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RESEARCH PAPER

Big fishing: the role of the large-scale commercial fishing industry in achieving Sustainable Development Goal 14

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Abstract United Nation's Sustainable Development Goal (SDG) 14 'life below water', is directed to the sustainable use and conservation of the oceans and marine resources. However, there is very limited information available on how the large-scale commercial fishing industry might contribute to the achievement of SDG 14. This paper shows engagement opportunities for the fishing industry, with a focus on fish harvesting, for the different targets of SDG 14. We find that the fish harvesting sector can contribute to almost all SDG 14 targets, except in the prohibition of certain forms of fishing subsidies. The fishing industry has the opportunity to implement practices that, for example, can help to reduce marine pollution or bycatch. More work is needed to provide specific reporting mechanisms for fisheries companies to assess their progress against the other SDGs.

Keywords Fishing industry · Marine policy · Ocean governance · Stakeholder engagement · Sustainability

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Introduction

Worldwide, the oceans play a significant role, not only through the supply of fish, but also directly and indirectly through supporting the livelihood and food security of millions of people, particularly those in developing countries. Fish is not only an essential part of the daily diet for millions of people, but also an important source of income for fishers and related industries (Béné et al. 2015). The United Nations Food and Agriculture Organization (FAO) estimates that in 2016 around 59.6 million people were employed in the primary sector of capture fisheries and aquaculture (FAO 2018). Furthermore, in 2006 the fishing industry contributed about US$300 billion to the global economy (Sumaila et al. 2016a). However, the rising demand for fish and the economic importance of the fishing industry (Sumaila et al. 2016a) has placed significant pressure on many fish stocks (Pauly et al. 1998, 2002). An increasing percentage of fished species are considered to be overfished (from 31.4% in 2013 to 33.1% in 2015) and around 40% are fished

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to their maximum limit (FAO 2016b, 2018). The level of human activities upon the ocean continues to grow and there is no area in the ocean which is not affected by some kind of human pressure (Halpern et al. 2008). Human impacts are matched by changes in ocean dynamics, such as regime shifts (Conversi et al. 2010) and extreme events (Froelicher and Laufkoetter 2018; Hughes et al. 2018). Collectively, all these stressors lead to reduced resilience of the ocean and coastal ecosystems. This reduced resilience affects the food security and well-being of many people, including their identities and cultural values (IUCN 2017; Visbeck 2018).

The United Nations Sustainable Development Goals (SDGs), seek to link social, economic and environmental aspects to achieve a sustainable future. Seventeen SDGs, each supported by different targets, resulting in 169 targets overall, aim to achieve sustainable development in all three areas. The SDGs differ from international treaties, in that the goals are not legally binding in international law (Biermann et al. 2017). States are not legally obliged to implement the SDGs in their national legal and policy frameworks (Biermann et al. 2017). It is also recognized that the SDGs are difficult to achieve (Stafford-Smith et al. 2017) due to their broad and universal application (Allen et al. 2016). Despite the non-binding nature of the SDGs, member states are still expected to implement the goals in their national framework and report regularly on their progress (United Nations 2018a). The reporting mechanism supports transparency and makes all the information publicly available (United Nations Global Compact 2018b). For example, Australia maintains a platform which tracks the progress of the Australian Government regarding the SDGs. The annual performance of 157 countries is also presented by the SDG Index and Dashboard Report, produced by the Sustainable Development Solutions Network (SDSN) and the Bertelsmann Stiftung (SDG Index & Dashboards 2018).

The fishing industry has a key role in achieving SDG 14 (Brooker et al. 2016): the conservation and use of the oceans, seas and marine resources for a sustainable development. The involvement of the private sector is important to achieve not only SDG 14, but also other SDGs (Index Initiative 2017). This importance is also emphasised by several initiatives such as the UN Global Compact Action Platform for Sustainable Ocean Business (United Nations Global Compact 2018a) and the World Ocean Council (World Ocean Council 2018). These initiatives aim to support the private sector to engage with sustainability, or the Seafood Stewardship Index, which plans to assess seafood companies' performance according to societal expectations (Index Initiative 2017). Another initiative is the Seafood Business for Ocean Stewardship (SeaBOS), where the nine largest fishing companies in the world are committed to the stewardship of the oceans (Österblom et al. 2017; Stockholm Resilience Centre 2018a). These nine fishing companies are highly transnational and together control 19–40% of the world's capture fisheries and are important keystone actors in policy-making (Österblom et al. 2015).

The aim of this paper is to provide an overview of how large-scale commercial fishing industries, with a focus on the harvest industry, can engage with the seven primary targets of SDG 14, providing specific examples for several of the targets. The fishing industry can have valuable input to reducing marine pollution and greenhouse gas emissions, applying sustainable practices during fish harvesting, and in combating illegal, unreported, and unregulated fishing. Leadership from big transnational, but also smaller companies, has the potential to play an important role in changing fisheries and resource management (Österblom et al. 2015). Many papers have been written about the SDGs (Biermann et al. 2017; Cormier and Elliott 2017; Covert 2017; Le Blanc et al. 2017; Mohammed et al. 2017; Visbeck et al. 2014), however, with a few exceptions (Brooker et al. 2016; Fleming et al. 2017), this literature places emphasis on ocean governance and management, and the indicators (Bhaduri et al. 2016) and interactions among the goals (Griggs et al. 2017; Singh et al. 2017). This paper aims to add a different perspective, by providing information about the possibilities for the large-scale commercial fishing industry to contribute to the achievement of the primary targets (numbered one to seven) of SDG 14. The secondary targets (given the letters a, b, and c) play also a role for fishing, however, their specific achievements are not as clearly formulated as for the primary targets and are therefore not considered in this study.

Engaging with the single targets of SDG 14

To achieve SDG 14 many different stakeholders must work together to address targets that address economic, environmental, and social conditions. In the past the focus has centred on ecological impacts to fish stocks and less attention was paid to wider social and economic effects (Benson and Stephenson 2018; Stephenson et al. 2017). Now, businesses have recognised the need to take responsibility to address the SDGs, as part of broader commitments to corporate social responsibility (Kittinger et al. 2017). The key social areas which have to be addressed by businesses, can be summarised under "protecting human rights and dignity and respecting access to resources; ensuring equality and equitable opportunities to benefit; and improving food and livelihood security" (Kittinger et al. 2017, p. 912).

The seven targets of SDG 14 cover almost all ocean issues, such as marine pollution, ocean acidification, sustainable management and fisheries, and conservation approaches. Thus, management institutions and governments are also involved. Some of these issues are also encompassed in other international agreements, such as the Aichi Targets or the FAO Port State Agreement (Table 1), thus achieving the SDGs will also benefit these agreements (Driscoll et al. 2018).

As mentioned in the introduction, the SDGs are a complex framework and one reason for this might be the high rate of interconnection of the goals with each other. For example, to end poverty (SDG 1) and hunger (SDG 2), it is necessary to achieve at least five of the SDG 14 targets, which highlights the central role of SDG 14 in achieving many of the other goals (Singh et al. 2017).

Target 14.1: Marine pollution

Target 14.1 aims to prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution (United Nations 2018b). Not all aspects of this target are relevant for fish harvest and this paragraph emphasises marine debris and pollution, which arise as part of fishing activities. Overall, there are more than 268,940 tons of plastic currently floating in the oceans (Eriksen et al. 2014) and this is clearly a problem beyond just the fishing industry (Haward 2018). However, many studies have shown that fishing activities make a substantial contribution to the amount of marine debris in the oceans (Buhl-Mortensen and Buhl-Mortensen 2017; Edyvane and Penny 2017; Page et al. 2004; UNEP 2016; Unger and Harrison 2016). For example, debris from fisheries was found in high amounts on beaches in the UK (Unger and Harrison 2016) and in some areas such as the coastline of the Northern Territory in Australia fishing-related debris was the highest source of waste in the ocean (Edyvane and Penny 2017). Abandoned, lost or otherwise discarded fishing gear represents high volumes of waste in the oceans and has a large impact on habitats and living organisms (UNEP 2016). One particular problem arising from abandoned, lost or otherwise discarded fishing gear is ghost fishing, where abandoned nets and traps still catch fish and shellfish (UNEP 2016). Ghost fishing negatively impacts marine ecosystems by increasing the pressure on commercial stocks (UNEP 2016) and interfering with harvest strategies and conservation measures (Gilman et al. 2013). Thus, ghost fishing not only has a negative effect on the ecosystem, but also on economic and social aspects.

Fishing vessels are one of the main sources for marine litter and therefore mitigation measures, such as waste reduction or storage facilities, should be installed on board. Generally, it is important that fishing vessels comply with the International Convention for the Prevention of Pollution from Ships (MARPOL), concluded by the International Maritime Organization (IMO) in 1973 (IMO 2018a). MARPOL urges all ships longer than 12 metres to display placards concerning discharge requirements and there has to be a garbage management plan and a garbage record book in place on ships with 100 and 400 gross tonnage, respectively (IMO 2018c). To reduce the risk of losing fishing gear it is necessary to avoid unwanted gear contact with the seabed and to have technologies on board to track the gear position (FAO 2016a). Another opportunity is the use of biodegradable material for fishing gear instead of plastic (Gilman 2015).

Overall, it is important to prevent waste and to ensure that there are enough measures on board of the vessels to deal with accruing waste. Participating in regional or international programmes, such as the 'Fishing for Litter' initiative by KIMO International in northwest Europe, (KIMO 2018) also provide opportunities to tackle marine pollution. This program

Table 1 Overview of SDG 14 and its seven targets (United Nations nd.-b) showing associated international agreements (binding and non-binding)

SDG 14 targest (United Nations nd.-b)	International agreements relevant for the targets
14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular for land-based activities, including marine debris and nutrient pollution	MARPOL, London Convention, Honolulu Convention, Basel Convention, UNCLOS
14.2: By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	UNFSA, FAO Code of Conduct, UNCLOS
14.3: Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	MARPOL, UNFCCC, Manado Ocean Declaration, Paris Agreement for Climate Change
14.4: By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	UNCLOS, UNFSA, FAO Code of Conduct, CBD, Aichi Targets, CITES, FAO Port State Ageement
14.5: By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	IUCN, Aichi Targets, CPUCH
14.6: By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing countries should be an integral part of the World Trade Organization fisheries subsidies negotiation	WTO
14.7: By 2030, increase the economic benefits to Small Island developing States and least developed countries form the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	

MARPOL International Convention for the Prevention of Pollution from Ships, *UNCLOS* United Nations Convention on the Law of the Sea, *UNFSA* United Nations Fish Stock Agreement, *UNFCCC* United Nations Framework Convention on Climate Change, *CBD* Convention on Biological Diversity, *CPUCH* Convention on the Protection of the Underwater Cultural Heritage

equipped fishing fleets with garbage bags to store the waste from commercial fishing activities and provides cost-free disposal opportunities (UNEP 2016). Such initiatives are model mitigation strategies and can be readily replicated (Borrelle et al. 2017). Another initiative worth mentioning is the Global Ghost Gear Initiative, which engages with the problem of ghost fishing gear at the global scale in cooperation with several stakeholders, for example the private sector, non-governmental organizations or governments (Global Ghost Gear Initiative 2018). The Global Ghost Gear Initiative undertakes and supports many different projects, such as collection of ghost gear in different areas, selling old gear to companies, which use the plastic as raw material, or holding workshops on ghost gears and providing removal trainings (Global Ghost Gear Initiative 2018).

Target 14.2: Sustainable management

The aim of target 14.2 is to sustainably manage and protect marine and coastal ecosystems, strengthening their resilience, mitigate negative impacts and take action to achieve healthy and productive oceans (United Nations 2018b). Achieving this goal depends on management arrangements that take all human activities into account. However, almost all activities are managed by separate organizations, resulting in highly fragmented ocean management (Blanchard 2017; Gjerde et al. 2008; Haward and Vince 2008).

Moreover, new activities, such as bioprospecting (Rayfuse and Warner 2008) have increased in the last 15 years (Blasiak et al. 2018) and may contribute to further fragmentation. Bioprospecting in EEZs is guided by state commitments to the Nagoya Protocol, under the Convention for Biological Diversity, however no similar arrangements exist for the high seas (Blasiak et al. 2018). This gap is also addressed by current negotiations for an international legally binding instrument for biodiversity beyond national jurisdictions, which may have the potential to provide some regulations for bioprospecting at the high seas (Tiller et al. 2019).

An important part of ocean management is the management of marine resources. These resources are mostly managed by a single species approach, which does not take into account interspecies relationships, ecosystem dynamics and habitat impacts resulting in overfishing, habitat destruction and changes in the marine community (Pikitch et al. 2004) and can be considered a "flawed conceptual model" (Hughes et al. 2005). One possibility to achieve comprehensive management, not only for fisheries activities, is ecosystem-based management (EBM). In contrast to the single species approach, ecological, social, and economic aspects are integrated in EBM (Long et al. 2016). EBM is currently accepted as the best strategy to manage complex marine ecosystems and to consider different activities (Cormier et al. 2017; Link and Browman 2017; Sardà et al. 2014; Walther and Möllmann 2014). Despite these advantages, the implementation of EBM has been slow, largely due to complexity and lack of guidance (Link and Browman 2014, 2017).

Implementing EBM is a long-term overarching goal, which has to be addressed at several levels. The fishing industry could participate in discussions and in the decision making process regarding EBM and provide valuable input (Long et al. 2016). Another opportunity to engage with this goal is to address fisheries impacts such as habitat destruction or bycatch. For example, the company SANFORD is an investor and shareholder in Precision Seafood Harvesting and along with Aotearoa Fisheries and Sealord they are investing into a project which produces a special harvesting system to minimise the pressure on the marine ecosystem (SANFORD 2018d). SANFORD is also using SLEDs, solid stainless grids inserted into the trawl net, that allows sea lions to escape and collaborates with other organisations concerning the management and protection of indigenous species (SANFORD 2018a). Seabirds are also impacted by fishing activities, and the company Sealord is one of the founding members of the Southern Seabird Solutions Trust (SEALORD 2018), which works with fishers to reduce the impact of fishing on seabirds (Sothern Seabird Solutions 2018). Generally, environmental stewardship by fishing companies will be important to restore marine ecosystem and reduce overfishing (Hughes et al. 2005).

Target 14.3: Ocean acidification

Increasing CO_2 uptake in the ocean leads to changes in its chemistry and seawater becomes more acidic (Orr et al. 2005). Target 14.3 addresses ocean acidification (OA), through enhanced scientific cooperation at all levels (United Nations 2018b). The impact of OA affects the ecosystem directly, but also indirectly through exacerbating the impact of ocean warming (Fernandes et al. 2017; Nagelkerken and Connell 2015). Thus, it is necessary to see OA and warming as connected, instead of two separate topics. In general, the impact of OA on the marine ecosystem is still not clear and it is considered that adult fish are less vulnerable than juveniles, which could result in changes in the food web (Heinrich and Krause 2017). It is uncertain how strong these changes are, and some studies observed the capacity of species to adapt to increasing OA, especially in combination with warming (Calosi et al. 2017; Schlüter et al. 2014). However, it is agreed that OA is a serious threat to the marine ecosystem and besides the SDGs, no other international treaty yet addresses this problem (Herr et al. 2014). One of the main sources for OA are greenhouse gas (GHG) emissions and therefore to address OA it is necessary to reduce GHG emissions.

All the different stages of fish processing contribute to GHG emissions, with fish capture showing one of the highest amounts (Farmery et al. 2015). The fishing industry uses 1.2% of global oil consumption, resulting in 130 million tonnes of CO_2 emissions (Tyedmers et al. 2005), however in comparison with agriculture and livestock the emission rate from fish production is quite low (Parker et al. 2018). Other significant GHG drivers in the capture industry are electricity and refrigerator gas leakage from the cooling chamber on boats (Denham et al. 2016). As demand for fish

increases it will be accompanied by an increasing demand for energy in the fishing industries (IPCC 2018), especially if species shift or extend their range and fisherman have to travel further to find them (Hobday and Pecl 2014).

The fishing industry can contribute to OA mitigation, for example via reduction of GHG emissions. In 2018 the IMO adopted under Annex VI of MARPOL mandatory measures to reduce GHG emissions from international shipping and make them more energy efficient (IMO 2018b, d). Simple methods, such as maintenance of refrigerators, a hotspot source of GHG, or technological modification and input substitutions can reduce emissions by almost 11% (Denham et al. 2016). The fishing company Maruha Nichiro addressed this problem by changing all their non-CFC freezers to freezers which use natural coolants and have a lower global warming potential (Maruha Nichiro 2018). Further reduction possibilities include more efficient engines, biofuels, alternative energies, vessel design and technology, fishing tactics and techniques (Guillen et al. 2016), or speed reduction (Crist 2009).

Other examples regarding this target include the fishing company SANFORD, which is collecting data and information on GHG emissions and also participated on international programmes for OA (SANFORD 2018b). Or the Thai Union which signed a memorandum of understanding with the Thailand Greenhouse Gas Management Organizations to develop GHG emissions monitoring and reporting guidelines (ThaiUnion 2017a). Also, the fishing company Austral Fisheries has been certified as carbon neutral under the Australian Government's Carbon Neutral Program. To achieve this they offset their CO_2 emissions by planting around 220,000 trees in the eastern wheat belt area of Western Australia annually and also aim to implement GHG reduction measures (Austral Fisheries 2017). Generally, planting trees to offset carbon from other activities is a common method to reduce CO_2 (Trexler 1991). Fishing companies can deal with GHG emissions in different ways and may be role models for other companies to start engaging with GHG emissions. Reduced GHG emissions will not only help to achieve target 14.3, but also SDG 13, climate actions, and the 2015 Paris Agreement on climate change, which has the goal to reduce GHG emission worldwide and to limit human induced climate change to between 1.5 and 2 °C (United Nations Framework Convention on Climate Change 2018).

Target 14.4: Sustainable fisheries

Target 14.4 addresses the important issue of overfishing, along with ending illegal, unreported and unregulated (IUU) fishing, destructive fishing practices and the implementation of science-based management plans (United Nations 2018b). Between 1950 and 2010 more than 322 million tonnes of potential global catch was lost through overfishing, amounting to lost revenue of US$298 billion (Ding et al. 2017). This is particularly problematic in the Northeast and Northwest Atlantic, and Northwest Pacific Ocean, where more than half of the fish stocks are considered to be overfished (Ding et al. 2017). Moreover, overfishing has major implications for marine ecosystems, since it can lead to changes in the food web (Pauly et al. 1998) resulting in whole ecosystem changes (Conversi et al. 2010). IUU fishing contributes to overfishing and threatens marine ecosystems and the services they provide (Ortuño Crespo and Dunn 2017). It also interferes with management measurements and undermines willingness to comply (Lindley and Techera 2017). However, IUU fishing is not only linked to destructive fishing practices, but also to transnational and organized crime, particularly trafficking of weapons, drugs and people (Lindley and Techera 2017). Furthermore, marine debris (target 14.1), particularly lost fishing gear is also more of a problem for IUU fishing (Edyvane and Penny 2017). IUU fishing is hampered by widespread problems of poor monitoring control and surveillance systems, ineffective management and subsidies (Gjerde 2006; Le Gallic and Cox 2006). Countries with weak patrol surveillance and monitoring, control and surveillance capacity show higher engagement with IUU fishing (Petrossian 2015). Thus, to reduce overfishing, management methods have to be updated, but also the complex social problem of IUU fishing has to be addressed and mitigated.

To ensure sustainable fishing practices, it is useful to have monitoring systems on board, which help to assess compliance with management measures and also give information about the status of fish stocks and ecosystems. These collected data can support management organizations to enhance the quality and accuracy of the management advice (Environmental

Defense Fund et al. 2018) and would support the implementation of EBM as a management tool (Pikitch et al. 2004). Furthermore, the use of monitoring technologies such as electronic reporting and video monitoring of the catch increases traceability and transparency (Environmental Defense Fund et al. 2018), which are important parts of sustainable fisheries. Examples of fishing companies using these tools are SANFORD, which installed an integrated video monitoring system on 70 vessels (SANFORD 2018c) and Thai Union Group, which also implemented the former mentioned measures (ThaiUnion 2017b).

Traceability and transparency are also core components in many fishery certification schemes, for example the Marine Stewardship Council or the certification by the Australian Department of Environment. Fishery certification schemes or eco-labelling are a good way to raise public awareness and support a sustainable fishery (Potts and Haward 2007). Eco-labelling guides customers to buy environmentally-friendly products, whereas fisheries benefit through public recognition and a potentially higher price (Wakamatsu and Wakamatsu 2017). Besides ecological issues, fishery certifications are a good platform to address human rights, ensure legally earned incomes (van Holt et al. 2016), which would also reduce incentives to engage in IUU fishing activities. Similar to certification schemes are national reporting programs, which assess fisheries according to their sustainability. One example is the Healthcheck for Australian Fisheries, which has the goal to collect available information about the sustainability of fisheries and inform fisheries managers and other stakeholders concerning their strengths and weaknesses (Hobday et al. 2015).

