VALUE CHAIN ANALYSIS OF SPOTTED SEA CATFISH (ARIUS MACULATUS) IN TANGUB CITY, PANGUIL BAY, PHILIPPINES

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Abstract

This study aimed to analyze the value chain of Tambangongo in Tangub City, Panguil Bay. The researchers used the purposive sampling approach in collecting the data. The results of the study identified the key players in the value chain namely, the fishermen, local traders/viajeros, wet market vendors and the final consumers. The following were the marketing activities done by the respondents where tambangongo was sold in fresh form, marketed according to sizes at their residences and in the wet market outlets. Suki was one of the reasons of the fishermen in selecting market outlets. As to the method of sale, pick-up and delivered were identified which accounted to about 69.2% and 30.8%, respectively in the form of cash (56.4%), cash advance (23.1%) and cash and credit (20.5%). On the other hand, traders bought fresh tambangongo directly from the fishermen. Overall, wet market vendors got higher ROI which accounted to 67.72% over local trader/viajero with an ROI of about 13.96%. In addition, the industry was still vulnerable due to several issues, specifically the weather conditions. A sudden change in weather that causes a decrease in volume of catch, like typhoons which can lead to an increase in water contamination. Overall, the findings of this study can be used to encourage fishermen, considering tambangongo is a profitable species based on the ROI which gives 86.07% and 41.97% return to capital respectively. Thus, based on the findings, government must formulate policies to protect and improve tambangongo industry. Then, established a market-oriented framework to help increase the value and demand by making a new added-value product out of the tambangongo fish; declaration of marine protected areas will greatly aid in the preservation and expansion of this species of fish; providing credit-assistance, training, and seminars on new technology that will help increase the value and profitability of the tambangongo. Finally, organize a group to hold a local management meeting to impart information to every individual the benefits of tambangongo.

Keywords: *Value chain analysis, fisherfolks, traders, viajero, wet market vendors*

INTRODUCTION

The Spotted Sea Catfish (Arius maculatus), locally known as "tambangongo" (Thunberg, 1792), is a commercially valuable fish species prevalent in Southeast Asia, particularly in muddy, shallow coastal and estuary environments of Panguil Bay, Philippines (Bolante & Lapinig, 2018). It plays a vital role in artisanal fisheries, contributing to local food security and livelihoods (Mansor et al. 1998). Beyond its culinary significance, tambangongo possesses promising attributes for aquaculture due to its potential medicinal properties and essential fatty acid profile (Al-Bow et al., 1997; Osman et al., 2007). Notably, Notably, extracts from this catfish exhibit wound-healing properties (Al-Bow et al., 1997), while its flesh constitutes a valuable source of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) - crucial polyunsaturated fatty acids (Osman et al., 2007). Despite its economic and potential health benefits, a significant knowledge gap exists regarding the value chain of tambangongo. While studies by Bolante & Lapinig (2018) explored possibilities for cage culture, and Opeña & Sabasales (2023) investigated its reproductive biology in Panguil Bay, a comprehensive understanding of the key stakeholders, marketing practices, profitability distribution, and challenges within the tambangongo value chain remains elusive (Opeña & Sabasales, 2023). This information is critical for optimizing resource management, promoting sustainable fisheries practices, and maximizing the economic potential of this valuable species.. Previous research has focused on specific aspects of tambangongo, such as reproduction (Jeyaseelan, 1998; Jumawan et al., 2020) and population dynamics (Lapinig & Bolante, 2018). Opeña and Sabasales (2023) further highlighted the low catch rates and potentially declining population in Panguil Bay. however, limited research exists on the value chain, hindering efforts to improve the livelihoods of fishers and optimize the overall management of this crucial fishery resource. A value chain encompasses all the activities involved in bringing a product from its raw state to the final consumer (Kaplinsky, 2000). In the context of tambangongo, this includes fish capture by fishers, processing activities (if any), and distribution channels leading to the final consumer. By analyzing this value chain, we can identify the key participants (fishers, traders, etc.), their roles, and the interactions between them (Hellin & Meijer, 2006). This analysis helps us understand how value is added at each stage and how efficiently the chain operates. Value addition refers to the in-

crease in a product's worth as it progresses through the value chain (Chivaka, 2007). Each participant contributes to this process by performing specific tasks, such as catching, transporting, or processing the fish. Ideally, each step adds value for the consumer and generates a profit for the involved parties. Value chain analysis is a valuable tool for promoting sustainable fisheries practices and improving livelihoods within the industry (Hempel, 2010). By identifying bottlenecks and inefficiencies, we can develop strategies to:

- Increase the overall value of tambangongo products reaching consumers.
- Ensure that fishers receive a fair share of the profits.
- Promote sustainable fishing practices to ensure the long-term viability of the resource.

