ISSN: 1995 –1132

CRFM Technical & Advisory Document
Number 2019 / 04

VALUE CHAIN REPORT – EASTERN CARIBBEAN FLYINGFISH FISHERIES

Technical Support to Facilitate Long-term Enhancement of Livelihoods and Human Well-being for Eastern Caribbean Flyingfish Fisheries

CRFM Secretariat
2019

CRFM Technical & Advisory Document - Number 2019 / 04

Value Chain Report - Eastern Caribbean Flyingfish Fisheries

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CRFM Secretariat
Belize, 2019

CRFM TECHNICAL & ADVISORY DOCUMENT – Number 2019 / 04

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Correct Citation:
CRFM. 2019. Value Chain Report - Eastern Caribbean Flyingfish Fisheries. *CRFM Technical & Advisory Document,* Number. 2019/04. 46p.

ISSN: 1995-1132
ISBN: 978-976-8293-17-6

Published by the Caribbean Regional Fisheries Mechanism Secretariat,
Belize and St. Vincent and the Grenadines.

CONTENTS

1 INTRODUCTION

The Eastern Caribbean flyingfish fishery exists within the western tropical Atlantic Ocean and is recognized as the single most important small pelagic species in the Eastern Caribbean. The Eastern Caribbean flyingfish fishery stock is shared by Barbados, Dominica, Grenada, Martinique (France), Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.

There are three key species of flyingfish, *Hirundichthys affinis, Cypselurus cyanopterus and Parexocoetus brachypterus,* that are regularly harvested out of the around thirteen species that occur in the region. Of those three species, the four winged (*Hirundichthys affinis*) is the most sought-after species, accounting for approximately 99% of the commercial harvest.

In addition to being an important food fishery, particularly in Barbados, flyingfish is an important foraging species for a number of larger pelagic species such as tuna. Thus, the majority of Member States harvest the species to use as commercial bait. The commercial flyingfish fishery is highly season occurring between December and June and is largely based on the seasonal availability of the species.

1.1 Methodology

1.1.1 Data Collection

Data for the value chain analysis was collected from three main sources:

1. **In-person interviews** - key stakeholders in Barbados, Grenada, and Trinidad and Tobago were identified and interviewed by the Study Team over the course of a three-week consultation in October 2017. Stakeholders included harvesters, marketers, processors, and Fisheries Division personnel. All interviews were conducted using a standardized interview guide designed to structure but not constrain open discussions.
2. **Past flyingfish fishery reports and data** – although recent data on the Eastern Caribbean flyingfish fishery was generally not available, considerable research was produced through the 1990s and early 2000s. While this data cannot be relied upon to assess the current state of the fishery, it provided important historical perspective and context.
3. **Online review of business websites** – recent market-related data (i.e. product prices, business activity) was gathered through a search of local business websites.

1.1.2 Fisheries Value Chain Analysis

Value chain analysis is a valuable tool in the development of a country or region's Blue Economy policy. The term "value chain" generally refers to the activities that are performed by a firm or industry in the production and delivery of a good or service. The fisheries value chain at its highest level is the sum total of activities that are performed to harvest, process, market, and distribute seafood products, including whole fish (sold as food or used as bait), processed fillets and other cuts, and value-added niche products, such as roe. Value chains can be analyzed at the level of the firm or sector. Where identifying key differences in firm- level competitors' value chains can often identify competitive advantages between companies, sector-level value chain analysis can uncover potential productivity and processing improvements, buying and distribution efficiencies, and value-added opportunities that broaden product markets and industry-level returns.

At its core, value chain analysis is employed to understand an industry's activities and identify and measure the margin generated at each step in the chain. Value-added margin is the difference between the cost of performing activities and the total value produced at each level of the chain. Increasing harvesting efficiency

and value-added processing are examples of approaches to increase margin at specific points along the value chain. Furthermore, it involves identifying approaches to increase margin where possible.

Value chain analysis can also be performed to identify two potential sources of competitive advantage: cost and differentiation. Cost-based analysis involves identifying the operating and capital costs associated with activities at each level of the value chain, understanding what drives cost and how it has changed over time, and looking for opportunities for the industry to become more cost-efficient. Differentiation-based analysis focuses more on identifying existing and potential ways in which value chain activities and/or products are unique and can command a premium. Producing unique value-added products or superior service to harvesters are examples of potential differentiation advantages. Data limitations and the simplicity of flyingfish value chains presented a major challenge in assessing factors of both cost and differentiation in this study.

The value chain analysis completed as part of this project was conducted at the level of the flyingfish fishery – from harvesting to retail sales, and it should be noted that flyingfish value chains are different for each Member State. The value chain in Barbados is the most complex, as it reflects the importance of the species as a food and export-oriented fishery. It is most simple in Grenada, where flyingfish are used almost exclusively as bait in other large pelagic fisheries, such as tuna.

1.1.3 Stakeholder Consultations

The NEXUS Consultancy Team organized a trip to set up meetings with key fisheries stakeholders in Barbados, Trinidad and Tobago and Grenada. The purpose of this trip was to meet with representatives of National Fisheries Departments, fishing industry and other relevant stakeholders involved in the fishery. The Consultancy Team prepared an interview guide (described below) to help guide the conversations and gather information on data collection, data management, fishery, fishing activities, markets, import/export, and socio- economic components (employment, livelihoods, etc.).

INTERVIEW GUIDE

The Consultancy Team used the following outline to guide the conversation held with key fisheries stakeholders.

- General introduction and discussion of project objectives.
- Review of data and information needs for project outcomes.
- Discuss matching project outcomes with Division work plans.

Discussions regarding data and information needs were guide by the following:

Data:

- Number of harvesters / enterprises.
  - Number of vessels.
  - Annual landings (volume and value).
- Number of buyers / brokers
- Number of processors / facilities.
  - Annual throughput
  - Annual sales
  - Employment

Markets

1. How does the flyingfish fishery work?
   a) When does the season start and end?
   b) How many days per week do people fish?
   c) How many hours per day? From when to when?
   d) Who decides when the season starts/ends?
   e) How much is typically caught in a day/ month/ year?
      i) Most?
      ii) Least?
   f) Where does the fishery take place?
2. What dictates what is caught?
   a) Nature / opportunity
   b) Buyers / customers
   c) How does that work?
3. Describe the value chain from dockside to retail.
   a) To whom are fish sold and how? (large firms, small firms, wholesalers, exporters, retailers, direct to consumers, etc.)?
   b) What percentage goes to each?
   c) How much do fish currently sell for (per kilo)?
   d) Who decides the price?
   e) How much does price change from day to day, week to week, month to month?
   f) Where do fish go once bought?
      i) Processing
      ii) Direct to retail
      iii) Other

LIVELIHOODS SURVEY

During a second trip to the region in July and August 2018, the NEXUS team followed up on the value chain interviews conducted in 2017. The following livelihoods survey was developed and employed:

Fishers:

1. What is your primary reason for fishing flyingfish?
2. Are you a vessel owner?
3. If no, are you directly employed by the vessel owner?
4. If not, do you lease the vessel from the vessel owner?
5. Do you need to have a license to fish?
6. If yes, do you have a license?
7. What are the conditions of having a license? If any?
8. If no, does the captain have the license?
9. Do you think there should be licenses for the flyingfish fishery?
10. How many hours do you fish per trip?
11. How many trips do you fish per week?
12. How many months per year do you fish?
13. Which part of the island do you fish?
14. What species of fish do you catch?
15. What type of gear do you use to fish?
16. How much flyingfish do you typically catch per trip?
17. How much do you sell your flyingfish catch for at the market?
18. How much do you earn fishing (either per day/ per week/ per month/ per year)?
19. What portion of your income comes from selling flyingfish?
20. How much does it cost you (fuel, labour, supplies) to fish per day?
21. Does the sale of your catch cover all your costs to fish?
22. If no, how do you cover your costs?
23. Do you hire helpers?
24. If yes, how much do you pay them per day?
25. Do you have another job?
26. What portion of your total income (from all jobs) comes from fishing?
27. Do you use flyingfish for bait?
28. If you buy flyingfish for bait, how much do you spend on it?
29. If you aren't able to catch flyingfish for bait, how much would you have to pay for it?
30. What are your major challenges for catching flyingfish?
31. Do you like your job?
32. If yes, what is the best part of the job?
33. If no, why not?

Buyer:

1. How many days per week do you buy/sell flyingfish?
2. How many weeks per year do you sell flyingfish?
3. How much do you buy flyingfish for?
4. How much flyingfish do you buy?
5. How much do you earn buying/selling flyingfish?
6. How much does it cost you to be a buyer/seller?
7. Who do you sell flyingfish to?
8. How much does it cost to be a buyer/seller?

Processor:

1. How much do you buy flyingfish for?
2. What percentage of flyingfish do you value added process?
3. How much flyingfish do you buy?
4. Who do you sell flyingfish to?
5. How much do you sell flyingfish for?
6. How much flyingfish do you export?
7. Where do you export flyingfish to?
8. What percentage of your annual revenue comes from selling flyingfish products?
9. How many people work in your plant?
10. How many people work with flyingfish?
11. How much are plant worker paid?

Cleaner:

1. How much do you get paid to clean flyingfish?
2. How often do you clean flyingfish per week?
3. How many months a year would you clean flyingfish?
4. Do you clean other fish besides flyingfish?
5. If yes, what species?
6. How old were you when you learned to clean flyingfish?
7. Who taught you to clean flyingfish?
8. Do you have another job?
9. If yes, what percentage of your income comes from being a cleaner?

Consumer:

1. Where do you buy your flyingfish?
2. Do you prefer to buy flyingfish whole to prepare yourself or buy it cleaned?
3. If you buy it whole, do you pay to have it cleaned or clean it yourself?
4. If you pay to have it cleaned, how much do you pay?
5. How often do you buy flyingfish per month?
6. How often do you go to buy flyingfish and aren't able to get it?
7. How much do you usually pay to buy flyingfish?
8. How much are you willing to pay to buy flyingfish?

A number of meetings were held with Fisheries Division staff and key stakeholder groups within the fishery, including harvesters, processors, vendors, consumers, and buyers. In addition to the meetings, a total of 32 livelihood and 21 gender surveys were completed in person.

1.1.4 Constraints and Challenges

In order to conduct a thorough value chain analysis, key data must be available. Full value chain analysis of the Eastern Caribbean flyingfish fishery required data that was challenging to source. Specifically:

- Labour market characteristics for fishery industry / occupation, including gender considerations
- Landed volume and value
- Cost and earnings of harvesters
- Income (individual and/or household) for all occupations related to the flyingfish fishery and support activities
- Costs and revenues associated with marketing, processing, distributing, and retailing flyingfish
- The number of people employed in all occupations related to the flyingfish fishery
- Total imports and exports of flyingfish

- Enterprise counts

Much of this data was unavailable through Member States' Fisheries Divisions and statistical agencies and was gathered through a small sample of stakeholders and from past reports and data sets.

The following sections details the flyingfish value chains in Barbados, Grenada, and Trinidad and Tobago.

2 BARBADOS

2.1 Sector Overview

2.1.1 Production

There are currently approximately 180 ice boats operating in the flyingfish fishery in Barbados. Day boats are also used in the fishery, but their current numbers were unknown at the time of this writing. Historically, flyingfish have accounted for approximately two- thirds of landings of all fish species. Landings have fluctuated fairly widely, with volumes peaking in the late 1980s and ranging between 400 and 2,000 tonnes over the past decade.

