

Monoculture of Mudcrabs (*Scylla Serrata*) in Brackishwater Ponds Fed with Golden Apple Snail (*Pomacea canaliculata*)



Agriculture

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ABSTRACT

Mudcrabs (Scylla serrata Forskall) were cultured in a brackishwater pond at the stocking density of one per square meter. Golden apple snail (kohol) was given as feed at 10%, 8%, 6% and 4% of the total pond biomass, which was adjusted every sampling period of 30 days interval. Feeds were given by broadcasting. Results of the study showed effective utilization of kohol as feed for mudcrabs, with a feed conversion value of 1.2. Monocultured mudcrabs fed with kohol had 55% rate of recovery. Daily growth increment of the crabs was at 2.5 grams in weight; 0.271 mm in carapace length and 0.651 mm in carapace width. It is implicated that a hectare of brackishwater pond devoted to the monoculture of mudcrabs will use about 2, 277 kilograms of snail to produce about 1,897 kilograms of crabs. Economic valuation, given the prevailing local price, will yield a gross income of about P113, 820/hectare per cropping cycle concomitant to the control and eradication of snail population infesting the croplands.

INTRODUCTION

Mudcrabs, *Scylla serrata* Forskall, known in Tagalog as alimango and in Bicol as *han-it* or *kinis* commands lucrative price both in the local and international market. Its culture in a monoculture system however is not commonly practiced in the Philippines but rather as subsidiary crop to milkfish. They are considered a nuisance in the pond as they create burrow into the dikes causing leakages. In a study on the polyculture of milkfish with mudcrabs (Baliao, 1984), ponds were prepared and fertilized to trigger growth of plankton as feed for milkfish which is not necessary for mudcrabs as they were fed with trashfish/low-value fish, animal entrails and hides. Crabs were harvested at an average weight of 200 grams. In Taiwan, monoculture and polyculture systems of rearing crabs are both practiced. Stocking density of 3 pieces per sq. m. was observed with feeding rate of 5% of the body weight (Chen, 1976). At present, practically limited understanding on the mud crab resources and culture practices in many countries reflect the need to develop an ecologically sustainable approach amidst emerging issues, needs, risks and opportunities associated with mudcrab aquaculture (Shelley, C., 2008). Major challenges which restrict growth of mud crab industry disclosed the limited supply of juvenile 'seed' (crablets) intended for stocking enclosures and critical assessment of nutritional requirement of crabs through feed alternatives other than trash fish, a major traditional feed component (Keenan, C.P and Blackshaw, A. 1999, Hamad M., 2012).

The utilization of shellfish as feed or feed ingredient for swine, duck, chicken and other livestock have been practiced long before the introduction of golden apple snail. In prawns, *Penaeus monodon* Fabricius shellfishes are used to reverse the soft-shelling syndrome caused, among others, by nutritional deficiency (Baticados, et. al., 1992). However, most of the shellfishes used as feed are also fit for human food consumption, and supply became scarce and expensive.

When golden apple snail, locally known as *kohol*, was introduced in the Philippine as escargot, a gourmet delicacy that farmers could raise quickly in value for what was believed to be flourishing export market, the snail multiplied so rapidly and soon almost all bodies of water was teeming with kohol. The market proved to be an illusion, but the damage on crops was so great. A nutrient analysis of golden apple snail however showed 42% crude protein, which could be a cheap source of animal protein, especially for livestock and aquaculture. La Torres, et. al. (1991) showed that kohol is an acceptable and profitable feed for swine fattening. In most crab fattening projects, kohol is being utilized as fattener.

