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Polycentricity and Regional Ocean Governance: Implications for the Emerging UN Agreement on Marine Biodiversity Beyond National Jurisdiction

Kristina M. Gjerde[1] *and Siddharth Shekhar Yadav*[2]*

[1] *Global Marine and Polar Programme, International Union for Conservation of Nature, Cambridge, MA, United States,*
[2] *Permanent Mission of the Republic of Vanuatu to the United Nations, New York, NY, United States*

The governance of the two-thirds of the world's ocean in areas beyond national jurisdiction (the high seas and deep seabed beyond national jurisdiction or ABNJ) is currently fragmented into diverse institutions addressing specific activities, issues or regions. This has hampered the international community's ability to redress critical issues including biodiversity loss, pollution, climate change, ecosystem degradation and declining fisheries in an integrated and ecosystem-based manner. Our analysis of polycentricity theory and associated enabling conditions shows that the current polycentric approach to marine biodiversity in ABNJ is not yet fully functional: it is missing the two key attributes of: (1) generally applicable rules and norms structuring actions and behaviors, and (2) processes to enhance cooperation, coordination, and conflict resolution. Based on the enabling conditions conducive for achieving "a functional polycentric governance system" identified in Carlisle and Gruby (2019), combined with a prior analysis applying resilience principles for socio-ecological systems to ABNJ (Yadav and Gjerde, 2020), this article suggests seven ways the emerging United Nations agreement on the conservation and sustainable use of marine biodiversity of ABNJ (BBNJ Agreement) could stimulate coordinated and integrated action at both global and regional levels in ABNJ. These include: (1) overarching rules, goals and objectives; (2) formal and informal conflict resolution mechanisms; (3) robust global institutional arrangements; (4) strengthened global, regional and sectoral bodies with shared and overlapping responsibility for biodiversity conservation; (5) strengthened cooperation through integrated ecosystem assessments and strategic action programmes at ecologically meaningful scales that could include areas within and beyond national jurisdiction; (6) learning exchange mechanisms within and across regions; and (7) strengthened regional and national capacities for ecosystem-based management in ABNJ. Taken together, these tools could enhance the resilience of ocean institutions, ecosystems and biodiversity to cope with growing pressures, uncertainty and rapid change in ABNJ.

Keywords: polycentricity, resilience, regional ocean governance, large marine ecosystems (LMEs), areas beyond national jurisdiction (ABNJ), biodiversity beyond national jurisdiction (BBNJ), United Nations Convention on the Law of the Sea (UNCLOS)

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Reef Studies, Australia

****Correspondence:***
Siddharth Shekhar Yadav
sid.shekhar.un@gmail.com

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INTRODUCTION

The recognition of the crucial role of international ocean governance in building global ocean resilience is growing (UNEP, 2016; Wright et al., 2017; Gjerde and Wright, 2019; Mahon and Fanning, 2019b). The health and resilience of the global ocean in areas beyond national jurisdiction (the high seas and deep seabed beyond national boundaries or ABNJ) is threatened by climate change, overexploitation, pollution, and habitat degradation as well as their interacting and cumulative impacts (Ramirez-Llodra et al., 2011; Roberts et al., 2017; FAO, 2019; IPCC, 2019; Blasiak et al., 2020; World Ocean Assessment II, 2021). As noted by the United Nations Secretary-General in his foreword to the World Ocean Assessment II "to ensure sustainability, we must work together to improve integrated ocean management, including through joint research, capacity development and sharing of data, information and technology" (World Ocean Assessment II, 2021, p. 5).

To address these accelerating threats through more coherent and integrated management in ABNJ, the United Nations (UN) is currently in the final stages of negotiating a new Agreement for the conservation and sustainable use of marine biodiversity in ABNJ (BBNJ Agreement) under the UN Convention on the Law of the Sea (UNCLOS). In this context, the regional level [currently undefined but based largely on the geographic scope of regional seas agreements and/or regional fisheries bodies (see Section "Regional Ocean Governance: Institutional Arrangements, Benefits and Challenges")], is being considered as an important vehicle for implementing the emerging BBNJ Agreement because of its assumed ability to enable States and stakeholders to take action "closer, further and faster" (Rochette et al., 2015, p. 9; PROG, 2021).

However, as explored in this article, the current ocean governance framework for ABNJ is facing challenges including conflicts and power imbalances, lack of mechanisms for coordination, integration or conflict resolution, and mismatches in jurisdictional scope, which together are hampering cooperation for biodiversity conservation and ecosystem-based integrated management (Mahon et al., 2015; Blanchard et al., 2019; Gjerde et al., 2019; Yadav and Gjerde, 2020). For the current clusters of regional and sectoral ocean governance agreements and institutions managing activities or issues affecting BBNJ to achieve their potential for advancing the BBNJ Agreement's objectives, it is worth considering the enabling conditions for a functional polycentric governance system proposed by Carlisle and Gruby (2019) based on the work of Vincent and Elinor Ostrom (see Section "Polycentricity: Enabling Conditions, Benefits and Challenges" below).

The consideration of the regional level as a complement to global approaches in addressing the threats to the ocean is not new; several instruments encourage regional approaches including UNCLOS, the United Nations Fish Stocks Agreement (UNFSA) and the Convention on Biological Diversity (CBD) (UNEP, 2016; Harrison, 2017; Wright et al., 2017; Mahon and Fanning, 2019b). However, the current sectoral framework, which allocates responsibility to specific multilateral organizations to manage different maritime activities in ABNJ such as fishing (regional), shipping (global) or mining (global), currently lacks effective coordination or integration mechanisms for advancing conservation and sustainable use of marine biodiversity (Fanning et al., 2015; UNEP, 2016; Wright et al., 2018; Blanchard et al., 2019; Mahon and Fanning, 2019b). Areas and species considered as priorities for protection by global conservation agreements such as the Convention on Biological Diversity (CBD), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS) are generally poorly reflected in sectoral outcomes (Gjerde et al., 2019). Most regional seas and other non-sectoral organizations focus on waters within national jurisdiction [out to the limits of the territorial sea or Exclusive Economic Zones (EEZs)], with few opportunities to influence activities outside their limited geographical remit (see Section "Regional Ocean Governance: Institutional Arrangements, Benefits and Challenges" below).

In this regard, "polycentricity," a concept advanced by Vincent and Elinor Ostrom since the 1960s, is relevant to understanding the interplay between regional, sectoral and global conservation institutions in ABNJ. Polycentricity itself is defined as any governance system with multiple, interacting decision-making centers with some degree of autonomy (Ostrom et al., 1961; Schoon et al., 2015; Carlisle and Gruby, 2019). However, to derive the benefits associated with a "functional polycentric governance system," polycentric units should operate under shared rules, mechanisms for effective collaboration, cooperation and conflict resolution as well as other enabling conditions (Carlisle and Gruby, 2019, p. 929). This is particularly important for managing global common resources or global threats such as climate change or biodiversity loss. Hence, polycentricity theory can be a useful lens for considering under what conditions regional and sectoral institutions might advance global conservation goals more effectively in ABNJ (Mahon et al., 2015; Mahon and Fanning, 2019b) including through the emerging BBNJ Agreement.

