frontiers | Frontiers in Marine Science

PERSPECTIVE
published: 22 July 2022
doi: 10.3389/fmars.2022.931407

Evaluating the Feasibility of Sustainable Seafood Labelling Programmes in Small Island Developing States: A Pilot Study of Artisanal Fisheries in Seychelles

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OPEN ACCESS

Edited by:
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Specialty section:
This article was submitted to Marine Conservation and Sustainability, a section of the journal Frontiers in Marine Science

Received: *29 April 2022*
Accepted: *13 June 2022*
Published: *22 July 2022*

Citation:
Glass JR, Belle K, Berke G, Bodin N, Burt AJ, Duncan MI, Morgan SK, Pillay P and Talma S (2022) Evaluating the Feasibility of Sustainable Seafood Labelling Programmes in Small Island Developing States: A Pilot Study of Artisanal Fisheries in Seychelles. Front. Mar. Sci. 9:931407. doi: 10.3389/fmars.2022.931407

The Republic of Seychelles is one of six African Small Island Developing States (SIDS) and has a marine-based economy reliant on fisheries and international tourism. Seychelles has been flagged by the United Nations as highly vulnerable to climate change. Climatic threats are compounded with population declines of key fishery species. A progressive national stance towards ocean sustainability and an emerging economy partially driven by tourists are two of several factors that make Seychelles a good candidate for a sustainable seafood labelling and consumption programme, which would provide market-based incentives for fishery harvesters, regulators, buyers and consumers to improve sustainable practices. To address the feasibility of such a programme, we conducted a pilot study, surveying 33 artisanal fishers and mapping supply chain structure to examine incentives and challenges. Questions addressed fishers' years of experience, reliance on fishing for income, and flexibility in gear type and species targeted. Of the total number of respondents, 64% would like to see a programme implemented but only 34% thought it would be successful. Participants identified several barriers and benefits that primarily spanned socioeconomic and regulatory themes. Our pilot results indicate the sociocultural and economic impacts of sustainability programmes in Seychelles are as important as environmental considerations, a finding pertinent to anyone undertaking similar research efforts in other SIDS. We advocate for the necessity of thorough, location-based research and in-depth stakeholder consultation to elucidate economic, societal, behavioural and cultural factors that will affect the success of designing and implementing seafood labelling programmes in SIDS.

Keywords: market-based instruments, eco-label, emerging economy, marine fisheries, blue economy, small island developing states (SIDS), Indian Ocean, Africa

INTRODUCTION

Small Island Developing States

Developing countries play an increasingly larger role in global fish export and consumption (FAO, 2020). Many developing countries with significant marine resources belong to the United Nations Small Island Developing States (SIDS), a group comprising 58 nation states that represent some of the smallest and most remote nations in the world. The livelihoods and economies of SIDS depend on healthy marine ecosystems, yet these nations are some of the most vulnerable to climate change, over-exploitation of fisheries by industrial off-shore fishing, and by pressure placed on local resources from tourism (Techera and Appadoo, 2020). Small-scale fishery resources, in particular, are critical for food security and economic livelihoods in SIDS. Six SIDS are considered part of Africa: Cape Verde, Comoros, Guinea Bissau, Mauritius, Saõ Tome and Príncipe, and Seychelles. Among them, Seychelles has been a leader in climate change adaptation strategies (Robinson, 2017) and pioneering efforts towards establishing a blue economy (Hicks, and Schutter,2019; Christ et al., 2020).

Opportunity for Seafood Labelling in Seychelles

Sustainable seafood labelling and rating strategies and awareness campaigns have been developed in several countries worldwide and are designed to incentivise the alignment of harvesters, regulators, buyers and consumers around sustainable resource management (Jacquet and Pauly, 2007; Roheim et al., 2018). To-date, no sustainable seafood labelling initiative has been established domestically in African SIDS, or – to our knowledge – in any SIDS globally.

