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Rethinking the oceans and their management

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Abstract
This article argues that the vision of the oceans that underlies the United Nations Convention on Law of the Sea (UNCLOS) is fundamentally outdated. The new conceptual framework for ocean management must be centered on the role the world's oceans play in global supporting and regulating services, of which marine biota are critical components. These must be in turn be designated as an updated version of the Common Heritage of Mankind (CMH). Understanding marine ecosystem services well enough to manage oceans sustainably will require a large-scale, concerted international scientific effort in a time in which both science and the sense of global community are under direct assault. A new ocean regime must provide for an autonomous International Ocean Authority (IOA) that collects and integrates data, funds the necessary scientific work, builds epistemic communities, invests in or even provides scientific training, and offers, when necessary, safe haven to scientists and their work and to citizen activists.

Keywords United Nations Convention on Law of the Sea · Common Heritage of Mankind · Marine ecological goods and services · Areas Beyond National Jurisdiction · Oceans management

For most of human history, most of the oceans were Areas Beyond National Jurisdiction (ABNJ). In that time, the oceans were seen as avenues for the projection of state power and trade or the sources of food and other resources. Viewed in this way, it made sense that areas of the world oceans be divided up among territorial states and that distinctions be made between state-controlled areas and the high seas. The series of international agreements culminating in the United Nations Convention on Law of the Sea (UNCLOS) (opened for signature in 1982 and entering into force in 1994) did precisely that. However, our understanding of the world's oceans has changed fundamentally since then. This is particularly clear if we follow the development of thinking about the management of living marine resources, as is done in this essay.

It is widely accepted today that these resources can only be managed effectively over the long term using an ecosystem approach (Pitcher et al. 2009, 223). Marine ecosystems, of course, notoriously refuse to be constrained by political boundaries. The impossibility of achieving effective management by isolated, unilateral state action led inexorably to bilateral and multilateral cooperation in the management of shared stocks, and to the development (if all too slowly and with varying success) of regional management fisheries organizations (RFMOs).

But even this expansive view is eclipsed by the wide recognition today of the complex role that oceans play in the unfolding drama of climate change. Grappling with the issue of climate change reveals the complex interactions of land, sea, and air in the global processes necessary for sustaining life on earth. This understanding must compel a fundamental rethinking of ocean regimes. Instead of using a conceptual foundation for management political boundaries and the exploitation of resources, the new conceptual foundation for ocean management must be the role the world's oceans play in global supporting and regulating services, of which marine biota are critical components. These must in turn be designated as an updated version of the Common Heritage of Mankind (CMH). Understanding marine ecosystem services well enough to manage oceans sustainably will require a large-scale, concerted international scientific effort in a time in which both science and the sense of global community are under direct assault. A new ocean regime must provide for an autonomous International Ocean Authority (IOA) that collects and integrates data, funds the necessary scientific work, builds epistemic communities, invests in or even provides scientific training, and offers, when necessary, safe haven to scientists and their work and to citizen activists.

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A new view of oceans

Oceans are today understood to be highly complex, large-scale systems that are an integral part of fundamental global processes. In the 1960s, James Lovelock introduced the concept of Gaia, the idea that living and non-living parts of the earth form a single, global, interlocking system. While elements of the Gaia hypothesis have been disputed, the ideas of an intimate connection between living (biotic) and non-living (abiotic) elements of the earth and the interlocking nature of global processes remain core thoughts today. The concept of "ecosystem", the basis of marine renewable resource management, includes abiotic and biotic (including human) components and is found on many scales (ranging from the large marine ecosystem to small local ones). On a deliberately grander scale, the Stockholm Resilience Center has launched the concept of the nine planetary boundaries relating to systems that sustain life on earth as we know it (Rockström et al. 2009). These include both biotic and abiotic components, both land- and marine-based. The Millennium Ecosystem Report (2005) popularized the now broadly adopted concept of ecosystem services. They identified four ecosystem services: provisional, cultural, supporting, and regulatory. The food and other resources that marine ecosystems supply (provisional services) and the spiritual, cultural value of the oceans (including the economic importance of tourism, and collectively known as cultural services) have long been visible to humankind and did much to drive the legal framework embodied in the UNLOS. More important here are the concepts of supporting services (the building of soil, cycling of nutrients, and production of oxygen) and regulating services (the way ecosystems regulate flooding, disease, and the waste that all life produces) that especially transcend the geographically local.

