# Value Chain Analysis of the Wild Caught Sea Cucumber Fishery in Fiji

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# VALUE CHAIN ANALYSIS
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# WILD CAUGHT SEA CUCUMBER FISHERY IN FIJI

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# INTRODUCTION

Sea cucumbers, which are largely traded in a smoked dry-form referred to as bêche-de-mer or trepang *(Adams 1992)*, are high in protein and important amino acids and consumed mainly by Chinese and other Southeast Asians for health and medicinal benefits (*Purcell 2014)*. Over 3 million people are involved in sea cucumber collection *(Purcell et al. 2011)*, across 83 countries with over 90% of the world's tropical coastlines participating in the trade *(Eriksson et al. 2015)*. The main consuming countries are mainland China, Hong Kong, Taiwan, Singapore and Malaysia *(Ram et al. 2016)*.

The trading of sea cucumbers in the Pacific started in the early 1800s and is currently a multi-million dollar industry in the region, second only to tuna with some 21 sea cucumber species making up 90% of the trade *(Carleton et al. 2012)*. In the Pacific the sea cucumber fishery is characterised by: (i) heavily over-exploited stocks with most individuals below the reproductive size; (ii) a boom-and-bust history of exploitation; (iii) increase in trade of value low species as high values species are depleted; and (iv) loss of value due to poor-processing by local communities *(Anderson et al. 2011; Carleton et al. 2012)*.

*Curryfish Stichopus hermanni is a medium value species in the sea cucumber trade.*
© Stacy Jupiter/WCS

Furthermore, sea cucumbers play an important ecological role by contributing to calcium bioavailability *(Schneider et al. 2011)*, nutrient cycling by feeding on detritus and live organic matter and contributing to bioturbation *(Ulthicke 2001)*, and hosting other species *(Purcell and Eriksson 2015)*. The aeration and breakdown of stratified muddy and sandy sediments by sea cucumbers is thought to reduce microalgal biomass and algal blooms *(Uthicke 1999, 2001)*. Sea cucumbers are also prey for starfish, crustaceans and fish in both shallow and deep waters *(Anderson et al. 2011)*. Despite our growing understanding of the role sea cucumbers play within the ecosystems they inhabit, there is a lack of understanding of the short and long-term impacts concerning the removal of sea cucumbers from these ecosystems as a whole.

Sea cucumbers are an important source of income for local fishers, including women, and their export is considered one of the oldest trades in Fiji *(Ram 2008; Ram et al. 2016)*. Fiji has traded sea cucumbers since 1813 with 600 tonnes exported between 1827 to 1835 *(Pakoa et al. 2013)*. Stocks recovered following this initial exploitation, but the market was not profitable until mid-1980s when the trade was re-initiated in response to an increase demand from Asian markets, and export figures reached 717 tonnes. Hairy blackfish was a significant component of bêche-de-mer exports during the 1980s comprising 90% of catch and exports in 1988 *(Preston 1988).* There

*Sea cucumbers drying in the sun in Vunidamoli village.*
© Margaret Fox/WCS

were booms in sea cucumber exports in 1986-1987 and in 1996-1997, but since 1998 the export numbers dropped and have remained around 243 tonnes per year for a decade *(Fig. 10 in Pakoa et al. 2013, Fig. 2 Ram et al. 2016)*. While many other Pacific Island countries have declared moratoria around their crashed stocks, Fiji has continued trading sea cucumbers, making it the fourth largest exporter in the Indo-Pacific after Indonesia, Philippines and Papua New Guinea *(Purcell et al. 2013, 2014a)*.

The severe decline in sea cucumber populations throughout Fiji is of high concern. Despite Fiji's efforts to control the trade of sea cucumbers using a 76 mm size limit and an export ban in 1988 on the highly depleted sandfish (*Holothuria scabra*), population densities are some of the lowest recorded in the Pacific Island region *(Pakoa et al. 2013)*, including in more remote provinces such as Lau *(Jupiter et al. 2013)*. Exports for almost 50% of commercial species have declined *(Pakoa et al. 2013)*, and all species densities in Fiji are lower than the average Pacific regional densities and those recommended for healthy stocks *(Table 6 in SPC 2014)*. An increase in harvesting aided by Underwater Breathing Apparatus (UBA), especially in the Northern Fisheries Division, has meant that deeper water refuges for sea cucumbers between 15-80 m are now heavily exploited, and species such as amberfish, brown sandfish, elephant trunkfish and tigerfish are progressively being wiped out *(Pakoa et al. 2013)*.

Despite efforts to undertake in-water resource assessments, there has been little effort to map out and understand the supply chain in Fiji. Mapping out the markets is valuable for understanding the factors that might constrain the function or performance of a fishery, the value chain players, the enabling environment (e.g. policies, institutions, infrastructure) that surround a fishery, and the service providers that support the value chain operations.

*Dried sea cucumbers being sold in Yide Lu market in Guangzhou City in China.*
© Ravinesh Ram

In 2015, the Wildlife Conservation Society (WCS) and Department of Fisheries conducted a value chain analysis of the wild caught sea cucumber industry on the islands of Viti Levu and Vanua Levu in Fiji. **The objective of the study was to understand the relationships and linkages between buyers, processors, sellers, and other service providers, and to identify opportunities and constraints to industry growth and competitiveness in Fiji through the value chain lens.** Value chain analysis was selected because it examines the industry in detail across all the market players, and assesses their investments along the wild caught sea cucumber supply chain. This work was timely, given that the Department of Fisheries is drafting a national management plan for sea cucumbers and regional efforts to address the overexploitation of this fishery.

# METHODOLOGY

## Conceptual framework

A value chain analysis (VCA) is a detailed description of a full range of activities and services required to bring a raw product from its initial state to a marketable commodity for delivery to final customers *(Kaplinsky and Morris 2000)*. The value chain is a market-focused collaboration amongst a set of key players known as input suppliers, producers, processors and buyers that conduct activities to produce and add value to the product, while holding different market power. VCA focuses on segmenting the different activities that add value in the production and sale of a product or service, and allows for a better understanding of the constraints and opportunities within each segment, as well as the context in which the chain operates. While the chain remains similar for all products and services, the roles of key players are based on demands from the end market.

A two-step VCA was conducted for the wild caught sea cucumber fishery in Fiji. Firstly, using expert knowledge within the Department of Fisheries, WCS and James Cook University (JCU) the wild caught sea cucumber supply chain was qualitatively mapped out for Fiji and a list compiled of known exporters, middlemen, agents and villages active in the fishery *(Fig. 1)*. Secondly, a VCA questionnaire was developed in consultation with experts from WorldFish, JCU and Southern Cross University (SCU), and by adapting questionnaires designed by the Conservation Strategy Fund (CSF) and SCU for Palau and parts of Fiji, respectively. The questionnaire was divided into eight parts for each of the players initially identified and a ninth part specifically for enforcement agencies *(Appendix 1)*.

*Women processing sea cucumbers.*
© Watisoni Lalavanua/WCS

The questionnaire provided a quantitative approach designed to address five key questions *(adapted from Brown et al. 2010)*:

i. Who are the key players in the value chain, what roles do they each play and what is their relationship to each other?
ii. What are the activities that add value to the product along the value chain?
iii. What are the species, grades, volumes and product requirements?
iv. What is the flow of payment along the value chain, and how are prices determined?
v. What are the challenges faced by different players along the value chain and how can these be overcome?

*Fisheries officer interviewing a sea cucumber fisher at the local markets.*
© Yashika Nand/WCS

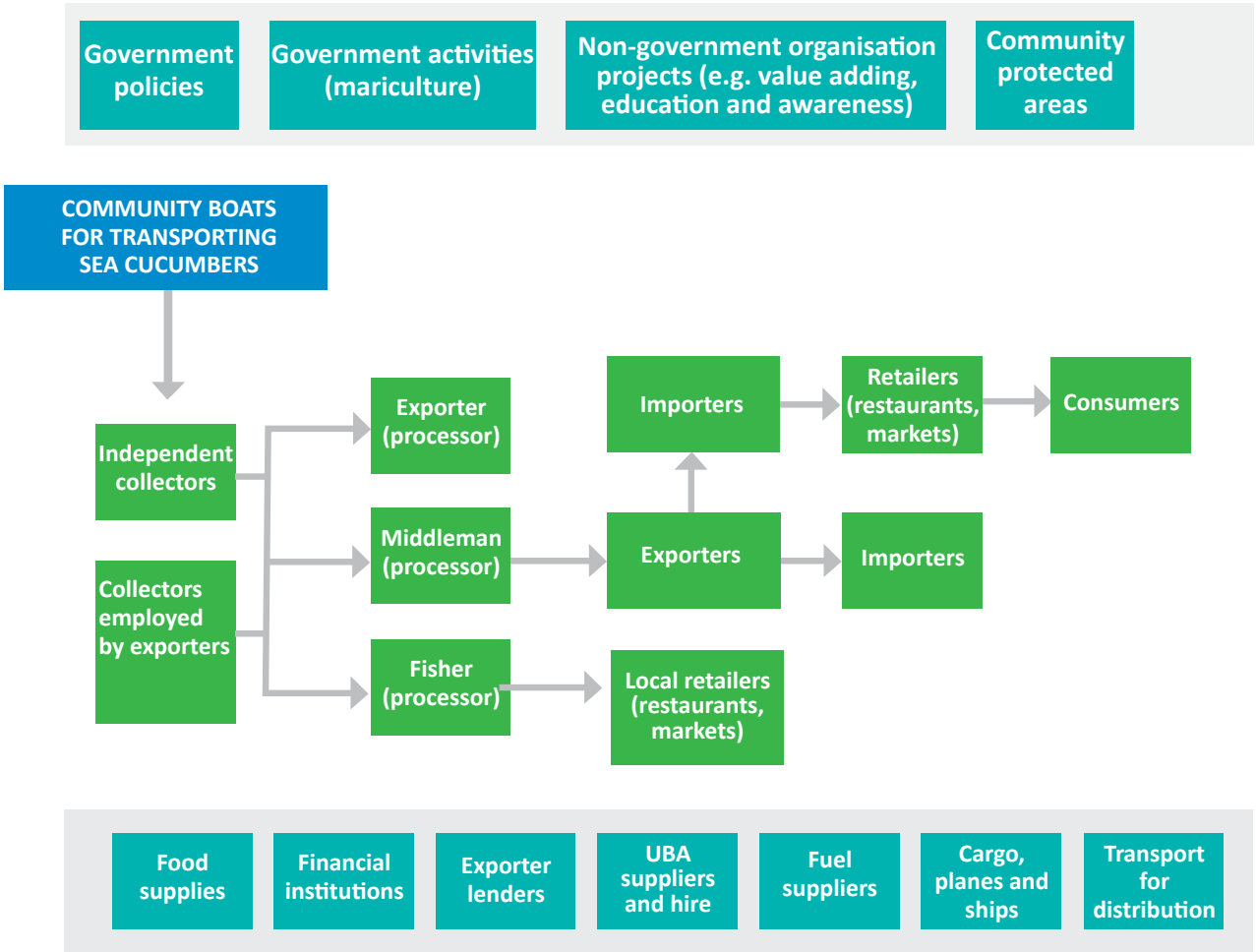



*Figure 1. Mapping out the sea cucumber fishery using expert knowledge from the Department of Fisheries, Wildlife Conservation Society and James Cook University. Top blue shaded boxes are external factors that might affect the value chain. Bottom blue shaded boxes are other supporting services that might benefit from the Fiji sea cucumber fishery.*

# Study area

A VCA questionnaire was conducted on Vanua Levu and Viti Levu between 19 February to 9 April, 2015. A total of 335 people were interviewed consisting of 155 fishers who only sell a raw product, 79 fishers that process sea cucumbers, 74 middlemen, agents or processors, 8 community boat drivers, 7 market sellers, 66 restaurant staff or owners, and 7 exporters. Of the fishers interviewed, 87 were women (37.2%) and 147 were men (62.8%), residing in 25 villages across 12 districts and 7 provinces *(Table 1, Fig. 2)*. In addition, six officers were interviewed from the Department of Fisheries as the lead fisheries enforcement agency. Despite sea cucumbers largely being consumed by customers in China and Hong Kong, funding limited this VCA to Fiji.

For the island of Vanua Levu, sites surveyed in Bua and Cakaudrove provinces were based on recommendations from the Department of Fisheries, environmental NGOs and academics with experience working with the sea cucumber industry. However, as exporters and middlemen buyers were interviewed it was clear that to get a more complete picture and understanding of the fishery, the study should be extended to villages in Macuata Province and to the provinces of Ba, Ra, Serua and Tailevu on the island of Viti Levu *(Fig. 2)*.

# Value Chain Analysis questionnaire

Two teams were established for the VCA study. One team focused on interviewing fishers, buyers/middlemen and boat drivers based in villages, while the second team focused on interviewing middlemen, agents and exporters based in towns, including the capital city of Suva. The two teams were in telephone contact and kept each informed of any emerging players in the value chain. For example, if fishers in villages provided the names of the middlemen, agents or exporters they sold to in towns, these were shared with the second team who would then try to find and interview these people or representatives of their companies.

The questionnaire for fishers focused around questions relating to harvesting strategies, fishing efforts, costs of equipment and perishable goods (e.g. fuel), catch species and volumes, market access, livelihood dependency and income satisfaction *(see Questionnaire 1, Appendix 1)*.

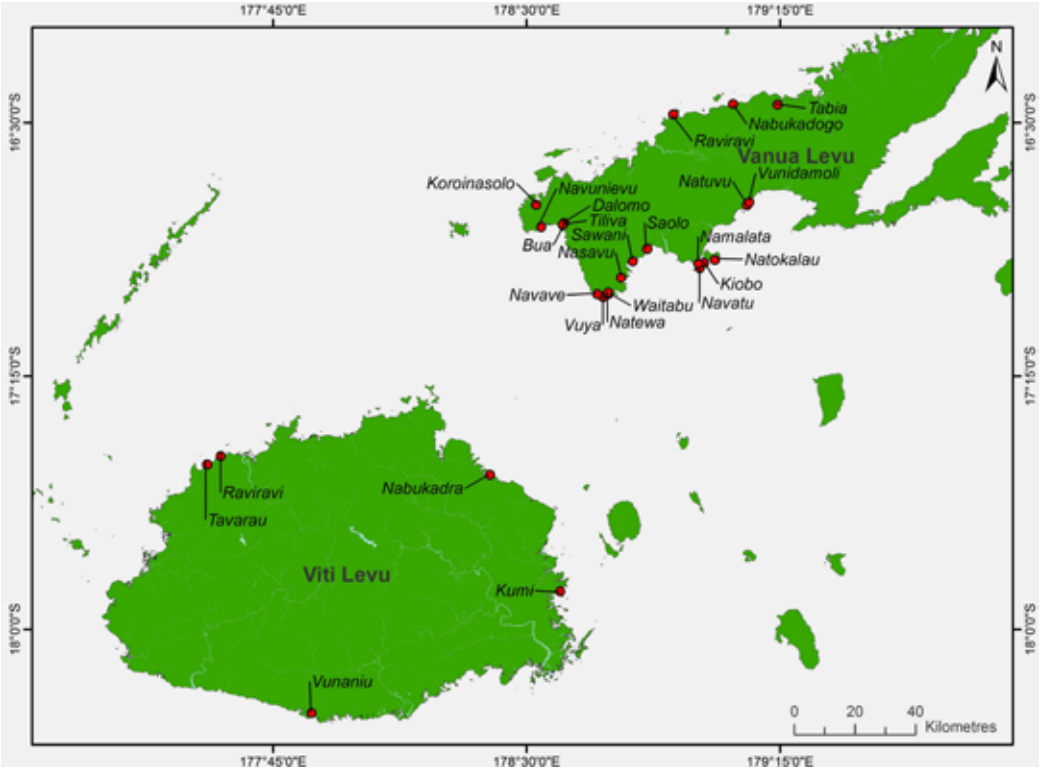



*Figure 2. Location of villages in Fiji where sea cucumber fishers were interviewed.*

*Conducting interviews with a local middleman.*
© WCS

Additional questions were asked to understand perceptions of resource change and community management strategies being implemented. Those fishers, middlemen and agents that processed sea cucumbers were asked about processing techniques, purchasing and selling prices (broken down by grades and sizes where applicable), staffing, input costs (e.g. equipment, perishable goods), livelihood dependency and income satisfaction *(see Questionnaire 2, Appendix 1)*. The questionnaire for exporters focused on species and volumes of sea cucumbers bought and sold (broken down by grades and sizes), purchasing and selling prices, export countries, number and size of shipments, operations costs, quality issues (relating to processing), and areas for growth for the industry *(see Questionnaire 5, Appendix 1)*. The two questionnaires for local markets and restaurants focused on purchasing and selling prices, levels of processing or other types of value-adding, livelihood dependency and income satisfaction *(see Questionnaires 8-9, Appendix 1)*. Boat owners who provided transport to sea cucumber fishers were asked about the number of fishers that used their services, the frequency and duration of trips and the costs associated with running their business *(see Questionnaire 3, Appendix 1)*. All currency throughout this report is in Fijian dollars (FJD) unless stated otherwise. At the time of the surveys 1 FJD was equivalent to 0.49 USD.

*Table 1. The provinces, districts and villages where sea cucumber fishers were interviewed on the islands of Viti Levu and Vanua Levu.*

| Island | Province | District | Village |
|---|---|---|---|
| **Vanua Levu** | Bua | Bua | Bua<br>Koroinasolo<br>Navunievu<br>Tiliva |
| | | Kubulau | Kiobo<br>Namalata<br>Natokalau<br>Navatu |
| | | Nadi | Nasavu<br>Sawani |
| | | Vuya | Natewa<br>Navave<br>Vuya<br>Waitabu |
| | | Wainunu | Saolo |
| | Cakaudrove | Wailevu West | Natuvu<br>Vunidamoli |
| | Macuata | Macuata | Nabukadogo<br>Raviravi |
| | | Sasa | Tabia |
| **Vitu Levu** | Ba | Nailaga | Raviravi<br>Tavarau |
| | Ra | Nakorotubu | Nabukadra |
| | Serua | Serua | Vunaniu |
| | Tailevu | Verata | Kumi |

# RESULTS AND DISCUSSION

Fiji is a major trader of sea cucumbers in the Pacific region. Of the 27 species present in Fiji, the VCA found 22 species of sea cucumbers are collected and exported from the islands of Viti Levu and Vanua Levu, including sandfish which is currently banned for export from Fiji *(Table 2)*.

