
Production and Marketing of Polycultured Crabs, Prawns, Shrimps, and Milkfish in Orani, Bataan since the COVID-19 Pandemic

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Abstract

Crabs, prawns, shrimps, and milkfish are the main aquaculture products of Orani, Bataan. The municipality's Comprehensive Development Plan for 2018-2024, however, cites the siltation of the Orani Channel as a problem that affects the quantity and quality of their products. This study was conducted to: (1) identify the participants and the utilities they create for Orani's aquaculture products; (2) determine their profits and margins; (3) illustrate their marketing channel; and (4) discuss the problems being faced by the fishpond operators since the COVID-19 pandemic. The needed data were obtained through interviews of 25 fishpond operators from and 25 stall lessees listed by the Municipal Agriculture Office and the Office of the Economic Enterprise, respectively. The study found that the participants are the fishpond operators, fish port administrators, stall lessees and their staff, wholesalers and exporters, and retailers who collectively create form, possession, place, and time utilities. Fishpond operators earned, on average, Php 225,756.00 per hectare in 2022 and Php 50,556.00 per hectare in 2021. For both years, wholesalers and exporters had margins of Php 100.00 – Php 200.00 per kilogram of crabs, prawns, and shrimps, and Php 20.00 per kilogram of milkfish. Retailers, on the other hand, had margins of Php 100.00 – Php 300.00 per kilogram of crabs, prawns, and shrimps, and Php 10.00 – Php 50.00 per kilogram of milkfish. One hundred percent of the products pass through the stall lessees and their staff for weighing, grading, and wholesale price determination through *bulungan* or secret bidding. Forty percent of the products are sold by the retailers in Orani and 60% by the retailers to the rest of Luzon and the world. Fishpond operators are facing problems such as high mortality rates due to environmental factors, theft by caretakers, collusion and price fixing by some stall vendors, and declining prices due to the pandemic.

Keywords: *crabs, milkfish, polyculture, prawns, shrimps*

Introduction

Mangrove crab or mud crab (*Scylla serrata*), giant black tiger prawn or shrimp (*Penaeus monodon*), Pacific white shrimp (*Penaeus vannamei*), and milkfish (*Chanos chanos*) are the main aquaculture products of Orani, Bataan in the Philippines. For decades, these products which are grown using the polyculture method (R. A. Tala, personal communication, May 24, 2023) have been boosting the local economy and contributing immensely to the municipality's revenues. The crabs produced in Orani are sold primarily in Metro Manila, while most of their prawns are exported to Japan and Taiwan (F. G. Razon, personal communication, May 24, 2023). The municipality's average daily crab output is seven tons, while that of prawns is 10 tons (Beltran, 2007). To give thanks to the bountiful harvest of crabs and prawns, the people of Orani celebrate in the second week of March of every year the Alimango and Sugpo Festival (Behold Bataan, 2019).

Since the outbreak of the Coronavirus Disease 2019 (COVID-19) in March 2020, however, a wide range of industries including manufacturing, transportation, services, construction, and agriculture and fisheries have been gravely affected. In Central Luzon, the economic losses from a 60-day enhanced community quarantine (ECQ) enforcement totaled to Php 174 billion. This figure includes the losses of the agriculture and fisheries sector which amounted to Php 1.5 billion. The sector suffered that huge loss because of the restrictions in movement that prevented products from being sold and consequently being spoiled (National Economic and Development Authority Regional Office 3, 2020).

Meanwhile, the Comprehensive Development Plan (CDP) of Orani for the period 2018-2020 cites the siltation of the Orani Channel as a problem that affects the quantity and quality of their aquaculture products. The municipality's CDP also mentions low productivity and inadequate infrastructure as the other problems of the industry. To address some of these problems, the Orani municipal government included in its Annual Investment Program for 2023 the following: (1) Php 310 million for the improvement and expansion of its fish port; (2) Php 60 million for the construction of new roads connecting the fish port and the public market; and (3) Php 2 million for the Alimango and Sugpo Festival (Municipality of Orani, 2023).

According to the Bureau of Fisheries and Aquatic Resources (2022), the low productivity of aquaculture farms is primarily caused by the occurrence of diseases and the low adoption of the Code of Good Aquaculture Practices (GAqP). These causes should immediately be addressed because the industry is an important contributor to the attainment of the country's food security. The GAqP for crabs and shrimps enumerates the practices that minimize the risk in brackish water aquaculture production. It covers food safety, animal health and welfare, environmental integrity, and socio-economic aspects of aquaculture production (Bureau of Agriculture and Fisheries Standards, 2017).