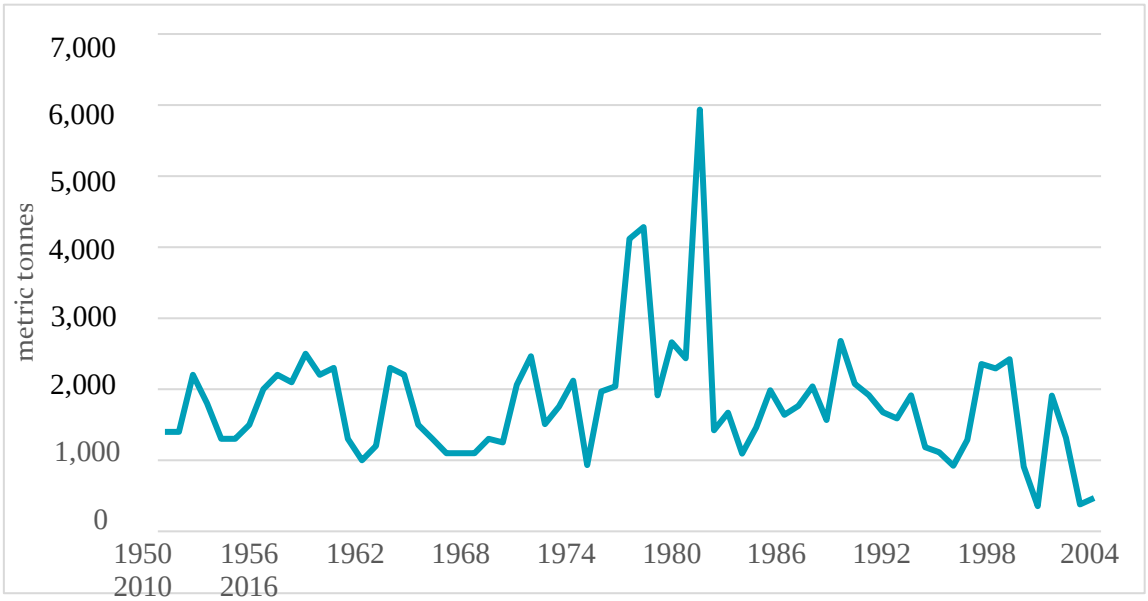


Figure 1: Flyingfish Landed Weight, Barbados 1950 to 2016[1]

2.1.2 Market Dynamics

There is currently no data available that fully describe changes in the demand for flyingfish in either local or export markets. Anecdotally, stakeholders interviewed in Barbados report that both local and export demand for flyingfish has remained stable over the past decade, while supply has declined in recent years. It was also reported that harvesters are shifting focus away from flyingfish and toward other higher value pelagic species that have seen increasing export demand. This observation is borne out somewhat in landings data by species. To illustrate the rising importance of other target species, the combined FAO reported landings in the Eastern Caribbean for tuna species are shown below (Figure 2).

[1] *FAO, 2017. Fishery and Aquaculture Statistics. Global production by production source 1950-2015 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2017. www.fao.org/fishery/statistics/software /fishstatj/en*

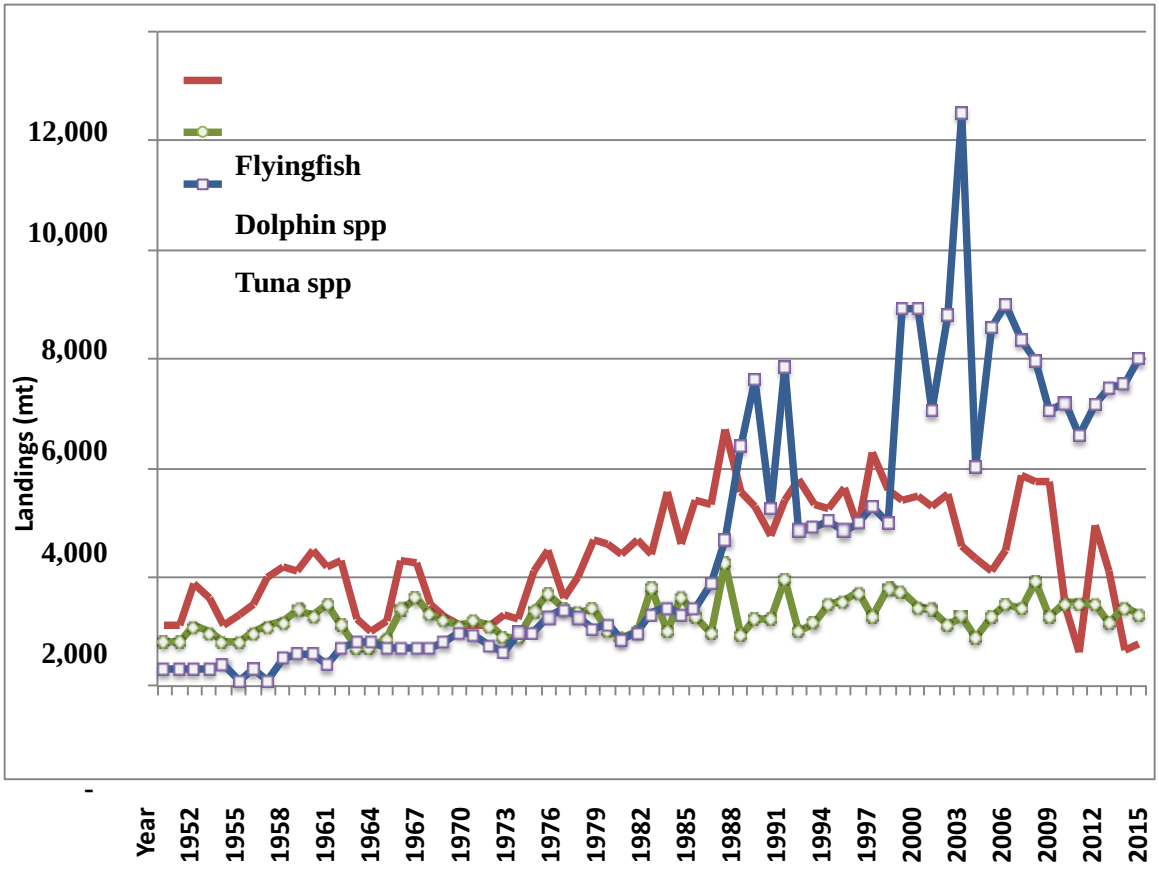


Figure 2: Flyingfish, Dolphinfish, and Tuna Landings, Barbados 1952 to 2015[2]

Following the mid-1970s rise in flyingfish landings, the tuna fishery rapidly developed in the mid-1980s, while dolphinfish landings fluctuated through a consistent range since the mid-1960s. The rising effort directed towards other species is not easy to account for in measures of flyingfish effort, and it is recognized that flyingfish used for bait is not reflected in the landings data.

According to the Food and Agriculture Organization (FAO), Barbados produced an average 2,381 tonnes of pelagic fish between 2003 and 2013. The country also imported more than twice that volume (5,114 tonnes) and exported a small amount (180 tonnes) of processed pelagic fish[3]. Approximately 70% of all pelagic fish consumed in Barbados over that time period was imported from other countries which is an indication of the challenges the country's fishing industry faces in meeting local demand for seafood products.

[2] *FAO. 2017. Fishery and Aquaculture Statistics. Global production by production source 1950-2015 FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2017. www.fao.org/fishery/statistics/software/fishstatj/en*

[3] *FAOSTAT Commodity Balances, http://www.fao.org/faostat/en/#home.*

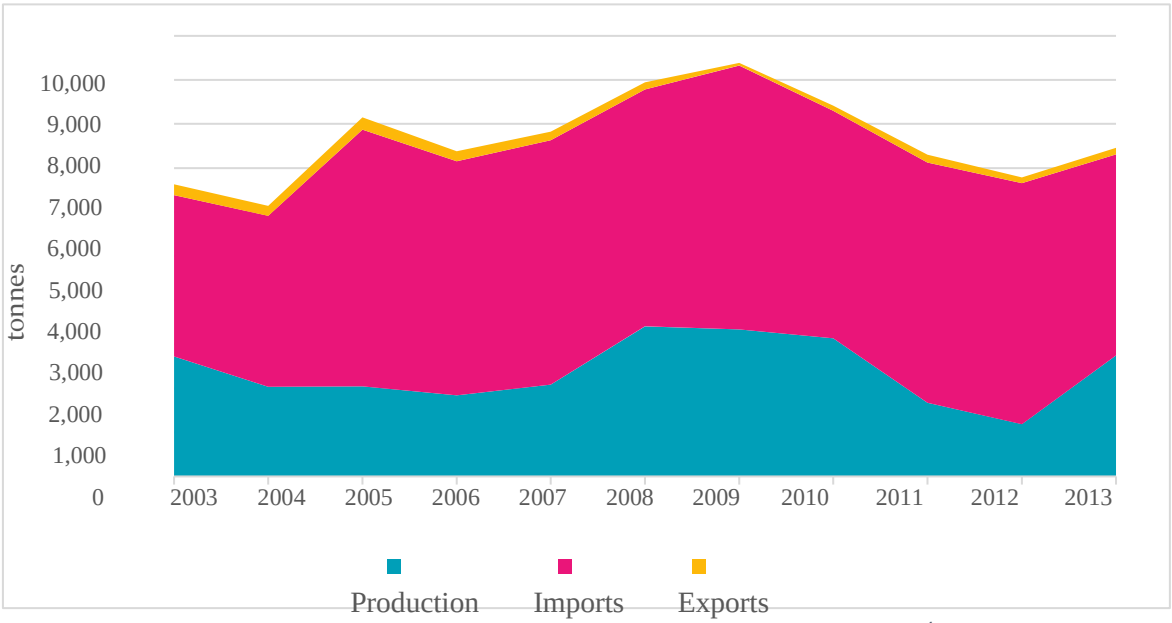


Figure 3: Pelagic Fish Production and Trade, Barbados 2003 to 2013[4]

The trade balance of flyingfish has historically followed a similar trend, with imports of processed product far outweighing exports with the exception of a couple of years in the mid-2000s. Flyingfish imports declined by over 90% from 2001 to 2015, perhaps reflecting both lower landings and other countries in the region shifting harvesting and processing from flyingfish to other pelagic species, such as tuna.

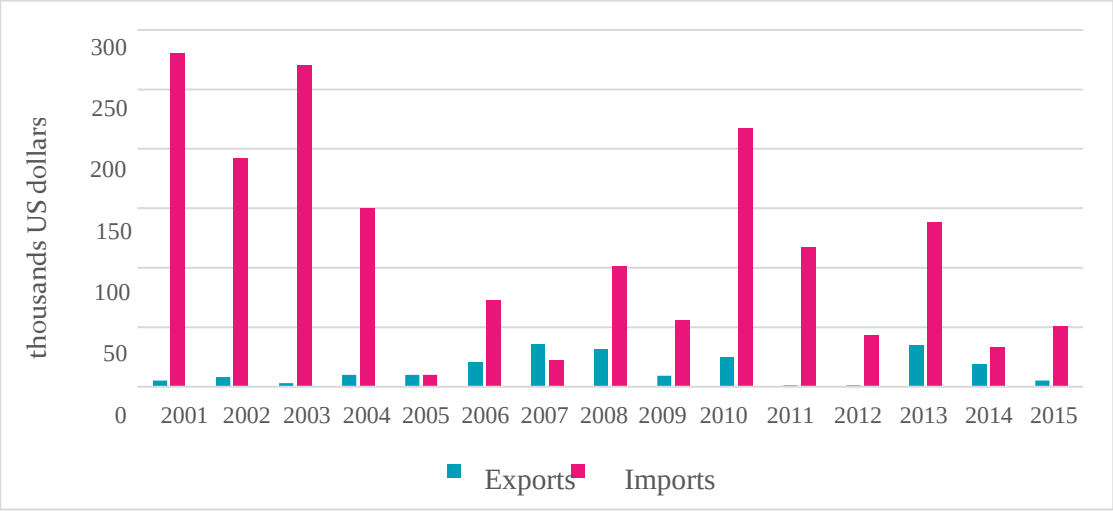


Figure 4: Flyingfish Trade, Barbados 2001 to 2015[5]

[4] *FAO. 2017. Fishery and Aquaculture Statistics. Global production by production source 1950 - 2015 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2017. www.fao.org/fishery/statistics/software/fishstatj/en*

[5] *FAO. 2017. Fishery and Aquaculture Statistics. Global production by production source 1950 - 2015 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2017. www.fao.org/fishery/statistics/software/fishstatj/en*

2.1.3 Socio-economic Importance

2.1.3.1 Contribution to Gross Domestic Product

Current estimates of the flyingfish fishery's contribution to the gross domestic product (GDP) of Barbados are unavailable. The most recent estimate of the fishery's contribution to the economy of the island was developed in 2007 through an analysis of the value added to harvested fish along the value chain – from harvester to processor / exporter[6]. While this study did not provide an estimate of the fishery's direct, indirect, or induced impact on GDP, employment, income, or tax revenue, it did provide key insight into the value of flyingfish in relation to other targeted species. Table 1 provides an overview of the analysis.

