

# Oceans Economy and Trade Strategy: Barbados

## Large pelagic longline fishery

Oceans Economy and  
Trade Strategies (OETS)  
Project Barbados

UNCTAD–DOALOS in  
cooperation with FAO



**Food and Agriculture  
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United Nations**



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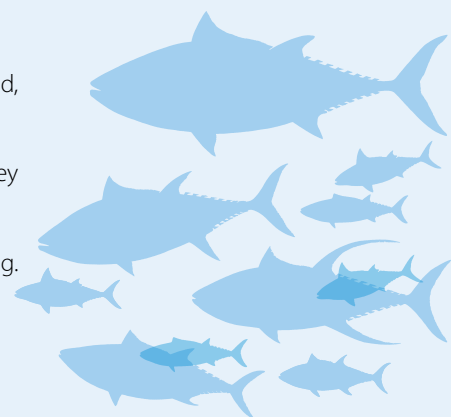
## Explanatory notes

Reference to “dollar” and “\$” indicates United States dollars, unless otherwise stated.

Use of a dash (–) between dates representing years, e.g. 2015–2017, signifies the full period involved, including the initial and final years.

To reflect the closest estimate for data, decimals and percentages are rounded off. Numbers in money are rounded to the nearest dollar, unless otherwise stated.

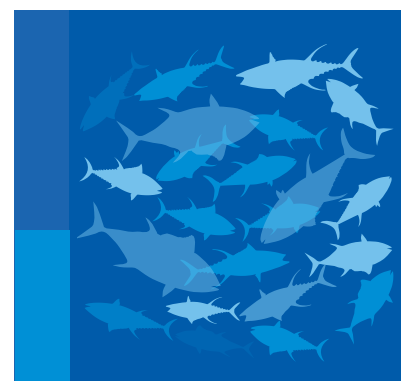
Decimals and percentages in this document do not necessarily add up to totals because of rounding.





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## Abbreviations and acronyms

<b>BARNUFO</b>	Barbados National Union of Fisherfolk Organizations	<b>IUU</b>	illegal, unregulated and unreported (fishing)
<b>BFC</b>	Bridgetown Fisheries Complex	<b>MABE</b>	Ministry of Maritime Affairs and the Blue Economy
<b>CARICOM</b>	Caribbean Community	<b>MCS</b>	monitoring, control and surveillance
<b>CARIFORUM</b>	The Caribbean Forum	<b>MOU</b>	memorandum of understanding
<b>C-FIP</b>	Comprehensive fishery improvement plan	<b>MSC</b>	Marine Stewardship Council
<b>CFO</b>	chief fisheries officer	<b>MSY</b>	maximum sustainable yield
<b>CPI</b>	consumer price index	<b>OETS</b>	Oceans Economy and Trade Strategy
<b>EEZ</b>	exclusive economic zone	<b>PPP</b>	public–private partnership
<b>EPA</b>	Economic Partnership Agreement (EPA) of the European Union	<b>RFMO</b>	regional fisheries management organization
<b>EPI</b>	Environmental performance index	<b>ROI</b>	return on investment
<b>FAO</b>	Food and Agriculture Organization of the United Nations	<b>SDG</b>	Sustainable Development Goal
<b>FIP</b>	fishery improvement project	<b>SIDS</b>	small island developing states
<b>FPI</b>	fishery performance indicators	<b>TAC</b>	total allowable catch
<b>FPI-DEV</b>	FPI for development	<b>TURF</b>	territorial user rights for fishing
<b>GDP</b>	gross domestic product	<b>UNCLOS</b>	United Nations Convention on the Law of the Sea
<b>GSP</b>	Generalized System of Preferences	<b>UNCTAD</b>	United Nations Conference on Trade and Development
<b>HACCP</b>	Hazard Analysis and Critical Control Point	<b>USFDA</b>	United States Food and Drug Administration
<b>HS</b>	Harmonised System (of the CARIFORUM/European Union EPA)	<b>UNFSA</b>	United Nations Fish Stock Agreement
<b>ICCAT</b>	International Commission for the Conservation of Atlantic Tunas	<b>WHO</b>	World Health Organization
<b>ITC</b>	International Trade Centre	<b>WTO</b>	World Trade Organization
		<b>VMS</b>	vessel monitoring system



# Executive summary

## Overview

The Oceans Economy and Trade Strategy (OETS) project was designed to support coastal developing countries, including small island developing states (SIDS) such as Barbados. The project aims to help these States derive improved economic benefit from sustainable trade of products and services in selected ocean-based economic sectors. This OETS report focuses on sustainable marine fisheries and seafood processing, specifically the Barbados large pelagic longline fishery and the process of moving from exporting fresh headed and gutted tuna to exporting fresh tuna loins.

The report assesses the large pelagic longline fishery and specifies improvements that can be made in accordance with UNCTAD's five pillars of oceans/blue economy: sustainable economic development, sustainable use and conservation of marine resources, inclusive social development, increased scientific knowledge and oceans and trade governance.<sup>1</sup> To underpin and inform the analyses required under the OETS format, this assessment used fishery performance indicators (FPIs) as key indicators of triple bottom line outcomes. Triple bottom line outcomes focus on the planet, people and profits. Effective fisheries development requires ecosystem sustainability and social acceptability, and supports livelihoods through resource rents or profits. The OETS report is the result of a collaborative effort between UNCTAD, DOALOS and FAO in the implementation of Sustainable Development Goal (SDG) 14. It provides guidance to support the policy and regulatory economic environment of the Barbados large pelagic longline fishery, and serves to examine the possibility of adding value in the tuna sector through opportunities in loining (removing the tuna meat from the head and backbone of a tuna). It is not intended to be a decision-making tool for investing in the fishing industry of Barbados, but it does provide baseline information relevant to necessary further analysis and consultations with all relevant stakeholders. The subsequent phase of the project will support certain modest implementing actions so as to take forward priority key recommendations of the report, as may be identified by the Government of Barbados.

## Major findings

The large pelagic longline fishery of Barbados offers a unique opportunity. There is significant potential to: (i) transition the fishery to produce a fresh loin product; and (ii) use sustainability criteria and traceability to improve market access and tuna sales prices, while improving sustainable fisheries management. A high-level summary of the implementation plan is presented in Box 1. The plan involves adding more value to tunas in Barbados by producing loins for export, rather than headed and gutted product. This ensures that more value is retained in Barbados for the benefit of local stakeholders.

Access to market could be improved by installing an electronic method of recording landings. Such a system would enable product traceability. Electronic data collection would also directly improve monitoring, control and surveillance (MCS) of the large pelagic longline fishery, which would facilitate compliance with rules and regulations of the International Commission for the Conservation of Atlantic Tunas (ICCAT).

It is recommended that the large pelagic longline fishery of Barbados enters a comprehensive fishery improvement plan (C-FIP), which will set sustainability benchmarks that are independently

<sup>1</sup> UNCTAD (2015). See <https://unctad.org/en/Pages/DITC/Trade-and-Environment/Oceans-Economy-Pillars.aspx>.



audited. A C-FIP increases market access, improves local management and enhances ICCAT compliance, all of which are important for Barbados to maintain favourable ICCAT country quotas and advocate for future quotas.

The eight high-level interventions presented in Box 1 are arranged in chronological order, although some may run concurrently. This report breaks down the eight high-level interventions into 22 more detailed interventions and 36 individual actions linked to the insights gained during the FPI scoring process and documented in the FPI report. Costs and timelines are included and the actions are linked directly to measurable results from the FPI scoring process.

### Box 1: Proposed high-level interventions

Source:  
Author's analysis of  
OETS report findings.

1. Engage stakeholders to seek buy-in and define implementation plan.
2. Design an electronic landings and export data system aligned with current and future Government regulations.
3. Structure a public-private partnership (PPP) for new fish handling processes and profit distribution.
4. Enter fishery into a C-FIP.
  - a. Conduct C-FIP pre-assessment.
  - b. Develop C-FIP work plan.
5. Invest in PPP and build loining facility.
6. Develop markets for loined product and move loins to market.
7. Take action on legislative and fishery management recommendations in C-FIP work plan.
8. Assess fishery progress bi-annually to ensure targets are met.

As implementation moves ahead, a structure will need to be developed that enhances the capability of local managers to sustain the programme into the future. That will entail negotiating business structures, potentially amending fisheries management legislation and creating a cost recovery mechanism that can fund the infrastructure enhancements. This report provides detailed information on the many small steps required to achieve these broad implementation goals. However, the implementation plan is not completely prescriptive. Instead, it sets out a broad framework for stakeholder engagement and negotiation, with the objective of developing a final plan based on contemporary, local conditions and solutions that are most suitable for stakeholders.

An initiative to implement the interventions presented in Box 1 could increase the gross revenue generated by Barbados' large pelagic longline fishery over the next seven years by **\$7.5 million**, or an average additional revenue of **\$1.1 million per year**, based on the assumptions and methodology detailed in Appendix A.<sup>2</sup> This translates to a **\$2.5 million** increase in revenue for fishers over the seven-year projection period, an average of **\$350,271** in additional revenue each year for all fishers. While at the time of reporting, records of the total number of trips and number of active vessels were not accessible, if this revenue increase was spread equally across the entire fleet of 47 boats, it would increase the revenue of every vessel by **\$7,500/year**. Putting that into perspective, \$7,500/year of additional revenue per vessel is equivalent to the profits of nearly five extra fishing trips per year. Finally, the cash flow analysis replaces the \$0.045/pound landings tax with a \$0.045/pound tax on exported loins. This change would increase tax revenue over the seven-year period by \$422,865, or on average, \$60,500 per year.

<sup>2</sup> The estimates are those of the author and do not necessarily reflect the views of the United Nations or its Member States.

To achieve the projected increase in revenue will require expenditure of **\$1.2 million, including \$190,000** for structuring, **\$960,000** for implementation and **\$20,000** for maintenance of the initiative. Blending capital types is necessary for this initiative in order to bring the total, effective interest rate for all debt to a level that is affordable for the large pelagic longline fishery. This initiative invests both in enabling conditions that are considered public goods, and in private goods that go towards the support of private profits. The proposed financing strategy has been scrutinized to avoid potential conflicts with current World Trade Organization (WTO) rules on subsidies, or any future WTO agreement or decision on fisheries subsidies, in light of SDG 14.6.<sup>3</sup> The initiative does not seek to support an increase in capacity, directly subsidize exports, build new vessels, or encourage activities that may be harmful to fish stocks. Instead, actions are planned to utilize existing harvests and capacity with the implementation plan. Overall, the implementation plan suggests required funding of \$480,000 in grants, \$245,000 in loans and \$495,000 in investments.

## Supporting evidence

Box 2 highlights the key SWOT analysis results derived from the FPI scoring during the field work stage of this project. The Barbados large pelagic longline fishery features a number of strengths that have the potential to help Barbados derive more value from fisheries resources, and improve local revenue generation. The strengths include good access to air freight infrastructure to facilitate exports, and an industry that is responsive and eager for change. In addition, the processing room identified for producing tuna loins already meets the United States of America's sanitation guidelines for headed and gutted product. Overall, the captains and crew active in the Barbados large pelagic longline fishery are experienced fishers and already follow industry best practices when handling tuna, which allows them to maximize the value of the landed fish.

However, the fishery also faces challenges. For instance, the fishers deal with high operating costs, particularly with respect to fuel and the new road tax on fuel. The Bridgetown Fishery Complex (BFC) is aging and maintenance of its infrastructure could be improved. Data on landings is inconsistent and a systematic compilation of price data is not available. To date, co-management has been limited, but there are noticeable areas of improvement in this regard. Currently, almost all fish exports are dispatched to a single importer which increases market risk, limits price discovery and exacerbates a lack of transparency in pricing. The Barbados large pelagic longline fishery is a consignment fishery and exports are only officially graded when they reach Miami, United States of America. This factor, coupled with the lack of transparency, means that fishers face a significant grading risk.

The combination of the fishery's strengths and the weaknesses does, however, present opportunities. There is strong global demand for raw tuna, yet the production of Barbados is too small to impact global supply and demand. By increasing market access, the fishery should be able to increase prices and market penetration. The electronic capture of landings data will support improved management of the fishery and enhance pricing transparency. Restricting entry will limit fishing capacity and allow the fishery's value to accrue to the permits, which the captains hold as a financial asset.<sup>4</sup> The proposed recommendations will lead to some level of import substitution of tuna and other large pelagic fishery products which will increase value for fishers and allow Barbados to retain a higher proportion of fisheries value in the local economy.

<sup>3</sup> For further understanding of the status of the current debate around WTO negotiations on fisheries subsidies (up to fall of 2019), see Vivas, Bellmann and Ok (2019). A Development perspective on WTO Fish Subsidies Negotiations. UNCTAD Research paper number 35.

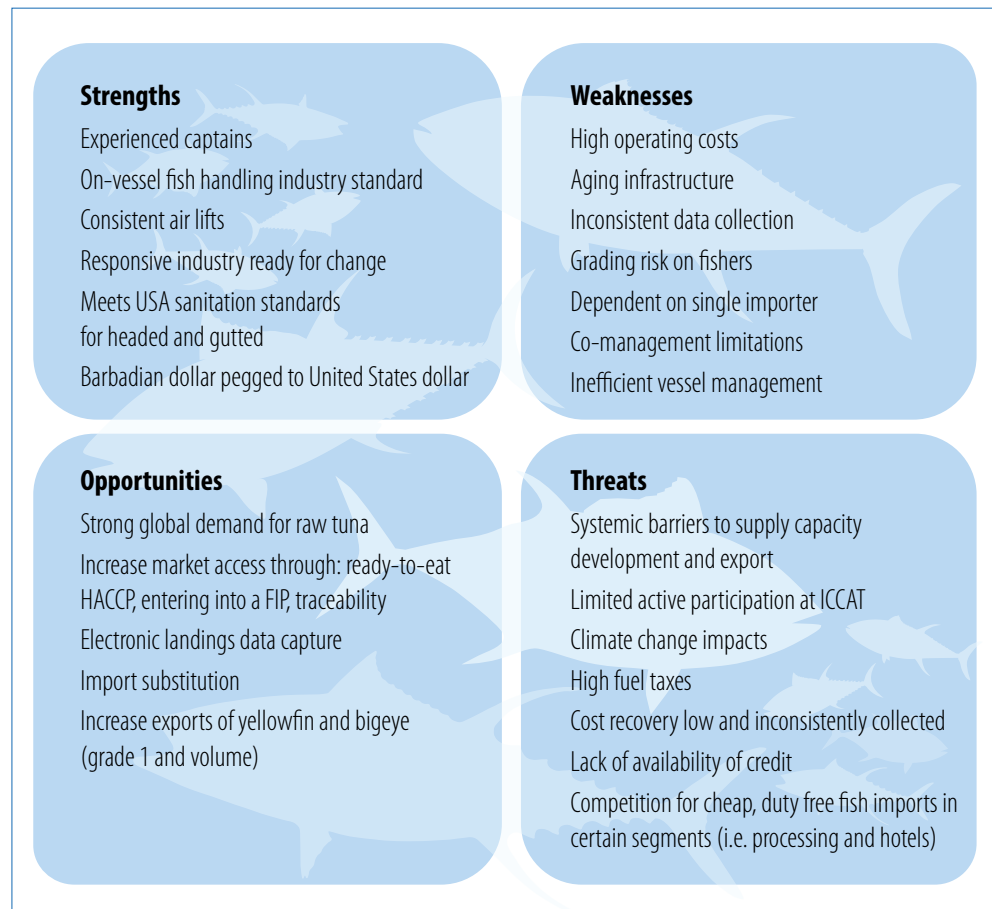
Available at [https://unctad.org/en/PublicationsLibrary/ser-rp-2019d7\\_en.pdf](https://unctad.org/en/PublicationsLibrary/ser-rp-2019d7_en.pdf). Also see Vivas (2020). How to craft a strong WTO deal on fishing subsidies.

Available at: <https://unctad.org/news/how-craft-strong-wto-deal-fishing-subsidies>.

<sup>4</sup> By limiting entry and allowing permit holders to sell permits, fishery rents will accrue to the permit. Those values can be withdrawn by the fishers by selling the permit.

**Box 2: Highlights from the SWOT analysis of the large pelagic longline fishery in Barbados**

Source:  
Author's analysis.



Threats, or risks to the fishery, were also documented in the SWOT analysis. For example, there are systemic barriers to trade and development, not the least of which are a lack of access to capital, a lack of integrated management frameworks, and a lack of knowledge of modern supply chains. Barbados is a member of ICCAT and should participate actively in the regional fisheries management organization (RFMO) so as to support its fishery development aspirations. Climate change poses risks for stock health, stock availability, quality of stocks and the safety of fisherfolk. High fuel taxes threaten business viability in this fishery which features slim profit margins. Cost recovery is a challenge, including its consistent application. Finally, cheap, duty free large pelagic fish imports affect the domestic market by driving down prices for good quality, fresh local seafood, and reducing consumer confidence in local fish products in certain segments (e.g. some processing establishments and hotels).

The revenue projections developed within this report are not predicated on increasing harvests. Instead, value is derived by increasing quality, improving market access and increasing in-country value-add, coupled with electronic traceability and order routing. Instead of increasing harvests, it is recommended that Barbados sets country level total allowable catches (TACs) for species in this fishery, based on the country-level TACs set by ICCAT. Nor are the revenue projections presented in this report dependent on increasing fishing capacity. Limiting entry to current levels and assessing capacity and ability to fish within ICCAT TACs implies a commitment to improving all triple bottom line outcomes, including stock sustainability.

# 1. INTRODUCTION



The OETS Project was designed to support coastal developing countries, including SIDS such as Barbados. It aims to help States derive economic benefit from the sustainable trade of products and services in selected ocean-based economic sectors, within their law of the sea and ocean affairs frameworks. For Barbados, the sectors chosen for in-depth assessment were sustainable marine fisheries, sustainable marine aquaculture, seafood processing, and coastal and marine environmental services. Based on the in-depth assessment, OETS research findings, and after consultations with national stakeholders (including the First National Stakeholder Workshop: Oceans based sectors selection and assessment<sup>5</sup>), the two sectors selected for Barbados are sustainable marine fisheries and seafood processing, specifically the large pelagic longline fishery and processing fresh tuna loins for export. This report therefore focuses on these two sectors, through an economic and trade assessment (Section 3), a value chain analysis (Section 4) and a strategic design and implementation plan for improving triple bottom line outcomes in the large pelagic longline fishery in Barbados (Section 5). It is the result of a collaborative effort of UNCTAD, DOALOS and FAO, with a view to implementing the SDGs, specifically SDG 14.

To underpin and inform the analyses required under the OETS format, this report utilizes the fishery performance indicators for development (FPI-DEV) methodology, developed by 1Skip Fishery Development Company. This methodology was developed as an extension of the fishery performance indicators (FPI) expert scoring technique (Anderson et al., 2015). FPIs were conceived to address a lack of data in the fisheries world, and the recognition that to succeed with development or conservation projects in fisheries, measurable outcomes are needed. The tool was developed to address the general lack of standardized, precise data and to measure the current state of ecological, economic, stock, governance and community dimensions in fisheries. The focus of the indicator development was to evaluate the effectiveness of management systems in aligning ecosystem health and human well-being. Effective management requires ecosystem sustainability, social acceptability and supports livelihoods through resource rents or profits.<sup>6</sup>

<sup>5</sup> See <https://unctad.org/en/pages/MeetingDetails.aspx?meetingid=2052>.

<sup>6</sup> The development of the tool was funded by ALLFISH, a PPP created by the seafood industry, the World Bank, FAO and the Global Environment Facility (GEF) (Anderson et al., 2015). 1Skip Fishery Development Company funded the extension of the base FPI methodology to collect detailed financial data and build cash flow models of the supply chain during the same rapid assessment process, increasing the value of the process and improving efficiency.



## 2. ECONOMIC AND TRADE ASSESSMENT

This section identifies key strengths and weaknesses of Barbados' large pelagic longline fishery, while referring to core economic and trade trends. The analysis includes an update of key aspects already identified in the UNCTAD–DOALOS Barbados OETS fact sheets<sup>7</sup> and a clear reference to the current situation and the potential of the fishery with respect to supply capacity and market access, specifically as it relates to the pelagic longline fishery and the production and export of headed and gutted tuna and fresh tuna loins. Attention is given to the underlying factors that could hinder medium- to long-term sustainability (social, economic and environmental) in the tuna and related species sector.

Barbados is a 430 km<sup>2</sup> island that is part of the Eastern Caribbean, Lesser Antilles island chain. Its western coast faces the Caribbean Sea and it shares maritime boundaries with France (Martinique), Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago. It has direct access to the Atlantic to the east and has a large ratio (1:434) of land to exclusive economic zone (EEZ) (UNCTAD and DOALOS, 2019a). Figure 1 displays the Barbados EEZ. The island has a population of 280,000 people which makes it the fourth most densely populated country in the Americas. Gross domestic product (GDP) for Barbados is currently \$4.4 billion, with a GDP per capita of \$14,300.<sup>8</sup>

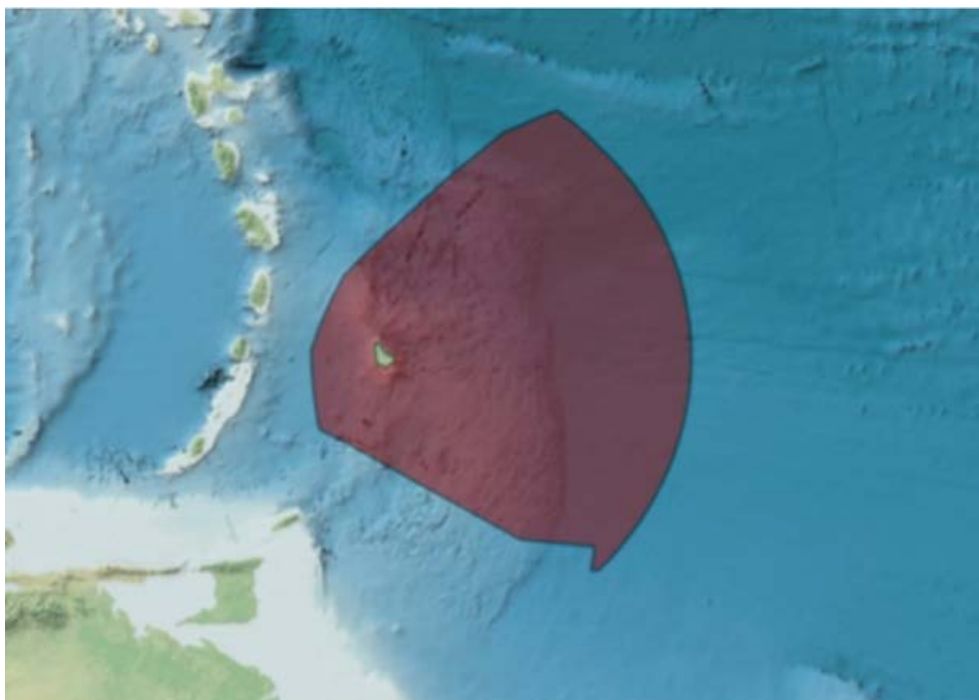
Fisheries contribute 0.15 per cent to GDP according to official statistics (UNCTAD and DOALOS, 2019a). In 2016, the total ex-vessel wholesale value of all Barbadian marine capture fisheries was \$7.9 million, from 3,200 tons of total fishery production (UNCTAD and DOALOS, 2019a). Flying fish is the largest contributor by volume and by value. Flying fish is also a very important fish for local consumption. Ninety nine per cent of fishers are male, as are 91 per cent of vessel owners (UNCTAD and DOALOS, 2019a). Only licensed vendors are allowed to sell directly to the public at the BFC. Processors and food service distributors can buy directly from the fishers but are not allowed to compete with vendors. According to the Caribbean Regional Fisheries Mechanism (CRFM), 8,800 people, or 6.2 per cent of the labour force, is employed in the fisheries sector in Barbados (UNCTAD and DOALOS, 2019a).

Overall Barbados is a net fish importer. It imports \$16.2 million worth of fish from other countries (UNCTAD and DOALOS, 2019a). The imports include inexpensive products of foreign industrial longline fleets, with bycatch species landed and transshipped through other countries in the Caribbean Community (CARICOM) region.<sup>9</sup> Barbados exports only a limited amount of fish, predominantly tuna.

<sup>7</sup> UNCTAD-DOALOS (2019). OETS fact sheets on sustainable marine fisheries; sustainable marine aquaculture; seafood processing; and coastal and marine environmental services. See <https://unctad.org/en/pages/MeetingDetails.aspx?meetingid=2052>.

<sup>8</sup> <https://data.worldbank.org/indicator/ny.gdp.pcap.cd>.

<sup>9</sup> Author's personal observations.



**Figure 1. Barbados exclusive economic zone<sup>10</sup>**

Source:  
Marine Regions  
Gazette (2019).

The Barbados large pelagic longline fishery<sup>11</sup> is an open access fishery that targets mostly tunas but also lands other large pelagic fish and flying fish. Table 1 details the number of vessels in the current large pelagic longline fishing fleet. There are 1,146 registered vessels in all of Barbados. The large pelagic longline fleet, the largest class of boat, consists of 47 vessels of various sizes, but all less than 25 m in length, with single inboard diesel propulsion. These vessels can carry as much as 20 tons of ice and remain at sea for 7 to 14 days (Bealey, 2019).

There are two types of boats that catch large pelagic fish – iceboats and longliners – but the vast majority of large pelagic catches are taken on the longline boats (Bealey, 2019). Iceboats are decked vessels with similar hulls to dayboats, but are generally larger and have holds with ice for storing the catch at sea. These vessels target the same species as dayboats, using the same gears, but during the large pelagic fishing season they fish further afield and generally stay at sea for less than seven days. Iceboats rarely engage in nearshore fisheries and generally operate in the offshore areas. In 2016, the Barbados registered fishing fleet included 193 iceboats with a mean overall length of 11.2 m. Inboard engines with an average of 203 horsepower are used. Longliners also carry ice in their holds but primarily use longline gear to target large, highly migratory pelagic species such as tunas and billfishes. However, longliners also typically carry gill nets for the capture of flying fish and will also land these fish if hold space is available. The number of hooks used by each vessel per set ranges from 200 to 750, with each vessel making between 6 to 10 sets per trip. In 2016, the Barbados-registered fishing fleet included 47 longliners with a mean overall length of 14.1 m and powered by inboard engines with an average of 319 horsepower. Fishing trips by longline vessels vary in length, but they rarely exceed 10 days (Bealey, 2019).

<sup>10</sup> Source: <http://www.marineregions.org/gazetteer.php?p=details&id=8418>.

<sup>11</sup> Open access fisheries are fisheries without any entry limitations. Any person can buy a boat, obtain a license and enter the fishing industry.



**Table 1. Number of licensed vessels by vessel type in Barbados**

Vessel type	Average length overall (m)	Average HP	Average trip length (days)	Number of registered vessels	
				2017	2016
Moses				672	672
Dayboat				234	234
Iceboat	11.2	203	<7	193	193
Longline	14.1	319	10	47	47
Total				1 146	1 146

Source: Bealey, 2019; Barbados Fisheries Division.

Tunas are caught year-round and dominate the volume and value of the catches of the large pelagic longline fleet in all seasons (Schuhmann et al., 2010). Discussions with fishers confirm the high season for tunas to be between November and June. Wahoo catches are higher in the first six months of the year, whereas swordfish catches are generally higher in the second half of the year (Schuhmann et al., 2010). During the tuna season, the highliners<sup>12</sup> will land between 40 and 60 heads per trip but in the summer off season, this drops to an average of 20 to 30 heads per trip. For the larger longline boats, 15 to 20 heads are the financial break-even point.

In recent years, fishers have reported that increased flooding of South American rivers – for Barbados the Amazon river is of particular importance – has led to increases in fresh water which brings greener, cloudier and relatively warmer water with lower salinity and lower oxygen levels. This type of water is not favourable for tunas because they require oxygenated water to function optimally. (The biggest species of fish, like sharks and tunas, are particularly vulnerable to depleted oxygen levels because they need highly oxygenated water to survive). The challenge for every boat seeking to maximize catch rates for tuna is therefore to find blue, clean, cold, highly oxygenated water with a high degree of salinity. When fresh water intrusion from South America increases, search times for fishers climb and catch rates decrease.

## 2.1 Landings

As indicated in many previous studies, the reporting of landings data is limited (Bealey, 2019; Mahon, et al., 2007; UNCTAD and DOALOS, 2019b). Three sources of data were used to estimate landings data for this study: Barbados Fisheries Division, FAO FishStat, and ICCAT Task 1. According to FAO FishStat, in 2016, 383 tons of tuna were landed (based on UNCTAD–DOALOS, 2020) (Table 2). This represents a 24 per cent increase from 2015 and more than double the catch of 2010. Currently, ICCAT has allocated 10 tons of white marlin and 10 tons of blue marlin to Barbados. The baseline TACs for bigeye tuna and albacore tuna were 3,500 tons and 200 tons respectively in 2017, but the TAC for albacore tuna increased to 215 tons in 2019–2020 (ICCAT, 2018). There is also a 45 ton TAC for swordfish (ICCAT, 2018), with a carryover. The data shows Barbados is complying with the swordfish TAC and that there are opportunities for increasing the catch of this species.

<sup>12</sup> "Highliners" refers to the boats that catch the majority of the fish.



**Table 2. All fisheries landings by species groups (tons) (2010–2016)**

Species	2010	2011	2012	2013	2014	2015	2016
Tuna	147	144	232	222	258	309	383
Albacore	6	4	20	23	13	16	38
Yellowfin tuna	129	131	195	188	218	262	324
Skipjack tuna	–	1	2	0	1	1	2
Bigeye tuna	12	8	15	11	26	30	19
Flying fish	2 424	908	354	1 909	1 314	378	469
Dolphinfish	465	505	459	514	278	373	405
Swordfish	13	23	21	16	21	29	20
Shark	11	11	15	10	12	23	15
Marlin	15	16	19	17	18	44	25
Snapper	28	10	19	14	11	21	31
Other varieties	177	202	242	275	296	322	387

Source: UNCTAD calculations based on FAO, Fishery and Aquaculture Statistics. Global Capture Production (FAO, 2020).

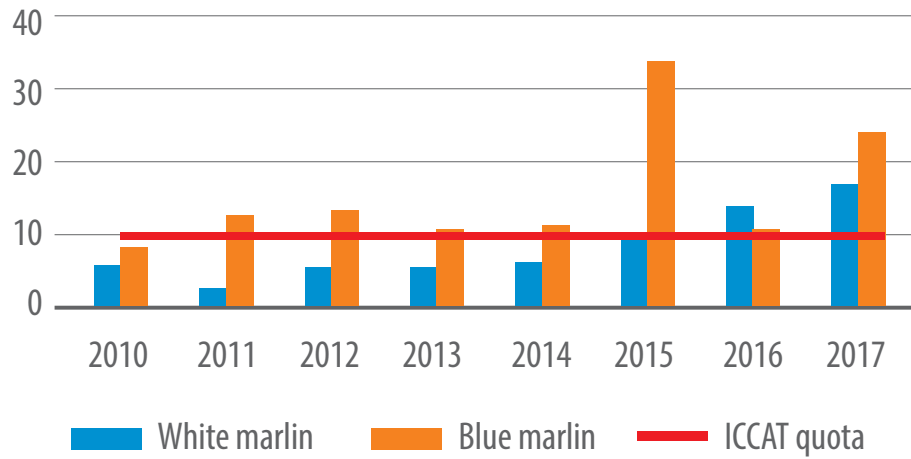
Country quotas have not been allocated for yellowfin tuna and both albacore tuna and bigeye tuna stocks are not easily accessible to Barbadian vessels fishing within the Barbados EEZ because these fish prefer colder waters than yellowfin tuna. Most of the bigeye tuna and albacore tuna harvest in the Atlantic region is in the high seas off the coast of Brazil – much further south and east than the Barbadian fleet can travel. Without significant changes to fishing techniques, such as setting gear deeper or fishing on the high seas (beyond the Barbados EEZ), it is unlikely that Barbadian landings of either albacore tuna or bigeye tuna will increase appreciably. There is not yet a quota system in place at the national level for yellowfin tuna and there are concerns about the ICCAT stock assessment for yellowfin tuna. Whereas the ICCAT stock assessment showed that the stock is not overfished and overfishing is not occurring, catches are declining and there appears to be significant recruitment overfishing in the purse seine fishery that utilizes floating fish aggregation devices off the coast of Africa. As a result, ICCAT is considering the institution of country level TACs for yellowfin tuna and may begin allocating them within the next two years.<sup>13</sup>

Table 3 contains the Task 1 data reported to ICCAT by Barbados (ICCAT, 2021). These are the landings data that the remainder of this report refers to and upon which its analysis is based. These data have been selected because they are the data used by both Barbados and ICCAT. While the white marlin and blue marlin landings correspond to FAO data in 2016 (Table 2), the tuna landings summed across all species are only 1 ton higher in the ICCAT data (Table 3) than the FAO data. Overall, there is not a large discrepancy between the FAO and ICCAT reporting, but only some very small differences. Looking at Figure 3, Barbados has exceeded its blue marlin quota every year since 2011 and in 2017 exceeded its 10 ton quota by 14 tons. Barbados also exceeded its white marlin quota in 2016 and 2017, landing 7 tons over the quota in 2017.

<sup>13</sup> <https://iss-foundation.org/knowledge-tools/technical-and-meeting-reports/download-info/issf-2019-09-a-snapshot-of-the-large-scale-tropical-tuna-purse-seine-fishing-fleets-as-of-june-2019>.

**Figure 2. Blue and white marlin landings compared to ICCAT quotas (2010–2017)**

Source: ICCAT, 2021.



Improving data reporting enables better management. Currently, Barbados does not routinely collect price or value information. Some very rough pricing information has been obtained from captains and exporters, but it is impossible to know the total value of the large pelagic LL fishery without collecting additional data. Currently there is no data available on the volume of products exported relative to landings, and what grades are exported. Recent UNCTAD calculations based on data from the International Trade Centre (ITC) (ITC, 2020), show that tuna exports increased from \$313,000 in 2015 to \$454,000 in 2016 (138 tons and 163 tons, respectively). This increasing trend confirms the importance of the large pelagic LL fishery for Barbados’ exports and could potentially show even better prospects for income and livelihoods with domestic value addition. The main exporter, which handles over 90 per cent of tuna landings, only exports fish with a grade of 2 or better (2+). According to interviewed stakeholders, it is estimated that about 75 per cent to 80 per cent of all tuna landed are exported, but a more realistic estimate based on available export and landing data by ICCAT (table 3) may be closer to 50 per cent.

