Expanding narratives of governance constraints to improve coral reef conservation

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Abstract

The widespread degradation of coral reefs is often attributed to local to global failures of governance. To understand and address the failures of reef governance it is critical to understand the perceptions of diverse policymakers and practitioners about the challenges they face in achieving their goals. Examining the discourse of policymakers and practitioners can reveal the extent to which these perceptions capture the full spectrum of potential governance challenges, including those related to management, institutional structures and processes, the values and principles underpinning governance, and the social and environmental context. This study examined the governance challenges perceived by 110 policymakers and practitioners across multiple sectors, scales and contexts in four countries of the Wider Caribbean Region. Thematic qualitative analysis informed by theories of interactive governance and governability found that perceived challenges were broadly consistent across countries, but differed by sector ($V = 0.819$, $F_{(6, 60)} = 1.502$, $p = 0.01$) and by level (community compared to national; $V = 0.194$, $F_{(1, 10)} = 2.178$, $p = 0.026$). The findings show that management inputs and outputs, challenges relating to the socio-economic context, issues of leadership and power, and stakeholder engagement were common themes. In contrast, few respondents discussed challenges relating to the ecological context, governance processes, or the values and principles underpinning governance. We argue that examining perceptions can inform both efforts to improve governance and to assess the appropriateness of particular management tools under context-specific governance constraints. Furthermore, expanding the narratives of governance challenges to encompass the subtle values and images underpinning governance, and the scale of the challenges faced, can help to identify a wider set of opportunities for change.

Introduction

The plight of global coral reefs is a long-standing concern in environmental science and conservation research. The ecological state of coral reefs has deteriorated rapidly, with global coverage of living

coral and the capacity of coral reefs to provide important ecosystem services to coastal communities both having declined by half since the 1950s (Eddy et al. 2021). The diverse threats facing coral reefs, and the failures to halt their decline, are often attributed ultimately to poor governance (Christie & White 2007; Sale 2008; Hughes et al. 2017b; Forster et al. 2017) , leading to widespread calls for an overhaul of governance arrangements, especially in light of rapid and complex social and environmental changes that present new challenges and intensifying pressures (Hughes et al. 2017a; Morrison et al. 2020a; Andrello et al. 2021).

Despite calls for governance reform, literature on the effectiveness of coral reef conservation has been dominated by a relatively narrow focus on developing and evaluating management measures that aim to reduce human pressures, such as protected areas or fisheries management tools. Mounting evidence suggests that this focus has led to dominant conservation tools being widely advocated, often without sufficient consideration of the capacity of the governance system to implement them (Chuenpagdee & Jentoft 2007; Chuenpagdee 2011). This has contributed to phenomena such as 'paper parks' – protected areas that lack effective governance and management, and consequently achieve few conservation benefits (Jentoft et al. 2007; Agardy et al. 2011). Similarly, co-management approaches to conservation are widely promoted but can be undermined by a failure to consider communities' willingness and capacity to engage in resource governance (Gelcich et al. 2009; McConney & Pena 2012), or to adequately engage with issues of environmental social justice (Gurney et al. 2021). The potential conservation benefits of coral reef management tools can therefore be undermined by over-optimism about governance capacity and a lack of knowledge about context-specific governance challenges.

Furthermore, a focus on management measures arguably gives insufficient attention to the underpinning governance structures and processes, questions of power and agency, and the values and worldviews that shape governance goals and outcomes. A substantial body of research

emerging from common pool resource management theory has directed attention to the structural characteristics of governance systems that promote effective natural resource management (Ostrom 2009; Cox et al. 2010). Several studies have applied a diagnostic approach to examine how different combinations of institutional design features are associated with positive or negative outcomes (Ostrom 2007; Cinner et al. 2012; Basurto et al. 2013). In addition, more qualitative perspectives on marine governance have contributed in-depth case studies that highlight how power dynamics, conflict, agenda-setting, and processes of inclusion and exclusion influence the ways in which governance systems evolve to pursue particular goals (Chuenpagdee et al. 2013b; Scholtens 2015; Blythe et al. 2017; Morrison et al. 2019a). Such processes often present challenges that can undermine effective governance, for example through competing priorities or resisting changes to the status quo (Fortnam 2019). Underlying these challenges are deep-held values, images (of the nature of governance systems and the problems they seek to address) and principles, which can differ among stakeholders and are slow to change (Song et al. 2013). The extent to which some of these less tangible aspects of governance are perceived as constraints by policy-makers and practitioners in comparison to more practical challenges of management is seldom explored.

Here we argue that to understand and address the failures of coral reef governance it is critical to examine how actors in reef governance systems perceive the governance challenges or constraints that they face. The importance of understanding these perceptions is twofold. First, understanding the perceptions of diverse policymakers and practitioners across multiple scales and sectors is essential to identify the real-world challenges they face in achieving their goals. Governance systems for coral reefs involve diverse stakeholders, and complex cross-scale and cross-sectoral dynamics mean that there is a need to understand a range of perspectives on where governance challenges lie. This includes an understanding of the perceived effectiveness of management tools and challenges to their implementation; the ways in which governance structures and processes enable or hinder effective management; and the question of what is feasible in a given social and

environmental context. Identifying common and diverging views of governance capacity across different contexts can inform efforts to strengthen coral reef governance. Where governance constraints are difficult to overcome, this knowledge can also inform the selection of management measures that may be better suited to particular contexts.

Second, examining these perceptions can indicate whether the expanding dialogue on reef governance – from management tools to wider governance structures and processes – is reflected in the narratives of practitioners and policy makers who are actively shaping governance systems on the ground. Effective governance reforms that support transitions to more positive social and environmental outcomes require attention to all aspects of governance and addressing gaps in the discourse on governance challenges could help to identify a wider set of opportunities for change. Though academic theory around natural resource governance has shifted to include a wider range of considerations, this must be mirrored in understanding and action by governance actors in order to create change (Ziegler et al. 2019). Shared understanding of mental models and narratives of the nature and causes of environmental problems can help to avoid conflict when identifying solutions (Brewer 2013; Song et al. 2013).

This paper examines the perceptions of policy makers and practitioners engaged in coral reef governance in four countries of the Wider Caribbean Region. We investigate: 1) the range of challenges perceived by actors in reef governance systems; 2) the extent to which they vary by country, level of governance or sector; and 3) the extent to which the discourse of policy makers and practitioners reflects the breadth of the scientific discourse as described above, considering challenges related to management, institutional structures and processes, and the values and principles that underpin governance.

Methods

Study area

The Wider Caribbean Region provides a unique context to investigate coral reef governance. Caribbean coral reefs hold exceptionally high biodiversity but have experienced rapid ecological decline (Hoegh-Guldberg et al. 2007; Jackson et al. 2014). They are threatened by growing demand for marine resources and impacts from climate change (Mora 2008). Recognition of these threats and the need for cross-scale solutions has led to calls for improved multi-level governance structures (Mumby & Steneck 2008; Mahon et al. 2014). However, geopolitical diversity, complex jurisdictions and overlapping responsibilities in the region present challenges to effective governance at national and regional scales (Fanning et al. 2007, 2009). Four study countries were selected to reflect some of this diversity, spanning both island and continental nations with varying extents of coral reef habitats, threats, and histories of conservation: Barbados, St Kitts and Nevis, Belize and Honduras (Bay Islands). In each country, three coastal communities were studied as well as national level governance actors, capturing a diversity of stakeholders and resource uses.

Governance systems differ across the four study countries. In the island nations of Barbados and St Kitts and Nevis, of which the latter is a federation, national government departments are the main actors in coral reef governance, with little distinction between national and local governance aside from the island-level administration for Nevis. Few local organisations are involved in reef governance. In contrast, in the two continental states of Belize and Honduras, both local government and NGOs play a greater role. In Belize this includes legally mandated town councils or informal village councils, while in Honduras municipal government departments have some responsibility for decision- making, implementation and enforcement. More complex governance structures in the continental nations, together with a longer history of marine conservation, mean that a wider range of actors are incorporated in governance processes, including through co-management arrangements with local NGOs (Cho 2005; McConney et al. 2007). Marine resource

users are well-organized in Belize through cooperatives and associations, but less so in Honduras and the island nations.