The role the oceans play in all this is well described in the First Global Integrated Marine Assessment (FGIMA) (Group of Experts of the Regular Process 2016) and the work of the International Panel on Climate Change (IPCC) (Rhein et al. 2013). Simply put, the oceans, which cover over 70% of the world's surface and contain 97% of the water on earth, play a central role in critical global regulating and supporting services. The complexity of global systems is immense and not wholly understood, but its broad outline, including the critical role played by biota, can be illustrated by following a few simplified pathways emanating from the lowest biological levels of marine ecosystems. The oceans are hugely important in climate regulation, including acting as a primary carbon sink and in absorbing the warming produced by the greenhouse effect. Carbon is captured in part by phytoplankton that are then eaten (keeping carbon in the system) or it drops out of the system embodied in detritus drifting to the sea floor. But ocean waters themselves also absorb carbon, slowly changing the chemical composition of the oceans, making them more acidic. This in turn affects life in the oceans more generally. Plankton play a hugely important role in this carbon cycle but the long-term effect of ocean acidification and warming on planktonic communities is still substantially unknown. Warmer oceans will hold less oxygen which will also affect marine life, although unevenly and over time. Temperature changes are already visibly affecting the distribution of the marine life humans typically eat (provisioning services), either directly (because of the low tolerances of some species for changing water temperatures) or indirectly (because of the similar effects on prey—such as plankton).

In addition, changes in water temperature can contribute to changing physical characteristics of the oceans such as currents and the degree to which the water column is stratified into impermeable layers. Plankton is the captive of currents and goes where they go; biological productivity is dependent on the exchange of nutrients and marine life among temperature layers. Effects on plankton matter because they are both key primary producers in the complex food web that generates a substantial amount of the world's food and producers of about 50% of the oxygen we breathe (Group of Experts of the Regular Process 2016, 48).

Indirect human impact on the oceans (such as through carbon emissions) is both large and collective (i.e., not restricted to coastal states) (Rhein et al. 2013). Conversely, the benefits bestowed by the oceans are also huge and also collective. In a very real sense, everyone on earth is an important stakeholder when it comes to the oceans. Everyone is directly dependent upon the state of the oceans and everyone plays a role in what happens to them (even if responsibility is differently distributed both in time and in space). While this sounds like a diffuse, idealistic, effete, city-dweller, eco-warrior kind of jeremiad, current scientific research makes it clear that this is true in a very specific and material way.

UNCLOS, the area and the common heritage of mankind

UNCLOS was created by states for states, with a firm foundation in boundaries, the rights of coastal states within them, and the assumption that all marine resources were open to utilization. But the boundary concept proved to be problematic from the outset. UNCLOS created a specific zone of territorial waters, but allowed for the establishment of zones contiguous to territorial waters that facilitated the meaningful enforcement of national sovereignty within them. It gave coastal states the power to establish Exclusive Economic Zones (EEZs) where they could exploit the resources of the water column and seabed but denied them sovereignty there. The extended continental shelf that states can claim does not give them rights to the waters over these. UNCLOS recognized the right of coastal states to exploit resources within

their zones but also imposed at least theoretical duties upon them.