A number of factors suggest Seychelles may be well-suited for the introduction of a sustainable seafood labelling and consumption programme. First, Seychelles has a marine-based economy, with industrial tuna fishing and marine tourism comprising the two main productive sectors (Breuil and Grima, 2014). Second, Seychelles has a number of initiatives already underway that illustrate its readiness to undertake leadership to safeguard marine resources. The country hosts the world's first debt-for-nature swap, which has led to the establishment of marine protected areas and sustainable use zones comprising 30% of the nation's federal waters (Silver and Campbell, 2018; Techera and Appadoo, 2020). Other initiatives include a comprehensive marine spatial plan and the development of a Blue Economy Roadmap (Commonwealth Secretariat, 2018). Third, geo-politically Seychelles has been considered an emerging economy since 2015 (Commonwealth Secretariat, 2018), partially due to the high rates of tourism from Europe, where labelling of seafood is commonplace (Paolacci et al., 2021). The awareness of ocean-oriented tourists to sustainable seafood concepts presents the potential for intuitive use of local seafood labels and a possible readiness to absorb price increases that would cover costs of implementing gear shifts or other sustainability improvements. Addressing these challenges is particularly important in nations heavily reliant on marine resources, such as Seychelles and other African SIDS.

Pilot Study Objectives

The complex and distinctive interplay between market actors and members of the public sector in SIDS nations suggest that piloting the feasibility of a sustainable seafood labelling programme is a wise step to optimise strategic use of project resources (time, funding and expertise) and to avoid unintended consequences (Lewis et al., 2020). With Seychellois project leaders, we used Seychelles as a case study to examine both incentives and challenges associated with a possible Seychelles Sustainable Seafood Initiative (SSI), aiming to anchor our work on a clear operational understanding of local supply chains. We started with a "skeletal" understanding of value chains and used our pilot interviews to both examine incentives and to adjust **Figure 1** to most accurately represent the importance/significance of market actors and their relations (i.e., line weighting represents 'weight' in the system and relative connectivity). Here we report on pilot surveys with 33 fishers to demonstrate the breadth of information gleaned from just one stakeholder group. We also draw conclusions about necessary steps for market-based sustainable seafood strategies and discuss operational considerations for SIDS practitioners who may wish to implement such strategies in their nation's waters.

METHODS

Small-Scale Fisheries in Seychelles

The artisanal fishery of Seychelles is charterised by approximately 500 active vessels using gear types including handlines, traps, gill nets, beach seines and harpoons. Artisanal fishers operate off small boats (< 14 m length), usually within 10 nm of the core granitic islands, the 'inshore' area, and often in waters adjacent to vessel mooring and landing sites. Artisanal fishers target reef-associated species such as Lutjanidae (snappers), Serranidae (groupers), Lethrinidae (emperors), Scombridae (notably the Indian mackerel), Sphyraenidae (barracuda), Carangidae (trevallies), Siganidae (rabbitfish), and Scaridae (parrotfish). Some species such as groupers and snappers are also exported. Larger, semi-industrial vessels (14–23 m length) target offshore banks and the outer islands, with catches often landed in Port Victoria, Providence or other landing sites to then be exported. Depending on the season and species targeted, larger vessels may also operate inshore. The catches of the artisanal vessels supply the local market demand, including hotels and restaurants (**Figure 1**).

Questionnaires

During 2021–2022, we surveyed numerous relevant stakeholders in Seychelles to begin gauging interest in a sustainable seafood labelling and consumption programme. Our pilot study targeted sample sizes based on practical considerations including participant flow, budgetary constraints, and the number of participants needed to reasonably evaluate feasibility goals. The stakeholder groups consist of fishers (artisanal), retailers (including traders, seafood processors, suppliers, restaurants, hotels, catering and take-aways), consumers (Seychelles residents and tourists), and regulators (Seychelles Fishing Authority). We

designed questionnaires that were conducted face-to-face in one of the three national languages: Seychellois Creole, English or French. These surveys were led by a local team of experts and developed by project partners who were on-the-ground in Seychelles, had extensive experience working with the Seychelles fisheries sector, or who had global experience with sustainable seafood labelling and consumption programmes and ecolabel -certifications. We aimed to address several pilot objectives pertinent to carrying the project forward (**Table S1**). In our survey of fishers – the focus of this paper – questions spanned economic, social, regulatory and ecosystem considerations to understand how long they have been fishing, the percent of their income from fishing, gear types used, and flexibility in gear type and species targeted (Supplementary Material). We also asked targeted questions about fishers' opinions on a Seychelles SSI after briefly explaining what such a programme might entail, using the Southern African Sustainable Seafood Initiative (WWF SASSI, 2016) as an example system. Targeted questions included, "do you think a SSI programme would work and why?" and, "would you like to see a SSI programme and why?" with options for open-ended responses.