Aim of the Article

This article applies insights drawn from polycentricity theory to explore how the emerging BBNJ Agreement might strengthen integrated management for biodiversity benefits across regional and global level institutions, based on current UN discussions regarding potential institutional arrangements. This article aims to deepen the analysis in Yadav and Gjerde (2020) which applied the seven principles for building resilience in socio-ecological systems by Biggs et al. (2015) to the BBNJ Agreement. These seven principles are: (1) Maintain Diversity and Redundancy, (2) Manage Connectivity, (3) Manage Slow Variables and Feedbacks, (4) Foster Complex Adaptive Systems Thinking, (5) Encourage Learning, (6) Broaden Participation, and (7) Promote Polycentric Governance. Although the focus is on cooperation and integration amongst global and regional bodies, to consider how polycentricity theory might be applied at a smaller ecologically meaningful scale to implement the BBNJ Agreement, the article examines one innovative yet

challenging approach to sub-regional ocean governance, the Large Marine Ecosystem (LME) programme, for further lessons on fostering integrated ecosystem-based management at a bio-regional scale. The article also seeks to highlight the need for further study of polycentricity in ABNJ, especially on the effects of the power dynamics within international ocean governance, as power asymmetries and differing priorities may hinder the achievement of global environmental goals (Morrison et al., 2019).

State of Play: Institutional Arrangements in the Draft BBNJ Agreement

Before investigating the issues surrounding polycentric theory and governance in ABNJ, it is helpful to understand the state of play of the BBNJ Agreement negotiations regarding the relationship between the BBNJ Agreement and other institutions and agreements, noting that formal negotiations are presently postponed until the first half of 2022. Three alternative approaches to the BBNJ institutional arrangements have emerged in the negotiations so far: (1) a global approach that would create a new global body with decision-making mechanisms and implementation authority; (2) a regional approach allocating authority to the existing bodies for decision-making and implementation; and (3) a mixed approach that could include a blending of global decision-making, standard-setting and implementation authority with strengthened cross-sectoral regional-scale implementation mechanisms (Wright et al., 2018; Clark, 2020).

Those supporting a more global approach have called for a centralized implementing role of the global body that could, for example, directly adopt protective measures for marine protected areas (MPAs) and review and approve environmental impact assessments (EIAs). This could enable States Parties to the BBNJ Agreement to adopt ambitious measures amongst themselves while seeking collaboration with other States and bodies (Clark, 2020). Some fear that such a global approach might "undermine" existing bodies and agreements, and often prefer a regionally-centered approach where existing sectoral and regional bodies would retain the primary if not sole authority for decision-making, implementation and monitoring (Friedman et al., 2018; Wright et al., 2018). This type of regional approach raises fears in turn that it could result in leaving authority primarily within the hands of existing sectoral bodies. Still others, including the authors, posit that a blended approach is needed that could both allocate many centralized powers to a global COP while seeking to strengthen existing sectoral and regional bodies and enhance cross-sectoral coordination. This blending could, it is hoped, pave the way for more integrated ecosystem-based management at a range of ecologically meaningful scales (Durussel et al., 2018; Gjerde et al., 2018, 2019). Hence, polycentric theory is relevant to better understand the enabling conditions for any of these three approaches to function effectively.

At present, there appears to be broad support for establishing at least the following core global institutional arrangements: (1) a Conference of Parties (COP) to provide a platform for the parties to take decisions, carry out coordination and integration efforts, and review progress; (2) a scientific and technical body to advise on scientific and technical matters; and (3) a Secretariat to provide support to the bodies (Gjerde et al., 2018; Clark, 2020; Nordquist and Long, 2021).

However, less discussion has been devoted to considering how existing regional and sectoral agreements and bodies such as Regional Seas Conventions and Action Plans (RSCAPs), regional fisheries management organizations (RFMOs), the International Maritime Organization (IMO) or the International Seabed Authority (ISA) may need to be strengthened and what other mechanisms for cooperation and conflict resolution may need to be instituted to achieve effective implementation.

Discussion on this topic has been constrained by the concerns of some States and sectors that any effort to strengthen or influence existing global, regional or sectoral bodies would automatically "undermine" such bodies. This argument stems from a specific reading of the UNGA Resolution launching negotiations that set forth: "the process and its result should not undermine existing relevant legal instruments and frameworks and relevant global, regional and sectoral bodies" [GA Res 72/249, UNGAOR, Doc A/RES/72/249 (24 December 2017)]. However, "not undermine" can also be read as it is used in the UNFSA, another implementing agreement to UNCLOS, as "not undermining the effectiveness of" such bodies (Friedman et al., 2018; Clark, 2020). UNFSA further provides a useful model as it obliges its States Parties to strengthen existing institutions to improve their effectiveness in establishing and implementing conservation and management measures (e.g., by applying key conservation principles, adopting precautionary decision-rules and reference points, improving transparency) (Gjerde et al., 2019). Nevertheless, the UNFSA has been only partly successful in enhancing RFMO performance due in part to lack of mechanisms for global accountability or for taking into account other actors and interests in ABNJ (Gjerde et al., 2013), two central conditions for functional polycentric governance systems.

Organization

Section "Polycentricity and Regional Ocean Governance" introduces polycentricity theory including its enabling conditions, benefits and challenges; and current regional ocean governance arrangements relevant to ABNJ. Section "Materials and Methods" describes the Methods and primary source material. Section "Results," presents the findings on the application of polycentricity concepts to regional clusters of ocean governance in ABNJ. It also throws light on challenges faced in achieving the benefits of a functional polycentric ocean governance system for ABNJ, and on LME approaches. The Discussion section, focuses on implications of the above for the BBNJ Agreement taking into account existing polycentricity theory including Carlisle and Gruby's (2019) theoretical model, the Stockholm Resilience Centre's resilience framework, as well as lessons offered by LME approaches. It highlights seven ways the emerging BBNJ Agreement could contribute toward achieving the benefits associated with functional polycentric governance to advance institutional resilience, biodiversity conservation and

ecologically sustainable use in ABNJ. Finally, it draws attention to issues that require further research.

POLYCENTRICITY AND REGIONAL OCEAN GOVERNANCE

Polycentricity: Enabling Conditions, Benefits and Challenges

The concept of polycentricity was used by Ostrom et al. (1961) to describe why and how a diverse array of agencies providing public services could in fact produce better results than a single monolithic arrangement. In the seminal work on *"Polycentric systems for coping with collective action and global environmental change"* Elinor Ostrom (2010) applied this polycentric lens to the challenges of instigating action to redress the global issue of climate change, finding that "polycentric approaches facilitate achieving benefits at multiple scales as well as experimentation and learning from experience with diverse policies" (Ostrom, 2010, p. 550). Ostrom et al. (1961, p. 831, emphasis added) explain "polycentric" and polycentric "system" as follows:

"Polycentric" connotes many centers of decision making that are formally independent of each other. . . **To the extent that they take each other into account in competitive relationships, enter into various contractual and cooperative undertakings or have recourse to central mechanisms to resolve conflicts**, the various political jurisdictions in a metropolitan area may function in a coherent manner with consistent and predictable patterns of interacting behavior. To the extent that this is so, **they may be said to function as a "system."**

It is important to note that E. Ostrom (2010) was not against binding global agreements and global scale action on collective problems such as climate change. Rather, E. Ostrom (2010) saw value in action at all levels, noting "that problems involving multiple levels (e.g., global, national, regional, and small scales) should involve contributions at each of these levels" (Ostrom, 2010, p. 552).