*Sandfish*
© Sangeeta Mangubhai/WCS

*White teatfish*
Watisoni Lalavanua/WCS

*Golden sandfish*
Watisoni Lalavanua/WCS

*Prickly redfish*
Watisoni Lalavanua/WCS

*Leopardfish and Eye-spot curryfish*
Watisoni Lalavanua/WCS

*Table 2. Trade, Fijian and scientific names for sea cucumber species collected in Fiji for export, and their considered value in the trade. IUCN Red List of Threatened Species: Endangered with Extinction (**), Vulnerable to Extinction (*)*

| TRADE NAME | FIJIAN NAME | SCIENTIFIC NAME | VALUE |
|---|---|---|---|
| Sandfish** | Dairo | *Holothuria scabra* | Very High |
| White teatfish* | Sucuwalu | *Holothuria fuscogilva* | Very High |
| Black teatfish** | Loaloa | *Holothuria whitmaei* | High |
| Deepwater redfish* | Tarasea | *Actinopyga echinites* | High |
| Golden sandfish** | Dairo kula | *Holothuria lessoni* | High |
| Greenfish | Dri-votovoto, Barasi | *Stichopus chloronotus* | High |
| Prickly redfish** | Sucudrau | *Thelenota ananas* | High |
| Surf redfish* | Vula ni cakau | *Actinopyga mauritiana* | High |
| Amberfish | Basi | *Thelenota anax* | Medium |
| Brown sandfish | Vula | *Bohadschia vitiensis* | Medium |
| Chalkfish | Mudra | *Bohadschia marmorata* | Medium |
| Curryfish* | Laulevu | *Stichopus hermanni* | Medium |
| Deepwater blackfish | Dri ni cakau | *Actinopyga palauensis* | Medium |
| Dragonfish | Katapila | *Stichopus horrens* | Medium |
| Flowerfish | Senikau | *Pearsonothuria graeffei* | Medium |
| Hairy blackfish* | Dri, Driloa | *Actinopyga miliaris* | Medium |
| Leopardfish/tigerfish | Vulu wadrawadra | *Bohadschia argus* | Medium |
| Pinkfish | Loli piqi | *Holothuria edulis* | Medium |
| Snakefish | Yarabale | *Holothuria coluber* | Medium |
| Stonefish | Dri vatu | *Actinopyga lecanora* | Medium |
| Elephant trunkfish | Tina-ni-dairo, | *Holothuria fuscopunctata* | Low |
| Lollyfish | Loliloli | *Holothuria atra* | Low |

*Black teatfish*
© Stacy Jupiter/WCS

*Dried Actinopyga flammea and surf redfish*
© Watisoni Lalavanua/WCS

*Curryfish*
© Sangeeta Mangubhai/WCS

*Hairy black fish*
© Steven Purcell

*Deepwater redfish*
© Steven Purcell

# Overview of the Sea Cucumber Fishery in Fiji

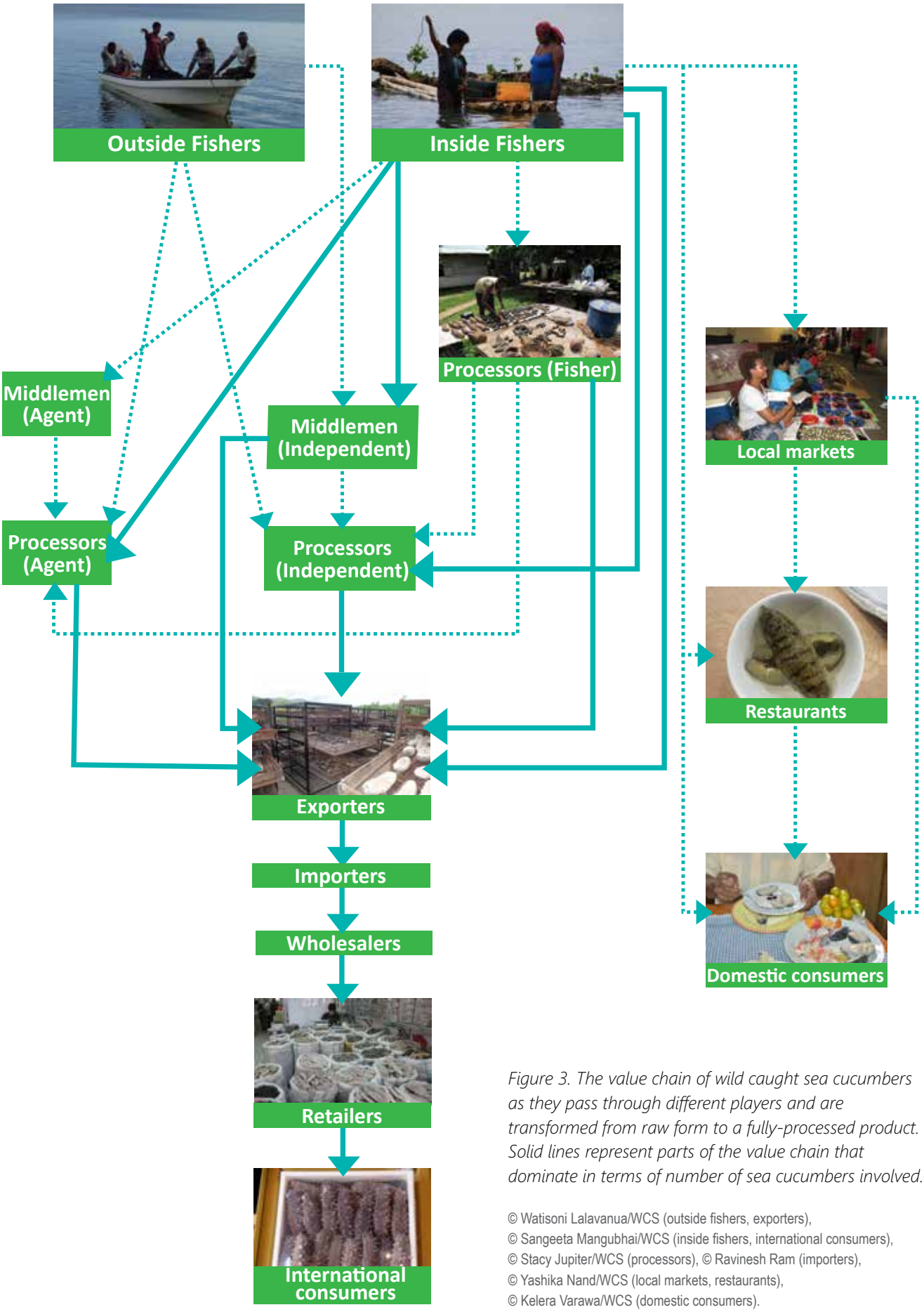


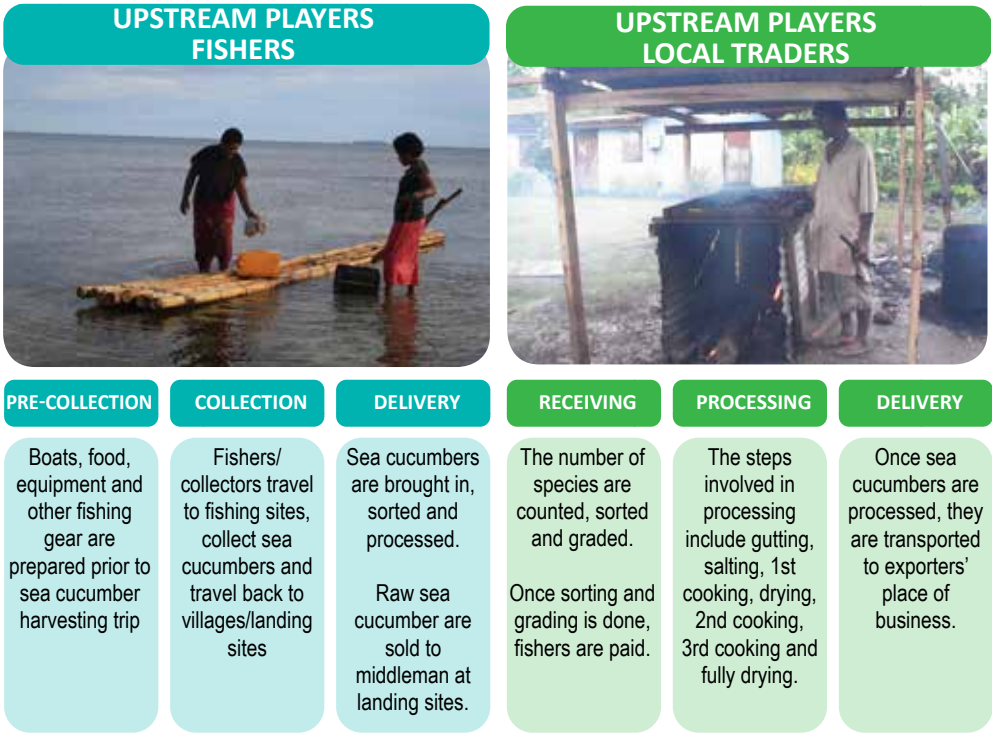

*Figure 3. The value chain of wild caught sea cucumbers as they pass through different players and are transformed from raw form to a fully-processed product. Solid lines represent parts of the value chain that dominate in terms of number of sea cucumbers involved.*

## Overview of the Sea Cucumber Fishery in Fiji

The flow of product and activities involved from the source to the final markets is shown in Figures 3 and 4. The VCA revealed there were four main players: (1) fishers, (2) processors (fishers, independent processors, agents for exporters), (3) middlemen (independent middlemen, agents for exporter), and (4) exporters *(Fig. 3)*. For fishers, these include those that originate from within the village being interviewed, as well as fishers from outside villages. Smaller players involved in the trade were community boat drivers who specifically targeted sea cucumber fishers, as well as local market sellers and restaurants. In this report, middleman and exporter agents that buy, sell, and at times process sea cucumbers, are collectively referred to as local traders. Fishers that process sea cucumbers are presented separately throughout the report. Fishers, processors and local traders are sometimes referred to as the upstream players of the value chain, because they are the primary suppliers, while exporters are the downstream players *(Fig. 4)*.

*Figure 4. Value chain mapping of activities for the wild caught sea cucumber fishery in Fiji.*

© Sangeeta Mangubhai/ WCS (left top), © Ravinesh Ram (right top), © Watisoni Lalavanua/WCS (bottom)




# Customers and Product Requirements

## International consumers

Sea cucumbers are predominantly a commercial commodity that is exported from Fiji as a fully-processed product. Fiji exports largely to mainland China and Hong Kong, with smaller volumes exported to New Zealand, Taiwan, Australia and the United States of America *(Fig. 5)*. Of the 22 species exported from Fiji, white teatfish, black teatfish and deepwater redfish have the highest market value, while brown sandfish, snakefish, pinkfish, lollyfish and chalkfish have the lowest value *(Table 2)*. Prices fetched in Asian countries are determined by the species, size and quality of product. Fiji's sea cucumbers are largely considered to be of grade B in Asian countries, because of poor processing, which results in estimated losses of 10-50% for the final dried product *(Ram et al. 2014)*.

Sea cucumbers are consumed raw, boiled, pickled or fermented on a daily basis for health purposes and/or for special occasions in gourmet soups or other Chinese delicacy dishes, especially for Chinese New Year celebrations *(Purcell 2014)*. In the past, sea cucumbers were a high end food item reserved for the wealthy, but with a growing Asian middle-class population there is an increased demand for high end fisheries products like sea cucumbers *(Anderson et al. 2011)*. The body wall of sea cucumbers is consumed reconstituted from a dried form or in a wet/frozen form in China, and the viscera and body wall are eaten raw or pickled in Japan and Korea *(Fukunaga et al. 2004; Toral-Granda et al. 2008)*. According to traditional Chinese medicine sea cucumbers nourish the blood, treat disorders of the kidneys, and moisten the intestines *(Bordbar et al. 2011)*. They are high in protein (at least 55%), low in fat and have mucopolysaccharides that are thought to reduce arthritis pain and help build the cartilage *(Saito et al. 2002; Zhong et al. 2015)*. Asian customers purchase and consume sea cucumbers based on species, size and quality preferences. Higher prices are fetched for dried sea cucumbers that are straight, without damage to the skin, have a dark colour (for dark species), mild odour and are not covered by salt *(Purcell 2014)*.

*Processed sea cucumbers being sold in Yide Lu in China.*
© Ravinesh Ram

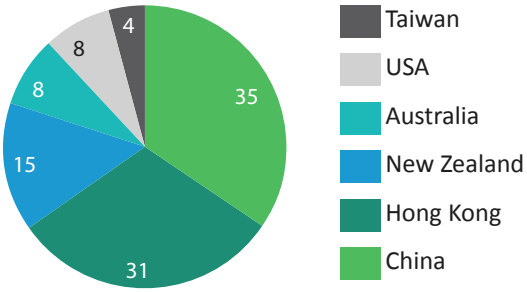



*Figure 5. Target countries for sea cucumbers exported from Fiji. Numbers represent relative percentages.*

## Customers and Product Requirements

### Domestic consumers

A small number of sea cucumbers are consumed in villages or sold at local markets or restaurants in Fiji. Indigenous Fijians (*iTaukei*) eat a few sea cucumber species (e.g., sandfish and white teatfish) cooked in coconut milk (e.g. *vakasoso, vakasekera*). Consumption was higher on Vanua Levu with 29.2% of fishers there stating they sometimes or often consume sea cucumbers, compared to 7.4% of fishers on Viti Levu who only sometimes consume sea cucumbers *(Table 3)*. Only a small percentage of sea cucumbers harvested are sold at local markets in Suva and Lautoka, largely to Chinese consumers and restaurants. Sandfish and white teatfish were the two main species sold at local markets throughout the year, mostly in heaps, with each heap comprising up to 12 animals, depending on the size. Local sellers, who are almost exclusively women, sold largely a raw (85.7%) rather than a cooked (14.3%) product in local markets. However, most fishers stated they preferred to sell to local traders or exporters because they receive a better price than if they sold it directly themselves at local markets.

Of the 66 restaurants interviewed, only five (7.6%) served sea cucumbers. Sandfish or white teatfish are served year round as part of seafood, chicken, pork or mushroom dishes, with only Chinese customers ordering these dishes from the menu. Suva-based restaurants indicated there was no increase in demand around the Chinese New Year celebrations for sea cucumbers. Only one restaurant had golden sandfish listed in the menu, but it was not clear how often they sold this dish given it has not been seen in the local markets in recent years. Golden sandfish is listed as Vulnerable to Extinction under the IUCN Red List, and was not recorded in 2014 and 2015 resource surveys in Bua Province *(WCS, unpublished data)*, and has been absent from export data for the last ten years *(Pakoa et al. 2013)*.

*Sandfish dishes sold in restaurants in Suva.*
© Sangeeta Mangubhai/WCS

*Table 3. Consumption of sea cucumbers by local fishers in Fiji. Numbers represent relative percentages.*

| Island | Never | Rarely | Sometimes | Often |
|---|---|---|---|---|
| Vanua Levu | 59.0 | 11.8 | 16.8 | 12.4 |
| Viti Levu | 88.9 | 3.7 | 7.4 | 0 |
| Overall | 63.3 | 10.6 | 5.4 | 10.6 |

*White teatfish sold raw at the Suva market on Saturdays.*
© Sangeeta Mangubhai/WCS

# Sea cucumber harvesting in Fiji

In Fiji, the average age of the men participating in the fishery was 36 and ranged from 19-70, while the average age of the women was 45 and ranged from 16-64. Sea cucumber harvesting is largely done by iTaukei communities by free-diving (45.7%), gleaning/hand collection (42.4%) or with the use of UBA (11.9%) within their traditional fishing grounds (*qoliqoli*). The number and relative percentage of UBA fishers is likely to be an under-estimate given many fishers were hesitant to admit they used this gear type, and others refused to be interviewed. At the time of the study, the use of UBA for collecting sea cucumbers was prohibited, unless an exemption was granted. In Fiji, an exemption can be granted at the discretion of the Permanent Secretary of the Ministry of Fisheries and Forests for individual applicants who intend to use UBA, on the condition that there is evidence of insurance paid for divers, dive equipment are certified and checked by the Ministry of Labour officials, and all divers are certified to dive. Currently two exporting companies hold exemptions to harvest sea cucumbers using UBA. In late 2015, the Department of Fisheries submitted a paper to cabinet to ban the use of UBA and prohibit any exemptions being issued.

There were gender preferences for harvesting methods. Women preferred hand collection (64.6%) or free-diving (35.4%), while men preferred free-diving (52.2%), hand collection (38.9%) and UBA (8.9%). Most fishers (94.2%) were assisted by their family, friends and community members and only a small number (5.8%) harvested on their own.

Fishing effort and sea cucumber volumes were highly dependent on the mode of transportation available to communities and travelling time to areas targeted for sea cucumbers. Fishers in Vanua Levu used motorised boats (64.9%, 19-24 feet long, 15 or 40 hp), boats without engines (4.6%) or bamboo (*bilibili*) rafts (2.9%) to get to harvest areas. Others walked to sites at low tide (23.6%) or swam (4.0%). In contrast, all Viti Levu fishers interviewed used motorised boats (18-28 feet long, 40 hp) to access harvest areas. However, the majority of fishers (90.9%) on both islands do not own motorised boats, but were renting from others in the village. This means part of their income from harvesting sea cucumbers goes to transport costs. This affects men in particularly, who have a greater preference for motorised boats (80.5%) compared to women (52.8%). Depending on their transportation mode, fishers spend <1 to 5 hours traveling to and from harvesting sites, with notable differences between the two main islands of Fiji. The majority of fishers in Vanua Levu spend less than an hour (52.3%) travelling to sites, compared to those on Viti Levu that spend one (47.4%) to two (23.7%) hours. This further supports the higher reliance Viti Levu fishers have on motorised boats to collect sea cucumbers from the wild.

*Searching for sea cucumbers on shallow coral reefs.*
© Sangeeta Mangubhai/WCS

*Table 4. The volume and number of sea cucumbers collected by fishers on their last trip. SD=Standard Deviation. All figures have been rounded up to the nearest kg or number.*

| Island | Volume (kg) | | Numbers | |
|---|---|---|---|---|
| | Range | Average ± SD | Range | Average ± SD |
| Vanua Levu | 2-600 | 56 ± 96 | 2-3000 | 213 ± 479 |
| Viti Levu | 1-250 | 23 ± 45 | 3-300 | 61 ± 60 |
| **Overall** | 3-600 | 48 ± 85 | 2-3000 | 162 ± 397 |

## Sea cucumber harvesting in Fiji

*Women searching for invertebrates at low tide.*
© Sangeeta Mangubhai/WCS

Most fishers (75.9%) spent 3-5 days/week harvesting sea cucumber and between 3-5 or more hours per day out at sea. Harvesting is done at different times of the day and night, and is dependent on the tide. About a third (33.2%) of fishers harvest all year, while the remaining two thirds (66.8%) are more selective over what months they harvest sea cucumbers, preferring the months of October to March (47.5%) for harvesting, while April to September (19.3%) was the least preferred period for harvesting. Fishers generally need more money in the months building up to Christmas and early in the new year when they have to pay school fees and purchase other items for school children *(M. Fox, personal communication)*.

There was a wide range in the estimated volumes of sea cucumbers harvested from 2 to 600 kg by fishers on their last trip, suggesting that for some fishers this is an incidental catch-based fishery. Average trip volumes were higher on Vanua Levu (56±96 kg/trip) than Viti Levu (23±45 kg/trip) *(Table 4)*. The reported numbers of sea cucumbers harvested were likewise highly variable from 2-3000 individuals by fishers on their last trip, with higher numbers collected on Vanua Levu (213±479 individuals/trip) compared to Viti Levu (61±60 individuals/trip) *(Table 4)*. This variability likely reflects the condition of the resource between the two islands, and differing fishing practices, i.e. some fishers collected sea cucumbers opportunistically while targeting finfish or gleaning, while others are fishing specifically for sea cucumbers. There were notable differences between the reported numbers and volumes collected by men and women. Women collected about 17.2% less sea cucumbers numerically, and 56.2% less sea cucumbers volumetrically (kg) compared to men. Once collected, the majority of fishers hold onto their product for one day or less (62.1%), and only some hold onto their product for 2-7 days (31.0%) or periods of up to a month (6.9%).

*Table 5. Perceptions of local fishers on the state of sea cucumber stocks. Numbers represent relative percentages.*

| Islands | Depleted | Declining badly | Stable | Increasing | Increasing greatly |
|---|---|---|---|---|---|
| **Vanua Levu** | 3.7 | 39.9 | 20.2 | 30.3 | 5.9 |
| Female | 2.9 | 24.6 | 18.8 | 46.4 | 7.3 |
| Male | 4.0 | 49.0 | 21.0 | 21.0 | 5.0 |
| **Viti Levu** | 17.1 | 65.7 | 14.3 | 2.9 | - |
| Female | 16.7 | 75 | 8.3 | - | - |
| Male | 17.4 | 60.8 | 17.4 | 4.4 | - |
| **Overall** | 5.8 | 43.9 | 19.3 | 26.0 | 4.9 |

Local communities have been using a number of traditional and modern fisheries management tools to improve the stocks and general condition of their fishing grounds *(Jupiter et al. 2014)*. Tabu areas (periodically harvested closures; 54.5%) and size limits (20%) were the most widely used management tools by local communities. Just under half the fishers (47.9%) interviewed stated that stocks were depleted or had declined badly, while just over a quarter of fishers stated stocks were increasing or increasing greatly (25.8%) *(Table 5)*. Only 19.3% of fishers stated cucumber stocks were stable. The perceptions of healthy or stable stocks are not consistent with biological surveys that have shown sea cucumber densities are very low around Fiji *(Pakoa et al. 2013; Jupiter et al. 2013; WCS, unpublished data)* and below regional densities for all species *(SPC 2014)*. Perceptions of stock declines were higher in Viti Levu (82.2%) compared to Vanua Levu (43.6%), likely reflecting the differences in the health of stocks between the islands *(Table 5)*. Overharvesting (49.3%) and changes in fishing gear (15.5%) were the two main reasons given by fishers for their perceived declines in stocks.

