

# MILKFISH CULTURE IN A BUKIDNON FRESHWATER POND

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## **Abstract**

In a Pilot Project on the culture of Milkfish (*Chanos chanos* Forskal) in freshwater pond jointly undertaken by MSU, DOST X and a private entrepreneur, a total of 114 pieces of wild milkfish fingerlings of various sizes from Simanoc Creek of Naawan, Misamis Oriental were acclimatized to freshwater and stocked in a 510 m<sup>2</sup> Freshwater Earthen Pond. The pond was located 500 meters above sea level in Valencia Bukidnon. The fingerlings were fed rice bran and grew to marketable size in five months of culture. The survival rate was about 45% and the highest individual weight of 260 grams was comparable to the growth rate obtained of milkfish cultured in commercial brakishwater pond. The soil and water conditions in the pond, as well as the species and size composition of the harvest, are presented, the potential for the introduction of milkfish culture in Bukidnon is recognized; and the recommendations for its development are enumerated.

**A**n entrepreneur in Bukidnon who has availed of some funds for a proposed Freshwater Fish Culture Project for sex-reversed Tilapia (*Oreochromis niloticus*) and Milkfish (*Chanos chanos* Forskal) requested for technical assistance from the Regional Office of the Department of Science and Technology (DOST). To fully attend to the needs of the entrepreneur, the DOST committed a modest financial support and established a linkage with Mindanao State University at Naawan and

Central Mindanao University in Musuan, Bukidnon. This report deals on the attempt to culture milkfish in the landlocked and mountainous province of Bukidnon.

Milkfish, *Chanos Chanos* Forskal is a catadromous tropical finfish known for its tolerance of a wide range of salinity and is popularly cultured in commercial scale in marine and brackishwater ponds (Bardach et al., 1973; SEAFDEC--IDRC, 1983; Mr. & Mrs., 1989). Tubb (undated) and Roestami and Nanidjaja (1985) reported that milkfish is cultivated in rice paddies in Thailand and Indonesia. In the Philippines, the adaption of the technology for brackishwater culture of milkfish in producing milkfish in freshwater environment has been profitable in fish pens of Laguna de Bay and some other freshwater bodies of Luzon (LLDA, 1973; Mane, 1976; Gabriel, 1979; Baguilat, 1979). Grover (1973) also reported successful experiments in growing milkfish in combination with common carp (*Cyprinus carpio*) and Thai catfish in fertilized ponds of Central Luzon State University. To date, there is no record on the use of milkfish culture technology in the highland areas of Northern Mindanao.

The culture of milkfish presented in the report is a pilot project jointly undertaken by the Department of Science and Technology, Region X; Mindanao State University at Naawan; and Engr. Dionisio Asok, the entrepreneur from Valencia, Bukidnon. A small earthen pond owned by Engr. Asok was stocked with acclimatized milkfish fingerlings from MSU Naawan on September 8 and October 2, 1992. The stock was given fine rice bran as major food source throughout the culture period and was harvested on February 25, 1993. The project produced marketable-size fish but, more importantly, it yielded valuable information on the potential for growing milkfish in Bukidnon.

### Objectives

The pilot project was aimed at determining the applicability of brackishfish pond in Bukidnon and to gather benchmark bio-chemical and physical information on the pond.

## Methodology

**Collection of Soil and Water Samples.** Soil and Water samples were collected for analysis prior to and during the pond preparation stage. The Samples were taken from the pond and from NIA Irrigation Canal, the main water source.

**Preparation of the Milkfish Pond.** The technical know-how in preparing the pond for stocking and managing it during the culture period was provided by MSU Naawan but its implementation was carried out by the pond owner. The preparation of the pond followed the procedures described by Angudong (1983). Lime was applied to neutralize the acidity of the pond soil (Potter, undated). Fertilizers were introduced to enhance the primary productivity of the water, increase the growth of algae, and hence of fish (Davide, undated).

**Acclimation, Transport and Stocking of Fingerlings.** Milkfish fingerlings obtained from local catchers in Simanoc Tidal Creek, Naawan were held in seawater in a small fiberglass tank at MSU Naawan Wet laboratory. After 24 hours, the fingerlings were gradually acclimatized to freshwater. During the acclimation period that lasted for seven days the fingerlings were fed either fry diet prepared at MSU Naawan Feed Laboratory or *lumut* from MSU marine ponds.

