

Value Chain Analysis of the Fiji Grouper Fishery



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Adult female *Epinephelus polyphekadion*, a favourite *kawakawa* in Fiji. She is bloated with eggs and about to spawn the next generation in a spawning aggregation. These gatherings are the only times she produces her young and so she needs healthy aggregations to find males to mate with.

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Executive summary

We conducted a seafood Value Chain Analysis (VCA) for the coral reef grouper (*Epinephelidae*)¹ fishery in Fiji with the goal of understanding the distribution of value gained from grouper along the trade chain, from fisher to consumer. Our aim was to use the study outcomes to inform policy makers on how higher economic values and benefits can be derived from grouper for value chain actors, particularly fishers in Fiji. We highlight the overall value of grouper in Fiji's coastal fishery and the importance of maintaining healthy populations into the future. We also examined the implications for Fiji of exporting this limited and valuable resource given high market demand and the depleted condition of the grouper fishery.

Based on our findings from socioeconomic survey questionnaires with fishers, middlemen, hotels, restaurants, and exporters involved in grouper fishery and trade, and referring to the literature, we describe the trade chain as it applies to both domestic and export trade. We also gauged perceptions of resource condition and history as well as gathered opinions on possible management approaches. To understand more about the export component of Fiji's grouper trade we conducted a brief study of retail prices of chilled grouper of several species in one of the major export destinations, mainland China. Considering both the domestic and export trade components, the condition of and pressures on the grouper fishery, we provide recommendations on how to manage the fishery considering both food security and national economic benefits for Fiji.

Since most fishers catch grouper for both food and income, and considering the widely perceived declining status of the grouper resource indicated by interviewees, it is clearly important that local food security and sovereignty be given top priority in the shaping and management of Fiji's grouper fishery and in the country's approach to regulating and overseeing grouper exports. The majority of fishers perceived that grouper populations in their areas are declining, in part due to increased fishing effort and overfishing. This perception is consistent with independent studies that suggest that coastal finfish catches over three decades or so, grouper catches included, have declined several-fold (Lee et al. 2018). Yet despite the declines several fishers interviewed noted that they have received government funding for their boats and gear in recent years which increases fishing effort and can further exacerbate overfishing in the absence of effective management. Fishers highlighted major management options, including spatial, temporal and gear controls and players along the value chain are supportive of the seasonal fishing ban for several key grouper species² introduced in 2018.

1 The grouper selected for this study are those most commonly taken for food and trade and those that are more valuable species (Lee et al. 2018).

2 At the time of the study groupers were part-protected by a voluntary seasonal ban, which ran from 6 June through 30 September. The ban became legally binding in on 1 June, 2018, and covers 'donu' and 'kawakawa' which includes all 27 species of grouper and coral trout inclusive of all species in this survey: https://static1.squarespace.com/static/5a9bc5c95ffd20a2c8d82c8b/t/5b32bfda0e2e7265a27f8377/1530052620400/Kawakawa+%26+Donu+Fish+Guide+A4_MID.pdf

Some of the key findings of this study were:

- Most grouper fishers in Fiji target more than one species of grouper, using primarily hook and line, spear and/or speargun, with or without SCUBA;
- Most fishers catch grouper for both food and income;
- The estimated total annual grouper catch volume according to daily catch rates and fishing frequency of interviewed fishers was estimated at 845,000 kg plus 245,000 bundles of unknown weight³;
- The structure of Fiji's grouper value chain appears to resemble an hourglass shape – that is, many fishers, few exporters, and many consumers – similar to other small-scale developing country fisheries linked to international markets;
- The exporters interviewed in the study export approximately 70,080 kg of grouper per year (although the quantity could be much greater) from Fiji, mainly to New Zealand, the US, China (including Hong Kong), and South Korea⁴;
- Fishers received more money for all grouper species when selling to customers at public markets than when selling to middlemen although the expenses associated with selling grouper by these two sectors need further clarification;
- The prices for grouper sold by fishers directly to hotels, restaurants, and exporters appeared to be higher than obtained from middlemen in most cases;
- Particularly high prices were gained for the leopard coral grouper, *Plectropomus leopardus*, because of high market desirability, both within Fiji and for the export market. Other important species were *Epinephelus polyphemadion* and *E. fuscoguttatus*;
- While grouper had varying levels of monetary importance to respondents, most respondents from each link of the trade chain (or segment) reported that grouper represented less than 25% of their total income from seafood trade;
- The majority of fishers stated that they had not experienced changes to grouper fishing grounds in recent memory although most considered that grouper populations in their area were declining due to increased fishing effort, overfishing, and natural changes as the likely key causes. They suggested that spatial and/or seasonal protection and gear restrictions were appropriate options for managing grouper; and
- Several of the more sought-after grouper may need conservation attention due to declines, including *E. cyanopodus*.

3 A bundle is a weight unit of sale that is somewhat variable and can consist of one, two or many more fish of one or several species of a similar or combination of sizes; grouper are often sold together without other species unless the individuals are very small.

4 This represents as much as twice the officially reported national catch in 2014-16 and about 10% of total estimated national annual catch (Lee et al. 2018). However, there appears to be underreporting or under-recording of grouper exports so these may be much higher than indicated.

Key recommendations of this study are:

To achieve higher values from grouper for Fijians, particularly fishers, and reduce risk of overfishing in a situation in which unit prices vary by season, species, sales outlets, etc., it is important that market prices and needs are better understood and the resources managed accordingly. For example, fishers receive similar prices for all groupers caught yet the price differentials downstream can be considerable. *P. leopardus* prices are often double those of other species while size and condition and availability (scarcity versus market gluts) can substantially affect prices. Given the high values that groupers fetch and increasing market demand there is much opportunity for fishers, in particular, to gain more for their catches, given better organization and information. For example, it could be worthwhile to organize fishers into producer groups to share resources, better understand market pricing to enhance their bargaining power, and provide training to add value to catches by improved handling, processing, transportation and storage.

To eliminate overfishing, improvement in the management of grouper in Fiji is fundamental. In addition, any harmful subsidies currently given to the fishing sector need to be redirected away from activities that promote overfishing. If a resource evaluation determines that exports can be sustained alongside domestic trade without further depleting grouper populations, an appropriate export coding and improved monitoring of exports as well as an export tariff could be introduced to ensure greater economic benefits to Fiji and better oversight of export trade. Priority should be given to national food security and no exports should be considered until and unless fishing pressure can be controlled and domestic grouper sales sustained.

Species for which there is conservation concern, such as *E. cyanopodus*, should be closely monitored or put under moratorium until recovery. Highly valued species such as *P. leopardus* and *E. polyphkadion*, should be recognized and managed carefully to prevent depletion.

Mixed reef fishes for sale in Suva market featuring several groupers (front row), mainly *E. cyanopodus* and *E. polyphkadion*.
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Introduction

Coastal Fisheries in Fiji

Seafood is an important globally traded food commodity, yet the costs and benefits of this trade are not evenly distributed (Gudmundsson et al. 2006). Some studies have found that small-scale fishers, particularly in less developed countries, reap the lowest share of financial benefits from traded seafood (Bjørndal et al. 2015; Purcell et al. 2017). However, data are generally lacking for these types of seafood supply chains, and it is also important to consider not just price markups and the distribution of value, but also operating margins and costs along the entire value chain, as well as implications for fishing pressure (Kohls and Uhl 1998; Gudmundsson et al. 2006; Purcell et al. 2017). In particular, there are gaps in knowledge related to the value chains connected to coral reef fisheries, as well as resource-dependent and food commodity markets in the Asia-Pacific region (Kittinger et al. 2015). Similarly, there is little known of the growing export market in reef fishes from Fiji, in terms of volumes and species, and the possible implications of exports for source fisheries and domestic sales, given that demand for wild grouper evidently exceeds natural supplies. We herein report on a seafood value chain analysis (VCA) for grouper, an important group of coral reef fishes taken in Fiji's coastal fishery. We examine both domestic and export trade chains.

As in other parts of the world (e.g., Sumaila et al. 2012), it has been demonstrated that coral reef fisheries in Fiji contribute both food and income to fishers and coastal communities (Teh et al. 2009). For example, Starkhouse (2009) estimated that Fiji's coral reef fisheries provide income and/or nutrition for up to 28,880 fishers, 842 middlemen and 2,480 vendors. However, these reefs and their associated fisheries are under increasing anthropogenic pressure, and it has been recognized that there is a need to further assess the socio-economic values of Fiji's coral reef fisheries (Starkhouse 2009; Teh et al. 2009). It has also been documented that high market prices in Asia for certain seafood products, such as sea cucumber processed into *bêche-de-mer*, are driving harvesting pressure for exports within Fijian fisheries (Purcell 2014). The case is likely the same for grouper species, many of which are increasingly sought for export. In some cases groupers gather temporarily in large groups to spawn at predictable sites and times, and are thus highly susceptible to heavy harvesting at such gatherings; the high numbers caught can lead to temporary market gluts which can lower fish prices (Sadovy and Domeier 2005; Sadovy and Colin 2012). Like sea cucumbers, groupers are increasingly sought after for exports. But a major and important difference is that sea cucumbers are largely exported, whereas grouper are also important for local consumption including for national food security and for tourism, both as food and for diving experiences in Fiji.



Fish vendors selling by the roadside.

© Raw Fiji

Coral reef fisheries are increasingly commercialized, and demand for, and hence value of, reef fishes is growing globally. Groupers are an important example because they are highly valued food fish for which prices and demand are high and increasing, while they are particularly vulnerable to overfishing without management. Given somewhat limited supplies of wild groupers relative to demand, the growing export trade and consumer interest in groupers in many countries collectively represent an important set of challenges and opportunities for developing source countries because many of their fisheries are already overexploited and unlikely to even meet domestic needs without management for sustainability; Fiji is no exception. While they can provide income, job opportunities and foreign exchange, export fisheries may not always benefit source communities in developing countries; to the contrary, they may exacerbate overfishing and can threaten biodiversity (Sadovy de Mitcheson and Yin 2015). On the

other hand, some grouper species and certain sizes can fetch particularly high prices and it is important for producer communities, particularly fishers, to be more informed about market interests and forces.

Hence the export sector, in particular should be closely examined for its implications for national resources and to determine what benefits exports may bring to the country. While economic benefits from exports are widely assumed to flow down to those with low incomes it is by no means certain that they do, in fact, trickle all along the economic chain. In the case of natural resources, this economic thinking tends to treat the underlying natural resources as inexhaustible (Dasgupta 2013). In a revealing comparative study of 11 developing, mainly tropical, countries, Kurien (2005) showed that, while the social and economic benefits of exporting fish varied considerably across countries, impacts were uniformly negative when the underlying natural resources were not managed.



Value Chain Analysis

There are several reasons why it is worthwhile to conduct a VCA on a fishery that is particularly at risk of overfishing due to high value, growing demand and natural vulnerabilities, and which is showing evidence of declines. On the one hand, value chains should not be structured in ways that incentivize overexploitation. For example, one recent study documented how a seafood exporter in a Pacific Island nation chose to offer low prices to fishers for sea cucumber, so that they would continue to harvest at a high rate and sell greater volumes, leading to resource declines. A longer term perspective and more biologically sustainable approach in this case would be to harvest at a lower rate (i.e. fewer animals taken per unit time) but for fishers to earn a higher income per animal (per kg/animal) ex-vessel prices⁵ (Purcell et al. 2017). This study also states:

“Generally, poor financial returns to fishers can keep them in poverty traps in which unscrupulous fishing rates are the only means to secure a basic livelihood. Understanding the economics of fisheries through the value-chain lens is therefore useful to reforming fisheries to alter the benefit distribution so as to promote improved fisher (and small-scale trader) livelihoods and resource sustainability”

(Purcell et al. 2017).

⁵ Price received by fisher at the point of landing for the catch

Fisher weighing his catch for pickup by middleman in northeast Vanua Levu (2005).

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In another example, the high demand for live grouper to be exported from Indonesia to Hong Kong has resulted in middlemen pressuring fishers to take more than they normally would to supply the export market leading to concerns about resource condition⁶. Both examples relate to pressures from export markets, which are increasingly supplied in addition to demand from domestic markets. Clearly, strong fisheries management is required if both markets are to be accommodated into the future without depleting the underlying grouper resource base and if fishers are to receive greater economic benefits for the grouper they supply to the trade chain (Gudmundsson et al. 2006). These issues are addressed through this VCA on Fiji's grouper fishery.



Groupers for sale – one or two fish per bundle – during the spawning season for *Epinephelus fuscoguttatus*. Two *Plectropomus leopardus* are shown.

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Given the high value of and demand for grouper and their natural susceptibility to overfishing, especially in the case of aggregating species, a study was conducted in Fiji to understand the relationships and linkages between fishers, buyers, sellers and exporters of coral reef grouper, and identify opportunities and challenges for improving benefits and reducing risks from the trade. The study was designed to answer a number of questions critical to the management of Fiji's grouper fishery:

- Q1.** What is the structure of Fiji's grouper fishery and value chain?
- Q2.** What is the revenue distribution, and comparative financial costs versus benefits, of different actors along the seafood value chain?
- Q3.** What are the key challenges to value creation, and possible areas of loss of value, along the chain?
- Q4.** How do value chain actors, particularly fishers, perceive the state of grouper resources in Fiji?
- Q5.** In which ways can higher values be garnered from grouper for value chain actors (particularly fishers) in Fiji?
- Q6.** Which recommendations can be put forward from this VCA with regards to managing grouper exports from Fiji, particularly in relation to (1) resource sustainability, (2) economic benefits to the Fijian economy, and (3) competition with the domestic market?

⁶ As communicated by Fisheries Minister to Sadovy de Mitcheson, August 2018

Methodology

Interviews

Interviews were conducted on the two main islands of Viti Levu and Vanua Levu one-on-one with fishers (*iTaukei* and Indo-Fijian fishers), middlemen/traders and the service sector (hotels, restaurants, fish shops) in fishing villages or locations of business; the offices of exporter offices were visited directly. Interviews were conducted between September 2016 and April 2017 (Table 1). To identify key links

along the grouper trade chain in Fiji, a two-day workshop with fisheries and non-government staff was conducted at the Lami Fisheries Office on 15-16 August, 2016 when interviewers were trained and trial interviews conducted in the field to test the questionnaires. The grouper selected as a focus for this study were those regularly landed in Fiji, or of greatest value or size (Lee et al. 2017).