The social and environmental context of coral reefs and their use differs across study countries. Barbados and St Kitts and Nevis have narrow shelf areas and a smaller extent of coral reefs compared to Belize and Honduras, both of which have associated coastal islands and include part of the large Meso-American Barrier Reef System (MBRS). Reefs around Barbados and St Kitts and Nevis are considered to be threatened by human activities, including overfishing and coastal development (Burke et al. 2011). Sediment and pollution from land-based sources and coastal development are considered major threats to reef health in Belize and Honduras, while overfishing is also considered a significant threat to reefs in the MBRS as a whole (Burke & Maidens 2004). Across all countries, rising sea temperatures, coral bleaching, and increasing intensity of hurricanes and storms have long been recognized to exacerbate reef decline (Wilkinson & Souter 2008; Agostini et al. 2010).

The study countries reflect a range of development, with higher poverty levels in Belize and Honduras (41% and 65% below the poverty line, respectively; CIA 2013). Tourism is the primary source of foreign exchange in Barbados, Belize and St Kitts and Nevis, with many activities focused on the reef and nearshore areas. In Honduras, rapid growth of tourism in the Bay Islands has increased stressors on coral reefs through unregulated development (Moreno 2005, Harborne et al 2001). Fisheries contribute less than tourism to national economies but play an important role in all four countries. In Barbados, reef fishes form a relatively small component of landings, though the fishing industry is considered to be a social safety-net (McConney et al. 2003). High local demand for reef fishes and the importance of marine exports has led to over-exploited nearshore fisheries in St Kitts and Nevis (CRFM 2011). In Belize and Honduras, fisheries are important for both local consumption and exports, including high value species such as lobster and conch. Small-scale fisheries in Belize are concentrated in shallow waters of the barrier reef and atolls, while close

proximity to the continental shelf edge in Honduras allows small-scale fishers to target both reef-related and pelagic species (Box and Canty 2011).

Data collection

Semi-structured interviews were conducted with 110 'governance actors' comprising individuals involved in reef management, decision-making or policy in each country at local and national levels (Table 1). Though we recognise the important role played directly by resource users themselves in local governance systems, it was beyond the scope of this paper to fully capture these perspectives comprehensively (see Turner et al. 2014, 2017 for analysis of resource user perceptions of coral reef governance). Here, we include local resource users only where they acted in a representative capacity in wider decision-making processes, for example as leader of a local fisheries cooperative or tour operator association. Interviewees operating in the three case study communities in each country were classified as 'local', while those with a broader remit were classified as 'national'. Respondents were selected based on preliminary searches and subsequent snowball sampling, selecting respondents purposively to represent the broad range of reef governance actors. Respondents worked across a range of sectors and within several organisation types, spanning government departments, NGOs, industry bodies and educational institutions. Sample sizes reflect the varying complexity of governance arrangements across the study sites. While perceptions of governance challenges may be influenced by individual knowledge and experience, interviewees represented a range of experience in each country. Interviews were conducted between February 2011 and August 2012, lasted 45-90 minutes and were recorded and transcribed where permitted. Interviews included open-ended questions about a range of topics (Appendix S1). Specific questions designed to elicit perceptions of governance challenges asked respondents about any management activities they would like to pursue but felt unable to, and more generally whether they perceived challenges to managing reefs effectively. The entire interview was included in the analysis as

respondents frequently referred to governance challenges when responding to open-ended questions.

Data analysis

Transcripts were coded in NVivo 9 by two researchers, with cross-checking to ensure consistency in code development and interpretation. First, inductive coding identified the different constraints that respondents perceived to managing coral reefs effectively. Second, these constraints were grouped into themes, informed by the theoretical framework of interactive governance (Kooiman et al. 2005). The interactive governance approach offers a useful lens to examine narratives of governance challenges because it draws attention to three 'orders' of governance that provided an analytical framework to differentiate challenges relating to management activities, institutional structures and processes, and the values and principles that underpin governance, enabling analysis of the extent to which each of these are represented in the narratives of reef governance actors. The first order involves problem identification and formulation of solutions, encompassing day-to-day decision-making. The second order relates to the design of appropriate institutions (such as norms, laws and organisations) and instruments (such as regulations, incentives, and procedures) to solve problems or create opportunities. The third order, or meta-order, involves the deliberation of values and principles that shape the goals of governance and underpin the roles of governing actors. Linked to the interactive governance framework is the concept of 'governability' which examines governance capacity by considering the properties of both the 'governing system' and the 'system to be governed' (Jentoft 2007; Chuenpagdee et al. 2013a). The system to be governed includes the ecological and social components of natural resource systems, which can be diverse, complex and dynamic, presenting inherent challenges to those who seek to govern it. Here we use the three orders of governance and the social and ecological context of governance as a framework to examine the governance challenges identified (Table 2).

In total, 112 individual codes were generated (Appendix S2) each of which was mentioned by between 1-102 respondents, and on average by 19 respondents. These codes were categorized under 13 themes corresponding to different aspects of the governance framework (Table 2). In this paper we present a quantitative overview of the data, summarising the frequencies of responses across themes in relation to study sites, governance levels, and the different aspects of governance. These quantitative indicators of governance quality can support monitoring, aid initial diagnosis of governance weaknesses, and enable some generalisation across contexts (Kaufmann et al., 2000, Engle and Lemos, 2010). Coding matrix queries in NVivo were used to identify the number of respondents referring to each theme. Multivariate ANOVA (MANOVA) was conducted to explore whether perceptions of governance themes differed significantly among respondents in different locations (country and level) and roles (sector).

Results

The number of codes generated in relation to each theme varied (Table 2), with the largest number of codes relating to: 1) perceived challenges in the social and economic context within which governance was taking place; 2) challenges relating to management outputs; and 3) issues of leadership and power. The number of codes associated with each theme may reflect the specificity of some of the challenges discussed compared to others. For example, some themes such as socio-economic context generated a high number of codes reflecting distinct local challenges, while other challenges such as issues of connectivity were discussed in more general terms. The number of codes generated under each theme may also indicate the extent to which each of the governance components were considered by the respondents and therefore the breadth of issues discussed.

Perceptions of governance challenges

Overall, each theme was mentioned by 35-100% of respondents (Table 2). Though many of the themes incorporated a diverse range of specific issues (Appendix S2), the results highlight a broadly

common perception of the challenges to coral reef governance, with 10 of the 13 themes mentioned by over 50% of respondents. The most commonly mentioned themes broadly corresponded to those that generated greater numbers of codes. Management outputs, including implementation and enforcement of specific management actions, were mentioned by 99-100% of respondents across all countries. Challenges relating to the socio-economic context, management inputs, leadership and power, and issues of engagement and participation were also mentioned by over 75% of respondents in each country. In contrast, fewer respondents discussed challenges relating to the ecological context, management processes, and topics relating to meta-governance.

Differences in perceptions of challenges

The frequency with which governance themes were perceived did not differ significantly across the study countries ($V = 0.300$, $F_{(3, 30)} = 1.022$, $p = 0.438$). There were, however, qualitative differences within themes that highlighted the context-specific challenges faced by respondents in different settings, shown in the varying frequency that individual codes were discussed within each theme (Appendix S2). These differences reflected both variation in the social and environmental context, including for example higher levels of poverty and livelihood dependence on reefs in Belize and Honduras, and differences in the types of management tools implemented – for example marine protected areas are common in Belize and Honduras but not in St Kitts and Nevis or Barbados.

Local level respondents had different perceptions of governance challenges to national level respondents ($V = 0.194$, $F_{(1, 10)} = 2.178$, $p = 0.026$; Fig. 1a). In particular, local actors were less concerned with management processes (perceived by 20% local compared to 46% national); legislation and regulations (61% compared to 85%); research and information (53% compared to 74%); and meta-governance (22% compared to 46%). In contrast, local actors' concerns about the socio-economic context of reef governance, management inputs and outputs, and leadership and power were similar to those of national actors (Fig. 1a).

