

# Analysis of the *Macrobrachium rosenbergii* prawn trade in markets and restaurants in Mexico

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## ABSTRACT

**Objective:** To identify the links that integrate the production-distribution-consumption chain of the Malaysian prawn *Macrobrachium rosenbergii* in Mexico.

**Design/methodology/approach:** The survey method, semi-structured interview, and open-ended questions were used to learn about the origin and destination of the product, installed technological capacity, production volumes, purchase and sale prices, supply and demand characteristics, as well as the perception of product quality, which was carried out through the “mystery customer” technique.

**Results:** Imports are the origin and driving force of the *M. rosenbergii* prawn market in Mexico, mainly in the markets of Mexico City (La Nueva Viga) and Zapopan, Jalisco (Mercado del Mar), which concentrate more than 80% of the domestic market through a network of importers, wholesalers, retailers and restaurateurs, mainly. Aquaculture production is incipient, with two farms and two programs promoted by academic institutions.

**Limitations on study/implications:** This study was a first effort to understand the structure and components of the *M. rosenbergii* prawn market in Mexico. It focuses on descriptive work that will serve as a basis for future research.

**Findings/conclusions:** There are international marketing companies that stockpile the product and introduce it into the domestic market; this import reaches large supply centers and is then distributed to retail markets and supermarkets. This marketing chain is a motivating factor for inducing domestic production of the *M. rosenbergii* prawn.

**Keywords:** Aquaculture, supply, demand, quality, prices.

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## INTRODUCTION

Breeding and trade of Malaysian prawn (*Macrobrachium rosenbergii*), also known as giant freshwater prawn, has attained relevance in the aquaculture sector globally (New and Kutty, 2010). In Mexico, despite having been introduced more than 50 years ago, its production is still limited and faces technological and commercial challenges (Asiain-Hoyos *et al.*, 2022). Malaysian prawn is a product present in the local market (CONAPESCA, 2021) in different



regions of the country, and it is imported from Vietnam, Bangladesh and Malaysia (FAO, 2020). Many times, it is a substitute for native prawns such as *M. acanthurus* and *M. carcinus* in the Gulf of Mexico coast, and *M. americanum* and *M. Tenellum* in the Pacific coast (García-Guerrero *et al.*, 2013). These species have increasingly less presence in the markets. There are naturally other freshwater crustaceans with various ethnic uses (Vázquez-García *et al.*, 2004), but the ones mentioned before are important for their commercial value in local markets.

Despite its scarce production in the country (INAPESCA, 2018), the Malaysian prawn has considerable potential because of its flavor, texture and size, which make it attractive both for the gourmet market and for popular consumption.

In seafood markets (López-Tostado, 2013), *M. rosenbergii* can be found in window displays together with other species of crustaceans such as marine shrimp (*Litopenaeus* spp.), crabs (*Callinectes* spp.), among others, and a wide diversity of marine and freshwater fish. In the supermarkets, they are in the sections of select products (Kotler and Armstrong, 2017), with high commercial value, since *M. rosenbergii* reaches a value of \$500.00 pesos MX kg<sup>-1</sup>. In restaurant menus in touristic zones of important cities like Veracruz, Boca del Río, Puebla, Mexico City, among others, its value reaches \$1,200.00 pesos MX kg<sup>-1</sup>. In gourmet services (Porter, 2010), it has been found proportionally in weight per portion at \$3,000.00 pesos MX kg<sup>-1</sup>.

However, aquaculture production is limited; the price of *M. rosenbergii* at the pond ranges between \$500.00 pesos MX kg<sup>-1</sup> and \$700.00 pesos MX kg<sup>-1</sup>. The objective of this study is to identify the market structure (Resico, 2011) of Malaysian prawn (*Macrobrachium rosenbergii*), analyzing the links that make up its production, distribution and consumption chain, as well as the interrelation between the stakeholders involved (Cayeros-Altamirano *et al.*, 2016). Understanding the offer and demand of the Malaysian prawn in the country clarifies the viability of the market to drive its breeding, and therefore, the growth of aquaculture, an activity that generates employment and participates in the market economy.

