

## Policy pointers

**UN member states**

negotiating a legally binding instrument governing Areas Beyond National Jurisdiction (ABNJ) must include provisions to ensure that all future management regimes are informed by their potential impacts on territorial waters — particularly in Least Developed Countries and other developing coastal states.

**The criteria for**

establishing Marine Protected Areas (MPAs) and other area-based management tools in ABNJ must include the potential socioeconomic benefits for vulnerable coastal communities, as well as the ecological or biological significance of the area in question.

**Governments must**

ensure that management systems in ABNJ are adaptive and dynamic, and share the technology, data capacity and investment needed to rapidly respond to shifts in species distribution or ocean circulation caused by climate change.

**Uncertainty around**

future climate change and impacts on connectivity necessitate a precautionary approach to ABNJ governance.

## So far, yet so close: ecological connectivity between ABNJ and territorial waters

United Nations member states are negotiating a new International Legally Binding Instrument (ILBI) on the conservation and sustainable management of marine biodiversity in Areas Beyond National Jurisdiction (ABNJ). These waters do not exist in isolation: marine ecosystems are interconnected by ocean currents and the movement of migratory species. What happens in ABNJ can therefore cause impacts in territorial waters. Many Least Developed Countries (LDCs) and Small Island Developing States (SIDS) depend heavily on marine resources, but the benefits from conservation and management measures in ABNJ will not be evenly distributed. By highlighting which regions of ABNJ are most connected to coastal LDCs and other developing coastal states via ocean currents, this briefing aims to help the parties ensure that area-based management regimes in ABNJ protect these countries' interests and rights.

United Nations member states have started a process to negotiate the establishment of a new International Legally Binding Instrument (ILBI) on the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction (BBNJ). These negotiations are taking place under the auspices of the UN Convention on the Law of the Sea (UNCLOS).

One of the main issues the new instrument will address is the development of area-based management tools, notably Marine Protected Areas (MPAs). In line with UNCLOS and Sustainable Development Goals 1 (No Poverty), 2 (Zero Hunger) and 14 (Life Below Water), the instrument is also expected to recognise the rights and special requirements of developing countries — particularly Least Developed Countries (LDCs) — in terms of the conservation

and sustainable use of BBNJ. The ocean is a highly interconnected system, which means an inclusive international agreement will need to reflect the way conservation measures in Areas Beyond National Jurisdiction (ABNJ) can affect coastal waters (defined here as territorial waters). For example, numerous marine species spend some of their life as larvae that drift hundreds or even thousands of kilometres with ocean currents, while other species actively migrate between coastal waters and ABNJ. Ecological connectivity between marine ecosystems means that negative impacts — such as overfishing and pollution — within ABNJ can affect coastal populations of marine species, and ultimately change the structure of coastal ecosystems. Connectivity varies between different ABNJ and coastal waters,

## *Ecological connectivity between marine ecosystems means that negative impacts within ABNJ can affect coastal populations of marine species*

and countries with stronger connectivity will capture many more benefits than others from conservation measures such as MPAs.<sup>1</sup> Most coastal LDCs, Small Island Developing States (SIDS), and other developing coastal states depend heavily on marine resources for food security, livelihoods and government revenues. Marine resources and traditional fishing practices also have important cultural significance for many coastal communities. Furthermore, many coastal communities are

already facing climate shocks such as extreme weather events and sea-level rise. It is therefore crucial that any ILBI considers both the potential impacts of economic and other activities in ABNJ on vulnerable communities, and the distribution of ecosystem benefits that may arise from conservation efforts. In the context of limited resources for conservation, prioritising regions in ABNJ that are most likely to benefit vulnerable coastal communities could significantly contribute to poverty alleviation and food security.

**What is ecological connectivity?** Ecological connectivity is a complex natural phenomenon linking various components of marine

ecosystems in time and space. Ecological connectivity between ABNJ and coastal waters occurs via two distinct processes: (1) passive circulation-driven connectivity and (2) migratory connectivity.