Data Analysis

The interviewee responses were transcribed and each transcript was reviewed to develop a conceptual framework from the qualitative data using an inductive coding approach (Hsieh and Shannon, 2005). First, we listed perceived barriers to a Seychelles SSI mentioned by fishers, followed by perceived benefits. Inductive coding was used to allocate each barrier and benefit to one or more topics which emerged to form the coding framework. These topics were reduced to five overarching themes; socioeconomic, regulatory, technological, behavioural and environmental.

RESULTS

We present pilot study results after surveying 33 fishers (**Figure 2**). All fishers interviewed were male and 88% of participants were fishers by profession (**Table S2**), 55% of whom have been fishing for more than 20 years. There are very few female fishers in Seychelles; there are some female boat owners but they do not fish. Additional demographic information on fisher pilot respondents is available in the Supplementary Material (**Figures S1 –S5**). Overall 64% of respondents would like to see a SSI programme implemented in Seychelles but only 34% thought such a programme would be successful (**Figure 2A**). When asked why they thought such a program would or would not work, respondents voiced 16 perceived barriers to an initiative such as a Seychelles SSI (**Figure 2B**). The barriers most frequently mentioned by fishers were concerns over a lack of regulation and enforcement, whereby they perceived nothing would change, as well as a lack of control by fishers over what species they catch. The most frequently perceived benefit of a SSI programme was the potential to increase the price of a broader range of species. The barriers spanned socioeconomic, regulatory, technological, behavioural and environmental themes, although the majority (56%) were socioeconomic (e.g., "poorer people will eat any fish"), followed by regulatory (e.g., "lack of data on stock assessments hinders such initiatives;" **Figure 2B**). Likewise, four of the eight (50%) perceived benefits of a SSI identified by the fishers were socioeconomic (e.g., "[A SSI could] raise the price of a broader selection of species") followed by benefits relating to behaviour (e.g., "[A SSI could] decrease stigmas around species deemed bad to eat;" **Figure 2B**).

DISCUSSION

After conducting a pilot survey of fishers – one of five identified stakeholder groups relevant to the Seychelles artisanal seafood value chain (**Figure 1**) – we obtained key information that will drive additional research. Important for our piloting purposes is that by surveying a small subset (~7%) of Seychelles' fishers, we could still identify numerous barriers and benefits to implementing a SSI programme. These barriers and benefits spanned socioeconomic, regulatory, technological, behavioural and environmental themes, with several responses addressing one or more themes simultaneously. Fishers brought up legitimate concerns about a sustainable seafood labelling and consumption programme, some of which were anticipated by our research team (e.g., fishers have limited control over what they can catch) and others which were novel (e.g., perception of more work for fishers but no reward). Given that a critical component of market-based incentive programmes is buy-in from fishers (Pérez-Ramírez et al., 2012), such concerns are important to acknowledge so they can guide future research and communication.

What is immediately apparent from our work is that in Seychelles the sociocultural impacts of sustainability programmes must carry a comparable weight to environmental impacts. Our results may also guide similar efforts in other SIDS nations with equivalent dependencies on small-scale fisheries. Indeed, market-based conservation tools are currently poorly linked to metrics used to assess ecosystem services where such services are intuitively understandable from a human value perspective (Murphy et al., 2021).

