

Swordfish

Market Analysis Report

UNCTAD-DOALOS

OETS Project



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WARNING

Draft report for comments at the Workshop on the implementation of priority actions on sustainable trade of swordfish and other longline fisheries under Barbados Oceans Economy and Trade Strategies, 22 July 2022, Bridgetown Barbados.

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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.

Reference to “t” is made for metric tons.

Reference to “M” is made for millions.

Reference to “mph” is made for miles per hour.

Reference to “lb” is made for pounds.

Reference to ‘kg’ is made for kilograms.

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.

ACRONYMS AND ABBREVIATIONS

| | |
|----------|---|
| ACP | Africa, Caribbean and Pacific |
| ALDFG | Abandoned, lost, or otherwise discarded fishing gear |
| BARNUFO | Barbados National Union of Fisherfolk Organisations |
| BBD | Barbados |
| BFD | Barbados Fisheries Division |
| BHTA | Barbados Hotel and Tourism Association |
| BTMI | Barbados Tourism Marketing Inc |
| COVID-19 | Coronavirus disease |
| CNG | Compressed Natural Gas |
| CNFO | Caribbean Network of Fisherfolk Organisations |
| CRFM | Caribbean Regional Fisheries Mechanism |
| DOALOS | Division for Ocean Affairs and the Law of the Sea |
| FAC | Fisheries Advisory Committee |
| FAO | Food and Agriculture Organization of the United Nations |
| GCFI | Gulf and Caribbean Fisheries Institute |
| ICCAT | International Commission for the Conservation of Atlantic Tunas |
| KI | Key Informant |
| NOAA | National Oceanic and Atmospheric Administration |
| OETS | Oceans Economy Trade Strategies |
| SDG | Sustainable Development Goal |
| SIDS | Small Island Developing States |
| TNC | The Nature Conservancy |
| UNCLOS | United Nations Convention on the Law of the Sea |
| UNCTAD | United Nations Conference on Trade and Development |
| UNDP | United Nations Development Programme |
| WECAFC | West Central Atlantic Fishery Commission |

EXECUTIVE SUMMARY

This report documents the outcomes of the investigation of the market potential both local and export for Swordfish (*Xiphias gladius*). The objective of this preliminary study is to expand sustainable production opportunities available within the Barbados quota allocations for Swordfish under the International Commission for the Conservation of Atlantic Tunas (ICCAT). The report begins with an introduction of the UNCTAD-DOALOS “Evidence-based and policy coherent Oceans Economy and Trade Strategies” (OETS project) and its overall objective. A brief overview of the longline fishery including a historic development timeline is presented to provide context and highlight major milestones over a 70-year period. Information on Swordfish biology, harvesting and management is also outlined.

A multi-method approach, which included both primary and secondary data collection was employed in this study. Data collection, including 55 semi-structured interviews, analysis of Swordfish landings, a literature review and participant observation, was conducted during the first semester of 2022. The use of multiple methods and data sources allowed researchers to obtain information on respondents’ perceptions on barriers and enablers to establishing and sustaining a local swordfish market. Stakeholder perceptions and information gleaned through desk study were categorised into main themes that best illustrate key issues and opportunities at the different stages along the value chain (Inputs, Harvest, Processing and Distribution, Sales and Marketing and Consumers) and the essential support activities including quality control and environmental and social safeguards.

Swordfish landings by longline fishing vessels averaged 15 metric tons (t) over the period 1997-2020. Landings were quite variable from year to year given the fact that Swordfish are usually incidental catches and not specifically targeted by the longline fleet. Landings were well below the allotted annual quota of 45t (round weight) for Swordfish except in 2005 when 44t was landed, with the longline fleet accounting for 33t. Exports have been minimal in recent years due to the low prices (\$3.75/lb) being offered by the Miami importer. However, prices in 2022 have increased to \$5.50-7.50/lb providing an opportunity to increase exports. Input costs for longline vessels generally range from \$4500 - \$9000 for a typical 7–14-day trip resulting in a high market price for this premium product. Fresh Swordfish is sold from the boat at \$4.00/lb, while market prices range from \$5.00 - 10.00/lb.

This preliminary analysis has given insight to the key issues and opportunities that exist along the value chain to promote the expansion of the local and export Swordfish market. The recent increase in the export price offers an opportunity to explore new markets and earn foreign exchange. Key findings suggest that there is room for expansion within sustainable limits. However, there are some barriers that have hindered development in the past including high operational costs, limited access to funding and inconsistent data collection, along with, low ex-vessel price and lack of marketing and limited value added. Enablers also exist that can be promoted as interventions for changing practices such as communication tools and technology, youth engagement and fisherfolk leadership, representation, and advocacy. Recommendations for future development of Swordfish local and export markets including innovative ideas for

marketing Swordfish are also presented. Literature cited and other resources are included in the penultimate section of this document. Appendices including interview questions, fuel receipts and examples of marketing initiatives close the report.

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INTRODUCTION

This section provides a report outline, summary of the UNCTAD-DOALOS “Evidence-based and policy coherent Oceans Economy and Trade Strategies” (OETS project), its overall objective and related project activities. A brief overview of the longline fishery including a historic development timeline is also presented. Information on Swordfish biology, harvesting and management is outlined in the final sub-section of the introduction.

Report outline

This report documents the outcomes of the investigation of the market potential both local and export for Swordfish (*Xiphias gladius*). The document begins with a summary of the UNCTAD-DOALOS “Evidence-based and policy coherent Oceans Economy and Trade Strategies” (OETS project), its overall objective and related project activities. A brief overview of the longline fishery including a historic development timeline is also presented to provide context and outline major milestones over a 70-year period. Following the introduction, the multi-method approach employed in the study and key findings are outlined. The discussion section outlines barriers that have hindered development of Swordfish markets in the past and enablers that can be promoted as interventions for changing practices. Recommendations for future development of Swordfish local and export markets including innovative ideas for marketing Swordfish are also presented. Literature cited and other resources are included in the penultimate section of this document. Appendices including interview questions, fuel receipts and examples of marketing initiatives close the report.

UNCTAD-DOALOS OETS Project

The United Nations Conference on Trade and Development (UNCTAD), in cooperation with the Division for Ocean Affairs and the Law of the Sea of the Office of Legal Affairs of the United Nations (DOALOS), is executing the project "Evidence-based and policy coherent Oceans Economy and Trade Strategies", (OETS project) from January 2018 to June 2022, within the framework of the eleventh tranche of the United Nations Development Account. The beneficiary countries of the project are Barbados, Belize, and Costa Rica.

The project aims at supporting coastal developing countries, and particularly small island developing States (SIDS), in realizing economic benefits from the sustainable use of marine resources and understanding the legal and institutional frameworks underpinning such potential. It will further assist coastal developing countries and key stakeholders in promoting the sustainable trade of products and services in ocean-based economic sectors by analyzing, elaborating, and adopting evidence-based and policy-coherent Oceans Economy and Trade Strategies (OETS) and enhancing national implementing capacities (UNCTAD 2018).