The inadequacy of the boundaries' concept for the management of marine resources was immediately evident in practice. Transboundary issues abounded. Individual fish stocks seldom stick to a single EEZ or national zone: they are shared among states or they straddle boundaries between EEZs and ABNJ. National management was frequently meaningless without bilateral or multilateral cooperation. The 1995 Fish Stock agreement (entered into force in 2001) was prompted by the specter of armed conflict between Canada and the European Union (EU) (the so-called Turbot War of 1994+) generated by EU fishing on transboundary fish stocks. The agreement resulted in the strengthening of the obligation of states to "cooperate to ensure conservation and promote the objective of the optimum utilization of fisheries resources both within and beyond the exclusive economic zone" (Division for Ocean Affairs and the Law of the Sea 2016). RFMOs have become important in managing areas of the high seas. While their success is as yet uneven, RFMOs represent the clear recognition of the inadequacies of impermeable boundaries.

But the UNCLOS contained two important innovations that can open the way towards a new approach. First, it designated the seabed, ocean floor, and their subsoil in ABNJ (aka, the "Area") as "the Common Heritage of Mankind" (CHM). Part XI, Article 140 §1 states that

> Activities in the Area shall, … , be carried out for the benefit of mankind as a whole …. taking into particular consideration the interests and needs of developing States and of peoples who have not attained full independence or other self-governing status …

CHM as set out in UNCLOS is a transitional concept that lays out a path towards a new way of thinking about the oceans while reflecting the realities and politics of its origins. It was then (and is still today) strongly associated with deep seabed mining. The benefits of the Area it deals with are "financial and other economic benefits" that would accrue from the exploitation of resources. It talks in terms of States, would promote the transfer of technology to developing states, and is an attempt to prevent the most powerful, technologically advanced states from monopolizing the resources of the Area (Ranganathan 2016). However, it also promotes use of resources to "benefit of mankind as a whole", even if this might be realized through the division of resources among states, and it obliges states to respect the marine environment in exploiting the riches of the Area (Noyes 2012).

To make the CMH genuinely meaningful, UNCLOS created the International Seabed Authority (ISA), or the "Authority", to manage the seabed commons. The Authority was to be a self-financed, independent organization. It was a new departure in that it would manage economic activities in the Area in an active way. In addition, it was to "promote and encourage the conduct of marine scientific research in the Area, and shall coordinate and disseminate the results of such research and analysis when available" (142§2). While States Parties should participate in this work, the Authority itself was to be an active agent in it.

The concepts of CHM and the Authority cannot be applied directly to marine ecosystems. CMH was a broad legal principal the meaning of which was always difficult to fix (Lodge 2012, 734) and the significance of the Area, CHM, and the Authority has been widely debated since the Convention was available for signature starting in 1982 (Noyes 2012). It was in fact the inclusion of these concepts in Part XI that held up adoption of the convention by developed states in general and the USA in particular. UNCLOS entered into force in 1994 after negotiations produced a modified version of Part XI, which was embedded in an 1994 agreement on Part XI (which entered into force in 1996) (Division for Ocean Affairs and the Law of the Sea 2012).

Even so, some aspects of Part XI do seem to have stuck. CHM has been explicitly incorporated into one other convention, the Moon Treaty, although this has never gathered enough ratifications to come into force. On the other hand, it remains in the 1994 agreement establishing the International Seabed Authority (ISA). The UNESCO Universal Declaration on Cultural Diversity recognizes cultural diversity as the "common heritage of humanity" (Article 1). Some version of the concept is often proposed for application to other areas or resources. For example, Moore and Squires (2016) argue for the designation of deep sea living resource systems of the Area as CHM; Rhodes (2016, 268) notes talk of using CHM with respect to genetic resource governance, particularly with respect to marine resources in ABNJ. The Food and Agriculture Organization of the United Nations (FAO) tried (but failed) in the early 1980s to apply the concept to plant genetic resources.

