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Regional ocean governance: Polycentric arrangements and their role in global ocean governance

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ABSTRACT

The importance of regional and subregional levels in global ocean governance is being increasingly recognised. Regional approaches are prominent in the 2030 Sustainable Development Agenda. The UN Environment Regional Seas Programme bodies focusing on pollution and biodiversity and the UN Food and Agriculture Organisation (FAO) regional fisheries bodies focusing on fisheries are the best known regional arrangements. However, there are other regional and subregional multilateral agreements that should be considered in building comprehensive regional ocean governance; in particular 'indigenous' agreements developed by the countries of the regions. This study examined 165 regional arrangements related to ecosystem-based management of oceans and allocated them into 20 regional clusters covering most of the world's oceans. The study explores the characteristics of these regional clusters which exhibit characteristics of polycentric systems. The suite of 20 regional clusters as well as global level oceans arrangements raises the question of whether there is an overall governance structure that should be pursued to strengthen ocean governance as envisaged in the Sustainable Development Goals and provide a holistic context for improving regional ocean governance. This study poses the question as to whether polycentric regional clusters can provide the 'missing link' for achieving global ocean governance objectives and whether these clusters are more than just the sum of their arrangements.

1. Introduction

The UN Convention on the Law of the Sea (UNCLOS) provides for and encourages regional approaches, but these have been slow in emerging (Rothwell and Stephens, 2010). Nonetheless, the importance of the regional and subregional levels in governance of the global oceans is being increasingly recognised [1–4]. There is growing understanding that governance arrangements at any level; local, national, subregional, regional and global, are part of a multilevel governance structure in which each of the levels is important [5]. It is also increasingly understood that upward and downward linkages between these levels are critical for effective governance [6–8]. These concepts are relevant for governance of most sustainable development issues but are especially important for coastal and marine ecosystems where most issues are transboundary and require cooperation for solutions [9]. However, much of the implementation of solutions developed at the regional level must take place at national and local levels. At the same time, the ocean is a global resource and coordination of the solutions to its many issues is essential at the global level. These observations further underscore the importance of a multilevel approach in ocean governance.

Several studies have noted the plethora of regional intergovernmental arrangements for governance of ocean ecosystems [9–12]. An analysis of these arrangements as they relate to governance of Areas Beyond National Jurisdiction (ABNJ) observed that one way of making sense of them was to deal with them as regional clusters of arrangements [10]. Another study looked at regional ocean governance arrangements from the perspective of their relationship to Large Marine Ecosystems (LMEs) and concluded that the fit between them was poor [11].

The recent emphasis on regional ocean governance raises several questions that require answers if a structured and holistic approach to regional ocean governance is to be taken:

- What arrangements are in place for regional ocean governance around the world?
- How do these regional arrangements relate to global ocean governance arrangements?
- How do these regional arrangements relate to each other within regions?

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- How do these arrangements relate to other regional initiatives such as LMEs?

To address these questions, this study looks at the entire set of regional ocean governance arrangements globally, groups them into regional clusters and examines the characteristics of these clusters with particular reference to the demand for Ecosystem Based Management (EBM) of the oceans globally.

2. The path towards regional ocean governance

In the post-war II, post-colonial period of the 1950s and 1960s much attention was paid to national sovereignty and building national capacity for governance. In parallel, the emergence and development of the United Nations system led to an emphasis on global systems and solutions; and ultimately to UNCLOS [13,14]. As the challenges to achieving sustainability became more prominent in the 1970s and 1980s, the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janiero, heralded the need for greater attention to regional cooperation; not just to address transboundary issues, but also for technical cooperation and sharing of costs among developing countries [15]. It also gave prominence to the need for EBM for all ecosystems, including those in the ocean, and thus to the need for a holistic approach to marine ecosystem sustainability.

Regional fisheries bodies (RFBs) of FAO and UNEP's Regional Seas Programme were among the earliest efforts by UN agencies to focus attention at the regional level [16,17]. The 1980s and 1990s saw the formation of numerous other regional organisations promoted by the countries themselves, indicating their awareness of the need to take up the challenge of regional ocean governance; at least at the sectoral level, and at times under the umbrella of regional multipurpose organisations [10,18]. As ocean governance arrangements proliferated, it was frequently stated that there was significant fragmentation of ocean governance arrangements at the global level, even within the United Nations system [9,12,19,20].

By Rio + 20, the evidence of major human impacts on the world's ocean resulted in a specific focus on oceans in the 2030 Agenda, and to the development of Sustainable Development Goal (SDG) 14 – Life Under Water - and many other ocean related targets in other SDGs [4,21,22]. Furthermore, the importance of regional level cooperation and coordination is prominent in the 2030 Agenda [23]. In its resolution on the 2030 Agenda, the United Nations General Assembly (UNGA) noted “the importance of the regional and subregional dimensions (…) in sustainable development” and emphasized the role of the regional level in the follow-up and review process (United Nations 2015a, paras 21 and 80). The importance of the regional level is also noted in many other paragraphs (45, 47, 68, 73, 74b, 77 and 81). Targets 1.b, 2.5, 11.a and 17.6 also explicitly refer to the regional level [24]. Enhanced regional ocean governance has been proposed as an essential component of achieving ocean related SDG targets, especially those of SDG14. It has also been argued that the regional level must play a key role in governance of Areas Beyond National Jurisdiction (ABNJ) [25], including Biodiversity Beyond National Jurisdiction (BBNJ) which is being addressed by a new global agreement [10,26–29]).

The regional level capacity needs for improved regional ocean governance range from institutional architecture, through policy development, management planning to technical capacity for on-the-ground implementation. They also include the development, at the regional level, of the capacity to coordinate among regional organisations in order to achieve the integration required for successful EBM [20,30–32]. A companion paper to this one examined regional integration mechanisms for the regional clusters described herein and found that most regions either had coordination mechanisms or were attempting to develop them [33]. Based on that observation and the role of the United Nations Convention on the Law of the Sea (UNCLOS) [34] as an overarching set of rules for ocean governance, the study concluded that the clusters met, or were trying to meet the criteria for polycentricity [35,36]. The perspective of the clusters as polycentric multilevel systems is fully discussed in that paper, and is referred to throughout the present study.

3. Methods

This study is based on an inventory and analysis of all regional ocean governance arrangements covering fisheries, biodiversity and habitats, pollution and climate change. Arrangements are the multilateral agreements for ocean governance and the institutional measures put in place to facilitate their implementation. An inventory of ocean governance arrangements was carried out for the GEF Transboundary Waters Assessment Programme (TWAP) for arrangements that are relevant to ABNJ [10] and to LMEs [11]. For this study, those inventories were combined and expanded to include any additional agreements developed since that study, such as Port State Control MOUs and Strategic Actions Plans (SAPs) developed by Global Environment Facility (GEF) LME Projects. A full list of the arrangements included in this study along with their acronyms/short names can be found in the supplementary material.

For the purposes of this study, 20 ocean regions were defined globally starting with the UN Environment Regional Seas regions and based on the existence of regional level arrangements and their areas of competence [10](Fig. 1). For each ocean region the governance arrangements that are fully contained within, or partially overlap, the marine space covered by the region were determined, based on their area of coverage [10,37]. This resulted in three additional regions being identified: the Northwest Atlantic and two derived by splitting the Northeast Pacific Region of the Regional Seas Programme into Northeast Pacific (north of the tip of the Baja Peninsula, Mexico, to the Bering Sea) and the East Central Pacific (from the tip of the Baja Peninsula south to the northern limit of the Humboldt Current LME).

