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Culture Practices and Value Chain Analysis of Mud Crab in Sta. Teresita, Cagayan, Philippines

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ABTRACT

The municipality of Sta. Teresita has extensive brackish water and mangrove areas which inhabit the high- valued commodity in the market which is the mud crab. But the baseline data regarding the culture practices and value chain analysis of mud crab is still lacking in the municipality. This research was conducted to assessed the practices and techniques in culturing of mud crab and to analyze its value chain in Sta. Teresita, Cagayan. Data are gathered using questionnaires and mud crab farmers and value chain actors are interviewed. The results shows that most of the mud crab farmers are male while most of the value chain actors are female. The culture system utilize is pond culture for grow-out and fattening and is purposely used for polyculture, monoculture and box culture of mud crab. Mud crab are cultured from ≥ 3 to ≤6 months and most of the mud crab growers are not applying acclimatization but they are providing shelters in their ponds to minimize cannibalism. Apparently, the constraints that hinder the sustainability of mud crab are inconsistent supply of quality crab seeds, lack of professional knowledge in crab farming, flooding, and intra-species cannibalism. The key stakeholders involved in the value chain are the crab farmer, fattener, dealer, retailer, peddler and consumer and 6 chains are formed in terms of the distribution pattern of mud crab. Only live mud crabs are being transported and sold to the markets. The preferences in buying mud crab may vary for body size, body weight, intactness of limbs, gender, gonad maturity, and odor. As crabs moved through the chain their value increased based on its grade or weight. Mud crab weighed >200 grams are considered as marketable size and it is graded as small and mud crab weighed >350 grams are graded as medium and mud crab weighed >500 grams are graded as large. Seemingly, the selling of mud crab is divided in terms of trading season (off and peak season). The value chain actors stated that crabs during peak season (April- Lenten Season and December- Christmas season) are more expensive compared to off-season.

Keywords: *acclimatization, mud crab grading, market distribution of mud crab*

INTRODUCTION

Scylla spp., or mud crabs from the Portunidae family is widely distributed and consider as one of the top commodities in aquaculture (Rahman et al., 2020; Macintosh et al., 2002). The Philippines has a long history of mud crab farming and is the world's second largest producer (Quinitio, 2017). Mud crabs are tough and can survive for lengthy periods of time out of the water at lower temperatures, making them a good species for live export to other nations and to local market (Lalramchhani et al., 2019). The three commercially important species of mud crab, Scylla serrata, S. tranquebarica and S. olivacea are commonly found in the country Philippines, but S. serrata is the preferred species for farming (Quinitio, 2017).

Mud crab are raised in a pen, cage, or even simultaneously with shrimp in ponds (Chakraborty et al., 2018). As a result, shrimp producers are switching to crab farming, which is less prone to illness, easier to cultivate, more flexible to climatic change, and has a better market price than shrimp farming (Salam et al., 2012). And the soaring demand and higher price in the overseas markets further aggrandized the farmer's interest in ranching crabs (Rahman et al., 2017). There are three main culture systems in use (crab fattening,

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grow-out, and soft-shell crab production) that cater to various segments of the worldwide crab market (Rahman et al., 2017). All of these farming systems are entirely dependent on seed supply from the wild (Salam & Ross, 2000; Rahman et al., 2018). As a result, the seed shortage has tightly restricted the expansion of crab culture (Marichamy & Rajapackiam, 2001). The lack of hatchery facility to produce crablets has been a challenge for the continuous source of seed stock and hampers the expansion of crab industry, hence the dependence on wild stocks (Ballad & Bañarez, 2019).

The mud crab value chain includes a number of intermediaries, including crab catchers, farmers, suppliers, exporters, and consumers (Sultana et al., 2019). It focuses on market collaboration between diverse suppliers, producers, processors, and purchasers with varying degrees of market power (Mangubhai et al., 2017). The current mud crab value chain is extended and unstructured, with too many parties making it a complicated system, and crab fisheries being abused by intermediaries and receive little government assistance (Sanoara, 2018).