# Processing sea cucumbers and value adding

Post-harvest processing of sea cucumber is the conversion of a raw product into a non-perishable form that can be stored in dry, conditions commonly known as bêche-de-mer *(Ram et al. 2015, 2016)*. Processing both adds value to the final product and if done correctly (e.g. proper salting, drying times, etc.), will prevent spoilage. Losses will be less if the product is transferred to distant markets. Individual species of sea cucumber have different skin textures and tolerance to stress, hence processing techniques are species specific *(Fig. 6, see also Purcell 2014)*. Processing methods of sea cucumbers in Fiji have been used since the 1800s and the techniques have very few modifications. There are several stages of processing that are conducted in different sequences, depending on the buyer specifications and expertise of a supplier/processor. More complete processing is done by local traders and exporters in order to meet quality demands of the international market.

*A fisher from Fulaga village in southern Lau Province drying sea cucumbers in the sun.*
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*Figure 6. General steps for processing sea cucumbers in Fiji. Source: adapted from Purcell (2014)*
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*Seagrass beds at Natokalau village provide important habitat for sea cucumbers.*
© Sangeeta Mangubhai/WCS

## Processing sea cucumbers and value adding

### Fisher Processors

The majority of fishers sell sea cucumbers in raw form (76.5%), and only a small number complete the first stage of processing (salting and/or first cook) (16.5%). Sea cucumbers are processed straight away to avoid spoilage and only a very small number of fishers (1.5%) stored animals in a freezer for sale later to local traders. Men and women generally process their own sea cucumbers (67.3%) or with their spouse (28.6%). Men generally worked with a wider diversity of fishers to collect sea cucumbers for processing, whereas women preferred to largely collect on their own (60.6%) or source them from immediate family members (27.3%) *(Table 6)*.

Fishing camps were documented in Vanua Levu (Vunidamoli, Vuya and Nasavu) and Viti Levu (Raviravi and Tavarau), with 11.7% sea cucumber fishers camping away from their village for 1-7 nights to collect sea cucumbers. Five fishers camped at Navave who worked for a local trader refused to be interviewed. Some of the fishers camping at Lekutu and Navakasiga districts were from Ovalau and Suva but harvesting in Bua Province. Only 4.7% fishers conducted post-harvest sea cucumber processing while camping away from their villages.

Fishers only partially-processed sea cucumbers prior to sale to local traders or exporters because they had not received sufficient training on the correct processing methods to use for different species, and/or they did not have key processing materials, such as rock salt. While Vanua Levu fishers had more opportunity for training in sea cucumber handling and processing than Viti Levu fishers, with the exception of Natuvu village, none of the fishers interviewed fully-processed sea cucumbers using the correct order and methods preferred by exporters. Natuvu village fully processed sea cucumbers, particularly sandfish from their village tabu area, with assistance from a former employee of one of the export companies, in order for it to meet exporter requirements. Those fishers with some knowledge of processing methods generally preferred to sell their products in semi-processed form, as some traders refuse to pay the market price for fully processed products *(M. Fox, personal communication)*.

*Table 6. Shows where fishers who do processing get their sea cucumbers from, and whom they process with. Numbers are relative percentages.*

| Gender | Self | Spouse | Family | Friends | Local fishers | Other |
|---|---|---|---|---|---|---|
| **Source** | | | | | | |
| Female | 60.6 | | 27.3 | 12.1 | - | |
| Male | 37.7 | | 16.4 | 9.8 | 29.5 | 6.6 |
| Overall | 45.7 | | 20.2 | 10.6 | 19.1 | 4.3 |
| **Processing** | | | | | | |
| Female | 76.0 | 20.0 | 4.0 | | | |
| Male | 58.3 | 37.5 | 4.2 | | | |
| Overall | 67.3 | 28.6 | 2.0 | | | |

*Fishers processing sea cucumbers in Lakeba (left) and at an exporter facility (right).*


## Local traders

Local traders, which includes processors (excluding fisher processors), middlemen and agents, generally purchased raw sea cucumbers for resale to exporters or other traders in a raw form or as a semi- or fully-processed product. The semi-processed form is in a state that allows for further processing to improve quality and maintain nutrients *(Ram et al. 2014)*, whereas fully-processed sea cucumbers are ready for export to international markets. Some local traders, a number of which are based in local villages, process the sea cucumbers they buy off local fishers *(Table 7)*. While these traders complete many more processing steps than fisher processors, it is interesting to note that exporters will still do some level of reprocessing to improve the quality prior to export *(R. Ram, personal communication)*. This suggests there is still room for adding value to sea cucumber products being produced by local traders in Fiji.

Independent processors mostly employed divers to collect sea cucumbers for them, but opportunistically purchase raw or semi-processed sea cucumbers from local fishers for reprocessing and/or sale to exporters. Independent middlemen were based in villages or the towns of Savusavu, Labasa or Nabouwalu, and purchased raw or semi-processed sea cucumbers which they then sold to other middlemen or directly to exporters. Agents (i.e. middlemen employed by exporter companies) purchased sea cucumbers directly from fishers in villages and were based in Labasa and Lautoka.

*Fisher processing sea cucumbers on Yadua Island in Bua Province.*
© Stacy Jupiter/WCS

At a local scale, it is common for local traders to grade sea cucumbers before sale. As expected, the quality of the final product is highly dependent on the knowledge and experience of individual traders and what training they have received on the processing steps required for the different species (Table 8). The majority of local traders on Vanua Levu (63%) stated they had not received any formal training, while those that did, had received training from other buyers (13.7%) or other fishers (13.7%). Viti Levu traders obtained their training largely from other buyers (66.7%).

| Location | Gutted | Salted | First cook | Second cook | Dry/ Smoke | Deep freeze | Third cook |
|---|---|---|---|---|---|---|---|
| Vanua Levu | | | | | | | |
| Galoa Island | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Bua | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Nadi | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Vuya | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Kubulau | ✓ | ✓ | ✓ | | ✓ | | |
| Savusavu | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Labasa | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Wailevu West | ✓ | | ✓ | ✓ | ✓ | | |
| Taveuni | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Viti Levu | | | | | | | |
| Raviravi | | | | | | | |
| Tavarau | | | | | | | |
| Lautoka | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |

*Table 7. The different levels of processing done by local traders at different sites.*

## Processing sea cucumbers and value adding

*Table 8. Descriptions of sea cucumber processing techniques used for different species by local traders in Fiji. d=day(s), w=week(s)*

| Type of processing | Processing steps | Processing time | Species processed |
|---|---|---|---|
| Semi process A (2 steps with different combinations) | Gut > Cook | 1 d–1 w | black teatfish, brown sandfish, chalkfish, curryfish, deepwater redfish, dragonfish, elephant trunkfish, greenfish, lollyfish, pinkfish, snakefish, stonefish |
| | Gut > Dry | 1.5 d–1 w | amberfish |
| | Gut > Salt | 2-4 d | amberfish, black teatfish, brown sandfish, chalkfish, curryfish, deepwater blackfish, deepwater redfish, dragonfish, elephant trunkfish, flowerfish, greenfish, hairy blackfish, tigerfish, lollyfish, pinkfish, prickly redfish, snakefish, stonefish, surf redfish, white teatfish |
| | Soaked > Cook | 2–3 d | lollyfish, pinkfish |
| | Cook > Dry | 2–5 d | chalkfish, dragonfish, greenfish, lollyfish, pinkfish, sandfish |
| Semi process B (3 steps with different combinations) | Gut > Cook > Dry | 1 d–2 w | amberfish, black teatfish, brown sandfish, chalkfish, curryfish, deepwater redfish, dragonfish, flowerfish, greenfish, hairy blackfish, lollyfish, pinkfish, sandfish, snakefish, stonefish, surf redfish |
| | Gut > Salt > Cook | 1 d–1 w | black teatfish, brown sandfish, chalkfish, curryfish, deepwater blackfish, deepwater redfish, dragonfish, elephant trunkfish, flowerfish, golden sandfish, greenfish, hairy blackfish, tigerfish, lollyfish, pinkfish, prickly redfish, sandfish, stonefish, surf redfish, white teatfish |
| | Gut > Salt > Deep Freeze | 2–3 d | black teatfish |
| | Gut > 1st Cook > 2nd Cook | 1 w | chalkfish, curryfish, deepwater redfish, dragonfish, hairy blackfish, lollyfish, pinkfish, sandfish |
| | Soak in freshwater > Gut > Cook | 2-3 d | amberfish, black teatfish |
| | Soak in freshwater > Cook > Deep Freeze | 1 d–1 w | greenfish |
| Semi process C (4 steps in different combinations) | Gut > Salt > Cook > Dry | 3 ds–3 w | amberfish, black teatfish, brown sandfish, chalkfish, curryfish, deepwater blackfish, deepwater redfish, dragonfish, elephant trunkfish, hairy blackfish, tigerfish, prickly redfish, sandfish, snakefish, stonefish, surf redfish, white teatfish |
| | Gut > Salt > 1st Cook > 2nd Cook | 4 d-2 w | amberfish, black teatfish, brown sandfish, chalkfish, curryfish, deepwater blackfish, deepwater redfish, dragonfish, elephant trunkfish, hairy blackfish, tigerfish, greenfish, lollyfish, prickly redfish, snakefish, stonefish, surf redfish, white teatfish |
| | Gut > Salt > Cook > Deep Freeze | 2-3 d | amberfish |
| | Gut > 1st Cook > 2nd Cook > Dry | 2-7 d | brown sandfish, chalkfish, curryfish, deepwater redfish, dragonfish, sandfish |
| Semi process D (5 steps in different combinations) | Gut > Salt > Cook > Dry > Deep Freeze | 4-6 d | brown sandfish, deepwater redfish, elephant trunkfish, hairy blackfish, tigerfish, lollyfish, stonefish, surf redfish |
| | Gut > Salt > 1st Cook > 2nd Cook > Dry | 4 d–6 w | amberfish, black teatfish, chalkfish, curryfish, deepwater blackfish, deepwater redfish, dragonfish, elephant trunkfish, greenfish, hairy blackfish, tigerfish, pinkfish, prickly redfish, sandfish, snakefish, stonefish, white teatfish |
| Semi process E (7 steps) | Soak in freshwater > Gut > Salt > 1st Cook > 2nd Cook > Dry > Deep Freeze | 4–60 d | deepwater blackfish, white teatfish |
| Complete process A (5 steps) | Gut > Salt > 1st Cook > 2nd Cook > Dry | 4 d–6 w | flowerfish |
| Complete process A (6 steps) | Gut > Salt > 1st Cook > 2nd Cook > 3rd Cook >Dry | 4–60 d | amberfish, blackfish teatfish, brown sandfish, chalkfish, curryfish, deepwater blackfish, deepwater redfish, dragonfish, elephant trunkfish, flowerfish, golden sandfish, greenfish, hairy blackfish, tigerfish, lollyfish, pinkfish, prickly redfish, sandfish, snakefish, stonefish, white chalkfish, white teatfish |

## Exporters

Sea cucumbers are collected by exporters directly from community fishing grounds or purchased through fishers or local traders are sorted by species, size and stage of processing at exporters' place of business. Exporters purchase raw/semi-processed sea cucumber directly from local fishers (43%), from local traders (29%), local processors (21%) or others (7%) *(Fig. 7)*. All exporters stated they preferred to process sea cucumbers themselves, especially high and medium value species, to ensure the correct processing technique is applied to each species to control the quality of the product for the export market and prevent wastage or value loss. Export company staff are involved in different stages of processing such as cooking, gutting, drying and sorting sea cucumbers on a rotational basis. They also provide some training to processors to ensure they process sea cucumbers to a standard and quality to meet export market demand.

Exporters apply three specific types of processing techniques *(Fig. 8)*, which differ from those used by local traders *(Table 8)*. These differences occur because exporters have a greater knowledge on the final product required by Asian consumers and make larger investments into the processing of sea cucumbers. For example, exporters use ovens rather than the sun to dry their product to gain greater control over the temperature and length of the drying process (48-72 hours). To process high commercial value species such as white teatfish and black teatfish, the majority of Fiji exporters adopt the "Exporter Process B" method *(Fig. 8)*. For this method, the harvested species is first laid on a clean surface to flatten out the animal. The first cook is done in warm water for about 20–25 minutes, until the sea cucumbers attain a cylindrical shape and become hard and bouncy. After the first cook the sea cucumbers are removed and left on the clean surface to cool before cutting and gutting takes place. Once cooled, a neat straight cut is made on the middle dorsal surface, leaving an inch at either end, and the gut contents are removed. The sea cucumbers are then salted for about 2–3 days and cooked for a second time and left in the sun to dry. The sea cucumbers are then cooked for a third time to correct the shape and close the gut cavity before the product is fully dried *(Ram et al. 2015)*.

*Fully-processed sea cucumbers at an exporter's facility.*
© Watisoni Lalavanua/WCS

Medium and other high value species are processed using "Exporter Process A" or "Exporter Process B" type of processing sea cucumbers *(Fig. 8)*. Deepwater redfish, brown sandfish, chalkfish, deepwater blackfish, prickly redfish, tigerfish, hairy blackfish, deepwater blackfish and surf redfish are processed using "Exporter Process A". The first steps involves making a small cut (2.5 cm) near the anus and the gut contents are emptied. For larger sized sea cucumbers, a single cut is made in the middle of the ventral surface to empty the gut contents. The sea cucumbers are then salted for about 2 days, before they are cooked for the first time for about 15–20 minutes depending on the size of the sea cucumber. Larger sea cucumbers take longer to process. After the first cook, the sea cucumbers are either

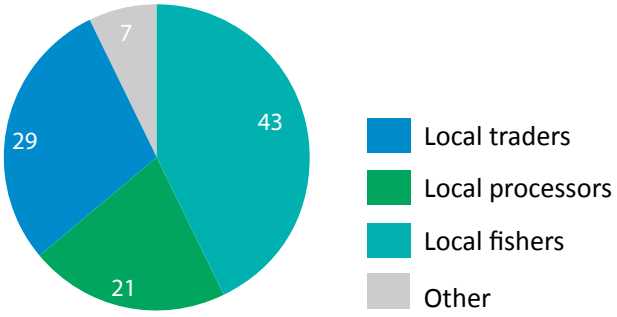



*Figure 7. Domestic purchase of sea cucumbers by exporters in Fiji.*

## Processing sea cucumbers and value adding

*Cutting white teatfish.*
All photos © WCS

*Salting sea cucumbers.*

*Cooking in processing facility.*

*Sun drying.*

*Packing* Actinopyga *species for export.*

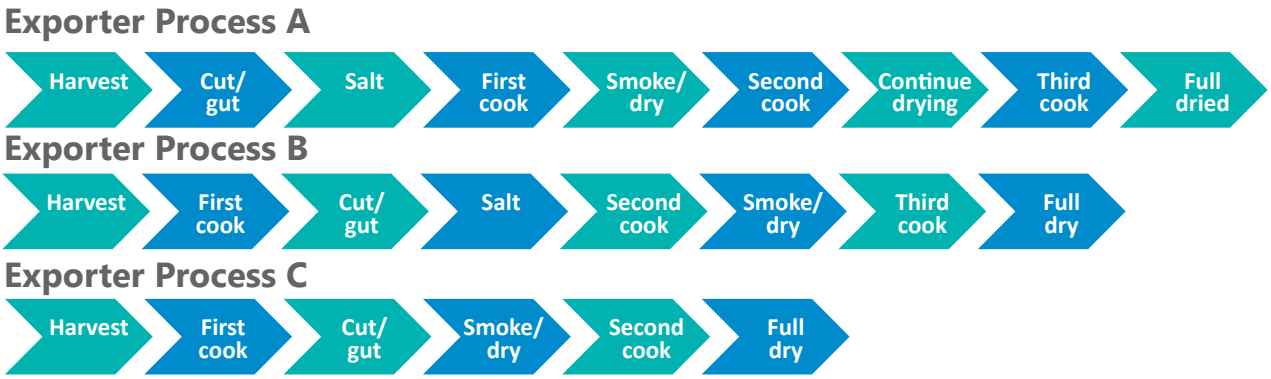



*Figure 8. Different processing methods used by exporters for different species of sea cucumbers harvested in Fiji.*

smoked or dried in the sun. The smoking of sea cucumbers (versus drying in the sun) depends on the market preference. After drying (which usually takes a week), the sea cucumbers are then cooked for the second time to straighten the shape. During the drying process, salt crusts form on the skin which need to be washed off to ensure the drying is effective. The final third cook is only required to straighten any sea cucumbers that became bent during the drying process. The final cook is done for approximately 10–15 minutes in boiling water.

Other medium value species that require instant cooking after processing are greenfish, amberfish, curryfish, dragonfish, flowerfish and snakefish that use the processing method outlined by "Exporter Process B" *(Fig. 8).* Curryfish, dragonfish, and greenfish are very fragile; they need to be processed as soon as they are harvested due to the risk of tissue degradation after harvest and prolonged storage. The first cook is done in warm water for 15–20 minutes followed by cutting and gutting the sea cucumber near the anal region *(Purcell 2014)*, and salted for 2 days before they are cooked for the second time before drying. A third cooking is optional and is only required if animal became bent in the long drying process, and therefore needs straightening *(Purcell 2014).*

*Collecting dragonfish.*
© Watisoni Lalavanua/WCS

Sea cucumbers that are low value species such as elephant trunkfish, lollyfish and pinkfish are generally processed using "Exporter Process C" *(Fig 8).* The low value species, especially lollyfish and pinkfish, lose about 50% of their overall size when fully dried. The harvested sea cucumbers are cooked in warm water and cooled for about 20 mintes before they are cut and gutted. After gutting the sea cucumbers are sun-dried until they are hard as a rock. A second cook is only needed if the animal has become bent and needs to be re-straightened.

# Product Value

There was very high variation in the prices received for different species, especially between men and women *(Table 9)*, and between fishers and local traders *(Tables 10-11)*. In general, fisher men receive a higher price for individual species than fisher women *(Table 9)*. Prices per piece are largely used with local fishers *(Table 10)*, whereas local traders and exporters deal in prices per kg *(Tables 11-12)*.

The market value is highly dependent on post-harvesting and handling techniques and the quality of the final product. For example, white teatfish is valued at $63/kg on average in raw form, whereas the same species is valued at $59-$105/kg depending on the grade as it moves up the value chain and value is added through local traders *(Table 11)*. The same species is valued by exporters at $170-$469/kg depending on the quality of the final product *(Table 11)*. As value is added, the price increased 3- to 4-fold for low, medium and high-valued species *(Table 13)*. More generally, high value species such as white teatfish, black teatfish, greenfish, prickly redfish, deepwater redfish in raw state fetched on average from $1–$200/kg by fishers but once processed from $53–$469/kg dry weight *(Table 11)*. Similarly low and medium value species in raw state are traded for $1–80/kg by fishers but after processing can fetch an exporter up to $15–$341/kg.