The acclimatized fingerlings were transported to Bukidnon in plastic bags (Seville, undated). Each bag containing no more than 20 fingerlings was filled with three liters of freshwater and with compressed air. The bags were placed in styrofoam boxes whose inside temperature was lowered during travel by putting them in wrapped ice cubes. Upon arrival at the pond site, the transported plastic bags were left to float in the pond for some time so that the temperature of the transport water would equalize with that of the pond water. Afterwards the bags were opened and some amount of pond water were added to acclimatize the fingerlings. After the short acclimation the fingerlings were released gently into the pond.

**Feeding, Pond Management and Fish sampling.** The milkfish fingerlings were fed a daily ration of fine rice bran at the rate of one liter

and administered two to three times a day. The rate of feeding was gradually increased as the fish grew. The level of pond water was maintained at the maximum holding capacity of 30 to 50 cm. The pond water was changed as often as possible when water was available at the NIA Irrigation Supply Canal. The fish stock was sampled only once last January 21 and the individual fish was weighed to the nearest 0.25g.

**Harvesting.** The fish stock was totally harvested after over five months of culture. Harvesting was accomplished by completely draining the pond and the fish were seined or picked manually.

## Results

**The Pond Site.** The pond site of the joint pilot project was about a hectare of small depressed area in the midst of a vast plantation of rice, corn and sugarcane in Barangay Dabongdabong, Valencia, Bukidnon (Fig. 1). It was located some 200 km from MSU Naawan at an elevation of some 500 m above sea level (Elevation Map, BSWM). From the National Highway the site was accessible via a kilometer-long dirt feeder road of NIA.

The site was manually excavated and divisional dikes were constructed to make the seven small pond compartments of varied sizes that could hold water to a maximum depth of about 50 cm. Only one of the pond compartments was stocked with milkfish fingerlings; the other were intended for tilapia culture. The Milkfish pond measured 17x30 m or had an area of 510m<sup>2</sup>. The irrigation water was conveyed to the pond compartment by means of a trench about 30 cm wide and 20 cm deep. Extending along the opposite side of the pond was a ditch about 45cm wide and 1m deep that served as the lateral drainage canal for water from the pond compartments (Fig. 2).

**Characteristics of Pond Soil and Water.** At the initial pond flooding and times during the culture period, the water from the NIA Canal was found relatively clear and suitable for milkfish culture. The results of the laboratory analyses of the water samples showed several biological and

chemical properties commonly observed in many river waters and stagnant freshwater where fish could survive and grow. The planktonic and algal content of the water from the pond and the irrigation canal showed an abundant occurrence of plankton (Table 1). Among the plankton were four species ordinarily found in brackishwater ponds, namely; *Brachionus*, *Navicula*, *Thalassiosera*, and *Chaetoceros*.

The pH level of pond water obtained from NIA irrigation Canal was found slightly alkaline per pH classification by the Bureau of Soil and Water Management of the Department of Agriculture Region X. The values for water salinity were within the range for freshwater and the total hardness was solely attributable to the magnesium content of the water. But nitrite and ammonia nitrogen, as well as phosphorus levels, were low (Table 2).

The analyses of pond soil samples revealed some characteristics that generally fell short of those desirable for fish production (Angudong, 1983; Davide, undated; Potter, undated). Firstly, the soil was moderately to slightly acidic mainly because Bukidnon soil is generally 'adtuyon' clay with an average pH value of 5.29. Next, the organic matter content and the level of phosphorus were deficient (Table 3).

**Pond preparation.** On June 20 a total of 45 kg lime was broadcasted on the surface of the partially dried pond. After four days the pond was flooded with 10--15 cm of water fertilized with 110 kg of dried pig manure in combination with 15 kg of inorganic fertilizer (18-46-00). *Lumut* (moss) started growing in a few days and the water level was gradually increased. But the pond was completely drained when it was found that some snakeheads (*Ophicephalus striatus*), a predatory species, were able to enter it. The pond was prepared again and was declared ready for stocking on September 8.

**Acclimation, Transport and Stocking of Fingerlings.** At MSU Naawan Wet Laboratory a survival rate of 100 percent was obtained from milkfish fingerlings that were acclimated from seawater to freshwater. Mane(1979) and PCARRD (1982) reported a lower rate of survival in their fingerling production records in freshwater. The transport survival of the fingerlings was also 100 per cent after about four hours of overland trip

from Naawan to Bukidnon.