Figure 1: Locations of fisher interviews.
Source: Ingrid Qauqau/WCS

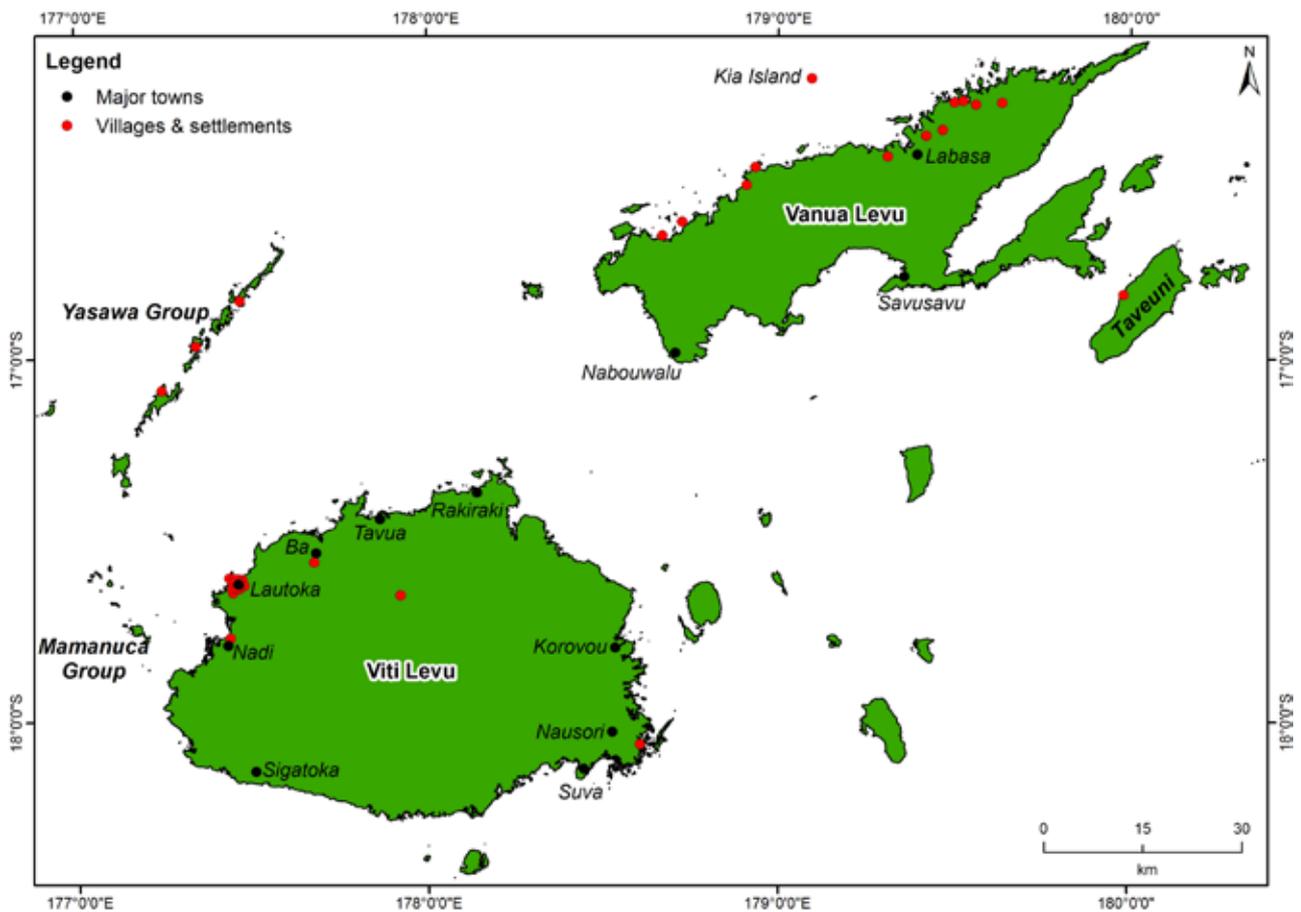


Table 1: Grouper Fishery Sector interviewed

Village, settlements and towns	District, Province	Number of interviews
Northern Division, Vanua Levu		
Naividamu Village	Macuata District, Macuata Province	8
Raviravi Village	Macuata District, Macuata Province	3
Galoa Island	Lekutu/Navakasiga District, Bua Province	10
Tavea Island	Lekutu/Navakasiga District, Bua Province	9
Kia Island	Macuata District, Macuata Province	1
Navoalevu Settlement	Nadogo District, Macuata Province	2
Coqeloa Settlement	Labasa District, Macuata Province	1
Wavuwavu, Matiavai Settlement	Nadogo District, Macuata Province	3
Lagalaga, Wainikoro Settlement	Nadogo District, Macuata Province	1
Qelewaqa Settlement	Labasa District, Macuata Province	1
Soasoa Settlement	Labasa District, Macuata Province	2
Waikava Settlement	Somosomo, Taveuni	1
Central and Western Division, Viti Levu		
Waiyavi	Lautoka Town Area	2
Banaras	Lautoka Town Area	1
Natabua	Lautoka Town Area	1
Kashmir	Lautoka Town Area	1
Lautoka	Lautoka Town Area	4
Tumuka	Lautoka Town Area	2
Kalakarfi	Lautoka Town Area	1
Tavakubu	Lautoka Town Area	1
Naikabula	Lautoka Town Area	1
Cernode	Lautoka Town Area	1
Balawa	Lautoka Town Area	1
Delatabuka	Lautoka Town Area	1
Namaka	Nadi & Sikituru District, Ba Province	1
Vio Island	Lautoka, Ba Province	4
Nabukeru Village	Yasawa & Nacula District, Ba Province	1
Vuaki Village	Nacula District, Ba Province	1
Naviti, Nasolo Village	Naviti District, Nailaga & Bulu District, Ba Province	1
Gunu Village	Naviti District, Ba Province	1
Marou Village	Naviti District, Ba Province	2
Naimalavau Village	Nakelo District, Tailevu Province	1

Hotels and Restaurants serving grouper

Hotels/ Restaurants	Location
Northern Division- Vanua Levu	
Jogi-Valenikana Restaurant	Savusavu Town
Amritas Friendly North Restaurant	Labasa Town
Vishranji Café	Savusavu Town
Surf N Turf Restaurant	Savusavu Town
Takia Hotel	Labasa Town
Grand Eastern Hotel	Labasa Town
Central and Western- Viti Levu	
The Best Roti Shop	Dolphin Plaza, Suva City
Golden Price Restaurant	Suva City
Ming Du Restaurant	Suva City
City Cottage Wine & Dine	Suva City
Natural Blend	MHCC Supermarket, Suva City
Peking Restaurant	Suva City
Suva Women's Catering Association	Suva City Market
Nausori Food Stall	Nausori Town
Korean Kitchen	Namaka, Nadi Town
Sentai Seafood Restaurant	Nadi Town
Victoria's Apple	Namaka, Nadi Town
Hong Sheng Restaurant	Nadi Town
Greatwall Seafood Restaurant	Lautoka City
Mu Xing Restaurant	Lautoka City
Radisson Resort	Port Denarau, Nadi
Sheraton Resort	Port Denarau, Nadi

Grouper dish served at local restaurant.
© Sangeeta Mangubhai



Grouper Middlemen/ Agent Sector

Middleman/ Agent	Number of Interviews
Northern Division- Vanua Levu	
Buca, Natewa District, Cakaudrove	1
Savusavu Area	2
Nakama, Savusavu Town Area	1
Vunikoka, Savusavu Town Area	2
Labasa Town Area	4
Namara, Labasa Town Area	1
Nawadamu, Labasa Town Area	1
Line Point, Labasa Town Area	1
Nasarawaqa, Lekutu District, Bua Province	1
Benau, Labasa Town Area	1
Vunivau, Labasa Town Area	1
Seaqaqa Area, Macuata Province	1
Galoa Island, Bua Province	1
Naividamu Village, Macuata Province	1
Raviravi Village, Macuata Province	1
Central and Western- Viti Levu	
Suva Fish Market	8
Laqere Fish Market, Nasinu, Suva	3
Bailey Bridge, Laucala, Suva	3
Nausori Fish Market	2
Nakasi Area, Nausori	2
Nadi Town	1
Deuba, Pacific Harbour	1
Lautoka Fish Market	1

Middleman in Labasa selling *Variola louti*.
© Martin Russell



Vanua Levu

Fishers interviewed were from Naividamu, Nadogo, and Raviravi villages and Kia Island in Macuata Province, Soasoa, Navoalevu, Lagalaga, Wavuwavu, Qelewaqa, Wailevu and Coqeloa villages in Labasa District, Galoa and Tavea Island in Bua Province and Waikava in Savusavu District. Most were interviewed in their villages while others were interviewed at the Lautoka, Labasa, or Savusavu Fish Markets. Due to the time frame of the survey, it was not possible to interview many fishers from Savusavu or adjacent areas. However, it was possible to interview middlemen at the Savusavu Fish Market who sold fish from the Bua and Macuata provinces. These latter districts are important sources of grouper and were once very active supplying live grouper for export (Johnston and Yeeting 2006).

Other grouper middlemen/traders were based at Raviravi, Seaqaqa and Naividamu villages in Macuata Province, Galoa Island and Nasarawaqa in Bua Province, Vunikoka, Buca and Nakama in Savusavu, Benau, Line Point, Nawadamu, Namara and Vunivau in Labasa selling at Labasa and Savusavu Fish Markets.

All fisher interviewees had identified grouper to be their key fishing target, as revealed by their responses to initial questions in the questionnaire; those fishers who reported grouper not to be their primary target were not questioned further. The total number of grouper fishers in Fiji is not known because many fishers target grouper for much or part of their time, or take grouper incidentally as part of their multi-species catch. Interviewees were all full-time fishers, irrespective of gender, who caught grouper most of the time for commercial purposes, with some nominated to interviewers by the *Turaga ni Koro* (Village Headman). Only middlemen/

traders, sellers (market sellers and service sector) and exporters dealing with grouper were interviewed. While the total number of middlemen or sellers is not known, eight export companies were identified by the Ministry of Fisheries of which five were selected for interview, including the longest-established and largest exporter of grouper in Fiji.

In each district interviews were conducted by Ministry of Fisheries' staff using a standard questionnaire designed for interviewees in each section (i.e. fisher, middleman, service sector, exporter) of the value chain, and after permission was obtained from provincial offices and/or community leaders, as necessary. The questionnaires focused on 10 commonly caught grouper species in Fiji (Table 2) (Lee et al. 2018), and included questions on participant demographics, fishing and business statistics, catch and sales volumes, grouper pricing, income from grouper, costs related to grouper, sales outlets, product forms, and perceptions on the state of Fiji's grouper resources, among other topics. Questions considered possible seasonal differences which referred to 'high' versus 'low' seasons when catches were greatest/lowest; high seasons were often associated with spawning periods when aggregating grouper gather to spawn (i.e. reproduce) and are easier to catch, a situation often leading to notably higher catch rates and volumes. Interviews were reviewed each evening by the interview team and were conducted in *iTaukei* (Fijian) language, and dialects in different districts, English or Hindi. Survey data were supplemented by literature review on coral reef fisheries and seafood value chains in Fiji, as well as other small island and/or developing nations (i.e., Sadovy 2005; Zyllich et al. 2012; Hara 2014; Sadovy and Ramoica 2015; Barclay et al. 2016; Mangubhai et al. 2016; 2017; Rosales et al. 2017).

Table 2: Grouper species included in the study. Maximum size and size at maturity information as cited in Lee et al. (2018) and Prince et al. (2018) (indicated by asterisk).

Scientific name	Common name	Fijian name	Maximum size (cm) ⁷	Size of sexual maturation (cm)
<i>E. polyphkadion</i>	Camouflage grouper	Kawakawa, kasala, kerakera	90 SL	41.2 TL*
<i>E. fuscoguttatus</i>	Brown-marbled grouper	Delabulewa	120 TL	59.2 TL*
' <i>E. tukula</i> ⁸ '	-	-	-	-
<i>E. cyanopodus</i>	Speckled blue grouper	Ceva/ Revua/ Rogoceva	120 TL	32 TL (female) 52 TL (male)
<i>E. coioides</i>	Orange-spotted grouper	Kawakawa ni Veidogo/Soisoi/ Kasala Seilagi	114 TL	58.5 TL*
<i>E. malabaricus</i>	Malabar grouper	Soisoi/ Votosiga	150 TL	40-50 TL
<i>E. merra</i>	Honeycomb grouper	Senikawakawa	32 TL	Approx. 15 cm TL
<i>Plectropomus areolatus</i>	Squaretailed coral trout	Batisai	73 TL	43.5 TL*
<i>P. laevis</i>	Blacksaddled coral grouper	Donu Loa	130 TL	49.8 TL*
<i>P. leopardus</i>	Leopard coral grouper	Donu Damu, Drodroua	120 TL	43.5 TL*

TL=total length; SL=standard length

Viti Levu

Fishers interviewed were mostly available at the Lautoka Wharf or other landing sites where they came to sell their catch. These fishers resided mainly in communities around the Lautoka area. Some fishers were from the outer islands of Yasawa and Naviti in Ba Province. Some fishers had lived around the areas where they were interviewed their entire lives while others had just settled there within the previous three years. Middlemen/traders interviewed came from Vunivau, Nadali and Lakena villages and sold fish at the Nausori Fish Market; those from Nepani, Nadawa, Vatuwaqa, Valelevu, Samabula, Nadera, Kadavu

Island and Davuilevu sold at the Laqere and Suva Fish Markets. Some middlemen/traders from Tamuka in Lautoka, Nadera, Suva and Wailoku also sold grouper at the Suva Fish Market. Traders from Nausori sold at the Bailey Bridge. One middlemen had his fish shop in Deuba, Pacific Harbour, and supplied fillets to major hotels around Fiji (e.g. Grand Pacific Hotel, Sofitel, Radisson, etc.).

Only one exporter was present in Vanua Levu, based in Labasa. He was interviewed and is the biggest grouper exporter in Fiji; his company is also the longest established (since before 2000 in Fiji).

⁷ While this name is often used in Fiji, it was recently confirmed that this species does not occur in the country. Species likely included under this category consistent with appearance, availability and already regularly confirmed in catches are *E. caeruleopunctatus*, and, possibly occasionally *E. lanceolatus*. It is also possible that larger *E. cyanopodus* are included. However, until identification is confirmed we continue to refer to this form as *E. tukula*.



Interviewers from the Ministry of Fisheries practicing with a fish seller to test out the VCA questionnaire.
@ Yvonne Sadovy

Kawakawa dina/Kesala (camouflage grouper) *Epinephelus polyphekadion*
© Stanley Shea



Delambelewa (brown-marbled grouper) *Epinephelus fuscoguttatus*
© John Randall



Donu (leopard coral trout) *Plectropomus leopardus*
© Stanley Shea



Plectropomus laevis (black-saddled coral grouper)
© Stanley Shea



Epinephelus coioides (Green or orange-spotted grouper)
© Jack Randall



Batesai (squaretailed coral trout) *Plectropomus areolatus*
© Steve Lindfield



Seravua (blue maori, speckled blue grouper) *Epinephelus cyanopodus*
© Anon



Votonimoli (potato cod) *Epinephelus tukula*. The correct species identification for Votonimoli is unclear, and it may involve several species, but it has this general appearance. © Anon



Analyses

A total of 71 fishers, 40 middlemen, 22 hotels and restaurants, and 5 exporters were interviewed (138 interviews in total). A data analysis plan was formulated, and relevant questionnaire data entered into an Excel spreadsheet, checked for quality and consistency and analyzed to address the identified research questions. To gain further insights into price data from retail outlets from mainland China price data were collected between June 2017 and June 2018 (see Appendix) while 15 consumer interviews were conducted in Labasa Fish Market in May 2018 to determine consumer attitudes.

To determine the structure of Fiji's grouper fishery and value chain (Q1), a description of Fiji's grouper fishery is first provided based on data from fisher respondents. For example, gear types, fishing frequency, catch volumes (and seasonal catch trends), top caught species, total estimated catch, and fishing purpose (food versus income) are indicated. The connections between grouper value chain segments from boat to plate/export are described, highlighting transactions between fishers, middlemen, public markets, hotels, restaurants, exporters, and end consumers in Fiji and export out of the country. This value chain structure is depicted as a flow chart (Figure 2). Finally, details on grouper exports from Fiji provided by exporter respondents are summarized, including age of grouper export business, main export markets, frequency and size of shipments, and estimated annual export volumes.

To determine revenue distribution and comparative financial costs versus benefits of different actors along Fiji's grouper value chain (Q2), survey price

data from each respondent group were first integrated to compare the prices that different value chain segments receive for different grouper species. Trends between sales of different grouper species in different units (bundles vs. kilograms) and in different seasons (high vs. low) were highlighted. Markups earned by middlemen, hotels and restaurants, and exporters for each species were calculated, and the species with the highest mean sales value at each stage of the chain was noted. The key costs associated with fishing or trading grouper for each respondent group were summarized, and monthly net incomes from grouper for individuals from each value chain segment were calculated. The contribution of grouper to the incomes of different actors was noted, as was the reported satisfaction of some actors with their grouper income.

For fishers, we compared the ex-vessel prices⁸ received when selling to middlemen versus when they sold to public markets, as well as the percentage of export value gained by Fiji fishers for different grouper species. For the hotel and restaurant (service) sector, the value earned through sales of different types of grouper dishes was highlighted. It is important to note that not all respondents in each value chain segment sold each grouper species, and thus mean prices are based on varying numbers of data points. One exporter provided export sales prices in US dollars, which were converted to Fijian dollars at a rate of 2.02 (the rate on 30 September, 2017).

To understand key challenges to value creation and distribution and possible areas of loss of value (which could potentially be addressed), along Fiji's grouper value chain (Q3), several factors were analysed. The popularity,

8 The price received by a captain or fisher at the point of landing or unloading catch is an 'ex-vessel' price.

and volumes caught, purchased, and sold, of different grouper species at different segments of the chain were first assessed. Grouper product forms sold at each end of the value chain in Fiji (i.e., fishers and exporters) were also compared, as were the perceptions of different actors along the chain with regards to which factors influence grouper pricing. Additional insights were analysed from hotels and restaurants and from middlemen in relation to grouper supply and potential for increasing profits.

To highlight how value chain actors, particularly fishers, perceive the state of grouper resources in Fiji (Q4), it was first noted how many fishers in the sample reported having experienced changes to grouper fishing grounds (in recent memory). For those who reported that they had to travel further

to catch grouper and opinions for why this had occurred were summarized. Fishers' opinions regarding the state of grouper resources in Fiji were also summarized. For those who noted declines in the resource, perceived reasons for these declines were described. Measures suggested to deal with grouper declines, and alternative livelihood options reported by fisher respondents were also analysed. Lastly, respondent awareness of the "4FJ" grouper conservation campaign⁹ was compared across value chain segments.