Fishing companies also have the opportunity to play an active role in combatting IUU fishing. The fishing company Austral Fisheries has invested a lot of effort to reduce IUU fishing, for example, via surveillance, private investigators and consultants (Österblom and Sumaila 2011). Furthermore, fish harvesters can collaborate with other seafood businesses implementing risk-based traceability systems that can detect products which are caught illegally (Environmental Defense Fund et al. 2018). One example of such a collaboration is the Coalition of Legal Toothfish Operators (COLTO) which was founded by Austral fisheries and other companies in the year 2013 (Österblom and Sumaila 2011) and covers around 85% of the world's toothfish catch (COLTO 2015). Compliance is ensured through 'social licence' (Kelly et al. 2017) and COLTO played an important role in convincing the politics to develop management measures for non-compliance (Österblom and Sumaila 2011). COLTO, together with the Australian Fisheries Management Authority and the Australian Antarctic Division were among the top four most important organizations in combating IUU fishing in the Southern Ocean (Österblom and Bodin 2012), thus, it is a great example of the impact of industry-based initiatives. IUU fishing is also addressed by the International Seafood Sustainability Foundation (ISSF) (ISSF 2018) that brings together fishing companies and environmental groups. These two initiatives provide great opportunities for fishing companies to engage in ensuring sustainable harvest (Stockholm Resilience Centre 2018b). Another initiative, SeaBOS, which not only addresses IUU fishing, but also transparency and traceability in global seafood or governments and the improvement of regulations, provides a great example for the cooperation between seafood companies and science (Stockholm Resilience Centre 2018a).

Reducing overfishing and IUU fishing is a prerequisite to achieve target 14.2 sustainable management and the restoration of the marine ecosystem. Addressing IUU fishing will not only benefit marine ecosystems, but has also the potential to reduce illegal labour practices (addressed by SDG 8.7 and 16.2), increase access to education (SDG 4.1 and 4.3), reduce malnutrition (SDG 2.1 and 2.2) and preserve biological and cultural heritage (SDG 11.4) (Singh et al. 2017).

Target 14.5: Conservation

The aim of this target is to conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific advice (United Nations 2018b). Marine protected areas (MPAs) are an important tool in the conservation of biodiversity (Kelleher and Phillips 1999; Kelleher and Kenchington 1992). The importance of MPAs has increased in recent years, resulting in a rush to establish MPAs, but often ended in so called "paper parks" with insufficient design, management, or enforcement (White and Courtney 2004). Thus many MPAs have not fulfilled their potential,

due to ignoring local livelihoods and incorporating little community involvement in management, as well as insufficient no-take areas, and little to combat IUU fishing (Le Blanc et al. 2017; Rife et al. 2012). Furthermore, there is a discrepancy between protected areas and areas which need protection. Areas with high fish biodiversity, ecosystem services and human impacts, are mostly not protected (Lindegren et al. 2018). At the moment only 4.1% of the high seas and 10% of coastal and marine areas under national jurisdiction are protected (UNEP-WCMEC and IUCN 2016), to which only 1.6% are no-take zones (Sala and Giakoumi 2017). There is a need to enhance the effectiveness of MPAs and implement them as a conservation tool in the management of marine ecosystems. It is important to seek engagement with the harvest industry to increase the support and acceptance of MPAs (Kincaid et al. 2017; McClanahan et al. 2005, 2014; Voyer and Gladstone 2017).

The most common problem concerning MPAs is low compliance, which is often linked to poorly implemented frameworks, and can be increased through taking stakeholder perspectives into account (Selig et al. 2016). Fisheries knowledge plays an important role in decision-making and recently information on social and economic aspects has an increasing role, which can be provided by fishery participants (Stephenson et al. 2016). In some places the fishing industry also plays an active role in establishing MPAs, such as in the Southern Indian Ocean. The Southern Indian Ocean Deepsea Fisheries Association (SIODFA) was founded by several fishing companies and has established five benthic protected areas in 2018 (Austral Fisheries 2018). These protected areas are part of a bigger network of areas, which were voluntarily closed by SIODFA members in 2006 (Austral Fisheries 2018).

There are always positive and negative connections between the targets and the other goals. In this case, 14.5 is negatively linked with SDG 1 (no poverty), SDG 10 (reduced inequalities) and SDG 16 (peace, justice and strong institutions) (Singh et al. 2017). However, experts underlined that these trade-offs can be avoided through consultation and fair implementations (Singh et al. 2017).

Target 14.6: Subsidies

Subsidies are financial contributions from the public sector which are granted to private beneficiaries in the fisheries sector and are part of the problem concerning overfishing (World Bank 2009) and fleet overcapacity (Clark et al. 2005). Target 14.6 aims to prohibit subsidies which contribute to these problems (United Nations 2018b). Subsidized overcapacity can cause long-term damage and has a direct impact on the productivity of the marine ecosystem (Da-Rocha et al. 2017). Sumaila et al. (2016b) estimated that in 2009, states spent US$35 billion on subsidies and capacity-enhancing subsidies had the greatest share in developed and developing countries. Compared to other countries, Japan spent the most money on subsidies followed by China (Sumaila et al. 2016b). After countries became aware of the problem of overcapacity, they tried to reduce their fleets by buying ships back. However, it turned out that buyback programs are not the solution and even exacerbated the problem, due to increased incentives of profits (Ye et al. 2013).

The aim of 14.6 is to stop negative subsidies in the fisheries sector, however this is linked with social and political difficulties (Cisneros-Montemayor et al. 2016). Reducing subsidies is also negatively linked with other SDGs such as SDG 8 (decent work and economic growth) (Singh et al. 2017). Addressing this issue may need careful attention, for example ensuring funding for income supplementation and transition activities that would reduce short-term losses (Cisneros-Montemayor et al. 2016). The model of Da-Rocha et al. (2017) showed that eliminating subsidies resulted in lower social costs than previously expected. Methods to reduce the number of vessels include for example, diversification or controlled days at sea. Diversification is a common approach and it is important that the governance reduce constraints which hamper exits from fishing (Morgan 2017). Unlike the other targets, this is the only one where no current engagement opportunities or examples were found. This might be through the political nature of this target, aimed at higher levels of decision-making.

Target 14.7: Small island developing states (SIDS) and less developed countries (LDCs)

Increased benefits, through sustainable use of marine resources and sustainable management, for small

island developing states (SIDS) and less developed countries (LDCs), is addressed by target 14.7 (United Nations 2018b). Marine resources play an important role in almost all countries, however, particularly for SIDS and LDCs. These countries rely on fish as an essential part of their daily diet and as a contribution to the economic welfare of whole communities (Ye et al. 2013). However, governance systems in SIDS and LDCs are mostly weak and favour overfishing and ecosystem degradation (Smith et al. 2010). Overfishing of high valued species, such as tuna, have an enormous impact on trade. SIDS and LDCs mostly export high-valued seafood and import low-valued seafood, which give them the opportunity to purchase necessary goods and services (Smith et al. 2010). Through their dependence on marine resources, SIDS and LDCs are particularly vulnerable to food shortages because of overfishing.

Most of the fishing companies engage via developing programmes from their country with SIDS. Examples of such programmes are the aid programme of the Australian Government's Department of Foreign Affairs (Australian Government 2018) or the Fish for Development programme launched by the Norwegian Ministry of Foreign Affairs (Norwegian Ministry of Foreign Affairs 2018).

Increasing the economic benefits to SIDS and LDCs will strongly rely on the successful implementation of the other six targets of SDG 14, for example sustainable management, and fisheries are necessary to help maintain the livelihood of SIDS and LDCs. This target is the only one which is related to all other SDGs (Singh et al. 2017). Generally, developing the SDGs and their operational indicators has been a significant achievement. As important, and arguably more challenging is consideration of monitoring and assessing performance of these indicators. The challenge of providing standardised and repeatable performance measures from agreed indicators is common to all such tools. SDG 14 indicators are to be assessed and tested in a wider range of circumstances and at different scales of fishery governance and management—from single-species fisheries management to management of multi-species assemblages; from centralized fishery management systems to community and stakeholder led co-management approaches; from small scale to large scale fisheries.

There are likely to be significant barriers to successfully meeting the SDG 14 indicators. Most fisheries agencies in developing countries face challenges in managing their fisheries, managing economic development and imperatives for social and community benefit. Implementing SDG 14 will require considerable capacity in such situations, fisheries agencies and stakeholders. This will be extremely important for government, industry and communities that have responsibility and authority for effective governance.

Discussion and conclusions

SDG 14 aims to conserve and use the oceans, seas and marine ecosystem in a sustainable way. To achieve this, all marine stakeholders have to contribute to the different targets of SDG 14. The fishing industry, especially the commercial sector, can play a key role in achieving the seven targets. This industry has large economic significance and may act as a wider example in raising awareness of implementation process for the SDGs. The aim of this paper was to present different opportunities for large-scale commercial fishing sector to engage with the different targets of SDG 14. Most of the engagement possibilities were found for the first four targets: marine pollution, sustainable management, ocean acidification, and sustainable fishing. Engagement was more difficult for the reduction of fisheries subsidies in target 14.6. There are already some industry relevant international agreements in place, which can help meet some of these targets, such as MARPOL, which deals with the prevention of pollution from ships. Industry compliance with such agreements can help to achieve the different SDG targets. The main fishing industry engagement opportunities can be summarized as information and data, engagement and participation, and policy and management strategies (Fig. 1).

Information and data measures help to prevent, mitigate, or compensate certain impacts. For example, vessels have the opportunity to adopt a zero-waste strategy, use different bycatch prevention measures, or apply measures which help to reduce GHG emissions. A GHG compensation measurement was demonstrated by Austral fisheries, which offset their whole carbon emissions via an offset strategy of planting trees. Fishing companies' engagement and participation strategies can center on programs, such as the Global Ghost Gear Initiative, COLTO, Southern

	Information-data	Engagement-participation	Policy-management-
14.1	waste reduction, storage facilities, gear tracking device	Global Ghost Gear Initiative	compliance with MARPOL
14.2	bycatch mitigation measures e.g. SLEDS	non-governmental groups e.g. Southern Seabird Solustions Trust	participation in discussions and decision-making progress
14.3	GHG emission reduction e.g. maintenance of refrigerators	scientific programs	
14.4	monitoring technologies e.g. VMS	e.g. COLTO, ISSF fishery certification and reporting programmes	
14.5		international associations e.g. SIODFA	participation in discussions and decision-making progress
14.6			
14.7		engaging with developing programmes	

Fig. 1 Engagement opportunities for the large-scale commercial fishing industry with the seven primary targets of SDG 14

Seabird Solutions Trust, ISSF, SIODFA, or scientific programs for ocean acidification, and in certification and reporting programs. Lastly, policy and management strategies were mainly relevant for target 14.2 and 14.5 and describe the active industry engagement in policy and management fora to provide industry opinions and fisheries knowledge-based input.

Each of these seven targets are linked with each other and at least one target is a prerequisite for another one (for example, target 14.7 highly depends on the achievement of targets 14.2 and 14.4). Target 14.7, SIDS and LDCs, shows especially high connection with the other targets, but also with all the other SDGs. As many of these targets are not only linked with each other, but also linked with many of the other SDGs, SDG 14 is one of the key goals. There are a few cases where negative trade-offs were observed, however, these are less certain and might be preventable.

In summary, the fishing industry has many options to engage with SDG 14 and there are already specific examples demonstrating that some companies are already working on key areas. However, more work is needed to provide reporting mechanisms to assess the progress of fisheries companies against the SDGs and their monitor progress in this regard. Furthermore, the fishing industry is only one key actor in the marine environment and it is necessary that other sectors, such as mining or shipping, to similarly engage with the SDGs.

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Factors influencing the performance of regional fisheries management organizations

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ABSTRACT

A key challenge for humanity is to conserve and sustainably use the earth's oceans and marine resources as millions of people rely on fish for food, income, and well-being. Regional fisheries management organizations (RFMOs) are key players in international fisheries management. However, despite their importance, the ability of these institutions to manage fisheries in a sustainable way and to prevent overfishing has often been questioned. This article aims to provide an overview of issues which impact the RFMOs performance. We conducted an extensive literature review to summarize issues which were mentioned in the peer-reviewed literature. Moreover, we also discuss the impact of new international agreements and processes, such as the Sustainable Development Goals and the currently negotiated agreement for biodiversity beyond national jurisdiction, due to the overlap of themes such as biodiversity protection and sustainable fisheries management. We identified 17 issues which were mentioned in the literature, with the most frequent ones being precautionary and ecosystem approach and decision-making. RFMOs are slowly making progress regarding these issues and some organizations are already applying good practices. This highlights the importance of RFMOs to learn from each other. While the agreement for biodiversity beyond national jurisdiction might potentially impact RFMOs and speed up to the process of applying best practices, the sustainable development goals are less likely to influence RFMOs.

1. Introduction

Marine resources play an important role in the livelihood of millions of people and the economic revenue of the fisheries sector is vital for many countries [1,2]. With a growing global population, the demand for fish continues to rise and 33.1% of all fished species are already considered to be overfished [1]. Almost 6% of the global fish catch in 2014 came from high seas areas [3], which lie outside national jurisdiction and comprise more than 60% of the ocean's surface [4–6]. Until the entry into force of the United Nations Law of the Sea (UNCLOS) in 1994, high seas areas were dominated by a freedom of states to fish [7]. While UNCLOS maintained a commitment to the freedom of high seas fishing [8, Article 116], this was linked to a concurrent obligation of states to cooperate and conserve resources of the high seas. UNCLOS indicates that "states shall cooperate with each other in the conservation and management of living resources in the areas of the high seas […] and shall enter into negotiations with a view to taking the measures necessary for the conservation of the living resources concerned" [8, Article 118]. Thus, UNCLOS provides the foundation for the establishment of Regional Fisheries Management Organizations (RFMOs)[1] (Table 1), which are formed to manage international fisheries.

In 2001, the United Nations Fish Stocks Agreement (UNFSA) entered into force. The UNFSA is a key agreement in fisheries governance and is directly linked to UNCLOS. UNFSA aims to conserve and to manage straddling fish stocks and highly migratory fish species [9, Article 2]. In the UNFSA, Article 8 contains an obligation for states to cooperate with each other directly or through sub-regional or regional fisheries management organizations [9]. Moreover, the UNFSA lays an important foundation for the application of conservation principles by states, such as the use of the precautionary approach [9, Article 6]. The UNFSA

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[1] We recognize that there are differences in the mandate, organization, focus and legal base of the organizations, but note that the acronym RFMO has become standard usage for what are diverse organizations.

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Table 1
Regional Fisheries Management Organizations (Year of entry into force, acronyms, and full names in alphabetic order).

General RFMOs		
1952	GFCM	General Fisheries Commission for the Mediterranean
1982	CCAMLR[a]	Commission for the Conservation of Antarctic Marine Living Resources
1979	NAFO[b]	Northwest Atlantic Fisheries Organization
1982	NEAFC[c]	North East Atlantic Fisheries Commission
2015	NPFC	North Pacific Fisheries Commission
2004	SEAFO	South East Atlantic Fisheries Organization
2012	SIOFA	South Indian Ocean Fisheries Agreement
2012	SPRFMO	South Pacific Regional Fisheries Management Organization
Tuna RFMOs		
1994	CCSBT	Commission for the Conservation of Southern Bluefin Tuna
1949	IATTC	Inter-American Tropical Tuna Commission
1969	ICCAT	International Commission for the Conservation of Atlantic Tunas
1998	IOTC	Indian Ocean Tuna Commission
2004	WCPFC	Western and Central Pacific Fisheries Commission

[a] This article considers the fisheries management responsibilities of CCAMLR and, therefore, has included it in the analysis (see following).
[b] NAFO was preceded by the International Commission for the Northwest Atlantic Fisheries (ICNAF – 1949-1970).
[c] NEAFC was preceded by the 1959 North-East Atlantic Fisheries Convention.

reinforced the role of RFMOs [9, Article 10] and strengthened them.

The first RFMO was the Inter-American Tropical Tuna Commission (IATTC), which was established in 1949[2] (Table 1). Today there are 13 RFMOs, which have the ability to produce measures (i.e. relating to the mandate of RFMOs) which are legally binding upon their member states and which manage fisheries in high seas areas. Included in the 13 RFMOs is CCAMLR, which is not a typical RFMO but a conservation organization with fisheries responsibilities [10].[3] Generally, RFMOs might be viewed as important institutions that exist at the interface between the goals of global agreements (such as UNCLOS) and the particular fishing and other interests of various countries [11]. Each RFMO manages a specific geographical area and/or species, summarized in Fig. 1. RFMOs can be generally divided into those which manage non-highly migratory and straddling species, and the five tuna RFMOs, which manage tuna and tuna-like species.

The aim of this article is to summarize the existing literature concerning the performance of RMFOs. Despite their important role in fisheries management, these institutions face many challenges and are criticized as weak and ineffective [12,13]. To investigate which actual issues RFMOs face, an extensive literature review of scientific papers on the performance of RFMOs was carried out. We identified 17 key issues which impact the overall performance of RFMOs, with the five most frequent issues being precautionary and ecosystem approach, decision-making, members, transparency and scientific advice and data. Furthermore, we also discussed the RFMOs ability to deal with international environmental instruments, such as the United Nations Sustainable Development Goals (SDGs) and the Agreement on Biodiversity Beyond National Jurisdiction (BBNJ). This article summarized the existing literature and highlights best practice examples for several issues, supporting RFMOs to speed up their progress.

The article proceeds as follows. The first section briefly describes the structure of RFMOs. The second section explains the way the literature review has been conducted. The third section presents the results of the literature review and discusses the five most frequent issues in more detail. This is followed by a discussion of the impact of two international governance arrangements, one current and the other emerging (i.e. the United Nations Sustainable Development Goals and negotiations on an agreement for Biodiversity Beyond National Jurisdiction) and their likely influence upon RFMOs. The two final sections combine discussion of all these areas and conclusion.

2. Structure of RFMOs

The Food and Agriculture Organization (FAO [14]) describes RFMOs as regional fisheries bodies, which provide a mechanism for states to cooperate and to work together, with the ability to enforce legally binding measures on their members [14]. The RFMOs typically have a Commission, a scientific committee and various subsidiary bodies such as a technical compliance committee and a secretariat body. The Commission consists of the member states and has the task of making decisions to manage the fish stocks under their responsibility. The scientific committee provides the Commission with scientific advice on several issues of relevance to the RFMO, for example, the status of fish stocks and the ecosystem. Generally, there are three models of scientific committees identified [15]. One of the most common models, used for example in the IOTC, ICCAT, CCSBT, NAFO, GFCM and CCAMLR, is the "national scientist model", where the advice for the scientific committee is provided by scientists of member countries, who normally meet once a year for a few weeks [15]. Some RFMOs have established a sub-committee which complete stock assessments (e.g. CCSBT, CCAMLR, GFCM) [15]. Other RFMOs have scientists permanently employed ("scientific staff model", IATTC) or have an independent organization which provides the RFMOs with scientific advice ("independent scientist model" such as the WCPFC, NEAFC) [15]. Thus, even though the structure of all the RFMOs is quite similar, the differences in management areas and/or species, make each RFMO unique.

3. Methods

To gain a comprehensive understanding of the existing literature, we performed a scoping exercise using the keywords 'regional fisheries management organizations' and 'RFMO' to search the two databases 'Scopus' and 'google.scholar' for peer-reviewed literature. The search in 'Scopus' found 231 articles for the term 'regional fisheries management organizations' and 76 articles for the term 'RFMO', which used those respective terms either in the title, abstract or as a keyword. Since the search in 'google.scholar' resulted in 1870 entries, we limited the queries to the title, resulting in 23 results for 'regional fisheries management organization' and 35 for 'RFMO'. We then excluded papers which have not studied the performance of RFMOs in general or for a certain topic, reducing the number of papers to 34 (Fig. 2). These papers were examined, and we listed all the issues which were stated as impacting the RMFOs performance (see Appendix 1).

Some papers examined the overall performance of RFMOs [e.g. 12, 16], while other papers addressed a particular issue such as the precautionary approach and ecosystem approach for fisheries management [e.g. 17], decision-making [e.g. 18, 19] or transparency [20]. However, even when a paper specialised on one particular issue, they mostly mentioned other issues which influence the RFMOs performance. Most of the papers have analysed all RFMOs (19) and only a few specialised on only tuna RFMOs (5), general RFMOs (3), or case studies (8).