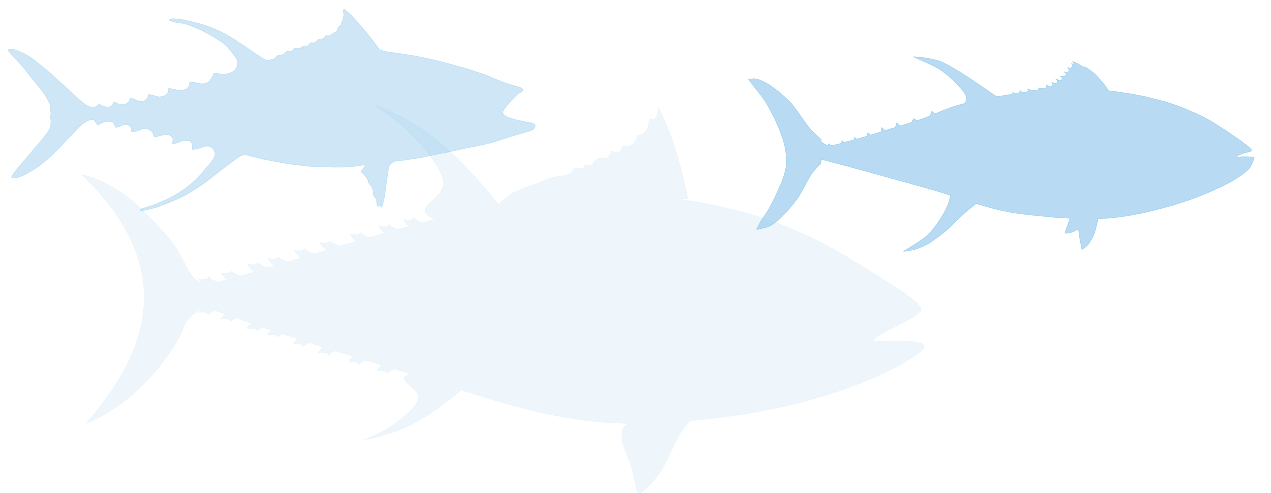


Table 3. ICCAT Task 1 capture data for Barbados in tons (2008–2017)

Species group	Species	Scientific name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1 – Tuna (major sp.)	albacore tuna	<i>Thunnus alalunga</i>	7	4	6	4	20	22	13	16	38	32
	bigeye tuna	<i>Thunnus obesus</i>	14	7	12	7	15	11	26	30	19	16
	blue marlin	<i>Makaira nigricans</i>			9	13	14	11	12	34	11	24
	sailfish	<i>Istiophorus albicans</i>			18	36	36	39	44	54	56	42
	skipjack tuna	<i>Katsuwonus pelamis</i>				1	2	0	1	1	1	2
	swordfish	<i>Xiphias gladius</i>	39	20	13	23	21	16	21	29	20	21
	white marlin	<i>Tetrapturus albidus</i>			6	3	5	6	6	10	14	17
	yellowfin tuna	<i>Thunnus albacares</i>	156	79	129	131	195	188	218	262	324	270
<b>Sub total</b>			<b>216</b>	<b>110</b>	<b>191</b>	<b>218</b>	<b>308</b>	<b>293</b>	<b>340</b>	<b>435</b>	<b>484</b>	<b>423</b>
2 – Tuna (small) Total	dolphinfish	<i>Coryphaena hippurus</i>										185
	wahoo	<i>Acanthocybium solandri</i>	27	17	30	29	22	21	17	10	11	10
	<b>Sub total</b>			<b>27</b>	<b>17</b>	<b>30</b>	<b>29</b>	<b>22</b>	<b>21</b>	<b>17</b>	<b>10</b>	<b>11</b>
3 – Sharks (major)	blue shark	<i>Prionace glauca</i>								9	6	7
	shortfin mako shark	<i>Isurus oxyrinchus</i>								4	3	3
	<b>Sub total</b>									<b>13</b>	<b>9</b>	<b>10</b>
4 – Sharks (other)			15	9	11	10	14	9	12	10	7	8
<b>Total</b>			<b>258</b>	<b>135</b>	<b>232</b>	<b>257</b>	<b>344</b>	<b>323</b>	<b>369</b>	<b>469</b>	<b>511</b>	<b>637</b>

Source: ICCAT, 2021.

Note: Task 1 catch statistics include nominal annual catch of tuna, tuna-like species and sharks, by region, gear, flag and species and, where possible, by EEZ or high seas. Catches should be reported in kilograms, round (live) weight. For more information see [www.iccat.int/en/submitSTAT.html](http://www.iccat.int/en/submitSTAT.html).

## 2.2 Markets and the supply chain

The export tuna fishery is a consignment operation meaning that fishers consign their fish to be graded and purchased in Miami. There are three exporters in Barbados that act as export service providers. They do not purchase fish, but sell grading, boxing and logistical services, enabling the vessel owners to ship their tuna to Miami. One exporter handles roughly 90 per cent of all exported tuna. A second exporter handles a much smaller portion of the catch, and the third exporter is a family operated business comprising several boats that export its own landings. The boxing room is owned by the BFC and the exporters pay to use the facility (Figure 3). The BFC boxing room may be used by anyone to prepare tuna for export.

**Figure 3.**  
The boxing room  
at the BFC

*Photo:*  
Keith Flett



Due to the consignment business model, fishers do not know the final grade or price of the fish until it is purchased in Miami. The exporter in Barbados provides a predictive grade by taking a tail cut and a core sample behind the pectoral fin. The exporter weighs the fish, records temperatures, tags the fish with a weight and predicted grade, boxes the fish with frozen gel coolant packs and forwards the box to the airport for shipping. However, the final grading is not established until the fish is sold in Miami and the price is determined by the importer. The fish are typically landed very early in the morning and packaged and air freighted to Miami the same day.<sup>14</sup>

In other countries of the region, such as Grenada, a more traditional supply chain is in place: the exporter purchases the fish from the fishers at the landing site and there is no delay or uncertainty over price and payment. From the fishers' point of view, there are both pros and cons to the consignment system. It provides fishers with an incentive to follow best practices when handling tuna and to achieve a high quality product. Although the fishers and vessel owners reap the benefits of proper handling, they also carry an internal grading risk. Under the traditional, non-consignment model, a dockside buyer can take some, or all, of the high grade premium for themselves. That takes pricing risk and grading risk away from the fishers and transfers it to the dockside buyer, yet the buyer is compensated for taking on that risk because the margins are higher. In the consignment fishery, fishers have to wait one to three weeks to be paid for their fish, whereas in a traditional model they would be paid instantly by the dockside buyer. In the Barbados fishery, fishers indicated that the delay in payment can lead to situations whereby they are frequently unable to buy fuel, bait and other supplies for their next trip until payment from the importer arrives.

As is the case in Barbados, consignment fisheries are often based on strong relationships with single importers. This helps the fishers because they do not spend time looking for buyers whenever they land their fish, but it also creates a system whereby fishers feel locked into a relationship with a single buyer and they assume the pricing and grading risk in a process that is not transparent. Some stakeholders have indicated that monitoring of pricing per grade should provide clarity in pricing and seasonality, but this will not address the fact that the grading continues to be conducted by importers in Miami, or other locations, with similar risks to fishers.

<sup>14</sup> See Luxe Gourmets (2021) for an overview of the tuna grading process.

Confounding the lack of transparency with respect to export pricing are local distributors that buy between four and six export quality yellowfin tuna per fishing trip, before the boat takes its catch to the exporter. As a result, the fishers have to decide when they land the fish, how many to sell to the local distributor at a set, clearly determined price that is generally lower than the best price they could realize in Miami, but higher than the lowest price they could achieve in Miami. In addition, the local distributors will only downgrade the fish and request a credit, if the fish grades less than grade 3, which rarely occurs. Selling to the local distributor, lowers the grading risk even further but the local distributor can only accept a limited number of fish at a time. Several fishers have indicated they wished to sell a higher proportion of their fish locally for a cash price at landing. Again, the fishers do not know the final grade until the product is loined in the foreign market (i.e. Miami). The lack of price transparency and the wait for price confirmation creates risk and inefficiency for the fishers.

The exporters charge fishers for boxes and a boxing fee of \$0.35 per pound. Shipping is paid by the vessel owners and shipping rates are between \$0.48 per pound and \$0.77/pound, depending on whether the shipment is transported via an airfreight company or a commercial airline. The fishers pay a small customs broker fee and a landings tax to the Government of Barbados of \$0.045 per pound. Once the fish arrive in Miami, the importer grades them and pays the fishers based on the grade they assign. This may differ from the grade assigned by the exporter upon boxing. Therefore, market power is ultimately retained by the importer, who is downstream in the value chain and outside of Barbados. The fishers receive settlement statements from each shipment that detail the prices and grades of each fish, deductions of between \$0.90 per pound to \$1.50 per pound for boxing, shipping and brokerage (total fee is dependent on the shipper used). The fishers pay the landings tax directly to the BFC from their settlement. The exporter acts as the fishers' intermediary in the sense that the Miami importer sends the exporter payment for the entire shipment and the exporter deducts its own fees and arranges payment to the individual fishers/boat owners.

Consignment is an effective means to pass quality incentives onto the fishers, yet it also shifts all the grading risk to them, even though the grading process in Miami is completely non-transparent to the fishers and they cannot be certain of the amount they will be paid (or if they will be paid at all) until the fish arrives in Miami and has gone through the grading process. The risk of damages occurring during shipping is also carried by the fishers. During the fieldwork, fishers commented on this lack of transparency and indicated they desired a more transparent system. They explained that they can get a good price for grade 2+ fish by selling directly to a local distributor, rather than exporting the fish to Miami.

By selling locally, fishers know the price of their catch on the day of landing and there is no grading risk. While there is the potential to achieve a better price in Miami, there is also a risk that a fish could be downgraded or even rejected and fetch a zero price. If fishers knew exactly what price their fish would realize on the export market, they could make a more informed decision regarding how much to sell to the local market and how much to ship to Miami. The most effective, and perhaps the only way, to remove the grading risk is to process fish locally, such as through loining. This would ensure a homogenous quality product for foreign and internal markets and, importantly, provide opportunities for local value addition. Under such a system, fishers would have a much better understanding of what prices are offered while they are at sea and would be able to make better decisions prior to landing.

During the field mission the captains and the exporters indicated that 75 per cent to 80 per cent of all yellowfin tuna and bigeye tuna landed achieve the correct grade and are exported. A small proportion of grade 2+ fish, perhaps 3 tons to 4 tons annually, are sold directly from the boat to local distributors who supply the domestic food service industry. This is approximately the same amount in the fact sheet for all species, which lists direct-to-restaurant sales of 2 per cent (UNCTAD and DOALOS, 2019a). The remaining 20 per cent to 25 per cent of the tuna landed that do not make the required grade are sold to local vendors at the BFC.



# 3. OCEANS ECONOMY ASSESSMENT

This section will analyse the current situation of the large pelagic longline fishery in Barbados and assess the potential for improving the sector in terms of the five UNCTAD oceans economy pillars. These are sustainable economic development, sustainable use and conservation of marine resources, inclusive social development, increased scientific knowledge, and oceans and trade governance. This report utilizes the FPI-DEV model to set a baseline across these five pillars and map the FPI metrics into all five (see Appendix B). The FPIs are structured to address triple bottom line outcomes and gauge future implementation success against the key performance indicators.

Appendix A provides a complete description of the FPI-DEV methodology. Appendix B contains the output and input scoring tables that describe each metric and the logic and methodology behind them.

Within the text below, assessment insights that link directly to the results-based management Intervention Plan (Tables 6 to 10) will be highlighted by their link number in bold. For instance, **L1** references link number 1 in the Intervention Plan: “Need for revamped taxation models for increased government revenue for MCS and ICCAT compliance.” While the full Intervention Plan will be detailed below, it is helpful to label the factor, or assessment insights, that led to the individual items in the results-based Intervention Plan. Therefore, the discussion of those interventions and the linkage to the mission are included here. The FPI methodology is particularly well suited for generating insights that translate readily into interventions.

## 3.1 Sustainable use and conservation of marine resources

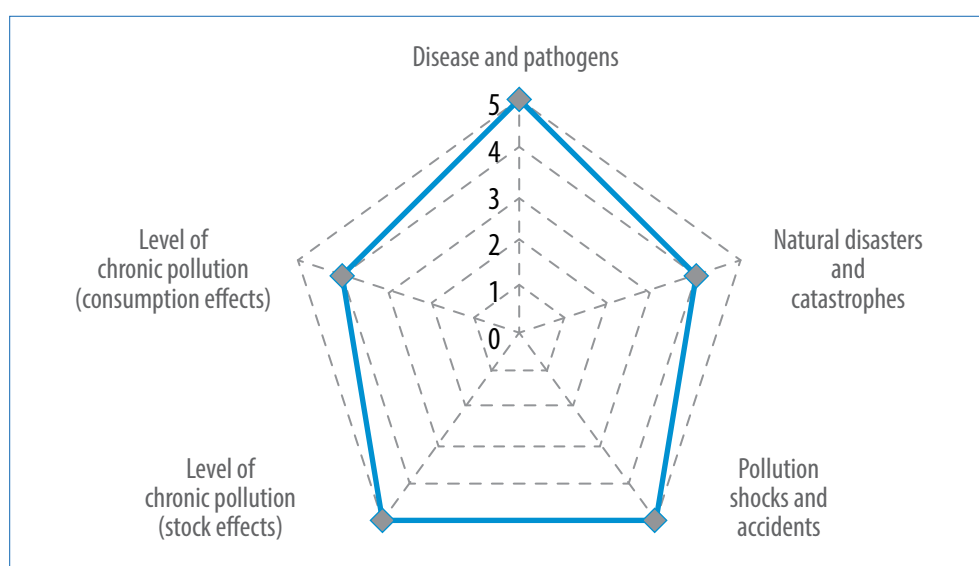
### 3.1.1 Inputs – exogenous environmental factors

In terms of exogenous environmental factors (Figure 4), the Barbados large pelagic longline fishery scores highly. In the first category, Diseases and pathogens, the fishery does not suffer from diseases or pathogens. This is generally the case with pelagic fisheries because fishing mostly takes place a long way from shore and the fishery is relatively unaffected by land-based pollution and disease vectors. Barbados is also located in an area that is traditionally affected by frequent or severe weather events, such as hurricanes. Generally, for large pelagic fisheries, as long as large sections of the fleet are not critically damaged, hurricanes rarely impact annual harvests. While the high score is based on historical records, there is nonetheless a certain degree of risk which lies in both infrequent extreme events and changing earth–atmosphere system dynamics which could cause increased frequency and intensity of such events in the future.

The next metric, “pollution shocks and accidents”, rarely applies to pelagic fisheries because fishing grounds are located far from human-induced pollution events and the highly migratory nature of target species means they can generally avoid events that occur at sea. This also applies to once-off shocks. Barbados has not been affected by such shocks in recent times. While there is a known problem with nutrient rich water moving into Barbados from the South American continent, this

does not impact the health of the stock. It does, however, impact the stock's availability to the large pelagic longline fishing fleet in the summer months.

There is a level of chronic pollution that has the potential to affect consumption. Rodriques and Amorim (2016) found mercury levels in all blue marlin samples taken in the region to be above the World Health Organization (WHO) guidelines, and found that many of the swordfish samples were also higher than the guidelines.<sup>15</sup> While there appear to be mercury levels above the WHO guidelines for these species, an official consumption advisory has not been issued in Barbados and it does not appear that consumption is affected by these findings. There is also a widely held but incorrect local view that the United States of America has banned the import of Barbados-caught swordfish due to elevated mercury levels. The United States of America has, however, instituted import alerts that result in the detention and testing of all imported swordfish by the United States Food and Drug Administration (USFDA). This had clear negative impacts on the Barbadian fresh swordfish exports, but the import alerts were lifted in 2015.<sup>16</sup> The United States does have catch documentation and minimum size requirements, which would be addressed by implementing a traceability programme.



**Figure 4.**  
Input – exogenous  
environmental factors

Source:  
Author's analysis from  
FPI scoring.

The first metric across Post-harvest management inputs measures the amount the industry contributes to management (Figure 5). A score of 5 indicates that the harvest and post-harvest sectors contribute less than 5 per cent of total fishery value towards sharing the cost of management (**L1**).

The enforcement capability metric was scored as 3 because the current enforcement capacity of the Fisheries Division and Coast Guard is limited with respect to the entire EEZ. Enforcement is currently confined to the major landing sites and there is limited effective capacity offshore.

Barbados is an ICCAT member and it scores highly on "management jurisdiction" as a result. ICCAT is effectively a coordination institution that facilitates joint management throughout the region of primary importance (**L2**).

Finally, Barbados scores highly in the "level of subsidies" metric because very few harmful subsidies are in place. The fishers' and boat owners' only subsidy is the value-added tax waiver that is granted for some imported fishing supplies. The use of the BFC for low or zero fees is not regarded as a potentially harmful or particularly large subsidy (**L1**).

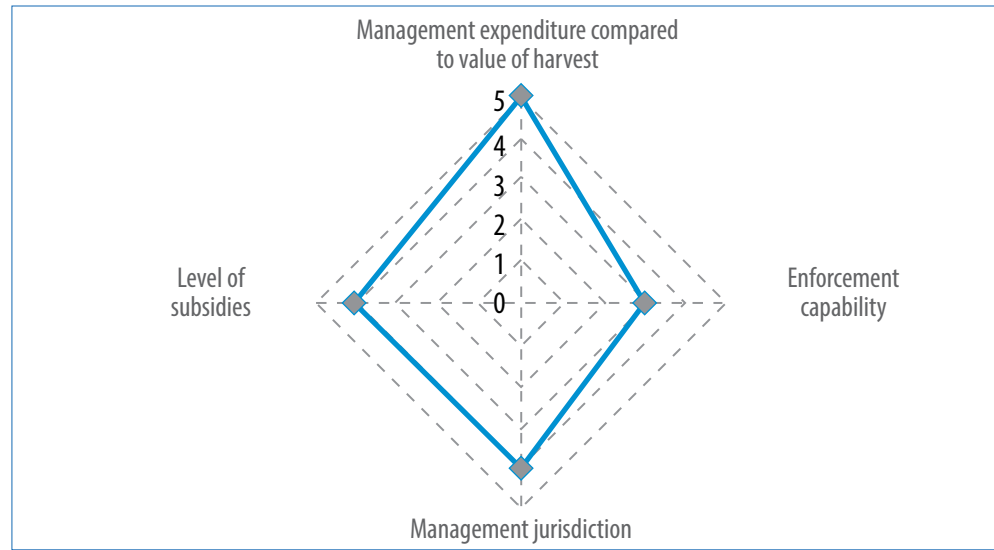
<sup>15</sup> World Health Organization mercury limit = 0.5µg/g.

<sup>16</sup> <https://www.seafoodsource.com/news/supply-trade/fda-lifts-fresh-swordfish-mercury-import-alert?fbclid=IwAR141cB-moABAFR5EbD86KbUeSdKfIUH5SHTabU8ArcKzRO--vOVZPotjxc>.

### 3.1.2 Post-harvest management inputs

**Figure 5.**  
Post-harvest  
management inputs 1

Source:  
Author’s analysis from  
FPI scoring.

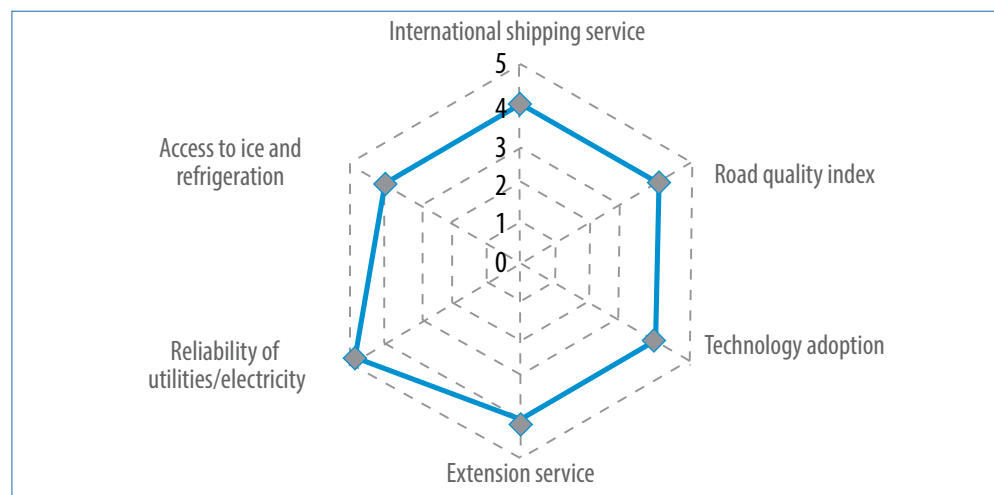


Basic infrastructure for the post-harvest sector is generally good, as indicated in Figure 6. The fishers have access to international air shipping services at average airfreight rates, and to good quality road infrastructure. Overall, the fishers have access to cellular telephones and some vessel electronics. Improved access to satellite sea surface temperature and chlorophyll A maps would improve the efficiency of the fishery because they would reduce search time and increase catch per unit effort. When assessing the landing logistics, it is important to move from paper forms towards electronic landings reporting (**L5, L20**).

Although Barbados does not have a university-linked extension service, as is the case in the United States of America,<sup>17</sup> the Barbados National Union of Fisherfolk Organizations (BARNUFO) provides at least one training session per year on fish handling and safety-at-sea. The electricity grid is of sufficiently good quality to operate without outages that can cause product loss, and the airport has cold storage facilities in case of delays. Finally, the fishers have access to ice and refrigeration. The landings facility has an air-conditioned boxing room, three large freezers and one large chiller and a large ice machine. As a result, this metric was assessed as 4, noting only that in periods of high demand, boats have to wait for ice.

**Figure 6.**  
Post-harvest  
management inputs 2

Source:  
Author’s analysis from  
FPI scoring.



<sup>17</sup> In the United States, fisher extension services are hosted by universities designated as “Sea Grant” institutions. Generally, extension service refers to educational opportunities provided by colleges and universities to people who are not enrolled as regular students.



### 3.1.3 Management inputs

Figure 7 details the scores for management inputs. The first score refers to the price discovery process which involves determining the price of fish in the marketplace through the interaction of buyers and sellers. As is explained in detail above, at the BFC fish are not sold through a transparent, daily competitive pricing mechanism such as an auction or centralized wholesale market in which sellers interact with many buyers and prices are public information (**L3**). Instead, fishers commonly sell a few tuna to the local food service distributor while the remainder are sold on consignment to a single buyer who may not give pricing information to the fishers for 7 to 14 days after their product has been shipped (**L4**). Additionally, there is no facility or structure in place for the Markets Division or the Fisheries Division to collect price information. The fishers are only required to report their landings by volume and to pay their landings tax at the BFC after the fish are landed. This system encourages underreporting, particularly as there is limited monitoring of the accuracy of reporting.

For data availability, the score reflects limitations in the available data, which are based on small samples and extrapolation and inferences about the biological or economic management (**L5**) (Figure 7). The data reporting process has limitations and there is an incentive to underreport so as to avoid paying taxes. There is also limited data analysis for management purposes, beyond basic data compilation to meet ICCAT reporting requirements, and those of the annual statistical compendiums (Fishery Division, 2017).

The fishers work with a small number of coordinated buyers (**L4**) (Figure 7). There is one major exporter and a few local distributors that take a small proportion of the grade 2+ tuna for the local market. There is little vertical integration in the fishery,<sup>18</sup> but there is one family that owns and operates boats and conducts its own preparations for export. The fishers do not pay export tariffs and import duties are waived for fishing equipment, resulting in favourable scores for the level of tariffs metric (**L1**).

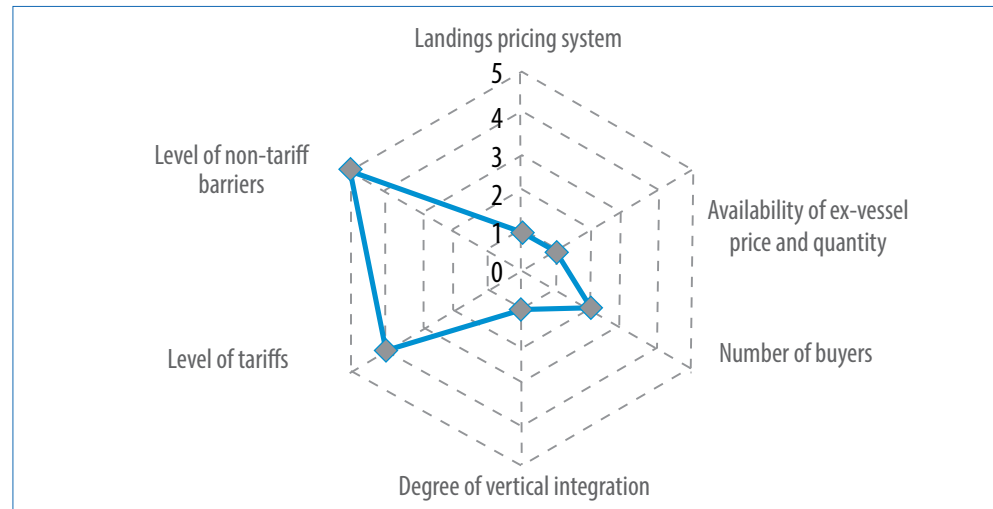
Barbados is a member of CARICOM, a regional single economic accord that enables free trade and economic integration between its Member States. While the membership of CARICOM can bring benefits, it also results in readily available imports into Barbados of cheap, frozen seafood, including large pelagics. These imports are largely derived from distant water, industrial longline vessels that freeze their catch onboard and transship their product through other CARICOM countries. These distant water vessels ship their high-quality tuna products via shipping container to international markets outside of the CARICOM area and sell lower valued species and by-catch (such as billfish) in the CARICOM region. This can drive down prices for fresh caught product in Barbadian markets where the cheap frozen product is not differentiated from the frozen imported product (**L3, L4, L8**). For example, imported dolphinfish is sold alongside fresh, locally caught dolphinfish with no differentiation between the origin of the products, or the fact that the imported product has been defrosted.

Some processors consider the Barbados large pelagic longline fishery to be unaffected by such imports because the supply is rather limited and some species are purchased at a premium price. The impact that cheap imports have on the large pelagic longline fishery requires further study.

<sup>18</sup> Vertical integration is the combination in one company of two or more stages of production normally operated by separate companies. This allows for the profit from at least two stages of the supply chain to accrue to a single company.

**Figure 7.**  
**Management inputs**

Source:  
Author's analysis from  
FPI scoring.



### 3.1.4 Outputs – harvest

Landings level refers to the level of landings relative to maximum sustainable yield (Figure 8). The outcome of the recent stock assessment of yellowfin tuna was unexpected because the yellowfin tuna was not declared overfished, although it was thought that overfishing was occurring (ICCAT, 2021). A declaration of “overfished with overfishing occurring” would have resulted in ICCAT issuing country level TACs. In spite of the ICCAT assessment of yellowfin tuna, there are major problems with the stock and it is possible that country level TACs will be issued within the next one to two years. Barbados’ landings amount to a very small portion of yellowfin tuna catches taken in the Atlantic Ocean. Bigeye tuna is overfished<sup>19</sup> and overfishing<sup>20</sup> is occurring, but Barbados’ catch levels are far below its country level TAC for this species.

The two billfish species that are managed through ICCAT country level TACs are white marlin and blue marlin. In 2017, Barbados exceeded its blue marlin and white marlin limits but the Fishery Division is not enforcing catch limits to counter the overharvesting and it does not yet have a mechanism in place to establish a country level TAC based on the ICCAT TACs.

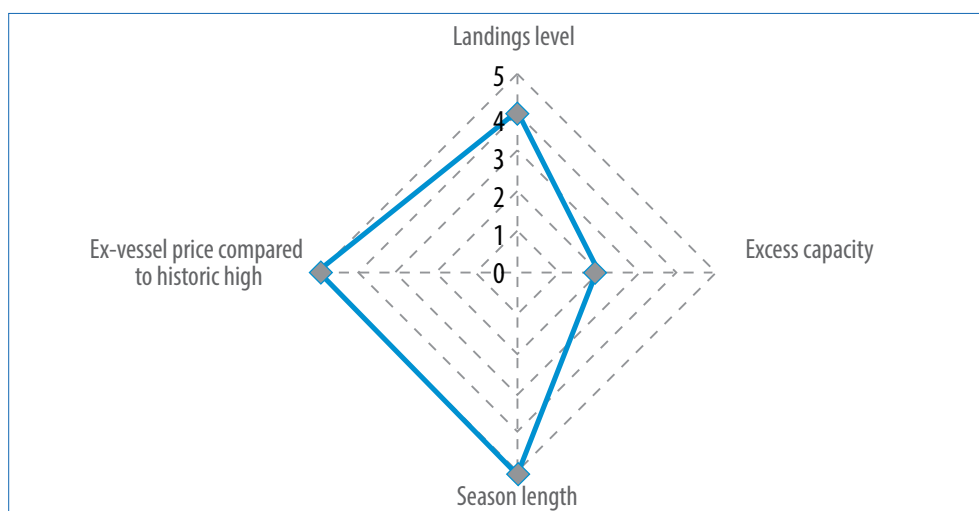
There is currently insufficient data to measure capacity or excess capacity in a technical sense. However, calculations indicate that if the current fleet was to undertake two trips a month for 10 months, and if each trip landed a conservative 1 ton, the fleet could catch over three times the recent total harvest levels across all species (L6). This indicates that there is potentially excess capacity in the fishery.

The fishery scores highly across season length because there are no regulatory closures in the large pelagic longline fishery.

Ex-vessel prices seem stable compared to historic highs. Since there is no price data available it is impossible to estimate this metric quantitatively (Figure 8). However, the fishers indicated that prices have been relatively stable year on year.

<sup>19</sup> Overfished = when the fish stock is below a prescribed threshold. ICCAT uses maximum sustainable yield (MSY) as that threshold.

<sup>20</sup> Overfishing = rate of removal from the stock is higher than natural reproduction can replace.



**Figure 8.**  
Outputs – harvests

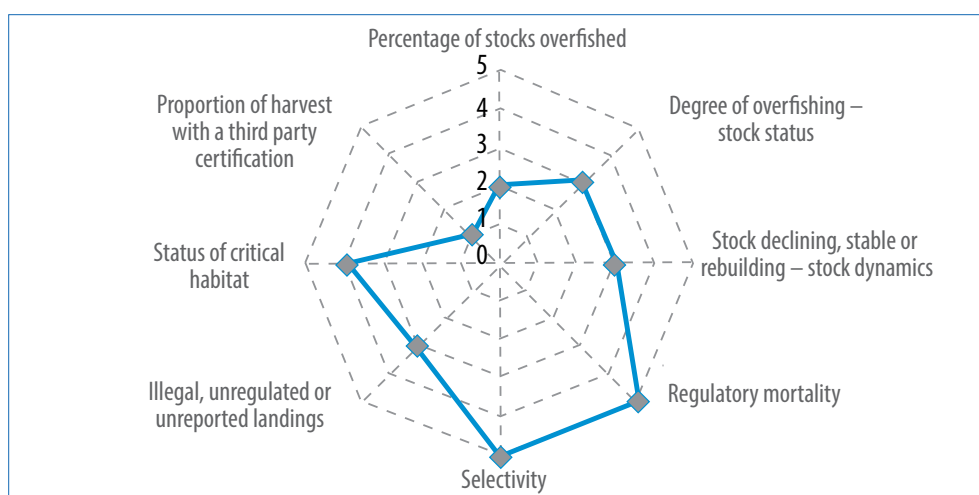
Source:  
Author’s analysis from  
FPI scoring.

Although Barbados is not single handedly responsible, blue marlin and white marlin have been declared to be overfished. In contrast, sailfish and dolphinfish are unlikely to be overfished (Figure 9). In recent years, yellowfin tuna catches have increased, billfish catches have been stable and sailfish catches have increased slightly locally. While there is no indication that stocks are rebuilding, there is also no evidence that stocks are rapidly declining (ICCAT, 2018). The stocks managed by ICCAT that are harvested by the Barbados large pelagic longline fleet are generally thought to be stable, even if some individual stocks are overfished.

### 3.1.5 Outputs – fish stock health and environmental performance

There is no regulatory mortality in this fishery because there are generally no regulations that would cause mortality (Figure 9).<sup>21</sup> In addition, there is virtually no non-target catch because the entire catch is sold and no part of the catch is considered by-catch in the strict sense of the word. Official landings by vessel trip are not available and there could be a degree of underreporting of catches.

The illegal, unregulated and unreported (IUU) landings metric was scored by the team at 2.5, mainly because of underreporting of catches. The status of critical habitat did not receive a perfect score because of increasing amounts of runoff from the South American continent, which increases nutrient loads and potentially water temperatures, and increases the influxes of sargassum, a type of macroalgae (seaweed) in the region. Nutrient rich, warm waters reduce oxygen levels and encourage tunas to seek colder waters or to move into deeper waters. This results in increased catch effort for fishers. Finally, none of the catch is under a third-party certification programme (L7). Certification of fishery sustainability by a third-party certification programme can increase prices and/or market access.



**Figure 9.**  
Outputs – fish stock health and environmental performance

Source:  
Author’s analysis from  
FPI scoring.

<sup>21</sup> Regulatory mortality is the discarding of fish because of regulation (e.g. the imposition of size limits).

### 3.2 Inclusive social development

The FPIs are an excellent tool for gauging inclusive social development by measuring social development baselines. For incentive-compatible development plans to be successful, incentives must be passed all the way down to the production end of the supply chain, to the fishers. By ensuring implementation is focused on driving incentives to the bottom end of the supply chain, and focusing on the top-down enabling conditions that ensure the success of the programme and its participants, no one is left behind.

#### 3.2.1 Inputs – collective action

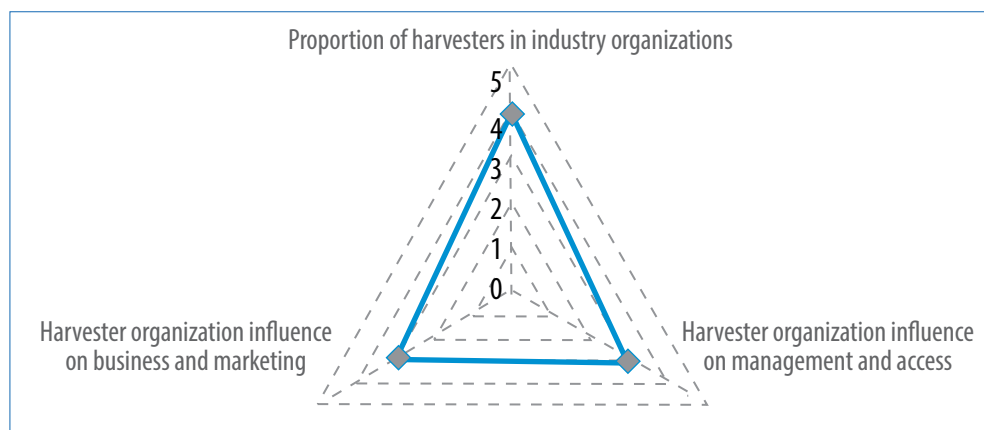
At the industry level, the promotion of sustainable fisheries, proper governance, fisherfolk development and sanitary and phytosanitary standards is mainly conducted by BARNUFO, which was established in 1999 and serves as an alliance platform for its primary members, including five fisherfolk associations and two boat owners’ associations. Some members of BARNUFO are presently inactive (UNCTAD-DOALOS, 2020).

Between 70 per cent and 95 per cent of all fishers in Barbados indicate that they are members of an industry organization. The President of BARNUFO is also the Chair of the Caribbean Network of Fisherfolk Organizations. BARNUFO advocates on behalf of fisherfolk in interactions with the Fishery Division, is a member on the Fisheries Advisory Committee (FAC) and organizes annual training sessions on fish handling and safety at sea. The organization is very active in promoting infrastructure development, but experiences limited uptake from the Fishery Division or the government (Figure 10).

BARNUFO’s action has some influence on business and marketing decisions by boat owners and fishers. While a score of three for this metric seems low, it corresponds with “large subgroups facilitating marketing and joint purchasing”. This is based solely on some joint purchasing agreements for equipment, such as fishing tackle, and collective management of the room used to box tunas for export. Future focus could be on increasing this score – collective action and co-management in general – such that the organization is aiding in collective marketing and branding of Barbados quality tuna (L8).

Figure 10. Inputs – collective action

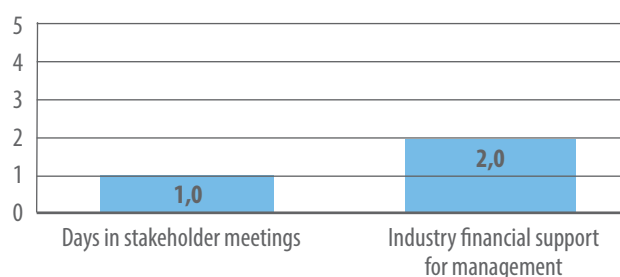
Source: Author’s analysis from FPI scoring.



#### 3.2.2 Inputs – management participation

While BARNUFO holds occasional meetings, the current co-management mechanism – the FAC – has only recently been reactivated and to date there has been low fisher participation in its meetings (L9) (Figure 11). The FAC is designed to be a stakeholder body that passes management advice and recommendations to the Ministry of Blue Economy and Marine Affairs through to the Fisheries Division. The FAC has not been fully active in this role for some time, but there are good indications that this is changing. The cost recovery metric was scored at 2. Between 1 per cent and 5 per cent of management costs are funded by the industry, but with very low confidence (L1).

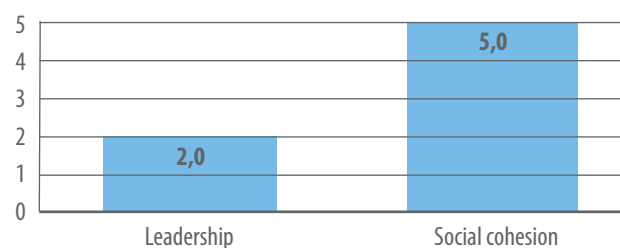
The BFC was designed to run with industry cost sharing, but usage fees were never set at a level that would cover all operational costs. The fees to use the boxing room are extremely low, as are the costs to use the dock, freezers, chillers and cleaning rooms for flying fish. There is a landings tax of \$0.045/pound for fish, which equates to \$50 per ton. According to the ICCAT data in Table 3, this fee should have raised \$30,000 in 2017. Although the BFC was set up and designed for cost recovery, the fees are either too low or not fully collected.