Table 1: Estimated Value Added in Commercial Fisheries, Barbados 1999 to 2003[7]

Species	Average Landed Value 1999-2003 ($BBD)	Value Added ($BBD)	Overall value ($BBD)	% Value Added
Flyingfish	3,588,498	26,648,676	30,237,174	88%
Dolphinfish	5,005,384	6,002,346	11,007,731	55%
Tuna	1,402,850	2,435,389	3,838,239	63%
Sea eggs	2,775,000	0	2,775,000	0%
Billfishes	615,609	654,605	1,270,214	52%
All others	402,095	57,780	459,875	13%
Kingfish	266,918	184,283	451,201	41%
Snappers	164,301	245,929	410,229	60%
Swordfish	193,043	123,037	316,080	39%
Shark and barracuda	89,441	84,633	174,074	49%
Reef fishes	89,314	56,056	145,370	39%

[6] *Mahon R., C. Parker, T. Sinckler and S. Willoughby and J. Johnson. 2007. The value of Barbados' fisheries: a preliminary assessment. Fisheries Division, Ministry of Agriculture and Rural Development, Barbados, Fisheries Management Plan Public Information Document No. 2: 24 pp.*

[7] *Mahon R., C. Parker, T. Sinckler and S. Willoughby and J. Johnson. 2007. The value of Barbados' fisheries: a preliminary assessment. Fisheries Division, Ministry of Agriculture and Rural Development, Barbados, Fisheries Management Plan Public Information Document No. 2: 24 pp.*

Species	Average Landed Value 1999-2003 ($BBD)	Value Added ($BBD)	Overall value ($BBD)	% Value Added
Jacks	59,252	33,796	93,048	36%
Bonito	9,771	9,369	19,139	49%
Lobster	7,867	7,775	15,642	50%
Total	**14,669,343**	**36,543,674**	**51,213,016**	**71**

It is clear that, from an economic perspective, flyingfish are extremely valuable. From 1999 to 2003, flyingfish accounted for nearly one-quarter of the total landed value of all commercial inshore and offshore fisheries in Barbados. The fishery also added over $30 million BBD in added value through distribution and processing, representing 73% of the total value added to seafood products over the same time period. The value of flyingfish increased 88% as it moved through the value chain.

The timeframe of this analysis was its major limitation. While flyingfish landings have remained relatively stable since 1999, stakeholders reported in 2017 that overall demand and value of flyingfish products have not increased in recent years, while global and regional demand for other seafood products has increased steadily. For example, global imported value of frozen skipjack and yellowfin tuna has increased 277% and 161% respectively since 2001 (Figure 5).

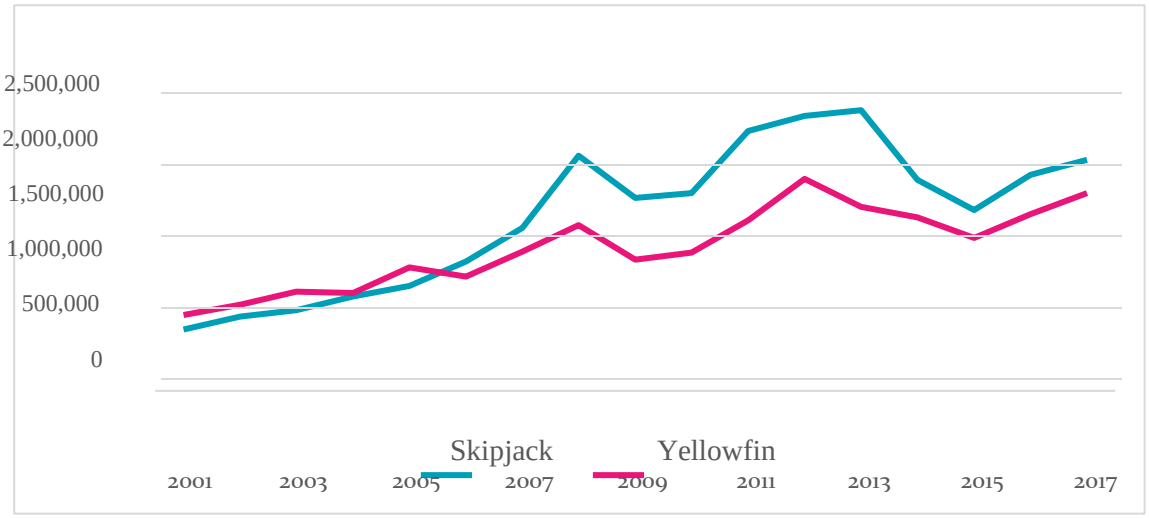


Figure 5: Global Imported Value Skipjack and Yellowfin Tuna, 2001 to 2017[8]

It is reasonable to assume that this rise in demand for other pelagic species would have displaced some of the demand for and value of flyingfish in Barbados. Indeed, stakeholders interviewed in 2017 reported an increase in the targeting of other pelagics and a rise in the prevalence of targeting flyingfish for use as bait in these fisheries.

2.1.3.2 Employment

While no official labour force data was available at the time of this writing, Fisheries Division staff interviewed in 2017 stated that between 1,500 and 2,000 people work full time as harvesters in the flyingfish fishery in Barbados, with an additional 200 harvesting part time. There are also up to 800 full-time and 200 part-time workers employed as vendors in the various landing sites and markets across the island. In addition, over 200 persons are employed as scalers or cutters at fish markets and approximately 125 are employed at fish processing plants. Flyingfish account for a large percentage of the production of these plants.

[8] *ITC calculations based on UN COMTRADE and ITC statistics, http://www.intracen.org/itc/market-info-tools/trade-statistics/*

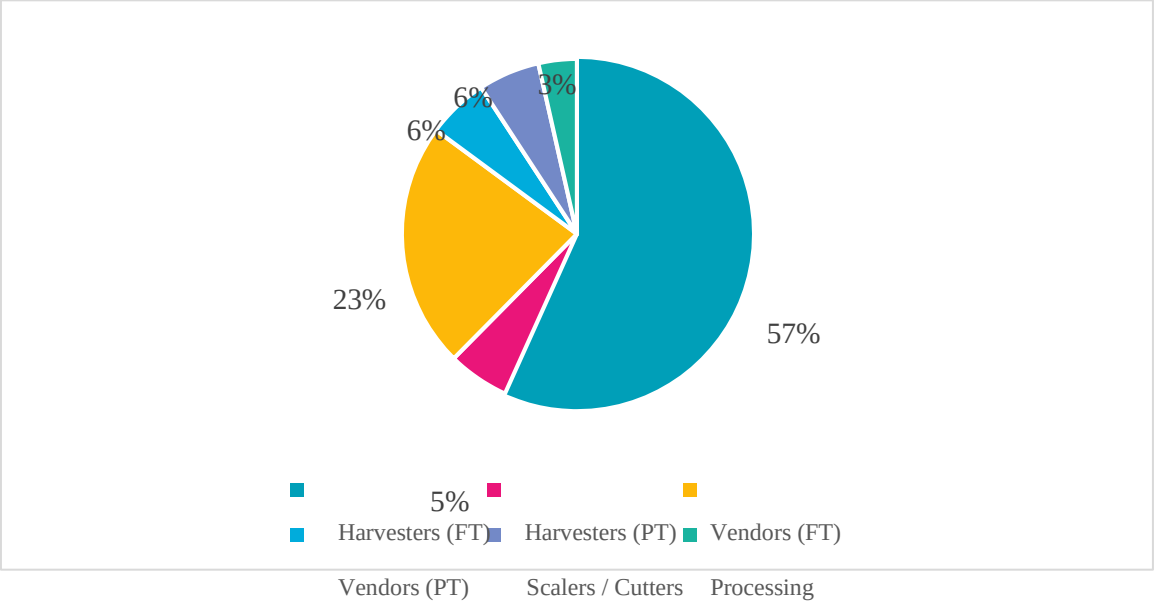


Figure 6: Distribution of Flyingfish Fishery Employment, Barbados 2017[9]

An examination of official labour statistics reveals that, on average, approximately 3,600 people were employed full-time in occupations related to agriculture, forestry, and fishing between 2010 and 2015 in Barbados, representing about 3% of the workforce.

Table 2: Average Employment by Industry, Barbados, 2010 to 2015[10]

	Average 2010 – 2015 (thousands)	**%**
Wholesale & Retail Trade	20.4	16%
Accommodation & Food Services	13.9	11
Construction, Mining & Quarrying	12.9	10%
Public Administration & Defense	9.4	7%
Manufacturing	9.0	7%
Administrative & Support Service	7.3	6%
Education	7.3	6%
Transportation & Storage	6.9	5%

[9] *Adapted from data collected during stakeholder interviews, 2017.*
[10] *Barbados Statistical Service, http://data.centralbank.org.bb/GeneralStatistics.aspx*

	Average 2010 – 2015 (thousands)	%
Other Groups	6.8	5%
Human Health & Social Work	6.8	5%
Finance & Insurance	6.0	5%
Activities of Households as Employers	5.2	4%
Other Services	4.4	3%
Professional, Scientific & Technical Services	4.3	3%
Agriculture, Forestry & Fishing	**3.6**	**3%**
Electricity, Gas, Steam, Water & Air Conditioning	2.8	2%
Total Employed	**130.5**	**100%**

2.1.3.3 Income

Official data on current flyingfish harvester earnings was unavailable. Stakeholders interviewed in 2017 indicated that harvesters can earn between $100 and $170 per day when actively fishing flyingfish. Historical records of daily flyingfish catch indicate that harvesters land an annual average of 44 kilograms of fish per day, which (at current prices) would translate to a daily income of between $100 and $400 BBD per day[11].

Workers in the flyingfish processing industry are generally paid on a per-fish-filleted basis. Stakeholders reported that in 2017, skilled flyingfish cutters were being paid between $0.18 and $0.21 BBD per fish filleted. An experienced cutter could fillet between 600 and 800 fish per day translating to an income of between $540 and $840 BBD per week, or between roughly $28,000 and $44,000 BBD annualized. This is well above the average $200 to $500
BBD per week earned in Barbados[12].