## MATERIALS AND METHODS

The study was carried out from October 2023 to October 2024, considering as study region the states of Mexico, Puebla, Veracruz and Jalisco. The main seafood markets were included such as La Nueva Viga, which is part of the Central Supply Market in Mexico City; Mercado del Mar in Zapopan, Jalisco; the popular seafood market located at 18 Oriente in the historical Center of the city of Puebla; and Plaza del Mar in the city of Veracruz. In addition, malls and restaurants that sell seafood, including prawns, were visited.

### Surveys with shopkeepers (tenants)

Open interviews were applied (Tonon, 2009) with tenants (shopkeepers) to identify the trading companies that introduce the *M. rosenbergii* prawn to Mexico, and to characterize the product in terms of price and presentation (Dvoskin, 2004).

### **Interviews with producers**

The method of interviews with open questions was used (Vega-Budar and Taguenca-Belmonte, 2012) to identify the socioeconomic and technological characteristics of the farms devoted to the production of *M. rosenbergii*, considering their geographic location, annual production, breeding technique, and characteristics of the product.

### **Interviews with traders**

The technique of semi-structured interview was used (Ríos-Martínez, 2019) to understand the volume of imports, origin, and destination of the product, as well as prices, quality conditions, and characteristics both of the offer and the demand, through interviews with previously identified wholesale and retail traders.

### **Visits to restaurants**

Restaurants were visited in the cities of Mexico, Puebla and Veracruz. The technique of “mysterious customer” was applied (Block *et al.*, 2022), through which questions were formulated as a diner to understand the origin of the product, prices and quality. In addition, the menus from ten restaurants visited in those cities were reviewed.

### **Self-service stores**

Visits were conducted to self-service stores (Islas, 2007), detecting the presence of the *M. rosenbergii* prawn in window displays, and obtaining the information from exhibitors and applying open interviews to the persons in charge of the seafood departments in the stores.

### **Surveys with consumers**

Surveys were applied to consumers (Schiffman and Kanuk, 2005) in the markets visited, with the purpose of knowing their socioeconomic characteristics, frequency of purchase, preferences, and the product prices.

### **Analysis of the trade chain**

With the information gathered, a model of the trade chain was built (Stern, 1998), based on the general systems theory (Ríos and Santillán, 2017). A quota-controlled non-probabilistic sampling was used, considering the participation of each agent in the production-distribution-transformation-consumption chain, through the “snowball” method. This strategy allowed an agent to lead to establishing contact with other informant agents in each of the chain links.

Descriptive statistics were used, backed by field observations, since the small number of agents that make up the market structure did not allow a robust statistical analysis.

### **Data processing**

A database was built with the information gathered in the field, which was analyzed using the Statistica software.

## RESULTS AND DISCUSSION

### International packaging companies of *M. rosenbergii* in the Mexican market

International trade of crustaceans has, as part of its marketing strategy, packaging the product with the aim of conserving, transporting and trading in presentations that are ready for storage and exhibition of the product by wholesale and retail traders (Simoes *et al.*, 2019). In Vietnam, packaging companies of prawn play a key role in the export chain (Son *et al.*, 2005); they purchase the prawns from fishermen and local farmers settled on the Mekong River delta, a crucial region for the aquaculture production of this country. Then, the *M. rosenbergii* prawn is frozen and packed, allowing its conservation and later distribution to different countries of the world, mainly the United States (USA) and the Popular Republic of China (PRC). Despite this regional activity, some of the prawn exported from Vietnam is stockpiled from other nearby countries like Bangladesh (30-40%) (Kibria *et al.*, 2022). One of the reasons why it is necessary to stockpile for export is because of the decrease in local product, as a result of contamination of the Mekong River (Sneddon and Fox, 2012) and overfishing (Clayton *et al.*, 2003), aspect that has reduced the natural populations of the prawn. This way, the global supply chain is ensured despite the environmental challenges. The product that reaches Mexico is through companies that provide their services to Asian packagers of prawn (Table 1); that is, there are basically three companies that supply the national market primarily through La Nueva Viga Market in Mexico City (López-Tostado, 2013) and the Seafood Market in Zapopan (Palomino-Núñez *et al.*, 2022), Jalisco, which concentrated 80% of the national seafood market.