Key characteristics, features and attributes of polycentric governance have been explored in a range of fields and diverse literatures. Carlisle and Gruby (2019, p. 6), based on the conceptualization by Ostrom et al. (1961), propose the following two attributes of polycentric governance systems: (1) "multiple, overlapping decision-making centers with some degree of autonomy," and (2) "choosing to act in ways that take into account of others through processes of cooperation, competition, conflict, and conflict resolution." Focusing on governance in the context of climate change, Jordan et al. (2018) propose five characteristics that polycentric systems have: local action, mutual adjustment, experimentation, trust, and overarching rules. Mahon and Fanning (2019a) have used these propositions by Jordan et al. (2018) in analyzing the extent to which regional ocean governance arrangements meet the criteria for functional polycentricity.

The existing literature associates polycentric governance with multiple advantages (McGinnis, 1999, 2000, 2005; Marshall, 2009; Galaz et al., 2012; Cole, 2015; Schoon et al., 2015; Carlisle and Gruby, 2019; Mahon and Fanning, 2019a; Morrison et al., 2019). By empowering multiple actors at multiple levels, it is said to create new opportunities for creative approaches to developing and applying solutions (Carlisle and Gruby, 2019) and build resilience by enhancing diversity, redundancy, connectivity, learning, and participation of stakeholders (Schoon et al., 2015; Yadav and Gjerde, 2020). Cole (2015) further explains that polycentric approaches: (1) improve policy outcomes by offering more opportunities for learning and experimentation, and (2) help build trust required for increased cooperation by enhancing communications and interactions among parties. Mahon and Fanning (2019a, p. (3) draw on Gruby and Basurto's (2013) work on protected area management in Palau, to note that a nested polycentric system can enable local resource users to apply local knowledge to the design of context-specific rules, while larger organizations, including governments, "can enhance local capacity to deal with non-contributors or local tyrants, share and invest in information, and coordinate cross-boundary problems" (Gruby and Basurto, 2013, p. 50).

In the context of resilience theory, polycentric systems may be more resilient and robust to external shocks as another institution can step in if one institution falls short: the system can adapt and recover faster due to its diversity and redundancy (Low et al., 2003; Galaz et al., 2012; Biggs et al., 2015; Schoon et al., 2015; Morrison, 2017; Blanchard et al., 2019; Yadav and Gjerde, 2020).

However, it is also important to recognize that these advantages are more likely when the key attributes and enabling conditions identified by Carlisle and Gruby (2019) are present. **Table 1** shows the attributes and enabling conditions identified by Carlisle and Gruby (2019) that at least in theory lead to a more functional polycentric governance system.

Moreover, scholars note that power dynamics may create pitfalls and challenges through political conflicts and tradeoffs among parties, inconsistent policies, power imbalance, and financial challenges (Ostrom, 2010; Galaz et al., 2012; Schoon et al., 2015; Morrison et al., 2019) and have called for further research into this issue. As has been explored elsewhere, such issues along with jurisdictional and accountability gaps are especially pertinent in ABNJ (Ortuño Crespo et al., 2019; Gjerde et al., 2021). Additionally, evidence that polycentric systems always perform well or better over time than other forms of governance is lacking, and more empirical research is required to explore the circumstances and contexts in which polycentric governance systems may perform well or be ineffective (Ostrom et al., 1961; Marshall, 2015; Schoon et al., 2015; Carlisle and Gruby, 2018, 2019; Mahon and Fanning, 2019a).

Regional Ocean Governance: Institutional Arrangements, Benefits and Challenges

The "regional level," the role of which is instrumental in international environmental policy and law, has unique significance in ocean governance for biodiversity in ABNJ especially considering the need for an integrated and

TABLE 1 | Attributes and enabling conditions for functional polycentric governance (Carlisle and Gruby, 2019).

Attributes
Attribute 1: Multiple, overlapping decision-making centers with some degree of autonomy.
Attribute 2: Choosing to act in ways that take account of others through processes of cooperation, competition, conflict and conflict resolution.
Enabling conditions
Enabling Condition 1: Decision-making centers employ diverse institutions.
Enabling Condition 2: Generally applicable rules and norms structure actions and behaviors within the system.
Enabling Condition 3: Decision-making centers participate in cross-scale linkages or other mechanisms for deliberation and learning.
Enabling Condition 4: Mechanisms for accountability exist within the governance system.
Enabling Condition 5: A variety of formal and informal mechanisms for conflict resolution exist within the system.
Enabling Condition 6: Decision making centers exist at different levels and across political jurisdictions.
Enabling Condition 7: The jurisdiction or scope of authority of decision-making centers is coterminous with the boundaries of the problem being addressed.

coherent ecosystem-based approach to ocean management and the transboundary characteristics of marine issues (IOC-UNESCO, 2014; Rochette et al., 2015; Gjerde and Wright, 2019; PROG, 2021). Regional ocean governance has gained increased attention of late, mainly due to its reinforcement in the SDG 14 and the wider 2030 Agenda (UNGA, 2015; UNEP, 2016; Wright et al., 2017; Mahon and Fanning, 2019b). When compared with exclusively national or global approaches, there are clearly a number of distinctive advantages associated with the regional level: better consideration of the uniqueness of a marine ecosystem prior to policy development and implementation, customized management of a given region, facilitation of cooperative action through typically fewer players with shared history, potential for more effective coordination and cooperation across sectors and geopolitical boundaries, all essential elements for functional polycentric governance (Rochette et al., 2014; Biggs et al., 2015; Wright et al., 2017; Gjerde and Wright, 2019; Yadav and Gjerde, 2020; PROG, 2021). However, it needs to be recalled that some of the premises for regional ocean governance, that all share the same values, goals and objectives, may be strained as membership of regional (or global) management bodies focusing on resources or uses primarily in ABNJ may be dominated by States from outside the region giving rise to power asymmetries and conflicting interests (Gjerde and Wright, 2019).

Regional ocean governance is said to involve five types of institutions or arrangements, some long-established while others relatively more recent, as shown by Wright et al. (2017): (1) Regional Seas Conventions and Action Plans (Regional Seas or RSCAPs), many of which are managed or supported by United Nations Environment Programme (UNEP); (2) Regional Fisheries Bodies (RFBs) including many that have been established under the United Nations Food and Agriculture Organisation (FAO); (3) Political and economic communities that aim to address ocean issues at the regional level, e.g., the Caribbean Community (CARICOM), the European Union (EU), the African Union (AU), among others; (4) Leader-driven initiatives, for example, the Micronesia Challenge, the Pacific Oceanscape, and the Western Indian Ocean Coastal Challenge, among others, which are regional initiatives set up by heads of States and other leaders; and (5) Large Marine Ecosystem (LME) mechanisms supporting transboundary management largely between coastal states, which the Global Environmental Facility (GEF) has played a significant role in supporting. Political/economic integration arrangements, leader-driven initiatives, LMEs, and other arrangements developed specifically by countries in the region (Mahon and Fanning, 2019a) can be important vehicles to address mismatches between externally imposed Regional Seas and RFMO regions and bio-regional ecosystems but are often non-binding.