The milkfish pond was stocked with fingerlings in two batches: on September 8 and on October 2, 1992. A total of 114 fingerlings were stocked in the milkfish pond. This stocking density which was equivalent to 2,000 fingerlings per hectare is below the 3,000-5,000 fingerling in commercial brackishwater fishponds (Angudong, 1983).

The fingerling were caught from a tidal creek and consisted of many sizes. Our initial measurements of five fingerlings were; 1.5006 grams, 2.6176 grams, 4.3748 grams, 8.7989 grams, and 17.6422 grams. After over five months the individual weight measurements of the sampled fish ranged from 20 grams to 200 grams.

**Harvest.** The stock was harvested by completely draining the pond (Fig. 3) on February 25, 1993 (Coloma, undated). The total harvest weighed 10.75 kilograms and composed of seven species of finfishes and one small species of freshwater shrimp (Fig. 4). Milkfish weighed 4.605 kilograms which was less than half of the combined weight of all other finfishes collected from the pond. The largest milkfish weighed 260 grams and a few more weighed above 200 grams or almost four pieces to a kilo (Figs. 5 & 6). The individual sizes of milkfish was so varied that they consisted of 25 weight measurements and 30 forklength sizes (Fig. 7). In number, the milkfish recovered from the pond was less than half the number of Tilapia that was stocked by the owner (Fig. 8). The survival rate of milkfish was estimated at 44.74%. Some snakeheads that were harvested had grown in the pond to the size almost as large as the biggest milkfish (Fig. 9).

## Discussion

The results of the culture of milkfish in the freshwater pond of Engr. Asok indicates that the current technology for the commercial production of milkfish is applicable under Bukidnon conditions. In addition, the results also show that the irrigation water from NIA Canal in Valencia is apparently free of pesticide and other pollutants that may be harmful to fish. They also indicated that the water is suitable for growing milkfish

since the acclimatized fingerlings survived, grew and attained marketable size.

The persistent acidity of pond soil was not completely corrected with lime application so that the growth of micro-and macroalgae in the pond was entirely inadequate to supply the needs of milkfish for rapid growth. Yet the milkfish showed a great capability of normal growth as they fed on rice bran which was available in abundance in Bukidnon.

The pond operation resulted in relatively low survival for milkfish (Angudong, 1983). Most probably, the poor recovery was the result of predation since snakehead is ordinarily capable of preying upon fish much bigger than its size. The harvest was also multiple-size; this result was expected from a multi-size seedstock.

The freshwater finfish species including the snakehead, a predatory species, could have encroached into the pond through the water inlet which was inadequately provided with nylon screen. On the other hand, the tilapia that were harvested from the pond did not enter via the water inlet but were actually stocked. The presence of tilapia and other freshwater fishes could have adversely affected the growth of milkfish as the latter were competing with the non-milkfish fish population for water space and available but scarce food.

Despite these minor management problem the overall result obtained from the pilot project demonstrated the good prospect for milkfish production in Bukidnon. With more planning and support, the production of milkfish in Bukidnon freshwater can be developed into commercial and profitable private enterprise.

### **Recommendation**

Bukidnon has a great potential for commercial and largescale milkfish production because of its good number of freshwater bodies, trainable agricultural labor force, the increasing demand for fish in the progressive agricultural communities of Bukidnon, and the general acceptability of milkfish for human consumption.

A number of steps are recommended to develop milkfish culture in Bukidnon. Firstly, it is recommended that we train people who will eventually manage commercial milkfish ponds. A good training program that requires non-college graduate educational background may be arranged with the Department of Agriculture, Fisheries component, with the assistance of MSU Naawan Training and Extension Office. The training course will focus on the widely practiced method of milkfish production for adaption to freshwater environment, including the use of pond layout composing the nursery, transition and rearing (grow-out) ponds. The course must also include acquisition of the skill for raising milkfish in pens and cages in natural and man-made lakes, dams and reservoir, slow-flow and dead-end section of the Pulangi River.