Most Seychellois fishers in our pilot survey depend on fishing for their livelihoods, spending 5–7 days a week fishing. As such, any incentive system must be equitable, inclusive and avoid undermining, penalising or shaming certain fisher groups or gear types, particularly those without the financial capital to make behavioural and technological changes. If not implemented carefully, conservation policies can lead to unintended negative consequences such as supply chain shortages and increased pressure on sustainable fisheries, both of which are detrimental to local food security (Lewis et al., 2020; Murphy et al., 2021). Some fishers surveyed expressed concerns that a SSI programme would raise the prices of local species too high for local Seychellois, or that the programme would only benefit certain fisher types. We anticipate our additional planned surveys will add new insights that span these five themes.

Notably, our pilot study revealed distinct attributes of the Seychelles artisanal fishery value chain likely to impact the future effectiveness of a SSI programme: these merit additional attention. First, there is a high reliance on traders due to their more-flexible pay structure (**Figure 1**), a common situation in small-scale fisheries (Thủy et al., 2019; Bartkus et al., 2021). Bypassing traders – a common tactic in programmes aimed to increase fisher earnings – would therefore disrupt the existing value chain in Seychelles and would likely face strong resistance, since traders hold significant power in the community. Second, there was distrust expressed by several fishers in government-led initiatives due to a variety of historical and cultural factors (Wood, 2007; Daw et al., 2011). As such, we believe a SSI programme would be more successful if initiated and implemented by a non-governmental organisation. Third, many fishers are not aware of existing trends indicating poor stock status for species they fish and may resist a sustainability programme that ranks a species as unsustainable (Daw et al., 2011; Robinson et al., 2019; Christ et al., 2020; Robinson et al., 2020; Bijoux, 2021).

One of the reasons leading to mistrust and miscommunication between regulators and fishers in Seychelles is poor attendance by many fishers at workshops hosted by regulators, in spite of incentive awards for attending (Daw et al., 2011; Trimble et al., 2014). Sometimes workshops are held during fishing seasons, making it difficult for fishers to attend, but poor attendance also stems from feelings of indifference in fishers arising from a history of mistrust and frustration with regulators. Moreover, misinformation can spread quickly, and there is a perceived belief by artisanal fishers that they receive unequal treatment from regulators compared to operators of larger, industrial vessels (e.g., purse seiners). For example, when asked if they would stop fishing for any reason, one fisher stated, "No, I will keep fishing. [The] problem is the large vessels, not [the] small people." During the time of our fisher pilot surveys, strict quotas on yellowfin tuna catches in Seychelles were being negotiated by the Indian Ocean Tuna Commission, which attracted high media coverage in local newspapers and on social media. These negotiations coincided with new regulations for the artisanal fishery– specifically, size limits for two overexploited species – set by the Seychelles Fishing Authority and Ministry of Fisheries and the Blue Economy. While these events were not directly related to our survey questions, this context surfaced in interviews. Several fishers made unsolicited statements that they thought size limits would be enforced on the artisanal fishers but not on the industrial fleet, which they felt was unequitable. It is also important to acknowledge that current events (e.g. fishery regulatory changes, the COVID-19 pandemic) may have affected our pilot survey responses. Nonetheless, identifying critical barriers upfront-particularly behavioural and sociocultural obstacles- and whether those barriers can be overcome, is a necessary step to advancing market-based sustainability solutions.

We reviewed the quality of our questions, examining the amount of time it took fishers to answer questions, the range of interpretations apparent in responses, and root cause ambiguity in wording. On this basis, we identified some questions that will require significant modification to more-accurately capture the nuances of the Seychelles artisanal fishery in a full-scale feasibility study. For example, some questions such as "What were your fishing strategies before COVID?" garnered a wide variety of answers from fishers (**Table S3**). Our interpretation of this question, specifically, speaks to the challenges of disentangling current events – the COVID-19 pandemic – with what has been a relatively rapid development of fisheries in Seychelles over the past ~30 years. Several fishers we interviewed have been fishing for over two decades and have already had to make many adjustments to their fishing methods and gear over time (Woodhead et al., 2021). Climate change, including severe coral bleaching events (Gudka et al., 2020), as well as seasonal weather variations and tourism levels have all fluctuated largely over the past several years and led to constant changes in the market demand for fresh fish (Woodhead et al., 2021). COVID-19 was just one additional component of this change. After a one-month shutdown in 2020, the Seychelles government gave fishers a lockdown exemption and facilitated a nation-wide fish purchasing programme, possibly even increasing the demand for local fish. Moreover, fishers are already accustomed to three-month gaps in fishing, given the Seychelles' monsoon patterns. As such, the impacts of COVID-19 on fishers in island nations such as Seychelles may have been relatively minimal (Ferguson et al., 2022), and we observed several responses to this question that were more representative of all the changes fishers have had to make because of previous events over the past 20-30 years. We therefore stress the importance of critically evaluating survey questions and responses *via* pilot studies and making adaptive changes in survey phrasing and delivery to better capture targeted information.

