

SOME OBSERVATIONS AND EXPERIENCES
IN PEN CULTURE FOR BANGOS
IN LAGUNA DE BAY

by

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Introduction

Bangos fishpen culture was ushered into the fisheries industry with great enthusiasm and expectation due to high production in the initial operation of a few fishpens (about 1,600 sq m each) in Cardona, Rizal in 1971. It was reported that as much as 10 tons of fish could be produced in one hectare.

The initial success in fishpen culture attracted the capitalists to invest in fishpen business, hence the mushrooming of fishpens in Laguna de Bay. Starting in Cardona, it spread to the neighboring towns of Tanay, Pililla, Quisao, Jala-jala, Binangonan, all of Rizal Province; and in Biñan, Calamba, Los Baños, Sta. Cruz, Pakil and Mabitac, in the Province of Laguna.

From a few hectares in 1972, the area expanded to about 5,000 ha in 1973. In mid-1975 there were 7,000 ha of developed fishpens. Many operators, however, expressed disappointment when they did not get the expected production. Their disappointment worsened when their fishpens were destroyed by a series of typhoons in the later part of 1974. Until mid-1975 many fishpens remained unrepaired and practically abandoned.

When the fishpen industry started, most operators had to depend on meager information they got from early operators and government technicians. Lack of knowledge on proper fishpen management was greatly responsible for the failure of many operators. The purpose of this paper, therefore, is two-fold: 1) to provide information which may guide those in the fishpen ventures; and 2) to stimulate government action in promoting research on fishpen culture as a basis of sound regulation and development of the fishpen industry.

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Review of Literature

In 1974 two articles appeared, namely: "Raising of Fish in Fishpens and Fish Cages" by Sergio S. Felix of the BFAR, and "Fish Farming in Pens, a New Fishery Business in Laguna de Bay" by Medina N. Delmendo and Robert H. Godney, both of the LLDA. The first article gives a history of fishpen culture; advantages and disadvantages of fishpen industry; and description of fishpen operation including fishpen construction, fish culture on pens and harvesting. The second paper assesses the contribution of fishpen culture to fish production in Laguna de Bay; the biological/ecological aspects of fishpen culture; operation, maintenance and investment potentials; and the future outlook of the industry.

General Features of Laguna de Bay

A background knowledge of the environmental conditions influencing fish production in Laguna de Bay is necessary for proper fishpen management and operation.

Area and water level. Laguna de Bay is shallow and rich in nutrients. It has an area of about 90,000 ha and its only outlet to the sea (Manila Bay) is the Pasig River. Its water level is about 3 ft higher than the mean sea level and most of the time the flow of water in Pasig River is toward the sea. During high tide the flow is reversed; but before the sea water reaches the lake, the ebb tide begins and the seaward flow resumes. However, during the highest tide in Manila Bay and the lowest tide in Laguna de Bay, sea water may incurse into the lake. The incursion of sea water laden with waste materials from factories along Pasig River affects greatly the quality of water in the lake. Studies should be conducted on how far sea water penetrates the lake to find out its effect on lake fisheries and the planned utilization of the lake as water source for Manila.

Depth. The average depth is about 3 m based on an elevation of 10.5 m at mean sea level in Manila Bay. The lake bottom consists of mud and clay or clay loam, soft on the surface but becomes firm with depth. The shallowness of the lake, coupled with muddy bottom, makes it most suitable for setting fishpens made of bamboo poles which are cheap and readily available.

Winds. The prevailing winds are influenced by the monsoons and two seasons according to wind direction, identified, namely: the amihan or the easterly winds, and the habagat or the westerly winds. During the northeast monsoon (November to January) the wind blows hard for long duration causing the water lily to

drift with the waves, thus damaging many fishpens. From March to June, the wind is quite gentle; this is the period when fishpen operation is at its best. This period coincides with the fast production of fish food in the lake which will be discussed below.

Climate. Two distinct climatic seasons prevail, namely: the dry season and the wet or rainy season. The rainy season starts in late May or early June and lasts until October or early November. Heavy rainfall occurs during the typhoon months where the rise in water level is fast. Since the difference in water level during dry season and wet season is about 1 1/2 m, the net should be high enough such that the portion above water level will not get inundated even at the highest water level during rainy season. Dry season lasts from December to May which is the period of abundant production of fish food and fast fish growth.

