Article

Using Sustainable Development Goal Indicator 14.7.1 to Measure Sustainable Fishery: The Statistical Limitations

Suyu Liu

Food and Agriculture Organization of the United Nations, 00153 Rome, Italy; suyu.liu@linacre.ox.ac.uk

Abstract: Sustainable Development Goal (SDG) Indicator 14.7.1 is the only statistical indicator under the SDG framework which measures the progress to achieve sustainable fisheries. However, despite its advantages, it suffers from substantial limitations. One main problem is that it is ambiguous what this indicator really measures and what the definition of sustainable fisheries is, which is the core concept of SDG Indicator 14.7.1. In particular, this indicator has both an environmental dimension and an economic dimension, but it is unclear how one indicator can exactly reflect these two dimensions at the same time. In addition, while SDG Indicator 14.7.1 emphasizes inclusiveness in name, its definition, methodology, and practical application reveal the exclusion of a substantial number of countries from this indicator. These limitations not only diminish the anticipated functionality of SDG Indicator 14.7.1 but also contradict the objective of inclusivity. Such shortcomings of SDG Indicator 14.7.1 are possibly a result of the non-statistical considerations during the development of this indicator, including possible political influence on the statistical scientific process. A number of implications for improving the further development and use of this indicator are provided, such as the provision of more specific data and metadata

Keywords: SDG Indicator 14.7.1; sustainable fisheries; limitations

Key Contribution: This article introduces SDG Indicator 14.7.1 and explains that, due to the ambiguity of the indicator itself and the unclear definition of 'sustainable fishery', there are limitations of using this indicator to measure the progress of achieving sustainable fishery. Some reasons and implications for improvement are also outlined, alongside a few directions for future studies.

1. Introduction

There is a long history and wide practice of applying statistics to the field of fisheries science to process and interpret information and make decisions based on evidence, for example [1]. However, there is increasing attention being paid to the challenges and limitations of fishery statistics. For example, as a specialized agency of the United Nations (UN) which has a formal mandate to support the national, regional, and global collection, analysis, and dissemination of fishery statistics, the Food and Agriculture Organization (FAO) of the UN pointed out that the standardization of the various methods, standards, and data sources in different parts of the world is a challenge of using statistics in fishery science and supporting well-informed policies [2].

Sustainable Development Goals (SDGs) are at the heart of the 2030 Agenda for Sustainable Development, which is a shared blueprint for sustainable development that was adopted by the UN in 2015 [3]. The SDGs have 169 targets and 231 unique indicators to monitor the progress of sustainable development. These SDG targets and indicators shape a statistical framework that supports the collection, analysis, and use of data for sustainable development, including the standardization of methods, data sources, and principles [4,5]. The SDGs have a wide coverage of social, economic, and environmental sustainability, including sustainable fisheries. For example, SDG 14, 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development', or in short form, 'Life

under Water', is the goal that specially focuses on the sustainability of marine resources, including fishes.

SDG Indicator 14.7.1, which is expressed as 'Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries' [6] (p. 1), stands as the only indicator under the SDG framework that monitors the sustainable development of the fishery sector. It is also the sole indicator which evaluates the progress of achieving SDG Target 14.7: 'By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism' [6] (p. 1).

This article aims to unveil some statistical limitations of using SDG Indicator 14.7.1 to monitor the sustainable development of the fishery sector. By exploring such limitations, a number of scientific and practical implications can be generated to further develop SDG Indicator 14.7.1 and enhance its use for sustainable fishery policies. Furthermore, this article serves as a call for future studies on this indicator and encourages more research on using statistics to support sustainable fisheries.

The remaining part of the article will be organized as follows: The next section will have a more detailed explanation of SDG Indicator 14.7.1. This will function as a prerequisite for analyzing its limitations in monitoring the progress of sustainable fisheries, which is the main content of Section 3. Section 4 further discusses the analysis in Section 3 and provides more academic and practical implications. Section 5 concludes the paper.

