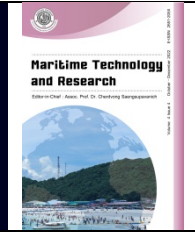




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Research Article

Developing a bottom-up approach with performance indicators for ocean governance and sustainability in the fisheries sector for United Nations interagency cooperation

Miguel J. Núñez-Sánchez^{1,2,*} and Luis Pérez Rojas²

¹Ministerio de Transportes, Movilidad y Agenda Urbana 28071 Madrid, Spain

²Universidad Politécnica de Madrid, Avenida de la Memoria s/n Madrid, Spain

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Abstract

Oceans provide sustainability for the planet and fisheries is a key sector operating in them, however the regulatory regime in regions such as the high seas is weak due to its lack of development and enforcement. Administrations may find difficult to combine different interests and cater for small communities while breaking ground in sustainability. This paper sets a bottom up approach for sustainability in fisheries after a consultation with Maritime Administrations from Africa, America and Oceania to set indicators to assist in the governance of the ocean in areas under the purview of FAO, ILO and IMO. These indicators were connected to the 2030 Sustainable Development Goals and when further adjusted via interagency cooperation may assist developing and develop countries, to measure sustainability in their territorial waters and exclusive economic zones, supporting governance at all levels. They have the potential to be expanded to the high seas and integrate a top down approach consistent with the work of the UN and its agencies to fight illegal unreported and unregulated fishing. It is also demonstrated that sustainability analysis in the current agendas of the UN Agencies is possible.

1. Introduction

Oceans ecosystems do not exist in isolation; they are the ecological hub of the entire marine ecosystem. However, an inadequate governance leaves them unattended and overexploited (Rogers et al., 2016). Overfishing, pollution, climate change, and ocean acidification are pushing the ocean system to the point of collapse. Technological advances, combined with a lack of regulation, are widening the gap between those countries which can exploit the resources and those which cannot but might suffer the consequences of an unsustainable exploitation (Jackson, 2001).

The threats oceans face are global, and the current governance system for the management of human activities impacting all areas needs to ensure long-term sustainability or equity in resource allocation and to create the conditions for maximizing economic benefits (Lambach et al., 2021). However, governance needs improvement in areas such as the high seas, where the regulatory framework does not allow effective control unless suitable measures are taken.

*Corresponding author: Ministerio de Transportes, Movilidad y Agenda Urbana 28071 Madrid, Spain
Universidad Politécnica de Madrid, Avenida de la Memoria s/n Madrid, Spain
E-mail address: mnunez@mitma.es

At the same time, society is becoming more conscious of the value of the resources and services provided by ocean space, resulting in a rise in public concern around the world. However, there is a need to measure the impacts. If governance and ocean degradation could be measured to determine how the high seas are being impacted by humans, it could contribute to provide visibility so that the current cycle of decline is transformed into a cycle of recovery (Hildebrand et al., 2017).

The adoption of the Sustainable Development Goals (SDGs) and the 2030 Agenda (the 2030 SDGs) in 2016, following the merging of the Millennium Development Goals (MDG) and the sustainable development agenda from 2012, provides an opportunity for the United Nations (UN) in the implementation of holistic frameworks for their maritime and fisheries sector (Haraksign et al., 2016). The determination of indicators is not a straightforward process, although there have been some initiatives by different stakeholders to trigger the 2030 SDGs in the maritime transport sector; however, the interactions among the goals has not been assessed in detail (DNV GL, 2017), and further work is needed in the maritime domain. At the same time, developing countries may lack sufficient resources to assess and set the desired level of sustainability.

In ocean governance, a key activity is commercial fishing. During meetings held at the International Maritime Organization (IMO), when the issue of governance in the fisheries sector has been raised, it has been agreed that there is a need to deal with fisheries in a holistic manner (IMO, 2017), including measuring sustainability. Measuring performance globally may also contribute to the sustainability of the high seas in relation to matters such as illegal, unreported, and unregulated fishing (IUU fishing). However, there are fundamental problems in extrapolating individual governance systems in territorial waters to the oceans and the high seas, due to reasons such as system interoperability and interconnectivity (Stuchtey et al., 2020). Furthermore, the issue of sustainability in the fisheries sector is multifaceted, and the intervention of UN agencies such as the Food and Agriculture Organization of the UN (FAO) runs the risk of not reaching the best possible results, since fisheries are also connected with other issues such as labor conditions (ILO, 2016), safety, or environmental pollution.

In order to assist countries to be able to measure their performance in fisheries, four technical cooperation projects carried out under the IMO were used to approach stakeholders from the maritime, labor, and fisheries administrations in different countries to assess their views in sustainability, including their local communities, to rank the indicators that would also be relevant for them to preserve artisanal fisheries (Jentoft et al., 2016), to contribute towards sustainability in their EEZs and beyond, also focused on the prevention of IUU fishing, and to connect them with the 2030 SDGs. In addition, it was explored how sustainable development goals work in a UN agency, which could later be extrapolated to interagency cooperation in the fisheries domain.

In this paper, we will explain some of the difficulties in the fisheries sector, and the gap in ocean governance in relation to fishing. The methodology will consist of exploring the governance regime at the UN in fishing with its main agencies, identifying performance indicators that could enable the measuring of the impacts of fisheries in the EEZs and beyond, connecting them with the 2030 SDGs. We will also analyze, at the level of one UN agency, how sustainability is understood and interrelated with its scope of work.

The methodology will use qualitative assessments via expert consultation filtering indicators that would later be assessed by administrations to rank them and to offer the possibility of connecting them with the 2030 SDGs. With regards to the interrelation of the 2030 SDGs in a UN agency a simplified Bayesian Network will be used.

2. The difficulties of fisheries governance

Maritime transport and commercial fisheries are activities providing welfare to society, but these activities will not be carried out if they are not profitable. The main focus on fisheries has been in resources, as it is a key activity providing nutrition to humankind (Nunez-Sanchez et al., 2020) and to the economy of many countries. Since the 1960s, developed countries have found

opportunities by building larger fishing vessels able to sail on the high seas and fish in other countries, but this activity, when not carried out in a sustainable manner, may result in poverty; this is one of the potential consequences of industrial fisheries, carried out in the exclusive economic zones (EEZs) of developing countries and the high seas, when there is no control of the activity (McCauley et al., 2018). In this area, the need for sustainability is more evident than in maritime transportation because, while fish are disappearing, partly due to the activity of large commercial fishing vessels, local fishermen dedicated to artisanal fisheries have lowered their profits and increased their risks, since they fish farther (Mustapha, 2013). This has led to higher fatality rates and an increase in poverty.

As indicated by Pringle, any attempt to tackle real and appropriate ocean governance reforms for this century need to consider the complex economic factors related to the management of resources and the role that states, markets, civil society, and private industry can play in contributing to sustainable solutions (Pringle, 2011). However, fisheries governance regimes find difficult to determine policy at the national and international level. It is not just a matter of data availability (Guggisberg, 2022), but is also related to the lack of economic or human resources at the level of the administrations. At this level, the emphasis on biological and ecosystems indicators might not be addressing the essential issue of managing fisheries (Fabinyi, 2021). This issue in governance is more acute in developing countries, for which the fisheries policies may fail, since over-simplistic solutions to safeguard fisheries, such as “no fishing”, are not solutions (Jefferson, 2022; Simpendorfer et al., 2017).