Table 2 shows the geographical scope of the various regional ocean governance arrangements, highlighting whether they include areas within or beyond national jurisdiction, or both in some cases. While each type of mechanism mentioned above has its own advantages and may have contributed to strengthening ocean management, none individually is sufficient in mandate or geographic scope to deal with the multitude of growing anthropogenic threats to BBNJ (Galaz et al., 2012; Fanning et al., 2015; Rochette et al., 2015; UNEP, 2016; Durussel et al., 2018; Gjerde and Harden-Davies, 2018; Ortuño Crespo et al., 2019).

The challenge is that most of these regional ocean governance arrangements (other than RFMOs) were designed to focus primarily on areas and issues within national jurisdiction. Scaling these arrangements up to fully embrace and consider biodiversity and ecosystem-based management in ABNJ presents a new array of issues. Human activities occurring in ABNJ are mainly regulated sectorally by organizations including RFMOs, IMO and ISA (Ringbom and Henriksen, 2017; UNEP-WCMC, 2017; Blasiak et al., 2020; Yadav and Gjerde, 2020). The current fragmented framework hampers coordination and integration to address critical issues including biodiversity, pollution, climate change, ecosystem health and fisheries (Galaz et al., 2012; Fanning et al., 2015; Mahon et al., 2015; UNEP, 2016; Ortuño Crespo et al., 2019).

This fragmentation can be exacerbated as sectoral institutions *via* their members often act on divergent and conflicting principles and values (Barkin et al., 2018; Yadav and Gjerde, 2020) and risk tolerances for environmental harm (Rice and Garcia, 2011), with few interactions and thus poor sharing of knowledge among key ocean stakeholders (Vousden, 2015; Harrison, 2017; Alexander and Haward, 2019; Gjerde and Wright, 2019; UNEP-WCMC, 2019). Power dynamics and asymmetries may further influence outcomes. For example, IMO, ISA and RFMOs have the power to set rules binding upon their member states, whereas Regional Seas organizations and most international conservation agreements such as the Convention on Biological Diversity (CBD) primarily recommend, advise and coordinate (Gjerde et al., 2019). Various domestic drivers

TABLE 2 | Geographical extent of regional ocean governance arrangements.

Regional ocean governance arrangement	Geographical extent
Regional Seas Conventions and Action Plans	Generally cover coastal areas up to the outer limits of EEZ. Only four regional systems (Antarctic, Mediterranean, North-East Atlantic and South Pacific) have specific mandates to cover ABNJ as well.
Regional Fisheries Bodies	RFBs can be divided into 3 categories: (1) Both ABNJ and coastal State maritime zones, (2) only or mainly ABNJ, and (3) only coastal state maritime zones Note: Of the RFBs, only regional fisheries management organizations (RFMOs) can adopt management measures in ABNJ; some RFMOs focus on tuna or tuna-like species, others focus on a region but may not cover all fish species (Ortuño Crespo et al., 2019).
Political and economic organizations	The scope of this arrangement varies greatly depending on the political and economic organizations themselves.
Leader-driven initiatives	Mainly covers challenges in the coastal and marine environments of the given countries and jurisdictions with shared resources and common concerns.
Large Marine Ecosystem (LME) mechanisms	The geographical extent of an LME is based on ecological criteria: (1) bathymetry, (2) hydrography, (3) productivity, and (4) trophic relationships (Sherman, 1994; Vousden, 2015). LMEs mainly consist of EEZs and territorial waters only (coastal State maritime zones). However, a few LMEs do include nearby ABNJ.

Sources: Rochette et al. (2015), UNEP (2016), and Wright et al. (2017).

of international fisheries policies (Barkin et al., 2018) as well as consensus-requirements for decision-making within RFMOs may help to explain why certain RFMOs have been slow to advance measures necessary for ecosystem-based approaches to fisheries such as assessing fisheries impacts, reducing by-catch, increasing observer coverage and reporting, or limiting impacts on dependent and associated species and ecosystems (Gjerde et al., 2013, 2021; Ortuño Crespo et al., 2019). The study by Barkin et al. (2018) establishes a framework for considering the extent to which differing national policies and priorities may affect RFMO decision-making and fisheries policies "from those that in practice support sustainable management to those that seem implicitly committed to fishing as much as possible in the short term" (Barkin et al., 2018, p. 256). A similar framework could presumably be applied to other sectors to better understand and potentially reduce the differences between sectoral outcomes. Furthermore, regional cooperation is more complicated when it comes to ABNJ because of their "commons" (open access) status with regard to access and exploitation of marine resources (Vousden, 2015, p. 393).

Implementation of tools that could enhance cross-sectoral integration focused on ocean health and resilience, such as ecosystem-based integrated ocean management (Lieberknecht, 2020) or Marine Spatial Planning (MSP) remain weak in ABNJ (UNEP-WCMC, 2019). International or transboundary interactions that are required for effective management of the ocean continue to face the "Tragedy of the Commons" problem which refers to the theory that actors who operate individually and on the basis of their own self-interest, would act contrary to the greater good of a larger stakeholder group by exhausting a common resource for their own respective individual advantages (Hardin, 1968; Basurto and Ostrom, 2009; Vousden, 2015; Gjerde and Harden-Davies, 2018). The governance of ocean resources and marine biodiversity represents a typical collective action problem where individual goals may be in conflict with broader societal goals, but also where polycentricity has potential for providing solutions (Olson, 1965; Schoon et al., 2015; Bodin, 2017).

Considering the scope of the Special Issue, one of the five types of regional ocean governance arrangements—the LME mechanisms—is analyzed in section "Large Marine Ecosystems" as it is the most focused on advancing ecosystem-based management at a biophysically-based sub-regional scale.

MATERIALS AND METHODS

This article applies some of the key studies on polycentricity (Ostrom et al., 1961; Ostrom, 1999, 2000, 2010; Galaz et al., 2012; Biggs et al., 2015; Schoon et al., 2015; Jordan et al., 2018; Carlisle and Gruby, 2019; Mahon and Fanning, 2019b; Mahon and Fanning, 2019a) to analyze polycentricity in regional arrangements relevant to BBNJ, what the key challenges related to polycentricity are, how they could be addressed, and the lessons offered for the BBNJ Agreement.

Its approach builds on the analysis and application of resilience-enhancing principles in the context of ocean ABNJ in Yadav and Gjerde (2020). **Figure 1** shows the seven resilience principles, developed by the Stockholm Resilience Centre (Biggs et al., 2015) and applied in Yadav and Gjerde (2020): Principle 1—Maintain Diversity and Redundancy; Principle 2—Manage Connectivity; Principle 3—Manage Slow Variables and Feedbacks; Principle 4—Foster Complex Adaptive Systems Thinking; Principle 5—Encourage Learning; Principle 6—Broaden Participation; and Principle 7—Promote Polycentric Governance. Yadav and Gjerde (2020) thoroughly engaged with the Stockholm Resilience Centre's resilience framework, highlighting how each of the seven principles could be applied and operationalized in the context of ABNJ governance.