The municipality of Sta. Teresita is situated at the northeastern region of Cagayan Valley. Its coastal area has wide area of brackish water and mangrove areas that are suitable for the culture of the high- valued commodity in the market which is the mud crab or mangrove crab. But the availability of data regarding on the culture practices and value chain analysis of mud crab is still deficient and not yet given much attention in the municipality.

Objectives of the Study

This study focuses on investigating the Culture Practices and Value Chain Analysis of mud crab farming in Sta. Teresita, Cagayan. Specifically, our objectives are: (a) to profile the demographic characteristics of Mud crab farmers and value chain participants; (b) to understand the techniques and management practices employed in mud crab farming; (c) to identify obstacles hindering the sustainability of mud crab culture and propose solutions to enhance production, profitability, and sustainability in Sta. Teresita; and (d) to analyze the existing mud crab value chain in the region.

MATERIALS AND METHODS

Research Design

The study employed the descriptive method of research to achieve its objectives. The descriptive method was chosen to assess the culture practices and conduct a value chain analysis of mud crab in Sta. Teresita, Cagayan.

Sampling Technique

Random sampling was utilized to select the study's participants. Specifically, forty (40) mud crab farmers (constituting 20% of the total crab farmers population from MAO Sta. Teresita, Cagayan) were chosen for assessing culture practices, and an additional forty (40) value chain actors were selected for the value chain analysis.

Locale of the Study

The study was conducted in Sta. Teresita, a coastal municipality in the province of Cagayan, Philippines. This location was chosen due to its relevance to the research objectives.

Research Instruments

The primary instrument for data collection was a structured questionnaire. Two distinct questionnaires were designed, one for crab farmers and the other for value chain actors. Secondary data was also gathered from the Municipal Agricultural Office (MAO) and various scholarly articles and related literature through online sources.

Data Gathering Procedure

The data gathering procedure encompassed a multi-faceted approach. Firstly, questionnaires were distributed to the chosen participants to gather primary information. Additionally, informal interviews were conducted with key stakeholders in the crab industry to gain valuable insights. Furthermore, secondary data was meticulously compiled and organized from authoritative sources, including the Ministry of Agriculture and online repositories. This comprehensive approach ensured a robust and well-rounded dataset for the research.

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Analysis of the Data/ Statistical treatment Descriptive statistics, particularly percentages, were employed to analyze various aspects of the data. These included socio-economic data of crab farmers, profit distribution among value chain actors, and other relevant information obtained from the sample respondents. Data were organized and presented in tables and graphs to facilitate analysis, interpretation, and discussion.

RESULTS AND DISCUSSION

Table 1. Demographic Profile of the key stakeholders

Table 1. Demographic condition of the key stakeholders in the mud crab industry.

	Characteristics	Mud crab farmers	(%)	Value chain actors	(%)
Age	≤20	0	0	0	**0**
	21-30	1	2.5	3	**7.5**
	31-40	8	20	11	**27.5**
	41-50	12	30	13	**32.5**
	51-60	12	30	9	**22.5**
	61-70	5	12.5	4	**10**
	≥71	2	5	0	**0**
Sex	Male	28	70	1	**2.5**
	Female	12	30	39	**97.5**
Civil status	Single	2	5	2	**5**
	Married	37	92.5	35	**87.5**
	Widowed	1	2.5	3	**7.5**
Educational attainment	Elementary level	10	25	2	**2.5**
	Elementary graduate	7	17.5	5	**12.5**
	Highschool level	7	17.5	10	**25**
	Highschool graduate	4	10	8	**20**
	College Level	5	12.5	9	**22.5**
	College graduate	3	7.5	6	**15**
	Vocational	4	10	0	**0**
Monthly income	1000-5000	25	62.5	10	**25**
	6000-10,000	9	22.5	24	**60**
	11,000-15,000	1	2.5	4	**10**
	≥16000	**5**	**12.5**	**2**	**5**

Table 1 shows the personal, socio- economic and social status of the mud crab farmers and value chain actors.

