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ORIGINAL RESEARCH

The future of ocean governance

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Abstract Ocean governance is complex and influenced by multiple drivers and actors with different worldviews and goals. While governance encompasses many elements, in this paper we focus on the processes that operate within and between states, civil society and local communities, and the market, including industry. Specifically, in this paper, we address the question of how to move towards more sustainable ocean governance aligning with the sustainable development goals (SDGs) and the UN Ocean Decade. We address three major risks to oceans that arise from governance-related issues: (1) the impacts of the overexploitation of marine resources; (2) inequitable distribution of access to and benefits from marine ecosystem services, and (3) inadequate or inappropriate adaptation to changing ocean conditions. The SDGs have been used as an underlying framework to develop these risks. We identify five drivers that may determine how ocean governance evolves, namely formal rules and institutions, evidence and knowledge-based decision-making, legitimacy of decision-making institutions, stakeholder engagement and participation, and empowering communities. These drivers were used to define two alternative futures by 2030: (a) 'Business as Usual'—a continuation of current trajectories and (b) 'More Sustainable Future'—optimistic, transformational, but

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technically achievable. We then identify what actions, as structured processes, can reduce the three major governance-related risks and lead to the More Sustainable Future. These actions relate to the process of co-creation and implementation of improved, comprehensive, and integrated management plans, enhancement of decision-making processes, and better anticipation and consideration of ambiguity and uncertainty.

Keywords Actors · Agency · Marine policy · Sustainable development goals · Resource management

Introduction

The importance of the oceans cannot be underestimated; thus, effective ocean governance is imperative. The oceans are global common-pool resources managed under national jurisdictions (e.g. territorial waters) and by different sectoral and regional organisations (e.g. Regional Fisheries Organisations, Regional Fisheries Management Organization, International Maritime Organization, the International Seabed Authority). Oceans are governed by numerous actors, formal and informal institutions, and nation-states, for a variety of often conflicting services and uses. Inconsistencies in sectoral approaches, conflicts between actors, jurisdictions with overlapping mandates, and poor communication among governance institutions have undermined the effectiveness of ocean governance (Balgos et al. 2015; Stephenson et al. 2019). Addressing these challenges is integral to developing effective governance for marine ecosystem sustainability (Alexander and Haward 2019).

While governance encompasses many elements, in this paper we focus on the processes that operate within and between states, civil society and local communities, and the market, including industry (Jentoft and Chuenpagdee 2009; Lemos and Agrawal 2006; Vince and Haward 2019). These processes steer decision-making and human interactions with the ocean in response to social, ecological, political or economic change and through, for example, institutional arrangements and legal and policy frameworks. However, governance is more than formal institutions and laws. It encompasses actors (for example states, non-state actors—including businesses—and international organisations) and how they influence and implement the rules that mediate human interactions with resources (McGinnis 2011, see also Young 1991).

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The complexity of marine socio-ecological systems has often led to ocean governance arrangements in which policies can lack effectiveness (Underdal 2002; Willock and Lack 2006; Gjerde et al. 2008; Haward and Vince 2008; Blanchard 2017) and coherence (Nilsson et al. 2012). International treaties, regional agreements and national policies often comprise complex design, development and implementation, that reflect the desire to move towards specific objectives. To improve oceans governance, the 1992 United Nations Conference on Environment and Development agreement (Chapter 17, Agenda 21) and the 2002 World Summit on Sustainable Development (Vandeweerd et al. 2006) encouraged states to develop and implement integrated ocean and coastal policy approaches. However, ad hoc, disjointed management regimes have resulted in poor compliance among member states (Ban et al. 2014) and poor outcomes, such as overfishing (Hobday et al. 2011) and increasing marine pollution (Vince and Hardesty 2018). This has had negative impacts on the marine ecosystem, markets and society (Rogers et al. 2016).

We use the United Nations Sustainable Development Goals (SDGs) as an underlying framework to identify three major risks for marine ecosystems to frame the discussion of future ocean governance. The SDGs comprise 17 goals which seek to achieve sustainable development across social, economic, and ecological sectors. These goals are highly interlinked with each other (Singh et al. 2017) and the progress towards these goals will likely impact the ocean. Derived from the SDGs we have summarized three major risks for the ocean where future governance is pivotal for change. These risks are:

1. the impacts of the overexploitation of marine resources e.g. overfishing (SDG12, SDG14, SDG16);
2. inequitable distribution of access to and benefits from marine ecosystem services e.g. technology transfer and gender inequalities (SDG1, SDG8, SDG10, SDG16); and
3. inadequate or inappropriate adaptation to changing ocean conditions e.g. ocean warming and acidification and sea level rise (SDG1, SDG13, SDG11, SDG16).

