Small-scale IMTA of Milkfish in Pens: The Pandaraonan, Guimaras, Philippines Experience

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Introduction

Milkfish, *Chanos chanos* is one of the most economically-important farmed fish species in the Philippines and in Southeast Asia. Milkfish, being a eurythermal and euryhaline species, may be cultivated in various environments such as freshwater, brackishwater, and marine (Yap *et al*. 2007). Milkfish culture, next to seaweed, comprised 19 % of the total aquaculture production in the Philippines with an annual production of 411 metric tons in 2017 (PSA, 2017) and still continues to grow. The increasing interest in milkfish mariculture farming paved the way to intensive culture systems motivated by high profits and strong competition. Intensification in fish farming tend to contribute to a crucial environmental threat. The introduction of integrated multitrophic aquaculture (IMTA) is said to mitigate further degradation of the coastal environment and may potentially increase income from cultivating various species.

This study examines IMTA as an option for small-scale fish farmers to grow multiple species in the same area in the coastal waters of Barangay Pandaraonan in Nueva Valencia, Guimaras, Philippines. The study aimed to explore the feasibility of an economically profitable IMTA system where milkfish is grown with sandfish and seaweeds.

Methods

The study collaborated with the fisherfolks and women of the Pandaraonan Unified Association (PUA) and the local government of Barangay Pandaraonan, a coastal village in the municipality of Nueva Valencia in Guimaras province, Philippines. We implemented a milkfish grow-out culture in pens using the milkfish culture techniques developed at SEAFDEC/AQD and discussed in another paper by Diamante *et al.*, in this Proceedings. It also integrated the indigenous knowledge of fisherfolks on small-scale fish farming. The socio-economic component of the study aimed to improve the potential economic benefits from fish farming as a supplemental income source for artisanal fishers. It also aimed to enhance skills on value-adding of milkfish harvest (*e.g.,* milkfish in oil and sun-dried milkfish) through participatory training activities. Value-adding through processing was applied, especially when economic losses in the grow-out phase where incurred due to mortalities, inclement weather and social factors.

Results and Discussion

The IMTA demonstration implemented six production cycles from July 2015 to October 2018. Run 1 (July to Dec 2015) was not included because its pen design, set-up and activities were on an exploratory phase. Run 2 was conducted during the summer season (March to July) while the production cycles 3, 5, and 6 were done in the wet season (August to February). Run 4 was during a transition from dry to wet season (May to August). The six production runs produced an average marketable size of milkfish at ≥300g at harvest. Run 2 had the best production performance, in terms of total biomass at harvest and growth compared to the other production runs (**Table 1**).

Seaweeds growth and yield also performed better in the initial run (Run 2), but deteriorated in the succeeding production runs. This may be attributed to the sudden increase of sea surface temperature that caused the seaweeds thalli to be easily infested with epiphytes, "*ice-ice disease*" and predation of herbivore fish (*i.e.,* rabbitfish). Sandfish growth and survival showed improved outcome in subsequent production runs (Runs 4, 5, and 6) but either lower or zero recapture rates were recorded during the initial runs as may be caused by predation (*i.e.* crabs, goby, etc.).

As shown in **Table 1**, the milkfish yield can drastically decline, as in Run 6. So, some inteventions on value-adding may address the problem of low income due to poor harvests. The women members of the Pandaraonan Unified Association (PUA) were introduced to post-harvest processes such as val-

ue-adding of milkfish into sun-dried form (locally known as *lamayo)*, deboned milkfish and cooking in oil. Notably, the women preferred "*lamayo"* because of the lower cost of input requirements compared with cooking in oil.

Table 1. Comparison of IMTA in milkfish pen culture operations (Run 2 to 6; Run 1 excluded) in Barangay Pandaraonan, Nueva Valencia, Guimaras, Philippines

	Run 2	**Run 3**	**Run 4**	**Run 5**	**Run 6**
	2016		2017		2018
Culture period	Apr – Jul	Sept – Dec	May – Aug	Oct– Feb	May – Oct
Days of culture	95	109	Pen 1: 54 Pen 2: 55	P1: 120 P2: 121	P1: 103 P2: 160
Number of pens	1	2	2	2	3
Area per pen, m^2	144	Pen 1: 150	P1: 150	P1: 150	P1: 150
		Pen 2: 162	P2: 162	P2: 162	P2: 162
Stocks					
Milkfish, pcs	3,354	Pen 1: 3,138	P1: 3, 832	P1: 4,353	P1: 3, 568
		Pen 2: 3,712	P2: 5, 498	P2: 4,760	P2: 4,500
(Stocking density, pcs/m^2)	23	Pen 1: 25 Pen2: 27	P1: 25 P2: 27	P1: 25 P2: 27	P1: 25 P2: 27
• seaweeds, kg	20	30	4	4	4
• sandfish, pcs	92	Pen 1: 100 P2:100	150	150	400
(stocking density, pcs)		(Control: 100)		Re-stocking after typhoon: 163 pieces	100 pieces per pen
Harvest					
Milkfish, pcs	3,321	Pen 1: 2,532	P1: 3,372	P1: 2,025	P1: 2,720
		Pen 2: 1,270	P2: 5,405	P2: 3,395	P2: 586
Milkfish, pcs (*incl. unaccounted*)		***Pen 2: 3,138***	***P1: 3,823***	***P1: 2,726*** ***P2: 3,425***	***P1: 3,361*** ***P2: 3,144***
Milkfish, kg	1,176	Pen 1: 822	P1: 928	P1: 596	P1: 692
		Pen 2:1, 241	P2: 1,511	P2: 841	P2: 155
Milkfish, kg (*incl. unaccounted*)		***Pen 1: 1,051***	***P1: 1,659***	***P1: 749*** ***P2: 887***	***P1: 951*** ***P2: 999***
seaweeds, kg	250	0.97	1.8	0	0
sandfish, pcs	0	0	8	150	160
Feed consumed, kg	2, 329	5,625	5, 975	5, 895	3, 700