### *M. rosenbergii* farmers in the incipient national market

Based on the information gathered through desk research and field work, three important producers were identified (Reta-Mendiola *et al.* 2021), the first in the state of

**Table 1.** International packaging companies of Malaysian prawn (*M. rosenbergii*) detected in the national seafood markets in Mexico.

Company	Country of origin	Sizes per pound (lb)	Package (g)	Market /Company
Calcutta Seafoods Private Limited	India	2 prawns per pound 4 prawns per 2 pounds box	907	Plaza del mar, Veracruz / Pescados y Mariscos Pérez
Divron Bioventures	Sri Lanka	4 por libra	>400 250-400 150-250	La Nueva Viga/ El Galión
NewgenInter Trading Co., Ltd.	Thailand		>400 250-400 150-25	La Nueva Viga/Plaza del Mar, Veracruz.
Factory viet asia foods Co.	Vietnam		>400 250-400 150-250	La Nueva Viga/ El Chirgo/ Mercado de Pescados y Mariscos, Puebla/Mercado de San Juan, Ciudad de México

Source: Prepared by the authors based on field research.

Quintana Roo in the municipality of Othón P. Blanco, the second in the state of Veracruz in the municipality of Soledad de Doblado, and the third in the state of Oaxaca in the municipality of San José Chacalapa. The first has an intensive modernized production system to produce post-larvae and juveniles to fatten *M. rosenbergii*. The average annual production is 300 kg of prawn, which is traded directly in the restaurants of the Riviera Maya (Jouault and García de Fuentes, 2020) at an average price of \$400 pesos MX kg<sup>-1</sup> (\$20.12 USD) for females of weight that ranges between 30 and 40 g, while for the males (blue claws), the price is \$650.00 pesos MX kg<sup>-1</sup> (\$32.70 USD) with average weight of 70 g.

The presentation of both is packaged and frozen in 1 kg bags. The prices are kept constant throughout the year, the seasons of greatest demand are the ones that generally agree with the vacation period, mainly of foreign tourism. The main competitor is product imported from Vietnam, Bangladesh and Malaysia; the prices are similar, but consumers prefer national product because of its freshness and flavor, in addition to proximity to its supply, so the farm as productive unit presents a competitive advantage.

The second producer, located in the municipality of Soledad de Doblado, Veracruz, also uses a modernized and intensive production system for prawn, in addition to post-larvae production which is traded inside the state of Veracruz and the states of Oaxaca and San Luis Potosí. The sale of prawn is done at the farm gate, with an average price of \$650.00 pesos MX kg<sup>-1</sup> (\$32.70 USD); consumers visit the farm to purchase the product considering freshness and flavor as the main characteristics that they demand from the product; this purchase is generally done on weekends since it is considered as a meal for parties. In addition, buying at the farm gate causes an additional intangible satisfier in the consumers by being in contact with the natural environment in a recreational environment. The average production of this farm is 100 kg per year; the average sale weights are 35 g for females and 70 g for males.

The third producer was found in the municipality of San José Chacalapa, Oaxaca. The unit is based on a technological transference project to produce Malaysian prawn in the zone, coordinated by the Universidad del Mar. Its production system is extensive in rustic ponds with an average harvest of 12 kg per 10×20 m pond; the harvest is used for self-consumption among the same farmers who participate in the project. It is considered that the price can reach \$700.00 pesos MX kg<sup>-1</sup> (\$37.80 USD) with good acceptance within the project's influence area.

Another effort for technology transfer is taking place in the region of Sotavento and the High Mountains of the state of Veracruz (Reta-Mendiola *et al.*, 2019) including the municipalities of Paso del Macho, Tierra Blanca, Cuitláhuac and Tezonapa, through Colegio de Postgraduados Campus Veracruz, which managed to involve 10 tilapia (*Oreochromis* spp.) producers to accept using part of their infrastructure to breed prawn in association with the fish. The average sale price attained in these municipalities ranged from \$400.00 pesos MX kg<sup>-1</sup> (\$21.60 USD) to \$700.00 pesos MN kg<sup>-1</sup> (\$37.80 USD), with an average weight of 30 g, sold at the farm gate.