This problem, to determine policy, is also related to the difficulties in dealing simultaneously with the activity in different dimensions. It is not uncommon to find that the responsibilities in the sector are under different ministries, with little or no collaboration among them (FAO et al., 2014). On the contrary, when the responsibility falls under a “Ministry of Fisheries”, the power is concentrated in a single hand. While this may help to improve synergies, it could also lead to acting in a paternalistic approach, risking the prospect of not allowing policy to further develop. In addition, as the focus is mainly on fisheries, the social aspects of the industry may also be overlooked. An example is regulating ecology without considering fishermen living conditions. Without understanding these interlinked foundations, it is difficult to develop coherent and integrated policies, which are needed to attract appropriate investment and implementation benefits (Hall et al, 2013), and this is important in fighting IUU fishing. Once this issue is extrapolated at the international level, the situation becomes complex, due to the combination of multinational interests (Rudolph et al, 2020). At this point, silos are created, and the possibility to develop a very much needed capacity building for developing countries becomes more difficult.

All of the above leads to the need to provide sustainability in three dimensions: economy, society, and environment, and to develop indicators, if possible, working in cooperation with other organizations at the national level, and at inter-institutionally at the international level, to support the sector.

3. The high seas and EEZs’ gap in fisheries governance

Sixty four percent of the ocean’s surface (**Figure 1**) are high seas (Hefferman, 2018), which are surrounded by countries and their EEZs. Each EEZ around the high seas has its own particularities, but the rise of temperatures, the acidification of the oceans, greenhouse gases, and plastic pollution, also from inland industry, have a mutual influence. In order to measure the whole picture, low level models are needed, with the additional problem of the need for data. For the time being, no model has been able consider all elements at the same time.

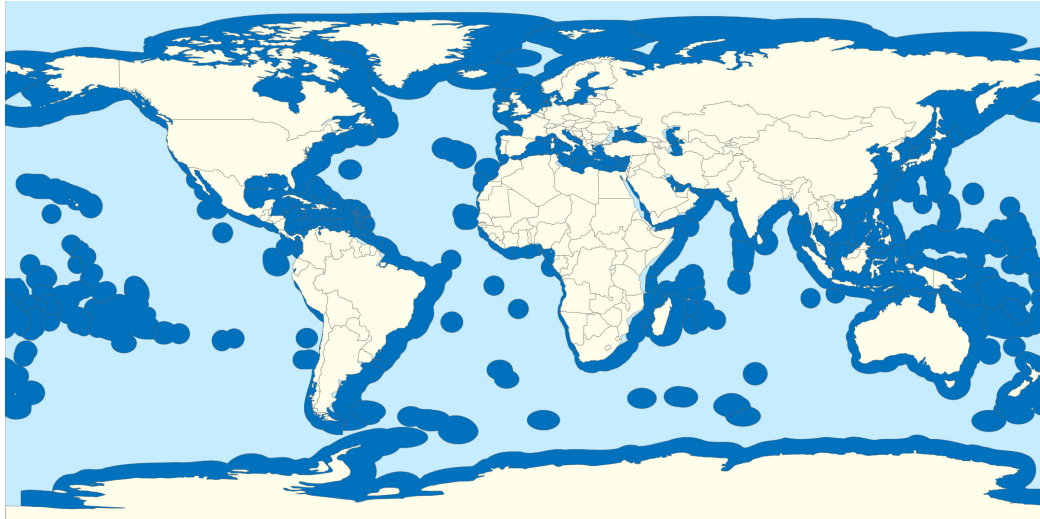


Figure 1 EEZs and high seas. High Seas are shown in light blue color (B1mbo, 2019).

In order to measure the sustainability of the fisheries sector globally, there is a need to consider the impact of fisheries operating in the EEZs in the high seas in a harmonized manner. Conversely, the impact of the high seas in the fisheries sector in the EEZs also needs to be measured. Since measuring sustainability on the high seas is complex, there is a benefit in proceeding with a bottom-up approach and trying to use the same indicators (**Figure 2**) used at the country level, both in territorial waters and the EEZs. However, outside the EEZs, consideration is needed at the global level, and this will also require a top-down exercise (Schüter et al., 2021), so any selected indicators help in this approach. Due care needs to be taken, since both the high seas and the EEZs may be harvested by vessels flagged for countries other than those with their EEZs and territorial waters around that region of the high seas. These vessels are acting on a portion of the oceans, and sustainability also depends upon them, so they need to be incorporated.

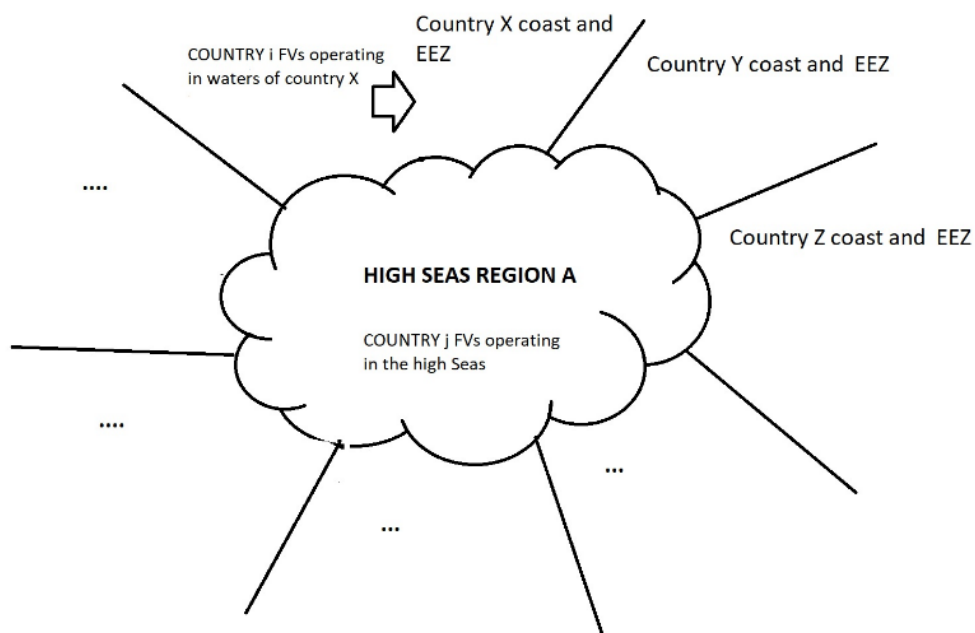


Figure 2 The high seas are influenced by countries surrounding the EEZ and ships registered in other countries operating in them.

4. Methodology

Considering commercial fisheries and their potential impact in artisanal fisheries, their local communities, and the difficulty of fisheries governance, we will assess the indicators that would better contribute towards sustainability in the fisheries sector, starting from the bottom.

Beforehand, in order to be able to deal with this matter internationally, to find a wider response, and to be able to extrapolate it globally and to the high seas, an examination of the UN framework was carried out to select relevant conventions related to fisheries governance and, from there, focus on the agencies where regular interagency cooperation already exists (IMO, 2019), facilitating the selection of indicators that may enable the setting of controls and the measuring of the sustainability of the oceans in relation to fisheries, and also to IUU fishing.

Based on this assessment, and in order to provide a more focused approach, we filtered the performance indicators with an expert group based on the mandates of the organizations. We then invited officers from Fisheries, Labor and Maritime administrations, from forty-six countries, to analyze the most relevant preselected indicators and establish their linkages with the 2030 SDGs.