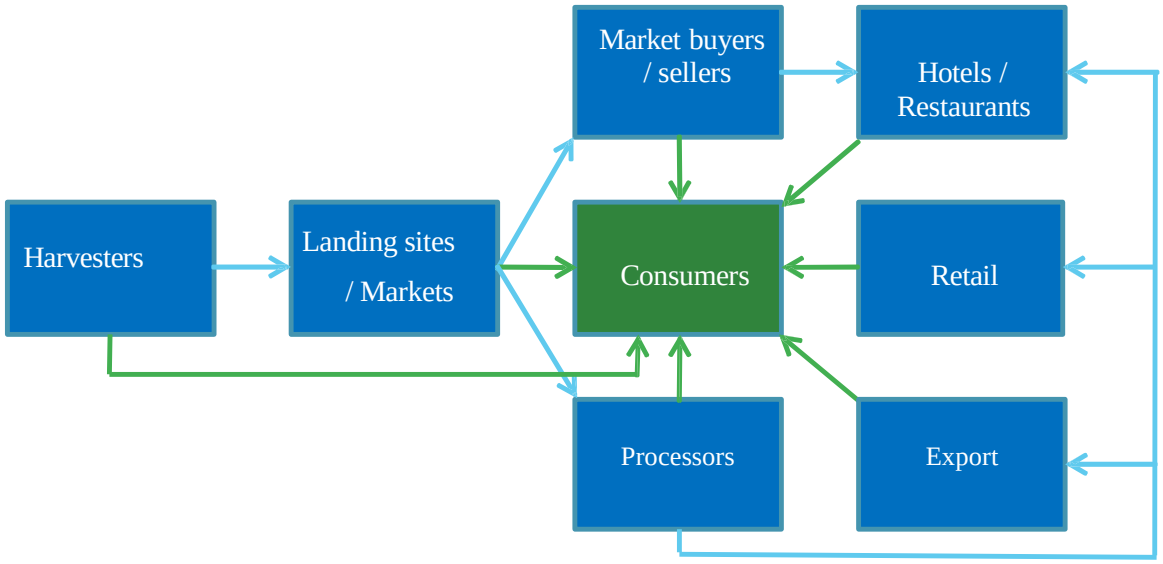
[11] *Oxenford, H. A., R. Mahon and W. Hunte. 2007 [eds.]. The Biology and Management of Eastern Caribbean flyingfish. Center for Resource Management and Environmental Studies, University of the West Indies, Barbados. 267pp.*

[12] *No current estimate of average earnings could be found. The most recent was from a 2009 interview with the Executive Director of the Centre for Money and Finance at the UWI Cave Hill Campus (https://en.wikipedia.org/wiki/Economy_of_barbados#cite_note-2009_wages-17).*

2.2 Flyingfish Value Chain

The flyingfish fishery plays a central role in the culture and economy of Barbados as both an economic generator and the provider of one of the most popular household and restaurant food products. Because of this, the Barbados flyingfish Tobago has the only value chain of any size or complexity in the region. It is comprised of the following elements and flows:

Figure 7: Flyingfish Fishery Value Chain



2.2.1 Harvesters

The Barbados flyingfish value chain begins with harvesters who execute the fishery using either small inshore dayboats or larger iceboats that range further offshore harvesting flyingfish as well as larger pelagics[13]. There were 180 ice boats operating in the flyingfish fishery in Barbados in 2017, with a large number of dayboats also executing the fishery. In the same year, there were between 1,500 and 2,000 fulltime fishers harvesting flyingfish, with an additional 200 fishing part-time[14].

Both inshore and offshore fleets land the bulk of their flyingfish catch at one of three primary landing sites - Bridgetown Fisheries Complex, Oistins Fish Market, and Speightstown Fish Market, which provide ice, refrigeration, basic processing (cutting), and marketing facilities. A small percentage of the overall catch is landed at one of ten secondary sites with basic slab / shed facilities[15]. A further small percentage of flyingfish harvested bypasses these landing sites and is either consumed by harvester families or sold direct to consumers.

Once fish are landed at one of these major sites, the landed weight of the catch is estimated and recorded by market data collectors, and harvesters pay a toll based on weight landed.

[13] *Mahon R., C. Parker, T. Sinckler and S. Willoughby and J. Johnson. 2007. The value of Barbados' fisheries: a preliminary assessment. Fisheries Division, Ministry of Agriculture and Rural Development, Barbados, Fisheries Management Plan Public Information Document No. 2: 24 pp.*
[14] *Stakeholder Consultation, Fisheries Division Staff, October 2017.*
[15] *http://www.crfm.net/index.php?option=com_k2&view=item&id=46:Barbados&Itemid=289*

The bulk of flyingfish harvested is distributed out from these landing sites through one of three channels: market buyers / sellers, processors, consumers[16].

2.2.2 Market buyers / sellers

Buyers / sellers (also known as "venders" or "hawkers") are employed at landing sites and purchase approximately half of all flyingfish landed directly from harvesters. These intermediaries then sell fresh fish to hotels and restaurants or directly to consumers through market stalls.

In 2017, there were approximately 800 full-time vendors employed at landing sites in Barbados, with an additional 500 working part-time[17].

2.2.3 Processors

Seven processing companies operate on the island and purchase roughly one-third of all flyingfish landed directly from harvesters at the landing sites[18]. These companies process fish into a variety of frozen filleted products for wholesale to restaurants, hotels, food service companies, and retail grocery stores. A small percentage of their production is exported to the United States, Canada, and the European Union.

In 2017, it was estimated that approximately 125 people were employed in the Barbados fish processing sector. Total industry production could not be assessed due to data availability constraints; however, in depth analysis was conducted on one of the largest processing operations on the island and provides insight into the importance of flyingfish to the sector.

Case Study: Flyingfish Processing in Barbados

According to a leading processor in Barbados, local demand for flyingfish is as healthy as it has ever been. The challenge in recent years has been securing adequate supply to meet that demand, as well as service small but economically important export markets in the US, Canada, and EU.

This processing company obtains all flyingfish for processing at one of the major government landing sites on the island. In 2017, they paid harvesters between $0.35 and $1.36 BBD per fish at the primary markets, depending on availability of supply. Fish are transported back to the plant where they are hand-filleted by an increasingly scarce workforce with the skills necessary to efficiently cut flyingfish. Cutters are paid between $0.18 and $0.21 BBD per fish, and experienced cutters can fillet up to 800 flyingfish per day.

Fillets are then either sold fresh, frozen, or breaded / frozen to the retail and hospitality sectors. Wholesale prices ranged between $0.60 and $3.00 BBD, depending on the product form and buyer. Value-added gross margins on processed flyingfish products can range from $0.07 to $1.43 BBD per fish.

The processor studied in this case was able to procure approximately 300,000 flyingfish in 2017, where volumes commonly reached close to 2 million in recent years. This sharp decline in supply has hurt flyingfish sales and forced processors to focus on more plentiful, higher margin seafood products.

[16] *http://www.fao.org/fi/oldsite/FCP/en/BRB/profile.htm*
[17] *Stakeholder consultation, Fisheries Division staff, October 2017.*
[18] *http://www.crfm.net/index.php?option=com_k2&view=item&id=46:barbados&Itemid=289*

2.2.4 Consumers

A small percentage of flyingfish (~10%) is also sold directly to consumers through market stalls. Consumers also enter further along the value chain as purchasers of flyingfish through restaurants, hotels, and retailers.

It was noted during field surveys that some consumers will buy larger quantities of flyingfish in the middle of the season when the market is flooded with product as a result of increased landings. This often means that consumers are able to negotiate lower prices compared to at the beginning of the season or end of the season when demand increases. During this time consumers buy large quantities that are processed and frozen for later use.

2.2.5 Restaurants / hotels

A small percentage bypasses all other intermediaries and is sold directly to the hospitality sector. Restaurants and hotels also procure flyingfish from processors in fresh, frozen, and breaded product forms.

2.3 Value-Added Margin Analysis

Value-added margin in this case refers simply to the difference between the cost of purchasing flyingfish and the price received when selling it. It does not take into account cost of sales or other transaction costs.

As with almost any seafood value chain, margin increases as product moves and is transformed through the system. Economic returns tend to be lowest for harvesters who are generally pure price takers. This is particularly true in the flyingfish fishery where product differentiation is virtually non-existent. For example, because flyingfish are sold by the unit or "grain" and measured by the bin, price premiums are not currently paid for size, quality, or freshness. Price fluctuates based on the availability of supply, as demand appears to remain fairly constant over time. Data on the cost of harvesting flyingfish was not available, so the calculation of harvester gross margin could not be completed.

Gross value-added margin for processors can range from just over 100% to approximately 250%, depending on the market they sell product into. Processors report having purchased flyingfish for an average price of $0.86 BBD per fish throughout 2017. Processed flyingfish was then sold for an average price of $1.80 BBD per fish to both retail and hospitality customers, and $3.00 BBD per fish to export markets. Selling price and margin vary based on product form (e.g. fresh, frozen, and breaded) and purchaser (e.g. fish fry versus hotel restaurant). It should be noted that no database of market prices was available at the time of this writing. The following table outlines reported sales prices by a small number of Tobago participants. Ongoing and detailed data collection is required for future value chain margin analyses to be completed with a high degree of accuracy.

Table 3: Value-added Gross Margin in the Barbados Flyingfish Fishery[19]

Supplier	Cost ($BBD/fish)	Purchaser	Sale Price ($BBD/fish)	Gross Margin ($BBD/fish)	Gross Margin (%)
Harvesters	-	Market buyers / sellers	1.86	-	-
	-	Processors	1.36	-	-
	-	Consumers	2.12	-	-
Processors	0.86	Hotels / restaurants	1.80	0.94	109%
	0.86	Retail	1.80	0.94	109%
	0.86	Export	3.00	2.14	249%
Restaurants	1.80	Consumer (fast food)	16.00	14.20	789%
	1.80	Consumer (mid-range)	25.00	23.20	1,289%
	1.80	Consumer (fine dining)	85.00	83.20	4,622%

2.4 Barbados Value Chain Analysis – Key findings and Observations

2.4.1 Support Activities

2.4.1.1 Harvesters

While harvesters are considered the foundation of the flyingfish value chain, a number of key activities and inputs go into supporting this sector. In Barbados, well-developed industries exist to supply flyingfish harvesters, including:

- Suppliers of fishing gear, fuel, bait, ice, food, and water
- Full- and part-time boat crew
- Onshore prep work (repairing nets, preparing boat, etc.)
- Infrastructure – boat launches, wharfs, landing facilities
- Technology – boats, navigation, communication, fishing gear

No recent estimates have been developed that assess the value or contribution of these industries to the economy of Barbados – a factor central to effective value chain analysis and Blue Economy policy planning and policy development. These industries and activities represent potential strategies for livelihood diversification for people working in the flyingfish fishery in that they are additional avenues of employment and income generation that could be pursued by flyingfish fishery participants should economic returns

[19] *Stakeholder consultation (October 2017); online review of food establishments (September 2018).*

from that fishery alone be insufficient to meet their households' financial requirements. Stakeholders interviewed in 2017 reported that most harvesters fish opportunistically and target multiple species as a primary livelihood diversification strategy.

Availability of labour was the major challenge or bottleneck identified at the harvester level of the value chain. It was noted by stakeholders interviewed that flyingfish harvesting is increasingly seen by youth as an occupation or activity of last resort. Increasing prevalence of higher educational attainment and youth outmigration contribute to what is seen as a shrinking fishery labour supply. Additionally, government programs that provide work for unemployed Barbadians are considered a threat to the fish harvesting sector as they offer competitive wages for what is seen as less demanding work.

2.4.1.2 Markets / Landing Sites

The government landing sites, or markets, that help drive the flyingfish Tobago are consumers of a wide range of support activities that should be considered an important part of the value chain. These activities include:

- Human resources –data collectors, buyers / sellers, market staff / managers
- Infrastructure – sheltered facility, ice, fish totes, wharf, carts to move totes
- Technology – scales, data entry tech (computers), communications

Expenditure on all of these support activities represents important spinoff economic activity that adds to the value of the flyingfish fishery. Providing these products and services can also be considered part of a livelihood diversification strategy. No recent estimates have been developed that assess the value or contribution of these support activities to the overall economy of Barbados. Such an assessment can provide useful information to the Government of Barbados in further developing policies related to the development of the Blue Economy.

2.4.1.3 Processors

The processing industry represents the step in the value chain where the bulk of added value is created through transformation and distribution of product. Processors are connected to and depend on a broad range of support activities, including:

- Human Resource – skilled / unskilled processing labour, drivers, loaders, pilots, brokers, managers / supervisors, admin
- Infrastructure – stainless steel cutting tables with water source, trays, bins, processing plant, trucks, road system (transportation infrastructure), forklifts and loading equipment, ship sand airplanes.
- Technology – knives, sanitary equipment (gloves, hairnets, apron, etc.), refrigeration / freezing, cooking and packaging equipment, navigation / communication for transport
- Brokers, administrators, admin support, transporters

The backward and forward economic linkages associated with processing seafood generate the most significant contribution to economy in both the range of goods and services consumed as well as the margin that is added to raw product as it gets transformed into its various filleted, cooked, and frozen forms. The only recent analysis that estimated the economic value of the processing industry and its many spinoff benefits looked at gross value added across all fisheries (referenced in Section 2.1 above).