Objectives:This study aims to conduct a comprehensive analysis of the value chain for spotted sea catfish (Arius maculatus) in Tangub City, Panguil Bay, Philippines. By addressing critical knowledge gaps, this research seeks to:

Identify and characterize key stakeholders: This objective focuses on comprehensively mapping the tambangongo value chain by identifying all the key players involved, from fishers and processors to wholesalers and retailers.

Characterize marketing practices: This objective delves into the marketing strategies employed by fishers and traders within the value chain. It will explore how they handle product presentation, pricing, distribution channels, and any promotional activities undertaken. *Evaluate profitability and value addition:* This objective aims to assess the economic performance of the value chain. It will estimate the profitability of marketing tambangongo at each stage and analyze the value added by different actors in the chain. *Identify challenges and bottlenecks:* This objective focuses on pinpointing critical areas hindering the efficiency and profitability of the value chain. This may include factors related to infrastructure, regulations, market access, or resource management. *Develop evidence-based policy recommendations:* Drawing on the findings from the previous objectives, this research will formulate specific and practical policy recommendations to address the challenges identified within the tambangongo value chain. These recommendations will be geared towards promoting sustainable practices, improving livelihoods for stakeholders, and enhancing the overall efficiency and profitability of the industry.

METHODOLOGY

1. Study area

This study was conducted in

Tangub City, a coastal component city with Misamis Occidental province, Philippines, bordering Panguil Bay. Tangub City encompasses 162.78 square kilometers (62.85 square miles), representing 8.11% of Misamis Occidental's total area. The 2020 Census recorded a population of 68,389, distributed across 55 barangays (villages). These barangays include 32 rural, 23 urban, and 15 coastal barangays. The research focused on 15 coastal barangays: Sumirap, Balatacan, Bocator, Panalsalan, Pangabuan, Lorenzo Tan, Aquino, Maquilao, Garang, San Apolinario, Mantic, Migcanaway, Maloro, Minsubong, and Silanga. Barangay selection was purposive, based on a preliminary survey that identified these areas as having documented catches of Tambangongo within the survey period. Figure below shows the map where the sampling sites are located.

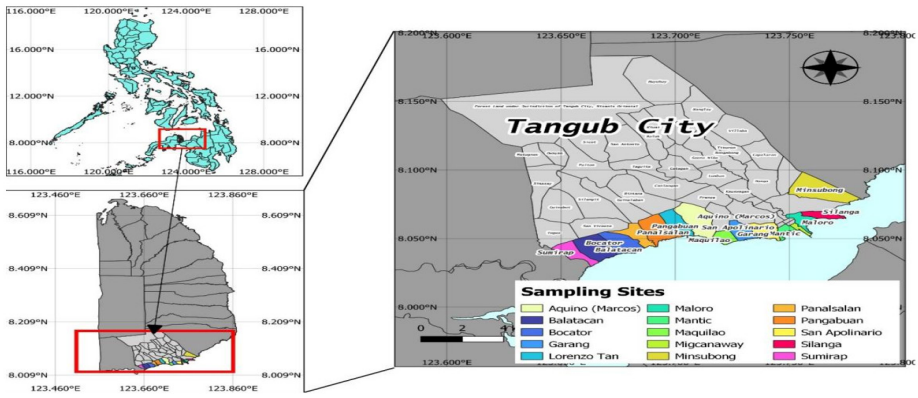

Figure 1. Shows the research environment of the researcher

2.2 Sample Size and Sampling Technique

Purposive sampling was employed to recruit a total of 50 participants: 39 fisherfolks directly involved in Tambangongo fishing and 11 key players within the value chain, including local traders ("suki") and wet market vendors. This targeted approach ensured data collection from individuals with firsthand knowledge of Tambangongo capture, trade, and market dynamics.

