ORIGINAL RESEARCH

A comparison of socioeconomic dynamics and market performance in lobster and giant freshwater prawn value chains in Sri Lanka

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ABSTRACT. Wild-captured lobster fisheries and cultured giant freshwater prawns (GFP) in Sri Lanka cater to high-end markets with significant exports. However, there is a notable gap in existing literature on value chain analysis and market performance aspects in both sectors. This study identified actor profiles and value chain dynamics in both sectors using structural mapping. Market performance was assessed through costs, margins, price spread, and marketing efficiency, with differentiation strategies proposed for sectoral growth. Data collection involved interviewer-administered questionnaires and in-depth interviews with 748 fishers, 44 collectors, and 12 exporters from December 2022 to March 2024. Results highlighted that the lobster value chain was highly export-driven, with a concentration on live trade and premium pricing. Fishers and collectors faced risks from fluctuating stocks and strict regulations, while exporters dealt with logistical and market volatility. Upstream actors often overexploit resources to increase yields, rather than improve quality, leading to unsustainable practices. To mitigate market challenges, actions like promoting products under branding tags such as 'wild-caught lobster' and 'conventionally cultured GFP', maintaining food safety and quality standards and optimizing logistics are essential for enhancing competitiveness. The GFP sector operates in both domestic and export markets, competing with commodity shrimp. While it provides employment, its financial performance is moderate, limited by high farming costs and pricing competitiveness. Differentiation efforts should focus on sustainable labeling, value-added products, direct exports, and catering to niche markets to boost profitability and reduce dependence on bulk markets.

Key words: Differentiation strategies, high-value crustaceans, sustainability.

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Comparación de la dinámica socioeconómica y el desempeño del mercado en las cadenas de valor de la langosta y el camarón gigante de agua dulce en Sri Lanka

RESUMEN. Las pesquerías de langosta silvestre y langostino gigante de agua dulce (GFP) de cultivo en Sri Lanka abastecen a mercados de alta gama con exportaciones significativas. Sin embargo, existe una notable brecha en la literatura sobre el análisis de la cadena de valor y los aspectos del desempeño del mercado en ambos sectores. Este estudio identificó los perfiles de los actores y la dinámica de la cadena de valor en ambos sectores mediante un mapeo estructural. El desempeño del mercado se evaluó a través de costos, márgenes, diferencial de precios y eficiencia de comercialización, y se propusieron estrategias de diferenciación para el crecimiento sectorial. La recopilación de datos incluyó cuestionarios administrados por entrevistadores y entrevistas en profundidad con 748 pescadores, 44 recolectores y 12 exportadores, entre diciembre de 2022 y marzo de 2024. Los resultados destacaron que la cadena de valor de la langosta estaba altamente orientada a la exportación, concentrándose en el comercio de ejemplares vivos y precios prémium. Los pescadores y recolectores se enfrentaban a los riesgos derivados de la fluctuación de las poblaciones y las estrictas regulaciones, mientras que los exportadores lidiaban con la volatilidad logística y del mercado. Los actores aguas

arriba a menudo sobreexplotan los recursos para aumentar la producción, en lugar de mejorar la calidad, lo que conduce a prácticas insostenibles. Para mitigar los desafíos del mercado, acciones como la promoción de productos con etiquetas como "langosta silvestre" y "GFP de cultivo convencional", el mantenimiento de los estándares de inocuidad y calidad alimentaria y la optimización logística son esenciales para mejorar la competitividad. El sector de GFP opera tanto en el mercado nacional como en el de exportación, compitiendo con el camarón comercial. Si bien genera empleo, su rendimiento financiero es moderado, limitado por los altos costos de cultivo y la competitividad de precios. Los esfuerzos de diferenciación deben centrarse en el etiquetado sostenible, los productos con valor añadido, la exportación directa y la atención a nichos de mercado para impulsar la rentabilidad y reducir la dependencia de los mercados a granel.

Palabras clave: Estrategias de diferenciación, crustáceos de alto valor, sustentabilidad.

INTRODUCTION

The lobster fishery is one of the oldest and well-established fisheries industries, and a highly valuable commercial venture in Sri Lanka (Seneviratne and Munasinghe 2013; Hewapathirana et al. 2022; Basnayake and De Silva 2023). In addition, the lobster market is primarily geared toward exports, with only a small portion of the catch reserved for local markets, especially tourist hotels (Koralagama et al. 2007). Six species of spiny lobsters have historically been recorded in Sri Lankan coastal waters (Jayakody 1989; Jayawickrema 1991), specifically *Panulirus homarus* (Linnaeus, 1758), *P. ornatus* (Fabricius, 1798), *P. versicolor* (Latreille, 1804), *P. longipes* (A. Milne-Edwards, 1868), *P. polyphagus* (Herbst, 1793), and *P. penicillatus* (Olivier, 1791). However, due to intense fishing pressure and other human activities, only five species remain, and *P. polyphagus* is no longer present (Liyanage and Long 2009). Furthermore, due to a significant decrease in the lobster population in Sri Lanka, several regulations have been implemented to protect this valuable industry (Seneviratne and Munasinghe 2013).

The Giant Freshwater Prawn (GFP), *Macrobrachium rosenbergii* de Man 1879, is a prominent species in global aquaculture. It is widespread across tropical and subtropical regions, with a natural range extending from northwest India to Southeast Asia (Haslawati et al. 2022). According to Amarasinghe (2014), the inland fisheries sector in Sri Lanka encompasses capture fisheries in freshwater, culture-based fisheries, and shrimp farming. The National Aquaculture Development Authority (NAQDA) of Sri Lanka, in collaboration with public and private stakeholders, has carried out ongoing stocking of the native GFP in selected reservoirs (Rajeevan et al. 2021). The GFP also has gained importance due to its appealing flavour, high market value, export-oriented nature, and suitability for large-scale cultivation in both freshwater and brackish environments (Basnayake et al. 2023) However, *M. rosenbergii* culture remains limited primarily due to a shortage of freshwater prawn seeds (Rajeevan et al. 2019). More importantly, the final harvests of GFP are being sold to high-end restaurants and hotels in Sri Lanka or exported. According to the export data of NAQDA (2023), the GFP export quantity was recorded at 86.02 t, with a value of 1.75 million USD. Primary exporting destinations are Thailand and China (Ariyaratne and Amaraweera 2015).

In the case of lobster fisheries, several components of the value chain such as price, trade, product exploitation, eco-certification and the impact on policy changes have been evaluated in different countries (Salladarré et al. 2017; Wang et al. 2019; Otumawu-Apreku and McWhinnie 2020; Gordon 2021), and in the case of GFP, culturing and production, marketing and trade, and consumer behavior were mainly targeted, including Sri Lanka (Liao and Smith 1981; Wijenayake et al. 2005; Ahmed et al. 2007, 2014, 2016; Dasgupta et al. 2007, 2008; Jeyanthi and Gopal 2012; Freeman et al. 2016; Pushpalatha et al. 2017; Abeyrathne et al. 2020).

Surprisingly, the structure of the value chain of the lobster fishery and GFP, based on socio-economic and market dynamics in Sri Lanka, has not been examined in detail despite the economic importance of these resources.

This study aimed to identify differentiation strategies to gain a competitive advantage by analyzing the profiles of value chain actors and comparing value chain activities from fishers to local traders, collectors, exporters, and consumers. The study sought to address the following questions: 1) What are the actor profiles for both the lobster and GFP value chains? 2) What type of value chain dynamics, such as flows, relationships, and governance, operate among actors? 3) How does market performance vary across the two value chains? 4) What differentiation strategies can be developed to improve both sectors?

MATERIALS AND METHODS

The study was conducted on the southern, eastern, and western coasts of Sri Lanka, which have been identified as the most important lobster fishing locations in the country. Seventeen perennial reservoirs were selected in North-central (n = 9), North (n = 4), Sabaragamuwa (n = 2), and southern (n = 2) provinces in Sri Lanka, where GFP catching is actively functioning for export purposes.

A multistage stratified random sampling approach was implemented to form a representative sample of fishermen from both lobster and GFP fisheries. At the initial stage, the total number of fishermen in both marine and aquaculture fisheries districts was considered and divided into lobster fishing license holders/divers and GFP harvesting reservoirs, and GFP-catching fishermen in each reservoir. The final stage involved randomly reservoir, selecting 30 fishermen from each of the designated reservoirs, and registering lobster fishermen from the coastal areas. Ten fishermen were selected in the lobster fisheries due to the low number of registered divers in those areas. The sample size of the lobster fishermen was 273; in GFP, it was 475. Collectors from each area in lobster (n = 20) and reservoirs (n = 24) were selected for this study. In addition, exporters registered with the Export Development Board as lobster (n = 9) and GFP (n = 3) exporters were selected as downstream actors in both value chains (Table 1).