Governance has frequently focused on addressing such risks through legal and institutional architecture (Young 2010). There is, however, increasing value in developing an understanding of the impact of interplay and interaction between actors and institutions as well as within these institutions (Beunen et al. 2017; Beunen and Patterson 2016; Scobie 2016). As the climate changes and the oceans face increasing degradation and sustainability challenges, there is a renewed urgency to reform governance structures and systems to address current and emerging problems (Biermann et al. 2010, 2012).

We use these three priority risks for marine ecosystems to frame our discussion on how improved ocean governance may mitigate such risks and offer specific and tangible examples of pathways of change. As such we look at addressing these risks through the lens of agency. Agency is defined as the capacity of an actor or an organization to make decisions and to act upon them, and thus to influence government and institutions' behaviours (Hall 2010; Bloomfield 2017; Lawrence et al. 2009). Institutions are shaped by the individuals who work within them; addressing individual and organizational agency helps to analyse how institutions are created, how they interact, and how they adapt to changing needs and expectations. By recognising agency as a driver of governance, we can begin to identify interactions between actors that foster or hinder the development of norms and related government systems (Burch et al. 2019) and thus help explain the dynamics of interplay between different institutions, organizations, and stakeholders. We use agency as it provides a critical lens that centres on actors within institutions as key to changes (positive or negative) and thus is a key concept in identifying pathways of change. Agency moves away from a simple focus on state and organisational action.

The aim of this paper is to envision ocean governance for a more sustainable future by 2030, which is the end of the United Nations Decade of Ocean Science for Sustainable Development, and to propose tangible actions towards such a vision. To address this aim, we identify five drivers (Sect. "-Drivers of change") shaping ocean governance which might steer the direction of the immediate future (Nash et al. forthcoming). Based on these drivers, we define the narratives of two alternative futures ('business as usual' and an aspirational, more sustainable but technically achievable 2030) (Sect. "Narratives of alternative futures"). These futures are based on the perception and opinions of the authors and we acknowledge that some topics which others might

consider as important have not been included. For example, we acknowledge that the blue economy, (the use and stewardship of ocean resources) is likely to have an impact on the different scenarios, however, we are not addressing this concept here as it is analysed in great details in Novaglio et al. (forthcoming) and Bax et al. (forthcoming). We also identify actions that may facilitate change towards a more sustainable future (Sect. "Pathway to achieve sustainable 2030"). While not addressed in this paper we acknowledge that the disruptions of 2020, in particular the COVID-19 pandemic, are currently causing major changes to economies and socioecological systems at the global scale. These changes will likely change future trajectories as the COVID-19 pandemic has extensive impacts on for example small-scale and community fisheries (Bennett et al. 2020). Thus, the business as usual scenario we describe is based on evidence from the recent past before the pandemic and assumes a general return to this trajectory in the next few years. We note that current disruptions to the global ocean, environment and society because of COVID-19 may influence the described actions and indeed present a platform for change and an opportunity to 'reset' trajectories in the coming decade. The more sustainable future presented here is one option for such a shift.

Drivers of change

We identify five key drivers that influence current ocean governance and can steer the direction of governance within the next decade. These drivers are based on the perceptions and experience of the authors and had been identified in numerous workshops through an established iterative method (see Nash et al. forthcoming for more details on this methodology). We acknowledge that the opinion regarding these drivers might differ among different scholars. The first driver is *formal rules and institutions* (Ostrom 1990). Rules (including norms and regulations) created by formal governance institutions play a role in steering actors' behaviour and influence institutional arrangements towards the implementation of effective management, which includes compliance and enforcement. The second driver is *evidence and knowledge-based decision-making* (Cash et al. 2003) as *t*he sharing of knowledge, brokering between scientific and policy institutions and the acknowledgement of traditional knowledge are important for decision-making processes. The third driver is *legitimacy of decision-making institutions* (Clark et al. 2011). Public's trust is important in decision-making processes and relative outcomes and whether actors judge these processes and outcomes as fair and adequate. The greater the level of legitimacy, the more likely actors will comply with its rules without the need for enforcement actions (Tyler 1990; Franck 1990). The fourth driver is *stakeholder engagement and participation* (Cash et al. 2003). To facilitate cooperation at all levels of human interaction with the oceans, all relevant stakeholders need to be included in the governance processes. The last driver is *empowering communities* (Ostrom 1990). Collective actions, as well as social licence for human use of the ocean, benefits the different actors and the various scales at which they operate. Table 1 centres on the three risks in relation to these five key drivers and provides examples of each promoting or undermining ocean governance.