In the context of the implementation actions under the OETS project, an update and expansion of the 2008-2010 study "Economic Valuation of the Barbados Longline Fishery-Landings, Costs,

Net Profit and Return on Investment" was commissioned at the request of the Barbados Fisheries Division. Additional project activities include the exploration of the market potential for both local and export of Swordfish (*Xiphias gladius*) and the implementation of an experimental fishing exercise to identify best fishing techniques and costs for Swordfish harvesting. The objective of this preliminary study is to expand sustainable production opportunities available within the Barbados quota allocations for Swordfish under ICCAT. Finally, an assessment of the impact of circle hooks on catch composition and the rates of live vs. dead capture of all species at haul-back taken by local longline gear will be conducted.

The preliminary findings of these experiments will be presented to stakeholders for their feedback, and participants will be encouraged to offer innovative ideas for marketing and selling Swordfish. It is anticipated that the outcomes of this OETS project component will improve the capacity of national stakeholders to assess and identify promising products and/or services in key ocean-based economic sectors within the framework of the 1982 United Nations Convention on the Law of the Sea (UNCLOS).

Brief Overview of the Barbados Longline Fishery

The development timeline of the longline fishery in Barbados spans approximately 70 years (**Figure 1**). The first notable milestone on the timeline occurred in the 1950s when experiments with miniature surface longlines were conducted by the Barbados Fisheries Division (Wiles, 1963). A decade later, fishing trials were conducted with much longer surface longline gear under the UNDP/FAO Caribbean Development project. These trials had little success and it was concluded that it would not be profitable to develop a longline fishery in the eastern Caribbean region.

During the winter of 1983-1984, United States longliners operating in the region effectively demonstrated that fishing for large pelagics in the eastern Caribbean region was financially viable (Hunte et al. 1994). This stimulated the interest of some local boat owners in the fishery and experiments with small longlines were conducted on some of the larger iceboats (Weidner et al. 2001).

In January 1988, trials using a typical longline operation to target Swordfish ("Florida Style") were conducted as part of the Crown Agent Institutional Strengthening Project (Crown Agents 1990). According to the report, the style of operation was very different to that which was practiced in Barbados at the time. Unfortunately, there was no account of the results of the trials in Volume 3 of the report.

Commercial fishing had a modest start in 1988 with just 3 vessels, *Lady Di* became the first longline vessel registered to operate in Barbados. Since then, the fishery has grown rapidly, experiencing several shifts in target species, gear design and fishing operations (Walcott et al. 2009). Large pelagic species specifically targeted include mainly sailfish (*Istiophorus albicans*), blue marlin (*Makaira nigricans*), white marlin (*Tetrapturus albidus*) collectively referred to as billfish; and the aggregate group of tunas comprised primarily of yellow fin tuna (*Thunnus*

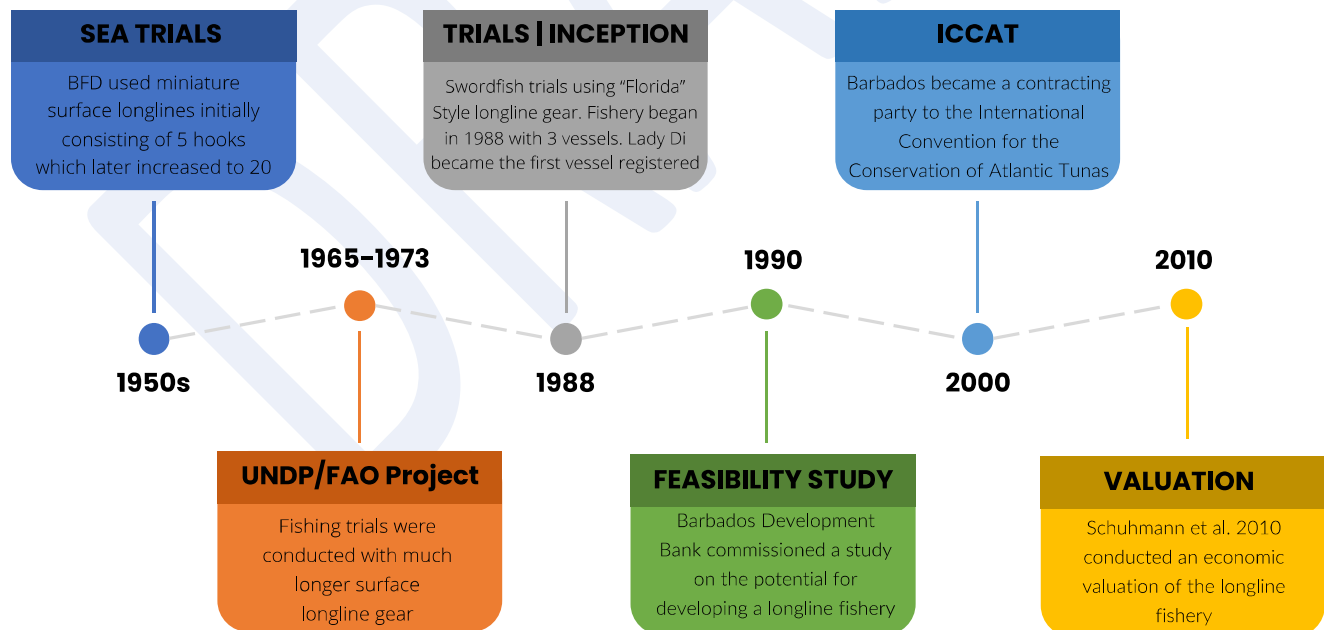
albacares), bigeye tuna (*Thunnus obesus*) and albacore (*Thunnus alalunga*). Swordfish (*Xiphias gladius*) are also taken on longline gear.