Primary data were collected using two main instruments: pre-tested interviewer-administered structured questionnaires and in-depth interviews with key informants (government institutes, private sector, and academics). Structured questionnaires were developed to capture detailed socioeconomic information, production practices, and value chain dynamics from fishers and other key actors involved in the lobster and GFP value chains. Questionnaires included sections on marketing costs, market margins, and market efficiency to evaluate the performance of each marketing channel. Additionally, they contained components assessing value chain governance, focusing on coordination mechanisms, decision-making processes, and stakeholder roles. Key questions explored stakeholder interactions, power dynamics, conflict resolution methods, and levels of collaboration. Respondents were purposively selected based on their active participation across different nodes of the value chain, ensuring representation from producers, collectors, processors, and exporters. Data was collected through interviewer-assisted surveys lasting approximately 30 to 45 min, with responses recorded using a combination of paper-based forms and digital entry to ensure accuracy.

In-depth interview guides were developed to collect qualitative data from key stakeholders, including collectors and exporters. Respondents were purposively selected based on their extensive experience and active involvement in the lobster and GFP value chains. Each interview lasted approximately 45 to 60 min and focused on issues related to market structure, financial and infor-

Table 1. Data collection methods and sample size for target groups.

Target group	Sample size	Data collection method	Variables
Fishermen	Lobster: 273, GFP: 475	Interviewer administrated questionnaire	Demographic factors Production Details Financial flow Knowledge and information flow Post-harvest practices Relationships and linkages among other value chain members Governance Constraints and opportunities
Collector	Lobster: 20, GFP: 24	Key informant interviews	Demographic factors Post-harvest practices Financial flow Market information Characteristics of the Business Trade challenges Relationships and linkages among other value chain members Governance
Trader/exporter	Lobster: 9, GFP: 03	Key informant interviews	Demographic factors Financial flow Market information/performance information Safety and quality measures Characteristics of the business Trade challenges Relationships and linkages among other value chain members Governance

mation flows, value addition practices, and production processes. Key questions explored actors' roles, challenges, and opportunities within the market chain. All interviews were audio-recorded (with consent) and supplemented by detailed note-taking to ensure accurate data capture for analysis. All instruments were pre-tested with a small group of stakeholders and subsequently refined for clarity, relevance, and reliability.

To evaluate the market performance in both value chains, key market measures such as marketing costs, market margins, price spreads, and the overall market efficiency (Acharya and Agarwal 2016; Gori and Kharkwal 2016; Thakur et al. 2022) were examined. The total cost involved in marketing, whether spent in cash or kind by the producer/seller and the various traders, encompasses the buying and selling of the lobster or GFP until they reach the final consumer (Gori and Kharkwal 2016; Thakur et al. 2024):

$$TC = Cp + \sum_{i=1}^{n} MC$$

where TC = Total cost of marketing, Cp = Cost incurred by the producers in marketing the product, MC = Cost incurred by the trader/exporter.

The market margin was determined by calculating the difference between the producer and retail prices. The producers' share, a commonly used metric, is calculated as the ratio of the producer's price (ex-vessel) to the consumer's price (retail). In mathematical terms, the producers' share (Urgessa 2011; Cheffo et al. 2016; Gori and Kharkwal 2016; Bakala and Tadesse 2019; Thakur et al. 2024) is:

$$PS = \frac{P_x}{P_r} = 1 - \frac{MM}{P_r}$$

where PS = Fishermen's share, P_x = Fishermen's price, P_r = Retail price of lobster/GFP, which is the consumer price, MM = market margin.

Total Gross Marketing Margin (TGMM) was computed by using the following formula:

$$TGMM = \frac{CPrice\text{-}FPrice}{CPrice} \times 100$$

where Cprice = Consumers' price, FPrice = Fishermen's price.

The Gross Market Margin Price (GMMp), which means the percentage of the consumer price received by the fishermen (Gori and Kharkwal 2016; Thakur et al. 2024), was calculated as follows:

$$GMMp = \frac{CPrice\text{-}GMMargin}{CPrice} \times 100$$

where GMMargin = Gross marketing margin.

The Net Marketing Margin (NMM) pertains to the share of the final price that intermediaries receive as their net income, considering the subtraction of their marketing costs (Thakur et al. 2024), and was estimated as:

$$NMM = GMMargin\text{-}MCost \times 100$$

where MCost = Marketing costs.

The Price Spread (PS) denotes the difference between the price paid by the final consumer and the price received by the fishermen (Gori and Kharkwal 2016; Thakur et al. 2024):

$$PS = \frac{PF}{PC} \times 100$$

where PS = Producer's share in consumer's rupee, PF = Price of produce received by fishermen, PC = Price of produce paid by consumer.

The marketing efficiency of both lobster and GFP value chains was calculated by adopting Acharya's modified efficiency index (Gori and Kharkwal 2016; Thakur et al. 2024), as:

$$\text{Marketing efficiency} = \frac{PF}{PC} \times 100$$

where FP = Price received by the fishermen, MC = Total marketing cost, and MM = Net market margins.

Econometric analysis played a crucial role in determining the relationship between the dependent and independent variables. It established the magnitude and direction of the effect of changes in the independent variable on the dependent variable (Bakala and Tadesse 2019).

In this study, a linear regression model using Ordinary Least Squares (OLS) was used to examine the relationship between the monthly volume of GFP and lobster supplied for the market considering factors such as age, sex, education, marital status, experience, farmgate price, and membership in fisheries associations. It was appropriate

for estimating relationships where the dependent variable is continuous, and the assumptions of linearity, independence, homoscedasticity, and normal distribution of errors were reasonably met (Cheffo et al. 2016; Tammaroopa et al. 2016; Bakala and Tadesse 2019), and it was described as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon$$

where Y = Monthly volume (kg), β_0 = Intercept (baseline supply when all factors are zero), β_1 to β_7 = Coefficients for each independent variable (age, sex, education, marital status, experience, farmgate price and membership in fisheries associations), and ε = Error term (captures unexplained variability).

The model's goodness-of-fit was assessed using the coefficient of determination (r^2), adjusted r^2, and F-statistics. These statistics provided insight into how well the model explains the variation in supply volume. The cutoff significance levels for interpreting coefficient estimates were set at 1% (***), 5% (**), and 10% (*), and were indicated in the corresponding regression output tables. The SPSS v22.0 software was used explicitly for the regression analysis of this study. The differentiation strategy was analyzed based on the comparison of market performance and innovative potential, which was recommended through qualitative analysis.

RESULTS AND DISCUSSION

The lobster value chain

Actor profile analysis

Generally, the fisheries value chain encompasses a wide range of participants and processes, from input suppliers to end consumers. Each group within this chain is diverse and interconnected with others through numerous networks (Kerutagi et al. 2023). Two main marketing channels were identified, originating with fishermen or divers (Figure 1). As intermediaries within the local supply, collectors, tourist hotels or restaurants, and a few local traders were identified. Exporters took the leading role in delivering locally caught lobsters to the international market.

Input supplier. The main functions included diving equipment, repairing, and filling O_2 to tanks for the fishers, and as there are no official records, they are considered invisible actors.

Fishermen. They were the largest actor group in the lobster value chain and were identified as the group with the least decision-making power. Under current regulations, only individuals who hold the necessary licenses or permits are allowed to catch lobsters within the specified geographical area. All these fishermen were members of fishing cooperatives or organizations specific to their coastal region. Of the sample lobster value chain, 70% of fishermen practiced skin diving, while 30% used nets to catch lobsters. Additionally, all fishermen used either polythene bags or gunny sacks to store and transport lobsters to collection centers. Typically, each bag contained 10 to 15 lobsters, which were transported live to the collecting center. Most common ways of transportation included personal vehicles, such as three-wheelers, bicycles, motorcycles, and public buses. However, these transport methods often contributed to the degradation of lobster quality during transit.