In Panay Island, Philippines some fish farmers practically de-

spise the presence of mudcrabs in the ponds, because they burrow into the dikes, destroying it in the process. Thus, only undeveloped ponds are stocked with crabs (Lavina, 1980). Monoculture of mudcrabs, however, may adopt structural provisions or enclosure to prevent its migratory and burrowing characteristics (Baliao, 1984). Apparently high mortality of the crabs in some culture system can be observed due to lack of food especially under intensive culture and fattening enclosures. When crabs were fed with frozen or fresh chopped trashfish, recovery of the stock significantly increased and its culture was determined to be economically feasible. However, the utilization of trashfish in a commercial crab culture may present an economic prohibition beside from being seasonal and directly competing with human food consumption (Hutabarat, J., 1997, Hamad, M., 2012). Conversely, golden apple snail (*Pomacea canaliculata*) or kohol considered pest by farmers because of its voraciousness, abounds almost anywhere where water and vegetation are present. It is afflicting the production of about 426,000 hectares of rice fields all over the Philippines, particularly the newly transplanted rice and directly seeded crops, destroying 50-80% of the harvest (ICLARM, 1992). A nutrient analysis of the organism showed 42% crude protein (UPLB), among others, which could be a very cheap source of animal protein if utilized as feed for livestock and aquaculture, at the same time helping the farmers abate the population of snails.

Considering that feeds constitute about 30% to 60% of the operating cost in aquaculture production, this study utilized snails as feed in the monoculture of mudcrabs in brackishwater ponds and evaluate its economic viability. The feed conversion value and rate of recovery of crabs fed with kohol were determined. Some water physicochemical parameters of the pond receiving kohol feeds were likewise measured.

METHODOLOGY

Ponds and Stock

The study was conducted in a 1000 sq. m. divided into four compartments by a nylon net with 1.5 cm mesh size. Nets were buried to the pond bottom by about 15 cm and was extended by 50 cm above the water line. Bamboo pegs were installed every 2.5 m to strengthen and support the nets. Existing earth mounds were not removed and ponds were not leveled. Juvenile mudcrabs with a mean weight of 35 g were used in the study. They were purchased from crab collectors from Viga, Catanduanes. Stocking was done in a cool day at the rate of 1 pc./sq. m.

Feed and Feeding

Snails used in the study were collected from canals and rice-fields. The average net weight of shelled snails was determined and was the basis of the feeding rate, but crushed snails (shell-

on) was the form of feed given. Feeding was by broadcasting at the rate of 10%, 8%, 6% and 4% of the biomass, adjusted after sampling with 30 days interval. Feeds were given three times a day, specifically at 0900H, 1300H and 1700H, apportioned as follows 25%, 25% and 50%, respectively. Feed ration at 1700H were doubled since mudcrabs actively feed at night.

Pond Management

Each gate was provided with a screen to prevent escape of the stock. Surveillance was conducted during the period of the study to determine possible escape of the stock and other factors affecting the stock. Water quality parameters like salinity, temperature, turbidity and dissolved oxygen were monitored before and after water exchange or 10-15 days interval, using refractometer, thermometer, sechi disk and S. O. water, respectively.

A 20% sample from each compartment was retrieved by crablift netting every sampling. Ponds were totally drained after 120 days of culture and the rate of recovery determined.

Experimental Design and Data Analysis

Two adjacent compartments, each measuring 250 sq. m. received feeds, representing treatment 1 (two replicates) the other two adjacent ponds received no feeds, treatment 2 (control). Mean results of the two treatments were compared statistically by t-test. A 0.06 level of significance was observed. Partial budget analysis was used to assess the economic viability of the study.

RESULTS AND DISCUSSION

Feed Efficiency of Kohol

Results of the study showed effective utilization of the golden apple snail (*Pomacea canaliculata*) as feed for mudcrabs. It gave a feed conversion value of 1.2, higher than trashfish (3.72) which is commonly used as feeds for mudcrabs (Baliao, 1983, 1984; Lavina, 1980; Chen, 1978). This could be due to the consistency of feed ration containing 42% protein from kohol. When crabs are fed with trashfish, protein content may vary depending on the source and species of fish.

