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Oyster Farming in Ilocos Sur, Philippines

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ABSTRACT

The study looked into the management and culture methods used by oyster farmers in Ilocos Sur. The support given by numerous groups was also noted, along with a number of challenges and issues. Using an expert-validated survey questionnaire data were collected from 148 oyster producers from six municipalities namely, Candon, Sta. Maria, Narvacan, San Vicente, Caoayan and Sto. Domingo. According to the findings, the growers cultivate oysters using three different techniques: long line hanging, raft hanging, and stake (tulos) methods. Empty oyster shells, PVC, rubber strips, and bamboo poles are used for spat collection. The growing season is typically carried out in estuaries, rivers, and fishponds. According to the farmers, oyster prices are erratic but tend to rise around the holidays. Every production cycle, their oyster farming brings in an average of Php5,000 to 15,000 in revenue. Despite receiving technical and financial assistance from various authorities. oyster growers encounter a number of socioeconomic and environmental constraints that affect their production processes. In light of the aforementioned problems, it is recommended that institutions support growers by organizing and registering them and strengthening capacity building on sustainable oyster production technologies, including marketing and post-harvest management assistance. In order to create business opportunities in the neighborhood and increase household income, additional skill training should be offered. In addition, the province needs to develop marketing plans to control pricing.

Keywords: *Culture management, Culture methods practices, Oyster growers, Oyster hangings, Spat collector*

INTRODUCTION

Oysters (*Crassostrea* sp.), locally known as “talaba” in Tagalog and “tirem” in Iloko, are among the commonly cultivated shellfish commodities in the country, along with mussels. The Department of Science and Technology's Harmonized National R&D Agenda (2017-2022) included oyster in the lists of mollusk species as a priority commodity in the Agriculture, Aquatic, and Natural Resources Sector, or AANR. Oyster farming in the Philippines began in Bacoor Bay in Bacoor, Cavite, with small farm and family operations. Cavitenio oyster producers used stake and hanging methods. Broadcast ("sabog"), stake (tulos), lattice, and hanging oyster farming are the four methods now used in the country (sampayan). Based on observation, the hanging method is the most often employed in Ilocos Sur. On the other hand, growers harvest spat using a variety of materials, including empty oyster shells and coconut shells.

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Oyster aquaculture production has increased significantly in recent decades, paralleling overall aquaculture growth, according to Botta et al (2020). Despite this, there hasn't been a lot of attention paid to global trends in this production and its markets. China currently controls the majority of global oyster aquaculture production, accounting for 86% by weight in 2016. Outside of China, production is slow and, depending on the country, is hampered by disease, parasites, and legislative issues. Demand for farmed oysters appears to be increasing, but producers are unable to make use of them due to supply shortages

According to Statista Research Department (2021), the annual per capita production index of oysters in 2020 was approximately 184 percent, an increase from the base record of 100 percent in 2018. Oyster production in the Philippines has been gradually increasing since 2016. As an archipelago, the Philippines has many oyster farms. The problem with oyster farming, however, is rapid siltation and pollution.

Oyster farming grounds can be found in Ilocos Sur's southern and northern municipalities in several coastal communities. In coastal areas, it is seen as a source of income. From the preparation of the spat collector to the spat collection, grow-out, harvesting, and commercialization, both men and women are involved. More women are involved in the preparation of spat collectors, which are made of empty shells or coconut shells strung together on a synthetic rope. These spat collectors are placed in the oyster grounds, and the grow-out management is usually taken care of by men.

The Provincial Oyster Farm is located in Barangay Nalvo Sta. Maria, which is one of the province's main oyster grounds. This is a project of the Ilocos Sur provincial government's Office of Provincial Agriculture (Fishery Division). They mostly collect spat and distribute oyster hangings to oyster producers throughout the province.

Even though oyster aquaculture production has grown quickly in recent years, there is little written about its status in the local environment. An overview of the state of the province's oyster farming is given in this paper.

