Delving Ethnomathematics in the Practices and Productions of Chanos Chanos

An Ethnomathematics Research Study

Joven E. Dooma, Edrose V. Cabrera, Edmar P. Pasol, Stephen Raymund T. Jinon, Michelle P. Bales

Iloilo State University of Fisheries Science and Technology

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Abstract: Mathematics is a science that cannot be separated from human life. It is also applied in various aspects of daily life, one of which is in the activities of fishermen in the community. The purpose of this study is to describe the Local mathematical reasoning behind stocking rates, feed calculation, harvesting schedules, and yield forecasting in the activities of caretaker or pond owner. The method used is ethnographic research design, in which relevant data is collected through recordings, observations, and documentations then analyzed and finally concluded descriptively. The results showed that ethnomathematics activities in the fishing activities of the fishermen included manual counting of fingerlings, estimation in purchasing of fingerlings, number of feeds for bangus feeding, as well as buying and selling activities in the market which involved mathematical concepts. As concluded by the researchers, this study showed significant mathematical concepts for the pond owners and caretakers relating ethnomathematical concepts, as well as giving suggested ways or practices that may its community could adapt in the field of aquaculture specifically nurturing and producing Chanos Chanos or bangus fish. This study recommends all future researchers to go deeper in reaching the necessary mathematical concepts that are relevant to Math Education using ethnomathematics.

Keywords: Chanos Chanos, Fingerlings, Lablab, Pond, Caretaker, Abono

Introduction

In the world of aquaculture and local fisheries, effective management practices are crucial for sustainability and profitability. Central to these practices is the application of mathematical reasoning, which aids fishers in making informed decisions about stocking rates, feed calculations, harvesting schedules, and yield forecasting. By leveraging quantitative methods, local fishers can optimize their operations, ensuring that they maintain healthy fish populations while maximizing their output. Understanding the balance between these elements not only contributes to the economic viability of local fisheries but also supports environmental sustainability.

The topic of cultural mathematics (also called ethnomathematics) is a fascinating topic about the human aspects of mathematics, and it is easy to ask readers to participate in the topic by thinking about mathematics from their own perspectives. (Gilsdorf, T. E., 2012)

According to *Batiibwe, 2024*, the value of ethnomathematics in the process of teaching and learning mathematics is acknowledged on a global scale. In light of this, the majority of nations have argued in favor of its inclusion in the mathematics curriculum. Whereas mathematics teachers in affluent nations receive guidance and support, most mathematics teachers in developing nations are left to their own devices.

The Philippine aquaculture sector is primarily dominated by milkfish, with the province of Iloilo as one of the key producing areas *(Zeller, Catelo, and Carambas)*. Milkfish (Chanos chanos) locally called Bangus in the Philippines, is a popular food fish in terms of production and consumption in the Philippines, Indonesia and Taiwan *(Macusi, E., Macusi. E., Bongas, H., and Cayacay, M., 2023)*.

According to *Garcia, Luis Maria*, Milkfish (Chanos chanos Forskal) is one of the most important food fish species

in the world. In Indonesia, Taiwan and the Philippines, more than a quarter of a million tonnes of milkfish are harvested annually in brackish ponds, contributing roughly 60% of the total fish production from aquaculture in Southeast Asia. This tremendous level of production from a single fish commodity is projected to further increase in the coming years to meet the dietary protein needs of an ever-growing population in Southeast Asia. To address vital research gaps afflicting the milkfish industry, research has correspondingly intensified over the past 15 years particularly in the Philippines, Taiwan and Hawaii. Results of such research projects have widespread application not only among Southeast Asian nations but also among many untapped areas in the Pacific, the Middle East, Africa and Central America where milkfish culture is feasible.

As the most important part of the production management of industrial aquaculture, the fish feeding process is not only directly related to the growth and welfare of fish, but is also a significant factor affecting the cost of aquaculture *(Atoum et al., 2015; Wei et al., 2021)*. In current industrial aquaculture, fish are mainly fed manually or by feeders at regular intervals and fixed quantities. The quality of both feeding methods depends on experience, without taking into account the specific needs of fish, thus causing insufficient or excessive feeding *(Zhang et al., 2022)*. In aquaculture, fish exhibit different feeding activities that correspond to different appetite levels. Accordingly, the appetite levels and feeding needs of fish may be accurately evaluated through continuous monitoring and accurate analysis of their feeding activity, which facilitates precise feeding.