**Figure 11.**  
Inputs – management participation

Source:  
Author's analysis from FPI scoring.

The leadership metric is a subjective measure of whether the fishing community has strong leadership capable of envisioning and implementing effective management, a role that is often filled by processors in other locations. This assessment scored the metric at 2, which is a midpoint between no recognized leader providing vision for the fishery and *ex-officio* leadership stations that maintain management institutions, but are not currently providing a strong vision (**L9**) (Figure 12). Leadership drivers are informal: among interviewees, some outspoken fishers who might be considered charismatic appear to motivate others, but none were considered to play a leading or visionary role. In Barbados, the product is exported without a processor in the traditional sense; the fish are boxed and shipped, but the price relationship is with the importers in Miami. This has implications for the FPI scoring.



**Figure 12.**  
Inputs – community involvement

Source:  
Author's analysis from FPI scoring.

In Barbados, social cohesion is considered to be high (Figure 12). Fishers sometimes hold fish fry parties for the public, participate in community activities together, and hold various Fishermen's Day celebrations. They sell fish through the same market and come together for training sessions and other educational activities. There do not appear to be any cultural or social status divisions between various sectors in the supply chain.

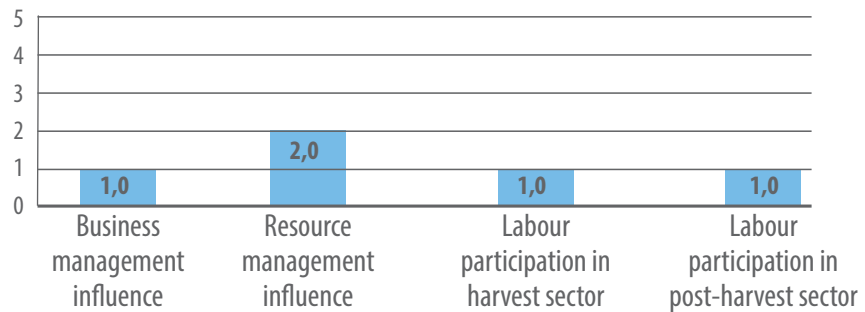
In Barbados, market vendors are primarily female, but the pelagic longline fishery has little to do with this post-harvest sector (Figure 13). The processing, shipping and business management ("business management influence" metric) sectors of the pelagic longline fishery are dominated by men and, as such, this metric receives a low score. Across "resource management influence", a score of 3 is an equal balance between men and women. There are some women in the management realm, but the majority are men (**L10**). Regarding "labour participation in the harvest sector", there are no women fishers, resulting in the low score of 1. The vendors, who are mostly women, seem

### 3.2.4 Inputs – gender issues

to predominantly employ men to portion large pelagic fish into steaks. When the product moves into the food service value chain through the local distributors, the process is similarly dominated by men. The score of 1 for this category translates into less than 20 per cent of the labour force being female.

**Figure 13.**  
**Inputs – gender issues**

Source:  
Author’s analysis from  
FPI scoring.

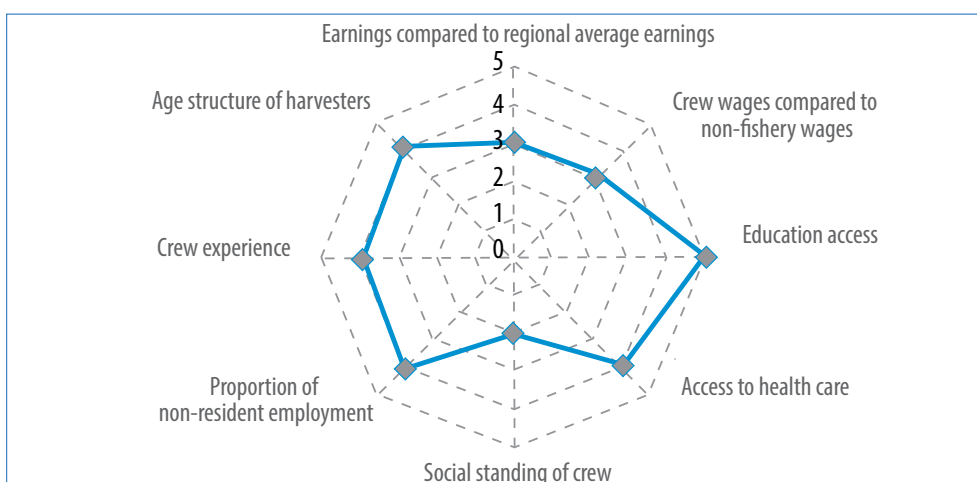


### 3.2.5 Outputs – labour returns

It was impossible to determine quantitative salary information due to a lack of price data. The fishery operates on the share system with 50 per cent of the net revenue returning to the boat owner(s) and the remaining 50 per cent split equally between roughly four crew, including the master of vessel. In contrast to other fisheries, a non-owner master earns the same as his/her crew. This is not always the case. Some boat owners allocate a bonus to the master, but this is included in the vessel expenses share. The earnings of the crew and non-owner masters are expressed as the ratio of annual earnings per crew member to the regional average earnings for the purposes of the FPI scoring (Figure 14). Crew in this case is defined as those depending on others for access and therefore excludes the boat owner or owner/captains. Compared to other large pelagic fisheries in the region, this ratio is within 10 per cent of the regional average, equivalent to a score of 3 for “earnings compared to regional average earnings”.<sup>22</sup>

Within Barbados, the next metric is “crew wages compared to non-fishery wages in a similar job”. This was also scored as being within 10 per cent of an alternative wage. Barbadians have excellent educational access overall, with high school education available to everyone. Workers also have access to licensed doctors that provide trauma care, surgery and general practice medicine. Regarding “social standing of crew”, it was found that the crew are perceived as comparable to unskilled blue-collar workers or service workers. There is very little non-resident employment in the fishery, less than 5 per cent. Some fishers interviewed indicated that some crew from the CARICOM region are employed. Crew members seem to have five to ten years of crew experience on average, which is a relatively high level of skill. Finally, regarding “age structure of fishers”, the working ages are slightly skewed towards younger or older. More precise data would be required to score this metric more accurately.

<sup>22</sup> See annex B: Output and input scoring tables.

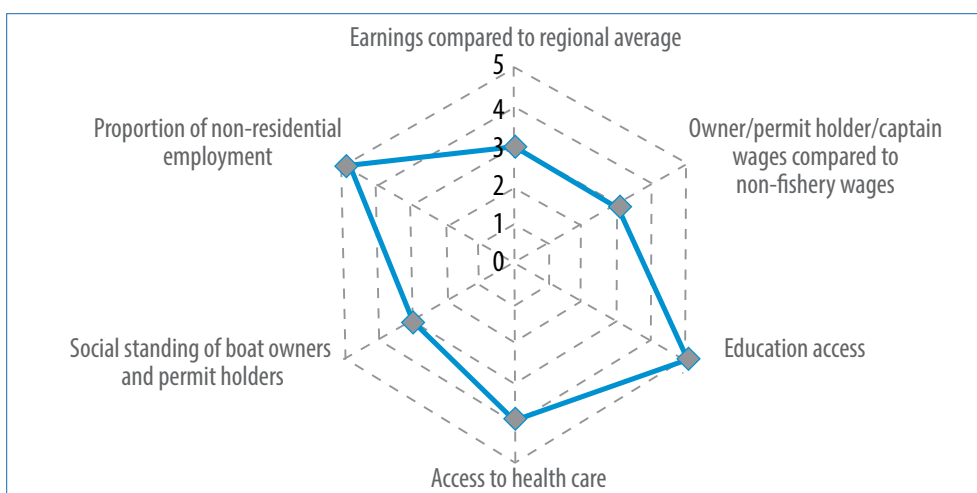


**Figure 14.**  
Outputs – labour returns

Source:  
Author’s analysis from  
FPI scoring.

Managerial returns, or returns to the owners of capital in the fishery, are within, above or below, 10 per cent of regional averages (“earnings compared to regional average earnings”<sup>23</sup> (Figure 15). Owner/permit holder/captain wages compared to non-fishery wages are similarly within 10 per cent of regional averages. Barbados has universal access to education, which is free throughout high school and the owners of capital in the fishery have the same access to healthcare as the captains and crew. Their social standing seems to be higher, more in line with skilled labour or owners in a trade business. There are no non-resident boat owners in the fishery.

### 3.2.6 Outputs – managerial returns



**Figure 15.**  
Outputs – managerial returns

Source:  
Author’s analysis from  
FPI scoring.

In Barbados, there is no limit on entry and licenses are not transferable. Because access permits have no capital value, fishery wealth cannot accrue to them (Figure 16). Typically, this is scored as 1 if vessels or quotas are not limited by regulation. In Barbados, there is no limit on entry and licenses are not transferable (**L11**). However, since no price data is publicly available, gross landed revenues are unknown and it was not possible to calculate the ratio.

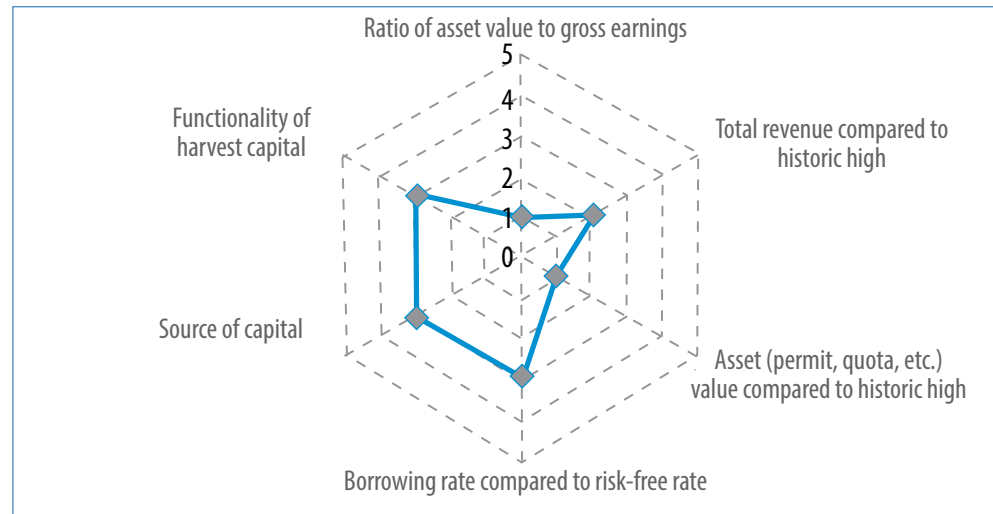
### 3.2.7 Outputs – harvest asset performance

Total revenue compared to historic high is likewise impossible to calculate, due to the lack of price data. Consequently, this was scored as 2 with low confidence (Figure 16). Stable, high relative revenue suggests a sustainable level of harvest. Fisheries with declining total revenue could be in decline due to overfishing, marketing failures or poor market access. In a fishery actively managed for wealth creation, the stock should be harvested sustainably and the focus should be on enhanced market access and innovation. Stable or increasing revenue would be the result.

<sup>23</sup> See annex B: Output and input scoring tables.

**Figure 16.**  
**Outputs – harvest asset performance**

Source:  
Author's analysis from  
FPI scoring.



### 3.2.8 Outputs – risk

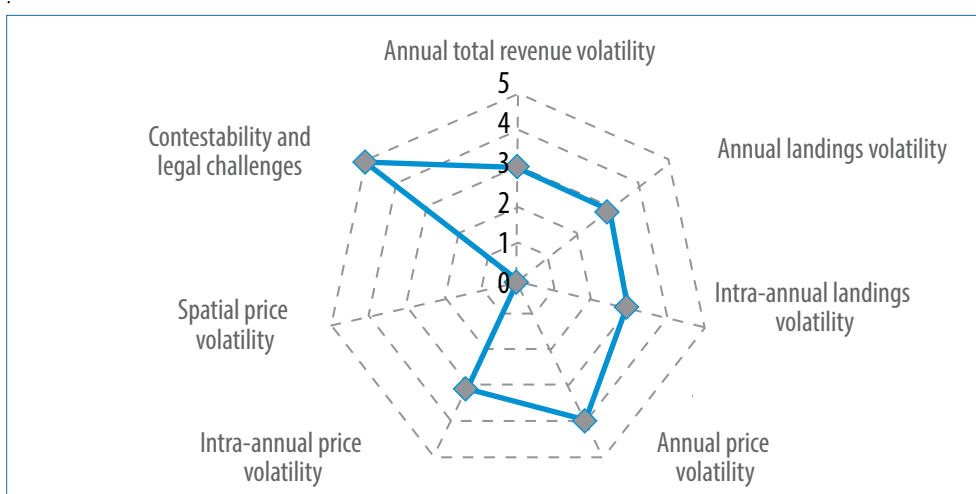
Asset value was scored as 1 because there is no harvest asset (**L11**) (Figure 16). There are no limits on entry<sup>24</sup> to the fishery and thus there is no need for tradability in the license space. It does not appear that any value from the fishery accrues to the vessel, given the replacement values for vessels (Schuhman et al., 2010). That is, vessels are sold for the value of the vessel only, not the value of the vessel plus the value of the fishing right. The borrowing rate compared to the risk-free rate for fishers is comparable to good credit card rates (approximately 15.5 per cent). The source of capital is loans from banks, secured with personal rather than business assets (**L11**). “Functionality of harvest capital” references the age and quality of the vessels. In this fishery the capital is older, but it is moderately well maintained. Maintenance would be better with fenders on the docks and better access to, and less expensive, maintenance facilities (haul out services).

Although there was no data available for price, annual total revenue volatility was proxied using the landings data from Table 3, resulting in a score of 3 which represents moderate volatility (Figure 17). Using landings as a proxy masks any price changes, and, as a result, the confidence in this score is low. Because landings data were used as a proxy, the annual landings volatility was scored the same. The only data that could be obtained was annual data, so intra-annual landings volatility was based on a discussion with fishers about seasonality. The metric was scored as a moderate level of volatility. Discussions with fishers indicated that annual prices have been stable and have not kept up with inflation, particularly inflation in the cost of fuel. Thus, price volatility scores a moderate to low 4. Intra-annual price volatility was scored as moderately volatile because seasonal gluts can drive prices down during the peak winter season. Because there is only one landing site feeding three markets (export, food service and local vendor), there is essentially no spatial variability or risk (**L12**).

There is some risk associated with the process by which the fishers select who will sell their catch, but this is not conveyed by the data. The consignment model presents fishers with significant price/grading risk. Grading risk would all but disappear if the fish was processed locally (e.g. loined at the BFC) and the grade was known (**L12**). There are no legal challenges or contestability that prevent this fleet from fishing, besides the normal holding of permits and valid inspection certificates.

<sup>24</sup> Limited entry is the opposite of open access. To avoid capacity increases it is good management practice in many cases to limit the number of fishing licenses that are issued. Additionally, if permits are transferable, then fishery rents will accrue to either the vessel or the permit, depending on how the entry right is structured.





**Figure 17.**  
**Outputs – risk**

Source:  
Author's analysis from  
FPI scoring.

Much of the risk scoring was conducted with limited data (See Appendix B). Risk is a very important element of community and social sustainability. The biggest lesson learned from the exercise to estimate risk is that acquiring better data on landings – including monthly, or even per trip landings – would be extremely useful. Similarly, information about prices realized at the conclusion of a fishing trip would generate valuable information that would be useful for building implementation plans that address risks and improve triple bottom line outcomes in this fishery.

### 3.3 Increased scientific knowledge

A recurring theme throughout this report is the lack of complete data on landings and pricing, which limits the ability of ICCAT to conduct stock assessments. Increased scientific knowledge about billfish landings, particularly from the small-scale fisheries in the region, is desperately needed, (Arocha, 2019). The need to improve data with a view to enhancing management capacity by increasing scientific knowledge of the stocks, is another theme expressed in a number of reports (McConney et al., 2003; Schuhmann et al., 2010; Walcott et al., 2009; UNCTAD and DOALOS, 2019a). One way to improve the quality and time efficiency in data entry and access would be the installation of electronic data entry terminals in the landing area (**L3, L5**). Every fish would be weighed, and a price could be noted if the product was sold to a vendor or a wholesaler. If the fishery remains a consignment fishery with export prices unknown until settlement 14 days after shipping, a system would have to be devised to capture those prices after the landings. If the fishery was to develop domestic processing (e.g. loining), all prices could be captured electronically. This could easily be expanded to cover all fish landed at the BFC, and, eventually, expanded to all landing sites through the use of mobile applications.

Electronic data reporting would improve ICCAT Task 1 and FAO data reporting. It would enable more direct and consistent reporting, making it less likely that three different catch totals would be available for any given year, as is currently the case (USAID, 2017). This in turn would greatly improve ICCAT's ability to conduct accurate stock assessments, particularly for billfish species. There are significant data gaps across small island fisheries in the region for the billfish stock assessments (Arocha, 2019). More consistent and more accurate data will also improve Barbados' standing at ICCAT, potentially improving its ability to negotiate for better country quotas (Bush et al., 2017; Doddema et al., 2018). Better price data would also help to enhance triple bottom line outcomes by increasing the profile of the large pelagic longline fishery based on its contribution to the economy. It would also improve social conditions by contributing to a better understanding of risk and an improved ability to address it (**L13**).

Electronic data collection is also the first step in fisheries traceability. Full product traceability increases access to markets and has the potential to increase prices paid for fisheries products (USAID, 2019). Full traceability will allow Barbadian swordfish to be imported into the United States of America more readily, fulfilling the requirements of the United States of America's catch documentation scheme, provided the fish exports meet grade and minimum size requirements. A traceability system can also enhance a fishery's chance of achieving a sustainability certification, or improve its standing by participating in a fishery improvement project (FIP), which also improves market access. Processing and selling product with a known grade will also decrease price/grading risk **(L13)**.

An excellent way to increase scientific knowledge, and apply that knowledge to better management and better market access, is to enter a fishery into a C-FIP.<sup>25</sup> C-FIPs require an evaluation of current scientific knowledge and management, and create a plan to improve both. The incentive to participate comes from the promise of improved market access because many large retailers in the United States of America and the European Union require evidence of participation in a FIP before they will purchase a seafood product. These programmes may recommend the implementation of other technologies, such as vessel monitoring systems (VMS). VMS can enhance MCS. For example, VMS can improve safety at sea through emergency alert functions, and could allow the Fishery Division and/or fishing industry to analyse and utilize information on spatial behaviour to increase catches and improve stock assessments. Electronic logbooks could also be used by the fishers to enhance their own catch per unit effort **(L7)**.

Finally, ICCAT may require that Barbados reduces its catch of blue marlin and white marlin, which is currently above the limit of the country TACs assigned by the RFMO. There are gear modifications that can be used to reduce billfish catch, and hook types that can be utilized to keep billfish alive during haulback which allows for the live release of by-catch species. Moving from J-hooks to circle hooks is an adjustment that may improve the grades realized by fishers. This is because the tunas stay alive on the hook until haulback. Tuna that are dead at haulback rarely make a high grade, while billfish that are dead at haulback cannot be released. Additionally, setting drop lines deeper than current practices can reduce billfish harvests, increase swordfish harvests, increase bigeye tuna harvests and improve yellowfin tuna grades. Running gear trials with the fleet using longer drop lines and circle hooks may reduce billfish mortality **(L14)**.

### 3.4 Oceans and trade governance

This section presents a brief analysis of the United National Convention on the Law of the Sea (UNCLOS) and the use of incentive-compatible sustainability tools to manage large pelagic fisheries for triple bottom line, economic, social and environmental outcomes under international legal frameworks. It concludes that if Barbados continues to implement its obligations under UNCLOS and the United Nations Fish Stock Agreement (UNFSA) through the action plan, this will enhance the role of the country as a fisheries steward in the region.

#### 3.4.1 Overarching international and regional legal framework

A full description of the international legal framework for oceans and its application in Barbados is contained in UNCTAD-DOALOS (2019c). This section addresses specific aspects of the international legal framework that may be particularly relevant for the actions proposed by this report to strengthen the fisheries sector in Barbados.

Barbados is a contracting party to UNCLOS, having signed the Convention in October 1982. Ratification took place in December 1993. Barbados became party to UNFSA in 2000. UNCLOS sets out the legal framework within which all activities in the oceans and seas must be carried out. It establishes the limits of the maritime zones and sets out the respective rights and obligations of States with regard to ocean space and its uses, including maritime delimitation, conservation and management of living resources, navigation, protection and preservation of the marine

<sup>25</sup> <https://solutionsforseafood.org/wp-content/uploads/2018/02/Alliance-FIP-Guidelines-English.pdf>.

environment and marine scientific research. UNCLOS also contains procedures for the peaceful settlement of disputes between States.

It is noteworthy that UNCLOS sets out the rights of coastal States for the purposes of exploring and exploiting, conserving and managing living resources within areas under national jurisdiction, as well as their duties with regard to the conservation and utilization of such resources. It, *inter alia*, requires that the coastal State, taking into account the best scientific evidence available to it, ensures through proper conservation and management measures, that the living resources in the EEZ are not endangered by overexploitation. The coastal State is also obliged to promote the objective of the optimum utilization of living resources in its EEZ.

UNFSA builds upon the legal framework in UNCLOS with respect to the conservation and management of straddling stocks and highly migratory fish stocks. In this regard, UNFSA elaborates on the principle, established by UNCLOS, that States should cooperate to ensure conservation and promote the objective of the optimum utilization of fisheries resources both within and beyond the EEZ. In particular, UNFSA contains a number of specific rights and obligations of both flag and coastal States.

Under UNFSA, coastal States are, *inter alia*, required to apply certain general principles in the exercise of their sovereign rights for the purpose of exploring and exploiting, conserving and managing straddling fish stocks and highly migratory fish stocks within areas under national jurisdiction. Provisions relating to the precautionary approach and the compatibility of conservation and management measures also apply to the conservation and management of such stocks within areas under national jurisdiction, subject to the different legal regimes as provided for in UNCLOS.

States Parties to UNFSA are required to cooperate in the conservation and management of straddling fish stocks and highly migratory fish stocks through relevant RFMOs and regional fisheries management arrangements (RFMAs).

In addition to these instruments, Barbados is a party to the FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing and implements the FAO Code of Conduct for Responsible Fisheries.

Barbados is a party to one RFMO/A and one FAO fisheries advisory body: ICCAT and the Western Central Atlantic Fishery Commission (WECAFC), respectively. ICCAT is the most relevant RFMO for the Barbados large pelagic longline fishery. The role of WECAFC is to promote the effective conservation, management and development of the living marine resources of the area of competence of the Commission, in accordance with the FAO Code of Conduct for Responsible Fisheries, and address common problems of fisheries management and development faced by members of the Commission.

Barbados is also a member of CARICOM and the CRFM, which provides technical fisheries support and advice. While the CRFM is not a RFMO, it provides research and extension to help States manage their fisheries.

Barbados is also a signatory to the Caribbean Community Common Fisheries Policy (CCCCFP). This treaty calls for Barbados to:

- protect biodiversity
- increase food security
- enhance fish research
- improve livelihoods
- increase fishery investment
- integrate regulations and enforcement to minimize conflicts
- unify food safety standards
- improve MCS and reduce IUU
- coordinate data systems
- recognize the Caribbean Sea as a special area of sustainable development.

Because Barbados is a contracting party to ICCAT, it can send up to three delegates to meetings of the RFMO and as many scientific advisors as it would like. It is important for Barbados to participate in this process, to ensure the enforcement of ICCAT rules, and to meet certain data reporting requirements (**L1; L2**). ICCAT is a consensus-driven body and each contracting party has one vote, regardless of the size of the nation or its fisheries. ICCAT is also very responsive to the needs of SIDS and can modify strict TACs to enhance economic development aspirations.

While Barbados is a contracting party, it is currently not participating fully in ICCAT, specifically with respect to representation at ICCAT meetings. Nevertheless, ICCAT has allocated to Barbados a 10 ton quota for white marlin and a 10 ton quota for blue marlin. The quota for white marlin is a special dispensation because of the importance of billfish to local food security, and Barbados' status as a SIDS.

Table 3 suggests that Barbados is not complying with its obligations under ICCAT. The total landing of all marlins reported by the Fisheries Division, was 76 tons in 2016, 83 tons in 2015 and 55 tons in 2014. Furthermore, the catch has been as high as 150 tons in the past ten years. According to FAO data (FAO, 2020), where the species are separated, much of the marlin landings are in fact sailfish. However, the ICCAT data in Table 3 is inconsistent with both FishStat and the official Ministry of Agriculture – Fisheries Division landings. As Table 3 indicates, Barbados reported 24 tons of blue marlin and 17 tons of white marlin, which substantially exceeds its ICCAT TACs. For sustainability purposes, and in order to improve compliance with ICCAT rules, it is important for Barbados to make an effort to reduce landings of both these species, or to renegotiate existing quota allocations under a more flexible approach.

ICCAT has not set country level quotas for yellowfin tuna, but it has established default country level TACs for bigeye tuna and albacore tuna. The default TAC for bigeye tuna is 3,500 tons. For albacore tuna the TAC was 200 tons in 2017, but increased to 215 tons for the 2019–2020 fishing season. Barbados does not catch anywhere near those levels, with harvests of 16 tons and 32 tons for bigeye tuna and albacore tuna respectively recorded by ICCAT in 2017 (Table 3). This underutilized quota may represent an important opportunity for the country but would likely require that vessels set gear in cold water outside the EEZ. While recent stock assessments have not evaluated yellowfin tuna to be overfished, nor is overfishing occurring in the region, there are problems with the stock that may lead to lower harvests and, eventually, country level TACs (ICCAT, 2021). In that light, it would behoove Barbados to become more active at ICCAT and protect its yellowfin tuna landings. Barbados has landed an average of 195 tons of yellowfin tuna per year over the past ten years and landed as much as 324 tons of yellowfin tuna in 2016.

If Barbados wants to grow its yellowfin tuna exports, it needs to improve data reporting to ICCAT, participate in ICCAT meetings and work towards reducing white marlin and blue marlin landings. (**L13**) Barbados is not landing its full TACs for bigeye tuna and albacore tuna, as has been noted by other reports (UNCTAD and DOALOS, 2019a). Given what is known about the bigeye tuna and albacore tuna stocks in the region and their availability to the Barbados fishing fleet, it is very unlikely that those quotas will ever become binding on Barbados. However, without appropriate participation in ICCAT and in the absence of improved data reporting and reduced billfish landings, it is possible that Barbados will receive a binding yellowfin tuna quota that is lower than existing catch levels.

### 3.4.2 International and regional trade-related agreements and organizations

Barbados is party to various international institutions and agreements for regulating and overseeing international trade. These agreements are detailed below and have been considered in the compilation of this report and its recommendation of potential strategies for the Government of Barbados.

UNCTAD is a permanent intergovernmental body established in 1964 to support developing countries in accessing the benefits of a globalized economy more fairly and effectively. Technical assistance is provided so that nations may use trade, investment, finance and technology as vehicles for inclusive and sustainable development. The Generalized System of Preferences (GSP)

gives preference to certain products originating from developing countries through the imposition of reduced or zero tariff rates (UNCTAD, 2019b). Barbados is a beneficiary of five out of 13 GSP schemes: Belarus, Canada, Japan, Switzerland and Turkey, all of which could provide interesting options for export diversification – particularly Canada and Switzerland.

Beside these preference schemes, there is UNCTAD's Global System of Trade Preferences (GSTP, 1988). The GSTP is a framework for the exchange of trade preferences among developing countries in order to promote trade between them. Barbados has not acceded to or ratified the GSTP, but the country could become a member if it is interested in accessing southern markets and enhancing south–south cooperation.

The WTO, established in 1995, is the international organization dealing with the rules of trade between nations. Barbados has been a WTO member since 1 January 1995. Important WTO agreements that are relevant to this report include:<sup>26</sup>

- General Agreement on Tariffs and Trade 1947, 1986 and 1994.
- Technical Barriers to Trade Agreement 1995.
- Agreement on the Application of Sanitary and Phytosanitary Measures 1995.

CARICOM is a grouping of 20 countries established in 1973.<sup>27</sup> It has an external tariff system which allows a single tariff rate to access the single market, depending on the product (last version adopted in 2017)<sup>28</sup>. Most of the external tariffs relating to fish and fish products have a 40 per cent *ad valorem* import duty. There are zero import duties for most “processing” tariff lines, which can be considered a form of industrial policy to promote value addition. CARICOM has also negotiated several bi-lateral trade agreements with States in the wider Caribbean and Central America, namely Columbia, Cuba, Bolivarian Republic of Venezuela, Costa Rica and the Dominican Republic. These could be attractive markets for fisheries products from Barbados.

The Caribbean Forum (CARIFORUM)/European Union Economic Partnership Agreement (EPA) is another trade agreement that Barbados is party to as a result of its membership of CARICOM.<sup>29</sup> Under the EPA, European customs duties on CARIFORUM goods have been phased out for almost all products of Harmonised System (HS) Chapters 1 to 97<sup>30</sup>, with some exceptions, e.g. sugar and sugar-based products, and products listed under chapter 93 (arms and ammunition). Therefore, there are zero tariffs applied by the European Union on tuna loins and all fish and seafood species. This does not apply to French territories in the Caribbean region. The French Caribbean Outermost Regions of French Guiana, Guadeloupe and Martinique, are limited by certain regulations, taxes and other barriers. The most important of these is the so called “*octroi de mer*” (dock dues). The *octroi de mer* is applied to imports from the European Union and the rest of the world. It affects all goods, both locally produced and imported (Caribbean Exports, 2014)<sup>31</sup>. *Octroi de mer* rates can range between 0 per cent and 30 per cent and are applied against the relevant HS codes. Upon importation, goods attract application of both the *octroi de mer* and the “*octroi de mer regional*”, which is a regional rate capped at 2.5 per cent (Caribbean Exports, 2014).

<sup>26</sup> For additional information on the participation of Barbados at WTO and main market access commitments on goods (including fisheries) and services undertaken by Barbados. See Barbados country profile at [https://www.wto.org/english/thewto\\_e/countries\\_e/barbados\\_e.htm](https://www.wto.org/english/thewto_e/countries_e/barbados_e.htm).

<sup>27</sup> For more information about CARICOM see <https://caricom.org/>.

<sup>28</sup> See revised CARICOM External Tariff (2017) at: [https://caricom.org/documents/16273-revised\\_cet\\_of\\_caricom\\_hs\\_2017\\_revised\\_11\\_april\\_2018\\_\(for\\_link\).pdf](https://caricom.org/documents/16273-revised_cet_of_caricom_hs_2017_revised_11_april_2018_(for_link).pdf).

<sup>29</sup> For more information about EPA see <https://ec.europa.eu/trade/policy/countries-and-regions/regions/caribbean/>.

<sup>30</sup> See Annex II of the European Union CARIFORUM Agreement (2008). See <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:289:0003:1955:EN:PDF>.

<sup>31</sup> See <http://docplayer.fr/16652965-Final-report-caribbean-export.html>.

Nevertheless, the main challenge in accessing European Union markets for fish and seafood products is multiple and sometimes complex non-tariff measures such as sanitary and technical measures. According to a recent ITC and European Union report<sup>32</sup>, 54 per cent of all interviewed fish exporters indicated that they were significantly affected by non-tariff measures when seeking to penetrate the European Union market.

Barbados does not have trade agreements with the United States of America outside of the WTO framework, but the market is almost completely open, at least with respect to tariffs on most fish and seafood products. It is only fish preparations that attract a tariff of about 8 per cent (UNCTAD-DOALOS, 2019a; UNCTAD-DOALOS, 2020).<sup>33</sup>

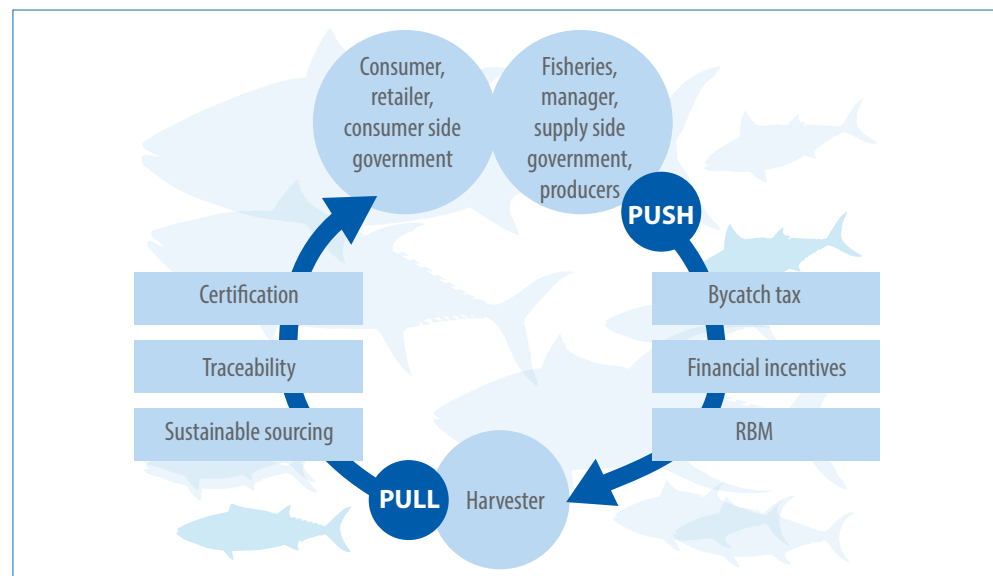
### 3.4.3 Incentive-compatible interventions and international law

Fishers, boat owners and markets respond to incentives. Economic incentives can be introduced to influence individual behaviour and actors can decide themselves how best to meet those incentives. Incentives can be as local as the individual or as regional as the entire industry. The incentives depend on the existence of enabling conditions to be successful. Some enabling conditions are public goods, while others are private goods. As a result, a mix of public and private financing is necessary to move development projects to implementation, and may include financial instruments that apply direct leverage on sustainability and livelihoods (L16).<sup>34</sup>

In designing incentive-compatible management, implementers must first decide which part of the supply chain to incentivize: fishers, owners, exporters and/or governments. Next, the incentive instruments must be identified. Figure 18 defines the types of incentives, separating them into “pull” incentives that shape demand, and “push” incentives that focus on the producers and the supply side of the value chain. Pull incentives include labels and certifications, engaging directly with a buyer to make sustainability or livelihood choices, and catch documentation or traceability schemes. Push incentives include technology investments, by-catch taxes, rights-based management or any activity that directly impacts the operating margins of the exporter or fisher.

**Figure 18.**  
Push versus pull  
incentives

Source:  
Getner, 2018.



<sup>32</sup> ITC and European Union (2016). Navigating Non-Tariff Measures: Insights from a business survey in the European Union. See [https://trade.ec.europa.eu/doclib/docs/2016/december/tradoc\\_155181.pdf](https://trade.ec.europa.eu/doclib/docs/2016/december/tradoc_155181.pdf).

<sup>33</sup> For a more detailed discussion on tariff and non-tariff barriers applicable to fish and seafood processed products to and from Barbados, see “Sustainable Marine Fisheries and Seafood Processing Fact Sheet, Barbados” (UNCTAD and DOALOS, 2019a), and “Economic and Trade Aspects of Fisheries And Coastal And Marine Environmental Services Sectors In Barbados” (UNCTAD and DOALOS, 2020).

<sup>34</sup> For a more complete discussion on incentive-compatible management for highly migratory species see: Getner, 2018.

The interventions for Barbados detailed below fall into the class of interventions considered to be incentive-compatible. That is, they work directly with fisher and other supply chain actors to impact triple bottom line outcomes. RFMOs have wide management discretion in developing management instruments and interventions. Currently, there is no specific legal impediment to adopting incentive-based tools such as, inter alia, market access, certifications and tenure-based management consistent with applicable international law (Anderson et al., 2018).

Within this framework, much of what is recommended in the proposed action plan with respect to increasing market access, are ways to remove non-tariff barriers that have been imposed by governments. These include sanitation requirements and catch documentation/traceability requirements, or private requirements. For instance, some supermarket chains in the United States of America and the European Union require sustainability certification or a FIP and/or traceability or sanitation requirements above and beyond the government-required sanitation standards. Typically, non-tariff barriers refer to government regulations, but this report aggregates private and governmental barriers to trade under the heading “market access.” It is the view of the author that these pull type incentives are not barriers per se, but opportunities. Public and private barriers are actually important incentive tools that encourage more sustainable and safer food handling and can simultaneously generate additional wealth.

Within this context, and considering the interventions detailed below, it is recommended that Barbados enhance its abilities to meet ICCAT obligations by improving timely reporting of data and working towards fishing under the assigned TACs for the tuna and billfish species. This report proposes investments in enabling conditions to address the problems with data, and sets forth instruments to enable Barbados to fish within its ICCAT TACs (**L13**). To achieve these goals, incentive-compatible mechanisms such as FIPs, HACCP<sup>35</sup> plans for ready-to-eat product, electronic data reporting and traceability and improved market access, will be detailed.