Scylla serrata is the most preferred species for growing mangrove crab or mud crab in the Philippines. In 2013, the country produced around 16,000 metric tons of mangrove crabs worth Php 5.2 billion, a reason for the Food and Agriculture Organization of the United Nations to call the Philippines as the second biggest producer of mangrove crabs in the world in 2015. Crab juveniles for farming are sourced mostly from the wild, although a few are produced in hatcheries. However, their population is nearing depletion due to the destruction of their natural habitat and the uncontrolled collection of crabs of all sizes. This prompted the Bureau of Fisheries and Aquatic Resources and local government units to prohibit the gathering and selling of crab juveniles equal to or smaller than three centimeters in size outside the municipality of origin. This stopgap measure, in turn, led to the increased acceptability of crab juveniles produced from hatcheries among crab growers. To make crab production more sustainable, the Aquaculture Department of the Southeast Asian Fisheries and Development Center has intensified the dissemination of sustainable management practices of mangrove crab culture. (Qunitio & Parado-Estepa, 2017).

Majority of the previous studies on crabs, prawns, shrimps, and milkfish focused on their production aspect (e.g., Cerezo, 2001, De Leon, 1994, Eda, 1982, Kitche, 2012, and the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development, 2021), while a few tackled both their production and marketing aspects (e.g., Agbayani, 2001 and Damaso, 2023). Damaso's study is particularly interesting because it found that annual income in crab production has a strong positive correlation with production area and annual production.

The limited number of available pieces of literature on the polyculture of crabs, prawns, shrimps, and milkfish in Orani, Bataan, especially since the COVID-19 pandemic, and the industry's problems with productivity, siltation of the Orani Channel, and inadequate infrastructure as mentioned in the municipality's CDP provides a rationale for this study.

The study relates to, if not addresses, the United Nations' Sustainable Development Goals (SDGs), particularly, decent work and economic growth, sustainable cities and communities, responsible production and consumption, climate action, life below water, no poverty, and zero hunger.

The study sought the answers to the following questions: (1) who are the participants in Orani's aquaculture industry, and what are the utilities they create? (2) how big are their profits and margins? (3) how can their marketing channel be illustrated? and (4) what are the problems being faced by the participants, especially the fishpond operators?

Hence, the study was conducted with the following aims: (1) to identify the participants and the utilities they create for Orani's aquaculture products; (2) to determine the size of their profits and margins; (3) to illustrate their marketing channel; and (4) to discuss the problems being faced by the participants, especially the fishpond operators, since the COVID-19 pandemic.

Framework

The institutional approach to the study of marketing, and the concepts of profit or loss and marketing margin were used for the study's framework. The institutional approach to the study of marketing was used because it identifies the participants who create utilities for a particular product. These participants are the middlemen who may be considered parasitic if the marketing margins they receive are not justified by the utilities they create for the product (Casavant, Infanger, & Bridges, 1999). The most common middlemen are the following: (1) processors who create form utility; (2) merchant middlemen who are either wholesalers or retailers that create possession utility; (3) agent middlemen such as brokers and commission men who create place utility; (4) speculative middlemen who create possession utility; and (5) facilitators who provide the necessary market information, grading, and standardization.

The second element of the framework is the basic concept of profit or loss that is taught in general economics. Profit or loss is simply the difference between total revenues (TR) and total costs (TC). TR is obtained by multiplying the quantity of output sold by the price per unit of output. TC, on the other hand, is obtained by multiplying the quantity of inputs by the price per unit of input. If TR is greater than TC, there is a profit. But if TC exceeds TR, there is a loss.

The third and final element of the framework is the marketing margin concept. Casavant, Infanger, and Bridges (1999) defined marketing margin as the difference in the price the producer receives for the raw product and the price the consumer pays for the final product. It represents the costs of providing marketing services, and alternatively, the costs of the creation of form, time, place, and possession utilities. It is given by the formula $MM = PR - PF$, where MM is marketing margin, PR is retail price, and PF is farm price. Marketing margins that simply cover the real costs of marketing and value addition services (e.g., transportation, processing, storage, grading, packaging, wholesaling, retailing, and other merchandising activities) including normal returns to market intermediaries indicate marketing efficiency (Pabuayon et al., 2013).

Methodology

This study used a combination of qualitative and quantitative research approaches and a survey research design. Identification of market participants and the utilities they create, illustration of the marketing channel, and discussion of the problems being faced by the participants, including the adverse effects of the COVID-19 pandemic on their operations, call for a qualitative research approach. Calculation of profits or losses and marketing margins, on the other hand, call for a quantitative research approach. The survey research design was used because it allows quantitative inferences about the population of crab, prawn, shrimp, and milkfish producers and marketers in the study site. A survey research design could capture the behavior or profile of the target population subject to some degree of uncertainty (Portus et al., 2020). The study's units of analysis were the individual farm or fishpond used in the polyculture of crabs, prawns, shrimps, and milkfish in Orani, Bataan.

The primary data needed for the study were obtained through interviews of 25 fishpond operators from the Municipal Agriculture Office and 25 fish port stall lessees from the Office of the Economic Enterprise. In addition, the officials and staff of the following offices of the Orani municipal government were also interviewed: (1) Municipal Agriculture Office; (2) Municipal Planning and Development Office; (3) Office of the Economic Enterprise; and (4) Office of the Orani Fish Port Administration. The interviews were conducted from April 24, 2023 to July 15, 2023.