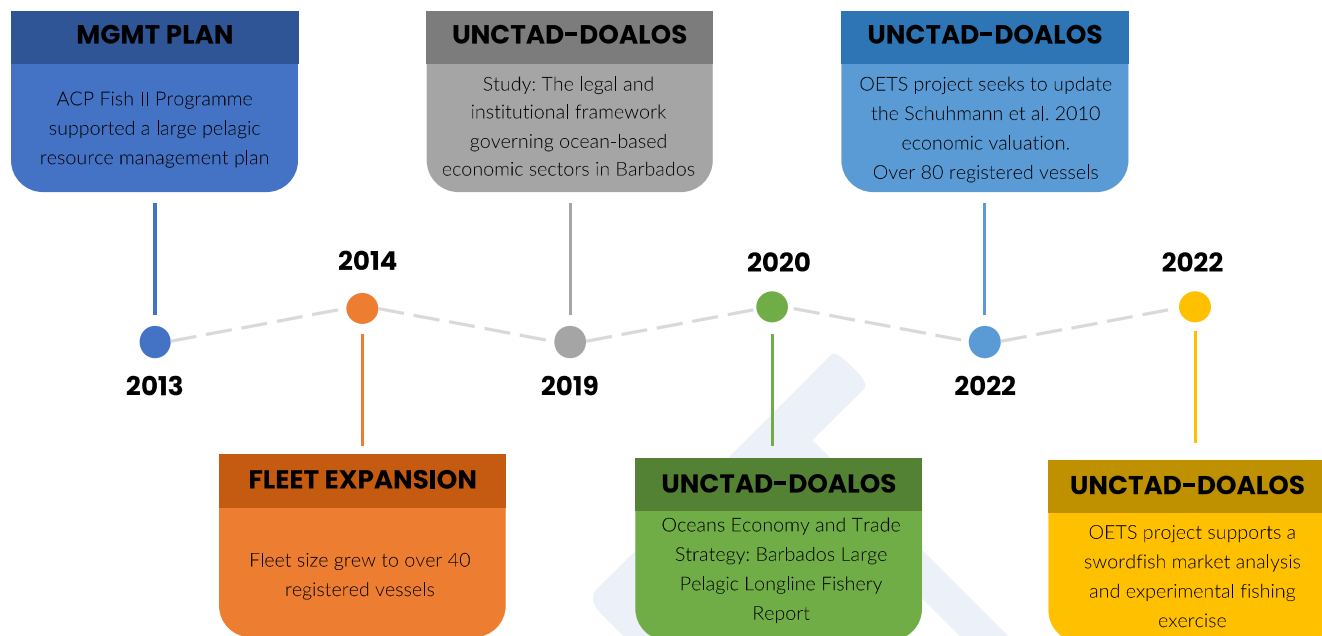
The Barbados longline fishery is currently an important contributor to the Barbados fishing industry. The fishery contributes over 90 per cent of the State’s total catch of tunas, billfish and swordfish. The fishery was valued at \$5.3M in 2009 after considering vessel-level spending, landings and fleet earnings (Schuhmann et al. 2010). Exports generate approximately \$1.6M in foreign exchange annually based on an average of 176t tuna being shipped to the United States.

During sargassum years (2011-present), flyingfish landings, which accounted for 62 per cent of total landings before 2011, now only account for 36 per cent (Leslie 2021). Over the same period, the contribution of large tunas has increased from 8 per cent to 17 per cent and billfish by 2 per cent. This recent development has shown the potential for the fishery to maintain a year-round supply of fresh fish, and support full-time direct and indirect employment in the fishing industry.

Taking into consideration the achievements of the longline fishery in such a short timeframe, the existing pool of human resources, and the important contribution to the Barbados fishing industry, the immediate future of longlining seems certain. The long-term outlook of the sector however is dependent on a variety of factors including the status of the target and ancillary species, private sector investment and continued demand in local and export markets.

Figure 1: Development timeline of the Barbados Longline Fishery (1950s-2022)





Source: Elaborated by the author (2022).

Swordfish biology, harvesting and management

Swordfish (*Xiphias gladius*) are one of the fastest predators in the ocean. Their streamlined body allows them to swim at high speeds, up to 50 mph. They are described as highly migratory meso-pelagic fishes widely distributed throughout tropical and temperate waters between 45°N and 45°S, and in large, enclosed basins such as the Gulf of Mexico (GOM), the Caribbean Sea, and Mediterranean seas (Palko et al. 1981, Nakamura 1985). Swordfish grow quickly and reach a maximum size of about 1,165 pounds and up to 14 feet long. However, the average size caught in the fishery is 50 to 200 pounds (NOAA 2020). Swordfish have a lifespan of about 9 years, they reach sexual maturity between 4 and 5 years of age. Spawning occurs multiple times throughout the year in warm tropical and sub-tropical waters. Swordfish feed at the top of the food chain and are rarely preyed on by other animals. They feed on a variety of fish and invertebrates such as squid.

Fishermen mainly use pelagic longline gear to harvest Swordfish. Fishing is usually conducted at night with lightsticks acting as lures attached to the gear (Parker et al. 2015). Rod-and-reel, harpoon, and buoy gear are also used to target swordfish. Pelagic longline gear has no impact on habitat because they're used in the water column and do not come into contact with the ocean floor.

Deep-drop fishing gear to harvest Swordfish is being promoted by The Nature Conservancy (TNC) and partners as a more sustainable way to fish. A recent TNC magazine article outlines the following description of how the gear is configured to maximise catch rates (Jenkins 2021). "Fishing tackle is suspended off a buoy that floats at the water's surface. A flag acts like a bobber,

visually indicating when a fish has been caught. Instead of placing swordfish baits near the water's surface, this new gear is set 800 to 1,200 feet deep. This is where swordfish are likely to be caught during the day, and where the baits will attract fewer other fish or marine mammals. The main line is outfitted with a weight to keep it steady in the ocean currents and reduce entanglement with other animals. It also has a small strobe light, believed to either attract swordfish or mimic the bioluminescence of squid. Baited hooks are attached to the main line”.

Barbados became a contracting party to the international fisheries management organisation, responsible for managing fisheries for large pelagic species, the ICCAT in 2000. Since then, Barbados has been operating within the management restrictions of ICCAT which enforces an annual quota of 45t for Swordfish. Parker et al. 2015 outlines that Barbados acquires several rights and obligations in relation to the management of its large pelagics fisheries through its membership in ICCAT. The authors argue that to strengthen its negotiating position with ICCAT to benefit the local longline fishery, Barbados must both demonstrate a clear commitment to effectively manage the fishery while articulating its development objectives.

In 2013, a Large Pelagic Resource Management Plan for Barbados was developed with support from the Africa Caribbean and Pacific (ACP) Fish II Programme. The main objective of the plan was to improve the management of the fishery to address central issues such as increasing profitability and controlling fishing pressure pending the collection of relevant data and information.

Future management measures to be implemented include the use of large circle hooks to prevent by catch and the use of dehooking devices to release incidentally caught turtles. Circle hooks minimize the damage caused by hooking, giving sea turtles and other marine mammals a better chance of survival when released.

METHODOLOGY

A multi-method approach, which included both primary and secondary data collection was employed in this study. Primary data collection involved interviews with longline boat owners (n=12), longline captains (n=4), sport fishers (n=2), restaurants and hotels (n=4), and fisheries management officials (n=3). Barbados National Union of Fisherfolk Organisations (BARNUFO) board members were also consulted. Interviews were conducted in person at the Bridgetown Fisheries Complex, online using Zoom web conferencing and over the telephone. Semi-structured interviews were conducted since they facilitated a predetermined list of interview questions (**Appendix I**) but still gave the interviewers the scope to ask further and more in-depth questions. This flexibility allowed responses to be coded by theme, while still preserving the individuality of responses.

Interviewees were selected using a snowball sampling approach. The sole tuna exporter was a key informant consulted in the early stages of the study to ascertain the number of active boats (n=32) and acquire contact information for boat owners and captains. Snowball sampling is a non-probability sampling technique where existing participants recruit other participants for the

study. Here, key informants identified other interviewees of interest. This method can be useful in identifying participants within a specific area since it exploits existing social relationships. This made it easier for researchers to find participants and as a result, data collection was cost effective and time efficient. Codes are used in the Key Findings section of the report to refer to the perspectives of key informants. The codes used follow a simple format KI BBD #, where 'KI' stands for key informant, BBD refers to Barbados and a specific number is included to differentiate interviewees.

