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COMMENTARY

Addressing Food Security in Batangas, Philippines through Backyard Tilapia Farming

Miguel Enrique Ma. Azcuna*, Jonel M. Corral, Karlo L. Pintor

Verde Island Passage Center for Oceanographic Research and Aquatic Life Sciences (VIP CORALS-Nasugbu), Batangas State University ARASOF-Nasugbu, Nasugbu, Batangas 4231

*Corresponding Author: *miguel.azcuna@g.batstate-u.edu.ph*
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BACKGROUND

The onset of the COVID-19 pandemic showed how food supply could become unstable when lockdowns and curfews hamper transportation and delivery logistics. Difficulties arose in producing and selling agricultural products (e.g., vegetables, fruits, meats, and others). Supermarkets had limited or no stock of food supplies. In other cases, deliveries were postponed or canceled due to a lack of transportation or long lines at checkpoints, which would have caused the goods to rot and perish (Pamplona 2020). In addition, people from isolated towns could not commute to supermarkets for many reasons (e.g., no public transportation, entire household under home quarantine). These situations highlight the relevance of food security in the Philippines amidst the COVID-19 pandemic.

Tilapia is the second most important farmed fish in the Philippines produced in ponds (Guerrero 2019; Bureau of Fisheries and Aquatic Resources 2006). However, low production in the last decade was attributed to problems in tilapia farming, such as incapacitation of tilapia farmers due to lack of government assistance, poor breed of tilapia, high cost of production, and lack of capital (Guerrero 2019; Toledo et al. 2008). In 2019 and 2020, tilapia comprised 96% of the aquaculture from freshwater ponds in the Philippines. However, Region 4A contributed only 0.2–0.3% to this, indicating that tilapia farming in fishponds is uncommon in this region (Bureau of Fisheries and Aquatic Resources 2019; Bureau of Fisheries and Aquatic Resources 2020). In fact, no tilapia was produced from fishponds in Batangas during 2019–2021 (Philippine Statistics Authority 2020; Philippine Statistics Authority 2021). Tilapia production in lake-based fish cages is more common in Batangas.

In 2019 and 2020, tilapia comprised 83% and 87% of the aquaculture from fish cages in the Philippines, respectively. Region 4A contributed 88% and 86% to these, indicating that most tilapia from fish cages originated from this region (Bureau of Fisheries and Aquatic Resources 2019; Bureau of Fisheries and Aquatic Resources 2020). Batangas province accounted for 84% in 2019 (77,849 MT) and 82% in 2020 (52,678 MT) of all freshwater fish cage production in Region 4A (2019: 92,463 MT; 2020: 64,577 MT) (Philippine Statistics Authority 2020; Bureau of Fisheries and Aquatic Resources 2019; Bureau of Fisheries and Aquatic Resources 2020). In Batangas, tilapia sold in markets originates from fish cages in Taal Lake (Teodoro Jonson Jr. pers. comm.) However, access to tilapia from lake-based fish cages can be challenging amidst quarantine protocols and road checkpoints in a COVID-19 scenario. In light of this, aquaculture of tilapia in ponds is one solution that can augment the food supply in isolated rural areas. To address this opportunity and the problems associated with tilapia farming, small-scale backyard tilapia fishponds were set up for beneficiaries in Batangas, provided that they had an available source of fresh water (e.g., deep well, stream, river, or irrigation canal). In addition, sex-reversed tilapia (SRT) fingerlings and feeds were provided to the beneficiaries, along with training on tilapia aquaculture. The project ensured that they

would be able to address their basic food requirements, especially in terms of protein. It also allowed them to develop and implement livelihood activities post-lockdown.

The project was implemented by the Batangas State University ARASOF-Nasugbu in cooperation with the Municipal Agriculture Offices of Nasugbu, Tuy, and Balayan in Batangas from November 2021 to June 2022. Fifteen (15) project sites from 15 beneficiaries in Batangas were identified for backyard tilapia culture. SRT fry/fingerlings were obtained from commercial fingerling sources in Los Baños, Laguna. The identified sites had a sustainable source of freshwater during the 4–5 months culture period of tilapia and already had an excavated area for the fishpond. The selection of beneficiaries considered the following conditions: (a) that the household's income is largely dependent on tilapia production; (b) that the volume of fish produced is not of commercial-scale (semi-intensive: 5 fish per m^2 of pond); (c) that the fisherfolk's family may be considered vulnerable to the indirect effects of COVID-19 (e.g., only one salaried worker in the family, which would affect the family's income if he/she is required to undergo quarantine).