*Packed and sealed fully-processed sea cucumbers, ready for export from Fiji.*
© Watisoni Lalavanua/WCS

The large variation in prices for the raw product likely reflects the bargaining

| Trade names | Price-wet-weight | | Price-dry-weight | | Price-per-piece | |
|---|---|---|---|---|---|---|
| | Women | Men | Female | Male | Female | Male |
| White teatfish | 32.1 | **67.9** | | **100.0** | 15.0 | **54.2** |
| Stonefish | 15.1 | **28.3** | 7.8 | **23.6** | **28.0** | 16.0 |
| Hairy blackfish | 9.2 | **27.1** | 10.0 | **22.0** | 11.0 | **17.1** |
| Black teatfish | **34.0** | 25.3 | 25 | **26.3** | **27.5** | 14.5 |
| Greenfish | **30.3** | 24.8 | **23.1** | 22.2 | **3.3** | 1.1 |
| Prickly redfish | 15.0 | **23.0** | 30.0 | 30.0 | | **30.1** |
| Curryfish | 11.8 | **22.0** | 9.5 | **16.1** | 4.5 | **8** |
| Deepwater blackfish | 18.3 | **19.7** | **10.6** | 10.0 | **10.0** | 8.4 |
| Snakefish | 6.2 | **18.5** | 8.0 | **9.9** | | |
| Surf redfish | 6.1 | **16.8** | 5.2 | **6.0** | | 3.0 |
| Brown sandfish | 6.4 | **14.4** | 9 | **13.0** | **4.3** | 3.8 |
| Deepwater redfish | 10.7 | **14.3** | 24.5 | **24.6** | 7.7 | **10.2** |
| Sandfish | 9.6 | **13.4** | **20.0** | 8.8 | | |
| Pinkfish | 2.8 | **11.1** | **5.0** | 3.0 | | **20.0** |
| Chalkfish | 8.0 | **11.0** | 16.3 | **19.0** | **5.0** | 2.2 |
| Leopardfish/tigerfish | 7.0 | **10.7** | 6.0 | **8.5** | | **4.9** |
| Flowerfish | 3.7 | **10.6** | 2.5 | **3.5** | 2.0 | **50.0** |
| Lollyfish | 5.0 | **9.6** | **11.1** | 8.7 | | |
| Amberfish | | 7.5 | **5.8** | 5.1 | | **4.1** |
| Elephant trunkfish | 2.0 | **5.7** | | | | **2.5** |
| Dragonfish | **7.1** | 5.0 | 2.8 | **18.5** | | **2.0** |
| Golden sandfish | | 4.5 | | | | |

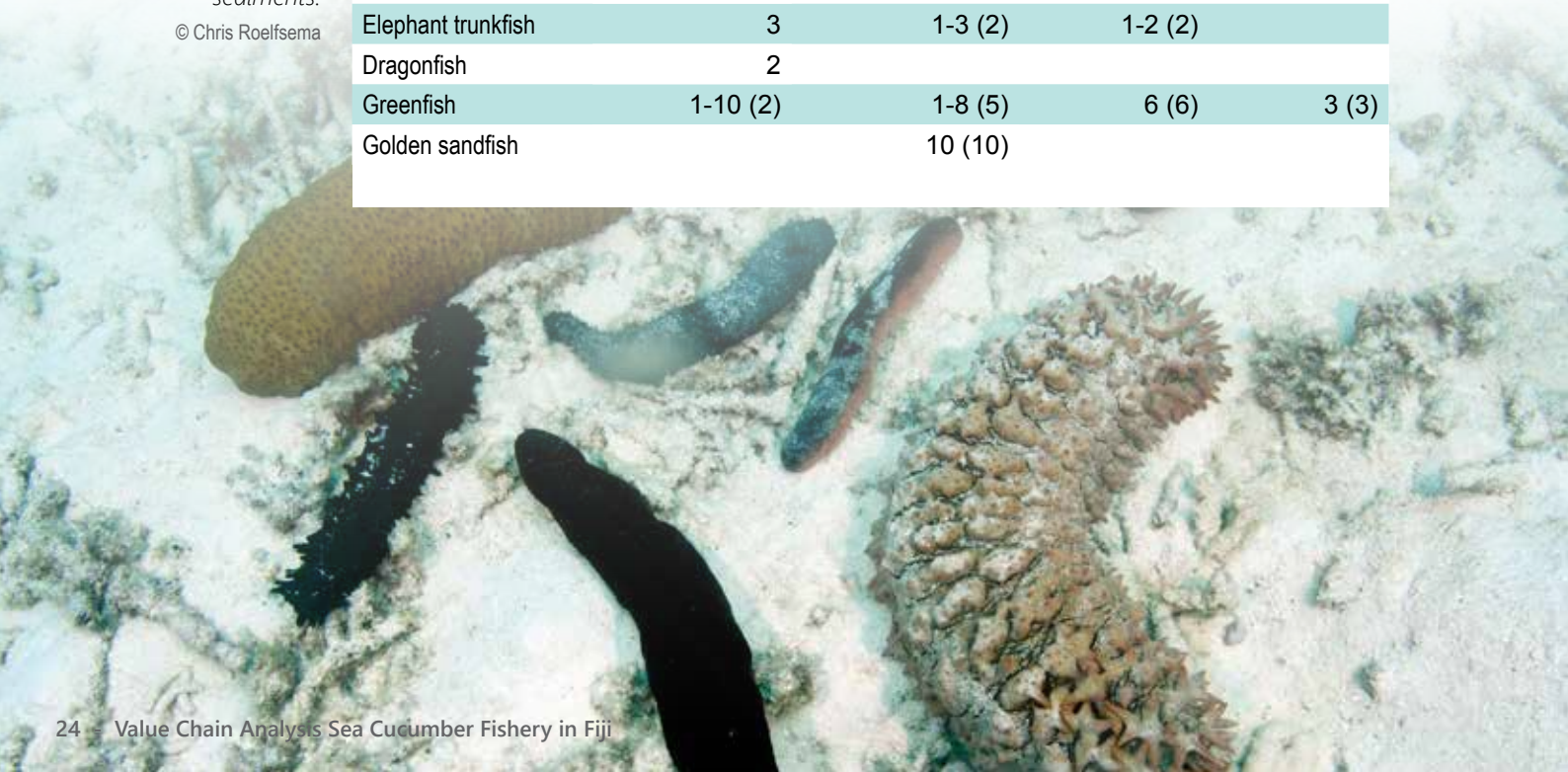
*Table 9. Differences in the averages prices received for sea cucumber species by fisher men versus fisher women, with those receiving the higher price highlighted in bold.*

power of the fishers. Discussions with fishers suggested that those traveling larger distances from their village to towns to sell to local traders or exporters had lower bargaining power, as there was a finite time to sell their raw product before it degraded. Some complained that their net profit was low, once they took into consideration the cost of the return bus ticket *(see section 3.8.1)*.

Each key player has different systems of setting market value and grades for sea cucumbers. Fishers sell raw or semi-dried sea cucumber by piece or per kilogram, and a grading system is generally not applied *(Table 10-11)*. As expected, the values for processed products are higher than in raw form *(Tables 11)*. The same species moving along the value chain through local traders that include middleman, processors and exporter agents, will be graded based on exporter preferences on the quality of product. Most middlemen and exporter agents in Fiji prefer to buy raw sea cucumber rather than a partially-processed product so that they can control the quality of the processing and therefore fetch higher prices.

*Table 10. Sea cucumber species and the range in prices (and average price) received per piece in raw form by fishers and local traders. Only the species for which data were provided are shown. All figures are in Fijian dollars rounded up to the nearest dollar.*

| Trade name | Fishers | Local traders (Grade A) | Local traders (Grade B) | Local traders (Grade C) |
|---|---|---|---|---|
| White teatfish | 15-100 (50) | 50-100 (75) | 40-50 (45) | 35 (35) |
| Prickly redfish | 5-60 (30) | 10-50 (23) | 5-35 (20) | |
| Flowerfish | 2-50 (26) | | | |
| Pinkfish | 10-30 (20) | | | |
| Black teatfish | 5-40 (18) | 20-35 (27) | | |
| Stonefish | 7-28 (17) | 13-20 (16) | 2 (2) | 7-10 (9) |
| Hairy blackfish | 5-65 (16) | 8-20 (15) | 15 (15) | 10 (10) |
| Deepwater redfish | 4-15 (10) | 15 (15) | 5 (5) | |
| Deepwater blackfish | 5-10 (9) | 20 (20) | 15 (15) | |
| Curryfish | 1-30 (7) | 9-30 (16) | 8 (8) | 6 (6) |
| Chalkfish | 2-5 (3) | | | |
| Leopardfish/tigerfish | 3-8 (5) | 6-38 (15) | 2-6 (4) | |
| Amberfish | 2-7 (4) | 5-7 (6) | 3-4 (4) | |
| Brown sandfish | 2-5 (4) | 3-6 (5) | 1-5 (3) | |
| Surf redfish | 2-5 (3) | | | |
| Elephant trunkfish | 3 | 1-3 (2) | 1-2 (2) | |
| Dragonfish | 2 | | | |
| Greenfish | 1-10 (2) | 1-8 (5) | 6 (6) | 3 (3) |
| Golden sandfish | | 10 (10) | | |



*Range of sea cucumber species found on sandy sediments.*
© Chris Roelfsema

*White teatfish at Savusavu market.* © Yashika Nand/WCS

*Flowerfish on coral rubble.* © Sangeeta Mangubhai/WCS

Exporters provided details of their purchase price range, as value is added to sea cucumbers *(Table 12)*. There are clear price differences between raw and full processed sea cucumbers. However, there are no consistent differences in prices between a semi-dried versus a semi-processed product, reflecting a wide range in quality in partially-processed products and lack of a grading standard in Fiji.

*Table 11. Sea cucumber species and the range in prices (and average price) received per kilogram, by different players when they sell their product in different forms. Grades A to C represent a semi/fully processed product. All figures are in Fijian dollars and are ordered from the highest to lowest prices fetched by exporters. *Asterisks indicate prices may be incorrect or reflect different sizes that that are being sold within the grade.*

| Common name | Exporter | Local traders (middleman, agents) | | | Fishers | |
|---|---|---|---|---|---|---|
| | Fully processed | Grade A | Grade B | Grade C | Raw | Dry |
| White teatfish | 170-469 (376) | 35-250 (105) | 25-150 (81) | 15-150 (59) | 20-200 (63) | 100 (100) |
| Black teatfish | 149-383 (304) | 20-180 (50) | 25-80 (61)* | 15-70 (48) | 5-80 (28) | 15-30 (26) |
| Dragonfish | 64-320 (256) | 5-60 (30) | 3-40 (20) | 10-25 (18) | 3-20 (6) | 3-40 (13) |
| Deepwater blackfish | 128-341 (233) | 25-120 (48) | 15-20 (18) | 12-15 (14) | 3-70 (20) | 10-13 (10) |
| Greenfish | 117-313 (226) | 12-150 (88) | 20-100 (63) | 1-80 (43) | 1-80 (26) | 1-100 (23) |
| Deepwater redfish | 107-341 (213) | 5-100 (27) | 5-40 (24) | 10-40 (30)* | 2-36 (13) | 10-40 (25) |
| Sandfish | 107-213 | 2-120 (60) | 15-80 (58) | 10-60 (43) | 2-50 (12) | 3-20 (13) |
| Curryfish | 117-298 (200) | 1.5-100 (40) | 1-80 (31) | 3-60 (26) | 4-80 (20) | 4-65 (14) |
| Stonefish | 106-341 (139) | 10-140 (38) | 6-40 (16) | 5-20 (12) | 4-60 (26) | 6-60 (16) |
| Prickly redfish | 53-341 (194) | 7-140 (57) | 20-60 (40) | 30 (30) | 2-60 (23) | 30 (30) |
| Hairy blackfish | 85-298 (198) | 10-180 (59) | 8-100 (33) | 5-80 (28) | 3-60 (23) | 10-40 (17) |
| Surf redfish | 75-256 (139) | 10-150 (38) | 8-15 (11) | 5-8 (7) | 3-40 (15) | 2-6 (6) |
| Golden sandfish | 213 | | | | 3-7 (5) | |
| Flowerfish | 17-170 (94) | 1-15 (6) | 10 (10) | 2-3 (3) | 1-30 (9) | 3-4 (3) |
| Amberfish | 43-139 (92) | 3-40 (12) | 2-8 (5) | 4 | 2-30 (8) | 3-6 (6) |
| Leopardfish/tigerfish | 64-128 (92) | 5-70 (15) | 3-30 (12) | 20* | 3-40 (10) | 6-16 (7) |
| Brown sandfish | 60-107 (79) | 5-50 (13) | 5-25 (13) | 7 | 2-60 (13) | 2-45 (11) |
| Snakefish | 64-86 (75) | 5-45 (13) | | | 2-70 (15) | 7-18 (9) |
| Elephant trunkfish | 15-170 (58) | 3-164 (48) | 64 (64) | 40 | 2-10 (5) | |
| Lollyfish | 32-85 (38) | 2-30 (6) | 2-5 (3) | 1-4 (3) | 1-45 (8) | 3-25 (10) |
| Chalkfish | 21-53 (36) | 2-25 (17) | 6-25 (18) | 5-25 (16) | 1-50 (10) | 7-35 (17.2) |
| Pinkfish | 26-85 (26) | 2-15 (6) | 3 | 1 | 1-40 (9) | 3-6 (4) |

## Product Value

*Table 12. Range in exporter purchase prices as value is added to sea cucumbers. Averages are in parentheses, rounded up to the nearest Fijian dollar.*

| Trade names | Price for fresh/raw (piece) | Price for fresh/raw (kg) | Price for semi-dried product (kg) | Price for semi-cooked/cooked & salted product (kg) | Price for fully dried processed product (kg) |
|---|---|---|---|---|---|
| White teatfish | 25-50 | 20-120 (45) | 100 | 40-100 | 80-220 (220) |
| Black teatfish | 10-50 (40) | 15-35 (30) | 70-80 | 20-60 (60) | 80-180 |
| Dragonfish | 1 | 1 | 15 | 5 | 30-100 (30) |
| Deepwater blackfish | 10-30 (18) | 25 | | 50-60 | 120-160 (160) |
| Greenfish | 0.5-1.5 (1) | 120 | 40-60 (50) | 40 | 80-150 (135) |
| Deepwater redfish | 10-30 (20) | | 75 | 50-60 (50) | 50-160 (155) |
| Sandfish | | 3-5 | | | 15-100 |
| Curryfish | 3-10 (9) | 2-10 | 40-60 (50) | 25-40 (33) | 80-150 (130) |
| Hairy blackfish | 5-16 (12) | 10-27 | 70 | 40-60 (40) | 80-150 (140) |
| Prickly redfish | 15-35 (33) | 5-40 | 70 | 60-70 | 100-160 (145) |
| Surf redfish | 5-17 (10) | 10-20 | 30-60 (45) | 30-40 (35) | 50-120 (115) |
| Stonefish | 5-15 (11) | 5-8 (9) | 30 | 10-60 (10) | 40-160 (110) |
| Flowerfish | | 1-1.5 (1.3) | 5 | 3 | 10 |
| Amberfish | 2-8 (7) | 6-7 | 15-20 (20) | 15-20 (16) | 25-65 (45) |
| Leopardfish/tigerfish | 2-8 (8) | 4-8.5 (9) | 25-30 (28) | 25-30 (28) | 30-60 (57) |
| Brown sandfish | 1.5-3 (2) | 4-8 (8) | 25 | 25-26 (26) | 30-50 (47) |
| Snakefish | | 3-6 (4.7) | 15-22 (22) | 15-20 (20) | 30-45 (38) |
| Elephant trunkfish | 2-4 (3) | 1-2 | 7-15 (15) | 7-8 | 7-25 (16) |
| Lollyfish | | 1.5-4 (2) | 10-15 (15) | 10-15 (10) | 10-40 (30) |
| Chalkfish | | 2.5-6 (4) | 10 | 6 | 10-20 (20) |
| Pinkfish | | 2-5 (2) | 9 | 6 | 10-40 (14) |

*Table 13. Percentage price gain as different sea cucumbers species are sold from fishers to local traders (in kg), fishers to exporters, and local traders to exporters. All figures are in Fijian dollars.*

| Common name | Fishers to local traders | Fishers to local traders | Fishers to exporters | Local traders to exporters (fully processed) | | |
|---|---|---|---|---|---|---|
| | Raw/semi-dried sale | Raw sale | Dry product sale | Grade A | Grade B | Grade C |
| White teatfish | 45-75 | 43-52 | 79-90 | 47-79 | 68-85 | 68-91 |
| Black teatfish | 81 | 25-81 | 92-95 | 53-87 | 79-83 | 82-90 |
| Dragonfish | 99 | 98 | 88-92 | 81-92 | 88-95 | 84-92 |
| Deepwater blackfish | 84 | 79 | 96-99 | 65-80 | 94-88 | 91-96 |
| Greenfish | 20 | 20 | 68-91 | 52-90 | 68-83 | 74-99 |
| Deepwater redfish | 78-96 | 60-64 | 88-97 | 71-95 | 88-95 | 88-91 |
| Sandfish | 80-95 | 50-96 | 91-97 | 44-98 | 62-86 | 72-91 |
| Curryfish | 93-98 | 33-90 | 78-94 | 66-99 | 73-99 | 80-97 |
| Stonefish | 88-95 | 50-94 | 82 | 59-91 | 88-94 | 94-95 |
| Prickly redfish | 75-95 | 29-71 | 88-91 | 59-87 | 82-62 | 91 |
| Hairy blackfish | 82-88 | 0-85 | 87-97 | 40-88 | 66-91 | 73-94 |
| Surf redfish | 80-83 | 0-87 | 98 | 41-87 | 89-94 | 93-97 |
| Flowerfish | 85 | 0-90 | 93-98 | 91-94 | 94 | 88-98 |
| Amberfish | 76-89 | 83-100 | 91-96 | 71-93 | 94-95 | 97 |
| Leopardfish/tigerfish | 86-87 | 20-88 | 88-97 | 45-92 | 77-95 | 84 |
| Brown sandfish | 84-87 | 20-84 | 58-89 | 53-92 | 77-92 | 93 |
| Snakefish | 87-90 | 40-87 | 79 | 48-92 | | |
| Elephant trunkfish | 86-94 | 67-99 | | 4-80 | 62 | 76 |
| Lollyfish | 85-90 | 25-87 | 67-71 | 65-94 | 94 | 95-97 |
| Chalkfish | 70-75 | 25-76 | 34-88 | 53-90 | 53-71 | 53-76 |
| Pinkfish | 80-88 | 0-67 | 93 | 82-92 | 96 | 99 |

# Income Profile of Key Players

## Fishers

The majority of fishers interviewed (62.8%) stated that sea cucumbers were the only marine resource they sold, with almost no differences in responses between men and women. Because fishers in Fiji do not use logbooks or keep track of household earnings, it is difficult to assess how much income is generated annually per household from this fishery. To overcome this, fishers were instead ask to recall how much they made on their last sale of sea cucumbers, and whether this figure was normal, more or less than what they usually earned.

Overall the VCA found fishers earned on average $522 during their last sale of sea cucumbers, with most sales occurring recently (weeks rather than months ago) *(Table 14)*. There was a large range in income on the last sale from $17-$6000, reflecting the level of effort and investments individual fishers make in this fishery. Women earned less than men, reflecting the differences in the species, number and volume of sea cucumbers collected. In the majority of cases, especially for Vanua Levu, sea cucumbers are contributing to fisher incomes more than any other livelihood *(Table 14)*. Overall, most fishers indicated that their earnings on their last sale was within the range of what they normally earned (42.5%), with the remaining indicating it was more (23.6%) or less (33.9%) than previously earned. Interestingly, 75.1% of fishers stated they were 'very satisfied' or 'mostly satisfied' with the income they were earning. Only 24% indicated they were 'very unsatisfied' or 'mostly unsatisfied'.

*Harvesting sea cucumbers.* © Stacy Jupiter/WCS

*White teatfish in a processing facility in Taveuni.*
© Sailasa Tagica

Sea cucumber fishers from Vanua Levu were dependent on the sea cucumber fishery (44.2%), agriculture (23.0%), and then sales from other marine resources (11.5%) and kava (11.5%) for their livelihoods *(Table 15)*. In contrast, sea cucumber fishers from Viti Levu stated they were dependent on sea cucumbers (48.5%), sales from other marine resources (36.4%), followed by agriculture (9.1%) for their livelihoods *(Table 15)*. It is important to note the VCA specifically targeted communities that harvested sea cucumbers, and therefore these patterns should not be extrapolated to other communities. These results suggest that across both islands sea cucumbers are a critical source of income, but this is not the only livelihood they have.

The VCA documented high incomes being generated in Bua and Macuata through sea cucumbers sales *(Table 16)*. Fishers are not limited their fishing to within their fishing grounds. For example, fishers from Ra appear to be fishing in waters around Vanua Levu, earning as high as $1800/trip and on average $453 on their last trip *(Table 16)*. Fishers from Macuata and Cakaudrove also fished in the neighbouring province of Bua. Fishers from Tailevu do not fish within their fishing ground, likely because of depleted stocks. Fishers are selling to local traders and/or to two main companies – Flysha Seafood Fiji Ltd and Gold Hold Seafood Ltd who have a presence in both Vanua Levu and Viti Levu.