Prior to the interviews, permission to conduct the study and interviews were obtained from the Director of the University of the Philippines Diliman – Extension Program in Pampanga, the Orani Municipal Agriculturist, the Orani Municipal Planning and Development Coordinator, and the chairs of the coastal barangays of Kabalutan, Pantalan Bago, and Tapulao. Free prior and informed consent (FPIC) of the interviewees was also sought before the interviews. The interviewees gave their FPIC by signing the second page of the Informed Consent Form. The identities of all interviewees were kept anonymous throughout the study.

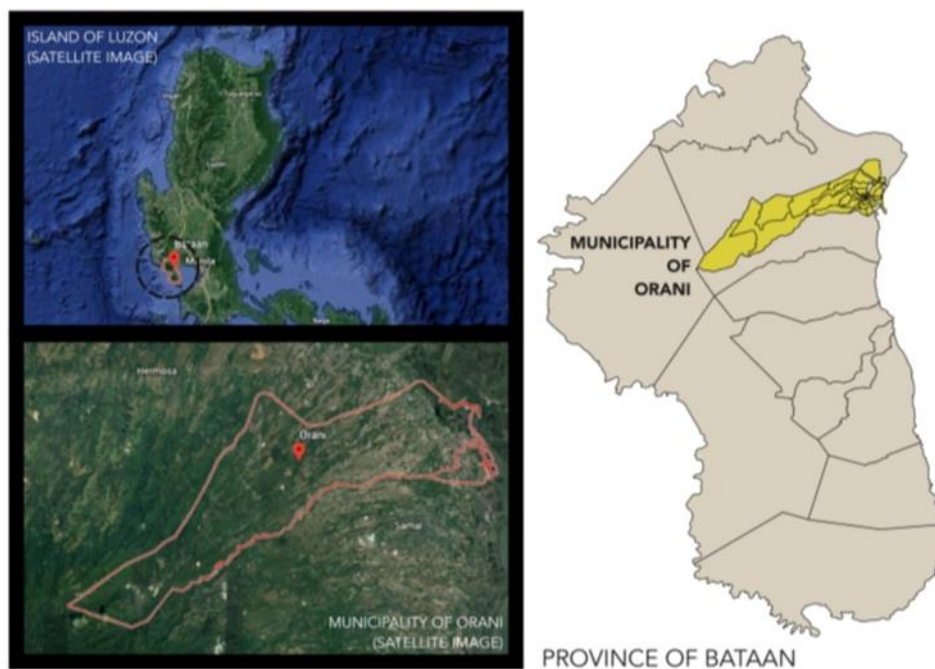
The interview questions were divided into seven parts. The first two parts were about the profile of fishponds and fishpond operators. The third part was about the market participants and the utilities they create or the activities they perform. The fourth part asked about returns or revenues and costs or expenses which are vital in computing for the annual net profit per hectare of each fishpond operator. The fifth part, in turn, asked for the buying and selling prices of crabs, prawns, shrimps, and milkfish which are needed in computing for the margins of the wholesalers/exporters and retailers. The sixth part asked the interviewees for a description of the marketing channel for their aquaculture products. The seventh and final part asked the interviewees, particularly the fishpond operators, to enumerate and describe the problems they are facing, especially since the COVID-19 pandemic.

The primary data gathered from the interviews were summarized in a spreadsheet. The modal responses of interviewees were used to fulfill the first, the third, and the fourth aims of the study, while their responses on returns or revenues, costs or expenses, and buying and selling prices of products were used to compute for profits and margins.

Results and Discussion

The Study Site: Orani

Orani is a first-class municipality in the province of Bataan. It has a population of 66,909. Its economy is dependent on agriculture, fisheries or aquaculture, and wholesale and retail businesses. Eleven percent of its workforce are skilled agricultural and fishery workers, 19% are service and sales workers, and the rest have occupations ranging from managers or supervisors to plant and machine operators. Aquaculture products such as crabs, prawns, shrimps, milkfish, tilapia, mussels, and oysters are harvested from Orani's rich fishing grounds and fishponds (Municipality of Orani, 2018). According to the Municipal Agriculture Office, the fishponds are located in the coastal barangays of Kabalutan, Pantalang Bago, Tapulao, Kaparangan, Puksuan, Parang-parang, and Tenejero.



Source: Map Atlas of the Municipality of Orani (2023)

Figure 1. Map of Orani, Bataan

The Fishpond Operators and their Fishponds

All 25 fishpond operators are male, married, and have, on average, four children. Their mean age is 58.4 years. Twenty or 80% of them are college graduates, while the remaining five or 20% are undergraduates. They have been in fishpond business for an average of 35 years. Twenty or 80% of them acquired their knowledge on fishpond operation from their fathers, while the remaining five or 20% got their knowledge from their previous work.