Sex-reversed fingerlings and commercial feeds were delivered to the beneficiaries in two croppings. Each cropping lasted 4–5 months, and monitoring sessions were conducted every two weeks to measure water parameters (e.g., temperature, dissolved oxygen, pH) and determine the average body weight (ABW) necessary to adjust the feeding scheme. Harvest was done at least four months after the initial stocking of fingerlings.

The beneficiaries were trained to compute the costs associated with backyard tilapia culture (e.g., cost of fingerlings, feeds) to determine the net profit income after the market sale of the harvested tilapia (Tables 2–4). The comprehensive training included fishpond construction and management, use of organic and inorganic fertilizers, feeds and feeding, harvesting of stocks, post-harvest processing, record keeping, and cost and return analysis.

Outcomes of backyard tilapia farming in Batangas

The results of the first and second cropping cycles are summarized in Table 1. The project was able to address food security in Batangas during the post-lockdown period (after the COVID-19 delta variant that was rampant in October 2021). In terms of yield per unit area, the majority of the beneficiaries had a value greater than the average yield for freshwater ponds which is 0.45 (Asian Development Bank 2004). In addition, the beneficiaries performed better on the second cropping, as seen in lower FCR values. An estimated 4.5 tons of tilapia was produced from the 15 beneficiaries, contributing to the tilapia supply chain in the Batangas province. Prior to project implementation, tilapia availability in remote rural areas of Batangas mainly relied on the tilapia supply chain from Taal or Laguna Lake. After the implementation of the project in isolated municipalities and barangays of Batangas, more tilapia was made available in remote areas. It was also easier for people in these areas to access freshly harvested tilapia due to the proximity of the fishponds to their homes. Some beneficiaries sold their harvested tilapia for profit, knowing that there is a demand for affordable fish in markets (Bestari et al. 2004; Asian Development Bank 2005), while other beneficiaries used the harvested tilapia for personal consumption. This allowed protein-rich food to become readily available to people in Batangas, especially in isolated rural areas (e.g., Brgy. Putat, Nasugbu; Brgy. Tan-ag, Lian; Brgy. Dalima, Tuy) as tilapia is known to be an essential component in the Filipino diet as a meat substitute owing to its taste and nutrients (Olalo 2001).

For some beneficiaries, the problems encountered during the culture period that resulted in higher FCRs were predators (e.g., monitor lizards), riparian vegetation that can reduce dissolved oxygen in the water, and the failure of the beneficiaries to move newly stocked fingerlings to the pond. These can be prevented through more frequent monitoring sessions (e.g., once a week) to ensure that good aquaculture practices and consultants' advice are implemented. Pond fertilization is also crucial for achieving low FCRs because it promotes fish dependence on natural feed. This will favorably result in a decreased dependence on artificial feeds (Guerrero 1994).

The farming activities increased tilapia production in freshwater ponds in Batangas in 2022. Pre-project implementation, no tilapia was produced in fishponds for Batangas (Philippine Statistics Authority 2020; Philippine Statistics Authority 2021). The project improved tilapia production in fishponds in Batangas by producing 4.5 MT of fresh tilapia. This augmented the supply chain of tilapia in Batangas for 2022. The results show that backyard tilapia farming is an effective way to address food security in isolated areas of Batangas province.

Table 1. Summary of harvest data and pond performance of project beneficiaries.