As detailed above, ICCAT can pass management recommendations down to Member States but does not have direct enforcement power. It is the State’s responsibility to enact regulations and build enabling conditions that allow it to implement the measures, including compliance with ICCAT TACs and timely data reporting. Many States link fishery legislation to RFMO recommendations, but Barbados does not directly link fishery regulations to ICCAT recommendations.

### 3.4.4 Local legal framework

Some basic considerations for a FIP to successfully improve market access might include:

1. The ability to set and enforce a TAC;<sup>36</sup>
2. Vessel registry;<sup>37</sup>
3. Vessel logbooks;
4. Vessel monitoring;
5. Catch documentation and traceability (CDT) scheme;
6. Electronic catch reporting; and
7. Limited entry to the longline fleet.

None of these interventions are expressly identified in the current Fisheries Act, with the exception of a vessel registry, but care must be taken to ensure the vessel registry complies with international standards on vessel registration.<sup>38</sup>

<sup>35</sup> HACCP (Hazard Analysis Critical Control Point) is a food safety management system.

<sup>36</sup> Items 1, 5 and 7 are required components to be described for each fishery management plan. See Section 4.

<sup>37</sup> Vessel registration and a Register of Local Fishing Vessels are required under the Fisheries Act. The vessel registry should be unique and conform to the FAO standards on vessel registries. For a traceability scheme to be successful, landings should be followed from the vessel all the way to their final destination.

<sup>38</sup> The Fisheries Act Chapter 391 of the Laws of Barbados. This Act was passed on 1 October 1993 and was last amended in the year 2000.



However, new legislation is being drafted which could support the introduction of these interventions. Moves towards the establishment of a FIP may require changes in legislation. Currently, major regulation changes need to be approved legislatively while others, such as the Sea Egg fishing season, can be determined by Notice in the Official Gazette (**L7**). Therefore, it may be possible to meet the requirements of a FIP through notices in the Official Gazette.

The Fisheries Division in Barbados, once under the Ministry of Agriculture, has been recently relocated to the new Ministry of Maritime Affairs and the Blue Economy (MMABE). Within the Fisheries Division, the Chief Fisheries Officer (CFO) is responsible for fishery development and management.

The current fisheries legislation includes the creation a FAC. This is a stakeholder body charged with developing fishery management and development policies and providing advice to the Minister through the Fisheries Division. Specifically, the body is charged with joint venture investments, access agreements, harmonization of fisheries legislation including licensing of foreign vessels, coordinating fishery policy with other agencies, and any other matters specified under the fisheries legislation (UNCTAD and DOALOS, 2019c).

The FAC is composed of the CFO or their designate, a fishery biologist, a representative of the Ministry of the Environment, four industry representatives appointed by the Minister, a representative from the Fish Markets Division and a representative from the registered fishing associations. It was noted by some interviewees that FAC recommendations often do not result in reforms (**L7; L1**).

The current policy on fishery management is codified in the Barbados Fishery Management Plan and the Fisheries Division has also published the Barbados Fishery Sector Management and Development Policy (FMDP) (UNCTAD and DOALOS, 2019c). Broadly, the goals are legislative reform, infrastructure development, resource sustainability and livelihood sustainability for the fisherfolk. The guiding principles of the FMDP are:

1. Applying the principles of regional and international instruments;
2. Applying the principles of good governance;
3. Taking appropriate action to protect and where necessary rehabilitate habitats to provide fish with healthy places to live, feed and reproduce;
4. Making effective management decisions by involving stakeholders, using best available information and taking into account, inter alia, biological, social, economic and environmental considerations; the status of fishery resources and habitats; and the long-term sustainability of resources;
5. Applying the precautionary approach to fisheries management;
6. Collaborating and cooperating with other individuals, groups, institutions, sectors, international organizations and States;
7. Complying with quality assurance standards, namely under agreed sanitary and phytosanitary conditions, and minimum fish safety and quality assurance standards;
8. Effective data sharing and consulting among stakeholders; and
9. Monitoring fishing activities by, inter alia, registering and licensing all fishers and local fishing vessels, compiling data, and controlling, surveying and tracking fishing activities, fishing capacity and compliance with agreed vessel and seafood safety standards and operational procedures. (UNCTAD and DOALOS, 2019c, p. 43).

Guiding principle 1 does not bind the country to ICCAT TACs and other recommendations. All the regulatory interventions in the list are consistent with these guiding principles and, as such, should be interventions that the Fisheries Division can support if adequate investment can be made.



Under the FMDP, strategies and policies include:

1. Upgrade of local fisheries legislation and policy to reflect Barbados' obligations under regional and international instruments (**L7**);
2. Provision, upgrade and/or maintenance of landing and boatyard facilities;
3. Adoption of good governance procedures and implementation of charge fees to develop and manage effective and functional operation procedures (**L7**);
4. Development and implementation of an individual fishery management plan providing for sustainable use of the fish resource and healthy ecosystems (**L7**);
5. Adoption of cost-effective data collection procedures to provide data and information required for decision-making in a timely manner (**L18**);
6. Adoption, implementation and enforcement of measures preventing, deterring and eliminating IUU fishing in Barbadian waters and on the high seas by local and foreign vessels (**L7**);
7. Development and implementation of strategies providing for, inter alia, safe working conditions for fisheries workers and for protection and sustainability of fishery assets and resources (**L7; L10**);
8. Enhancement and development of skills, knowledge and abilities of fisheries workers through training, education and formal certification/accreditation in critical areas of the fisheries sector (**L10**);
9. Assistance and support of marketing and distribution initiatives (**L8; L9; L17**);
10. Fostering an environment in which microfinancing opportunities and programmes specifically tailored to the needs and circumstances of fisherfolk are provided (**L12**); and
11. The generation and marketing of value-added fish products (**L12**). (UNCTAD and DOALOS, 2019c).

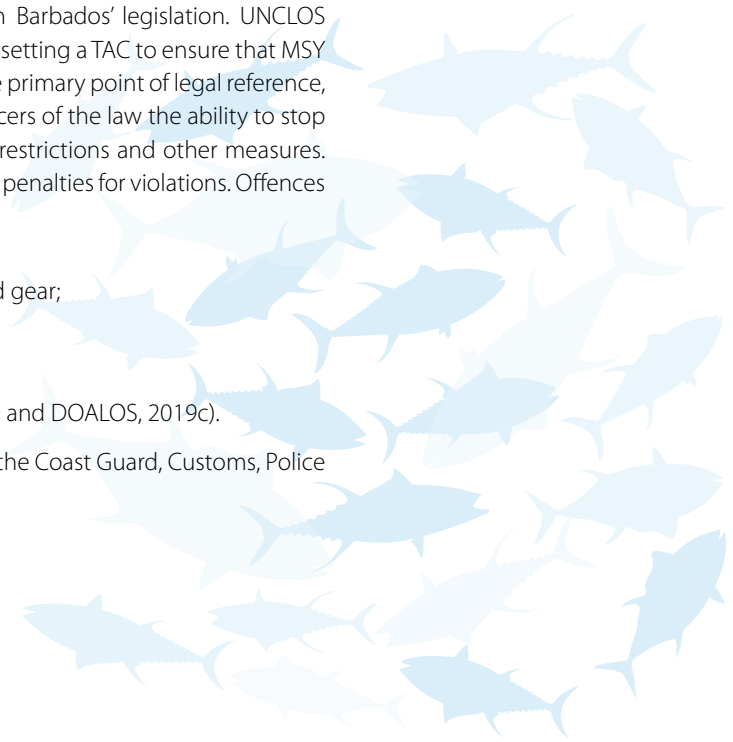
Again, these strategies and policies are in line with good governance in general and should support the professionalization of the large pelagic longline fishery. The strategies and policies, as well as the guiding principles of the FDMP align well with the triple bottom line recommendations proposed below.

All these initiatives are covered by the National Fisheries Legislative Framework. The framework is underpinned by the goal of ensuring optimal utilization of fisheries for the benefit of the people of Barbados<sup>39</sup>. This would seem to allow for either maximum sustainable yield (MSY) or maximum economic yield (MEY) as fishery management objectives. ICCAT uses MSY, tempered by risk, in setting management measures and TACs, which is in line with Barbados' legislation. UNCLOS articles 61 and 62 require States to pursue optimum utilization by setting a TAC to ensure that MSY is not exceeded. It is suggested to maintain these provisions as the primary point of legal reference, and to base drafting thereon. The legislative framework gives officers of the law the ability to stop and board vessels to enforce licensing, registration, fishing gear restrictions and other measures. The legislation requires dealer reporting of landings and allows for penalties for violations. Offences under this act include:

1. Selling fish caught during research without prior approval;
2. Using prohibited fishing methods or possessing prohibited gear;
3. Fishing without a license;
4. Failure to give notice of a change of vessel ownership; and
5. Failing to render assistance to a vessel in distress. (UNCTAD and DOALOS, 2019c).

The stop-and-board authority is granted to authorized officers of the Coast Guard, Customs, Police officers and the Barbados Defence Force.

<sup>39</sup> Ibid.





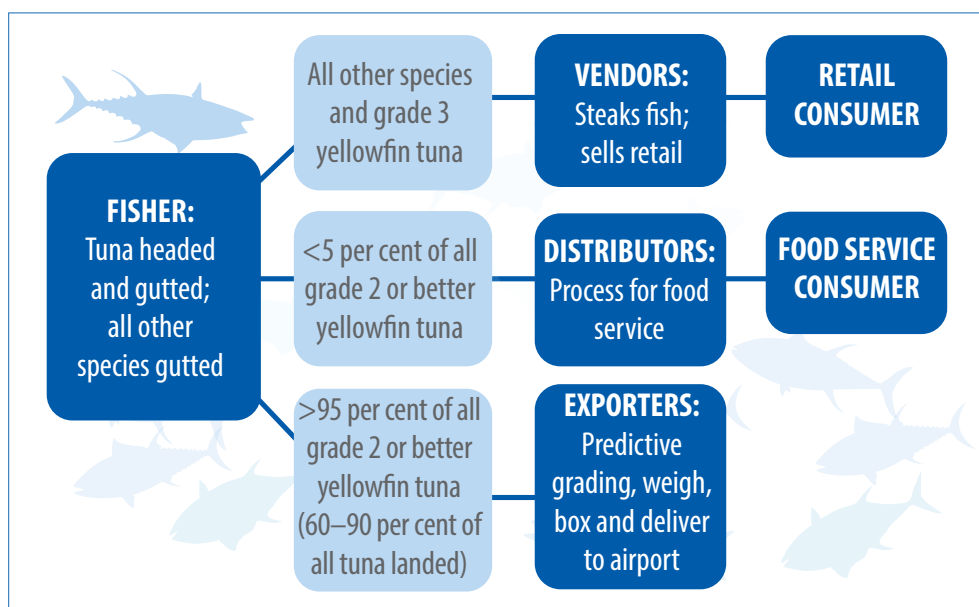
## 4. VALUE CHAIN ANALYSIS

The simple value chain for large pelagic fish caught in the Barbados large pelagic longline fishery is detailed in Figure 19. There is no typical “first dealer” or buyer in this value chain, as there are in most other fisheries. All fish are held in the vessel holds until either exported or sold locally. Generally, landing is timed to allow for air freighting with as little delay as possible (Bealey, 2019). All landings that are not yellowfin tuna or bigeye tuna are sold directly to the vendors. Fishers have the option of selling a small amount of yellowfin tuna and bigeye tuna to the local distributor or exporting those fish on consignment. While there are many importers in Miami, the fishers have chosen to work with a single importer. Price information is not known when the fish is boxed and shipped to Miami. There can be considerable risk for the fisher in this price discovery process (**L3**).

The local distributors will generally pay \$6 per pound for five to ten yellowfin tuna, sometimes more, from any one fishing trip, as long as the grade of the fish is at least grade 2+. If the fish does not achieve this grade, the distributor will ask for a reimbursement of the price differential from the fisher, but that rarely happens. The distributors pay cash on the day they collect the fish – generally \$6 per pound – as do the market vendors at BFC. Vendors purchase non-exportable product for prices lower than the distributors would pay for grade 2 or better fish. Generally, the vendors pay less than \$3 per pound. The remainder of the catch is sold on consignment to an importer in Miami, provided they are graded at 2+ and weigh over 70 pounds. The Miami importer pays between \$4 per pound and \$9 per pound, depending on grade. Three exporters all use the same boxing room at the BFC where they charge a flat fee to grade and box fish. The fisher also pays for the freight, boxes and customs brokerage fees. All fees are deducted from the settlement ticket by the exporter/boxer.<sup>40</sup> The payment terms are 7 to 14 days<sup>41</sup> from the importer. The exporter receives the payments and settlement tickets from the importer, subtracts boxing and handling fees and distributes final payment to the fishers (**L17**). If the fishers have landed all grade 1 fish, they can usually achieve better prices by exporting the fish than the \$6 per pound paid by the distributor, but if the catch is graded lower than grade 1, they stand to make less money than if they sell directly to the local distributors, depending on tuna prices in Miami. If the grader that works for the exporter preliminarily grades the fish below grade 2, the fish is rejected for export and is held to be sold to the vendors with the rest of the catch. Less than 5 per cent of the tuna destined for export are rejected (Bealey, 2019).

<sup>40</sup> A settlement ticket is a receipt issued to the fisher that details the weights, prices and grades of all fish sent to the importer. It includes the total owed to the fisher for their entire shipment.

<sup>41</sup> The fisher is not paid until 7 to 14 days after the fish is shipped to Miami.



**Figure 19.**  
Value chain for large pelagic fish caught in the Barbados longline fishery

Source:  
Author's analysis based on fieldwork, 2019.

In this supply chain, the fisher faces pricing risk in the following ways: there is a lack of transparency in the prices paid by Miami importers. Until the tuna is loined in Miami, the exact grade of the tuna is not known. Therefore, fishers run the risk that the price that is paid by local buyers (BFC vendors or a food service distributor) might have been higher than the price realized in the export market. The importer controls the final grading and the price paid for each grade of fish. Fishers have no control over the grading risk and shrinkage that occurs during transportation<sup>42</sup>. Delays at the airport or at Customs in the United States of America, may cause product quality to deteriorate and impact grading and the prices paid for the shipped fish. This is a factor in the grading risk that fishers currently face under the consignment model.

Introducing a more transparent grading, pricing and information system would significantly reduce the risks that fishers experience. Processing tuna in Barbados, rather than exporting whole headed and gutted tuna, would eliminate these risks. For example, loining could be conducted in two steps in the value chain in Figure 19, with the final location dependent on stakeholder input and business structures created for the implementation; both of which are beyond the scope of this report. The product could be loined by a new fisher cooperative, PPP or business that exists separate from the export service provider. Loins would enter an existing value chain. The second method would be to loin only the fish that are exported. That activity could be another fee-for-service provided by the exporter, or a new export corporation could be formed. The organizational structures are numerous and varied, and would have to be decided by the stakeholders. Finally, if the fish are delayed in transport or are mishandled, quality will decline, which impacts the grade. Processing product locally can reduce these transportation risks (**L12**).

There is very little processing of tuna products in Barbados. Exports are shipped as fresh headed and gutted fish and the heading and gutting is done at sea. The captains utilize global standards for fish handling to preserve product quality. They bleed the fish and pith the spinal column with a piece of monofilament fishing line. Fish are kept on ice in clean, fiberglass coated fish holds to reduce bacteriological contamination. The offloading dock is at stern level and each fish is lifted by hand onto a plastic pallet covered with ice and moved with a pallet jack a short distance to the recently remodeled packing room. The packing room recently passed a USFDA audit which certifies it as acceptable for the shipment of fresh product (**L18**) to the United States of America.<sup>43</sup> The headed and gutted fish are handled minimally, with a temperature probe inserted as soon as the fish enters the packing room. The grader samples the meat near the tail and near the head

<sup>42</sup> Shrinkage = a reduction in the earnings of a business due to wastage or theft.

<sup>43</sup> Personal communication with BARNUFO, 29 July 2019. BARNUFO Office.

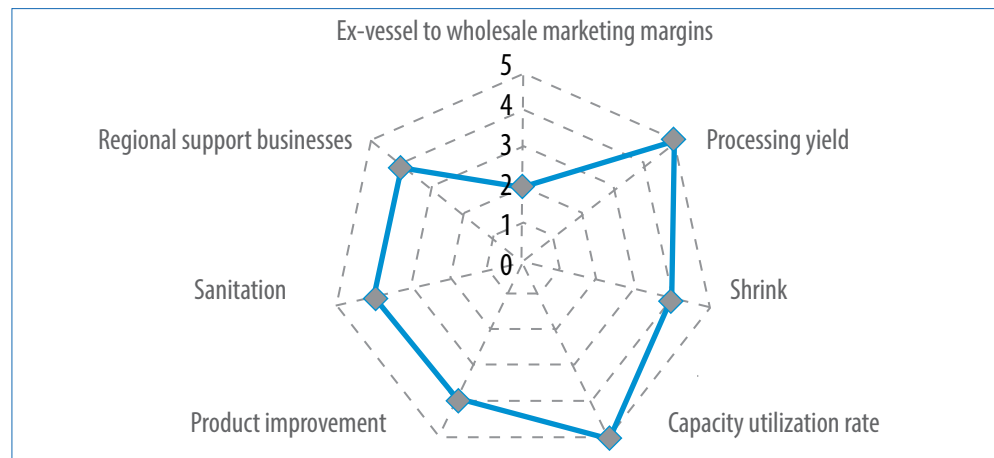
and records a preliminary grade and weight on a paper tag which is affixed to each fish. The fish are placed two to three in each insulated box (maximum box weight of 250 pounds) and 10 to 12 frozen gel packs are inserted before the box is sealed. All landings are timed so that the fish are boxed and transported to the airport for a specific same-day flight. As a result, there is very little need for cold storage at the BFC. If there are delays at the airport, the boxes are placed in temporary cold storage, but that increases transport risk.

Ex-vessel to wholesale marketing margins are low in this fishery, with fishers often barely breaking even<sup>44</sup>. Because they mainly ship a headed and gutted product and follow industry standard processes, this was scored as generating yields at the feasible frontier of yields (Figure 20). Fishers cannot expect any additional meat yield by switching practices. Likewise, with the vendor market that primarily sells tuna steaks (L19). While transportation risk exists and has been higher in the past, only 5 per cent to 10 per cent of the exported product is lost due to spoilage, giving this a score of 4. The BFC is open year-round, as is the exporting room, so capacity utilization was scored as 5.

Using rough estimates, because detailed export data was not available at the time of this study, over 50 per cent of the tuna landings are exported into a premium raw fish market in the United States of America, granting the fishery a score of 4 across all fish landed for product improvement. Sanitation is generally good but there is room for some improvement. The exporters are not certified to ship into the European Union, thus resulting in a score of 4. Regional support businesses<sup>45</sup> are generally available but are capacity constrained, or services must be imported. Currently, the exporters import boxes but are thinking about manufacturing boxes themselves. One exporter makes its own gel packs using imported gel and imported bags.

**Figure 20.**  
**Product form**

Source:  
Author’s analysis  
from FPI scoring.



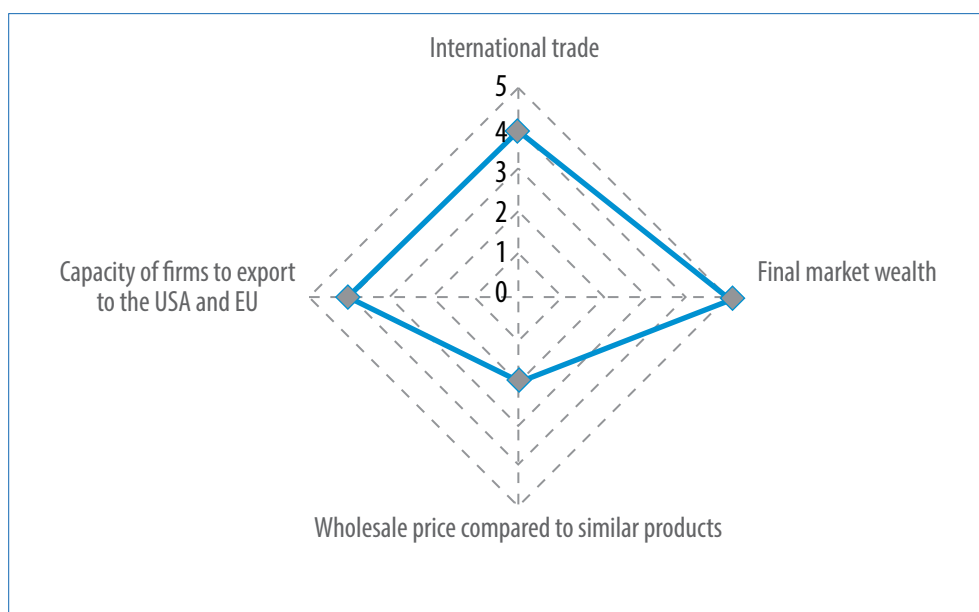
### 4.1 Exports

Barbados scores a 4 with respect to International trade (Figure 21). Final market wealth measures the wealth, in terms of GDP per capita, of the final export market. All of the Barbadian tuna exports are destined for the United States of America, resulting in a score of 5 for the “final market wealth” metric. While no formal price data could be obtained, Barbados prices are within 50 per cent and 80 per cent of global averages, suggesting Barbados has significant potential to increase the value of its exports. Thus, a score of 2 is assigned to “wholesale price compared to similar products “(L12). Barbados scored a 4 on “capacity of firms to export to the United States of America or European Union”. They currently do not fully meet European Union catch certification requirements and health and labeling requirements, but do meet the United States of America’s health requirements

<sup>44</sup> Personal communication. Fishers meeting at Fisheries Division office, 30 July 2019.

<sup>45</sup> Regional support businesses include chandlery, tackle, motors and other maintenance supplies.

for fresh headed and gutted product. Barbados could enjoy significant price increases by improving its HACCP plan to include ready-to-eat raw product (value-added products like loins, poke cubes or saku blocks) and by entering the large pelagic longline fishery into a FIP because buyers will pay a premium price for fish caught in a sustainable fishery, something that the FIP process guarantees (L7).



**Figure 21.**  
**Trade**

Source:  
Author's analysis  
from FPI scoring.

## 4.2 Wholesale distributors

As mentioned above, there are a relatively limited number of local processors/wholesalers/distributors that sell to the food service industry (restaurants, hotels and houses) in Barbados. Houses are large estates that are privately owned but regularly feed large groups of people and place food orders that are more in line with hotels than residences. Distributors buy as much local high grade fish as possible, but generally purchase lower grade (cooking grade) imports that they process and repackage for the food service industry.

Distributors will buy as many grade 2+ tuna locally as they are able to sell in fresh form. Their volumes are not easy to estimate and can range between 6 tons and 12 tons annually<sup>46</sup>. These sales represent an important source of ready cash for the large pelagic longline fishers because the distributors pay cash on the day of landing and their prices are consistent and known in advance. In contrast, fishers wait between 7 and 14 days to get paid under the consignment system. It is assumed that direct sales to the local high-end market will not change from a volume perspective if the industry moves towards the loining of tuna, but they might be enhanced by the availability of electronic information landings. Export prices for grade 2+ tunas will not exceed the efficiency gained by selling headed and gutted or loins direct to the local market.

## 4.3 Fishers and vessel owners

Fishers active in the Barbados large pelagic longline fishery face high costs. Schuhmann et al. (2010) from a 2007 survey of Barbadian longline fishers, constructed an average year for the longline fleet. On average, the entire fleet takes about 300 trips, with a maximum number of 356 trips recorded in 2005 and a minimum of 242 trips reported in 2002. Out of the 3,201 registered fishers in all of Barbados, 175 reported using longline gear. Of that number, 108 considered

<sup>46</sup> Feedback provided by local processor in peer review process.

themselves fishers, 57 were boat owners, nine were boat agents and one was a processor. In the Schuhmann et al. (2010) study, 135 fishers actively used longline gear, but the fleet has subsequently increased in size from 36 vessels to 47 vessels. As a result, the estimate of an average of 300 trips per year is probably too low.

Schuhmann et al. (2010) warned about the quality of the landings data, stating that it would be difficult to draw strong conclusions because of data reporting issues. In an effort to calculate fleet landings capacity as verification of reported landings – if the entire fleet of 47 longline boats took 16 trips per year, landing on average 2,500 pounds (roughly 25 heads), total landings would be around 850 tons. The figure of 16 trips per year comes from the fisheries fact sheet (UNCTAD and DOALOS, 2019a). If the fleet took 300 trips per year at the same landings rate, the total harvest would be 340 tons, but that figure is based on the 36 vessels actively fishing in the study by Schuhmann et al. (2010). Three hundred trips per year translates into a little more than eight trips per year, which is half of what was reported in the fisheries fact sheet (UNCTAD and DOALOS, 2019a). If the eight trips per year is used as the average across the 47 boats registered in 2018, then the total potential landings of tuna would be 445 tons. This suggests that there may be some level of underreporting of landings, that the fleet is fishing far below its capacity or that there is significant latent capacity<sup>47</sup>.

According to Schuhmann et al. (2010), the average vessel runs 490 km of mainline. They typically fish 498 branch lines with 498 hooks under 124 buoy drops and 3 beacon buoys. In 2007, it cost \$8,400 for full gear replacement and each vessel spends approximately \$5,600 annually on replacing or repairing gear. Stated vessel value was, on average, \$148,500 in 2007. Boat owners spend \$6,457/year on insurance and \$3,560 on vessel maintenance (haul out services) annually.

Captains indicate that the costs of removing vessels from the water to carry out maintenance have increased significantly, as have wait times. Using a crane at the BFC costs \$2,500 to pull the boat and \$2,500 to put the boat back into the water, with wait times as long as three months to schedule a haulout. Hauling out at a nearby boat ramp costs \$1,500 and is available at almost any time but there are severe limitations in terms of hurricane preparedness and the ability to haul out all boats in time for an impending disaster.

Per trip costs are high for this fleet, mostly driven by high diesel and bait costs. The fuel cost data presented in Schuhmann et al. (2010) were converted to gallons using the average diesel price in 2007 from the World Bank<sup>48</sup>. Making that conversion, the average vessel on the average trip uses 675 gallons of diesel. At today's prices of \$5.68 per gallon, fuel costs amount to \$3,731 per trip. When including the Schuhmann et al. (2010) costs for all other items, total costs per trip amount to \$6,713. Inflating those costs by using an inflation calculator for Barbados results in a 2019 trip cost of \$8,514/trip<sup>49</sup>. The source for the inflation estimate shows that inflation since 2007 has been 60.4 per cent. As a reference, the increase in fuel prices has been 45.6 per cent. Average trip costs are calculated to be between \$6,700 and \$8,500.

On the revenue side, value information was difficult to obtain because it is not collected by the government. This is likely because the actual value is not known until well after the trip is completed and the settlement tickets are returned from Miami. Prices quoted in Schuhmann et al. (2010) seem not to be very different from what was observed in the limited number of settlement tickets obtained. If anything, during certain times of year, current prices are lower. Schuhmann et al. (2010) reported prices of \$6.35 to \$7.48 for tuna in 2007. This suggests for an average per trip landing of approximately 1 ton (20 to 25 heads) the gross revenue per trip would be approximately \$14,000. If trip costs are on the high side of \$8,500 per trip, the net revenue would be \$5,500. Fifty per cent

<sup>47</sup> Latent capacity refers to boats that are licensed to fish but are not fishing for one reason or another. Latent capacity is a concern when setting harvest control rules because it is harvest capacity that could be brought on line very quickly and therefore cause catch limits to become binding quicker than current catch histories would indicate. It is an issue when improving profitability in a fishery because increasing profits tends to attract latent capacity back into a fishery. For more information on fishery capacity, please see <http://www.fao.org/3/Y4849E/y4849e02.htm>.

<sup>48</sup> <https://data.worldbank.org/indicator/EP.PMP.DESL.CD?end=2014&locations=BB&start=2001>.

<sup>49</sup> <https://www.worlddata.info/america/barbados/inflation-rates.php>.

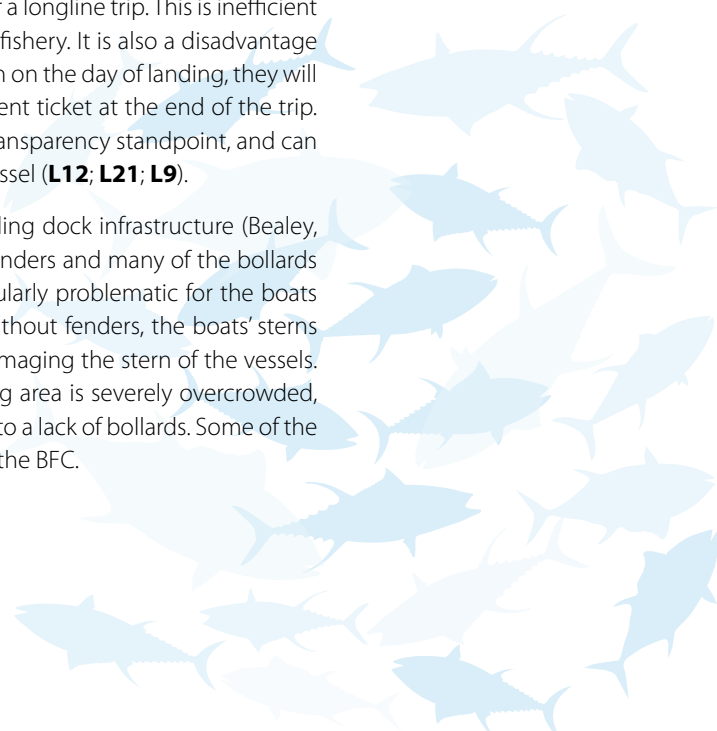
of that is allocated to the boat owner and 50 per cent is split equally between the captains and the three crew members. This means that per trip, a captain or crew member would make \$690 or about \$11,000 a year if they take the average 16 trips annually. This is very close to the per trip crew earnings reported by Schuhmann et al. (2010) of \$400 to US\$700 per trip. For the period of the Schuhmann et al. (2010) study, the average per trip profit was approximately \$3,700. Average annual fleet profit across the years of the study (1997–2006) was \$527,000. This figure was however highly variable during the study period, with annual average vessel profit of \$3,000 in 2002, jumping to \$26,000 in 2005. Overall, Schuhmann et al. (2010) estimated that the return on investment (ROI) in the Barbados large pelagic longline fishery was approximately 8.7 per cent over the 10 years of the study. If a vessel needs to replace a motor in that 10-year period, the ROI drops to 7.5 per cent.

Captains and boat owners in Barbados indicated that they find it more and more difficult to break even. Fuel prices have increased and a recent fuel tax of approximately \$0.14 per gallon (2.5 per cent) labeled a “road tax” was added. Bait costs have also risen. Most fishers use either locally caught jacks or imported, frozen squid. Fuel, ice and bait make up 80 per cent of variable costs in the fishery. It is very difficult to lower these costs. It is too expensive to build new and more fuel-efficient vessels and so generally fishers must continue to maintain existing equipment. However, search times could be reduced by using more advanced electronics to find fish more quickly, which would reduce fuel use and therefore fuel costs.

Technology adoption in the fleet is relatively high (Schuhmann et al. 2010). All boats have very high frequency radios and global positioning systems. Most now have automatic identification system receivers for locating beacon buoys deployed with the gear. The captains that have satellite receivers on their boats can access SSTs and chlorophyll-A counts, thus adapt their travel time to target ideal water conditions (avoiding green water and searching for cold water). Other captains may look at maps showing SST and chlorophyll-A counts before they leave the dock, then make a decision about finding productive waters for tunas and swordfish. However, if optimal water conditions have moved, this will result in increased search time. For costs, obtaining real time data is a double-edged sword. Satellite receivers and bandwidth are expensive and the real time forecasts cost money, making such upgrades unaffordable for many boat owners. Many fishers complained that fishing provided a living but did not provide for investing in the future. Investments in this kind of technology would reduce fuel costs, increase catch rates and improve vessel and fleet profits.

Another cost carried by large pelagic longline vessels is a lack of access to credit. Often a captain will not have enough money from the previous trip, after shares are disbursed, to pay for fuel for the next trip. Some vessel owners will loan or advance payments to their captains. Frequently, the captain will also embark on a short fishing trip of two to three days to catch flying fish or coastal pelagic species in order to earn enough money to purchase fuel for a longline trip. This is inefficient and is likely reducing the total effort that could be applied in this fishery. It is also a disadvantage of the consignment system. In fisheries where dealers purchase fish on the day of landing, they will also often front for all the trip costs and net them off the settlement ticket at the end of the trip. However, this type of system can also be problematic from a transparency standpoint, and can lead to an asymmetric relationship between the dealer and the vessel (**L12; L21; L9**).

Another cost issue identified by several other reports was the failing dock infrastructure (Bealey, 2019; Mahon et al., 2007; UNCTAD and DOALOS, 2019b). All the fenders and many of the bollards have rotted off the docks and need to be replaced. This is particularly problematic for the boats tied up on the long walkway that surrounds the harbour (**L1**). Without fenders, the boats’ sterns can become trapped under the walkway at extreme low tides, damaging the stern of the vessels. The walkway is also severely degraded in some areas. The docking area is severely overcrowded, and vessels are often tied to each other instead of to the dock due to a lack of bollards. Some of the overcrowding is also the result of multiple derelict boats based at the BFC.





## 4.4 SWOT analysis

The current SWOT analysis is based on previous SWOT analyses and on additional information gathered from informal interviews and various documentary sources (UNCTAD and DOALOS, 2019a; UNCTAD and DOALOS, 2019b; Bealey, 2019; UNCTAD and DOALOS, 2018; Arocha, 2019; Schuhmann, et al., 2010; McConney et al., 2003). To date, few of the recommendations from these documents appear to have been addressed. Each component will be addressed separately below.

### 4.4.1 Strengths

- Party to UNCLOS and UNFSA, as well as all other international fisheries agreements under the United Nations and relevant RFMO/As;
- Beneficiary of some GSP schemes;
- Member of the WTO, CARICOM and European Union–CARIFORUM EPA;
- Captains are highly experienced and very knowledgeable;
- The on-vessel fish handling standards for high-end fresh product are high;
- The properly sanitized, air-conditioned boxing room which is currently used to process headed and gutted tuna meets USFDA sanitation and health standards for the raw headed and gutted product;
- There are consistent air lifts from air freight companies and commercial passenger airlines, including adequate handling facilities at airports;
- The Barbadian dollar is pegged to United States of America’s dollar; and
- The industry appears to be responsive to new avenues to enhance business.

### 4.4.2 Weaknesses

- Limited institutional capacity to implement legislation, policy and fisheries management regulations;
- High operating costs/low profitability for fishers;
- High maintenance/haul out costs;
- Aging fleet;
- Consignment system places all price and grading risk on fishers;
- Local co-management mechanisms are limited and challenged;
- Aging BFC with a high degree of deferred maintenance although recently the market has seen improvements:
- Failing BFC infrastructure is damaging boats;
- Limitations in the data collection system:
  - Limited quality control or monitoring;
  - Data is not always collected consistently or collated in a timely manner;
  - Price data is not collected systematically;
  - Export data is not collected systematically;
  - Collect grade or product type data;
  - Collect effort data.
- Dependence on single importer (United States of America); and
- Inefficient vessel management at BFC:
  - Congestion slows refueling and reloading of ice;
  - Potentially decreases profitability.



- Strong global demand for high-end, raw tuna products;
- Strategically located in the Caribbean for a region-wide tuna marketing and governance strategy;
- Internal process for updating national fisheries regulations in light of international and regional commitments;
- Underutilized TACs on certain tuna and large pelagic species, such as YFT;
- Increase market access through:
  - entering into FIP or certification programme;
  - seeking raw, ready-to-eat HACCP certification for United States of America and European Union markets;
  - establishing traceability within the fisheries;

If the above are addressed, potentially use preferential access under the EU-CARIFORUM Agreement;

- Increase local value adding (e.g. loin tuna for raw, ready-to-eat market);
- Install electronic landings data terminals for:
  - multi species traceability;
  - improved data timeliness and consistency.
- Switch to circle hooks to:
  - reduce billfish harvest;
  - increase tuna quality.
- Managing entry and capping capacity;
- Increase use of satellite remote sensing of SST and chlorophyll A;
- Improve vessel monitoring for MCS and safety at sea;
- Differentiate fresh, local caught fish from cheap, frozen imported product;
- Convert fish waste to fertilizer if processing operations are developed;
- Increase catches under the current ICATT TAC and potentially recommence exporting swordfish;
- Increase catches of bigeye tuna; and
- Use of electronic vessel logbooks to improve data collection.

