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Editorial

Diagnosis and Management of Small-Scale and Data-Limited Fisheries

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Historically, small-scale fisheries (SSFs) have largely been overlooked by fisheries scientists and management authorities at national and international levels. This disregard stems from a misperception and undervaluation of the socio-economic significance of SSFs' contributions to society's well-being. Although SSFs are sometimes disregarded or marginalized due to their poor economic value, they are essential for employment and may be economically valuable for locals. SSFs are estimated to be responsible for more than half of all landings globally, provide food security for millions of people worldwide, and employ more than 90% of all wild-catch fishers. SSFs are typically multi-gear and multi-species, play an important role in maintaining household and community livelihoods, and contribute considerably to the local and international trading of seafood products. This lack of attention has meant fewer resources assigned for data collection and the assessment of their stocks, especially for those stocks with relatively low commercial value. For this reason, most of the world's fish stocks are considered data limited. This also compromises the decision-making process and the implementation of adequate management measures and regulations when managers must make decisions in the absence of data and/or adequate scientific advice.

Many people associate the term SSFs with relatively small, traditional fishing boats equipped with low-technical gear and labor-intensive fishing methods. SSFs are especially difficult to define due to the usage of multiple criteria to describe them and the reusability of terminologies, such as small-scale fisheries, artisanal fisheries, subsistence fisheries, and traditional fisheries. Because of the considerable diversity of SSFs across the world, it is difficult to construct a widely agreed definition. The Food and Agricultural Organization (FAO) has defined small-scale or artisanal fisheries as "traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption. In practice, the definition varies between countries, e.g., from gleaning or a one-man canoe in poor developing countries, to more than 20-m trawlers, seiners, or long-liners in developed ones. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export".

In 2015, the FAO also created the "Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries" (hence referred to as the "SSF Guidelines") to raise awareness of SSFs and encourage states to fund projects for their sustainability [1]. In the SSF Guidelines, with an emphasis on disaggregated data that make SSF more visible to decision-makers, the FAO urges states to improve (or establish) data collection programs for SSFs. Section #11.1 of the guidelines makes the most explicit request for disaggregated data: "States [i.e., Nations] should establish systems of collecting fisheries data, including bioecological, social, cultural and economic data relevant for decision-making on sustainable management of small-scale fisheries with a view to ensuring sustainability of ecosystems, including fish stocks,

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in a transparent manner. Efforts should be made to also produce gender-disaggregated data in official statistics, as well as data allowing for an improved understanding and visibility of the importance of small-scale fisheries and its different components, including socioeconomic aspects".

The challenges and threats that face SSFs are rarely attributable to a single cause or problem. For example, international organizations, such as the FAO, routinely collect data on fisheries landings at the national level and aggregate that data at regional and global levels. However, in many cases (developing countries), there is frequently no distinction between landings from SSFs and larger-scale commercial ventures. The sustainable management of stocks is severely challenged by the insufficient catch, survey, and other biological data available for most worldwide fish stocks, making it difficult to estimate current abundance and productivity using traditional stock assessment methods. In developed countries, between 10% and 50% of fish stocks are subject to assessment, while in developing countries, this percentage often runs between 5% and 20%. The fact that SSFs mostly operate in developing countries, where there are few protective measures in place and/or insufficient enforcement of any existing restrictions, also highlights other ecological issues such as bycatch of non-target species. Due to the inherent characteristics of SSFs, such as diffuse effort, far and many landing sites, and marginalization, the bycatch rates are often difficult to estimate. In addition, the conventional fisheries assessment approaches created for large-scale fisheries do not serve as an appropriate basis for the management of SSFs because they assume a comparatively simple relationship between the productive capacity of the resource and the extractive capacity of fishing fleets. Therefore, a management strategy based on benchmarks and reference points, such as the Maximum Sustainable Yield (MSY), is meaningless in the absence of data on the fleet structure, fish abundance, fishing mortality, and regulation.

To diagnose SSFs, one should evaluate the relative importance of various opportunities, strengths, and threats by synthesizing the information already available on the fishery system. These include ecological opportunities and threats that exist within the fishery system (such as overexploitation and habitat loss), social and economic processes that exist within the system (such as an excessive fishing effort/capacity, institutional capacity for management and advice, and opportunities for livelihood diversification), as well as those that originate from the outside environment. The diagnosis sets the boundaries of what is feasible at that specific stage in the evolution of a fishery and provides a picture of the history and potential of the fishery. It is important to note that a diagnosis is not, in the conventional sense, a quick evaluation of the stock status that results in management advice.