4. Results

We found 17 issues, which were highlighted in the papers as being important for the RFMOs performance. Most of the authors mentioned the need for a precautionary and ecosystem approach for fisheries management, including topics, such as the implementation of vulnerable marine ecosystems (VMEs) or fisheries bycatch, and the impact of decision making (18) (Fig. 3). These two issues were followed by the

[2] The predecessor of NAFO was also established in 1949.
[3] CCAMLR has been described as 'a conservation body with the attributes of a regional fisheries management organization", see *Report of the Commission for the Convention on the Conservation of Antarctic Marine Living Resources CCAMLR-XXI* 2002 para 15.2: 88.

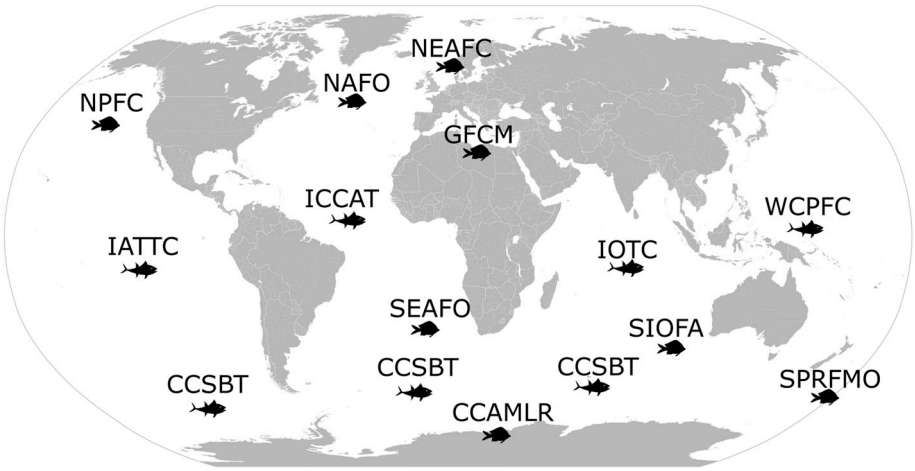

Fig. 1. Overview of RFMOs. Geographical distribution of non-tuna RFMOs (🐟) and tuna RFMOs (🐟).

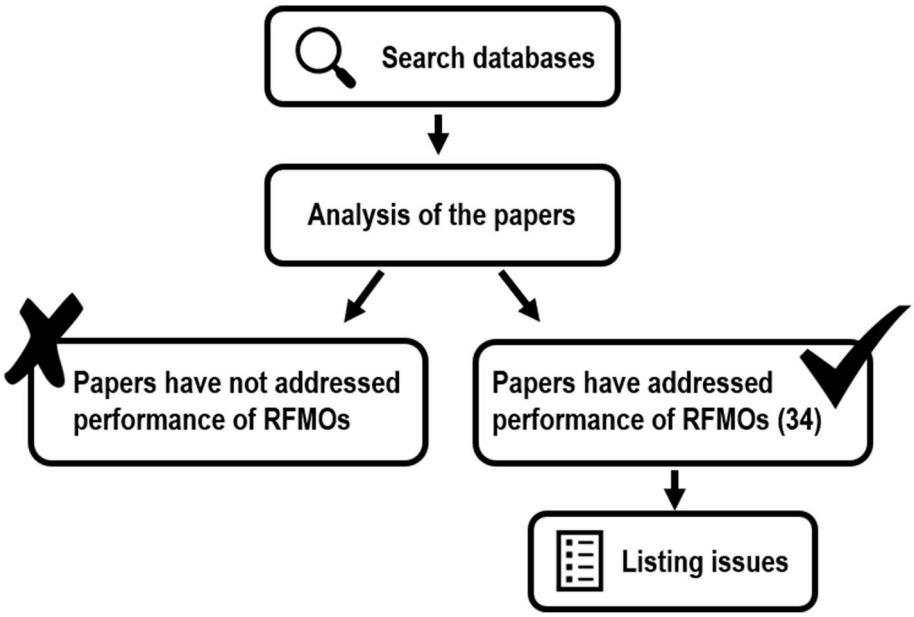

Fig. 2. Summary of steps taken to conduct the literature review.

impact of members, the need for transparency and the need to follow the scientific advice and collect data (9). Other issues which were mentioned were, for example, the need to cooperate (5), lack of political will (4), overcapacity (3), clearer management objectives (1) or transhipment (1). It is important to note that this list is not exhaustive, but only mirrors themes which were described in the peer-reviewed literature.

Most of these issues influence each other and for example, decision making was frequently mentioned as hindering the application of the precautionary approach [e.g. 17, 21, 22] or makes it difficult to establish sound regulations for transhipment at sea [23]. Moreover, aspects such as the precautionary and ecosystem approach or transparency can only be achieved when members agree, support the proposals for conservation and management measures and follow the scientific advice. Generally, all the identified issues are influencing each other. The next sections will describe the five most frequently occurring issues in more detail.

4.1. *Precautionary & ecosystem approach*

The precautionary and ecosystem approach to fisheries management are important components of modern fisheries management. Many articles highlight the role of the precautionary and ecosystem approach in the RFMO's management [13,15–18,22,24–26]. The two most important instruments in this regard are the UNFSA (a binding agreement) and the FAO Code of Conduct (a voluntary instrument), which task RFMOs to manage fisheries in a sustainable way and to take a precautionary and ecosystem approach to fisheries management [9,27]. RFMOs which have entered into force after the negotiation of UNFSA often include the precautionary and ecosystem approach in their convention texts, for example, SPRFMO and NPFC [24,25]. The conventions of older RFMOs are often incompatible with the UNFSA, as they lack important features such as the precautionary approach or ecosystem considerations [22]. However, some of these RFMOs, such as the IATTC and GFCM, have adapted to new environmental norms, such as long-term sustainability of fisheries and ecosystems, and re-established their convention to address areas such as the precautionary approach or ecosystem-based approach [28,29].

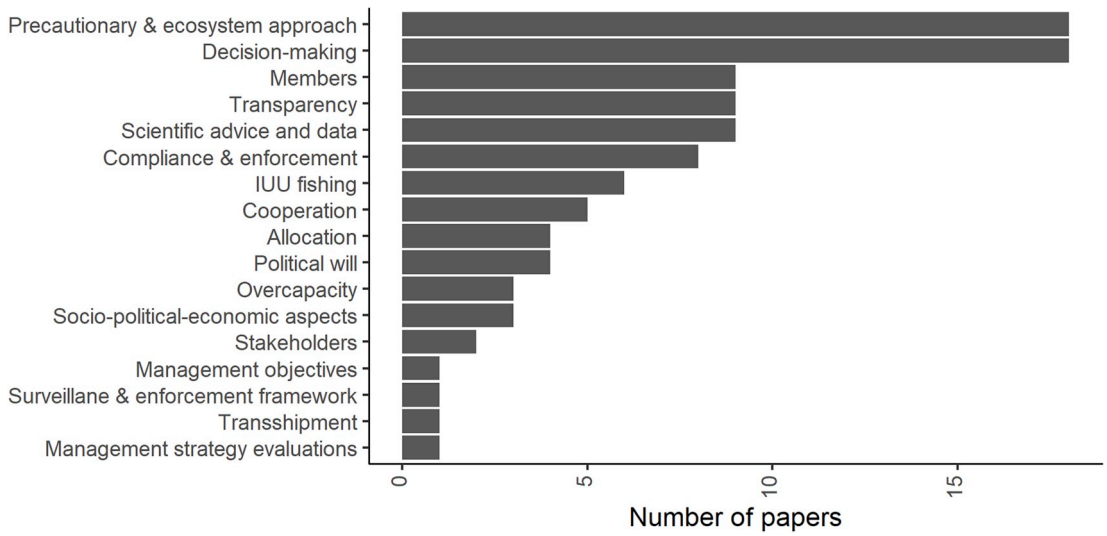

Fig. 3. Summary of identified issues.

Another way for RFMOs to modernize their approach, without adopting a new convention, is by interpreting their treaties in a different way. A good example is the WCPFC, which interpreted its treaty text as having the competence to adopt marine environmental protection measures, without having this specifically stated in the founding agreement [25]. It is important to note that even though WCPFC has been implemented after the enforcement of UNFSA, only the most recent organizations, such as SPRFMO and NPFC, have included the need to protect ecosystems in their treaty texts [25]. Many different factors are impacting treaty discussions, thus it is not possible to make a statement concerning the reasons why the WCPFC, as a modern RFMO, has no environmental protection provisions in its founding agreements.

The precautionary and ecosystem approach are an important aspect of sustainable management and RFMOs work hard to adapt their management. Juan-Jordá et al. [17] analysed the implementation of the ecosystem approach in tuna RFMOs and found that they made noticeable progress in integrating the ecosystem approach into their management. However, their study also found that even though these organizations have integrated the ecosystem approach, they have not done a good job. For example, most of the organizations did not have proper implementation plans in place and which are ad-hoc and short term [17]. Another study found similar results in the area of deep-sea bottom fishing, which showed that RFMOs made improvements, such as the increased implementation of several United Nations General Assembly resolutions on bottom trawling, but there are still issues which urgently need consideration [30]. Issues which need more work are, for example, the implementation of adequate impact assessments or cumulative impact assessments, or the lack of information on stock status for deep-sea species [30].

Many organizations have implemented area closures to protect vulnerable marine ecosystems, which are important components of the ecosystem approach. However, in many RFMOs the conservation aspects of those area closures are not fully implemented, no cumulative impact assessments are available and bottom fishing is still allowed [30]. RFMOs often use an approach of 'freezing the footprint', which means that areas get closed where no fishing occurs, to hinder vessels to start fishing in these areas [26]. Members often request more information before adopting closures, which is inconsistent with the precautionary approach, since it requires members to act on suspicion of potential impact without having all the information on the scale of this impact [26]. However, there are also positive examples which show that RFMOs can improve their conservation capacity. For example, NEAFC established a Memorandum of Understanding with OSPAR, the Convention for the Protection of the Marine Environment of the North-East Atlantic, to establish marine protected areas in the northeast Atlantic [26]. Another aspect of the ecosystem approach which has gained some attention is the area of bycatch. While many RFMOs have included assessments of seabirds, sea turtles, marine mammals and elasmobranchs, hardly any of the RFMOs has taken the broader marine ecosystem into account in their management approach [22]. Therefore, even though RFMOs have started to implement the precautionary and ecosystem approach to fisheries management, there is still much more work needed, especially in the area of broader ecosystem components such as vulnerable marine ecosystems or bycatch species.

4.2. Decision making

One of the most criticized aspects of RFMOs is the way the decision-making process works, especially the possibility to object against conservation and management measures [13,15–18,22,24,31,32]. The Commission makes decisions either based on a consensus, voting (simple majority, three quarters, or two-thirds majority), or a mixture of mandatory consensus and voting [15]. Organizations which make decisions by consensus are, CCAMLR, CCSBT, SEAFO, SIOFA, and IATTC, whereas ICCAT, GFCM, IOTC, NEAFC, NAFO, WCPFC and SPRFMO apply majority voting with the right to object [32].

The right to object and opt-out, which exempts members from the obligation to implement the agreed measure, is an important aspect of the decision-making process and one of the core problems of RFMOs. Consensus-based decision-making and the possibility to opt-out or not to agree are likely to result in the lowest common denominator agreement [33] and weak or ineffective measures which are not able to address the particular problem [15,18,31]. In the case of consensus decision-making, states can simply block the whole negotiation. Arguably, this makes the consensus-based model the least favourable, since it is harder to get members to agree on more progressive reforms [19]. While in other decision-making models such as majority, members can object against the established measures, it is still more likely that members are encouraged to seek fairer compromises. Even if a member is willing to take stronger measures, it mostly ends in measures which are weaker due to the need to reach an agreement [32].

Three organizations, the WCPFC, NAFO, and SPRFMO enhanced the opt-out procedure and made it more efficient, for example, they established a review panel which resolves the dispute in a transparent manner [32]. SPRFMO, in particular, which is one of the newest organizations, addressed this issue in a way which is considered to be 'best practice' [32]. SPRFMO parties have to explain in detail the reasons for their objections to the proposed measure [13] and have to implement

alternative measures that have the same effect as the decision that was the focus of the objection [34]. This procedure limits any kind of discrimination and ensures that decisions are consistent with UNCLOS and the SPRFMO convention. Over the years NAFO, NEAFC, IATTC, and GFCM revised their decision-making procedure, however, none followed the example of SPRFMO [32]. Generally, decision-making is slowly evolving, but many of the organizations are still resistant to implementing greater changes [32].

4.3. Members

RFMOs play an important role in managing fisheries, however, their role is highly influenced by their member countries [35–37] and often also by the lack of political will of members [18,31]. These countries bring different cultural and economic perspectives to the RFMO meetings. For example, the way countries manage their national fisheries also impacts their behaviour in international settings, such as RFMOs [21]. Some members are more led by their economic interests while other members apply a more conservationist approach, which can lead to tensions during the meeting process. Those different interests also play an important role in what members put forward during the Commission meetings and which topics get addressed or not.

RFMOs are also influenced by the economic diversity of their countries and their economic dependence on marine resources [36]. The performance of an RFMO with many developing countries as members and countries who are highly dependent on these resources is on average poorer compared to organizations with a lot of developed countries as members [36]. Most of the developing countries lack the capacity to implement the required measures [36]. The number of developing countries present in the RFMO also influences the way they address certain issues. For example, addressing overcapacity in convention areas often conflicts with the aspirations of developing countries to develop their fleets and often leads to tensions between developed and developing countries [38]. Especially, since one of the proposed solutions is to transfer vessel capacity from developed to developing countries [39]. Moreover, not only the composition of the member countries but also the number of countries involved influences RFMOs. This aspect is especially important for decision-making since it is harder to achieve consensus with more members, who have different economic interests [40].

4.4. Transparency

Another issue which is often mentioned as an important factor of managing marine resources is transparency of the meetings and processes of RFMOs, referring to documentation of events, access to the documentation, the involvement of independent experts in performance reviews, and the participation of non-governmental stakeholders [13,16,20,22,26].

While transparency plays a relevant role in fisheries management, it is only one aspect of sustainable management and is not sufficient alone [20]. The results of the study by Clark et al. [20] showed that individually each of the RFMOs had good practices in place, however, the authors of the study intentionally set the bar rather low and still none of the RFMOs had adopted the full range of measures. To increase their transparency, RFMOs could learn from each other and adopt each other's examples of best practice [20]. One of the best organizations in the aspect of transparency is SEAFO, and their improvement in transparency was highlighted in their second performance review [41]. Overall, the secretariats of the organizations are working on improving transparency, for example by making more information publicly available, and non-governmental organizations are increasingly pushing RFMOs to become more transparent [20].

4.5. Scientific advice and data

The last issue which was listed under the top five was scientific advice and data. This issue addresses factors such as the need to follow the scientific advice and the quality of the advice, but also the lack and quality of data. Moreover, it is highly linked with other aspects mentioned in this article, such as decision-making or precautionary approach. For example, how well policymakers are following the scientific advice is a good indicator of how effective the measures concerning the precautionary and ecosystem approach will be [16]. Generally, establishing a scientific advice is quite complex [42] and the way how the scientific advice is structured is *inter alia* influenced by the institutional and operational framework of the RFMOs [15]. The scientists prepare advice for several issues, which are important to the commission members and ideally the commission members follow these suggestions. However, sometimes members do not follow the advice or adopt measures which are less effective than the measures suggested by the scientists [42]. In some organizations, commission members have a low record for following the scientific advice [42]. While this is often linked to the lack of political will of the member states, the study by Galland et al. [42] showed that in some cases the advice was written in a vague language and policymakers either have misinterpreted or misunderstood the advice. Furthermore, it is important to note that some countries may lack the required scientific expertise, which hinders them to effectively engage with the process [16].

The quality of the scientific advice relies on the data submitted by the member states of the RFMOs, which often depend on the support of their fishing industry to get for example catch data [16]. However, the data submission is not always on time and in some cases incomplete, missing important data for the implementation of the precautionary and ecosystem approach [43]. In many RFMOs, long-term data collection and monitoring programs which address important aspects of the ecosystem approach are not existing [17]. This is especially true for data on bycatch and ecosystem impacts [17,44]. However, not only the presence of data is relevant but also the quality of the data and for example, ICCAT and its member countries work hard to improve this aspect of their data [45]. But again, this aspect is often influenced by the availability of resources in the respective country [36]. Thus, there is a strong connection between the availability of data and the quality of the scientific advice with the members engaged in the respective RFMO.

5. Impacts of governance instruments

5.1. SDGs

Besides the challenges, which are related to the RFMOs' framework, structure, and objectives, international environmental agreements can potentially also impact the performance of these organizations. The United Nations Sustainable Development Goals (SDGs) are not binding but still might have an influence on RFMOs. The SDGs were adopted in 2015 and aim to achieve a sustainable future [46]. The SDGs are comprised of 17 goals and each goal is supported by specific targets, resulting in 169 targets overall. One goal, which is of particular importance for the marine sector, is SDG 14, which has the aim to conserve and sustainably use the oceans, seas and marine resources for sustainable development. The seven targets deal with global ocean issues, such as marine pollution (target 14.1), ocean acidification (14.2), sustainable management and sustainable fisheries (14.2 and 14.4, respectively), or conservation approaches (14.5). The fishing industry is an essential actor in achieving SDG 14 [47,48]. RFMOs are the main institutions which have the mandate to achieve sustainable management and fisheries in high seas areas and thus, also play an important role in achieving SDG 14. However, the SDGs are quite comprehensive and broadly formulated [49], making it difficult for existing organizations such as RFMOs, to see how they can contribute.

5.2. BBNJ

Another international environmental agreement which might influence the RFMOs is the proposed agreement for biodiversity beyond national jurisdictions (BBNJ). In recent years, greater stakeholder awareness of the threat of biodiversity loss has led to increasing calls from the international community for a new instrument to address biodiversity in areas beyond national jurisdiction. In 2015, the United Nations General Assembly voted to launch negotiations for an international legally-binding instrument under UNCLOS, which started in 2018 and will end 2020. From the start of the negotiations for BBNJ, the parties were concerned about the interaction between a new agreement and existing treaties and international institutions on ocean governance. Therefore it was stated that the new BBNJ agreement should not undermine with existing instruments, frameworks and bodies [50]. While this applies to all ocean governance agreements, it has particular relevance to RFMOs, which are the main regime for fisheries governance [51].

Even though the term 'not undermine' is frequently referenced, its meaning remains rather unclear [25] and it was suggested that this term could also be interpreted in a way that it would support "the improvement of status quo" [52, p.39]. Thus, the new agreement has the potential to strengthen and complement the existing instruments and support these organizations in protecting the marine ecosystem [52,53]. This is especially relevant in the aspect of fish biodiversity and a study by Ortuño Crespo et al. [53] showed that RFMOs are primarily managing species which are of commercial interest to the member countries, leaving around 95% of the fish biodiversity in areas beyond national jurisdiction unprotected. Furthermore, this study stated that "RFMOs are in a unique position to both benefit from and contribute to the conservation and sustainable use of BBNJ under a new international legally binding instrument" [53, p.4]. Therefore, it is quite likely that RMFOs are going to be influenced by the new BBNJ agreement and it is important that these organizations are getting involved in the negotiations.

6. Discussion

Sustainably managing marine resources is imperative as overfishing has far-reaching consequences for food and job security for billions of people [2]. Moreover, most states have joined UNCLOS and the UNFSA and thus also have a legal obligation to conserve and protect marine resources [8,9]. RFMOs play an important role in managing fisheries at the high seas but also in EEZs of coastal states. This article aimed to summarize the existing literature concerning RFMOs and to identify key issues which hinder RFMOs to perform sustainably. We have analysed 17 issues, which are depending on each other and cannot be solved in isolation. This article showed that RFMOs are slowly improving over time and learning from each other [25]. Table 2 highlights some of the best practices examples mentioned in the peer-reviewed literature.

The two issues which were most frequently mentioned in the literature were the precautionary and ecosystem approach and decision-making. The way how RFMOs make decisions heavily influence their ability to implement the precautionary and ecosystem approach [e.g. 17, 21, 22]. Another relevant issue was members and it is important to acknowledge that members are making decisions. In the consensus-based model, countries, who are not willing to take stricter measures, which might have short-term economic impacts, can block progress [17]. These countries, who might not be following the rules, impose a potential risk to the agreed measures and to the whole ecosystem. Moreover, the political will of the member countries not only influences the RFMOs ability to agree on certain issues, but the political side of RFMOs also interferes with the scientific process [54].

Besides these identified problems, international instruments, such as the SDGs or the possible BBNJ agreement, may influence RFMOs. The SDGs have been in place since 2015 and RFMOs are already playing a

Table 2
Best practice examples for some of the identified issues.