## Income Profile of Key Players

*Table 14. Fisher income made on the last sale of sea cucumbers and from other (non-sea cucumber) livelihoods. The higher income earner is highlighted in bold. Numbers are rounded up the nearest Fijian dollar. SD=Standard Deviation.*

| Location | Gender | Sea cucumbers | | | | Other livelihoods | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Mean | SD | Min | Max | Mean | SD |
| Vanua Levu | All | 19 | 6000 | **649** | 1034 | 0 | 6000 | 385 | 831 |
| | Female | 45 | 2500 | **557** | 701 | 0 | 1000 | 250 | 229 |
| | Male | 19 | 6000 | **709** | 1210 | 0 | 6000 | 447 | 989 |
| Viti Levu | All fishers | 17 | 1800 | 216 | 417 | 0 | 1500 | **289** | 486 |
| | Female | 28 | 200 | **77** | 83 | 0 | 60 | 35 | 21 |
| | Male | 17 | 1800 | 259 | 471 | 0 | 1500 | **378** | 541 |
| Overall | All fishers | 17 | 6000 | **522** | 916 | 0 | 6000 | 366 | 776 |

*Other livelihoods: selling of invertebrates at the Suva market.* © Sangeeta Mangubhai/WCS

*Other livelihoods: selling of seaweed at the Suva market.* © Sangeeta Mangubhai/WCS

*Table 15. Main livelihood of fishers (%) in Vanua Levu and Viti Levu, broken down by gender. Note that these figures only cover fishers within communities that actively engage in the sea cucumber fishery, who were targeted for this study.*

| Island | Livelihoods | Female | Male | All fishers |
|---|---|---|---|---|
| **Vanua Levu** | Fishing sea cucumbers | 37.8 | 47.4 | 44.2 |
| | Agriculture | 18.9 | 25.0 | 23.0 |
| | Fishing other resources | 2.7 | 15.8 | 11.5 |
| | Yaqona | 24.3 | 5.3 | 11.5 |
| | Weaving | 8.1 | | 2.7 |
| | Copra | 2.7 | 2.6 | 2.7 |
| | Rent-boat owner | | 2.6 | 1.8 |
| | Small artisanal business | 5.4 | | 1.8 |
| | Salary | | 1.3 | 0.9 |
| **Viti Levu** | Fishing sea cucumbers | 71.4 | 42.3 | 48.5 |
| | Fishing other resources | 28.6 | 38.5 | 36.4 |
| | Agriculture | | 11.5 | 9.1 |
| | Salary | | 3.8 | 3.0 |
| | Small artisanal business | | 3.8 | 3.0 |

*Table 16. Profile of sea cucumber fishers in Fiji. Average income is rounded up the nearest dollar, with the range provided in parentheses. d=day(s), w=week(s), mo=month(s), yr=year(s)*

| Island | Origin of fishers (province) | Collection area | Mean no. sea cucumbers harvested | Average income on last sale | Timeframe (Last sale) | Harvesting support | Buyer |
|---|---|---|---|---|---|---|---|
| **Vanua Levu** | Bua | Bua, Dama, Kubulau, Lekutu, Nadi, Navakasiga, Vuya, Wainunu | 205 (8-1000) | 460 (30-1500) | 1 d–36 mo | Group, spouse, siblings, relatives, others | Flysha Seafood Fiji Ltd, Gold Hold Seafood Ltd, His Hand Trading Company Ltd, Middleman |
| | Cakaudrove | Nadi, Wailevu West | 347 (8-860) | 81 (14-212) | 1 d-1 w | Spouse, siblings, parents, relatives, others | Gold Hold Seafood Ltd |
| | Macuata | Cokovata, Macuata, Sasa Bua, Lekutu, Navakasiga, Vuya | 111 (25-298) | 76 (32-120) | 1 w | Spouse, siblings, relatives, friends, others | Flysha Seafood Fiji Ltd, Gold Hold Seafood Ltd |
| **Viti Levu** | Ba | Others | 54 (4-140) | 67 (15-207) | 1 d-4 w | Spouse, siblings, friends, relatives, others | Amigo Trading Company Ltd, Gold Hold Seafood Ltd |
| | Ra | Cokovata, Macuata, Others | 35-89 | 453 (156-1800) | 1 d-1 w | Siblings, friends, relatives, crew boys from village | Flysha Seafood Fiji Ltd, Gold Hold Seafood Ltd |
| | Serua | Vasaratu, Others | 22 (3-44) | 139 (48-280) | 1 w-5 mo | Friends, relatives | Flysha Seafood Fiji Ltd, Gold Hold Seafood Ltd |
| | Tailevu | Others | 133 (30-300) | 352 (70-1007) | 2 mo-1 yr | Spouse, friends, relatives | Flysha Seafood Fiji Ltd, Gold Hold Seafood Ltd, Star Dragon General Trading Company Ltd |

*Fishers from Vanuabalavu with their catch.*

## Income Profile of Key Players

*Processing sea cucumbers on Oneata island in Lau Province.*
© Watisoni Lalavanua/WCS

### Fisher Processors

The majority of fishers who processed sea cucumbers (68.1%) stated that sea cucumbers were the only marine resource they sold, with almost no difference in responses between men and women with almost all of these fishers (93%) from Vanua Levu. Women processors earned on average $178 (range of $15-$800) on their last sale, compared to men who earned $8102 (range of $19-$96,170) *(Table 17)*. This likely reflects a combination of women getting a slightly lower price for their product *(Table 9)*, and differences in investments made in the number and volume of sea cucumbers collected and processed. Overall, most fishers indicated that their earnings on their last sale of semi-processed sea cucumbers was within the range of what they normally earned (42.7%), and only some indicated it was more (23.6%) or less (33.6%) than previously earned. More than three quarters (75.1%) of fisher processors stated they were 'very satisfied' or 'mostly satisfied' with the income they were earning, while less than a quarter (23.9%) stated they were 'very unsatisfied' or 'mostly unsatisfied'.

Almost all fisher processors sold their sea cucumbers individually, with the exception of two communities in the districts of Nadi (Bua Province) and Wailevu West (Cakaudrove Province) who collected, processed and then sold their sea cucumbers together as a community following the opening of a well-managed *tabu* areas (periodic harvest closures). The profits from the tabu harvest went towards the community as a whole, rather than to individuals.

Only 3 of the fishers interviewed were wholly dependent on sea cucumbers for income, with the remaining 71 (or 95.9%) fishers gaining additional income from other livelihoods. Women processors earned on average $140 (range of $20-$400) on their last (non-sea cucumber livelihood) sale, compared to men who earned $1224 (range of $15-$20,000) *(Table 17)*. Both men and women earned on average more on their last sale of processed sea cucumbers than their other livelihoods on both Vanua Levu and Viti Levu, confirming this is an important income earner for communities that engage in this fishery, but they also invested in other livelihoods to supplement their income.

*Table 17. Average income (and range in parentheses) earned by fisher processors on their last sale from sea cucumbers and from other sources of income. All figures have been rounded up to the nearest dollar. SD=Standard Deviation*

| Island | Sea cucumbers | | | | | | Other livelihoods | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Female | | Male | | All | | Female | | Male | | All | |
| | Average | SD | Average | SD | Average | SD | Average | SD | Average | SD | Average | SD |
| Vanua Levu | 179 (15-800) | 193 | 7642 (19-96,170) | 18,597 | 4727 (15-45,000) | 14,903 | 140 (20-400) | 146 | 1224 (15-20,000) | 3897 | 827 (15-20,000) | 3127 |
| Viti Levu | 143 | | 14,081 (744-4000) | 22,449 | 10,597 (143-40,000) | 19,610 | | | 1755 (10-3500) | 2468 | 1755 (10-3500) | 2468 |
| **Overall** | 178 (15-800) | 190 | 8102 (19-96,170) | 18,653 | 5072 (15-96,170) | 15,099 | 1340 (20-400) | 146 | 1262 (10-20,000) | 3783 | 870 (10-20,000) | 3082 |

## Local Traders

All middlemen, agents and independent processors were men, with no women working in this part of the value chain *(Table 18)*. Independent processors had operated their own businesses for 2-12 years and were based in Lekutu, Navakasiga and Wailevu West *(Table 19)*. Middlemen were based in the villages of Tavarau in Ba (Viti Levu) and Bua village in Bua District (Vanua Levu). Local traders were hesitant to disclose how much they earned annually and so were instead asked what they earned from their last sale, and whether that reflected a normal, or a higher or lower than usual earning. Processors working as agents for exporter companies earned the highest ($50,000-$96,170) on their last sale, with independent processors earning the least ($50-$3000).

*Sorting sea cucumbers into species.*
© Watisoni Lalavanua/WCS

In terms of satisfaction with their income; fisher processors and middlemen agents were satisfied with the income they were earning while 50% of independent middlemen and processor agents were dissatisfied *(Table 20)*.

*Table 18. Gender composition (%) of fisher processors and local traders in the sea cucumber fishery.*

| Local traders | Vanua Levu | | Viti Levu | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| Processors (fishers) | 45.3 | 54.7 | 100 | |
| Middlemen (independent) | | 100 | | 100 |
| Processors (independent) | 33.3 | 66.7 | | |
| Processors (agents) | | | | 100 |
| Middlemen (agents) | | | | 100 |

*Table 20. Relative income satisfaction (in percentages) for local traders operating in the sea cucumber fishery.*

| Local Trader | Very satisfied | Mostly satisfied | Indifferent | Not satisfied | Very unsatisfied |
|---|---|---|---|---|---|
| Processors (fishers) | 61.1 | 37 | | 1.9 | |
| Processors (independent) | 66.7 | 33.3 | | | |
| Processors (agents) | 25 | 16.7 | 8.3 | 50 | |
| Middlemen (independent) | | 50 | | 50 | |
| Middlemen (agents) | 100 | | | | |

*Table 19. Profile of local traders of sea cucumbers in Fiji. mo=month(s), yr=year(s). All figures have been rounded up to the nearest dollar and are in Fijian dollars.*

| Local Traders | Sea cucumber supplier | Active period (average, range) | No. of Employees | Buyers | Income on last sale (FJD) | Average volume sold (last sale, kg) |
|---|---|---|---|---|---|---|
| **Vanua Levu** | | | | | | |
| Middlemen (independent) | Self, local fishers, friends | 4 yr | 1-2 | Flysha Seafoods, Gold Hold Seafood | 1500-3000 | 20 (20-150) |
| Processors (independent) | Self, local fishers, friends, family | 6.5 yr (2-12 yr) | 2-15 | Flysha Seafoods, Gold Hold Seafood | 50-3000 | 104 (6-290) |
| Processors (agents) | Local fishers, friends, others | 14.8 yr (8 mo–25 yr) | 1-8 | Flysha Seafoods , Gold Hold Seafood, Amigo Trading Co | 400-45,000 | 679 (120 -2553) |
| Middlemen (agents) | Local fishers | 10 yr | 1 | Gold Hold Seafood | 50,000 -96,170 | 1030 (500-1030) |
| **Viti Levu** | | | | | | |
| Middlemen (independent) | Local fishers, others | 18 mo | 1 | Gold Hold Seafood, Amigo Trading Co., middlemen, agents, processors | 750-1500 | 23 |
| Middlemen (agents) | Local fishers | 8 yr | 2 | Gold Hold Seafood | 40,000 | 1.5 |

## Income Profile of Key Players

### Exporters

In 2015, there were 13 export companies in Fiji that traded in sea cucumbers, of which 7 were interviewed for this study *(Table 21)*. Despite the increase in the number of exporters from 7 to 15 between 2008 to 2014 *(Fig. 9)*, only 7 have remained active in the last 8 years. The majority of the exporters (60.0%) are based in the Central Division (Suva, Nausori, Nasinu, Wailada), while a smaller number of exporters are based in the Northern (Labasa) (13.3%) and Western divisions (Lautoka, Nadi) (26.7%). Those interviewed included exporters new to the business (4 years) and those who have been operating for a long period of time (up to 24 years).

About a third of the exporters were large-scale companies and the remaining two thirds were small-scale companies that trade in sea cucumbers opportunistically. Large-scale exporters usually have a main office and a few processing stations near their main harvesting areas *(Table 21)*. Small-scale exporters have a main office and they usually purchase directly from fishers, middlemen and/or processors. For instance, Gold Hold Seafood Limited operates from Labasa but has multiple offices and processing stations in other parts of Fiji, while Jeff's Seafood Export & Import, which is a small-scale exporter, operates from Lautoka and mainly works with middlemen and/or fishers around the same fisheries division.

Based on information provided on the number of shipments made per year, and the quantity of sea cucumbers per shipment, annual export volumes were calculated to be in the order of 978.2-1405.7 tonnes *(Table 21)*. This is at least 21-31 times higher than that recorded in Department of Fisheries 2015 export data (estimated at 44.8 tonnes), and 4.6 times higher than has been documented in recent years *(243 tonnes, Pakoa et al. 2013)*. This suggests that export records may not be a true reflection of the quantity of sea cucumbers being exported from Fiji.

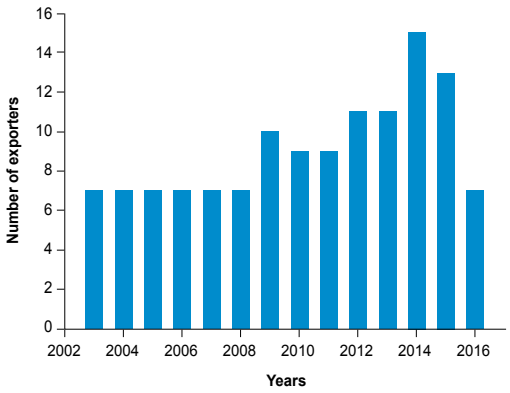



*Figure 9. Number of sea cucumber exporting companies in Fiji from 2003 to 2016. Source: Fiji Department of Fisheries*

*Table 21. Profile of sea cucumber exporters in Fiji.*

| Name | Size of business | Employees | Supplier | Destination | Shipments per year | Quantity per shipment | Estimated export volume (tonne) |
|---|---|---|---|---|---|---|---|
| Gold Hold Seafood Ltd | Large-scale | >15 | Local fishers, local processors, traders/ middleman | China, New Zealand | 10-30 | 12-14 tonne | 120-420 |
| Flysha Seafoods Fiji Ltd | Large-scale | >15 | Local fishers, local processors, traders/ middleman | China | 7-8 | 120 tonne | 840-960 |
| His Hand Trading Co Ltd | Large-scale | 7 | Others | Australia, China, New Zealand, Taiwan, USA | 8 | 700-800 kg | 5.6-6.4 |
| Best Seafoods | Small-scale | 11 | Local fishers, traders/middleman | Australia, China, New Zealand, USA | 15 | 500 kg | 7.5 |
| Amigo Trading Co Ltd | Large-scale | 6 | Local fishers, local processors, traders/ middleman | No data provided | 4-5 | 1-2 tonne | 4-10 |
| Sakai Export and Import | Small-scale | 6 | Local fishers | China, New Zealand, USA | 3-4 | 300-400 kg | 0.9-1.6 |
| Jeff's Seafood Export and Import | Small-scale | 3 | Local fishers | China | 1 | 200 kg | 0.2 |

*Sandfish sold at the Suva market.*
© Kelera Varawa/WCS

## Local Market Sellers

The Suva market had seven sea cucumber sellers, the Lautoka market had one and none were found at the Labasa market at the time of the interviews. Sellers were between 27-57 years of age. Six of the seven Suva-based sellers were women selling sandfish and white teatfish they had caught largely on their own, and selling without assistance from other family members. At Lautoka market, the seller interviewed made $100-200 per week from selling cooked sandfish and charged $10/plate, with each plate holding about 10 sandfish. Sellers at the Suva market made between $10-350 per week (or on average $135 per week) for white teatfish. Small white teatfish were being sold at $10/plate, medium at $50-250/plate and large at $350/plate. Sea cucumbers were sold once per week on Saturday throughout the year, alongside other marine products collected through gleaning such as seaweed (e.g. *lumi*, *nama*), marine molluscs (e.g. *sici*) and occasionally marine crustaceans (e.g. mud crabs, lobsters). All sellers stated they were very or mostly satisfied with the prices they got from their sea cucumber sales.

*Sandfish sold per plate at Lautoka market.*
© Yashika Nand/WCS

## Restaurants

Of the 25 restaurants visited in Vanua Levu and 41 restaurants visited in Viti Levu, only 5 served sea cucumber dishes. Of the 5, China Town Restaurant had been open for 17 years while the other four had been operating for 5-7 years. Despite the large number of sea cucumbers being collected in Vanua Levu, none were being sold in restaurants in Labasa and Savusavu at the time of the surveys. Sea cucumbers are purchased by the owner or the chef, either directly from local fishers or from local markets, in roughly equal proportion. The majority are satisfied with the product and only one owner stated he threw out 5% of his purchase. Their main concerns were the animals were too small, not cut properly, or had burn marks. Restaurants spent $10/plate for medium sized sandfish, $70-80/kg for medium sized white teatfish, and $140-250/kg for large sized white teatfish. Sea cucumber dishes cost $41-58, depending on the size of the dish. Only one of the five restaurants that sold sea cucumber dishes knew anything about the endangered status of sea cucumbers, or about the export ban on sandfish.

*Traditional Fijian sandfish dishes.*
© Kelera Varawa/WCS

# Product Spoilage and Wastage

The prices fetched for sea cucumbers vary greatly depending on the care taken during collecting and processing. Poor handling methods during collecting can result in the body of the animals having abrasions or disintegrating. Poor processing can result in a product that is bent, not fully dried, has a strong odour, or is covered in salt, which are traits not desired by overseas consumers. Spoilage affects the income and profit made by each of the players in the value chain.

*Sea cucumbers that have been poorly handled or processed.*
© Ravinesh Ram

Fishers held or stored sea cucumbers for periods of less than a day to one month. The majority of fishers stated they had no losses (75.5%), with just over a fifth (22.3%) stating they lost 1-10 animals/ trip due to inappropriate storage or dehydration in the sun. Only 2.2% of fishers interviewed lost >10 animals/ trip. One fisher reported a loss of 50 sea cucumbers on a single trip due to poor handling practices. Processors on the other hand stated they had no wastage of product.

Most spoilage (50%) occurs with low value species such as lollyfish and pinkfish, with fishers either under- or over-drying animals during the smoking process. Exporters stated that 0.5–2% of sea cucumbers bought from local fishers are damaged due to use of destructive harvesting methods, and 0.5% are cooked incorrectly further reducing the value of the final product *(Table 21)*. Similarly problems are also noted for the high value black teatfish, where 5% of the received individuals are incorrectly boiled due to lack of handling skills. These species were classed as undersized by the exporters, which suggest that adult stocks may be over harvested, are now severely depleted in Fiji and require urgent management action.

According to exporters, approximately 40% of brown sandfish, 0.4% of deepwater redfish, 28% of dragonfish, 5% of sandfish, flowerfish and prickly redfish, and 2% of snakefish, stonefish and surf redfish are damaged during collection and cannot be exported *(Table 22)*. The VCA revealed that fishers with limited knowledge of processing steps were likely to use one processing technique for every single species, leading to loss in value of the product. For example, overseas consumers in Southeast Asia prefer white teatfish unsmoked. However, fishers in Fiji tend to smoke white teatfish to prevent spoilage because they lack access to salt. Exporters also stated that 3% of black teatfish were undersized, and were increasingly difficult to find suggesting this species is severely overharvested in Fiji. Exporters highlighted that 50% of low value species such as lollyfish and pinkfish were not dried properly or over-dried from excessive heat.

The VCA clearly shows there is a pressing need for fishers to receive training on processing techniques to minimise and where possible avoid spoilage or poor quality products. Poor quality products often result in exporters receiving the lower end price which in turn affects the price received by fishers. Overall only 20% women and 49% male have had some training in processing, mostly from exporters. Some training is being provided to select communities through an ACIAR project implemented by SCU, in collaboration with Partners in Community Development Fiji (PCDF) local NGO, to assess if training results in a better processed product and consequently fetches a better price for local communities.

*Table 22. Percentage spoilage of sea cucumber reported by exporters due to poor handling and processing techniques.*

| Trade Name | Incorrect boiling | Undersized | Not dried properly | Over dried | Damage during collection |
|---|---|---|---|---|---|
| Black teatfish | 5 | 3 | 1 | | 2 |
| Greenfish | | 0.5 | | | 5 |
| Tigerfish | | | 26 | 26 | |
| Lollyfish | | | 50 | 50 | 5 |
| Pinkfish | | | 50 | 50 | 5 |
| White teatfish | 0.5 | 0.5 | | | 0.5-2 |

# Activities and Costs

There are various expenses or costs incurred by each of the different players in the sea cucumber fishery in Fiji, which are critical to understanding investments in the fisheries, as well as redundancies or inefficiencies in the value chain. The value chain mapping closely links these activities to the final product with every step corresponding to a set of costs.