In order to do this, we set a multipolar questionnaire (Bradburn, 2015) (**Appendix**), which was distributed on site during three seminars. The first was carried out in December 2016, and was hosted by the Government of Côte d'Ivoire, with the participation of representatives from Benin, Cameroun, Comoros, Congo (Republic of), Congo (Republic Democratic of), Côte d'Ivoire, Gabon, Guinée (Conakri), Madagascar, Mauritania, Senegal, and Togo. The second, in August 2017, was hosted by the Government of Cook Islands, with the participation of representatives from Cook Islands, Fiji, Kiribati, Republic of the Marshall Islands, Nauru, Papua New Guinea, Tonga, Samoa, Solomon Islands, and Vanuatu, and the third, in July 2019, was hosted by the Government of Ghana, with the participation of representatives from Cape Vert, Equatorial Guinee, Gambia, Ghana, Guinea Bissau, Liberia, Nigeria, Sao Tome, and Principe, Sierra Leone. In addition, questionnaires were sent by email to the following countries: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago in the Caribbean, and to Mauritania, Morocco, and Tunisia in North Africa as a follow up of seminars carried out in 2014.

Finally, since it would also be desirable to work on a top-down approach, from the highest level at the UN, to be able to provide effective technical cooperation, we combined the indicators, and made a general analysis of sustainability at the IMO, which could later be made applicable to the work of selected relevant agencies in relation to fisheries. This analysis would allow better establishment of the interrelations among the 2030 SDGs at a high level, facilitating a top-to-bottom approach.

5. Findings

In the following sections, we address the findings for each of the steps indicated in the methodology, followed by a discussion.

5.1 FAO, ILO, and IMO and their roles in Ocean Governance for the UN System

The UN and its specialized agencies play key roles in ocean governance, with the development of regulatory and control mechanisms, but in order to understand ocean governance for fisheries at the level of the UN system, the main conventions were identified (**Figure 3**). The UN Agencies mainly dealing with fisheries activities are the FAO, the International Labour Organization (ILO), and the IMO, whose respective missions are related to food-economy-ecology, health-working conditions, and safety-marine environmental pollution prevention, and therefore are very much connected with the three dimensions of sustainability. These agencies provide not only secondary legislation, enabling controls that can be extrapolated to fishing vessels operating on the high seas, but also assistance by means of technical cooperation. Their legislation is, on many occasions, directly transposed into national legislation.

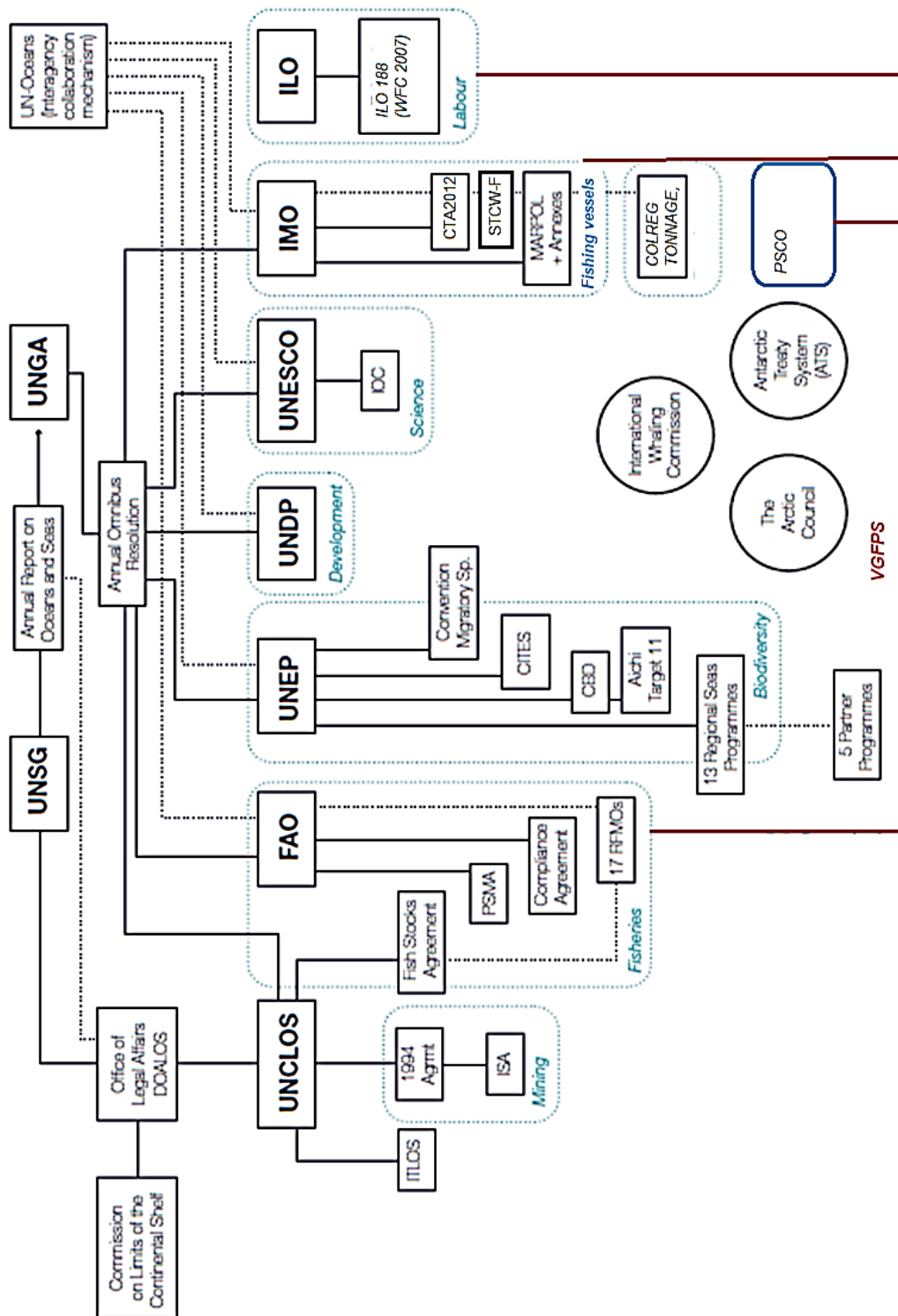


Figure 3 Schematic diagram of international governance structure with sectorial approach[†] and how this can be considered in relation to combatting IUU fishing.

[†]Note. “CBO” is the Cities and Biodiversity Outlook, “CITES” is the Convention on International Trade in Endangered Species of Wild Fauna and Flora, “COLREG” are Collision Regulations, “IOC” is the International Oceanographic Commission, “ITLOS” is the International Tribunal for the Law of the Sea, “ISA” is the International Seabed authority, “TONNAGE” is the 1969 Tonnage Convention, “UNCLOS” is the UN Convention of the Law at Sea, “UNDP” is the UN Development Programme, and “UNEP” is the UN Environment Programme.

Notwithstanding the key importance of 1982 UNCLOS and the UN 1995 Fish Stocks Agreement (UN, 1995), in particular its general principles indicated in its Article 5, with regards to FAO, ILO, and IMO, several instruments are identified as key in providing appropriate ocean governance from the regulatory point of view in fisheries-related areas:

1. FAO's Port State Measures Agreement (PSMA) (FAO, 2010), which is the primary driver, since it relates to the economic activity, and the reason for the existence of the fishing industry;
2. ILO 188, Work in Fishing Convention of 2007 (ILO, 2007), which provides labor conditions on board for industrial fishing vessels; and
3. MARPOL, Cape Town Agreement of 2012 (CTA, 2012) and Standards of Training Certification and Watch keeping in Fishing (STCW-F) from IMO, which provide environmental pollution prevention, safety, and training standards for fishermen and fishing vessels.