The purpose of this study was to document the current status of oyster production in the province using these scenarios. This study aimed to acquire data on oyster growers' culture management methods and procedures. It also outlined the growers' socioeconomic situation, obstacles and issues, and requests for government support to help them maintain their source of income.

The study's findings would aid in the development of plans for improving oyster resource management in the province. Oyster resource managers and policymakers will use it to establish policies for the livelihood's long-term viability and improvement. The growers' economic situation will eventually improve due to this livelihood. As a result, oyster farmers and their families will have opportunities to raise their family income and access to technical help and government interventions.

Objectives of the Study

Generally, this study aimed to document the status of oyster farming in Ilocos Sur. It specifically sought to describe, determine and identify the following aspects:

a. culture management practices in terms of methods used and the quantity, area, and period of production

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b. harvest marketing practices and income generated from oyster production
c. issues and problems encountered by the oyster growers and the interventions and assistance provided by the government and private sector

Review of Related Literature

The researchers were aided in conceptualizing this investigation by the related literature and previous studies. These sources were examined to help the researchers better comprehend the theories by elaborating on the concepts and determining the consequences for the presentation of the findings.

The oyster is a filter-feeding bivalve mollusk that can be found in almost every coastal area on the planet (Peng et al., 2021). Their feeding mode is the extraction of algae and other food particles from the water, which they draw over their gills almost constantly. They reproduce by broadcast spawning when the water warms and will change gender once or more during their lifetime. They are highly sensitive to water quality and are vulnerable to coastal pollution. Toxins can also be retained in their flesh, making them unfit for human consumption.

Oysters act as ecosystem engineers producing biogenic reef habitats. They are environmentally and economically important. Oysters' ecosystem services include water filtration, food provision, habitat, and coastal defense (Long et al., 2017). As Benliro (2018) mentioned, USAID (2013) considers small-scale oyster culture environment-friendly. Because oysters are filter feeders, no feed substances are introduced, and no habitat changes are required. Oyster farming is considered to be one of the oldest forms of oyster farming in the world aquaculture. Oyster aquaculture production has increased dramatically in recent decades. Despite its increased aquaculture, global trends in this production and its markets have received little attention (Botta et al., 2020).

One of the best-known forms of marine aquaculture in the United States is oyster farming. According to a 2019 article in Marine Aquaculture, approximately 31 million pounds of oysters were harvested in the United States in 2011, with a dockside value of approximately $135 million (National Marine Fisheries Service). According to the article, this was most likely a low estimate of the oyster's overall value because it did not take into account the ecological value of fish species that use oyster reefs as a source of food and breeding habitat, as well as coastal and water protection. quality services provided by coral reefs. When the economic and ecological value of oyster reefs are considered, the number rises into the billions (Peng et al., 2021).

Some countries have oyster hatcheries where oyster seeds are produced and cultured in different ways. The hatchery products are used in two types of oyster aquaculture in Mexico and the Chesapeake Bay: intensive farming (off bottom, in containers) and extensive farming (loose bottom). Whether oyster seeds are obtained as spat-on-shell or as individuals from a nursery system, the ultimate goal is to grow them to a salable size wherein the size of the market varies by state. The intensive culture, also known as cultchless production, employs a single seed (or without cultch). The seeds are stored in floats, bags, rafts, trays, longline systems, racks, and off-bottom cages. Each of these systems must contend with factors that can impede production, such as storm impacts, fouling organisms,

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and conflicts with other users of the waters. The system applied by growers depends on water quality, wave action, and predation levels at the grow-out location. Intensive culture is more expensive because it necessitates more labor for equipment and product upkeep. In boxed or half-shell markets, however, a single, more uniform product sells for a higher price. The second method of aquaculture production, extensive culture, also known as spat-on-shell or cultched production, is more traditional in that oyster larvae from a hatchery are planted directly on the bottom of shells. oysters clean (cultch) and reared in clusters. Because there is little to maintain once planted, this production method is considered relatively less expensive. However, mortality is higher overall for extensive culture, and the product is destined for the shucked market, which generally garners a lower price (Marine Aquaculture, 2019).