Perceptions of governance challenges also differed by sector (V = 0.819, $F_{(6, 60)}$ = 1.502, p = 0.01; Fig. 1b). Some constraints were commonly perceived across all sectors, including challenges relating to the socio-economic context, management inputs and outputs, and engagement and participation (all perceived by >70% of respondents in each sector). Issues of leadership and power, and legislation and regulations were also commonly discussed across all sectors (>60%). Respondents from the conservation, fisheries, and environment sectors more commonly discussed constraints relating to the ecological context and institutional structures. Issues around meta-governance were most commonly discussed by respondents in the research sector (67%) compared to all other sectors (below 50%). Researchers and those in the conservation sector also more commonly mentioned issues relating to research and information, connectivity, and quality of governance processes. Overall, those in the enforcement sector noted fewer governance challenges, perceiving 7 of the 13 themes least frequently.

Discussion

This study aimed to identify the range of governance challenges perceived by coral reef governance actors; to examine how these differed across contexts, scales and sectors; and to ascertain potential gaps in the discourse of policy makers and practitioners around governance challenges. This analysis is motivated by the urgent need to enhance the effectiveness of coral reef governance, and the important role of local governance actors in shaping and implementing changes to governance systems. Here, we interpret the key findings and discuss their implications for ongoing endeavours towards improved coral reef governance.

The findings suggest that actors in coral reef governance systems perceive a range of common governance challenges. Though our research did not explicitly explore the relative importance of these, we assume that commonly discussed issues reflect challenges that respondents perceived to

be important. There was little difference in the themes discussed across the four study countries, despite these encompassing diverse social, economic, cultural, political and ecological systems. The underlying coding showed that the specific nature of the challenges within each theme differed across sites in some cases, while in others they comprised a similar set of common constraints.

It is more difficult to interpret why some themes were *not* commonly discussed. We suggest three possible explanations: first, that the themes did not represent a constraint or problem to the respondents (in some cases because they may be considered outside the remit of their role); second, that the respondents were not aware of the issues; or third, that the themes were alluded to but not discussed directly and consequently were underrepresented in data coding. We discuss these possibilities in the following sections. Despite these challenges of interpretation, these data provide a useful indication of how policy makers and practitioners perceive governance and the challenges they face, informing a greater understanding of their perspective on what makes a system more or less governable.

Key challenges perceived

First order challenges related to management inputs and outputs were near-ubiquitous among respondents, indicating a clear focus on these governance issues. Despite emphasis on the evaluation and refinement of coral reef management tools in academic and grey literatures, their implementation and enforcement remain a challenge in many contexts. It is well-established that capacity shortfalls constrain the effectiveness of management tools, with limited human and financial capacity among the most important factors explaining ecological outcomes of MPAs, for example (Gill et al. 2017).

Several second order governance challenges were also commonly mentioned. Challenges perceived in relation to leadership and power often reflected constraints of working within hierarchical

governance structures where limited higher-level prioritisation and a lack of authority at local scales make governance difficult. Hierarchical reef governance systems and top-down regulations inherited from colonial administrations often prove ineffectual for resource management and conservation because monitoring and enforcement are challenging where resource use is rural and dispersed (Mahon 2008). Correspondingly, challenges of community engagement were commonly mentioned, particularly by national level respondents. While Honduras and Belize have experienced recent transitions towards co-management, this can prove challenging because of inadequacies in (often small) government departments as well as the limited capacity of resource user organisations (Mahon 2008; McConney & Pena 2012). This reflects a wider problem of policy layering in which new approaches such as co-management are applied without sufficient attention to existing governance weaknesses, often leading to substantial implementation challenges (Kelly et al. 2019). Moves towards greater sharing or devolution of power can also engender resistance in defence of the status quo (Fortnam 2019), and power imbalances can pose a challenge to governability (Chuenpagdee & Jentoft 2009). Consequently, though challenges discussed reflected the differing governance structures in place, themes of power and leadership were prevalent across all countries. Addressing the underlying weaknesses of existing governance systems to support more effective collaborative governance may require an enabling approach that promotes self-organisation, local cooperation, and effective resource user organisations (Mahon 2008). It may also require continued improvements to broader governance systems to shift power away from actors such as industry lobbies that can influence government priorities (Morrison et al. 2020b).

Second order issues of connectivity and institutional structures reflected concerns about the sectoral nature of coral reef governance, commonly discussed by respondents from the conservation, fisheries, and environment sectors. Given the complex set of drivers influencing reef health and the diversity of stakeholders involved (Forster et al. 2017), there is no single authority responsible for coral reef governance, leading to a lack of clarity around roles and responsibilities, and challenges of

connectivity and information-sharing across sectors. While institutional diversity can have benefits for addressing complex challenges (Baird et al. 2019), fragmentation can be a problem (Kelly et al. 2019). Reframing narratives about coral reef conservation to highlight interconnected goals and mutual interests may support more integrated approaches to reef governance, while also supporting the achievement of other biodiversity and sustainable development goals (Morrison et al. 2019b).

Finally, commonly discussed challenges related to the socio-economic context have implications for understanding governability. Ability to govern is determined not only by the capacity of the governing system, but also by the characteristics of the 'system to be governed', including aspects of social systems such as stakeholder diversity, level of conflict and mobility (Kooiman et al. 2008). The prevalence of this theme across all countries and sectors reflects that human pressures are an important challenge for achieving effective resource governance and remain difficult to integrate into decision-making. Recent research suggests that the potential for local management to contribute to environmental goals is strongly linked to the level of human pressure (Cinner et al. 2020). High human pressure not only exerts greater anthropogenic influence on coral reefs, but also, high dependence of coastal populations on natural resources can lead to potential conflicts and trade-offs between social and environmental objectives of reef governance. These challenges may indicate a poor fit between the 'images' of how a system should be governed (and the management tools associated with these) and the diversity and complexity of local contexts (Mahon 2008). For example, marine protected areas are often not well-supported in contexts of high resource dependence. This was evident in St Kitts and Nevis, where despite top-down authority for coral reef governance there was clear political reluctance to impose restrictions on fisheries. Correspondingly, concerns about the fairness of governance processes and their outcomes were also common, reflecting contemporary debates about equity and environmental social justice in conservation (Dawson et al. 2018; Friedman et al. 2018). Compounding these challenges, coastal management agencies often have limited skills in social science, and attention to livelihoods, though increasing,

often fails to provide viable alternative or supplementary income (McConney & Pena 2012). Governability may be enhanced by evaluation of and attunement to the social context (Bavinck et al. 2008).

Gaps in the discourse

Meta-governance, or third order governance, was the least commonly mentioned theme, capturing more intangible issues such as the clarity of goals for reef governance, underlying values, and challenges of establishing a shared long-term vision. The low occurrence of this theme may indicate that these issues are not perceived to present a challenge for effective coral reef governance or that the subtle nature of these challenges may lead to them being underrepresented in the data coding. Arguably though, other explanations for the limited discussion of these issues are plausible. Given the focus of the interviews on coral reef governance, respondents may not have made a conceptual connection between resource management and lofty topics like principles and values, which are deeply ingrained (Song et al. 2013) and may be taken as given and not up for discussion. If there are few opportunities for debate about the goals of governance, respondents may have focused on discussing the challenges they perceive within the confines of the status quo. Similarly, with respect to management, discussion centred on inputs and outputs, with little attention to management processes. Issues around meta-governance were most commonly discussed by respondents in the research sector, reflecting both the more abstract nature of these ideas and the role of researchers as having an 'outsider' perspective, typically less embedded in the day-to-day processes of coral reef governance. Higher awareness among researchers also reflects that academic governance literature is often very theoretical and can be inaccessible to policymakers and practitioners (Bennett & Satterfield 2018). In addition, local actors discussed these issues less often than national actors, which may correspond to the nature of hierarchical systems where local governors focus on first order implementation and problem solving, while agenda-setting tends to take place at higher levels. Even at a national level, this may predominantly entail signing up to the principles and values

embedded in multi-lateral environmental agreements, which may not be translated into local action or taken up by communities (Mahon 2008). If leveraged effectively by informed local actors, though, international efforts towards more integrated and scaled-up approaches (e.g. those of the UNESCO World Heritage Centre and Ramsar Convention on Wetlands of International Importance) can support the reframing of national goals and priorities for reef governance (Morrison et al. 2020b; Bridgewater & Kim 2021).