Narratives of alternative futures

Business as usual: *Managing complexity*

The Business as Usual (BAU) scenario is based on the current status quo predicting that global oceans governance will continue to face highly interconnected and multifaceted problems. The three major risks of the impacts of the overexploitation of marine resources, inequitable distribution of access to and benefits from marine ecosystem services, and inadequate or inappropriate adaptation to changing ocean conditions are partially addressed by some actors, but efforts to address issues related to ocean conservation will not start soon enough and will not be sufficient to place ocean use and exploitation on a sustainable footing (Duarte et al. 2020). Human pressure on marine ecosystems will increase to meet the growing demand for goods and services (Halpern et al. 2019; FAO 2020), and exploitation of marine resources will receive the most attention from government institutions (Sumaila et al. 2019). The distribution of benefits and/or costs will continue to be recognised as an important topic of discussion in national and international fora. However, it will be difficult for actors with

Table 1 Risks, Drivers and Ocean Governance

Risks	Driver	Aspects of the driver	Examples of driver promoting more sustainable governance	Examples of driver undermining more sustainable governance
Over-exploitation of marine resources/ Inequitable distribution of benefits from marine ecosystems/ Inadequate adaptation to changing oceans and marine ecosystem services	Formal rules, norms and institutions	International agreements	Wide range of international agreements promoting conservation and sustainable use of oceans resources e.g. United Nations Fish Stock Agreement promotes precautionary decision making over highly migratory and straddling fish stocks; establishes formal arrangements for regional cooperation and benefit-sharing (UN 1995)	Governance gaps in important areas, such as environmental stressors oceans (e.g. acidification), protection of biodiversity in high seas areas (Gjerde et al. 2008; Gjerde 2012)
		National laws, rules and regulations	MARPOL[1] rules on the prevention of pollution from ships (IMO 2020)	STCW (The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978) provided standards for training and certification for seafarers, however, the number of accidents and incidents due to human errors has not declined (Uğurlu et al. 2015)
		Formal institutions created by such treaties or national laws		
		Governance of a specific subject-matter (e.g. Economic sector) or geographic area		
		Compliance and enforcement mechanisms		
	Evidence- and knowledge-based decision making	Improved knowledge and data collection including through: technological advancements, investments by actors, and brokering of new, local and traditional knowledge;	Use of scientific knowledge for site-specific Marine Protected Areas (MPAs) and most appropriate zonings for marine spatial planning at a national level, e.g. Great Barrier Reef (Williamson et al. 2006)	Decision-making processes that require consensus can enable a small number of actors to block progress by rejecting evidence/scientific knowledge base for decisions (Underdal 1980);
		Improved knowledge sharing between organisations	IPCC reports providing strong and accessible science basis for mitigation and adaptation decisions (IPCC 2020)	Use of single stock Maximum Sustainable Yield (MSY) to set Total Allowable Catch (TAC) (e.g. in Regional Fisheries Management Organizations) ignores inter-relationships with other species, habitats, and competing uses and capacity of target species to stay at sustainable levels (Mace 2001, Thorson et al. 2014)
		Establishing effective monitoring systems	Collaborative development of integrated marine plans by Canada, Province of British Columbia and First Nations	

Table 1 continued

Risks	Driver	Aspects of the driver	Examples of driver promoting more sustainable governance	Examples of driver undermining more sustainable governance
	Legitimacy	Accountability of governance institutions, actors, decision-makers, processes, decisions and outcomes	Marine Stewardship Council Certification provides independent legitimacy to products from certified fisheries (Gulbrandsen 2009; Gutiérrez et al. 2012)	High levels of Illegal, Unregulated and Unreported fishing in some fisheries undermine trust on effectiveness of international rules and domestic enforcement capacity (Lindley and Techera, 2017)
		Achieved through: improved transparency consultation, accountability, clarity, suitable resources being available		
		Respecting traditional and indigenous ways		
		Improves prospects for actor compliance with rules; social licence and trust between stakeholders		
	Engagement and Participation	Co-operation between regional and international agreements;	Arctic council: a high-level intergovernmental forum that promotes cooperation, coordination and interaction among Arctic States with 8 Arctic States and 6 Arctic indigenous organizations acting as permanent participants (Arctic Council 2020)	Use of development assistance to manipulate outcomes e.g. Japan and whaling (Strand and Tuman 2012)
		Enhanced input from civil society/ non-government organisations	Indigenous participation in governance would be the Pacific Salmon Commission that manages and conserves salmon stocks on the northwest coast of North America (First Nations Fisheries Council, 2020	
		Cross-sectoral cooperation and coordination;		
		Engagement with markets, e.g. Shareholder responsibility		
	Empowered communities	Communities more responsible with more capacity for self-governance	Effective community and NGO campaigns on whaling (Sakaguchi 2013) and marine plastic (Phal et al. 2017; Dauvergne 2018)	Lack of specificity in claims or untested/not assessment statements, for example, claims that nodule mining is environmentally friendlier than other mining activities (Cuvelier et al. 2018; Levin et al. 2016)
		Achieved through co-management arrangements; solution- and truth-orientated media; leadership and champions; human capacity; more accessible and relevant research		

[1]International Convention for the Prevention of Pollution from Ships

different economic interests (e.g. developed and developing states) to agree on solutions that address inequities (Shelton 2008). Adapting to changing ocean conditions will be difficult, due to lags between impacts and policy responses (Blasiak 2020; Slawinski et al. 2017). Knowledge gaps about the oceans such as in species distribution (Menegotto and Rangel, 2018) will persist and these knowledge gaps will undermine prospects for evidence- and knowledge-based decision making (Columbus 2016).