The obligation to protect the environment has been strengthened significantly over the years in many conventions and declarations and in ways that support the marine ecosystem/global processes perspective. For example, signatories to the Convention for the Protection of the Marine Environment of the North-East Atlantic (known as the OSPAR Convention) "recognize" that "the marine environment and the fauna and flora which it supports are of vital importance to all nations" (Preamble); Signatories to the Biodiversity Convention are "Conscious … of the importance of biological diversity for evolution and for maintaining life sustaining systems of the biosphere"(Preamble). The Part XI notion of UNCLOS that industrialized countries should in particular share the benefits of the Area with less industrialized countries lives on in the recognition of common but differentiated responsibilities as recognized in The Rio Declaration and the Framework Convention on

Climate Change (International Centre for Sustainable Development 2002; Noyes 2012, 470).

It will require considerable conceptual stretching to make the CHM fit the designation of marine regulating and supporting ecosystem services as the Common Heritage of Mankind. Despite a built-in obligation to protect the environment and other good things, the CHM was really about sharing the economic benefits of the exploitable substances of the seabed; it was not an environmental agreement. Most international agreements that incorporate its heritage have at their center a similar concern, and endorse the rights of states to utilize their natural resources, renewable or otherwise, for the development of their people. Sustainable development may incorporate concern for the environment but it is still development.

Applying CHM to supporting and regulating marine ecosystem services would mean the reformulation of the concept in ways that reflect current thinking about the oceans, atmosphere, and global processes. As noted above, the significance of the oceans in critical environmental processes is widely recognized, as is the meaninglessness of trying to contain global processes within political boundaries. The benefits that application of CHM would be established to protect are not those that generate immediate profit, nor could they be appropriated by individual states or companies. They would be non-excludable, non-rivalrous public goods.

Designating supporting and regulatory marine ecosystem services as the CHM would at least not result in debate about the direct redistribution of resources from rich to poor countries or about the proper public-private mix of exploitation, as was the case with deep seabed mining. On the other hand, it would present significant other difficulties. Primary among these is the open-endedness of global ecosystem services, particularly if it is accepted that the atmosphere and the oceans are tightly coupled. Since everyone on earth contributes greenhouse gases (GHG) to the atmosphere, all are potentially accomplices in any violation of the CHM.

Conceptually repackaging marine ecosystems and their biodiversity as key elements in global supporting and regulatory services threatens coastal state sovereignty in national waters and EEZs, a development that most of these will surely resist. The concept of common but differentiated responsibility, however, must apply to coastal states. Coastal states have had an enormous impact on marine ecosystems. The most productive biological areas or "hotspots" in the oceans are located relatively close to shore and most fishing still takes place within national-controlled zones or RFMO areas. The effect of fishing on the ocean's ecosystems is not trivial. Marine fishing removes an astounding amount of biomass from the oceans. This affects the characteristics of individual species and can affect the structure and functioning of marine ecosystems (the displacement of cod as the top predator in the ecosystem off of Canada's eastern coast stands as one of the most dramatic illustrations of this). The oceans are also sinks for human-produced pollution of all kinds that flows into the sea from land. While the effects of pollution are not necessarily additive—nutrients can be utilized by marine life while others substances can drift out of marine systems—coastal states have a greater direct impact on the oceans than do land-locked ones. Coastal states have long enjoyed the benefits of sea-based resources and expanded their control to capture the most productive areas; their treatment of the oceans has globally significant externalities and gives them differentiated—greater—responsibility.

It is hard to deny the importance of preserving fundamental regulating and supporting marine ecosystem services, and fewer states and groups than ever are seriously trying to do so. The United Nations sponsored FGIMA states that those biological hotspots "are necessarily hotspots for production of oxygen as a direct result of photosynthesis" (Group of Experts of the Regular Process 2016, 25). The signature or ratification of the Paris Climate Change agreement by every country in the world (although the USA will withdraw both)[1] is a powerful affirmation that the world community recognizes the existence of (and threats to) global ecosystem supporting and regulating services that encompass ocean systems. The IPCC (Rhein et al. 2013, 260) and FGIMA (Group of Experts of the Regular Process 2016) clearly documents this.