Out of the 25 fishponds covered by the study, 15 or 60% are located in Kabalutan, five or 20% are in Pantalang Bago, and the remaining five or 20% are in Tapulao. The mean size of the fishponds is 5.4 hectares. All of them are owned by their operators and have been in operation for an average of 16.4

years. Ten or 40% of these fishponds were acquired through informal loans, 10 or 40% through savings, and the remaining five or 20% through formal loans. The mean acquisition cost of these fishponds is Php 4.9 million. The mean of the real estate taxes paid by the owners to the local government for these fishponds is Php 64,000.00 per year.



Source: De Leon, P. C. (2023)

Figure 2. A Sample Fishpond in Kabalutan, Orani, Bataan

The mean of their initial operating capital is Php 312,200.00. Fifteen or 60% of the 25 fishpond operators sourced their initial operating capital from informal sources, five or 20% from their savings, and five or 20% from their other farm income (e.g., income from mallard duck raising or balut production). Out of the 25 fishpond operators, only five or 20% have nonfarm income (e.g., salaries as local government employees).

Market Participants and the Utilities They Create

There are five groups of market participants in Orani's aquaculture industry. They are: (1) the fishpond operators; (2) the fish port administrators; (3) the stall lessees and their staff; (4) the wholesalers and exporters; and (5) the retailers. Each group creates utilities as the aquaculture products move from the point of production to the point of consumption.

The fishpond operators are the producers. They create form and possession utilities. In general, they take four steps in the polyculture of crabs, prawns, shrimps, and milkfish. The first step is pond preparation. Pond preparation starts with the draining and drying of the fishpond. Next is tee seed application. Tee seed is applied in order to eliminate various species of fish that act as predators of prawns and shrimps. The third and final sub step of pond preparation is fertilizer application. Fertilizer is essential for the growth of algae and other plants that serve as natural food of crabs, prawns, shrimps, and milkfish. The next step after pond preparation is conditioning. The crab juveniles, prawn and shrimp fries, and milkfish fingerlings are conditioned in a nursery section of the fishpond. They are conditioned for water temperature and salinity. When they have already adjusted to the temperature and salinity of the water in

the fishpond, they are released. Supplemental feeding is done whenever the natural food supply is depleted. Gasang – a mixture of tiny shellfish – is also given in order to harden the shell of crabs, prawns, and shrimps. The milkfish serves as aerator of prawns and shrimps. After three months, the crabs, prawns, shrimps, and milkfish are ready for harvesting. Harvesting is the fourth and final step of the production process. The harvested aquaculture products are then brought to the Orani Fish Port for sale to the wholesalers and exporters.

The fish port administrators are the facilitators. They report to the Office of the Economic Enterprise Supervisor and the Municipal Planning and Development Coordinator. They are in charge of the smooth operation of the fish port. They provide the stalls, and ensure the continued supply of water and electricity to the stalls. They also provide security for the stall lessees. They create place utility because they bring the producers, stall lessees and their staff, and wholesalers and exporters under one roof. In return, the fish port administrators charge the producers Php 24.00 per cooler of fish and Php 36.00 per cooler of crabs, prawns, and shrimps. Meanwhile, they charge the lessee a rental fee of Php 2,550.00 per month. They also charge wholesalers and exporters parking fees of Php 80.00 per truck, Php 50.00 per jeepney, and Php 20.00 per tricycle (R. Tuazon, personal communication, June 19, 2023). All these become revenues of the local government.

The stall lessees and their staff are the third group of market participants in Orani's aquaculture industry. They collectively act as middlemen and facilitators. They primarily create place utility because they bring producers (or sellers) and wholesalers and exporters (or buyers) together. But they also perform the grading function. They consist of the following: (1) the stall lessees who the local people refer to as stall owners; (2) the bookkeepers who are referred to by locals as secretaries; (3) the *bentadors* or vendors; (4) the collectors; (5) the porters; and (6) the *taga-kilo* or weighing staff. Once the aquaculture products arrive at the fish port, they are weighed by the *taga-kilo*. Then, they are sorted by the porters into various classes or grades, such as jumbo, first class, second class, third class, and reject. After that, the *bentadors* are approached by the interested wholesalers and exporters. They whisper their bids or buying prices to the *bentadors*. Hence, this process of wholesale price determination is locally termed as *bulungan* or secret bidding. The *bentadors* sell the products to the highest bidder. The transaction is then recorded by the bookkeeper or secretary. Finally, the collector accepts the payment of the winning bidder (wholesaler or exporter), deducts the commission of the stall lessee, and remits the payment to the producer.



Source: De Leon, P. C. (2023)

Figure 3. The Stalls at the Orani Fish Port

The wholesalers and exporters belong to the fourth group of market participants in Orani’s aquaculture industry. They are merchant middlemen who buy the aquaculture products in bulk, pack and put them in cold storage, transport them, and sell them to local and foreign retailers. Hence, they create possession, time, and place utilities.

The retailers are the fifth and final group of market participants in Orani’s aquaculture industry. They are merchant middlemen who buy from wholesalers and sell the products directly to consumers. They primarily create possession utility. However, their use of ice or cold storage prior to sale, consequently creates time utility as well. Table 1 lists the market participants and the utilities they create for Orani’s aquaculture products.