Positive developments will include the widespread adoption of some key international oceans agreements, such as the United Nations Fish Stock Agreement (UNFSA), which is ratified by most countries that harvest straddling and highly migratory fish stocks (United Nations Treaty Collection 2020). The MARPOL Convention—the International Convention for the Prevention of Pollution from Ships—will further reduce vessel-based marine pollution. The draft convention for the conservation and sustainable use of Biodiversity Beyond National Jurisdiction (BBNJ) will enter into force but will lack broad implementation and enforcement capacity as states struggled to reach an agreement (de Santo et al. 2020; Cremers et al. 2020). However, the implementation of the BBNJ agreement will likely be accompanied by an increase in establishing high seas marine protected areas. Besides marine protected areas there will be a growing use of marine spatial planning as a management strategy, which will result in a more coherent ocean management strategies, even though conceptual and practical challenges will remain (Santos et al. 2019).

Formal rules, policies and institutions for oceans management at the national level will continue to be developed or modified iteratively. However, these rules will remain poorly integrated across sectors, resulting in gaps and missed opportunities in addressing the three key risks (Vince 2015). Implementation, compliance, and enforcement will remain patchy, due to lack of resources (Vince et al. 2017) and political will (Nilsson et al. 2019). Governance actors' main priority will be economic growth, promoting, for example, harmful subsidies, which further contributes to overfishing (Sumaila et al. 2019). Moreover, the direction of funding towards economy-oriented aspirations may lead to funding cuts for basic research and capacity development or may influence research topics and direction.

Key governance decisions will not make the best use of existing scientific, indigenous, and traditional knowledge (Pentz and Klenk 2017; Weiss et al. 2012). With the need for increased evidence-based decision making, new challenges related to data sharing, protection and management will emerge (e.g. Intellectual Property), leaving important information hidden, unavailable or overlooked. Investments in government infrastructure and capacity will remain low, especially in developing nations and small island states, resulting in reliance on outdated research technologies. Despite growing efforts, gaps in knowledge and governance capacity between developed and developing countries will continue, limiting our adaptive and collective responses to ocean governance challenges (Chiarolla 2016).

In a BAU scenario, few parties will acknowledge the need for change, and climate change induced impacts such as redistribution of important species will lead to increased conflicts (Mendenhall et al. 2020). Legitimacy and trust will remain essential for co-governance across scales, but their development will continue to be difficult (Turner et al. 2016). Thus, while system-wide legitimacy in some parts of ocean governance may slowly increase at globally significant decision-making meetings, less influential stakeholders will still struggle to speak up and be heard. For example, indigenous and traditional stakeholders will increasingly participate in global meetings as a result of international pressure for improved legitimacy and transparency, but their influence on the meetings' outcomes will remain limited (Weiss et al. 2013). As a result, the ocean will continue to be governed by a small elite (whose composition varies depending on fluctuating alliances), with members having trade powers and rights of exploitation but different perceptions and understandings of environmental risks and fairness.

Media will play an important role in influencing ocean users and coastal communities (McCombst 2002; Soroka 2003) and will not always make use of the latest scientific evidence (Boykoff 2008). In addition, there will remain a lack of investment in capacity and key infrastructure for communities that are exposed to sea-level rise, oil and gas pollution and other ecological impacts resulting in poor adaptive capacity and high transaction costs for sustainable resource use and collective actions. While some companies will be role models in sustainable resource

use, most will participate in "blue-washing" activities (Voyer et al. 2018). For example, deep-seabed mining companies are promoting themselves as sustainable, less invasive and vital to a low-carbon and green-tech based future, despite the potential for vast ecological damage of the industry to seabed ecosystems (Cuvelier et al. 2018; Levin et al. 2016).

Sustainable 2030: *Embracing complexity*

Following the approach described in Sect. "Drivers of change" and by Nash et al. (forthcoming), we explored different future scenarios. Scenario parameters were set by the project teams—see Nash et al. forthcoming. The scenario drivers and narratives for this paper were developed iteratively through several workshops and discussions by team members to identify drivers, constraints and opportunities for the two scenarios elaborated here. Our vision of a More Sustainable Future embraces the complexity of ocean governance and moves towards reducing the three major risks. Unlike non-place-management, place-management takes into account the distinctive features of an individual place and customize management measures and regulations specific to that place (Young et al. 2007). Adoption and implementation of place-based management and precautionary approaches, together with increased public awareness of ocean overexploitation, will lead to improvements in managing resource use and impacts. A realisation of the need to address social inequity will lead to transformations in cooperation on ocean issues and capacity to adapt to changes in the ocean (Coscieme et al. 2020; Díaz et al. 2019).

