but it has to be meaningful – just a workshop for a week is not going to get us far.

Technology and institutional capacity

Acquiring and maintaining the necessary technical capacity such as research equipment and research infrastructure, is needed for SIDS stakeholders to be able to apply their skills and undertake research. Maintenance resources are also important. A **permanent program** that provides SIDS a shared research vessel for use, on a regional or ocean-basin scale, for conducting open and deep ocean research is currently lacking.

We have sophisticated lab equipment…but there are limitations—a huge system like 'next generation [DNA] sequencers' needs a lot of money, expertise and maintenance.

Collaboration

Partnerships within and outside of regions, are important to overcome capacity constraints in SIDS. For example, **regional hubs** already exist such as The University of the West Indies and the University of South Pacific. International partnerships, with partners from areas

outside the region, can boost national and regional institutional capacity by bringing expertise, funding, technology, or equipment such as research vessels and other equipment. Piecemeal approaches such as stand-alone workshops or one time cruise participation could distract efforts as they are no substitute for co-designed and co-delivered activities. Facilitating **connections** with potential partners and collaborators to solve scientific, conservation and development challenges, including by building networks and **partnerships** on the regional and global level can help enhance skills and acquire technologies to meet SIDS' needs.

We don't want to see tokenistic partnerships (…) the opportunity to go on a research vessel can be a good thing if it is meaningful, but not if the person has no facility to return home to, no equipment to use, no colleagues to collaborate with. So, it really hinges on the needs assessment so we can determine the most appropriate opportunities for us.

Funding

Attaining adequate **funding** remains a challenge to building and sustaining institutional capacity in SIDS and to employ SIDS scientists, managers and entrepreneurs to allow them to innovate and acquire and apply scientific knowledge. Ensuring that SIDS can access funds in a timely manner, can use funds for the purposes that they require, and can sustain funds in the long-term is an important factor in considering the capacity of SIDS to engage in research relating to MGRs of ABNJ and to implement the BBNJ agreement.

'Stop – start' [in funding] is a problem for scientists in SIDS and their partners.

5. The BBNJ agreement could help SIDS to meet science and innovation capacity needs with respect to MGR of ABNJ.

The BBNJ agreement could provide a way forward to realizing SIDS aspirations in relation to the conservation and sustainable use of marine biodiversity and addressing SIDS's science and technology capacity needs by:

i. Needs Assessments.

Supporting national (and perhaps regional) capacity **needs assessments** to help SIDS stakeholders to self-determine desired support and direct international partnerships in ways that will benefit SIDS, including in relation to the use of MGRs. The conduct of needs assessments could benefit from support (e.g. guidance, funding, assistance) from the BBNJ agreement The development of **national or regional research and innovation agendas**, and related capacity development **strategies** drawing on needs assessments, could make it easier for SIDS to seek assistance from international bodies and donors, ensuring that the aid provided directly addresses national needs and aligns with ocean and science policy priorities.

We still see projects happening 'the wrong way', we get 'aid bombing' sometimes where someone comes to us and says 'here is new equipment, or a new portal - enjoy!' and then leaves: it is not conducive to capacity building. That is where the needs assessments become so important.

ii. A Global Plan of Action.

Developing a shared global vision and strategy for addressing country capacity and technology needs for implementing the BBNJ agreement, (rooted in existing policies, such as the Sustainable Development Goals, SDGs, and the SAMOA Pathway or national blue economy strategies) and in expressed country needs. Such a plan could guide initiatives, including under the UN Decade of Ocean Science for Sustainable Development, as well as support future monitoring efforts.

iii. Facilitating genuine partnerships.

Genuine and durable partnerships including between scientific institutions regionally and globally, and with donors, NGOs and the private sector that help meet national and regional needs of SIDS could be supported by: enabling interpersonal connections such as through scholarships, fellowships and long-term mentoring; developing guidance, guidelines and/or principles for genuine and durable BBNJ-related partnerships; and linking existing and new networks with and in SIDS.

As an island we are disconnected as to what we can do to valorise our blue economy. We have to find the networks ourselves (…) I try to keep up to date – but where is the portal to get the knowledge?

iv. Access to information

Access to data and information relating to BBNJ, MGR and capacity building and technology transfer should be user-friendly, meet country needs, and actively foster participation, inclusivity, and transparency. Under the BBNJ agreement, a **clearinghouse mechanism** could usefully facilitate information sharing regarding relevant marine scientific research activities, partnership opportunities for research and development, and needs assessment. This will require linking to and working with existing databases and information portals, including regional platforms. It will also require incorporating a **strong human element** to actively facilitate access to networks of practitioners for expert advice and for sharing experiences, including in a SIDS-to-SIDS context, to champion inclusivity and to coordinate, update and support users.