## Fishers

The costs associated with the harvesting of sea cucumbers across Viti Levu and Vanua Levu are shown in Table 23. Fishers incur costs such as the purchasing or renting of fishing gear (e.g. fins, masks, torches, UBA gear), renting boats to fishing grounds, processing, and traveling to markets (e.g. Labasa, Savusavu, Lautoka) to sell their products. A large number of fishers fully own and use their own equipment (62.5%), while others partially rent equipment (6.2%) or use traditional hand collection techniques that do not require equipment (15.5%). The remaining fishers rent UBA gear (12.9%) themselves or are provided UBA gear by export companies or commercial collectors (3%). Of the fishers that incurred rental costs, 40.2% stated that they make direct payments for gear rental, while 2.1% rented on credit. The remaining 57.7% provided no explanation of how they covered their rental cost. Some of the local traders and exporters provide fishing equipment, including UBA gear directly to local fishers in return for their catch.

*Women fishing in front of Natokalau village in Kubulau District.*

©Sangeeta Mangubhai/WCS

Vanua Levu fishers (that need to travel some distance to profitable fishing grounds) rent 19-32 foot boats that on average uses 2-5 gallons of fuel per boat (or 7.6-18.9 litres of fuel), and the rental cost is shared between 1-7 fishers. Fishers on Viti Levu rent 14-43 foot boats that use 2-6 gallons of fuel (or 7.6-22.7 litres of fuel) per boat, and the rental cost is shared between 5-6 fishers. Interestingly, some fishers do in-kind payment for boat rental such as giving a portion sea cucumbers collected to the boat owner.

*Fisher offloading sea cucumbers for processing.*

© Watisoni Lalavanua/WCS

*Table 23. Ranges in purchase and rental costs incurred by local sea cucumber fishers. Average costs are shown in parentheses. All figures have been rounded up to the nearest Fijian dollar.*

| Cost items | Purchase cost | Rental cost |
|---|---|---|
| Buckets and drums | 2-100 ( 30) | |
| Diving/snorkelling gear | 5-400 (98) | 5-800 (152) |
| Fishing gear | 2-495 (191) | |
| Other gear (torch, gloves, knives) | 2-200 (32) | |
| Fuel cost | 28-250 (89) | |
| Boat rental/head | | 3-60 (17) |
| Boat rental/trip | | 5-200 (37) |

## Activities and Costs

*Smoking house.* © Watisoni Lalavanua/WCS

*Cooking sea cucumbers.* © Watisoni Lalavanua/WCS

*Jet blast air dryer for effective sea cucumbers drying.* © Watisoni Lalavanua/WCS

### Local Traders

The costs local traders incurred in trading sea cucumbers across Viti Levu and Vanua Levu are shown in Table 24. For local traders their daily expenses include wages, transportation and rental for dive equipment, vehicle and boats. On a weekly basis, local traders purchased sea cucumbers and salt for processing. On a monthly basis money is spent on gear/ boat maintenance, water and electricity bills, and the maintenance and servicing of UBA. Yearly costs incurred include the equipment purchases. Across Viti Levu and Vanua Levu local trader's highest expenses are largely associated with the purchase of sea cucumbers.

*Sea cucumbers on racks for drying.* © Watisoni Lalavanua/WCS

*Table 24. Costs incurred by local traders buying and seller sea cucumbers in Fiji. All figures are in Fijian dollars.*

| Cost items | Daily | Weekly | Monthly | Yearly | Other |
|---|---|---|---|---|---|
| UBA | | | | 300-680 | |
| Racks | | | | 12 | 5-3000 |
| Sea cucumbers | | 600-25,000 | 19,000 | | |
| Wood | | | | | 700 |
| Salt | | 25-32 | 25 | | 0.75-1000 |
| Electricity and water | | | 30-800 | | |
| Transport | 100-300 | 80-200 | 150 | | |
| Food | | 200 | | | |
| Rental (office) | 300 | 100-300 | 150 | | |
| Maintenance/Servicing | | | 1500 | | 500-6000 |
| Permits/ Licenses/ Traditional fishing ground fees | | | | | 600-20,000 |
| Other | | 20-400 | 400 | | 20-19,000 |

*Gutting sea cucumber (left).*
© Watisoni Lalavanua/WCS

*Sea cucumbers being salted (right).*
© Yashika Nand/WCS

## Exporters

The costs exporters incurred in trading sea cucumbers across Viti Levu and Vanua Levu are shown in Table 25. Annual expenses include business licenses, insurance (divers, medical), export permit, export taxes, and i-qoliqoli access fees, equipment maintenance and purchase of materials (e.g. salt). For exporters their monthly expenses include wages, export fees, transportation, equipment (e.g. UBA), consumables (e.g. fuel) and maintenance costs.

Export companies in Fiji have total monthly expenses ranging from $62,530–$158,200 and annual expenses ranging from $11,455–$623,042, depending on the size of their company and operation. Purchasing sea cucumbers from the local fishers and middlmen are their largest expense ($30,000–$40,000/month) and also the purchasing of processing materials such as salt ($80–$3000/ month or $240–$190,000/year). In general the annual operational expenses for the exporters are at $30,000–$8,000,000 depending on the size of the company and the scale of its operation. Profits by exporters will be in excess of these operational expenses.

| Operational expenses | Expenses (month) | Expenses (year) |
|---|---|---|
| Business license | | 292 |
| Divers insurance | | 4000 |
| Divers wages | 8000 | |
| Electricity bill | 200-8000 | |
| Export permit | | 15-150 |
| Export fee | 30-4000 | |
| Export taxes | - | 2000 |
| Firewood for processing | 20-800 | |
| Fisher food | 8000 | |
| Freight | 6000-7000 | |
| Gas for processing | 70-10,000 | |
| Insurance & health | | 1600-400,000 |
| Traditional fishing ground fee | | 1000-8000 |
| Kerosene | 800 | |
| Labour wages | 300-32,000 | |
| Machine maintenance | | 8000-10,000 |
| Processing sea cucumber from fishers | 30,000-40,000 | |
| Building rent | 3000-4000 | |
| Salt for processing | 80-3000 | |
| UBA gear purchase/maintenance | | 600 |
| Transport hire for sea cucumber pick up | 20,000-200,000 | |
| Boat fuel for harvesters | 8800-100,000 | |
| Water bill | 30-1000 | |

*Table 25. Monthly and annual costs incurred by exporters across Viti Levu and Vanua Levu. Some exporters provided averages, and other gave ranges. Figures are in Fijian dollars.*

# Supporting Services - boat owners

Villagers that owned boats with engines play an important support service to fishers engaged in the sea cucumber fishery in Fiji who are unable to afford a boat for themselves. All 8 of the boat owners interviewed were self-employed males that owned 23 foot boats with 15 or 40 hp engines that would carry on average between 3–8 fishers per trip. The number of trips per week varied from 1–6, with each boat doing between 4–24 trips per month, and spending anywhere between 2–5 hours at sea. Some boat owners operate on their own or sometimes hire a boat boy to assist them. Many stated they collected sea cucumbers opportunistically during the trips. On average a boat owner charged individual fishers between $5–$20 per person or $70–$80 per boat load of fishers. Some boat owners charge $15 per gallon fuel and an additional $10 if a boat boy was needed. Boat owners earn on average of $100-$500 per week. However, a large amount is spent per month on boat maintenance ($112), fuel ($113), and loan payments ($265), and their profit ranges from $55-$264. Each boat owner is also required to spend annually $22.82 to renew their boat licence. None of the boat owners interviewed had boat insurance.

*Boats and bilibili used by villagers for harvesting sea cucumbers.*
© Sangeeta Mangubhai/WCS

# Enforcement

At the time of the VCA, the Department of Fisheries did not have staff specifically tasked with enforcement, or specific enforcement programs targeting the sea cucumber fishery. The main tasks Fisheries are involved in, specific to the sea cucumber fishery were: (i) arranging for the sale of confiscated illegally harvested sea cucumbers; (ii) facilitating training on sea cucumber processing methods; (iii) data collection from exporters; (iv) licensing, (v) market surveys; and (vi) provision of ice to fishers.

Fisheries officers interviewed were from Labasa, Lekutu, Nabouwalu, and Savusavu and had worked for the Department of Fisheries for 6-10 years. The majority of officers interviewed were high ranking staff for the department, with a number of junior level staff working under them who were specifically assigned for enforcement activities. In Vanua Levu, between 2 to 7 officers are involved in enforcement activities who allocated 4-7 hours per week towards enforcement. The department spends between $50-$5000 annually on enforcement.

In contrast, officers from Lautoka and Suva fisheries stations had worked for the Department of Fisheries for 12-35 years, and had 12-23 officers involved in activities related to fisheries enforcement in Viti Levu which includes the sea cucumber fishery. These officers spend 1-3 hours on enforcement activities which costs the department on average $5000-$15,000 a year. Fuel was the biggest cost associated with enforcement.

# Underwater Breathing Apparatus (UBA)

The effectiveness and productivity of the sea cucumber fishery is dependent on a number of external influences, including access to technology. Despite the ban on the use of UBA, the VCA found this gear type was being used across the provinces of Bua and Macuata, and district of Nailaga to access depths of greater than 35 m, which is beyond safety limits for no decompression diving. The use of UBA is only possible through applying for an exemption with the Ministry of Fisheries and Forests. Only two companies have exemptions for the use of UBA for harvesting sea cucumbers *(Department of Fisheries, unpublished data)*.

Fishers were asked how many people they knew had had a UBA related injury, and how many UBA related deaths had occurred in their village. The greatest number of injuries and deaths were recorded in the provinces of Bua, Macuata and Ba *(Table 26)*. The highest number of deaths was recorded in Bua Village where five males had died as a result of UBA diving for sea cucumbers.

*Table 26. Average number of injuries and deaths relating to the use of UBA to collect sea cucumbers. Range in numbers are provided in parentheses.*

| Island | District | Number of injuries | Number of deaths |
|---|---|---|---|
| Vanua Levu | Bua | 5 (1-15) | 2 (1-5) |
| | Kubulau | | |
| | Macuata | 3 (4-5) | 1 (1-2) |
| | Nadi | | |
| | Solevu | | |
| | Vuya | | |
| | Wailevu East | | |
| Viti Levu | Wailevu West | | |
| | Nailaga | 4 (3-7) | 4 (3-5) |
| | Ra | 1 | |
| | Verata | | |

*Fisher woman from Nasau village.*
© VCreative

*Fishing for sea cucumbers using UBA.*© Watisoni Lalavanua/WCS

# CONCLUSIONS

Wild caught sea cucumbers are a high value export fishery, which has historically been unmanaged and threatened with over-exploitation in Fiji and throughout the wider Pacific *(Pakoa et al. 2013)*. Prices are driven by Asian consumers who have specific species, size and quality preferences, which with the exception of exporters, is largely unknown to other players in the value chain. The increasing trend in the global market prices for sea cucumbers and the failure to aquaculture sea cucumbers species at a commercial level *(Purcell et al. 2012)*, means that this fishery will rely on wild caught animals and will continue to crash, unless effective measures are put in place both nationally and globally to prevent this *(Purcell et al. 2014b; Eriksson et al. 2015)*.

The fishery operates year round and the volume of product that moves along the value chain does not show a distinct seasonal pattern in Fiji. There was no indication to suggest for example, that higher volumes were taken, or higher prices received, in the months leading up to Chinese New Year. There is a wide variety in prices in the value chain, reflecting a range in the quality of semi- or fully-processed product, and no national standards for grades to guide the transfer of product along the value chain and ensure fair pricing.


*Size of deepwater surf redfish found in a community tabu area in Kubulau District in Bua Province.* © Stacy Jupiter/WCS

and limited choices for fishers and fisher processors. The fishery is a buyer-driven supply or value chain, where fishers (the 'producers') have few options for selling their raw or semi-processed product, and little bargaining power to negotiate prices. In contrast, exporters in Fiji hold the strongest power and influence along the value chain, capturing much of the value generated by the fishery. With formal and informal relationships with the fishers and fisher processors and unlimited access to fishing grounds, there is little incentive for exporters to invest in sustainable harvesting practices. One exporter stated that past efforts to work with communities to establish good management practices failed, as there was poor compliance with *tabu* areas, and no guarantee that the community would sell sea cucumbers to them, rather than their competitors.

There are low barriers to entry in the fishery, other than the health of stocks, but there are both logistic limitations

There are a number of challenges and constraints that are faced by different players in the sea cucumber fishery in Fiji.

*Processed sea cucumbers.* © Ravinesh Ram

## Inequity in terms of the fair distribution

of the economic gains in the value chain amongst the different players. With the exception of a small number of villages, fishers operate individually rather than as a cooperative, making it difficult to exert the pressure (bargaining power) on local traders and exporters, and better control the prices received for sea cucumbers. Lack of national standards for grades of sea cucumbers means that fishers have insufficient knowledge to negotiate prices for semi-processed sea cucumbers, and therefore preferring to sell a raw product to minimise low return.

## Power imbalances in participation

with local traders and exporters having many alternatives (i.e. many suppliers to choose from) compared to fishers (i.e. limited pool of people to sell to). Uncontrolled and unlimited access to fishing grounds gives local traders and exporters stronger bargaining power in the value chain, and little incentive to harvest sustainably.

## Economic empowerment

of fishers is low, especially of women, due to inadequate information on market prices, limited time to sell a raw product before it spoils and lack of access to credit to make a larger investment in the fishery. This results in fishers and fisher processors, having the lowest bargaining power and smallest economic gain compared to other players in the value chain.

## Lack of national standards

for the different forms and grades of sea cucumbers means there is nothing to guide the transactions along the value chain to ensure fair pricing for each of the players. There are large price differences within and between species and good and bad quality products in the value chain. There is also product wastage and inefficiencies, due to poor standards for the fishery.

## Capacity to value add is low

in communities, and poor knowledge and skills in processing sea cucumbers means that most fishers are selling raw to avoid getting a low price for their efforts and cost investments. There are no government initiatives to improve processing knowledge and skills.

## Limited access to market-related information

such as prices for raw, semi-processed and fully processed product, as well as the species, size and grade requirements, means fishers are ill-informed about the value of their product, and therefore again have to accept what price local traders and exporters are offering them. Local fishers are also unaware and therefore not benefitting from the increases in the global prices of sea cucumbers around Chinese New Year.

## Gender inequalities

Greater disadvantages in the sea cucumber fishery including lack of information on the value of both the raw and processed product are faced by women who have less access to information. They have lower daily profit than men, because of poor access to pricing information, difficulties in accessing markets (e.g. mobility, security, tradition).

## Technological limitations

mean most fishers have insufficient capital or no access to equipment (e.g. boats) processing materials (e.g. salt, racks, smokers) and storage, forcing them to sell a raw product with a short finite timeline (24 hours). Poor supporting infrastructure such as poor roads and transport services, especially in Vanua Levu also impacts their access to markets in Labasa, Savusavu and Nabouwalu.

## Poor data collection

means species and volumes of product being exported are grossly under-reported, with potential 21-31 fold differences recorded in 2015. This can lead to gross under-estimation of how over-exploited the fishery is and failure in putting management actions in place before stocks crash. Export data needs to be cross checked with customs data to address any discrepancies.

## Enforcement of laws

such as size limits, requirements for commercial licenses and the ban on the use of UBA are challenging for the enforcement agencies because the fishery has an 'hour glass model'. There are a lot of fishers dispersed over a wide area, with many fishers harvesting outside their own traditional fishing grounds.

# RECOMMENDATIONS

The Department of Fisheries has drafted a national management plan for the sustainable management of the wild caught sea cucumber fishery in Fiji, in consultation with industry, non-government organisations and other interested partners. At the time of this report, the management plan was being reviewed by the Solicitor General's office. The following recommendations are made, based on the results of the value chain analysis.

*Sea cucumber monitoring*
© Margaret Fox/WCS

## Sea cucumber management plan

Poor management of sea cucumber stocks means that most fishing grounds do not have sufficient densities to sustain harvesting levels or reproduce to maintain the fishery. The National Sea Cucumber Management Plan should be passed by Cabinet and implemented immediately, with adequate control and enforcement measures in place to ensure there recovery of depleted stocks.

## Banning use of UBA

The use of UBA has resulted in the depletion of sea cucumber populations to greater depths, and with it increasing diving-related accidents and deaths. Most divers interviewed were not certified and did not know safe diving depths and practices, with high social costs to local communities. UBA should be banned, and exemptions should be stopped to both protect stocks of sea cucumbers and human life. When UBA is prohibited, there is a natural sanctuary for sea cucumbers below the depth possible for free diving. The sanctuary allows re-population of overfished areas.

## Transparency in grading prices

The establishment of industry grades and standards in Fiji is critical to guide transactions along the value chain, and to ensure fishers and processors receive a fair price for their product. This will remove the standards being set solely by exporters and ensure greater transparency for the fishery.

## Limiting the number of exporters

The number of licenses issued should be limited to reduce the pressure on the resource. Areas allowed for harvesting should be specified on licenses to encourage sustainable harvesting, and prevent serial depletion.

## Process upgrading

The biggest opportunity to upgrade the value chain is to improve the quality of the processing of sea cucumbers, especially at the community level. This requires training on processing techniques, as well as systems to be put in place to enable them to access materials such as rock salt. A semi- or full-processed product would allow fishers to hold onto their product as they negotiated a good price, without the fear of spoilage, and raising the quality of products from Fiji.

## Communal harvesting

Although there were only a small number of examples, there was evidence to suggest that communities that had well-enforced *tabu* areas, and that sold sea cucumbers as a community (rather than as individual fishers), received a greater price for their product. Communities could also potentially negotiate prices with exporters before the harvest to ensure receiving the best price for their sea cucumbers while minimising spoilage.

## Enforcement

Given the hour glass model of the fishery, enforcement efforts are more cost effective when focused at the export level. Stronger controls over what species, sizes and volumes leave Fiji, would have a quick 'trickledown effect' throughout the value chain. Fisheries officers in the export division should coordinate with customs on both enforcement and data collection to accurately record export volumes of sea cucumbers from Fiji. Data collected should be used to inform number of permitted licenses and adaptive management of the fishery.

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# QUESTIONNAIRE

## SEA CUCUMBER / BECHE-DE-MER TRADE IN FIJI

**Goal** To undertake a value chain analysis (VCA) of the sea cucumber/ beche-de-mer fishery in Bua Province and parts of Cakaudrove Province, to understand the relationships and linkages between buyers, processors, sellers (and other service providers/market actors), to identify opportunities and constraints to industry growth and competitiveness in Fiji.

**Introduction to respondents (please tick boxes to confirm completion)**

- ☐ Introduce yourself/the team and give background on project (see information sheet provided).
- ☐ Explain the survey can take up to 30-60 minutes, depending on their level of engagement with the sea cucumber fishery, and that all information will be kept confidential and only aggregate information will be used in publications.
- ☐ Explain how they will receive feedback: a report, presentation on subsequent visits, or at a proposed Northern Division Fisheries Forum.
- ☐ Give the respondent the relevant contact information in case they have any further questions or concerns.

**Respondent information**

| | |
|---|---|
| Name | |
| Gender (Male/Female) | |
| Age | |
| Location: | |
| Time Started | |
| Time Finished | |

**Tell respondents**

Throughout the survey "sea cucumber" refers to the live animal and "beche-de-mer" to refer to the processed, fresh or dried, product made from the sea cucumber. If there are any other terms that you do not understand at any point in the survey, please ask for an explanation of the term used.

**What activity are respondents engaging in?**

Ask respondents the questions below. Then go to the corresponding section(s) for follow-up questionnaires for each YES response.

| SURVEY | Questions | Yes/No |
|---|---|---|
| Q1 | Do you collect sea cucumbers from the sea? | |
| Q2 | Do you process sea cucumbers? | |
| Q3 | Do you transport fishers to sea to collect sea cucumbers? | |
| Q4 | Do you transport sea cucumbers or beche-de-mer to buyers/exporters? | |
| Q5 | Do you export beche-de-mer? | |
| Q6 | Do you provide supporting services to the sea cucumber/beche-de-mer industry/ trade? (not listed above)? | |
| Q7 | Do you provide monitoring/law enforcement/resource management/verification services for the Fiji Department of Fisheries? | |
| Q8 | Do you sell sea cucumbers or beche-de-mer at local markets? | |
| Q9 | Do you serve sea cucumbers or beche-de-mer in a restaurant? | |

# QUESTIONNAIRE 1

## Sea Cumber Collection / Harvesting from the Wild

Survey Number..... Date of Interview ..... Interviewer's Name.....