Defining the transboundary ocean regions based on Regional Seas arrangements appears reasonable from a large-scale geopolitical perspective. The regions correspond to the coasts of the continents and the major semi-enclosed seas. The approach in this study was to start with these regions and determine the suite of arrangements that overlap the Regional Seas space in each region. Another approach would be a hierarchical clustering of all arrangements, including the Regional Seas arrangements. Intuitively, this approach is more appealing as it would allow for selection of clusters of arrangements at different clustering levels that best fit the ecosystem characteristics. However, this approach would be extremely challenging technically given the wide variation in area of the individual arrangements. It would be necessary to use geographical centroids for the arrangements and this would probably distort the clustering relationships, given the large differences in size of the arrangements and their nestedness. This second approach is mentioned here for completeness, or for the uptake of experts in spatial analysis to consider. Three other bases for clustering would be: (1) Marine Ecoregions, which are based on marine biodiversity [38], (2) Large Marine Ecosystems, which are based on large-scale bio-geophysical ocean processes and have been proposed as the appropriate management scale for the oceans [39]; and ocean biomes and provinces [40]. At this time, the approach adopted in this study appears to be the most practicable and grounded in existing practice.

For each ocean region, the number of LMEs, their total area, the number of countries with EEZs in the region and the number of agreements were tabulated. The Arabian Sea LME was the only LME that spanned two or more regions (The ROPME Region and the Western Indian Ocean Region). Its area was divided between them. Each governance arrangement was classified according to scope, origin, source and the binding nature of the arrangement as described in Table 1.

Engagement by the countries of a region with an arrangement relevant to that region was estimated as the percentage of eligible countries in the region that had signed on to the arrangement at the

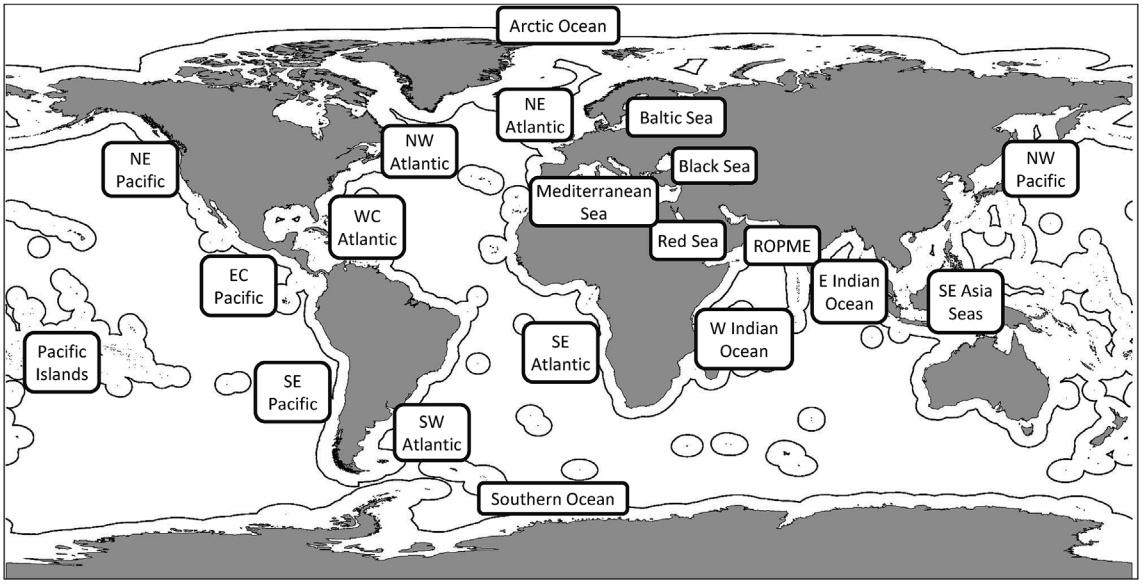

Fig. 1. The 20 ocean regions.

highest level possible. Some agreements are binding and signature, ratification or accession indicates a willingness to be bound by their terms. Others are not binding and signature indicates a willingness to cooperate or take part in the relevant activities on a voluntary basis.

The methodology developed and applied in the Global Environment Facility Transboundary Waters Assessment Programme (GEF TWAP) was used to estimate the percent 'completeness' for each arrangement [10]. Completeness is an indication of the strength of the architecture and processes of an arrangement based on criteria that reflect international norms. Such architecture and processes are referred to exhibiting 'good' governance. In contrast, governance that achieves the outcomes that it was set up to achieve is referred to as 'effective' [41,42]. The overall completeness score is the sum of scores for each of seven policy cycle stages considered necessary for an arrangement to function effectively. These are: (1) Data and information acquisition and management; (2) policy analysis and the provision of policy advice; (3) policy decision making; (4) planning analysis and the provision of planning advice; (5) planning decision making; (6) implementation of plans; and (7) review and evaluation. Generally, binding arrangements score higher than non-binding ones in terms of the requirement to implement plans and in review and evaluation.

Other information associated with each arrangement includes year of establishment for non-binding agreements or binding agreements not yet in force, and dates of entry into force for binding agreements in force. Regional characteristics were determined by aggregating information on the arrangements, countries or LMEs associated with the region.

4. Results

4.1. Numbers and characteristics of arrangements

One hundred and sixty-six regional arrangements were identified based on the inclusion criteria for the study. See the supplementary material for a list of arrangements with full names, acronyms or short names, and their distribution among regions. The suite of regional ocean governance arrangements associated with a region is referred to as a 'regional cluster'. Other possible terms include 'regional system' after Ostrom [43], 'regional regime complex' after Keohane and Victor and Orsini et al. [44,45], or 'regional institutional complex' after Stokke and Oberthür [46]. The applicability of these are discussed later in this paper and by Mahon and Fanning [33].

There are 156 coastal countries included. The distribution of countries among regions is given in the supplementary material. For most dependent territories, the metropolitan country signs international agreements, so only that country is counted in a region even though it may have several dependencies. These dependencies may have varying degrees of autonomy for marine management, increasing the complexity of the regional situation. The number of regions that a country must deal with may have significant administrative implications, especially for small developing countries. The majority (75%) have only one region to deal with (Fig. 2). The countries with the most regions are: France with six, the United Kingdom and the United States with five, Russia with four, and Australia, Canada, Mexico, Spain with three regions each. Still 20% of countries, many of them small, must deal with two regions.

Of the regional arrangements 58 (35%) are non-binding and 107 (65%) are binding. Most regional arrangements (74%) pertain to only one region (Fig. 3). ICCAT is the arrangement that pertains to the highest number of regions (8) as it covers the entire Atlantic Ocean and

Table 1
Categories for classifying ocean governance arrangements.

Category	Description
Scope	The issue or issues addressed by the arrangement (fisheries, pollution, biodiversity and habitat, environment generally or multipurpose economic). An arrangement could be in more than one of these categories
Origin	Whether the development of the arrangement was initiated by an external agency (external) or by the countries (indigenous)
Institutional source	The agency that initiated the development of the arrangement (e.g. LME Project, UN agency such as IMO, FAO, UNEP).
Binding	Whether an agreement is binding, or compliance is voluntary

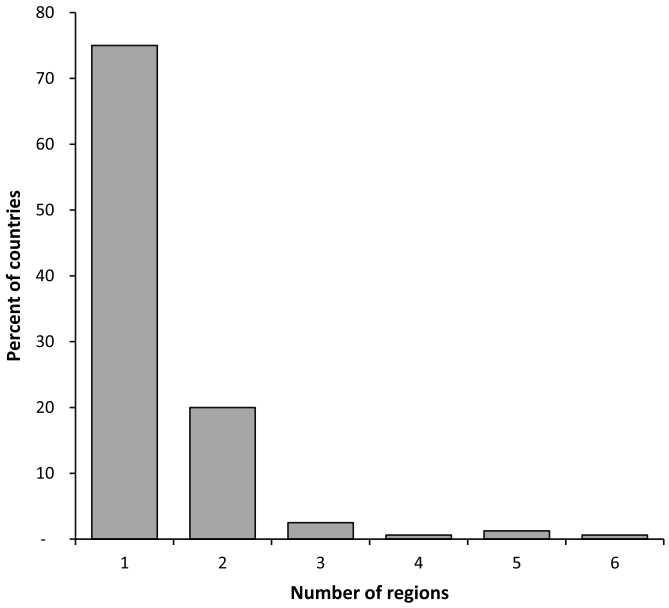

Fig. 2. The number of regions that individual countries must deal with.