2. 3 Data Collection

Both structured and semi-structured questionnaire adopted from Guigue (2021) were used to collect primary data from tambangongo fishermen and traders by direct personal interview. Key Informant Interviews (KII) were also used in order to collect information from a wide range of expert people. All the sessions were recorded and note keeping was done too. Direct observation of the activities of fishermen and traders were done in or-

der to gather data and have a clear idea about how existing market dynamics work. It was also observed that how sizing, pricing, and payment was performed by the value chain actors. Secondary data was collected from published research articles and reliable internet sources to obtain information on Tambangogo value chain, actors, involved, and their interrelationships.

2.4 Data Processing and Analysis

Quantitative data from the demographic characteristics of respondents was analyzed using frequency counts and percentages. To assess the cost-return relationship for fisherfolks, the return on investment (ROI) metric was employed, adapted from Guigue's (2021) study on prawn supply chains in Northern Mindanao, Philippines.

3 Results and Discussions

3.1 Key Players in the Tambangogo Value Chain

Table 1 identifies the key actors involved in the Tambangogo value chain and their respective roles:

Table 1. Key players and their roles

Key players	Roles
Fisherfolks	Small-scale fishers operating in Panguil Bay who directly capture Tambangongo.
Local Traders (Suki)	A specific kind of merchant who purchase Tambangogo directly from the fisherfolks and then resell it to walk-in customers.
Viajeros (suki)	These are specialized traders who buy, transport, and deliver Tambangongo to neighboring towns and more distant locations beyond the reach of wet markets..
Wet Market Vendors	These are business owners who manage stalls within wet markets and sell Tambangongo to consumers..
Final Consumers	These represent the end users who purchase Tambangongo for personal consumption.

3.2 Marketing activities of the fisherfolks and traders

3.2.1 Fisherfolks Marketing Practices

Tambangongo is exclusively sold fresh by fisherfolks due to limited processing facilities in Tangub City. The study confirmed that fisherfolks are not involved in

any post-harvest processing activities (0% engagement). Sales are hindered by negative consumer perceptions, with some consumers avoiding Tambangongo due to the misconception that it is associated with cemeteries, as revealed by both fisherfolks and traders. This finding aligns with the highly perishable nature of Tambangongo, as emphasized by the fisherfolks. Supporting this, Nooralabettu et al. (2011) highlight the rapid quality decline of the fish, necessitating immediate sale after capture and limiting long-distance transport and storage options. Pricing and sizing are straightforward: all respondents (100%) reported selling Tambangongo based on size categories. Smaller fish range from 1/2 kg to 2 kg, while larger ones weigh between 2 kg and 3 kg. The majority of fisherfolks (69.23%) utilize their homes as their primary marketing channel. Here, established relationships with "suki" (local trusted buyers) play a crucial role. Suki collect the fish directly from the fisherfolk's residences, eliminating transport costs and effort for the seller. Convenience is a major factor influencing marketing channel selection, with 56.41% of respondents prioritizing suki relationships despite potentially lower prices offered by market vendors (17.95%). The remaining 30.77% of fisherfolks sell at wet markets. Cash is the dominant mode of payment, with 56.41% receiving full payment and 23.1% receiving cash advances. Some fisherfolks (20.5%) request cash and credit to cover fuel and other operational costs. These advances are typically deducted from future earnings, creating a credit system with their suki. Local traders (viajeros) may also extend credit to fisherfolks, but these debts are typically settled within a day.

Table 2. Marketing activities of the fisherfolks

What forms did you sell your Tambangongo?	Frequency (n=39)	Percentage (%)
Fresh	39	100
Processed	-	-
If fresh, does Tambangongo marketed according to sizes?		
Yes	39	100
No	-	-
Where did you sell your product (Point of selling)?		
Residence (Pick-up)	27	69.23
Wet Market (Delivered)	12	30.77
Market outlets		
Local traders (suki)	27	69.2

Wet market vendors	12	30.8
Reasons on selecting market outlets		
Suki (local traders)	22	56.41
High price (market vendors)	7	17.95
Accessible in neighborhood	10	25.64
Mode of payment		
Cash	22	56.4
Cash advance	9	23.1
Cash & credit	8	20.5

3.2.2 Traders marketing information profile

Traders act as intermediaries, purchasing Tambangongo directly from fisherfolks in its fresh form. They determine the purchase price based on fish size. According to the traders, this approach offers cost-effectiveness for buyers as it eliminates markups typically associated with retailers, viajeros (itinerant traders), and other market channels. Furthermore, traders confirmed the absence of processed Tambangongo products in local commercial establishments.