Table 1. Market Participants and the Utilities They Create for Orani’s Aquaculture Products

Market Participants	Utilities Created
Fishpond Operators	Form and possession
Fish Port Administrators	Place
Stall Lessees and Their Staff	Place, grading, and wholesale price determination
Wholesalers and Exporters	Possession, time, and place
Retailers	Possession and time

Profits of Fishpond Operators

In 2021, the fishpond operators had, on average, a TR per hectare per year of Php 175,200.00, a TC per hectare per year of Php 124,644.00, and a profit per hectare per year of Php 50,556.00. In 2022, however, they had on average, a TR per hectare per year of Php 350,400.00, a TC per hectare per year of Php 124,644.00, and a profit per hectare per year of Php 225,756.00.

The much lower TR and profit per hectare per year in 2021 as compared to those of 2022 are attributed to the COVID-19 pandemic. In 2021, the government implemented lockdowns and strict quarantine procedures. The restrictions in the movement of people, coupled with the loss of jobs and incomes by many, resulted to a weak demand for aquaculture products. According to 15 out of 25 fishpond operators, this weak demand consequently lowered the prices of their aquaculture products by half. Fortunately, in 2022, the lockdowns and strict quarantine procedures were lifted, and the demand for aquaculture products returned to their pre-COVID-19 pandemic levels.

The claim of the 60% of the fishpond operators that prices had decreased by half in 2021, however, was not corroborated by the Office of the Economic Enterprise. According to the supervisor of the said office, the wholesale and retail prices of aquaculture products in Orani in 2021 and 2022 were generally similar. The supervisor attributed the weaker demand for aquaculture products in 2021 as compared to that of 2022 to the loss of jobs and incomes of many people during the lockdowns of 2021. The fish port administrators share this view of the Office of the Economic Enterprise Supervisor.

In both years, prawn sales were the top contributors to the TR of fishpond operators. In 2021, prawn sales, on average, was Php 70,000.00 per hectare per year, while in 2022, it was Php 140,000.00 per hectare per year. For both years, the contributions of prawn sales to TR were followed by those of crab sales. Crab sales in 2021 were Php 48,250.00 per hectare per year, while in 2022, they were Php 96,500.00 per hectare per year.

Meanwhile, the salaries of the fishpond caretakers were the top contributors to TC in 2021 and 2022. For both years, the fishpond operators paid their caretakers, on average, Php 54,600.00. Collectively, prawn and shrimp fries, crab juveniles, and milkfish fingerlings were the second biggest contributor to TC. For both years, the fishpond operators incurred, on average, Php 45,000.00 per hectare per year of expenses on prawn and shrimp fries, crab juveniles, and milkfish fingerlings. The other expense items or contributors to TC are shown in Table 2.

Despite the effects of the COVID-19 pandemic, the average annual profits per hectare per year earned by the fishpond operators in 2021 and 2022 were much bigger as compared to the opportunity costs of the nearly Php 125,000.00 per hectare per year spent on the polyculture of crabs, prawns, shrimps, and milkfish. The readily available opportunity cost of capital would be the annual interest income from savings accounts. Given that most universal banks in the country pay only 0.0625% per annum of interest on savings deposits, the Php 125,000.00 of fishpond operators would have earned a gross interest of only Php 7,812.50 if their money had been deposited in a bank instead. This figure would further reduce to Php 6,250.00 after the 20% government tax on interest income is deducted.

Table 2. Costs and Returns per Hectare per Year of Fishpond Operators in 2021 and 2022

Cost/Revenue/Profit Item	2021 (Php)	2022 (Php)
Crab sales	48,250.00	96,500.00
Prawn sales	70,000.00	140,000.00
Shrimp sales	33,450.00	66,900.00
Milkfish sales	23,500.00	47,000.00
Total Revenues (TR)	175,200.00	350,400.00
Crab juveniles	13,000.00	13,000.00
Prawn fries	8,900.00	8,900.00
Shrimp fries	14,600.00	14,600.00
Milkfish fingerlings	8,500.00	8,500.00
Tee seed	2,240.00	2,240.00
Fertilizer	1,800.00	1,800.00
Caretaker	54,600.00	54,600.00
Utilities (electricity and water)	1,200.00	1,200.00
Gasoline	6,980.00	6,980.00
Pump	4,400.00	4,400.00
<i>Lim</i> (mixture of small fish)	382.00	382.00
<i>Gasang</i> (mixture of tiny shellfish)	882.00	882.00
Hired labor	7,160.00	7,160.00
Total Costs (TC)	124,644.00	124,644.00
Profit (TR – TC)	50,556.00	225,756.00

Margins of Wholesalers and Exporters, and Retailers

For both 2021 and 2022, the wholesalers and exporters had margins of Php 100.00 – Php 200.00 per kilogram of crabs, prawns, and shrimps, and Php 20.00 per kilogram of milkfish. The retailers, on the other hand, had margins of Php 100.00 – Php 300.00 per kilogram of crabs, prawns, and shrimps, and Php 10.00 – Php 50.00 per kilogram of milkfish. These margins were calculated based on the prices given by the fish port administrators and the Office of the Economic Enterprise Supervisor. Table 3 summarizes the margins computed for both wholesalers and exports, and retailers.