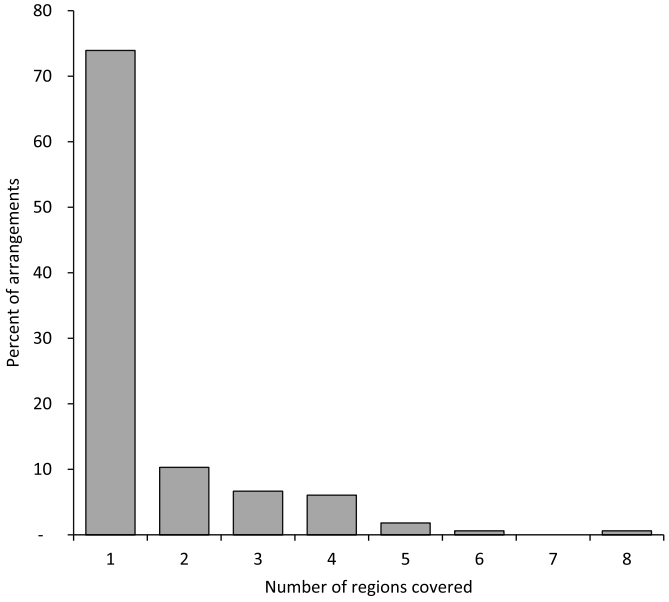

Fig. 3. The number of regions covered by arrangements.

several of its adjacent seas. This and other tuna commission with transoceanic mandates are included in this study because there are interactions between the highly migratory species that migrate ocean-wide and more localised, coastal species that must be considered at the region level.

The fact that most regional arrangements are specific to only one or a few regions lends support to pursuing a regional perspective on ocean governance. It also suggests that either the regions have been defined at an appropriate scale, or, if many arrangements are found to be smaller than the regions as defined here, that the current scale for governance is smaller than these regions. LMEs are almost entirely at the same scale as, or smaller than, the regions defined here. Only one LME, the Arabian Sea LME extended over two regions (the distribution of LMEs by regions is provided in the supplementary material). Three LMEs were not allocated to a region: the Southwest Australian Shelf LME, the Southeast Australian Shelf LME and the West Central Australian Shelf, all entirely within the jurisdiction of Australia.

The dates of establishment or entry into force for regional arrangements span seven decades, with a broad peak centered around the turn of the century (Fig. 4). Note, however, that there is usually a long time-span between opening an agreement for signature and its coming into force, about 4–5 years on average [10], making the process of institution building for ocean governance a slow one. The distribution of dates in Fig. 4 suggests that the numbers of new arrangements are declining, and that the overall suite of regional ocean governance arrangements is stabilizing. Perhaps the next phase is a focus on structuring and strengthening the full global-regional suite of arrangements and its national linkages.

4.2. Characteristics of the regions

The regions as defined in this study vary widely in several ways, such as area (as indicated by the combined area of the EEZs of the coastal countries), number of coastal countries, ecosystem diversity (as indicated by the number of LMEs within the region) and Human Development Index (HDI) (Fig. 5). Other aggregate regional characteristics will be considered as the analysis proceeds. The important point to be made at the outset of this analysis is that there is considerable diversity among regions that must be considered in reflecting on regional ocean governance and how to strengthen it.

4.3. Characteristics of the clusters of regional arrangements

The characteristics of the cluster of arrangements comprising each region are shown in Table 2. Note that an arrangement may contribute to more than one scope category. LME arrangements are all Strategic Action Programmes (SAPS) developed by LME Projects. Regional Seas are so classified whether overseen by UN Environment or not. FAO covers all FAO affiliated fisheries arrangements. United Nations arrangements is the total developed under the auspices of UN agencies such as UN Environment, the UN Food and Agriculture Organisation (FAO) and the International Maritime Organisation (IMO). Indigenous arrangements are those developed by the countries of a region, as opposed to an external agency. Multipurpose regional arrangements are those developed for economic and sustainable development that include a mandate for ocean affairs. The category environment may include biodiversity, fisheries and pollution in various combinations.

4.4. Number of arrangements

In most regions, countries have 10 or more arrangements to deal with. Exceptions are the Baltic Sea, the Northwest Atlantic and the Southwest Atlantic. In the Baltic Sea, this is partly because the Regional Seas agreement does not have any protocols. The equivalent to protocols are included as annexes in the main HELCOM agreement. Nor is there any FAO fisheries body covering this area. Finally, neither ICCAT nor the NEAFC extend into the Baltic Sea. Only the EU Common Fisheries Policy addresses fisheries; but not all countries are EU members.

In the NW Atlantic there are only three countries, the USA, Canada and France, and the first two have jurisdiction over most of the marine space there, so that marine ecosystem matters can be dealt with through bilateral arrangements. The USA and Canada have a long history of cooperation on ocean affairs. The situation for the Northeast Pacific is similar. Although there are only three countries in the SW Atlantic - Argentina, Uruguay and the UK - contentions over marine space have resulted in there being few regional agreements.

In several regions, countries have 15 or more arrangements to deal with (Table 2). The highest number is 21 in the West Central Atlantic, with the Mediterranean and the Southeast Atlantic each having 20. Notably, the Arctic has 19 arrangements. This is because many arrangements that focus mainly south of the Arctic overlap Arctic marine space as defined by the Arctic Council, e.g. ICCAT, NEAFC, PHC,

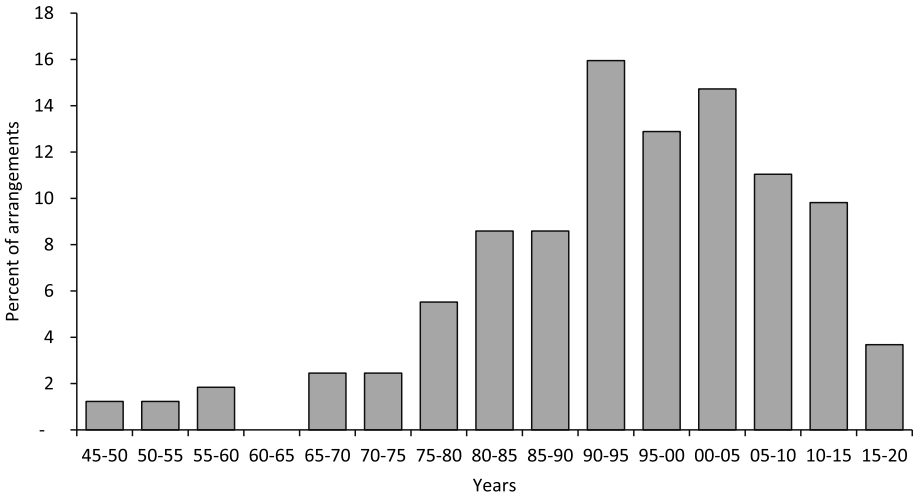

Fig. 4. The dates of establishment of regional arrangements.