- Systematic barriers to trade and development:
  - Aging infrastructure;
  - High energy costs;
  - High fuel taxes;
  - Lack of price transparency.
- Lack of participation at ICCAT could weaken position for future allocation of yellowfin tuna country level quotas:
  - Main species targets overfished and some country level TACs being exceeded;
  - Billfish over catching could result in sanctions from ICCAT;
- Climate change impacts, including through increases in SSTs and reduced dissolved oxygen, changes in salinity and water clarity. This increases fishing search times but can also negatively affect the quality of tuna catches.
- Increased frequency and severity of extreme weather events;
- Fuel road taxes applied to fuel purchased by fishers for their boats;
- Cost recovery, while low, is not being used to improve BFC infrastructure;
- Cheap imported fish transshipped from distant water longline fleets into CARICOM economy; and
- Lack of access to short- and long-term credit.

### 4.4.3 Opportunities

### 4.4.4 Threats

Given the right structure, financing and guidance, Barbados has ample room for sustainable growth of the large pelagic longline fishery. Barbados' tuna volumes are moderate but could potentially be increased, particularly in albacore tuna and with the country's active participation in ICCAT. The RFMO looks favourably on SIDS and their development aspirations when setting country level TACs, particularly if a State is taking an active role in managing data, MCS and reducing harvests of blue marlin and white marlin. If a country enters its fishery into an FIP, it can increase market access and prices achieved for H&G tuna. Moreover, if a processing facility (e.g. for loining) can be established and meet global standards for raw, ready-to-eat product, market access and prices could be further increased. Such a facility could be a first step in creating capacity for developing a larger range of other value-added products (e.g. cubes and *saku* [tuna blocks]) and with various packaging formats (e.g. glass, cans and pouches).

The industry shows a strong desire to improve the fishery and is willing to embrace reforms. Moving towards electronic data entry and traceability will allow for the development of incentive models to enable behavioural change on the water. Although considerable weaknesses and threats can compromise the position of the Barbados large pelagic longline fishery and the broader fishing sector, proper risk mitigation strategies, such as better business structures, professional guidance and targeted financing can mitigate these issues and enable its development.

## 4.5 Sample cash flow analysis

The cash flow analyses from H&G to loining tuna for fresh, ready-to-eat exports are detailed in Table 4. The methodology used for the cash flow analysis is included in Appendix A, and assumes that the ICCAT data is the official record of landings (Table 3). The analysis focuses solely on adding more value to the tuna product by loining fish locally, which reduces grading risk because the grading is done at the time of loining, in Barbados. Loining fish in Barbados reduces shipping costs because the fishery will not pay for the shipment of fish frames that will only be discarded after processing. Loined products tend to receive higher prices than H&G products, once conversion rates are accounted for. From a cash flow perspective, loining would pay for the necessary investments in a such a facility and still enable exporters, fishers and the government to realise greater profits. The full set of assumptions used for these projections, and the impact of relaxing those assumptions is fully detailed in Appendix A. The model does not consider increases in harvesting in areas of potential expansion for albacore tuna, as catches are currently low, or for swordfish because it is not a tuna species, nor is it currently exported. If such potential expansion was included in the model, the result would have been slightly more profitable for value addition in the tuna value chain that is effectively in place in Barbados.

As detailed in Table 4, the gross additional revenue generated by switching to loining over a period of seven years would be \$7.5 million or an average additional revenue of \$1.1 million each year. If the fishers remain under a consignment programme, it is projected that they would collectively earn an additional \$2.5 million over the seven-year projection period. This equates to an average of \$350,271 in additional revenue each year when spread equally across the entire fleet of 47 boats, effectively increasing the revenue of every vessel by \$7,500/year. When compared to the revenue and cost profiles presented in Schuhmann et al. (2010), \$7,500/year in additional revenue is equivalent to the profit made on nearly five additional trips per year for each vessel. Finally, the cash flow analysis replaces the landings tax with a tax on exported loins. Such a change in tax policy would potentially increase the tax revenue over the seven-year period by \$422,865, or on average, \$60,500 per year.

The figures in Table 4 also depend on the percentage of landings that are exported. Those interviewed in this study estimated that the percentage of landings that are exported is close to 75 per cent to 80 per cent of fish harvested. However, and as noted above, by using available export data and the ICCAT landings from Table 3, the percentage of tuna that could be exported may be closer to 50 per cent. For this analysis, it is conservatively estimated that the export percentage is 50 per cent but if the export percentage is closer to 80 per cent, then the gains would be roughly 30 per cent higher. It is also assumed that increases in export grade quality and/or landings will

increases exports at a rate of 3 per cent per year beginning in 2022, for a total increase of 15 per cent by 2027.

With respect to grades, it is assumed that 63 per cent of all exported fish are grade 1 fish, which was the average determined from two settlement tickets shared by fishers. This is the only assumption that may not be conservative because other fisheries in the region do not typically land as many grade 1 fish on average. However, during dock visits when large pelagic longline vessels were offloading, the fishers were observed to follow international best practice on managing fish quality. In the absence of additional data on grades at export, the analysis relies on the figure of 63 per cent and assumes that in the future, the same proportion of grade 1 fish will be landed. Even if this assumption is lower or higher than the reality, it does not change the relation between headed and gutted and loins because the same proportion was used for the baseline as the projection.

The fixed costs of transitioning the fishery towards loining are included in Table 10. Variable costs of loining are assumed to follow examples from other large pelagic fisheries in the region, with a significant buffer to compensate for uncertainty. The loining cost used in this analysis is \$2.80/pound. If loining costs are lower than assumed, all revenues under the loining scenarios will be higher and the relation between the loining and the headed and gutted baseline will be greater. The current boxing and shipping cost for the baseline is roughly \$0.83/pound, which assumes the very lowest air freight cost using an air freight carrier and not commercial airlines. (Using airlines for shipments costs approximately 60 per cent more for shipping.) The current exporter uses a mix of air freight carriers and commercial airlines and, as a result, the average freight costs for the baseline are likely higher than the lower bound used here. Anything that increases the costs in the baseline headed and gutted projections increases the value of the switch to loining.

This analysis assumes an industry standard headed and gutted-to-loin yield of 56 per cent. If Barbadian cutters can improve upon this yield, the cash flows for loining will improve. If value-added products can be made from the fish frames, it will also improve the loining cash flows.

**Table 4. Cash flows current headed and gutted compared to loining**

Revised yearly cash flows	2021	2022	2023	2024	2025	2026	2027
<b>Total export value</b>	<b>PROJECTIONS</b>						
Loining export value	\$2,669,824	\$2,822,330	\$2,974,836	\$3,127,342	\$3,279,848	\$3,432,354	\$3,432,354
Headed and gutted export value	\$2,040,408	\$2,040,408	\$2,040,408	\$2,040,408	\$2,040,408	\$2,040,408	\$2,040,408
Gross increase (decrease) in value of fishery	\$629,416	\$781,922	\$934,428	\$1,086,934	\$1,239,440	\$1,391,946	\$1,391,946
Net increase (decrease) in value of fishery to fishers	\$4,845	\$120,227	\$235,609	\$350,991	\$466,372	\$581,754	\$692,100
Increase (decrease) in tax revenue	\$47,808	\$52,218	\$56,629	\$61,039	\$65,450	\$69,860	\$69,860

Source: 1Skip Development (2020). This table was developed by 1Skip Development using its own methodology and is based on interviews and available data. See <https://www.oneskipdevelopment.com/about>.

No assumption has been made regarding the structure of the loining operation or the remainder of the supply chain workings. It is assumed that consignment pricing will remain in place, with contract processing, which also seems to be the norm for the flying fish catch. Barbados is an excellent example of the benefits of consignment pricing and moving the quality incentive directly to the fishers. That success is reflected in the relatively high quality standards employed on the boats and achieved by the fishery as a result of capacity building and training on fish handling that has been conducted in the past and which should continue. It is possible that grades could improve further, particularly if gear technology tests prove successful. Moving to circle hooks, for example, results in less fish stress and fewer fish dying on the line before haulback, and therefore improved quality. Setting lines deeper and in colder water also improves fish grade and might also increase harvests of bigeye tuna and swordfish.

## 4.6 International legal considerations

Overarching legal considerations have been discussed above and will be discussed in further detail in the following section on implementation. The cash flows detailed here do not rely on increasing harvests or increasing capacity. In fact, the entire implementation strategy is aimed at achieving triple bottom line outcomes that include a strong foundation in sustainability criteria.

Market access is predicated on the industry establishing strong ties to sustainability standards and the implementation plan calls for linking local fishery regulations, and the setting of TACs in particular, to the catch limits set by ICCAT. Many Member States<sup>50</sup> link the local TAC directly to the country level TACs set by the RFMO. The implementation plan recommends changing fishery regulations to harmonize local TACs with ICCAT TACs. Currently, there is no country level quota for yellowfin tuna, but it is possible that ICCAT will set country level TACs in the near future.

Bigeye tuna and albacore tuna both have country level TACs and for both species Barbados' catch is well under the limits. ICCAT has also assigned country level TACs for BHM and white marlin. These TACs have been exceeded by Barbados in the past and it is hoped that by making ICCAT TACs binding on local fishers through legislation change and real-time monitoring, that Barbados can comply with those limits. The implementation plan includes testing of alternative technologies, such as circle hooks that can keep billfish alive for longer, or fishing at different depths, with a view to reducing catch rates of billfish and assisting fishers to comply with ICCAT TACs. In addition, the proposed implementation plan does not call for increased fishing capacity, either through vessel construction or vessel modernization, but rather for improved management. As such, the implementation plan recommends that capacity is maintained at current levels and that technology is improved for the existing fleet, so as to promote more targeted fishing. Increased revenues tend to attract increases in capacity. By legislatively limiting entry to current levels, capacity can be controlled. There may be some latent capacity in the fishery that may need to be addressed if the fleet has difficulty remaining within the limits of the TACs set by ICCAT. Limiting entry also allows resource rents to accrue to the current license holders.

The cash flows do not include any analysis of swordfish landings and exports. Barbados has attempted to target swordfish in the past but the fishers interviewed in this study considered the United States of America's regulations on imports to be overly stringent and regarded the cost of light sticks needed to target swordfish to be prohibitively expensive. Currently, prices for imported swordfish in the United States of America are lower than tuna prices, sometimes by a wide margin. While the interviewees mentioned regulatory barriers, particularly with respect to mercury content, such restrictions were lifted by the United States of America in 2015.<sup>51</sup> The United States of America requires a minimum size limit for swordfish and a catch documentation scheme for swordfish imports. These requirements could be met by implementing a traceability programme as suggested in the implementation plan below. Historically, Caribbean nations catch relatively small swordfish, and this factor may be a barrier to Barbados exporting the species to the United States of America. However, there are opportunities to develop swordfish exports and further improve revenues. Projections of potential revenues relating to swordfish exports were not included in the analysis because this was beyond the scope of the present report and would require additional information and stakeholder consultations.

## 4.7 Key issues as triple bottom line outcomes

The triple bottom line outcomes focus on people, planet and profit. In the section below, these key issues, indexed by "I" for interventions, are linked to the assessment insights, indexed by "L" in the section above and in Table 7 and then to the individual actions, indexed by "A" in the subsequent tables (Tables 8, 9 and 10). In this section, the interventions are listed by each triple bottom line category: people, profit and planet.

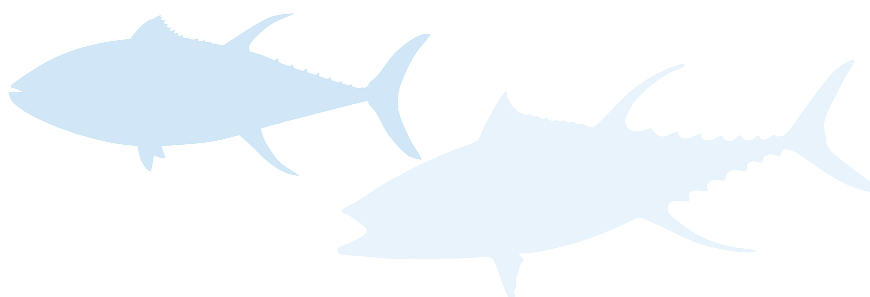
<sup>50</sup> For example, the United States of America, Mexico, Ecuador.

<sup>51</sup> See <https://www.seafoodsource.com/news/supply-trade/fda-lifts-fresh-swordfish-mercury-import-alert?fbclid=IwAR141cB-moABAFR5EbD86KbUeSdKflUH5SHTabU8ArcKzRO--vOVZPotjxc>.

Table 5. Interventions by triple bottom line impacts

Impact	Index	Description
Profit	I 1	Create a blended equity model and business structure for project financing.
People, profit	I 2	Structure incentives for all stakeholders to share the benefits of an increase in export value, including fishers, processors and government entities.
Planet, profit	I 3	Develop C-FIP work plan to put Barbados' large pelagic longline fishery on the pathway to apply for sustainability verification or certification schemes (e.g. Marine Stewardship Council (MSC), Friend of the Fish or Blue Biotrade).
Planet	I 4	Reinforce and streamline processes for government fisheries data collection.
People, planet	I 5	Create cost recovery models based on projected industry growth.
Planet, profit	I 6	Finance and test by-catch reduction gear technologies.
People, planet, profit	I 7	Create a collectively led PPP to act as financier, visionary and project manager of development plans moving forward.
Profit	I 8	Create joint marketing programme under new PPP structure for increased marketing of Barbados' products.
Planet, profit	I 9	Implement Information Technology (IT) systems to streamline the fish landings data collection process, vessel registration and monitoring systems, export tracking and reporting in compliance with United States ID eCDT architecture. System to comply with: current policies of Barbados fisheries management plan (legislation), ICCAT standards, international import standards, MSC supply chain standards and market order processing standards.
Profit	I 10	Implement industry-based order routing system, possibly through block chain, for two way communication between buyers/end users and exporters/fishers based on government landings data.
People, profit	I 11	Create two-way information flows and user interfaces from end users to exporters and fishers.
People, planet, profit	I 12	Develop food safety plan for new processing plant.
People, planet	I 13	Shift ministry labour from data collection to active MCS of harvesting sector.
People, profit	I 14	Build in-country processing facilities for tuna landings (e.g. loining facility) to add value to tuna products landed in Barbados and to increase market reach and reduce grading risks.
People	I 15	Implement processing facility rules and hiring policies that comply with, and lead to the development of, international social standards that enable gender and diversity inclusion.
Profit	I 16	Facilitate faster payment terms through the use of a market maker programme.
Planet	I 17	Improve fisheries legislation for more accurate TAC monitoring and controls according to ICCAT regulations.
Planet, profit	I 18	Revise fisheries legislation to include limited entry to Barbados' longline fisheries.
People, planet, profit	I 19	Integrate incentive models, data collection IT systems and payment instruments for sharing financial benefits of increase in export value with fishers.
Profit	I 20	Increase orders from end users for tuna products produced in Barbados.
Profit	I 21	Undertake a market study and marketing campaign to explore export opportunities and potential barriers for the Barbados longline fisheries products in markets with preferential access, whether through the GSP (e.g. Canada and Switzerland) or through Preferential or Free Trade Agreements (e.g. European Union-CARIFORUM EPA).
Profit	I 22	Consider becoming a Party to UNCTAD's GSTP in order to increase market access opportunities in southern markets.

Source: Author's analysis from FPI analysis.



Whereas Table 10 contains detailed costs as part of the Strategic Design and Action Plan, Table 6 summarizes the investments necessary to attain the benefits from a switch to loining, while improving fishery sustainability. The investments needed to achieve the triple bottom line outcomes outlined in general above and in detail below, are separated by functional stages:

- Structuring – includes stakeholder outreach and engagement; structuring traceability architecture; development and agreement on memorandums of understanding (MOUs); revision of fisheries legislation; MSC pre-assessment; familiarization with the pre-assessment; secure tuna purchase contracts; development of loan terms and financing vehicles; and the creation of a PPP to govern implementation.
- Implementation – includes physical infrastructure development, technology installations, food safety plans, circle hook trials and other required elements.
- Maintenance – includes expenditure needed to keep the plan running smoothly throughout implementation.

Implementing fishery improvement often requires blended financing in two dimensions. The first dimension is the public versus private good dimension. Fisheries are a public good, but profiting from fisheries is a private good. In order for private use of the resource to be sustainable, investments need to be made to enable sustainable management of the public resource (Anderson et al., 2018). With tight margins, as are often encountered in fisheries and agriculture, private businesses often do not have the capacity to finance the entire cost of enhancing fisheries management. Likewise, the public sector should not be expected to invest in private profits. Blended financing allows for the investment in enabling conditions to be paid for using grants or low interest loans that are paid off by the public, or through cost recovery from the private sector (like landings taxes or technology use fees). Private financing must come from private forms of capital at various interest rates (Bush et al., 2017; Gentner, 2018).

The second dimension of blended financing is the interest rate dimension. Financiers charge interest to deal with the risk of employing capital. Some capital types demand very high interest rates and it can be difficult for fisheries in general, and small-scale fisheries in particular, to realize sufficient profits to pay high interest rates. Equally, governments would pay high interest rates. The blending of capital types is the most appropriate mechanism to reduce the overall project interest rate. For example, development banks such as the Caribbean Development Bank or the Latin American Development Bank may provide financing at 2 per cent to 5 per cent interest or lower, while private investors may charge 15 per cent to 20 per cent. By blending both types of capital, the overall interest rate can be reduced to a level that is manageable across the entire project.

**Table 6. Investment summary (over 7-year period)**

Investment stage	Amount
Structuring investments	\$190 000
Implementation investments	\$960 000
Maintenance investments	\$20 000
<b>Total</b>	<b>\$1 170 000</b>

Source: Author's analysis.

## 5. STRATEGIC DESIGN AND ACTION PLAN



Management instruments – a catch-all term for title, lease, permit, contract, legislation, treaty or soft-law instruments – can be binding or non-binding, and can be top-down or bottom-up. Such instruments can also be incentive-compatible or incentive blocking, and can be designed in a way to ensure compliance with international legal agreements. Within the context of this report on large pelagic longline fisheries, those instruments can be applied at the international, regional, national or local levels. Practical experience shows that it takes a combination of instruments to achieve success (Gentner, 2018; Anderson et al., 2018).

The literature also suggests that some intervention points are better than others. A small number of influencers or leaders can have wide systemic impacts up and down the supply chain (Gentner, 2018). Doddema et al. (2018) supports the success of private electronic monitoring installations. Understanding data collection as a set of socially mediated practices that can directly improve livelihood outcomes incentivizes improved data collection and more timely reporting through the promise of better access to end markets. Bush et al. (2017) emphasize this result, showing that private information provision can be suitable for traceability programmes and can enhance stock assessments.

There is a strong case for the use of incentive-compatible tools in transboundary stock management because incentives can work across State boundaries and can be implemented in a manner consistent with international legal obligations. Incentives also do not necessarily require regulatory action by States because some act directly on fishers and exporters to align behaviours with RFMO edicts.

For example, the private provision of traceability systems may improve access to markets for the private sector and increase profits for the private sector. Benefits from such an investment by the private sector spill over into the public sphere through better data collection and MCS. Without any government intervention, some fisheries have switched to the private provision of public good data because they have been incentivized to do so by market access requirements (Bush et al., 2017; Doddema et al., 2018). In these cases, the private sector can proceed, take effect and have a positive impact rapidly. It can also enhance and improve regional cooperation (Anderson et al., 2018; Gentner, 2018).

The implementation of interventions or management instruments has associated costs, some of which need to be expended on enabling conditions like stock assessments, MCS, and other items that improve the public good for the benefit of all stakeholders. Some pull incentives can build local value and private wealth through public investments in public goods. Such public goods and enabling factors that are not directly tied to business profits are extremely difficult to finance through private capital channels. Purely private goods, on the other hand, should be paid for by the businesses that will benefit from them. Unfortunately, in many cases in the developing world there is limited access to credit and, as is often the case with fisheries, margins to pay back investments are very small. Successful, incentive-compatible triple bottom line interventions in developing fisheries require multiple instruments, as well as a blend of capital types.

The single, overall strategic goal for the large pelagic longline fishery in Barbados is to improve the sector's market access by moving towards domestic value-added products, for example through the production of fresh tuna loins, while focusing on triple bottom line outcomes and using incentive-compatible interventions. The rest of this section will identify priority actions, key results indicators, implementing agencies, a timeline and estimated costs for such an approach. All of the tables in this section are linked through the coding system. Assessment links are designated by an "L" which are in turn linked to interventions designated by an "I", which are in turn linked to actions designated by an "A".

## 5.1 Priority actions

Table 8 contains the draft implementation plan for the Barbados large pelagic longline fishery. The index on the left of the table refers to the assessment text above. The table links the assessment findings to the interventions that were first introduced in Table 5 and which will be detailed further in Table 9. While the assessment links are numbered relative to their position in the assessment text, the intervention index is in the order in which the interventions should be undertaken.

**Table 7. Intervention plan**

Recommended intervention	Report insights	Report link	Results table linkage
Create taxation models based on projected industry growth.	<b>Need for reinforced taxation models for increased government revenue for MCS and ICCAT compliance. This also can provide revenue for depreciating infrastructure (fenders).</b>	<b>L1</b>	I5
Shift civil service labour from data collection to active MCS of harvesting sector.	<b>ICCAT membership provides for basic management infrastructure, but challenges with reporting reduces the effectiveness of the infrastructure. Inefficient data systems also inhibit local real time management functions.</b>	<b>L2</b>	I13
Create two-way information flows and user interfaces from endusers to exporters and fishers.	<b>The lack of a proper pricing mechanism is inhibiting the ability of fishers to make decisions on where to sell and the best markets to sell into at the point of landing.</b>	<b>L3</b>	I11
Increase orders from end users for tuna products produced in Barbados.	<b>Creation of more buyers can increase demand for products, but increasing buyers in mid-supply chain does not necessarily increase demand and can lead to decreased prices.</b>	<b>L4</b>	I20, I21, I22
Streamline processes for government fisheries data collection.	<b>Reinforcement of data collection for accuracy and efficiency. Although data is being collected, challenges remain with its inaccuracy and analysis.</b>	<b>L5</b>	I4
Revise fisheries legislation for hard TAC monitoring and controls according to ICCAT regulations.	<b>Linking ICCAT TACs with country-level recognition, monitoring and enforcement of those TACs enhances the local, regional and global management of highly migratory stocks by increasing local compliance with ICCAT catch limits.</b>	<b>L6</b>	I17
Develop FIP work plan to put Barbados large pelagic longline fishery on the pathway to MSC certification.	<b>The creation of a C-FIP will baseline the fishery against the MSC's environmental certification standard and put the fishery on the pathway to MSC certification. The creation of the C-FIP will also address some of the issues with bycatch and the overharvesting of yellowfin tuna, blue marlin and white marlin by baselining the C-FIP with the 28 MSC standards and the creation of a C-FIP work plan. Furthermore, C-FIPs provide a good framework for regulation change by providing a platform for dialogue and an active work plan to address changes in regulation and give direction to the MMABE and fishers behaviour. The incentives in L17 will increase compliance with new fisheries legislation and make it easier to move forward.</b>	<b>L7</b>	I3
Create joint marketing programme under new PPP structure for increased marketing of Barbados products.	<b>A joint marketing programme can increase revenues to BARNUFO (creating an artificial linkage with this organization and the longline fishers) and government through a levy on "brand" and help build markets and buyers for Barbados-caught tunas. This increase in financial capacity can also empower the organization to influence management by playing a major role in the marketing and sale of tuna products.</b>	<b>L8</b>	I8, I21, I22



Recommended intervention	Report insights	Report link	Results table linkage
Create a collectively led PPP to act as financier, visionary, and project manager of development plans moving forward.	<b>Industry collaboration is necessary through aligned incentives, taxation, financing and stakeholder engagements. This could be accomplished through PPPs and innovative financing structures that can be applied through the PPPs to create cohesion, vision and collective action. This model would need to be justified by an increased value to industry and a central distribution of profits, to align these incentives with the financing, taxation and engagement models.</b>	<b>L9</b>	17
Implement processing facility rules and hiring policies that comply with, and lead the development of, international social standards that enable gender and diversity inclusion.	<b>The creation of value-add facilities will require more personnel and a shift of current roles on the plant floor. Locally, women have held the role of oversight of local processing and sales. Through the creation of new roles such as Quality Assurance/Quality Control and general plant management and oversight, these roles can be conducted by women currently in industry.</b>	<b>L10</b>	115
Revise fisheries legislation to include limited entry to Barbados large pelagic longline fisheries.	<b>Limited entry will make permits an asset, but also a barrier to new entrants.</b>	<b>L11</b>	118
Build tuna loining facility to add value to tuna products landed in Barbados and to increase market reach and reduce grading risks.	<b>Mechanisms to sell further down the supply chain and control grading risk will limit price volatility and reduce risks of vessel profitability. Furthermore, grading risk in the tuna industry stems from the lack of knowledge of actual quality because of the headed and gutted form of the fish. By processing loins, the exporter will be able to establish the proper grade and market for the product and identify the proper price for exports. The creation of a processing facility will allow for direct end user sales because grade, price and market will be established at the point of landing. This will: (1) limit the pricing volatility seen at an export industry level; (2) increase the price paid for tunas being exported; (3) reduce grading risk for fishers shipping on consignment; and (4) incentivize stakeholders to comply with the agreed laws of ICCAT.</b>	<b>L12</b>	114, 121
Implement IT systems to streamline fish landings data collection process, vessel registration and monitoring systems, export tracking and reporting in compliance with United States ID eCDT architecture. System to comply with current policies of Barbados fisheries management plan (legislation) and ICCAT standards, international import standards, MSC supply chain standards and market order processing standards.	<b>Refining the ability of Barbados to report to ICCAT can increase the general standing of the country within the RFMO. This can easily be achieved through better data collection methods and by improving collection capacity. The refinement of data collection processes and incorporation of data collection software can drastically increase the data accessible to ICCAT and the country overall.</b>	<b>L13</b>	19
Finance and test by-catch reduction gear technologies.	<b>The introduction of circle hooks can increase the grade of tunas and provide further incentives for compliance with ICCAT regulations and TACs.</b>	<b>L14</b>	16
Structure incentive models for all stakeholders, including fishers, processors and government entities, to share in the benefits of an increase in export value.	<b>Creation of incentive models will create fishers' good will towards legislation changes recommended in L7.</b>	<b>L15</b>	12
Create a blended equity model and business structure for project financing.	<b>In order to create and finance incentive models, innovative financing mechanisms will need to be designed and incorporated into the implementation model.</b>	<b>L16</b>	11
Facilitate faster payment terms through usage of a market maker programme.	<b>A decrease in payment terms will help facilitate better cash flows for the vessel owners, captains and crew.</b>	<b>L17</b>	116
Develop a food safety plan for the new processing plant.	<b>Increase in food safety practices through better handling of products in loining facility will lead to compliance with international end market standards; i.e. ready-to-eat HACCP plans.</b>	<b>L18</b>	112, 121, 122
Integrate incentive models, data collection IT systems and payment instruments for sharing the financial benefits of an increase in export value with fishers.	<b>Increased profit margins for fishers can be created through better access to markets and buyers due to in-country value addition. This will lead to increased compliance with fisheries regulations and increased profits for fishers.</b>	<b>L19</b>	119, 121, 122
Implement industry-based order routing system, preferably through block chain, for two way information communication between buyers/end users and exporters/fishers based on government landings data.	<b>Better supply chain data coupled with a deeper reach into the market brings enhanced transparency back to the fishers.</b>	<b>L20</b>	110

Source: Author from linkage analysis.

## 5.2 Key results indicators

Table 8 takes the indexed interventions from Table 5 and Table 8 and indexes them to actions, translates them into indicators and outcomes and labels the key performance indicators from the FPI process. This allows for direct measurement of impacts relative to the baseline FPI triple bottom line measures as the implementation progresses to completion. This plan includes the key performance indicators from the already complete FPI assessment detailed above and will be linked through implementation to the MSC criteria during the implementation phase.

Table 8. Key results indicators

Interventions (in order of implementation)	Linked actions	Indicator(s)/ outcome(s)	Key performance indicator by FPI measurement	↑↓	
11	<b>Create a blended equity model and business structure for project financing.</b>	A1, A2, A4, A8, A12, A13, A35, A36	M1.1	Borrowing rate compared to risk-free rate	↑
			M1.2	Ratio of asset value to gross earnings	↑
			M1.3	Asset value compared to historic high	↑
12	<b>Structure incentive models for all stakeholders to share benefits of increase in export value, including fishers, processors and government entities.</b>	A1, A2, A4, A5, A11, A14, A22, A27, A29	M2.1	Enforcement capability	↑
			M2.2	Management jurisdiction	↑
			M2.3	Percentage of stocks overfished	↑
			M2.4	Degree of overfishing	↑
13	<b>Develop FIP work plan to put Barbados large pelagic longline fishery on the pathway to MSC certification.</b>	A9, A10, A14	M3.1	Portion of harvest with a third party certification scheme	↑
			M3.2	Percentage of stocks overfished	↑
			M3.3	Degree of overfishing	↑
			M3.4	Number of buyers	↑
14	<b>Streamline processes for government's collection of fisheries data.</b>	A3, A6	M4.1	Data availability	↑
			M4.2	Data analysis	↑
15	<b>Create taxation models based on projected industry growth.</b>	A2, A6, A8, A30	M5.1	Enforcement capability	↑
			M5.2	Level of tariffs	↑
			M5.3	Industry's financial support for management	↑
16	<b>Finance and test of by-catch reduction gear technologies.</b>	A1, A9, A10, A19	M6.1	Percentage of stocks overfished	↑
			M6.2	Degree of overfishing	↑
17	<b>Create a collectively led PPP to act as financier, visionary and project manager of development plans moving forward.</b>	A1, A2, A4, A5, A6, A8, A9, A10, A12, A14, A33, A34	M7.1	Days in stakeholder meetings	↑
			M7.2	Industry financial support for management	↑
			M7.3	Leadership	↑
			M7.4	Social cohesion	↑

Interventions (in order of implementation)		Linked actions	Indicator(s)/ outcome(s)	Key performance indicator by FPI measurement		↑↓
18	<b>Create joint marketing programme under new PPP structure for increased marketing of Barbados' products.</b>	A8, A11, A14, A22, A31	BARNUFO is delegated oversight of marketing of fishery products and general building of fishery awareness in collaboration with PPP board and management staff; BARNUFO earns a pre-determined fee for services to the PPP.	M8.1	Harvester organization's influence on business and marketing	↑
				M8.2	Harvester organization's influence on management and access	↑
				M8.3	Proportion of harvesters in industry organizations	↑
				M8.4	Number of buyers	↑
19	<b>Implement IT systems to streamline fish landings data collection process, vessel registration and monitoring systems, export tracking and reporting in compliance with United States eCDT architecture. System to comply with: current policies of Barbados fisheries management plan (legislation) and ICCAT standards, international import standards, MSC supply chain standards and market order processing standards.</b>	A3, A6, A8, A14, A15, A16, A18, A20, A22, A23, A27, A29, A30, A31, A32, A34	90 per cent of longline landings data is recorded by electronic receiving stations and streamed directly to government database; IT system is developed and implemented in accordance with eCDT architecture and has the ability to verify landings and export data at the time of export.	M9.1	Tech adoption	↑
				M9.2	Percentage of stocks overfished	↑
				M9.3	Degree of overfishing	↑
				M9.4	Enforcement capability	↑
				M9.5	Management jurisdiction	↑
				M9.6	Data availability	↑
				M9.7	Data analysis	↑
110	<b>Implement industry-based order routing system, preferably through block chain, for two-way communication between buyers/end users and exporters/fishers, based on government landings data.</b>	A2, A11, A20, A22, A27, A29	IT infrastructure has the ability to accept and route purchase orders direct to landings facilities; purchase order fulfillment is directly linked to block chain verification and smart contracts; specific data is collected both up and down the supply chain and made available to users based on agreed terms.	M10.1	Ex-vessel to wholesale marketing margins	↑
				M10.2	Data availability	↑
				M10.3	Landings pricing system	↑
				M10.4	Availability of ex-vessel price and quality information	↑
111	<b>Create two-way information flows and user interfaces from end users to exporters and fishers.</b>	A2, A8, A18, A22, A29	User interfaces are developed for end users, exporters, market makers and vessels that allow specific information types to be shared between them.	M11.1	Landings pricing system	↑
				M11.2	Availability of ex-vessel price and quality information	↑
112	<b>Develop food safety plan for new processing plan.</b>	A15, A23, A25	Food safety plans are in place and in compliance with ready-to-eat HACCP standards.	M12.1	Sanitation	NC
				M12.2	Capacity of firms to export	↑
113	<b>Shift Fishery Division's labour from data collection to active MCS of harvesting sector.</b>	A16	Job descriptions are revised for Fisheries Division's staff so as to shift role(s) from data collection to data analysis.	M13.1	Enforcement capability	↑
				M13.2	Management jurisdiction	↑
114	<b>Build tuna loining facility to add value to tuna products landed in Barbados and to increase market reach and reduce grading risks.</b>	A1, A2, A4, A5, A8, A11, A12, A14-A17, A21-A27, A29, A32	Operational tuna loining facility is built in Bridgetown landings facility and owned/operated by PPP.	M14.1	Annual total revenue volatility	↑
				M14.2	Annual price volatility	↑
				M14.3	Intra-annual price volatility	↑
				M14.4	Spatial price volatility	↑
				M14.5	International trade	↑
				M14.6	Wholesale price	↑
				M14.7	Capacity of firms to export	↑
				M14.8	Final market wealth	↑
				M14.9	International shipping	↑
				M14.10	Degree of vertical integration	↑
115	<b>Implement processing facility rules and hiring policies that comply with, and lead the development of, international social standards that enable gender and diversity inclusion.</b>	A17, A24, A26	Employee handbooks are developed by PPP management and hiring policies are defined in operational guidelines.	M15.1	Business management influence	↑
				M15.2	Resource management influence	↑
				M15.3	Labour participation	↑
				M15.4	Labour participation in post harvest sector	↑

Interventions (in order of implementation)		Linked actions	Indicator(s)/ outcome(s)	Key performance indicator by FPI measurement		↑↓
I 16	Facilitate faster payment terms through usage of a market maker programme.	A11	Payment terms from market maker are less than eight days from receipt of shipment.	M16.1	Landings pricing system	↑
				M16.2	Capacity of firms to export	↑
I 17	Revise fisheries legislation for hard TAC monitoring and controls according to ICCAT regulations.	A7, A16, A28	Fisheries legislation includes hard TAC.	M17.1	Percentage of stocks overfished	↑
				M17.2	Degree of overfishing	↑
I 18	Revise fisheries legislation to include limited entry to Barbados' large pelagic longline fishery.	A2, A5, A7, A20, A27, A28	Fisheries legislation includes government's ability to limit number of vessels fishing in the large pelagic longline fishery.	M18.1	Social standing of boat owners and permit holders	↑
				M18.2	Ratio of asset value to gross earnings	↑
				M18.3	Asset value compared to historic high	↑
				M18.4	Borrowing rate compared to risk-free rate	↑
I 19	Integrate incentive models, data collection IT systems and payment instruments for sharing financial benefits of increase in export value with fishers.	A2, A18, A22, A32	Payment mechanisms are facilitated through digital transactions and linked to receiving reports and end user prices.	M19.1	Landings pricing system	↑
				M19.2	Availability of ex-vessel price and quality information	↑
				M19.3	Ex-vessel to wholesale marketing margins	↑
I 20	Increase orders for tuna products produced in Barbados from end users.	A11, A14, A31	Number of buyers submitting purchase orders increases.	M20.1	Number of buyers	↑
				M19.3	Ex-vessel to wholesale marketing margins	↑
I 21	Undertake a market study and marketing campaign to explore export opportunities and potential barriers for the Barbados large pelagic longline fishery's products in markets with preferential access, whether through the GSP (e.g. Canada and Switzerland) or through Preferential or Free Trade Agreements (e.g. European Union-CARIFORUM EPA).	A11, A14a, A31	Number of buyers submitting purchase orders increases.	M20.1	Number of buyers	↑
				M19.3	Ex-vessel to wholesale marketing margins	↑
I 22	Barbados should consider becoming a Party to UNCTAD's GSTP in order to increase market access opportunities in southern markets.	A11, A14a, A31	Number of buyers submitting purchase orders increases.	M20.1	Number of buyers	↑
				M19.3	Ex-vessel to wholesale marketing margins	↑

Source: Author's key results analysis.