2.4.1.4 Hotels / Restaurants / Retail

Local and international hospitality and retail industries are the final link in the flyingfish value chain in Barbados. Selling processed flyingfish products to end-use consumers requires the support of a wide range of activities and industries, including:

- Human resources – skilled labour (cooks), unskilled labour, service staff, managers, salespeople, cashiers
- Infrastructure – buildings, kitchen and kitchen appliances / tools, reliable, storage, refrigeration, parking
- Technology – cooking / refrigeration equipment, computers, POS system, computers, communication systems
- Advertising, marketing

A large proportion of the value added to flyingfish occurs at this step in the value chain, where retail and hospitality margins are generally very high. Employment in hospitality and tourism has increasingly been seen as an attractive livelihood diversification strategy for workers in primary industries. In many areas, the growth of these industries driven primarily by tourism has drawn workers out of primary production and into customer service, hospitality, and sales occupations. No recent estimate has been developed that assesses the value or contribution of these sectors to the economy of Barbados.

2.4.2 Value-added Activities

In an effort to extract maximum economic value from any resource, participants at each step of a value chain may undertake specific activities that allow them to increase the amount they receive for the products or services they provide. The following summarizes findings from primary and secondary research on value-added activities in the Barbados flyingfish fishery.

2.4.2.1 Harvesters

Stakeholder interviews and secondary research conducted for this study did not identify any new or innovative value-added activities currently pursued by harvesters in the flyingfish fishery in Barbados. Typical harvest-related value-added activities in fisheries around the world include technologies that improve quality, at-sea processing and packaging, improved handling and refrigeration/freezing techniques, and harvesting technologies that improve catch quality or reduce damage. Ice boats were introduced to the flyingfish harvesting fleet in the 1970s, which was the last major innovation in value-added activity. The artisanal nature of the Eastern Caribbean flyingfish fishery does not lend itself to the practical application of advanced technology that enhances catch quality and value with the exception of harvesters having access to clean ice and the ability to land catch in a timely manner.

2.4.2.2 Landing Sites / Markets

Landing sites and market stalls in Barbados add value to flyingfish in two ways: by providing ice and refrigeration and through minimal processing of a small proportion of landed catch. Providing ice for ice boats and to refrigerate landed catch helps maintain freshness which, in theory, preserves quality and adds value. In practice, flyingfish are sold by the grain in bins and harvesters are not generally rewarded for improvements in quality. Processing flyingfish into fillets is a value-added activity undertaken by market sellers whereby a small amount of labour is applied to transform a whole fish into a more finished product that can garner a higher price.

2.4.2.3 Processors

Seafood processing operations account for the greatest number of value-added activities that take place in the flyingfish fishery in Barbados. In 2017, four major seafood processors and a number of smaller operations purchased hundreds of thousands of flyingfish from fish markets and transformed them into a

range of fresh, frozen, and cooked seafood products for distribution to hotel, restaurant, grocery store, and export markets.

2.4.2.4 Restaurants / Hotels

Restaurants and hotels add value to fresh and processed flyingfish by creating and selling a wide range of culinary preparations to local, tourist, and business-travel clientele. Gross margin on the value-added component at this level of the value chain is usually orders of magnitude greater than what harvesters and even market sellers can achieve.

2.4.2.5 Grocery / Retail

Grocery markets in Barbados and abroad purchase both fresh and packaged flyingfish products. Some value can be added to fresh products through filleting in-store, but generally speaking, most of the potential value has been added through processing and packaging. Retailers will mark wholesale product up and extract their share of the total economic return.

2.4.3 Major Costs / Cost Drivers

2.4.3.1 Energy / Fuel

The rising cost of energy and fuel represents one of the most significant cost drivers for participants at every level of the value chain. Aggregate average retail gasoline prices rose 74% from 1998 to 2016 (Figure 8) in Barbados, Grenada, and Trinidad and Tobago, while the landed price of flyingfish has essentially remained stable over the same period of time. For harvesters targeting mostly flyingfish (dayboats) to sell at market, rising fuel costs could have a negative impact on the profitability of their fishing enterprises, as operating costs rise while flyingfish revenues remain relatively stable. Larger boats may have the ability to offset rising fuel costs by diversifying their catch and targeting higher-value species that have seen increasing market prices relative to flyingfish.

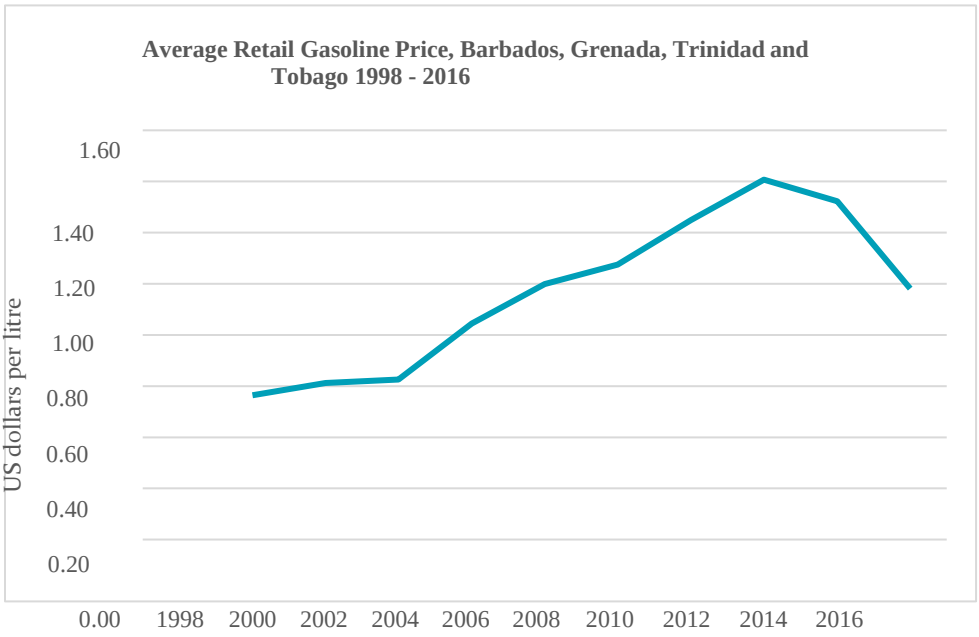


Figure 8: Average Retail Gasoline Price, Barbados, Grenada, Trinidad and Tobago 1998 to 2016[20]

For all other participants along the value chain, rising energy and fuel prices negatively impact the cost of operating facilities (i.e. air conditioning, refrigeration, ice-making, lights, machinery, etc.) and vehicles necessary to process and distribute product.

2.4.3.2 Labour

In an environment of increasing educational attainment and declining labour availability due to demographic shifts in the age of the population, sourcing labour to work in primary production and processing industries can be challenging. In general, a tightening labour market drives employers to offer higher wages in order to attract workers away from higher- paid, less physically demanding occupations and into jobs associated with fisheries. This increase in labour cost places downward pressure on economic returns at all levels of the value chain when prices for flyingfish products remain relatively stable, as stakeholders interviewed in 2017 indicate they have over the past decade.

2.4.3.3 Financing

Stakeholders interviewed in 2017 indicated that one of the major cost drivers at all levels of the flyingfish value chain is the cost of financing. Harvesters reported both the inability to secure adequate financing and the cost of any financing secured as major barriers to entry and constraints on profitability. The costs of financing property, infrastructure, machinery, and other capital investments are also considered major cost drivers and barriers at all other levels of the value chain.

[20] *World Development Indicators, the World Bank (2018, httpd://datacatalog.worldbank.org/dataset/world-development-indcators*

2.4.4 Efficiencies

There are a number of logistical or cost efficiencies that have been or could be exploited at various points along the Barbados flyingfish value chain.

2.4.4.1 Harvesters

Major advances in efficiency and productivity were achieved in the 1970s and 1980s through the introduction of iceboats, which allowed harvesters to range further offshore and fish multiple days while keeping catch relatively fresh. No recent innovations in efficiency were identified during consultation and research.

2.4.4.2 Landing Sites / Markets

Investment in infrastructure and the addition of the manufacture and provision of ice at landing sites had the effect of increasing the efficiency of the distribution of flyingfish in Barbados. Creating central supplies of ice allowed harvesters to load ice boats in a more efficient and cost-effective manner and having a consistent supply on hand for landed fish helps ensure freshness and quality.

2.4.4.3 Processors

A small number of processors on the island have invested in facilities and equipment to produce fresh, cooked, and frozen value-added seafood products increased which had the effect of increasing their local market and opened up export markets throughout the region and in the US, Canada, and EU. These investments increased both process and cost efficiency thereby improving economic returns for those who have implemented them.

Technology aside, efficiency in flyingfish processing is also a function of the level of skill inherent in the cutters employed to fillet fish by hand. Stakeholders reported in 2017 that it was becoming increasingly difficult to source processing labour that possessed an adequate level of cutting efficiency. Efficiency could be improved through the development and implementation of training and mentoring initiatives.

2.4.5 Potential Value-Added Enhancements

A central goal of value chain analysis is the identification of strategies to enhance the value added to the primary product or industry in question. The following outlines some of the potential value-added enhancements identified in the course of this research.

2.4.5.1 Harvesters

The simplicity of primary production in the flyingfish fishery limits the ways in which value can be added. Harvesters recognized decades ago that ice and refrigeration would help ensure freshness and preserve the value of their catch but have not developed any other innovative value-added strategies to improve efficiency, lower cost, or increase the price they receive for their catch. Fisheries in other countries, such as Canada, have invested heavily in fish handling research and training, with some jurisdictions mandating harvesters complete handling courses as a condition of receiving their fishing license in order to ensure high quality and that maximum value is received for product in international markets[21]. If price premiums were available for higher quality flyingfish, proper fish handling would become a value-added strategy, and

[21] *https://www.cbc.ca/news/canada/nova-scotia/lobster-handling-course-keith-colwell-1.3485591*

training could be designed to help harvesters maximize returns on their catch. At present, processors pay the same price per fish regardless of size or quality.

2.4.5.2 Landing Sites / Markets

Consumers are increasingly demanding seafood products from sustainable, environmentally responsible fisheries. Traceability and certification are the means by which producers and processors can provide the assurance that their catch meets these standards[22]. The data gathering and processing that supports traceability has the added benefit of providing fisheries managers with information needed to effectively monitor and manage fish stocks. The introduction of traceability data gathering, and processing represents an opportunity to add value at the landing site / market level of the Barbados flyingfish value chain.

2.4.5.3 Processors

Most of the innovation and opportunity to add value by processing flyingfish has been captured by a small number of processors in Barbados. The most innovative have invested in seafood processing technologies that allow them to produce a wide variety of value-added packaged seafood products. One potential value-added opportunity that was not being pursued by any known processor at the time of this writing was the production of nutraceuticals and food and agricultural inputs derived from seafood byproducts. Human consumption of fish oil as a nutraceutical and functional food has been steadily increasing, surpassing 100,000 tons in 2006, and 300,000 tons by 2015, with projections of over 700,000 tons by 2025. Collectively, 2025 projected demand for fish oils alone are estimated to be more than 1.6 million tons, representing an increase of 8% per year. Nutraceuticals and functional foods now use 20 to 25% of the global supply of fish oil.