Turbidity. Turbidity is an important factor affecting the production of fish food as well as the feeding of fish. When the water is muddy, sunlight penetration is shallow because of screening by the suspended mud particles and other components. Hence, the heat energy from the sun required in photosynthesis does not reach the deeper water layers, especially at the bottom where food nutrients are more concentrated. Less production of fish food results. Turbid water particles clog the gills causing inflammation which inhibits the fish to take much food. The turbidity of Laguna de Bay is caused by the spread of flood waters from tributaries laden with mud during the rainy months followed by the stirring of muddy bottom during typhoons and the northeast winds. Lake water remains turbid from October to January or February and clears up when the silt has already settled at the bottom.

Temperature. Water temperature enhances the chemical and biological processes in water. At high temperature organic materials decompose fast producing nutrients for fish food. Thus during dry season when the temperature of water is high, lake productivity is at its highest. Decomposition of organic matter, however, produces substances harmful to fishes. During cold months when water temperature is low, the fish in the pen is less active and does not relish as much food so its growth is slow and stunted.

Water current. Bangos grows faster in areas where sufficient water currents bring in the fish food and dissolved oxygen from outside. Where water is stagnant, algal blooms

often occur with the algae (lia) forming a thick layer on the water surface, thus causing fish suffocation.

Chemical conditions. The periodic incursion of sea water from Manila Bay makes its water somewhat saline especially at the mouth of Pasig River. This condition develops during dry season when the water level is at its lowest. The water is normally basic with average pH value (hydrogen ion concentration) ranging from 7.4 to 8.6. At the start of rainy season (late June or early July) patches of acidic water with pH values of 5.0 or less may be encountered. This water mass is known to fishermen as "masamang tubig" (literally meaning "bad water") killing fishes and other aquatic organisms especially those in fishpens and fish corrals. This may be the cause of "Fish kills" reported recently in the fishpens in Cardona, Rizal and other parts of Laguna de Bay.

The analysis of water collected from affected fishpens where fishes were then still dying showed deficiency in dissolved oxygen and abundance of free carbon dioxide and hydrogen sulfide (1.0 or more mg/l). The FAO Aquaculture Bulletin (Vol. 3, No. 4: July 1971) gives the following account of the effect of hydrogen sulfide on fish mortality:

"The Department of Physiology and Microbiology, Jeyssel Attila University, Szeged, Hungary, reports the occurrence of large scale mortality of fish in Palies Lake due to the accumulation of hydrogen sulfide in the bottom mud. Concentration of 1-4 mg/l was found to be lethal to fish, whereas 0.1-1.0 mg/l affected the algae and consequently produced low levels of oxygen in the water".

Available literature points to sulfur bacteria as the cause of the production of hydrogen sulfide. The Standard Methods for the Examination of Water and Waste Water (11th Edition, 1960, p. 534) shows the origin of hydrogen sulfide in lake water as follows:

"Sulfur bacteria are rather difficult to group because of the wide diversity of their relationship. Still another group, mostly filamentous, oxidizes hydrogen sulfide independently of light (which the sulfur purple bacteria do not) and stores elemental sulfur. Most of them are autotrophs, and they all reduce carbon dioxide to obtain energy, although other substances are also used. They are considered nuisance

bacteria primarily because some of them produce hydrogen sulfide".

As to how water with deficient dissolved oxygen and hydrogen sulfide at the bottom is brought to the surface, Swingle (1966) avers:

"The trouble comes with overturns or upwelling of the oxygenless waters to the surface. This sometimes occurs over the entire pond causing complete kill. There are various causes of upwelling. A sharp drop in air temperature causes colder surface water to drop toward the bottom and the oxygenless water to rise to the surface ---. Another cause of overturn is heavy rains falling on the pond surface and forcing deeper waters to the surface."

Biological Conditions of Bangos

Characteristics. Bangos has wide range of salinity tolerance; it can thrive in very salty water as well as in freshwater. It is primarily a plankton feeder, although it may take other food such as shrimps, filamentous algae, organic detritus in mud, and artificial feeds (rice bran, break, etc.). With sufficient food it grows from the fingerling size to two to three pieces per kilo in four to five months.

Food. As has been said, the natural food of bangos consists principally of plankton organisms abundant in Laguna de Bay. The rich nutrient water and the long dry months favoring rapid photosynthetic activity contribute to the high production of this fish food. The availability of fish food in the lake, however, varies from month to month and from year to year depending on the prevailing weather and climatic conditions. Stormy winds and the northeast monsoon which stir the water from top to bottom cause turbidity and low production of fish food. During dry season when weather is calm and the water clear, production of fish food is fast. Studies on the relative abundance of fish food in the lake are helpful because they guide fishpen operators in determining the stocking rate of fish in fishpens. With the proper stocking rate, fishes grow faster and rearing period is shorter.