Secondly, a Seed Bank is recommended to be established in Bukidnon for the production of milkfish fingerlings. In this outfit, milkfish fry will be reared to fingerling size and acclimatized to the freshwater environment. As a Fingerling Dispersal Center, the Seed Bank must be adequate to sustain an anticipated increase in milkfish production in Bukidnon. The source of milkfish fry for the Bukidnon Seed Bank are the fry grounds in several coastal waters of Northern Mindanao.

Finally, to encourage more people to go into milkfish culture, it is recommended that the government formulates and support a credit program to support initial capitalization not only for pond construction, development and improvement but also to fund the initial production inputs.

### **Acknowledgement**

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Table 1. Pond Water Organisms (June 27 and July 17 samples).

Organisms	Estimated Count
Spirogyra	6,257 cells/ml
Navicula	238 cells/ml
Fragilaria	238 cells/ml
Amphipora	79 cells/ml
Coscinodiscus	79 cells/ml
Microcystis	79 cells/ml
Brachionus	1 ind/liter
Ostracods	500 ind/liter
Nitzchia	1,250 cells/ml
Chlorella	2,500 cells/ml
Tintinnids	1,000 cells/ml
Scenedesmus	1,250 cells/ml
Melosira	20,500 cells/ml
Cymbella	500 cells/ml
Pinnularia	500 cells/ml
Thalassiosera	12,000 cells/ml
Chaetoceros	1,000 cells/ml
Notholca	250 ind/liter
Protozoan	1,000 ind/liter

Table 2. Some Chemical Characteristics of Milkfish Pond Water

Parameter/Pond Sample	06/13/92	06/29/92	07/06/92
pH (Digital pH Meter)	7.33	7.58	7.25
NO <sub>2</sub> (Sulfanilic Acid Method)	0.1104	0.0871	0.0245
NH <sub>3</sub> (Nesslerization Method)	0.3354	0.0911	0.1390
PO <sub>4</sub> (Stannous Chloride Method)	0.0926	0.0116	0.1030
Salinity (Titration Method)	0.6798	0.2004	0.0343
Ca as ppm CaCO <sub>3</sub> (EDTA Complex Method)	556.0698	0.00	0.00
Mg as ppm MgCO <sub>3</sub> (EDTA Complex Method)	556.0698	404.4144	438.1156
Total Hardness as ppm CaCO <sub>3</sub> (EDTA Complex Method)	660.00	480.00	520.00
H <sub>2</sub> S	0.0051	0.0049	0.0234

Table 3. Physico-Chemical Analysis of Pond Soil

<u>Pond Soil Sample</u>	<u>06/13/92</u>	<u>07/06/92</u>	<u>02/15/93</u>
<u>Parameter</u>			
pH (Potentiometric)	5.42	6.19	5.50
Organic matter (Walkey-Black)	5.50		6.80
Available Phosphorus (Modified Truog)	39.00	11.10	52.00
Potassium (Flame Photometer)			150.00
<u>Grain Size</u>			
course sand (rocks, gravel)		67 %	
fine sand (silty)		25.2%	
very fine sand (silty clay)		7.6%	

**Table 4. - Species Composition, Abundance and Weight of Pond Harvest**

Tilapia	116 pieces	47.9%	3625 grams
Milkfish	51 pieces	21.07	4605 grams
Mudfish	6 pieces	2.47	1305 grams
Pait	37 pieces		
Puyo	14 pieces		
Gourami	15 pieces	28.51	1215 grams
Palaemonid Shrimp	2 pieces		
Hito	1 piece		
<b>TOTAL</b>	<b>242 pieces</b>		<b>10750 grams</b>

Table 5. Individual Body Weight and Fork Length of Harvested Milkfish

Weight (grams)	Length (cm)	Weight (grams)	Length (cm)
260	36	55	26.5
240	35.5	55	25.75
230	35	50	25.5
225	35	50	25.5
220	35	50	25.25
220	34.75	50	25
185	33.5	45	25.5
160	32.5	45	25.25
160	32	45	25
150	31.5	45	25
145	32	45	25
145	31.5	45	25
140	31.5	40	24.5
135	31.5	40	25.4
135	31	40	25.25
100	30	40	24
95	29	40	24
90	28	40	24
85	28.5	40	24
75	27.25	40	23
70	27.5	35	23.75
70	27	35	23.5
60	26.5	35	23.5
60	26.5	35	23.5
60	26.5	30	22.5
		20	21.5



Fig. 1. The Pond Site of the Pilot Project in Dabongdabong, Valencia, Bukidnon.