## Type and Location of Fishing

*1.1 Are sea cucumbers the only marine resource you sell?*

☐ Yes, only sea cucumbers ☐ No, sell other fish/marine resources too

*1.2 Which districts do you collect sea cucumbers from?*

☐ Bua ☐ Dama ☐ Kubulau ☐ Lekutu ☐ Nadi
☐ Navakasiga ☐ Vuya ☐ Wainunu ☐ Wailevu ☐ West
☐ Wailevu East ☐ Other: .....

*1.3 Which village iqoliqoli / ikanakana areas do you collect from?* .....

*1.4 How did you collect sea cucumbers? (tick all that apply)*

☐ Breath-hold diving ☐ SCUBA (with tanks) ☐ Collecting by hand (in shallow)
☐ Hookah diving (with compressor) ☐ Use of lead bomb with barb ☐ Other: .....

*1.5 Do you rent the equipment or own your equipment?* ☐ Rent only ☐ Own equipment ☐ Both

*1.6 If you rent equipment, do you pay directly or on credit?* ☐ Pay directly ☐ On credit ☐ Both

*1.7 What equipment did you use to collect sea cucumbers and what is the price of that equipment?*

(This question applies to bought and/or rented equipment, which are in separate columns. We are trying to understand the financial investments fishers make in the fishery)

| Equipment bought | Cost (FJ$) | | Equipment rented | Cost (FJ$) |
|---|---|---|---|---|
| Knife | | | | |
| Spear | | | | |
| Buckets | | | | |
| Snorkeling mask | | | | |
| Flippers/Fins | | | | |
| Torch | | | | |
| Batteries | | | | |
| | | | | |
| | | | | |

*1.8 How do you store the sea cucumbers after harvest? (tick all that apply)*

☐ Styrofoam boxes (mixed with other fish) ☐ Styrofoam boxes (only sea cucumbers within)
☐ Buckets ☐ Sacks ☐ Large 44 gallon cut drums ☐ Other.....

*1.9 What time of day/night do you harvest sea cucumbers? (tick all that apply)*

☐ Early morning ☐ Morning ☐ Midday ☐ Afternoon ☐ Evening ☐ Night time

## Fishing Effort and Costs

*1.10 Do you collect sea cucumbers with anyone?* ☐ Yes ☐ No

*If so, with whom? (tick all that apply)*

☐ Husband ☐ Father ☐ Brother ☐ Other family member ☐ Wife
☐ Mother ☐ Sister ☐ Friend ☐ Buyer ☐ Other .....

*1.11 Over the past year, how many hours per day (on average) do you spend collecting sea cucumbers?*

☐ <1 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ >5

*1.12 Over the past year, how many days per week (on average) do you spend collecting sea cucumbers?*

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

*1.13 Which months do you collect sea cucumbers?*

☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun
☐ Jul ☐ Aug ☐ Sept ☐ Oct ☐ Nov ☐ Dec

*Why only these months?* .....

*1.14 On your fishing trips, how many hours do you spend traveling to and from the fishing sites (i.e. not including the fishing time)? If respondent answers in half hours, add tick the right box, and add ½ after the number.*

☐ <1 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ >5

*1.15 How do you get to your sea cucumber fishing area? (tick all that apply)*

☐ Foot ☐ Swim ☐ Bilibili / Raft ☐ Boat (no engine) ☐ Boat (with engine)
☐ Other .....

*1.16 Do you own a boat?* ☐ Yes **(Go to Q1.17-18)** ☐ No **(Go to Q1.19-21)**

*1.17 What is the size of the boat you own?* ..... feet ..... engine size

*1.18 How much fuel do you use on the last trip to collect sea cucumbers?*

Gallons ..... Cost .....
How many other people (not including you) shared the fuel cost? ..... people

*1.19 What is the size of the boat you normally rent?* ..... feet ..... engine size

*1.20 How much does the boat rental cost?*

a) ..... per head b) ..... per boat trip c) Nothing

*1.21 Who do you rent a boat from? (get name and location)* .....
**Use information from Q1.19 to interview people that hire out their boats to sea cucumber fishers – see QUESTIONNAIRE 3**

*1.22 Do you camp away from the village when harvesting sea cucumbers?*

☐ No ☐ Yes If Yes, how many days away on average? ..... days

*1.23 Do you do any processing while you are away from the village harvesting sea cucumbers?*
*1.23 Do you do any processing while you are away from the village harvesting sea cucumbers?*

☐ No ☐ Yes **(Respondent will need to complete QUESTIONNAIRE 2)**

## Sea Cucumber Catch

*1.24 During your last trip to collect sea cucumbers, how many did you actually collect?*

(Please get respondents to provide numbers or weights. They can give both if they want.)
Number of sea cucumbers: ..... sea cucumbers
Number of kg ..... kg
If kg weight is provided, is this "gutted weight"? ☐ Yes ☐ No

*1.25 Is this typical of your normal catch?* ☐ Yes ☐ No, it is less ☐ No, it is more

*1.26 Do you consume sea cucumbers as part of your diet?*

☐ Often ☐ Sometimes ☐ Rarely ☐ Never
List the species you consume: .....

*1.27 What do you do with the sea cucumbers you do not consume? (tick all that apply)*

☐ Process them yourself immediately **(Respondent will also need to complete QUESTIONNAIRE 2)**
☐ Sell them raw (unprocessed) to buyers **(Go to Q. 1.29)**
☐ Store them (e.g. in a freezer) for processors or buyers **(Go to Q1.28)**
☐ Other .....

*1.28 If you store sea cucumbers for processors or for collectors, how many days, weeks or months to you hold onto them? Write actual numbers (don't just tick).*

..... Days ..... Weeks ..... Months

*1.29 How many sea cucumbers are thrown away on average per fishing trip (e.g. sea cucumbers spoilt, or could not sell)?*

..... sea cucumbers / trip

*1.30 Do you sell directly to any export companies? (tick all that apply)*

☐ Gold Hold ☐ Flysha ☐ Seafoods ☐ Star Dragon
☐ Amigo Trading ☐ Tuvu Seafoods ☐ His Hand Trading
☐ Best Seafoods ☐ Other exporter companies .....

*1.31 Are there buyers/middlemen you sell your fresh sea cucumbers to? If the person does not work for a company, write "individual" to mean the person operates on his own.*

| Name of buyers | Company name | Role (buyer/trader, transporter, etc.) | Where are they based? |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

*1.32 Where do you collect from and what price do you receive for raw (unprocessed) sea cucumbers?*

Spoilage refers to sea cucumbers that go bad or of poor quality, and therefore cannot be sold.
Frequency refers to how often fishers are seeing different species of sea cucumbers, as defined in the table below

| | |
|---|---|
| 1 = seldom | meaning one or two sea cucumbers (individual animals) caught per week or less |
| 2 = sometimes | meaning they catch a few (3-6) of that species each week, or at least one or two each trip |
| 3 = often | meaning they catch many each week, and probably a number of them on an average trip |

| | Fijian names | Trade names (species) | Depth S:0-10m D:>10 | Frequency (1, 2, 3) | Price – wet weight ($/kg) | Price per piece ($) | Spoilage (pieces) |
|---|---|---|---|---|---|---|---|
| 1 | Sucuwalu | White teatfish (*H. fuscogilva*) | | | | | |
| 2 | Loaloa | Black teatfish (*H. whitmaei*) | | | | | |
| 3 | Sucudrau | Prickly redfish (*T. ananas*) | | | | | |
| 4 | Dri vatu | Stonefish (*A. lecanora*) | | | | | |
| 5 | Tarasea | Deepwater red fish (*A. echinites*) | | | | | |
| 6 | Dri, Driloa | Hairy blackfish (*A. miliaris*) | | | | | |
| 7 | Dri ni cakau | Deepwater blackfish (*A. palauensis*) | | | | | |
| 8 | Vula ni cakau | Surf red fish (*A. mauritiana*) | | | | | |
| 9 | Tina-ni-dairo, Dairo ni toba | Elephant trunkfish (*H. fuscopunctata*) | | | | | |
| 10 | Vulu wadrawadra | Leopardfish /tigerfish (*B. argus*) | | | | | |
| 11 | Vula | Brown sandfish (*B. vitiensis*) | | | | | |
| 12 | Laulevu | Curryfish (*S. hermanni*) | | | | | |
| 13 | Dri-votovoto, Barasi | Greenfish (*S. chloronotus*) | | | | | |
| 14 | Basi | Amberfish (*T. anax*) | | | | | |
| 15 | Mundra | Chalk fish (*B. marmorata*) | | | | | |
| 16 | Yarabale | Snakefish (H. coluber) | | | | | |
| 17 | Dairo, Curuki | Sandfish (*H. scabra*) | | | | | |
| 18 | Loliloli | Lolly fish (H. atra) | | | | | |
| 19 | Loli piqi | Pinkfish (*H. edulis*) | | | | | |
| 20 | Dairo kula | Golden sandfish (*H. lessoni*) | | | | | |
| 21 | Katapila | Dragonfish (*S. horrens)* | | | | | |
| 22 | Senikau | Flowerfish (*P. graeffei*) | | | | | |
| | | | | | | | |
| | | | | | | | |

*1.33* *How much did you earn from your last sale of sea cucumbers?* FJ$ .....

*1.34* *When was your last sale? (answer one only)*
a) ..... weeks ago
b) ..... months ago

*1.35* *What your earnings from your last sale normally what you earn?*
☐ Yes, normal ☐ No, more ☐ No, less

*1.36* *Do you have any other source of income?*
☐ No **(Go to Q1.39)** ☐ Yes **(Go to Q1.37)**

*1.37* *Can you rank which sources of income you get most of your money from and which you get less money from? '1' is most important. (Please do not tick boxes)*
☐ Agriculture ☐ Fishing other resources ☐ Salary
☐ Government support ☐ Small artisanal business ☐ Money from family members in Fiji
☐ Fishing sea cucumbers ☐ Money from family members overseas ☐ Other .....

*1.38* *How much would you earn in the last two weeks from other income sources?*
FJ$..... (make sure respondents do not include the money they got for sea cucumbers)

*1.39* *If you could no longer collect sea cucumbers which source of income above do you think would become most important?*
☐ Agriculture ☐ Fishing other resources ☐ Salary
☐ Government support ☐ Small artisanal business ☐ Money from family members in Fiji
☐ Fishing sea cucumbers ☐ Money from family members overseas ☐ Other .....

*1.40* *Are you satisfied with the income you get from sea cucumber fishing and processing?*
☐ Very satisfied ☐ Mostly satisfied ☐ Not satisfied ☐ Very unsatisfied ☐ Indifferent

*1.41* *How many people have been injured from diving to collect sea cucumbers?* ..... people

*1.42* *How many people have died from diving to collect sea cucumbers?* ..... people

## Local Management

*1.43* *How many years ago did you first start fishing sea cucumbers?* .....years

*1.44* *What do you think about the status of sea cucumber stocks in your fishing area?*
*(Note declining badly means they can still get sea cucumbers but it is hard. Depleted means there are almost no sea cucumbers left to collect).*
☐ Increasing greatly ☐ Increasing Stable ☐ Declining badly ☐ Depleted

*If declining or depleted, why do you think so?*
☐ Stocks declining as a natural change ☐ Change in fishing strategies/gear
☐ Too much sea cucumbers taken by fishers ☐ Pollution (e.g. sewage outlets, agricultural run-off)
☐ Other .....

*1.45* *What management measures are in place to manage your sea cucumber populations?*
☐ Tabu areas ☐ Gear restrictions ☐ Size limits
☐ Catch limits quotas) ☐ None ☐ Other .....

*1.46* *Who gave you information on which species of sea cucumber to collect? (tick all that apply)*
☐ Fisheries Department ☐ Exporter ☐ Buyers (Middle men traders/collectors)
☐ Processors ☐ Family members ☐ Other villagers
☐ NGOs ☐ Others .....

# QUESTIONNAIRE 2
## *Sea Cucumber Processors*

Survey Number..... Date of Interview ..... Interviewer's Name.....

## General Questions

*2.1 Where did you get your sea cucumbers to process?*

☐ Collected by self ☐ Collected by family ☐ Collected by friends in the village
☐ Collected by local fishers ☐ From a trader (seller) ☐ Other .....

*2.2 Who do you process your sea cucumbers with?*

☐ Self ☐ Father ☐ Brother ☐ Other family member
☐ Wife ☐ Mother ☐ Sister ☐ Friend
☐ Husband ☐ Buyer ☐ Other .....

*2.3 What methods do you use for processing sea cucumbers? (please tick all that apply)*

Note for total time spent, some species take days (d), others weeks (w). Please indicate which it is.

| | Fijian names | Trade names (Species) | 1st Boil | Gut | Salted | 2nd Boil | Dry in sun/ smoke | 3rd boil | Time spent? (d, w) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Sucuwalu | White teatfish (*H. fuscogilva*) | | | | | | | |
| 2 | Loaloa | Black teatfish (*H. whitmaei*) | | | | | | | |
| 3 | Sucudrau | Prickly redfish (*T. ananas*) | | | | | | | |
| 4 | Dri vatu | Stonefish (*A. lecanora*) | | | | | | | |
| 5 | Tarasea | Deepwater red fish (*A. echinites*) | | | | | | | |
| 6 | Dri, Driloa | Hairy blackfish (*A. miliaris*) | | | | | | | |
| 7 | Dri ni cakau | Deepwater blackfish (*A. palauensis*) | | | | | | | |
| 8 | Vula ni cakau | Surf red fish (*A. mauritiana*) | | | | | | | |
| 9 | Tina-ni-dairo, Dairo ni toba | Elephant trunkfish (*H. fuscopunctata*) | | | | | | | |
| 10 | Vulu wadrawadra | Leopardfish /tigerfish (*B. argus*) | | | | | | | |
| 11 | Vula | Brown sandfish (*B. vitiensis*) | | | | | | | |
| 12 | Laulevu | Curryfish (*S. hermanni*) | | | | | | | |
| 13 | Dri-votovoto, Barasi | Greenfish (*S. chloronotus*) | | | | | | | |
| 14 | Basi, 4 Corner | Amberfish (*T. anax*) | | | | | | | |
| 15 | Mundra | Chalk fish (*B. marmorata*) | | | | | | | |
| 16 | Yarabale | Snakefish (*H. coluber*) | | | | | | | |
| 17 | Dairo, Curuki | Sandfish (*H. scabra*) | | | | | | | |
| 18 | Loliloli | Lolly fish (*H. atra*) | | | | | | | |
| 19 | Loli piqi | Pinkfish (*H. edulis*) | | | | | | | |
| 20 | Dairo kula | Golden sandfish (*H. lessoni*) | | | | | | | |
| 21 | Katapila | Dragonfish (*S. horrens*) | | | | | | | |
| 22 | Senikau | Flowerfish (*P. graeffei*) | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

*2.4 Would you mind telling us how much money you receive for the sea cucumbers you sell?*

- ▶ Remind respondents we will keep their answers confidential, and are only using aggregate data, not individual responses).
- ▶ Make sure "product form" is completed, so we know if they are talking about dry or wet weight.
- ▶ * Note, Grade D this generally only applies to Sucuwalu, White teatfish.
- ▶ For Size, use the sheet provided for S=Small, M=Medium, L=Large, VL=Very Large

| Fijian names | Trade names (Species) | Price (F$) | | | | Unit (Kg or Piece) | Size (S, M, L, VL) |
|---|---|---|---|---|---|---|---|
| | | Grade A | Grade B | Grade C | Grade D* | | |
| Sucuwalu | White teatfish (*H. fuscogilva*) | | | | | | |
| Loaloa | Black teatfish (*H. whitmaei*) | | | | | | |
| Sucudrau | Prickly redfish (T. *ananas*) | | | | | | |
| Dri vatu | Stonefish (*A. lecanora*) | | | | | | |
| Tarasea | Deepwater red fish (*A. echinites*) | | | | | | |
| Dri, Driloa | Hairy blackfish (*A. miliaris*) | | | | | | |
| Dri ni cakau | Deepwater blackfish (*A. palauensis*) | | | | | | |
| Vula ni cakau | Surf red fish (*A. mauritiana*) | | | | | | |
| Tina-ni-dairo, Dairo ni toba | Elephant trunkfish (*H. fuscopunctata*) | | | | | | |
| Vulu wadrawadra | Leopardfish / tigerfish (*B. argus*) | | | | | | |
| Vula | Brown sandfish (*B. vitiensis*) | | | | | | |
| Laulevu | Curryfish (*S. hermanni*) | | | | | | |
| Dri-votovoto, Barasi | Greenfish (*S. chloronotus*) | | | | | | |
| Basi, 4 Corner | Amberfish (*T. anax*) | | | | | | |
| Mundra | Chalk fish (*B. marmorata*) | | | | | | |
| Yarabale | Snakefish (*H. coluber*) | | | | | | |
| Dairo, Curuki | Sandfish (*H. scabra*) | | | | | | |
| Lolililoli | Lolly fish (*H. atra*) | | | | | | |
| Loli piqi | Pinkfish (*H. edulis*) | | | | | | |
| Dairo kula | Golden sandfish (*H. lessoni*) | | | | | | |
| Katapila | Dragonfish (*S. horrens*) | | | | | | |
| Senikau | Flowerfish (*P. graeffei*) | | | | | | |
| | | | | | | | |
| | | | | | | | |

*2.5 Did someone train you to process (gut, boil, salt, dry) sea cucumbers?*

☐ No training received ☐ Family members ☐ Other fishers in village
☐ Fisheries Officer ☐ Buyers ☐ Town Processor
☐ Exporter ☐ NGOs ☐ Other .....

*2.6 Do you employ anyone to help you process sea cucumbers?* ☐ Yes ☐ No

*If yes, please list the people who help you, and how much you pay them (if relevant)?*

| Job type | Number of people | Wages/hour (FJ$) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

*2.7 When processing sea cucumbers what fuel and equipment do you use and what are the costs for you to do processing?*
(examples provided to start respondents off)

| Fuel Items | Cost |
|---|---|
| Kerosene | |
| Bottled gas | |
| Wood | |
| | |
| | |
| | |
| | |
| | |

| Equipment Items | Cost: |
|---|---|
| Racks | |
| Salt | |
| | |
| | |
| | |
| | |
| | |
| | |

*2.8 Do you sell directly to any export companies? (tick all that apply)*
☐ Gold Hold ☐ Flysha ☐ Seafoods ☐ Star Dragon
☐ Amigo Trading ☐ Tuvu Seafoods ☐ His Hand Trading
☐ Best Seafoods ☐ Other exporters.....

*2.9 Are there buyers/middleme you sell your processed sea cucumbers to? If the person does not work for a company, write "individual" to mean the person operates on his own,*

| Name | Company name | Role | Where are they based? |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

*2.10 Do you have any difficulty selling beche-de-mer (not price elated)?*
☐ Yes ☐ No

If Yes, please indicate the reasons.
☐ Poor quality of product ☐ Limited buyers ☐ Transport problems ☐ Other: .....

**The following questions ONLY apply to interviewers who are ONLY processors (not those that are fishers and processors)**

*2.11 How much did you earn from your last sale of beche-de-mer?*
(Respondents can list total number of pieces or total weight if known)
(a) FJ$ .....
(b) How many pieces in total was that if known? .....
(c) How many kg in total was that if known? .....

*2.12 Do you have any other source of income?*
☐ Yes **(Go to Q2.12)** ☐ No **(Skip to Q2.13)**

*2.13 Over the last two weeks how much did you earn from all other income sources?*
(Make sure respondents do not include money made from sea cucumbers)
FJ$.....

*2.14 Are you satisfied with the income you get for processed sea cucumbers?*
☐ Very satisfied ☐ Mostly satisfied ☐ Not satisfied
☐ Very unsatisfied ☐ Indifferent

# QUESTIONNAIRE 3

## *Boat owners providing transport to sea cucumber areas*

Survey Number..... Date of Interview ..... Interviewer's Name.....

*3.1 Who do you work for?*

☐ Own self ☐ A buyer ☐ A processor ☐ An exporter ☐ Other .....