In the Philippines, oyster farming began in Hinigaran, Negros Occidental, in 1921. The country employs a variety of cultural methods. Stake (tulos), hanging (pabitin), longline (sampayan), and stone are the most common methods (paringit) wherein the hanging method is more preferred by the growers. Oyster farms can be found in 17 provinces spread across Regions I, IV, and VI. Negros Occidental, Pangasinan, and Cavite are major producers. Indigenous species of spawners are present in viable oyster farming grounds. The water should be clean and have a green to blue-green color. The area should be free of flooding, which can cause 0-10 ppt salinity, which causes high mortality and siltation. At the lowest tide, the water depth should be 1.5-4.0 m. The bottom is either hard and stable, or soft and muddy. Cultured areas must be naturally protected from strong winds and wave action along landlocked bays or estuaries. Structure materials should be readily available and inexpensive. Sites should ideally be within 100 kilometers of markets or population centers. Although the presence of endemic seeds or spats in the area is preferred, oyster seeding or transplanting may be undertaken (DA-BFAR CARAGA Region, 2017).

A study of the impact of oyster farming on the sustainability of rural communities was conducted in 2014 by Pierce and O'Connor in North Vietnam. Findings revealed that oyster farming has had an overall positive impact on the lives of farmers and their communities. Income from oyster farming has enabled diversification into other types of agriculture, job creation, increased wealth, improved living standards and housing opportunities for the youth of the community. The social impact of the new industry has often been linked to its impact on community spirit and quality of life. A number of negative impact issues were raised including pests, seed quality and low oyster prices. Farmers have hinted in photos that the next generation of oyster farmers may stay in the area.

On the other hand, the findings of a study conducted by Benliro et al. (2018) revealed that oyster farmers in Panay, Capiz are relatively old and earn less than the minimum wage. They use a primitive artisanal method of oyster farming that requires very little capital investment. Their income is impacted by dwindling wild stocks and unpredictable weather patterns. The annual per capita oyster production index in the Philippines was around 127.2% in 2019, up from the benchmark record of 100% in 2018. Oyster production in the Philippines has gradually increased since 2016. The Philippines, as an archipelago, has many oyster farming locations. The major issues that oyster farming faces, however, are rapid siltation and pollution (Statista Research Department, 2021).

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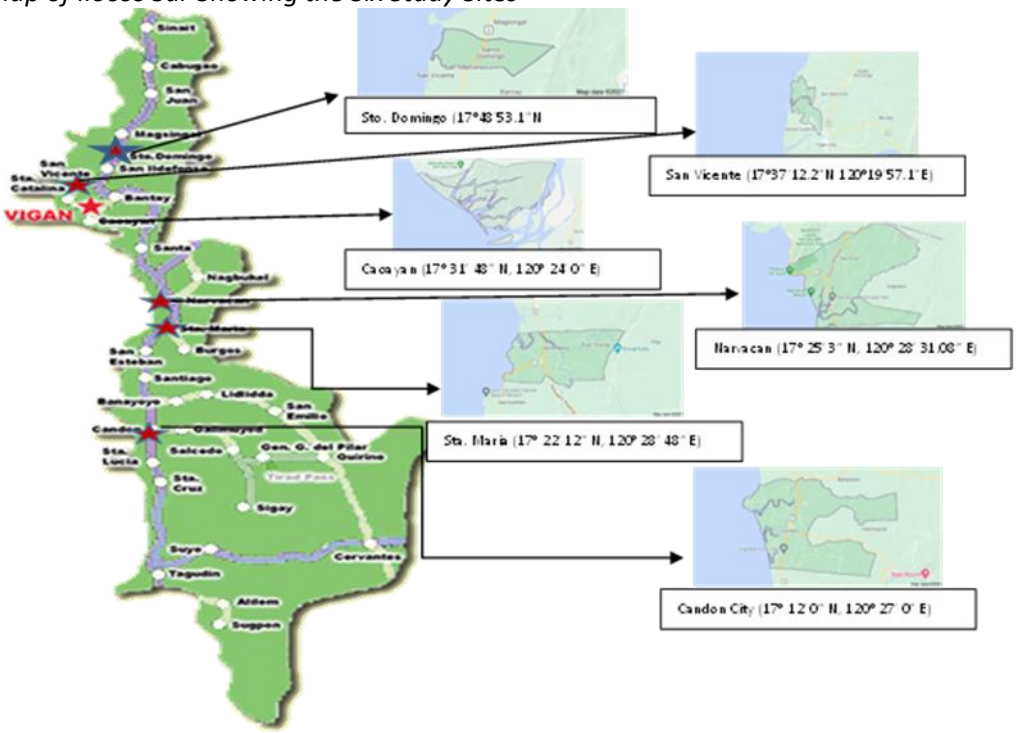
METHODOLOGY