The main results obtained while addressing Qs 1-4, combined with existing seafood VCA data and recommendations, formed the basis for addressing Q5 and Q6.

Fisher being interviewed for the grouper survey. He is selecting a fish from a set of photographs to confirm identification.

© Yvonne Sadovy

9 This campaign aims to get the public to make voluntary pledges to not buy or consume grouper during their main spawning months from June to September each year (www.4FJ.org.fj).



Results and Discussion

Q1. Structure of Fiji's grouper fishery and value chain

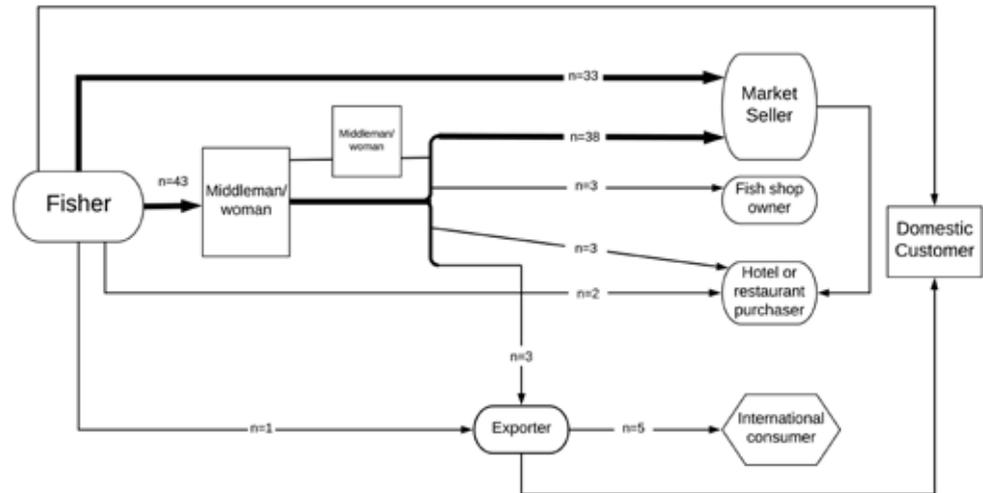


Figure 2: Structure of Fiji's grouper value chain. "n" indicates number of interviews conducted for a total of 138.

All fisher interviewees were males; this highlights that the grouper fishery is male-dominated, and was not a reflection of gender selection of interviewees. Thirteen service sector interviewees were female. The main gear type that respondents reported using in Fiji's grouper fishery was handline/hook and line (Figure 3). Some fishers in the sample (n=13, 18%) reported using more than one type of fishing gear to catch grouper – for example, 11 fishers (15%) reported using two types of gear, one fisher (1%)

reported using three gear types, and one fisher (1%) reported using four gear types. The results indicate that the majority of fisher respondents from Fiji's grouper fishery utilize 'small-scale' gear types. The majority of fisher respondents (n=37, 52%) reported fishing for grouper three to four times per week (Table 3). Using a chi square test, it was found that there was not a significant relationship between fishing gear type and the number of grouper trips per week ($p=0.244$)¹⁰.

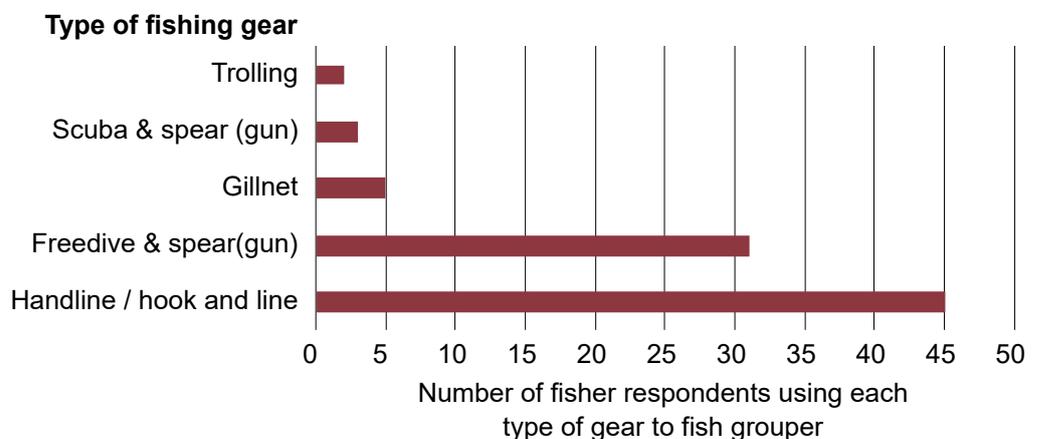


Figure 3: Gear types used by local fishers in Fiji's grouper fishery.

¹⁰ Throughout the analysis, significance was assigned at the 0.05 level.

Table 3: Frequency of grouper fishing by local fishers.

Number of trips per week	Number and percentage of fisher respondents	
	(n)	(%)
Less than 1	1	1
1 to 2	21	30
3 to 4	37	52
5 to 6	12	17
TOTAL	71	100

There was large variation in reported catch volumes per fishing trip of different grouper species among fisher respondents (Figure 4). This was true both within and between seasons (reproductive or 'high' season, versus non-reproductive or 'low' season). The highest volume of one grouper species that a respondent reported during the high season was 300 kg per trip. Of fisher respondents who provided catch data (n=70), around half specified catching higher volumes of one or more particular grouper species. Most notably, 26% of those respondents stated that *Plectropomus leopardus* was their highest volume species, in both the high and low seasons. In total, if respondents (i.e. 71 fishers) were to fish all 52 weeks of the year, the sample's estimated annual catch of grouper would be around 845,000 kg plus 245,000 bundles, based on respondents' reported catch volumes and fishing frequencies.

If these fishers represent typical catch rates of grouper then national landings of this taxon must be far more than the recently estimated national annual landings of 600–800 t (metric tonnes) calculated using data from a range of studies (Lee et al. 2017) and well over 10-fold the official Ministry of Fisheries figures for the taxon (loc. cit). If so, the value to Fiji of its grouper is considerably underappreciated which may negatively influence incentives to manage the fishery.

It should be noted that volumes in kilograms and bundles were not summed in this analysis because survey data highlighted the lack of a uniform conversion rate from bundles to specific weight units in Fiji's fishery and value chain. For example, different fishers reported one bundle as being equal to varying numbers of fish (i.e., two, three, four, or five) with bundle composition depending on both size and species. One fisher stated that a bundle includes more fish in the high season (n=5) than the low season (n=3), while another estimated that one bundle equals around 4.5 kg and bundle pricing tends to be more consistent. Some middleman and hotel/restaurant respondents noted that they purchase mixed (rather than single) species bundles, and it is possible that this practice exists elsewhere in the value chain as well.

Mixed bundles are often seen in fish markets in Fiji for smaller fish sizes (S. Mangubhai, pers. comm.). As an example, one middleman explained that a bundle of *Epinephelus polyphemadion* is equal to two fish (plus some other species), while a bundle of *P. areolatus* is equal to one or two fish (plus some other species). Another middleman who purchases *E. fuscoguttatus* and *P. leopardus* stated that they pay FJ\$30 per bundle for one large fish, or FJ\$20 per bundle for 7 smaller fish of the same species.

Overall, caution should be taken when interpreting results in this report that are related to bundles of grouper as there is too much variation across the fishery to standardise. This makes it challenging for management agencies such as the Ministry of Fisheries to quantify the volumes of fish being caught and traded domestically.



Groupers are arranged for sale in bundles of different numbers of fish according to fish size.

Above © Randy Thaman (top and bottom right) © Yvonne Sadovy

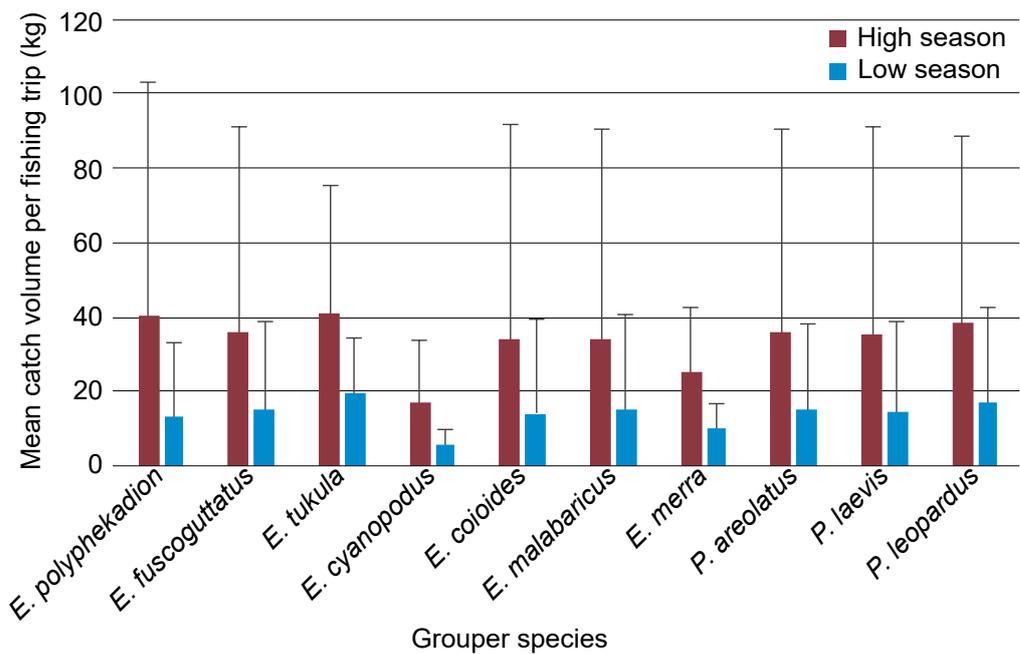


Figure 4: Mean grouper catch (kg) per fishing trip (mean and standard deviation).

The majority of respondents reported differences in catch volumes between seasons, and trends varied based on the measurement unit in which catch was reported. For example, the species with the highest mean catch volume per fishing trip during the high season was '*E. tukula*' (40.8 kg) when reported in kg, versus *E. cyanopodus* and *E. coioides* (8.3 bundles) when reported in bundles. Similarly, the highest average variation between the high season and the low season was for *E. polyphkadion* (62% higher in the high season) when reported in kilograms, versus *P. laevis* (59% higher in high season) when reported in bundles (Table 4).

P. leopardus was the species that most respondents (n=58, 85%) reported catching (Table 5). It also had one of the top three mean catch volumes per fisher (in both kg and bundles) among the different grouper species. *E. polyphkadion* was the second most commonly taken species, as well as having the second highest mean catch volume per fisher (in kg).

It should be noted that the majority of fishers (n=66, 93%) reported catching more than one species of grouper, with an average of five grouper species caught per fisher.

Table 4: Seasonal variations (expressed as percentage and standard deviation¹¹) in grouper catch per fishing trip. The negative sign indicates that mean catch by weight or bundles were less in the low season than in the high season.

Grouper species	Difference in volume between high season to low season			
	% (measured in kilograms)		% (measured in bundles)	
	Mean	Standard deviation	Mean	Standard deviation
<i>E. polyphkadion</i>	-62	24	-52	24
<i>E. fuscoguttatus</i>	-60	26	-54	25
' <i>E. tukula</i> '	-45	39	-43	31
<i>E. cyanopodus</i>	-59	29	-41	28
<i>E. coioides</i>	-57	26	-58	28
<i>E. malabaricus</i>	-56	28	-41	29
<i>E. merra</i>	-53	46	-40	27
<i>P. areolatus</i>	-57	27	-52	24
<i>P. laevis</i>	-61	22	-59	25
<i>P. leopardus</i>	-55	30	-56	23

11 Standard deviation (SD or sd) expresses the amount by which the members of a group differ from the mean value for the group.

Table 5: Different grouper species reported by fishers in their catches.

Grouper species	Number of fisher respondents catching each species	
	N	%
<i>P. leopardus</i>	58	85
<i>E. polyphekadion</i>	54	76
<i>E. fuscoguttatus</i>	46	63
<i>P. areolatus</i>	44	61
<i>P. laevis</i>	41	56
<i>E. coioides</i>	35	48
<i>E. malabaricus</i>	34	45
<i>E. cyanopodus</i>	19	28
<i>E. merra</i>	15	18
' <i>E. tukula</i> '	11	16

Fiji's grouper fishery is important for both local incomes and food security, with 91% (n=64) of fisher respondents reporting that they fish grouper for both income and food, while 8% (n=6) reported fishing for income only, and 1% (n=1) reported fishing for food only (Table 6). The one fisher who catches grouper only for food targets *E. polyphekadion* and *P. leopardus*, while two other fishers specifically noted that they only catch *E. merra* for food rather than for sale.

Table 6: Fishers' reasons for fishing grouper.

Reason for fishing	Number and percentage of fisher respondents	
	n	%
Income only	6	8
Food only	1	1
Both income and food	64	91
TOTAL	71	100

Among the respondents who reported fishing grouper for both income and food, the majority (n=48, 76%) reported dedicating more of their grouper catch toward sales than towards food. However, there was a large variation in responses (Table 7), with some respondents (n=5, 8%) reporting more of their total grouper catch as food than as sales, and others (n=10, 16%) reported an equal split for use of grouper between food and sales.

Table 7: Fishing for food and income by local fishers

Portion of grouper catch	Mean (%)	Range (%)	Standard Deviation (σ)
For food	28	5-95	18.8
For sales	72	5-95	18.8

Figure 2 depicts the structure of Fiji's grouper value chain, based on survey data from fishers who sell grouper (n=70), middlemen (n=40), hotels and restaurants (n=22), and exporters (n=5). Most respondents purchased or sold grouper through one type of sales outlet. However, some middlemen (n=8, 20%), hotels and restaurants (n=5, 23%), and exporters (n=1, 20%) purchased from more than one type of supplier. In addition, some fishers (n=7, 10%) and middlemen (n=16, 40%) reported grouper sales through multiple outlets, while the majority of hotels and restaurants and exporters reported variation in their types of end markets/consumers. For example, most hotels and restaurants (n=17, 77%) stated that more than one ethnic group purchased grouper dishes from their establishment.

The majority of fishers (n=43, 61%) sold their grouper catch to middlemen, while others sold direct to customers at public markets (n=33, 47%), to restaurants or hotels (n=2, 3%), or to exporters (n=1, 1%). Chi square tests showed that fishing factors such as gear type and number of fishing trips per week did not influence fishers' sales outlets for grouper ($p > 0.05$). Most middlemen (n=37, 93%) reported purchasing directly from fishers, while some (n=11, 28%) purchased from other middlemen. In terms of sales, most middlemen sold direct to consumers (n=38, 95%), while some sold to hotels (n=6, 15%), restaurants (n=8, 20%), exporters (n=3, 8%), and fish shops/retailers (n=3, 8%). Half of the hotels and restaurants (n=11, 50%) indicated purchasing from public markets, while some also stated that they purchased from middlemen (n=8, 36%) or fishers (n=6, 27%), or acquired grouper through their own supply businesses (n=2, 9%)¹². More hotels and restaurants reported selling grouper to locals (n=18, 82%), than to tourists (n=13, 59%), while some also indicated that they sold grouper to an "other" category of consumers (n=7, 32%). *I-Taukei* (indigenous Fijian) customers were the main consumers of grouper noted by most hotels and restaurants (n=10, 45%).

In terms of exports, some exporter respondents (n=3, 60%) indicated purchasing grouper direct from fishers, while others stated that they purchase from middlemen (n=3, 60%). None of the exporters said that they import grouper for re-export, indicating that grouper exported from Fiji has likely all been harvested in Fiji. *E. merra* was the only species among those studied that was not reported as being exported; this is

the smallest grouper species amongst those investigated is most commonly consumed rather than sold by fishers. Most exporter respondents (n=4, 80%) reported selling grouper solely to export markets, while one sold to both domestic and export markets (with less than 25% of their sales going to export markets). The majority of exporters started to export grouper from Fiji in the 2000s; the reported years that each company began exporting grouper from Fiji were 1978, 2002, 2013, 2015, and 2016.