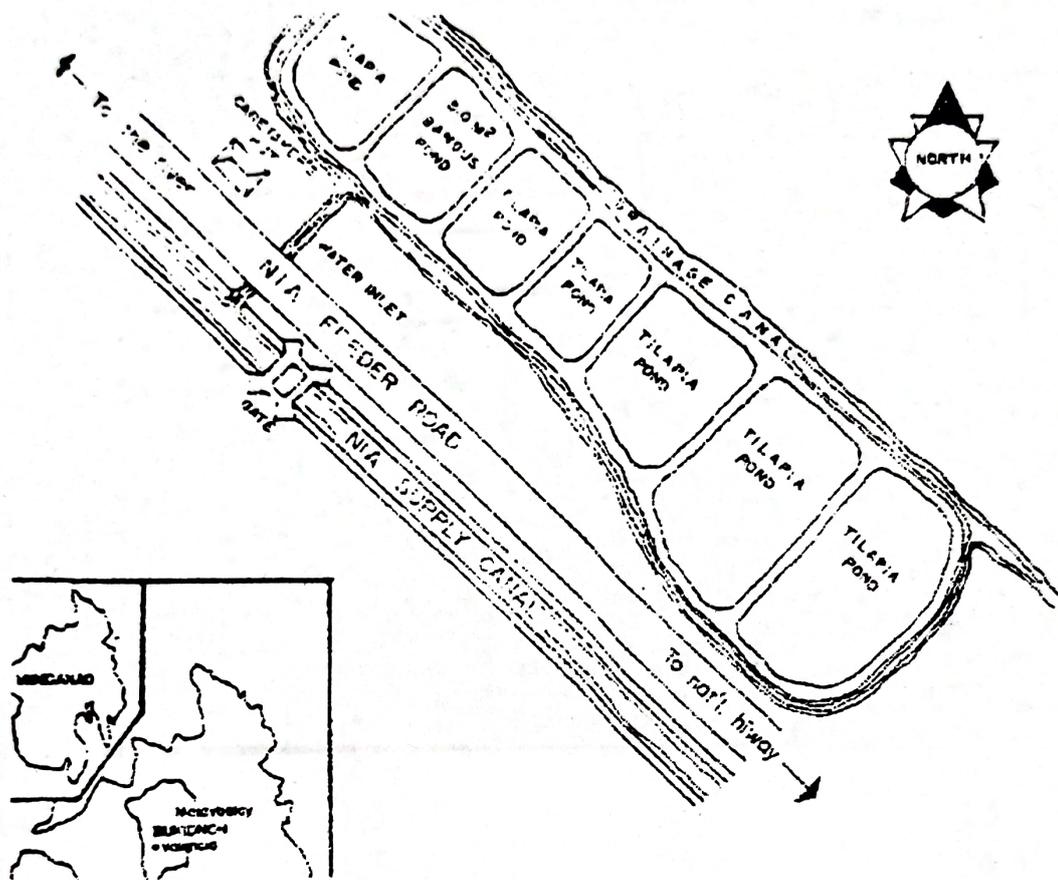


Fig 2. Schematic Diagram of the Pilot Freshwater Ponds.