Collector. The key middlemen group of the lobster value chain. They are bridges between fishermen and downstream or exporters. They usually have direct connections with exporters, and collection centers, which are strategically located near coastal areas. Upon arrival at the collecting center, dead lobsters are stored in refrigerators, while live lobsters are placed in saltwater tanks with salinity 34-35 (3.1 m × 3.1 m) until they are dispatched to exporting companies. The process of sorting,

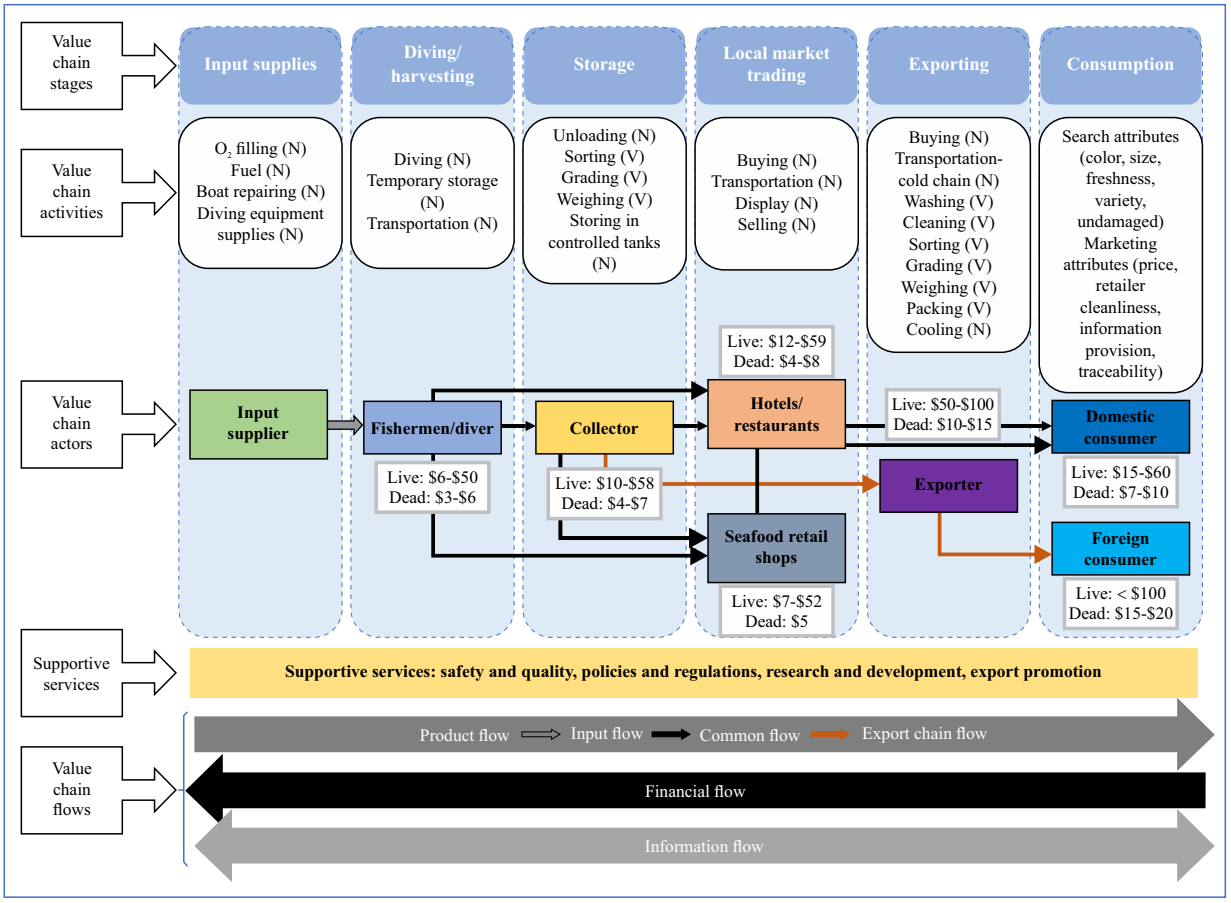

Figure 1. The structure of Sri Lanka's lobster value chain. V = value added; N = necessary but non-value added.

cleaning, and grading begins at collection centers. Grading is based on factors such as weight, species, and the level of damage. Lobsters of lower quality (Grade II) are purchased at half the price of premium-grade lobsters. Quality assessment considers damage to claws and the abdomen, as well as the size of the lobster (> 500 g, 300-500 g, and 200-300 g categories).

Hotels/restaurants/local traders. These actors primarily target high-end local consumers and foreign tourists, focusing mainly on dead lobsters for meal preparation. They maintain direct connections with fishermen or collectors to ensure a steady supply. This group purchases a significant portion of low-grade lobsters for their operations. Local traders act as vital intermediaries between local communities and alternative buyers. This fact positions them to potentially exert greater influence on resource suppliers, encouraging compliance with external demands.

Exporter. Lobster exports in the country's international lobster trade are managed by a countable number of exporters, with nine dominating. These nine primary exporting companies also exporter occasionally, mainly focusing on seafood. Other companies export only when specific orders are received. Exporters play a crucial role in determining both the final market price and the farmgate

price within the value chain. They are in charge of the maintenance of storage facilities, capacity, packaging and labelling, transportation logistics, and cash flow management. From the sample, exporters shipped lobsters (live or frozen) to the following destinations: 55% to China, 44% to Singapore, 33.3% to Japan, Russia, and EU countries, and 22% to Hong Kong, Taiwan, Australia, and the UAE. Exporters adhere to stringent quality standards, including ISO 22000, HACCP, GMP, BRCGS, and FDA requirements. Cooler wagons are used to transport live lobsters through the distribution channels, from coastal collection points to factories. For air freight, rectangular boxes are used, with inner arrangements made from natural, simple materials, such as dried beach sand covered with newspaper strips. Additionally, four frozen water bottles or gel packs are placed in the corners of the rectangular box, wrapped in newspapers to ensure proper cooling. Each lobster is individually wrapped in newspapers, allowing them to remain alive for up to 14 h during transit. Moreover, the preparation for export follows similar steps, with the addition of dried beach sand as part of the packaging process. The export process begins with grading the lobsters based on weight and quality. A new method is employed where the lobsters are submerged in a tank with water maintained at 28-27 °C and then transferred to 20 °C de-frosted water for 10-15 min. This process induces a temporary state of inactivity, allowing the lobsters to remain alive for approximately 17 h during air transit to export destinations. Following this, each lobster is carefully dried before being individually packed for shipment.

Consumers. The value chain includes both local and foreign consumers. Typically, domestic consumers purchase lobsters as a luxury food delicacy for special occasions. Local and foreign consumers are concerned with physical appearance, size of the animal, color, odor, texture, nutrient value, date of catch, and also the price as when making their purchasing decisions (Basnayake and De Silva 2024). Furthermore, most consumers in import markets prefer to buy live lobsters for later cooking, as they believe live lobsters are healthier for the consumer and better tasting than those killed earlier or preserved.

The lobster value chain dynamics

Structure

The product flow. This phase begins with catching lobsters during the primary fishing season. September, November, and February are closed seasons for lobster fishing, transportation, or sale. Mainly, five different lobster species are available, so the price is also determined by the species as well. Lobster products are available in various forms, including whole lobster, tail, meat, and claw. Whole lobsters are the most popular product, with a minimum weight requirement of 300 g and no visible damage. This is followed in demand by lobster tails, meat, and claws. Any damage sustained during the catching and handling process can lead to rapid quality deterioration, which in turn impacts on the overall value of the product. Furthermore, local supplies are directly delivered to tourist hotels or seafood trading shops, whereas direct sales to consumers are rare. In the export value chain, lobster flows directly from fishermen and collectors to exporters. Lobster production is concentrated in the southern and eastern coastal areas, while exporters are primarily located in the western province. Consequently, logistics and distribution system play a critical role in maintaining product quality and determining market prices (Figure 2).

The financial flow. Financial flows take place from consumers backward towards input suppliers. The findings of this study suggest that these flows may take the form of credit, monetary advances, and spot payments. Usually, consumers make spot payments to retailers or hotels. In the export value chain, exporters make credit payments to collectors to transfer due amounts to the bank accounts of

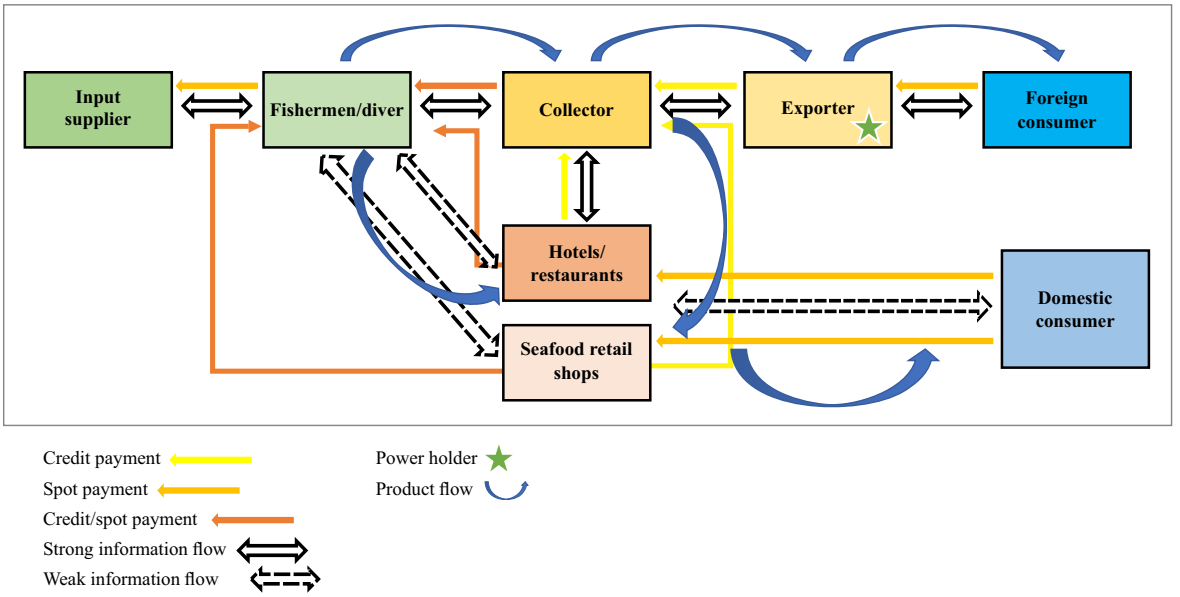

Figure 2. Flows of product, finance and information, and power in the lobster fisheries value chain.

collectors' agents a few days after delivery. The collectors make both spot and credit payments to fishermen with their financial conditions. The price is determined primarily by key exporters, and subsequently, intermediary prices and farmgate prices are established based on the final price. The farmgate price can vary from USD 6 to USD 50, depending on species, weight, sex, and any damages incurred (Figure 1).