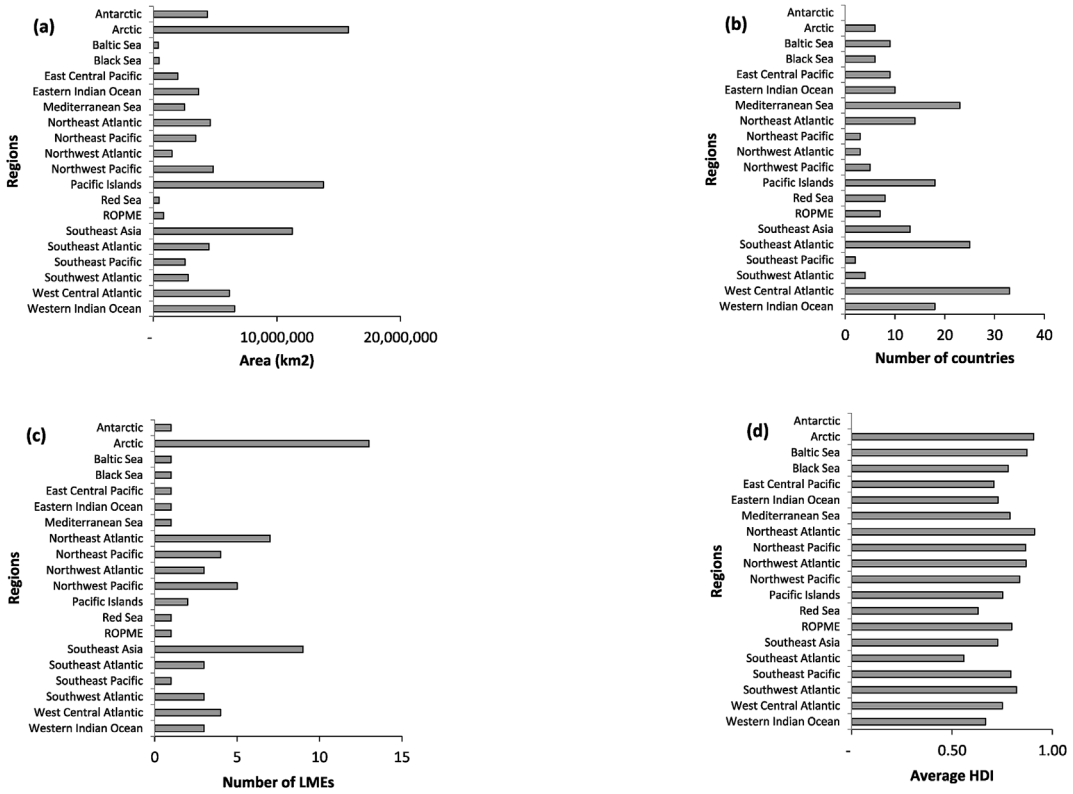

Fig. 5. (a) The combined area of LMEs, (b) number of countries and (c) the number of LMEs in each region, (d) HDI.

NAMMCO. Other regions in which countries have notably high numbers of agreements to deal with are the Black Sea and Pacific Islands Region. This can place a significant burden on national governments, especially in small countries, and they may find it difficult to engage effectively [47–49]. To address this problem, projects supported by the Global Environment Facility International Waters programme have required countries to establish Interministerial Committees (IMCs) or National Intersectoral Committees (NICs), but there has been varied success with this approach [50]. This is an area of institution building that requires much greater attention for strengthening regional ocean governance.

Except for the three largest regions, the number of agreements per region does not appear to be closely related to the size of the region (Fig. 6a). This is unexpected as a larger region would be expected to have a larger number of subregional arrangements. Similarly, the number of arrangements does not appear strongly related to the number of LMEs, an indicator of large scale ecosystem diversity (Fig. 6b). However, the number of arrangements per region is related to the number of countries in the region. Thus geopolitical complexity appears to be more important than overall area or ecosystem diversity in determining the proliferation of arrangements.

4.5. Scope of arrangements

The overall distribution of scope of arrangements among regions is shown in Fig. 7. All regions have at least some arrangements for biodiversity, fisheries and pollution. However, this does not mean that all fisheries, biodiversity and pollution issues are covered as there may be a

Table 2
The numbers of arrangements found in the 20 regions, according to institutional source, origin and scope as described in Table 1.

Region	Number of arrangements											
	Total	Institutional source				Indigenous origin	Scope					
		LME	Region-al Seas	FAO	United Nations (total)		Multi-purpose	Environ-ment	Bio-diversity	Fisher-ies	Pollution	Climate Change
Antarctic	6		3	1	1	2		3	2	2		
Arctic	19		2	8	8	11	3	2	4	9	1	
Baltic Sea	10		1		2	8	2	4	2	1	2	
Black Sea	14		5	2	2	6	1	4	3	3	3	
East Central Pacific	10		2	1	3	6	1	2	3	5	2	1
Eastern Indian Ocean	12	1	1	2	3	9	2	2	3	5	1	
Mediterranean Sea	20		8	2	11	9	3	6	4	4	7	
Northeast Atlantic	15		1	4	5	10	1	4	4	5	2	
Northeast Pacific	9			4	5	4		1	2	6	1	
Northwest Atlantic	5			4	5				1	4	1	
Northwest Pacific	10	1	1	4	5	4		4	1	5	1	
Pacific Islands	16		3	3	4	9	1	2	3	8	4	
Red Sea	10	1	4	1	2	8		3	5	1	4	1
ROPME	12		5	1	3	9	1	1	4	2	6	
Southeast Asia	16	3	1	1	3	13	1	5	4	7	1	
Southeast Atlantic	20	3	3	3	7	13	3	5	3	8	4	1
Southeast Pacific	12	1	5	1	2	5		4	3	2	4	
Southwest Atlantic	5			1	2	3	1	1	2	1	1	
West Central Atlantic	21	3	4	2	7	14	3	6	4	5	6	2
Western Indian Ocean	15	1	4	3	8	7	3	3	5	3	4	1

wide range of issues in each of these categories and the arrangements may be specific to only one of the issues, e.g. the Polar Bear Convention in the Arctic, or the Dugong MOU in the Indian Ocean. All but one region, the Northwest Atlantic, has an environmental arrangement. This type of arrangement is more likely to have the capacity to cover a range of issues. Few regions have arrangements that pertain specifically to climate change, although many of the more recent arrangements reference climate change as a crosscutting issue.

All regions except the NW Atlantic, NE Pacific and SW Atlantic have Regional Seas arrangements (Table 2). These range from conventions with binding and non-binding protocols to regional actions plans such as NOWPAP in the Northwest Pacific and COBSEA in SE Asia. All regions except the Baltic Sea are covered by at least one FAO Regional Fisheries Body (RFB) not all of which are Regional Fisheries Management Organisations (RFMOs) [51]. Furthermore, these RFBs are for three different types of fisheries: highly migratory pelagics, other fisheries in ABNJ and fisheries within national waters. Therefore, the presence of an RFB does not mean that all fisheries issues are covered. However, even when there is no FAO RFB in a region, there may still be a variety of other RFBs established by the countries. It should be noted that even though these RFBs are not formed under the auspices of FAO they can still participate in FAO's Committee on Fisheries (COFI) and its meetings of RFBs. This provides a means of interregional interaction and learning that is an important component of a global-regional approach to ocean governance.

4.6. Engagement with arrangements

Engagement of the countries with regional arrangements is the percent of countries that have signed on to an arrangement. Engagement varies widely within and between regions (Fig. 8). Between regions the average percentage engagement ranges from a low of 68% in the Northwest Atlantic to a high of 95% in the Baltic Sea region. In some cases, it must be noted that there is low engagement with an arrangement because it has only recently become available for signing, for example, some International Maritime Organisation (IMO) Port State Control MOUs. However, weak engagement with arrangements may also be the result of a country's assessment of the costs and benefits of engagement. On the cost side, there is the country's perception of its own capacity to meet the conditions imposed by the arrangements or simply the actual costs of engagement. On the benefit side, there may be the country's perception that the benefits of investing in ocean affairs are sufficiently great relative to other more pressing national concerns such as health, agriculture and national security. There is also a need to

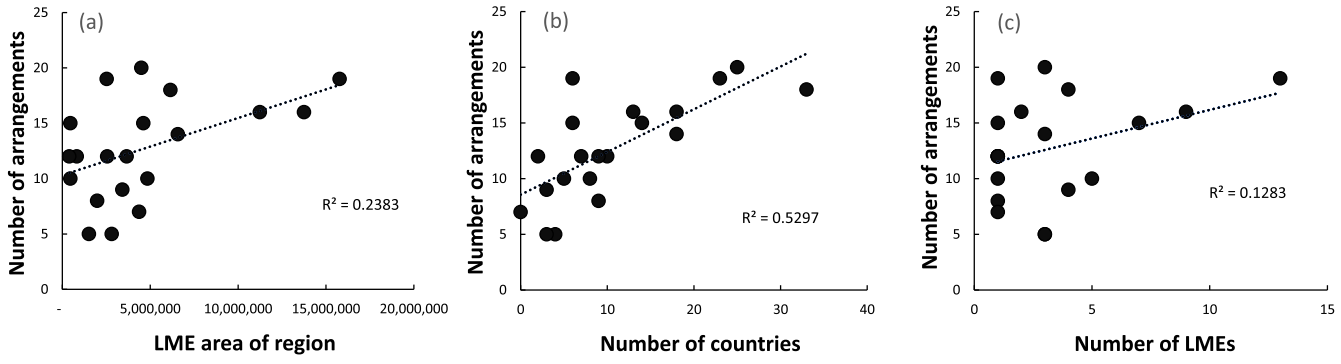

Fig. 6. The number of arrangements per region versus: (a) EEZ area of the region in km2, (b) number of countries in the region and (c) number of LMEs in the region.