Of the four producers located in the country, only two are within the productive sector while the others are academic projects for innovation and technology transfer;

therefore, it is necessary to promote and develop the activity, because of the ease of association with other species, the possibility to diversify production, and the attractive market price.

### Wholesale traders

La Nueva Viga (Mexico City) is the main distribution center of fishing products in the country; it distributes products from all national ports and imports from the four continents, which places it as the second largest market in the world, exceeded only by the market in Tokyo. It has a surface area of 90,000 m<sup>2</sup>, with 202 wholesale warehouses, 55 retailers, and 165 commercial shops. Four of these warehouses already have certifications and 80 more are in process of obtaining them. An approximate daily volume of 1,500 tons of seafood is handled, which is equivalent to 60% of the national fishing production. In this market, around 300 species of fresh and frozen products are traded, plus 100 more species of imported frozen products (López-Tostado, 2013). In the case of Malaysian prawn, only five shopkeepers sell it in two-pound or master packaging, which is equivalent to two boxes of prawns with 12 two-pound boxes, respectively. The wholesale trader who sells most at the supply center of La Nueva Viga is a distributor company that handles an average wholesale sale price of \$350.00 pesos MX kg<sup>-1</sup> (\$18.97 USD) starting at 10 masters, which have 12 one-kg or two-pound boxes. They trade up to 500 masters per month during high season, which coincides with the vacation period, and a public price of \$400.00 pesos MX (\$21.60 USD) per box.

### Retail traders

The city of Puebla is one of the most economically important cities in southeastern Mexico. The seafood market, known as Mercado Popular de la 18 Poniente in Puebla, receives products coming mainly from La Nueva Viga and to a lesser extent from other states. During a field visit, a single establishment was identified that sells the Malaysian prawn (*M. rosenbergii*) from Vietnam, which shared space in commercial window displays with other high-value species like squid, crab claws, smoked oysters, and lobster; the prawn is traded at a public price of \$650.00 pesos MX (\$32.91 USD) per two-pound box (eight pieces) or boxes with 4-6 pieces depending on size.

Using the commercial name of prawn, some native species can be found such as acamaya (*M. carcinus*) and Australian lobster (*Cherax quadricarinatus*), which compete as substitutes.

Plaza del Mar in Veracruz receives fishing products and freshwater crustaceans with commercial value, among which the following stand out: *M. acanthurus*, *M. carcinus*, *M. americanum* and *M. tenellum*, from regional fishing and from the states of Tabasco, Campeche, Tamaulipas, Nayarit, Sinaloa, and Colima. Only two shopkeepers were identified who traded *M. rosenbergii* prawn, with a stock of 10 masters in the warehouse per month; the product is imported from Vietnam and Bangladesh with a similar average price and product presentation to what is found in Puebla's market. The interview respondents agreed that it is a luxury product for special occasions, for the weekend and/or a party, and not accessible for all social classes, since their main sales are for middle-class customers and restaurants.

In the neighboring Veracruz-Boca del Río zone, an establishment was found devoted to the sale of Malaysian prawn; the presentation is the same as in the markets mentioned before, in box packaging presentation (box with eight pieces) but with the difference that this establishment carries out the sale per piece, focused on customers that cannot acquire the product by box (\$650.00-\$700.00 pesos MX).

### **Restaurants**

With the technique of “mysterious customer”, seven restaurants were visited, two in Mexico City, two in the city of Puebla, and two in the city of Veracruz. It was found that they offer Malaysian prawn dishes with average weight of 80 g in different presentations, the most popular being with garlic sauce, butter, or fine herbs, with prices that range from \$600.00 pesos MX kg<sup>-1</sup> (\$30.19 USD) to \$1,800.00 pesos MX kg<sup>-1</sup> (\$90.58 USD), depending on the type of establishment. It is considered that diners who prefer this product are middle and/or high class, since it is regarded as a gourmet product, which is consumed at events and/or on special occasions.