This study utilized a descriptive quantitative research design, particularly the survey method of data gathering. The researchers made use of a survey questionnaire to gather data. The questionnaire was formulated by the researchers and validated by experts.

Figure 1

Map of Ilocos Sur Showing the Six Study Sites



This study was conducted in the oyster production grounds of six Ilocos Sur municipalities: Candon, Sta. Maria, Narvacan, San Vicente, Caoayan, and Sto. Domingo. These areas have oyster-growing areas, according to preliminary interviews with the Provincial Oyster Farm. Candon City, Sta. Maria, and Narvacan are municipalities in Ilocos Sur's second district. Candon, a coastal component city of the province, is located on the island of Luzon at approximately 17° 11' north, 120° 27' east. At these coordinates, the elevation is estimated to be 10.0 meters or 32.7 feet above mean sea level. Santa Maria's municipal center is roughly 17° 22' north and 120° 29' east. 8.7 meters, or 28.6 feet, above mean sea level. Narvacan's municipal center is located on the island of Luzon at approximately 17° 25' north, 120° 29' east. At these coordinates, the elevation is estimated to be 7.9 meters or 26.0 feet above mean sea level.

On the other hand, Caoayan, San Vicente, and Sto. Domingo are towns in the province's first district. Caoayan's municipal center is roughly located at 17° 33' North and 120° 23' East on the island of Luzon. The elevation at these coordinates is estimated to be 8.0 meters (26.2 feet) above mean sea level. San Vicente is located on the island of Luzon at

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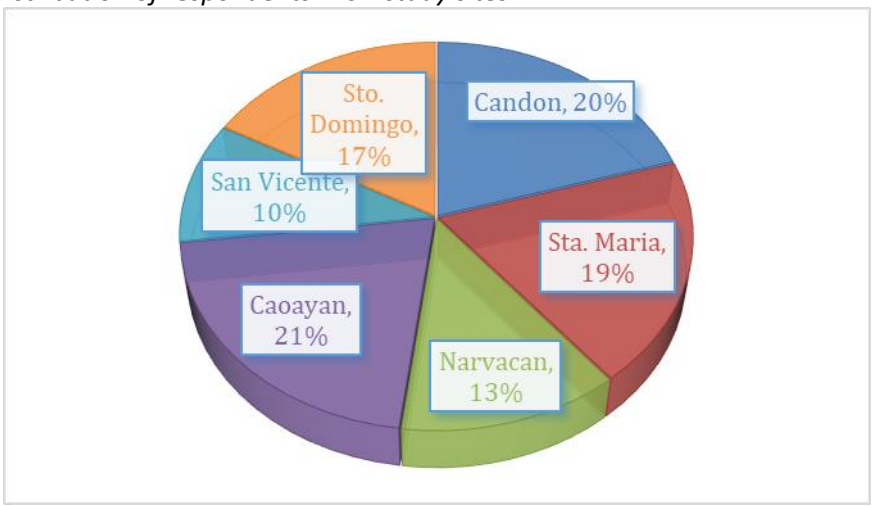
approximately 17° 36' North and 120° 22' East. At these coordinates, the elevation is estimated to be 9.1 meters or 29.7 feet above mean sea level. Santo Domingo's municipal center is located on the island of Luzon at approximately 17° 38' north, 120° 25' east. At these coordinates, the elevation is estimated to be 15.9 meters (52.2 feet) above mean sea level. This study included both male and female oyster farmers from the aforementioned municipalities. The respondents were recommended by the Municipal Agriculture Office-Fishery Department and were registered in the Fisherfolks Registration System. Participants in this study included 148 oyster farmers in total. Growers from Caoayan and Candon City account for 21% and 20% of the 148 respondents, respectively. Sta. Maria has 19% of the growers, Sto. Domingo has 17%, Narvacan has 13%, and San Vicente has 10%.