Cooperator	Total Stock (pcs)		Harvested ABW (g)		Harvested Biomass (in kg)		Survival (in %)		Yield Per Unit Area (in kg/m^2)		FCR	
Code, (Location, Pond Area)	1st Crop	2nd Crop	1st Crop	2nd Crop	1st Crop	2nd Crop	1st Crop	2nd Crop	1st Crop	2nd Crop	1st Crop	2nd Crop
1 (Nasugbu)100 m^2.	900	900	121	43	80	32	73	82	0.80	0.32	1.25	2.34
2 (Tan-ag, Lian 1400 m^2)	9800	7000	148	200*	1,300	1,400*	99	100	0.92	1.00	0.86	0.68
3 (Putat, Nasugbu 100 m^2)	1000	1000	220	80*	185	80*	84	100	1.85	0.80	0.64	0.87
4 (Putat, Nasugbu 120 m^2)	1000	800	264	30*	225	6	85	20	1.88	0.05	1.28	2.16
5 (Dalima, Tuy 700 m^2)	4000	4500	120	80*	395	360*	82	95	0.56	0.51	1.55	0.87
6 (Magahis, Tuy 80 m^2)	500	-	100	-	2	-	4	-	0.03	-	22.5	-
7 (Cogonan, Nasugbu 300 m^2)	1500	-	0	-	0	-	0	-	0	-	n/a	-
8 (Gimalas, Balayan 20 m^2)	400	500	100	50*	16	25*	40	100	0.80	1.25	4.06	0.90
9 (Santol, Balayan 175 m^2)	1000	1000	113	100*	17	100*	15	100	0.10	0.57	5.5	0.85
10 (Putat, Nasugbu 350 m^2)	-	2000	-	180*	-	252*	-	70	-	0.72	-	0.63
11 (Santol, Balayan 175 m^2)	-	1000	-	60*	-	60*	-	100	-	0.34	-	1.00
12 (Sanpiro, Balayan 20 m^2)	-	500	-	30*	-	15*	-	100	-	0.75	-	0.86
13 (Sanpiro, Balayan 20 m^2)	-	500	-	40*	-	20*	-	100	-	1.00	-	0.65
14 (Putat, Nasugbu, 20 m^2)	-	500	-	30*	-	15*	-	100	-	0.75	-	0.86
15 (Malapad na Bato, Nasugbu, 30 m^2)	-	500	-	30*	-	15*	-	100	-	0.50	-	0.86
TOTAL	20,100	20,700	1,186	893*	2,220	2,342			6.94	8.56		
Mean			131	69*	247	180	54%	90%	0.77	0.66	2.76	1.04

Legend:

* Fish were not yet harvested. Average body weight was recorded last August 17, 2022 and used to estimate the Harvest Biomass.

\- Fingerlings were not stocked for the beneficiary during the respective cropping.

n/a No FCR was computed

Table 2. Assumptions for cost-benefit analysis.

Parameter	Value
Total Pond Area	20 – 100 m^2
Culture Period	4–5 months
Number of Cropping per Year	2
Stocking Density (Semi-intensive)	4–5 pieces per m^2
Survival Rate	85%
Harvest Weight per Piece	250 grams
Number of Pieces per Kilo	4
Market Price per Kilo of Harvested Fish *based on the average market price for tilapia in 2021 (Bureau of Fisheries and Aquatic Resources 2021)	PHP 140.00/kg

Table 3. Variable cost assumption for cost-benefit analysis of 100 m^2 fishpond.

Item	Cost
Fingerlings (PHP 0.85 per piece, size 17)	PHP 340.00–425.00
Feeds (PHP 2,000 per 100 m2 per crop x 2 croppings)	PHP 4,000.00
Pond Repair (PHP 1,000 per 100 m2 per crop x 2 croppings)	PHP 2,000.00
Aquaculture Supplies (PHP 1,000 per 100 m2 per crop x 2 croppings	PHP 2,000.00
Total	PHP 8,340.00–8,425.00

Table 4. Cost-Benefit Analysis for Fishpond with Area = 100 m^2

Parameter	Value
Stocking Density	5 pieces
Total Fingerlings Stocker per Crop	500 pieces
Pieces per Harvest @ 85% Survival per Cropping	425 pieces
Kilos Harvested per Cropping @ 4 pieces-kg size	106 kg
Total Operating Cost	Php 8,425.00
Revenue = 106 kg x Php 140.00 x 2 croppings	Php 29,680.00
Net Profit	Php 21,255.00
Break-even Price	Php 39.74 per kg

CONCLUSIONS

The results showed that backyard tilapia farmers in Batangas can produce additional fish supply if provided with good quality fingerlings, feeds, and training on good aquaculture practices. The cost-benefit analysis allowed the beneficiaries to assess how to balance the expenses and profits associated with a cropping cycle. The 4.5 MT of fresh tilapia produced contributed to the supply chain of tilapia in the province and demonstrated how the inland pond culture of tilapia could be expanded in Batangas, where it is seldom practiced. This would make fresh tilapia easily accessible to people residing in isolated rural areas. This has implications for increasing the capacity of other rural areas in the Philippines to practice backyard tilapia farming to increase food security.

CONFLICTS OF INTEREST

To the best of our knowledge, no conflict of interest exists.

ETHICS STATEMENT

No animal or human studies were carried out by the authors.

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