### **Circulation connectivity**

Circulation connectivity between coastal waters and ABNJ depends on the prevailing direction, timescale and variability of ocean currents. The complex ways these various factors can interact means that close geographical proximity, or 'adjacency', of coastal waters to ABNJ is not always a good indicator of strong connectivity.<sup>2</sup> Most coastal regions are connected to other, often remote, regions due to the presence of significant boundary currents or features such as coastal upwelling. There are exceptions, however. For example, oceanic islands located in subtropical gyres of the major basins may experience limited connectivity due to relatively weak currents.<sup>3</sup>

A study completed in 2018 estimated the level of circulation connectivity between the coastal waters of all coastal LDCs and ABNJ, incorporating inter-annual and seasonal variability.<sup>1,3</sup> By tracking virtual particles in space and time as they move in relation to modelled ocean currents, the authors estimated the degree of circulation connectivity of ABNJ to coastal waters for each LDC. The study looked specifically at currents moving in the direction from ABNJ towards coastal areas, as opposed to those moving from coastal areas to ABNJ. Numerous Pacific Small Island Developing States (PSIDS), African coastal states and other coastal LDCs exhibited strong connectivity to ABNJ (see Box 1).

### **Migratory connectivity**

Numerous migratory species of conservation importance, including highly migratory fish such as tuna, travel long distances across the jurisdictions of multiple states and ABNJ. A recent study of the migration of 14 marine predators — from leatherback sea turtles to albatross — found that, cumulatively, these species visited 86% of Pacific states, with some spending up to three-quarters of their annual cycles in ABNJ.<sup>4</sup> Large MPAs and networks of smaller MPAs that target preferred or critical habitats in ABNJ can therefore serve as effective conservation tools for migratory species.<sup>5,6</sup> The planning and design of these MPAs should be informed by their migratory connectivity to LDCs, since many migratory species are of significant social, cultural and economic value. By influencing the migration patterns of such species, remote MPAs in ABNJ

### **Box 1. Circulation connectivity of coastal LDCs to ABNJ<sup>1</sup>**

Within the Indian Ocean, Tanzania showed the strongest connectivity to ABNJ, closely followed by other East African states, including Somalia; in the Pacific, Kiribati showed the strongest connectivity, closely followed by Tuvalu, Vanuatu and the Solomon Islands; and in the Atlantic Ocean, Liberia showed the strongest connectivity (Figure 1). Coastal LDCs with tight connectivity to ABNJ, and short timescales of connectivity, face significant threats from activities such as fishing, shipping, mining and geoengineering experiments in ABNJ. (Note that some threats, such as pollution, may affect even wider communities across a longer timescale). Based on this evaluation, these countries will likely benefit from MPA designations in ABNJ that is tightly connected to their coastal waters in two ways: (1) they will be protected from any potential negative impacts of economic activities in ABNJ, and (2) their coastal waters will benefit from the protection of ABNJ that play a crucial role in the recovery and maintenance of coastal fish stocks and other coastal living marine resources. This will in turn improve the resilience of coastal communities and ecosystems to climate and economic shocks. We have therefore identified the most important regions of ABNJ for coastal LDCs, measured in terms of having strong connectivity to the greatest number of individual LDCs (Figure 2). Three areas are most prominent: the central Indian Ocean (the ABNJ portion of the Mascarene Plateau), the northern Bay of Bengal, the East Atlantic Ocean (North West Africa) and the 'donut hole'<sup>16</sup> of the Pacific Islands.

could affect the rights and interests of some coastal states.

For example, tuna is distributed throughout much of the western and northern Indian Ocean and the low- and mid-latitude regions of the Pacific, where it migrates between spawning and feeding grounds.<sup>7</sup> In the Indian Ocean, the main tuna distribution spans the coastal waters of many western Indian Ocean states and reaches into ABNJ.<sup>7,8</sup> In the Pacific, the main tuna distribution spans the territorial waters of the Philippines, the island groups of Micronesia, Melanesia and Polynesia, the west coast of Central and South America and ABNJ.<sup>8</sup> Tuna fisheries (subsistence, commercial and, increasingly, recreational) in these regions play a crucial role in food security and employment, particularly for PSIDS and coastal LDCs in the Indian Ocean.<sup>9,10</sup> They also generate significant government revenues that are used to fund national budgets, service international debt and import food needed to bolster national food security and diversify diets.<sup>11</sup> Via migratory connectivity, coastal tuna fisheries are heavily influenced by activities in ABNJ.