This article seeks to move forward from the application of all the seven principles to a more focused analysis of polycentricity as there are assumptions about the implicit effectiveness of "promoting polycentric governance" in the Stockholm Resilience Principles that are important to clarify for ABNJ. In particular, polycentricity theory has implications for many open issues in the ongoing BBNJ negotiations including the future institutional framework, relationships with other bodies, responsibilities for implementation, and questions of "undermining," among others.

To analyze polycentricity in regional ocean governance clusters relevant to ABNJ, this article takes into account the study of Mahon and Fanning (2019a,b) in which they have defined 20 ocean regions globally and evaluated the extent to which governance polycentricity could be applied in these regions,

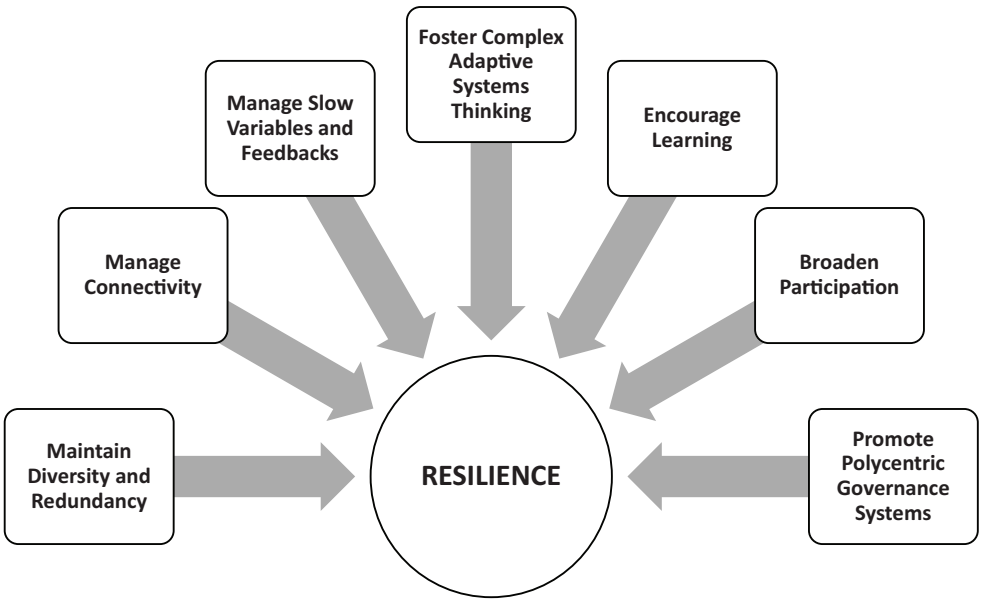

FIGURE 1 | Resilience Principles (graphic by SSY and KMG, based on Biggs et al., 2015).

based on the polycentricity criteria developed by Jordan et al. (2018). The 20 ocean regions defined globally by Mahon and Fanning (2019b) are: (1) Antarctic, (2) Arctic, (3) Baltic Sea, (4) Black Sea, (5) East Central Pacific, (6) Eastern Indian Ocean, (7) Mediterranean Sea, (8) Northeast Atlantic, (9) Northeast Pacific, (10) Northwest Atlantic, (11) Northwest Pacific, (12) Pacific Islands Region, (13) Red Sea, (14) ROPME, (15) Southeast Asia, (16) Southeast Pacific, (17) Southeast Atlantic, (18) Southwest Atlantic, (19) Western Central Atlantic, and (20) Western Indian Ocean. For the assessment of polycentricity in the context of ABNJ governance, this article draws on the findings of the "*Transboundary Waters Assessment Programme (TWAP) Assessment of Governance Arrangements for the Ocean, Volume 2: Areas Beyond National Jurisdiction"* by Mahon et al. (2015).

The article then applies the studies and lessons learned from polycentricity theories including Carlisle and Gruby's model, the Stockholm Resilience Centre's resilience framework, and LME sub-regional cooperation mechanisms, to derive considerations for advancing a more functional polycentric governance system for integrated ecosystem-based biodiversity conservation and sustainable use through the BBNJ Agreement.

RESULTS

Applying Polycentricity Concepts to Regional Ocean Governance Arrangements for ABNJ

Prior to exploring the implications of polycentricity thinking in the context of ABNJ governance, it is necessary to first analyze the degree of polycentricity in the regional clusters of intergovernmental agreements and bodies related to ecosystem-based ocean management as shown by Mahon and Fanning (2019a).

As noted above, Mahon and Fanning (2019a) analyzed the regional clusters of agreements in 20 ocean regions (see Section "Materials and Methods" above). To measure the extent to which the regional clusters meet the criteria for polycentricity, Mahon and Fanning (2019a) used the five propositions developed by Jordan et al. (2018): local action, mutual adjustment, experimentation, trust, and overarching rules. They categorized the levels of polycentricity on a spectrum from *centralized authority* to *functional polycentric* (when the criteria of polycentricity given by Jordan et al. (2018) are fully met) with the following levels in between: *fragmented polycentric* (when there is little or no interaction among the arrangements), *polycentric bricolage* (when there are clear efforts by some participating bodies to manage the existing set of arrangements to address gaps or overlaps, and enhance effectiveness), and *polycentric codesigned* (when these efforts involve cooperation and establishing integration mechanisms in deliberately reorganizing the existing set of arrangements) (Mahon and Fanning, 2019a).

In their analysis, Mahon and Fanning (2019a) found that only 2 of the 20 ocean regions – Arctic and the Pacific Islands Region – met the criteria for polycentricity of Jordan et al. (2018). The extent of polycentricity in several other regional clusters was found to be weak and fragmented. Two regions—Antarctic and Southeast Pacific were found to have long-standing mechanisms for coordination that were comparatively centralized. Mahon and Fanning (2019a, p. 6, emphasis added) concluded that "it is appropriate to refer to the majority of regional clusters as polycentric systems *in various stages of becoming functional*."

Several regional clusters could qualify as "*polycentric*" mainly because of the involvement of multiple centers of

decision-making at differing scales (Cleaver and de Koning, 2015; Abe et al., 2016; Vousden, 2016; Mahon and Fanning, 2019a). However, even though they did qualify as *polycentric*, they could not necessarily qualify for the *functional polycentric* category because of lack of coordination and integration mechanisms (Mahon and Fanning, 2019a). The Pacific Islands Region, for instance, on the other hand qualified for the functional polycentric category because of its stronger coordination and integration mechanisms under the Pacific Island Forum (PIF) (Mahon and Fanning, 2019a).

This link between functional polycentricity and processes of coordination and integration among the decision-making actors has implications for polycentricity in ABNJ governance as well (Mahon et al., 2015). Mahon et al. (2015) in their study on ABNJ governance show that coordination and integration among arrangements to manage issues including climate, pollution, fisheries and biodiversity in ABNJ are weak, despite the wide range of regional and global conventions, treaties and other arrangements. This weakness in coordination and integration processes among actors in ABNJ governance is the reason why a key theoretical attribute for functional polycentric governance in Carlisle and Gruby's (2019) model described in Section "Polycentricity and Regional Ocean Governance" is not achieved.