The information flow. Information is crucial for enhancing the performance of value chains (Ariyawardana and Collins 2013). Information exchange within the value chain is generally weak and uneven, especially between local traders and consumers (Figure 2). While consumers communicate their preferences and purchasing habits, either directly or indirectly, traders frequently fail to supply sufficient information in return. Collectors serve as the central hub or gatekeepers of information within the value chain. They possess insight into market demand, pricing, and availability due to their extensive backwards and forward linkages. To ensure a consistent supply, collectors maintain regular communication with fishermen and stay informed about market demand from exporters. However, the strong information flow between collectors, exporters, and fishermen often contributes to overfishing and illegal lobster harvesting during restricted periods, driven by the high demand relayed by collectors.

Governance

Value chain governance describes the dynamics of relationships among value chain participants, the coordination of value-creating activities, and the distribution of power and influence throughout the chain (Prowse and Moyer-Lee 2014). The highest power is constrained among exporters regarding market decisions, which include determining the final price, volume, as well as the handling/grading process (Figure 3). Furthermore, the time of fishing and the type of species is decided by fishermen. Moreover, exporters were identified as the leading power players due to their linkages with importers, infrastructure, financial resources, and access to export-related information. Therefore, it is evident that there is a captive governance structure

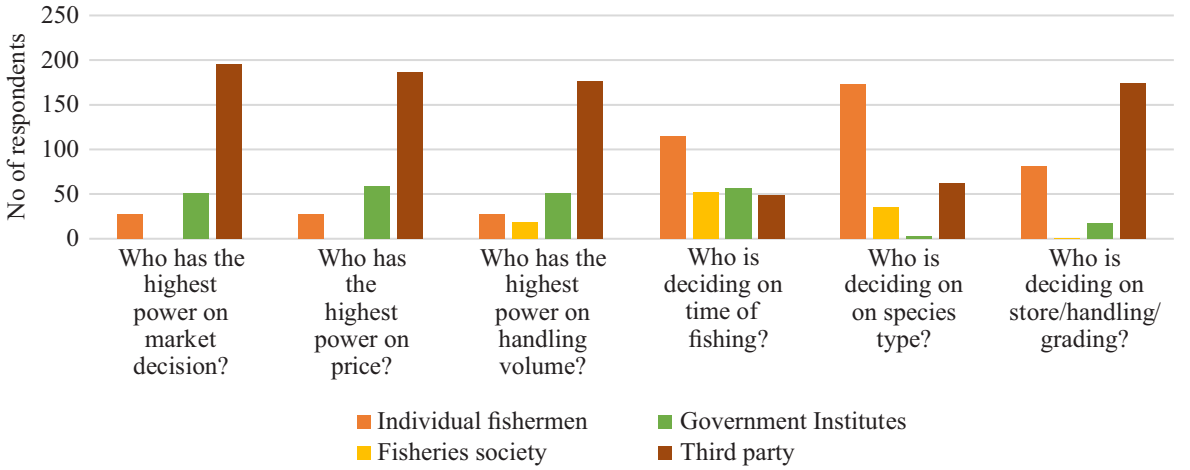

Figure 3. The governance of lobster fisheries in Sri Lanka.

in lobster value chain, since fishers have limited bargaining power, as they depend on exporters for final market and pricing decisions, and exporters, in turn, exert control over key aspects of the value chain, including handling, grading, and compliance with international standards.

The GFP value chain

Actor profile analysis

The GFP value chain also has its starting point with rural fishers and ends with the catering for both export and domestic markets. Actors involved in the value chain included input suppliers, including fish seeds, fishers (both men and women), collectors, exporters, restaurants/hotels, local traders, and domestic and foreign consumers. Exporters, local tourist hotels, and high-end restaurants, as intermediaries, play a significant role in reaching the final product to end consumers. At the same time, a lot of fishermen are also engaged in the supply chain.

Input suppliers. They play a critical foundational role, especially in supporting culture-based fisheries (CBF) practices. Input suppliers include breeders, hatcheries, and suppliers of equipment such as boats, nets, and feed. Both government agencies, particularly the National Aquaculture Development Authority (NAQDA) and private breeding centers, are key players in providing high-quality post-larvae (PL). The process typically begins with NAQDA breeding centers or private hatcheries producing PL. Fisheries cooperatives often act as intermediaries, purchasing PL in bulk from these centers and fishermen or cooperative members, then stocking these PL in reservoirs where they manage feeding, monitoring, and rearing practices over several months until prawns reach marketable size. Boat builders and net suppliers are horizontally linked with fishers, providing the necessary gear and vessels to enable fishing and culture operations. Vertically, seed producers and breeders are linked upstream, forming the base of the supply chain that directly impacts on the success of fishers' production activities. This integrated process ensures a steady flow of inputs, from hatchery to harvest, underpinning the entire GFP value chain (Figure 4).

Fishers. In the GFP fisheries, both men and women actively participate as fishers, and all of them are affiliated with fisheries organizations at their respective reservoirs or landing sites. However, no fishers target the GFP exclusively; instead, the GFP is harvested alongside other fish species as a bycatch. Hence, daily GFP catches per fisher range

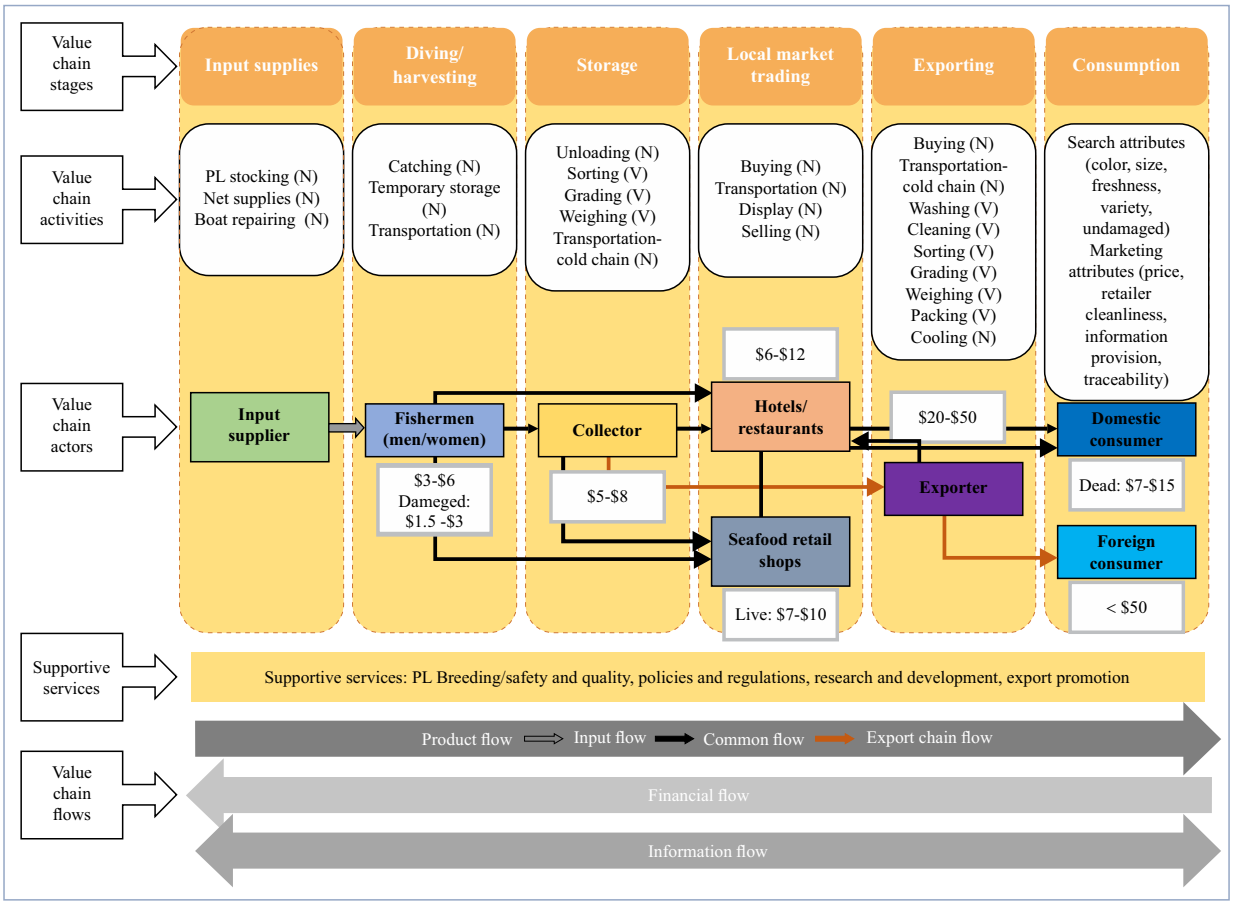

Figure 4. The structure of Sri Lanka's giant freshwater prawn (GFP) value chain. V = value added; N = necessary but non-value added.