2. A Review of SDG Indicator 14.7.1

This section introduces SDG Indicator 14.7.1 and its development process. As one of the ten indicators monitoring the progress of SDG 14, SDG Indicator 14.7.1 focuses on an important aspect of 'Life under Water', which is the sustainability of the fishery sector. However, despite its claim to measure the entire fishery sector, the actual scope of SDG Indicator 14.7.1 has been narrowed to focus '. . .only on the sustainable use of marine resources by fisheries' [6] (p. 4). This means that all inland fisheries are excluded from this indicator. Also, only marine capture fisheries are included, and harvests from aquaculture (regardless of whether it is inland or marine) are not included.

According to metadata [6], this indicator consists of two dimensions: an economic dimension and an environmental dimension. The economic dimension is measured by the share of marine-capture fisheries' value added (VA) in a country's gross domestic product (GDP). Both VA and GDP are reported in domestic currencies based on constant prices, ensuring the consistency of measurement over years.

The environmental dimension of SDG Indicator 14.7.1, in definition, pertains to the sustainability of fishery area(s) in which a country's fishery fleet harvest. The sustainability of the fishery area(s) is measured by the 'sustainability multiplier', which is defined as '. . .the average sustainability weighted by the proportion of the quantity of marine capture for each respective fishing area in which the country performs fishing activities' [6] (p. 6). The 'respective fishing area' is arbitrarily classified for statistical purposes [7]. Notably, the metadata lack further explanation on how to assess the sustainability of each fishing area.

An equivalent of the 'sustainability multiplier' is another indicator (SDG Indicator 14.4.1), which measures the biologically sustainable proportion of fish stocks [6]. However, although the definitions of 'fish stocks' and 'biologically sustainable' are introduced, it is unable to find the exact measurement of these two definitions [6]. In other words, the technical details of how to assess fish stocks and biological sustainability levels are not available in the metadata.

The final value of SDG Indicator 14.7.1 is the product of the values of both the environmental and economic dimensions. In statistical terms, it is expressed as '$SuGDP_F = Sm \times VA_F$', where SuGDPF is the VA of sustainable fisheries as a proportion of GDP, 'Sm' stands for 'Sustainability Multiplier', and VA_F refers to the VA of marine-capture fisheries [6] (p. 6). The final data for SDG Indicator 14.7.1 are updated biannually [6].

The development of SDG Indicator 14.7.1 was not straightforward. It took around one year to establish the initial formulation of this indicator until November 2016 [8]. This indicator was initially proposed by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) instead of its custodian agency, FAO [8]. SDG Indicator 14.7.1 was classified as a Tier 3 indicator, signifying the unavailability of global methods, standards, and/or concepts (possibly under testing). Three years later, in December 2019, SDG Indicator 14.7.1 was upgraded to a Tier 1 indicator, which has internationally established methods and standards, plus a data reporting rate higher than 50% in each region where this indicator is relevant [9].

Similar to other SDG indicators, the development of SDG Indicator 14.7.1 is a process not wholly driven by statistical considerations. Instead, the process of developing SDG indicators, including SDG Indicator 14.7.1, is influenced by political factors, such as tensions between statisticians and diplomats who have entirely different stances and expertise [10]. The development of SDG Indicator 14.7.1 involves not only statisticians, but also other stakeholders such as national government policymakers, diplomats, and international organization officials [8,11]. This indicator's focus on small-island developing states (SIDSs) and least-developed countries (LDCs) is also a result of the SDGs' emphasis on inclusiveness instead of being purely based on statistical considerations. For example, as of June 2023, 12 of 26 member countries of the IAEG-SDGs are low-income countries and lower–middle-income countries [12].

3. Analysis: Statistical Limitations of SDG Indicator 14.7.1

Based on the review of SDG Indicator 14.7.1 in the previous section, this section analyzes the main statistical limitations of the indicator itself and the use of it for monitoring the progress of sustainable fisheries.