More than half of the exporters in the sample exported multiple types of products, not just seafood (Table 8). Of those exporter respondents who reported exporting both seafood and other products (n=3, 60%), one reported that seafood constituted 26-50% of their total exports, while the other two respondents reported that seafood constituted greater than 75% of their total exports. Other types of seafood reported as exported included pelagic fish, shellfish, and other reef fish – for example, respondents mentioned marlin, rabbitfish, snapper, wrasse, parrotfish¹³, unicornfish, emperor, Spanish mackerel, crabs, prawns, lobsters, deep sea snappers, jacks, jobfish, and *bêche-de-mer*, among others. Those exporters with non-seafood exports mentioned okra, long bean, cow peas, chillies, eggplant, chester beans, green leafy vegetables, cooked and frozen chicken drumsticks, jackfruit, pumpkin, pawpaw, cassava, taro, yams, Pick-Me-Up sauce, coconut cream, and sandalwood. All exporter respondents sold their grouper to an overseas importer/company, while the one exporter with domestic sales sold grouper to local restaurants and through his own fish shop.

12 There could be some overlap in terms of the purchaser and supplier categories within the surveys. For example, hotels and restaurants could be purchasing grouper from fishers and/or middlemen at public markets. In addition, as noted above, some respondents engaged with more than one entity for their grouper purchasing and sales.

13 Note that this includes 'Kalia' or bumphead parrotfish, *Bolbometopon muricatum*, which is protected in Fiji and should not be exported.

Table 8: Types of products exported by respondents.

Export types	Number and percentage of exporter respondents	
	(n)	(%)
Only seafood	2	40
Seafood and other products	3	60
TOTAL	5	100

There was a large range in the frequency and size of grouper export shipments reported by respondents (Table 9). This led to large variations in estimates of total annual grouper export volumes per company. The exporter respondent who also sells grouper domestically reported selling around

26,000 kg of grouper per year to local markets, versus 2,200 kg per year to export markets. Based on the figures provided, it is estimated that the study sample exports at least 70,080 kg of grouper per year from Fiji.

Five main export markets for grouper caught in Fiji were noted by respondents: New Zealand, United States, mainland China, Hong Kong, and South Korea (Figure 5). However, it is noted that these locations could be either trans-shipment locations (for example some or all shipments for mainland China almost go via Hong Kong) or final end markets. All but one exporter, who ships grouper from Fiji to four countries, reported shipping to just one export market.

Table 9: Frequency and volume of grouper exports from Fiji.

Grouper exports	Mean	Range	Standard Deviation (σ)
Number of grouper export shipments (per year)	18.2	1.0-52.0	20.6
Average size of grouper export shipments (kg per shipment)	1,031.0	80.0-4,000.0	1668.2
Total annual export volumes (kg per year)	14,016.0	80.0-48,000.0	19,756.9

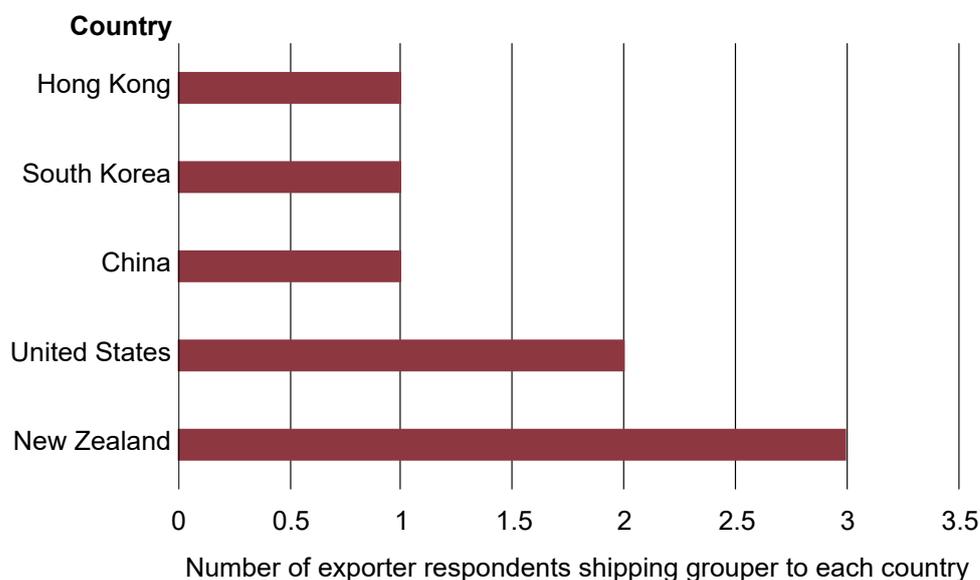
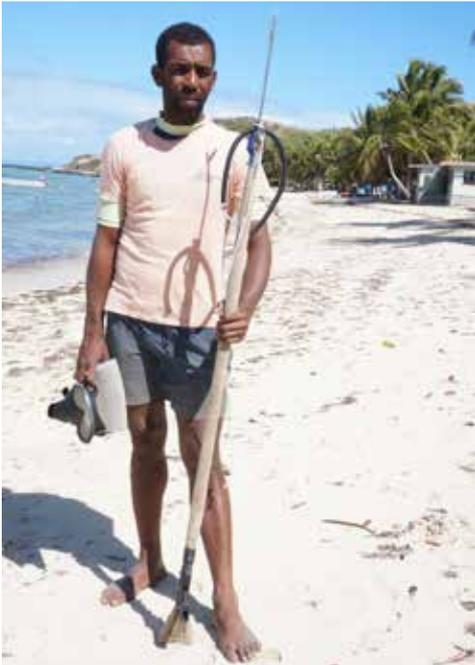


Figure 5: Export profile: destination countries for Fiji's grouper exports



Fisher from Kia who catches grouper with speargun by freediving on a nearby aggregation.

© Yvonne Sadovy



Fisher after catching and cleaning one *E. polyphkadion* taken from a spawning aggregation in 2005; fish is in one hand and gonad (reproductive organ) in the other, from northwestern Vanua Levu.

© Yvonne Sadovy

Fishing on grouper aggregation which is close to shore in northeastern Vanua Levu.

© Yvonne Sadovy

In summary, most fisher respondents targeted more than one species of grouper, primarily with hook and line and spear and speargun with three to four fishing trips per week. Most fishers catch grouper for both food and income. While catch volumes varied widely among fishers, most fisher respondents reported catching more *P. leopardus* versus other species, as well as noting it as their highest volume species. The samples' total annual grouper catch volume was estimated at 845,000 kg plus 245,000 bundles. It should be noted that kilogram and bundles were kept as separate units throughout the analysis due to inconsistent conversion rates highlighted by respondents. While catches between high and low seasons varied across species, differences were highest for camouflage grouper when considered by catch weight. The structure of Fiji's grouper value chain resembles an hourglass shape – that is, many fishers, few exporters, and many consumers – similar to other small-scale developing country fisheries linked to international markets (e.g. Purcell et al. 2017; Mangubhai et al. 2016).

It is estimated that the exporters interviewed collectively export at least 70,080 kg of grouper per year from Fiji, primarily to New Zealand, the United States, mainland China, Hong Kong and South Korea. Given that these interviewees represent the major exporters in Fiji for grouper currently, this provides a minimal indication of total exports and is consistent with official figures (Lee et al. 2017)¹⁴. However, data on exports were not always forthcoming from some exporters interviewed, and are not comprehensively documented, hence the figure is potentially considerably higher; this possibility is reaffirmed by the many vessels that are dedicated to catch grouper by a major exporter; each boat is supplied with several coolers for the catches (Sadovy de Mitcheson and Ramoica 2015).

¹⁴ However possible underreporting



Q2. Costs and benefits for different participants along the chain

Previous studies have highlighted the distribution of value for different fish and agricultural products between different value chain segments (e.g., Bjørndal et al. 2015). For example, in Fiji Starkhouse (2009) estimated that fishers will be paid 60%, 80% or 100% of a fish's market value when selling to a middleman, vendor, or consumer, respectively.

In this study, fishers received more for all grouper species when selling by the kilogram to customers at public markets than when selling to middlemen (Figure 6)¹⁵. The same was the case when selling by the bundle (Table 10). The one fisher who stated that they sell grouper directly to an exporter indicated receiving a higher price per kilogram than when selling directly to a middleman; exporters most typically buy from middlemen. For the most part, middlemen reported paying higher prices per kilogram to fishers for grouper than fishers reported for their sales to middlemen (except for *E. fuscoguttatus*). The opposite was true for the price per bundle for some grouper species which may be reflective of marketing strategies around the use of bundles rather than using direct weight; the influence of the 'bundle' system on marketing requires further study to understand better the relationships between cost and weight for different species of grouper. For example, one middleman noted that they may pay a different price per kilogram for different sizes of the same grouper species, however examples of these price variations were not provided. Prices also vary by

species although this is most marked at the export level, with *P. leopardus* consistently the most valuable for exporters. However, it is noteworthy that fishers and often middlemen do not always get higher prices for this most valued species (Figure 6). See also supplementary data in the Appendix on price by size for three species (*P. leopardus*, *E. fuscoguttatus*, *E. coioides*) collected in mainland China (2017–2018), a major export market for Fiji grouper (Hong Kong plus mainland China) showing clear interspecies differences in retail prices and reflecting similar price differences as noted in Fiji.

Fifteen consumer interviews were conducted in Labasa market to gauge consumer attitudes. The interviewees were both male and female and predominantly Indo-Fijian or *iTaukei* typically aged 30-50 years and earning salaries ranging from about FJ\$10,000 to FJ\$52,000 per year. Most liked grouper because they find these fish to be tasty and 'kawakawa' (the brown *Epinephelus* spp.) were generally selected more often than donu (*Plectropomus* spp.) although both were popular. Size of fish and freshness were also identified as important. The interviewees consumed fish between once or twice per week to once per month, or infrequently. All but one interviewee purchased fish from the fish market, one directly from villagers. Consumers indicated that prices currently are acceptable but that they would not pay more than now,. Their perceptions about changes in grouper availability on the market were very mixed.

¹⁵ However, need to note that more details on cost are needed

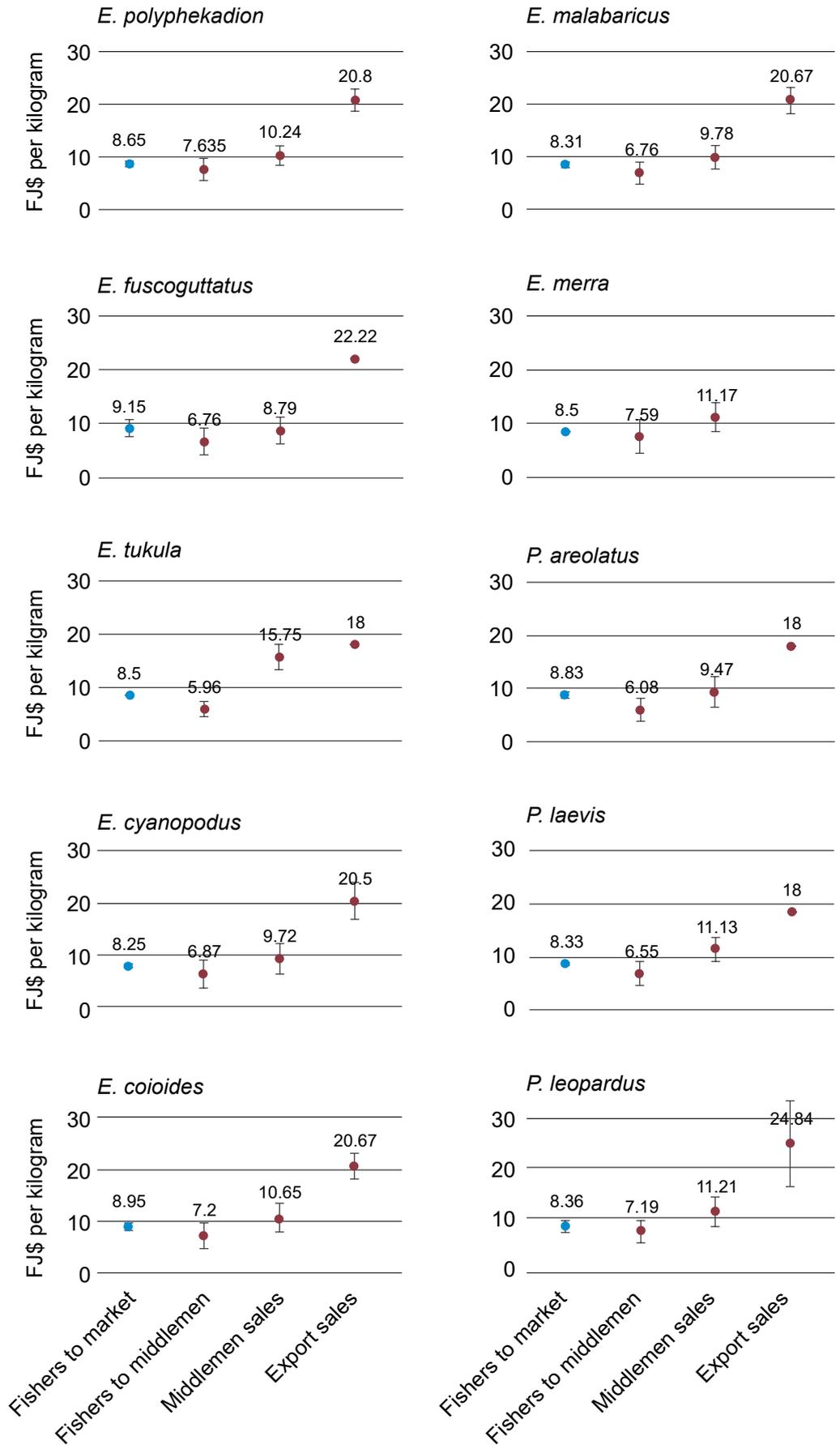


Figure 6: Distribution of value (in FJ\$) along Fiji's grouper value chain. Note that *E. merra* is not exported. End market sales (i.e. China retail) prices were available (given in US\$) for 3 species (*P. leopardus*, *E. coioides*, *E. fuscoguttatus* (see Appendix).

Table 10: Grouper sales by the bundle.

Grouper species	Sale price (FJ\$ per bundle)					
	Fishers			Middleman sales		
	To middlemen Mean/SD	To market customers Mean/SD		Mean/SD		
<i>E. polyphemadion</i>	25.00	7.07	28.48	8.12	29.70	5.99
<i>E. fuscoguttatus</i>	18.75	8.54	30.38	9.13	28.93	5.99
' <i>E. tukula</i> '	20.00	0.00	27.19	8.32	23.50	2.12
<i>E. cyanopodus</i>	20.00	0.00	30.63	8.26	26.44	7.55
<i>E. coioides</i>	20.00	0.00	29.46	9.73	30.67	12.50
<i>E. malabaricus</i>	20.00	0.00	28.75	7.35	24.92	6.17
<i>E. merra</i>	20.00	0.00	23.13	2.93	24.50	6.22
<i>P. areolatus</i>	15.00	5.00	28.57	6.39	26.00	3.70
<i>P. laevis</i>	20.00	0.00	27.31	6.06	24.00	1.73
<i>P. leopardus</i>	21.25	13.15	30.69	6.82	29.73	7.38

Overall, fishers capture on average 33% of the export value of grouper when selling through middlemen, versus 43% when selling at markets (Table 11). Fishers captured the least amount of export value through sales of *P. leopardus*, compared to other species. However, generally there was little variation between the different species in terms of fishers' share of export value.

Table 11: Fishers' share market values for grouper from sales via middlemen and directly via public market. N/A = not applicable as not exported.

Grouper species	Proportion of sales price captured by fishers (% of export value)	
	Sales via middlemen	Sales via public market
<i>E. polyphemadion</i>	33	42
<i>E. fuscoguttatus</i>	30	41
' <i>E. tukula</i> '	33	47
<i>E. cyanopodus</i>	34	40
<i>E. coioides</i>	35	43
<i>E. malabaricus</i>	33	40
<i>E. merra</i>	N/A	N/A
<i>P. areolatus</i>	34	49
<i>P. laevis</i>	36	46
<i>P. leopardus</i>	29	34
Mean	33	43
<i>Standard Deviation</i>	2	5

Table 12 shows the mean prices paid by hotels and restaurants for different grouper species, as well as the mean price of dishes that include each species. There was a large range in prices of grouper dishes, not only in terms of species but also depending on the type of dish sold. For example, grouper curries and grouper boiled in coconut milk were cheaper than raw, steamed, deep-fried, pan fried, or baked whole fish. This is likely because the cheaper dishes would use a lower volume of grouper than the whole fish dishes or could use cheaper species or smaller fish in the case of curries. Prices for whole fish dishes varied based on the size of grouper used.

Based on the survey data, exporters, hotels and restaurants had higher markups for all grouper species than middlemen (Table 13). Markups for hotels and restaurants were calculated

based on an average reported volume of 1.15 kg of grouper used per dish. However, some hotels and restaurants purchased by the bundle, or did not report the estimated volume of grouper in their dishes, and thus the estimated markups for grouper dishes at hotels and restaurants should be approached with caution.