from 0 to 25 kg. Despite the relatively low capture volumes, fishers benefit financially from the high market price of the GFP. Fishers use the same nets employed for catching finfish and hand over their GFP harvest to leaders of their fisheries organizations. At landing sites, the GFP is weighed, sorted, and graded based on factors such as damage, size, and weight, with the involvement of collectors. The grading system is: 100-150 g, 150-250 g, 250-400 g, 400-500 g, and > 500 g. If the GFP head is damaged, collectors reject the animal, and fishers sell it to local village consumers instead. Beyond the harvesting process, fishers also maintain cages for post-larvae (PL) until the animals adapt to the reservoir environment (Figure 4).

Collector (middleman). The collector is directly connected to the exporter or an employee of the exporter. A monopoly of collectors exists in all reservoirs. Consequently, a competitive market structure is absent, and market information is 'hidden' to a larger extent. As a result, collectors face less competition and keep strong and healthy ties with fishers and especially with leaders of fisheries organizations. Unlike the lobster value chain, GFP collectors are responsible for both storing and transporting the harvest to the exporter's factory. Collectors usually visit the landing sites or the leader's home (where GFP is stored in the freezer) three days a week to collect the GFP harvest, following cold-chain management protocols, and

properly packing goods in cool boxes with ice after sorting and grading.

Hotels/restaurants/local traders (middlemen). These actors establish direct connections with fishers or collectors to ensure a continuous supply of GFP to high-end local consumers and foreign tourists. Like lobster fisheries, a significant portion of low-grade GFP is purchased by this group. Additionally, one of the sampled exporters also supplies GFP to restaurants as part of their export operations (Figure 4).

Exporter. Exporters lead 76% of the GFP value chain. There are only three exporters directly involved in GFP export in Sri Lanka, and among them, only one exporter is exclusively involved in GFP as their primary exporting product. They also control price determination. Some exporters monitor their operations to guarantee consistent stocking and maintain a reliable supply. The majority of the GFP harvest is exported as dead animals due to poor postharvest management techniques. The primary export destinations are Thailand and China. According to exporters, unlike lobsters, it is challenging to ship live GFP. Exporters employ proprietary techniques that are kept as trade secrets to address this issue, including significant amounts of ice to keep the GFP alive. However, no value chain employs a proper traceability system. At best, the final harvest can only be traced to the provincial or district level. Furthermore, they adhered to stringent quality standards, including ISO 22000, HACCP, and GMP requirements (Figure 4).

Consumer. Both local and foreign consumers are part of the GFP value chain (Figure 4). Many are willing to purchase GFP due to the rising prices of seafood and its reputation as a high-quality protein source. Most of the time, local consumers either buy unprocessed GFP directly from fishers for home cooking or enjoy it as a meal at high-end restaurants and hotels. This product is popular as 'Jambo prawn' among local people and is less priced compared to lobsters. Although the export market is the focal point of the GFP value chain, there is potential for market expansion. This can be achieved by targeting tourism and hotel industries and capturing the attention of local consumers by making GFP available at the retail level at affordable prices. When consumers purchase GFP in unprocessed form, they are mainly focused on physical appearance, size of the animal, taste, color, odor, texture, date of catch, and price. Most consumers prefer small-sized GFP (< 300 g) because larger animals are perceived as having less flavor. The primary reason for buying GFP is the taste and high nutritional value. Consumers are more likely to purchase fresh products over frozen ones (Basnayake and De Silva 2024).

The GFP value chain dynamics

Structure

The product flow. The final product reaches live, dead-unprocessed, or processed (meal/dish) to the end consumers (Figure 5). The entire GFP harvest by collectors from reservoirs is sold to an exporting company. Once there, the company sorts the GFP based on weight and appearance. High-quality prawns are packed in ice and exported, while the lower-grade prawns are supplied to hotels in the western and southern parts of Sri Lanka. Unlike lobsters, GFP is sold as a whole animal, and value addition is rare or very limited. Logistics and cold chain management play a key role, as the product is highly perishable. Any damage during the operation can easily occur, ultimately reducing the price.

The financial flow. Financial flows take place from consumers backward towards input suppliers as forms of credit, monetary advances, and spot payments (Figure 5). Typically, consumers make spot payments to retailers or hotels. In the export value chain, exporters provide advance payments to cover expenses such as fuel, cooler boxes, and ice,

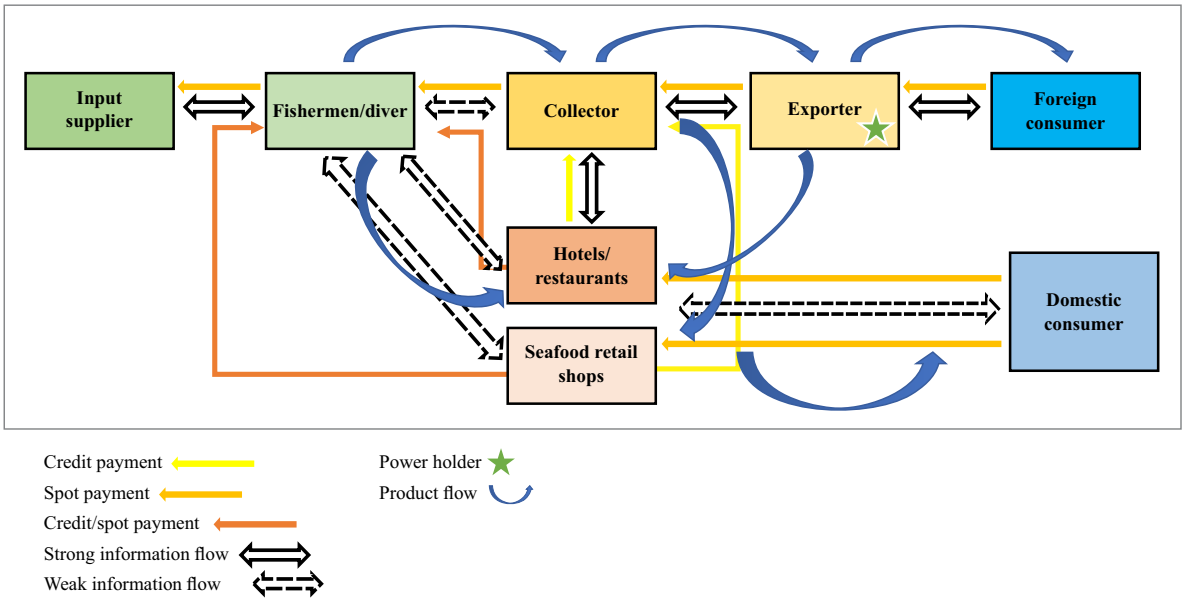

Figure 5. Flows of product, finance and information, and power in the giant freshwater prawn (GFP) value chain.

which are supplied weekly to collectors. Exporters usually pay the remaining balance after delivery to the export company, and collectors typically make spot payments to fishers or leaders of fisheries associations managing reservoirs. The entire price is primarily determined by exporters, and depending on the final price, intermediary prices and farmgate prices are determined. However, the price of direct selling to local/village consumers can be determined by fishers. The farm gate price can vary from USD 3 to USD 6 according to the weight and damages (Figure 5). Additionally, fishers rarely benefited from favorable price trends in international markets, as exporters predominantly capture the financial gains from these trends.

The information flow. Fishers receive market-related information, including size, level of damage, required quantity, weight, dead or alive, and market trends, through collectors, hoteliers, or directly from consumers (Figure 5). However, this flow of information is weak due to a lack of awareness about the current market conditions and the value of GFP. Most fishermen are unaware that GFP is being exported from Sri Lanka or even from its final export destinations. However, a strong information flow could be observed between the collector and the exporter, as well as between the end customer (importer) and the exporter, especially regarding the quantity, quality, special occasional demand, and cultural production practices of other Asian countries.