3.1. Ambiguity of SDG Indicator 14.7.1: What Does It Actually Measure?

An important role of statistics is to use relevant methods and approaches to collect and interpret data [13]. However, although SDG Indicator 14.7.1 has a good data reporting rate (54.1%) [13], and therefore it is classified as a Tier 1 indicator [9], the interpretation of data for this indicator is a challenge. In other words, it is ambiguous on what this indicator actually measures.

The metadata of SDG Indicator 14.7.1 state that this indicator measures the share of value added from sustainable fisheries to GDP [6]. However, it does not provide the definition of 'sustainable fisheries'. Instead, the 'Sustainability Multiplier' is introduced to facilitate the operationalization of the concept of a 'sustainable fishery'. But the definition of 'Sustainability Multiplier' is not clearly presented (only refers as the proportion of fish stocks within biological sustainable levels), and the method of calculating the 'Sustainability Multiplier' is not published in the metadata either. Consequently, the 'Sustainability Multiplier' does not facilitate the understanding of what SDG Indicator 14.7.1 actually measures. Instead, it appears more like an arbitrary figure that determines how sustainable a country's fishery sector is, while this figure is not available to the public.

Even though the data for the 'Sustainability Multiplier' are occasionally accessible to the public, its actual meaning is still ambiguous. For example, in 2013, the 'Sustainability Multiplier' for Turkey (now its official name is changed to 'Türkiye Cumhuriyeti' and is often shorten as 'Türkiye') was 0.41: around 41% of Turkey's marine fish stocks were within biological sustainable levels [8]. But what message does this percentage convey? In the context of SDG Indicator 14.7.1, does that mean 41% of marine harvest fishes are sustainable and the other 59% are unstainable? This figure does not reveal the percentage of the country's gross marine-harvest fishes from each fishing region, either.

For the economic dimension of SDG Indicator 14.7.1, the relevant concepts such as GDP and VA from marine fisheries are clear. But there is still ambiguity as to what it measures. Based on the definition [6], we can find that the share of VA from marine fisheries in a country's GDP can be affected by the GDP itself, or the VA contributed by

marine fisheries, or both of them. To explain it in another way, a change in the share of VA from marine fisheries in GDP can be a result of an increase/decrease in marine fishery sector's VA, or an expansion/shrink in GDP, or changes in both the VA from marine fisheries and the country's GDP. However, since the national data of GDP and VA from marine fisheries are not presented as part of SDG Indicator 14.7.1, it is difficult to really understand what its economic dimension actually measures.

For example, a reduction in the share of VA from marine fisheries in a country's GDP could signify various scenarios. It may mean that the country's marine fishery sector shrinks faster than its national economy, or possibly indicate that the country's marine fishery sector still grows, but at a slower speed than the country's economy as a whole. Alternatively, it may mean that the marine fishery sector shrinks while the country's overall economy still grows. However, without the exact data for the country's GDP and VA of marine fisheries, we are unable to know which one is the precise information that the economic dimension of SDG Indicator 14.7.1 actually conveys.

SDG Indicator 14.7.1 is an indicator that monitors both an economic and an environmental dimension. This dual dimensionality of SDG Indicator 14.7.1 increases this indicator's ambiguity. Since the data for SDG Indicator 14.7.1 are calculated as the product of the economic and environmental dimensions, it is difficult to adequately understand what this indicator measures. For example, in 2019, the value of SDG Indicator 14.7.1 for the Faroe Islands was 11.52, which is the highest figure in all countries [14]. However, the interpretation of this figure is difficult. We are unable to evaluate how sustainable the country's marine fishery is. This figure does not show the scale of the marine fishery sector in the Faroe Islands either. Furthermore, this figure itself cannot tell the share of VA from marine fisheries to GDP. In other words, from this figure only, we are unable to understand that how much this value is contributed to by the environmental dimension and the economic dimension, respectively.