The analysis of regional clusters has further implications for wider ocean governance including ABNJ. One reason is the interconnected nature of the ocean, whereby activities in one State or region could have an impact on other States and regions, including ABNJ (Harrison, 2017). For instance, even though pollution from land-based activities originates within the jurisdiction of one State, it could spread beyond the State's coastal waters and end up impacting marine biodiversity in ABNJ (Mahon et al., 2015; Harrison, 2017). In this case, regional agreements addressing land-based sources of pollution can be linked directly to ABNJ (Mahon et al., 2015).

Given the interconnected nature of the ocean, it is not just the horizontal linkages among actors at the regional level but also the vertical linkages among other jurisdictional levels including local, national, and global, that are critical for ABNJ governance (Fanning et al., 2007, 2021; Mahon et al., 2015). Furthermore, the analysis of regional clusters is relevant for the global ocean governance including ABNJ, especially because regional agreements can act as action points for customizing global agreements to specific geographical areas which is essential for advancing ecosystem approach (Mahon et al., 2015). "Strengthening regional clusters of agreements, particularly so that they can undertake EBM (ecosystem-based management) in offshore waters and ABNJ, is seen as a critical component of strengthening ABNJ governance" (Mahon et al., 2015, p. 64). Implementation of the BBNJ agreement, therefore, will depend greatly on regional efforts and their effectiveness.

Challenges in Achieving Functional Polycentric Governance in ABNJ

As analyzed on the basis of the attributes (see **Table 1**) proposed in the theoretical model of Carlisle and Gruby (2019), ABNJ governance does not fully meet the criteria for functional polycentric governance. It is the failure to achieve the second attribute, *"choosing to act in ways that take account of others through processes of cooperation, competition, conflict and conflict resolution*," that forms the key challenge in achieving functional polycentric governance.

Criteria for the first attribute "*multiple, overlapping decision-making centers with some degree of autonomy*" are fulfilled due to the existence of a multiplicity of decision-making centers in ABNJ governance in the form of various regional and global conventions, treaties, and other arrangements (Mahon et al., 2015). While this multiplicity of decision-making centers is sufficient for a *polycentric system*, it is not for a *functional polycentric governance system* (Ostrom et al., 1961; Carlisle and Gruby, 2019). To achieve the latter, the second attribute is required as well. Given that the coordination and integration processes among these regional and global arrangements in ABNJ governance remain weak, as shown by Mahon et al. (2015), the criteria for the second attribute are not fully achieved.

Since the second attribute is largely missing, several of the "enabling conditions" identified by Carlisle and Gruby (2019, p. 946) associated with this attribute are also weak, if not absent. Drawing from **Table 1** above, these include five of the seven enabling conditions: (2) generally applicable rules and norms that structure actions and behaviors within a system; (3) cross-scale linkages for collaboration and shared learning; (4) mechanisms to ensure accountability in the governance systems; (5) mechanisms to enable conflict resolution; and (7) co-terminus jurisdiction or scope of decision-making authority with boundaries of the problem being addressed, i.e., the boundaries necessary for global biodiversity conservation as well as bio-regionally based ecosystem-based management. Similarly, three of the five propositions developed by Jordan et al. (2018) are lacking: mutual adjustment, trust, and overarching rules. Taking all the factors into account, the key challenges of achieving effective polycentric ocean governance could thus be encapsulated under three main categories as follows:

Lack of Overarching Rules and Norms to Structure Cooperation and Coordination

In order to function as a system, it is essential for polycentric governance systems to have coordination under an overarching system of rules (Pahl-Wostl and Knieper, 2014). It is under such a shared set of rules, norms, principles and obligations that the various regional and sectoral actors would be better able to interact on a more level playing field (Yadav and Gjerde, 2020). While UNCLOS could be considered to provide a set of overarching rules, it is the absence of rules, standards and procedures for protection and preservation of the marine environment including ocean life in ABNJ, as envisaged in UNCLOS Articles 192 and 197, that provided the impetus for the BBNJ Agreement. The lack of such rules also inhibits cross-scale linkages, shared learning and accountability for players who do not abide by the overarching rules and norms (enabling conditions 2, 3, and 4).

Lack of Conflict Resolution Mechanisms

Conflict resolution mechanisms (enabling condition 5) have been given special emphasis in polycentric governance literature. For Ostrom et al. (1961), a polycentric system would be composed of multiple autonomous units choosing to act in ways that consider others through processes including conflict resolution. Carlisle and Gruby (2019, p. 935) argue that "maintaining the capability to resolve conflict is critical." Conflict resolution mechanisms in the BBNJ Agreement could contribute in many ways, from building trust that all players are more likely to play by the rules to enabling mutual adjustment despite differences in power and priorities. Provisions for enhanced cooperation and conflict resolution could thus support more effective ecosystem-based management at all levels in ABNJ (WWF, 2016). Given the importance of conflict resolution mechanisms in polycentric governance, its absence in the current ocean governance framework continues to be a critical challenge.

Lack of Global and Eco-Regional Levers for Action

As the global ocean is both interconnected and comprised of numerous interlocking ecosystems, multiple levers are needed to meet enabling condition 7: "*co-terminus jurisdiction or scope of decision-making authority with boundaries of the problem being addressed*." The global level is needed for its ability to: define rules and norms to structure actions and behaviors within ABNJ; set out ambitious priorities for global scale biodiversity conservation; act directly and in collaboration with other institutions; establish, manage and support cross-scale linkages for collaboration and shared learning; ensure accountability of the various components within the system; resolve conflicts between the different sectors, as well as between sectoral activities and biodiversity concerns; and provide the necessary redundancy in cases where one or more institutions is unable or unwilling to act (enabling conditions 2, 3, 5, and 7). At the same time, cooperative mechanisms are needed at ecologically meaningful regional or subregional scales to advance integrated ecosystem-based management. As noted, LME approaches that promote collective investigation, strategic planning and collaboration to enable shared learning, understanding, mutual adjustment and cooperation, could provide a useful model.

Large Marine Ecosystems

Large Marine Ecosystems (LMEs) are relatively large regions of ocean (approximately 200,000 km^2 or higher), which are adjacent to the continents in coastal waters and where primary productivity is mostly greater than in open oceans (CBD, 2009; Rochette et al., 2015; Vousden, 2015; Wright et al., 2017). Currently, 66 LMEs have been recognized globally on the basis of a concept developed by the United States' National Oceanic and Atmospheric Administration (NOAA) (Fanning et al., 2015; UNEP, 2016). The physical extent of an LME is not determined on the basis of geopolitical or economic factors, but on four ecological criteria instead: (1) bathymetry, (2) hydrography, (3) productivity, and (4) trophic relationships (Sherman, 1994; Vousden, 2015). The GEF has played a significant role in promoting the concept of LMEs through 18 LME projects and initiatives addressing 24 LMEs (Mahon et al., 2011; Vousden, 2015; UNEP, 2016; Harvey et al., 2017).