### 5.3 Timeline and implementing agencies

Table 9 lists the individual actions needed to complete the interventions listed in Table 8, along with assumptions, deliverables, completion metrics, stakeholders to be engaged at each step, responsible agencies, duration and completion date. Actions 1 to 14 (A1–A14) represent the structuring phase of the implementation strategy. Actions 15 to 31 (A15–A31) represent the implementation phase of the project. Actions 32 to 36 (A32–A36) represent the maintenance phase of the implementation plan. Actions are labeled and listed in the order in which they should be completed.

Table 9. Timeline and responsible parties

Action(s)	Assumption(s)	Output(s) / deliverable(s)	Measured by	Consulted/ informed agencies	Responsible, accountable agencies	Duration	
A1	<b>Host roundtable meeting with stakeholders to discuss results of OETS report</b>	Stakeholders buy-in to work plan	Letter of intent to stakeholders to engage in next steps of discussions	Completed output	All stakeholders	Fishery developer	1 week
A2	<b>Discuss and define structure of traceability architecture, investments and PPPs with government, funding agencies, financiers and stakeholders</b>	Outline of investment structures and financing options are agreeable to all parties	General terms outlined and project proposal is developed	Completed output	All stakeholders	Fishery developer	6 weeks
A3	<b>IT architecture is developed and shared with government</b>	Government is informed of eCDT and role of technology in data collection and MCS	Architecture is refined and incorporated in MOU process	Completed output	Fisheries Division, BARNUFO, processors, exporters	Fishery developer	1 week
A4	<b>Project proposal is shared with government, stakeholders, funding agencies and financiers</b>	Outline of investment structures and financing options are agreeable by all parties	MOU(s) are developed with key stakeholder participants	Completed output	Fisheries Division, BARNUFO, processors, exporters	Fishery developer	6 weeks
A5	<b>MOUs are signed by commercial stakeholders involved in moving project forward</b>	Terms are agreeable to all parties	Signed MOUs	Completed output	BARNUFO, exporters	BARNUFO, exporters	4 weeks
A6	<b>MOU is signed by government</b>	Terms are agreeable to all parties	Signed MOUs	Completed output	Fisheries Division, BARNUFO, processors, exporters	Fisheries Division	12 weeks
A7	<b>Fisheries legislation is revised to include hard TACs and limited entry</b>	Stakeholders in agreement with policy changes	Revised fishery legislation if drafted	Completed output	Fisheries Division	Fisheries Division	8 weeks
A8	<b>Detailed plans for investments are defined, including physical infrastructure, traceability deployment costs, and tax models</b>	Financing is available for the project	Detailed financing plans are developed and return on investment is defined	Completed output	Fisheries Division, BARNUFO, processors, Exporters	Fishery developer	4 weeks
A9	<b>MSC pre-assessment of Barbados large pelagic longline fishery is conducted</b>	Funding is available for MSC pre-assessment	MSC pre-assessment report is developed and draft work plan is developed with stakeholders	Completed output	All stakeholders	Fishery developer	6 weeks
A10	<b>Familiarization of MSC pre-assessment</b>	Funding is available for MSC pre-assessment	MOU(s) are developed with key stakeholder participants	Completed output	All stakeholders	Fishery developer	1 week
A11	<b>International tuna buyers are introduced to products from Barbados and purchasing contracts are secured with market makers</b>	Terms are agreeable to all parties	Purchase contracts are secured with buyers/market makers	Completed output	Exporter and PPP board	Fishery developer	6 weeks
A12	<b>Financing for PPP is drafted</b>	Terms are agreeable to all parties	Term sheets are developed and shared with stakeholders	Completed output	All stakeholders	Fishery developer	6 weeks
A13	<b>Impact metrics and loan terms are agreed to and drafted in operational agreement of PPP</b>	Terms are agreeable to all parties	Term sheets signed by all stakeholders	Completed output	All stakeholders	Fishery developer	2 weeks

Action(s)		Assumption(s)	Output(s) / deliverable(s)	Measured by	Consulted/ informed agencies	Responsible, accountable agencies	Duration
A14	<b>PPP is incorporated in Barbados according to terms and structures outlined in MOU</b>	Financing is available for the project, terms are agreeable to all parties	Legally recognized company is incorporated in Barbados and all organizational documents are developed and signed by stakeholders	Completed output	Fisheries Division, BARNUFO, Exporters	Fishery developer	6 weeks
A14a	<b>Undertake a market study to explore export opportunities and potential barriers for products from the Barbados large pelagic longline fishery in markets with preferential access, whether through the GSP (e.g. Canada and Switzerland) or through Preferential or Free Trade Agreements (e.g. GSTP, European Union-CARIFORUM EPA)</b>	Terms are agreeable to all parties and financing is available	Identification of new markets and new market access pathways	Completed output	Fisheries Division, BARNUFO, processors, exporters	Fishery developer	6 weeks
A15	<b>Food safety, sustainability and traceability training is conducted</b>	Financing is available for the project	Plant staff recognizes the fundamental functions of food safety, traceability and lean manufacturing processes for tuna facilities	completed output	Exporters, processors and plant management	New PPP	1 week
A16	<b>Capacity training is conducted with Fisheries Division to enhance understanding of MCS systems, ICCAT regulations and ICCAT politics</b>	Financial support is available for capacity training	Fisheries Division has the capacity for and understanding of MSC systems and ICCAT regulations; ministers have gained a level of comfort to properly engage in ICCAT meetings	Completed output	Fisheries Division and BARNUFO	FAO/fishery developer	2 weeks
A17	<b>Contracting firms are engaged in support of the project work plan in the project proposal</b>	Financing is available and deployed to the project	Scope of work defined with contractor	Completed output	Exporters, processors and plant management	Exporters/new PPP	4 weeks
A18	<b>Processing and technology equipment is ordered and received</b>	Financing is available and deployed to the project	All equipment is paid for and imported into Barbados	Completed output	Exporters, processors and plant management	Fishery developer	8 weeks
A19	<b>Circle hook trials conducted to test by-catch and product quality from gear changes</b>	Vessels participate in trials	Reports defining catch composition differential between circle hooks and gear currently used in large pelagic longline fishery	Completed output	Vessels, BARNUFO	Fishery developer	8 weeks
A20	<b>Technology installation in Fisheries Division and at points of landing</b>	All equipment is paid for and imported into Barbados	Centralized database is installed in Fisheries Division, data collection hardware and applications are installed in landing facilities; vessel tracking and vessel registration processes are mimicked and installed on test hardware	Completed output	Fisheries Division, exporters and plant management	Fishery developer/new PPP	16 weeks
A21	<b>Contracting firms complete construction of loining facility</b>	Financing is available and deployed to the project	Plant is ready for processing tuna loins	Completed output	Fisheries Division, exporters, processors and plant management	Fishery developer/ exporters	16 weeks

Action(s)	Assumption(s)	Output(s) / deliverable(s)	Measured by	Consulted/ informed agencies	Responsible, accountable agencies	Duration	
A22	<b>Technology installation is completed in loining facility</b>	Financing is available and deployed to the project	Plant is ready for order processing	Completed output	Exporters, processors and plant management	New PPP	4 weeks
A23	<b>Food safety plans are developed and HACCP plan is in place according to “ready to eat” standards</b>	Financing is available and deployed to the project; food safety training is complete	Food safety documentation is in place	Completed output	Exporters, processors and plant management	Fishery developer	4 weeks
A24	<b>Employee handbooks are developed and social policy standards are met</b>	Willingness to participate in social policy discussions from all stakeholders	Social auditing documentation is in place	Completed output	Exporters, processors and plant management	Exporters/new PPP	4 weeks
A25	<b>Food safety and social audits are scheduled</b>	Financing is available and deployed to the project; food safety documentation is complete	Audits are scheduled	Completed output	Exporters, processors and plant management	Exporters/new PPP	4 weeks
A26	<b>Hire new staff in compliance with employee hiring guidelines and train them to properly operate loining facility</b>	Financing is available and deployed to the project	Staff is in place for loining facility	Completed output	Exporters, processors and plant management	Exporters/new PPP	6 weeks
A27	<b>Register all active vessels in large pelagic longline fleet with government database and create unique identifier codes for each vessel</b>	Successful technology installation is complete in Fisheries Division and at points of landing	All vessels in Barbados large pelagic longline fleet are registered with Fisheries Division	Completed output	Vessels, BARNUFO, Fisheries Division	New PPP	4 weeks
A28	<b>Implement new fisheries management legislation</b>	Acceptance of draft legislation by lawmakers	New legislation is passed	Completed output	MMABE	MMABE	16 weeks
A29	<b>Integrate incentive models into data collection systems based on revised vessel registry</b>	Successful technology installation is completed in loining facility	All vessels in Barbados large pelagic longline fleet are registered with supply chain software	Completed output	Vessels, exporters and plant management	New PPP	2 weeks
A30	<b>Integrate tax models into IT software</b>	Successful technology installation is complete in Fisheries Division and at points of landing	Landings taxes are assessed from landings data	Completed output	Fisheries Division, exporters and plant management	New PPP	2 weeks
A31	<b>Marketing plan is developed and clients are encouraged to participate in promotional campaigns through market makers</b>	Customers willing to participate	Marketing materials are developed and disseminated to customer base	Completed output	BARNUFO, exporters, processors and plant management	BARNUFO	4 weeks
A32	<b>Begin shipments to market maker and end users</b>	Supply chains are aligned and all other actions are complete	90 per cent of tuna products are sold through new supply chains in first year	Begin net positive cash flows	All stakeholders	Exporters/new PPP	Begin date
A33	<b>Regular PPP management meetings will be conducted weekly upon implementation and will continue through first year of operation</b>	Shipments are successful	Meeting minutes will be shared with stakeholders	Completed output	All stakeholders	New PPP	Begin date
A34	<b>Bi-Annual FPI assessment is conducted to track project progress</b>	PPP is operating successfully	FPI report is shared with stakeholders and project financiers	Completed output	Independent FPI assessor, all stakeholders	New PPP	4 weeks
A35	<b>Progress that achieves forgiveness metrics rolls equity allocations back to stakeholders at agreed rate</b>	PPP is operating successfully and achieving pre-defined impact metrics	FPI report is shared with project financiers	Completed output	Independent FPI assessor, financiers, all stakeholders	Fishery developer/new PPP	2 weeks



Action(s)		Assumption(s)	Output(s) / deliverable(s)	Measured by	Consulted/ informed agencies	Responsible, accountable agencies	Duration
A36	<b>After loan and equity hold term is complete, stakeholders regain full industry ownership</b>	PPP is operating successfully and achieving all pre-defined impact metrics	Final and project FPI report is shared with project financiers and stakeholders	Completed output	Independent FPI assessor, financiers, all stakeholders	Fishery developer/new PPP	6–8 years

Source: Author's implementation analysis.

## 5.4 Estimated costs

Table 10 takes the summarized costs from Table 6 and expands those estimates for individual actions. The table is also organized by implementation phase; structure, implementation and maintenance. It includes a completion timeline and the type of financing that should be sought for the action, i.e. a grant, loan or investment. The report does not propose to allocate any funds, public or otherwise, to increase capacity, directly subsidize exports or build new vessels. To the contrary, actions are planned to manage harvests and capacity within the context of Barbados' policies and ICCAT guidance and commitments. Overall, the implementation plan would require \$480,000 in grants, \$245,000 in loans and \$495,000 in investments for an implementation plan total of \$1.2 million. Some of these costs are only estimates at this stage, and will need to be re-examined through the structuring phase and as the implementation actions proceed.



Table 10. Estimated costs

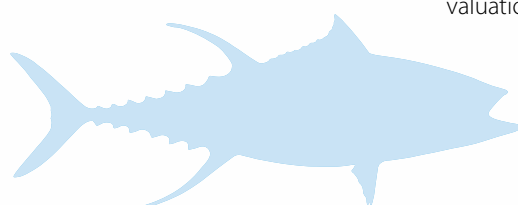
Stage	Action(s)	Output(s)/deliverable(s)	Durat0ion	Financing type	Cost estimates	
<b>Structure</b>	A1	Host roundtable meeting with stakeholders to discuss results of OETS report	Stakeholders buy in to work plan	1 week	Grant	\$5,000
	A2	Discuss and define structure of traceability architecture, investments & PPPs with government, funding agencies, financiers and stakeholders	Outline of investment structures and financing options are agreeable to all parties	6 weeks	Grant	\$15,000
	A3	IT architecture is developed and shared with government	Government is informed of eCDT and role of technology in data collection and MCS	1 week	Grant	\$5,000
	A4	Project proposal is shared with government, stakeholders, funding agencies and financiers	Outline of investment structures and financing options are agreeable to all parties	6 weeks	Grant	\$15,000
	A5	MOUs are signed by commercial stakeholders involved in moving the project forward	Terms are agreeable to all parties	4 weeks	Grant	\$10,000
	A6	MOU is signed by government	Terms are agreeable to all parties	12 weeks	Grant	\$10,000
	A7	Fisheries legislation is revised to include hard TACs and limited entry	Stakeholders in agreement with policy changes	8 weeks	Grant	\$10,000
	A8	Detailed plans for investments are defined, including physical infrastructure, traceability deployment costs, and tax models	Financing is available for the project	4 weeks	Grant	\$25,000
	A9	MSC pre-assessment of Barbados large pelagic longline fishery is conducted	Funding is available for MSC pre-assessment	6 weeks	Grant	\$35,000
	A10	Familiarization of MSC pre-assessment	Funding is available for MSC pre-assessment	1 week	Grant	\$15,000
	A11	International tuna buyers are introduced to products from Barbados and purchasing contracts are secured with market makers	Terms are agreeable to all parties	6 weeks	Grant	\$5,000
	A12	Financing for PPP is drafted	Terms are agreeable to all parties	6 weeks	Grant	\$5,000
	A13	Impact metrics and loan terms are agreed upon and drafted in operational agreement of PPP	Terms are agreeable to all parties	2 weeks	Grant	\$10,000
	A14	PPP is incorporated in Barbados according to terms and structures outlined in MOU	Financing is available for the project; terms are agreeable to all parties	6 weeks	Loan	\$25,000
A14a	Undertake a market study to explore export opportunities and potential barriers for products from the Barbados large pelagic longline fishery in markets with preferential access, whether through the GSP (e.g. Canada and Switzerland) or through preferential or free trade agreements (e.g. European Union–CARIFORUM EPA).	Identification of new markets and new market access pathways	6 weeks	Loan	\$50,000	
<b>Implement</b>	A15	Food safety, sustainability and traceability training is conducted	Financing is available for the project	1 week	Grant	\$20,000
	A16	Capacity training is conducted with MMABE to enhance understanding of MCS systems, ICCAT regulations and ICCAT politics	Financial support is available for capacity training	2 weeks	Grant	\$50,000
	A17	Contracting firms are engaged for work to be completed in support of the project work plan, as outlined in the project proposal	Financing is available and deployed to the project	4 weeks	Investment	\$5,000
	A18	Processing and technology equipment is ordered and received	Financing is available and deployed to the project	8 weeks	Loan	\$100,000

Stage	Action(s)	Output(s)/deliverable(s)	Durat0ion	Financing type	Cost estimates	
	A19	Circle hook trials conducted to test by-catch and product quality from gear changes	Vessels participate in trials	8 weeks	Grant	\$75,000
	A20	Technology installation at Fisheries Division and at points of landing	All equipment is paid for and imported into Barbados	16 weeks	Grant	\$150,000
	A21	Contracting firms complete construction of loining facility	Financing is available and deployed to the project	16 weeks	Investment	\$250,000
	A22	Technology installation is complete in loining facility	Financing is available and deployed to the project	4 weeks	Investment	\$75,000
	A23	Food safety plans are developed and HACCP plan is in place according to ready-to-eat standards	Financing is available and deployed to the project, food safety training is complete	4 weeks	Loan	\$25,000
	A24	Employee handbooks are developed and social policy standards are met	Willingness to participate in social policy discussions from all stakeholders	4 weeks	Loan	\$5,000
	A25	Food safety and social audits are scheduled	Financing is available and deployed to the project; food safety documentation is complete	4 weeks	Investment	\$125,000
	A26	Hire new new staff in compliance with employee hiring guidelines and train them to properly operate the loining facility	Financing is available and deployed to the project	6 weeks	Investment	\$5,000
	A27	Register all active vessels in large pelagic longline fleet with government database and create unique identifier codes for each vessel	Successful technology installation is complete in the Fisheries Division and at points of landing	4 weeks	Loan	\$15,000
	A28	Implement new fisheries management legislation	Acceptance of draft legislation by lawmakers	16 weeks	Grant	\$–
	A29	Integrate incentive models into data collection systems based on revised vessel registry	Successful technology installation is completed in loining facility	2 weeks	Loan	\$15,000
	A30	Integrate tax models into IT software	Successful technology installation is complete in Fisheries Division and at points of landing	2 weeks	Loan	\$10,000
	A31	Marketing plan is developed and clients are encouraged to participate in promotional campaigns through market makers	Customers willing to participate	4 weeks	Investment	\$35,000
	<b>Maintain</b>	A32	Begin shipments to market maker and end users	Supply chains are aligned and all other actions are complete	Begin date	Investment
A33		Weekly PPP management meetings are conducted upon implementation and continue through the first year of operation	Shipments are successful	Begin date	Investment	\$–
A34		Bi-annual FPI assessment are conducted to track project progress	PPP is operating successfully	4 weeks	Grant	\$20,000
A35		Progress that achieves “forgiveness metrics” rolls equity allocations back to stakeholders at an agreed rate	PPP is operating successfully and achieving its pre-defined impact metrics	2 weeks	Loan	\$–
A36		After loan and equity hold term is complete, stakeholders regain full industry ownership	PPP is operating successfully and achieved all pre-defined impact metrics	6–8 years	Loan	\$–
<b>Project totals by capital type</b>						
			<b>Grant</b>	<b>\$480,000</b>		
			<b>Loan</b>	<b>\$245,000</b>		
			<b>Investment</b>	<b>\$495,000</b>		
			<b>Total</b>	<b>\$1,220,000</b>		

Source: Author's budget analysis.

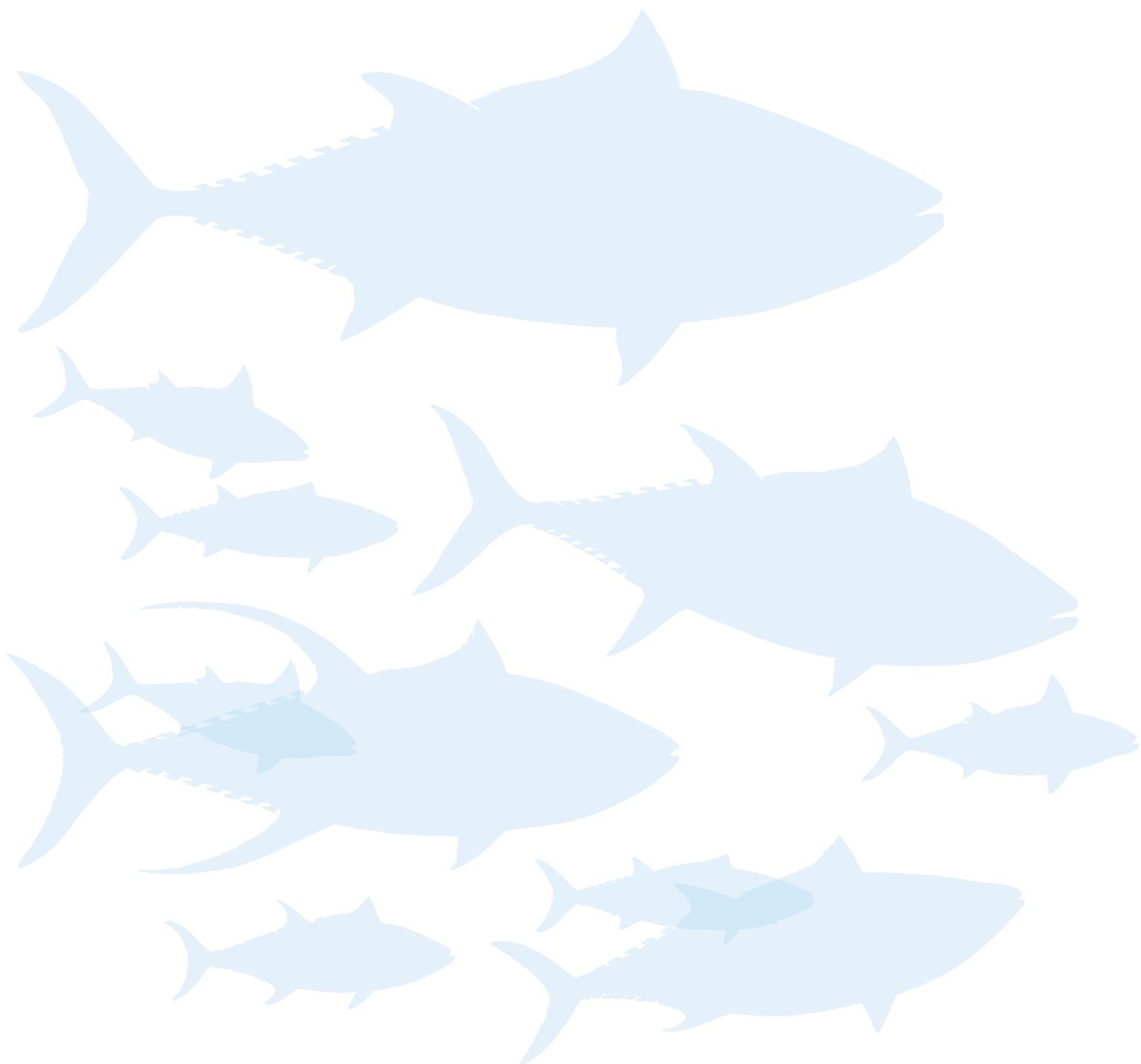
# References

- Anderson JL et al. (2015). The fishery performance indicators: A management tool for triple bottom line outcomes. *PLoS ONE* 10(5): e0122809. Available at <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0122809> (accessed 26 May 2021).
- Anderson JL et al. (2016). Fishery Performance Indicators Manual (Version 1.3). See [https://www.researchgate.net/publication/313903811\\_Fishery\\_Performance\\_Indicators\\_Manual\\_Version\\_13\\_2016](https://www.researchgate.net/publication/313903811_Fishery_Performance_Indicators_Manual_Version_13_2016).
- Anderson J et al. (2018). *Principles for Fisheries Management in Areas Beyond National Jurisdiction – the Essential Role of Incentive Based Approaches*. World Wildlife Fund. Washington, DC. 70pp. Available at [https://c402277.ssl.cf1.rackcdn.com/publications/1219/files/original/08818\\_WWF\\_WB\\_Report\\_GloTT\\_final.pdf?1555943000](https://c402277.ssl.cf1.rackcdn.com/publications/1219/files/original/08818_WWF_WB_Report_GloTT_final.pdf?1555943000) (accessed 18 May 2021).
- Arocha F. (2019). *Comprehensive Study of Strategic Investments Related to Artisanal Fisheries Data Collection in ICCAT Fisheries of the Caribbean/Central American Region: Final Report*. ICCAT Technical Report. SCRS/2018/114. ICCAT. Madrid. Available at [https://www.iccat.int/Documents/CVSP/CV075\\_2018/n\\_8/CV075082319.pdf](https://www.iccat.int/Documents/CVSP/CV075_2018/n_8/CV075082319.pdf) (accessed 18 May 2021).
- Bealey R. (2019). In Press. Draft Opportunities to Promote the Climate Change Resilience of Barbados Fisheries and Value Chains Through Sustainable and Efficient Resource Use.
- Bush SR et al. (2017). Private provision of public information in tuna fisheries. *Marine Policy*, 77: 130–135. Available at <https://www.sciencedirect.com/science/article/abs/pii/S0308597X16303876> (accessed 18 May 2021).
- Caribbean Exports. (2014). *Legal Opinion on the Imposition of the "Octroi de Mer" by the French Caribbean Outermost Regions on Products Originating from CARIFORUM States*. Available at <http://docplayer.fr/16652965-Final-report-caribbean-export.html> (accessed 18 May 2021).
- Doddema M et al. (2018). Fishers responses to private monitoring interventions in an Indonesian tuna handline fishery. *Fisheries Research*, 208: 49–57. Available at <https://research.wur.nl/en/publications/fisher-responses-to-private-monitoring-interventions-in-an-indone> (accessed 19 May 2021).
- FAO. (2020). Fishery and Aquaculture Statistics. Global Capture Production (FishstatJ). See <http://www.fao.org/fishery/statistics/global-capture-production/en> and <http://www.fao.org/fishery/statistics/software/fishstatj/en>.
- Gentner B. (2018). *Innovative and Incentive-Based Tools in Reform of Highly Migratory Fisheries at Project Development and Regional Scales*. World Wildlife Fund, Inc. Washington, DC. 139 pp. Available at [https://c402277.ssl.cf1.rackcdn.com/publications/1220/files/original/08818\\_WWF\\_WB\\_Innovations\\_Local-Reg\\_Final-pxp.pdf?1555943228](https://c402277.ssl.cf1.rackcdn.com/publications/1220/files/original/08818_WWF_WB_Innovations_Local-Reg_Final-pxp.pdf?1555943228) (accessed 19 May 2021).
- Gentner B et al. (2018). *Fishery Performance Indicator Studies for the Commercial and Recreational Pelagic Fleets of the Dominican Republic and Grenada*. FAO Fisheries and Aquaculture Circular No. 1162. FAO, Rome. Available at <http://www.fao.org/3/I8833EN/I8833en.pdf> (accessed 19 May 2021).
- ICCAT (International Commission for the Conservation of Atlantic Tunas). (2021). Access to ICCAT Statistical Databases. Available at <https://www.iccat.int/en/accesingdb.html> (accessed 19 May 2021).
- ICCAT. (2018). *Tropical Tuna Fishery Development/Management or Fishing/Management Plans*. Doc. No. PA1-501/2018. ICCAT, Madrid.
- ITC (International Trade Centre). (2020). Trade statistics for international business development (Trade map database). See <https://www.trademap.org/Index.aspx>.
- ITC. (2016). *Navigating Non-Tariff Measures: Insights from a Business Survey in the European Union*. Available at <https://www.intracen.org/publication/EUNTMsurvey/> (accessed 19 May 2021).
- Luxe Gourmets. (2021). Sushi Grade Tuna: The Grading System. Available at <https://www.luxegourmets.com/chefs-column/tuna-grading-system> (accessed 19 May 2021).
- Mahon R et al. (2007). *The Value of Barbados' Fisheries: A Preliminary Assessment*. Barbados Fisheries Management Plan, Public Information Document 2. 2FMP-PID-2. Available at [https://www.cavehill.uwi.edu/cermes/docs/publications/barbados\\_fishery\\_valuation\\_2007\\_08\\_31.aspx](https://www.cavehill.uwi.edu/cermes/docs/publications/barbados_fishery_valuation_2007_08_31.aspx) (accessed 19 May 2021).



- McConney P, Mahon R and Oxenford H. (2003). *Barbados Case Study: The Fisheries Advisory Committee*. Report for the Caribbean Conservation Association. 78 pp. Available at <https://www.cavehill.uwi.edu//cermes/docs/publications/barbadosfaccasestudy.aspx> (accessed 19 May 2021).
- Rodrigues T and Amorim AF. (2016). Review and analysis of mercury levels in blue marlin (*Makaira nigricans*, Lacepede 1802) and swordfish (*Xiphias gladius*, Linnaeus 1758). *bioRxiv*, 043893. Available at <https://www.biorxiv.org/content/10.1101/043893v1> (accessed 19 May 2021).
- Schuhmann PW et al. (2010). *Landings, Costs, Net Profit and Return on Investment in Two Contrasting Fisheries. Part 1: The longline fishery*. Second Project Report on the Economic Valuation of the Fisheries of Barbados. Prepared for the Fisheries Division, Ministry of Agriculture, Barbados. Available at [https://www.cavehill.uwi.edu/cermes/getdoc/584e4a57-65d5-4f94-84e4-81b6c3f4d560/schuhmann\\_et\\_al\\_2010\\_economic\\_valuation\\_of\\_barbado.aspx](https://www.cavehill.uwi.edu/cermes/getdoc/584e4a57-65d5-4f94-84e4-81b6c3f4d560/schuhmann_et_al_2010_economic_valuation_of_barbado.aspx) (accessed 19 May 2021).
- UNCTAD (United Nations Conference on Trade and Development). (2018). *Generalized System of Preferences: List of Beneficiaries*. United Nations Publication. No. UNCTAD/ITCD/TSB/Misc.62/Rev.7. New York and Geneva. Available at [https://unctad.org/en/PublicationsLibrary/itcdtsbmisc62rev7\\_en.pdf](https://unctad.org/en/PublicationsLibrary/itcdtsbmisc62rev7_en.pdf) (accessed 19 May 2021).
- UNCTAD and DOALOS. (2019a). *Sustainable Marine Fisheries and Seafood Processing Fact Sheet. Barbados*. Evidenced-Based and Policy-Coherent Oceans Economy and Trade Strategies Project. UNCTAD and DOALOS, Geneva and New York, United States of America. Available at [https://unctad.org/system/files/official-document/Fisheries\\_Seafood\\_Feb21\\_DRAFT.pdf](https://unctad.org/system/files/official-document/Fisheries_Seafood_Feb21_DRAFT.pdf) (accessed 26 May 2021).
- UNCTAD and DOALOS. (2019b). *Barbados Mission Report. Barbados*. Evidenced-Based and Policy-Coherent Oceans Economy and Trade Strategies Project. National Stakeholder Workshops. Sector Assessment and Selection in Barbados. UNCTAD and DOALOS, Geneva and New York, United States of America. Available on request.
- UNCTAD and DOALOS. (2019c). *The Legal and Institutional Framework Governing Ocean-Based Economic Sectors in Barbados*. Evidenced-Based and Policy-Coherent Oceans Economy and Trade Strategies Project. Available at [https://unctad.org/system/files/official-document/ditctedinf2019d14\\_en.pdf](https://unctad.org/system/files/official-document/ditctedinf2019d14_en.pdf) (accessed 19 May 2021).
- UNCTAD and DOALOS. (2020). *Economic and Trade Aspects of Fisheries and Coastal and Marine Environmental services Sectors in Barbados*. Evidenced-Based and Policy-Coherent Oceans Economy and Trade Strategies Project. Available at [https://unctad.org/system/files/official-document/ditctedinf2020d1\\_en.pdf](https://unctad.org/system/files/official-document/ditctedinf2020d1_en.pdf) (accessed 19 May 2021).
- USAID (United States Agency for International Development). (2017). *Fisheries Catch Documentation and Traceability in Southeast Asia: Technical Concept and Specifications*. The USAID Oceans and Fisheries Partnership. Available at [https://www.seafdec-oceanspartnership.org/wp-content/uploads/USAID-Oceans\\_CDT-201\\_Technical-Overview-and-Specifications\\_December-2017.pdf](https://www.seafdec-oceanspartnership.org/wp-content/uploads/USAID-Oceans_CDT-201_Technical-Overview-and-Specifications_December-2017.pdf) (accessed 19 May 2021).
- USAID. (2019). *The Value of Traceability for Business Impacts and Lessons Learned*. The USAID Oceans and Fisheries Partnership. Available at [https://www.seafdec-oceanspartnership.org/wp-content/uploads/2019.04.11\\_USAID-Oceans\\_Impact-Series\\_Nutrindo\\_v3.docx.pdf](https://www.seafdec-oceanspartnership.org/wp-content/uploads/2019.04.11_USAID-Oceans_Impact-Series_Nutrindo_v3.docx.pdf) (accessed 19 May 2021).
- Walcott J, Oxenford HA and Schuhmann P. (2009). *Current Status of the Longline Fishery in Barbados*. Proceedings of the 61<sup>st</sup> Gulf and Caribbean Fisheries Institute, 10–14 November, 2008, Gosier, Guadeloupe, French West Indies. Available at [https://www.researchgate.net/publication/266476288\\_Current\\_Status\\_of\\_the\\_Longline\\_fishery\\_in\\_Barbados](https://www.researchgate.net/publication/266476288_Current_Status_of_the_Longline_fishery_in_Barbados) (accessed 19 May 2021).
- Willoughby S and Cecil RG. (2001). Evolution of the Fisheries Fleet in Barbados: Causes and Implications. In *Proceedings of the Gulf and Caribbean Fisheries Institute*, 52: 271–284.

# Appendices



# Appendix A: Fishery performance indicators for development methodology

Fishery performance indicators, the Fishery performance indicators for development (FPI-DEV) process and sustainable economic growth

FPIs were conceived to address the lack of data in the fisheries world and the recognition that in order for development or conservation projects in fisheries to succeed, measurable outcomes, or key performance indicators, are needed. To address a general lack of standardized, precise data, FPIs were developed to measure the current state of ecological, economic, stock, governance and community dimensions. The focus of indicator development was to evaluate the effectiveness of management systems in aligning ecosystem health and human well-being. Effective management requires legal and institutional frameworks, ecosystem sustainability, social acceptability and supports livelihoods through resource rents or profits.

The commercial instrument was developed by James Anderson, Chris Anderson, Jingjie Chu and Jennifer Meredith. The development of the tool was funded by ALLFISH, a PPP created by the seafood industry, the World Bank, FAO and the GEF. The commercial FPI manual<sup>52</sup> contains great detail on the development of the tool, as does a *PLOS One*<sup>53</sup> journal article (Anderson et al., 2015; Anderson et al., 2016). The indicators included in the tool fall into two categories: output and input factors. After the success of the commercial instrument, a recreational fishery assessment tool was also developed.

The commercial FPIs have been implemented over 150 times across the globe and recently in the Dominican Republic and Grenada for similar fisheries (Gentner et al., 2018).<sup>54</sup> The range of fisheries that have been surveyed is extensive and includes many large pelagic fisheries using longline gear. Therefore, the suitability of the FPIs for this project has been well tested. One of the developers, Chris Anderson, was a technical adviser on the Caribbean Billfish Project (CBP). He ensured that the commercial protocols were followed for the Grenada and Dominican Republic large pelagic fishery FPIs (Gentner et al., 2018) and provided data continuity for the larger FPI mission around the globe.

The **output factors**<sup>55</sup> are a set of indicators that measure whether the fishery is delivering economically viable and socio-ecologically sustainable results. The World Bank has a focus on triple bottom line outcomes and the output factors correspond to environmental, economic or community well-being. They correspond to the stock, or to the fisher or post-harvest sector on the commercial side, and also examine other important areas in global fisheries like gender, equity, risk/volatility and climate change.

The **input factors**<sup>56</sup> or enabling conditions, contribute to the process of incentivizing socio-ecologically sustainable use of fish resources. These are the indicators that drive or support success.

<sup>52</sup> [http://isfs.institute.ifas.ufl.edu/media/isfsinstituteifasufledu/FPI\\_Manual\\_V1.4.pdf](http://isfs.institute.ifas.ufl.edu/media/isfsinstituteifasufledu/FPI_Manual_V1.4.pdf).

<sup>53</sup> <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0122809>.

<sup>54</sup> <https://www.fpilab.org/world-embed/>.

<sup>55</sup> Page 2 of the FPI User's Manual: Fishery Performance Indicators Version 1.4, p.2.

<sup>56</sup> Page 3 of the FPI User's Manual: Fishery Performance Indicators Version 1.4, p.3.

By linking the outputs to enabling factors, it is possible to link the weak areas in outputs to the supporting factors that are faltering. By knowing where to invest, changing outcomes is more efficient.

FPIs are fishery focused. That is, they focus on the fishery rather than the port or the fisher or the species. A fishery is the combination of species, gear type and vessel size class (or technology level). In this case, the fishery is the large pelagic longline fishery in Barbados. The FPIs are not a typical survey instrument because interviewees are not asked to fill out a questionnaire. Instead, only one score sheet is filled out for the entire Barbados large pelagic longline fishery, using insights from all interviewed stakeholders.

This effort does not require a random sample or large sample sizes. Instead, the project consists of an expert scoring exercise. Our panel of experts, Keith Flett and Brad Gentner, met with as many individuals or groups as possible during its time in Barbados, aiming for key informants in the fishery. The expert panel then scored a single spreadsheet for the fishery, collaborating on the scores for each metric. Many metrics can be scored directly if quantitative data are available for the fishery. Generally, the best, most cost-effective approach is to use a local facilitator. The facilitator can be a local ministry official who supports the assessment or development effort. In this case, the local facilitator was a FAO staff member, Roy Bealey, who is familiar with the CBP and the FPI methodology. The local facilitator generated the itinerary for the visit by the panel of experts.