Governance

In the GFP value chain, governance is characterized by multiple layers of authority (Figure 6). Exporters hold the greatest influence over market decisions, by fixing the final selling price, due to their established links with international buyers, access to infrastructure, and financial strength. This mirrors the governance pattern in the lobster export chain, where exporters hold a dominant position due to similar advantages.

At the production level, fisheries associations are key governance actors responsible for decisions regarding the volume of fish harvested, the timing of fishing activities, and designated fishing areas within reservoirs. These decisions are critical

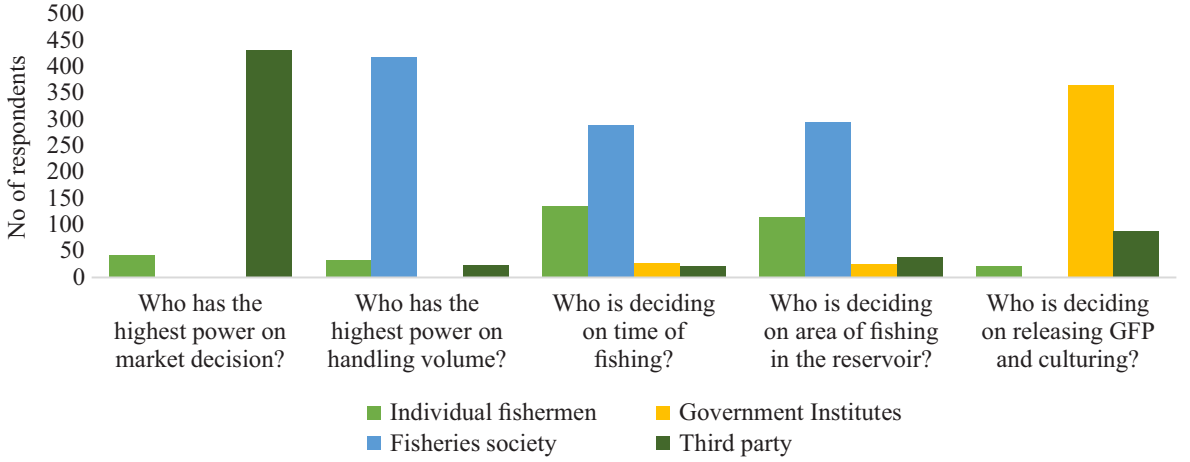

Figure 6. The governance of the giant freshwater prawn (GFP) in Sri Lanka.

for managing resource sustainability and ensuring equitable access for members. Meanwhile, government institutions such as the NAQDA oversee GFP stocking and culture practices, ensuring that environmental and quality standards are maintained. Furthermore, reservoir-based fishing is tightly regulated through a permitting system; every fisher must obtain a valid fishing permit to engage in harvesting activities. This requirement not only helps to monitor and control fishing pressure but also ensures compliance with national fisheries policies.

When comparing both value chains, it is evident that actor profiles of each value chain differ in primary activity, added value, and working conditions while showing similarities in market power allocation and financial performance (Table 2). The lobster value chain is generally more lucrative than the GFP due to its higher global demand and premium market positioning. Both value chains are hierarchical, with exporters holding the most power and profitability, while fishers remain the most vulnerable due to unstable incomes and market dependence.

Market performance

Marketing costs and market margins for both lobster and GFP provides a comprehensive comparison of the financial dynamics across export and local marketing channels (Table 3). In channel A, where the final harvest is sold to the export market, the total marketing cost amounts to USD 7 and USD 8 per 10 kg in lobster and GFP value chains. In contrast, channel B, which involves sales to local consumers, marketing costs is USD 5 per 10 kg for lobster and USD 6 per 10 kg for GFP. The variation in marketing costs between the two channels highlights the additional expenses incurred in the export market channel, primarily to maintain high-quality standards required for international markets. Despite the marketing costs, all value chain actors enjoy greater market margins in the export channel compared to the local market channel. Among the actors, intermediaries earn significantly higher market margins than rural fishers. Such information is crucial for policymakers seeking to improve the efficiency and effectiveness of the lobster and GFP marketing networks.

Fishers experience price variability for both lobster and GFP value chains across local and export marketing channels (Table 4). In channel A, prices ranged from USD 32 to USD 143, followed by channel B, while in channel B they ranged from USD 14 to USD 65. The highest (USD 143) was found in lobster exports across various channels. Consumers pay much higher prices in lobster value

Table 2. Summary of actor profile comparison of lobster and giant freshwater prawn (GFP) value chains.

Actor	Primary activity	Value added	Working conditions	Financial performance	Market power
Fisher (lobster)	Harvesting wild lobster by diving	Limited processing (sold live or fresh)	Physically demanding, risk of injury, seasonal work	High variability in income, dependent on season and market demand, depending on the final quality	Low-fishers are price takers, dependent on demand from collectors and traders
Fisher (GFP)	Catching GFP as a bycatch while fishing the other aquatic fish species	Some processing-sorting/weighing/grading	Moderate physical effort	Moderate income, relatively stable/depending on the final quality	Low-fishers have limited control over prices, dependent on market trends and middlemen
Collector (lobster)	Buying lobster from fishers and temporarily storing it in controlled tanks	Sorting: dead/damaged animals/weighing/packaging	Moderate effort, but requires storage facilities	Stable income, but profits depend on volume and quality	Moderate-can negotiate better prices but still relies on exporters for market access
Collector (GFP)	Collecting GFP from fishers and transporting it to the exporter	Sorting/grading/cleaning, weighing, quality control, and cold chain management	Moderate effort, requires logistical skills	Stable income, moderate margins	Moderate-some bargaining power but influenced by exporter demand
Exporter (lobster)	Processing and exporting live or frozen lobster to global markets	Processing (grading, packaging, sometimes frozen value-added products like separate body parts)	Office and factory-based work with export compliance requirements	High-value exports, profits depend on market prices and value chain efficiency	High control over pricing, market access, and value chain efficiency
Exporter (GFP)	Exporting live or frozen GFP to domestic and international markets	Processing (grading, freezing, packaging	Office and factory-based work with export compliance requirements	Profitable but requires large-scale operations for sustainable margins	High-strong influence over value chains, pricing, and international market access

Table 3. Marketing costs and margins of various functionaries in the lobster and giant freshwater prawn (GFP) value chains. All costs are represented in USD per 10 kg of animals, based on the assumption that the average volume of catch is 10 kg per trip. Marketing costs were calculated by considering transportation costs, packaging material costs, and costs associated with loading and unloading (Chand et al. 2020; Thakur et al. 2024).

		Lobster value chain		GFP value chain	
Actor	Particulars	A	B	A	B
Fishermen	Net price received by the fishermen	143	65	32	14
	Costs associated with transportation	7	5	5	3
	Commission charge (fisheries organizations)			3	3
	Total	7	5	8	6
	Fishermen's selling price	150	70	40	20
Collector	Gross price paid by the exporter/trader	200	100	70	40
	Costs associated with transportation	14	10	15	8
	Costs associated with loading/unloading	11	7	7	5
	Packaging	10			
	Total	35	17	22	13
	Collector margin	15	13	8	7
Exporter	Gross price paid by the exporter/trader	200	100	70	40
	Costs associated with transportation	20	12	20	10
	Costs associated with loading/unloading	15	10	12	10
	Packaging	14	8	10	5
	Total	49	30	42	25
	Exporter/trader margin	251	20	88	15
	Exporter/trader selling price	500	150	200	80
	Consumer purchase price	500	150	200	80

chains than in GFP value chains, indicating that lobster is a higher-value seafood product. The GMM is higher for lobster (USD 357 in A and USD 85 in B) compared to GFP (USD 168 in A and USD 66 in B), reflecting the larger profit margins in lobster value chains. The total gross marketing margin exhibited the highest percentage in GFP channel A (84%), followed by GFP channel B (82.5%), lobster channel A (71.4%), and the least in lobster channel B (56.6%). Furthermore, fishers

Table 4. Price spread and marketing efficiency of lobster and giant freshwater prawn (GFP) value chains.