In a sustainable 2030 future scenario, new operational rules that complement or reform existing laws will be developed and implemented. Together, these rules will build a more holistic and strategic framework. They will be informed by ambitious objectives shared across players and will be better equipped to address the challenge of fragmented ocean governance. The BBNJ agreement will provide a starting point to address increased pressures from deep-sea resource use. Even though the BBNJ agreement was established on the principle of "not undermining" existing organizations and initiatives, the outcome of the BBNJ negotiations strengthens rather than undermines existing organization (Gjerde et al. 2019). The increasing availability of resources and management capacity will improve compliance and enforcement. Institutional coordination and cooperation between national, sub-national, and local communities will improve sustainable practices and will lead to coordinated efforts to close managerial and regulatory loopholes.

A broader range of organisations and actors will contribute to decisions. Decision-making will be guided by the best available scientific, indigenous, and traditional knowledge. The use of technology will improve monitoring, control and surveillance, and will support more equitable use of ocean resources. Better use of indigenous and traditional knowledge in planning and decision making will improve the legitimacy of ocean governance. Increased transparency will improve the availability of data, will allow scrutiny of decisions and actions, will reduce information asymmetry among actors, and will improve trust amongst important communities, Non-Governmental Organizations (NGO) and other stakeholders. This will lay the foundation for ongoing negotiations to continue improving and adapting ocean governance over time.

Focused research will advance our understanding of ocean processes. Research will be supported by local communities organised as citizen scientists. Policymakers will use improved research and crowd-sourced data in their strategic planning, emergency preparedness, and adaptive management. Through technological advances, local communities will be empowered to participate in monitoring coastal environments against illegal, unreported and unregulated activities, pollution, and sea-level rise. As more local communities and civil society will be engaged in policy and decision-making, their commitment to better oceans management will be strengthened. This will lay the foundations for consensus or acceptable compromises regarding global ocean management goals which will, in time, lead to international commitments.

Pathway to achieve sustainable 2030

Through the lens of agency, we identified 40 actions across the five drivers to address the three risks highlighted by the Sustainable Development Goals and thus likely leading towards our vision of the sustainable future (Fig. 1). We grouped these actions