Decision making		
SPRFMO	Parties have to explain in great detail the reasons for their objection and have to implement alternative measures.	(Schiffman, 2013)
Precautionary & ecosystem approach		
IATTC, GFCM	Revision of whole convention to include new issues such as the precautionary and ecosystem approach.	(GFCM, 2019; IATTC, 2018)
NEAFC	Cooperation with OSPAR to establish MPAs in the northeast Atlantic.	(Wright, Rochette, et al., 2015)
NEAFC, NAFO, SEAFO	These RFMOs have closed important areas to bottom fishing.	(Gianni et al., 2016)
CCAMLR	Prohibited bottom trawling in their convention area.	(Gianni et al., 2016)
CCAMLR	Binding measures related to managing discharge.	(Gilman, Passfield, & Nakamura, 2014)
IOTC	Developed and adopted stock specific interim limit and target reference points associated with the biomass and fishing mortality rate indicators for all its target species.	(Juan-Jordá et al., 2017)
CCSBT	Adoption of a management procedure.	(Juan-Jordá et al., 2017)
ICCAT	Adopted objectives with associated state indicators and limits, and has an established management response in place when limits are exceeded for dolphins in the eastern Pacific Ocean	(Juan-Jordá et al., 2017)
NAFO	Amended its convention mandate to include the ecosystem approach to fisheries.	(Scanlon, 2018)
ICCAT	Adopted resolution, which requires the application of an ecosystem-based approach in its recommendations.	(Scanlon, 2018)
CCAMLR	Quick procedure concerning the protection of VMEs and following up on VMEs encounters.	(Wright, Ardron, et al., 2015)
IATTC	Focuses specifically on understanding the impact of climate change and ocean acidification on the population status and dynamics of managed species.	(Rayfuse, 2019)
CCAMLR	Takes climate change into consideration in its research and research question.	(Rayfuse, 2019)
Transparency		
SEAFO	Transparent website and papers and reports are available to observers and members.	(SEAFO, 2016)
WCPFC	Provides open access to amalgamated data records of spatial resolutions.	(Gilman, Passfield, & Nakamura, 2014)
Allocation		
SEAFO, WCPFC	Included guidance on allocations in their constituent instrument.	(Lodge et al., 2007)
Scientific advice and data		
ICCAT	Developed multiple research programmes and training workshops to improve data collection and analysis in developing countries.	(Pons, Melnychuk, & Hilborn, 2018)
Transshipment		
SEAFO	Banned transshipment at-sea for all vessels.	(Ewell et al., 2017)
IUU fishing		
SPRFMO	Formally recognises all other RFMO's IUU vessel lists.	(Hutniczak, 2019)

key role in achieving sustainable management of international fisheries and are therefore providing a notable input to SDG 14, even if this is not explicitly mentioned. In contrast to the SDGs, negotiations for the BBNJ agreement started 2018 and will go until 2020, and the potential impact on RFMOs is highly discussed in the literature [51,55,56]. Although it is not clear what the final BBNJ agreement will contain, it has the potential to strengthen the existing organizations such as RFMOs [52,53]. Especially, since these negotiations discuss issues which are important for RFMOs, such as precautionary and ecosystem approach, and scientific advice and data. Thus, the BBNJ negotiations provide an opportunity for RFMOs to actively engage in the international fora and demonstrate their willingness to improve themselves.

7. Conclusion

This article identified 17 issues, which have been mentioned in the literature as impacting RFMOs performance and highlighted best practice examples. All these problems relate to each other and for example, decision-making was frequently mentioned in the literature as hindering RFMOs to address important areas such as transparency, overcapacity or socio-political-economic aspects. Therefore, it is important to acknowledge that these problems cannot be solved in isolation. Addressing these issues would also help RFMOs to deal with international instruments such as the SDGs and the BBNJ. While it is questionable that the SDGs will have a great influence on RFMOs, any BBNJ agreement is more likely to impact RFMOs. However, whether this is in a positive way or in a negative remains to be seen. Overall, RFMOs are important organizations concerning international fisheries management and it is important that they learn from each other on applying best practices and speed up their progress in applying sustainable management practices.

Declaration of competing interest

None.

Appendix

A1 – List of papers

Issue	Nr of paper	Papers
Overcapacity	3	(Aranda, Murua, & de Bruyn, 2012; de Bruyn, Murua, & Aranda, 2013; Schiffman, 2013)
Members	9	(Aranda, Murua, & de Bruyn, 2012; Barkin et al., 2018; Cullis-Suzuki & Pauly, 2010; Lodge et al., 2007; Pentz & Klenk, 2019; Pentz et al., 2018; Pons, Melnychuk, & Hilborn, 2018; Small, 2005; Willock & Lack, 2006)
Decision-making	18	(Barkin & DeSombre, 2013; Barkin et al., 2018; de Bruyn, Murua, & Aranda, 2013; Ewell et al., 2017; Gilman, Passfield, & Nakamura, 2014; Juan-Jordá et al., 2017; Leroy & Morin, 2018; Lodge et al., 2007; McDorman, 2005; Mooney-Seus & Rosenberg, 2007; Nakatsuka, 2017b; Pentz & Klenk, 2017, 2019; Rayfuse, 2019; Scanlon, 2018; Schiffman, 2013; Small, 2005; Willock & Lack, 2006)
Lack of compliance and enforcement	8	(Barkin & DeSombre, 2013; Barkin et al., 2018; de Bruyn, Murua, & Aranda, 2013; Lodge et al., 2007; Mooney-Seus & Rosenberg, 2007; Pentz et al., 2018; Sumaila, Bellmann, & Tipping, 2016; Willock & Lack, 2006)
Lack of socio-political-economic aspects	3	(Aranda, De Bruyn, & Murua, 2010; Barkin & DeSombre, 2013; Mooney-Seus & Rosenberg, 2007)
Lack of political will	3	(Barkin & DeSombre, 2013; Gilman, Passfield, & Nakamura, 2014; Small, 2005)
Need for precautionary and ecosystem approach	18	(Aranda, De Bruyn, & Murua, 2010; Barkin et al., 2018; Bell, Guijarro-Garcia, & Kenny, 2019; de Bruyn, Murua, & Aranda, 2013; Gianni et al., 2016; Gilman, Passfield, & Nakamura, 2014; Juan-Jordá et al., 2017; Lodge et al., 2007; McDorman, 2005; Miller, 2013; Mooney-Seus & Rosenberg, 2007; Pentz & Klenk, 2019; Rayfuse, 2019; Scanlon, 2018; Schiffman, 2013; Small, 2005; Willock & Lack, 2006; Wright et al., 2015)
Transparency	9	(Clark, Ardron, & Pendleton, 2015; Gilman & Kingma, 2013; Gilman, Passfield, & Nakamura, 2014; Lodge et al., 2007; Nakatsuka, 2017a; Pons, Melnychuk, & Hilborn, 2018; Schiffman, 2013; Small, 2005; Willock & Lack, 2006)
Allocation	4	(Cullis-Suzuki & Pauly, 2010; Lodge et al., 2007; McDorman, 2005; Willock & Lack, 2006)
IUU fishing	6	(Cullis-Suzuki & Pauly, 2010; Hutniczak, 2019; Schiffman, 2013; Small, 2005; Sumaila, Bellmann, & Tipping, 2016; Swan, 2016)
Lack of clear management objectives	1	(de Bruyn, Murua, & Aranda, 2013)
Need for better surveillance and enforcement frameworks	1	(Gilman, Passfield, & Nakamura, 2014)
Scientific advice and data	9	(Aranda, De Bruyn, & Murua, 2010; Galland et al., 2018; Juan-Jordá et al., 2017; Lodge et al., 2007; Mooney-Seus & Rosenberg, 2007; Nakatsuka, 2017a; Pons, Melnychuk, & Hilborn, 2018; Small, 2005; Willock & Lack, 2006)
Need to cooperate	5	(Aranda, De Bruyn, & Murua, 2010; Lodge et al., 2007; Scanlon, 2018; Willock & Lack, 2006; Wright et al., 2015)
Transhipment	1	(Ewell et al., 2017)
Management strategy evaluations	1	(Nakatsuka, 2017b)
Stakeholders	2	(Nakatsuka, 2017b; Small, 2005)

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The influence of performance reviews on regional fisheries management organizations

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Regional fisheries management organizations (RFMOs) are key bodies responsible for managing fisheries on the high seas and also in areas of the ocean under national jurisdiction. The performance of RFMOs has, however, become the focus of broad-based criticism in the context of increasing fishing effort, the scale, and sophistication of illegal, unregulated and unreported fishing, and concerns over the wider environmental impacts of fishing activities. In response to these criticisms, the United Nations General Assembly has called on RFMOs to carry out performance reviews (PRs) to assess their record in fisheries management. PRs can provide the opportunity to assess the strengths and weaknesses of past actions by specific RFMOs. There is, however, limited information and analysis available on the progress made by RFMOs after PRs have been carried out. To fill this gap, this paper assesses the performance of five RFMOs that have undergone PRs on two occasions. The paper assesses the performance of these five RFMOs against a scoring system that analyses improvements made after the first PR based on the recommendations made in the second PR. This analysis is encouraging, as all five RFMOs demonstrated significant improvement in their performance in the period after their initial PR, especially in "conservation and management" and "international cooperation" activities.

Keywords: fisheries management, management performance, ocean governance, SDGs

Introduction

The Anthropocene is characterized by significant human impacts on the global environment, including the world's ocean (Crutzen, 2002). During the 2012 Rio Plus 20 conference, many states sought to elevate the crucial role of the oceans in planetary systems and human wellbeing on the global agenda (Cicin-Sain, 2014). The oceans are subject to multiple human-induced stressors. For example, in 2015 it was estimated that 33.1% of all fished stocks were overfished and around 40% of such stocks were fished to their maximum limit (FAO, 2018, p. 6). The management of fisheries plays an important role in marine ecosystems and also for millions of people employed globally in the fisheries sector (i.e. fishing, processing, etc.) (FAO, 2018). Almost 60% of the ocean are high seas areas under the United Nations Convention on the Law of the Sea 1982 (UNCLOS) (FAO, 2014) and the various regional fisheries management organizations (RFMOs) are the main organizations, which manage the marine living resources in these areas. RFMOs have the competence to establish legally binding measures regarding fisheries management that apply in areas beyond and inside national jurisdiction.

The overarching legal framework governing human activities in the world's oceans is provided by the 1982 UNCLOS, that entered into force in 1994. UNCLOS formalized state jurisdiction over the 12 nautical mile territorial sea extending from the baseline of coastal states and established an exclusive economic zone extending to 200 nautical miles (EEZs) where coastal states have sovereign rights over natural resources (United Nations, 1982). In terms of fisheries management, UNCLOS requires states to cooperate with each other in conservation and management of

living resources in the high seas and establish sub-regional and regional fisheries organizations (United Nations, 1982, Art. 118).

The status of RFMOs was further strengthened by the adoption of the 1995 United Nations Fish Stocks Agreement (UNFSA) that entered into force in 2001. The object of UNFSA is the conservation and management of straddling fish stocks and highly migratory fish stocks (United Nations, 1995). This was a significant development, as many highly economic important species, such as tuna species, either straddle national and high seas areas, or are highly migratory species. The UNFSA promotes the application of conservation principles, such as the precautionary approach, reinforces states' obligations to cooperate on fisheries management through sub-regional or regional fisheries management organizations (see Article 10), and elaborates on the key functions of an RFMO (United Nations, 1995).

RFMOs are important institutions for managing marine living resources in areas beyond national jurisdiction (United Nations, 1995), however, their ability to deal with important issues such as stopping illegal, unreported, unregulated (IUU) fishing or the impact of fishing on the marine environment has been questioned (Hoel, 2010). Thus, in 2006, the United Nations General Assembly (UNGA) called for performance reviews (PRs) of all RFMOs—the assessment of current performance against certain criteria (UNGA, 2007). As a result by 2016, all RFMOs, which had entered into force by 2012 had undergone at least one PR process (SPRFMO, 2017). New RFMOs, formed since 2012, such as the South Pacific Regional Fisheries Management Organization (SPRFMO), also included performance requirements in their treaty texts (SPRFMO, 2015. Art. 30). The idea behind the PR process is that through systematic reviews organizational learning on "best practice" in fisheries management will occur (Hoel, 2010). PRs may provide concrete results on important issues, such as precautionary approach or ecosystem-based approach, which can be adopted and implemented by organizations (FAO, 2007), thereby encouraging improvement of conservation and management standards within RFMOs.

The aim of this paper is to explore the use and impact of PRs in improving fisheries management. We address this aim by analysing the progress of five RFMOs in the period from their first PR until their second PR. In particular; the paper focuses on the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), the International Commission for the Conservation of Atlantic Tuna (ICCAT), the Indian Ocean Tuna Commission (IOTC), the North East Atlantic Fisheries Commission (NEAFC), and the South East Atlantic Fisheries Organization (SEAFO). These five RFMOs were selected as case studies because they have already undergone a second PR. They thereby offer rich publicly available data as to the actions that were undertaken after their first PR. These five RFMOs were selected to provide a cross-section of cases in terms of species coverage, number of participating parties, number of developing country members, but also due to their broad geographical range. These results may therefore also apply for other RFMOs. We argue that PRs can positively influence RFMO performance and lead to improvements in key criteria for fisheries management.

This paper begins by providing an overview of RFMOs and describes the evolution of PR and their key properties in fisheries management. We then look at the second PR of the five selected RFMOs and assess the progress of these bodies since the first PR. Finally, we assess the extent to which the PR process can assist in addressing emergent issues and realize the aims of wider policy objectives, such as the United Nations Sustainable Development Goals (SDGs).

Regional fisheries management organizations

RFMOs play an essential role in fisheries governance and achieving cooperation between fishing nations. They are the institutional interface between the goals of global agreements and the interests of states (Hoel, 2010). RFMOs are distinguished from other international fisheries organizations through their ability to agree on legally binding measures for their members (FAO, 2019). Despite common responsibilities, RFMOs may differ in their institutional structure, such as in the presence or absence of an integrated scientific committee or secretariat body. Despite small institutional variations, other contextual factors such as biophysical environmental conditions, species under management, and member composition, make each RFMO unique.

The five selected RFMOs not only cover different geographical areas of the world's ocean but also different species. While the CCSBT manages southern bluefin tuna through its range, ICCAT and IOTC manage tuna and tuna-like species within specific areas, and NEAFC and SEAFO have more general objectives and manage a number of non-tuna species in their defined geographical area (Figure 1).

The oldest organization of the five is ICCAT, that entered into force in 1969. SEAFO is the youngest institution, established in 2004 (Table 1). SEAFO is the only organization that was established after the entry of the force of the UNFSA (SEAFO, 2016).

RFMOs are highly influenced by the number of member states since it is more difficult to agree on certain topics with a larger

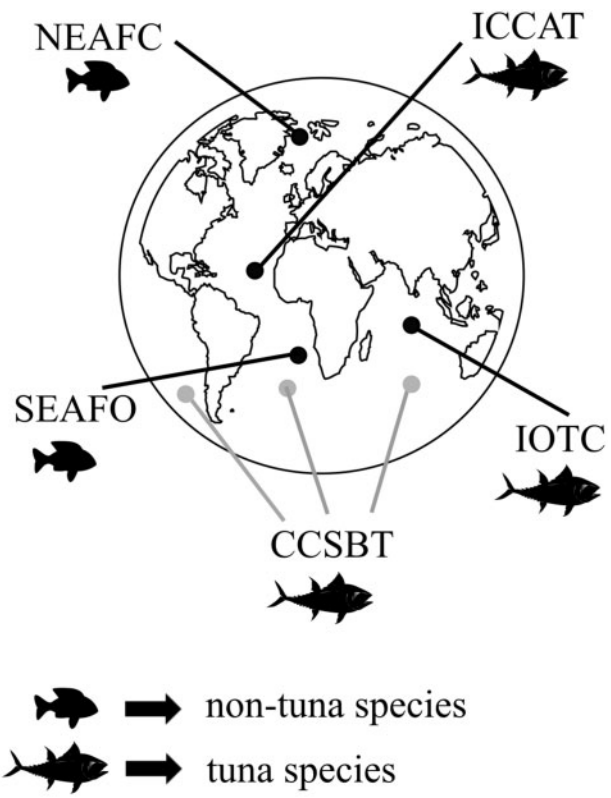

Figure 1. Geographical area and managed species of the five selected RFMOs.

Table 1. Overview of the five RFMOs.

RFMO	Entry into force	Nr. Members	Nr. of developing countries	Year of first PR	Year of second PR	PR panel of second PR
Commission for the Conservation of Southern Bluefin Tuna (CCSBT)	1994	7	3	2008	2014	Independent
International Commission for the Conservation of Atlantic Tuna (ICCAT)	1969	52	36	2008	2016	Independent
Indian Ocean Tuna Commission (IOTC)	1998	32	23	2009	2014	Mixed
North-East Atlantic Fisheries Commission (NEAFC)[a]	1982	5	0	2006	2013	Independent
South-East Atlantic Fisheries Organizations (SEAFO)	2004	7	3	2010	2016	Mixed

[a]Successor of an earlier commission.

number of parties (ICCAT, 2009; Pons *et al.*, 2018). ICCAT is not only the oldest RFMOs but also has the highest number of members (50), followed by IOTC with 32 members. In comparison, CCSBT and SEAFO have seven while NEAFC has only five members. On the basis of the number of participants, it is not surprising that ICCAT and IOTC also have the highest number of developing countries as members, with 36 and 23, respectively. The number of developing countries also impacts the way an RFMO functions (Ceo *et al.*, 2012; Pons *et al.*, 2018). SEAFO and CCSBT each have three developing country parties out of seven members, while NEAFC has no developing country members.

PRs

Development of PRs

PRs emerged first from the experiences in domestic state-centered administrative reforms, that address the expectations concerning the operation of public organizations and second the rising critiques of international organizations (Victor *et al.*, 1998; Geri, 2001; Hoel, 2010). RFMOs are important for fisheries management, however, a study by Cullis-Suzuki and Pauly (2010) revealed that RFMOs have failed to meet their core objectives. This failure to meet objectives was linked to non-compliance of their members with key conservation and management measures (UNGA, 2006; FAO, 2007).

The first call to assess the performance of RFMOs came in the early 2000s from non-governmental organizations (NGOs), such as the World Wildlife Fund (WWF) and the International Union for Conservation of Nature (IUCN) (Hoel, 2010). This was mostly driven by NGOs desire to be part of resource management decisions of RFMOs (Hoel, 2010). Even though NGOs have been strong advocates for PRs of RFMOs, they have rarely been a part of the review process. NGOs have only been involved in one PR of the five assessed RFMOs, for the first and second PR of IOTC (IOTC-PRIOTC01, 2009; FAO, 2015; IOTC-PRIOTC02, 2016).

States have been the primary drivers of the RFMO reviews. In 2006, the Ministerially-led Task Force on IUU Fishing on the High Seas (led by the United Kingdom with Ministers from Australia, Chile, Namibia, and New Zealand) recommended assessing the performance of RFMOs (High Seas Task Force, 2006). This was followed by the 2006 UNGA debate that urged states to strengthen and modernize RFMOs and undertake PRs in a transparent manner and develop guidelines for best practice (UNGA, 2007). In 2007, Chatham House produced a report titled "Recommended Best Practices for Regional Fisheries Management Organizations" (Lodge *et al.*, 2007), which was supported by the call from the 2006 UNGA resolution, which called for PR for RFMOs (UNGA, 2007; Lodge, 2010). A further important step in establishing PR on the international fisheries management agenda was the first Joint Meeting of Tuna RFMOs organized by the Food and Agriculture of the United Nations (FAO) in Kobe, Japan, in 2007. At this meeting it was agreed that the five tuna RFMOs [the International Commission for the Conservation of Atlantic Tuna (ICCAT), the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), the Inter-American Tropical Tuna Commission (IATTC), the Indian Ocean Tuna Commission (IOTC), and the Western and Central Pacific Fisheries Commission (WCPFC)] would conduct PR, based on common criteria and elements of the tuna RFMO charters (Tuna-org, 2007).

Conducting PRs

The process of carrying out PR is complex and time-consuming. It takes approximately one year to complete the task. It is also expensive, for instance, the budget for the second PR of CCSBT was US$75 000 (CCSBT, 2013). RFMOs must, therefore, decide if the PR should be carried out by an internal panel, external panel or mixed panel of reviewers. While expert knowledge regarding the organization is one of the advantages of the internal or mixed model, the external model may benefit from an independent and more objective viewpoint (Hoel, 2010). The importance of transparency was repeatedly emphasized by the UNGA (UNGA, 2006) or the FAO (FAO, 2007) as an important aspect of PRs. Experts nominated from external institutions help to address this criterion (Ceo *et al.*, 2012). RFMOs usually request the FAO and the United Nations Division for Ocean Affairs and the Law of the Sea (UNDOALOS) to nominate experts who will be part of the PR panel (FAO, 2015). Three of the five selected RFMOs have chosen an independent panel of reviewers for their second PR, namely, CCSBT, ICCAT, and NEAFC (Garcia and Koehler, 2014; NEAFC, 2014; ICCAT, 2016). IOTC and SEAFO had a mixed panel assessing their performance (IOTC-PRIOTC02, 2016; SEAFO, 2016) (Table 1).