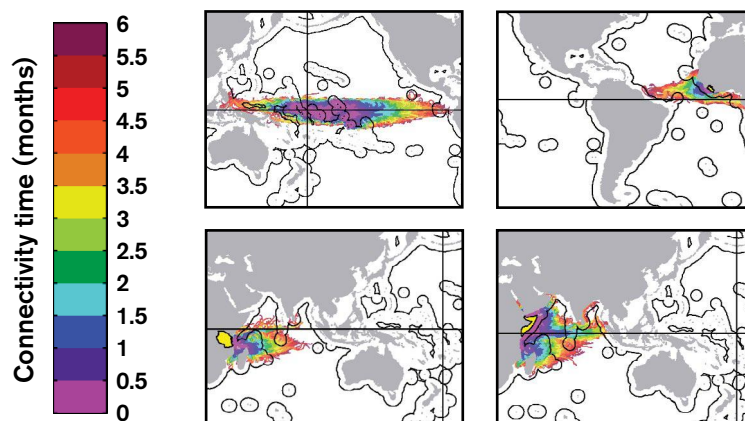
Most sea turtles also migrate vast distances across oceans to lay eggs, feed and reproduce. Leatherback turtles, for example — which are highly threatened — have been shown to travel through 32 country jurisdictions and ABNJ within the Pacific Ocean.<sup>4</sup> The negative impacts of activities such as industrial longline fishing in ABNJ can be observed in coastal waters. Turtles are of major socioeconomic and cultural value to coastal LDCs, particularly in the Pacific and Indian Oceans.<sup>12</sup> Historically, traditional turtle fisheries have supported subsistence economies in the region, and they remain culturally significant to coastal communities throughout the Western Pacific today (such as in Papua New Guinea). Turtles also support ecotourism, which is of growing economic importance to many coastal LDCs.

## Implications and challenges for BBNJ governance

The new international instrument provides an opportunity to ensure that BBNJ is managed not only by those with a direct economic stake in human activities in ABNJ, but also by those potentially distant coastal states that are exposed to the impacts of those activities via their ecological connectivity.

A growing body of evidence can be used to identify which sections of ABNJ are of most importance to vulnerable coastal communities, and which coastal LDCs are most vulnerable to the impacts of human activities in ABNJ.

**Figure 1. Maps showing connectivity of Kiribati, Liberia, Somalia and Tanzania (clockwise) to ABNJ on a six-month timescale**

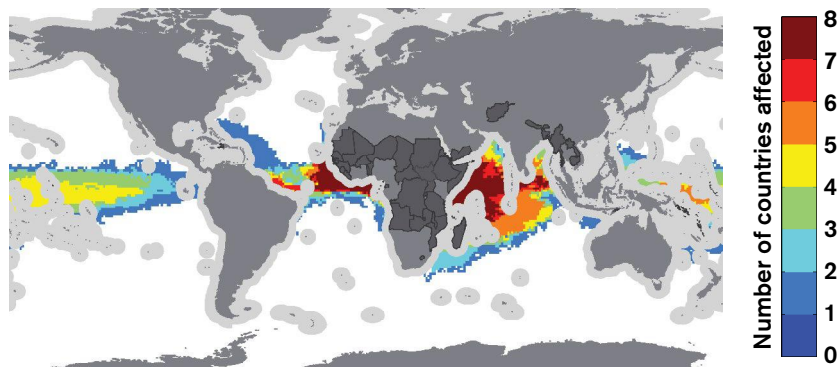


Coastal border indicates Exclusive Economic Zones (EEZ) of each state (up to 200 nautical miles from land). This map assumes that all States have established EEZ and that all territorial disputes have been resolved.