There were no consistent trends in terms of which grouper species held the highest value at different stages of the value chain (Table 14). However, the three species that had the highest mean value in more than one instance were *E. polyphekadion*, *E. fuscoguttatus*, and *P. leopardus* which is also consistent with additional independent market data (Appendix). *P. leopardus*, in particular can gain very high consumer prices in the mainland China retail sector.

Table 12: Grouper purchasing and sales at hotels and restaurants in Fiji. N/A = not available as no data were collected

Grouper species	Purchase price (FJ\$)				Sales price (FJ\$)	
	Per kilogram Mean/SD		Per bundle Mean/SD		Per dish Mean/SD	
<i>E. polyphekadion</i>	8.85	2.00	23.50	4.54	20.18	14.12
<i>E. fuscoguttatus</i>	N/A	N/A	27.50	0.00	43.00	0.00
' <i>E. tukula</i> '	7.63	0.53	N/A	N/A	20.50	20.51
<i>E. cyanopodus</i>	7.63	0.53	N/A	N/A	20.50	20.51
<i>E. coioides</i>	8.75	1.98	26.88	2.65	19.70	11.75
<i>E. malabaricus</i>	8.00	1.57	21.25	5.30	20.83	18.79
<i>E. merra</i>	7.25	0.00	N/A	N/A	18.00	16.97
<i>P. areolatus</i>	7.63	0.53	N/A	N/A	20.50	20.51
<i>P. laevis</i>	7.63	0.53	32.50	0.00	21.75	13.23
<i>P. leopardus</i>	8.45	1.62	30.69	6.16	26.32	15.07

Table 13: Price markups for grouper along the value chain. N/A = not applicable, species not recorded in the trade chain.

Grouper species	Mean price (per kg, bundle, or dish)								
	Middlemen			Hotels & restaurants			Exporters		
	Purchase (FJ\$)	Sale (FJ\$)	Markup (%)	Purchase (FJ\$)	Sale (FJ\$)	Markup (%)	Purchase (FJ\$)	Sale (FJ\$)	Markup (%)
<i>E. polyphekadion</i>	8.37	10.24	18	8.9	20.18	43	11.5	20.8	45
	22.91	29.7	23						
<i>E. fuscoguttatus</i>	6.74	8.79	23	N/A	43	N/A	6.5	22.22	71
	22.3	28.93	23						
' <i>E. tukula</i> '	8.5	15.75	46	7.6	20.5	50	5	18	72
	20	23.5	15						
<i>E. cyanopodus</i>	7.69	9.72	21	7.6	20.5	50	11.5	20.5	44
	18.42	26.44	30						
<i>E. coioides</i>	7.98	10.65	25	8.8	19.7	42	12	20.67	42
	18	30.67	41						
<i>E. malabaricus</i>	7.93	9.78	19	8	20.83	49	12	20.67	42
	19.71	24.92	21						
<i>E. merra</i>	8.58	11.17	23	7.3	18	46	N/A	N/A	N/A
	17	24.5	31						
<i>P. areolatus</i>	7.97	9.47	16	7.6	20.5	50	10.5	18	42
	21.46	26	17						
<i>P. laevis</i>	8.29	11.13	26	7.6	21.75	52	10.5	18	42
	14.5	24	40						
<i>P. leopardus</i>	9.02	11.21	20	8.5	26.32	55	12.63	24.84	49
	21.06	29.73	29						

Table 14: Grouper species with highest mean sale value along the value chain

Fisher sales				Middlemen sales		Hotel and restaurant sales	Export sales
To middlemen		To market		Per kg	Per bundle	Per dish	Per kg
Per kg	Per bundle	Per kg	Per bundle				
<i>E. polyphekadion</i>	<i>E. polyphekadion</i>	<i>E. fuscoguttatus</i>	<i>P. leopardus</i>	' <i>E. tukula</i> '	<i>E. coioides</i>	<i>E. fuscoguttatus</i>	<i>P. leopardus</i>



Boats typically used for fishing grouper along outer reefs in northwestern Vanau Levu. Large coolers (photo on right) are placed on board to fill with grouper in the season. © Yvonne Sadovy

There were some seasonal price shifts between the high and low season in Fiji's grouper fishery and along the value chain (Table 15), although survey data highlighted variable interpretations of "high season" and "low season" among respondents. High is understood to be the season with highest catches per trip and is particularly noticeable in those species that aggregate to spawn (such as *E. polyphkadion*). While some other species also have this reproductive habit, their aggregative behaviour is such (i.e. multiple, small aggregations rather than few large aggregations) that catch rates may not differ so markedly between high and low seasons. However, seasonal

patterns were not always apparent to interviewees.

In addition, there was wide variation in responses with regards to seasonal price trends. For example, while the majority of fishers did not indicate seasonal differences in ex-vessel prices for grouper, those who did highlighted both increases and decreases between seasons. Amongst middlemen, some respondents reported no seasonal price differences, while those who did primarily indicated price increases from high season to low season (suggesting price increases with declines in fish availability for sale). However, one middleman stated the inverse (a

Table 15: Seasonal price changes (%) along Fiji's grouper value chain. N/A = no data available

Grouper species	Change in grouper prices (FJ\$ per kg, bundle, or dist) from high season to low season (%)										
	Fisher				Middlemen				Hotel & restaurant		
	Sales to middlemen		Sales to market customers		Purchase		Sales		Purchase		Sales
	Mean	s	Mean	s	Mean	s	Mean	s	Mean	s	Mean
<i>E. polyphkadion</i>	-1	9	6	13	13	48	16	49	0	0	0
	0	0	-6	19	16	27	14	21	28	39	0
<i>E. fuscoguttatus</i>	0	8	6	13	14	57	19	62	N/A	N/A	0
	0	0	-3	19	11	22	25	34	75	0	0
' <i>E. tukula</i> '	-3	7	0	0	0	0	0	0	0	0	0
	0	0	6	18	0	0	33	47	N/A	N/A	0
<i>E. cyanopodus</i>	2	7	14	20	6	18	9	25	0	0	0
	0	0	-11	13	26	23	31	3	N/A	N/A	0
<i>E. coioides</i>	1	6	6	13	8	19	17	29	0	0	0
	0	0	1	18	14	25	22	38	-4	6	0
<i>E. malabaricus</i>	0	0	0	0	5	14	7	21	1	2	0
	0	0	-9	18	14	22	14	27	0	0	0
<i>E. merra</i>	0	0	0	0	15	26	28	48	0	0	0
	0	0	-2	21	0	0	0	0	N/A	N/A	0
<i>P. areolatus</i>	1	11	0	0	11	23	8	23	0	0	0
	0	0	-10	18	21	29	16	25	N/A	N/A	0
<i>P. laevis</i>	7	19	10	16	16	33	17	36	0	0	0
	0	0	-12	16	22	31	30	34	0	0	0
<i>P. leopardus</i>	0	7	4	11	6	15	4	17	0	0	0
	0	0	-7	18	12	18	28	44	7	13	0

price decrease from high season to low season), while another stated that prices per kilogram did not shift seasonally, while prices per bundle did. Most hotels and restaurants did not indicate seasonal price changes when purchasing grouper by the kilogram, but they did when purchasing by the bundle. Of the latter, most noted a price increase from high season to low season, while one respondent stated the inverse (a price decrease from high season to low season). Hotels and restaurants did not indicate any difference in the sales prices of their grouper dishes between seasons. Similarly, exporters noted no seasonal differences in the grouper purchase or sales prices between seasons, and hence are not included in Table 15.

Distribution of value does not speak to profitability for different actors in a value chain if cost items are not incorporated (Gudmundsson et al. 2006), and so the amounts and types of costs associated with grouper fishing and trade, as noted by respondents within each value chain segment in Fiji, are highlighted below. Of those fishers who fish grouper only for income (n=6, 8%) or for both income and food (n=64, 90%), the mean monthly gross profit margin (i.e. after the costs of selling were accounted for) from grouper was 57%. However, there was a large variation in individual fishers' reported revenues, costs, and profits (Table 16).

Table 16: Fishers' monthly grouper finances

Grouper finances (per month)	Mean (FJ\$)	Standard Deviation
Revenue	1,388	2,234
Costs	629	1,305
Profits	787	1,474

Fisher respondents outlined several costs associated with fishing grouper in Fiji (Table 17). For example, almost half of the respondents owned fishing boats (n=35, 49%), while slightly fewer reported fishing on boats owned by friends or family (n=31, 44%); only a few fished from a boat owned by a company or middleman (n=3, 4%).

On average, fishers reported fuel costs of FJ\$15 per gallon ($\sigma = 15$)¹⁶, and fuel use of 11 gallons ($\sigma = 18$) per fishing trip. The durability of fishing gear types, and subsequently the frequency of incurring costs to purchase gear, varied. For example, respondents reported replacement timelines for fishing gear that ranged from one week to 20 years. Additional cost items only mentioned by 1-2 respondents (and therefore not included in Table 17) were radio (FJ\$55), flashlight (FJ\$60), kerosene (1 liter) for lamp (FJ\$1), and market space rental (FJ\$0.30 per kg).



Inspection of seller at Suva market. Mostly *E. fuscoguttatus* being sold during its spawning season.

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16 Four respondents provided unit costs for fuel of FJ\$ 50 per gallon or greater, which was significantly higher than the rest of the responses.

Table 17: Fishers' grouper-related costs.

Expense type	Mean	Standard deviation	Frequency	Response rate (n)
Boat ¹⁸	12,824	9,463	Varies	31
Fuel	127	146	Per trip	54
Gear				
Hook & line	70	155	Varies	41
Gillnet & floats	283	143	Varies	6
Bait	44	48	Varies	7
Spear or speargun ¹⁹	209	100	Varies	30
Mask & snorkel ²⁰	70	22	Varies	25
Fin	168	52	Varies	21
Scuba tank	180	28	Varies	2
Ration	65	74	Per trip	38
Battery	24	44	Per trip	24
Boatman ²¹	102	177	Per trip	8
Boat hire	54	40	Per trip	6
Storage (i.e., ice) ²²	24	28	Per trip	48
Transportation to market (i.e., van, bus) ²³	48	81	Per trip	31
Staff (i.e. transportation, sales)	58	77	Per trip	13
License/access fee	91	171	Per year	33

Some middlemen respondents reported having financial arrangements with their fisher suppliers (n=18, 45%) (Figure 7). These arrangements included loans, advances, profit sharing, credit, and other deals. However, as specific figures were not provided, this expense is not figured into the cost tables for fishers or middlemen.

Middlemen respondents reported several costs associated with buying and selling grouper (Table 18). For example, an average of 1 employee to help with grouper sales and purchasing ($\sigma = 2$) was employed per middleman. However, most respondents (n=26, 65%) did not report employing individuals to help with their grouper operations. Those who did report employees stated that they were hired for grouper purchasing, unloading,

17 This is based on data from the 49% of fisher respondents who own their boat, however some of these respondents did not provide cost information, as their boats had been provided through the National Development Program (NDP) through a cost-sharing scheme. When reported separately, a boat without an engine cost an average of FJ\$8,529 ($\sigma = 7,164$), while an engine cost an average of FJ\$6,446 ($\sigma = 3,105$).

18 For spearguns, respondents noted that a frequent associated cost was the replaceable rubber.

19 When reported separately, a mask cost FJ\$47 ($\sigma = 20$) and a snorkel cost FJ\$19 ($\sigma = 11$).

20 This cost was also reported by one fisher respondent as FJ\$1 per kg.

21 This cost was also reported by some as an average of FJ\$5 per bag, or FJ\$0.40 per kg.

22 Respondents noted much lower costs to transport fish to market by bus than by van.

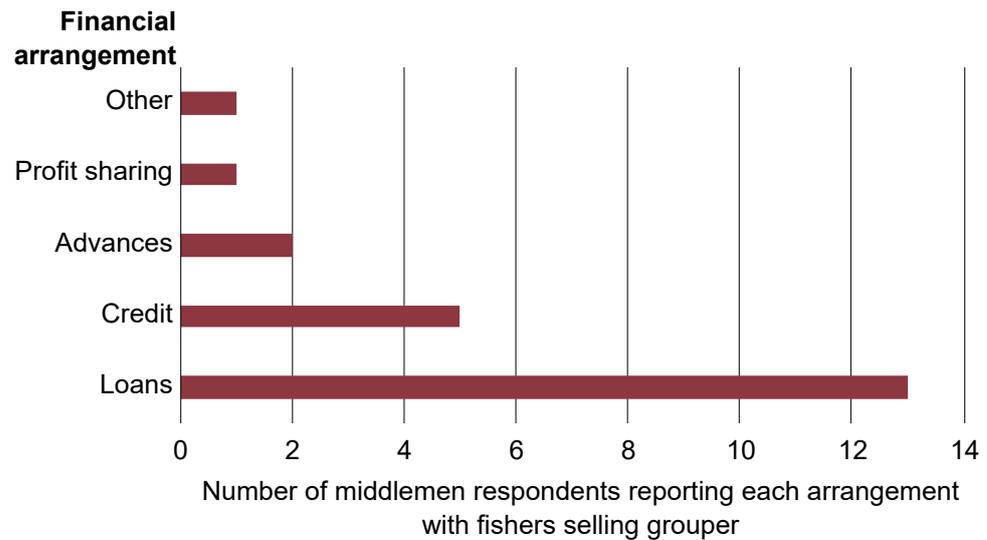


Figure 7: Financial arrangements between fishers and middlemen

sorting, cleaning, scaling, gutting, packing, icing, and sales. Additional cost items that were only noted by one respondent (and therefore not included in Table 18) were payments to a community or chief (FJ\$25) and water bill (FJ\$6).

Other than raw material costs, hotel and restaurant respondents noted few specific costs associated with purchasing and selling grouper (Table 19). Costs mentioned included transportation and storage, although these are likely intertwined with the establishments' other operations. With regards to sales of grouper dishes, hotel and restaurant respondents reported earning an average of FJ\$306 per week in net income from grouper, however there was a large range, from FJ\$10 per week to FJ\$2,250 per week (SD = 545).

Exporter respondents indicated various costs associated with buying and selling grouper (Table 20). Most exporters (n=4, 80%) did not report having any employees associated with grouper purchasing and sales. The one respondent who reported employees had 50 permanent employees who were involved in processing and packaging grouper (and other fish)

and training villagers who fish for the company. Wages were FJ\$225 per week per employee, or around FJ\$1 per kg. The same respondent provided boats and engines to fishers in return for them supplying his company with grouper and other fish, however the costs to the exporter of these boats and engines were not provided.

It was noted that air shipment unit costs were cheaper for short haul than long haul flights (i.e., air shipments from Labasa to Nadi cost around FJ\$3 per kg, while air shipments from Nadi to Hong Kong cost around FJ\$4 per kg). Air shipment unit costs were also lower for larger volumes (i.e., FJ\$3 per kg for shipments greater than one tonne, versus FJ\$4 for shipments between 500 kg and one tonne, and FJ\$5 for shipments less than 500 kg). Licensing (i.e., business, fire, biosecurity, occupational health and safety, and fisheries permits) was one of the higher annual expenses reported by exporters. Overall, three exporter respondents reported costs related to grouper that averaged FJ\$183,333 per year, while another respondent reported grouper costs of FJ\$1,000 per shipment, and another did not report their total costs related to grouper.

Table 18: Middlemen grouper-related costs.

Expense type	Mean (FJ\$)	Standard deviation	Frequency	Number of responses (multiple responses possible per interviewee) (n)
Employees	23	6	Per day	14
Transportation	158	155	Per week	11
Fuel	75	44	Per week	6
Rental space ²⁴	58	49	Per week	20
Electricity	28	6	Per week	4
Bags	23	15	Per week	13
Ice	114	173	Per week	31
Licences	92	83	Per year	3
Raw material ²⁵				
<i>E. polyphkadion</i>	8.37	1.70	Per kg	16
<i>E. fuscoguttatus</i>	6.74	1.81	Per kg	12
' <i>E. tukula</i> '	8.50	2.12	Per kg	2
<i>E. cyanopodus</i>	7.69	2.45	Per kg	8
<i>E. cooides</i>	7.98	2.58	Per kg	7
<i>E. malabaricus</i>	7.93	1.81	Per kg	12
<i>E. merra</i>	8.58	1.66	Per kg	3
<i>P. areolatus</i>	7.97	2.34	Per kg	11
<i>P. laevis</i>	8.29	1.98	Per kg	7
<i>P. leopardus</i>	9.02	2.87	Per kg	19



Selling grouper selection at Laqere. Bundles in this photo typically include one or two fish.