Large Marine Ecosystem mechanisms typically include a Transboundary Diagnostic Assessment (TDA) and subsequent negotiation of a Strategic Action Programme (SAP) to guide recovery and sustainability. TDAs are comprehensive assessments to provide the science and socio-economic basis for ecosystem-based management (Bensted-Smith and Kirkman, 2010; Rochette et al., 2015; UNEP, 2016). The TDA process brings together local/regional experts to strategically examine and investigate priority impacts, analyze the causes or drivers of those impacts, diagnose the root causes and also identify barriers to removing those root causes to improve the welfare and sustainability of the LME, its goods and services and dependent communities (Sherman and Hempel, 2008; UNEP, 2016; GEF LME:Learn, 2017; UNDP, 2017). The TDA not only enables comprehensive assessments of the environment but also facilitates a broad and diverse participation at all levels and encourages inter-ministerial and multi-stakeholder dialogue (Duda and Sherman, 2002; Rochette et al., 2015). Sherman and Hempel (2008, p. 7) observe that the TDA "provides a useful mechanism to foster participation of policy makers, scientists, management experts, stakeholders, and civil society at local, regional, national and international levels of interest." Such participation of a diversity of stakeholders helps build trust and relationships, and promotes shared learning and understanding, therefore enhancing institutional resilience (Biggs et al., 2015; Leitch et al., 2015; Lieberknecht, 2020).

Strategic Action Programme processes, based on the findings of the TDA, foster an agreed vision, a set of Ecosystem Quality Objectives and steps to be taken to remove the barriers to action (UNDP, 2017). The SAP further identifies the mechanisms for action to achieve the Ecosystem Quality Objectives, applies those objectives as a way to measure and monitor progress, and thereby can deliver both accountability and capacity for adaptive management (Duda and Sherman, 2002; Sherman and Hempel, 2008). The LME: Learn component complements these efforts by enhancing learning exchange between and amongst the regions (GEF LME:Learn, 2017). Such a science-based approach including shared and cooperative monitoring and assessment processes can encourage transparency and accountability, facilitate collaborative learning and governance, build trust among nations, thus fulfilling many (but not all) of the key enabling conditions for more effective polycentricity (Duda and Sherman, 2002; Bodin, 2017; Carlisle and Gruby, 2019; Yadav and Gjerde, 2020).

While the LME projects offer valuable lessons for building trust and understanding, and fostering effective collaboration (Mahon et al., 2011; Fanning et al., 2015; Vousden, 2015), they face their own set of challenges mainly related to governance. It has been shown that even though LME mechanisms do offer a robust scientific foundation for action, they often face governance challenges (Rochette et al., 2015), for instance, the science activities in their modular approach "stand alone from governance, rather than in support of it" (Mahon et al., 2009, p. 318). Moreover, the LME governance arrangements are often not connected to existing arrangements leading to

minimal uptake of progress made after the completion of an LME project, have poor levels of cooperation with other regional arrangements, and may also face financial sustainability issues (Rochette et al., 2015; Vousden, 2015; UNEP, 2016; Mahon and Fanning, 2019b).

Despite these challenges, the LME-approach may offer a valuable model for advancing ecosystem-based management at a bio-regional scale entirely within or including ABNJ, if prior LME-specific and wider polycentricity lessons are applied. The first experiment with an LME-style project for ABNJ is now underway in the Sargasso Sea as the GEF has recently approved a project for improving science-based management and stewardship in the region (Freestone, 2021).

DISCUSSION

Implications for the BBNJ Agreement

If the challenges to achieving functional polycentric governance for ABNJ (as highlighted above) are addressed, a number of benefits associated with effectively functioning polycentric governance systems should be more likely to be achieved. Biodiversity benefits include enhanced ocean resilience to future shocks and shifts from climate change, other pressures, and their cumulative effects. Institutions could become more resilient, in the form of a feedback loop, through the very processes (such as fostering cooperation, learning, trust, adjustment and coordination) that are necessary for strengthening polycentricity in the first place. This is because polycentric governance is said to enhance other resilience-enhancing principles by: enabling broader participation of stakeholders and decision-makers; improving trust and cooperation among these actors; increasing accountability; maintaining response diversity, redundancy and improving connectivity (Low et al., 2003; Biggs et al., 2015; Schoon et al., 2015; Carlisle and Gruby, 2019; Yadav and Gjerde, 2020). Moreover, polycentric governance is also better suited to managing complex adaptive systems, the key characteristics of which are clearly reflected in marine ecosystems and their governance systems (Young, 2002; Kim and Mackey, 2004; Galaz et al., 2008; Bohensky et al., 2015; Blanchard et al., 2019; Yadav and Gjerde, 2020).

The following recommendations are suggested on the basis of the seven enabling conditions in the theoretical model of Carlisle and Gruby (2019), the Stockholm Resilience Centre's seven resilience principles, as well as lessons offered by LME approaches. The specific enabling condition and/or resilience principle to which any particular recommendation can be linked is shown in brackets where applicable:

Overarching Rules, Goals, and Objectives (Enabling Conditions 2, 4)

The BBNJ Agreement could advance cooperative and collaborative interactions by establishing core obligations, objectives, values and principles. These could include conservation of biodiversity, integrated ecosystem and precautionary approaches, as well as principles to build ecological and institutional resilience, among others. Such principles and accompanying rules and objectives would guide the behavior of States Parties, other States and stakeholders in multiple global, regional and sectoral arenas (Yadav and Gjerde, 2020). Moreover, principles to promote good governance, trust and accountability including open communication, broad participation, efficiency, and strong collaborative platforms need to be given priority in the BBNJ institutional arrangements in order to contribute to effective polycentric governance of the ocean (Gunderson, 2000; Goldstein, 2011; Schoon et al., 2015; Gjerde et al., 2019; Yadav and Gjerde, 2020).

Formal and Informal Conflict Resolution Mechanisms (Enabling Condition 5)

As shown previously, the absence of conflict resolution mechanisms in the current ocean governance and management framework continues to be a critical challenge in achieving functional polycentric governance. A global mechanism for conflict resolution could serve to mediate any conflicting interests and power imbalances in a fair, equitable and consistent manner to advance ocean health and resilience (Harden-Davies et al., 2020). A strong mandate for conflict resolution in the BBNJ institutional arrangements that could offer a diversity of formal and informal conflict resolution forums and approaches such as conciliation, mediation, and arbitration, as well as including participatory and dynamic processes built into multiple layers could be crucial (Dietz et al., 2003; WWF, 2016; Carlisle and Gruby, 2018, 2019). Such conflict resolution processes particularly if open to States, international organizations as well as representatives of civil society could complement but also potentially lessen the need to rely on more formal dispute resolution processes.

Robust Global Institutional Arrangements (Enabling Conditions 2, 4, and 7)

An empowered global Conference of Parties is necessary to ensure that the scope of authority of at least one decision-making center is "coterminous with the boundaries" of the global biodiversity problems being addressed (enabling condition 7). A Conference of Parties supported by a strong Secretariat could simultaneously serve to promote universal participation, harmonize UNCLOS with the Sustainable Development Goals (SDGs), CBD, CITES, CMS and other instruments, strengthen coordination, integration and conflict resolution mechanisms, while enabling participation of all stakeholders (Mahon et al., 2015; O'Leary and Roberts, 2017; Mahon and Fanning, 2019a; Yadav and Gjerde, 2020). An independent globally-focused scientific and technical advisory body could ensure an authoritative voice and global perspective regarding conservation measures such as MPAs and EIAs, with the BBNJ Conference of Parties empowered to adopt protective measures for MPAs and impose conditions for approval of EIAs. The BBNJ global body could thus have independent authority with responsibility for advancing global biodiversity interests in consultation with sectoral and regional organizations as well as the CBD, CITES and CMS (Yadav and Gjerde, 2020).