When dealing with data-poor fishery sectors, much of the process involves collecting data and then verifying them. Collecting data involves balancing expediency with costs. Often, particularly in this case, achieving data goals on short timelines with modest budgets means seeking out synergies. The data collection in this case was no different, relying on existing data, formal primary data collection, informal data collection and other secondary methods.

Appendix B contains the output and input scoring tables that describe each metric and the logic behind metric scoring. The spreadsheet tools include scoring guidance, data entry tables for landings if available, formulas and chart creation worksheets. They are self-contained to provide all the outputs needed and, beyond the scoring, only require a brief compilation of regional history and fishery background to complete.

While the focus of the FPI developers was rapid assessment of sustainable development benchmarks that were comparable across projects, 1Skip Fishery Development Company has invested in the expansion of the FPIs into the FPI-DEV tool, which responds to the rest of the requirements in the OETS report format. Our use of the tool in this format provides many synergies with the project developer. Used holistically (with fishery development as a goal) and synergistically, the FPI-DEV methodology provides:

1. FPI sustainability benchmarks;
2. Initial stakeholder engagement;
3. Supply chain mapping;
4. Cash flow model development;
5. Initial development project financial evaluation; and
6. Development scenario creation.

Leveraging the FPIs to develop a baseline across a broad set of input and output factors and collect basic fishery data helps to identify where inefficiencies, and therefore opportunities, lie within the local context. This, in turn, helps to generate insights and findings for developing a project across the entire industry and economy, instead of focusing only on a single supply chain or community. The remainder of this section will map FPI scores to the five UNCTAD Oceans Economy pillars that include sustainable economic development, sustainable use and conservation of marine resources, inclusive social development, increased scientific knowledge, and oceans and trade governance.

## Cash flow analysis

Cash flows for the fisher/boat owner were not modeled for two reasons. First, up to date cost and earnings data are not available for this fishery. There is a cost and earning profile in Schuhmann et al. (2010) based on data from a survey conducted in 2007 and 2008. That data could be used to model fleet cash flows if necessary, but the fishery also lacks price data. Second, there are no implementation interventions that impact fleet costs, only revenues. As such, modeling the total increased value at the export level fully describes the benefit of the implementation plan. However, it will be up to the implementation team and local stakeholders to determine the business structure that will be used for implementation, and to direct how the benefits should flow to the stakeholders.

If the stakeholders wish to model regulations or interventions that impact costs, such as harvest reductions or changes in vessel technology, additional data on vessel costs and earnings would be required.

Because this is a consignment fishery, the exporter provides boxing services and logistical support for a fee. As such, all increases in revenues pass directly back to the fisher. This cash flow model combines the fisher and exporter function into a single cash flow model. Equations 1 to 4 below detail the typical firm-level cash flow model. The equations were calculated using current data and then calculated again with projected data based on shifting the export product to raw, ready-to-eat loins. In this case, it is assumed that the only costs that are changing are the processing costs, while the revenues increase based on increased quality and changes in product form. Total revenue for each fisher is given in equation 1.

Trip cash flows and total annual flow for the fleet are:

1.  $TR_i = \sum_{j=1}^n p_j Q_j$
2.  $TC_i = \sum_{k=1}^n C_k$
3.  $\pi_i = TR_i - TC_i$
4.  $\Pi_h = \sum_{i=1}^m \pi_i$

The subscript  $h$  represents the combined harvest/export sector,  $i$  indexes the trip,  $i = 1$  to  $m$  for the analysis period,  $j$  indexes species over  $n$  species and  $k$  indexes cost categories over  $n$  cost categories. For the export link,  $TR_h$  is the sum of the pounds of fish  $j$  times the price of fish  $j$  for all  $j$  fish caught on the trip (1). Because price data are not available for Barbados, prices in this case are based on two settlement tickets and experience with similar prices. Future prices are likewise based on experience in similar fisheries that have switched to raw, ready to eat loins under a FIP.

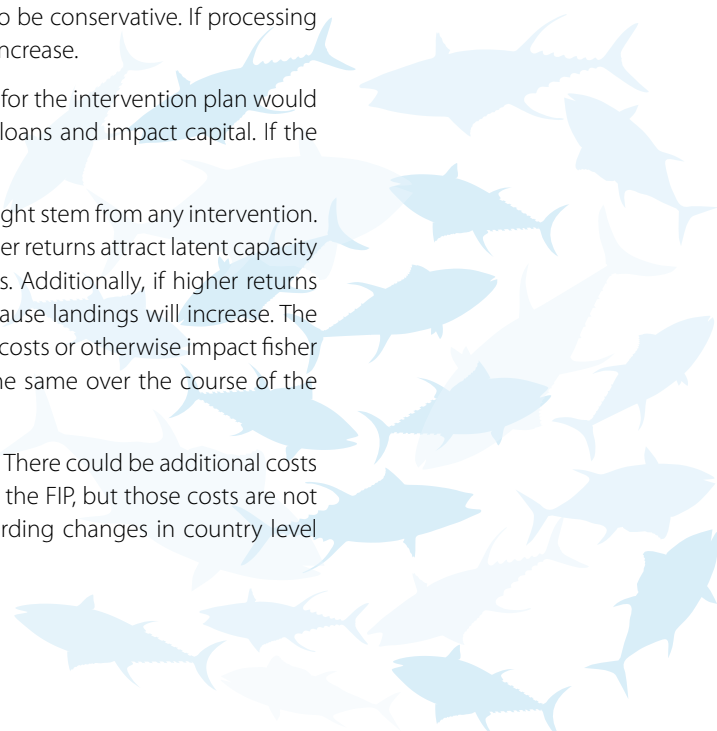
For costs (2), only the change in costs for moving to loining are included in the comparison because it is assumed that nothing in the implementation plan will change fisher or exporter production costs, besides the new loining step. Because this fishery operates currently on consignment, any additional benefit is assumed to pass directly back to the fisher. Therefore, the combined sector's cost,  $TC_h$ , is the sum of all costs associated with exporting before the switch to loining and after the switch to loining. It includes items such as all the variable costs of loining such as loining labour, vacuum bags, gel packs, boxes, etc.

Cash flow,  $\pi_i$  (3) is the cash flow for each vessel on a per trip basis and  $\Pi_h$  (4) is the total fishery cash flow across all trips for the entire fleet. Currently, only aggregate landings data are available, so all calculations were made in the aggregate at the annual level using three-year average landings (2015 to 2017, ICCAT data). All calculations are conducted in a spreadsheet model of the fishery that allows changes in processing costs, changes in export percentages, changes in landings and changes in all prices (past prices and future prices). If trip level data were available, such as individual settlement tickets, this analysis could be extended to the individual trip and aggregated by fisher.



## Assumptions

1. All assumptions are based on producing conservative, or lower bound, estimates if possible. In this case, because current pricing and grading data were extremely limited, it is impossible to tell if the price assumptions are optimistic or conservative. This assumption was mostly a factor in taking the lowest possible calculated percentage of tuna landings that are exported. From the data received, that percentage was approximately 50 per cent. The exporter and many of the fishers stated this percentage was closer to 75 or 80 per cent. If the proportion of the catch that is exported is higher than the assumed percentage, positive returns will be higher, perhaps considerably higher. Likewise for prices and grades. If prices are worse, on average, than the limited pricing data received and utilized in the analysis, then cash flow will be higher and vice versa. For this analysis, prices come from limited price information collected during the off-season when prices tend to be higher than average. If the prices in the model are indeed above average, actual returns will be lower than forecast. Also, if grades are higher in practice than has been assumed, then returns will likewise be greater.
2. All projections are based on ICCAT reported landings using a three-year average. The report above describes concerns with data reporting. If the fishery is currently underreporting landings, the actual benefits from the interventions described will be higher than projected and vice versa. It is unlikely that landings are being underreported, but it is recommended that improved data on landings that includes price information are collected.
3. The proportion of tuna that meet export grades was assumed to be approximately 50 per cent. This proportion comes from the limited export data that were available. The cash flow analysis assumes that this proportion increases over the life of the project by 15 per cent to 67.5 per cent. This increase doesn't represent an increase in landings but an increase in the quality of landings due to improved handling and/or removing grading risk through loining. Anecdotally, the exporter says the proportion is already close to 80 per cent, so this secondary assumption may be moot. In any case, the estimated cash flows are likely lower bound estimates.
4. The model removes a \$0.045 landings tax and replaces it with a \$0.045 export tax on loins.
5. The grade proportions were taken from a single settlement sheet. That sheet showed 63 per cent grade 1, which is a very high proportion for the region. If the actual proportion of grade 1 fish is lower than this value on average, then the actual returns will be lower than projected.
6. Processing for loins was assumed to cost \$2.80/pound, inclusive of all inputs including labour, vacuum packing, boxing, vacuum bags, boxes, gel packs, etc. This is about 30 per cent higher than actual, real world loining costs in other supply chains. The buffer was added because of the uncertainty around the new process and in an effort to be conservative. If processing costs are more in line with other facilities, overall returns will increase.
7. It was assumed the average interest rate for all debt taken on for the intervention plan would be 9 per cent. This is based on blending grants, no interest loans and impact capital. If the actual blended interest rate is lower, returns will be higher.
8. Scenarios do not account for any behavioural changes that might stem from any intervention. That is to say, no behavioural modeling was conducted. If higher returns attract latent capacity to enter the fishery, revenues will go up, but so will landings. Additionally, if higher returns induce boats to take more trips, revenues will be higher because landings will increase. The FIP may also lead to changes in regulations that may increase costs or otherwise impact fisher behaviour. These estimates assume behaviour will remain the same over the course of the projections.
9. There are no assumptions made regarding any stock changes. There could be additional costs in MCS and enforcement in order to meet items identified in the FIP, but those costs are not considered here. Additionally, there are no assumption regarding changes in country level TACs from ICCAT.



# Appendix B:

## Output and input scoring tables

Table 11. Fishery performance indicator output metrics

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
Stock performance	Ecologically sustainable fisheries	Ecology	Percentage of stocks overfished	<ul style="list-style-type: none"> <li>5: None overfished</li> <li>4: 1–25 per cent of stocks overfished</li> <li>3: 26–50 per cent overfished</li> <li>2: 51–75 per cent overfished</li> <li>1: 76–100 per cent overfished</li> </ul>	Percentage of commercial stocks within the management authority's jurisdiction that are considered to be overfished, to be experiencing overfishing, or whose stock status is generally unknown. (Degree of overfishing and current trend are the next questions.) Single stock fisheries will be scored 1 or 5.
		Ecology	Degree of overfishing – stock status	<ul style="list-style-type: none"> <li>5: Stock is not overfished or is rebuilt; <math>B/BMSY \geq 1</math></li> <li>4: Stock is mildly overfished; <math>0.75 \leq B/BMSY &lt; 1</math></li> <li>3: Stock is moderately overfished; <math>0.5 \leq B/BMSY &lt; 0.75</math></li> <li>2: Stock is seriously overfished; <math>0.25 \leq B/BMSY &lt; 0.5</math></li> <li>1: Stock is severely overfished and in danger of collapse; <math>0.25 &gt; B/BMSY</math></li> </ul>	Current status of stock. For multispecies fisheries do a value-weighted average of the top three stocks. Two alternative scoring systems are offered. The first is for fisheries for which stock levels are not known with any precision. The second is for fisheries where scientific stock assessments are being conducted and measures of B (biomass level) and BMSY (biomass level required to obtain maximum sustainable yield) are available.
		Ecology	Stock declining, stable or rebuilding – stock dynamics	<p><b>Add or subtract from previous metric according to:</b></p> <ul style="list-style-type: none"> <li>+2: Stock is rapidly rebuilding</li> <li>+1: Stock is rebuilding</li> <li>+0: Stock is stable</li> <li>-1: Stock is declining</li> <li>-2: Stock is rapidly declining</li> </ul>	Extent to which current effort levels affect stock status. For multispecies fisheries do a value-weighted average of the top three stocks. This measure is scored by taking the fishery's score in the previous question and then adding or subtracting points depending on whether the fishery is rebuilding or declining. The maximum score for this measure is 5 and the minimum score is 1. If the fishery scored 5 in the previous question then the score here is automatically 5. If the fishery scored less than 5 in the previous measure, then take the fishery's score from the previous measure and add or subtract as noted.
		Ecology	Regulatory mortality	<ul style="list-style-type: none"> <li>5: No regulatory mortality of the target species;</li> <li>4: Regulatory mortality is less than 5 per cent of total catch</li> <li>3: 5–25 per cent</li> <li>2: 25–50 per cent</li> <li>1: For every 100 lbs of fish caught, more than 50 lbs are discarded</li> </ul>	Ratio of estimated regulatory mortality to actual landings of the target species. Regulatory mortality is defined as fish loss that is induced by regulation, such as size restrictions.
		Ecology	Selectivity	<ul style="list-style-type: none"> <li>5: There is virtually no non-target catch</li> <li>4: Less than 5 per cent of catch is of non-target species</li> <li>3: 5–25 per cent</li> <li>2: 25–50 per cent</li> <li>1: For every 100 lbs of fish caught, more than 50 lbs are non-target species</li> </ul>	Percentage of total catch that is made up of non-target species. Note that non-target species are distinct from multispecies fisheries in that the catch of non-target species does not increase the value of fishing, or imposes costs on the target fishery.
		Ecology	IUU landings	<ul style="list-style-type: none"> <li>5: There is virtually no IUU catch</li> <li>4: Less than 5 per cent of catch is IUU</li> <li>3: 5–25 per cent</li> <li>2: 25–50 per cent</li> <li>1: For every 100 lbs of fish caught, more than 50 lbs are IUU</li> </ul>	Proportion of landings from the managed stock using illegal gear, area, methods, etc., or that goes unreported or falls outside of the regulatory structure. See manual for how to deal with incursion from the recreational sector.

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation		
		Ecology	Status of critical habitat	<ul style="list-style-type: none"> <li>5: Critical habitat is healthy and not threatened</li> <li>4: Less than 25 per cent is degraded or dysfunctional</li> <li>3: 25–75 per cent is degraded or dysfunctional</li> <li>2: More than 75 per cent of critical habitat is destroyed</li> <li>1: Nearly all critical habitat is damaged or dysfunctional</li> </ul>	Portion of critical habitat that is damaged or dysfunctional. Critical habitat is defined as that playing a significant role in the life cycle of the fish. Portion damaged is based on area, and from all sources of damage including fishing damage, pollution and development.		
		Ecology	Proportion of harvest with a third party certification	<ul style="list-style-type: none"> <li>5: 76–100 per cent of landings are certified</li> <li>4: 51–75 per cent of landings are certified</li> <li>3: 26–50 per cent of landings are certified</li> <li>2: 1–25 per cent of landings are certified</li> <li>1: No landings have third party certification</li> </ul>	The proportion of harvest (quantity) harvested under one of the recognized third party programmes that certify ecological sustainability, such as the MSC certification. See manual for how to deal with other certification or fishery improvement programmes.		
		Harvest sector performance	Harvest performance	Economics	Landings level	<ul style="list-style-type: none"> <li>5: Harvest is less than MSY (stock is above MSY level) to increase profit</li> <li>4: Harvest is approximately at MSY</li> <li>3: Harvest reduced to promote recovery</li> <li>2: Harvest is constraining stock recovery</li> <li>1: Harvest is causing overfishing (stock is below MSY and declining)</li> </ul>	Average annual harvest over the past three years. Note that this measure refers to MSY but there are many fisheries where a lack of stock assessments and reliable data mean that these estimates are unattainable. In such fisheries, score is based on discerning the goal of management/fishers when deciding how much to land.
		Economics	Excess capacity	<ul style="list-style-type: none"> <li>5: Within 5 per cent of days required; no evidence of excess capacity</li> <li>4: 90–95 per cent</li> <li>3: 75–90 per cent</li> <li>2: 50–75 per cent</li> <li>1: Less than 50 per cent of days required; excess capacity imposes heavy costs in the fishery</li> </ul>	In the absence of a fishery-specific measure of overfishing, use estimated standardized vessel-days required to catch the MSY compared to the number of standardized vessel-days available. Days are considered not to be restricted by trip limits.		
		Economics	Season length	<ul style="list-style-type: none"> <li>5: Virtually no regulatory closures</li> <li>4: 90–99 per cent</li> <li>3: 50–90 per cent</li> <li>2: 10–50 per cent</li> <li>1: Less than 10 per cent</li> </ul>	Ratio of number of days on which fishing occurs to the number of days the species is available in economically feasible quantities. This is primarily a measure of the extent of derby (including short regulatory seasons to limit total effort), not lack of biological availability or closures to prevent within-season growth overfishing.		
		Economics	Harvest safety	<ul style="list-style-type: none"> <li>5: Less than 0.1 deaths per thousand person seasons</li> <li>4: Less than 0.5 deaths</li> <li>3: Less than 1</li> <li>2: Less than 5</li> <li>1: More than 5 deaths per thousand person seasons</li> </ul>	Number of fisher (captain or crew) on-the-job deaths, per thousand person fishing season. We consider there to be one season per year, but do not annualize mortality if the fishing season is less than a year.		

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
Harvest asset performance		Economics	Ratio of asset value to gross earnings	<ul style="list-style-type: none"> <li>5: 10 or higher</li> <li>4: 7.5–10</li> <li>3: 5–7.5</li> <li>2: 2.5–5</li> <li>1: Below 2.5</li> </ul>	Extent to which fishery wealth is accumulated in access capital (e.g., quota, permits or vessels). Ratio of average price of capital and licenses required to access the fishery over the past five years to the average annual gross earnings for a similarly scaled access right in the same period. Typically 1 if vessels or quota not limited by regulation. Same business or same family sales are excluded, where they can be identified. See “Historical data” tab.
		Economics	Total revenue compared to historic high	<ul style="list-style-type: none"> <li>5: Above 95 per cent</li> <li>4: 85–95 per cent</li> <li>3: 70–85 per cent</li> <li>2: 50–70 per cent</li> <li>1: Below 50 per cent</li> </ul>	The indicator is the ratio of total real revenue (in local currency) to the average of the three highest total real revenues in the past ten years. Adjust by local consumer price index (CPI) if inflation was significant. See “Historical data” tab.
		Economics	Asset (permit, quota, etc.) value compared to historic high	<ul style="list-style-type: none"> <li>5: Above 95 per cent</li> <li>4: 85–95 per cent</li> <li>3: 70–85 per cent</li> <li>2: 50–70 per cent</li> <li>1: Below 50 per cent</li> </ul>	The indicator is the ratio of the current value of the harvest asset (permit, quota, vessel, etc.) to the average of the three highest asset values in the past ten years. Adjust by local CPI if inflation was significant. Typically 1 if wealth is not accumulating in vessels, permits or quota. See “Historical data” tab.
		Economics	Borrowing rate compared to risk-free rate	<ul style="list-style-type: none"> <li>5: Less than 1.75; cf. 30-year conforming mortgage</li> <li>4: Less than 2.5; cf. personal bank loan</li> <li>3: Less than 4; cf. good credit card rates</li> <li>2: Less than 7; cf. bad credit card rates</li> <li>1: Greater than 7; usury</li> </ul>	Average ratio between the interest rate on loans made to fishers in the industry to risk-free rates over the past three years. If businesses can access international credit markets, then the international risk free rate (US 10-year Treasury Bill) is an appropriate comparison; otherwise, use local risk-free rate. See “Historical data” tab.
		Economics	Source of capital	<ul style="list-style-type: none"> <li>5: Unsecured business loans from banks/venture capital</li> <li>4: Secured business loans from banks/public stock offering investment from elsewhere in supply chain</li> <li>3: Loans from banks secured by personal (not business) assets/government-subsidized private lending/government-run loan programmes/international aid agencies; secured loans from elsewhere in supply chain</li> <li>2: Microlending/family/community-based lending; loans from supply chain significantly reduce margins</li> <li>1: Mafia/no capital available; exploitative relationship from elsewhere in supply chain</li> </ul>	Points to be assigned based on the category of lenders or investors that are most typically used by fishers in the fishery. Second scoring method offered if the supply chain (e.g. traders, processors, exporters) are the primary source of capital.
		Economics	Functionality of harvest capital	<ul style="list-style-type: none"> <li>5: Capital is new</li> <li>4: Capital is older but well maintained, e.g. freshly painted</li> <li>3: Capital is moderately well maintained</li> <li>2: Maintenance is poor</li> <li>1: Serious concerns about seaworthiness or safety throughout fishery</li> </ul>	Average age of the key durable harvesting capital unit (vessels, weirs). Ages are not assigned to scores due to differences in expected useful life, but buildings and industrial vessels have expected life of roughly 20 years.

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
	Risks	Economics	Annual total revenue volatility	<ul style="list-style-type: none"> <li>5: Less than 0.15</li> <li>4: 0.15–0.22</li> <li>3: 0.22–0.40</li> <li>2: 0.40–1</li> <li>1: Greater than 1</li> </ul>	Ratio of the standard deviation of the first differences of annual total revenue to the mean of total revenue over the past ten years. Best guess may be calculated based on shorter time series if data not available. See “Volatility” tab.
		Economics	Annual landings volatility	<ul style="list-style-type: none"> <li>5: Less than 0.15</li> <li>4: 0.15–0.22</li> <li>3: 0.22–0.40</li> <li>2: 0.40–1</li> <li>1: Greater than 1</li> </ul>	Ratio of the standard deviation of the first differences of annual total landings to the mean of total landings over the past 10 years. Best guess may be calculated based on shorter time series if data not available. See “Volatility” tab.
		Economics	Intra-annual landings volatility	<ul style="list-style-type: none"> <li>5: Less than 0.15</li> <li>4: 0.15–0.22</li> <li>3: 0.22–0.40</li> <li>2: 0.40–1</li> <li>1: Greater than 1</li> </ul>	Ratio of the standard deviation of the weekly/monthly total landings over the past three years to the mean of total landings. Observations of zero landings are included if there is biological availability. If the biological season is so short that there is not meaningful variation at a monthly level, this measure can be NA (not applicable). Best guess may be calculated based on shorter time series if data not available. See “Volatility” tab.
		Economics	Annual price volatility	<ul style="list-style-type: none"> <li>5: Less than 0.13</li> <li>4: 0.13–0.20</li> <li>3: 0.20–0.30</li> <li>2: 0.30–0.85</li> <li>1: Greater than 0.85</li> </ul>	Ratio of the standard deviation of the first differences of annual ex-vessel prices to the mean of ex-vessel price over the past 10 years. Best guess may be calculated based on shorter time series if data not available. See “Volatility” tab.
		Economics	Intra-annual price volatility	<ul style="list-style-type: none"> <li>5: Less than 0.13</li> <li>4: 0.13–0.20</li> <li>3: 0.20–0.30</li> <li>2: 0.30–0.85</li> <li>1: Greater than 0.85</li> </ul>	Ratio of the standard deviation of average monthly ex-vessel prices over the past three years to the mean ex-vessel price. Observations of zero landings are included if there is biological availability. If the biological season is so short that there is not meaningful variation at a monthly level, this measure can be NA. Best guess may be calculated based on shorter time series if data not available. See “Volatility” tab.
		Economics	Spatial price volatility	<ul style="list-style-type: none"> <li>5: Less than 0.13</li> <li>4: 0.13–0.20</li> <li>3: 0.20–0.30</li> <li>2: 0.30–0.85</li> <li>1: Greater than 0.85</li> </ul>	Ratio of the standard deviation across data collection regions of average annual ex-vessel price to the mean of ex-vessel price across data collection regions. Measure should be averaged over past three years. Best guess may be calculated based on shorter time series if data not available. See “Volatility” tab.
		Community	Contestability & legal challenges	<ul style="list-style-type: none"> <li>5: No significant legal challenges, civil actions, or protests regarding the fishery management system</li> <li>4: Minor legal challenges slow implementation</li> <li>3: Legal challenges, civil actions or protests impede some management measures</li> <li>2: Legal challenges, civil actions or protests suspend major elements of the management system</li> <li>1: Legal challenges, civil actions or protests suspend or prohibit implementation of key management reforms and regulation certification</li> </ul>	This captures the degree to which political activity limits the ability to implement effective fishing regulations.

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
	Owners, permit holders & captains (those holding the right or ability to access)	Community	Earnings compared to regional average earnings	<ul style="list-style-type: none"> <li>5: More than 50 per cent above the regional average</li> <li>4: Between 10 and 50 per cent above the regional average</li> <li>3: Within 10 per cent of the regional average</li> <li>2: Between 50 per cent and 90 per cent of the regional average</li> <li>1: Less than half of the regional average</li> </ul>	Ratio of annual earnings per owner/captain to the regional average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew. The owners are defined as those holding the ability to access, including rights and capital. Note that this is earnings from all sources, not just fishing.
		Community	Owner/permit holder/captain's wages compared to non-fishery wages	<ul style="list-style-type: none"> <li>5: More than 50 per cent above the alternative wage</li> <li>4: Between 10 and 50 per cent above the alternative wage</li> <li>3: Within 10 per cent of the alternative wage</li> <li>2: Between 50 per cent and 90 per cent of the alternative wage</li> <li>1: Less than half of the alternative wage</li> </ul>	Ratio of captain's average daily wage in this fishery to the average daily wage in the owner/captain's alternative occupations within their economic sphere. The comparison is to jobs in the village that the owner/captain qualifies for if all economic activity is within the village, but to jobs within the nation if the owner/captain participates in national markets as a consumer and labour markets are fluid. Meant to capture the average personal opportunity cost of participating in the fishery.
		Community	Education access	<ul style="list-style-type: none"> <li>5: Higher education is accessible</li> <li>4: High school level education or advanced technical training is accessible</li> <li>3: Middle school level education or simple technical training is accessible</li> <li>2: Basic literacy and arithmetic training is accessible</li> <li>1: Formal education is not accessible</li> </ul>	Measure is based on the highest level of education that is accessible (available and affordable) to the families (i.e., children) of permit holders and captains. Not based on the actual educational attainment levels of current captains and owners.
		Community	Access to health care	<ul style="list-style-type: none"> <li>5: Global standard treatment for illness is accessible</li> <li>4: Licensed doctors provide trauma, surgical and drug treatments</li> <li>3: Nurses or medical practitioners provide emergency and routine drug treatments</li> <li>2: Basic and simple drug treatment is accessible</li> <li>1: Medical or drug treatment is not accessible</li> </ul>	Measure is based on the quality of healthcare that is accessible (available and affordable) to the owners/permit holders and their families.
		Community	Social standing of boat owners and permit holders	<ul style="list-style-type: none"> <li>5: Among the most respected in the community, comparable to civic and religious leaders and professionals, such as doctors and lawyers</li> <li>4: Comparable to management and white collar jobs</li> <li>3: Comparable to skilled labour jobs</li> <li>2: Comparable to unskilled blue collar or service jobs</li> <li>1: Among the least respected, such as slaves or indentured servants</li> </ul>	Measure is based on the social standing of owners/permit holders/captains within the community where they spend the majority of their time.
		Community	Proportion of non-resident employment	<ul style="list-style-type: none"> <li>5: 95–100 per cent local</li> <li>4: 70–95 per cent local</li> <li>3: 35–70 per cent local</li> <li>2: 5–35 per cent local</li> <li>1: Virtually no local captains/permit holders</li> </ul>	Proportion of owners/permit holders/captains who are local. "Local" is defined as coming from, and spending their earnings within, the local fishing community. Nationals who are transient non-residents, or considered outsiders in the fishing community, are not local.

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
	Crew (those depending on others for access)	Community	Earnings compared to regional average earnings	<ul style="list-style-type: none"> <li>5: More than 50 per cent above the regional average</li> <li>4: Between 10 and 50 per cent above the regional average</li> <li>3: Within 10 per cent of the regional average</li> <li>2: Between 50 per cent and 90 per cent of the regional average</li> <li>1: Less than half of the regional average</li> </ul>	Ratio of annual earnings per crew member to the regional average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew. Crew is defined as those depending on others for access. Note that this is earnings from all sources, not just fishing.
		Community	Crew wages compared to non-fishery wages	<ul style="list-style-type: none"> <li>5: More than 50 per cent above the alternative wage</li> <li>4: Between 10 and 50 per cent above the alternative wage</li> <li>3: Within 10 per cent of the alternative wage</li> <li>2: Between 50 per cent and 90 per cent of the alternative wage</li> <li>1: Less than half of the alternative wage</li> </ul>	Ratio of crew's average daily wage in this fishery to the average daily wage in the crew's alternative occupations within their economic sphere. The comparison is to jobs in the village that the crew qualify for if all economic activity is within the village, but to jobs within the nation if the crew participates in national markets as a consumer and labour markets are fluid. Meant to capture the average personal opportunity cost of participating in the fishery.
		Community	Education access	<ul style="list-style-type: none"> <li>5: Higher education is accessible</li> <li>4: High school level education or advanced technical training is accessible</li> <li>3: Middle school level education or simple technical training is accessible</li> <li>2: Basic literacy and arithmetic training is accessible</li> <li>1: Formal education is not accessible</li> </ul>	Measure is based on the highest level of education that is accessible (available and affordable) to the families (i.e., children) of crew. Not based on the actual educational attainment levels of current crew members.
		Community	Access to healthcare	<ul style="list-style-type: none"> <li>5: Global standard treatment for illness is accessible</li> <li>4: Licensed doctors provide trauma, surgical and drug treatments</li> <li>3: Nurses or medical practitioners provide emergency and routine drug treatments</li> <li>2: Basic and simple drug treatment is accessible</li> <li>1: Medical or drug treatment is not accessible</li> </ul>	Measure is based on the quality of healthcare that is accessible (available and affordable) to the crew and their families.
		Community	Social standing of crew	<ul style="list-style-type: none"> <li>5: Among the most respected in the community, comparable to civic and religious leaders and professionals, such as doctors and lawyers</li> <li>4: Comparable to management and white collar jobs</li> <li>3: Comparable to skilled labour jobs</li> <li>2: Comparable to unskilled blue collar or service jobs</li> <li>1: Among the least respected, such as slaves or indentured servants</li> </ul>	Measure is based on the social standing of crew members within the community where they spend the majority of their time.

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
		Community	Proportion of non-resident employment	<ul style="list-style-type: none"> <li>5: 95–100 per cent local</li> <li>4: 70–95 per cent local</li> <li>3: 35–70 per cent local</li> <li>2: 5–35 per cent local</li> <li>1: Virtually no local crew</li> </ul>	Proportion of crew members who are local. "Local" is defined as coming from, and spending their earnings within, the local fishing community. Nationals who are transient non-residents, or considered outsiders in the fishing community, are not local.
		Community	Crew experience	<ul style="list-style-type: none"> <li>5: More than 10 years (skilled career crew)</li> <li>4: 5–10 years</li> <li>3: 3–5 years</li> <li>2: 1–3 years</li> <li>1: 0 full years of experience (mostly new crew each season)</li> </ul>	Average years of experience of crew members.
		Community	Age structure of fishers	<ul style="list-style-type: none"> <li>5: All working ages are well represented</li> <li>4: Slightly skewed toward younger or older</li> <li>3: Skewed toward younger or older</li> <li>2: Almost entirely younger or older, but working age</li> <li>1: Fishers primarily younger or older than working age</li> </ul>	Age range of both captains and their crews.
Post-Harvest Performance	Market performance	Economics	Ex-vessel price compared to historic high	<ul style="list-style-type: none"> <li>5: Above 95 per cent</li> <li>4: 85–95 per cent</li> <li>3: 70–85 per cent</li> <li>2: 50–70 per cent</li> <li>1: Below 50 per cent</li> </ul>	The indicator is the ratio of current ex-vessel prices to the average of the three highest annual ex-vessel prices in the past 10 years. Adjust by local CPI if inflation was significant. See "Historical data" tab.
		Economics	Final market use	<ul style="list-style-type: none"> <li>5: Premium human consumption (premium quality and products)</li> <li>4: High-value human consumption</li> <li>3: Moderate-value human consumption</li> <li>2: Low-value human consumption</li> <li>1: Fish meal/animal feed/bait or non-consumptive</li> </ul>	The measure indicates the final market use of the top three species. Where a supply chain is diverse, score each and weight by value. Premium products are typically distinct to species, or species and source.
		Economics	International trade	<ul style="list-style-type: none"> <li>5: 90–100 per cent export</li> <li>4: 60–90 per cent export</li> <li>3: 30–60 per cent export</li> <li>2: 2–30 per cent export</li> <li>1: Virtually no export</li> </ul>	Percentage of the fishery's value that is derived from fish exported to higher value international markets for consumption.
		Economics	Final market wealth	<ul style="list-style-type: none"> <li>5: Greater than \$35,000</li> <li>4: Greater than \$25,000</li> <li>3: Greater than \$12,500</li> <li>2: Greater than \$5,000</li> <li>1: Less than 5,000</li> </ul>	Average per capita GDP of the consumer of a fishery's primary final product. If multiple important products, weight by value.
		Economics	Wholesale price compared to similar products	<ul style="list-style-type: none"> <li>5: More than twice global average</li> <li>4: 120–200 per cent of global average</li> <li>3: Within 20 per cent of global average</li> <li>2: 50–80 per cent of global average</li> <li>1: Less than half global average</li> </ul>	Ratio of average price for wholesale fish product from the fishery, to the global average price for similar species. Convert the price of fish to global currency for comparison (i.e. make sure that both prices are in \$ when composing the ratio).



Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
		Economics	Capacity of firms to export to the United States & European Union	<ul style="list-style-type: none"> <li>5: Over 90 per cent meet United States and European Union health and labeling standards</li> <li>4: 50–90 per cent</li> <li>3: Less than 50 per cent</li> <li>2: A small amount of product meets United States/European Union standards</li> <li>1: Banned in the United States of America or European Union, or cost of compliance with United States/European Union standards is prohibitive</li> </ul>	Percentage of a country's fish exports that meet United States of America or European Union health and labeling standards. This is usually a country-level measure, though individual high-value fisheries sometimes develop their own supply chains; measure refers to all processing capacity for export, including to regional markets.
		Economics	Ex-vessel to wholesale marketing margins	<ul style="list-style-type: none"> <li>5: More than 200 per cent increase in value;</li> <li>4: 100–200 per cent</li> <li>3: 50–100 per cent</li> <li>2: 10–50 per cent</li> <li>1: Less than 10 per cent increase in value</li> </ul>	Increase in value of processed wholesale product from unprocessed ex-vessel product. $[(\text{Wholesale } \$/\text{lb.}) - \text{ex-vessel } \$/\text{lb.}] / (\text{ex-vessel } \$/\text{lb.})$
	Post-harvest, processing and support industry performance	Economics	Processing yield	<ul style="list-style-type: none"> <li>5: At feasible frontier</li> <li>4: Within 5 per cent of the feasible frontier</li> <li>3: Within 10 per cent</li> <li>2: Within 25 per cent</li> <li>1: Less than 75 per cent of maximum yield</li> </ul>	Ratio of actual processing yield (kg/pounds) to the maximum processing yield technically achievable.
		Economics	Shrink	<ul style="list-style-type: none"> <li>5: Less than 5 per cent</li> <li>4: 5–10 per cent</li> <li>3: 10–25 per cent</li> <li>2: 25–50 per cent</li> <li>1: More than 50 per cent</li> </ul>	Percentage of fishery product weight that is lost due to handling, spoilage, or theft. This is very likely to be an estimate.
		Economics	Capacity utilization rate	<ul style="list-style-type: none"> <li>5: Virtually year-round</li> <li>4: 75–95 per cent of days</li> <li>3: 50–75 per cent;</li> <li>2: 20–50 per cent</li> <li>1: Less than 20 per cent</li> </ul>	Days open for processing each year. Such days would not normally include religious or civic holidays, or weekly rest days. This should be full-time employment days; when the plant is open but only operating at 10 per cent capacity then this only counts as 1/10 of a day.
		Economics	Product improvement	<ul style="list-style-type: none"> <li>5: 75–100 per cent of landings are enhanced</li> <li>4: 50–75 per cent</li> <li>3: 25–50 per cent</li> <li>2: 1–25 per cent</li> <li>1: No landings have enhancements</li> </ul>	Proportion of harvest meat weight going into certified, branded, fresh premium, portioned, live or value-added products.
Community	Sanitation	<ul style="list-style-type: none"> <li>5: Sanitation in landing and processing areas meets global health standards</li> <li>4: Basic treatment, but falls short of global standards</li> <li>3: Human waste is adequately handled, but fish waste presents sanitation problems</li> <li>2: Functional toilets are available, but fish or fish handlers are exposed to untreated sewage</li> <li>1: Functional toilets are not available in landing or processing areas</li> </ul>	This measures the sanitation conditions in the landing and processing areas. This measure is scored relative to global standards, not local standards. Pit latrines or toilets that are not improved, do not have proper drainage/sewage treatment, and do not allow for proper washing do not count as functional toilets.		