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²³ This cost was also reported by one respondent as FJ\$0.30 per kg

²⁴ Some middlemen also reported their raw material costs by the bundle, however these are not listed here because of the lack of consistency in this unit.

Table 19: Hotel and restaurant grouper-related costs. N/A = data not available

Expense type	Mean (FJ\$)	Standard deviation	Frequency	Response rate (n)
Transportation	5	0	Per trip	2
Storage (i.e. fridge space, ice) ²⁶	29	39	Varies	3
Raw material costs ²⁷				
<i>E. polyphekadion</i>	8.85	2.00	Per kg	5
<i>E. fuscoguttatus</i>	N/A	N/A	N/A	0
' <i>E. tukula</i> '	7.63	0.53	Per kg	2
<i>E. cyanopodus</i>	7.63	0.53	Per kg	2
<i>E. coioides</i>	8.75	1.98	Per kg	3
<i>E. malabaricus</i>	8.00	1.57	Per kg	5
<i>E. merra</i>	7.25	0.00	Per kg	1
<i>P. areolatus</i>	7.63	0.53	Per kg	2
<i>P. laevis</i>	7.63	0.53	Per kg	2
<i>P. leopardus</i>	8.45	1.62	Per kg	5

Table 20: Exporters' grouper-related costs. N/A means data not available.

Expense type	Mean (FJ\$)	Standard deviation	Frequency	Response rate (n)
Vehicle	350	212	Per week	2
Fuel ²⁸	500	0	Per week	1
Boxes ²⁹	4	1	Per kg	2
Rental space	2	1	Per kg	3
Licence/permits	1,674	1,042	Per year	4
<i>e.g. fish permit</i>	64	50	<i>Per shipment</i>	3
Electricity ³⁰	3,500	2,121	Per month	2
Bags ³¹	250	0	Per week	1
Ice	2	3	Per kg	2
Processing	2	0	Per kg	1
Pest control	120	0	Per month	1
Shipping by air	3	0	Per kg	1
Shipping by sea	1	0	Per kg	1
Raw material			Per kg	
<i>E. polyphekadion</i>	11.50	2.07	Per kg	4
<i>E. fuscoguttatus</i>	6.50	0.00	Per kg	1

25 This cost was also reported by one respondent as FJ\$0.30 per kg

26 Some hotel and restaurant respondents also reported their raw material costs by the bundle, however these are not listed here because of the lack of consistency in this unit.

27 This cost was also reported by one respondent as FJ\$175 per shipment.

28 This cost was also reported by one respondent as FJ\$14 per box.

29 This cost was also reported by one respondent as FJ\$4 per kg.

30 This cost was also reported by one respondent as FJ\$4 per kg.

Expense type	Mean (FJ\$)	Standard deviation	Frequency	Response rate (n)
'E. tukula'	5.00	0.00	Per kg	1
<i>E. cyanopodus</i>	11.50	3.54	Per kg	2
<i>E. coioides</i>	12.00	2.52	Per kg	3
<i>E. malabaricus</i>	12.00	2.52	Per kg	3
<i>E. merra</i>	N/A	N/A	N/A	0
<i>P. areolatus</i>	10.50	0.00	Per kg	1
<i>P. laevis</i>	10.50	0.00	Per kg	1
<i>P. leopardus</i>	12.63	8.60	Per kg	4

Individual exporters in the study (n=5) had the highest average monthly net income (gross revenue minus costs) from grouper, followed by middlemen (n=40), hotels and restaurants (n=22), and fishers (n=70) (Figure 8)³¹. Taken together, it is estimated that all value chain participants in the study (n=137) earn a monthly net income of FJ\$240,417 from grouper, or FJ\$2,885,007 annually.

Grouper had varying levels of importance to the income of fisher respondents (Table 21), with most fishers stating that grouper contributed less than 20% of their total income (n=31, 44%) or 21-40% of their total income (n=22, 31%).

Table 21: Contribution (%) of grouper to fisher income.

Portion of total income	Number and percentage of fisher respondents	
	(n)	(%)
<20%	31	44
21-40%	22	31
41-60%	7	10
61-80%	1	1
81-100%	10	14
TOTAL	71	100

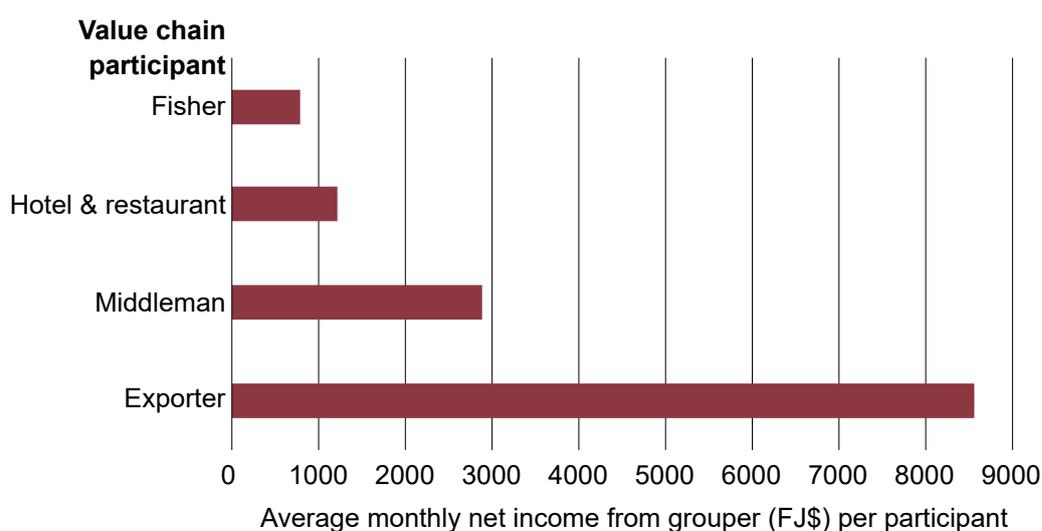


Figure 8: Monthly net income from grouper (FJ\$) per value chain participant.

31 These values were calculated based on fishers' reported mean monthly grouper profits, middlemen's mean monthly grouper costs and revenue, hotels and restaurants' reported mean weekly net income from grouper, and exporters' reported mean annual grouper costs and revenue.

Table 22: Grouper as a portion of total seafood trade.

Portion of total seafood trade	Number (%) of respondents					
	Middlemen		Hotels and restaurants		Exporters	
	(n)	(%)	(n)	(%)	(n)	(%)
<25%	34	85	14	64	3	60
26-50%	4	10	3	14	1	20
51-75%	1	2.5	1	4	0	0
>75%	1	2.5	4	18	1	20
TOTAL	40	100	22	100	5	100

Similarly, grouper had varying levels of contribution to the total seafood trade of middlemen, hotels and restaurants, and exporters involved in Fiji’s grouper value chain (Table 22). For all three respondent groups, the majority of respondents stated that grouper factored as less than 25% of their total seafood trade, although respondents did not indicate whether they were referring to trade volume or value.

Two respondent groups – middlemen and hotels and restaurants – were asked about their level of satisfaction with their income from grouper (see Table 23). In both cases, most respondents stated that they were “mostly satisfied” with their grouper income.

Table 23: Respondents’ satisfaction with grouper income

Level of satisfaction	Middlemen		Hotel and restaurant	
	n	%	n	%
Very satisfied	14	35%	5	23%
Mostly satisfied	15	38%	11	50%
Not satisfied	10	25%	6	27%
Don't care	1	3%	0	0%
TOTAL	40	100%	22	100%

In summary, fishers received more per kilogram for all grouper species when selling to customers at public markets than when selling to middlemen and, on average, they captured around 33% of the export value of grouper (per kg) from Fiji, although this figure does not consider the cost of selling which can be highly variable. However, their average individual net monthly income from grouper (FJ\$787) was lower than that of individual hotels and restaurants (FJ\$1,224), middlemen (FJ\$2,890), and considerably less than exporters (FJ\$8,561) (Figure 8). There were inconsistent trends in terms of which species held the highest value at each stage of the chain, however *E. polyphkadion*, *E. fuscoguttatus*, and *P. leopardus* held the highest value at six out of eight stages. Grouper markups by hotels, restaurants, and exporters appeared to be higher than by middlemen. Seasonal grouper price shifts occurred, especially for fishers’ sales at public markets, and for middlemen’s purchasing and sales, however consistent trends were unclear.

All respondent groups reported various costs associated with fishing or trading grouper that are important to consider alongside the unit values that they attain from grouper. Overall, while grouper had varying levels of monetary importance to survey respondents, the most respondents from each segment reported that grouper represented less than 25% of their total income or seafood trade.

Q3. Challenges to attaining value, and possible areas of wastage (loss of value), along the chain

There were some clear trends between different respondent groups (fishers, middlemen, hotels and restaurants, and exporters) in terms of the popularity of selling different grouper species (Table 24). For example, across segments, the species sold by the most number of respondents were *P. leopardus* and *E. polyphkadion*. Conversely, *E. merra* was amongst the least three popular species sold for all groups and was the least frequently marketed. However, other than the relatively higher value usually noted for *P. leopardus*, there was a lack of consistency in the popularity of sales of other grouper species.

Some grouper species were caught, purchased, or sold in higher volumes than others although trends between value chain segments were unclear (Table 25). For example, in the high season and when reporting in kg, fishers on average reported '*E. tukula*' and *E. polyphkadion* as having the highest catch volumes per trip, compared to '*E. tukula*' and *P. leopardus* during the low season. However, catch volume trends were different when reported in bundles. On

average, middlemen reported their highest monthly sales volumes for *E. malabaricus*, *P. leopardus*, and *E. polyphkadion* when reporting in kilograms, versus *E. merra*, *E. fuscoguttatus*, and *E. polyphkadion* when reporting in bundles. Hotels and restaurants reported purchasing the highest volumes of '*E. tukula*', *E. cyanopodus*, *E. merra*, *P. areolatus*, and *P. laevis* (per kg), versus *P. leopardus* and *E. coioides* (per bundle).

Some potential causes of inconsistencies in the data are that the frequencies of hotel and restaurant respondents' reported purchase volumes were uncertain, and are being compared with per trip catch volumes for fishers and per month catch volumes for middlemen. In addition, sales volumes of grouper dishes from hotels and restaurants were not distinguished by species (generally averaging 17 dishes per week during the high season [SD = 26], and 16 dishes per week during the low season [SD= 26]); likewise exporters' grouper volumes were not distinguished by species and hence these are not included in Table 25.

Table 24: Percentage of each respondent group selling each species of grouper along value chain.

	Fishers (n=71)		Middlemen (n=40)		Hotels and restaurants (n=22)		Exporters (n=5)	
1	<i>P. leopardus</i>	85	<i>E. polyphkadion</i>	73	<i>P. leopardus</i>	59	<i>E. polyphkadion</i>	80
2	<i>E. polyphkadion</i>	76	<i>P. leopardus</i>	70	<i>E. polyphkadion</i>	50	<i>P. leopardus</i>	
3	<i>E. fuscoguttatus</i>	63	<i>E. malabaricus</i>	45	<i>E. malabaricus</i>	36	<i>E. coioides</i>	60
4	<i>P. areolatus</i>	61	<i>P. areolatus</i>	43	<i>E. coioides</i>	23	<i>E. malabaricus</i>	
5	<i>P. laevis</i>	56	<i>E. fuscoguttatus</i>	40	<i>P. laevis</i>	18	<i>E. cyanopodus</i>	40
6	<i>E. coioides</i>	48	<i>E. cyanopodus</i>	28	' <i>E. tukula</i> '	9	' <i>E. tukula</i> '	20
7	<i>E. malabaricus</i>	45	<i>E. coioides</i>	23	<i>E. cyanopodus</i>		<i>E. fuscoguttatus</i>	
8	<i>E. cyanopodus</i>	28	<i>P. laevis</i>		<i>E. merra</i>		<i>P. areolatus</i>	
9	<i>E. merra</i>	18	<i>E. merra</i>	20	<i>P. areolatus</i>		<i>P. laevis</i>	
10	' <i>E. tukula</i> '	16	' <i>E. tukula</i> '	13	<i>E. fuscoguttatus</i>	5	<i>E. merra</i>	0

Table 25: Harvest, purchase, and sales volumes of grouper species.

	Mean catch, purchase, or sales volume (kilograms or bundles)							
	Fishers				Middlemen		Hotels & restaurants	
	High season catch (per trip)	SD	Low season catch (per trip)	SD	Sales (per month)	SD	Purchases (variable frequencies)	SD
<i>E. polyphemadion</i>	40.1	62.8	12.8	20.2	230	210	28.4	31.4
	7.3	3.3	2.9	1.3	56.8	56.2	2	1.4
<i>E. fuscoguttatus</i>	35.4	55.2	14.6	24	120	70.9	N/A	N/A
	7.4	3.2	3	1.5	74.7	70.7	N/A	N/A
' <i>E. tukula</i> '	40.8	34.4	19.2	15	40	0	75	0
	8.2	4.1	3.3	1.6	22	25.5	N/A	N/A
<i>E. cyanopodus</i>	16.9	16.4	5.4	4.3	106.3	83.1	75	0
	8.3	4	3.8	1.6	45	35.4	N/A	N/A
<i>E. coioides</i>	33.7	57.8	13.7	25.3	176.7	128.6	41	48.1
	8.3	3.5	2.7	1.3	70	42.4	5.5	6.4
<i>E. malabaricus</i>	33.5	56.7	15.1	25.1	233.3	220	49	45.7
	7.3	3.7	3.3	1.4	51	49.1	1.8	1.1
<i>E. merra</i>	25.2	17.1	9.5	7.1	200	0	75	0
	7.3	3.4	3.5	1.6	77	75.6	N/A	N/A
<i>P. areolatus</i>	35.9	53.9	14.8	23.2	188	219.9	75	0
	7.5	3.4	2.9	1.2	38.6	46.5	N/A	N/A
<i>P. laevis</i>	34.7	55.7	14.2	24	211.7	160.8	75	0
	7.3	3.6	2.8	2.2	13.5	9.2	1	0
<i>P. leopardus</i>	38	50.3	16.5	25.5	231.7	196.1	29.1	30.7
	7.5	3.3	2.8	1.4	38.3	33.2	6.4	7.4

Comparing the grouper product forms sold by different actors along the value chain could be helpful for uncovering possible areas for enhancing value to certain participants (e.g., fishers). For example, while the majority of fisher respondents (n=49, 70%) sold their grouper whole and cleaned (i.e. gutted and/or gilled), several respondents sold their catch whole and uncleaned (n=21, 30%) (Table 26). Several reasons were provided for not gutting or gilling grouper catch, including maintaining quality, freshness, and colour, and avoiding bacteria and spoilage (n=11); buyer preferences or requirements (n=7); not having enough time to clean grouper between catching it and selling it (n=3); cleaning being the customer's responsibility (n=1); and no gutting being allowed at the public market where grouper is sold (n=1).

Table 26: Form of grouper product sold by fishers.

Form of grouper when sold	n	%
Whole, uncleaned	21	30
Whole, cleaned	49	70
i.e. gutted	48	69
i.e. gilled	46	66

Frozen leopard coral trout all stacked into a freezer in plastic for export shipment.
@Yvonne Sadovy



Dead leopard coral trout being sold in market all displayed.
@Yvonne Sadovy



While processing details were not provided by exporters, respondents did state the form in which they sold grouper (frozen, fresh, or live) (Table 27). Responses varied based on species, however more exporters sold grouper frozen rather than fresh, although exports are often not reported to species level and export sizes are not indicated. One exporter reported exporting *P. leopardus* in both fresh and frozen forms. None of the respondents reported live exports of grouper species from Fiji. Frozen *P. leopardus* are carefully packed for export and attractively arranged for domestic sale.

Table 27: Product forms (number and % of respondents) of grouper exports from Fiji; none were exported live. NA=data not available.