Table 4: Top 10 Global Importers of Fish-liver Oils and Their Fractions ($000 USD)[23]

Top 10 global importers (2017)	Imported value in 2013	Imported value in 2014	Imported value in 2015	Imported value in 2016	Imported value in 2017
World	**138,789**	**140,782**	**137,306**	**153,227**	**132,304**
1. Singapore	22,199	20,635	12,568	28,815	19,334
2. United States of America	18,883	14,564	15,980	16,229	16,448
3. Japan	11,974	13,819	17,298	26,606	15,759
4. China	5,385	2,470	5,130	5,042	12,810
5. Denmark	4,702	4,864	4,413	6,877	9,991
6. United Kingdom	12,579	11,489	14,351	13,238	8,236
7. France	4,409	4,401	3,857	5,524	6,377
8. Portugal	2,407	7,049	4,520	8,156	3,733
9. Poland	5,758	6,854	3,864	2,911	3,343
10. Canada	4,472	3,594	4,358	2,428	2,801

[22] *https://www.fish20.org/images/Fish2.0MarketReport_Traceability.pdf*

[23] *Misund, B., Oglend, A., & Pincinato, R.B.M. (2017). The rise of fish oil: from feed to human nutritional supplement. Aquaculture Economics & management, 21 (2), 185-210.*

3.5 Barbados Value Chain Analysis Summary

Table 5: Barbados Flyingfish Fishery Value Chain Analysis Summary

	Current State	Challenges / Bottlenecks	Opportunities
Support Activities (procurement, technology development, human resources, infrastructure)	**Harvesters** - Sourcing fishing gear, fuel, bait, ice, food, water, crew, and boat - Human resources – boat crew, onshore prep work (repairing nets, preparing boat, etc.) - Infrastructure – boat launches, wharfs, landing facilities - Technology – boats, navigation, communication, fishing gear **Landing Sites** - Human resources –data collectors, buyers / sellers, market staff / managers - Infrastructure – sheltered facility, ice, fish totes, wharf, carts to move totes - Technology – scales, data entry tech (computers), communications	**Harvesters** - High costs associated with fuel, bait, ice, etc. - Human resources – obtaining financial support (bank loans), access to training (health and safety, business management, book-keeping, etc.), limited capacity of data collectors to visit all landing sites - Infrastructure – lack of infrastructure at secondary landing facilities (i.e. ice machines, etc.), **Landing Sites** - Human resources – lack of regular data collectors - Infrastructure – lack of infrastructure at secondary landing facilities (i.e. ice machines, etc.) - Technology – lack of data collection systems that are simple to integrate into an online platform.	**Harvesters** - Human resources – enhancement of fisher organizations will strengthen the ability of fishers to be involved and support the management of the fishery - Access to training will provide fishers with stronger business plans to approach banks for financial support to further advance their ability to participate in the local, regional and global markets through the introduction of new technologies **Landing Sites** - Technology – introduction of alternative data collection systems (i.e. dockside monitoring and electronic video monitoring) to streamline the data collection process - Human resources – opportunity to enhance or develop a new business sector through data collection system.

	Current State	Challenges / Bottlenecks	Opportunities
	Market Buyers / Sellers - Human resources – skilled labour, cleaners/ vendors/ sellers / fish cutters - Infrastructure – market stalls, buildings - Technology – scales, communications **Processors** - Human Resource – skilled / unskilled processing labour, drivers, loaders, pilots, brokers, managers / supervisors, admin - Infrastructure – stainless steel cutting tables with water source, trays, bins, processing plant, trucks, (refrigerated not refrigerated), road system (transportation infrastructure), forklifts and loading equipment, ships and airplanes - Technology – knives, sanitary conditions (gloves, hairnets, apron, etc.), refrigeration /	**Market Buyers / Sellers** - Human resources – seasonal access to fish products, access to high grade product - Infrastructure – access to ice to keep product fresh can be difficult and costly **Processors** - Human resources – seasonal fishery - Infrastructure – high operational costs	**Market Buyers / Sellers** - Human resources – training to support the proper handling of fish to ensure higher grade product - Infrastructure – assess current state of fish markets to identify ways to improve the quality of catch (i.e. refrigeration and ice) **Processors** - Human resources – access to training to support proper fish handling for higher grade products

	Current State	Challenges / Bottlenecks	Opportunities
	freezing, cooking and packaging equipment, navigation / communication for transport - Brokers, administrators, admin support, transporters		
	Restaurants / Hotels - Human resources - skilled labour (cooks), unskilled labour, service staff, mangers - Infrastructure - kitchen and kitchen appliances/tools, reliable, storage, refrigeration - Technology – cooking / refrigeration equipment, computers, POS system - Advertising, marketing	**Restaurants / Hotels** - Human resources – high dependency on tourism industry, tourist - Infrastructure – direct and indirect negative impacts tourism industry (i.e. hotels, resorts, and restaurants) can have on the fishery – through increased demand for fish products, wastewater into the local	**Restaurants / Hotels** - Human resources – marketing strategies that focus on promoting flyingfish products to tourists through hotels, resorts, restaurants etc.
	Retail - Human resources – workers, cashiers, etc. - Infrastructure – buildings, cold storage/ refrigerators, parking - Technology – computers, communications, POS systems	**Retail** - Access to fresh flyingfish products in local grocery stores - High costs and import/export regulations of accessing global markets	**Retail** - Promote expansion into international markets for frozen and value-added products

	Current State	Challenges / Bottlenecks	Opportunities
Estimated Costs **(key costs and cost drivers)**	**Harvesters** Key Costs: - Energy / fuel, ice, food - Boat (initial investment plus maintenance) - Fishing gear - Labour - Cost Drivers: - Energy / fuel prices - Vessel financing rates, wear and tear (replacement) - Labour market (competition and training) - For bait fishing – competitive prices of other bait **Landing Sites** Key Costs: - Ice, water, energy / fuel - Labour - Equipment - Landing site facility (buildings, wharfs, etc.) construction and maintenance	**Harvesters** - High and fluctuating fuel costs - Access to loans or investment - High costs for initial investment in fishing gear and boat **Landing Sites** - High cost of ice and operational costs	**Harvesters** - Access to business training (i.e. book-keeping) to support and demonstrate the economic viability of fisher's operation to access investment/loans **Landing Sites** - Investment in renewable energy operational costs of landing sites.

	Current State	Challenges / Bottlenecks	Opportunities
	Cost Drivers: - Energy / fuel prices - Labour market (wages) - Natural Disaster Reconstruction **Market Buyers / Sellers** Key Costs: - Labour - Storage equipment - Space rental Cost Drivers: - Energy / fuel prices - Labour - Natural disaster reconstruction - Lack of skilled workers / labour availability **Processors** Key Costs: - Energy / fuel - Labour - Trucks and maintenance - Equipment and supplies Cost Drivers:	**Market Buyers / Sellers** - High cost of ice **Processors** - Labour - Energy / fuel prices - Flyingfish	**Market Buyers / Sellers** - Investment in renewable energy sources (solar, wind) to lower the operational costs of landing sites, which will transfer to the space rental fees to buyers / sellers. **Processors** - Investment in training to increase labour force.

	Current State	Challenges / Bottlenecks	Opportunities
	- Transportation infrastructure - Energy / fuel prices - Natural Disasters - Trade barriers - International Import/Export logistics/ Inspection **Restaurants / Hotels** Key Costs: - Labour - Energy / fuel - Other food products - Purchase price – ability to buy fish - Marketing - Infrastructure costs (restaurant construction, maintenance, insurance, financing) Cost Drivers: - Energy / fuel prices - Power use - Labour availability - Scarcity of fish - Location - Quality of fish	**Restaurants / Hotels** - Competition for other higher-grade food products (i.e. tuna, mahi mahi, etc.)	**Restaurants / Hotels** - Product promotion

	Current State	Challenges / Bottlenecks	Opportunities
	Retail Key Costs: - Energy / fuel - Labour - Advertising, marketing - Infrastructure costs (store construction, maintenance, insurance, financing) Cost Drivers - Energy / fuel prices - Power use - Labour availability - Location - Competition - Location – proximity to residential communities	**Retail** - High export costs	**Retail** - Product promotion and global marketing strategies in key markets (i.e. Toronto, New York, etc.)
Value Add Activities (transformation to various product forms)	**Harvesters** - None identified. **Landing Sites** - Cutting and cleaning fish.	**Harvesters** - None identified. **Landing Sites** - Aging infrastructure - Labour availability/skill	**Harvesters** - None identified. **Landing Sites** - Labour force training - Infrastructure upgrades

	Current State	Challenges / Bottlenecks	Opportunities
	Market Buyers / Sellers - Cutting and cleaning fish.	**Market Buyers / Sellers** - Demand for value added product (fillet vs whole) is dependent on consumer demand and market price	**Market Buyers / Sellers** - None identified
	Processors - Processing fish into a variety of value-added products (frozen whole, frozen fillets, breaded and frozen fillets). - Package product for retail sales.	**Processors** - Competition for other higher-grade fish products (i.e. tuna, mahi mahi, etc.)	**Processors** - Expand into global markets
	Restaurants / Hotels - Variety of preparations (cutters, fried fillets, grilled fillets, baked fillets, etc.)	**Restaurants / Hotels** - Competition for other higher-grade fish products (i.e. tuna, mahi mahi, etc.) - Demand for fresh not frozen products	**Restaurants / Hotels** - Product promotion
	Retail - Sales of processed fish products. - Preparation and display of fish products (fillets, whole fish, fresh, and frozen)	**Retail** - Competition for other higher-grade fish products (i.e. tuna, mahi mahi, etc.)	**Retail** - Product promotion

	Current State	Challenges / Bottlenecks	Opportunities
Logistics / Cost Efficiencies **(potential improvements)**	**Harvesters** - Adoption of iceboats in 1980s greatly increased efficiency, range, quality of landings.	**Harvesters** - Lack of refrigeration on dayboats. - Freshness and low quality of unrefrigerated fish. - Lack of training / quality standard in fish handling. - Variable quality of landed product due to refrigeration / handling.	**Harvesters** - Fish handling training can increase quality. - Refrigeration / timely landing can increase quality. - Promotion of quality standards / variation can lead to higher prices and increased economic returns for harvesters.
	Landing Sites - Investment in landing site infrastructure, ice machines, etc. at primary landing sites increased efficiency of fishery.	**Landing Sites** - Availability of financial support to improve infrastructure due to the fiscal constraints facing national governments	**Landing Sites** - Promotion of quality standards / variation can lead to higher prices and increased economic returns for buyers / sellers. - Increased ice use efficiency can increase product quality. - Increased labour efficiency through training can reduce cost / increase economic returns.
	Market Buyers / Sellers - None identified	**Market Buyers / Sellers** - None identified	**Market Buyers / Sellers** - Increased process efficiency through process analysis / training can reduce cost / increase economic returns.

	Current State	Challenges / Bottlenecks	Opportunities
	Processors - Investment in facilities and equipment to produce frozen value-added seafood products increased local market and opened up export markets. **Restaurants / Hotels** - None identified **Retail** - None identified	**Processors** - Lack of trained / skilled flyingfish cutters. - Lack of processing labour force in general (undesirable) **Restaurants / Hotels** - None identified **Retail** - None identified	**Processors** - Training in flyingfish handling / cutting can increase efficiency, reduce waste / cost, increase economic returns. - Refrigeration / freezing technology upgrades can reduce cost, increase efficiency. - Investment in / development of efficient processing / packaging technology can broaden product offerings, increase efficiency. - Investment in energy efficient construction, equipment. **Restaurants / Hotels** - None identified **Retail** - None identified
Value Added Enhancements	**Harvesters** - None identified	**Harvesters** - Access to training	**Harvesters** -None identified

	Current State	Challenges / Bottlenecks	Opportunities
			- Training in better handling practices - Price differential for increased quality
	Landing Sites - None identified	**Landing Sites** - Aging infrastructure	**Landing Sites** - Introduction of traceability data gathering / processing. - Training for data collectors to enhance date accuracy and consistency.
	Market Buyers / Sellers - None identified	**Market Buyers / Sellers** - None identified	**Market Buyers / Sellers** - None identified
	Processors - Production of a variety of processed products	**Processors** - Consumer demand for fresh unprocessed products	**Processors** - Development of value-added products from flyingfish by-products - Development of nutraceutical products to meet increasing global demand - Individually quick frozen (IQF) / vac pac products for export - Expansion of market through online sales

	Current State	Challenges / Bottlenecks	Opportunities
	Restaurants / Hotels - None identified **Retail** - None identified	**Restaurants / Hotels** - Competition for high grade fresh fish products **Retail** - Competition for high grade fresh fish products	**Restaurants / Hotels** - None identified **Retail** - None identified
Resource Optimization (raw materials and human capital)	**Harvesters** - Harvesters fish opportunistically targeting multiple species **Landing Sites** - Some flyingfish processed on site, minimizes requirement for transportation, extensive cold storage - Multiple landing sites around island offer range of landing options for harvesters, optimizes steaming time / helps ensure product freshness **Market Buyers / Sellers** - Operate directly at landing site maximizes freshness,	**Harvesters** - Variability of access to target species due to changes in distribution and abundance **Landing Sites** - Aging infrastructure at landing sites, particularly secondary sites. **Market Buyers / Sellers** - Aging or lack of infrastructure at some landing sites (i.e. ice	**Harvesters** - Diversification of targeted species. **Landing Sites** - Investing in renewable energy sources (i.e. solar and wind) to minimize the operational costs of facilities, where possible **Market Buyers / Sellers** - Investing in renewable energy sources (i.e. solar and wind) to