Fishpen Operation and Maintenance

Location. Fishpens should be located: 1) In lake areas where the bottom has firm mud so that the bottom poles or wooden posts could be driven deep and support the pen even during the rigorous weather conditions; 2) In the direction of water current to receive continuous food replenishment and dissolved oxygen consumed by the growing fish; and 4) In a place not frequently used as navigation lanes and as paths of drifting water lily during hard monsoon winds.

At the start of the fishpen craze in Cardona, Rizal, there was a rush in getting permits from the municipality. Once the permit is obtained, the fishpen operator constructs his pen without determining the proper site. Starting near the shoreline, setting of pens proceeded outward to the open waters without zoning plans, thus resulting to overcrowding. Fishpens near the shore do not get the food needed by the fish and the obstruction of water current creates stagnancy in shallow fishpens.

Construction. Fishpens may be constructed using different sizes, designs and materials. They may consist of only one enclosure or are divided into compartments of different sizes. Some are fenced singly, while others provide a second or barrier fence which serves to protect the fishpen from water lily and from intrusion of possible pilferers.

Bamboo is the most common material used for support; wooden posts were later interspersed between bamboo poles. During the fishpen construction boom, the demand for these materials was so great even the young and short-lasting bamboo poles or wooden posts were used. From experience, less than one-year-old bamboo should not be used in fishpen construction.

Another problem of the early fishpen operators was fencing materials. At first wire screen was tried but it did not last for even one year. The LLDA used bamboo screen but because it was cumbersome and expensive it was not popular among fishpen operators. Synthetic nets made of polyethelene, nylon, kuralon, vinylon filament, poly-vinichloride and tetron were found more acceptable. Many fishpen owners use only one kind of net. Others use a combination of polyethelene and nylon nets because plastic nets do not last long when exposed to air but last long under water; on the other hand, nylon nets last longer than plastic nets when exposed to rain and sunshine. During the boom period when the demand for nets was very high, low-quality nets were sold in commercial houses. These nets got destroyed earlier than expected.

Seeding of Stocking Fishpen

Bangos fingerlings are produced in nursery ponds especially built for the purpose. This activity is an industry in itself. The center for fingerling production is at Dampalit, Malabon, Rizal. However, with the development of the fishpen industry, the fishpond nursery has been expanded and extended to nearby towns in Obando, Hagonoy and Paombong, all in the Province of Bulacan.

Bangos fingerlings are abundant from March to July with peak in May and June. This period coincides with the fry season. In other months, they are very scarce and only those that have been stunted are available.

When the fishpen industry was not yet developed, the only buyers of fingerlings were the fishpond operators. The demand for the fish was not so brisk and the price was more or less stable (about 10 to 12 centavos). However, with the development of the fishpen in Laguna de Bay, the demand for fingerlings was so big that the price went as much as 35 to 40 centavos each. With these prices, it is doubtful whether fishpen can still be made profitable. Due to inadequate fingerling supply, studies should be made on how to increase and/or improve seed production.

Time of Seeding Fishpens

The time to seed fishpen with fingerlings needs careful consideration. It takes at least five months to rear the fish to marketable size with abundant food and favorable weather conditions. The best time to seed fishpens is during March and April because food is abundant and fish could be harvested before the onset of strong typhoons. Water is less turbid and warm from surface to bottom.

Procurement and Transport of Fingerlings

At the start of the fishpen industry, operators preferred to seed fingerlings which were 3-4 inches long. Due to the difficulty of handling and transporting big size fingerlings, smaller and younger fish (2 inches or less) were later preferred because they can stand rough handling and more could be placed in oxygenated plastic bag containers and motor boats. With big size fingerlings, only 50 fish could be placed in one plastic bag with a capacity of 2 gal of water and about 20,000 in motor boats (made specially for fingerling transport) to avoid over-crowding and high mortality. With small size fingerlings as much as 200 could be placed in a standard plastic bag and from 40,000 to 50,000 in motor bancas.

Counting of Fingerlings

After the price of fingerlings has been agreed upon and the time of delivery set, actual procurement from the nursery comes next. First, the fingerlings in the nursery compartments are concentrated in the catching pond either by flushing water from outside during high tide so that fish would swim naturally into it or driving with nets. Great caution is needed in handling the fish as they are easily injured or weakened, contributing to high mortality when placed, eventually, in fishpens.