Negotiations around criteria for the designation of MPAs and other area-based management tools in ABNJ should focus not only on the ecological and biological significance of the area in question, but also on the potential positive and negative impacts of management — particularly for vulnerable coastal communities.

However, the emerging impacts of climate change on both ocean circulation and the global distribution of species indicate that today's patterns of ecological connectivity will not remain static in time.<sup>13,14</sup> Without adaptive and dynamic management, these impacts could undermine conservation efforts. This may not be easy: poor coordination between different management agencies and a lack of funds are hampering existing attempts to adaptively manage MPAs. Furthermore, MPAs tend to be established with fixed boundaries that do not

**Figure 2. Map of ABNJ connectivity to the coastal waters of LDCs (dark grey)**



Colour scale shows the number of LDCs that each ABNJ is connected to within a six-month timescale. Grey coastal regions indicate Exclusive Economic Zones (EEZ) of each state (up to 200 nautical miles from land). This map assumes that all States have established EEZ and that all territorial disputes have been resolved.

allow managers the flexibility to rapidly respond to change. The new instrument should therefore ensure that BBNJ governance goes a step further by delivering effective international cooperation and applying dynamic ocean management, such as mobile MPAs.<sup>15</sup> This will require governments to share technology, data and investment in systems to rigorously research and monitor patterns of ecological connectivity, as well as the efficacy of management systems.

Despite rapid progress in the development of technologies for monitoring ocean circulation and species distribution,<sup>1</sup> there are still gaps in the evidence underpinning ecological connectivity, and changes are hard to predict. The precautionary principle should therefore be incorporated into all phases of ABNJ governance. As defined in Article 6 of the UN Fish Stocks Agreement, the precautionary approach provides a basis for political action to protect resources and preserve the marine environment in circumstances where information is uncertain, unreliable or inadequate. The absence of adequate scientific information should not be a reason for the international community to postpone or fail to implement conservation and management measures.

Finally, our findings on ecological connectivity should also inform a broader approach to environmental impact assessments (EIAs) of

economic and non-economic activities in ABNJ. The potential impacts we have demonstrated mean that any activity that is likely to affect coastal waters should be subject to an EIA, which must take implications for vulnerable coastal communities into account.

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## Knowledge Products

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The National Oceanography Centre is the United Kingdom's centre of excellence for oceanographic sciences. We have a remit to provide national capability and leadership for big ocean science.

The Department of Ichthyology and Fisheries Science at Rhodes University, South Africa is a leading African academic institution that supports the study of fish and the sustainable utilization of aquatic resources.