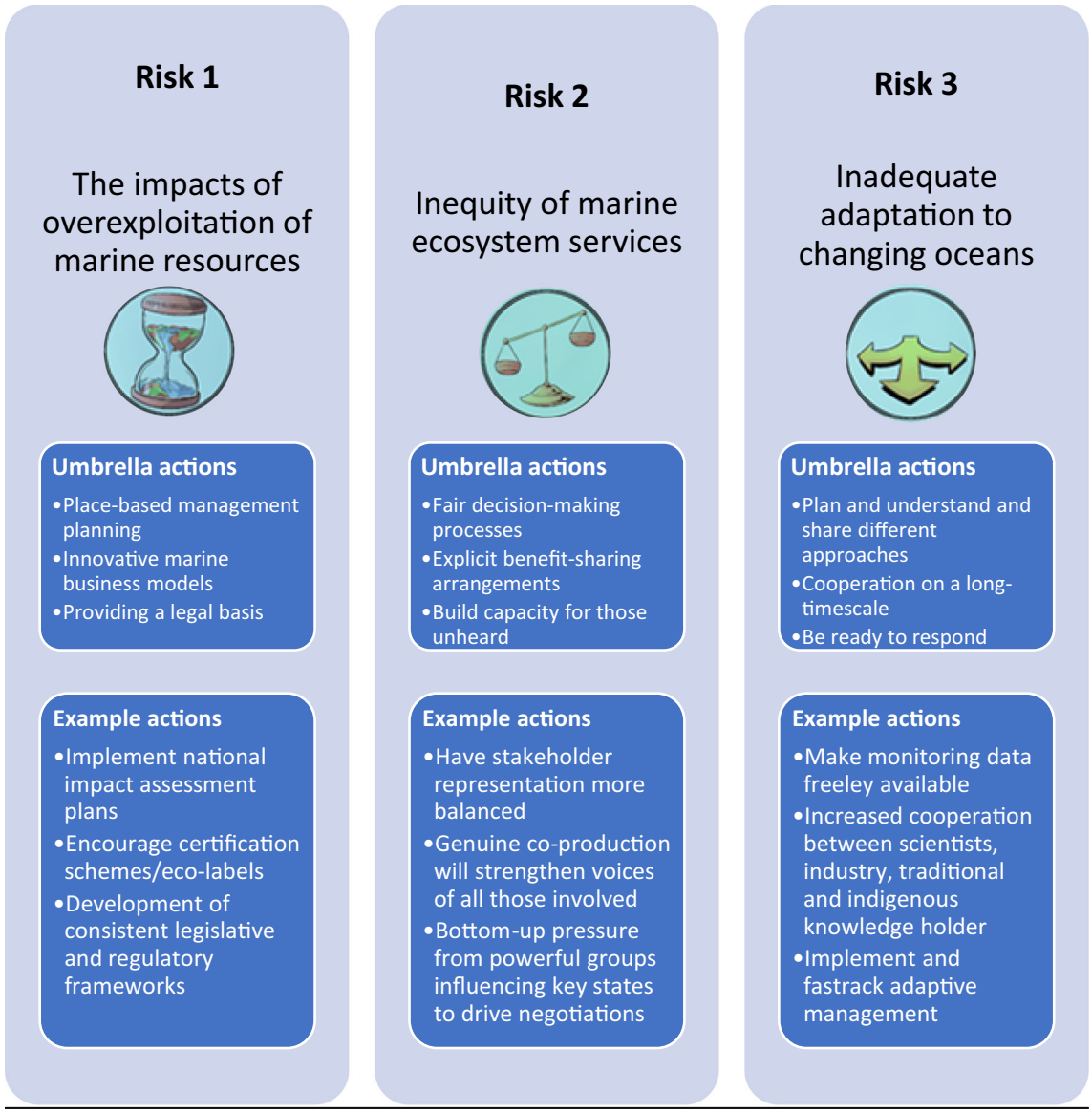

Fig. 1 Umbrella and specific actions to move towards a more sustainable 2030 where ocean governance complexity is embraced. Actions organised in response to three key risks; (1) the impacts of the over-exploitation of marine resources; (2) inequitable or unfair distribution of access to and benefits from marine ecosystem services, and (3) inadequate adaptation to changing oceans

and provide a brief description in the next section (see Appendix 1 for a full list of actions). A clear challenge in moving from a business as usual trajectory is the complex interactions among actors in shaping institutional action or non-action. Enhancing agency of actors such as first nations peoples, whose interests are under-, or non-represented, through engagement and capacity building is a key here.

Actions to address the impacts of the overexploitation of marine resources

Place-based management and planning

Implementing new management plans for the sustainable use of ocean resources requires consideration and coordination of many interacting factors (Jentoft 2000; Leslie et al. 2015; Finkbeiner et al. 2017). It

needs input from academia, industry, governments, civil societies, and markets. It demands a renewed focus on implementation, through the creation of place-based management (Leenhardt et al. 2015; Finkbeiner et al. 2017; Mikalsen and Jentoft 2001). Effective place-based management is conditional on the assessment of local conditions. This assessment facilitates the integration of social, cultural and local knowledge, needs and beliefs, and scientific understandings (Actions 1, 2, 30, 32, 33). Examples from the Philippines, Chile, and Mexico showcase such effective place-based management (e.g. Basurto 2005; Gelcich et al. 2007, 2010; Kittinger et al. 2013; Pomeroy 2013; Purcell and Pomeroy 2015). Furthermore, resourcing the creation and implementation of comprehensive, integrated management plans has motivated innovative funding arrangements, for example, public–private arrangements such as cost recovery in Australia's New South Wales Rock Lobster Fishery (NSW Government 1994), Canadian fisheries royalty system and aquaculture fees in Norway (Action 5). Auditing of plans and outcomes can be routinely undertaken by governments, environmental NGOs or due to public pressure. In Chile, a Territorial User Rights in Fisheries (TURF) approach has been applied which is a co-management approach which granted exclusive territorial rights to artisanal fishers (Castilla 1994). This approach has been extended by a management policy which fostered the targeted management of specific species within a defined regions, via a management committee, involving different stakeholders such as fisheries, industry and government representatives (Gelcich 2014). The Management Plan policy and its application in TURF environments in Chile have provided a framework for successful access to local and global markets, monitoring, compliance, and auditing (Gelcich 2014) (Actions 3, 5, 6, 11).

Innovative marine business models for marine industries

Market changes can be achieved by altering current business models, for example, through the adoption of more transparent supply chains. This can be done through participation in third-party certification systems, such as the Marine Stewardship Council, and other auditing programs (Actions 25, 26). The application of standards from certification programs to public regulation, as in the forestry industry, can enable industry participants to abide by an additional set of conservation-based measures (Faure et al. 2017). By taking socially and environmentally responsible action, corporations help to achieve a more sustainable future. Annual Impact Reports are published for transparency and demonstrate a clear commitment to human rights, environmental health, and resource sustainability, in addition to returning profits to corporate shareholders (Actions 25, 28, 36). Moreover, shareholders could use their influence to demand change towards more sustainable actions and ensure the publication of those changes to improve transparency (Action 29). Increased focus on sustainability actions within co-management arrangements is also relevant (Actions 37, 38).