	Current State	Challenges / Bottlenecks	Opportunities
	concentrates market in small number of locations **Processors** - Many have developed wide variety of value-added products using whole fish, including by- products - Flash freezing technology increases energy and cost efficiency **Restaurants / Hotels** - None identified **Retail** - None identified	machines) to help keep product fresh **Processors** - Access to global markets **Restaurants / Hotels** - None identified **Retail** - None identified	minimize the operational costs of facilities, where possible **Processors** - Explore new markets for fish by- products, such as nutraceuticals **Restaurants / Hotels** - None identified **Retail** - None identified.
New Businesses	**Harvesters** - None identified **Landing Sites** - None identified	**Harvesters** - Access to resource due to changing distribution and abundance **Landing Sites**	**Harvesters** - Diversification into other industry sectors (i.e. tourism, research, etc.) **Landing Sites** - Dockside monitoring

	Current State	Challenges / Bottlenecks	Opportunities
		- Access to investment capital or government funding	- Data collection and processing
	Market Buyers / Sellers	**Market Buyers / Sellers**	**Market Buyers / Sellers**
	- None identified	- Access to investment capital or government funding	- None identified.
	Processors	**Processors**	**Processors**
	- None identified	- Access to investment capital or government funding	- Potential to develop online distribution locally and internationally
	Restaurants / Hotels	**Restaurants / Hotels**	**Restaurants / Hotels**
	- None identified	- None identified	- None identified
	Retail	**Retail**	**Retail**
	- None identified	- None identified	- Potential to develop online retail business

3 GRENADA

3.1 Sector Overview

3.1.1 Production

Commercial fishing fleets in Grenada predominantly target small and large pelagic species, including tunas, billfishes, and dolphin fish. Coastal pelagic and demersal species, including scads, groupers, snappers, and parrotfish are also harvested commercially. There are currently no known fishing vessels targeting flyingfish for commercial sale in Grenada. All flyingfish harvested by inshore and offshore commercial fleets are used as bait in other fisheries.

Annual flyingfish landings in Grenada were consistently around 100 tonnes from the 1950s through the 1970s, with two major peaks in 1977 (583 tonnes) and 1978 (799 tonnes)[24]. Landings declined significantly through the 1980s and 1990s with negligible volumes through the early- to mid-2000s. Grenada Fisheries Division staff noted in 2017 that the local market for flyingfish has disappeared and virtually all flyingfish harvested by Grenada fishing fleets are used as bait in other pelagic fisheries[25]. No data is collected on the flyingfish bait harvest, as none of the harvest is landed in Grenada.

The FAO reports total Grenada fisheries landed 2,800 tonnes in 2014, with 70% of that catch consisting of tuna and tuna-like species. Total capture production grew approximately 80% from 1980 to 2015 (Figure 9).

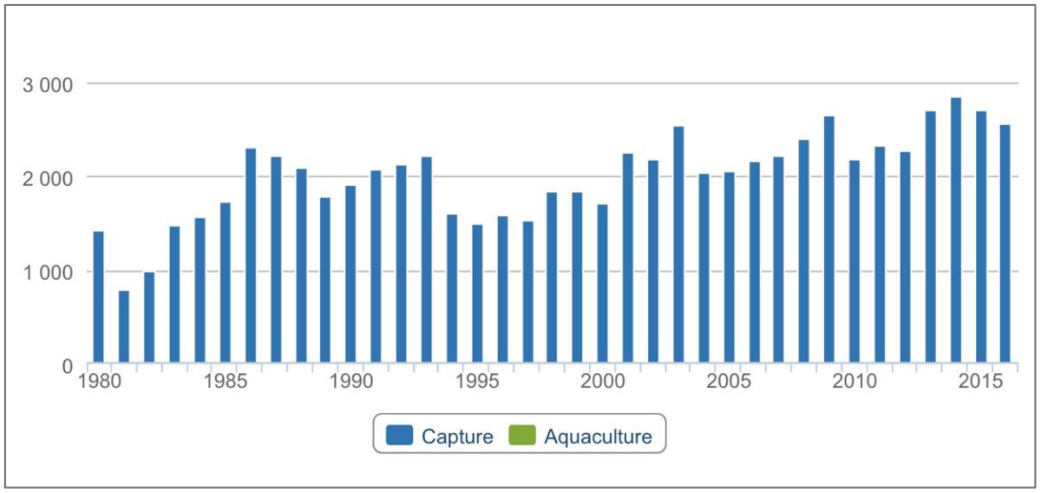


Figure 9: Grenada Capture Fisheries 1980 to 2015[26]

[24] *FAO. 2017. Fishery and Aquaculture Statistics. Global production by production source 1950-2015 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2017. www.fao.org/fishery/statistics/software/fishstatj/en*

[25] *Stakeholder consultation. Fisheries Division staff, October 2017.*

[26] *http://www.fao.org/fishery/facp/GRD/en*

3.1.2 Market Dynamics

There is currently no local or export market for flyingfish harvested in Grenada, as all flyingfish caught are used for bait in other pelagic fisheries. It was reported that before the rise of other pelagic fisheries, such as tuna, there existed a thriving local market for flyingfish as a food commodity as well as a small but healthy local processing and export sector. A major processor interviewed in 2017 noted that at the peak of the commercial flyingfish harvest, his company employed 14 people to cut and process flyingfish alone. As of that time, no fishers he dealt with were willing to catch flyingfish for processing as it was more lucrative to use it as bait in other fisheries.

There are six main fish markets on the island of Grenada and one on Carriacou. In 2014, approximately $7.6 million USD worth of seafood was exported regionally to islands such as Martinique and Guadeloupe. Imports totaled $3.2 million USD in the same year[27].

3.2 Socio-Economic Importance

3.2.1 Contribution to GDP

Current estimates of the flyingfish fishery's contribution to the GDP of Grenada were unavailable at the time of this writing. The fisheries sector overall has in recent years become a major source of employment and income and represented one-third of agricultural GDP and 1.5% of the national GDP in 2012[28].

3.2.2 Employment

Discussions with Fisheries Division staff indicated that there is currently no known commercial harvest of flyingfish in Grenada. In 2007 it was estimated that 505 people were employed in the flyingfish Tobago across occupations that included fishers, vendors, and boat builders[29]. In 2017 there were approximately 3,000 fishers harvesting fulltime, with another few hundred employed as vendors, gear and fuel suppliers, and boat builders.

3.3 Flyingfish Value Chain

There is currently no flyingfish value chain of any complexity in Grenada. Flyingfish are occasionally caught as bait by fishers steaming to outer fishing grounds to target other pelagic species, particularly tuna. The cost of harvesting flyingfish for bait was not known by any stakeholders consulted as part of this study. Flyingfish have occasionally been harvested by small fishing boats and sold to larger vessels as bait, however, this basic value- added practice is becoming less common as cheaper, more plentiful bait species have been sourced. One large processor reported that it is currently more economical to import bait from the United States than it is to catch locally.

Due to the lack of information about harvesting, processing, marketing, and distribution in the Grenada flyingfish fishery a flyingfish value chain summary table, as presented in the Barbados section of the report, was not developed for Grenada.

[27] *http://www.fao.org/fishery/facp/GRD/en*
[28] *Ibid*
[29] *Oxenford H. A., R. Mahon and W. Hunte. 2007 [eds.]. The biology and Management of Eastern Caribbean Flyingfish. Centre for resource Management and Environmental Studies, University of the West Indies, Barbados.*

4 TRINIDAD AND TOBAGO

4.1 Sector Overview

4.1.1 Production

Pelagic capture fisheries comprise the bulk of seafood production in Trinidad and Tobago, with annual harvests averaging over 13,000 tonnes since 2006, 25% of which is represented by tuna species. Approximately 1,900 vessels comprised mainly of small pirogues execute the fishery landing fish at 100 landing sites, the vast majority of which are located around Trinidad. Pelagics are also targeted by a recently developed industrial fleet comprised of more modern vessels ranging from 14 to 23 metres in length[30].

Historical flyingfish landings in Trinidad and Tobago ranged from a low of 7 tonnes in 1979 growing to a peak of over 600 tonnes in 1994[31]. Fisheries Division staff consulted in 2017 reported that flyingfish landings data for the past decade have been collected but largely remain unprocessed and were unavailable at the time of this writing[32]. While not specifically noted by harvesters or Fisheries Division staff, it is likely that flyingfish are being targeted for use as bait in other fisheries.

The FAO reports total Trinidad and Tobago fisheries landed 13,000 tonnes in 2016, which represents a nearly two-fold (200%) increase from 1980 (Figure 10)[33].

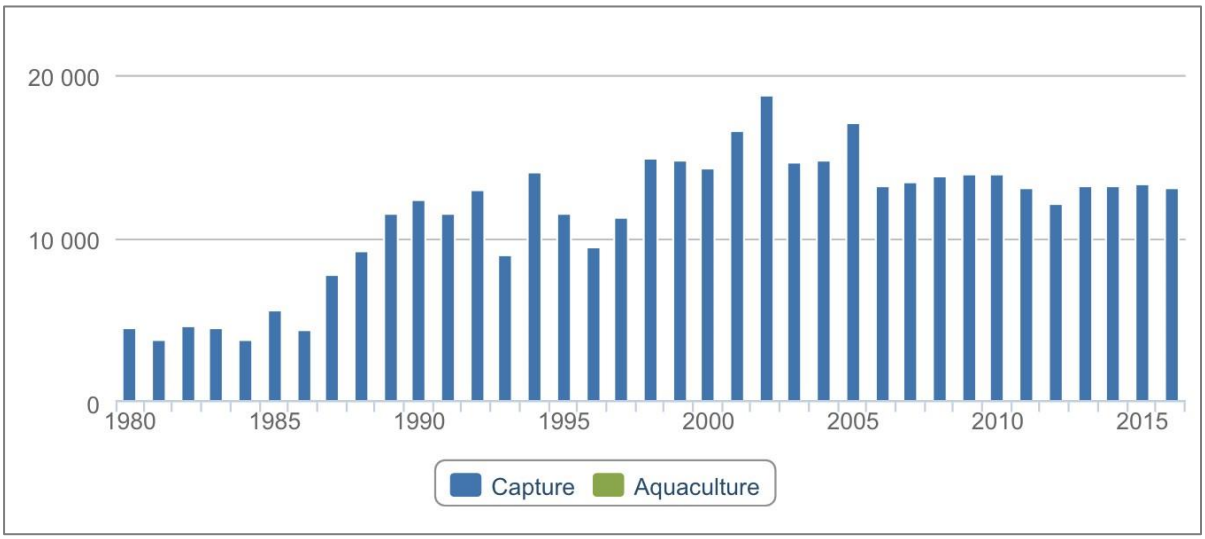


Figure 10: Trinidad and Tobago Capture Fisheries 1980 to

[30] *http://www.fao.org/fishery/facp/TTO/en*
[31] *http://www.fao.org/tempref/docrep/fao/005/y3856e/y3856e02.pdf*
[32] *Stakeholder consultation, Fisheries Division staff, Trinidad, October 2017.*
[33] *http://www.fao.org/fishery/facp/TTO/en*

4.1.2 Market Dynamics

All fish species harvested are generally marketed fresh through one of 29 landing sites around Tobago. Historically, major flyingfish landing sites were located in Buccou, Milford Bay, Mount Irvine, and Pigeon Point in Tobago. The town of Scarborough is where larger offshore vessels land catch. The wholesale market in the Port of Spain is where the majority of landed fish are auctioned in Trinidad.

$13.5 million USD worth of high-value seafood was exported from Trinidad and Tobago in 2014, with over $50 million USD worth of imports used to substitute for the decline in local low-value food and bait fisheries[34].

In 2014, whilst the estimated exports amounted to USD 13.5 million, imports reached a level of USD 52.5 million. These imports are large quantities of lower-value fish to compensate for the decrease in local supplies. Fish exports consist mainly of high-value species such as shrimp, tuna, snapper, kingfish, dolphin and flying fish in fresh and frozen forms.