### **Self-service stores**

Considering that Malaysian prawn is a gourmet product, based on the information gathered in the field, a visit was conducted through self-service stores in the cities of Veracruz (2 stores), Puebla (2 stores), and Mexico City (4 stores) devoted to the sale of specialized products. The prawn was found in presentations of four to seven pieces in plastic domes at prices that range between \$650.00 pesos MX kg<sup>-1</sup> (\$32.91 USD) and \$680.00 pesos MX kg<sup>-1</sup> (\$34.49 USD). However, through observation, it was possible to detect that the quality was not the same as in the other members of the market structure given that they presented a deteriorated appearance, not fresh, and of low quality (Tacon *et al.*, 2020). This is possibly because of the time of refrigeration, and which can be inferred that it is not the main way for consumers to acquire the prawn, given that freshness is an important aspect that they consider at the time of buying.

### **General profile of buyers of Malaysian prawn in Mexico**

According to Del Río-Zaragoza *et al.* (2022), the profile of seafood consumer can be characterized and classified. Based on surveys, as well as triangulating the information with various agents that integrate the structure of the Malaysian prawn market in Mexico, a consumer's profile could be created. The gender of the consumer is unimportant, with age between 35-65 years, so it can be inferred that consumers present some economic stability with monthly income >\$20,000 pesos MX (\$1,006.0 USD), so it is thought that there are no budget restrictions for food purchasing. They present an educational level of undergraduate and/or graduate studies, and they are from middle, middle-high class in urban zones. According to New and Kutty (2010), there are emotional codes to identify the purchasing decisions of the consumer, and in this study, it is detected that the consumer decides to make his/her dishes buying the prawn in gourmet supermarkets or online stores; or sometimes, when they decide to try dishes, they attend restaurants. They consider that the Malaysian prawn is a dish for special occasions; they show high

willingness to pay taking into consideration the quality and freshness of the product; there is greater preference for live presentations (movable way of trading, with control systems for water quality) (Table 2).

**Commercialization structure of *M. rosenbergii* in Mexico**

According to Vilaboa-Arróniz *et al.* (2009), there are diverse agents who participate in the commercialization of a product, shaping a system with operative structure and function. These agents are interrelated, in different combinations, to establish the distribution channels of the product. Figure 1 shows the commercialization structure of Malaysian prawn *M. rosenbergii* in Mexico. The elements considered are the following: production as initial element, which considers international and national market movements; wholesale and retail traders which reach distribution centers such as seafood supply centers, malls and restaurants, until reaching the final consumer.