Grouper species	Frozen		Fresh	
	n	%	n	%
<i>E. polyphemadion</i>	4	80	0	0
<i>E. fuscoguttatus</i>	0	0	1	20
' <i>E. tukula</i> '	0	0	1	20
<i>E. cyanopodus</i>	2	40	0	0
<i>E. coioides</i>	3	60	0	0
<i>E. malabaricus</i>	3	60	0	0
<i>E. merra</i>	N/A	N/A	N/A	N/A
<i>P. areolatus</i>	1	20	0	0
<i>P. laevis</i>	1	20	0	0
<i>P. leopardus</i>	4	80	1	20

There were some similarities between value chain actors with regards to perceptions about which factors affect grouper pricing (Table 28). For example, the largest number of fishers, middlemen, and exporters³² stated that size was the most important factor determining price, while the fewest noted season as being important. At the same time, there were some inconsistencies in perceptions with regards to price. As an example, a majority of fishers and middlemen

³² This information was not available for hotel and restaurant respondents.

stated that grouper prices were affected by whether or not the fish was fresh, versus a minority of exporters. In addition, all exporter respondents stated that grouper species and appearance, and whether the grouper has been speared (spearing can negatively affect the appearance of the fish) or cleaned, affects prices, while fewer respondents in the fisher and middlemen categories noted the same. It is possible that different factors affect price at different stages of the chain (i.e., for shipments to export markets, versus for local sales). However, it is also possible that price factors are not communicated adequately from downstream to upstream actors along the chain, and that providing such information (i.e., to fishers) in future could present an opportunity for improved price transmission.

While hotels and restaurants were not included in Table 28, they did provide insights as to problems with grouper supply to their establishments (Figure 9). Most respondents (n=16, 73%) identified more than one type of problem with grouper supply to their establishments, with poor appearance and small size of grouper being the top two issues noted. Most respondents also noted that there are substitutes for grouper in their dishes, such as trevally, mangrove jack, mullet, unicornfish, Spanish mackerel, red snapper, mahi mahi, wahoo, parrotfish, orange coloured sea perch, lobster, deep sea cod, barracuda, processed fish balls, rabbitfish, wrasses, emperors, snapper, among other reef fish species. Conversely, four respondents (18%) stated that they do not have substitutes for grouper, either because they only cook grouper (n=2, 9%) or because they specifically prefer to serve dishes with *P. leopardus* (n=2, 9%). It is noteworthy that *P. leopardus* is often identified as a higher valued species downstream along the trade chain.

Table 28: Perceptions of factors affecting grouper prices (in percentages).

	Fishers (n=71)		Middlemen (n=40)		Exporters (n=5)	
1	Size	54	Size	51	Size	100
2	Fresh	44	Fresh	38	(Un)speared	100
3	Appearance	42	(Un)cleaned	34	Species	100
4	(Un)cleaned	34	(Un)speared	28	Appearance	100
5	(Un)speared	21	Appearance	27	(Un)cleaned	100
6	Frozen	4	Species	7	Frozen	60
7	Species	3	Frozen	1	Fresh	40
8	Season	3	Season	0	Season	20

Middlemen noted several areas where improvements could be made to enhance their profits from grouper (see Figure 10). In particular, changing customer type, improving fish quality, and reducing costs were three key areas noted.

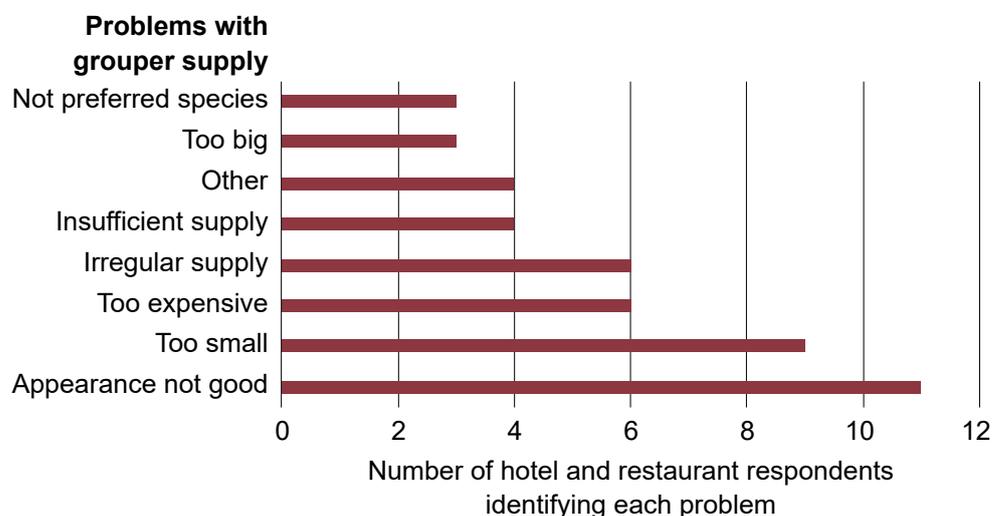


Figure 9: Problems with grouper supply identified by hotels and restaurants.

In summary, the species sold by the most respondents in each segment were *P. leopardus* and *E. polyphkadion*, while *E. merra* was in the bottom three for each group as a traded species. Some grouper species were caught, purchased, or sold in higher volumes than were others; however there were no consistent trends among value chain segments. Most fishers sold grouper whole and cleaned, while most exporters sold grouper frozen, some sold fresh, and none reported selling live grouper. There were some similarities between different value chain actors with regards

to which factors affect the prices of grouper – with size ranked as important by most respondents from each group, and season ranked as important by the least. However, there were also inconsistencies regarding perceived price factors between groups, and better information (particularly to fishers in relation to preferred species sizes and condition) might improve price transmission. Hotels and restaurants noted poor appearance and small size as the main issues with grouper supply, and had several substitutes for grouper available to them.

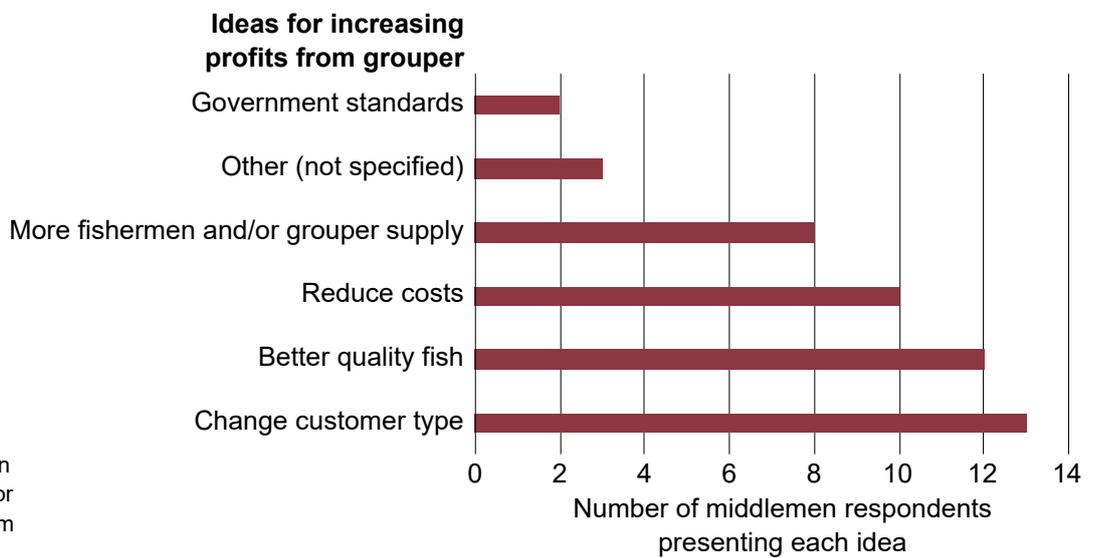


Figure 10: Middlemen respondents' ideas for increasing profits from grouper

Mixed fish, including many groupers, waiting to be picked up from middleman sales outlet and just scattered on the floor.

© Martin Russell



Q4. Perceptions on the state of Fiji’s grouper resources

Just over half of the fisher respondents stated that there has been no change to the fishing grounds where they catch grouper, while a third stated that they travel further now than they used to (n=20, 33%) and about a sixth travel less far now than they used to (n=10, 16%) (Table 29). Of those who travel further now (n=20), most (n=18, 90%) stated that there are fewer fish in nearby inshore reefs than there used to be, or that they catch more fish by travelling further; a few travel further now to fish in grouper spawning areas (n=1, 5%) or because their local chief no longer provides fishing licences for nearby fishing areas (n=1, 5%). There was not a question about whether fishers fished for longer nowadays than they did before (in order to maintain catches) which could also be an indicator of changing resource condition.

Table 29: Perception of changes to travel times to fishing grounds by local fishers.

Change in distance travelled when fishing	n	%
No change	31	51
Travel less far now	10	16
Travel further now	20	33
TOTAL	61	100

Some fishers noted issues with the sustainability of grouper fishing in Fiji. For example, while some fisher respondents (n=29, 41%) viewed grouper populations as stable or increasing, the majority (n=42, 59%) stated that grouper populations in Fiji were declining. Of those who stated the latter, perceived reasons for these grouper declines and proposed measures to deal with these declines are highlighted below. Several respondents identified more than one perceived cause of grouper declines, and/or more than one measure to deal with grouper declines.

In particular, fishing changes (i.e., more boats, new gear), overfishing, and natural changes were noted as causes for decline in Fiji’s grouper populations (Figure 11).

The primary measure suggested by fishers for dealing with these declines was spatial protection, followed by seasonal protection, gear restrictions, and other measures (Figure 12).

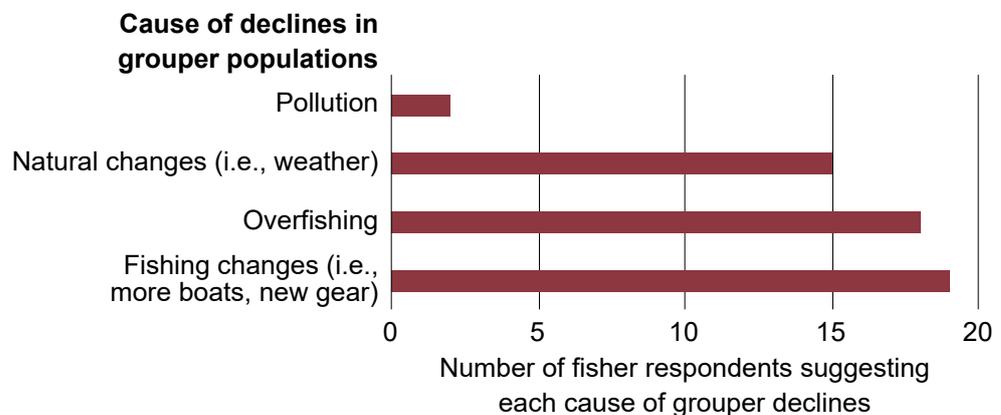


Figure 11: Fishers’ perceived causes of declines in grouper populations.

When asked how they would make a living if they could no longer catch grouper, most fisher respondents stated that they would continue fishing, but for other species (Figure 13). Examples of other fishing options presented included fishing for shellfish (i.e., bêche-de-mer, crab, lobster, prawn), pelagic fish, emperor and other reef fish. Non-fishing

livelihood options included farming (i.e., sugarcane, vegetables, rice, copra, chicken, eggs, sugarcane, sandalwood, goat, and the traditional root kava) or other businesses (i.e., fuel sales, canteens, market vending, and other stores). A minority of respondents (n=11, 15%) noted they had more than one alternative livelihood option.

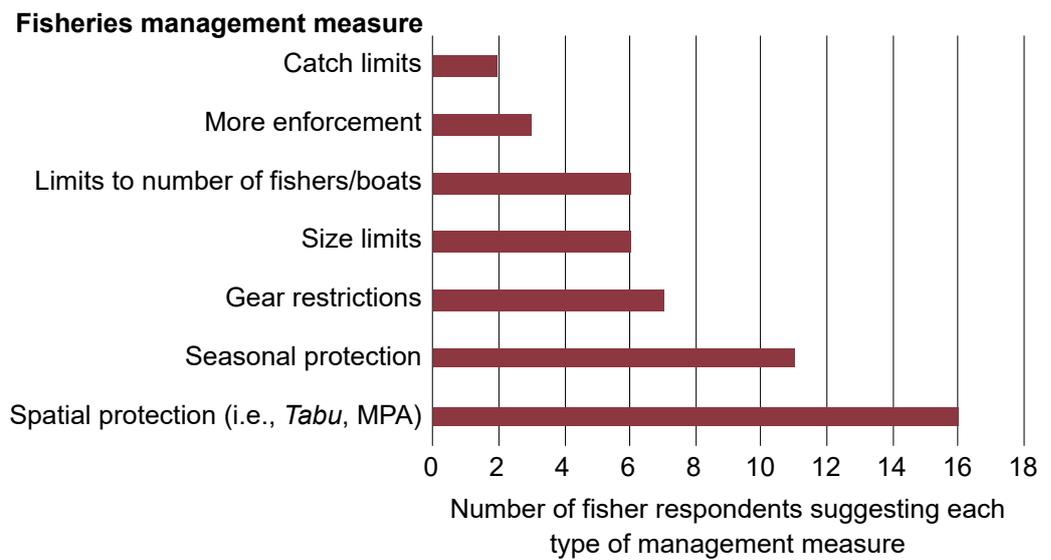


Figure 12: Suggested measures by fishers to address declines in grouper populations.

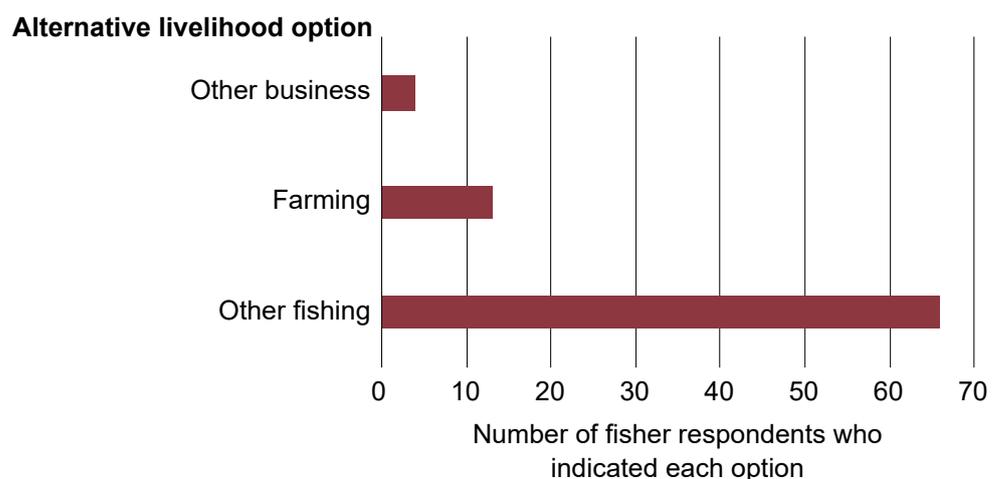


Figure 13: Alternative livelihood options expressed by grouper fishers.

The majority of respondents in each value chain segment was aware of the 4FJ campaign (Figure 14). This is a public awareness campaign aimed at discouraging Fijians from fishing, eating, buying, or selling grouper during the breeding season (June to September) to protect the resource and ensure the species has a future in Fiji to preserve its traditional use. It is possible that further leveraging this campaign – given that it is known to many of the value chain’s stakeholders – could be a mechanism for spreading the word more widely on grouper resource issues in Fiji.

In summary, while most fishers stated that they had not experienced changes to grouper fishing grounds some noted

that they travel further to fish now, and flagged fewer grouper in inshore reefs as the cause. The majority of fisher respondents stated that grouper populations in their area were declining, pointing to fishing changes (i.e., more boats, new gear), overfishing, and natural changes as the key causes perceived for these declines.

Ideas for addressing these declines included introducing spatial protections, seasonal protections, and gear restrictions. In terms of alternative livelihood options to catching grouper, most fishers envisioned continuing to fish, albeit for different species. The majority of respondents to the survey were aware and supportive of the 4FJ campaign for conserving grouper in Fiji.