After desk research to cover the above conventions in a holistic manner, it was identified that the flag state becomes paramount to comply with the conventions. In this regard, it was the FAO 1993 Compliance Agreement and the FAO Voluntary Guidelines for Flag State Performance (VGFSP) (FAO, 2015) which could serve as the base instrument to integrate the above conventions for the purpose of fighting against IUU fishing and other related matters, such as marine environmental pollution. These two FAO instruments allow escape from a silo approach, and will later assist in the governance of the high seas.

However, the gap still exists, and governance outside the EEZs or the extended continental shelf is practically limited to ships where people live and work, and to the ships that operate in them. The high seas are not fully covered by international conventions, and the applicable regimes are mainly related to national requirements stemming from the above indicated conventions, as enforced by the flag and coastal states. Though it was argued (Ppijkers et al., 2013) that the existing framework is sufficient, and there are no gaps at the level of the UN other than enforcement, the Intergovernmental Conference on Marine Biodiversity under the United Nations Convention on the Law of the Sea has been tasked with drafting a legally binding instrument on the conservation and sustainable use of marine biological diversity to be adopted; named the "Oceans Treaty on Marine Biodiversity", it will need to be both robust in its scope and practical in its application (UN, 2019), and awaits its final fifth conference before its adoption (UN, 2022).

The above three UN agencies may offer opportunities for cooperation and the potential to be translated into Performance Indicators for their strategic plans, stimulating new ideas for governance frameworks to be applied from the top-down, but in order to be able to help local communities, there is a need to set indicators that may have a positive influence on them and the fishing sector worldwide. Furthermore, considering the direct impact of the UN instruments in the governance of the oceans, it would be beneficial to link the applicable conventions (as related to fishing vessels) with the 2030 SDGs, because sustainability will remain, at least as a concept, for the near future. Hence, it may be important that the frameworks of SDGs (or their successors) are made comprehensive, in line with the mandatory conventions.

From a top-down approach, the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDG), mandated by the United Nations Statistical Commission as of May 2019, assigned Tier I, II indicators (which are conceptually clear and with available methodology, with or without data, respectively), and only assigned one Tier III indicator to the IMO (an indicator for which there is no established methodology or standards, or methodology/standards are being developed or tested for the indicator). The IMO is not yet a custodian of any indicator, while FAO and ILO are custodians of some Tier I and II indicators (UN Statistic Division, 2019). This means that, in the fisheries sector, and in relation to catches and catch management, labor, safety, and environmental pollution, there is some work left to be done.

5.2 Indicators for a bottom-up approach

Taking into account the need to face the above challenges, and the problem of finding quantitative data in many developing countries, it was decided to consult the available internationally-used indicators. The most promising ones were the fish performance indicators (FPIs) developed by Anderson (Anderson et al., 2015), used by the World Bank, which were tested for different communities all over the world. This approach helps to evaluate how management approaches interact with resource, community, and market conditions to not only assure stock health, but also to create economic and community benefits considering the environment.

These FPIs already consider the fact that data availability is a problem, and needs to be substituted with qualitative analysis carried out by suitable experts. The FPIs are divided in enabling factors, which act as inputs, and assess the country and output indicators as a result of the evaluation of the community, with a total 68 indicators using a scale of 1 to 5. These indicators, when suitable marked, offer a sound assessment instrument for measuring the fishery-derived benefits being created, not only in the fish stock in the water, but also in the harvest and postharvest sectors and fishing communities, in accordance with the World Bank's emphasis on the triple bottom line (Anderson et al., 2015) and the importance of an integrated ecosystem management approach. They also meet the need to have inputs that allow the measurement of the impact on the communities from the top, therefore meeting the requirements, indicated in Section 6, to be able to be used at global fora.

Taking into account the dimension of the matter at hand: fisheries (mainly economy and environmental), safety at sea (mainly social), marine environmental pollution (mainly environmental), labor and health (mainly economy and social), and the mandates of FAO, ILO, and IMO, the FPIs were filtered by a group of experts to provide the best targeted inputs that could later contribute to deter IUU fishing, and which may have influence on the sustainability of the high seas.

The intention was that these may work on a country basis, and then be able to combine them with other countries. The process would need to be iterative, so that the inputs representing the performance of a country in terms of sustainability reflect the status of the individual communities.

It was agreed that the economy indicators were two folded:

1. the protection of the physical asset, which would be the value the fishing vessel carrying out the activity, and
2. the revenue volatility, also associated with the ratio of asset value of gross earnings, which is the discounted value of future profits, and includes the efficiency of the harvest operations. In this case, the economic risks of the activity need to be taken into account, such as the fluctuations of fuel prices.

In addition, the post-harvest performance was considered, to determine whether fish catches are processed or not before being sold. Depending on the fishing community to be assessed, this aspect may be included or excluded, but for the sake of simplicity, these metrics were excluded.

With regards to the social indicators, more specific metrics were kept. This was done to consider the need to better measure safety and labor in the social dimension as:

1. the metric related to fatalities at sea (harvest safety) is critical, and very much in the spirit of safety at sea (CTA, 2012);
2. the perception of safety at sea is indirect, while labor conditions are direct (ILO Work in Fishing Convention, 2007);
3. it is necessary to consider other dimensions, such as education access and crew experience, which are also connected with other IMO mandatory instruments (IMO STCW-F Convention); and
4. the employees may or may not have access to health care and suitable or transparent earnings, which would very much link the work at sea with the scope of the ILO (Work in Fishing Convention, 2007).

In looking for sustainability, the environmental indicators are related to:

1. the status of the critical habitat;
2. environmental pollution (MARPOL); and
3. illegal unreported and unregulated fisheries (PSMA)

which may be considered basic output indicators for the communities, though the ecological indicators might not be very much correlated with the social indicators.

With this in mind, twenty-seven indicators were kept. Before showing them to the interviewees for their assessment, three basic questions were asked to identify whether there was a need to have such system in place.

Out of the 120 officers consulted, there were 96 responses provided, divided as follows: 40 % between fisheries officers, and 20 % labor and 40 % safety and environmental protection officers. In most cases, it was indicated that the countries lack suitable indicators (**Figure 4**), except for fisheries and ecology. For the cases where “No” was the answer provided, it was also requested whether there was a need to develop them. A majority indicated that they were needed (**Figure 5**).