Participant observation was also a key method used to support data collection and validate responses. Researchers were immersed in the day-to-day activities of participants through frequent visits to the Bridgetown fisheries complex to observe offloading, fish sales, and preparatory activities for fishing trips. This approach allowed the researchers an opportunity to observe social issues first-hand and provide information on human behaviours and experiences in a particular context.

Secondary data collection was conducted to gather existing data and information on the Barbados longline fishing industry generally and swordfish harvesting techniques, management challenges and marketing strategies specifically. Data and information were collected from peer-reviewed journal articles, technical reports, conference proceedings, newspaper articles, webpages, and grey literature. This review offered insight into the responses of key informants and validated information in many cases.

Swordfish landings data (1997 – 2020) were provided by the Fisheries Biologist of the Barbados Fisheries Division. Information on Swordfish exports was acquired from the sole tuna exporter. Figures on swordfish imports (2018-2022) were obtained directly from a large fish processor.

The use of multiple methods and data sources allowed researchers to obtain information on respondent's perceptions on barriers and enablers to establishing and sustaining a local swordfish market. Data collection and review took place between 15 February – 3 May 2022. Stakeholder perceptions and information gleaned through desk study were categorised into main themes of relevance to researchers, fisherfolk, fisheries management officials and policy makers interested in addressing gaps in knowledge and those concerned with supporting innovation using new fishing gear and harvesting methods.

Limitations

It was originally intended that the market analysis study would be conducted simultaneously with the swordfish experimental exercise to support participant observation, field trials and offer insight into the profitability of trips where Swordfish was targeted. Field trials would allow fresh swordfish and prepared dishes to be tested in real life selling conditions. Trials could also provide the opportunity to solicit consumer feedback and their willingness to pay. Due to delays with the procurement of gear and equipment, the experimental exercise is likely to begin in the final month of project implementation.

Fish import data acquired (2009 – 2019) from the Senior Economist in the Ministry of Agriculture and Food Security grouped billfish imports under the same entry. This made it difficult to determine imports of Swordfish since the commodity code was not indicated. Recommendations have been made by the Chief Fisheries Officer to disaggregate the data in future reporting.

KEY FINDINGS

In this section, a respondent profile, preliminary findings, and stakeholder perceptions are presented using a value chains lens. Evidence documented in published literature of the key constraints are also included. The implications of these findings are discussed in the section that follows.

Respondent Profile

A total of 55 semi-structured interviews (**Table 1**) were conducted over a two-and-a-half-month period (15 February – 3 May 2022). These interviewees were a subset of the range of stakeholders (**Figure 2**) involved in the harvesting, sale, and management of swordfish in Barbados. Given the short timeline of the study only key stakeholders were targeted.

Table 1: Summary of key informant stakeholders

| Interviewees | No. of respondents | Gender |
|------------------------------------|--------------------|-------------------------------|
| Longline boat owners | 12 | 12 M 0 F |
| Longline captains and crew members | 25 | 25 M 0 F |
| Sport fishers | 2 | 2 M 0 F |
| Fish vendors | 5 | 2 M 3 F |
| Large fish processors | 4 | 4 M 0 F |
| Restaurants and hotels | 4 | 3 M 1 F |
| Fisheries management officials | 3 | 2 M 1 F |
| TOTAL | 55 | 52 M 3 F¹ |

Source: Elaborated by the author (2022).

¹ Respondents were mostly male given the fact that the fishery is male dominated. There are no female longline fishers and only a few female-owned active vessels (n=5).

Figure 2: Stakeholder map of key players involved in the harvesting, sale, and management of Swordfish.



Source: Elaborated by the author (2022).

Swordfish Landings, Exports, and Imports

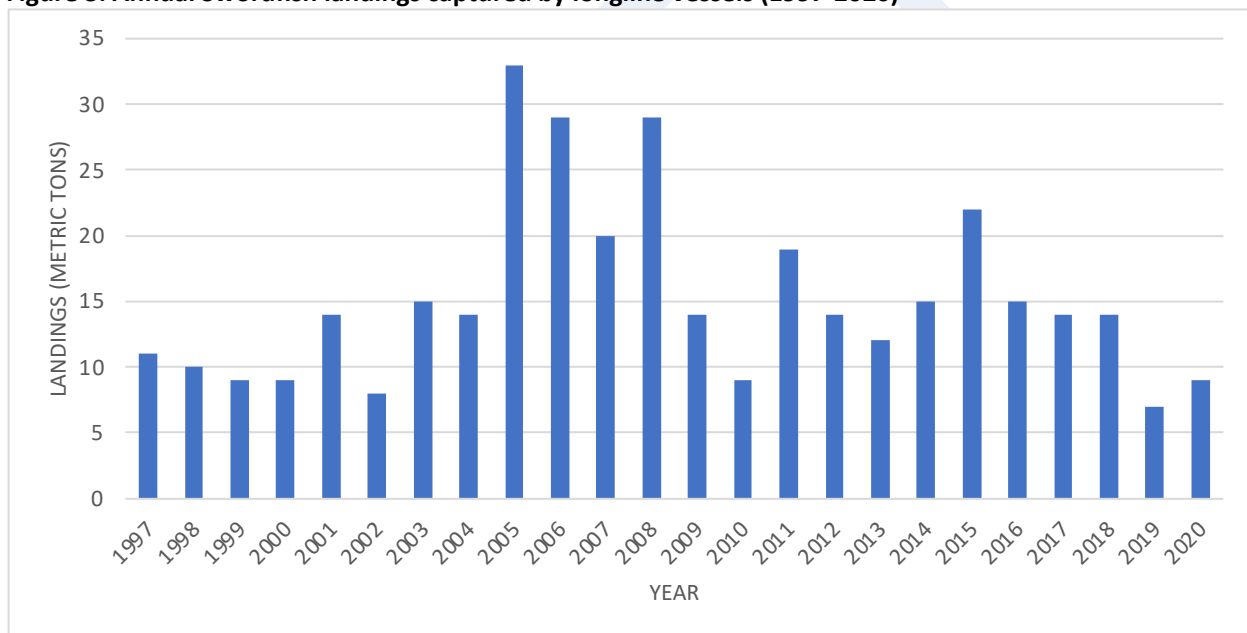
Swordfish landings by longline fishing vessels (1997-2020) are illustrated in Figure 3 below. Landings are quite variable from year to year (average of 15t) given the fact that catches are usually incidental as reported by longline captains and crew members. Swordfish catches are generally higher in the second half of the year (Schuhmann et al. 2010). Landings are also well below the allotted annual quota of 45t (round weight) for swordfish. In 2005, the industry came close to reaching that quota when Swordfish landings reached 44t (Parker, Earle and Marshall-Gill 2015), with the landings from the longline fleet accounting for 33t. The El Niño Southern Oscillation may be attributed as one of the factors that contributed to the exceptional low landings in 2019. Further research is needed to determine the reason for the occurrence. In 2020, an increase in landings occurred amidst lockdowns and government restrictions during the COVID-19 pandemic, but it was still well below landings in previous years.

The sole tuna exporter (KI BBD 1) reported that in recent years Swordfish was not exported due to low prices (\$3.75/lb) being offered in the overseas market. This was not profitable given the export cost and logistics involved, and the fact that the price in the local market started at \$4/lb. In 2022 however, the price increased to \$5.50 -7.50/lb. At the time of reporting, only 3 swordfish had been exported in 2022.