Table 3. Margins of Wholesalers and Exporters, and Retailers in 2021 and 2022

Aquaculture Product	Margin of Wholesalers and Exporters (Php/kg)	Margin of Retailers (Php/kg)
Crabs, prawns, and shrimps	100.00 – 200.00	100.00 – 300.00
Milkfish	20.00	10.00 – 50.00

The margins of the wholesalers and exporters (MMW) were computed by subtracting the prices that they paid to the producers (PWP) from the prices they received from the retailers (PWR). Tables 4-7 indicate the margins of wholesalers and exporters on crabs, prawns, shrimps, and milkfish for the years 2021 and 2022.

Table 4. Margins of Wholesalers and Exporters on Crabs in 2021 and 2022

Price or Margin	First Class (Php/kg)	Second Class (Php/kg)	Third Class (Php/kg)	Reject (Php/kg)
PWR	900.00	600.00	550.00	250.00
PWP	800.00	500.00	450.00	150.00
MMW	100.00	100.00	100.00	100.00

Table 5. Margins of Wholesalers and Exporters on Prawns in 2021 and 2022

Price or Margin	First Class (Php/kg)	Second Class (Php/kg)	Third Class (Php/kg)	Reject (Php/kg)
PWR	1,600.00	1,400.00	1,100.00	600.00
PWP	1,500.00	1,300.00	1,000.00	500.00
MMW	100.00	100.00	100.00	100.00

Table 6. Margins of Wholesalers and Exporters on Shrimps in 2021 and 2022

Price or Margin	First Class (Php/kg)	Second Class (Php/kg)	Third Class (Php/kg)	Reject (Php/kg)
PWR	700.00	600.00	550.00	400.00
PWP	500.00	450.00	350.00	200.00
MMW	200.00	150.00	200.00	200.00

Table 7. Margins of Wholesalers and Exporters on Milkfish in 2021 and 2022

Price or Margin	First Class (Php/kg)	Second Class (Php/kg)	Third Class (Php/kg)	Reject (Php/kg)
PWR	200.00	180.00	170.00	120.00
PWP	180.00	160.00	150.00	100.00
MMW	20.00	20.00	20.00	20.00

It is noted that only the margins of wholesalers and exporters on shrimps exhibited a Php 50.00 per kilogram difference between the first, the third, and the reject classes on the one hand, and the second class on the other. The fish port administrators and the Office of the Economic Enterprise Supervisor attribute this to the relatively more variable prices of shrimps as compared to the prices of the other aquaculture products.

Meanwhile, the margins of the retailers (MMR) were computed by subtracting the prices they paid to the wholesalers (PRP) from the prices they received from the consumers (PRR). Tables 8-11 show their margins on crabs, prawns, shrimps, and milkfish for the years 2021 and 2022.

Table 8. Margins of Retailers on Crabs in 2021 and 2022

Price or Margin	First Class (Php/kg)	Second Class (Php/kg)	Third Class (Php/kg)	Reject (Php/kg)
PRR	1,200.00	900.00	700.00	350.00
PRP	900.00	600.00	550.00	250.00
MMR	300.00	300.00	150.00	100.00

Table 9. Margins of Retailers on Prawns in 2021 and 2022

Price or Margin	First Class (Php/kg)	Second Class (Php/kg)	Third Class (Php/kg)	Reject (Php/kg)
PRR	1,700.00	1,500.00	1,300.00	800.00
PRP	1,600.00	1,400.00	1,100.00	600.00
MMR	100.00	100.00	200.00	200.00

Table 10. Margins of Retailers on Shrimps in 2021 and 2022

Price or Margin	First Class (Php/kg)	Second Class (Php/kg)	Third Class (Php/kg)	Reject (Php/kg)
PRR	1,000.00	800.00	650.00	550.00
PRP	700.00	600.00	550.00	400.00
MMR	300.00	200.00	100.00	150.00

Table 11. Margins of Retailers on Milkfish in 2021 and 2022

Price or Margin	First Class (Php/kg)	Second Class (Php/kg)	Third Class (Php/kg)	Reject (Php/kg)
PRR	250.00	200.00	180.00	140.00
PRP	200.00	180.00	170.00	120.00
MMR	50.00	20.00	10.00	20.00

As shown by Tables 8-11, the margins of retailers on the four aquaculture products varied across their four classes. The retailers at the Orani Public Market and the Office of the Economic Enterprise Supervisor attribute this variability to the different activities performed by the individual retailers prior to the actual sale of the products to the consumers such as tying several pieces of crabs together (Figure 4) or dividing prawns into several basins with specific weights (Figure 5).