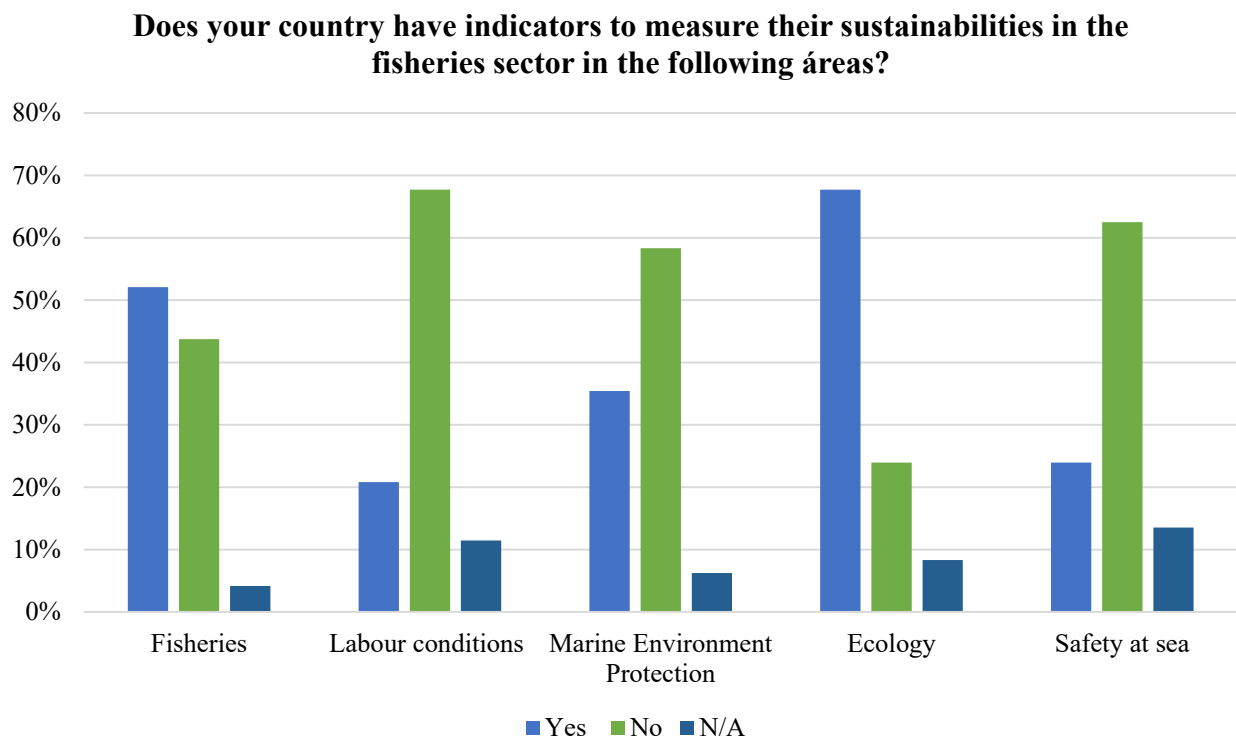


Figure 4 Question 1 (Q1), related to the availability of indicators. The areas where no indicators are generally provided are labor conditions, safety at sea, and marine environment protection.

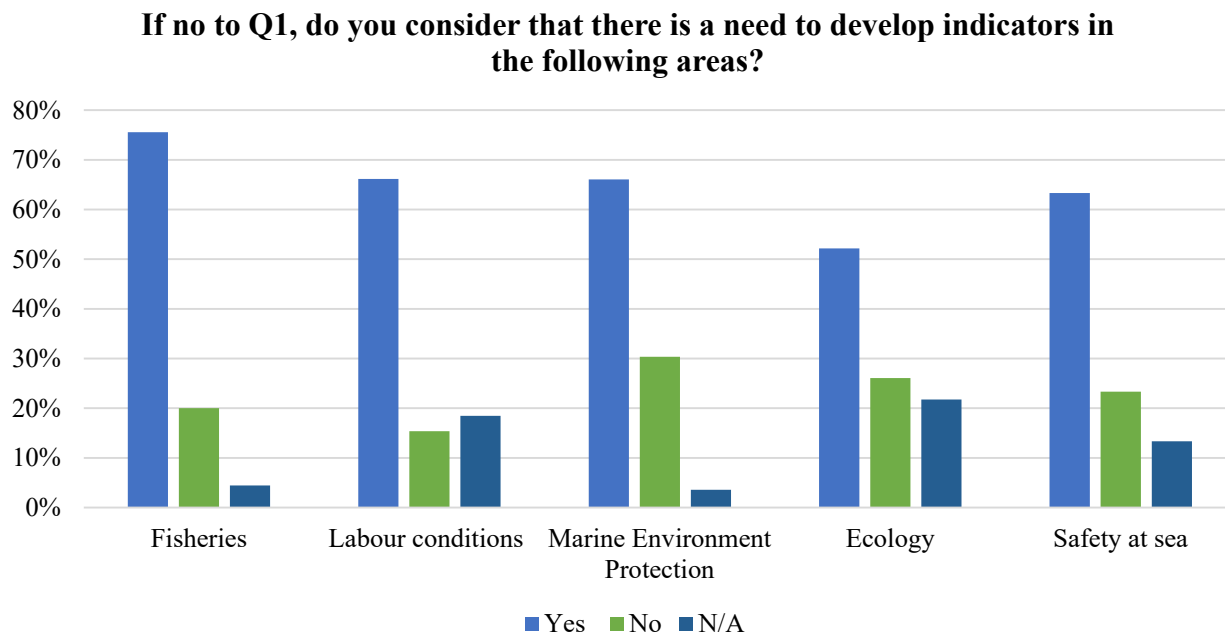


Figure 5 Question 2 (Q2), related to the need to develop indicators. The interviewees responded that there was a need to have such indicators.

Furthermore, 87 % of those consulted considered that it would be helpful for their country to have indicators that could be used at the level of the FAO, ILO, and IMO.

The preselected indicators were later shown to the interviewees. They were not ranked, so that the interviewees had the chance to select the ones that were more important to them. They were also allowed to point out others that might be important to them. In addition, they were requested to link them with the 2030 SDGs.

In relation to the selected outputs (**Figure 6**), landings, together with the status of critical habitat, prevail, are mostly related to the issue of IUU fishing. It is interesting to note that high earnings were also selected by interviewees, and this would help to contribute to deter IUU fishing, together with the control of catches. In the responses, it was indicated that high earnings are not possible if the stock is not healthy. Harvest safety was also found to be relevant, which is related to the social dimension of the activity in terms of labor conditions and health. This concerns decent work and living conditions (SDG 8) and becomes the major driver in sustainability, followed by quality and education (SDG 4), which is linked to the need to escape from poverty to be more sustainable.

In relation to the inputs or enablers (**Figure 7**) the number of protected areas, fishing mortality, and spatial planning take the leading roles, followed by the level of chronic pollution and the GDP per capita. The latter is very relevant, because the higher the indicator, the easier it is to implement measures for the protection of the resource and the waters, and the better it is aligned with the conclusions from the input. Other parameters were deemed to be considered less relevant. The interviewees linked their preferences for life below the water (SDG 14) and sustainable cities and communities (SDG 11). It could be also observed that spatial management, level of chronic pollution, and governance quality, together with the GDP, allow for a better connection to partnership for the goals (SDG 17). This confirms the need to have proper cooperation mechanisms at the national level; also, the thesis, indicated in Section 6.1, related to the need to work inter-institutionally at the international level.