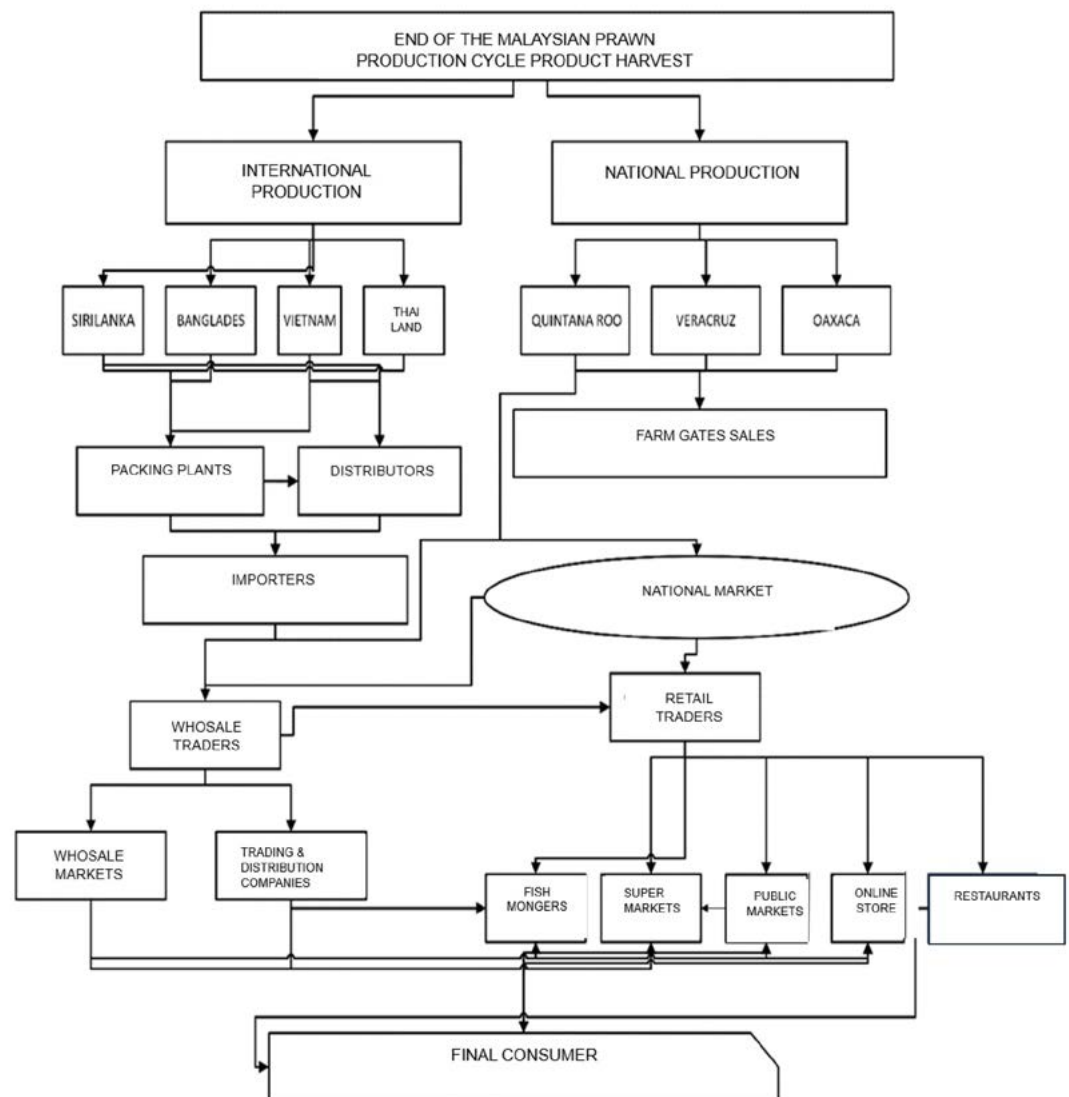


Figure 1. Commercialization structure of Malaysian prawn in Mexico.

**Table 2.** General motivations to purchase Malaysian prawn (*Macrobrachium rosenbergii*) in Mexico.

Feature	Description
Flavor	The intense and delicate nature of the prawn is its main motivator.
Status	It is a symbol of social status and good taste.
Health	It is perceived as eating healthy and nutritious food. They care about their diet and look for natural and nutritious products.
Culinary experience	It seeks to enjoy a complete gastronomic experience, from the choice of the product to its preparation.
Gourmet experience	Enjoy good food and are constantly looking for new culinary experiences. Appreciates high-quality products and good design.
Quality	Looks for the highest quality, fresh, and sustainably sourced produce.
Exclusivity	Attracted to unique and hard-to-find products.

Source: Prepared by the authors based on information from field research.

Malaysian prawn has proven to be a species with great potential in global aquaculture, especially in Asia. However, in Mexico, its production still faces challenges that limit its development, such as the lack of access to advanced technologies and scarcity of reproducers. For the country to take advantage of the opportunities that the international market offers, it is necessary to invest in technological innovation and to improve local production systems, which would allow Mexico to reduce its dependence on imports and become a relevant competitor in the global market of Malaysian prawn.

## CONCLUSIONS

The market structure and commercialization channels of Malaysian prawn vary significantly depending on the region and the level of development of aquaculture. Globally, oligopoly markets predominate where a few actors control most of the production and commercialization, while in local markets like Mexico, the commercialization chain includes several intermediaries that add value in each stage. The added value of Malaysian prawn is influenced by factors like the technology used in production, distribution systems, and consumer perception. These aspects are key to understanding the dynamics of the market and the opportunities to improve competitiveness of the product in global and national markets. Finally, it was found that there are two origins of the product, the national which is incipient and the imported from Asian countries, particularly Vietnam. There are trading companies that stockpile the product and introduce it to the market in the American continent, and Mexico is one of the importers. These imports reach the large supply centers and then are distributed to retail markets and supermarkets. This commercialization chain is motivating to induce national production of the *M. rosenbergii* prawn.

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