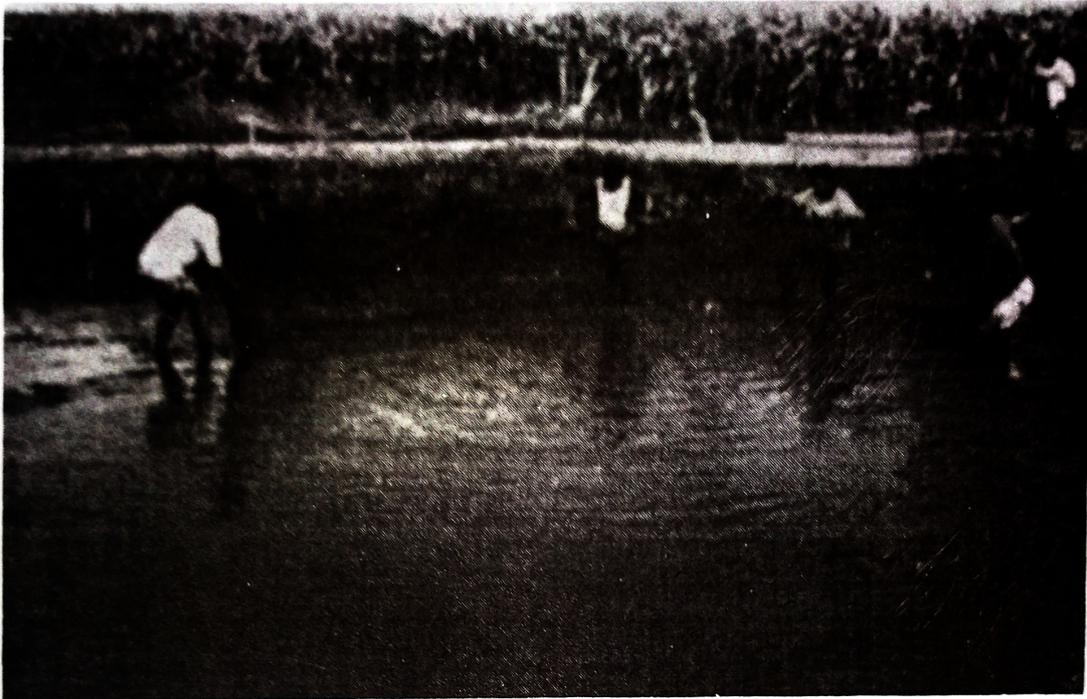


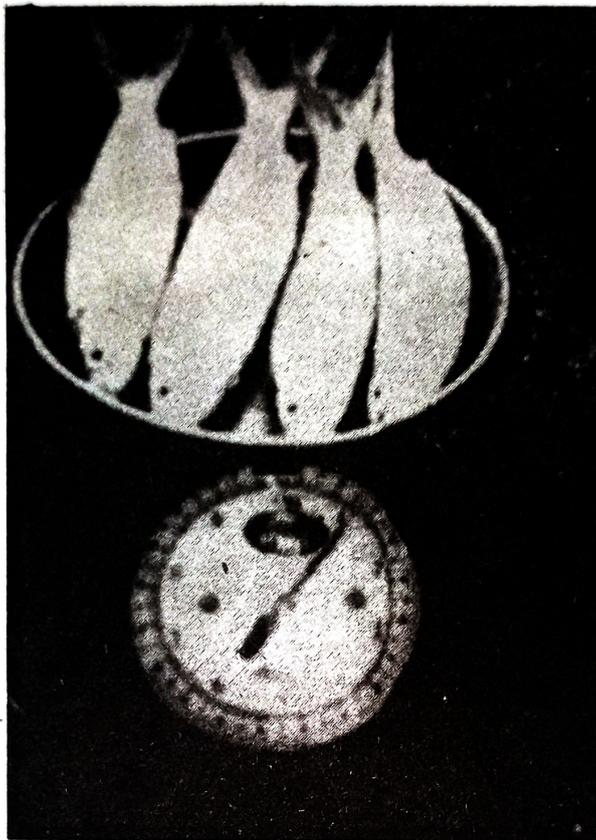
Fig. 3. Seining of Milkfish in the Pilot Freshwater Pond in Bukidnon.



**Fig. 4. Mix Species Harvested from the Pilot  
Freshwater Pond.**



Fig. 5. The Largest Among the Harvested Milkfish.



**Fig. 6. Some of the Bigger Milkfish Harvested from the Pond.**



Fig. 7. Harvested Milkfish of Various Sizes.