In addition to the wording of the questions themselves, we assert that market-based research etiquette, specifically the manner in which surveys are conducted, is also critically important. Without a team on-the-ground in Seychelles with expert knowledge of the market structure, of social and cultural contexts, and with the ability to gain the trust of fishers to answer survey questions honestly, coupled with independent experts unaffiliated with any government regulatory organisation, the barriers and benefits identified by fishers may not have been so readily captured. For example, the primary fisher surveyor had significant experience interviewing Seychelles fishers and a full suite of local language/dialect skills. The interviewer also recognized the importance of conducting surveys between monsoon seasons - and at times of day and in locations - when fishers had more time to answer questions. Along with capturing important considerations for future surveys, approaching fishers respectful of their primary need to fish, and the voluntary generosity of responding to surveys, also represented investing in an appropriate tenor for future relations.

The take-home from this pilot study is the necessity of thorough, location-specific research and in-depth stakeholder consultation to elucidate unique economic, societal, behavioural and cultural factors that will affect design considerations for seafood labelling and consumption programmes. We believe the findings from this study in Seychelles are generalizable across several SIDS. The very definition of SIDS means these nations share economic, geographic and ocean reliance features (Briguglio, 1995; Thomas et al., 2020). The most comparable pilot

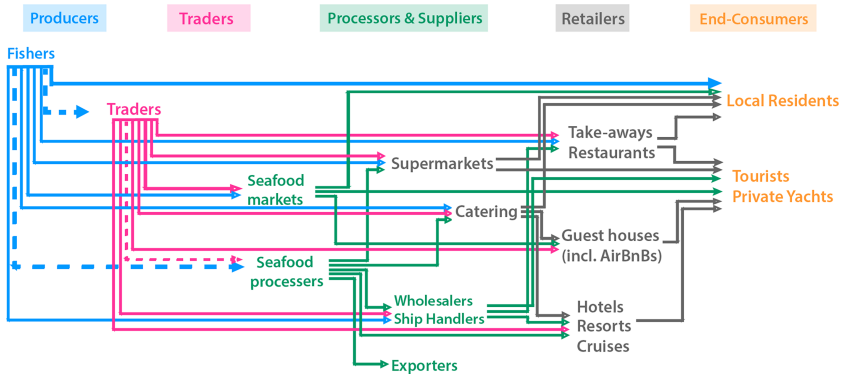

FIGURE 1 | Fisheries value chain in Seychelles. Thicker lines connecting fishers and local residents, traders, and seafood processors indicate that these three channels represent the majority of customers for fishers. The dashed lines represent scenarios where the traders and processors have direct arrangements with fishers to target specific species for a specific retailer