The ambiguity of SDG Indicator 14.7.1 poses challenges for cross-country comparisons of the data. For example, in 2019, Greenland had the second highest value in the data for SDG Indicator 14.7.1 (10.72), which was 0.8 percent lower than that of the Faroe Islands [14]. However, a comparison of these two data does not provide insights into which country possesses a more sustainable fishery sector or which country's marine fishery sector holds a larger share in its national economy.

The interpretation of SDG Indicator 14.7.1 and its data becomes more difficult and ambiguous when examining the trend of changes. Still taking the Faroe Islands as an example, in 2017, the value of SDG Indicator 14.7.1 was 13.6 [14]. In comparison with 2019, this figure dropped by slightly over two percentage points. However, what does this reduction actually mean? Merely examining these two figures does not allow us to determine whether this reduction signifies a decline in the sustainability of marine fisheries in the Faroe Islands, a contraction of the fishery sector in the national economy, or possibly both. Therefore, although we can find identify the trend of changes in the value of SDG Indicator 14.7.1, it is difficult to properly interpret the changes, which is another ambiguity as to what this indicator actually measures. This is particularly evident as the economic and environmental dimensions often interact with each other. For example, an expansion of marine fishery activities could have an impact on the 'Sustainability Multiplier', and a change in the 'Sustainability Multiplier' may also influence fluctuations in the VA from marine fisheries.

In short, this sub-section highlights that the dual-dimensional nature of SDG Indicator 14.7.1 leads to ambiguity regarding what this indicator actually measures and how to properly interpret the data for this indicator. Also, each dimension has its own ambiguity that leads to difficulty in the interpretation of SDG Indicator 14.7.1 and its data. The ambiguity is particularly noticeable when trying to understand a trend of changes and make inter-year and/or cross-country comparisons. It is also related to this indicator's limitation of inclusiveness at the country and sector levels, which will be further discussed in the next sub-section.

3.2. Conflict between Inclusiveness and Exclusion

As shown in the expression of SDG Indicator 14.7.1, this indicator underscores inclusiveness by mentioning that it monitors the VA from sustainable fisheries as a share of GDP in all countries. In addition, in consideration of the relatively weak statistical capacity of SIDSs and LDCs, SDG Indicator 14.7.1 highlights that it has a strong focus on the sustainable fisheries in LDCs and SIDSs. This also corresponds SDG Target 14.7, which is the target that SDG Indicator 14.7.1 aims to measure its progress.

However, the ideal inclusiveness is not easily achievable and we can notice that there is a high exclusiveness to SDG Indicator 14.7.1. One example is that this indicator only examines the VA from marine-capture fisheries; therefore, inland fisheries are excluded. However, recent data show that only less than 2/3 (around 63%) of fishes are obtained from marine waters [15]. This means that more than one third of fisheries in the world are beyond the radar of SDG Indicator 14.7.1, which reduces the expected inclusiveness of this indicator. Similarly, the VA from aquaculture is not monitored by this indicator. This also reduces the inclusiveness of SDG Indicator 14.7.1, as aquaculture's contribution to sustainable development and SDGs are observed [16,17].

For SDG Indicator 14.7.1, the exclusion of inland fisheries diminishes the intended inclusiveness of countries. There are 44 landlocked countries, among which 32 are developing countries, including 17 LDCs [18]. All of these 44 countries are automatically excluded from SDG Indicator 14.7.1, which is more than 20% of all countries in the world. The 17 LDCs count for more than one-third of all LDCs [19]. This means that more than one-third of LDCs are excluded from SDG Indicator 14.7.1, despite the indicator's stated emphasis on LDCs.