Figure 2

Distribution of respondents in six study sites



The respondents, who comprised both women and men oyster growers, were given validated questionnaires. The participant profile, cultural management strategies, and difficulties and issues faced by growers are all important aspects of the questionnaire. It also includes obtaining information on the fisheries sector's intervention from both private and public institutions. The researchers observed normal health measures such as physical distancing and the use of masks and face shields when administering the questionnaire.

RESULTS AND DISCUSSIONS

On Culture Methods and Management/Practices

Generally, the oyster farmers in all six municipalities use the hanging method, both the plot/longline and floating raft presented in Table 1. The growers in Candon City and Sta. Maria still use the stake or tulos method. According to the respondents, the hanging method has been a practice of the oyster farmers because they claim that using these methods provides them with a higher production. Such a claim supports the recommendation of

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Mellare (2000). As cited in Benliro et al. (2018), de Castro and Mellare (2000) recommended the raft method in oyster farming for the following advantages: fast growth and higher survival, easy transplantation and thinning, higher production and no accumulation of silt, unlike the staking method in which the bamboo poles used as stakes act as a barrier that gathers the silt.

Table 1
Culture methods used by oyster farmers in Ilocos Sur

Culture Methods	Candon (n=30)	Sta. Maria (n=28)	Narvacan (n=19)	Caoayan (n=31)	San Vicente (n=15)	Sto. Domingo (n=25)
	(%)	(%)	(%)	(%)	(%)	(%)
Technology Used						
Longline Hanging Method	100	100	100	100	100	100
Raft Hanging Method	100	71.4	-	74.2	86.7	60
Stake/Tulos	43.3	70	-	-	-	-
Spat Collection Materials						
Empty Oyster Shells	100	100	100	100	100	100
Rubber Strips		50	78.9	83.9	80	48
PVC	90.3	78.6	47.4	51.6	73.3	88
Bamboo Stakes	33.3	42.9	-	-	-	-
Source of Cultches/Spatted Hangings						
Own produce	100	100	100	100	100	100
Private	50	17.9	84.2	93.5	33.3	100
Government	100	17.9	100	74.2	93.3	72

**Data presented are based on multiple responses of the farmers.*

In all six oyster-producing municipalities, empty oyster shells and PVC are used as materials for spat collection, while rubber strips are used in four (4) growing areas, Sta. Maria, Santiago, Narvacan, and San Vicente. Only the farmers from Candon and Sta. Maria said that they are still using bamboo stakes as pat collectors. Oyster growers either make their own oyster hangings or cultches, or they get them from other farmers or private sources. The Office of the Provincial Agriculturist-Oyster Production Farm and the Bureau of Fisheries and Aquatic Resources, through the LGUs, are also used to procure some of the spats.

Table 2 shows data on season and area of oyster spat collection and grow-out. It can be seen from the table that the periods and areas of spat collection and grow-out varied among the province's six oyster-growing municipalities.

During the third quarter, farmers from Santa Maria, Narvacan, and San Vicente begin collecting oyster spats. In Candon City, on the other hand, spat collecting begins in the

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second quarter, while in Caoayan and Sto. Domingo, the collection begins in the last quarter of the year. Either an estuary or a river is used for the collection. The majority of oyster farmers, on the other hand, gather spats in estuaries, which they claim to have a greater salinity level that encourages oyster spats to settle. The grow-out or culture phase for spatted oyster hangings usually is 6-9 months, and they are usually stocked in rivers, estuaries, and ponds.