Table 2 compares the cost and returns profile of IMTA of milkfish with sandfish and seaweeds from Runs 2 to 6. Run 1 was also excluded being an exploratory or training phase. The profitability indicators such as net income, gross sales, total costs, and feed conversion ratio (FCR) overall showed economic losses. Run 2 gained a minimal net income while the subsequent production runs showed an increasing negative profit. Unaccounted milkfish and high mortalities were reported to be the major causes of huge income loss.

In the daily logbook of the collaborators, fish mortalities in the earlier runs (Runs 2 to 5) usually occur only within a week during the acclimatization at stocking of fingerlings, possibly due to stress induced during transport of fingerlings. However, in Run 6, a total of 207 pieces of milkfish was unaccounted after harvest which could be attributed either to natural mortality, escapees, negligent guarding of the pens, and poaching during the culture period. Diseases were discounted as cause of loss, because fish samples were submitted to SEAFDEC/AQD Fish Health Diagnostic Laboratory and showed non-occurrence of fish diseases as associated with any bacterial and parasitic infections. These poor results were discussed with the local government officials, the PUA officers and the fisherfolk collaborators, especially in order to address any social problems such as poaching that could have caused these unaccounted milkfish stocks.

The large number of unaccounted milkfish revealed after harvest further contributed to huge losses in Run 6 amounting to Php143,257. FCR was 2.8 in Pen 1, but it was disappointingly highest at 21.9 in Pen 2 where most of the unaccounted milkfish were recorded. The FCR was high because the unaccounted milkfish was still included in the computation of feeds to be administered for both pens. Factors such as quality of fingerlings, weather conditions, and social responsibilities also contribute to the huge decline of stocks, total biomass yield, and net income. Nonetheless, to alleviate losses, the women members of PUA showed sustained interest and participation by undertaking value-adding options. The benefits from value-adding were mainly in terms of non-cash benefits for the community members. The women honed their skills in food preservation and value-adding, especially of the undersized milkfish. Meanwhile, the school children had samples of the cooked milkfish to influence their food intake and nutritional improvement.

Table 2. Cost and returns analysis of IMTA in milkfish pen culture operations (Run 2 to 6, from 2016 to 2018; Run 1 excluded) in Barangay Pandaraonan, Nueva Valencia, Guimaras, Philippines.

	Run 2	Run 3	Run 4	Run 5	Run 6
Cost profile (Php)					
Milkfish fingerlings	16, 300	47, 813	46, 944	48, 875	46, 750
Sandfish Juveniles	552	1,800	900	900	2,400
Seaweed	300	750	80	80	300
Feed cost	82, 450	172, 025	184, 915	192, 005	114, 375
Labor	9,500	20, 000	24, 000	24, 000	51, 000
Pen depreciation	4, 202	7, 455	7, 455	7, 455	10, 004
Other costs	5, 407	2, 625	2, 625	2, 625	2, 625
Total cost	**121,040**	**258,093**	**266,919**	**275,940**	**227,454**
Gross sales (Php)					
Milkfish	123, 480	197, 970	231, 900	129, 450	83, 115
Seaweeds	2, 342	24	0	0	0
Sandfish	0	0	0	145	1, 082
Total Sales	**125,822**	**197,995**	**231,900**	**129,595**	**84,197**
Economic Indicators					
Net Income	*4,782*	*-60,098*	*-35,019*	*-146,345*	*-143,257*
FCR (kg feed/kg harvest)	2.23	Pen 1: 3.90	P1: 2.40	P1: 4.57	P1: 2.80
		Pen 2: 2.90	P2: 2.36	P2: 4.40	P2: 21.90
Total feed cost (Php) /harvest kg *(including unaccounted pieces)*	70.11	Pen 1:163.68	P1: 111.46	P1: 256.35	P1: 120.27
		Pen 2: 138.61	P2: 122. 38	P2: 236.41	P2: 114. 49

References

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