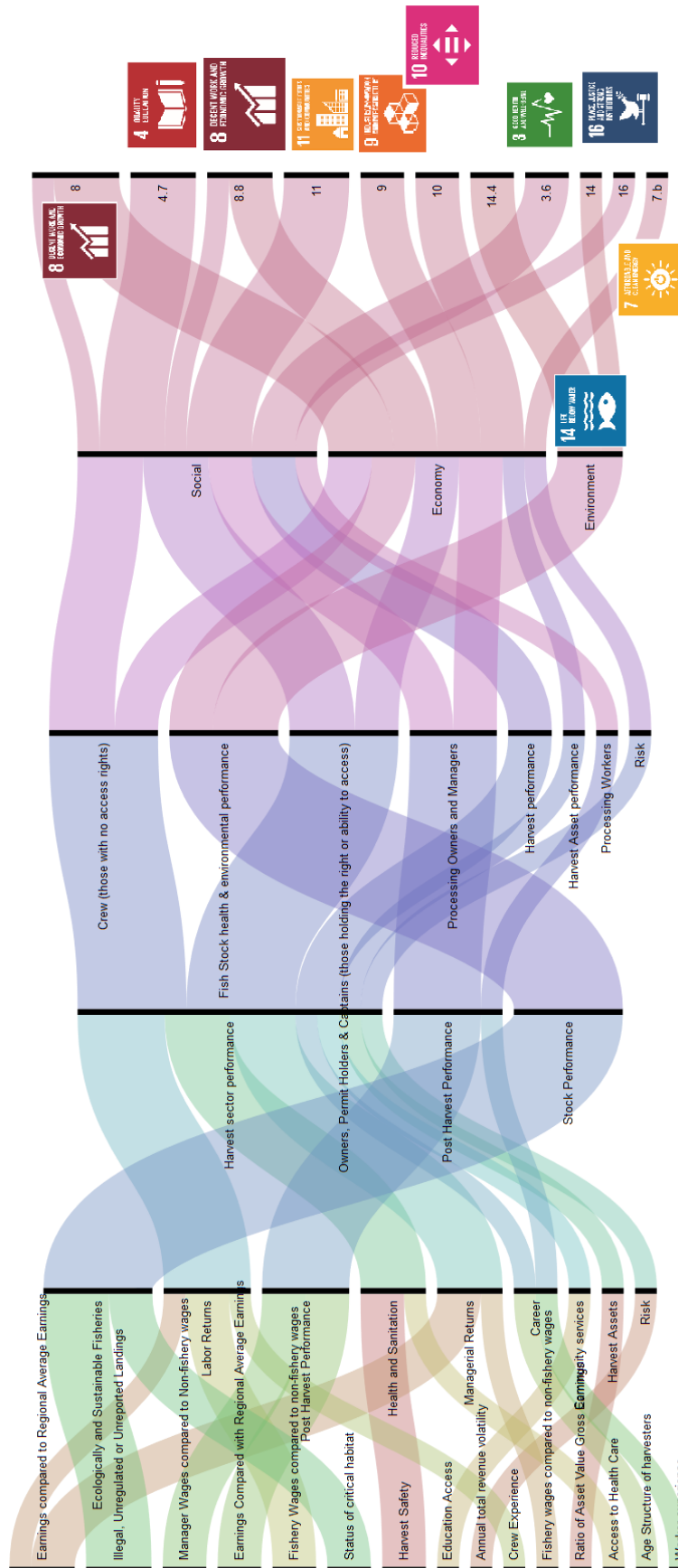


Figure 6 Output indicators with alluvial flow towards the 2030 SDGs. The most relevant indicators are shown on the left, and the black bars indicate the relative importance. From top-to-bottom, the most relevant outputs are shown in order, as selected by the interviewees.

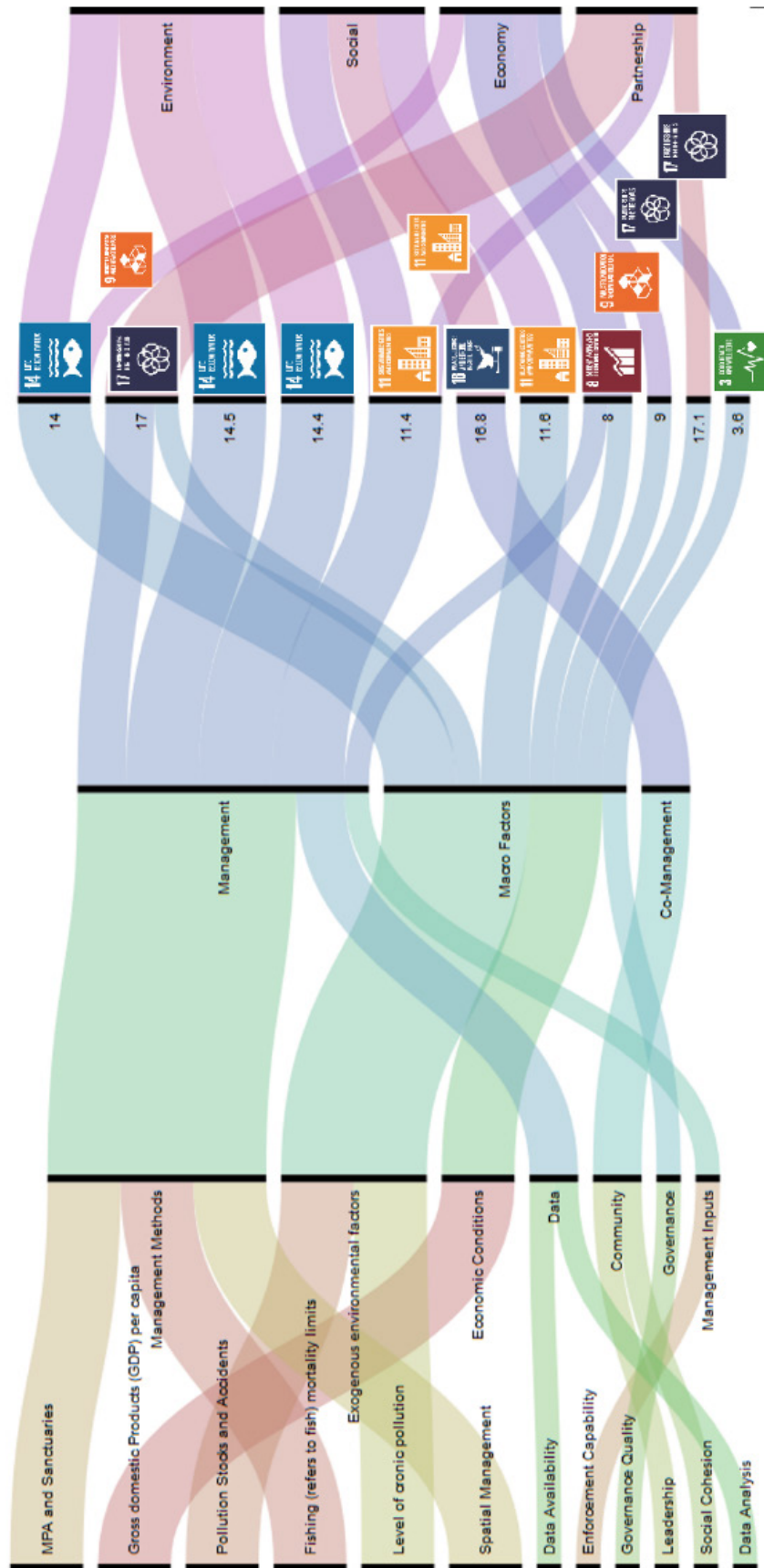


Figure 7 Input indicators (enablers) with alluvial flow contributing to the 2030 SDGs. The most relevant indicators are shown on the left, and the black bars indicate the relative importance. From top-to-bottom, the most relevant inputs are shown in order, as selected by the interviewees.

5.3 Discussion

Indicators for the UN Agencies

The inputs or enablers are more related to the countries themselves than to the communities. Overall, the results of the questionnaire lead to the fact that salary and earning conditions, together with education, set the base to make fisheries sustainable, provided that the Administrations provide suitable controls to prevent the depletion of stocks.

It was also identified that the responses provided at regional level, either for West Africa, the Pacific, and the Caribbean Regions, were aligned, which means that there is a common view of the EEZ that is important for neighbor countries and for the riparian states of a part of an ocean. However, more alignment was found on the inputs or enablers than the outputs, probably because the interviewees were officers of the administration.