Another important aspect is the choice and scope of the assessment criteria underpinning the PR. The categories generally used for a PR are: "(i) legal analysis of the Agreement; (ii) conservation and management; (iii) compliance and enforcement; (iv) decision-making and dispute settlement; (v) international cooperation; and (vi) financial and administrative issues" (Ceo *et al.*, 2012, p. 10). These categories are relevant to consider concerning the idea of a best practice framework and have been influential

and considered during almost all PRs (ICCAT, 2009; Garcia and Koehler, 2014). To assess these criteria, PR panels rely on official documents, interviews, and questionnaires (FAO, 2015). These criteria were also used in the "Balton list," a list of criteria to assess the tuna RFMOs (IATTC, 2008), and which mostly formed the basis for the PR for other RFMOs. The former US Ambassador established this list after the Kobe meeting, in consultation with the UNFSA, and suggested that these criteria should be used to assess the performance of RFMOs (IATTC, 2008).

PRs summarize the current weaknesses and strengths of an RFMO and the recommendations can help the organization deal with these issues that might otherwise remain unresolved. RFMOs have shown different ways of addressing the recommendations, from PRs. For example, the CCSBT established a tracking system to follow the progress of implementing the recommendations of the first PR (Garcia and Koehler, 2014). The ICCAT established an internal working group to address the panel's recommendations (ICCAT, 2016) and the IOTC adopted a resolution (Resolution 09/01—*On the performance review follow-up*), to establish a process to implement the recommendations from the first PR (IOTC-PRIOTC02, 2016).

Methods

To assess the progress of the five selected RFMOs since their first PR, we looked at the recommendations made at the time of their second PR. These recommendations are a good indicator of the progress that had been made since the first review and impact of PRs in effecting change. In particular, our analysis draws on one of the objectives in the second PR that each of the five RFMOs included, to assess progress since their first PR. In this way, our analysis is useful to provide early cross comparisons and learnings from the PR process across a range of RFMOs. The sections of the PR are divided into five overall categories, which were supported by criteria for which the panel gave recommendations (Table 2).

We conducted a scoring system to compare the progress of the five RFMOs. The scoring system is based on Garcia and Koehler (2014), who scored the evolution of CCSBT management system (none—basic—improving—advanced). We followed this approach and added a fifth category ("fulfilled") to better capture the state of the progress (Table 3).

To apply the different scores, we analysed the recommendations and the actions, which were taken by the RFMO, for example implementing new measures, for each category and criteria. We also analysed criteria, which were not part of the first PR, because the second PR panel stated the progress of these "new" criteria since the first PR. However, criteria which were only used for the first PR were not considered, since no in-depth analyses regarding their implementation progress were provided. The aim of this analysis is to provide an overview of the progress RFMOs have made since their first PR. The results were then further linked to the number of new or updated conservation and management measures and resolutions and the status of the managed stocks.

Table 2. Overview of all categories and criteria used by the different PRs of the five RFMOs.

Categories	Criteria
Conservation and management	Status of living marine resources
	Data collection and sharing
	Quality and provision of scientific advice
	Adoption of conservation measures
	Capacity management
	Compatibility of management measures
	Fishing allocations and opportunities
	Non-target species
	Ecosystem approach
Compliance and enforcement	Flag state duties
	Port state measures
	Monitoring, control, and surveillance
	Follow-up in infringements
	Cooperative mechanisms to detect and deter non-compliance
	Market-related measures
	Reporting requirements
Decision-making and dispute settlement	Decision making
	Transparency
	Dispute settlement
	Confidentiality
International cooperation	Relationship to cooperating non-members
	Relationship to non-cooperating non-members
	Cooperation with other organizations
	Special requirements of developing states
	Participation and capacity building
Financial and administrative issues	Availability of resources of RFMO activities
	Efficiency and cost-effectiveness
	Financial and administrative issues
	Staff regulations and staff remuneration

Table 3. Scoring system used to analyse the progress since the first PR.

Scoring system	Description
None	No progress, the RFMO has not even started to address the recommendation.
Basic	The RFMO has started to deal with this recommendation, mostly in the form of discussions, but no concrete measures have been adopted so far.
Improving	The RFMO has already invested a lot of time in this recommendation and has implemented actions to address the problem. However, there is still more which can be done.
Advanced	The recommendation is almost fulfilled, but a few more things could be done to address the issues.
Fulfilled	The recommendation has been fully addressed.

Results of the analysis

We analysed the progress of the five selected RFMOs since their first PR (Supplementary Appendix A1). Overall, the scoring category "improving" had the highest number of recommendations among all five RFMOs ($n = 79$), followed by "fulfilled" ($n = 32$) and "basic" ($n = 31$). "Improving" had the highest count by all RFMOs except SEAFO, which had most recommendations listed under "fulfilled" ($n = 8$) (Figure 2). The scoring category with the lowest overall count was "none," with only 12 recommendations among all RFMOs.

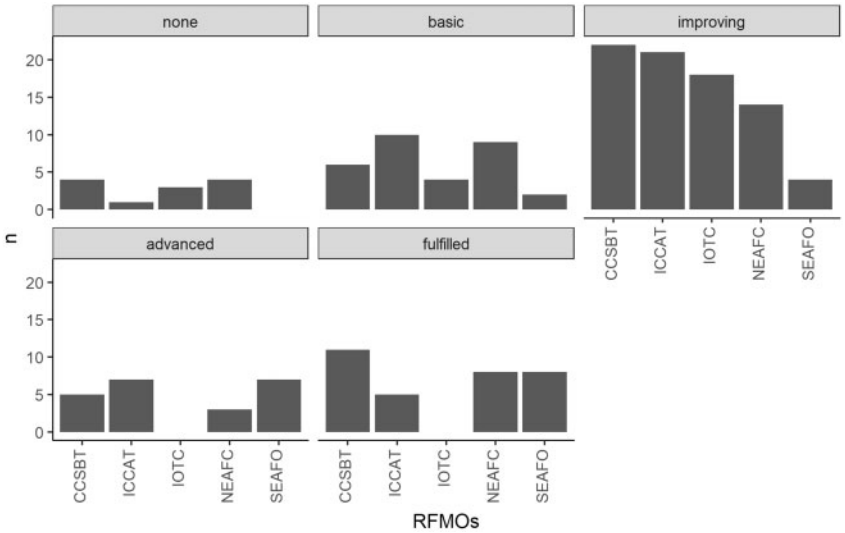

Figure 2. Summary of scoring categories among all RFMOs, with "*n*" as the number of recommendations listed under the specific scoring category.

Table 4. Number of new or updated measures and resolutions since the first PR.

RFMOs	New Res since first PR	New Res since second PR
CCSBT	6	12
ICCAT	15	0
IOTC	21	26
NEAFC	3	37
SEAFO	3	0

Each of the five categories, "compliance & enforcement," "conservation & management," "decision-making & dispute settlement," "financial & administrative issues," and "international cooperation," had several criteria, which differed among the RFMOs. The category "conservation & management" had the highest number of criteria, while "financial & administrative issues" and "decision-making & dispute settlement" had the lowest number of criteria (mostly two) (Figure 3), leading to the differences of "*n*" in Figure 3. Most of the RFMOs recommendations were listed under "improving," except for the two categories "decision-making and dispute settlement" and "financial and administrative issues."

The high number of recommendations showing improvement is also underpinned by the number of new or updated conservation measures and resolutions. Of all five analysed RFMOs, IOTC had the highest number of new or updated measures since the first PR (21 measures since the first PR and 26 measures since the second PR) (Table 4), followed by NEAFC with an overall of 40 measures, however, only three measures were updated or newly implemented after the first PR, whereas 37 measures were count after the second PR. SEAFO had the lowest number of newly enforced or updated conservation measures, namely, "Total Allowable Catches—2017 [CM32-16]," "Measure on Bottom Fishing Activities and VMEs in the SEAFO CA [CM30-15]," and "Reducing Incidental By-catch of Seabirds [CM25-12]" (SEAFO, 2019). The measures implemented by the IOTC covered a broad spectrum of different topics, with key issues such as the regulation of catching devices, transshipment, harvest control roles, or the conservation of target and non-target species (IOTC, 2019). The same applied to the NEAFC, which targeted areas such as amending the NEAFC Scheme and the conservation of target and non-target species (NEAFC, 2011).

Since the first PR, a number of stocks have improved, and the fishing mortality declined notably for species such the southern Bluefin tuna (under the management of CCSBT), however, the health of other stocks such as haddock (under the management of NEAFC), had declined (Supplementary Appendix A2). Overall, the number of stock assessments available for different species has increased since the first PR.

Discussion

PRs have the potential to positively influence RFMO performance, but only if the subsequent recommendations are implemented within the organization (Ceo *et al.*, 2012). This paper aimed to analyse the progress regarding the recommendations of five RFMOs, namely CCSBT, ICCAT, IOTC, NEAFC, and SEAFO, since their first PR. The results show that these organizations have done considerable work to implement the recommendations of the first PR. All analysed RFMOs, except SEAFO, had the highest amount of recommendations under the scoring category "improving," meaning that they have already been working on the recommendations (Figure 2). Compared with the other four RFMOs, SEAFO had the greatest share of its recommendations already "fulfilled" ($n = 8$) or the recommendations at an "advanced" level ($n = 7$) (Figure 2). The results of SEAFO might be linked to low fishing effort (only Patagonian toothfish and deep-sea red crabs are targeted) and low commercial interests (SEAFO, 2016). Overall, the scoring category "none" had the lowest number of linked recommendations, which means that the RFMOs have addressed at a certain level almost all recommendations.

The PR is divided into five categories, which have several criteria. The five RFMOs had in three out of five categories the highest amount of recommendations listed under "improving" (Figure 3). These three categories were "compliance and

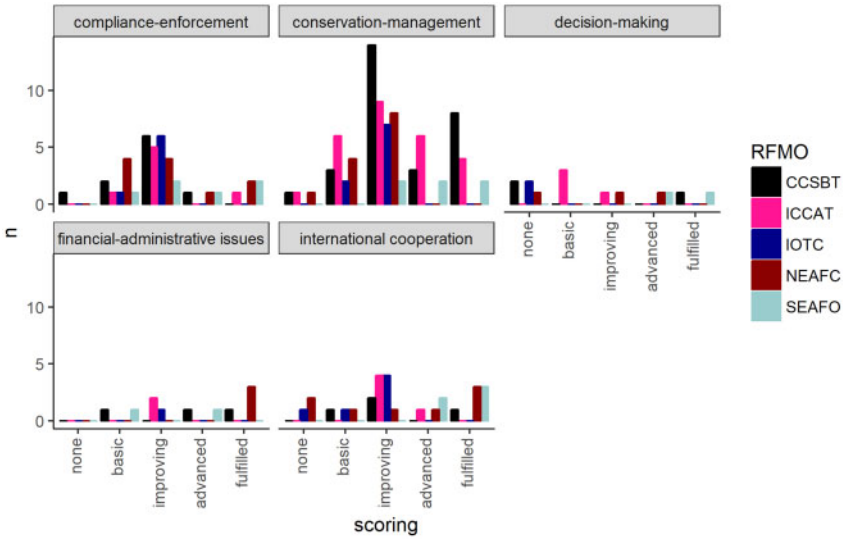

Figure 3. The number of recommendations (*n*) for each scoring category and each performance process category.

enforcement," "conservation and management," and "international cooperation." The remaining two categories were "decision-making and dispute settlement" and "financial and administrative issues." Most of the RFMOs had only two criteria under these categories, leading to a higher variety of scoring. Furthermore, the category "decision-making and dispute settlement" had the highest number of scores under "none," despite the small number of criteria. The highest number of "fulfilled" recommendations in the category "conservation and management" had CCSBT, however, it had also the highest number of criteria under this category. The low variety of the scores in the category "decision-making and dispute settlement" and "financial and administrative issues" might be because most of the decisions in RFMOs are made by consensus and it is difficult to reach consensus on fundamental changes (Pentz and Klenk, 2017).

Generally, the five categories cover important issues for RFMOs, such as "data collection and sharing strategies" or "transparency" (Table 2). For example, the CCSBT, which had a history of using inaccurate data through significant under-reporting of catches (Schiffman and MacPhee, 2014), made notable progress since the first PR in this criterion and had almost fulfilled the first recommendation (Garcia and Koehler, 2014). Also, transparency plays an important role for RFMOs and should become standard practice, especially to scientific and observer data (Willock and Lack, 2006; Clark *et al.*, 2015). SEAFO had the highest number of fulfilled recommendations under this criteria, and the panel particularly highlighted the work done by SEAFO and noted that "transparency is a hallmark of this organization" (SEAFO, 2016, p. 48).

The progress RFMOs have made from their first PR is also reflected by the number of new or updated conservation measures and/or resolutions. IOTC and NEAFC had the highest number of new or updated measures, while SEAFO had the lowest number with only three newly established measures (Table 4). This might be linked to the age of the RFMOs, as Cullis-Suzuki and Pauly (2010) found that newer RFMOs often perform better than older bodies. The IOTC and NEAFC's are considerably older than SEAFO, with the IOTC convention entering into force in 1998 and the NEAFC convention in 1982. SEAFO was the only RFMO in this study that was established after the enforcement of the United Nations Fish Stocks Agreement and thus its objectives and general principles are based on the requirements of this agreement (SEAFO, 2016). However, there might be also other reasons affecting performance. ICCAT was one of the older RFMOs (established in 1969) in this analysis. It had implemented only 15 new or updated measures since its first PR and no measures since its second. The case of ICCAT may be affected by the high number of members (50 parties), which could make it difficult to reach consensus on the establishment of new measures (Pons *et al.*, 2018).

Since their first PR, all RFMOs made progress to establish stock assessments for different species, which form the basis of their management (Supplementary Appendix A2). SEAFO conducted only one stock assessment, for the species southern boarfish, which is linked to high uncertainties due to missing data. Following low-fishing effort and low commercial interests (SEAFO, 2016), limited data are available for the managed stocks, thus, it is not possible to conduct stock assessments. The same might apply for NEAFC, which also had a high number of stocks where no stock assessments were available. Unlike the other RFMOs, the NEAFC does not conduct its own assessments, instead, it requests assessments from the International Council for the Exploration of the Sea (ICES).

Generally, the management of important species such as the southern bluefin tuna had improved and overfishing stopped in the period since the first PR. However, the stock is still overfished, albeit the fishing mortality declined. The same was observed at the management of Atlantic bluefin tuna, where the fishing mortality declined under F_{MSY}. However, other species such as bigeye tuna or haddock have changed to an overfished status. Many different factors influence the RFMOs ability to manage species and to enforce measures, for example, the number of member states, the number of authorized vessels, or the economic dependency

on fisheries (Pons *et al.*, 2018). Besides internal factors, Pons *et al.* (2018) stated that external biological and economic variables highly influence the status of stocks.

These results show that the RFMOs took their first PR seriously and have begun to address recommendations and proposed actions. ICCAT's second PR highlighted the progress made, especially in establishing re-building plans for target species and for the actions taken regarding the management of the Atlantic bluefin tuna (ICCAT, 2016). Pentz *et al.* (2018) have also shown that RFMOs made progress in recent years. We acknowledge, however, that a number of factors may influence these results, such as the different use of language, the different structure of the PR itself, or the different use of independent or mixed panels.

PRs and emergent issues

PR can provide a great opportunity to address new and emerging issues and their importance for the RFMOs, such as the SDGs, which play an important role for RFMOs, especially SDG 14 "life below water," which aims to achieve sustainable management of all marine resources. The SDGs were adopted in 2015, thus, since two of the PR were conducted prior to and three of them shortly after, none of the five organizations considered the SDGs in their PR.

Although the SDGs are not mentioned during PRs, the assessment criteria address areas, which are important to achieve SDG 14. For example, the criteria of the category "conservation and management," are supporting target 14.2 of SDG 14, which calls for sustainable management and the protection of the marine ecosystems (United Nations, 2018). Addressing all the recommendation of this category not only helps to achieve SDG 14 but also supports the resilience of marine ecosystem against climate change. Thus, even if the SDGs are not mentioned in PR protocols, PR processes can be used as vehicles to address emerging issues and increase awareness of new agreements, which are relevant for fisheries organizations. If the categories indirectly address SDG 14, it is necessary that these issues are officially addressed, by RMFOs developing their own criteria for the SDGs (Pentz *et al.*, 2018).

Conclusion

RFMOs are important for the management of highly migratory and straddling fish stocks and indirectly affect the livelihood of millions of people. The performance of RFMOs has been questioned in terms of meeting their mandates and they were encouraged to conduct PRs. Now almost all RFMOs have conducted at least one PR. The aim of this study was to examine the progress of five RFMOs since their first PR. The results showed that the RFMOs have done notable work to address their recommendations. Important categories such as "conservation and management" or "international cooperation" showed high numbers of recommendations under the scoring category "improving." It would be useful to include this scoring system in future PRs to give an overview of the progress made by the RFMO since their former PR. It will, however, be necessary to establish a standardized procedure to conduct PRs, including opportunities to address broader issues such as the SDGs. This will not only help to better compare the outcomes of PRs between different organizations but would also ensure that RFMOs are responsive to emergent issues.

Supplementary data

Supplementary material is available at the *ICESJMS* online version of the manuscript.

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ORIGINAL PAPER

Explicit targets and cooperation: regional fisheries management organizations and the sustainable development goals

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Abstract
In 2015, the international community adopted the United Nations Sustainable Development Goals (SDGs), a goal-setting governance strategy that aims to achieve sustainable development across social, economic, and ecological areas. SDG 14 ('life below water') is directed to the sustainable use and conservation of the oceans and marine resources. Regional fisheries management organizations (RFMOs) are key institutions in managing international fisheries and thus have the potential to play a significant role in realizing the attainment of SDG 14. This paper aims to assess how RFMOs could contribute to SDG 14 by examining their treaty texts and implementation of conservation and management measures or collaborative networks. The results of this paper highlights the contribution of RFMOs to targets such as ending overfishing and indicates the need for further attention towards area protection. The findings of the network assessment show that RFMOs mainly cooperate with other RFMOs or fisheries-related organizations, indicating a lack of cooperation with other maritime organizations. Moreover, the objective of most of these collaborations is sharing of information or data, while actions against problems such as the bycatch of non-target species are missing. Thus, this paper highlights how existing regional organizations have the potential to increase their contribution to SDG 14, by aligning more of their work to this goal. To support this process, we developed a list of considerations and actions.

Keywords Fisheries management · High seas · Ocean governance · Regional organizations · United Nations

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1 Introduction

In 2015, all member states of the United Nations adopted the United Nations Sustainable Development Goals (SDGs), a list of 17 goals, supported by 169 targets, aimed at global sustainable development across various social, economic, and ecological issues. Through the SDGs, the international community applies a goal-setting approach, which is a different governance strategy to the otherwise common rule-making approach (Young 2017). Contrary to rule-making, goal-setting aims to voluntarily change the behaviour of actors (e.g. countries) and to measure the progress of these actors by using indicators (Biermann and Kanie 2017; Young 2017). An effective goal-setting approach relies on an overarching goal with a small number of sub-goals, which should be hierarchically structured, as well as clearly identifying parties that are willing to cooperate to achieve these goals (Underdal and Kim 2017; Young 2017). Even though the SDGs lack most of the features for good goal-setting, such as a small number of goals or a clear hierarchical structure between the goals (Underdal and Kim 2017), they offer the opportunity to raise awareness among the global community of the importance of sustainable development across social, economic, and ecological issues (Young 2017).

The SDGs are built upon the Millennium Development Goals (MDGs), however, they are distinctly different. While the MDGs, which were established in the early 2000s, only applied to developing countries, the SDGs have universal application, applying to countries at all stages of development (Sachs 2012). The MDGs were the result of a political negotiation (Young 2017), whereas the establishment of the SDGs incorporated a much broader approach, which was influenced *inter alia* by social movements (Gupta and Nilsson 2017). Another important difference is the greater focus on environmental issues. While the MDGs had only one goal (goal 7) which focused on the environment, the SDGs have three goals (SDG 13—climate actions; SDG 14—life below water; and SDG 15—life on land).