However, local owners and caretakers are not only focusing on calculating the feeds for fish, they also used mathematical applications in fish production such that on how they determine the number of fish in a certain pond that could give or suffice healthy growth of the fishes, predicting the best time to harvest that could be beneficial in market-selling, and planning how fish production are manage through inventory processes and sales.With these reasons, fish farmers could ensure economic stability without any losses on their business.

In this study, the researchers are delving ethnomathematical application that more focused in answering the following inquiries (a) How caretakers or pond owners decide on fingerling quantities and distribution (b) Estimation of feed needs using non-standard computation and (c) Informal record-keeping or profit estimation systems used in the community. By identifying and analyzing these embedded mathematical ideas, the researchers seek to contribute to the broader discourse on the rating of cultural practices into mathematics education and promoting sustainable aquaculture methods.

Methodology

According to the study of Umbara, U., Wahyudin, W., and Sufyani Prabawanto, S., 2021, mathematics cannot be separated from everyday life. The use of mathematical concepts in cultural activities can be studied through the ethnomathematics program.

Ethnographic research is a qualitative research method that involves studying people and their cultures in their natural environments. By immersing themselves in the daily lives of participants, researchers gain a deep understanding of social norms, behaviors, rituals, and interactions. This method is widely used in anthropology, sociology, education, and marketing to explore cultural phenomena and human experiences. (Hassan, M., 2024)

In this study, the researchers used ethnographic research design to answer the research questions (a) How caretakers and pond owners decide on fingerling quantities and distribution (b) Estimation of feed needs using non-standard computation and (c) Informal record-keeping or profit estimation systems used in the community. Answering this study through the means of interviews and observation conducted to the one of the member of a community. The researchers were able to unlock knowledgeable answers from the respondent which give more meaning in studying natural - life context specifically *Chanos Chanos or bangus* fishes.

Through an in - depth interview with the respondent and recording his responses, with this research design the researchers could have an in-depth understanding and appreciation on how the caretaker quantified his practices mathematically and on how the production of fishes was being processed and decided.

A qualitative data analysis is the process of organising, eliciting meaning, and presenting conclusions from collected data. It could be a tedious process, as it involves a large volume of data which takes a significant amount

of time to order and analyse the data, for which Thematic Analysis provides an effective solution. Coding of meaningful themes, identifying patterns, categorising common codes and themes, conceptualising the inner meaning, generation of the underlying theory and reporting the same is brought out through the analysis. *(Jnanathapaswi, S. G., 2021)*

Qualitative research was used by the researchers to derive themes the researchers reviewed and transcribed the recorded data from the caretaker's responses. The research questions were used as bases in making codes to extract themes that are relevant and significant to the study. The three themes that are extracted out from the three research questions of researches are (a) From Bansutan to Larguhan: Estimation of number of Fingerlings (b) Feeding of *Chanos Chanos* (c) and Strategy on Selling Harvested Bangus.

However, there is a limitation of this study and that is, we only interviewed the fish pond's caretaker. The fact that the caretaker has 40 years of experience in taking care of fishpond there is limited information we only had gathered. Probably the expenses and profits in record book of the pond owner might help the study be more comprehensive. The owner's responses might help us also to expand the knowledge of how budgeting works and how income is precisely generated from the production.

Furthermore, to ensure the study is being conducted ethically, the researchers followed the following procedures (a) wrote a letter, addressed to the school's administrators and course facilitators as support for us researchers to conduct our study in a specific community (b) a letter also addressed to the barangay captain asking permission to do the conduct to its one of member of the community. (c) the experts validated researchers' interview questions. (d) profile of the interviewee and other confidential data are kept privately to ensure its privacy. (e) researchers arrive in the subject's place and before the interview proper the researchers introduce their profile and the purpose of the study.

Results and Discussions

This study identified three dominant themes which are mentioned in the methodology: (a) From Bansutan to Larguhan: Estimation of Number of Fingerlings (b) Feeding of *Chanos Chanos* (c) and Strategy on Selling Locally Harvested *Chanos Chanos.*

Theme 1. From Bansutan To Larguhan: Estimation Of Number Of Fingerlings

Fingerling production of milkfish in ponds may be operated as a commercial enterprise or a component of milkfish farming that comprises nursery, transition and rearing or grow-out phases. *(Coniza, E., Marte, C., Coloso, R., and Huervana, F., 2010)*

Figure 1 shows 150, 000 fingerlings which is prepared to put in the nursery pond. The caretaker of the fish pond and its owner doesn't have *"sabalu"* (fish *bangus* mother) and hatchery they need to buy fingerlings from a supplier. For privacy purposes he didn't mention the exact price of fingerlings of their supplier. However, he estimated that 100 000 fingerlings is equivalent to 40 000 pesos or 120 000 pesos for 300 000 of fingerlings. Actually, they are buying 300, 000 fingerlings in preparation for the transferring of fishes and most importantly for their harvest season in just a year or two.