Table 2
Oyster spat collection and grow-out area in Ilocos Sur

Spat Collection and Grow-out Area	Candon (n=30)	Sta. Maria (n=28)	Narvacan (n=19)	Caoayan (n=31)	San Vicente (n=15)	Sto. Domingo (n=25)
	(%)	(%)	(%)	(%)	(%)	(%)
Spat Collection Period						
Jan-Mar						
April-June	100	100	-	-	-	-
July-Sept	100	100	100	-	100	96
Oct-Dec	-	-	-	100	-	100
Spat Collection Site						
Estuary	100	100	100	100	100	-
River	-	-	-	-	100	100
Stocking Period						
Jan-Mar	-	-	-	-	-	100
April-June	-	-	-	-	-	-
July-Sept	100	-	-	-	-	-
Oct-Dec		100	100	100	100	
Grow-out Area						
Estuary	-	100	100	100	66.70	80
River	100	50	52.6	87.1	-	100
Fishpond	-	10.7	-	-	-	-

**Data presented are based on multiple responses of the farmers.*

On Size and Volume of Grow-out Production

In the province, oyster farming is regarded as a small-scale family business. Table 3 shows the average size and volume of production as well as the income generated from the production. Growers maintain production areas from 20 to 100 square meters, with 1000 to 2000 hangings being cultivated. The bulk of the responders, on the other hand, keep their

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grow-out space to a maximum of 30 square meters. Similarly, the farmers stated that the availability of spatted hangings from the vendors is a factor in how much they can produce. According to the farmers, the price of oysters fluctuates, with higher prices throughout the summer and Christmas seasons, and the price per can ranges from Php300 to Php600.

Table 3
Average volume of production and income generated from oyster farming

Practices	Candon	Sta. Maria	Narvacan	Caoayan	San Vicente	Sto. Domingo
Average Number of Clutches/ Hangings	1000	1500	1000	1000	2000	3000
Average Area of Production (sq.m)	30	80	60	30	30	100
Average Price (per can), Php	300	400	400	600	500	500
Average Income generated from oyster farming (Php)	5,000	10,000	8,500	15,000	8,000	15,000

Oyster farming generates an average income of Php5,000 to Php15,000 per cropping cycle Depending on the demand and market price of oysters. The poor revenues of the growers could be linked to this because of the volume and size of their crop. On the other hand, the growers claimed that they could earn more money if they didn't acquire their raw materials (such as bamboo) and if some of the things, such as the PVC spat collectors, could be reused for the following cropping season. Other factors that affect their income include environmental problems such as fluctuating water quality and natural calamities. The practices used by oyster farmers for harvesting and marketing are presented in Table 4.

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Table 4
Harvest and Marketing Practices of Oyster Farmers

Practices	Candon (n=30)	Sta. Maria (n=28)	Narvacan (n=19)	Caoayan (n=31)	San Vicente (n=15)	Sto. Domingo (n=25)
	%	%	%	%	%	%
Harvest per Year						
One time harvest	50				100	60
By Order	100	100	100	100	100	100
Modular		100		100		
How are oysters Sold?						
Shelled on	100	100	100	100	100	100
Shucked				80.6	46.7	24
In Hanging		21		67.7		
Market						
Public Market/ Neighborhood	100	100	100	100	100	100
Restaurants/ Hotels	6.7		21	9.7		
Trader	6.7	17.9			33.3	12

**Data presented are based on multiple responses of the farmers.*

Depending on the demands of the market, growers may harvest their product all at once, as needed, or in a modular or staggered manner. Depending on the customer's preference, oysters are either sold shell-on or shucked in public markets or neighborhoods (by ambulant sellers), or by restaurant owners or, in rare instances, dealers. Table 5 lists the management techniques employed by oyster farmers, the issues they have faced, and the solutions and assistance they have received.