Surprisingly, given the strong focus on the social context of reef governance, there was little discussion of challenges related to the ecological context. Challenges of diversity, complexity, dynamic and non-linear change, interconnectedness and scale in managing ecological systems are well documented in the literature, reflecting characteristics of the 'system to be governed' that can limit governability (Folke et al. 2007; Chuenpagdee & Jentoft 2009; Berkes 2010). The application of particular management tools also requires attention to the wider environmental context, since tools such as MPAs may be less effective where wider seascapes are degraded (Cinner et al. 2020). The low occurrence in interviews of challenges related to the environmental system may reflect a perception that they are beyond the ability of local governance actors to control. Research on recreational fisheries social-ecological systems similarly found that stakeholders showed lower awareness of the wider environment and governance system compared to the attributes of the resource system and influence of actors (Ziegler et al. 2019). The authors suggest that respondents might have viewed these slow-moving variables as "fixed contextual settings" (*ibid.* p1043). These issues were discussed more often by respondents in conservation, fisheries and environment sectors, perhaps reflecting heightened awareness of these challenges in comparison to tourism or enforcement sectors.

The ecological context theme included codes capturing challenges related to the scale of drivers influencing reef health, yet respondents discussed this topic infrequently. Mahon (2008) suggests

that Caribbean reefs are typically not treated as transboundary systems, despite ecological connectivity across borders (e.g. via larval dispersal). Underlying coding showed that some issues of scale were more commonly discussed in Belize, perhaps reflecting the country's significant responsibility in relation to the transboundary Meso-American Barrier Reef System. More broadly, our findings are a stark contrast to the increasing recognition that the escalating impacts of global climate change present some of the greatest threats to reef health, with calls to radically reframe the problem of coral reef governance to focus on these distal drivers and the actors responsible for them (Morrison et al. 2020a). Consideration of 'institutional fit' to the scale of environmental (and social) problems is important for effective governance, with mismatches of spatial scale a common reason for management failure (Berkes 2010; Epstein et al. 2015). Institutional fit can be enhanced through the presence of cross-scale linkages (Fanning et al. 2013), a challenge that was more commonly discussed by respondents under the theme of connectivity.

Implications and conclusions

In calls for governance reform in coral reef conservation, the term governance is often used loosely and the changes required lack the specificity to permit effective implementation. In this paper we have examined the narratives of policy makers and practitioners, whose perspectives shape the reality of evolving coral reef governance on the ground. The perceptions of practitioners are not static and are likely to change over time in response to changing circumstances. For example, since these data were collected, the acceleration of the climate crisis and its impact on coral reefs could mean that climatic and other large-scale ecological change may now feature more strongly in local governance discussions. Nevertheless, these data remain highly relevant, recent literature confirming that the pressing concerns of first order governance issues continue to be prominent challenges. There is little indication of a transition towards greater reflexivity around the goals and values underpinning coral reef governance at local and national scales.

Examining perceived governance constraints can inform an understanding of what makes a system more or less governable, providing a foundation for improvement. Acknowledging the common challenges perceived can inform an assessment of governability that considers conflicts, vested interests and power struggles as well as the more tangible concerns of limited resources and capacity and high dependence on coral reefs. Deliberate action to improve governance may be taken through adjustments to day-to-day management (first order), a more substantial institutional redesign (second order), or a re-thinking of the principles and values underpinning governance goals (third order or meta governance). Recognising that there are limits to the extent to which governance systems can match the systems they are designed to govern, an understanding of governance challenges can also act as a 'reality check' for potential interventions (Song & Chuenpagdee 2010; Scholtens 2015). For instance, the feasibility of genetic, ecological and environmental interventions identified to support coral reef conservation in a recent review (National Academies of Sciences Engineering and Medicine 2019), should be considered in relation to context-specific governance challenges. Governance goals can be amended in light of governability challenges to identify what can be realistically achieved rather than seeking success in relation to ideal images of governance. This requires an evaluation of prevalent images of how coral reefs should be governed, and the management tools associated with these, to assess their appropriateness to a particular context, rather than the acceptance of particular management approaches as 'cure-alls' (Ostrom et al. 2007).

Understanding the discourse of local and national governance actors is vital to improve coral reef governance and conservation outcomes. Our analysis examines commonalities and differences in the framing of the 'coral reef governance problem'. National and local actors are involved in ongoing efforts to improve coral reef governance in order to effectively address local stressors such as overfishing, pollution and coastal development. Given the range of actors across different sectors and scales who interact in formal and informal ways, shared mental models (or at least an

understanding of where mental models diverge) can be important to find agreement on appropriate solutions (Mahon et al. 2005; Jentoft 2007; Song et al. 2013). Using an interactive governance approach to map respondents' narratives of governance challenges against the different orders of governance, our findings highlight an overall pattern weighted towards first and second orders of governance, and the (predominantly social) context of the system to be governed, with least attention to third order issues, those of meta-governance. In the quest to improve governance, adding new policies and management approaches to existing flawed arrangements can make it increasingly difficult to challenge the status quo and achieve necessary governance transformations (Kelly et al. 2019). Interventions to improve first and second orders of governance may therefore not be effective without also paying attention to meta-governance. This is critical in the context of calls for transformative change in coral reef governance, with radical action required to improve governance at multiple scales in order to address key threats such as climate change (Kennedy et al. 2013; Morrison et al. 2020a). Such transformations will require the engagement and support of actors across all scales to achieve equity and sustainability outcomes (Blythe et al. 2021), necessitating the engagement of practitioners and policy-makers in wider conversations about governance. Though many improvements to governance may be incremental, a shared vision and goals can support a transformative agenda that such smaller changes contribute to (Patterson et al. 2017). Our findings point to a need to strengthen local level appreciation of what is involved in governance, beyond making and enforcing rules, to consider deliberating values and principles, evaluating governability, and building appropriate multiscale capacity to steer reef governance in the right direction.

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Literature Cited

Agardy T, di Sciara GN, Christie P. 2011. Mind the gap: Addressing the shortcomings of marine protected areas through large scale marine spatial planning. Marine Policy **35**:226–232. Elsevier. Available from http://dx.doi.org/10.1016/j.marpol.2010.10.006.

Agostini VN, Margles SW, Schill SR, Knowles JE, Blyther RJ. 2010. Marine Zoning in Saint Kitts and Nevis: A Path Towards Sustainable Management of Marine Resources. The Nature Conservancy.

Andrello M, Darling ES, Wenger A, Suárez-Castro AF, Gelfand S, Ahmadia GN. 2021. A global map of human pressures on tropical coral reefs. Conservation Letters:1–12.

Baird J, Plummer R, Schultz L, Armitage D, Bodin Ö. 2019. How Does Socio-institutional Diversity Affect Collaborative Governance of Social–Ecological Systems in Practice? Environmental Management **63**:200–214. Springer US. Available from http://dx.doi.org/10.1007/s00267-018-1123-5.

Basurto X, Gelcich S, Ostrom E. 2013. The social–ecological system framework as a knowledge classificatory system for benthic small-scale fisheries. Global Environmental Change **23**:1366–1380. Elsevier Ltd. Available from http://linkinghub.elsevier.com/retrieve/pii/S0959378013001350 (accessed February 20, 2014).

Bavinck M, Salagrama V, Bavinck M, Salagrama V. 2008. Assessing the governability of capture fisheries in the Bay of Bengal -a conceptual enquiry. Journal of Transdisciplinary Environmental Studies Th e Journal of Transdisciplinary Environmental Studies **7**:1602–2297. Available from http://hdl.handle.net/11245/2.59296%5Cnhttp://hdl.handle.net/11245/1.293274%5Cnhttp://www.journal-tes.dk/%5Cnhttp://hdl.handle.net/11245/2.59296%5Cnhttp://hdl.handle.net/11245/1.293274%5Cnhttp://www.journal-tes.dk/.