Providing a strong legal basis for protecting marine resources

Legal frameworks for ocean governance need to adapt to better address emerging governance challenges. This can be achieved by providing incentives for industry to engage with more environmentally friendly practices or by increasing taxes on environmentally harmful behaviour (Action 7). Major issues identified in the Business as Usual scenario were the inconsistency among existing regulations and the lack of coordination when implementing new rules. For more sustainable ocean governance, it is important that legislative and regulatory frameworks are developed in a consistent way and are informed by international and regional legal obligations (Action 9). Cooperation between international (e.g. United Nations Convention for the Law of the Sea—UNCLOS) and regional agreements need to be fostered through the use of mechanisms such as Memoranda of Understanding (MoU) (Action 10). Generally, it is important to incentivize cooperation regarding developing solutions for marine governance issues. Global institutional arrangements need to be established so that participants can directly act through them and support the ambitions of disparate regional and sectoral bodies (Laffoley et al. 2019) (Action 14). Moreover, governance rules need to be clearer and more defined in order to prevent elites from influencing actions (Action 21). In the area of fisheries management, the South Pacific Regional Fisheries Management Organization provides a good example

of a more progressive decision-making approach (Schiffman 2013). Increased cooperation is imperative to deal with complexity in ocean governance. To realize this, adequate funding mechanisms for full participation in Conferences of the Parties (CoPs) to global agreements are needed (Laffoley et al. 2019) (Action 12, 16).

Actions to address inequitable distribution of access to and benefits from marine ecosystem services

Fair decision-making process

The role of procedural and distributional justice in ocean governance cannot be overstated as we strive to build a safe and just operating space for humans and biodiversity (Bennett 2019a; Costanza et al. 1998). Equity, human rights, and social justice are core principles here as envisioned in Agenda 21, RIO + 20 and Agenda 2030. Moreover, these principles are important to strengthen an equal distribution of costs and benefits of ecosystem services. It is also important to address the injustice indigenous and traditional people are facing from colonization such as political domination, loss of territory and cultural imposition which are addressed under the 2007 UN Declaration on the Rights of Indigenous People (Moore 2016). For example, the planning and implementation of conservation zones need to be based on more reflexive (Action 3), balanced (Action 29), transparent (Action 23), and inclusive (Action 30) decision-making frameworks that ensure biodiversity and equity goals are considered. These frameworks ensure that communities relying on and benefitting from these and neighbouring zones are engaged and included in the management decisions and processes. Implementing this type of framework will require changes to legislation and policy, as well as new forms of financial incentives. Such changes may be difficult to achieve, especially in low-income countries that face important challenges in the transition towards a fair and just use of natural resources and may require long time frames for full implementation. They are dependent on long-term funding for monitoring, compliance, reporting and surveillance technology (Action 5). However, the application of a human rights-based approach to ocean governance (Allison 2001; Allison et al. 2012; Zheng 2018) and the movement away from property-rights approaches, may lead to actors taking responsibility for non-inclusivity and overdependence on marketisation and privatisation. Fair ocean citizenry and stewardship may be encouraged. In turn, existing legal and policy frameworks may be improved (Actions 2, 38) and better-suited to achieving sustainable ocean governance (Allison et al. 2012).

Explicit benefit-sharing arrangements

To achieve equitable and fair ocean governance, the discourse around ocean stewardship, access and use of marine resources, needs to be re-defined. In particular, ocean stewardship needs to address social inequity (Actions 24, 27) (Allison 2001; Bennett 2019b). This approach can offer many opportunities that are supportive of current institutional processes (Action 2), adopt meaningful co-designed governance principles, and have great potential for transformative change (Coscieme et al. 2020; Díaz et al. 2019). For example, moving away from the practice of trading-off ecosystem services such as prioritising fish harvesting over environmental damage by fishing gear (Clark et al. 2016; Kaiser et al. 2000) can help account for the unequal distribution of costs and benefits across society (Costanza et al. 1998; Daw et al. 2011). As noted in SDG1 (i.e. no poverty): growing social inequality is detrimental to economic growth and may undermine social cohesion and collective action to address governance problems. Thus, mainstreaming benefit-sharing mechanisms and access rights may strengthen stakeholder collaborations (Action 36) and foster the integration of different knowledge types (Actions 18, 19).

Build capacity for those unheard

Issues in ocean governance can challenge how we cooperate nationally, regionally, and internationally (Action 4) (Campbell and Hanich 2015; Costanza et al. 1998; Díaz et al. 2019). Understanding and achieving equity, alleviating poverty, and enhancing human resilience are required to foster cooperation. This can be done by designing and implementing context-relevant ocean governance policies that consider the marginalised, disenfranchised, and land-locked communities (Bennett 2019a; Coscieme et al. 2020). These communities often lack information,

power and influence, a platform, and representation (Actions 29, 30) and are thus less proactive in addressing ocean governance issues (Actions 27, 31, 32, 33, 40). For example, conflict resolution practices can explicitly focus on ensuring representation of all interests, and work hard to provide inclusive practices, and thereby contributing to capacity building. Addressing social inequity will not only facilitate fair-sharing and cross-sectoral cooperation but also transform how humans relate to and interact with the ocean (Campbell and Hanich 2015).