Source: De Leon, P. C. (2023)

Figure 4. Crabs for Sale at the Orani Public Market



Source: De Leon, P. C. (2023)

Figure 5. Prawns for Sale at the Orani Public Market

Marketing Channel

One hundred percent of the crabs, prawns, shrimps, and milkfish produced by the fishpond operators are brought to the Orani Fish Port. Upon arrival at the fish port, the fish port administrators count the coolers containing the aquaculture products which are charged their corresponding fees. Then, the producers take their products to the different fish port stalls which are locally referred to as consignment.

One hundred percent of the aquaculture products pass through the fish port stalls where they are weighed, sorted, graded, and priced through *bulungan* or secret bidding. These marketing functions or activities are performed by the stall lessees and their staff. Once the wholesale prices are determined, they are sold to the wholesalers and exporters – the winning bidders.

Sixty percent of the aquaculture products are sold by the wholesalers and exporters to the retailers from the rest of Luzon and the world, while the remaining 40% are sold to the retailers in Orani, particularly at the Orani public market (Figures 6-7). Consequently, 60% of the products are sold to consumers from the rest of Luzon and the world, while 40% are sold to the consumers in Orani. Figure 8 is a diagram of the marketing channel of polycultured crabs, prawns, shrimps, and milkfish in Orani, Bataan.



Source: De Leon, P. C. (2023)

Figure 6. Orani Public Market



Source: De Leon, P. C. (2023)

Figure 7. Seafood Section of the Orani Public Market

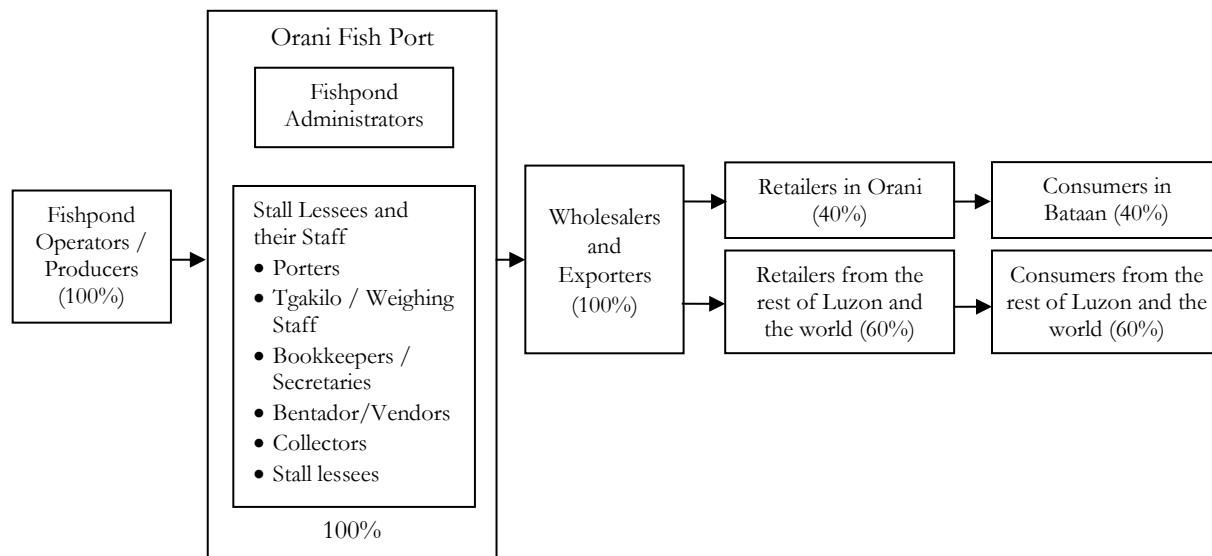


Figure 8. Marketing Channel of Crabs, Prawns, Shrimps, and Milkfish in Orani, Bataan

Problems Being Faced by Fishpond Operators

According to the fishpond operators, they have been facing high mortality rates due to environmental factors, theft by caretakers, and collusion and price fixing by some stall vendors even prior to the COVID-19 pandemic. They have also been suffering from declining prices due to the pandemic.

Their prawn and shrimp fries, particularly, have been having high mortality rates due to siltation of the Orani Channel, sudden changes in the temperature and water quality of fishponds, excessive algal bloom, and occurrence of typhoons. The fishpond operators confirmed the siltation problem which has already been mentioned in the Comprehensive Development Plan of the Municipality of Orani for the period 2018-2024. They likewise confirm the algal bloom, temperature, and water quality problems which have already been reported in the previous studies of De Leon (1994) and Fernandez (2023).

The fishpond operators were unanimous in identifying theft by caretakers as a serious problem. These caretakers harvest the prawns and shrimps at night and way ahead of the days of the harvest decided upon by the fishpond operators or owners. To avoid being victimized, the fishpond operators are now only hiring caretakers who they know personally. Some of the fishpond operators are also performing surprise visits or inspections of their fishponds at night or at dawn. In an attempt to remove the temptation or motivation to steal, the fishpond operators are also now giving their caretakers a share of the sales revenues aside from giving them non-monetary benefits such as food supplies.