Bennett NJ, Satterfield T. 2018. Environmental governance: A practical framework to guide design, evaluation, and analysis. Conservation Letters **11**:1–13.

Berkes F. 2010. Linkages and multilevel systems for matching governance and ecology: Lessons from

roving bandits. Bulletin of Marine Science **86**:235–250.

Blythe J, Cohen P, Eriksson H, Cinner J, Boso D, Schwarz AM, Andrew N. 2017. Strengthening post-hoc analysis of community-based fisheries management through the social-ecological systems framework. Marine Policy **82**:50–58. Elsevier Ltd.

Blythe JL, Armitage D, Bennett NJ, Silver JJ, Song AM. 2021. The Politics of Ocean Governance Transformations. Frontiers in Marine Science **8**:804. Frontiers. Available from https://www.frontiersin.org/articles/10.3389/fmars.2021.634718/full (accessed July 5, 2021).

Brewer TD. 2013. Dominant discourses, among fishers and middlemen, of the factors affecting coral reef fish distributions in Solomon Islands. Marine Policy **37**:245–253. Elsevier. Available from http://dx.doi.org/10.1016/j.marpol.2012.05.006.

Bridgewater P, Kim RE. 2021. The Ramsar Convention on Wetlands at 50. Nature Ecology and Evolution **5**:268–270. Springer US. Available from http://dx.doi.org/10.1038/s41559-021-01392-5.

Burke L, Maidens J. 2004. Reefs at Risk in the Caribbean. World Resources Institute, Washington, D.C. Available from http://pdf.wri.org/reefs_caribbean_front.pdf (accessed January 14, 2013).

Burke L, Reytar K, Spalding M, Perry AL. 2011. Reefs at Risk Revisited. World Resources Institute, Washington, D.C. Available from http://www.wri.org/sites/default/files/pdf/reefs_at_risk_revisited.pdf.

Cho L. 2005. Marine protected areas: a tool for integrated coastal management in Belize. Ocean & Coastal Management **48**:932–947. Available from http://linkinghub.elsevier.com/retrieve/pii/S0964569105000475 (accessed November 27, 2013).

Christie P, White a. T. 2007. Best practices for improved governance of coral reef marine protected areas. Coral Reefs **26**:1047–1056. Available from http://www.springerlink.com/index/10.1007/s00338-007-0235-9 (accessed July 27, 2010).

Chuenpagdee R. 2011. Interactive Governance for Marine Conservation: An Illustration. Bulletin of

Marine Science **87**:197–211. Available from http://openurl.ingenta.com/content/xref?genre=article&issn=0007-4977&volume=87&issue=2&spage=197 (accessed February 25, 2014).

Chuenpagdee R, Jentoft S. 2007. Step zero for fisheries co-management: What precedes implementation. Marine Policy **31**:657–668. Available from http://dx.doi.org/10.1016/j.marpol.2007.03.013 (accessed October 25, 2012).

Chuenpagdee R, Jentoft S. 2009. Governability Assessment for Fisheries and Coastal Systems: A Reality Check. Human Ecology **37**:109–120. Available from http://www.springerlink.com/index/10.1007/s10745-008-9212-3 (accessed January 8, 2013).

Chuenpagdee R, Jentoft S, Bavinck M, Kooiman J. 2013a. Governability – New Directions in Fisheries Governance. Pages 3–8 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. Governability of Fisheries and Aquaculture: Theory and Applications. MARE Publication Series 7, Springer, Amsterdam.

Chuenpagdee R, Pascual-Fernández JJ, Szeliánszky E, Luis Alegret J, Fraga J, Jentoft S. 2013b. Marine protected areas: Re-thinking their inception. Marine Policy **39**:234–240.

Cinner JE et al. 2020. Meeting fisheries, ecosystem function, and biodiversity goals in a human-dominated world. Science **368**:307–311.

Cinner JE, Basurto X, Fidelman P, Kuange J, Lahari R, Mukminin A. 2012. Institutional designs of customary fisheries management arrangements in Indonesia, Papua New Guinea, and Mexico. Marine Policy **36**:278–285. Elsevier. Available from http://linkinghub.elsevier.com/retrieve/pii/S0308597X11001072 (accessed November 11, 2012).

Cox M, Arnold G, Tomás S, Villamayor Tomas S. 2010. A Review of Design Principles for Community-based Natural Resource Management. Ecology & Society **15**:38. Available from https://books.google.com/books?hl=en&lr=&id=bcZ5CgAAQBAJ&oi=fnd&pg=PA249&dq=natural+resource+conflict+resolution&ots=OnVpehYCIH&sig=gTiM40GV_vVNcuGFiujhQHdxl8k.

Dawson N, Martin A, Danielsen F. 2018. Assessing Equity in Protected Area Governance: Approaches to Promote Just and Effective Conservation. Conservation Letters **11**:1–8.

Eddy TD, Lam VWY, Reygondeau G, Cisneros-Montemayor AM, Greer K, Palomares MLD, Bruno JF, Ota Y, Cheung WWL. 2021. Global decline in capacity of coral reefs to provide ecosystem services. One Earth **4**:1278–1285. Cell Press.

Epstein G, Pittman J, Alexander SM, Berdej S, Dyck T, Kreitmair U, Raithwell KJ, Villamayor-Tomas S, Vogt J, Armitage D. 2015. Institutional fit and the sustainability of social-ecological systems. Current Opinion in Environmental Sustainability **14**:34–40. Elsevier B.V. Available from http://dx.doi.org/10.1016/j.cosust.2015.03.005.

Fanning L et al. 2007. A large marine ecosystem governance framework. Marine Policy **31**:434–443. Elsevier. Available from http://linkinghub.elsevier.com/retrieve/pii/S0308597X07000097 (accessed March 14, 2014).

Fanning L, Mahon R, Mcconney P. 2013. Applying the large marine ecosystem (LME) governance framework in the Wider Caribbean Region. Marine Policy **42**:99–110. Elsevier. Available from http://linkinghub.elsevier.com/retrieve/pii/S0308597X13000511 (accessed August 1, 2013).

Fanning L, Mahon R, McConney P. 2009. Focusing on Living Marine Resource Governance: The Caribbean Large Marine Ecosystem and Adjacent Areas Project. Coastal Management **37**:219–234. Available from http://www.informaworld.com/openurl?genre=article&doi=10.1080/08920750902851203&magic=crossref%7C%7CD404A21C5BB053405B1A640AFFD44AE3 (accessed August 9, 2010).

Folke C, Pritchard L, Berkes F, Colding J, Svedin U. 2007. The problem of fit between ecosystems and institutions: Ten years later. Ecology and Society **12**.

Forster J, Turner RA, Fitzsimmons C, Peterson AM, Mahon R, Stead SM. 2017. Evidence of a common understanding of proximate and distal drivers of reef health. Marine Policy **84**:263–272. Available from http://linkinghub.elsevier.com/retrieve/pii/S0308597X1630731X.

Fortnam MP. 2019. Forces opposing sustainability transformations: Institutionalization of

ecosystem-based approaches to fisheries management. Ecology and Society **24**.

Friedman RS, Law EA, Bennett NJ, Ives CD, Thorn JPR, Wilson KA. 2018. How just and just how? A systematic review of social equity in conservation research. Environmental Research Letters **13**.

Gelcich S, Godoy N, Castilla JC. 2009. Artisanal fishers' perceptions regarding coastal co-management policies in Chile and their potentials to scale-up marine biodiversity conservation. Ocean & Coastal Management **52**:424–432. Available from http://linkinghub.elsevier.com/retrieve/pii/S0964569109000854.

Gill DA et al. 2017. Capacity shortfalls hinder the performance of marine protected areas globally. Nature **543**:665–669. Nature Publishing Group. Available from http://dx.doi.org/10.1038/nature21708.

Gurney GG, Mangubhai S, Fox M, Kiatkoski Kim M, Agrawal A. 2021. Equity in environmental governance: perceived fairness of distributional justice principles in marine co-management. Environmental Science and Policy **124**:23–32. Elsevier Ltd. Available from https://doi.org/10.1016/j.envsci.2021.05.022.