As it relates to imports, a large fish processor (KI BBD 2) reported that in the last 5 years, his company imported on average 70,000 lbs of swordfish per year. In 2021 after tourism had rebounded, 115,000 lbs of swordfish were imported with a steady demand throughout the year. The increased national demand may offer an opportunity if large fish processors are willing to pay a higher ex-vessel price.

Disaggregated data on Swordfish imports (2020-2021) acquired from the Ministry of Agriculture and Food Security reported 127,911 kg (281,404.2 lbs) of Swordfish imported in 2020 valued at \$564,994.00. In 2021, 326,502 kg (718,304.40 lbs) of imported Swordfish was reported at a value of \$1,063,012.00. These figures are well above what is currently being landed by the longline fleet (**Figure 3**).

Figure 3: Annual Swordfish landings captured by longline vessels (1997-2020)



Source: Elaborated by the author based on data procured from the Barbados Fisheries Division (2022).

However, in 2022 the supply chain crisis resulted in many challenges including the delays in the importation of food² and material and equipment for electricity generation³ required by processors. For this reason, only 7,984 lbs of Swordfish have been imported to date. Another large processor (KI BBD 3) also described challenges with imports and informed that the current price for frozen swordfish from Trinidad and Tobago was around \$3.50/lb – i.e., about half the price of local swordfish. This competitive pricing is possible because of lower fuel prices in Trinidad and Tobago among other factors.

² Henry 2022 identified several supply chain challenges in Barbados, including delays in clearance for the importation of food, important medical supplies, and pharmaceutical products.

³ Deane 2022.

Swordfish Value Chain Description

A value chains lens was employed to present the responses and stakeholder perceptions under relevant themes. These themes best illustrate key issues and opportunities at the different stages along the value chain (Inputs, Harvest, Processing and Distribution, Sales and Marketing and Consumers) and the essential support activities (Figure 4).

Figure 4: Simplified Swordfish Value chain. Source: Elaborated by author (2022).



Inputs

According to the longline boat owners and captains interviewed, input costs for longline vessels generally range from \$4500 - \$9000 for a typical trip (7-14 days). Fuel, ice, squid bait, food and gear replacements are the main recurring costs (Figure 5). Recent fuel prices have resulted in significant increases in input costs (\$0.29 increase in May 2022). One longline boatowner and captain (KI BBD 4) paid \$3,000 for 2143.1 litres of diesel on 23 March 2022, less than two months later (3 May 2022), he paid \$4,029.40 for 2289.42 litres of diesel (Appendix II). Other longline captains reported an increase in fuel costs ranging from \$750.00 – 1500.00.

Figure 5: Inputs used by longline vessels -



Source: Longline vessel loading ice (2019, top left) Photo credit: Clish Gittens | Boxes of Bait (2022, top right) | Fuel pump (2017, bottom left) Photo Credit: Pamela Burke | Gear aboard vessel (2022, bottom right).

Additional costs that are not paid every trip include cooking gas, oil, and filters and other preventive maintenance costs, vessel insurance, subscriptions to Vessel Monitoring Systems (VMS), satellite data products and satellite phones.

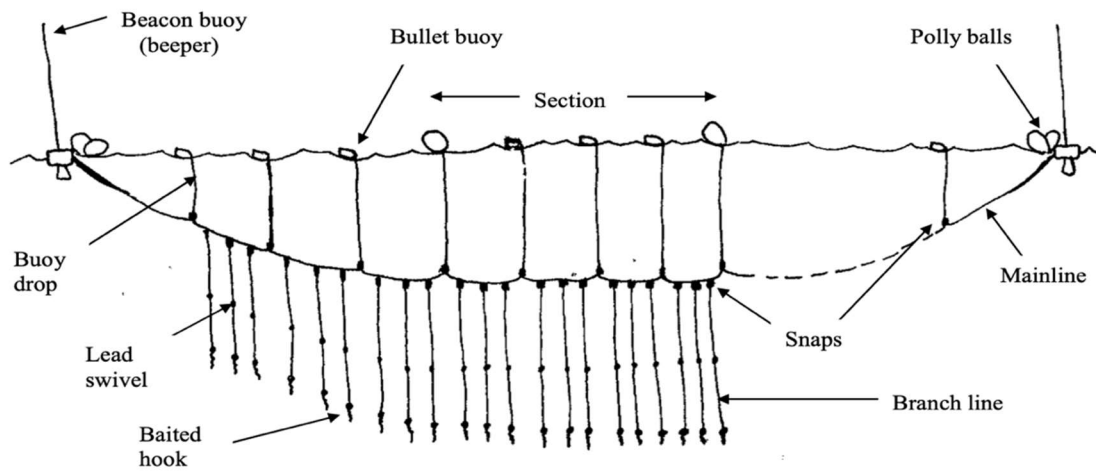
Key informants outlined that to specifically target swordfish, additional gear including circle hooks and light sticks would be needed. Trips would also have to coincide with the full moon. Ideally each of the 500 or more hooks on the branch line would need to have a light stick to attract the Swordfish. Local gear and equipment supply stores current sell light sticks for \$0.48 - 0.74 each and circle hooks in different sizes for \$ 0.57- 1.65 each. Interviewees also outlined that the gear may be configured in a different way to maximise swordfish catches and this may require the need for a separate hook tub (\$500 – 750 each).

Harvest

Anecdotal evidence from key informants suggests that fishing at night during the full moon is the best time to catch Swordfish. Some empirical studies have shown that surface longlines set at night are more productive for capturing swordfish (Poisson et al. 2010). Swordfish harvesting

techniques using surface longline gear are quite like the gear targeting yellowfin and bigeye tunas (**Figure 6**), but lines may be weighted to 120 feet, and buoys configured differently. The figure below illustrates fishing gear composed of a long main line to which several baited hooks are attached at intervals by shorter branch lines called snoods or gangions.

Figure 6: Typical longline fishing gear set up, showing details of the end and adjacent section only



Note: The full gear is made up of around 15 sections.

Source: Walcott et al. (2009).

Longline captains and crew members, and sport fishers also informed that there are swordfish breeding grounds close to shore, approximately 4 miles off the West Coast of Barbados by the 'shelf'. This is where juveniles referred to colloquially as 'mice', 'rats' and 'pups' were occasionally caught. The names correspond to the size in weight where mice are less than 25 lbs, rats are greater than 25 lbs, but less than 50 lbs and pups are greater than 50 lbs but less than 100 lbs. Adults are referred to colloquially as 'markers' at 100 lbs, 'double markers', 200 lbs and 'triple marker', 300 lbs. Larger swordfish referred to as 'Monsters' are known to be caught in the North and Northwest of Barbados. Other fishing grounds identified were 90 miles south of Barbados and even further offshore in the Southeast area known as the 'Research Ridge' (KI BBD 4).

Processing and Distribution

Swordfish is landed headed and gutted at the Bridgetown Fisheries Complex and sold directly to fish vendors, larger fish processors and restaurateurs who then transport it to their plants or places of operation for further processing. In some cases, the Swordfish is cut into smaller pieces, weighed, boxed, and prepared for export to Miami (**Figure 7**).