Figure 1. Number of Fingerling

Figure 2. Nursery Pond

Two nursery ponds are used by the caretaker and it measures three quarters of one hectare and the other nursery pond measures one half of one hectare. These two ponds have the equivalent of 150 000 fingerlings in a total of 300 000 fingerlings. This is enough for harvest season and cropping session in a year or two.

Figure 3. Bansutan Pond for Fingerling

After a month from nursery pond, there are estimated 40 000 fishes that were transferred in this pond *bansutan* or known as transition pond. In this pond he nurtured the fingerlings through feeding using the algae or known as *lablab*. Furthermore, the caretaker estimated a survival of 30 000 fishes out of 40 000 only because the 10 000 fishes are prepared for predators such as birds and other big fishes that could eat the fingerlings. After nurturing from the nursery pond, the fingerlings that have the length of 1.5 - 2 inches are transferred in the *bansutan*.

Figure 5. Larguhan of Fingerlings

According to the caretaker of the pond, in another month and a half the fingerlings from *bansutan* or transition pond he then transferred it to the *larguhan* or known as rearing pond where the fingerlings are nurtured to its full growth for harvest season. The fingerlings in this pond are all matured that could be already sold in the market. However, the number may not be exact as 40 000 fishes of *bangus* because it might be eaten by other predators while they are in *bansutan*.

Theme 2. Feeding the Chanos Chanos

"Lablab" is a local name in the Philippines for the algal mat adhering on the pond bottom like a green pasture under water. "Lablab" is technically known as periphyton which is a biological complex of minute plants (phytoperiphyton) and animals (zooperiphyton) attached to submerged surfaces. (Wetzel, 1971)

Figure 6. Chicken Manure

Chicken manure is used in the pond for "lab-lab" which are essential for primary production and promoting fish growth. (Priyadarshini et al.,2011). It is often preferred in fish farming due to its high solubility and nutrient content. It typically contains high levels of phosphorus, nitrogen, and potassium, making it a valuable source of nutrients for ponds.

This is the place where chicken manures are exposed under the sun to keep it dry. With this strategy the manure will decompose easier and the odor will be lessened. To make an algae or *lablab* as feed for the fish the bacteria or any contaminated substance brought by the manure will be eradicated.

Figure 7. Exposing Chicken Manure

Figure 8. Lab - Lab

The green pigments that are floating in the transition pond are known as *lab - lab*. This *lab - lab* are from the processed chicken manure which are exposed under the heat of the sun and are put in the pond. This is the place where *bangus* are fed by algae to develop a length of 1.5 - 2 inches.

Figure 8. Starter Feeds

Feeds starter is the food of a bangus in the nursery stage. It is fine in texture and smaller than the grower feeds. It contains nutrients that are needed for optimum growth and development.

Figure 9. Grower Feeds

It is used to feed a bangus in "larguhan" where it is ready for harvesting. It provides all the essential nutrients and energy needed for the growth and development of fish that is ready for market size.

In preparing the *lablab* according to the caretaker 100 sacks of chicken manure bought to be exposed under the heat of the sun. Secondly, he drained the water from the pond to make it dry. Thirdly, chicken manure was put into the pond wchich 10 sacks of abono was added. Lastly, he gradually let water into the pond and after 3 - 5 days *lablab* or algae will appear in the *bansutan* pond.

In the last stage of *Chanos Chanos* development, it was placed in *larguhan* where it ate grower feeds to grow faster and heavier. The feed grower serves as the food of fingerlings. The schedule of feeding is three times a day, early morning at eight o'clock, ten o'clock and two o'clock in the afternoon.

Theme 3. Strategy on Selling Local Harvested Bangus

According to the article written by Indeed Editorial Team of 2025, effective selling is the ability to lead a person or group of people toward a mutually beneficial transaction. Salespeople are persuasive communicators who reach people by actively listening to them, empathizing with their needs or wants and helping them solve a problem or reach a goal. Understanding the different selling strategies available to you may improve your sales approach and help you grasp the nuanced process of buying and selling.