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
		Economics	Regional support businesses	<ul style="list-style-type: none"> <li>5: All types of support are plentiful</li> <li>4: Some types of support are capacity constrained or unavailable</li> <li>3: Most types of support are capacity constrained or unavailable</li> <li>2: Support limited to variable inputs</li> <li>1: Industry support is not locally available</li> </ul>	Support businesses are those that provide critical inputs (e.g. food, ice, gear, boat maintenance) or post-harvest functions (e.g. brokering, logistics).
	Post-harvest asset performance	Economics	Borrowing rate compared to risk-free rate	<ul style="list-style-type: none"> <li>5: Less than 1.75; cf. 30-year conforming mortgage</li> <li>4: Less than 2.5; cf. personal bank loan</li> <li>3: Less than 4; cf. good credit card rates</li> <li>2: Less than 7; cf. bad credit card rates</li> <li>1: Greater than 7; usury</li> </ul>	Average ratio between the interest rate on loans made in the processing industry to risk-free rates over the past three years. If businesses can access international credit markets, then the international risk-free rate (\$ 10-year Treasury Bill) is an appropriate comparison; otherwise, use local risk-free rate.
		Economics	Source of capital	<ul style="list-style-type: none"> <li>5: Unsecured business loans from banks/venture capital</li> <li>4: Secured business loans from banks/public stock offering; investment from elsewhere in supply chain</li> <li>3: Loans from banks secured by personal (not business) assets/government-subsidized private lending/government-run loan programs/international aid agencies; secured loans from elsewhere in supply chain</li> <li>2: Microlending/family/community-based lending; loans from supply chain significantly reduce margins</li> <li>1: Mafia/no capital available; exploitative relationship from elsewhere in supply chain</li> </ul>	Points to be assigned based on the category of lenders or investors that are most typically used in the processing sector. Second scoring method offered if the supply chain (e.g. processors further up the supply chain, parent company, exporters) are primary source of capital.
		Economics	Age of facilities	<ul style="list-style-type: none"> <li>5: First quarter of expected life; less than 7 years for a building</li> <li>4: Second quarter of expected life; 7–15 years</li> <li>3: Third quarter of expected life; 16–20 years</li> <li>2: Fourth quarter of expected life; 21–25 years</li> <li>1: Exceeding expected life; greater than 25 years;</li> </ul>	Average age of the key durable processing capital unit (plants, catcher-processor vessels).

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
	Processing owners and managers	Community	Earnings compared to regional average earnings	<ul style="list-style-type: none"> <li>5: More than 50 per cent above the regional average</li> <li>4: Between 10 and 50 per cent above the regional average</li> <li>3: Within 10 per cent above the regional average</li> <li>2: Between 50 per cent and 90 per cent of the regional average</li> <li>1: Less than half of the regional average</li> </ul>	Ratio of annual earnings per owner/manager to the regional average earnings. This measure can include wealth accumulated to traders/intermediaries if they represent an important part of the supply chain. Note that this is earnings from all sources, not just fishing.
		Community	Manager wages compared to non-fishery wages	<ul style="list-style-type: none"> <li>5: More than 50 per cent above the alternative wage</li> <li>4: Between 10 and 50 per cent above the alternative wage</li> <li>3: Within 10 per cent above the alternative wage</li> <li>2: Between 50 per cent and 90 per cent of the alternative wage</li> <li>1: Less than half of the alternative wage</li> </ul>	Ratio of owner/manager's average daily wage in this fishery to the average daily wage in the owner/manager's alternative occupations within their economic sphere. The comparison is to jobs in the village that the owner/manager qualifies for if all economic activity is within the village, but to jobs within the nation if the owner/manager participates in national markets as a consumer and labour markets are fluid. Meant to capture the average personal opportunity cost of participating in the fishery.
		Community	Education access	<ul style="list-style-type: none"> <li>5: Higher education is accessible</li> <li>4: High school level education or advanced technical training is accessible</li> <li>3: Middle school level education or simple technical training is accessible</li> <li>2: Basic literacy and arithmetic training is accessible</li> <li>1: Formal education is not accessible</li> </ul>	Measure is based on the highest level of education that is accessible (available and affordable) to the families (i.e. children) of processing owners and managers. Not based on the actual educational attainment levels of current processing owners/managers.
		Community	Access to healthcare	<ul style="list-style-type: none"> <li>5: Global standard treatment for illness is accessible</li> <li>4: Licensed doctors provide trauma, surgical and drug treatments</li> <li>3: Nurses or medical practitioners provide emergency and routine drug treatments</li> <li>2: Basic and simple drug treatment is accessible</li> <li>1: Medical or drug treatment is not accessible</li> </ul>	Measure is based on the quality of healthcare that is accessible (available and affordable) to the processing owners/managers and their families.
		Community	Social standing of processing managers	<ul style="list-style-type: none"> <li>5: Among the most respected in the community, comparable to civic and religious leaders and professionals, such as doctors and lawyers</li> <li>4: Comparable to management and white collar jobs</li> <li>3: Comparable to skilled labour jobs</li> <li>2: Comparable to unskilled blue collar or service jobs</li> <li>1: Among the least respected, such as slaves or indentured servants</li> </ul>	Measure is based on the social standing of processing owners/managers within the community where they spend the majority of their time.
		Community	Non-resident ownership of processing capacity	<ul style="list-style-type: none"> <li>5: 95–100 per cent local</li> <li>4: 70–95 per cent local</li> <li>3: 35–70 per cent local</li> <li>2: 5–35 per cent local</li> <li>1: Virtually no local processing ownership</li> </ul>	Proportion of processing owners/managers who are local. "Local" is defined as coming from, and spending their earnings within, the local fishing community. Nationals who are transient non-residents, or considered outsiders in the fishing community, are not local.

Indicator	Dimension	Triple bottom line category	Metric	Score system	Additional explanation
	Processing workers	Community	Earnings compared to regional average earnings	<ul style="list-style-type: none"> <li>5: More than 50 per cent above the regional average</li> <li>4: Between 10 and 50 per cent above regional average</li> <li>3: Within 10 per cent above the regional average</li> <li>2: Between 50 per cent and 90 per cent of the regional average</li> <li>1: Less than half of the regional average</li> </ul>	Ratio of annual earnings per processing worker to the regional average earnings. Note that this is earnings from all sources and not just fishing.
		Community	Worker wages compared to non-fishery wages	<ul style="list-style-type: none"> <li>5: More than 50 per cent above the regional average</li> <li>4: Between 10 and 50 per cent above regional average</li> <li>3: Within 10 per cent above the regional average</li> <li>2: Between 50 per cent and 90 per cent of the regional average</li> <li>1: Less than half of the regional average</li> </ul>	Ratio of processing worker's average daily wage in this fishery to the average daily wage in the worker's alternative occupations within their economic sphere. The comparison is to jobs in the village that the worker qualifies for if all economic activity is within the village, but to jobs within the nation if the worker participates in national markets as a consumer and labour markets are fluid. Meant to capture the average personal opportunity cost of participating in the fishery.
		Community	Education access	<ul style="list-style-type: none"> <li>5: Higher education is accessible</li> <li>4: High school level education or advanced technical training is accessible</li> <li>3: Middle school level education or simple technical training is accessible</li> <li>2: Basic literacy and arithmetic training is accessible</li> <li>1: Formal education is not accessible</li> </ul>	Measure is based on the highest level of education that is accessible (available and affordable) to the families (i.e. children) of processing workers. Not based on the actual educational attainment levels of current processing workers.
		Community	Access to healthcare	<ul style="list-style-type: none"> <li>5: Global standard treatment for illness is accessible</li> <li>4: Licensed doctors provide trauma, surgical and drug treatments</li> <li>3: Nurses or medical practitioners provide emergency and routine drug treatments</li> <li>2: Basic and simple drug treatment is accessible</li> <li>1: Medical or drug treatment is not accessible</li> </ul>	Measure is based on the quality of health care that is accessible (available and affordable) to the processing workers and their families.
		Community	Social standing of processing workers	<ul style="list-style-type: none"> <li>5: Among the most respected in the community, comparable to civic and religious leaders and professionals, such as doctors and lawyers</li> <li>4: Comparable to management and white collar jobs</li> <li>3: Comparable to skilled labour jobs</li> <li>2: Comparable to unskilled blue collar or service jobs</li> <li>1: Among the least respected, such as slaves or indentured servants</li> </ul>	Measure is based on the social standing of workers within the community where they spend the majority of their time.
		Community	Proportion of non-resident employment	<ul style="list-style-type: none"> <li>5: 95–100 per cent local</li> <li>4: 70–95 per cent local</li> <li>3: 35–70 per cent local</li> <li>2: 5–35 per cent local</li> <li>1: Virtually no local workers</li> </ul>	Proportion of processing workers who are local. "Local" is defined as coming from, and spending their earnings within, the local fishing community. Nationals who are transient non-residents, or considered outsiders in the fishing community, are not local.
		Community	Worker experience	<ul style="list-style-type: none"> <li>5: More than 10 years (skilled career workers)</li> <li>4: 5–10 years</li> <li>3: 3–5 years</li> <li>2: 1–3 years</li> <li>1: 0 full years of experience (mostly new workers each season)</li> </ul>	Average years of experience of processing workers.

Table 12. Fishery performance indicator input metrics

Component	Dimension	Metric	Score System	Additional explanation
Macro factors	General environmental performance	Environmental performance index (EPI)	<ul style="list-style-type: none"> <li>5: EPI of 82–100</li> <li>4: 73–82</li> <li>3: 66–73</li> <li>2: 51–66</li> <li>1: 1–51</li> </ul>	The EPI considers factors such as disease, water quality, air pollution, biodiversity, natural resources and climate change. The EPI ranges from 1–100. Score is by 2016 EPI quintile.
	Exogenous environmental factors	Disease and pathogens	<ul style="list-style-type: none"> <li>5: Harvest value unaffected by disease</li> <li>4: Harvest value reduced by less than 10 per cent</li> <li>3: Harvest value reduced by 10–30 per cent</li> <li>2: Harvest value reduced by more than 30 per cent</li> <li>1: Harvest value almost completely eliminated by disease</li> </ul>	Extent to which harvest value is affected by exogenous disease, pathogens, toxic algae or similar factors (e.g. lobster shell disease or red tides).
		Natural disasters and catastrophes	<ul style="list-style-type: none"> <li>5: Harvest value unaffected by disaster</li> <li>4: Harvest value reduced by less than 10 per cent</li> <li>3: Harvest value reduced by 10–30 per cent</li> <li>2: Harvest value reduced by more than 30 per cent</li> <li>1: Harvest value almost completely eliminated by disaster</li> </ul>	Extent to which harvest value is affected by natural disasters such as earthquakes, volcanoes, hurricanes, tsunamis and typhoons. Harvest can be affected through stock effects or damage to harvest capacity. Gradual effects of climate change (e.g. shifts in temperature or salinity) are not included here.
		Pollution shocks and accidents	<ul style="list-style-type: none"> <li>5: Harvest value unaffected by shocks</li> <li>4: Harvest value reduced by less than 10 per cent</li> <li>3: Harvest value reduced by 10–30 per cent</li> <li>2: Harvest value reduced by more than 30 per cent</li> <li>1: Harvest value almost completely eliminated by shocks</li> </ul>	Extent to which harvest value in the reference year is affected by pollution shocks, such as an oil spill, industrial accident or piracy. These are one-time events, chronic pollution is addressed in the next two questions.
		Level of chronic pollution (stock effects)	<ul style="list-style-type: none"> <li>5: Not detectable</li> <li>4: Minimal detectable levels</li> <li>3: High levels detected</li> <li>2: Pollution affects stock growth</li> <li>1: Pollution leading to severe stock decline</li> </ul>	Extent to which chronic pollution, such as from industrial or agricultural runoff, affects the stock. Chronic pollution can be either always present, or frequently recurring, such as after each moderate rainfall.
		Level of chronic pollution (consumption effects)	<ul style="list-style-type: none"> <li>5: No consumption affected</li> <li>4: Minimal consumption effects</li> <li>3: Official consumption advisories</li> <li>2: Temporary ban on harvest for consumption</li> <li>1: Completely closed for consumption</li> </ul>	Extent to which chronic pollution limits consumption. Chronic pollution can be either always present, or frequently recurring, such as after each moderate rainfall.
	Governance	Governance quality	<ul style="list-style-type: none"> <li>5: Above 0.92 (highest-performing 2010 quintile)</li> <li>4: 0.10 to 0.92</li> <li>3: –0.43 to 0.10</li> <li>2: –0.81 to –0.43</li> <li>1: Below –0.81 (lowest-performing 2010 quintile)</li> </ul>	Average of four indicators in the World Bank's Governance Indicators, each scored [–2.5; 2.5] <ul style="list-style-type: none"> <li>Government effectiveness</li> <li>Regulatory quality</li> <li>Rule of law</li> <li>Control of corruption</li> </ul>
Governance responsiveness		<ul style="list-style-type: none"> <li>5: Above 0.96 (highest-performing 2010 quintile)</li> <li>4: 0.41 to 0.96</li> <li>3: –0.24 to 0.41</li> <li>2: –0.82 to –0.24</li> <li>1: Below –0.82 (lowest-performing 2010 quintile)</li> </ul>	Average of two indicators in the World Bank's Governance Indicators, each scored [–2.5; 2.5] <ul style="list-style-type: none"> <li>Voice and accountability</li> <li>Political stability</li> </ul>	
Economic conditions	Index of economic freedom	<ul style="list-style-type: none"> <li>5: IEF 69.2–100</li> <li>4: 62.5–69.1</li> <li>3: 57.1–62.4</li> <li>2: 50.5–57.0</li> <li>1: 1–50.5</li> </ul>	Country's score from the Heritage Foundation's Index of Economic Freedom.	
	GDP per capita	<ul style="list-style-type: none"> <li>5: Greater than \$30,000</li> <li>4: Greater than \$12,400</li> <li>3: Greater than \$6,000</li> <li>2: Greater than \$2,500</li> <li>1: Less than \$2,500.</li> </ul>	Country's per capita GDP on a purchasing power parity basis. Dollars are 2010 United States dollars.	

Component	Dimension	Metric	Score System	Additional explanation
Property rights & responsibility	Fishing access rights	Proportion of harvest managed under limited access	<ul style="list-style-type: none"> <li>5: Virtually all</li> <li>4: 70–95 per cent</li> <li>3: 35–70 per cent</li> <li>2: 5–35 per cent</li> <li>1: Virtually none</li> </ul>	The proportion of total harvest that is under limited access fishing regulation. This can include both regulatory and de facto access rights. Fisheries where there is a gatekeeper regulatory institution such as a beach management unit or a chief fisher to whom entrants must talk or buy a permit from prior to gaining access count as limited access for the purposes of this measure.
		Transferability index	<ul style="list-style-type: none"> <li>5: Very strong: fully transferable through well-established, efficient market institutions</li> <li>4: Strong: fully transferable, but institutions are poor or illiquid</li> <li>3: Moderate: transferable, but with severe restrictions on who can hold, or how much</li> <li>2: Weak: transferable only under highly restricted and limited conditions</li> <li>1: Access rights not transferable</li> </ul>	NA if no limited access but can be scored if there is even a nominal system for granting access rights.
		Security index	<ul style="list-style-type: none"> <li>5: Very strong: access rights are completely respected by the government</li> <li>4: Strong: rights are mostly respected by the government; generally survive changes in government administration</li> <li>3: Moderate: rights are at risk of retraction with changes in administration</li> <li>2: Weak: rights are highly threatened or there is high political uncertainty</li> <li>1: None: access rights are not protected</li> </ul>	Extent to which the government reduces or threatens to change the access rights. Even if no limited access, can be scored to reflect the extent of other restrictions that ensure the security of access right (though probably low).
		Durability index	<ul style="list-style-type: none"> <li>5: Very strong: &gt;10 years to perpetuity</li> <li>4: Strong: 6 to 10 years</li> <li>3: Moderate: 1 to 5 years</li> <li>2: Weak: Seasonal</li> <li>1: None: None/daily</li> </ul>	Duration of the property right. Even if no limited access, can be scored to reflect fishers' expectations of continued access. If the access rights are renewable with reapplication and the fishers expect to be able to continue to access then score based on these expectations.
		Flexibility index	<ul style="list-style-type: none"> <li>5: Very strong: all decisions on time of harvest, gear used and handling practices are in the owner's control</li> <li>4: Strong: minimal restrictions on time of harvest and technology</li> <li>3: Moderate: modest restrictions on time of harvest and technology</li> <li>2: Weak: significant restrictions on time of harvest and technology</li> <li>1: Time of harvest, gear used and handling practices are not in the owner's control</li> </ul>	Ability of right holders to be flexible in the timing and production technology employed. Low scores will reflect restrictions that force inefficiencies. Even without limited access, there may still be scorable restrictions (gear, seasons, areas) that limit access flexibility.
		Exclusivity index	<ul style="list-style-type: none"> <li>5: Very strong: all decisions and access to the property are controlled by the right's owner. A limited number of access rights are granted and no intrusion from those without rights such as recreational or by-catch fisheries</li> <li>4: Strong: little intrusion on resource by those without rights and there are a limited number of access rights granted</li> <li>3: Moderate: modest intrusion on resource by those without rights. There is some effort to restrict the number of access rights distributed</li> <li>2: Weak: significant intrusion on resource by those without rights or little limit on the amount of access rights distributed</li> <li>1: None: completely unrestricted open access, despite putative right. No limit on the number of access rights distributed</li> </ul>	Ability of right holders to exclude those who do not have the right from affecting the resource or market. Can still be scored to capture extent of de facto intrusion if access is not limited. This measure is meant to measure both illegal intrusion by outsiders through illegal fishing, by-catch, or subsistence and recreational fishing (see manual for exactly when subsistence/recreational fisheries affect this score). It is also meant to capture whether access rights are distributed with or without limits. If a management authority controls access yet chooses not to limit the number of fishers or frequently increases the number permitted (diluting existing access rights) then the exclusivity score should be very low.

Component	Dimension	Metric	Score System	Additional explanation
	Harvest rights	Proportion of harvest managed with rights-based management	<ul style="list-style-type: none"> <li>5: Virtually all</li> <li>4: 70–95 per cent</li> <li>3: 35–70 per cent</li> <li>2: 5–35 per cent</li> <li>1: Virtually none</li> </ul>	The proportion of total harvest that is under rights-based fisheries management. Harvest rights include those for some fixed quantity or fish (e.g. a quota), or a fixed share of landings in an area (e.g. a territorial user right for fishing [TURF] that gives 100 per cent of landings in an area). A TURF does not give harvest rights unless the species harvested are sedentary or their movement is completely contained within the territory. Rights can be held by individuals or communities, and can include de facto and de jure rights. (Input rights, like trap tags, are strong access rights, but not harvest rights included in this section.)
	Transferability index		<ul style="list-style-type: none"> <li>5: Very strong: fully transferable through well-established, efficient market institutions</li> <li>4: Strong: fully transferable, but institutions are poor or illiquid</li> <li>3: Moderate: transferable, but with severe restrictions on who can hold, or how much</li> <li>2: Weak: transferable only under highly restricted and limited conditions</li> <li>1: Harvest rights not transferable</li> </ul>	NA if there is no harvest right.
	Security index		<ul style="list-style-type: none"> <li>5: Very strong: harvest rights are completely respected by the government</li> <li>4: Strong: rights are mostly respected by the government and generally survive changes in government administration</li> <li>3: Moderate: rights are at risk of retraction with changes in administration</li> <li>2: Weak: rights are highly threatened or there is high political uncertainty</li> <li>1: None: harvest rights are not protected</li> </ul>	Extent to which the government threatens to reduce or eliminate the harvest rights. NA if there is no harvest right.
	Durability index		<ul style="list-style-type: none"> <li>5: Very strong: &gt;10 years to perpetuity</li> <li>4: Strong: 6–10 years</li> <li>3: Moderate: 1–5 years</li> <li>2: Weak: seasonal</li> <li>1: None: none/daily</li> </ul>	Duration of the harvest right. NA if there is no harvest right. If the harvest rights are renewable with reapplication and the fishers expect to be able to continue to harvest the same percentage then score based on these expectations.
	Flexibility index		<ul style="list-style-type: none"> <li>5: Very strong: all decisions on time of harvest, gear used and handling practices are in the owner's control</li> <li>4: Strong: minimal restrictions on time of harvest and technology</li> <li>3: Moderate: modest restrictions on time of harvest and technology</li> <li>2: Weak: significant restrictions on time of harvest and technology</li> <li>1: Time of harvest, gear used and handling practices are not in the owner's control</li> </ul>	Ability of right holders to be flexible in the timing and production technology employed. NA if there is no harvest right.
	Exclusivity index		<ul style="list-style-type: none"> <li>5: Very strong: management prevents harvest in excess of rights allocation; no intrusion by outsiders</li> <li>4: Strong: management allows little harvest in excess of allocation; little intrusion by those without rights</li> <li>3: Moderate: modest harvest in excess of rights allocation; modest intrusion on resource by those without rights</li> <li>2: Weak: harvest in excess of rights allocation significantly affects resource or markets; significant intrusion on resource by those without rights</li> <li>1: None: completely unrestricted open access, despite putative right</li> </ul>	Ability of right holders to exclude those who do not have the right from affecting the resource or market. This includes intrusion by competing resource users such as recreational or by-catch fisheries and dilution or lack of enforcement leading to excess harvest by licensed fishers. See manual for exactly when recreational/subsistence users affect this score. If a management authority chooses to dilute existing harvest rights by frequently increasing allocations then the exclusivity score should be very low. NA if there is no harvest right.

Component	Dimension	Metric	Score System	Additional explanation
Co-management	Collective action	Proportion of fishers in industry organizations	<ul style="list-style-type: none"> <li>5: Virtually all</li> <li>4: 70–95 per cent</li> <li>3: 35–70 per cent</li> <li>2: 5–35 per cent</li> <li>1: Virtually none</li> </ul>	Proportion of harvest where the primary fishers consider themselves to be members of organized associations. This captures whether the fishers are organized to influence outcomes, and thus can include organization along company lines in industrialized fisheries.
		Fisher organizations' influence on management and access	<ul style="list-style-type: none"> <li>5: Fisher organizations effectively determine allocation of resources</li> <li>4: Fisher organizations have significant influence in determining allocation</li> <li>3: Fisher organizations are politically active, but not controlling</li> <li>2: Fisher organizations conduct social or informal monitoring of participation and allocation</li> <li>1: Fisher organizations make no active effort or have no capacity to influence management</li> </ul>	Subjective measure of how much influence harvesting organizations have, either directly or through political collective action, on management and access to the fishery.
		Fisher organizations' influence on business and marketing	<ul style="list-style-type: none"> <li>5: Harvesting organizations cooperatively determine marketing and operational details</li> <li>4: Extensive joint marketing</li> <li>3: Large subgroups facilitating marketing; joint purchasing</li> <li>2: Small subgroups cooperating in purchasing or operations</li> <li>1: No active effort or capacity to influence business operations</li> </ul>	Subjective measure of how much influence harvesting organizations have, either directly or through political collective action, on business operations and marketing in the fishery.
	Participation	Days in stakeholder meetings	<ul style="list-style-type: none"> <li>5: More than 24 days per year</li> <li>4: 12–24</li> <li>3: 6–11</li> <li>2: 1–5</li> <li>1: None</li> </ul>	Days in stakeholder meetings per year spent by a participant in the fishery who is active in management. Note these are days with meetings, not full-time employment days. Include meetings of councils with public participation.
		Industry financial support for management	<ul style="list-style-type: none"> <li>5: Virtually all</li> <li>4: 50–95 per cent</li> <li>3: 5–50 per cent</li> <li>2: 1–5 per cent</li> <li>1: None</li> </ul>	Proportion of the fishery management budget paid for by the harvesting or processing sector.
	Community	Leadership	<ul style="list-style-type: none"> <li>5: Widely recognized individual leader, or small group of individual leaders, who provide vision for management and are able to attract stakeholders to that vision</li> <li>3: Ex-officio leadership stations that maintain management institutions, but are not currently providing strong vision</li> <li>1: No recognized leader providing vision for fishery stakeholders</li> </ul>	Subjective measure of whether the fishing community has strong leadership capable of envisioning and implementing effective management (this role may be provided by processors). Scores 2 or 4 are midpoints between descriptions.
		Social cohesion	<ul style="list-style-type: none"> <li>5: 6 points</li> <li>4: 5 points</li> <li>3: 3–4 points</li> <li>2: 1–2 points</li> <li>1: 0 points</li> </ul>	Measure of whether the resource users are socially connected and interact regularly in fishing and non-fishing spheres. Score one point for each of the following: <ul style="list-style-type: none"> <li>Common locations for gathering and meeting on a regular basis for non-fishery business, culture or commerce</li> <li>Presence of shared social norms that facilitate transactional trust</li> <li>Presence of shared public institutions (government, schools, markets)</li> <li>Absence of differences in social status or caste that prevent interaction</li> <li>Absence of religious differences and/or conflict</li> <li>Absence of cultural, ethnic or tribal differences that obstruct interaction.</li> </ul>



Component	Dimension	Metric	Score System	Additional explanation
	Gender	Business management influence	<ul style="list-style-type: none"> <li>5: Business management dominated by women</li> <li>3: Business management is balanced between women and men</li> <li>1: Business management dominated by men</li> </ul>	Extent of women's influence (not just participation) in the management of harvesting and post-harvest businesses, including decision-making, ownership and financing. This will not typically include development project staff or other "outsiders." Scores 2 and 4 are midpoints between descriptions.
		Resource management influence	<ul style="list-style-type: none"> <li>5: Resource management dominated by women</li> <li>3: Resource management is balanced between women and men</li> <li>1: Resource management dominated by men</li> </ul>	Extent of women's influence (not just participation) in the management of the resource, including scientific and resource access and allocation decisions. This will not typically include development project staff or other "outsiders." Scores 2 and 4 are midpoints between descriptions.
		Labour participation in harvest sector	<ul style="list-style-type: none"> <li>5: 80 per cent to 100 per cent are women</li> <li>4: 60 per cent to 80 per cent are women</li> <li>3: 40 per cent to 60 per cent are women</li> <li>2: 20 per cent to 40 per cent are women</li> <li>1: Less than 20 per cent are women</li> </ul>	Proportion of those involved in the harvest sector labour pool, either as captains or crew, who are women.
		Labour participation in post-harvest sector	<ul style="list-style-type: none"> <li>5: 80 per cent to 100 per cent are women</li> <li>4: 60 per cent to 80 per cent are women</li> <li>3: 40 per cent to 60 per cent are women</li> <li>2: 20 per cent to 40 per cent are women</li> <li>1: Less than 20 per cent are women</li> </ul>	Proportion of those involved in the post-harvest sector labour pool, as buyers, sellers, managers or workers, who are women.
Management	Management inputs	Management expenditure compared to value of harvest	<ul style="list-style-type: none"> <li>5: Less than 5 per cent of ex-vessel harvest value</li> <li>4: 5–25 per cent</li> <li>3: 25–50 per cent</li> <li>2: 50–100 per cent</li> <li>1: More than the ex-vessel harvest value</li> </ul>	Government, industry and aid agency expenditure on fishery management activities, including research, enforcement and management capacity development (but not infrastructure), relative to the ex-vessel value of the harvest.
		Enforcement capability	<ul style="list-style-type: none"> <li>5: Strong capacity to enforce regulations for entire coastline, both nearshore and offshore</li> <li>4: Capacity to enforce regulations for nearshore, but limited offshore</li> <li>3: Capacity to enforce nearshore in most of the ports, very limited capacity offshore;</li> <li>2: Capacity to enforce only in major ports, minimal effective capacity offshore</li> <li>1: No capacity to enforce</li> </ul>	Enforcement capacity includes that of the government, fishing organization or any other group that can effectively enforce management.
		Management jurisdiction	<ul style="list-style-type: none"> <li>5: Stock's life cycle is within a single management jurisdiction, or multiple jurisdictions have an effective, formal system for joint management throughout the range</li> <li>4: Effective coordination institution facilitates joint management throughout the region of primary importance</li> <li>3: There is a coordination structure, but it does not have binding authority</li> <li>2: Informal institutions for coordinating management</li> <li>1: Jurisdictions effectively manage the same stock independently</li> </ul>	Extent to which the life cycle or range of a stock can be managed under a single coordinated plan, or through which ineffective management in one jurisdiction can undermine efforts in another.
		Level of subsidies	<ul style="list-style-type: none"> <li>5: No subsidies</li> <li>4: 1 subsidy category</li> <li>3: 2 subsidy categories</li> <li>2: 3 subsidy categories</li> <li>1: 4 subsidy categories</li> </ul>	Receive one point each for four key categories of "bad" subsidies: (1) fuel subsidies, (2) fish access payment subsidies; (3) capital or capital loan subsidies; and (4) price support (through inputs or direct payments).

Component	Dimension	Metric	Score System	Additional explanation
	Data	Data availability	<ul style="list-style-type: none"> <li>5: Annual (or other appropriate period) sampling for stock assessment, landings and economic data available</li> <li>4: Consistently collected and comprehensive landings and price data available</li> <li>3: Limited reliable landings or price data available; data irregularly collected or based on large samples</li> <li>2: Available data based on small samples, or missing data, significantly impedes making inferences needed for management</li> <li>1: No data is centrally collected</li> </ul>	Extent to which biological and economic data are available.
		Data analysis	<ul style="list-style-type: none"> <li>5: Biological and economic data used in prospective analysis of management</li> <li>4: Biological data dominates simple prospective analysis</li> <li>3: Biological or economic data is used to track performance retrospectively</li> <li>2: Data is used inconsistently or irregularly</li> <li>1: No data analysis conducted in management process</li> </ul>	Extent to which biological and economic data are used by management.
	Management methods	MPAs and sanctuaries	<ul style="list-style-type: none"> <li>5: More than 25 per cent</li> <li>4: 10–25 per cent</li> <li>3: 5–10 per cent</li> <li>2: Less than 5 per cent</li> <li>1: None</li> </ul>	Percentage of area used in species life cycle where fishing is closed or highly restricted. Include total area under rolling or seasonal closures.
		Spatial management	<ul style="list-style-type: none"> <li>5: 75–100 per cent</li> <li>4: 50–75 per cent</li> <li>3: 25–50 per cent</li> <li>2: Less than 25 per cent</li> <li>1: None</li> </ul>	Proportion of fishing ground managed through either direct control by TURF or designated community management regions, or through indirect control by limiting access points (launch or landing sites).
		Fishing mortality limits	<ul style="list-style-type: none"> <li>5: Hard TAC established against which nearly all fishing mortality is counted</li> <li>4: Hard TAC established, but there are sources of unaccounted mortality totaling less than 10 per cent; or TAC is adjusted from biological guideline to compensate for sources of greater unaccounted mortality</li> <li>3: There is a guideline mortality level that is generally met; hard TAC exceeded 10–50 per cent by unaccounted mortality</li> <li>2: Frequently exceeded guideline; hard TAC exceeded by more than 50 per cent</li> <li>1: Fishery does not have an explicit mortality target</li> </ul>	Extent to which fishing mortality is an explicit instrument of management.
	Post-harvest	Markets and market institutions	Landings pricing system	<ul style="list-style-type: none"> <li>5: Virtually all</li> <li>4: 70–95 per cent</li> <li>3: 35–70 per cent</li> <li>2: 5–35 per cent</li> <li>1: Virtually none</li> </ul>
Availability of ex-vessel price and quantity information			<ul style="list-style-type: none"> <li>5: Complete, accurate price and quantity information available to market participants immediately</li> <li>4: Reliable price and quantity information is available prior to the next market clearing</li> <li>3: Price information is available but no timely quantity information</li> <li>2: Price and quantity information are inaccurate, lagged or available to only a few</li> <li>1: No information available</li> </ul>	Scores the ability of the market to provide timely information to fishers to which they can react by changing what or when they land.
Number of buyers			<ul style="list-style-type: none"> <li>5: Highly competitive</li> <li>4: 4–6 buyers</li> <li>3: 2–3 competing buyers</li> <li>2: A small number of coordinating buyers</li> <li>1: There is one buyer</li> </ul>	Typical number of buyers of ex-vessel product accessible to a seller in a given market. If there are many landing sites, this is the buyers per landing site. If fishers are generally indentured to a single buyer through credit relationships, there is one buyer.
Degree of vertical integration			<ul style="list-style-type: none"> <li>5: Virtually all</li> <li>4: 70–95 per cent</li> <li>3: 35–70 per cent</li> <li>2: 5–35 per cent</li> <li>1: Virtually none</li> </ul>	Proportion of harvest where the primary fisher and primary processor/distributor are the same firm. The role of vertical integration here is to ensure harvest and delivery of fish under a common management, increasing efficiency and reducing transactions costs.

Component	Dimension	Metric	Score System	Additional explanation
		Level of tariffs	<ul style="list-style-type: none"> <li>5: Virtually none</li> <li>4: 0.5 – 2.5 per cent</li> <li>3: 2.5 – 5 per cent</li> <li>2: 5 – 10 per cent</li> <li>1: Over 10 per cent</li> </ul>	Official tariff rates charged for exports or imports to consumption markets.
		Level of non-tariff barriers	<ul style="list-style-type: none"> <li>5: Are not used to limit international trade</li> <li>4: Have very limited impact on international trade</li> <li>3: Act to impede some international trade</li> <li>2: Act to impede a majority of potential international trade</li> <li>1: Act to effectively impede a significant amount of international trade</li> </ul>	Non-tariff barriers include: quantity restrictions (import quotas), regulatory restrictions, investment restrictions, customs restrictions and direct government intervention.
	Infrastructure	International shipping service	<ul style="list-style-type: none"> <li>5: Ocean/air shipping services are readily available at lower than average rates</li> <li>4: Ocean/air shipping services are readily available at average rates</li> <li>3: Ocean/air shipping services are readily available at higher than average rates</li> <li>2: Ocean/air shipping services are available but irregular</li> <li>1: International shipping is not available at reasonable rates</li> </ul>	The quality of the service available to access global high value markets, such as the United States of America or European Union (regardless of whether product is currently exported). Average of the two measures (one for ocean shipping and another one for air shipping).
	Road quality index	<ul style="list-style-type: none"> <li>5: High-quality paved roads and extensive highways</li> <li>4: Primarily paved two-lane roads and moderate highway</li> <li>3: Primarily paved two-lane roads and minimal highway</li> <li>2: Paved two-lane roads and well-graded gravel roads</li> <li>1: Poorly maintained gravel or dirt roads</li> </ul>	Travel time-weighted average road quality between the fishery's primary port and the most practical export shipping port for exported product. For non-exported product measure road quality between the primary port and the major consumption center.	
	Technology adoption	<ul style="list-style-type: none"> <li>5: Cell phones/fish finders/computers/processing/production technology are readily available</li> <li>4: Cell phones/fish finders, etc. are common, but some other technology is not always available</li> <li>3: Cell phones/fish finders, etc. are common, but some other technology is difficult to obtain</li> <li>2: Cell phones are common, but most other technology is prohibitive</li> <li>1: Very little advanced technology is accessible to the industry</li> </ul>	Average level of technology employed in the fishery.	
	Extension service	<ul style="list-style-type: none"> <li>5: Broad extension service with field offices and close linkage with the research community</li> <li>4: Extension service with moderate field coverage and adequate linkage with the research community</li> <li>3: Extension service, but with weak links to the research community</li> <li>2: Minimal, poorly supported extension service</li> <li>1: No extension service</li> </ul>	Degree to which government or non-governmental organizations help fishers improve fishing techniques or management through extension activities.	
	Reliability of utilities/electricity	<ul style="list-style-type: none"> <li>5: Reliable electrical grid provides power in sufficient quantity to prevent product loss</li> <li>4: Processors rely on grid, but maintain backup generators</li> <li>3: Supply chains rely on own generation capacity</li> <li>2: Supply chain sometimes loses product due to condition or irregular fuel supply for generators</li> <li>1: Reliable generators or fuel supply not available</li> </ul>	Extent to which utilities and electricity are reliable.	
	Access to ice and refrigeration	<ul style="list-style-type: none"> <li>5: Ice is available in various forms and in sufficient quantities to support fresh icing of all fish that needs to be iced</li> <li>4: Ice is available in various forms, but quantity limits prevent applying to entire catch throughout supply chain</li> <li>3: Ice is available in limited form and quantity, and thus applied only to most valuable portions of catch</li> <li>2: Ice is available but capacity constrained; ice often reused, or used through melting stage</li> <li>1: Ice quantities are extremely limited</li> </ul>	Extent to which ice and/or refrigeration are available.	