Notably, for the oceans, SDG 14 is titled 'life below water' and is specifically directed to the marine environment. It acknowledges the importance of the oceans for human livelihoods and seeks to promote conservation and sustainable development of oceans, seas, and marine resources. Seven main targets and three sub-targets support SDG 14 and specifically address issues such as marine pollution, sustainable management of fisheries, and conservation. Marine resources are important for the livelihoods and food security of millions of people around the world. For example, in 2018, the global fishing and aquaculture industry employed around 59.5 million people (FAO 2020) and contributed around US$300 billion to the global economy in the year 2006 (Sumaila et al. 2016). As the world's oceans are a vital supplier of ecosystem services for human social and economic well-being and are intimately connected with terrestrial and atmospheric systems, they have been identified as playing a key role in achieving other SDGs (Singh et al. 2017).

To achieve the SDGs it is important that existing institutions support actions targeted towards the goals which fall within their mandate (Bernstein 2017). Regional fisheries management organizations (RFMOs) are key institutions for managing marine resources in the high seas and have mandates to pursue sustainable management of marine living resources and the environment. These organizations have the ability to play an important role in supporting SDG 14, not least because they also influence the management of fisheries of member states in waters under their national jurisdiction, and are key sources for gathering scientific data concerning fisheries management (FAO 2018).

Countries who fish in high sea areas are required under the 1982 United Nations Law of the Sea and the 1995 United Nations Fish Stocks Agreement to become members of these organizations or to cooperate directly with each other (United Nations 1982, 1995). RFMOs have the ability to enforce legally binding measures on their members (FAO 2019b). Contemporary RFMOs not only manage fish but also increasingly address wider marine ecosystem protection from fishing activities (Scanlon 2018), even though the mandate of RFMOs is limited to their target species, leaving around 95% of fish species without management (Ortuño Crespo et al. 2019). RFMOs could be useful in facilitating the implementation of the SDGs, as ecosystem considerations are an important aspect of the targets of SDG 14, and provide a framework for fishing industry engagement with the SDGs. However, it is important to note that some of their measures are weak and ineffective (Juan-Jordá et al. 2017) and the impact of fishing on non-target species is high (Gilman et al. 2014). Thus, to effectively support the attainment of the SDGs, RFMOs need to strengthen their measures (Haas et al. 2020) and increase cooperation with each other and also with other institutions in coordinating such work (Bernstein 2017). Improving cooperation among different institutions that manage different ocean activities will strengthen ocean governance and minimize existing governance and regulatory gaps (Gjerde et al. 2016).

The aim of this paper is to examine how RFMOs could contribute to SDG 14 by assessing the existing work of RFMOs and their potential contribution to achieving the main targets of SDG 14. Little work has been done so far to assess how existing fisheries management organizations, such as the RFMOs, might engage with the implementation of the SDGs. To assist in filling this knowledge gap, we use document analysis to explore relevant RFMO treaty texts and conservation and management measures and determine their alignment with the different targets of the SDGs. Moreover, since cooperation is an important aspect of the achievement of the SDGs (Goal 17), we examined the RFMOs' cooperation with other organizations and assessed the Memorandums of Understanding (MoU) these organizations have in place. MoUs are a key way RFMOs cooperate with different institutions and organizations (Rochette et al. 2015). There is a lack of work exploring how RFMOs can contribute to the SDGs. This paper contributes to the literature on the connections between the SDGs and regional organizations, but might also help RFMOs to proactively shape their contribution to SDG 14, and thus to a sustainable ocean.

2 Methods

We selected 13 RFMOs that manage areas of the ocean beyond national jurisdiction and have an active commission in place (Pentz et al. 2018) (Table 1). These two characteristics are important in selecting RFMO case studies because the aim was to study fisheries management at the high seas and to examine RFMOs which have the ability to enforce binding measures, and thus need to have an active commission in place.

To assess the extent to which these 13 RFMOs are already engaging with the SDGs, we closely examined the meeting reports of their commission bodies and the scientific committees from 2014 onwards (i.e. the year before the SDGs were agreed). Through these records, we also identified key areas for RFMOs' contributions to the main targets of SDG 14 and established criteria which are linked to the specific targets of SDG 14. These criteria targeted conservation and management measures that would provide valuable contributions to meeting the respective target. Table 2 provides the criteria for target 14.4 as

Table 1 Selected RFMOs

Acronym	Full name
CCAMLR*	Commission for the Conservation of Antarctic Marine Living Resources
GFCM	General Fisheries Commission of the Mediterranean
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	Northeast Atlantic Fisheries Commission
NPFC	North Pacific Fisheries Commission
SEAFO	Southeast Atlantic Fisheries Organization
SIOFA	Southern Indian Ocean Fisheries Agreement
SPRFMO	South Pacific Regional Fisheries Management Organization
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tuna
IOTC	Indian Ocean Tuna Commission
WCPFC	Western and Central Pacific Fisheries Commission

*CCAMLR has a broader mandate than the other organizations and is rather a conservation organization with fisheries responsibilities than an RFMO (Constable et al. 2000)

Table 2 Assessment criteria for target 14.4

14.4 By 2020, effectively regulate harvesting, and end overfishing, illegal, unreported and unregulated (IUU) fishing and destructive fishing practices implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	Yes	No
Mentioned in the convention and/or is a resolution in place about IUU fishing?		
Do they have an IUU vessel list?		
Do they have vessels on their IUU vessel list?		
Do they have links to the IUU lists of other RFMOs?		
Do they have port state measures in place?		
Do they have trade measures?		
Do they have measures on a catch documentation scheme or a video monitoring system?		
Do they have a resolution on transhipment (Ewell et al. 2017)?		

an example. We analysed the academic literature and websites of the RFMOs for relevant information on the assessment criteria (see Appendix 1 of ESM). Following the framework by Cullis-Suzuki and Pauly (2010) and Pentz et al. (2018), each criterion could be answered with a 'yes' or 'no' response, which is discrete and not overlapping. To assess how much work organizations have already carried out towards implementing the different targets, we calculated the overall percentages for each target and RFMO.

However, the RFMOs' ability to deal with the targets varied, and therefore, the number of criteria was different for each target. For example, while there were only four potential criteria with target 14.1 (i.e. marine pollution), target 14.4 (i.e. sustainable fisheries, see

Table 2) had eight. To provide a clearer picture regarding the measures RFMOs have in place, we divided target 14.2 (i.e. sustainable management) into criteria which are related to the precautionary approach for fisheries management and the ecosystem approach for fisheries management. Another change was made concerning target 14.7, which relates to small island developing states and least developed countries. To make it more applicable for all RFMOs, we assessed their measures regarding developing countries in general. We also excluded target 14.3 (i.e. ocean acidification) and 14.6 (i.e. subsidies), since RFMOs do not have any measures in place which relate to these two targets. Ocean acidification is directly linked to climate change, and to address these impacts, it is important to have robust management in place that is able to respond to these uncertainties (Pentz and Klenk 2017; Cheung et al. 2017; Cheung 2018). Management considerations are addressed by target 14.2 (i.e. sustainable management) and 14.4 (i.e. sustainable fisheries). In the context of subsidies, it is important to note that this topic has been addressed by the World Trade Organization (WTO). Moreover, subsidies are a national matter and thus are difficult to address in a regional setting.

To assess the extent to which RFMOs cooperate, we assessed how many Memorandums of Understanding (MoUs) were signed between RFMOs and other organizations. We also analysed the objectives of these MoU to understand the areas of cooperation. The MoU partners were divided into 'conservation', 'intergovernmental', 'science', 'NGO', and 'others'. 'Others' included groups which did not fit the description of the other groups, such as regional fisheries bodies. This information was gained from RFMO websites.

3 Results

From the analysis of the meeting records, of the 13 RFMOs examined, only seven mentioned the SDGs in either the commission meeting reports or the reports from the scientific committee (CCAMLR, GFCM, IOTC, NAFO, NEAFC, SIOFA, and WCPFC). This shows a distinct lack of engagement for RFMOs to specifically pursue the SDGs. However, the work RFMOs are already doing and the measures these organizations have in place can be matched to the targets of SDG 14 (see Appendix 2 of ESM for an overall summary). Most of the measures in place related to issues relevant to target 14.4, sustainable fisheries (70.2%), followed by target 14.2—ecosystem approach, and 14.7, developing countries (64.7% and 61.5%, respectively). The target assessed as having the lowest value was 14.5, area protection (35.7%) (see Fig. 1).

There are also differences in place among the RFMOs. While general RFMOs (i.e. RFMOs which manage non-straddling and migratory species) and tuna RFMOs (i.e. RFMOs which manage tuna and tuna-like species) have on average almost the same amount of measures for target 14.1, marine pollution, 14.2, precautionary approach, and 14.7, developing countries, there were greater differences to observe for the three remaining targets (Fig. 2). The greatest difference between tuna and general RFMOs was for target 14.5 (i.e. marine protected areas). While general RFMOs had on average 46.43% measures in place, the tuna RFMOs had only 11.43%. For target 14.2, ecosystem, the tuna RFMOs had more measures in place than the general RFMOs, 77.78% and 55.56%, respectively.

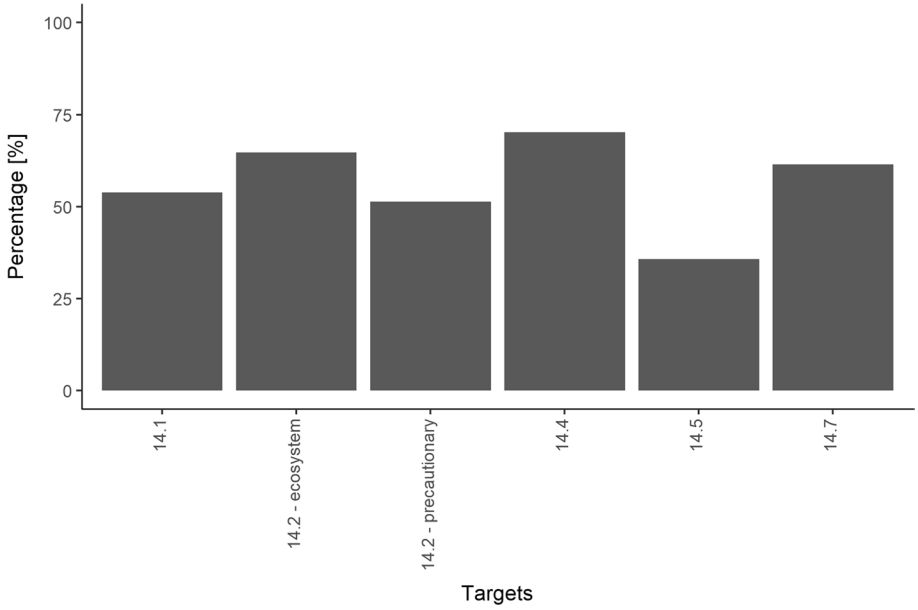

Fig. 1 Percentage of measures in place for each of the targets over all RFMOs. Target 14.2 is divided into-precautionary approach and ecosystem approach

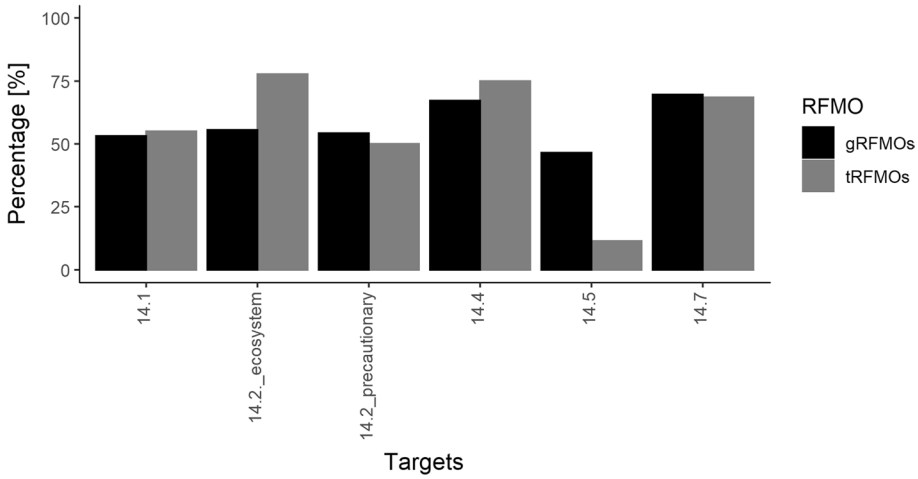

Fig. 2 Average percentage of measures in place for the targets, divided into general RFMOs (gRFMOs) and tuna RFMOs (tRFMOs)

Of the 41 criteria, only two criteria were represented across all RFMOs, namely, 'Are the RFMOs applying an ecosystem approach?' and 'Do they have an IUU vessel list?' (see A2). The lowest number of fulfilled criteria over all the RFMOs was found for target 14.5, for which only two criteria were addressed by the tuna RFMOs. These two criteria dealt with general habitat closures and habitat protection measures. Besides target 14.5, the tuna

RFMOs did not officially acknowledge climate change, while none of the general RFMOs had trade measures established.

Most of the MoUs which were in place were between multiple RFMOs or other fisheries-related organizations, such as scientific institutions which provide data and knowledge to these organizations or conservation organizations which focus on species which are impacted by fisheries, for example seabirds or turtles. The organization which had the most agreements was WCPFC, followed by CCAMLR, with 10 and 6 MoUs, respectively (Fig. 3). On the contrary, the organizations with the fewest MoUs in place were NAFO and ICCAT (1 each). More than half (8) of the RFMOs had signed an MoU with the Agreement for the Conservation of Albatrosses and Petrels (ACAP) and the only RFMOs which did not have an MoU in place with ACAP were RFMOs located in the north (NAFO, NEAFC, and NPFC) and ICCAT. The three RFMOs in the north and GFCM were also the only RFMOs which had no contract for cooperation with other RFMOs. Moreover, GFCM was the only organization which had MoUs with NGOs (namely OceanCare and WWF) (Fig. 3). The tuna RFMOs had on average slightly more MoUs than the general RFMOs (3.25 and 4.8, respectively, see Appendix 4 of ESM).

We also analysed the objectives of these MoUs, and seven themes have been identified. The theme which appeared most was *sharing activities* (26) including, for example, the exchange of information, data, expertise, or technique. Following this was the theme *educational activities* (15) describing activities such as the implementation of education and awareness programmes which was one objective in MoUs among RFMOs but also between RFMOs and conservation programmes. The theme *research activities* (12)

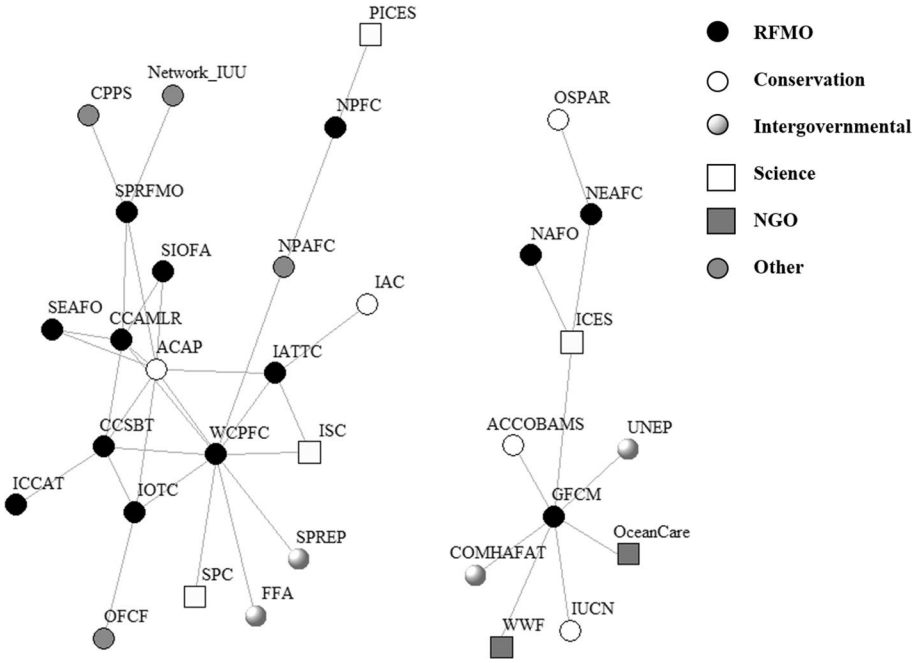

Fig. 3 Network of organizations which have signed a Memorandum of Understanding (see Appendix 4 of ESM for acronyms)

included areas such as collaboration on research efforts, but also included MoUs with institutions which act as science providers for RFMOs. Science providers such as the International Council for the Exploration of the Sea provide RFMOs, for example NEAFC, with stock assessment or other scientific information if requested. The theme *bycatch mitigation activities* (9) grouped objectives which were mostly used in MoUs between RFMOs and conservation organizations such as the Agreement on the Conservation of Albatrosses and Petrels (ACAP) or the Inter-American Sea Turtle Convention (IAC). The three remaining themes, *harmonizing conservation and management measures, theme-specific,* and *management improvement activities*, were less frequently used (six, five, and four times, respectively). The theme *harmonizing conservation and management measures* was often applied for MoU among two RFMOs, while the theme *theme-specific* including MoUs which were established for a certain purpose, for example the fight against IUU fishing (i.e., GFCM and the Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic Ocean (COMHAFAT)) or transhipment at sea (e.g. MoU between CCSBT and ICCAT). The last theme, *management improvement activities,* described aspects directly related to fisheries management, for example the establishment of management plans based on the ecosystem approach (e.g. between GFCM and the World Wildlife Fund (WWF)).

4 Discussion

Achieving the SDGs will be an enormous challenge and relies on the political will of the actors and the cooperation and coordination of existing institutions which have the mandate to address certain goals and their targets (Bernstein 2017). RFMOs are key management institutions for fisheries management at the high seas and, thus, are important to support the achievement of several targets of SDG 14. Despite this important role, RFMOs have not yet acknowledged their responsibility to support SDG 14. Acknowledging this role could, for example, help to provide data for the different targets of SDG 14. This study aimed to analyse the potential contribution of RFMOs to the targets of SDG 14. It is important to note that it is not the intent of this study to assess the effectiveness of the conservation and management measures.

The above results showed that RFMOs have measures in place which might assist in meeting the different targets. Most of the measures have been linked to target 14.4, sustainable fisheries. Using fisheries resources in a sustainable way is stated as part of the objectives in the convention of many RFMOs. One part of target 14.4 aims to end overfishing and illegal, unreported and unregulated (IUU) fishing. Ending IUU fishing is on the agenda of all RFMOs, and all RFMOs have established an IUU vessel list which is mostly linked to lists of other RFMOs and is publicly accessible. Constraining IUU fishing is imperative for a sustainably managed ocean since it can have major impacts on the whole marine ecosystem and also weakens management measures and compliance (Lindley and Techera 2017; Ortuño Crespo and Dunn 2017) and this contribution depends fundamentally on cooperation between and among the RFMOs. Another important aspect of IUU fishing is transhipment, which allows vessels to bypass monitoring and control enforcement since they do not have to go back to port for resupply (Ewell et al. 2017). Except for three organizations (i.e. NAFO, NEAFC, and SIOFA), all RFMOs have implemented a measure on transhipment. These measures require members to have, for example, an observer to monitor the

transhipment activity (SPRFMO 2018) or to tranship only in ports with an exception for large-scale tuna vessels (IOTC 2019).

The RFMOs also had a high number of measures in place which addressed the ecosystem approach for fisheries management (14.2—ecosystem). Target 14.2—ecosystem—deals with the impact of fishing on the marine environment and especially with bycatch of species such as seabirds and sharks. New environmental issues are constantly emerging, and many RFMOs have either updated their conventions, adopted new measures, or have updated old measures (FAO 2018). For example, the two oldest RFMOs, IATTC and GFCM, established in 1949 and 1952 respectively, updated and modernized their conventions to implement new issues such as the precautionary or ecosystem approach, which are key aspects for a sustainable fisheries management (de Bruyn et al. 2013; FAO 2019a). The organizations which had measures in place for most criteria were CCAMLR and WCPFC. Generally, CCAMLR is said to be one of the model organizations in the area of the precautionary and ecosystem approach (Hanchet et al. 2015). However, other organizations have also made progress concerning the implementation of the precautionary approach (Miller and Siicer 2014).

The target with the lowest contribution was 14.5, area protection. While almost all RFMOs (10 out of 13) have installed one kind of closure, only five have installed an MPA and CCAMLR was the only one which established no-take zones (Pentz et al. 2018) and is committed to a representative system of MPAs (CCAMLR 2019). Generally, it is important to acknowledge that the mandate of RFMOs is restricted to fisheries and to the water column (Scanlon 2018), while the seabed is managed by the International Seabed Authority. Contrary to the other RFMOs, CCAMLR has a much broader mandate with a greater focus on the conservation of the whole marine ecosystem (CCAMLR 1982). However, the other RFMOs still have the power to close areas to fisheries and to ban destructive fishing practices. The topic of area-based management tools, such as fisheries closures, and MPAs received considerable attention at the currently ongoing negotiations for a new international legally binding agreement on biodiversity beyond national jurisdiction (Wright et al. 2015b). While the outcome is uncertain at this point of time, having a treaty, which is open to all United Nations member states, might change the way area-based management tools and MPAs are implemented.