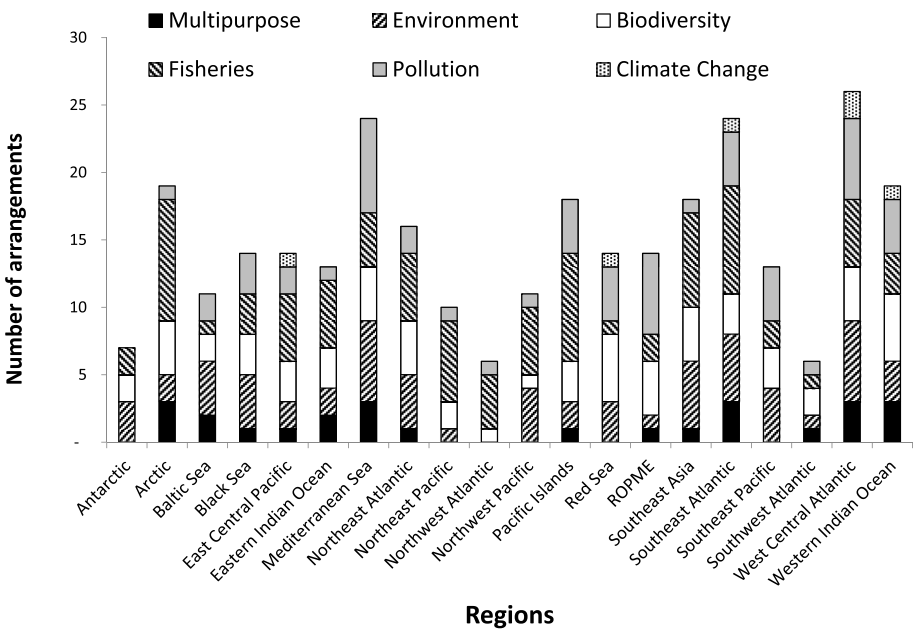

Fig. 7. The scope of arrangements found in each region.

consider how a country affords legitimacy to global and regional organisations based on their perception of the IGOs capacity to deliver what is agreed upon [52,53]. These and other questions such as 'to what extent does the perception that fragmentation at the regional level leads to duplication of effort and inefficiency deter engagement?' should be explored systematically through a programmatic approach to regional ocean governance. Understanding these issues could inform initiatives to establish regional coordination mechanisms aimed at improving inter agency efficiency.

4.7. Completeness of arrangements

Completeness of an arrangement is a percentage score that indicates how strong its policy cycle is, based on international standards for multilateral environmental agreements [10]. This is a measure of whether governance architecture reflects 'good governance' principles and practices. It does not indicate the extent to which governance is effective in achieving its objectives. However, with good architecture and processes in place there is an expectation that governance will be more likely to be 'effective' which is to achieve the outcomes that were intended [41,42]. It is recognised that while 'good' governance may be expected to provide the context for 'effective' governance, this link has not been demonstrated and needs to be explored further. However, it is worth noting that 'good' governance may be desirable in its own right as the transparency and accountability it promotes are likely to make it easier and more attractive for stakeholders to engage.

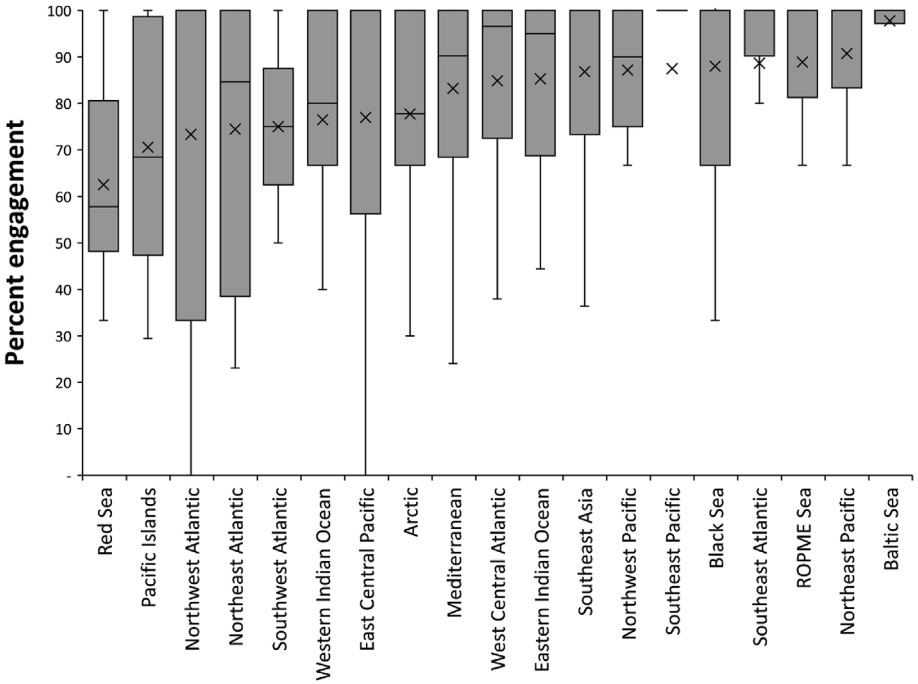

Fig. 8. Comparison of percent engagement with regional arrangements among regions (horizontal bar is the median, x is the mean, vertical boxes show second and third quartiles, the whiskers show points with 1.5 times the second and third quartiles).

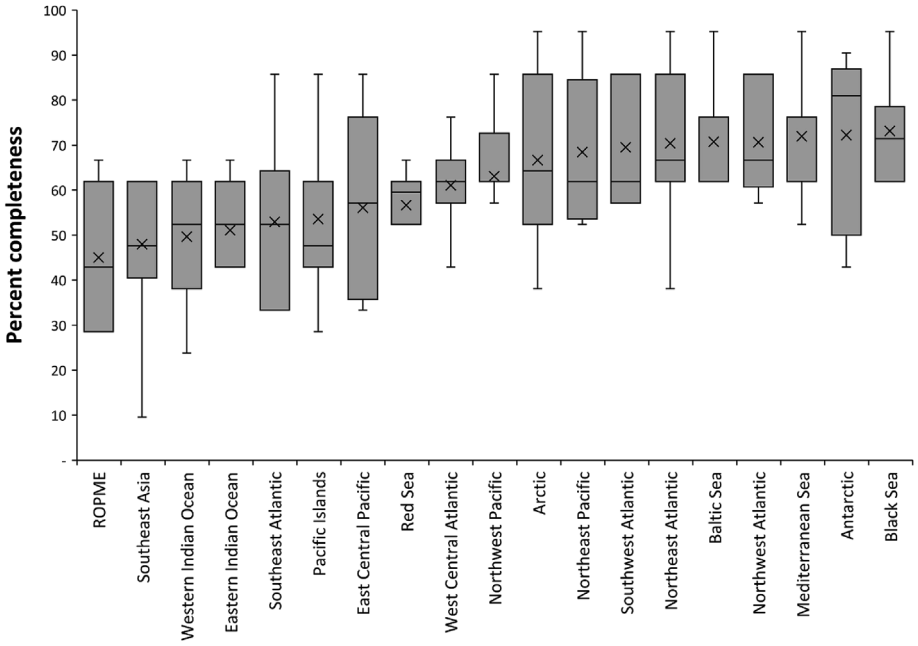

Fig. 9. Comparison of completeness of arrangements among regions (horizontal bar is the median, x is the mean, vertical boxes show second and third quartiles, the whiskers show points with 1.5 times the second and third quartiles.