Recently, scientific attention to SSFs and data-limited fisheries has been increasing, as evidenced by a remarkable increase in peer-reviewed papers regarding this topic in the last decade. Here, we list some examples of the studies that have analyzed the important issues affecting SSFs such as, among other things, adaptation pathways, adaptive capacity, and the impacts of climate change on SSFs [2–5], estimating the fishing effort of SSFs [6], market-based management and market weaknesses and opportunities for SSFs [7,8], reconstruction of historical fishing effort and catch per unit effort (CPUE) for SSFs [9], extinction risk, reconstructed catches and management for chondrichthyan in SSF [10], reducing the impacts of SSFs on marine megafauna [11], evaluating the ecosystem impacts of gear regulations in SSFs [12], the capacity of SSFs to provide food security [13], insights into Illegal, Unreported and Unregulated (IUU) fishing activities in SSFs [14], an assessment of the factors that influence the willingness of small-scale fishers to adopt property rights co-management options [15], an assessment of the MSY and related indicators for the main target species stocks [16], and the identification and forecast of potential fishing grounds for the main target species [17]. As the impact of climate change on SSFs is a critical issue, Salgueiro-Otero et al. [2] relied on a social–ecological network and sociodemographic data collected via face-to-face interviews with 404 small-scale commercial fishers from nine Galician communities (Spain), to empirically examine the adaptation pathways that fishers follow when they face hypothetical impacts on their fishery resources and test the role of five social-ecological network structures on fisher's stated intended responses to such scenarios. To estimate the fishing effort of SSFs, Behivoke et al. [6] monitored the movements of a sample of 31 traditional sailing fishing boats at around 45 s time intervals using small GPS trackers. A total of 306 daily tracks were recorded among five gear types (beach seine, mosquito trawl net, gillnet, handline, and speargun). To ground-truth the GPS location data, fishers' behavior was simultaneously recorded by a single onboard observer for 49 tracks. Typical, gear-specific track patterns were observed. Their findings showed that boat tracking combined with onboard observation would improve the reliability of spatial fishing effort indicators in SSFs and contribute to more efficient management. Additionally, Zeller et al. [9] reconstructed and investigated trends in the fishing effort and CPUE of SSFs in four Exclusive Economic Zones (EEZ) that constitute the Mozambique Channel, i.e., Union of Comoros, Madagascar, Mayotte, and Mozambique, from 1950 to 2016. The results indicate that the increased motorization combined with substantial growth in the overall vessel numbers were the drivers of the increasing fishing effort and decreasing CPUE and clearly suggest that continuing to increase the fishing capacity of SSF in the absence of effective and restrictive management actions may exacerbate overexploitation risk. Reducing fisheries' impacts on marine megafauna is particularly challenging in SSFs; for this reason, Booth et al. [11] presented a novel combination of methods—scenario interviews with contingent valuation (CV)—for exploring and designing locally appropriate payments for ecosystem services (PES) schemes; and apply these methods to investigate how different types of incentives might influence fisher behavior and mortality of critically endangered taxa in two case study SSF in Indonesia. In addition, in the lack of time series to estimate the predator–prey interactions (vulnerabilities) using Ecosystem models, such as Ecopath with Ecosim (EwE), Rehren et al. [12] explored available approaches for estimating the vulnerabilities to simulate the effects of a dragnet prohibition with and without reallocation of fishing effort. The results suggest that banning dragnets would be beneficial for the fishing community, judged by the increase in biomass of functional groups and fishers' profits, but not if dragnet fishers were to continue fishing in the bay by reallocating to other gears, indicated by the reduced fish biomass and fishers' profits. As for food security, Canty and Deichmann [13] evaluated long-term trends of marine SSF-landed catches in 85 Developing Economy Countries (DECs), and analyzed whether the yields of SSFs have the capacity to provide the coastal populations of DECs with a recommended annual intake (RAI) of 10.6 kg of fish per person, and how that capacity has changed over the period of 1960 to 2016. The results of the study demonstrated that landed catches of SSF alone are not a useful proxy for food security.

In the middle of all these efforts to find genuine, viable solutions to fisheries issues, it is evident that information concerning SSFs is still relatively scarce. The literature covers relatively little quantitative information on SSFs compared to large-scale fisheries. Except for the most recent efforts to gather information about SSFs through projects such as Too big to be ignored (http://toobigtoignore.net/tbti-contribution-to-ssf-knowledge/, accessed on 10 December 2022), much less has been undertaken to address the lack of comprehensive and systematic data on SSFs. Far less so is the analysis of gaps and challenges encountered in the assessment and management of SSFs, as well as an understanding of how SSFs are assessed and managed.

This Special Issue aims to provide new insights and empirical knowledge and collect original and high-quality manuscripts related to all aspects of small-scale and data-limited fisheries, such as the activity of SSF; an assessment of the effectiveness of management strategies; IUU fishing; management measures, regulations, policies, and strategies; monitoring programs; stock assessments; the sustainable development of fisheries; the sustainable exploitation of resources.

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