It must be active, not passive, someone needs to search for partners with you or for you, and/or you need workshops and events to meet people and to get to know people.

v. Funding

Funding will need to be accessible, appropriate, and of adequate amounts and duration to meet the identified needs of SIDS to access and utilize MGRs of ABNJ and implement the BBNJ agreement. At a minimum, a sustained public funding mechanism is vital for the BBNJ agreement, but it is likely not enough on its own. A fund specifically for capacity building and technology transfer might also be considered. Additionally, partnership of ocean funders, similar to the multi-donor ABS Capacity Development Initiative, might help fund the joint implementation of both the BBNJ Agreement and complementary national needs for SDG 14, and might also attract private sector participation.

vi. Monitoring

The BBNJ agreement will only be successful if no country is left behind, and it is important to monitor that countries,

including SIDS, are progressing in meeting their needs and implementing their research agendas. In addition, needs and circumstances change over time, and it is important that capacity and technology keep pace with changing needs.

vii. Considering connections with areas within national jurisdiction.

The BBNJ agreement, and the capacity building and technology transfer activities that are foreseen, could usefully be viewed as linked to broader national, regional and global efforts to enhance marine science for improved ocean governance, including the aspirations of SIDS as articulated in the SAMOA Pathway, and in the Sustainable Development Goals (SDGs). For the ocean, SDG 14 and in particular target 14.7 relating to blue economies, and target 14.A relating to scientific research capacity and technology, go hand in hand to support the aspirations of SIDS. The UN Decade of Ocean Science for Sustainable Development is a timely opportunity to go beyond 'business as usual' and ensure that SIDS are empowered to take leadership roles in designing and delivering programs that address their needs.

6. In conclusion, capacity building and technology transfer are vital for the success of the BBNJ agreement.

Without the necessary capacity and technology, it is unlikely that the agreement will be successful in achieving its objectives. Building long-lasting capacity requires cooperation and coordination amongst all countries and ocean stakeholders, as well as a holistic vision that corresponds to an ecosystem approach for the governance of an interconnected ocean. It will require more than individual training courses or ad hoc initiatives. It will require investment in both human and institutional capacity, including infrastructure, long-term funding, as well as an enabling environment that prioritizes work towards ocean protection, science and sustainable development. It will also require long-term mentoring and support network, as well as national-level benefits and ownership of the efforts, while ensuring whole ocean management through regional and global multi-sectoral networks and partnerships. It is time to chart a long-term course towards sustainable development and security that places the health of the ocean and the well-being of people at its centre, consider what a shared research agenda or a "Global Plan of Action" for the conservation and sustainable use of MGR of the entire ocean would look like, and build the capacity to implement it. SIDS have led the way towards the adoption of a standalone SDG for the ocean, and they can also lead the way towards the adoption of a BBNJ agreement that will maintain and restore the health of the global ocean in the long term. But this goal can only be realized if all countries work together to ensure that all have the capacity and technology to look after our shared ocean, and that in the words of Agenda 2030, no one is left behind.

The report was commissioned by the Alliance of Small Island States (AOSIS) and produced by the University of Wollongong (lead authors Dr Harriet Harden-Davies and Dr Marjo Vierros) under the guidance of an expert advisory group (Professor Judith Gobin, Professor Marcel Jaspars, Angelique Popounneau and Dr Katy Soapi). Additional research contributions were provided by Dr. Suzanne von der Porten, while insights from interviewees and reviewers greatly contributed to the study.

Summary of challenges facing SIDS, identified by key informant interviews[1]