Demographic profile shows the details of the personal, socio-economic and social status of the respondents of this study. Table 1 highlights the salient outcomes and background information of Mud crab Farmers and Value chain actors. The key stakeholder's age ranged from 21 to 71 years old and above. This indicates the involvement of middle age group and old age group of people in mud crab aquaculture and mud crab value chain. In terms of gender and civil status, it was observed that majority of the mud crab farmers are male and married. It could be noted from the early results on age, that the age bracket of most of the respondents ranges from 41-60, these are legal age where people are ready to enter in a married life. The dominance of male in our study is similar to the findings of Akwanyi et al. (2019) who both observed the dominance of men in fish farming.

However, this study found out that women also participate in mud crab farming. According to Pandey & Upadhayay (2012), fishponds that are located within and close to homesteads, women are able to work simultaneously on the fishponds and at their homes without forcing them to be away from their homes for long periods that might force them to neglect some of their roles at their homes. On the other hand, it was observed that majority of the value chain actors are females. Women are more trained in terms of vending and market negotiations. In aquaculture, women's roles and the extent of their participation in value chains are more significant than often assumed (Ndanga et al. 2013). Yap et al. (2017) also found out that women are active in all aspects of the fisheries value chain. In this study, most mud crab farmers only attained elementary level, elementary graduate and only few had finished college graduates. On the other hand, most of the farmers used their knowledge from training/seminars conducted by government organizations and NGOs and some used first-hand experience as preparation of skills in culturing mud crab. Also, majority of them had reported having attended seminars and

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workshops related to mud crab farming. These farmers said that because of these, they have been enlightened about mud crab farming and this has enabled them to improve their skills in mud crab aquaculture. These results are similar to the study of Amankwah et al. (2018) that being more educated gives a farmer the advantage in understanding improved farming practices with ease. While most of the value chain actors attained high school level, high school graduate, and college level. Data shows that most of the value chain actors have a higher educational attainment and this means that they had a capacity to understand the basics in marketing and selling of mud crabs. In general, family income is a key factor in determining the standard of living of people in the community or region (Pandey & Upadhayay, 2012). This study also revealed that majority of the mud crab farmers had a very low monthly income which fall under low-income group. According to Pandey & Upadhayay (2012), low level of income reflects their poor economic condition, which was not sufficient to maintain their normal livelihood and found it difficult to meet even their consumption requirements from their earnings. While most of the value chain actors had a medium income, level compared to the majority of mud crab farmers. According to Heenkenda & Chandrakumara (2016), entrepreneurial skills obtained from small businesses, which in turn lead to higher income.

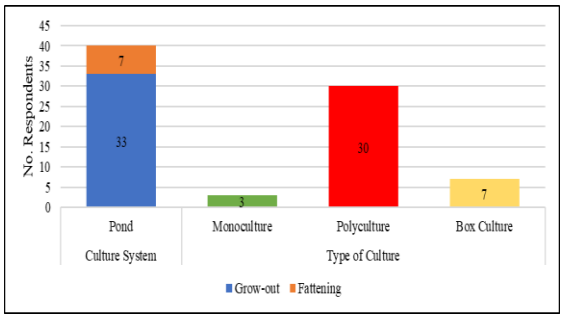

Figure 1. Culture system, farming method and culture type of mud crab in Sta. Teresita

Figure 1 presents the culture system, farming method and culture type of mud crab in Sta. Teresita. Data reveals that all of the mud crab farmers use pond as a culture system. Among those farmers, 33 (82.5 %) utilized grow-out and 7 (17.5%) utilized fattening. And most of them are applying polyculture (75%) as type of culture.