The creation of the ISA was a path-breaking event, even in its modified present form. Today's ISA is an autonomous international organization that has the authority to regulate, organize, and control use of the seabed resources. The Secretariat of the Authority carries out resource assessments of the Area, maintains a database on the Area's resources, and monitors relevant research. Its Endowment Fund (supplied by contributions from member states) supports participation of scientists from developing countries, and the Agency holds workshops and seminar on relevant topics. As of 25 July 2017, there were 168 members of the ISA (International Seabed Authority 2018). This suggests broad acceptance for the organization. All of this suggests some small possibility of establishing an International Ocean Authority (IOA) with somewhat similar characteristics.

An International Ocean Authority for our age

Creating an IOA would put into practical effect the insight from the UNCLOS Preamble that "that the problems of ocean

[1] According to the United Nations, 174 countries have ratified the Paris Agreement. Several countries have signed but not ratified, including the Russian Federation, several countries in the Middle East region, and a handful of countries in Asia (including Turkey) and Africa and one each in Latin America (Columbia) and Europe (San Marino). Nicaragua ratified the agreement without having signed it, in 2017 (United Nations Framework Convention on Climate Change 2018).

space are closely interrelated and need to be considered as a whole". To give the ISA true agency, it should be the core agency for integrated marine research focused on key ocean processes relating to supporting and regulating services. It should collect data and research relating to marine regulating and supporting services, and be a major funder and driver of such data collection and research. It should have a primary role in the monitoring of these. It should be the headquarters and coordinating service for those working with the myriad of models being constructed to map interactions within marine ecosystems (including its biotic (including human), and abiotic elements, within and among trophic levels, within and among the oceanic basins and with land, atmosphere. Like the ISA, it could sponsor the training of scientists from around the world.

Also, like the ISA, the IOA should have jurisdiction over its own Area, the High Seas Area (HSA) and regulate its use, with RFMOs brought under its jurisdiction and supervision. It would serve then as a platform for the exchange of best practice solutions among these. It could also (eventually) regulate other uses of the HSA from the perspective of their impact on global systems and regulate any geoengineering projects proposed for it. Unlike the ISA, however, the scope of IOA research would have to extend far beyond its Area. This would in turn mean that the IOA would have to have a role in connecting coastal states policies, practices, and marine conditions to far larger processes and actively promoting best practice solutions and policies from its holistic perspective.

Creating such an agency will be very difficult. The idea of the high seas, while diminished, is still a strong notion, with many states profiting in a very immediate and direct way from the status quo. An IOA with a mandate to focus on ocean processes that reach into nationally controlled zones and even beyond will undoubtedly be seen as threatening to national sovereignty. In addition, such an agency would be a huge, expensive, long-term undertaking. To achieve the desired degree of autonomy, an IOA would have to have some source of funding apart from the contributions by states; a user fee for the oceans is an intriguing idea, and perhaps a just idea, but it is unlikely to win many adherents in the foreseeable future. In addition, the international political climate is today noticeably less friendly to large cooperative ventures than it has been. While there have always been barriers (for example, during the Cold War), undermining of the notion of a collective good comes today from countries like the USA that once purported to support the idea.

There is also a chilling political wind blowing inside some of the oldest democracies, where populism is promoting a return to the idea of closed, impermeable boundaries and skepticism towards scientific work. This draws attention to just how important individual governments have been to the funding of and maintenance of access to important scientific data. The IOA should be the repository for data in a way that would minimize the vulnerability of the community to the shifting sands of political sentiment in any given place. The chilly political climate also discourages civil society organizations that play major roles in research, monitoring and inspiring. The IOA must provide safe haven for those working for the common good in this time of rampant national and individual egotism.

It comes down to this. The challenges of understanding, much less "managing" oceans are huge, but the stakes are enormous and the hour is late. The time for an IOA based on the designation of supporting and regulatory marine ecosystem services as the Common Heritage of Mankind is now.

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