Upon showing the results to the interviewees, the following input was also provided by them:

- data knowledge and its management are key data, such as maritime accidents, IUU fishing operations, transshipments, ships operating in different areas, labor accidents, areas of potential substandard fishing vessels, pollution, etc. Developing countries do not have the capacity to develop quantitative data, so the qualitative level is important, to enable progression to quantitative indicators;

- in relation to Marine Protected Areas in the high seas and maritime spatial planning, more indicators are needed stemming from the output indicators that may later be used to determine or safeguard Marine Protected Areas, as appropriate. These indicators would need to consider how maritime integrated maritime surveillance is done; and

- in order to have further measure the sustainability of the EEZ and high seas, indicators could also be examined at the level of the Regional Fisheries Management Organizations (RFMOs), and provide an input to the UN agencies.

With the responses provided, the experts examined, using a paired compared analysis (Davidson et al., 1976), which of the indicators could be adapted for a top-down approach at the UN level and, therefore, were more significant for ocean governance on the high seas and the SDGs (**Figure 8**). The most important indicators found were: mortality limits, which are linked to a maximum sustainable yield; IUU fishing landings; and MPAs and sanctuaries, pollution stocks, and levels of chronic pollution, which are again linked to SDG 14 and 8. SDG 14 remains the most relevant indicator. This is in line with the need to develop a mandatory instrument for the protection of diversity in the high seas, as indicated in Section 4, and offers indicators for technical cooperation to developing countries at the inter-agency level.

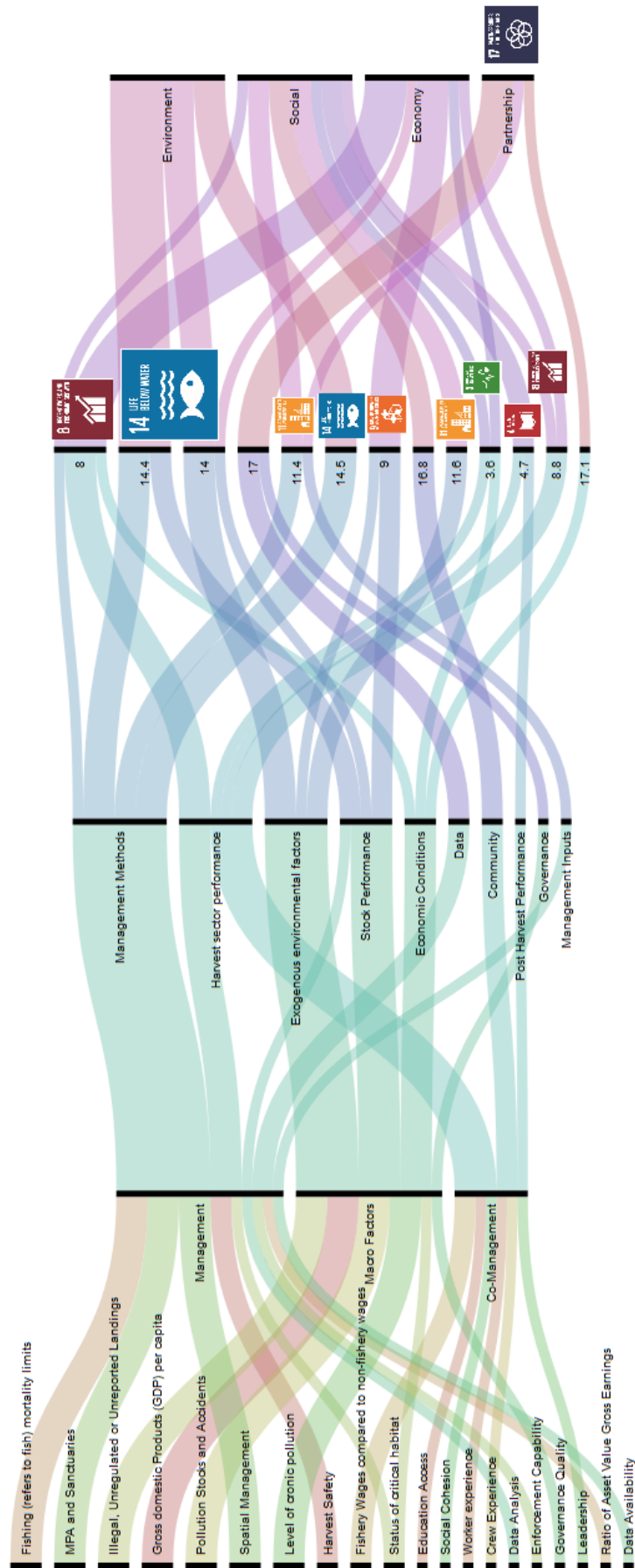


Figure 8 Proposed aggregated input indicators with alluvial flow to measure sustainability on the high seas and contribution to the 2030 SDGs.