Brackish water ponds are the culture system that are being used in Sta. Teresita with an average pond size of 0.25 to 0.50 ha. The study revealed that most of the respondents utilized ponds for grow-out and some utilized ponds for crab fattening. It shows that grow-out culture is the most commonly practiced among mud crab farmers because it was long performed decades ago. These results are similar to the study of Ballad & Bañarez (2019) that grow-out culture was noted as being practiced in the municipality of Sta. Teresita. In ponds, polyculture or culture of juvenile crabs to market size with one or two more species in earthen brackish water ponds is also commonly practiced. According to SEAFDEC (2016), crabs were commonly cultured together with fish in an earthen pond. Farmers preferred polyculture by stocking crabs with other finfish species such as tilapia, bangus, siganids, mullet and prawn. It is recommended as an alternative farming approach to avoid the production loss of farming (Shelley & Lovatelli, 2011). In addition, high profit and production has already been established in polyculture experiments of mud crab with tiger shrimp, milkfish, and mullet (Rahman et al. 2020). It is also presented in figure 2 that most of mud crab farmers select single size (five-to-ten-peso coin/ >3 cm) of crab seed and some prefer to use double size crab seed (one peso coin/ 2.5- 3 cm) for stocking. Most of them utilized single size crab seed since this was the available crab seed from the wild stock collectors.

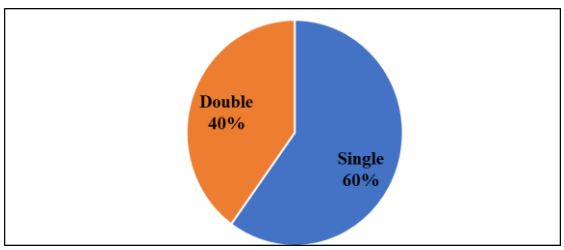

Figure 2. Size of Seed Stock for Mud crab Culture in Sta. Teresita

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Figure 2 shows the size of seed stock for Mud crab culture in Sta. Teresita, Cagayan. Crab farmers use double and single sized crab seeds but majority of them uses a single-sized crab seed with a total of (60%).

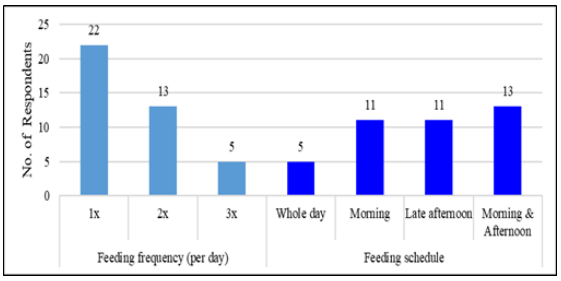

Figure 3. Feeding frequency and schedule for mud crab culture in Sta. Teresita,

Figure 3 displays the feeding frequency and schedule for mud crab Culture in Sta. Teresita, Cagayan. It shows that most of the mud crab farmers feed their stocks once daily with a total of (55%). Some of them feed their stocks every morning and late in the afternoon.

In feeding frequency, most of the mud crab farmers fed their stocks once a day. Based on findings, most of the farmers dispensed feed to the stocks every morning and late in the afternoon. The crabs that are being cultured are fed on different feed types according to the availability at the local level. Almost 90% of farmers fed their stocked crabs with trash fish, some used commercialized feeds and some utilized snails, carabao skin "caliente" and dried coconut meat. Indeed, low- cost trash fishes played a vital role as major feed components of protein sources in mud crab aquaculture and resulted in higher survival rates with better growth performance as compared to other feed types (Hasanuzzaman et al., 2014; Huq et al., 2015). On the study of Rahman et al. (2020), feedstuffs, their sources and feeding strategies are critically important for aquaculture systems in general. In terms of culture cycle, most of the farmers have 2 to 3 culture cycles yearly since mud crab culture duration ranges from 3 to 4 months. Some have limited culture cycles yearly due to seasonal factors and incompatibility of weather to the desired culture period.