The fish in the catching pond is seined and counted. In making the count, a small perforated plastic can with a capacity from 500 to 2,000 fish depending on size, is used. A can-full is first scooped and counted. Then the number of fish to be procured is determined by the number of can-fulls of fingerlings scooped from the net.

It is in this operation where the fishpen operator gets short-changed in the fish he is buying. The man making the count, through manipulation, could make it appear that the can is full of fingerlings but actually much of that is water.

The under-counting of fingerlings is one of the causes of complaints of fishpen owners which were only determined when they get very much less fish during harvest time after losses from mortality and escapement already are discounted. This unethical practice contributed much to the losses in fishpen operation.

Preparation of Nursery Pens

The nursery pens to receive the fingerlings should be well prepared for it. The area should at least be about 1/20 of that of the rearing pen. It should be made of fine-meshed nets. The V-plastic nets is in general use among the fishpen owners although fine mesh nylon nets are also availed of. The nursery pens are first cleaned of predator fishes such as the dalag and biya with the use of seine before they are stocked with fingerlings.

In releasing the fish to the nursery, they should not be poured from above the water but rather the container should first be immersed in water and acclimatized for at least 30 minutes before the fish is allowed to swim out freely.

Preparation of Pens for Growing Fish

Fishpens that had been used for some time have hard bottom due to the excreta of fish that form pavement of marl deposit. This hardened bottom prevents the nutrients that accumulate in mud to be released to the over-lying water for utilization in the production of fish food. This is the reason for the slow growth of fish and poor production in fishpen that have been in continuous use. Some operators have to fallow their fishpens to give time for waste materials to be washed out by the water current to regain its normal productivity.

The hardened bottom of the fishpen can be loosened by harrowing. The native harrow for cultivating rice fields had been used for this purpose with encouraging results. A long handle is fitted on the harrow and placed in front of a motor banca. It is held by a man who regulates the depth it is sunk into the mud as the motor banca pushes it forward. Harrowing the entire area of fishpen is done repeatedly until the marl formation has been broken and the bottom mud softened.

The fish in the nursery is reared for about a month. During this period, they are given supplemental feeds, as most often the natural food is insufficient in view of their concentration on a small space. The common feeds given are rice bran, ground shrimp, waste bread from bakeries, etc. It is highly desirable if studies would be made on the feeds and nutritional requirement of bangos fingerling that will promote faster growth.

After the fingerlings have grown to a size where they can no longer pass through the meshes of the net of the rearing compartments, they are released from the nursery into the grow-out pens. Vigilance is exercised to see to it that there is no destruction or tear in nets. A stray bamboo poles and other hard objects that pierce the net could tear it and make an escape opening especially during storms and hard winds.

During the later part of the dry season or at the onset of the rainy season, foul water or "masamang tubig" appears and causes "fish kills". This is first indicated by the surfacing of dead goby-eel and followed by death of other species such as the ayungin and biya. The bangos surface and gasp for air. Good results happen when motorized bancas are run inside the fishpen to churn the water.

Floating water hyacinth which usually are formed in masses with sizes of a few square meters up to a hectare drift in the lake. During strong winds and strong typhoons, they break through and destroy the fishpen. Government action should be initiated with the cooperation of all concerned to eliminate this hyacinth nuisance from the fish corrals, navigation fishpens, and other fixed fishery gear in the lake.

Harvesting of Fish

When the fish has attained a weight of 4 to 5 pieces to a kilo and when it is noticed that they are already crowded in the pen, thinning is usually done by catching with gill net. The remaining fish is allowed to grow to 2 or 3 to a kilo or bigger for better price. Certain precaution is exercised in harvesting the fish such that they will reach the market in as fresh a condition as possible. The fish catch is immediately iced even before rigor mortis (hardening) sets in. If possible the fish are lodged in ice after they have been drawn out of water. In this way, the fish will remain fresh and command a high price in the market.

It has been the mistake of some fishpen operators to harvest without first contacting the fish dealers who will buy the fish. Without the immediate buyer, the fish is held unnecessarily long, resulting in a higher expenditure for ice and, most often, spoilage of the catch as fresh fish deteriorates rapidly. Thus, very low prices could be had from them. Oftentimes, many fishpen operators harvest their fish at the same time and cause glut in the market. It would be well for them to form a Cooperative Marketing Association in order that they can get the best prices for their catch.

Government Policy on Fishpens

The fishpen industry, being new, started without the benefit of government policies and/or regulation. Prospective investors had to go to the municipalities where they intend to set their fishpen and ask for ordinances covering the construction of same. This paved the way for the municipal authorities to pass ordinances which were mostly directed to revenue collection. Different municipalities imposed different levies. Municipal boundaries were disputed for purposes of determining who would benefit on the taxes on fishpen on these disputed areas. Thus, confusion arose and conflicts occurred to the detriment of fishpen operators.