The daily growth increment of the stock during the period of the study was 2.5 g in weight; 0.271 mm in carapace length and 0.65 mm in carapace width. In a study by Escritor (1973), a fenced pond with a stocking density of one crab per 0.41 sq. m., recorded a growth increment of 0.136 mm in carapace length and 0.104 mm in carapace width. However, nothing was mentioned on the feeds and feeding scheme followed, if ever there was.

Recovery of the Stock

Rate of recovery of the stock after the culture period was significantly higher at the kohol fed ponds (55%) over the unfed ponds (14%). The lack of food apparently encouraged migration in spite of the nets provided and/or the cannibalistic behavior of the crabs resulting to low recovery. Lavina (1977) similarly observed that when feeding is intermittent or none, crabs migrate and forage for food or feed on the smaller and/or newly united crabs, resulting to high rate of mortality. The significantly low recovery of the stock in the unfed ponds may indicate that the provision of net enclosure deter migration provided food is adequate within the pond area.

Water Parameters

Measured water parameters during the study indicate no observed significant difference before and after water exchange which was about 10-15 days interval. These findings may suggest that feeds and feeding schemes followed during the period of study did not deteriorate the water quality in the pond system.

TABLE 1*: Partial Budget Analysis for the Monoculture of Mudcrabs (Fed and Unfed with Kohol) and Polyculture of Mudcrabs, Milkfish in one hectare Backishwater Pond for One Cropping (4 months)

Treatment/Technology	Average Yield (kg/ha)	Gross Income (P/ha)	Variable Cost					TVC (P)	Net Income
			Additional Labor	Stock	Fertilizer/Lime, Pesticide	Supplies (bamboo, nets etc)	Trashfish/Kuhol		
Polyculture		20270	12000	13750	2500	7500	17530	33280	36920
Mudcrabs	1062								
Milkfish	531								
Monoculture (Fed)	1897	113820	3000	20000		2000	4553	29553	84267
Monoculture (Unfed)	165	9912	3000	20000		2000		25000	-(15088)

*Assumptions: 1 kg mudcrabs costs P60.00, 1 kilogram milkfish is P50.00. Reflected cost of kohol refers to the P2.00/kg incurred labor cost during collection (data adopted from Baliao, 1984).

Economic Analysis

Results of the partial budget analysis of the study is presented in Table 1. The analysis showed negative returns for the unfed crabs while a net benefit of P84, 267.00 was realized for the kohol fed crabs. The variables cost the fed crabs amounted to P29, 553.00 which include P2.00 cost per kg of kohol for its collection.

In a study by Baliao (1984) on the polyculture of mudcrabs and milkfish, a gross income of P90, 270.00 was realized. However, more variable cost for pond preparation, i.e., lime, pesticide and fertilizer was necessary to condition the pond, eliminate predators and encourage growth of plankton as food for milkfish. Also, the provision of more structures, like bamboo screen (banatan), plastic and refuge to curtail the migration of crabs resulted to added variable cost. In this study, nets with 1.5 cm mesh size were the only added structure to prevent the stock from migration, thus lower variable cost. The increase in the stocking density of crabs was the only added variable cost for the monoculture system.

An added variable cost which amounted to more than 30% of the variable cost for polyculture system was the cost of trashfish. In this study, kohol is presented as an alternative to trashfish with very minimal cost. Its utilization will control the population of snail in croplands and the consequent damage.

CONCLUSION

Kohol is an effective feed for mudcrabs with a feed conversion value higher than trashfish feed while the optimal growth in weight and carapace size can be directly translated into higher rate of recovery (about 85%) relative to the unfed ponds. Partial budget analysis showed negative returns for the unfed crabs due to relatively lower economic yield while a net benefit of P84, 267 may be realized for the kohol fed crabs per hectare per cropping season. Thus, the utilization of kohol as feed for mudcrabs is potentially profitable while croplands are kept checked from consequent kohol infestation. Feeds and feeding of kohol-based diet to mudcrabs under fattening enclosure has no apparent negative effect on water quality of the culture system.

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