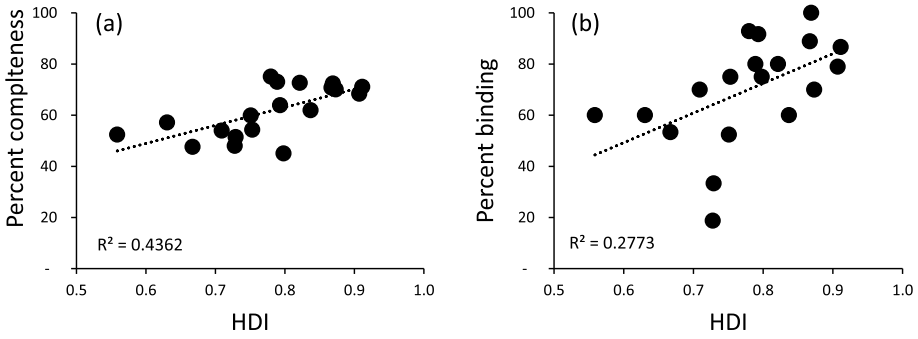

Fig. 10. The relationship between average HDI and (a) percent completeness of arrangements, and (b) the percentage of agreements that are binding.

In Fig. 9, regions are sorted from left to right in order of increasing average completeness of the regional ocean governance arrangements that pertain to them. Clearly, ocean regions differ in completeness of arrangements, ranging from an average of about 45% completeness in the case of the ROPME region to an average of about 75% in the case of the Black Sea region. Therefore, as indicated above, in moving from left to right across Fig. 10, 'good' governance architecture increases, and governance effectiveness can be expected to be higher; although whether this is indeed so remains to be evaluated.

There is a tendency for lower completeness to be associated with lower average Human Development Index, indicating that arrangements are weaker in developing regions (Fig. 10a). A large part of this association is due to the prevalence of non-binding agreements in these regions which tend to have lower completeness scores for the implementation and review and evaluation stages of the policy cycle (Fig. 10b). There is also a tendency for binding agreements to be less common in regions with international tension, which may explain the two lowest points in Fig. 10b, Southeast Asia (19% binding) the Eastern Indian Ocean (33% binding) [30,54]. Interestingly though, the Northwest Pacific, a region with high international tension does not have an anomalously low percentage of binding agreements (60% binding).

4.8. Indigenous and external arrangements

Indigenous arrangements, which include LME Strategic Action Programmes (SAPs), comprise a significant proportion of ocean governance arrangements in most regions and often outnumber the external arrangements, which are primarily Regional Seas and FAO-based fisheries arrangements. They are distributed widely across the ocean regions (Fig. 11). These are often developed by subregional groupings of countries that have specific common issues or that wish to have a collective voice in wider regional or global matters. These arrangements are an essential component of a polycentric, multilevel regional ocean governance [55–57]. They are one way in which the subsidiarity principle can be applied in regional affairs. It is important that their roles in regional ocean governance be understood and promoted. Their prevalence indicates that the countries of most regions see them as necessary and important. Clearly, they must be given serious consideration, in any initiatives to understand and promote regional ocean governance.

The scopes of arrangements comprising the external and indigenous categories differ considerably (Fig. 12). Notably, the multipurpose economic integration arrangements are exclusively in the indigenous category. The proportion of general environmental arrangements is much higher in the indigenous group. (Fig. 12). Finally, the proportion of fisheries and pollution arrangements is higher in the external

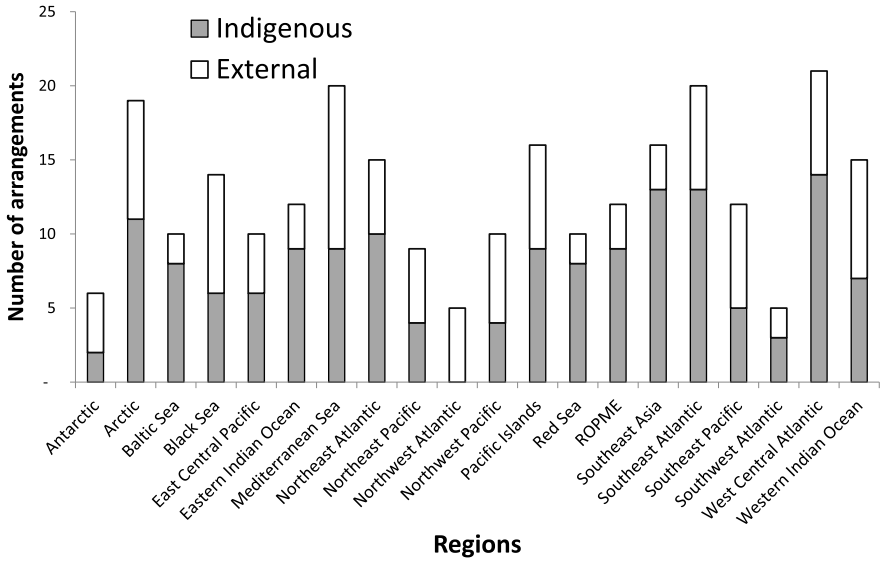

Fig. 11. The numbers of external and indigenous arrangements by ocean regions.

arrangements category, being mainly Regional Seas and FAO RFBs.

LME SAPs are one category of indigenous arrangement that are often ecosystem oriented and so categorized as 'environmental'. These are subregional arrangements that seek to address the mismatch between arrangements and ecosystems commonly observed in marine systems, [11]. From a multilevel polycentric governance, perspective these SAPs can be seen as being at the level between countries and regions, except in a few cases where LMEs and Regional Seas coincide spatially (Black Sea, Mediterranean, Baltic Sea, Red Sea). Where regions include several LMEs (Fig. 5c), such as in Southeast Asia and Southeast Atlantic, developing governance mechanisms at the LME scale can be a way to address the present mismatch between regional ocean governance arrangements and marine ecosystems, provided that the set of LMEs provides full coverage for that region.

There are differences between external and indigenous arrangements regarding the extent to which they are binding, their completeness, and the engagement of the countries of the regions with them. Ninety-two percent of external arrangements are binding as compared to 53% of indigenous ones. Since having binding decision making is part of completeness, it follows that average completeness of the external arrangements is also higher (62%) than that of the indigenous ones (45%).

5. Discussion

This study sheds some light on the questions posed in the introduction and provides insight into possible future directions, even if more in the form of questions than answers. It describes a global suite of polycentric multilevel regional ocean governance systems. It must be noted that this analysis of regional ocean governance has addressed only the multilateral arrangements for EBM. As the analysis is expanded to other sectors (transport, oil and gas, mining, etc.) and types of regional actors (e.g. civil society and private sector) as has been done for the West Central Atlantic [58], a fuller picture of multilevel polycentric governance will emerge.