Hoegh-Guldberg O et al. 2007. Coral Reefs Under Rapid Climate Change and Ocean Acidification. Science **318**:1737–42. Available from http://www.ncbi.nlm.nih.gov/pubmed/18079392.

Hughes TP et al. 2017a. Global warming and recurrent mass bleaching of corals. Nature **543**:373–377. Nature Publishing Group.

Hughes TP et al. 2017b. Coral reefs in the Anthropocene. Nature **546**:82–90. Nature Publishing Group.

Jackson JBC, Donovan MK, Cramer KL, Lam W. 2014. Status and Trends of Caribbean Coral Reefs: 1970-2012. Global Coral Reef Monitoring Network, IUCN, Gland, Switzerland.

Jentoft S. 2007. Limits of governability: Institutional implications for fisheries and coastal governance. Marine Policy **31**:360–370. Available from http://linkinghub.elsevier.com/retrieve/pii/S0308597X06001266.

Jentoft S, van Son TC, Bjørkan M. 2007. Marine Protected Areas: A Governance System Analysis.

Human Ecology **35**:611–622. Available from http://www.springerlink.com/index/10.1007/s10745-007-9125-6 (accessed October 7, 2010).

Kelly C, Ellis G, Flannery W. 2019. Unravelling Persistent Problems to Transformative Marine Governance. Frontiers in Marine Science **6**. Available from https://www.frontiersin.org/article/10.3389/fmars.2019.00213/full.

Kennedy E V et al. 2013. Avoiding coral reef functional collapse requires local and global action. Current Biology **23**:912–8. Available from http://www.ncbi.nlm.nih.gov/pubmed/23664976 (accessed January 13, 2014).

Kooiman J, Bavinck M, Chuenpagdee R, Mahon R, Pullin R. 2008. Interactive governance and governability: an introduction. Journal of Transdisciplinary Environmental Studies **7**:1–11.

Kooiman J, Bavinck M, Jentoft S, Pullin R. 2005. Fish for Life: Interactive Governance for Fisheries. Amsterdam University Press, Amsterdam.

Mahon R. 2008. Assessing governability of fisheries using the interactive governance approach: preliminary examples from the Caribbean. The Journal of Transdisciplinary Environmental Studies **7**. Available from http://www.journal-tes.dk/vol_7_no_1/no_4_Robin.pdf (accessed January 14, 2013).

Mahon R, Bavinck M, Roy RN. 2005. Governance in Action. Pages 353–376 in J. Kooiman, M. Bavinck, S. Jentoft, and R. Pullin, editors. Fish for Life: Interactive Governance for Fisheries2. Amsterdam University Press, Amsterdam.

Mahon R, Fanning L, McConney P. 2014. Assessing and Facilitating Emerging Regional Ocean Governance Arrangements in the Wider Caribbean Region. Ocean Yearbook **28**:631–671.

McConney P, Mahon R, Pomeroy R. 2007. Challenges Facing Coastal Resource Co-Management in the Caribbean. Pages 105–124 in D. R. Armitage, F. Berkes, and N. C. Doubleday, editors. Adaptive co-management: Collaboration, Learning and Multi-Level Governance. UBC Press, Vancouver, BC. Available from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Challenges+Facing+Coastal+

Resource+Co-Management+in+the+Caribbean#1 (accessed March 3, 2014).

McConney P, Pena M. 2012. Capacity for (Co)Management of Marine Protected Areas in the Caribbean. Coastal Management **40**:268–278. Available from http://www.tandfonline.com/doi/abs/10.1080/08920753.2012.677632 (accessed June 5, 2013).

Mora C. 2008. A clear human footprint in the coral reefs of the Caribbean. Proceedings. Biological sciences / The Royal Society **275**:767–73. Available from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2596901&tool=pmcentrez&rendertype=abstract (accessed November 1, 2012).

Morrison TH et al. 2019a. The black box of power in polycentric environmental governance. Global Environmental Change **57**:101934.

Morrison TH et al. 2019b. Save reefs to rescue all ecosystems. Nature **573**:333–336.

Morrison TH, Adger N, Barnett J, Brown K, Possingham H, Hughes T. 2020a. Advancing Coral Reef Governance into the Anthropocene. One Earth **2**:64–74. Elsevier Inc. Available from https://doi.org/10.1016/j.oneear.2019.12.014.

Morrison TH, Adger WN, Brown K, Hettiarachchi M, Huchery C, Lemos MC, Hughes TP. 2020b. Political dynamics and governance of World Heritage ecosystems. Nature Sustainability **3**:947–955. Springer US. Available from http://dx.doi.org/10.1038/s41893-020-0568-8.

Mumby PJ, Steneck RS. 2008. Coral reef management and conservation in light of rapidly evolving ecological paradigms. Trends in ecology & evolution **23**:555–63. Available from http://www.ncbi.nlm.nih.gov/pubmed/18722687 (accessed November 1, 2012).

National Academies of Sciences Engineering and Medicine. 2019. A Research Review of Interventions to Increase the Persistence and Resilience of Coral Reefs. Page A Research Review of Interventions to Increase the Persistence and Resilience of Coral Reefs. The National Academies Press, Washington, DC.

Ostrom E. 2007. A diagnostic approach for going beyond panaceas. Proceedings of the National

Academy of Sciences of the United States of America **104**:15181–7. Available from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2000497&tool=pmcentrez&rendertype=abstract.

Ostrom E. 2009. A general framework for analyzing sustainability of social-ecological systems. Science (New York, N.Y.) **325**:419–22. Available from http://www.ncbi.nlm.nih.gov/pubmed/19628857 (accessed October 26, 2012).

Ostrom E, Janssen MA, Anderies JM. 2007. Going beyond panaceas. Proceedings of the National Academy of Sciences of the United States of America **104**:15176–15178.

Patterson J, Schulz K, Vervoort J, Hel S Van Der, Widerberg O, Adler C, Hurlbert M, Anderton K, Sethi M, Barau A. 2017. Exploring the governance and politics of transformations towards sustainability. Environmental Innovation and Societal Transitions **24**:1–16. Elsevier B.V. Available from http://dx.doi.org/10.1016/j.eist.2016.09.001.

Sale PF. 2008. Management of coral reefs: Where we have gone wrong and what we can do about it. Marine pollution bulletin **56**:805–9. Available from http://www.ncbi.nlm.nih.gov/pubmed/18456286 (accessed March 19, 2014).

Scholtens J. 2015. Limits to the Governability of Transboundary Fisheries: Implications for Small-Scale Fishers in Northern Sri Lanka and Beyond. Page in S. Jentoft and R. Chuenpagdee, editors. Interactive Governance for Small-Scale Fisheries. MARE Publication Series 13, Springer International.

Song AM, Chuenpagdee R. 2010. Operationalizing governability: a case study of a Lake Malawi fishery. Fish and Fisheries **11**:235–249.

Song AM, Chuenpagdee R, Jentoft S. 2013. Values, images, and principles: What they represent and how they may improve fisheries governance. Marine Policy **40**:167–175. Elsevier. Available from http://linkinghub.elsevier.com/retrieve/pii/S0308597X13000274 (accessed June 11, 2014).

Turner RA, Fitzsimmons C, Forster J, Mahon R, Peterson A, Stead SM. 2014. Measuring good

governance for complex ecosystems: Perceptions of coral reef-dependent communities in the Caribbean. Global Environmental Change **29**:105–117. Available from http://linkinghub.elsevier.com/retrieve/pii/S0959378014001447 (accessed November 3, 2014).

Turner RA, Forster J, Fitzsimmons C, Gill D, Mahon R, Peterson A, Stead S. 2017. Social fit of coral reef governance varies among individuals. Conservation Letters:1–9.

Wilkinson C, Souter D. 2008. Status of Caribbean Coral Reefs after Bleaching and Hurricanes in 2005. Global Coral Reef Monitoring Network, and Reef and Rainforest Research Centre, Townsville.

Ziegler JP, Jones SE, Solomon CT. 2019. Local stakeholders understand recreational fisheries as social-ecological systems but do not view governance systems as influential for system dynamics. International Journal of the Commons **13**:1035–1048.