Table 3. Marketing activities of traders

What forms did you sell your Tambangongo?	Frequency (n=39)	Percentage (%)
Fishermen	11	100
Viajero	-	-
Retailers	-	-
What is the form of the tambangongo when purchased?		
Fresh	11	100
Processed	-	-
If fresh, does tambangongo marketed according to sizes?		
Yes	11	100
No	-	-

3.3 Performance analysis of key players

3.3.1 Fisherfolk Performance

Profitability analysis using return on investment (ROI) revealed a positive return for both fisherfolks selling Tambangongo directly from their residences and those delivering to wet markets. Home-Based Sales. Fisherfolks selling from their homes earned an average total income of ₱1,195, with an average total cost of ₱642.22, resulting in an average net income of ₱552.78. Tambangongo prices varied by size: smaller fish (1/2 kg to 2 kg) averaged

₱45/kg, while larger ones (2 kg to 3 kg) fetched an average of ₱65/kg. Notably, these home-based sellers achieved a higher ROI of approximately 86.07%. In simpler terms, for every peso invested, they earned a return of ₱0.86 (Guigue, 2021). Wet Market Sales. Fisherfolks delivering Tambangongo to wet markets earned an average net income of ₱309.38 from a total average income of ₱1,046.60. Their average expenses amounted to ₱737.22, resulting in a lower ROI of 41.97% (approximately a ₱0.42 return on every peso invested). The lower ROI for wet market sales is likely attributed to additional transaction costs incurred by these fisherfolks, despite similar selling prices. These costs might include transportation expenses or potential market fees.

Table 4. Average cost and return analysis of tambangongo fisherfolks, Tangub City, Panguil Bay, Philippines

ITEMS	DELIVERED		RESIDENCE		
	Amount (₱)	Total (₱)		Amount (₱)	Total (₱)
Sales		1,046.6			1,195
Volume Traded Large 10.3kg @ P65/kg Small 8.38 kg @ P45/kg	 669.5 377.1		Volume Traded Large 12.5 kg @ ₱ 65/kg Small 8.5 kg @ ₱45/kg	 812.5 382.5	
Less: Expenses		737.22			642.22
NET RETURN		309.38			552.78
ROI (Net Return/Total Expenses X100)		41.97%			86.07%

3.3.2 Trader Performance

Profitability analysis using return on investment (ROI) revealed a clear disparity between local traders and wet market vendors in the Tambangongo value chain. Local traders earned a lower average net income (P185) compared to their wet market counterparts (P769.80). This difference is reflected in their respective ROI estimates: 67.72% for wet market vendors and 13.96% for local traders. In simpler terms, for every peso invested, wet market vendors earned a return of P0.68, significantly higher than the P0.14 return for local traders. Two key factors likely contribute to this difference in profitability. Local traders may incur additional transaction costs compared to wet market vendors. These costs might include transportation expenses for acquiring Tambangon-

go from fisherfolks or fees associated with selling at alternative market outlets. Additionally, pricing strategy appears to play a role. Wet market vendors may set higher selling prices for Tambangongo compared to local traders. This could explain the higher average net income and ROI observed for wet market vendors.

Table 5. Average cost and return analysis of tambangongo traders, Tangub City, Panguil Bay, Philippines

ITEMS	WET MARKET VENDORS		LOCAL TRADERS (SUKI)		
	Amount (₱)	Total (₱)	Amount (₱)		Total (₱)
Sales		1,906.4			1,510
Volume Traded Large 10.3 kg @ P120/kg Small 8.38 kg @ P80/kg	1,236 670.4		12.5 kg @ P80/kg 8.5kg @ P60/kg	1,000 510	
Less: Expenses		1136			1,325
NET RETURN		769.8			185
ROI (Net Return/Total Expenses X100)		67.72%			13.96%