5.1. What arrangements are in place for regional ocean governance globally?

It is important to recall that there are at least 25 global governance arrangements relating to ocean EBM [10], and that the regional/subregional arrangements that are the subject of this study, some 165, are located in geographic scale between these global arrangements and the national level. Most of the world's sea areas within national jurisdiction are covered by the 20 ocean regions used in the study. Each of the regions has a cluster of arrangements addressing aspects of sustainable

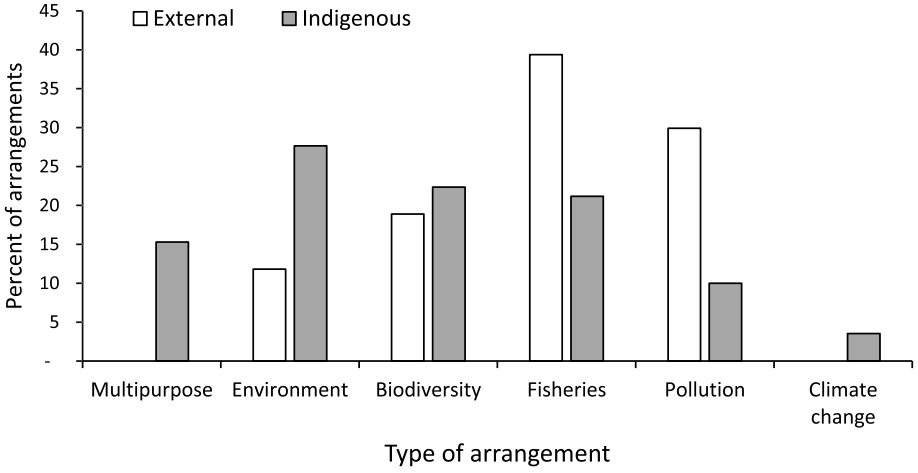

Fig. 12. Percent distribution of indigenous and external arrangements.

use and EBM of marine ecosystems. If these regional clusters are recognised as valid entities, and treated as such, by the global agencies that drive the agenda for global ocean governance, there are many questions that can be asked about them. Some basic questions about them have been addressed in this study, but many other more complex ones remain to be pursued. For example, what are the gaps among the arrangements within clusters regarding their coverage of the key ocean sustainability issues for that region? Where do the arrangements overlap in mandate and is this redundancy useful [59]? How do the arrangements interact? How do the integrating mechanisms at the regional level described by Mahon and Fanning function [33]? What is the potential for expanding the mandates of the arrangements in the regional cluster to adjacent ABNJ, as may be of interest under the BBNJ agreement being developed at the UN [60]? Are there tensions between external and indigenous arrangements and what are the drivers or constraints for formation of the latter? Several of these kinds of analyses have been carried out for a few regions, notably those around Europe [61], but the sample size is small and the opportunities for comparative analyses are few [62].

Ultimately, the overarching question is whether the clusters can be considered as entities for which the whole is greater than the sum of the parts and analyzed as a unit as was done for the Western Central Atlantic Region [55,58] and in this study. The many initiatives to develop regional coordination mechanisms suggest that the countries and intergovernmental organisations in these regions see their regions in this way [33]. They also indicate that several regions are functioning, or at least beginning to, function as systems. The role of regional integration mechanisms in the transition of regional clusters into functioning polycentric systems is more fully discussed by Mahon and Fanning [33]. Similarly, the prevalence of indigenous arrangements most of which are more connected to regional multipurpose arrangements than to global networks of arrangements suggests that the clusters should be considered as independent entities. The implications of these considerations for a global ocean governance architecture is considered at the end of the discussion.

5.2. How do regional arrangements relate to each other within regions?

This study has not explored the relationships among arrangements within regions. This aspect of regional ocean governance would require more detailed investigation for better understanding of the functioning of the regional clusters. It could be examined through formal linkages indicated in the documentation examined for each arrangement, and in MOUs between arrangements. However, it is likely that there are informal linkages among arrangements that are also of importance in determining governance outcomes. In the Western Central Atlantic, interactions among arrangements were explored in the context of the five stages of a conventional policy process: data and information; provision of advice, decision-making, implementation and review and evaluation [58]. These were used to examine data and information sharing networks and decision-making networks. The study revealed numerous connections at all stages of the policy cycle. However, the connections were most frequently at the level of data and information provision, and analysis and advice. They were much less frequent at the decision-making stage of the cycle [58].

Arrangements for scientific research and the formulation and provision of advice are usually built into arrangements. However, in seven regions there are arrangements whose sole function is to promote research and to formulate advice. These are: Antarctica (SCAR), Northeast Atlantic (ICES), Northeast Pacific and Northwest Pacific (PICES), Pacific Islands Region (SPC), Southeast Asia (SEAFDEC) and Western Indian Ocean (WIOMSA). A comparison of the role and functioning of these arrangements would be a valuable contribution to understanding how the 'best available scientific information' is incorporated into management advice in those regions, and what provisions might be desirable in other regions. In that regard, a review of the regional science policy interfaces for governance of marine ecosystems would be a valuable exercise.

The degree of linkage, especially of indigenous arrangements, to existing regional multipurpose economic development arrangements is likely to be an important factor in getting oceans on regional agendas and in securing sustainable financing [18]. Hewawasam and McLean suggest that one avenue to regional ocean governance in subSaharan Africa might be through such organisations [63]. However, as pointed out by Koivurova and Rosas this approach may not be as straightforward as it intuitively appears [64]. They observed that the broader role of the Commission of Baltic Sea States (CBSS) which aspires to be a 'forum for all multilateral intergovernmental cooperation and dialogue in the Baltic Sea Region', may actually make it more difficult to engage than the more narrow role of arrangements that are solely environmental such as the adjacent Arctic Council and Barents Sea Council. The apparent drawbacks to mixing political and sustainable development agendas make the need for well-developed science policy interfaces as discussed in the previous paragraph, even more critical. Nonetheless, this study has shown that there are multipurpose arrangements with ocean mandates and linkages in several regions. Indigenous, ocean sectoral regional arrangements with a management mandate are often subsidiary to these multipurpose arrangements and one might assume the linkages between them are well developed. Examination of the mechanisms, benefits of, and factors supporting these linkages would be a valuable exercise.

5.3. How do regional arrangements relate to global level ocean governance?

Most external regional arrangements are connected to a global arrangement or program. For example, Regional Seas, RFMOs, Convention on Migratory Species (CMS) MOUs and IMO Port State Control MOUs. Consequently, there is some oversight and coordination at the global level within each of these silos. UN Environment holds regular meetings of the Regional Seas arrangements at which programmes are compared and experiences exchanged. Similarly, Regional Fisheries Bodies (RFBs) and RFMOs meet under the auspices of FAO in connection with their Committee on Fisheries (COFI). These meetings are open to all RFBs whether FAO affiliated or not. They serve to strengthen global-regional connections for these suites of arrangements. In contrast, global regional connections are less structured for other indigenous arrangements, especially those that are biodiversity related. It appears to be largely up to the individual arrangements to develop the linkages that they need. However, costs of engagement are likely to be a limiting factor. A more connected and coordinated global ocean governance system would benefit from mechanisms that engaged indigenous arrangements in the way that FAO does for fisheries.

5.4. How do regional arrangements relate to Large Marine Ecosystems?

There are 66 Large Marine Ecosystems (LMEs) globally that have been defined based on biophysical characteristics (Sherman, 1994). The Pacific Islands Region (PIR) is also often treated as an LME [11]. LMEs have been proposed as the appropriate scale at which ocean management should take place [65]. Of the 66 LMEs, 51 are transboundary as is the PIR, the remainder falling entirely within the national waters of a single country. In many LMEs, the countries have received assistance with EBM through the GEF International Waters Programme projects [66] Rochette et al. reviewed the role of LMEs in regional ocean governance and identified several deficiencies relating to governance, primarily that they are not linked to existing arrangements, so that when an LME project ends there is minimal uptake of advances made [3]. Fanning et al. examined the match between LMEs and regional governance arrangements for transboundary ocean issues quantitatively and demonstrated that the spatial fit between LMEs and the regional ecosystem-oriented arrangements that overlapped them was poor [11]. The mismatch occurs mainly for the continental regions and

the Arctic; as the semi-enclosed Baltic, Black, Mediterranean, ROPME and Red Seas have only one LME that exactly matches the region. In the cases of the Western Central Atlantic and Southeast Asian Seas there are four and nine LMEs respectively (Table 2). The mismatch of governance arrangements to the 'system to be governed' has been frequently discussed as a problem to be addressed [67,68]. At the transboundary scale, this could be approached by recognizing LMEs as a subregional level that is intermediate between regional and national, and developing subregional arrangements that fit LMEs [11]. With this approach, the full regional level could focus more on harmonizing policy and strategy than on management.