About half of the fishpond operators allege that some stall vendors are colluding with wholesalers and exporters to fix prices. They believe, this is the reason why they could not get the right prices for their harvests. Two fishpond operators who happen to be municipal councilors have already reported the problem to the mayor. The mayor, in turn, has called a meeting with the fish port administrators and the stall lessees and their staff, particularly their *bentadors*. The said meeting, however, proved to be an exercise in futility because none of the stall lessees and their *bentadors* admitted to the unfair or “illegal” practice.

Finally, 15 out of 25 fishpond operators complained that the prices of their aquaculture products have declined by half due to the COVID-19 pandemic. Their complaint or claim, however, was not supported by the information on prices from the Office of the Economic Enterprise and the fish port administrators. According to the said information sources, the wholesale and retail prices of aquaculture products in pandemic years 2021 and 2022 were practically similar. The said information sources clarified that it was not the prices that had declined by half but the quantity sold. The demand for aquaculture products, in turn, was substantially weaker because many people had lost their jobs and incomes during the first two years of the pandemic. This is consistent with the job and income losses reported by the National Economic and Development Authority Regional Office 3 in 2020 and 2021.

Summary and Conclusion

The study identified the market participants in Orani's aquaculture industry as the following: (1) fishpond operators who create form and possession utilities; (2) fish port administrators who create place utility; (3) stall lessees and their staff who create place utility, perform the grading function, and wholesale price determination through *bulungan*; (4) wholesalers and exporters who create possession, time, and place utilities; (5) and retailers who create possession and time utilities.

The fishpond operators earned, on average, Php 225,756.00 per hectare in 2022 and Php 50,556.00 per hectare in 2021. These profits are much bigger when compared to the opportunity cost of capital, particularly the Php 7,812.50 annual gross interest income and the Php 6,250.00 annual net interest income of the Php 125,000.00 per hectare per year that were used in the polyculture of crabs, prawns, shrimps, and milkfish. Thus, the enterprise remained relatively profitable despite the COVID-19 pandemic.

For both years 2021 and 2022, wholesalers and exporters had margins of Php 100.00 – Php 200.00 per kilogram of crabs, prawns, and shrimps, and Php 20.00 per kilogram of milkfish. Retailers, on the other hand, had margins of Php 100.00 – Php 300.00 per kilogram of crabs, prawns, and shrimps, and Php 10.00 – Php 50.00 per kilogram of milkfish. The variation in margins is attributed to the different marketing activities performed, especially by the retailers, before the actual sale of the products to the consumers.

One hundred percent of the products pass through the stall lessees and their staff for weighing, grading, and wholesale price determination through *bulungan* or secret bidding. Sixty percent of the products are sold by the retailers to the rest of Luzon and the world, while 40% are sold by the retailers in Orani.

Fishpond operators have been facing high mortality rates due to environmental factors (e.g., siltation, algal bloom, changes in temperature and water quality, and typhoons), theft by caretakers, and collusion and price fixing by some stall vendors even prior to the COVID-19 pandemic. Due to the pandemic, they have the perception that the prices of their products have declined by half. The real culprits, however, were the job and income losses of people during the pandemic which have resulted to substantially weaker demand for aquaculture products.

Recommendations

The study recommends the periodic dredging of the Orani Channel to avoid siltation. The temperature, salinity, and water quality of the fishponds should also be regularly monitored. Physical and chemical treatments should be carried out if temperature, salinity, and water quality go beyond normal levels. The

fishpond operators should address algal bloom since it depletes the oxygen needed by the fish and shellfish. Fishpond operators should also fortify their fishponds against typhoons. To avoid losses, they can consider not producing at all during the peak of the typhoon season.

The fishpond operators should thoroughly check the character and employment background of their caretakers. To deter theft, they should continue making surprise visits to their fishponds at night and at dawn. To eliminate the temptation or motivation to steal, the fishpond operators should give a share of the sales revenues to their caretakers. They can also provide them with non-monetary benefits such as food supplies. They should, however, be ready to file criminal complaints against their caretakers if the latter still commit theft despite the generosity extended to them.

Collusion and price fixing between the *bentadors* and the wholesalers and exporters can be eliminated if wholesale prices were determined through open bidding instead of secret bidding or *bulungan*. The Office of the Economic Enterprise can also professionalize the operations of the fish port through the establishment of standard written procedures. It can also establish a system of accreditation for the stall lessees and their staff, particularly their *bentadors*.

Misconceptions about prices can also be avoided if the Office of the Economic Enterprise continues its wholesale and retail price monitoring. Their updated data on prices should be disseminated regularly to all market participants of the aquaculture industry.

Follow up studies on the profitability and technical efficiency of Orani's aquaculture industry should be conducted by researchers. If these future studies show that post-pandemic operations have become more profitable and technically efficient, then the industry would attract more capital.

Finally, the limitations of this present study, such as the reliance on memory recall on the part of the fishpond operators and the unavailability of audited financial statements, should be addressed in future studies. This implies encouraging fishpond operators to employ formal bookkeeping and financial accounting in their aquaculture enterprise.

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