	Lobster value chain		GFP value chain	
Particulars	A	B	A	B
Producer price (USD 10 kg^{-1})	143	65	32	14
Consumer's price (USD 10 kg^{-1})	500	150	200	80
Gross marketing margin (GMM) (USD 10 kg^{-1})	357	85	168	66
Net marketing cost (USD 10 kg^{-1})	91	52	72	44
Net market margin (USD 10 kg^{-1})	266	33	96	22
Total gross marketing margin (%)	71.4	56.66667	84	82.5
Marketing cost (%)	18.2	34.66667	36	55
Marketing margin (%)	53.2	22	48	27.5
Producer's shares (%)	28.6	43.33333	16	17.5
Marketing efficiency				
Net marketing cost	127	72	102	61
Consumer's price (USD 10 kg^{-1})	150	70	40	20
Net marketing margin (USD 10 kg^{-1})	243	25	78	17
Marketing efficiency	0.386486	0.670103	0.177778	0.179487

retain a smaller share in GFP value chains (16% in A, 17.5% in B) compared to lobster (28.6% in A, 43.3% in B), suggesting that producers' benefit is less from GFP products despite their low selling price. Marketing margins varied, with lobster channel A exhibiting 53.2%, followed by GFP channel A (48%), GFP channel B (27.5%), and 22% in lobster channel B, indicating that intermediaries profit more from lobster trade. Meanwhile, marketing costs ranged from 55% to 36% in channel A to channel B in GFP, with the highest being 18.2% and 34.6% in channel A to channel B in lobster fisheries. This implies that GFP distribution requires more resources or effort relative to its market value. The long distance and poor condition of roads (mostly off-road) from reservoirs to the export company may result in incurring a high marketing cost compared to lobsters. Results suggest that channel A, which involves the export market, offered the highest consumer price. This indicates a significant opportunity to prioritize and enhance production and trade in this channel. To ensure long-term viability, efforts should focus on developing and expanding this channel sustainably.

Results also revealed varying levels of efficiency in the different marketing output channels for both value chains (Table 4). Lobster value chains have a higher marketing efficiency in scenario B (0.67) than in scenario A (0.39), suggesting scenario B optimizes the cost-to-profit ratio. The GFP value chains exhibit very low marketing efficiency in both scenarios (0.18 and 0.18), highlighting inefficiencies. GFP value chains face high marketing costs and low producer shares, resulting in less overall efficiency. Regression analysis revealed that, at the 1% significance level, only age and farmgate price variables were found to be significantly correlated with the marketable supply of lobster (Table 5). In comparison, marital status and experience were found to be weakly significant

Table 5. Results of regression analysis of lobster fisheries.

Model		Coefficients[a]				
		Unstandardized		Standardized		
		B	Std. error	Beta	t	p
1	(Constant)	44.143	19.469		2.267	0.024 **
	Age	-10.893	3.765	-0.182	-2.893	0.004 ***
	Marital status	8.210	4.682	0.105	1.754	0.081 *
	Educational qualifications	3.632	3.010	0.078	1.207	0.229
	Membership	-17.419	11.348	-0.089	-1.535	0.126
	Experience	3.921	2.315	0.116	1.693	0.092 *
	Farmgate price	0.005	0.001	0.201	3.174	0.002 ***

[a]Dependent variable: volume monthly.
p at 1%***, 5%** and 10% marked as*.

at the 10% level. Education and membership in a fisheries organization, however, had no significant impact on monthly sales volume in this model, though experience showed a marginally positive trend. Age has both a negative and significant relationship with monthly sales volume. This suggests that younger individuals may sell more, potentially due to higher productivity or engagement in market activities, and the farmgate price has a positive and significant relationship with monthly sales volume. This suggests that higher prices may lead to increased sales. The model highlighted the importance of economic incentives (like pricing) over demographic or social factors in driving sales.

In the GFP industry, as explained in Table 6, age, sex, and farmgate price were significantly associated with the marketable supply of GFP. Age had a strong positive effect on the 1% level on sales volume. This indicates that older individuals were more likely to achieve higher sales, possibly due to accumulated knowledge or stronger networks, while sex had a negative and highly significant relationship. Similar to the lobster industry, the farmgate price has a positive and highly significant relationship with sales volume. This strong association (Beta = 0.737) indicates that price is the most influential factor in sales volume. Both models demonstrated acceptable goodness-of-fit, and the regression diagnostics confirmed the validity of the OLS assumptions.

CONCLUSIONS

The paper is the first comparative analysis of high-value marine and aquaculture fishery value chains, conducting an actor analysis, identifying value chain dynamics and market performance, as well as developing differentiation strategies. Both lobster and GFP value chains commenced with input suppliers and rural fishers, catering to the local and high-end foreign consumers, where exporters finally determine the final price. Lobsters generate higher producer shares and gross marketing margins due to exporters' stringent quality control measures and well-established networks, ensuring better market access and profitability. In contrast,

Table 6. Results of regression analysis of the giant freshwater prawn (GFP).

Model		Coefficients[a]				
		Unstandardized		Standardized		
		B	Std. error	Beta	t	p
1	(Constant)	-11.006	15.119		-0.728	0.467
	Age	7.459	3.124	0.097	2.388	0.017 **
	Marital status	-5.454	3.717	-0.048	-1.467	0.143
	Sex	-24.467	3.742	-0.207	-6.539	0.000 ***
	Educational qualifications	0.908	2.862	0.010	0.317	0.751
	Experience	-5.139	2.922	-0.069	-1.759	0.079 *
	Farmgate price	0.116	0.005	0.737	24.172	0.000 ***

[a]Dependent variable: volume monthly.
p at 1%***, 5%** and 10% marked as*.

the GFP value chain faces challenges such as weak financial flow and high marketing costs, which constrain its profitability despite increasing global demand. Strengthening financial support mechanisms and improving market efficiencies could enhance the competitiveness of the GFP sector. The econometric analysis revealed that key socio-economic factors significantly influenced the monthly supply volumes of lobster and GFP, and findings highlighted that both demographic factors and market-related variables, remarkably, farmgate price, are critical drivers of supply dynamics within the lobster and GFP value chains. Efforts to enhance the performance of both chains must give priority to sustainable practices, such as stricter adherence to fishing regulations for lobsters and investments in infrastructure for GFP. Strengthening governance frameworks and fostering equitable price-sharing mechanisms will empower rural fishers by enhancing their bargaining power, ensuring fair compensation, and improving market access. Studies have shown that well-structured governance models, such as co-management approaches and transparent pricing systems, lead to more equitable income distribution and sustainability in fisheries. To improve equity across the value chain, interventions such as cooperative models, direct-to-market strategies, and sustainable certification incentives should be explored. By leveraging product innovation, branding, and supply chain efficiencies, both sectors can achieve higher value capture, market resilience, and long-term sustainability. Additionally, this study will provide a new baseline for formulating informed policy decisions and strategies to improve fishing and trading practices within the two value chains in the marine and aquaculture sectors. Moreover, this research fills a critical gap in existing literature by offering a detailed case study that compares specific high-value crustacean candidates within a unique geographical context.

Author contributions

Ruwini Basnayake: conceptualization; investigation; methodology; data curation; formal analysis; writing-original draft. Achini De Silva: supervision; validation; writing-review and editing.

REFERENCES

Abeyrathne AHMTG, Jayasinghe-Mudalige UK, Wijenayake WMHK, De Croos MDST. 2020. Sustainable livelihood and market chain analysis of giant freshwater prawn culture-based systems in two selected reservoirs in Puttalam District, Sri Lanka. Sri Lanka J Aquat Sci. 25 (1): 33-42. DOI: https://doi.org/10.4038/sljas.v25i1.7574

Acharya SS. 2016. Policy analysis-what and how: a case of agricultural price and marketing policies in India. [accessed 2024 Sep 20]. Indian J Agric Market. 30 (3): 26-47. https://journals.indexcopernicus.com/search/article?articleId=2436640

Acharya SS, Agarwal NL. 2016. Agricultural marketing in India. New Delhi: Oxford and IBH Publishing Corporation Private Limited. 322 p.

Ahmed MK, Sultana S, Halim S, Islam MM. 2016. Marketing systems of freshwater prawns in three coastal districts of Bangladesh. Aquac Econ Manag. 20 (3): 272-282. DOI: https://doi.org/10.1080/13657305.2016.1177858

Ahmed N, Ahammed F, Lecouffe C. 2007. Socioeconomic aspects of small-scale freshwater prawn marketing systems in Mymensingh, Bangladesh. Aquac Econ Manag. 11 (4): 335-353. DOI: https://doi.org/10.1080/13657300701530324

Ahmed N, Bunting SW, Rahman S, Garforth CJ. 2014. Community-based climate change adaptation strategies for integrated prawn-fish-rice farming in Bangladesh to promote social-ecological resilience. Rev Aquac. 6 (1): 20-35. DOI: https://doi.org/10.1111/raq.12022

Amarasinghe US. 2014. Fisheries resources in alleviation of hunger and malnutrition in Sri Lanka-accomplishment and challenges. Sri Lanka J Aquat Sci. 18: 1-5. DOI: https://doi.org/10.4038/sljas.v18i0.7034

Ariyaratne MHS, Amaraweera R. 2015. Fish offal-based aqua-feed for rearing post-larvae of freshwater prawn, *Macrobrachium rosenbergii*. Sri Lanka J Aquat. 20 (2): 39-47. DOI: https://doi.org/10.4038/sljas.v20i2.7477

Ariyawardana A, Collins R. 2013. Value chain analysis across borders: the case of Australian red lentils to Sri Lanka. Asia Pac Bus Rev. 14 (1): 25-39. DOI: https://doi.org/10.1080/10599231.2012.717839

Bakala F, Tadesse B. 2019. Market chain analysis for potato: a case study in Masha District, South-western Ethiopia. Econ Bus Manage. 7 (1): 9-21. DOI: https://doi.org/10.33495/jeibm_v7i1.19.104

Basnayake BMRL, De Silva DAM. 2023. Best practices for lobsters: a precautionary approach for lobster fisheries management in Sri Lanka. Proceedings of the International Conference on Building Resilience in Tropical Agroecosystems, Colombo, Sri Lanka: University of Ruhuna. 23 p.