Strengthened Global, Regional and Sectoral Bodies With Shared and Overlapping Responsibility for Biodiversity Conservation (Enabling Conditions 1–7; Resilience Principles 1 and 6)

Institutional redundancy forms a critical enabling condition for polycentricity given the high likelihood of any one institution failing to be effective (Ostrom, 1999, 2012; Carlisle and Gruby, 2019). As part of sharing responsibility for biodiversity conservation, a diversity of organizational arrangements and bodies with overlapping mandates and participants ensures that any failure could be compensated by other actors (Ostrom, 2005; Carlisle and Gruby, 2019; Yadav and Gjerde, 2020). Thus, recognizing the authority of State Parties to act collectively *via* the Conference of Parties to adopt measures to protect marine biodiversity in ABNJ binding on themselves is an essential safeguard. This is especially true as long as sectoral bodies can be blocked from adopting conservation measures due to the ability of one or two powerful States to block consensus. At the same time, the BBNJ Agreement can enable sectoral and regional bodies to advance global and regional biodiversity goals in ABNJ through access, for example, to scientific information, financial and technical resources, needs-based capacity development, and partnerships, balanced by increased accountability including calls to reform decision-making processes. Multi-scale and cross-sectoral partnerships and alliances among States, political and economic organizations, the CBD, CMS, and CITES, sectoral and regional bodies, scientific and other academic institutions, private sector, environmental NGOs and other ocean stakeholders based on shared principles and norms would further enhance institutional redundancy, shared learning and mutual adjustment (Biggs et al., 2015; Schoon et al., 2015; Vousden, 2015).

Strengthened Cross-Sectoral Cooperation Through Ecosystem Assessments and Strategic Action Programmes at Ecologically Meaningful Scales That Could Include Areas Within and Beyond National Jurisdiction (Enabling Condition 3; Resilience Principle 5)

As with the LME approaches described above, regional scale collaboration for ecosystem-based management could be fostered by the BBNJ Agreement through support for a form of strategic environmental assessment (SEA) that supports regional-scale ecosystem diagnostic analyses and accompanying Strategic Action Programmes. Such efforts, supported by some form of regional coordinating mechanism with powers developed from the BBNJ Agreement could advance ecological and biodiversity related objectives involving all stakeholders interested in taking part. The regional-scale transboundary/ABNJ LME-style process could be used as part of an SEA under the BBNJ Agreement to generate new scientific knowledge to inform ecosystem-based management, enable States and other stakeholders to identify the common issues, threats, causes and barriers, and together identify and commit to taking the necessary actions to address the threats and their causes. Such efforts could complement proposals for MPAs, inform other types of area-based management tools, and provide the basis for adaptive management and EIAs (Gjerde et al., 2021). They could similarly complement other ocean-basin scale and transboundary initiatives such as protecting highly migratory species. Such efforts could build on the example of the recently approved GEF program for the Sargasso Sea in ABNJ.

Learning Exchange Mechanisms Within and Across Regions (Enabling Condition 3, Resilience Principle 5)

Setting up learning exchange mechanisms in and across the regions, akin to LME: Learn, so that the regional decision-making centers are able to learn from one another as they advance, is essential for ensuring coordination and integration, and for more effective polycentricity (Tatenhove et al., 2014; Alexander and Haward, 2019; Carlisle and Gruby, 2019; Mahon and Fanning, 2019a). Learning is crucial for building ecological and institutional resilience (Biggs et al., 2015; Cundill et al., 2015). The scientific and technical body under the BBNJ treaty could prioritize collaborative research, monitoring of key indicators, and data sharing, as well as be informed by the outcomes of the UN Decade of Ocean Science for Sustainable Development (2021–2030), and other global and regional scientific initiatives (Vousden, 2015; Yadav and Gjerde, 2020). Local, indigenous and traditional knowledge should be taken into account as well (Mulalap et al., 2020; Vierros et al., 2020). The scientific and technical body could also ensure that the knowledge is obtained, shared and communicated through effective science-policy advisory mechanisms (Gjerde and Wright, 2019).

Strengthened Regional and National Capacities for Ecosystem-Based Management of Marine Biodiversity in ABNJ

The capacity development initiatives being negotiated in the BBNJ treaty under the fourth element "Capacity Building and Transfer of Marine Technology" are also relevant for strengthening polycentric ocean governance. To strengthen institutional and individual capacities for managing a shared ocean, the BBNJ Agreement would need to go beyond short-term workshops to build long term-capacity for science, ecosystem-based management, administration and collaborative governance, taking into account specific national and regional needs (Bodin, 2017; Harden-Davies, 2017; Gjerde and Wright, 2019; Harden-Davies and Snelgrove, 2020). This capacity building could learn from the LME experiences and in turn the institutional framework for the BBNJ Agreement could provide an international forum to foster coordination, exchange innovative ideas, and drive ambition for capacity building outcomes.

Future Research

Development and implementation of conflict resolution mechanisms in the context of ocean governance is an important area that calls for further research and discussion. As highlighted in many studies, conflict resolution mechanisms are crucial for strengthening polycentricity. However, there is a lack of understanding around how to operationalize them in the case of ocean governance. The 2016 WWF introductory briefing

on "*Matters for inclusion in a new international legally-binding instrument under UNCLOS: enhanced cooperation and effective dispute resolution*" is the only study to date on this issue in the context of the BBNJ Agreement (WWF, 2016). More exploration is needed of how such mechanisms can influence the cooperation of States and intergovernmental bodies especially in the context of cross-sectoral collaboration. Furthermore, as there is a major lack of research and scientific understanding of power and political dynamics in ABNJ, a power-centered analysis of regional and high seas governance would be an important future research area (Morrison et al., 2019, 2020). The power dynamics in polycentric systems are complicated to identify and concealed to a greater degree as compared to other governance forms (Morrison et al., 2019). More empirical research is required with regard to political dynamics such as political lobbying and tradeoffs in the context of polycentric ocean governance, as has been highlighted in the case of multiscale environmental governance of World Heritage ecosystems (Morrison et al., 2020) and international fisheries policies (Barkin et al., 2018). The Barkin et al. (2018) framework could presumably be applied to other sectors to better understand and potentially reduce the differences between sectoral and conservation outcomes. Moreover, further research on enhancing the resilience and adaptive capacity of the BBNJ Agreement itself (Blanchard et al., 2019; Yadav and Gjerde, 2020) so that it is possible to embrace novel and innovative ecological thinking and management measures over time would be useful, and lessons can be learnt from the successes and failures experienced in other sectors such as watershed management (Bridgewater and Kim, 2021).

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

SSY and KMG conducted the research and wrote the manuscript. Both authors contributed to the article and approved the submitted version.

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