Survey also revealed that only few of the mud crab growers are applying acclimatization strategies before stocking and the rest just stocked their crab seed directly into ponds as shown in figure 4. Farmers are performing acclimatization by sprinkling the crab seeds with the water from the pond for 20 -30 minutes before releasing into ponds. The seeds stocked without proper acclimatization could result in higher mortality rates. Such preconditioning is expected to increase temperature tolerance and extend the range of passive tolerance (Rahman et al, 2020). On the other hand, majority of the mud crab farmers are providing shelters in crab farms. Farmers provide shelters in their crab farms because it serves as a safe place/ shelter for mud crabs during molting. Some are planting mangroves, putting PVC pipe and branches of trees inside their ponds. Reportedly, the shelters could contribute to avoid or minimize the cannibalism during molting (Rahman et al. 2020).

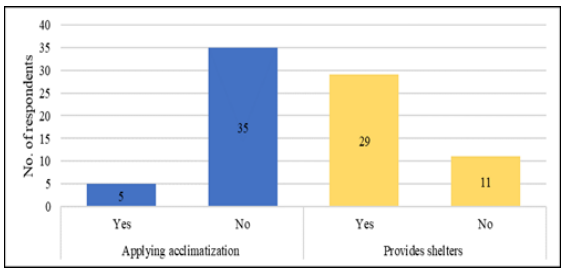

Figure 4. Respondents applying acclimatization and providing shelter in Ponds

Table 2. Summary of problems encountered by the Mud crab Farmers

1. Intra-species cannibalism during molting period.
2. Lack of professional knowledge on mud crab farming.
3. Flooding caused by long duration of rainfall.
4. Inconsistent supply of good quality crab seeds.

Table 2 shows the summary of problems encountered by the mud crab farmers. The data reveals the four most common problems encountered by the mud crab farmers that hinder the sustainability and profitability of mud crab aquaculture in Sta. Teresita, Cagayan.

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One of the major targets in mud crab culture is to have a high survival and growth rate. But due to some constraints, objectives are not being met. Table 2 reveals that inconsistent supply of good quality crab seeds, lack of professional knowledge of crab farming regarding on improved crab aquaculture methods, flooding which causes the decline in water salinity, and insufficient feeding which promote intra-species cannibalism, resulting in reduced production are some of the critical challenges that hinder the production and profitability of crab aquaculture. Therefore, strategies and solutions are needed to lessen the bottle neck in mud crab culture. Development and dissemination of mud crab hatchery technology is desirable to resolve the problems of the farmers which can reach the gap in the sustainability of crab seed supply. Programs providing training and introducing farmers to the best management practices are strongly advised with higher potential to upgrade the performance of farmers. Lowering the stocking densities and providing enough shelters can minimize the cannibalism in mud- crab culture because through this, the chance of encounter among crabs are lessened and at the same time serve as hiding places when they are molting.

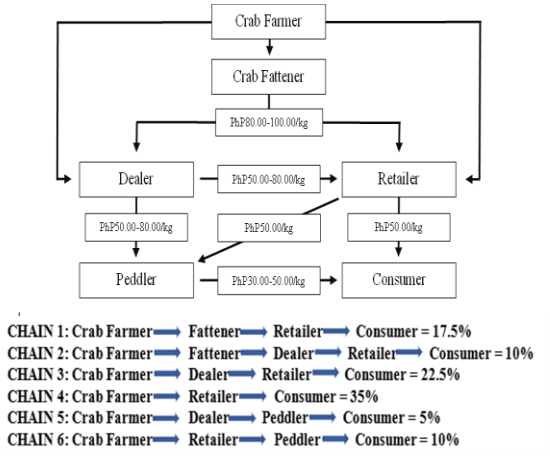

Figure 5. Distribution pattern and supply chain of mud crab in Sta. Teresita, Cagayan.