Figure 7: Swordfish being prepared for export (23 February 2022)



Source: Photo credit: Author.

Larger fish processors import headed and gutted Swordfish (preferred size is 80 lbs) from Trinidad and Tobago primarily and process at their plants. The fish is prepared to suit their clientele's needs (loins, steaks, fillets, etc.) and then collected or delivered. Swordfish is also prepared boneless and skinless and vacuum-packed by large processors usually for local supermarket chains. There is an online fish vendor that also sells vacuum-packed boneless and skinless Swordfish at a premium price of \$10.00 per lb (**Appendix III**).

Sales and Marketing

Locally caught fresh Swordfish is highly sought after by seafood companies and their clientele. Vendors usually purchase Swordfish directly from the boats at \$4.00/lb (KI BBD 5). The market price for fresh Swordfish ranges from \$5.00 - 10.00/lb. Frozen Swordfish is usually sold by large fish processors at \$6.00-7.00/lb. Fish vendors generally sell to market visitors or make deliveries to individuals. Large fish processors sell to hotels, restaurants, fryers, and even to individuals depending on the demand (KI BBD 3). The winter season (December-April) is usually when demand increases to account for the tourism season. The export market currently pays \$5.50-7.50/lb for fresh Swordfish (KI BBD 1). These prices are currently higher than the prices paid by vendors when they buy directly from the boat.

Marketing is usually done by word of mouth, radio announcements, websites, and social media (**Appendix III**). During the COVID-19 pandemic period, many online seafood marketplaces were launched making it easier for consumers to make online payments and have Swordfish conveniently delivered right to their door. Swordfish is usually marketed as a smart seafood choice which is sustainably managed and responsibly harvested.

In Barbados, the nutritional value of Swordfish is less promoted, and generally less known. This contrasts with international markets, including the United States, where swordfish nutritional properties are the main messages used in marketing. Swordfish is an excellent source of selenium, Omega-3, niacin, zinc, vitamin B12, D and other micronutrients that offer important

heart health, immune system and cancer-fighting properties and other benefits (Cobas et al. 2022).

Consumers

Consumers stated that they generally prefer fresh Swordfish and are willing to pay between \$5.00-\$6.00/lb. Hotels and restaurants are willing to pay premium prices for fresh Swordfish at \$6.00 or more during the tourism high season (November – April) when demand is high. Two all-inclusive hotels interviewed reported that they purchase 1,000 lbs of Swordfish a year at \$6.00/lb.

As discussed at the beginning of the section, international demand for Swordfish is increasing. The trend may be due to recent prices being offered by importers. This may also be a response to the increased demand for healthy products.

At present the Barbados exporter is the main source for data on Tuna and Swordfish exports that is sent to the Fisheries Division for archiving. Barbados' Fisheries Division also monitors import trends to inform the fishing fleet of potential opportunities.

DISCUSSION

This preliminary analysis has given insight to the key issues and opportunities that exist along the value chain to promote the expansion of the local and export Swordfish market. The above findings suggest that there is room for expansion within sustainable limits based on ICCAT quotas. However, there are some barriers that have hindered development in the past. Enablers also exist that can be promoted as interventions for changing practices (**Table 2**).

Barriers and Enablers

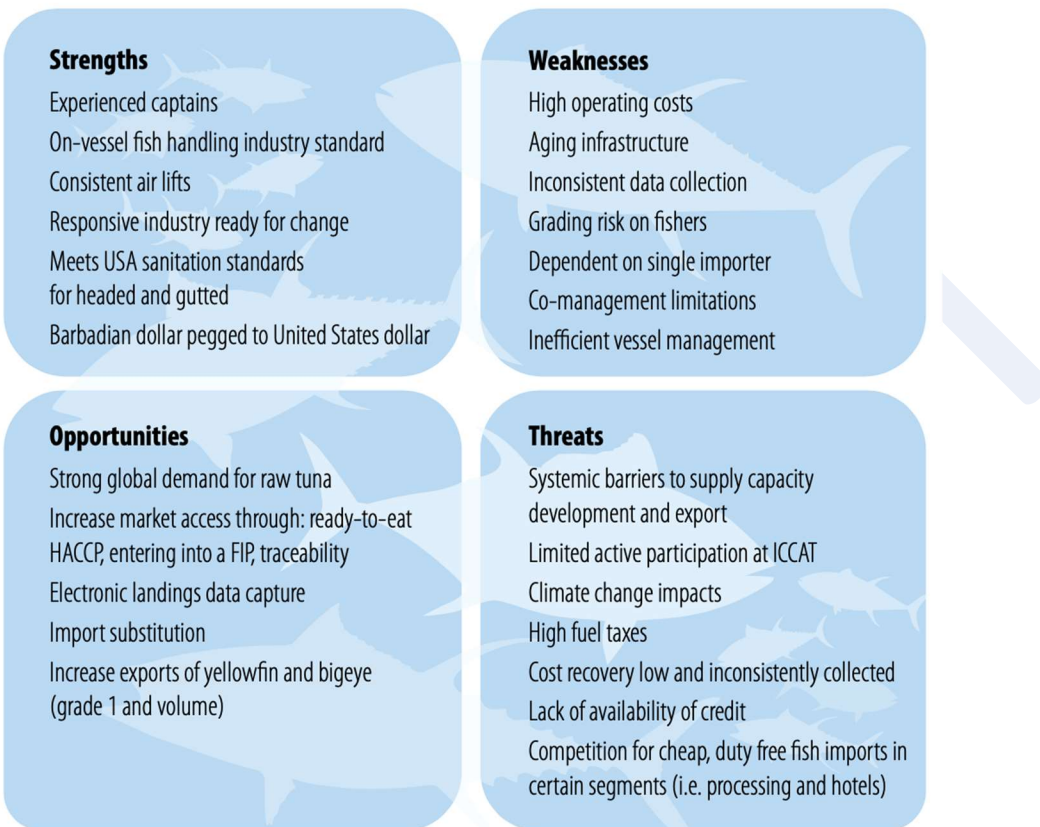
Table 2: Barriers and Enablers to the development of a local and export Swordfish market