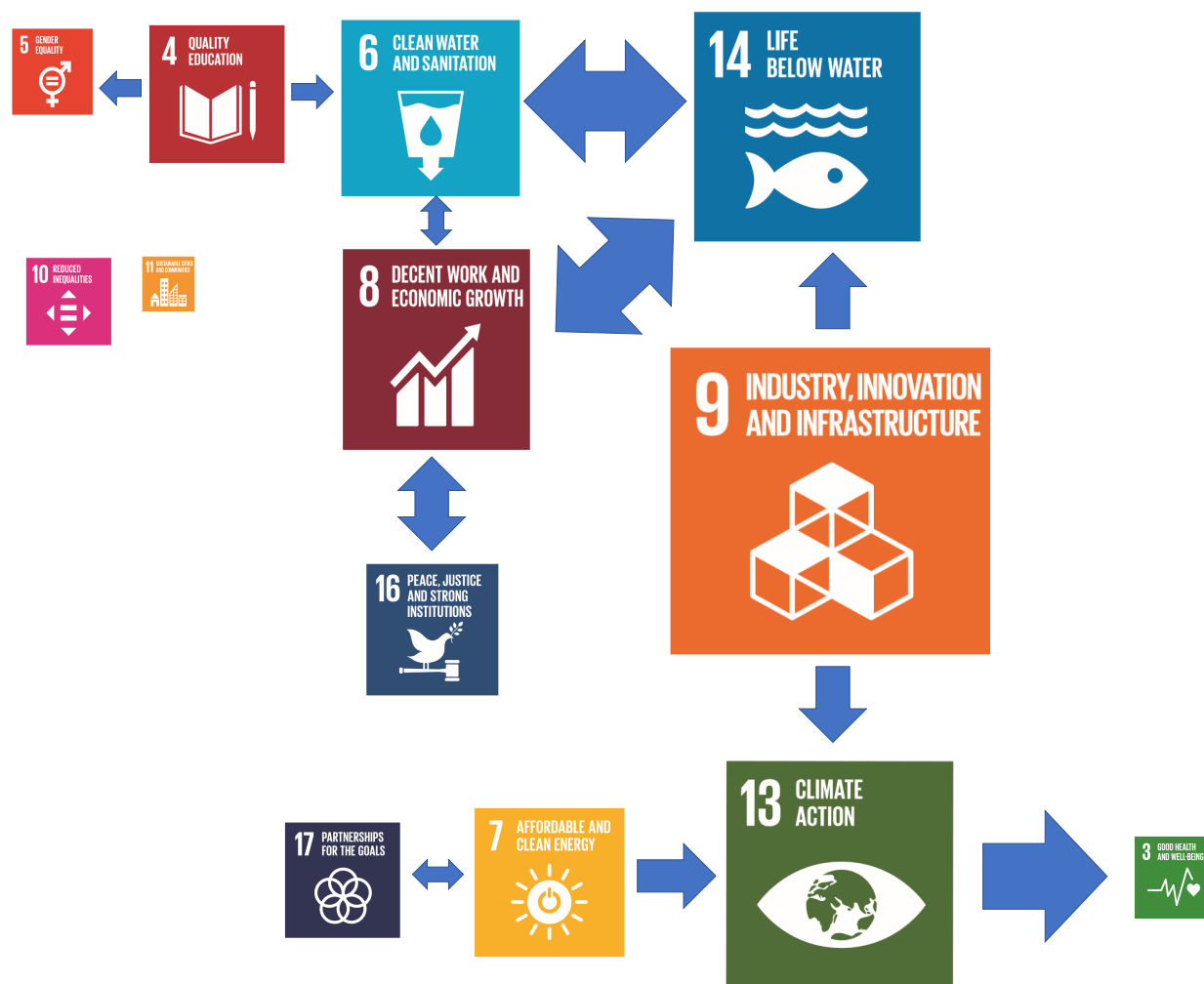


Figure 9 Influence analysis of the IMO’s SDGs.

6. Sustainable Development Goals consideration at the level of FAO/ILO/IMO

It was studied how it could be possible to connect the 2030 SDGs among the three agencies. Bibliography was examined to be able to align the sustainable development goals to small scale fisheries (Said et al., 2019), and how sustainability strategies had been applied in relevant agencies such as the FAO (Garcia et al., 1999), at the ILO (Montesano et al., 2021), or at the IMO (Sciberras et al., 2018) in the maritime domain (Carpenter et al., 2021). However, no relevant publication was found dealing with the 2030 SDGs from a holistic approach at the inter-agency level or ways to interrelate them in a systematic manner.

To break new ground, it was decided to explore means to measure how sustainability is considered at IMO. A bottom-up analysis was carried out to consider its current context, considering the views of the Secretariat in the agenda for the biennium 2018 - 2019 (IMO, 2018) with an analysis of simple influences on the SDGs. A simplified Bayesian Network (Requejo-Castro et al., 2020), and a diagram reflecting the determinants and descendent for the SDGs, was carried out.

A network with 12 knots was generated, with linear, converging, and diverging connections. The results show the relative importance of the SDGs in size (larger size means more importance) and stronger interrelation (thick arrows) (**Figure 9**). Some of the SDGs, namely “No poverty”, “Zero hunger”, “Responsible Consumption and Production” and “Life on Land” were not contemplated.

However, the connections between SDGs 8, 14, and 6, and SDGs 9, 7, and 13 were strong[‡], which means that interconnected SDGs are highly correlated. On the negative side the only overarching output was related to technical cooperation, indicating a view that SDGs are for developing countries only. This indicates how difficult it is to formally avoid silos and the need of improvements in the culture of the organizations considering that, contrary to the MDGs, the 2030 SDGs were developed for all countries, and not only for the developing ones.

On the positive side, this exercise implies that it is feasible to link all the conventions under the purview of an agency and measure how they approach sustainability. Considering the international conventions indicated in Section 4.5, under the purview of the FAO, ILO, and IMO, and leaving only the agenda items related to fisheries, allows a combined assessment of the agencies' contribution towards sustainability. If the selected indicators in Figure 8 were used to qualify the agenda items, a top-down approach would be then possible, and would be linked with the local communities which, at the same time, could carry out their analyses and be able to compare them and obtain knowledge.

In conclusion, benchmarking the 2030 SDGs for fisheries at the country level and the UN level would be possible. Framing the international conventions with the indicators would be possible, too, and a tool to assess the sustainability of the high seas could be available.

7. Conclusions

There are multiple agencies working on the oceans at different levels with different interests. In the fishing sector, the scope may be limited, but there is a possibility to deal with indicators specifically addressing fisheries and IUU fishing.

There is a lack of adequate frameworks for ocean governance on the high seas, despite the individual efforts made by the agencies and the UN. Although there are suitable regulatory instruments to carry out further work in the future, since they offer regulatory tools for control, there is a gap overall in SDG 14, which tends to agree with the need to have a new instrument at the level of the UN on the high seas.

In order to do this, and to protect artisanal fisheries, a bottom-up approach is desirable, engaging local communities and countries that may be applied in neighbor EEZs and be extrapolated to the high seas. Since the analysis contains inputs or enablers, a top-down approach is also possible at the UN agency level, to better contribute to the determination of the sustainability of the fisheries sector and to assist in technical cooperation.

The 2030 SDGs need further elaboration in order to make them applicable to measure sustainability. The current Tiers should be continuously updated to reflect sustainability in dimensions and sectors such as fisheries. Only with this sustainability could be able to progress and become an effective qualitative tool before measuring quantitatively can be feasible.

Further engagement of the IMO, ILO, and FAO in UN Oceans or other interagency mechanisms could be envisaged so that a broader engagement with a wider range of partners is achieved for solutions and conventions be implemented holistically. This stems from the analysis of the FPI inputs and is applicable at UN agency level. In order to do this, promotion in the FAO, the ILO, and the IMO of a steering mechanism to balance matters, with regular feedback from the stakeholders and the local communities.

Although the FPIs have only been ranked at the level of officers of administrations, a key issue would be to strengthen regional bodies to cut through the sectorial dissonance that characterizes the current management regime and to ensure effective regional governance in order to have a more holistic approach. It would be important to carry out the exercise with other relevant stakeholders. A possibility would be to use Regional Fisheries Management Organizations (RFMOs) operating in an ocean.

Upon examination of the instruments, there may be a need to develop or amend guidelines at the level of the three agencies for the effective cooperation and coordination amongst different competent

[‡]SDG 8-Economic Growth, SDG 14-Life below the water, SDG 6-Clean Water and Sanitation, SDG 9-Industry, Innovation and Infrastructure, SDG 7-Affordable and Clean Energy, SDG 13-Climate Action.

authorities in the success of regional initiatives to enhance governance at national levels. This would need to include the possibility to extrapolate FAO, IMO, and ILO experience/guidelines in ocean governance to assist all member states and not be limited to technical cooperation programs relating to “ocean governance for developing countries”.

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Appendix

Questionnaire

Q1. Does your country have indicators to measure sustainability in the fisheries sector in the following areas?

	Yes	No	N/A
Fisheries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Labour conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marine Environment			
Protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Safety at sea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2. If no to Q1, do you consider that there is a need to develop indicators in the following areas?

	Yes	No	N/A
Fisheries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Labour conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mar. Env Protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Safety at sea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3. Would you consider helpful for your country to have indicators that could be used at the level of the FAO, ILO, and IMO?

Yes	No	N/A
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4. Please select from the following list those indicators that are more relevant and related to the following areas (You may choose more than one)

	Fisheries	Labour	Ma. Env	Safety
Input 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Input 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...				
Output 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5. For each indicator could you select the most suitable sustainable development goal? Please select up to second level from the list (You may choose more than one)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Input 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Input 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Output 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Output 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q6. In your view which Organization should deal with this indicator. Rank the UN in order. You may choose one, two or three of them.

FAO/IMO/ILO Other

Input 1

Input 2

...

Output 1

Output 2