Target 14.5 had the greatest difference between tuna RFMOs and general RFMOs. The tuna RFMOs had measures in place for only two out of seven criteria. This might be due to the different fishing methods and different target species. Tuna fisheries fish primarily pelagic species, while general RFMOs also engage with demersal fish species and use gear such as midwater and bottom trawling that can have a greater impact on the ecosystem (Pusceddu 2014), leading to the designation of many 'vulnerable marine ecosystems' (VMEs) (Wright et al. 2015a) by these RFMOs. However, gaps remain due to, for example, inconsistencies between impact assessments and FAO Guidelines and United Nations General Assembly resolutions, lack of use of cumulative impact assessments, lack of information on the status of stocks, and unwillingness of member states to close identified areas to bottom fishing (Gianni et al. 2016).

Another target which showed some differences between general and tuna RFMOs was 14.2—ecosystem approach. Overall, tuna RFMOs had more measures in place which address the impact of fisheries on species such as mammals or seabirds. Even though tuna RFMOs have measures in place which aim to mitigate the impact of fishing on bycatch species, Juan-Jordá et al. (2017) showed that these measures are lacking important features,

such as pre-agreed operational objectives and indicators or pre-established reference points and performance standards.

To achieve the SDGs, existing institutions will have to cooperate and coordinate their work (Bernstein 2017). Currently, RFMOs are mainly cooperating with other RFMOs or fisheries-related organizations (Fig. 1). None of the RFMOs had an MoU or any kind of cooperation with institutions which deal with other ocean-related activities, such as the International Seabed Authority, the International Maritime Organization, or the International Labour Organization. The results also showed that the RFMOs in the southern area are better connected than the organizations in the northern areas.

To achieve the SDGs, it is important that the RFMOs are entering new areas of cooperation, especially with other actors in the ocean. There are several institutions which manage activities on the ocean and it is imperative to increase the communication among them and to align their mandates; otherwise, it impacts the effectiveness of ocean governance and enhances non-compliance behaviour of member states (Ban et al. 2014). Generally, cooperating with different stakeholders is an important aspect of sustainable fisheries management (Jentoft and McCay 1995; Pomeroy et al. 2001; Beddington et al. 2007; Bundy et al. 2017).

To support the achievement of the SDGs, RFMOs need to make a greater effort to cooperate with organizations outside their comfort zone but also expand the objectives of cooperation. Most of the MoUs are about sharing information, data, technology, or expertise. Even though this is important, for example, for the fight against IUU fishing (Hutniczak 2019), real actions are missing. Only a few MoUs included activities such as implementing bycatch mitigation measures or the adaptation of management plans which are based on the ecosystem approach.

It is important that RFMOs enhance the objectives of the MoUs and include actions which are directly linked to emerging issues. One example is climate change, especially the aspect of shifting species due to warming water (FAO 2016; Cheung et al. 2010; Pecl et al. 2017). Species will be found in different jurisdictional areas, and therefore, it is important that RFMOs start to address this issue as soon as possible. The lack of an agreement can lead to international conflicts, which happened between the European Union, Norway, the Faroe Islands, and Iceland because of the change in the geographical distribution of the northeast Atlantic mackerel stock (Spijkers and Boonstra 2017). Supporting the achievement of the SDGs requires more of the RFMOs than the sharing of information and data.

5 Conclusion

The SDGs are a goal-setting strategy for social, economic, and ecological sustainable development. To achieve them, it is important that existing institutions support the targets and goals which are linked to their mandate. The aim of this paper was to assess how RFMOs could contribute to SDG 14. We analysed the established measures of these organizations and linked them to the main targets of SDG 14. Furthermore, we mapped a network of institutional links between the different organizations based on the existence of MoUs and analysed the MoUs' objectives. The results showed that the framework of RFMOs provides an important contribution to several targets of SDG 14, especially sustainable fisheries. These organizations also cooperate with other organizations, however, primarily with other RFMOs, or fisheries-related organizations, and the

pattern of cooperation noted was mostly on information sharing or the establishment of educational programmes. This paper contributes to the scholarly debate concerning the implementation of the SDGs as little work has been done so far to assess how existing fisheries organizations could engage with and contribute to these global goals. Overall, the results showed that even though RFMOs do not officially address SDG 14, the measures these organizations have in place can be linked to the specific targets of SDG 14. The list (see Appendix 1 of ESM) developed to link the RFMOs work with the targets of SDG 14 could be used by RFMOs to start their proactive engagement with the SDGs and could also support the reporting towards the achievement of SDG 14.

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Regional fisheries organizations and sustainable development goals 13 and 14: Insights from stakeholders

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ABSTRACT

The importance of the oceans is highlighted by the United Nations Sustainable Development Goals (SDGs) through SDG 14, that aims to conserve and sustainably use the oceans, seas and marine resources for sustainable use. Regional Fisheries Organizations (RFOs) play a key role in managing fisheries on the high seas and therefore are vital for supporting the successful implementation of SDG 14. SDG 14 is intrinsically linked with SDG 13 (the need to take urgent action to combat climate change and its impacts). As biophysical impacts arise from human-induced climate change affect oceans, and fisheries therein, it is important that RFOs take account of such impacts on the management of fisheries. This paper examines the engagement of RFOs with SDG 14 and climate change through an analysis of interviews with 36 RFO stakeholders. The results show that even though there is consensus concerning the importance of climate change and SDG 14, most of the RFOs are not directly engaging with these two SDGs. However, it was stated that the work done by RFOs, to end overfishing, positively contributes to the realization of climate change and SDG 14, although the actions taken by RFOs need to increase in scale and speed if they are to fulfil their responsibility to effectively manage human impacts on ocean resources. Furthermore, member countries play a key role in supporting or resisting progress. This paper contributes to a gap in the literature concerning current perceptions of stakeholders of the issues RFOs are facing concerning the SDG 14 and climate change.

1. Introduction

The United Nations Sustainable Development Goals (SDGs), established in 2015, provide social, economic, and ecological value-based goals directed at achieving global sustainable development. The SDGs are separated into 17 goals, supported by 169 targets. The SDGs are, however, non-binding (Biermann et al., 2017), but apply to all United Nations members, both developed and developing economies (Sachs, 2012). Of the 17 goals, three are targeted towards ecological issues; SDG 13 (take urgent action to combat climate change and its impacts), SDG 14 (conserve and sustainably use the oceans, seas and marine resources for sustainable development) and SDG 15 (life on land). SDG 14 is particularly important due to the importance of the oceans for the realizations of other SDGs (Singh et al., 2017). SDG 14 aims to conserve and sustainably use the oceans, seas and marine resources for sustainable development and the fishing industry can play an important role in achieving this goal (Brooker et al., 2016; Haas et al., 2019). The time frame for achieving the SDGs is between 2020–2030. However, global progress towards the SDGs is currently too slow to be on track to achieve the SDGs by 2030 (United Nations, 2018). Thus, more urgent and significant actions are necessary (United Nations, 2018).

Climate change is likely to further impact meeting the SDGs (Singh et al., 2019) and the need to take action to combat climate change and its impacts have been emphasised in SDG 13. The impact of climate change on the marine ecosystem and the availability of resources will have major effects on human society (Allison and Bassett, 2015; Weatherdon et al., 2016), and because the ocean is linked to many other goals, the achievement of several SDGs will be challenged. Due to the important role of the oceans in the global climate system and human adaptive capacity, it is imperative to mitigate and adapt to climate change (Galland et al., 2012). Climate change is likely to have many negative impacts on marine fisheries but also, potentially, some positive impacts. (Lam et al., 2016). For example, marine species are already range shifting due to temperature increases (Cheung et al.,

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2010; FAO, 2016; Pecl et al., 2017). The unpredictable impact of climate change, for example in relation to extreme events, may complicate already existing challenges (e.g. overfishing or habitat degradation) facing fisheries managers (Hoegh-Guldberg and Bruno, 2010; Sumaila et al., 2011). Overall, climate change is likely to have extensive consequences on fisheries and will impact the livelihoods and security of millions of people.

Implementing actions concerning climate change is necessary to achieve other SDGs, such as SDG 1 (poverty reduction) and SDG 2 (zero hunger) (Lawrence-Samuel et al., 2017). Climate change will especially impact developing countries, which are not the main sources of greenhouse gas emissions (Sumaila et al., 2019). The targets of SDG 13 are directed at both climate change mitigation and adaptation. SDG 13 also recognizes the importance of the global community in achieving the goals of the Paris Agreement (i.e., to limit climate change to less than 2 °C above pre-industrial levels), which was established after the SDGs and thus, contains details regarding nationally determined commitments for reducing greenhouse gas emissions. Reducing greenhouse gas emissions would benefit fishing countries since it would decrease further impacts of climate change on fish stocks (Sumaila et al., 2019). To effectively address climate change, fisheries management has to become more adaptive and resilient by increasing the capacity to learn and to experiment (Ojea et al., 2017). This would allow RFOs to consider uncertainties and vulnerabilities of climate change in their fisheries management frameworks (Pentz and Klenk, 2017).

The aim of this paper is to provide a detailed analysis of the ability of selected Regional Fisheries Organizations' (RFOs) to address SDG 14 and SDG 13 (henceforth addressed as 'climate change') and to a lesser extent the agreement for biodiversity beyond national jurisdiction (BBNJ). The SDGs are an important international initiative and achieving them would be an enormous global achievement. Climate change is one of the largest human threats to the marine ecosystem and thus needs attention at many different levels. RFOs are key organizations for fisheries management at the high seas – areas beyond national jurisdiction – and these organizations play an important, although often overlooked role in supporting the implementation and reporting of SDGs 14 (UNDESA et al., 2014). There are 13 RFOs which have the mandate to enforce legally binding measures on their members and manage high seas areas (Table 1; Fig. 1). This paper, therefore, determines and analyses the perceptions of RFO stakeholders including scientists, government officials, industry, environmental non-government organizations and employees of secretariat, which are linked to four case study RFOs, namely the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), the Western and Central Pacific Fisheries Commission (WCPFC), the South Pacific Regional Fisheries Management Organizations (SPRFMO), and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

These four organizations were chosen due to the geographic location of the secretariats, which are in Australia, New Zealand or surrounding countries, which is close to the location of the researchers. Even though it can be argued that four RFOs are not presenting a complete picture of all existing RFOs, they cover many views relevant to other similar organizations since all RFOs follow a similar design and are based on the United Nations Law of the Sea and the United Nations Fish Stocks Agreement (United Nations, 1982, 1995). Furthermore, the participants also shared their knowledge concerning other RFOs, which enhanced the results of this analysis. Stakeholders are "any group or individual who can affect or is affected by the achievement of an organization's objectives" (Freeman, 1984, p.46) and play an important role in RFOs (Beddington et al., 2007). Industry and companies regularly participate in the meetings of these organizations (Petersson et al., 2019). The perception of these stakeholders thus provides valuable insights into the work of the RFOs.

Table 1
Acronyms and full names for all 13 RFOs.

Acronym	Full name
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
GFCM	General Fisheries Commission of the Mediterranean
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IOTC	Indian Ocean Tuna Commission
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	North East Atlantic Fisheries Organization
NPFC	North Pacific Fisheries Commission
SEAFO	Southeast Atlantic Fisheries Organizations
SIOFA	Southern Indian Ocean Fisheries Agreement
SPRFMO	South Pacific Fisheries Management Organization
WCPFC	Western and Central Pacific Fisheries Commission

2. Methods

To assess the perception of different stakeholders, 34 semi-structured interviews were conducted with scientists, government officials, industry, environmental non-government organizations and employees of the relevant RFO secretariats (University of Tasmania approval, Ethics Reference Number H0017184). The participants were selected due to their knowledge regarding RFOs, especially CCAMLR, WCPFC, CCSBT, and SPRFMO, rather than due to their knowledge concerning the SDGs. Most of the participants were familiar with SDG 14 and the issue of climate change but were less aware of the other SDGs. We interviewed 36 stakeholders, resulting in 34 interviews because three stakeholders chose to be interviewed together. This was done over a timeframe of six months in 2018–2019. During the interviews, we asked 15 semi-structured questions (see Online Supplementary Table A1), which were tested beforehand in two pilot interviews held with colleagues. The questions targeted interviewee knowledge and views on SDG 14, climate change and the future of the RFOs. The questions also addressed the BBNJ agreement, an agreement that is currently being negotiated under the UNCLOS. The negotiation of the BBNJ agreement is yet to be concluded but it potentially will impact on RFOs regarding climate change and SDG 14, or components relevant therein. The interviews were between 15 min–45 min long, depending on the participant's engagement with the topic and available time. With the approval of the participants, the interviews were audio-recorded.

The interviews were transcribed, coded (see Fig. 2 and Online Supplementary Table A2) and analysed using the qualitative data analysis software QSR NVivo® (QSR international, version 11). The codes were re-assessed after each round of analysis, to assure consistency and with the research question concerning the engagement of RFOs with the SDGs and climate change. The final codes were analysed, divided and summarised under higher-level categories (Online Supplementary A2), which are more abstract than the codes (Corbin and Strauss, 1998). These categories helped to better understand the data and to identify connection points. After grouping the codes into categories and sub-categories, the categories were organised into six themes to obtain an overview of the potential topics playing an important role in RFOs day-to-day work and concerning their engagement with SDG 14 and climate change. Fig. 2 presents the themes and categories and their frequency, which is still seen as a qualitative marker to indicate approximate size, as they are subjective and not absolute counts, which helps a high-level understanding of the data. There is a wide range among the frequency of the themes, which is due to the number of codes which are covered by these themes, but also due to the way participants talked about a certain topic. For example, the theme 'decision-making' received a very low number of responses as participants mentioned this issue without necessarily elaborating upon it. This theme was, however, highlighted as very important with regard to RFOs potential to engage with certain topics.

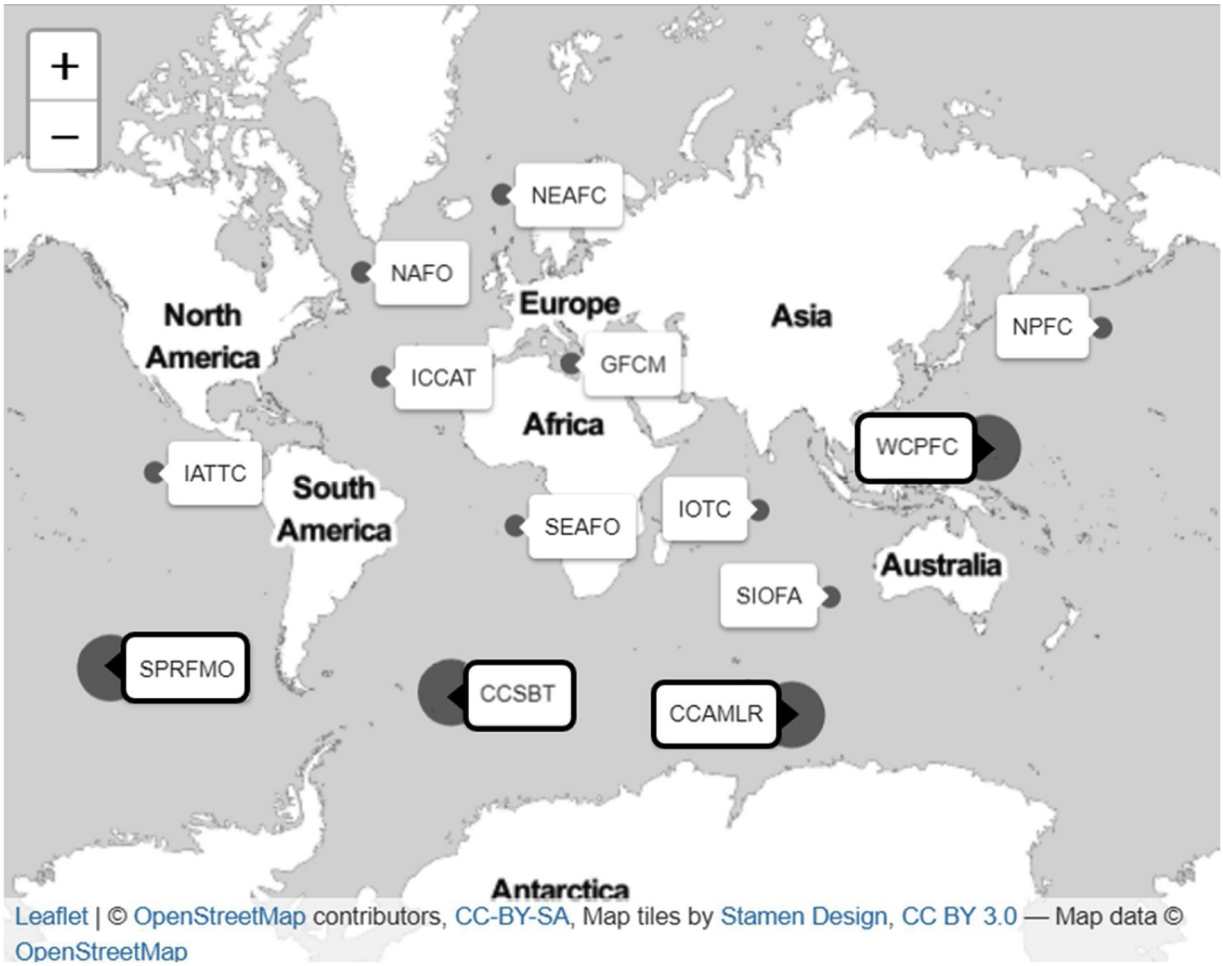

Fig. 1. Map showing the jurisdictions of all the RFOs. The case study RFOs have been highlighted. The map was produced using R (R Core Team, 2017), using RStudio (RStudio Team, 2015), with the package 'leaflet' (Graul, 2016). The data of OpenStreetMap are freely available (https://www.openstreetmap.org/copyright).

3. Results

The six themes identified issues which impact the linkages between the RFOs and SDG 14, climate change, and also the proposed BBNJ agreement. The theme with the highest number of references (441, Fig. 2) was *external drivers*. This theme summarized the opinion of the stakeholders concerning the SDG 14 and climate change (category 'perception of the impact of external factors'), which formed the basis of

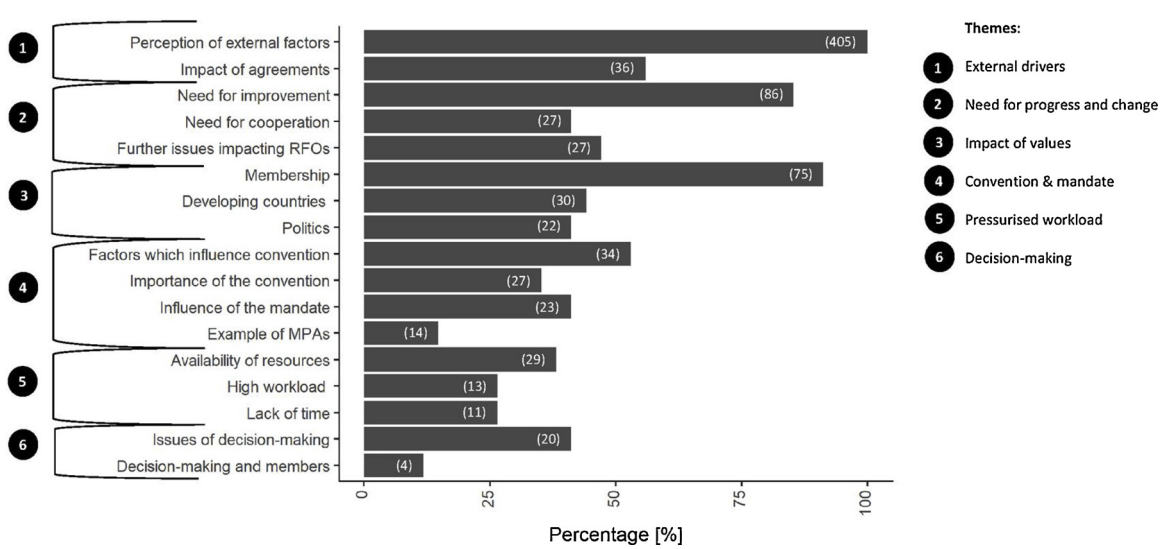

Fig. 2. How often each category was mentioned during an interview in percentage. The frequency, the number of times this code across all interviews, is shown in parenthesis. The categories were ordered in their themes, which are listed on the right side.

the interviews and thus was mentioned in all of them (100 %, Fig. 2). This theme gives insights into how the participants have perceived these two issues in the context of RFOs but also addresses the potential impact of other international agreements on these organizations. The second theme *need for progress and change* highlighted the need for the organizations to change and to perform better. Generally, fisheries management occurs in a dynamic environment. However, most of the RFOs adapt only slowly to new circumstances. For example, the CCSBT has adopted a management procedure, which is "a pre-agreed set of rules that can specify changes to the total allowable catch based on updated data" and which takes environmental fluctuations into account (CCSBT, 2020). This theme highlighted that the people working in these organizations or collaborating with them, are aware of their flaws and problems, but do not feel capable to change them.