3.3.3 Sea Spotted Catfish (Arius maculatus) Value Chain Mapping

The Tambangongo value chain, as illustrated in Figure 2, reveals two primary distribution routes. Local traders, also known as "suki" and "viajeros," act as intermediaries by picking up Tambangongo directly from fisherfolk residences. They deliver the fish fresh to end consumers, incurring a mark-up of approximately 106% on the initial purchase price from fisherfolks. Alternatively, fisherfolks can sell Tambangongo directly to wet market vendors. These vendors then sell the fish fresh to end consumers, with a lower mark-up of around 54% compared to local traders/viajeros. Pricing throughout the value chain is influenced by the size of the fish. Fisherfolks sell small and large Tambangongo for P45/kg and P65/kg, respectively. Both local traders and wet market vendors add mark-ups to these base prices. Local traders, for instance, purchase small Tambangongo for P45/kg and resell it for P60/kg to consumers, representing a 33% mark-up. Large Tambangongo experiences a 23% mark-up with local traders, with a purchase price of P65/kg and a final selling price of P80/kg. Wet market vendors, on the other hand, generally set higher mark-ups compared to local traders/viajeros. Small Tambangongo purchased for P45/kg is sold for P80/kg to consumers by wet market vendors, resulting in a higher mark-up of 78%. Sim-

ilarly, large Tambangongo experiences a more substantial mark-up (85%) by wet market vendors, with a purchase price of P65/kg and a final selling price of P120/kg. Notably, wet market vendors generally set higher final consumer prices compared to local traders/viajeros.

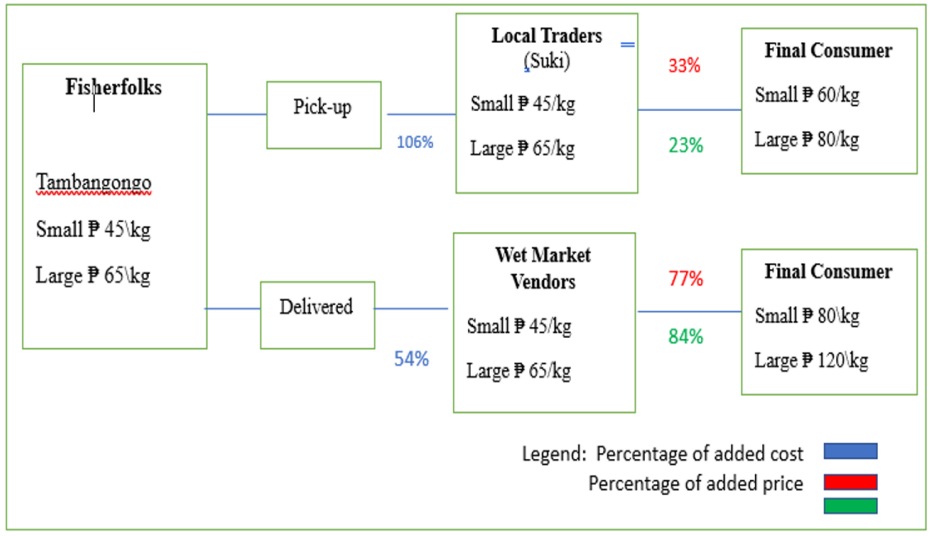

Figure 2. Percentage of added value in Tambangogo value chain

3.4 Problems Encountered by Fisherfolks

Adverse weather conditions, particularly strong waves, emerged as a significant challenge for most fisherfolks. This disrupts fishing activities and reduces overall catch volume, especially during typhoons or prolonged periods of heavy rain (Guijarro et al., 2020). Concerns were also raised regarding increased water pollution, particularly during the "hanging amihan" season (Guigue, 2021). This phenomenon, coupled with reduced water flow, can negatively impact fish quality and habitat health. While 23 fisherfolks reported participating in various livelihood programs, including seminars and trainings offered by government agencies (Department of Agriculture [DA], Local Government Unit [LGU], Bureau of Fisheries and Aquatic Resources [BFAR]), these programs often lacked specific relevance to Tambangongo capture or value chain optimization. Additionally, some fisherfolks expressed a desire for greater access to such programs, as participation slots were limited. This limited access suggests a potential gap between government initiatives designed to support fisherfolks and the specific needs of those engaged in the Tambangongo value chain (Suh & Pomeroy, 2020).