| ENABLERS | STAKEHOLDER PERCEPTIONS |
|--|---|
| | Paraphrased responses |
| Fisheries Act/regulations | Provides good guidelines but needs to be updated |
| Fisheries Policy | Draft policy exists but has not been finalised |
| Fisheries Advisory Committee (FAC) | FAC has not been appointed after recent elections |
| Fisherfolk leadership, representation, and advocacy | BARNUFO plays an important role in representing fisherfolk and advocating for change |
| Involvement of women in the sector | Women bring new effective leadership styles |
| Training and Education | Annual fisherfolk training programmes build capacity |
| Insurance and social security | Social security schemes exist and should be subscribed to |
| Coastal families preserving culture | Coastal fishing communities are keeping the culture alive |
| Youth engagement | Fishers are passing on skills to younger family members |
| Communication tools and technology | Digital technologies can support data driven solutions |
| BARRIERS | |
| Limited access to funding | It is very difficult to access loans for business development or to purchase vessels |
| Impacts of Climate Change, environmental factors, pandemic | The pandemic has resulted in a supply chain crisis that has a domino effect on operations along the value chain |
| Competitive pricing of imported frozen Swordfish | Competition from cheap fish imports which may be duty free |
| Fluctuating demand | Fluctuations in market demand are very dynamic |
| Limited integration with other institutions/sectors | Intersectoral collaboration is needed to solve complex problems |
| Limited ICT capacity and low digital literacy | Fisherfolk are not tech savvy but in recent times fisherfolk are using WhatsApp on their smartphones to communicate |
| Political involvement/interference | Government restrictions led to market closures in 2020 |
| Lack of fisherfolk participation and support to the national fisherfolk organisation | Fishers need to come together to advocate with one voice |
| Unsatisfactory insurance premiums/deliverables | Vessel insurance premiums are too high and the process for claims is very tedious |
| Inconsistent data collection | Landings recorded are underestimates of what is offloaded |
| High operational cost | High fuel taxes are significantly affecting the fishery's profitability |

Source: Compiled by the author (2022).

The barriers and enablers identified by respondents align well with the SWOT analysis (**Figure 8**) that was completed for the Barbados longline fishery in 2021 (UNCTAD, DOALOS & FAO, 2021). The strengths outlined in the figure below can be added to the existing list of enablers to support the access to markets.

Figure 8: Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of the Barbados Longline Fishery



Source: UNCTAD, DOALOS & FAO (2021)

An important point of discussion that arose during interviews was the fact that given high input costs it did not make economic sense for boatowners, captains and crew members to bear the cost of the extra gear needed to specifically target Swordfish. This is reasonable since they are presently getting better prices (\$7.50 – 11.00/lb) for Yellowfin and Bigeye tuna with current gear configurations. As a result, opportunistic catches are likely to continue.

Other respondents alluded to the fact that there is no guarantee that when a large Swordfish catch is landed that fish vendors and processors will want to pay \$4.00/lb, they most likely will offer a lower price for larger quantities. Larger fish processors stated their preference for 80 lb sizes as ideal for preparation of loins, steaks, and fillets requested by clientele (KI BBD 3). However, uniformed sizes of Swordfish have never been caught by longliners and in most cases fish landed are over 100 lbs (KI BBD 4). It is for this reason that large fish processors have been

importing Swordfish from Trinidad and Tobago and other countries where input costs are significantly lower, and prices are competitive.

Stakeholders also posited that the model for increasing Swordfish landings might be to outfit smaller vessels like iceboats with mini surface longlines or use rod and reel to target Swordfish. This may be more economical given the fact that there would be lower input costs and smaller storage capacity. Alternatively, fishing charter boats using rod and reel can explore Swordfish harvesting.

The arguments presented above warrant the need for an experimental Swordfish fishing exercise using different classes of vessels to determine the most efficient and profitable harvesting techniques for targeting Swordfish.

RECOMMENDATIONS

The following recommendations are proposed to promote future development of a local and export market for Swordfish and the longline fishery generally. The recommendations are structured using the five UNCTAD Oceans Economy Pillars and based on trade related targets of Sustainable Development Goal (SDG) 14.

Economic and Trade Pillar

Input cost strategies proposed include a reduction in the cost of bait by importing squid directly from Argentina. In addition, the consistent supply and use of other cost-effective bait including mackerel and jacks (Bigeye scad) needs to be explored. Renewable energy systems can be utilized to power lights, appliances, and charge batteries aboard vessels. Given the recent increase of fuel costs, the use of fuel efficient or hybrid engines, or the use of locally produced biofuels blends including Bio-CNG (Compressed Natural Gas) made using Sargassum (Rum and Sargassum Inc. 2022) can be considered.

Challenges posed by existing machinery and equipment can benefit from partnerships with stakeholders. Longline Captains and Boatowners raised concerns about the use of computerized hybrid engines due to the inability to troubleshoot and fix issues while out to sea. However, they were optimistic that the engines would become more desirable in a few years with the development of new technologies. Government should explore the installation of a solar-powered ice making machine at the Bridgetown Fisheries Complex to reduce the cost of ice. There is already of proof of concept that was piloted at the Skeete's Bay Fish Market in the early 2000's. Fisherfolk can consider buying their own ice making machinery or installing cooling systems onboard vessels. Furthermore, local production of circle hooks and other tackle, in the country or the region, should be explored. These strategies could be foreseen together with initiatives that promote direct advance purchase commitments by restaurants, hotels, and

vendors, as such contracts would provide the capital needed for increased gear requirements to target Swordfish.

Stakeholders should consider attending international fairs, notably the Seafood Expo North America and Seafood Expo Global to explore new export markets for Swordfish and Tuna. Funding can be requested to rent a booth to display high quality seafood products that are branded Bajan. Like Maine lobster, or Alaskan salmon—there is capacity to brand Bajan Swordfish, Yellowfin and Bigeye tuna as both exotic and superior. Barbados could promote the unique selling point such as that the fish is locally sourced, sustainably harvested by third and fourth generation fishers who are preserving their cultural heritage, and has a superior quality.

An innovative marketing strategy can begin by positioning Bajan Swordfish, Yellowfin and Bigeye Tuna as a delicacy. Restaurants that feature it, should identify it on the menu, chefs should refer to it as such when communicating with others about the product and ultimately, it should become commonly referred to in Barbados.

The marketing strategy should also capitalize on the health properties of Swordfish while cautioning about the potential high rates of mercury based on the size of the fish and other factors (Barone et al. 2018). Key messages should advise consumers to limit consumption to no more than one serving per week. Marketing Swordfish products as a healthier option is particularly important in a context where the international community is taking action at the country and global level, to increase consumption of healthier food to address the increasing trends of different forms of malnutrition (such as undernutrition, obesity) and non-communicable diseases.

Processors and vendors can explore the preparation of Swordfish in other forms, such as canned, or in jars for export to Europe and the United States. The sustainability of the production of these products will be based on the costs of equipment, labor, and packaging since cans or jars are not manufactured locally. Flyingfish canning was not sustained in the past for similar reasons.

Environmental Pillar

The impact of single-use plastic light sticks on the environment should be considered in fishing operations. Light sticks that are retrieved should be brought back to shore and disposed responsibly. Local fishing gear companies should be encouraged to keep cost-effective reusable battery operator light sticks in stock and explore bioplastic alternatives.

Abandoned, lost, or otherwise discarded fishing gear (ALDFG) from longline fishing operations is also an environmental problem that is increasingly of concern. Recommendations for future action to reduce ALDFG debris should be discussed and included in fishery management plans.

Social Pillar

To gain sufficient public buy-in, the public needs to be convinced that our Bajan Swordfish, Yellowfin and Bigeye tuna has the capacity to add to our economy, cultural heritage and food quality in a significant way. This also provides the opportunity for the fisheries sector in Barbados to build its overall brand, not only as it relates to Swordfish or tuna. Barbados should become known as the fish capital of the Caribbean, where the best quality fish is found. Barbados is uniquely positioned to do this, considering our heritage of fishing, the prominence of our main fishing village, our culture of consuming fish as well as our visual identity (flyingfish, the trident, blue as a national colour etc.). There are also many opportunities for cross collaboration with other sectors in Barbados, as fisheries is deeply connected to our identity. It spans culture, tourism, agriculture, health, and energy sectors.