When the question as to which agency of the government has jurisdiction over fishpen construction was brought up, this added to the confusion in the developing industry. The municipal government claims that water areas where fishpens are located are municipal waters by definition under Act 4003 and under the local Tax Code. The Laguna Lake Development Authority claims that under its charter, the management and the development of fishpen belong to them. The Bureau of Fisheries and Natural Resources, on the other hand, contends that it has jurisdiction over the fishpen of Laguna de Bay pursuant to Section 4 of Act 4003, as amended, Section 4(a), (b) and (c) of R.A. No. 3512 and Section 6, Par. B, Sub-paragraph 2 of Presidential Decree No. 43 and consequently promulgated Fisheries Administrative Order No. 109, dated 13 September 1973 with the subject: "Regulations governing the

Construction or Establishment of Fishpens or Fish Enclosures in all Inland Waters" which includes Laguna de Bay.

This Fisheries Administrative Order provides the definition of fishpen, prohibition on construction, establishment and operation of fishpen in inland water areas of the Philippines without license to operate issued by the Bureau of Fisheries, annual license fees, duration of the license, person, corporation and partnership entitled to construct or establish fishpens or fish enclosures, restrictions in size of fishpen to these different entities. Complications of this Order arose with the ordinances laid by the municipal government which bogged down to a certain extent the orderly development of the fishpen industry. In 1974, the series of typhoons hit the fishpen industry which inundated and/or destroyed almost all the fishpens causing great losses to fishpen operators. Petitions and request soliciting government aid for the fishpen industry through the Fishpen Owners Association of Laguna de Bay were made. On 18 December 1974, Letter of Instruction No. 235 was signed by the President in order to "expedite the rehabilitation of destroyed/damaged fishpens in Laguna Lake which has been unduly delayed because of constraints imposed by existing policies, rules and regulations and to stop the proliferation of unlicensed fishpens on said lake."

The above Letter of Instruction further provides that "the Bureau of Fisheries and Aquatic Resources shall, subject to the guidelines, rules and regulations which the Secretary of Natural Resources shall promulgate, grant a temporary license for a period of three (3) years to existing fishpen operators who have heretofore been operating without a license from the Bureau to avail themselves of the financial assistance from the Development Bank of the Philippines or any government financial institution; to restructure not later than December 31, 1977, their fishpens to conform with the rules and regulations governing the size and location of fishpens; instructs the Development Bank of the Philippines and other government financial institutions to extend to fishpen operators duly licensed by the Bureau of Fisheries and Aquatic Resources such financial assistance as may be necessary with certain provisions; prohibits the municipal authorities to issue license permit, or authorization of any kind whatsoever; and instructs the Secretary of Local Government and Community Development to enforce strictly the instruction.

Pursuant to the above Letter of Instruction, Fisheries Administrative Order No. 109 was issued to include the provisions in the Letter of Instruction. Among the pertinent provisions of this Order is the increase from 3 to 10 hectares and from 30 to 50 hectares that can be applied for by individuals and corporations, partnerships and cooperatives, respectively.

How the above policy would work in order to effect sound management and orderly development of the fishpen industry remains to be seen as they

have not been fully implemented as yet. However, it will be necessary to start reviewing new knowledge gained by the industry, for the benefit of the fishpen operators and the economy as a whole.

Summary and Conclusion

The culture of bangos in pens in Laguna de Bay as an industry is something new. It was started with the great enthusiasm and expectation and expanded very rapidly. Disappointment of operators, however, was expressed when they did not get the expected production and when losses had been incurred. Contributing to the failures were the poor management resulting from lack of knowledge and information on the proper method of culturing fish in pens and the adverse effect of certain ecological and biological conditions that obtained in the lake.

The present paper has been prepared to provide information on the proper management and operation of fishpen venture based on observation, experiences and exchange of views among operators and to stimulate government action in promoting research as bases for sound regulation and orderly development of the fisheries industry.

Discussion is given on the ecological and biological factors affecting the culture of fish and problems met by operators in the management and operation of fishpens. It also points areas where studies are needed for the improvement of production of fishpens.

Government policies on the fishpen industry are given to guide operators and would-be operators in constructing their fishpens with suggestions for a review for modification or amendment on the basis of new knowledge obtained and to meet changing conditions of the fishpen industry.

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