Table 7. Problems encountered by fishermen and traders

Problems Encountered	FISHERFOLKS		TRADERS	
	Frequency (n=39)	Percentage (%)	Frequency (n=11)	Percentage (%)
Weather conditions	33	84.6	-	-
Low yield	6	15.4	-	-
Low-priced	15	38.5	3	27.3
Not highly demanded	4	10.3	9	81.8
Lack of financing program to support the industry	9	23.1	-	-
Water pollution	19	48.7	2	18.2
Attended livelihood program/ seminar/ training				
Yes	23	59	2	18.2
No	16	41	9	81.8
Sponsoring agencies				
Government	23	59	2	18.2
Private	-	-	-	-

4. Conclusions and recommendations

4.1 Conclusions

This study investigated the Tambangongo (Sea Spotted Catfish, Arius maculatus) value chain in the Philippines. The findings highlight the profitability of Tambangongo for fisherfolks, based on return on investment (ROI) analysis. However, the fish is primarily marketed fresh, suggesting a lack of significant commercial value or processing capabilities within the local fishery industry. While processing could potentially add value to the product, it might require additional resources, equipment, and expertise beyond the capacity of small-scale fishers and traders. The majority of fisherfolks rely on established relationships with local buyers ("suki") for selling Tambangongo. This approach suggests a preference for trust-based transactions and potentially better prices or benefits like timely payments or credit facilities. Although fisherfolks participated in seminars and livelihood programs offered by the Bureau of Fisheries and Aquatic Resources (BFAR), these programs lacked specific relevance to Tambangongo capture or value chain optimization. This may indicate a need for more targeted training initiatives that address the specific needs and opportunities associated with this fish species. In conclusion, this study sheds light on the profitability of Tambangongo for fisherfolks despite the limitations in processing and marketing. It also high-

lights the importance of trust-based relationships in the value chain and the potential need for more targeted support programs to enhance the overall Tambangongo fishery in the Philippines

4.2 Recommendation

The analysis of the Tambangongo value chain reveals potential areas for improvement. Recommendations are directed towards government agencies, including the Department of Agriculture (DA), Bureau of Fisheries and Aquatic Resources (BFAR), Local Government Unit (LGU), Department of Science and Technology (DOST), and Department of Trade Industry (DTI). *Stock Assessment and Aquaculture Potential.* While Tambangongo holds promise as an aquaculture species, limited data exists regarding Panguil Bay stocks. Further research and support programs are crucial to assess stock sustainability and explore potential for aquaculture development. The Department of Agriculture (DA) and Bureau of Fisheries and Aquatic Resources (BFAR) can play a key role in facilitating these initiatives. *Market Diversification and Value-Added Products.* Developing a market-oriented approach for Tambangongo is essential. This could involve exploring new product development to attract broader consumer demographics and increase customer retention. The Department of Science and Technology (DOST) and Department of Trade and Industry (DTI) can contribute by supporting research and development initiatives related to value-added Tambangongo products. *Sustainable Fishing Practices and Capacity Building.* Promoting sustainable fishing practices is critical for long-term Tambangongo resource management. Training programs on sustainable fishing methods, gear technologies, and resource conservation, delivered by BFAR and DA, can empower fisherfolks with the necessary knowledge and skills. *Financial Support and Collaborative Management.* Providing access to credit and financial assistance programs can help fisherfolks invest in equipment upgrades and improve operational efficiency. Additionally, facilitating the formation of fisherfolk associations can foster collaboration and information sharing. Local Government Units (LGUs) can play a crucial role in promoting local management meetings and collaborative resource management initiatives. *Marine Protected Areas.* The designation of marine protected areas (MPAs) by relevant government agencies can contribute significantly to the long-term preservation and potential expansion of Tambangongo populations. *Catch Per Unit Effort (CPUE) Data*

Collection. For future research, a focus on collecting and analyzing CPUE data is recommended. This data will provide valuable insights into the economic performance of different value chain stages, informing strategies for optimizing the chain for sustainable and equitable economic development. By implementing these recommendations, various government agencies can work collaboratively to enhance the Tambangongo value chain, promoting its long-term viability and the well-being of those involved in the fishery.

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