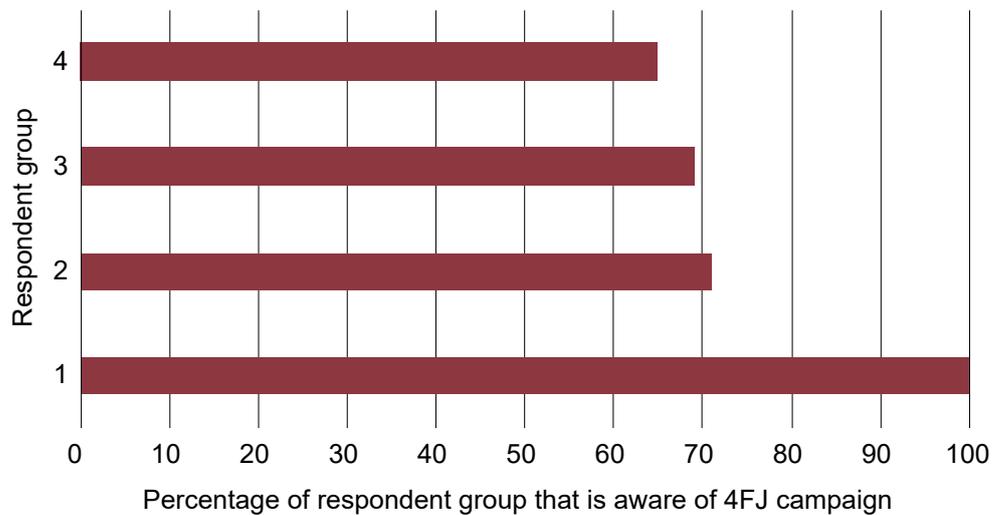
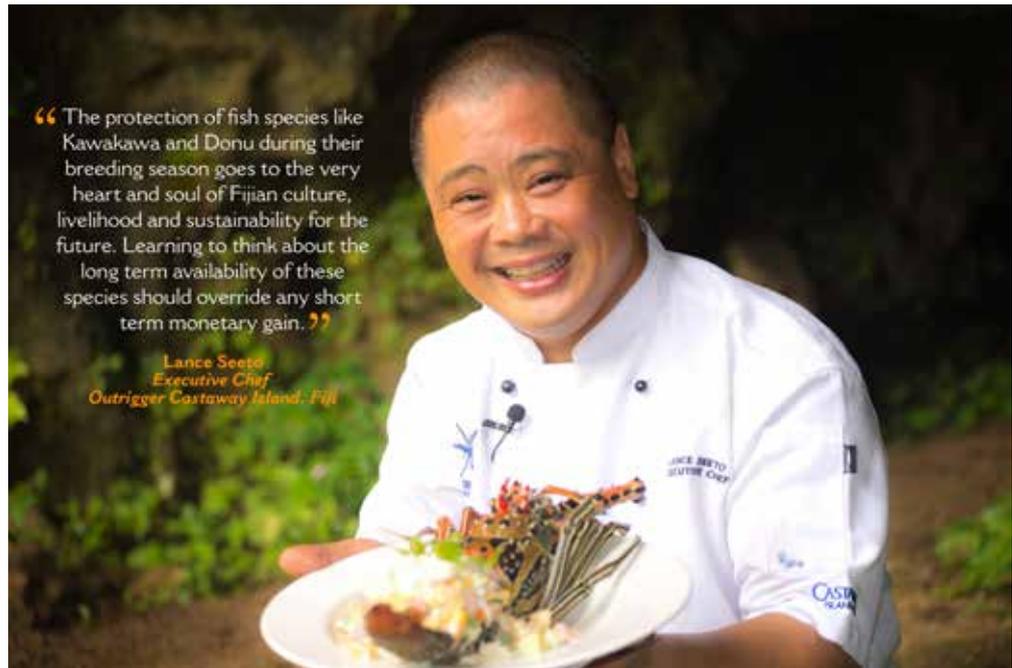


Figure 14: Knowledge of 4FJ campaign by different respondent groups.

1= exporter (n=5);
 2=hotel & restaurant (n=22); 3=fisher (n=71);
 4=middlemen (n=40)

Nationally renowned chef Lance Seeto pledges his support to the 4FJ campaign.
© cChange. Courtesy of Lance Seeto



Environmentalist Mrs Suliana Siwatibau pledges her support to the 4FJ campaign.
© cChange



Q5. Recommendations for attaining more value from Fiji’s grouper fishery

In total, the study’s value chain participants in Fiji earned around FJ\$3 million from grouper annually, yet of these, fishers had the lowest monthly grouper net (i.e. not including expenses associated with selling) incomes, compared to hotels and restaurants, middlemen, and exporters. This is consistent with other studies that have found that small-scale fishers, particularly in less developed countries,

reap the lowest share of financial benefits from traded seafood (Bjørndal et al. 2015; Purcell et al. 2017). A series of recommendations for enhancing fisheries value for small-scale fishers adapted and expanded from a Food and Agriculture Organization of the United Nations (FAO) study (Bjørndal et al. 2015) is relevant to the Fiji grouper value chain context (Table 30).

Table 30: Recommendations for enhancing value to fishers engaged in the grouper fishery in Fiji.

Key findings	Recommendations
Most fishers catch grouper for both food and income.	<ul style="list-style-type: none"> Consider local food security implications of growing export-oriented value chains. If food security is a national priority then this should be a key consideration when the resource is limited and/or depleted.
Fishers perceive different factors affecting grouper prices when compared with downstream actors (i.e., hotels, restaurants, exporters).	<ul style="list-style-type: none"> Disseminate price information to fishers for different species and sizes. This will need government or NGO support because it is in the interest of upstream actors to be opaque about pricing to increase bargaining power. For example, certain species such as <i>P. leopardus</i> can gain much higher downstream prices but fishers are not receiving the price differential; indeed the prices received by Fiji’s fishers vary little across species, unlike downstream. Fish condition and size are also important factors in pricing that fishers could benefit from. Seasonal price differences sometimes occur, with prices higher when supply is less.
Downstream actors (i.e., hotels, restaurants, exporters) have higher grouper markups than upstream actors (i.e., middlemen), while fishers have the lowest net income from grouper.	<ul style="list-style-type: none"> Organize fishers into producer groups to share resources and enhance bargaining power. With business training, more fishers could take on middleman roles (see also Sadovy de Mitcheson and Ramoica 2015). Fishers would need to be organized to take advantage of market price fluctuations and some of the price differentials.
Fishers earn more for all grouper when selling directly through public markets than to middlemen.	<ul style="list-style-type: none"> Promote sales outlets and opportunities that enhance seller power for fishers. Consider strengthening domestic sales channels. Explore direct sales, marketing and labelling strategies, and fisher cooperatives. Train fishers in managing money and sales.

Key findings	Recommendations
<p>Survey data suggest that at least 8% (and possibly much more) of Fiji's grouper catch is destined for export, and the highest net earnings and profit margins from grouper in Fiji are captured by exporters. With very few exporters and uncertain benefits of exporting to either middlemen or fishers, it is not clear how Fiji is benefitting from exports. Fishers and middlemen do not get better prices from exporters than selling domestically</p>	<ul style="list-style-type: none"> • Improve grouper catch data. • Consider export taxes for grouper if these are exported at all. • If grouper are exported, there is need to strengthen oversight of shipments (by volume and species, both of which appear to be underreported) to ensure that these are fully reported. Exports should also conform to existing minimum size regulations for grouper capture. • If exports are permitted, there should be sustainable export quotas assigned and only a limited number of trustworthy companies permitted to export controlled volumes outside the spawning season.
<p>The majority of fishers believe that grouper populations in their area are declining, in part due to increased fishing effort and overfishing.</p>	<ul style="list-style-type: none"> • Address price asymmetries (i.e., higher prices for diminished stocks and lowered supply). • Conduct simple but standardized catch monitoring and assessment methods to determine stock status (e.g. Prince et al. 2017)
<p>Several fishers noted that they have received government funding for their boats and gear despite declining resources.</p>	<ul style="list-style-type: none"> • Reduce subsidies that distort economic incentives and increase fishing effort.
<p>The majority of fishers sell grouper whole and fresh, sometimes without due attention to condition (gutting, placed on ice, etc.) while exporters primarily sell grouper whole and frozen.</p>	<ul style="list-style-type: none"> • Consider mechanisms for fishers to freeze their catch, and marketing campaigns that highlight the quality of frozen products, to enhance fisher selling power due to decreased perishability. Also assist fishers to improve the quality of the fresh fish they take to market. • However, this depends on the preferred market. For example, if tourism sector and domestic consumption is a priority then these are the sectors to focus on with respect to grouper quality (better handling in boat and during transportation, cleaning etc.).
<p>The structure of Fiji's grouper value chain resembles an hourglass shape (many fishers, few exporters or middlemen, many consumers).</p>	<ul style="list-style-type: none"> • Consider the effects of industry consolidation and vertical integration on fishers (see number 4 above for the value of cooperatives and of training fishers in marketing and money management).
<p>Some middlemen and export companies have economic arrangements with fishers that go beyond purchasing their catch.</p>	<ul style="list-style-type: none"> • Investigate whether there is indebtedness when companies supply fishers with boats such that the fish prices they gain may be reduced, to the disadvantage of fishers. • Determine whether middlemen are pushing fishers to increase production without concerns for resource condition (Sadovy de Mitcheson and Ramoica 2015). For example, fishers are sometimes told not to return to shore without filling supplied coolers. This pressure could increase with growing demand from domestic and export markets.

Q6. Recommendations for managing Fiji's grouper exports

1. Since most fishers catch grouper for both food and income it is important that local food security and sovereignty are considered in the shaping and development of Fiji's growing export-oriented value chain for grouper. This includes domestic use of some grouper for local consumption which have a local traditional importance (such as *E. polyphkadion*) and for the tourism sector (for food as well as tourism opportunities for divers).
2. Consider restricting exports to non-food fish (or invertebrates), or to cease commercial reef fish exports altogether, at least until better control measures can be implemented on species, volumes and sizes of fish exported and an assessment conducted to see whether exports can be sustained in addition to supply to the domestic market. If grouper exports are permitted, the volumes, species and sizes exported should be determined in line with resource status and exports not permitted during the spawning season.
3. Most fishers believe that grouper populations in their area are declining, in part due to increased fishing effort and overfishing. At the same time, several fishers noted that they have received government funding for their boats and gear. To eliminate overfishing and limit fishing pressure to within sustainable bounds close attention should be paid to pressures from export markets. These pressures come from middlemen prompting fishers to fish more than they otherwise would through provision of fishing vessels and assigning minimum catch quotas for fishers that use these boats.
4. Data are urgently needed on the condition of grouper populations that supply the fisheries directly associated with export trade which is under pressure to grow due to growing demand for certain reef fish species in several overseas markets. Exports should be carefully monitored for species, volumes and sizes and to avoid export of threatened fishes (such as bumphead parrotfish or humphead wrasse).
5. If exports are permitted, tax or tariff should be charged to provide greater benefits to Fiji from these fish. Middlemen and fishers appear to benefit equally whether fish are sold for domestic use or for export. As a result, the benefits of exporting fish only go to a handful of exporters yet put additional pressure on limited resources domestically.
6. Pricing could be much better adjusted for fish species, sizes and with better knowledge of buyer needs and supply issues. For example, fishers appear to be paid the same amount irrespective of species and yet some fish, like *P. leopardus*, should fetch much higher prices due to market interest; likewise, particular size ranges of fish are particularly valued (see Appendix for examples). Closer linkages between consumers or retailers and producers would shorten trade chains, and increase transparency, traceability and earnings along the trade chain. Species type is a high priority for exporters but much less of a consideration for middlemen or fishers.
7. In the government classification of economic species (under FIRCA- which controls export products) the export category of 'grouper' should be specifically identified and the grouper species indicated.

Conclusions

We set out to conduct VCA for the grouper coral reef fishery in Fiji, with the goal of informing policy makers on how higher economic values and benefits can be derived from grouper for value chain actors (particularly fishers) in Fiji and how well the trade chain might be supported by the underlying grouper resources. Based on our findings from survey questionnaires with fishers, middlemen, hotels and restaurants, and exporters involved in Fiji's grouper fishery and trade, we have provided recommendations on how to manage grouper exports from Fiji considering the importance of and need for better resource sustainability and for capturing more economic benefits for the Fijian economy while not undermining food security. We were particularly interested in increasing benefits for fishers.

Our findings show, among other things, that most grouper fishers in Fiji target more than one species of grouper, using primarily hook and line, or free dive with spear (although there are many reports of spearing grouper on SCUBA from other studies e.g. Sadovy de Mitcheson and Ramoica 2017); most fishers catch grouper for both food and income. Of a total annual potential estimated grouper catch volume of 845,000 kg plus 245,000 bundles, at least 70 tonnes of grouper per year are exported from Fiji to New Zealand, the United States, mainland China, Hong Kong and South Korea although export volumes may be considerably greater as inferred from reluctant reporting by a major exporter and their high investment in vessels for fishing for export. It is also clear that grouper catches are many-fold higher than official figures on grouper landings in Fiji. These data highlight the

urgent need to much better understand both the grouper landings and export volumes each year.

Our results suggest the following: it is important that local food security and domestic use be given top consideration in the management of Fiji's fishery and when considering the potential development of Fiji's growing export-oriented value chain for grouper. In addition, to achieve higher values from grouper and better availability for Fijians, it is important that exports be controlled and taxed, or prohibited until they are better controlled since these further drive fishing pressure on grouper and as demand for grouper from international markets grows. FIRCA could create a commodity code for 'groupers' or for key grouper species exported to gain a better understanding of the volume and value of this trade.

Training in finances, in grouper quality control and better access to market prices, could enable fishers to increase the value of the grouper they trade and sell recognizing that fish condition, availability, size and species can all be important price determinants.

To improve compliance and enforcement and also to gain a snapshot of the health of the grouper fishery over time, there is a need to ensure collection of data (including species, volume, size, supplier) at domestic market places. This could be achieved by collaboration between, for example, the Ministry of Fisheries and municipal city councils.

There are multiple opportunities for fishers to obtain better prices for the fish they catch and sell.

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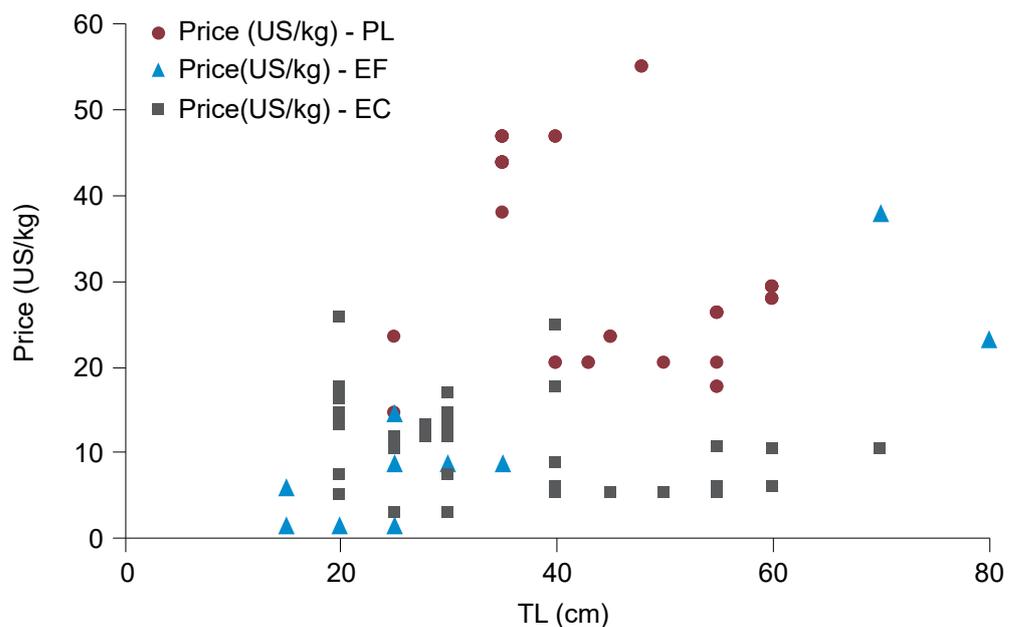
Appendix

Retail prices surveys in mainland China outlets

A retail market survey was conducted in mainland China, in Hainan Is, Shenzhen, Guangzhou and Xiamen between mid 2017 and mid 2018. Of the grouper being sold in retail outlets, such as shops, three species are exported from Fiji and so were used to provide price data at the consumer end of the export trade chain for the China market. Mean prices (and standard deviations) for *P. leopardus*, *E. coioides* and *E. fuscoguttatus* and mean sizes are provided in the following table and illustrated in the graph. The data clearly show price differentials among the three species, with *P. leopardus*

the highest priced and large price variability in particular for larger fish and for *E. fuscoguttatus*. The latter varies considerably in retail price because it is sold both from the wild and from mariculture and prices can vary substantially according to mode of production, with wild fish preferred. Note that in the table US\$ had been converted to FJ\$ at the rate of 2.02. It is noteworthy that the other highly valued species in these surveys was *Cephalopholis sonnerati*, also preferred for its red colour, which is no longer common in Fiji and so was not part of the main interview study.

	<i>P. leopardus</i> (PL)		<i>E. fuscoguttatus</i> (EF)		<i>E. coioides</i> (EC)	
	TL cm	PRICE (FJ\$)	TL cm	PRICE (FJ\$)	TL cm	PRICE (FJ\$)
Mean	45.05	67.57	21.9118	10.40	37.91	19.76
SD	10.79	23.78	11.2644	11.96	14.30	10.14





Plectropomus leopardus, which our study found to be the most valuable grouper, here shown in the wild.

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