4.2 Socio-Economic Importance

4.2.1 Contribution to GDP

Current estimates of the flyingfish Tobago's contribution to the GDP of Trinidad and Tobago were unavailable at the time of this writing. The fisheries sector overall continues to be a major source of employment and income and represented 0.06% of the national GDP in 2011[35].

4.2.2 Employment

Data on the number of people working in the flyingfish fishery in Trinidad and Tobago were unavailable at the time of this writing. The fishery employed approximately 125 people in the early to mid-2000s[36]. It is understood that between 1,500 and 2,000 people work harvesting fish of all species.

4.3 Flyingfish Value Chain

There is currently no flyingfish value chain of any economic significance in Trinidad and Tobago. A large processor interviewed in Tobago stated that his company stopped processing flyingfish in 2012 due to a lack of supply. Prior to the decline in supply, this processor processed significant quantities of flyingfish and exported frozen packaged product to the US, EU, and throughout the region. He would routinely ship two to three 40- foot shipping containers in August to Barbados alone[37].

A flyingfish value chain summary table similar to that presented in the Barbados section of the report was not prepared for Trinidad and Tobago due to the lack of information on harvesting, processing, marketing, and distribution.

[34] *http://www.fao.org/fishery/facp/TTO/en*
[35] *Ibid*
[36] *Oxenford, H.A., R. Mahon and W. Hunte. 2007 [eds.]. The Biology and Management of Eastern Caribbean Flyingfish. Centre for Resource management and Environmental Studies, University of the West Indies, Barbados.*
[37] *Stakeholder consultation, seafood processor, Tobago, October 2017.*

5 RECOMMENDATIONS

Based on the value chain analysis the following recommendations are offered to further enhance livelihoods and socio-economic well-being of communities involved in the Eastern Caribbean flyingfish fishery. These recommendations are:

1. Develop and harmonize the elements of the national flyingfish value chains across the region so there is a common approach to the harvest and use of flyingfish.

Flyingfish value chains differ between each of the three Member States involved in this study. Barbados has, by far, the most complex value chain that begins with an active commercial harvest and ends in value-added products processed for local and export markets. While Grenada and Tobago historically had value chains that involved commercial harvests and value-added processing for, primarily, export markets, these value chains are virtually non-existent today.

All human and infrastructural components of the value chain exist in the three Member States; however, work is required to re-establish the flyingfish value chains in Grenada and Tobago and harmonize them as much as possible across Member States. This will necessarily involve:

1. Assessment of the stock's status based on consistent collection and verification of data.
2. Market development in Grenada and Tobago to increase local and export (via tourism) demand for flyingfish products.
3. Leveraging unused processing capacity in both Grenada and Tobago. Since they have historically processed flyingfish, new growth in flyingfish demand could be managed with minimal adjustment to processing operation or capacity.
4. Exploring alternative bait strategies where flyingfish is used as bait in the targeting of other species.

Specific attention should be paid to developing market infrastructure and strategies to increase awareness of and demand for flyingfish among international tourists visiting the region as a means to bring foreign currency into Member States.

The redevelopment of flyingfish value chains in Grenada and Tobago depend, of course, on an abundant flyingfish biomass which will be supported by national and sub-regional fisheries management objectives. In order for redevelopment to be possible and sustainable, these objectives must be incorporated in any redevelopment initiative. Specifically, flyingfish redevelopment efforts must take into account that:

- Investment in value-added processing must be bounded by optimal harvesting levels and consider the competing priorities of local food demand (distribution, and availability) with more lucrative export markets abroad and within domestic tourism sectors (i.e. international tourists spending money from outside the regional in local food establishments).
- The use of flyingfish as bait for other species (e.g. tunas) should not be prioritized, and other bait strategies should be explored where it is used. Prioritizing it as bait strips flyingfish of its highest potential economic, social, and cultural value.
- As market development outside of Barbados progresses, the export of flyingfish should be focused on other markets within the region rather than markets outside the region (i.e. US, Canada, EU).

2. Collect and process data critical to value chain analysis at every step in the value chain

A major challenge to completing a detailed value chain analysis of the Eastern Caribbean flyingfish fishery was the lack of data available at the various steps in the chain. In order to effectively analyze and monitor livelihood health and sustainability, certain baseline data must be collected and available. Broadly speaking, data that describes the social, economic, cultural, and demographic characteristics of participants along the

flyingfish value chain is necessary to understand where meaningful enhancements can be made. For example, in order to determine which strategies to implement to enhance the livelihood of harvesters, one must have baseline data on harvester incomes or enterprise revenues. Furthermore, costs associated with generating that income must also be known so that net income can be estimated. Without these data, the ultimate effectiveness of any enhancement strategy would be unmeasurable. As value chain enhancement is achieved by either increasing production efficiency (i.e. decreased cost per unit of production) or increasing margin at the same cost of production (i.e. charging higher prices), all of these variables must be known at an industry level in order to conduct a thorough analysis.

In the case of flyingfish in the Eastern Caribbean, the following types of data should be collected and processed in the same way in all three member states:

- Labour market characteristics for fishery industry / occupation, including gender considerations
- Landed volume and value
- Cost and earnings of harvesters
- Income (individual and/or household) for all occupations related to the flyingfish fishery and support activities
- Costs and revenues associated with marketing, processing, distributing, and retailing flyingfish
- The number of people employed in all occupations related to the flyingfish fishery

Total imports and exports of flyingfish

- Enterprise counts

While some Member States collect some of this information, no one Member State collects and processes it all. Although research for this study was focused on Barbados, Grenada, and Trinidad and Tobago, these findings most likely apply to all states that harvest flyingfish in the region.

3. Investigate ways to enhance returns to harvesters through quality management and training programs

The margin available to harvesters for selling flyingfish can theoretically be increased by creating cost efficiencies or attaining price premiums for their products in the market, all other variables remaining constant. Fisheries around the world have pursued a number of strategies aimed at creating product differentiation that allows them to charge a premium over competitors selling the same species.

Another strategy adopted by some fisheries involves implementing handling and processing practices that create a product of noticeably higher quality. Processors are sometimes willing to pay harvesters more for fish that have been handled, cut, and refrigerated well. Processors interviewed in all three countries noted that the way flyingfish have been historically landed and marketed leaves little room for offering price premiums for higher quality product, but that they may be willing to pay more if product could be differentiated. At present, fish are sold by the bin with individual fish quality varying considerably. If fish were sold differently (i.e. in smaller batches where quality could be more easily inspected), price premiums that could contribute to enhancing livelihoods may be available for those harvesters who differentiate their product through higher quality.

A program that promotes quality as a product differentiator with associated training and education could be developed with the goal of increasing harvester returns and enhancing livelihoods. Better handling that results in higher quality could also benefit processors and retailers (specifically in the hotel and restaurant industries) who may also be able to garner higher prices for their products. Quality can also be enhanced through decreasing the time between harvesting and landing.

4. Leverage the skill and experience of the flyingfish fishery in Barbados to build capacity in other countries about processing and marketing flyingfish

Barbados has the most socially, culturally, and economically significant flyingfish fishery in the Eastern Caribbean - from harvesting to processing and marketing, and the relative complexity of the Barbados flyingfish value chain reflects this significance. The skills and knowledge required to execute the harvest and develop the value chain reside among those working in the fishery and could be leveraged to help redevelop the value chain in Grenada and Tobago and enhance flyingfish fishery livelihoods throughout the region.

Potential exists to develop programming that captures this skill and knowledge from the fishery in Barbados, conveys it through training and education, and results in increased capacity and renewed activity in the flyingfish fishery in Grenada and Tobago. Barbados fishery participants would be trained to deliver capacity-building programs which would, in turn, provide other opportunities for their livelihood diversification and enhancement.

5. Ensure any landing site tolls collected from flyingfish harvesters is re-invested in market infrastructure and training that increases the efficiency and effectiveness of the market element of the value chain

Currently in some Member States, harvesters are charged a percentage of the landed weight of their catch as a toll meant to support government fish landing site infrastructure and operations. It was unclear during in-country consultations in 2017 and 2018 whether toll revenues were, in practice, being reinvested in landing sites. There was some indication that these funds were simply absorbed into general government revenue and that reinvestment in landing sites was minimal.

The efficiency of the flyingfish fishery and the quality of its products depends to a great extent on the services and infrastructure provided by government landing sites. A portion of toll revenue should be committed to maintaining site infrastructure and improving it where possible. Another portion could be invested in developing skill and capacity among market buyers and sellers to ensure maximum efficiency in landing site operations. Further, facilities could be upgraded to attract tourists through direct sales and/or on-site food vendors and other attractions (e.g. arts and crafts stalls, entertainment). Upgrades at secondary landing sites that draw tourists could incent harvesters to land catch in their local communities.

6. Investing in training can improve efficiency at every level of the value chain

The following provides a list of suggested training programs that can be implemented at every stage of the value chain:

- Harvesters: quality enhancement training
- Market: processing efficiency training and market efficiency training
- Processing: processing efficiency training and value-added processing training

Where possible, gender equity should be promoted throughout the value chain with regards to training.

Investment targeted at increasing capacity at every level of the value chain can increase efficiency, increase returns to participants, and enhance livelihoods. Training can be targeted in the following ways:

- **Harvesters** – training in flyingfish handling and basic processing can improve the quality of product landed creating the potential to garner price premiums over competitors. Processors interviewed noted that product quality varies significantly and that they would pay higher prices for higher quality fish if the system could be changed to facilitate it.

- **Fish Market Workers** – training in market process efficiency and fish handling and cutting can increase flyingfish throughput, improve product quality, decrease spoilage, and reduce cost thereby increasing returns to buyers and sellers. Workers could be incented to participate in training through honoraria or increased wages, thereby enhancing livelihoods at that level of the value chain. Training and professionalization of workers also tends to improve morale and open up other opportunities for work in other sectors that can contribute to livelihood diversification.

- **Flyingfish Processing** – while most processors provide on-the-job training for flyingfish processing workers, training of more workers in specific skills, such as boning and filleting, can help fill gaps in the processing labour force. It was noted that it is becoming increasingly difficult to find and hire people with the experience and skill needed to process flyingfish. Offering training programs to youth and others interested in entering the fishery can help diversify livelihoods for trainees and help alleviate the labour supply bottleneck in the processing sector.

- **Hospitality / Retail** – although flyingfish is a culturally important food staple in Barbados, work could be done to increase awareness of the product among international tourists visiting the island. Training in tourism promotion and hospitality with a particular focus on local food and flyingfish could help increase demand for the dish in the hotel and restaurant industry. In Grenada and Tobago, significant work is required to rekindle demand for flyingfish as a local food and market it as a Caribbean delicacy (versus an exclusively Bajan food) to international tourists and locals alike

7. Integrate enhancement of the Eastern Caribbean flyingfish value chain into broader regional policy development and planning around climate change adaptation and the Blue Economy.

It has been noted in a UNEP report regarding climate change that "*One of the central aims of the first Strategic Plan for the Caribbean Community, which covers the period 2015 – 2019, is to reinforce socio-economic, technological and environmental resilience of CARICOM states. The overarching objective is twofold: to stimulate the productive capability of domestic firms and correct the current mismatch between training and the specialized knowledge and skills required by the market, in order to drive growth and combat rising levels of unemployment among the young, in particular. The plan outlines strategies for nurturing innovation and creativity, entrepreneurship, digital literacy and inclusiveness and for making optimum use of available resources*". As a result, it is recommended that efforts to enhance the value chain for the flyingfish fishery be undertaken consistent with the regions' climate change adaptation goals. This will place priority on nurturing innovation and promoting local entrepreneurship in harvesting, processing and marketing activities in a manner that is energy efficient, and climate resilient. By advancing local development within sustainable harvesting limits, the flyingfish fishery can contribute to growth in the region's blue economy.

The CRFM is an inter-governmental organization whose mission is to "Promote and facilitate the responsible utilization of the region's fisheries and other aquatic resources for the economic and social benefits of the current and future population of the region". The CRFM consists of three bodies – the Ministerial Council, the Caribbean Fisheries Forum and the CRFM Secretariat.

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