Tables

Table 1. Semi-structured interview respondents

Respondent type		Barbados	St Kitts & Nevis	Honduras	Belize	Total
Level	Local	5	1	20	23	49
	National	9	24	13	15	61
Sector	Community	0	0	1	2	3
	Conservation	3	4	12	15	34
	Enforcement	1	2	6	2	11
	Environment	2	5	7	3	17
	Fisheries	3	8	5	5	20
	Research	2	2	0	1	6
	Tourism	3	4	2	10	19
Total		14	25	33	38	110

Table 2. Coding scheme showing the orders of governance and the corresponding components of governance systems, key themes within each order, the number of inductively generated codes mapped on to each of these themes, and the frequency these were mentioned.

Governance order	Governance component	Theme	No. codes	Description of content coded under theme	Frequency mentioned (%) * BBD (14)	SKN (25)	BZE (38)	HON (33)	Total (110)
Context	System to be governed	Socio-economic context	29	General and specific issues relating to socio-economic pressures influencing reef governance, including poverty and livelihood dependency, economic and cultural context, and social problems (e.g. drugs, crime)	93	92	92	88	91
		Ecological context	7	Attributes of natural systems influencing reef management including complexity, issues of scale (e.g. drivers of change, ecological connectivity, temporal dynamics)	43	36	55	36	44
First order	Management	Inputs	3	Resources and capacity for management, changes in funding climate and reliance on project funding	79	88	89	91	88
		Processes	5	Misuse and ineffective use of resources, issues relating to nature of management activity (e.g. *ad hoc*, reactive)	29	40	29	39	35
		Outputs	14	General and specific issues relating to implementation of reef management activities and their enforcement	100	100	97	100	99
Second order	Governing system	Institutional structures	5	General and specific issues relating to the institutional arrangements in place for reef governance, including issues relating to scale and clarity of roles and responsibilities	64	52	58	55	56
		Leadership and power	13	Issues of political commitment and prioritisation, level of authority and leadership, and issues relating to conflicts of interest, corruption and susceptibility to public pressure	93	100	84	91	91
		Legislation and regulations	6	General and specific issues relating to weak or absent policy, legislation and regulation, role of informal governance and historical legacy, and mechanisms for change	79	84	68	73	75
	Governance interactions	Engagement & participation	9	Issues relating to stakeholder engagement, support for management, collective action, stewardship and voice	93	88	82	85	85
		Research and information	6	Availability, coordination and dissemination of scientific research and information, uptake in decision-making	79	60	58	70	65
		Connectivity	3	Level of cooperation and integration among governing bodies	79	60	74	82	74
Third order	Governing system	Meta-governance	5	Clarity of goals for reef governance, underlying values and culture, issues relating to lack of common and long-term vision	57	40	24	36	35
	Governance interactions	Process quality	7	Issues relating to the legitimacy of reef governance, fairness, accountability, transparency, flexibility and trust	71	56	63	76	66

* Column headers show number of respondents per country as detailed in Table 1. Barbados (BBD), St Kitts and Nevis (SKN), Belize (BZE) and Honduras (HON).

Figures

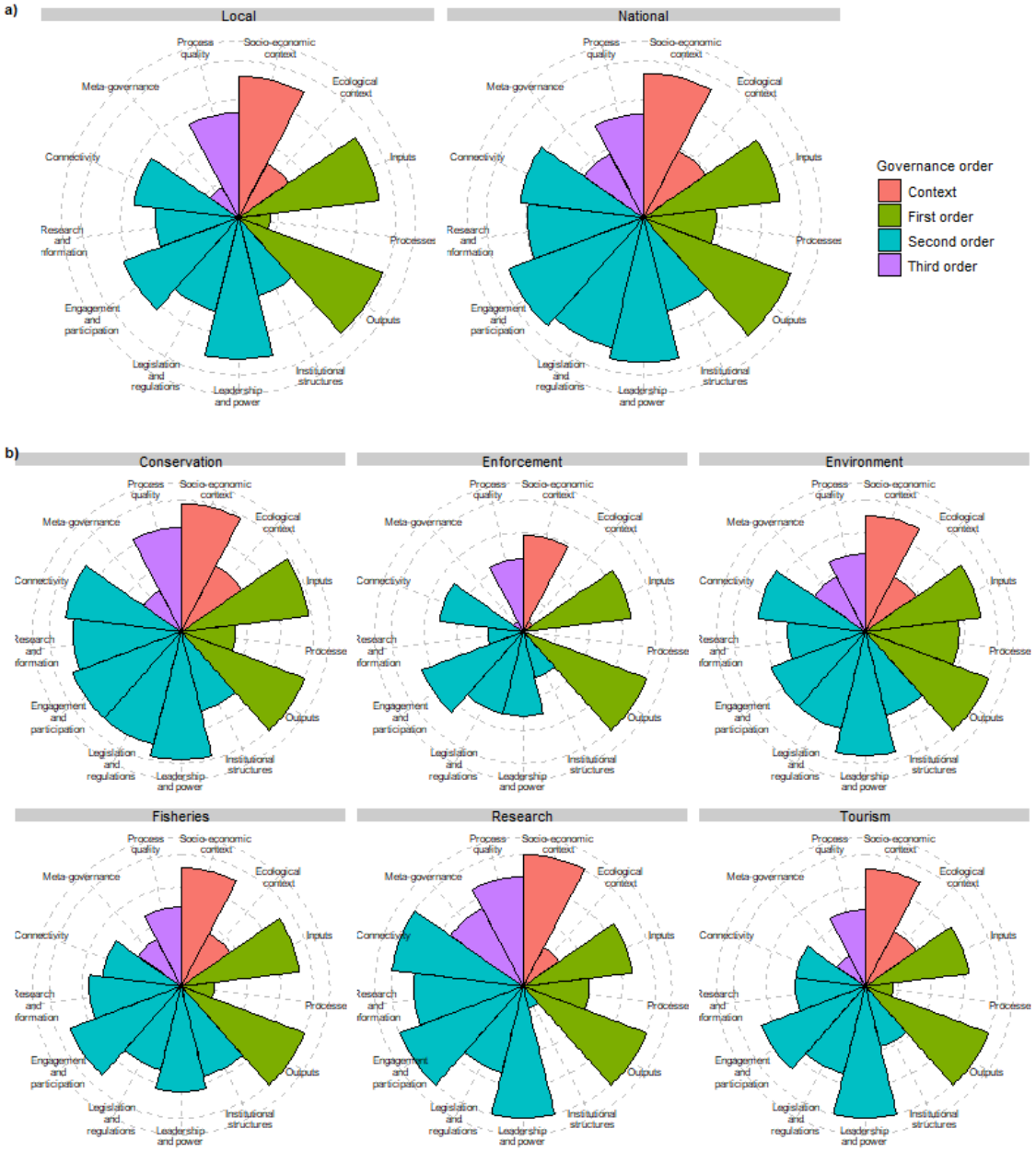

Figure 1. Percentage of respondents perceiving challenges coded under each governance theme for: a) local (n=49) and national (n=61) actors; and b) conservation (n=34), enforcement (n=11), environmental (n=17), fisheries (n=20), research (n=6) and tourism (n=19) sectors. Respondents categorized under the sector 'community' are not included because of the small sample size (n=3).

Appendix S1. Interview guide

Background

Name
Current position
Organisation/department
What are the main purposes and priorities of your organisation or department?
What are your main responsibilities?
Do you have any other relevant experience or responsibilities related to reefs?
Approximately how many members/employees are there? (Who? How do they become involved?)
When was your organization created? (And who was responsible for its creation?)
What is the main source of funding for the organisation?

Perception of status of reefs and impacts to reefs

What are the most important types of reef resource use in this area/country?
What attributes of the reef do these resource users depend on?
How healthy do you think the reefs are here/in your country, from 1 to 4, where 1 is very unhealthy and 4 is very healthy?
What do you think are the most important impacts to reefs in your area/country?
What are the causes of these impacts?
Have you noticed or heard about any changes in coral reefs over the past 10years?
Have you noticed or heard of any other changes in the marine environment over the past 10 years?
What do you think will be the main impacts of climate change on the health of reefs in this area/country?