Figure 10. Tray of Fish Bangus

In the interview with the caretaker, all of the harvested fish products were put inside the tray for delivery and transported to the market also known as "*palapala*" for sales. The cost of a tray is determined through kilograms as estimated of greater or equal to 160 pesos per kilo of tray of fish *bangus*. One tray full of fish bangus is equivalent to 34 kilos less the 2 kilos which is the weight of a tray. Therefore 32 kilos of tray of fish bangus sold in the market. In addition, sizes of fish *bangus* also vary in the cost per kilo which may drop into 130 pesos per kilo.

Figure 11. Tanks for Harvested Bangus

The 30,000 fingerlings once harvested has an estimated 12 tons of fish that could be sold in the market and if it has a cost of 170 pesos per kilo the profit is greater than the expenses spent. According to the caretaker, for example, 10 tons of harvested fish is equivalent to an estimated cost of 1.6million if it is less the expenses the owner spent, he may have a profit of one million at hand. This was recorded for safekeeping and to keep in track of the proceedings from his business. However, the recordings of information were kept by the owner for its privacy.

There are six cropping in 300 000 fingerlings with two harvesting periods. Researchers asked him of what months is good for harvesting and selling *bangus* this was his statement,

"Ti amu na gani ang hambal ko sa imo ang nami nga pag harvest pakadtu sa amo ni nga bulan (May). Pag June asta Agosto amu ni ang pigado sa pag harvest kay barato" (That's why I am telling you the months that are best for harvesting bangus fish are from the month of September to May and poor months were June to August because it is cheaper).

He then explained that these months of June to August are the enrollment period. It makes sense that the needs of consumers are school supplies and not food supplies. Therefore, the selling of fish bangus in kilo has its cheaper price during the months of June to August.

During the interview, He explained that at first, he used grams in measuring the amount of food to be fed to the fish, but one time a technician visited their pond to check the practices used by the caretaker in feeding the fishes he noticed that the caretaker used kilograms to measure the feed. According to the caretaker, the technician instead advised him that in feeding the fish it should be fed when it is hungry only where the feeds are put on the

container, using only a hand in feeding and throwing it following the direction of the wind specifically feeds are thrown not against the wind this practice ensures that all the feeds at hand its amount are all going directly to the pond and fishes.

Table 1. Explained and identified ethnomathematical concepts in this study

Ethnomathematics Concept	Description	Specific Example from the Document
Estimation of quantities	Using approximation and judgment rather than precise measurement.	Estimating the number of fingerlings (100,000 = 40,000 pesos; 300,000 = 120,000 pesos), survival rates (30,000 out of 40,000), and fish weight for sale.
Non-standard units of measurement	Employing locally understood units instead of standardized units.	Using sacks of chicken manure and abono for feed calculations; Describing Pond sizes using fractions of a hectare.
Informal record-keeping/profit estimation	Tracking income and expenses through personal methods, not necessarily formal accounting.	The caretaker's method of tracking profits based on the estimated weight and price of harvested fish.
Terminology and practices	Integrating local names and customs into mathematical practices.	Use of terms like "bansutan," "larguhan," and "lab-lab"; Traditional methods of algae cultivation and fish feeding.
Seasonal influences on decision-making	Adapting practices based on seasonal changes and market demands.	The caretaker's harvesting schedule based on the months with the highest market prices and lowest competition; Recognizing price fluctuations based on school enrollment.
Traditional knowledge integration	Combining traditional fishing methods with quantitative methods.	Applying years of experience to estimate survival rates, predict harvest times, and optimize feeding strategies.

Conclusions

The researchers concluded that this study was beneficial for those pond owners and caretakers, it suggested the ways or practices that their community might use in aquaculture specifically nurturing and producing Chanos Chanos or *bangus* fish. There are practices that use mathematical concepts like estimating the number of fingerlings that would suffice the pond and the proceedings or profit gain by the pond owner, the using of calendar for seasonal activities in marketing strategy, the time of feeding sessions, number of sacks of chicken manure in producing *lab - lab* in the pond and total sacks of feeds and the number of cropping and harvesting.

However, this study also encourages future researchers to deepen the understanding and appreciation in the field of aquaculture to a certain community while applying the ethnomathematical concepts that could help relate in the field of mathematics education.

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