While SDG Indicator 14.7.1 places importance on LDCs and SIDSs, due to the relatively weak statistical capacity of these countries, the data availability for these countries is relatively low. For example, the global data reporting rate for SDG Indicator 14.7.1 between 2017 and 2021 was 54.1% [13]. However, this global average reporting rate was largely boosted by the high reporting rate (61.7%) in developed countries such as Europe, Canada, the United States of America, Australia, and New Zealand [13]. By contrast, in Africa, which has a large proportion of LDCs and landlocked countries, the data availability is substantially lower. For example, the data reporting rate in Sub-Saharan Africa between 2017 and 2021 was 46.8%, and this figure for North Africa and the Near East was only 33.3% [13]. The low data availability, especially in LDCs, significantly undermines the inclusiveness of SDG Indicator 14.7.1 and also becomes a limitation for the use of this SDG indicator in monitoring the progress of sustainable fisheries, which is the main objective of this indicator. Despite the substantial efforts in improving the statistical capacity of countries and increasing the data reporting rate, there is always a long journey ahead [13].

4. Discussion and Implication

The above sections introduced the development of SDG Indicator 14.7.1 and explained a few main statistical limitations of using this indicator to monitor the progress of sustainable fisheries. One main limitation of SDG Indicator 14.7.1 is the ambiguity surrounding what SDG Indicator 14.7.1 truly measures. Another limitation is that the application scope of SDG Indicator 14.7.1 is unclear. It has an ambition of monitoring the progress of sustainable fisheries in all countries with a strong emphasis on SIDSs and LDCs, but in fact, its concepts and methods only include marine-capture fisheries and therefore exclude all landlocked countries, even though some of them are LDCs. In other words, the expected inclusiveness and exclusiveness in practice may not be consistent with each other.

The reasons for these limitations are various. One possible reason is that the development of SDG Indicator 14.7.1, similar to other SDGs and indicators, is a process not fully determined by statistical principles and instead affected by other factors such as politics [5,11]. For example, it is likely a political consideration for an international fishery indicator to highlight LDCs and SIDSs, even though this may have a lot of statistical difficulties such as concepts and methods.

Another contributing factor to the challenges associated with SDG Indicator 14.7.1 is its ambitious goal of monitoring both the economic and environmental dimensions of the fishery sector within a single indicator. Each dimension is rather complex and needs clear approaches to adequately collect and interpret the data. Currently, the adequate interpretation of data for each dimension is lacking as a result of missing explanations for the actual practical meaning of these two dimensions. The data for these two dimensions are not published in attachment to the main data for SDG Indicator 14.7.1, either. In other words, the specific data for the two sub-indicators ('VA from marine fisheries/GDP' and the 'Sustainability Multiplier') are not available to the public.

A number of implications and recommendations can be generated. These implications would be useful to support the collection, interpretation, analysis, and use of data for SDG Indicator 14.7.1. They can also enrich the scientific knowledge of fishery statistics (including SDG Indicator 14.7.1). Moreover, they could be helpful to boost the use of fishery statistics to support sustainable fisheries' practices and policies. The main implications and recommendations are presented below.

Firstly, given that SDG Indicator 14.7.1 has ambiguity on what it actually measures, it is advised to publish data for both its economic and environmental dimensions, rather than only publishing data for the indicator itself. It may also be suitable to publish data on the VA from marine fisheries and GDPs instead of only presenting the percentages. This may help the data users to understand not only the share of VA from marine fisheries in GDP, but also the scale of the marine fishery sector at the national level. Also, the wide presence of small-scale marine fisheries and artisan marine fisheries, especially in SIDSs, may affect the calculation of VA from marine fisheries. Thus, it would be suitable to develop some special data collection methods and/or tools to support the best estimation of VA from marine fisheries, especially in countries where small-scale fisheries and marine fisheries are prevalent.