Some of these flaws and problems are explicitly addressed in the remaining four themes. For example, the themes *impact of values* and *convention & mandate* show how the institutional setup and the member composition restrict the ability of the RFOs to make more impactful changes. The themes *pressurised workload* and *decision making* are highlighting aspects which were frequently mentioned during the interviews, for example, participants stated that these organizations are already dealing with a lot of work and do not have the time to address SDG 14 and climate change. The decision-making models applied in RFOs also make it difficult to address issues which might not be of high priority for the members, which links back to the importance of the members in these organizations. While these themes and categories might not be the only aspects, they stood out for stakeholders as most important. How often each of the different categories of the six themes were mentioned is shown in Fig. 2. The following sections provide a description of each theme and the associated categories.

3.1. External drivers

External drivers had the highest number of references (441, Fig. 2), with two categories linked to it, 'perception of the impact of external factors' and 'impact of agreements'. The first category addressed the stakeholder's perception concerning the link among the RFOs and SDG 14, climate change and the BBNJ agreement, in more details and was mentioned in each interview (Fig. 2). All participants (36) stated that there is no consideration, involvement or action concerning SDG 14 (codes 'no consideration', 'no action', and 'no involvement'). However, interviewees also indicated that these organizations are already doing work related to the SDG 14 (if for other reasons) and participants explained that the targets of SDG 14, such as sustainable management and fisheries, are part of the basic work of these organizations (Participant 13, code 'already do that'). Contrary to these findings, many participants thought that SDG 14 has the potential to positively influence RFOs (code 'potential to influence') and RFOs could play an important role in achieving SDG 14, even though this opinion was not shared by everyone (i.e., codes 'will not influence', 'nothing will change' or 'no acknowledgement of SDGs'). Concerning the negative perception of the ability of RFOs to address SDG 14, an interesting code was 'negative impact', saying that for example the general discourse of food security due to SDG 2, zero hunger, might be used to justify higher catch quotas (Participant 12).

Contrary to the SDG 14, climate change receives more attention during the RFO member meetings, and it was stated that some members are getting increasingly concerned about the possible impacts of climate change on the marine ecosystems (code 'concerned about impact'). Although climate change is seen as important (category 'high importance'), no specific actions have happened so far (code 'no action') and it is often described as one problem among many (Participant 27). It was also mentioned that RFOs do not see climate change as an immediate problem (code 'not an immediate issue') and RFOs are probably waiting until something concrete is happening (code 'wait and see approach'), as described by one of the participants:

> "*everyone is startled by the information that comes forward, but no one is really thinking about how they might go about addressing that decline, it is more, they more want to take it from the perspective let's wait and see*"

Generally, members of these organizations acknowledge the impact of climate change (code 'acknowledgement of impact') and participants highlighted the need to respond to climate change (code 'need to respond to CC'). One reason why actions for climate change are still missing might be the uncertainties linked to the impact of climate change on fisheries (code 'unknowns'), for example, species movements or the potential impact of acidification. These uncertainties make it hard to agree on certain measures and to start addressing the problem. Climate change was generally described as a difficult issue (code 'difficult issue'), which is impacted by the political will of members, and the availability of resources and time.

The second category, 'impact of agreements', describes the potential of international governance initiatives such as the United Nations Convention on the Law of the Sea, United Nations Fish Stocks Agreements, United Nations General Assembly resolutions, several agreements from the Food and Agriculture Organizations, the SDGs in generally and eventually the BBNJ agreement to impact members of these RFOs. Even when an organization does not mention these agreements in their founding convention, or do not officially refer to them during meetings, most of the members have signed those agreements (code 'Members signed agreements') and for example, most of the member countries have agreed to the SDGs and have them on their national agendas. In the long term, this has the potential to influence the policy of these countries and the way they approach fisheries management (code 'influence members').

3.2. Need for progress and change

The category 'need for improvement', one of three categories listed under this theme, describes areas and issues that need to change according to interviewees. It was generally acknowledged that RFOs need to perform better, especially in the way they manage their fisheries (28). This aspect was also frequently criticised in the scientific literature (see for example Cullis-Suzuki and Pauly, 2010). In the context of climate change, it was stated that RFOs can and need to do more. Climate change is a serious problem that needs to be addressed by RFOs and their individual member countries but also by other organizations. Participant 35 summarized that climate change is an issue which requires long term actions.

> *"So, these are all issues which everyone, it is pretty much status quo management at the moment, and no one is really thinking more than a few years ahead. But in the longer term, there need to be more sort of consideration, more engagement and probably more focused research in that area too."*

To reduce the potential impacts of climate change on the fish stocks, a good management system is needed (code 'need good management'). For example, a management framework, management procedures or harvest control rules are needed to make management more stable. It was emphasised that stocks need to be rebuilt to make them more resilient to biophysical changes driven by climate change. RFOs need to start acting on the precautionary and ecosystem approach, which means for example that members need to act on much less evidence for an impact than they would usually do, especially in the context of climate change (code 'need precautionary and ecosystem approach').

Besides the need to improve their management approaches, there is also an increasing need for more cooperation (category 'need for cooperation'), especially with other RFOs to deal with issues such as species redistribution due to climate change (code 'more cooperation with other RFOs'), which is likely to have consequences for existing rules and boundaries. Moreover, there is a rising need to cooperate with other institutions. Topics such as labour safety are getting more

attention among the members of RFOs and thus it is relevant to start working with the International Labour Organization (code 'more co-operation with different institutions'). Other institutions and frameworks such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on Migratory Species might become important for RFOs as well, to tackle problems related to shark and seabird bycatch.

The last category, 'further issues impacting RFOs', combines several problems which were raised by participants during the interviews. For example, participants mentioned the relationship between these organizations and the UN (code 'Relationship to the UN'), which was described as 'tense' by one participant. While CCAMLR does see itself as separate from the UN system and thus does not officially deal with UN-related initiatives such as the SDGs, four participants stated that there is a lack of trust between the UN and the other RFOs. This is important as it may be linked to the low consideration of SDG 14 and climate change in these organizations. The 17 SDGs cover many different issues, which makes it hard to break them down to regional requirements.

> "*It's just, they* (SDGs) *are very ambitious and when it comes to implementing that at a regional level, there are obvious challenges, the challenges of institutions, the human factor, it is just people speak different languages*."

Further issues which were listed under this category were, for example, the impact on non-target species, the issues of accountability and the lack of economic aspects.

3.3. Impact of values

The theme *impact of values* is made up of three categories, 'membership', 'developing countries' and 'politics', and in general emphasises the key role of the member countries in RFOs. The category 'membership' deals with different aspects of membership, such as the differences among members, or the influence of members on RFOs. For example, CCSBT has a much smaller number of members (8) compared to the WCPFC which has a higher number of members (26), with a high proportion of small island developing states (14). Another important influence in these organizations are the key players, such as the European Union in SPRFMO or Australia and Japan in CCSBT. All those different constellations make each organization unique. This is further enhanced by the different interests of those member countries and the reasons they engage with the RFO (code 'different reasons and interests'). The members bring different cultural values and economic interests to the table, which make it difficult to agree on a common view.

The member countries are the key players in RFOs and thus have a great influence on the way these organizations are dealing with SDG 14 or climate change (category 'the influence of members on RFOs'). Depending on the interest and economic value of the specific fishery these members adapt their behaviour (code 'behaviour of member states). Some members are more led by their economic interests while other members apply a more conservative approach during the discussion of, for example, new conservation measures or the total allowable catch. Those interests play an important role regarding what members put forward during the commission meetings and which topics get addressed or not (code 'members putting things forward'). This was especially highlighted by participant 30 who emphasized the role of members in RFOs.

> *"So, if there is a sense that RFOs could and should be doing more in either relating to the SDG goals or climate change, the way to do that would be in encouraging members to build that into how they are thinking about the RFOs and build that in the priorities they take into the RFOs."*

An important part of membership is the role of developing countries (category 'developing countries'). Fish is an important resource for livelihoods and economic aspirations for developing countries, small island developing countries and least developed countries. However, due to the lack of money, knowledge, and technology, these countries struggle to participate in RFOs and in some cases it is difficult for them to implement the basic principles of fisheries management (code 'issues of developing countries'). During the interviews, some participants pointed out that SDG 14 is more important for developing countries than for developed countries, due to the higher dependence on fish for food, economy, and livelihood (code 'more important for developing countries'). Several participants stated that SDG 14 is, therefore, more important for the WCPFC than for other organizations (code 'more important for WCPFC') since the WCPFC has the highest participation of small island developing states among all RFOs. The Pacific islands played a significant role in developing SDG 14 (Quirk and Quentin, 2015), and they may also need to take a leadership role in increasing the awareness of SDG 14 in RFOs.

The last category under the theme *impact of values* was 'politics'. An important aspect in analysing RFOs are the underlying national and industrial agendas which direct how member countries behave. Many participants emphasised the political impact in those organizations (e.g., code 'lack of political will' or code 'internal impact') and the importance to understand the political background of those members. The political nature of RFOs can either stagnate processes or drive change. However, those political influences are not only coming from their interests in fisheries but also from unrelated geopolitical events, such as elections or the relationship between countries, which impact decisions in RFOs (code 'external impact').

3.4. Convention/ mandate

Another theme was *convention & mandate*, which comprises four categories. The convention of an RFO plays an important role and can profoundly influence the RFOs framework ('importance of convention'). The convention determines the RFOs mandate which influences the ability to tackle certain issues, such as the establishment of MPAs for example (categories 'influence of the mandate' and 'example of mandate'). Mandate considerations and discussions are often used by members to influence the outcome of certain discussions. The mandate also influences the way RFOs deal with new emerging areas such as SDG 14 or climate change. Many participants stated for example, that the influence of SDG 14 on the RFOs depends on the mandate of those organizations (codes 'SDGs – discussions concerning mandate' and 'SDGs – influence depends on mandate'). Depending on their mandate, which is determined by the convention, the members of the RFOs feel more or less able to address SDG 14 or climate change. Overall, RFOs are a product of relationships, time and the circumstances of their foundation (codes 'RFOs products of relationships and time' and 'Different reasons to found an RFO'). Therefore, the age of a convention is related to the ability of RFOs to tackle new emerging issues such as the precautionary approach (code 'age'). While older RFOs such as the CCSBT have quite loosely worded issues around bycatch species, newer RFOs such as SPRFMO clearly state their mandate concerning ecosystem consideration and protection in their convention.

3.5. Pressurised workload

Another theme, which emerged during the interviews was *pressurised workload*. This theme is made up of three categories, 'availability of resources', 'high workload', and 'lack of time' and summarize three barriers RFOs have regarding their ability to deal with SDG 14 and climate change. For example, it was mentioned that these organizations have insufficient resources to address SDG 14 or climate change (code 'lack of resources'). Some of the RFOs have only a small secretariat and many developing countries as members, which influences the availability of money. Participants stated that the value of the fishery plays an important role in RFOs (code 'economic value') and also influence the availability of money (code 'Differences among organizations'). For an effective management system, more resources need to be available

(code 'more resources needed'). The two other categories 'high workload' and 'lack of time' describe two constraints, which make it hard for RFOs to deal with new things. The people who are working for the country's delegation already have a high workload and do not have the capacity to tackle other issues outside their day-to-day work. In addition, RFOs meet only a few weeks a year and there are already many topics on the agenda which need attention. Summarized, participants stated that RFOs do not have enough time and capacity to address SDG 14 and climate change.

3.6. Decision-making

The last theme was *decision-making,* and it is made up of two categories, namely, 'issues of decision-making' and 'decision-making and members'. Issues around decision-making, especially problems linked to the decision-making models were mentioned by half of the participants. Participants agreed that the consensus-based model makes it hard to get members to agree on certain topics (code 'difficult to get members to agree on things') and one participant also mentioned that even if a majority model is in place, these organizations still work towards a consensus.

> *"And international agreements tend to always, even if they have capacity to vote, so they have majority, they still tend to want to have consensus. And that is very much a case globally with any form of international agreement, they are always looking for consensus."*

Due to the previously mentioned aspects such as the role of members and political influences, underpinned by different values and interests, the way RFOs make decisions by consensus negatively influences their ability to address SDG 14 and climate change.

3.7. The future

The last few interview questions dealt with future outlooks, and participants were asked how they see the future of RFOs. Overall, there were positive perceptions concerning the future of RFOs among the participants (category 'Perception of RFOs') and it was highlighted that RFOs are a "*positive example internationally of shared governance of shared resources*" (Participant 30). Participants shared the opinion that RFOs are important frameworks for fisheries management at the high seas (code 'important framework'). It was noted, for example, that despite all the critiques concerning RFOs, there are currently no better models to manage fisheries at the high seas (code 'no better model').

> "*RFMOs are just a multilateral construct and you can say they are good, you can say they are bad, but there really is no other recipe but some sort of multilateral construct.*"

Overall, these organizations are slowly evolving, enhancing their management strategies and learning from each other (code 'learning from each other'), thus improving their performance and are still the best mechanism available for managing the high seas.

4. Discussion

RFOs are key organizations to support the achievement of SDG 14. However, little has been done to understand their position or to support them. Moreover, the achievement of SDG 14 will be negatively influenced by climate change, which has not received much attention from RFOs so far. The aim of this paper was to increase our understanding of RFOs perceptions of their ability to address external factors by highlighting barriers to RFOs engaging with SDG 14 and climate change. 36 stakeholders were interviewed and overall 6 themes were identified as shaping and influencing RFOs' ability to engage with SDG 14 and climate change. These themes cover topics that are related to the RFO's framework, such as the convention and their mandate, but also to administrative and logistical aspects. It is important to acknowledge that all these themes are related to each other, even though they have been described separately. Although participants emphasised that each RFO is unique, due to their geographical area, the managed species and fisheries, and their framework, these themes are likely to apply to all RFO organizations.

Generally, participants shared the opinion that SDG 14 and climate change are important topics which should be considered in RFOs (theme *external drivers*). RFOs have been influenced by international agreements throughout the time, for example by the FAO Code of Conduct for responsible fisheries or the agreement to promote compliance with international conservation and management measures by fishing vessels on the high seas. However, the impact of these agreements also depends on the age of these RFOs, which agreements existed at that time, and the way the convention was set up. The convention text guides RFOs and thus impacts their ability to deal with certain issues (theme *convention & mandate*). One of the categories was 'factors which influence convention', which deals for example with the age of the convention and it was noted that depending on the age of the RFO, as previously mentioned, different aspects are included in the convention text. While older conventions do not mention the precautionary and ecosystem approach, these aspects are clearly stated in newer RFOs such as SPRFMO. Generally, it is acknowledged that newer RFOs react better to newer governance approaches, such as ecosystem approaches (Cullis-Suzuki and Pauly, 2010) and there is a general need to update the conventions of the RFOs to adjust to current international ocean governance and to new emerging issues (Rochette et al., 2015b). Even though two RFOs, the General Fisheries Commission of the Mediterranean and the Inter-American Tropical Tuna Commission, have adopted a new convention that included a broader environment focus (GFCM, 2019; IATTC, 2018), it is time-consuming and difficult to adopt a new convention. Therefore, it is important that the members and other stakeholders acknowledge and consider the influence of the convention text and adapt their treaty interpretation to current and future problems. The way how RFOs take decisions and operate needs to change and the members need to think more widely about issues rather than being constrained to restrictive interpretations of the conventions.

Another theme that summarized barriers RFOs are facing was *pressurised workload*. Even though the three categories listed under this theme were not mentioned as much as other categories (30.4 % on average), they highlight an important topic that has not received much attention in the peer-reviewed literature. The categories 'lack of time' and 'high workload' summarized the restrictions to address new problems at the yearly meetings of the committee and the scientific commission. This problem is complicated since more and longer meetings also require more resources, which leads to the last category 'availability of resources' and also impacts RFOs capacity to address new issues or support SDG 14 and climate change. McCluney et al. (2019) found that the economic revenue member states gain from their catch is influenced by the end market, for example, tuna sold at local markets has a lower value than a tuna that was sold at the international market, and this, in the end, influences *inter alia* the availability of resources in RFOs. Also, the number of developed, industrialized fishing nations impacts the funding of RFOs, since, for example, the European Union can afford to provide more resources than a developing country (McCluney et al., 2019). The lack of resources, for example for the RFO's secretariats, is one of many challenges these organizations have to face and it is important to have a sustainable funding mechanism in place (Rochette et al., 2015b).

The availability of resources and the capacity to drive change is highly influenced by the member countries since they are the key actors in RFOs. Each RFO consists of a different member composition, who all have different objectives to meet through participating in these organizations. As highlighted by one participant, if there is the perception that RFOs need to do more, it is important to acknowledge that the member countries need to do more. Countries can introduce new topics in the meetings and set topics which are important for them on the

agenda. This leads to the conclusion that the countries do not currently see SDG 14 and climate change as topics that need to be addressed in these fora. Achieving SDG 14 relies on the actions taken by existing institutions, but as shown in the context of RFOs here, most of the members of such institutions do not acknowledge their role and only focus on their agenda and the reasons why the institute was established (Underdal and Kim, 2017).

Achieving SDG 14 will not only benefit the marine ecosystem but also the people who are dependent on these resources. Developing countries are often more dependent on marine resources than developed countries, thus more impacted by overfishing. Small islands in the Indian and the Pacific Ocean are especially reliant on fish as a source of food and nutrients and economic revenue (Golden et al., 2016; Tidd et al., 2018). Moreover, developing countries often do not have enough capacity to implement measures adopted by RFOs (Pons et al., 2018), and organizations with higher participation of small island developing states, such as in the WCPFC, are already challenged to manage fisheries in an equitable and sustainable way (Weng et al., 2015).

A critical view of the performance of RFOs concerning fisheries management is prevalent in the scientific literature, see, for example, (Cullis-Suzuki and Pauly, 2010). The need for progress is linked with the need for more cooperation among RFOs (category 'need for cooperation'). RFOs cooperate with each other for example via Memorandums of Understanding (Rochette et al., 2015a), such as the renewed Memorandum of Understanding between the CCAMLR and SPRFMO. The need for cooperation includes also different stakeholders, which play an important role in sustainable fisheries management (Beddington et al., 2007; Bundy et al., 2017; Jentoft and McCay, 1995; Pomeroy et al., 2001). Generally, industry and companies are well presented in RFOs, while civil society organizations are not (Petersson et al., 2019). In the future, more engagement of civil society may be one way to drive forward broader social issues. Generally, RFOs need to become more progressive in the way they manage fisheries and engage with other institutions and organizations. All these factors not only impact the way RFOs are dealing with SDG 14 and climate change but also how they are dealing with the BBNJ agreements. The current negotiations for the BBNJ agreement are a great chance for RFOs to contribute to this new agreement and to present their view. Especially since the outcomes of the agreement are very likely to affect RFOs through the implementation of tools such as area-based management (Barnes, 2016).

5. Conclusion

The aim of this paper was to increase our understanding regarding the ability of RFOs to address new emerging issues, such as SDG 14 and climate change (i.e., SDG 13) through an important, rare and timely qualitative analysis of stakeholder views. We analysed the perceptions of 36 stakeholders regarding factors which hinder engagement with SDG 14 and climate change. Six themes were identified, describing several factors which influence RFOs and their engagement. Participants mentioned the importance of the member composition, for example, the number of developing countries, but also areas such as time pressure and the lack of resources. Even though most of the participants thought that SDG 14 and climate change are important, not a lot of work was considered to be directly done for either of those topics. Concerning SDG 14, most of the participants held the view that the work of RFOs already contributes to SDG 14 and that there is no need to officially address it. Contrary to SDG 14, climate change was discussed in several fora. However, no direct responses have happened so far. The results of this study will help to address areas which hinder RFOs to effectively engage with SDG 14 and climate change. However, these findings also showed the key role of the RFOs' member countries in engaging with SDG 14 and climate change. Even though most of the participants agreed that the work of RFOs already contributes to SDG 14, it is important for them to officially acknowledge SDG 14 to better align their work towards the specific targets of SDG 14. The member countries must be willing to engage with these topics and to provide adequate resources to do so. These member countries also have to acknowledge that there is an increasing need for fundamental changes in how RFOs make decisions. Summarized, there are several factors which hinder the RFOs to effectively engage with SDG 14 and climate change and addressing these issues will help RFOs to better manage their fisheries in an uncertain environment.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.fishres.2020.105529.

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Regional fisheries management organizations and the new biodiversity agreement: Challenge or opportunity?

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