*3.2 How many boats do you own?*

☐ 1 ☐ 2 ☐ 3 ☐ >3

*3.3 On average how many fishers do you take per trip for collecting sea cucumbers?*

..... fishers/trip

*3.4 Approximately how many sea cucumber related trips are you doing per week?*

..... trips/week

*3.5. Approximately how many sea cucumber related trips are you doing per week?*

..... trips/month

*3.6 How many hours (on average) do you remain out at sea with the sea cucumber fishers?*

☐ <1 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ >5

*3.7 What is the size of the boat you own?*

.....feet ..... engine size

*3.8 Do you also collect sea cucumbers during these fishing trips?*

☐ Most times ☐ Sometimes ☐ Rarely ☐ Never

*3.9 What do you charge the sea cucumber fishers?*

☐..... per head ☐..... per boat trip ☐ c) Nothing

*3.10 How much income do you make per week from hiring out your boat?* ..... FJ$/week

*3.11 What are the costs of transporting sea cucumbers?*

| Responses | Cost |
|---|---|
| Gas/ petrol (per week) | |
| Boat maintenance (per month) | |
| License (yearly) | |
| Insurance (yearly) | |
| Interest on loan (monthly) | |
| Other: | |
| | |

*3.12 Are you satisfied with the income you get from transporting fishers/ boat rental?*

☐ Very satisfied ☐ Mostly satisfied ☐ Not satisfied ☐ Very unsatisfied ☐ Indifferent

# QUESTIONNAIRE 4

## Sea Cucumber or Beche-de-Mer Transporter

Survey Number..... Date of Interview ..... Interviewer's Name.....

*4.1 What type of product are you transporting?*

☐ Live sea cucumbers ☐ Partially processed ☐ Fully Processed

*4.2 Who do you work for?*

.....

*4.3 Who did you collect sea cucumbers from?*

☐ Local fishers ☐ Local processor ☐ Local Trader ☐ Other .....

*4.4 What type of vehicle did you have to transport sea cucumbers or beche-de-mer?*

☐ Refrigerated truck ☐ Truck ☐ Van ☐ Car ☐ Bus ☐ Boat ☐ Other

*4.5 How many kilograms of sea cucumber or beche-de-mer could you transport in one load?*

..... kg *Wet Weight / Dry Weight (please circle)*
..... number of pieces

*4.6 Where are you delivering the sea cucumbers or beche-de-mer to?*

☐ Gold Hold ☐ Flysha ☐ Seafoods ☐ Star Dragon
☐ Amigo Trading ☐ Tuvu Seafoods ☐ His Hand Trading
☐ Best Seafoods ☐ Other.....

*4.7 What did you charge for transportation of sea cucumber or beche-de-mer?* ..... FJ$

*4.8 What are the costs of transporting sea cucumber?*

| Items | Cost (FJ$) | Items | Cost (FJ$) |
|---|---|---|---|
| Gas/ petrol (per week) | | | |
| Vehicle maintenance (per month) | | | |
| License (yearly) | | | |
| Insurance (yearly) | | | |
| Interest on loan (monthly) | | | |
| Other: | | | |
| | | | |
| | | | |

# QUESTIONNAIRE 5

## *Exporter*

Survey Number..... Date of Interview ..... Interviewer's Name.....

5.1 *What do you export? (tick all that apply)*

☐ Live sea cucumbers
☐ Fully processed sea cucumbers
☐ Partially processed sea cucumbers **(complete 5.2)**
☐ Other marine products .....

5.2 *Which partially processed sea cucumbers do you export? (tick all that apply)*

☐ First boiled, frozen ☐ Raw Frozen ☐ Boiled, Salted frozen
☐ Semi-dried ☐ Full dried ☐ Other .....

5.3 *How many employees do you employ for different tasks? (write numbers in boxes)*

☐ Boiling ☐ For cutting and gutting ☐ Sorting ☐ General processing (packaging, shipment)

5.4 *Who do you buy sea cucumbers from? (tick all that apply)*

☐ Local fishers ☐ Local processors ☐ Traders/Middlemen ☐ Others .....

5.5 *Do you import sea cucumbers or beche-de-mer from neighbouring Pacific Island Countries, for re-export? (tick all that apply)*

☐ No ☐ American Samoa ☐ Kiribati ☐ Marshall Islands
☐ Samoa ☐ Solomon Islands ☐ Tonga ☐ Vanuatu ☐ Other .....

5.6 *Where do you ship the sea cucumbers to?*

☐ China Please list Chinese ports: .....
☐ USA ☐ Taiwan ☐ Singapore ☐ South Korea
☐ Australia ☐ New Zealand ☐ Other .....

5.7 *How many of your sea cucumbers or beche-de-mer spoil and you are unable to export?*

*Please answer in kg/dry, kg/wet, number of pieces or percentages.*

| Species | Under size | Improper process | | | | | | mold or other spoilage |
|---|---|---|---|---|---|---|---|---|
| | | Not dried properly | Not smoked properly | Not cut properly | Sand / debris | Skin damaged | Over dried | |
| White teatfish (*H. fuscogilva*) | | | | | | | | |
| Black teatfish (*H. whitmaei*) | | | | | | | | |
| Prickly redfish (*T. ananas*) | | | | | | | | |
| Stonefish (*A. lecanora*) | | | | | | | | |
| Deepwater red fish (*A. echinites*) | | | | | | | | |
| Hairy blackfish (*A. miliaris*) | | | | | | | | |
| Deepwater blackfish (*A. palauensis*) | | | | | | | | |
| Surf red fish (*A. mauritiana*) | | | | | | | | |
| Eleph. trunkfish (*H. fuscopunctata*) | | | | | | | | |
| Leopardfish / tigerfish (*B. argus*) | | | | | | | | |
| Brown sandfish (*B. vitiensis*) | | | | | | | | |
| Curryfish (*S. hermanni*) | | | | | | | | |
| Greenfish (*S. chloronotus*) | | | | | | | | |
| Amberfish (*T. anax*) | | | | | | | | |
| Chalk fish (B. marmorata) | | | | | | | | |
| Snakefish (*H. coluber*) | | | | | | | | |
| Sandfish (*H. scabra*) | | | | | | | | |
| Lolly fish (*H. atra*) | | | | | | | | |
| Pinkfish (*H. edulis*) | | | | | | | | |
| Golden sandfish (*H. lessoni*) | | | | | | | | |
| Dragonfish (*S. horrens*) | | | | | | | | |
| Flowerfish (*P. graeffei*) | | | | | | | | |
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*5.8 What species of sea cucumbers do you export from Fiji, and what is the purchase price?*

| Species | Price of fresh / raw sea cucumbers ($/kg wet) | Price processed sea cucumbers ($/kg dry) | Price semi processed sea cucumbers ($/kg wet) (boiled/ salted) | Price processed sea cucumbers ($/kg wet) semi dry | Quantity re-processed (kg/dry) | Quantity discarded as waste (#pieces or kg dry) |
|---|---|---|---|---|---|---|
| White teatfish (*H. fuscogilva*) | | | | | | |
| Black teatfish (*H. whitmaei*) | | | | | | |
| Prickly redfish (T. ananas) | | | | | | |
| Stonefish (*A. lecanora*) | | | | | | |
| Deepwater red fish (A. echinites) | | | | | | |
| Hairy blackfish (*A. miliaris*) | | | | | | |
| Deepwater blackfish (*A. palauensis)* | | | | | | |
| Surf red fish (*A. mauritiana*) | | | | | | |
| Eleph. trunkfish (*H. fuscopunctata*) | | | | | | |
| Leopardfish / tigerfish (*B. argus*) | | | | | | |
| Brown sandfish (*B. vitiensis*) | | | | | | |
| Curryfish (*S. hermanni*) | | | | | | |
| Greenfish (*S. chloronotus*) | | | | | | |
| Amberfish (*T. anax*) | | | | | | |
| Chalk fish (*B. marmorata*) | | | | | | |
| Snakefish (H. coluber) | | | | | | |
| Sandfish (*H. scabra*) | | | | | | |
| Lolly fish (*H. atra*) | | | | | | |
| Pinkfish (*H. edulis*) | | | | | | |
| Golden sandfish (*H. lessoni*) | | | | | | |
| Dragonfish (*S. horrens*) | | | | | | |
| Flowerfish (P. *graeffei*) | | | | | | |

*5.9 On average, how many sea cucumber or beche-de-mer shipments do you have per year?*
..... per year

*5.10 What size are your shipments?* .....

*5.11 What was the cost of shipping to the destination? (price/kg, price/ton, etc.)*

| | Air | | Ship | |
|---|---|---|---|---|
| **Destination** | **Cost** | **Weight** | **Cost** | **Weight** |
| Hong Kong | | | | |
| Singapore | | | | |
| Taiwan | | | | |
| Japan (name city) | | | | |
| South Korea (name city) | | | | |
| Vietnam (name city) | | | | |
| Other: | | | | |
| | | | | |

*5.12 What were your other costs in FJ$?*
*(Examples: labour, export taxes, rent, permits, fees, freight, insurance, travel, etc.)*

| One off costs | Cost: |
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| Ongoing costs | Cost |
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*5.13 What is your total annual cost of operations?* ..... FJ$ /year

*5.14 Were processors adequately trained to meet demands of export market?*
☐ Yes ☐ No

*5.15 Do you provide any training to processors?*
☐ Yes ☐ No

*5.16 Do you also process sea cucumbers to ensure quality processing?*
☐ Yes ☐ No

*5.17 What type of processing method do you use? (please describe in detail)*

.....

.....

.....

*5.18 Where in the processing method do you think the problems occur that lead to value loss?*

.....

.....

.....

*5.19 How do you overcome the problems addressed above?*

.....

.....

.....

*5.20 There are some published reports that say that Fiji receives Grade B prices even though it is a Grade A Product. How can you address this? Can you give some examples.*

.....

.....

.....

*5.21 How much did the importer pay for sea cucumbers from Fiji?*

*(Put currency in the column). Please indicate the product status (dry or wet/kg or number of pieces/kg)*

| | Species | Trade names | Price Buy fresh sea cucumbers ($/kg) | Price buy processed sea cucumbers ($/kg) |
|---|---|---|---|---|
| 1 | *Actinopyga echinites* | Deepwater red fish | | |
| 2 | *Actinopyga lecanora* | Stonefish | | |
| 3 | *Actinopyga mauritiana* | Surf red fish | | |
| 4 | *Actinopyga miliaris* | Hairy blackfish | | |
| 5 | *Actinopyga palauensis* | Deepwater blackfish | | |
| 6 | *Bohadschia argus* | Leopardfish /tigerfish | | |
| 7 | *Bohadschia marmorata* | Chalk fish | | |
| 8 | *Bohadschia vitiensis* | Brown sandfish | | |
| 9 | *Holothuria scabra* | Sandfish | | |
| 10 | *Holothuria atra* | Lolly fish | | |
| 11 | *Holothuria coluber* | Snakefish | | |
| 12 | *Holothuria edulis* | Pinkfish | | |
| 13 | *Holothuria fuscogilva* | White teatfish, | | |
| 14 | *Holothuria fuscopunctata* | Elephant trunkfish | | |
| 15 | *Holothuria lessoni* | Golden sandfish | | |
| 16 | *Holothuria whitmaei* | Black teatfish | | |
| 17 | *Pearsonothuria graeffei* | Flowerfish | | |
| 18 | *Stichopus chloronotus* | Greenfish | | |
| 19 | *Stichopus hermanni* | Curryfish | | |
| 20 | *Stichopus horrens* | Dragonfish | | |
| 21 | *Thelenota ananas* | Prickly redfish | | |
| 22 | *Thelenota anax* | Amberfish | | |
| | | | | |
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*5.22 Did the importer(s) that you worked with pay more for better processed beche-de-mer?* ☐ Yes ☐ No

*5.23 Did the importer pay more for higher value species of beche-de-mer?* ☐ Yes ☐ No

*5.24 Did pricing change at different times of the year?* ☐ Yes ☐ No

*5.25 When was the best time during the year to sell beche-de-mer?* .....

*5.26 When was the worst time of year to sell beche-de-mer?* .....

*5.27 What were the biggest challenges in exporting beche-de-mer?*

a) .....

b) .....

c) .....

d) .....

e) .....

*5.28 What areas of the business do you think are possible growth areas?*

a) .....

b) .....

c) .....

d) .....

e) .....

# QUESTIONNAIRE 6

## Provide supporting services to the sea cucumber fishery in Fiji

Survey Number..... Date of Interview ..... Interviewer's Name.....

*6.1 What company do you work for?*

.....

*6.2 What is the primary purpose of the company?*

.....

*6.3 What service do you provide?*
*(if multiple, list all relevant)*

a) .....

b) .....

c) .....

d) .....

e) .....

*6.4 Approximately how many hours a week do you spend providing these services?* .....(hours / week)

*6.5 What income do you earn from providing these services?* ..... FJ$/week

# QUESTIONNAIRE 7

## Providing monitoring / law enforcement / resource management / verification services for the sea cucumber fishery in Fiji

Survey Number..... Date of Interview ..... Interviewer's Name.....

*7.1 What organisation / agency do you work for?*

.....

*7.2 What is work do you do with the sea cucumber fishery in Fiji?*
*Please list the services you provide.*

a) .....

b) .....

c) .....

d) .....

e) .....

*7.3 How many staff do you have working with you on sea cucumber fisheries?* ..... staff

*7.4 Approximately how many hours a week do you spend providing these services?* ..... hours/week

*7.5 How much financial resources do you allocate to working on sea cucumber fisheries?* .....(FJ$ / year)

# QUESTIONNAIRE 8

## Sea cucumbers sellers at local markets

Survey Number..... Date of Interview ..... Interviewer's Name.....

*8.1 What type of sea cucumber product do you sell?*

☐ Live sea cucumbers ☐ Dried sea cucumbers ☐ Boiled sea cucumbers
☐ Cooked as part of a local dish ☐ Other .....

*8.2 If you sell cooked as part of a local dish, please provide details:*

Dish 1:.....Species ..... Price: FJ$ .....

Dish 2: .....Species ..... Price: FJ$ .....

Dish 3: .....Species ..... Price: FJ$ .....

*8.3 Where do you get your sea cucumbers from?*

☐ Caught self ☐ Caught by family members ☐ Bought from other fishers
☐ Bought from a trader ☐ Other .....

*8.4 Which local markets do you sell at? .....*

*8.5 How many days per week do you sell sea cucumbers? .....*

*8.6 How many months of the year do you sell sea cucumbers? .....*

*8.7 How much do you make each week from the sale of sea cucumbers?* FJ$ .....

*8.8 Are you satisfied with the income you get from selling sea cucumbers at the local markets?*

☐ Very satisfied ☐ Mostly satisfied ☐ Not satisfied ☐ Very unsatisfied ☐ Indifferent

*8.9 Which species do you sell, and how much did you buy sea cucumbers for (if you are not the fisher)?*
Note that this will only include species that are sold raw, dried or boiled only (not as a local dish)

| | Fijian names | Trade names (species) | Price bought (wet) | Price sold (wet) | Price bought (dry) | Price sold (dry) |
|---|---|---|---|---|---|---|
| 1 | Sucuwalu | White teatfish (*H. fuscogilva*) | | | | |
| 2 | Loaloa | Black teatfish (*H. whitmaei*) | | | | |
| 3 | Sucudrau | Prickly redfish (*T. ananas*) | | | | |
| 4 | Dri vatu | Stonefish (*A. lecanora*) | | | | |
| 5 | Tarasea | Deepwater red fish (*A. echinites*) | | | | |
| 6 | Dri, Driloa | Hairy blackfish (*A. miliaris*) | | | | |
| 7 | Dri ni cakau | Deepwater blackfish (A. palauensis) | | | | |
| 8 | Vula ni cakau | Surf red fish (A. mauritiana) | | | | |
| 9 | Tina-ni-dairo, Dairo ni toba | Elephant trunkfish (*H. fuscopunctata*) | | | | |
| 10 | Vulu wadrawadra | Leopardfish /tigerfish (B. argus) | | | | |
| 11 | Vula | Brown sandfish (*B. vitiensis*) | | | | |
| 12 | Laulevu | Curryfish (*S. hermanni*) | | | | |
| 13 | Dri-votovoto, Barasi | Greenfish (S. chloronotus) | | | | |
| 14 | Basi, 4 Corner | Amberfish (*T. anax*) | | | | |
| 15 | Mundra | Chalk fish (*B. marmorata*) | | | | |
| 16 | Yarabale | Snakefish (*H. coluber*) | | | | |
| 17 | Dairo, Curuki | Sandfish (*H. scabra*) | | | | |
| 18 | Loliloli | Lolly fish (*H. atra*) | | | | |
| 19 | Loli piqi | Pinkfish (*H. edulis*) | | | | |
| 20 | Dairo kula | Golden sandfish (H. lessoni) | | | | |
| 21 | Katapila | Dragonfish (*S. horrens*) | | | | |
| 22 | Senikau | Flowerfish (*P. graeffei*) | | | | |
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# QUESTIONNAIRE 9

## Serve beche-de-mer in the restaurant

Survey Number..... Date of Interview ..... Interviewer's Name.....

*9.1 What is the name of your restaurant? .....*

*9.2 What is your position/responsibilities in the restaurant? .....*

*9.3 What are the most popular beche-de-mer dishes on your menu?*
(list dishes and price)

a) .....

b) .....

c) .....

d) .....

e) .....

*9.4 Who purchases the sea cucumbers for your restaurant? .....*

*9.5 Who does the restaurant buy from?*
(tick all that apply)

☐ Local fisher ☐ Local market ☐ Local trader ☐ Other: .....

*9.6 Where there issues with product quality?*

☐ Yes ☐ No

*9.7 What were the issues, if any?*
(tick all that apply)

☐ Too small
☐ Too big
☐ Not dried properly
☐ Not smoked properly
☐ Not cut properly
☐ Not frozen properly
☐ Burn marks
☐ Too much sand/other material inside beche-de-mer
☐ Skin not in tact
☐ Species was protected
☐ Mold or other spoilage
☐ Other: .....

*9.8 Is there seasonality to the demand of beche-de-mer in the restaurant?*

☐ Yes ☐ No

*9.9 If so, when is the beche-de-mer in high demand?*
(months of the year) .....

*9.10 When is it in low demand?*
(months of the year) .....

*9.11 What species do you buy, and what price do you pay?*

| | Fijian names | Trade names (species) | Price bought (dry) (FJ$) | Price bought (wet) (FJ$) | Restaurant Menu price (for different size dishes) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Small | Medium | Large |
| 1 | Sucuwalu | White teatfish (*H. fuscogilva)* | | | | | |
| 2 | Loaloa | Black teatfish (*H. whitmaei)* | | | | | |
| 3 | Sucudrau | Prickly redfish (*T. ananas*) | | | | | |
| 4 | Dri vatu | Stonefish (*A. lecanora*) | | | | | |
| 5 | Tarasea | Deepwater red fish (*A. echinites)* | | | | | |
| 6 | Dri, Driloa | Hairy blackfish (*A. miliaris*) | | | | | |
| 7 | Dri ni cakau | Deepwater blackfish (*A. palauensis*) | | | | | |
| 8 | Vula ni cakau | Surf red fish (*A. mauritiana*) | | | | | |
| 9 | Tina-ni-dairo, Dairo ni toba | Elephant trunkfish (*H. fuscopunctata*) | | | | | |
| 10 | Vulu wadrawadra | Leopardfish /tigerfish (*B. argus*) | | | | | |
| 11 | Vula | Brown sandfish (*B. vitiensis*) | | | | | |
| 12 | Laulevu | Curryfish (*S. hermanni*) | | | | | |
| 13 | Dri-votovoto, Barasi | Greenfish (*S. chloronotus*) | | | | | |
| 14 | Basi, 4 Corner | Amberfish (*T. anax*) | | | | | |
| 15 | Mundra | Chalk fish (*B. marmorata)* | | | | | |
| 16 | Yarabale | Snakefish (*H. coluber*) | | | | | |
| 17 | Dairo, Curuki | Sandfish (*H. scabra*) | | | | | |
| 18 | Loliloli | Lolly fish (*H. atra*) | | | | | |
| 19 | Loli piqi | Pinkfish (H. edulis) | | | | | |
| 20 | Dairo kula | Golden sandfish (*H. lessoni)* | | | | | |
| 21 | Katapila | Dragonfish (*S. horrens*) | | | | | |
| 22 | Senikau | Flowerfish (*P. graeffei*) | | | | | |
| | | | | | | | |
| | | | | | | | |

*9.12 What is the nationality of the customers that are most frequently ordering beche-de-mer dishes on the menu?*
(please rank, with 1=most frequent nationality)

☐ Chinese ☐ Japanese ☐ i-Taukei ☐ Rotuman ☐ Indian
☐ European ☐ Don't Know ☐ Other: ……..

*9.13 Do you know if any species of sea cucumber are endangered and should not be bought/sold?*

☐ Yes ☐ No

For yes, "yes" please state which ones ……..