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## Notes

<sup>1</sup> Popova, E *et al.* (in review) Ecological connectivity between ABNJ and coastal waters: Safeguarding interests of coastal communities in developing countries. *Marine Policy*. / <sup>2</sup> Dunn, DC, Crespo, GO, Vierros, M, Freestone, D, Rosenthal, E, Roady, S, Alberini, A, Harrison, A-L, Cisneros, A, Moore, JW, Sloat, MR, Ota, Y, Caddell, R and Halpin, PN (2017) Adjacency: How legal precedent, ecological connectivity, and Traditional Knowledge inform our understanding of proximity. *Nereus Scientific & Technical Briefs on ABNJ series*. See: [nereusprogram.org/reports/policy-brief-biodiversity-beyond-national-jurisdiction](http://nereusprogram.org/reports/policy-brief-biodiversity-beyond-national-jurisdiction) / <sup>3</sup> Robinson, J (2017) Far-field connectivity of the UK's four largest marine protected areas: Four of a kind? *Earth's Future* 5(5) 475–494. / <sup>4</sup> Harrison, AL (2018) The political biogeography of migratory marine predators. *Nature Ecology and Evolution* (2) 1571–1578. / <sup>5</sup> Game, ET, Grantham, HS, Hobday, AJ, Pressey, RL, Lombard, AT, Beckley, LE, Gjerde, K, Bustamante, R, Possingham, HP and Richardson, AJ (2009) Pelagic protected areas: The missing dimension in ocean conservation. *Trends in Ecology & Evolution* 24(7) 360–369. / <sup>6</sup> Halpern, BS (2003) The impact of marine reserves: Do reserves work and does reserve size matter? *Ecological Applications* 13(1) S117–S137. / <sup>7</sup> Dhurmea, Z, Zudaire, I, Chassot, E, Cedras, M, Nikolic, N, Bourjea, J, West, W, Appadoo, C and Bodin, N (2016) Reproductive biology of albacore tuna (*Thunnus alalunga*) in the Western Indian Ocean. *Plos One* 11 (12): e0168605. / <sup>8</sup> Fonteneau, A and Hallier, JP (2015) Fifty years of dart tag recoveries for tropical tuna: A global comparison of results for the western Pacific, eastern Pacific, Atlantic, and Indian Oceans. *Fisheries Research* (163) 7–22. / <sup>9</sup> Gillet, R (2016) Fisheries in the economies of Pacific Island countries and territories. Pacific Community (SPC), Noumea, New Caledonia. / <sup>10</sup> Bell, JD, Cisneros-Montemayor, A, Hanich, Q, Johnson, JE, Lehoudey, P, Moore, BR, Pratchett, MS, Reygondeau, G, Senina, I, Virdin, J and Wabnitz, CCC (2018) Adaptations to maintain the contributions of small-scale fisheries to food security in the Pacific Islands. *Marine Policy* (88) 303–314. / <sup>11</sup> Bell, JD, Allain, V, Gupta, AS and Johnson, JE (2018) Climate change impacts, vulnerabilities and adaptations: Western and Central Pacific Ocean marine fisheries. In: Barange, M, Bahri, T, Beveridge, MCM, Cochrane, KL, Funge-Smith, S and Poulain, F (eds). *Impacts of climate change on fisheries and aquaculture: Synthesis of current knowledge, adaptation and mitigation options*. FAO, Rome. / <sup>12</sup> Campbell, LM (2003) Contemporary Culture, Use, and Conservation of Sea Turtles. In: Lutz, PL, Musick, JA and Wyneken, J (eds). *The Biology of Sea Turtles, Volume II*. CRC Press, Boca Raton, Florida, USA. / <sup>13</sup> van Gennip, SJ, Popova, EE, Yool, A, Pecl, GT, Hobday, AJ and Sorte, CJB (2017) Going with the flow: The role of ocean circulation in global marine ecosystems under a changing climate. *Global Change Biology* 23(7) 2602–2617. / <sup>14</sup> Pecl, GT, Araújo, MB, Bell, JD, Blanchard, J, Bonebrake, TC, Chen, I-C, Clark, TD, Colwell, RK, Danielsen, F, Evengård, B, Falconi, L, Ferrier, S, Frusher, S, Garcia, RA, Griffis, RB, Hobday, AJ, Janion-Scheepers, C, Jarzyna, MA, Jennings, S, Lenoir, J, Linnetved, HI, Martin, VY, McCormack, PC, McDonald, J, Mitchell, NJ, Mustonen, T, Pandolfi, JM, Pettorelli, N, Popova, E, Robinson, SA, Scheffers, BR, Shaw, JD, Sorte, CJB, Strugnell, JM, Sunday, JM, Tuanmu, M-N, Vergés, A, Villanueva, C, Wernberg, T, Wapstra, E and Williams, SE (2017) Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being. *Science* 355 (6332), eaai9214. / <sup>15</sup> Maxwell, SM, Hazen, EL, Lewison, RL, Dunn, DC, Bailey, H, Bograd, SJ, Briscoe, DK, Fossette, S, Hobday, AJ, Bennett, M, Benson, S, Caldwell, MR, Costa, DP, Dewar, H, Eguchi, T, Hazen, L, Kohin, S, Sippel, T and Crowder, LB (2015) Dynamic ocean management: Defining and conceptualizing real-time management of the ocean. *Marine Policy* (58) 42–50. / <sup>16</sup> A region of ABNJ that is entirely surrounded by the exclusive economic zones of adjacent Pacific island states.