It is on this premise that the development of an innovative marketing strategy and plan is proposed. The strategy should take the unique approach of human-centred marketing that makes customers feel seen, heard, and valued and immediately builds trust. The plan should highlight marketing initiatives that are experiential and promote products in a surprising and unconventional way. Gendered marketing was promoted in the past as a useful strategy for engaging consumers, however recent reports outline that consumers are generally becoming less receptive to this technique (Høyskolen 2020). This approach segmented consumers based on their gender and one or several elements of the marketing mix are tailored (product, price, promotion, place) based on gender stereotypes (Powers 2019). It is recommended that gender-neutral marketing should be considered for inclusion in the innovative plan proposed, where sophisticated consumer insights that allow a segmentation based on consumer's personality traits, interests and lifestyle are employed. Implementation of the key components of the strategy and plan should be supported by analytics and a monitoring and evaluation framework to measure performance and impact of communication products.

Scientific and technology Pillar

Experimental fishing exercises are key in informing the potential for expanding the Swordfish market. The exercises implemented under the UNCTAD-DOALOS OETS project will demonstrate the impact of using circle hooks and light sticks on catch rates and determine the feasibility of targeting Swordfish. Future exercises should consider the use of hook timers and time depth recorders to investigate direct and indirect effects of the lunar cycle and other operational factors that affect catch rates, catch composition, fish behavior, capture time, and fish survival.

Future research and development studies can consider the use of advanced tagging technology devices, such as archival tags and pop-up satellite archival tags that can provide comprehensive information on the behavior of swordfish and their movement patterns.

The use of VMS can also support efforts at mapping Swordfish fishing grounds areas and catch per unit effort (CPUE). VMS supports the development of data driven solutions that can inform

decisions about how a fishery can be best managed to balance diverse societal objectives and improve livelihoods. The use of VMS is also important in determining catch location and supporting the development of a traceability framework. There is a growing view among regulators that traceability can be an effective means to identify risk, improve data availability, reduce illegal imports, and address the fragmentation of seafood value chains. It also raises the value of seafood by allowing it to be marketed as sustainable.

The creation of a National Fisheries Innovation hub or cluster should be considered as a standalone initiative or as part of existing blue economy hubs e.g. UNDP Blue Lab to inspire creativity and offer the opportunity for ideas to become a reality. The hub can connect fisherfolk, fisheries management officials and software developers to funding agencies or financial institutions that can provide venture capital to support initiatives.

Governance Pillar

The integration of traditional and local knowledge such as locations of fishing grounds, biological and ecological information on fish species, and knowledge of oceanic climate variables, with natural and scientific information should be institutionalised within existing governance arrangements and should not remain exclusive to project related activities. Informal forums coordinated by fisherfolk organisations (Oistins and BARNUFO) can also support knowledge transfer and integration. Establishing and sustaining a longline fishery advisory committee that reports to the Fisheries Advisory Committee (FAC) can provide a mechanism for co-management and the formulation and implementation of a development strategy and plan for the fishery.

Fisherfolk and partners in the Caribbean should be encouraged to attend and present at regional forums like Gulf and Caribbean Fisheries Institute (GCFI) Annual Conference and the Caribbean Network of Fisherfolk Organisation's (CNFO) General Assembly. Their attendance can facilitate information exchange, provide learning opportunities about the latest technologies, and allow them to share their innovations and experiences.

Fisheries Learning Exchanges (FLEs) can be considered as a mechanism for promoting innovation in Swordfish harvesting techniques. FLEs promote experiential learning which allows participants to better grasp concepts and enhance knowledge and skills. An example of a FLE would be an exchange where fishers from Barbados would be given the opportunity to visit Trinidad, Grenada or the United States to observe and learn new Swordfish harvesting techniques.

Policy implications

The following supporting policy actions are recommended to promote the expansion of local and export markets for Swordfish:

- Mobilising local knowledge for evidence-based policymaking is essential for more effective and sustainable implementation of the fisheries policy and associated management plans.
- Policy formulation and fisheries management plans at the national level should integrate risk management concepts to ensure sustainability across the OETS pillars and build resilience to external factors.
- The engagement and support of the private sector should be enhanced to facilitate investment and innovation in the fisheries sector.
- Marketing strategies and plans should account for gender differences and capitalize on the different interests of men, women, and youth in the fisheries sector and public.

DRAFT

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APPENDICES

Appendix I: Interview questions

Questions for Longline captains and boat owners

| | |
|----------------------|------------------------------------|
| Name of interviewer: | Date: |
| Name of participant: | Boat name and registration number: |
| Gender: | |

1. In your opinion, is there a high demand in Barbados for Swordfish?
2. What harvesting techniques do you use to target Swordfish?
3. Where are the Swordfish fishing grounds located?
4. How often do you catch Swordfish?
5. What factors affect catch rates?
6. Are there specific months in the year when swordfish landings are higher?
7. What is the market price? How does the price fluctuate during the year?
8. Have you considered investing in the gear needed to target swordfish?
9. Are you familiar with ICCAT's annual quota of 45 mt?
10. What are your recommendations for building out a local swordfish market?
11. What has hindered development in the past?
12. Are there any factors that exist that can promote expansion?

Questions for Vendors, Large fish processors, Restaurants and Hotels

| | |
|----------------------|--------------------------------------|
| Name of interviewer: | Date: |
| Name of participant: | Company/Organisation/Title (if any): |
| Gender: | |

1. Is there a high demand for swordfish? Is so, can you give a brief overview of your clientele?
2. Are there specific months in the year when demand is higher?
3. What is the market price? How does the price fluctuate during the year?
4. How has the pandemic affected supply chain logistics?
5. Do you import or buy swordfish locally?
6. On average what volume of swordfish do you purchase monthly?
7. In your opinion, is the quality of fish caught locally superior to the frozen fish imported?
8. Do you think local longliners should invest in the gear needed to target swordfish?
9. Are you familiar with ICCAT's annual quota of 45 mt?
10. What are your recommendations for building out a local swordfish market? What has hindered development in the past?

Appendix II: Fuel receipts



Appendix III: Marketing initiatives



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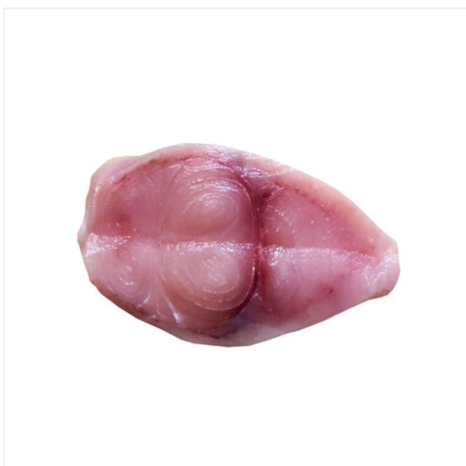
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