study conducted to-date on market-based seafood sustainability opportunities in SIDS, to our knowledge, took place in Bonaire, Saba and St. Eustatius: Caribbean islands belonging to the Netherlands Antilles. On these islands, researchers encountered similar challenges, including difficulties with data-limited stocks and lack of effective communication between fishers and governing bodies (WWF Netherlands and Good Fish Foundation, 2020). In Africa in particular, there is a pressing need to conduct in-depth, market-based fisheries research across the six African SIDS, as every one of them – from Seychelles to Cabo Verde – are engaging to various extents in Blue Economy strategies to enhance sustainable ocean production aligned with the United Nations Sustainable Development Goal 14 (SDG 14; AU-IBAR, 2019; Techera and Appadoo, 2020). Indeed, seafood labelling programmes are specifically proposed by the UN as a tool to help SIDS achieve SDG 14 (UNCTAD, 2019), highlighting the importance of helping countries perform gap analyses to build or develop the components needed to use market-based approaches and tools effectively in burgeoning Blue Economy frameworks, including mapping fishery supply chains. We believe this pilot work can serve as a valuable guide to direct future research on the development of seafood labelling programs in African SIDS nations. African SIDS share a disproportionate reliance on the ocean for economic production *via* tourism and fisheries, food security and cultural heritage, and face similar threats such as over-exploitation and climate-induced habitat loss (Obura, 2017; Intchama et al., 2018; González et al., 2020). Many African SIDS also share similar aspects of their fisheries which are deemed important for a seafood labelling program. These include multi-sector fisheries, targeting a variety of species, and distinctive

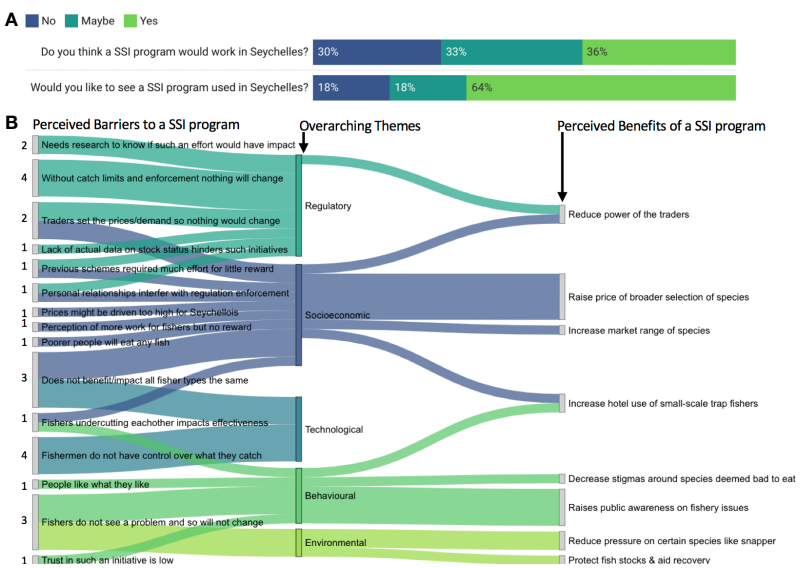

Figure 2 | Results from 33 fisher surveys demonstrating **(A)** responses to direct questions about a sustainable seafood initiative (SSI) in Seychelles, and **(B)** perceived barriers (left panel) and benefits (right panel) to such an initiative, grouped into five themes (middle panel).

value/supply chains for export, local and tourist consumption (UNCTAD, 2017; Advance Africa Management Services, 2018; González et al., 2020; Sweenarain 2012).

We recommend that researchers and agencies working in SIDS adopt a community and human-centred approach to implementing questionnaires related to sustainable seafood initiatives. Relationship-building and upfront consideration of fishers' time or other constraints were crucial to the success of this pilot study. We also emphasise the importance of thorough background research before implementing market-based incentive sustainable seafood programmes, acknowledging that such research demands significant time and resources. While several of our conclusions are generalizable across African SIDS, we recognize the challenges faced by SIDS are not always homogenous and acknowledge the complexities unique to each nation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Seychelles Ministry of Health (No: 2108).

AUTHOR CONTRIBUTIONS

JG, KB, NB, GB, AB, MD, SM, PP, and ST all contributed to project planning, study design, and manuscript writing. GB, KB, NB and ST implemented surveys. All authors contributed to the article and approved the submitted version.

FUNDING

Our work in Seychelles is being funded by the Seychelles Conservation and Climate Adaptation Trust (SeyCCAT) Grant No: BGF4-S-N58.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmars.2022.931407/full#supplementary-material

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Conflict of Interest: Authors ST, GB, SM, NB and KB are/were employed by various consultancies.

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