Challenge	Illustrative quote(s)
1. Connecting ocean areas *within* and *beyond* national jurisdiction	*We don't know what is in our EEZ. We need capacity to better understand our EEZ, and we could then use that to better engage with ABNJ. (Int. 7).*
2. Human capacity: training, retaining and sustaining talent	*It all comes down to the individual expertise that we have. (Int. 8).* *International cooperation is really important for training, but it has to be meaningful – just a workshop for a week is not going to get us far. (Int. 7)* *[My country] has highly trained scientists. Many go abroad to get their training, sometimes for 10 years or more, but they come back to serve their country. However, if there is no organisation to hire them, they end up doing jobs that don't utilise their science talent directly. (Int. 5)* *My co-supervisor for my Masters was based at [a university in USA], but she was more than an advisor, she was a mentor, and I am still in touch with her now. (Int. 7).*
3. Technology: owning and/or accessing equipment and the resources to maintain and operate	*We have sophisticated lab equipment for genetic science, natural products research and biodiscovery. We are investing in it ourselves, but there are limitations – a huge system like 'next generation [DNA] sequencers' needs a lot of money and expertise and maintenance. (Int. 5).* *The technology has to be left in the country forever, not on loan for a year or two, but there. (Int. 9).*
4. Institutions: a physical place or a connected 'hub'	*We need to know what would make careers in marine science interesting, then we need to ensure they can make a living – that means that they need facilities. We just don't have that in our country at the moment (Int. 5).*
5. Enabling measures: funding, coordination,	*As an island we are disconnected as to what we can do to valorise our blue economy. We have to find the networks ourselves – find conferences, look online to see what is available – there is not a lot of access about what is happening in outside science – except if I'm talking to [one collaborator from overseas]. I try to keep up to date – but where is the portal to get the knowledge? (Int.5).* *[Project funding] needs to be resource intensive, shoestring doesn't work, people need to be paid. One person spending half their time in a [SIDS] country and half their time out does not work. Even if that person is well intentioned, it doesn't work and ends up being like parachute science because of limited resources (Int. 9).* *'Stop – start' [in funding] is a problem for scientists in SIDS and their partners (Int. 13).*
6. Alignment to national needs	*We still see projects happening 'the wrong way', we get 'aid bombing' sometimes where someone comes to us and says 'here is new equipment, or a new portal - enjoy!' and then leaves: it is not conducive to capacity building. That is where the needs assessments become so important. (Int. 8).*

[1] For interviewee details, see main report.

Lessons for genuine and durable partnerships, identified by key informants[1]

Approach	Illustrative quote(s)
1. Dedicated resources to support people on the ground	*It must be active, not passive, someone needs to search for partners with you or for you, and/or you need workshops and events to meet people and to get to know people (Int. 13).*
2. Connecting people	*Facilitating the networking is key. For partnerships, it is crucial to have someone who is passionate about managing the relationships' keeping the channels of communication open and actively flowing (Int. 1).*
3. Co-ownership of programs Co-designing research questions; early, continuous and meaningful engagement Transparency with respect to data and samples Co-publication	*If we are players in certain marine scientific research initiatives it is all too often in the form of [an organisation coming into our country and saying to us] 'this is a capacity building exercise, you can come out on our boat, but then goodbye' (Int. 9).* *We don't want to see tokenistic partnerships [under the BBNJ agreement], such as 'come on our research vessel' only. The opportunity to go on a research vessel can be a good thing if it is meaningful, but not if the person has no facility to return home to, no equipment to use, no colleagues to collaborate with. So it really hinges on the needs assessment so we can determine the most appropriate opportunities for us (Int. 8).* *It is not about altruism, its about partnerships—science is better when you have meaningful engagements with in-country scientists, policymakers and NGOs (Int. 1).* *We have a copy of all data, the data can sit within the partnership structure – this is how you win the confidence of the government. (Int. 7).* *Our [SIDS] colleagues not getting onto publications is an issue that happens constantly – but at the same time I don't want to be a token on the paper either and do absolutely nothing (Int. 7).* *Publications equals prestige. (Int. 11)*
4. Adequate time	*For SIDS, you need a 20-year timeline for solid science partnerships, especially if biodiscovery is involved (Int. 8).* *This [project] might not be particularly long-term but it did give us a view below scuba-diving limits, which hadn't been done in [our SIDS country] before (Int. 5).* *I insisted on the partners coming into our country for more than 3 weeks, because you can only understand the landscape of different organisations, government agencies and NGOs once you are there (Int. 7).*
5. Coordination	*Knowing who is doing what is crucial. Sometimes, we don't even know what is happening within our own institutions (Int. 13).* *It happens that scientists sample the same bit of ocean over and over again – because they haven't coordinated or worked with the people in-country to find the grey literature where a lot of that information and data is recorded (Int. 1).*

Front cover images courtesy of: Nekton (top left image); NOAA Office of Ocean Exploration and Research, 'Discovering the Deep Exploring Remote Pacific MPAs' (bottom left image) and 2016 Deepwater Exploration of the Marianas (middle image); Dr Judith Gobin (top right image, bottom right image).