Actions to address inadequate or inappropriate adaptation to changing ocean conditions

Plan, understand and share different approaches

A pressing action required to face the negative disruptions associated with climate change is to establish what the impacts of change may be (Biesbroek et al. 2010; Mullan et al. 2015; Lesnikowski et al. 2016). In the face of a changing climate, knowledge gaps about oceans and ocean ecosystems are likely to widen. In times of uncertainty (Action 17) monitoring regimes need to be persistent, transparent, and freely available (Action 26). Academia, industry, society (Kelly et al. 2019), politics, and media need to collaborate in collecting and disseminating information and increasing awareness about improving ocean governance. As climate change is already impacting the marine ecosystems, it is important to increase preparedness to respond and recover, either through precautionary recovery plans (Hoeppner and Hughes 2019) or small scale rehabilitation work (Alderman and Hobday 2017). In such contexts, it is also key to consider, assess and monitor the impacts of climate change and different human uses (Halpern et al. 2015; Grech et al. 2016; Mach et al. 2017) (Actions 1, 13, 35). Industries that are susceptible to climate impacts are starting to call on national governments and political parties to acknowledge the effects of the changing climate and move from political contests over evidence to proactive steps to address looming impacts. An example is a recent statement by Australia's largest insurance company calling for effective policies to reduce risk from climate change enhanced natural disasters.

Co-operation on a long timescale

In times of drastic change, cooperation becomes crucial (Roch and Samuelson 1997; Cardenas et al. 2004). The spectrum of consequences expected from climate change will require legitimate, transparent, and honest cooperation among scientists, industry, society, politicians, and indigenous knowledge holders (Actions 20, 27). Inclusion of indigenous and traditional knowledge and perspectives, for example, allows different viewpoints to be incorporated into decision-making. This also has the potential to improve policy responsiveness as traditional landowners notice some effects of climate change earlier, due to traditional practices and interactions with the oceans (Green and Raygorodetsky 2010). The effects of climate change will not be addressed through short-term politics (Slawinski et al. 2017). Whilst flexibility is key to addressing unplanned change, there is a requirement for an imminent strong overarching climate change focused policy and agreements that go beyond typical political timeframes and include whole-of-government responses (Actions 8, 22). Examples of such policy at international levels are the Paris Climate Agreement or the EU Water Framework Directive. However, enduring climate change policy on national agendas is lacking [for example, Carbon Pricing in Australia (Crowley 2017)]. Governments need to address policy gaps and propose flexible policies that are appealing to increasingly dominant sections of the electorate (Jordan et al. 2015; Burch et al. 2019).

Be ready to respond

While it is important that future governance regimes adopt decisions based on the precautionary approach (Farbotko and Lazrus 2012; Himes-Cornell and Kasperski 2015; Morzaria-Luna et al., 2014) protecting natural ecosystems also requires governance to be responsive, proactive, and flexible. For example, adaptive management needs to be implemented when addressing the rapid and drastic climate and human-driven change affecting reef areas (Armitage et al. 2009; GBRMPA 2009; Mathews and Turner 2017; Maynard et al. 2010; Townsend et al. 2008; Weeks and Jupiter 2013; Cinner et al. 2019) (Action 3, 38). Last, government and industry need to establish public emergency funds for a rapid response to unexpected

and extreme events (Action 39). These funds have already been proposed, for example, for bushfire prevention in Australia (Arriagada et al. 2020) and flood control in the UK (Hannaford and Hall 2019). They complement private emergency funds (e.g. https://climateemergencyfund.org/) and can enable recovery plans (both social and ecosystem), adaptation plans, or new geoengineering approaches (Markusson et al. 2014).

Conclusion

In this paper, we have argued that ocean governance currently faces three core risks: (1) the impacts of the overexploitation of marine resources, (2) inequitable distribution of access to and benefits from marine ecosystem services; and (3) inadequate or inappropriate adaptation to changing ocean conditions. Various processes will challenge the governance of these risks and agency is key to progressing towards a more sustainable future. This is significant as current knowledge on oceans governance and the role of agency, as we have shown, can provide us with many examples of how we can move towards a more sustainable future. This means we can start to address this now. One way in which to start to address this would be for example to invest in place-based management based on assessments which integrate social, cultural and local knowledge, needs and beliefs and scientific understanding. Furthermore, it is important to increase cooperation among scientists, industry, society, politicians, and indigenous and first nations knowledge holders. These actions might be impacted by disruptions such as the COVID-19 pandemic, however, at this point, it is impossible to describe the extent of the impact. Overall improving governance of the oceans to achieve a more sustainable future—a better future than we can expect under business as usual conditions—is both a challenge and a crucial opportunity for the coming decade.

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