Reef management

Which of the following reef management measures (tools) are in place in this area/country?
To what extent do they have an impact on reef health and why? (Rate impact where 1 = negative, 2 = no effect, 3 = uncertain, 4 = likely positive, 5 = proven positive)

- Technical measures e.g. mooring buoys and fisheries technical measures
- Temporal measures e.g. seasonal closures
- Spatial measures e.g. MPAs
- Ecological monitoring and research
- Social surveys and research
- Alternative livelihoods and economic incentives
- Management approaches e.g. ecosystem-based and co-management
- Environmental education
- Communication and participatory processes e.g. workshops and forums, and stakeholder involvement
- Manuals and guidelines for reef managers
- Software support and decision-making tools e.g. computer mapping and modelling
- Legislation and legal instruments e.g. fisheries or pollution laws
- Policy and management plans

What do you think about current management of reefs in the area/country?
Are there mechanisms in place to enforce these management measures? What are they?
What do you think about the enforcement mechanisms? (e.g. fairness)
Are there any informal rules or community arrangements about how people use reef resources? If so, what are they and how do you think they affect reef health?
What could be done in the area/country to improve the health of coral reefs?

Decision-making

Could you describe how decisions about reef management are taken in the area/country? How, and by whom?
Are there any forums or meetings for departments, organisations or stakeholders from different sectors to discuss issues related to reefs?
Do you think local management priorities for reefs are the same as at the national level?
Do you think decisions about reef management are made at the right organizational level?
How flexible are current management mechanisms? E.g. if the reef status changes, could reef management change accordingly? How would changing reef management be achieved?
In terms of reef management, is there one thing you would like to do but can't? What are the challenges?
Thinking more generally, do you perceive any challenges to managing reefs effectively?

Stakeholder involvement

Is there an opportunity for stakeholders to be involved in reef management? If so, who and how?
Have any decisions about reef management disadvantaged any reef users? If so who and how?
If decisions are made about the management of reefs, is information provided to stakeholders to explain why a particular decision was taken?
Are there ways people can challenge the rules, laws or decisions made regarding reef management?
The previous questions about management, cooperation, decision-making etc, are all about reef governance. Do you have any suggestions for how governance could be improved?

National situation

What are the main priorities for the government?
How important are reef management issues in comparison to other government priorities?

Appendix S2. Frequency of codes underpinning governance themes

Theme	Codes Perceived challenges related to:	Frequency mentioned (%) BBD (14)	SKN (25)	BZE (38)	HON (33)	Total (110)
Socio-economic context	Education & awareness	71	60	47	48	55
	Socio-economic pressures (general)	50	40	42	70	52
	Diversity & conflict	64	32	18	21	28
	Livelihood dependency	14	28	26	36	28
	Alternative livelihoods	0	16	21	39	23
	Tradition & culture	36	24	3	12	15
	Economic downturn	7	12	16	6	11
	Sewage system	29	0	3	18	10
	Small society	0	20	11	3	9
	Fishing as a safety net	0	20	8	6	9
	Immigration	0	4	8	15	8
	Geography & location	0	0	16	6	7
	Population increase	0	4	5	15	7
	Poverty	0	0	5	15	6
	Past experiences	7	0	5	12	6
	External impacts	0	0	13	0	5
	Market demand	0	4	5	6	5
	Unemployment	0	0	3	9	4
	Education systems	0	8	3	3	4
	Political differences	0	12	0	0	3
	Sugar industry decline	0	12	0	0	3
	Political unrest	0	0	0	6	2
	Drug problems	0	0	0	6	2
	Crime	0	0	0	6	2
	Geopolitical complexity	7	0	0	0	1
	Social differences	0	4	0	0	1
	Poor health	0	0	0	3	1
	Access to seafood	0	0	3	0	1
	Historical legacy	7	0	0	0	1
Ecological context	Scale (general)	57	40	74	30	52
	Ecological connectivity	43	28	21	15	24
	Scale of climate change	21	8	29	3	16
	Ecological range	0	4	21	9	11
	Complex system dynamics	21	4	3	18	11
	Temporal dynamics	0	4	3	3	4
	Hurricanes	0	4	8	0	4
Management inputs	Resources & capacity	71	88	89	91	88
	Dependence on donor funds	0	0	5	18	7
	Changing funding climate	0	0	3	0	1
Management processes	Slow processes	21	28	18	36	26
	Ad hoc management	14	20	13	3	12
	Misuse of funds	0	0	5	3	3
	Ineffective use of resources & capacity	0	0	3	3	2
	Reactive management	7	0	0	0	1
Management outputs	Ineffective management (general)	93	100	95	94	96
	Enforcement	86	96	95	88	93
	Implementation	50	60	42	52	51
	Education & awareness programs	43	60	47	42	49
	Need for marine protected areas	0	64	32	27	34
	Monitoring & inspection	0	60	24	18	28
	Management plans	14	12	24	36	24
	Moorings	7	24	18	6	15
	Seasonal closures	0	28	11	0	10
	Recycling & waste collection	7	4	5	9	6
	Artificial reefs & reef restoration	0	8	5	6	5
	Watershed management	14	0	0	9	5
	Incentives	0	0	8	3	4
	Reliance on marine protected areas	0	0	3	0	1
	Compensation	0	0	0	0	1
Institutional structures	Appropriate institutional structures (general)	57	48	53	48	52
	Clarity of roles & responsibilities	21	24	16	27	22
	Appropriate fit to scale	7	16	11	18	14
	Specific marine management agency	36	8	5	0	8
	Bureaucracy	0	0	5	6	4

Leadership and power	Prioritisation	86	84	61	82	76
	Political will	50	48	29	48	43
	Conflict of interest	21	28	24	30	26
	Ongoing commitment	21	16	16	42	25
	Willingness & capacity	21	16	8	18	15
	Corruption	7	8	21	18	15
	Susceptibility to political change	14	8	8	24	14
	Insufficient authority	0	12	5	24	12
	Leadership	14	8	0	9	6
	Political influence	14	4	3	6	5
	Political reprisals	7	4	0	0	2
	Public pressure	0	0	0	3	1
	Willingness to confront complex issues	0	0	0	3	1
Legislation and regulations	Weak policy, legislation or regulations (general)	71	84	61	61	68
	Reliance on informal governance	29	20	16	21	20
	Inadequate penalties	7	4	13	15	12
	Outdated laws	7	4	8	15	9
	Tenure systems	7	0	8	3	5
	Mechanisms for change	7	0	0	0	1
Engagement and participation	Engagement (general)	79	68	74	76	75
	Stakeholder support	43	48	53	55	52
	Stewardship	0	20	11	12	13
	Little public demand/pressure	21	12	11	0	10
	Collective action	14	8	5	12	9
	Stakeholder voice	14	4	3	3	5
	Stakeholder fatigue	0	4	3	3	3
	Weak stakeholder engagement	7	0	5	0	3
	Media coverage	0	0	5	0	3
Research and information	Information & research	71	60	45	58	55
	Attention to science & technical advice	14	16	16	18	17
	Systems understanding	7	12	11	12	11
	Dissemination	0	4	8	6	5
	Examples & best practices	0	0	3	6	3
	Coordination of research	0	0	5	0	2
Connectivity	Cooperation & integration (general)	64	56	74	82	72
	Formal cooperation mechanisms	14	12	18	12	15
	Incomplete policy cycles	7	8	13	12	11
Meta-governance	Economic case for conservation	7	20	16	15	15
	Shared vision	14	16	8	12	12
	Clarity of goals	14	12	5	12	10
	Values	21	4	8	6	9
	Short-term outlook	29	16	0	6	9
Quality of process	Fairness	36	20	42	39	35
	Transparency	43	4	26	30	25
	Legitimacy	7	20	16	36	22
	Trust	14	0	21	21	15
	Flexibility	14	24	13	12	15
	Accountability	14	8	8	12	11
	Credibility	0	0	3	3	2