Secondly, more explanations of the economic and environmental dimensions of SDG Indicator 14.7.1, such as the details of calculating the 'Sustainability Multiplier', could also be published in order to help users better understand this indicator and its data [11]. It is suggested to publish some pilot reports based on the practice from a few countries, which may provide examples of how to interpret and calculate essential information such as the 'Sustainability Multiplier'. Furthermore, since SDG Indicator 14.7.1 is somewhat inter-related with SDG Indicator 14.4.1, it would also be suitable to publish more details about the calculation and interpretation of fish stocks within biologically sustainable levels in different fishing areas.

Thirdly, the expression of SDG Indicator 14.7.1 may be re-adjusted to reflect both its emphasis on LDCs and SIDSs and the exclusion of inland fisheries. For example, the term 'sustainable fisheries' may be replaced by 'sustainable marine fisheries' in this indicator, and the term 'all countries' could be removed. Although the process of developing SDG Indicator 14.7.1 involves different stakeholders such as statisticians, diplomats, and government officials, fundamental statistical principles and standards should be observed. Moreover, FAO and/or other international organizations can publish more case studies or country reports of using SDG Indicator 14.7.1. This would be helpful to reduce the ambiguity of SDG Indicator 14.7.1 and enhance its application in practice, including sustainable fishery policies.

Fourthly, global joint efforts would be important to further improve the development, interpretation, and use of SDG Indicator 14.7.1 (similar to several other global and globally developed indicators). Although FAO is the custodian agency of SDG Indicator 14.7.1, it does not mean that other stakeholders, such as international organizations and national statistical authorities, should leave this indicator unattended. Instead, as noted by other researchers [20–23], international and inter-organizational collaboration could support the development of global and globally produced statistics, including those around SDGs. The Committee of Chief Statisticians of the UN System can be considered as a good example of such inter-organizational collaboration [22].

Last but not least, enhancing the statistical capacity would be useful to improve the interpretation and use of SDG Indicator 14.7.1. As shown in existing studies, higher statistical literacy can support the provision of independent and objective data to support policy making [24]. This would be useful to reduce the possible political influence on the statistical scientific process of developing and using SDG Indicator 14.7.1. Raising statistical awareness would also support the better use of statistics for policies [25]. Recent technology improvements such as big data could also be used to support the enhancement of statistical capacity in association with SDG indicators [26,27], including SDG Indicator 14.7.1. This is particularly important for LDCs, which are under-represented in the data reporting of this indicator (and also some other SDG indicators) and may need extra technical support for data collection and reporting. Technological improvements such as remote and digital data collection tools also help national statistical authorities to mitigate the disruptions from external shocks [20,27–30]. Nevertheless, there are always more spaces for statistical capacity improvements for both developing and developed countries, and the challenges of enhancing statistical capacity are substantial [13,29].

5. Conclusions

Statistics play a crucial role in fisheries, assisting data interpretation and supporting evidence-based policy making. SDG Indicator 14.7.1 is the only indicator under the SDG framework to monitor the progress of sustainable fisheries, which has the objective to support data collection, use, and interpretation regarding fisheries, and also to facilitate the making of fishery-related policies at national, regional, and global levels. Its importance is observed, and there has been substantial improvements in the development and use of SDG Indicator 14.7.1 [8,9,11].

However, there are statistical limitations to SDG Indicator 14.7.1, which restricts the functionality of this indicator in practice. Particularly, in terms of statistics, SDG Indicator 14.7.1 has substantial ambiguity in terms of what it measures, and the application scope of this indicator also contradicts to its expected high inclusiveness. There are several reasons for these limitations, such as the dual dimensionality of this indicator due to its high aim, as well as the influence of non-statistical factors on the development of SDG Indicator 14.7.1. A number of recommendations are provided to reduce these statistical limitations of SDG Indicator 14.7.1. This article also calls for more studies can continue the exploration of SDG Indicator 14.7.1 and further examine how fishery statistics (including SDG Indicator 14.7.1) can be better used in practice, especially in supporting sustainable fishery policies.

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