Basnayake BMRL, De Silva DAM. 2024. Consumer perception vs supply of lobster and giant freshwater prawns. Proceedings of the First International Conference on University-Industry Collaborations for Sustainable Development. 2024 March 15-17, Colombo, Sri Lanka. p. 132-142.

Chand K, Kumar S, Suresh A, Dastagiri MB. 2020. Marketing efficiency of vegetables in developing economies: Evidences for critical intervention from Rajasthan, India. Indian J. Agric Sci. 90: 55-63. DOI: https://doi.org/10.56093/ijas.v90i8.105908

Cheffo A, Zemedu L, Geta E. 2014. Market chain analysis of koka reservoir fish in ethiopia. Am J Sci Res Essays. 1 (1): 42-53.

Dasgupta S, Davis KJ, Wirth FF. 2007. Selling freshwater prawn in food festivals: a marketing experiment in Kentucky. Aquac Econ Manag. 11 (1): 3-16. DOI: https://doi.org/10.1080/13657300701202635

Dasgupta S, Williams BR. 2008. The economics and management of small-scale freshwater prawn (*Macrobrachium rosenbergii*) processing using data from Kentucky. Aquac

Econ Manag. 12 (1): 1-24. DOI: https://doi.org/10.1080/13657300801959605

Freeman MA, Coatney K, Schilling M, Allen P, Ciaramella M. 2017. Willingness-to-pay for value-added freshwater prawns. Aquac Econ Manag. 21 (4): 419-432. DOI: https://doi.org/10.1080/13657305.2016.1180645

Gordon DV. 2021. Price and revenue projections under alternative policy shocks due to the coronavirus: Canadian lobster and snow crab. Mar Policy. 130: 104556. DOI: https://doi.org/10.1016/j.marpol.2021.104556

Gori UR, Kharkwal S. 2016. A comparative study of the structure and performance of two major fruits and vegetables markets under Uttarakhand APMC. Indian J Econ Dev. 4 (6): 1-15.

Haslawati B, Saadiah I, Siti-Dina RP, Othman M, Latif MT. 2022. Environmental assessment of giant freshwater prawn, *Macrobrachium rosenbergii* farming through life cycle assessment. Sustainability. 14 (22): 14776. DOI: https://doi.org/10.3390/su142214776

Hewapathirana SK, Ekanayake KBSSJ, Liyanage U, De Silva DAM. 2022. catch diversity of small-scale lobster fishery in the southern coast of Sri Lanka. Proceedings of the 26th International Forestry and Environment Symposium, Colombo, Sri Lanka, University of Sri Jayawardhanapura. p. 150.

Jayakody DS. 1989. Size at onset of sexual maturity and onset of spawning in female *Panulirus homarus* (Crustacea: Decapoda: Palinuridae) in Sri Lanka. Mar Ecol Prog Series. 57 (1): 83-87.

Jayawickrema SJC. 1991. Fishery and population dynamics of *Panulirus homarus* (Linnaeus) from Mutwal, Sri Lanka. J Nat Sci Coun Sri Lanka. 19 (1): 52-61. DOI: https://doi.org/10.4038/jnsfsr.v19i1.8172

Jeyanthi P, Gopal N. 2012. Growth and instability in Indian frozen scampi export. Fish Technol. 49: 187-192.

Kerutagi MG, Jangale AS, Gayathri S, Jagadeshwaran P, Sengar RS. 2023. Modern approaches in agricultural economics. New Delhi: Elite Publishing House. 270 p.

Koralagama DN, Amaraslnghe O, Jayakody S. 2007. Export market of lobsters in Sri Lanka, with special reference to slipper lobsters. Proceedings of the Fourth Academic Sessions, Technical Session III (NARA). 2007 March 2. Colombo, Sri Lanka. p. 84-90.

Liao DS, Smith TIJ. 1981. Test marketing of freshwater shrimp, *Macrobrachium rosenbergii*, in South Carolina. Aquaculture. 23 (1-4): 373-379. DOI: https://doi.org/10.1016/0044-8486(81)90031-4

Liyanage USPK, Long B. 2009. Status of the South Coast lobster fishery. CENARA Project Reports on Lobsters, National Aquatic Resources Research and Development Agency. 9-19 p.

National Aquaculture Development Authority. 2023. Annual aquaculture export statistics, Sri Lanka. [excel sheet]. NAQDA. [accessed 2024 Dec 17]. https://www.naqda.gov.lk/statistics.xlsx.

Otumawu-Apreku K, McWhinnie SF. 2020. Profit efficiency of the south Australian rock lobster fishery: a nerlovian and directional distance function approach. Mar Policy. 117: 103962. DOI: https://doi.org/10.1016/j.marpol.2020.103962

Prowse M, Moyer-Lee J. 2014. A comparative value chain analysis of smallholder burley tobacco production in Malawi 2003/4 and 2009/10. J Agrar Change. 14 (3): 323-346. DOI: https://doi.org/10.1111/joac.12022

Pushpalatha KBC, Chandrasoma J, Fernando WAJR, Sanjeewa KD. 2017. Impacts and importance of the introduction of culture-based fisheries in three medium-sized perennial reservoirs in Sri Lanka. Asian Fish Sci. 30 (139): 139-151. DOI: https://doi.org/10.33997/j.afs.2017.30.3.001

Rajeevan R, Edirisinghe U, Athauda ARSB. 2019. Performance of *Macrobrachium rosenbergii* in perennial reservoirs: a comparative assessment of fisheries in five perennial reservoirs in the Northern Province of Sri Lanka.

Trop Agric Res. 30 (3): 69-79. DOI: https://doi.org/10.4038/tar.v30i3.8320

Rajeevan R, Edirisinghe U, Athauda ARSB. 2021. Role of giant freshwater prawn (*Macrobrachium rosenbergii*) in livelihoods of the rural fishers of Northern Province of Sri Lanka. Int J Fish Aquat Stud. 9 (2): 44-51. DOI: https://doi.org/10.22271/fish.2021.v9.i2a.2441

Salladarré F, Guillotreau P, Loisel P, Ollivier P. 2017. The declining price anomaly in sequential auctions of identical commodities with asymmetric bidders: empirical evidence from the Nephrops norvegicus market in France. Agric Econ. 48 (6): 731-741. DOI: https://doi.org/10.1111/agec.12370

Senevirathna JDM, Munasinghe DHN. 2013. Identification of taxonomic status of spiny lobster species in Sri Lanka using DNA barcoding and its implications on fisheries and conservation programs. Trop Agric Res. 25 (1): 96-108. DOI: https://doi.org/10.4038/tar.v25i1.8033

Tammaroopa K, Suwanmaneepong S, Mankeb P. 2016. Socio-economic factors influencing white shrimp production in Chachoengsao Province, Thailand. Int J Agric. 12 (7.2): 1809-1820.

Thakur P, Mehta P, Guleria A, Singh P, Sharma P. 2022. Farmers' choice for output marketing channels of cauliflower in Himachal Pradesh, India: a multinomial logit model analysis. Econ Aff. 67 (5): 731-738. DOI: https://doi.org/10.46852/0424-2513.5.2022.6

Thakur P, Mehta P, Lal P, Chaudhary R, Pani SK, Singh AG, Devi C, Verma K, Sharma P. 2024. Agricultural produce supply chain network of capsicum: empirical evidence from India. Economies. 12 (1): 24. DOI: https://doi.org/10.3390/economies12010024

Urgessa M. 2011. Market chain analysis of teff and wheat production in Halaba Special Woreda, southern Ethiopia [MSc thesis]. Haramaya University. 104 p.

Wang O, Somogyi S, Charlebois S. 2019. Mapping the value chain of imported shellfish in China. Mar Policy. 99: 69-75. DOI: https://doi.org/10.1016/j.marpol.2018.10.024

Wijenayake WMHK, Jayasinghe UAD, Amarasinghe US, Athula JA, Pushpalatha KBC, De Silva SS. 2005. Culture-based fisheries in non-perennial reservoirs in Sri Lanka: production and relative performance of stocked species. Fish Manag Ecol. 12 (4): 249-258. DOI: https://doi.org/10.1111/j.1365-2400.2005.00447.x