As stated in table 5, the critical farm management actions noted by the farmers were proper spacing and thinning of oyster hangings. These practices, they claim, will help oysters grow more evenly and minimize the overpopulation of spats. Predators such as fish, mussels, and barnacles are physically removed to avoid nutrient and space competition. Repairs and replacements are also checked at the grow-out facility. The grower informants listed some issues that arise in the oyster industry. Fluctuating water quality and the incidence of typhoons that destroy the grow-out setup or facility are among the environmental factors that affect their output. As a result of competition for nutrients and space, growers also stated that the growth of other mollusks, algae, or lumot, as well as the presence of predator fish, affects the growth of the oysters. The majority of the respondents also stated that they lack the financial resources to maintain a larger production area and a higher output volume. Some complained that they frequently receive stock (spatted hangings) that are less than they require. Some growers reported seeing poachers and trespassers from other communities when they entered their grow-out area.

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Table 5

Farm Management Practices, Problems, and Interventions in Oyster Farming

Problems and Interventions		Specifics
Farm Management Practices		Proper Spacing
		Thinning Out
		Regular inspection
		Removal of Predators
		Regular clearing up of the substrate
Problems met		
	Environmental	Fluctuating water quality
		Typhoons
		Presence of predator fish
		Growth of barnacles, mussels, and other mollusks
		Algal Growth
	Socio-Economic	Lack of Seed capital
		Source of Stocks
		Poachers
Interventions and Support		
	Technical Assistance	Conduct Capability Training
		Provision of technological assistance
	Financial Assistance	Provision of material inputs
		Provision of Seed capital
	Agencies/Organizations	Local Government Units
		Office of the Provincial Agriculturist
		Bureau of Fisheries and Aquatic Resources
		Department of Agriculture
		Higher Educations Institutions
		Department of Social Welfare and Development
		TATEH Aquafeeds

Some growers also said that they receive technical and financial support and interventions from various organizations such as DA-BFAR, DSWD, LGUs, and HEIs and one feed company (TATEH). These organizations assist growers with training, material input, and seed financing, as well as equip them with the tools they need to succeed. Farmer's practices improved as a result of these actions. Many growers, on the other hand, claimed that they do not receive any aid from the government or any other group.

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CONCLUSIONS

Findings show that three methods of oyster farming are practiced in the province: long line hanging, raft hanging, and stake or tulos systems, which use empty oyster shells, PVC, rubber strips, and bamboo stakes as spat collectors. Oyster farmers either produce their own oyster seeds, or spats, or they purchase them from a variety of sources, including both public and private ones. The six municipalities in the province that grow oysters had different times and locations for collecting and growing out spat. Oyster farming in the province is a small-scale family business that provides supplementary earnings to the farmers. Oyster growers' culture and marketing practices, as well as the selling price of their goods, differ among oyster-producing towns in the province, according to the findings. Growers harvest their product all at once, as needed, or in a modular or staggered manner and depending on the customer's preference, oysters are either sold shell-on or shucked in public markets or neighborhoods (by ambulant sellers), or by restaurant owners or, in rare instances, dealers. The oyster farmers also deal with a number of socioeconomic and environmental challenges that have an impact on how they produce oysters. They also assert that numerous agencies and organizations provide them with the resources they need to succeed in terms of training, material input, seed funding, and technical and financial assistance. These actions led to an improvement in farmer practices.

RECOMMENDATIONS

With the aforementioned findings, oyster growers' ability to develop sustainable oyster culture technologies should be strengthened, empowering other community members, including women, too. Marketing and post-harvest assistance must also be included in the technical interventions. Marketing strategies or regulations should be developed to manage the pricing and assist growers in selling their produce at a suitable price. Additionally, there is a need for organization among the oyster farmers in the province. Other skills and livelihood training, as well as capacity-building seminars, should be held to give an alternative or additional source of income for families and community members, particularly youth and women.

ETHICAL STATEMENT

This study was reviewed and approved by the University of Northern Philippines Ethics Review Committee. Ethical principles observed in the study include the conflict of interest, principle of informed consent, principle of privacy and confidentiality, principle of vulnerability, recruitment, benefits, compensation, and community considerations.

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