5.5. The role of regional clusters in global ocean governance

The aforementioned suite of 25 global arrangements pertaining to sustainability of ocean ecosystems can be considered to comprise the core of global ocean governance. For the most part this level is uncoordinated except through reporting to the United Nations General Assembly (UNNGA). The global level arrangements were examined by Mahon et al. [10]. They noted, as have others, that at the global level there is considerable need for reducing fragmentation, or at least promoting cooperation [9,20]. Coordination among the global arrangements and their associated regional arrangements that fall under the auspices of the UN has been the role of UN Oceans. However, UN Oceans has not been effective, mainly due to a lack of resources [10,19]. Responsibility for UN Oceans has recently been assigned to the United Nations Division of Ocean Affairs and Law of the Sea (DOALOS) and new Terms of Reference drafted, but effectiveness does not appear to have improved yet [69].

In addition to the apparent challenges in getting UN Oceans to fulfil its coordinating role, there is the question of whether, even if functioning effectively, it would be adequate for the task of coordinating global-regional arrangements for the oceans. One aspect of this is that there are several global arrangements that do not come under the heading of UN Oceans, leaving gaps. Another aspect is the observation in this study that there is a high proportion of indigenous regional arrangements that are not directly associated with any UN body and may therefore not be included in UN Oceans coordination.

Beneath the global level there is the regional level comprising 20 regional clusters of arrangements, with a diversity of characteristics, considered in this study. Despite their diversity, these clusters all have a similar purpose - sustainable use of marine ecosystems through EBM. There are also many common cross-cutting aspects of these clusters such as Regional Seas arrangements, FAO related RFBs, IMO instruments, etc. Some regional clusters have more capacity and are more organized than others; largely those with a high proportion of developed country membership.

The global-regional picture described above raises the question as to whether together these two levels provide an overall ocean governance architecture for the world that is worth recognizing explicitly and working with in a comprehensive holistic way. This architecture is depicted in Fig. 13 in which the global level comprises the 25 United Nations (UN) and non-UN arrangements, such as the International Whaling Commission (IWC) and the International Convention on Trade in Endangered Species (CITES), the regional level comprises the 20 regional clusters, each with its suite of regional arrangements among and within which there must be interactions, and the national level comprising the countries which are the primary implementers of ocean governance measures. Not shown in Fig. 13 is the local level to which there must also be vertical linkages from the national level. As indicated by the multiple arrows, there is a great deal of vertical and horizontal interaction required among the components of this structure for it to function as an integrated whole.

Part of the answer to the question raised in the previous paragraph depends on whether the regional clusters are indeed more than the sum of their constituent arrangements. The extent to which there are efforts to establish integration mechanisms indicates that the countries and organisations of the regions think that this is, or should be, the case [33]. If so, what exactly are these clusters in governance architecture terms? In the sense of Ostrom these clusters are clearly holons or building blocks of governance [5]. Orsini et al. discuss the concept of regime complexes as suites of interacting regimes (arrangements) that focus on a common governance issue [44]. At first look, it would appear that the range of issues covered by these clusters is too broad for them to be termed 'regime complexes', unless all these issues are lumped under the heading of the single issue 'EBM'. If these regional clusters are not regime complexes, are they a new kind of governance structure or holon for which definition and discussion is required?

Whatever these systems should be termed, do they have the potential to be the 'missing link' between national and global systems that is needed to support the achievement of global ocean governance objectives? This leads to a key question for future action, which is whether viewing global-regional ocean governance as a single interconnected system comprising global and regional building blocks could be useful. Can it help guide programmatic initiatives to address fragmentation at global and regional levels, and with strengthening the overall structure [12,70]? If so, then whose responsibility is it to recognize this structure and to take on the task of nurturing and monitoring it and its component parts? Clearly, all stakeholders have a role in this task, but there needs to be a globally acknowledged integrated mechanism to lead it.

6. Conclusions

The 20 regional clusters of ocean governance arrangements identified and described in this study vary widely in characteristics such as EEZ area, number of LMEs and number of countries. They also vary widely in terms of the scopes of arrangements, their completeness, and the degree of country engagement. Additionally, this study noted that the majority of regional arrangements are indigenous, developed by the countries of the region as opposed to external agencies. This is a key finding, as hitherto, consideration of regional ocean governance has tended to focus on Regional Seas arrangements and RFBs. The study provides an initial description of these regional clusters, which is an essential and often undervalued first step in analyzing polycentric governance systems and determining how to strengthen or transform them [36].

The fact that some regions have up to 20 arrangements is likely to be challenging to the countries in these regions, especially developing and small countries. Furthermore, some countries must also deal with more than one region, adding complexity and an additional resource burden associated with participating in arrangements across different regions. While there are few well-developed regional coordination mechanisms to provide the integration needed for ecosystem-based management, several are planned [33]. Regions have taken different approaches, but mostly based on developing or accommodating a polycentric multilevel system of governance [33]. This diversity of approaches to regional integration provides scope for learning among regions regarding integration mechanisms and the structure and function of the regional clusters deserves to be analyzed and shared.

This analysis suggests treating regional clusters of arrangements as entities and as a part of an overall global-region ocean governance system that needs further elaboration and development. The question of whether regional clusters are more than just the sum of their arrangements is fundamental to this question. They may not qualify as regime complexes as per the current definition, but given integration efforts, they appear to be more than just random collections of arrangements that co-occur in a region. Additionally, the suite of regional clusters and global arrangements identified raises the question of whether there is an overall global ocean governance structure that should be worked with as a whole to strengthen ocean governance as envisaged in the Sustainable Development Goals. If so, given the large number of indigenous regional arrangements, global coordination of the entire suite

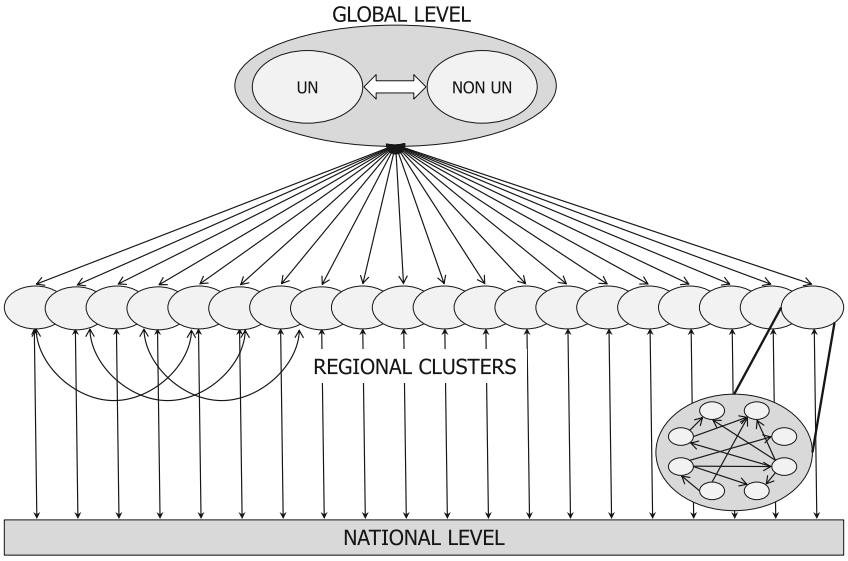

Fig. 13. Schematic representation of the global-regional ocean governance architecture, indicating the need for vertical and lateral linkages. All lateral linkages among regional clusters are not shown. The drop-down regional cluster on the right shows that lateral linkages are also required among arrangements within clusters.

of global and regional arrangements may require a more comprehensive approach than is currently envisaged under UN Oceans.

Declarations of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.marpol.2019.103590.

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