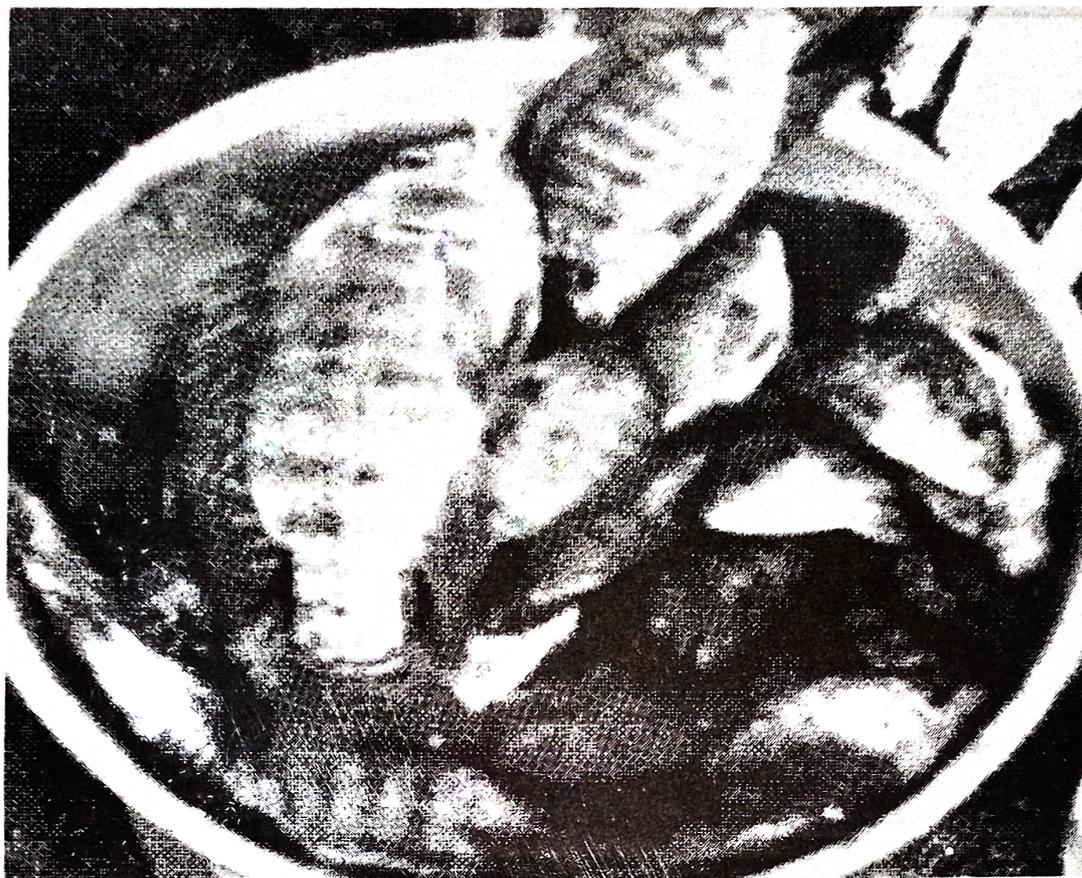


Fig. 8. Harvested Tilapia from Milkfish Pond.



**Fig. 9. Snakehead, a Predator Fish from  
Milkfish Pond.**

### Literature Cited

- Angudong, Ruperto Jr. 1983. Milkfish Production Systems. Paper presented at the Seminar-Workshop on Aquaculture Business Project Development and Management (APDEM), SEAFDEC Aquaculture Department, Tigbuan, Iloilo, Philippines. 17 pages.
- Baguilat. 1979. 5,000 Hectares of Fishpen produced 5,000 Kg/Ha/Yr.
- Coloma, David R. Undated. Harvesting, Transporting and Marketing of culturedfish products to local markets. Western Visayas Federation of Fish Producers, Inc. pp. 92-96.
- Davide, J. G. Undated. Fishpond Soils and Fertilizers. In: Pond Construction and Management. Western Visayas Federation of Fish Producers, Inc. pp. 1-6.
- Denila, Leonardo. Undated. Layout, Design and Construction and Levelling of fishponds. Western Visayas Federation of Fish Producers, Inc. pp. 90-91.
- Gabriel Benjamin Cer. 1979. Milkfish Culture in Freshwater Pens. Technical Consultation on Available Aquaculture Technology in the Philippines. 9 pages.
- Grover John, H. 1973. Production of Milkfish in Combination with Carp and Thai Catfish in Fertilized freshwater Ponds. *The Philippine Journal of Fisheries*. Nos. 1 & 2. 9 pages.
- LLDA. 1973. Larger Investment in Fish Pens Per Unit.
- Mane. 1976. Fishpen Investment.
- Mane. 1979. Milkfish Fingerling Production in Freshwater has a Recovery Rate of 33.37%.
- Mr. & Mrs. 1989. Special Ed. Bangus Business Brightens Agribusiness. page 4.

**PCARRD. 1982. 42% Survival of Bangus Fingerling in Plastic Lined Pools.**

**Potter, Thomas. Undated. Seminar on Fishpond Soil Quality. Wester Visayas Federation of Fish Producers, Inc. pp. 175-186.**