Figure 5 presents the distribution pattern and supply chain of Mud Crab in Sta. Teresita, Cagayan. There are 6 identified value chain actors (crab farmer, fattener, dealer, retailer, peddler and end consumer).

The value chain analysis describes the full range of activities that are required to crab farmers in order to trade the mud crab to a certain value chain actor. Different sectors might benefit from mapping the distribution processes and activities that bring items to customers. Therefore, the value chain of mud crab in Sta. Teresita has been studied to make the whole chain more efficient by transpiring the information across the chain and enhance the relationships between the actors of the chain including crab collectors, farmers, retailers and other intermediaries.

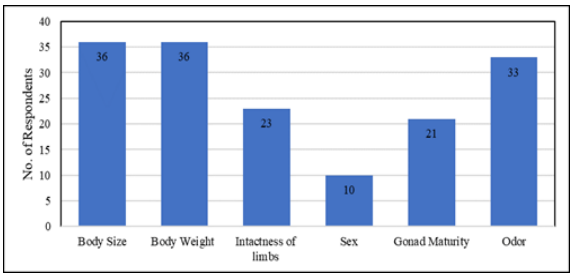

Figure 6. Preferences of Value chain actors in purchasing mud crab.

Figure 6 shows Preferences of Value chain actors in purchasing mud crab. Most of the respondents preferred to consider the body size, body weight, and color of mud crab.

Table 3. Grading of mud crab along the Value chain

Grade	Weight (g)	Price Range/ kg.	
		Off-Season	Peak-Season
Large	>500	500	800
Medium	>350	350	450
Small	>200	250	300

Table 3 shows the grading of mud crab along the value chain in Sta. Teresita. It was observed that the value of mud crab increased based on its grade or weight. Mud crab weighed >200 grams are considered as marketable size and it is graded as small and mud crab weighed >500 grams are graded as large.

CONCLUSIONS

Most of the key stake holders are composed of middle age group. Mud crab farmers are

dominated by males while value chain actors are dominated by female. The culture system utilize is pond culture for grow-out and fattening and is purposely used for polyculture, monoculture and box culture of mud crab. In management practices, traps with bait, direct hand picking and draining the pond are used in harvesting. Farmers also apply acclimatization before stocking. In addition, farmers are providing shelters in crab farms which serves as a shelter for mud crabs during molting. Common problems encountered are lack of good quality crab seeds, improper management, flooding, and intra-species cannibalism. Hence, development of mud crab hatchery technology, identification of cheap feed source and adoption of climate resilient mud crab technology are desirable to resolve the problems of the farmers which can fill the gap in the sustainability of mud crab supply. The key stakeholders involved in the value chain are the crab farmer, fattener, dealer, retailer, peddler and consumer. Mud crab are graded based on their weight and categorized as small, medium and large.

RECOMMENDATIONS

Based on the conducted study, several recommendations have been proposed for the sustainable development of the mud crab industry in Sta. Teresita. Firstly, establishing a mud crab hatchery is crucial to ensure a steady and healthy supply of crab seed and reduce reliance on wild stocks. Secondly, collaborative efforts with BFAR for training and workshops on crab grow-out and farming methods are essential, especially for beginners, to enhance their skills and knowledge. Thirdly, financial assistance or concessional loans with lower interest rates should be provided by the Local or National Government to ease the financial burden on marginalized mud crab farmers. Additionally, continuous monitoring of mud crab demand, market prices, and trade outside the municipality is recommended for crafting effective resource management policies. Organizing all stakeholders in the crab trade into an association will enable better government support and resource conservation efforts. Mud crab farmers should also aim to maximize the 6-month grow-out period for increased profits, and implementing grading practices can help establish price ceilings for each grade in the local market. These measures collectively aim to ensure the sustainability and prosperity of the mud crab industry in Sta. Teresita.

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