PRESENT STATUS OF MILKFISH FARMING IN THE PHILIPPINES

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In the mid-1950's milkfish farming in the Philippines achieved a major breakthrough of sorts. Commercial agricultural fertilizers was found to improve pond yields by promoting the growth of filamentous algae. This discovery ushered the Filipino fish farmers into the frontiers of scientific aquaculture.

A few years later, the industry saw an even more significant technological development. The benthic type of natural food complex, lablab, was demonstrated as superior to the traditional grass green algae. This technique, patterned after those practised in Taiwan, literally revolutionized the local milkfish farming system. With the prospect of higher yields, scores of milkfish farmers throughout the country adopted the new technique. Innovations were introduced to suit local conditions and practices.

These two major developments produced manifold effects. National average output from milkfish farms increased from about 500/kg/ha/yr in the late sixties to 640/kg/ha/yr in 1976. The culture system has transcended into the fertilization technology level.

The application of organic and inorganic forms of fertilizers, singly or in combination, has become a standard practice in pond soil and water conditioning along with the use of commercially prepared pesticides and molluscicides to eradicate pond pests and predators. There was a marked increase in the hectarage of developed milkfish farms as old and neglected ponds began to be improved and virgin swampland areas converted into new ponds. A sample survey completed in 1976 indicated that about 30% of existing fishponds was developed in the sixties and about an equal proportion after 1970.

However, industry constraints have recently become major considerations. Increased hectarage meant a proportionate increase in the demand for farm production inputs resulting to shortage in the supply of fry and fingerlings caught in the wild and of fertilizer materials. The alarmingly indiscreet use of agricultural chemicals poses a threat to natural pond productivity. Extensive proliferation of fishponds may lead to denudation of swampland and mangrove areas which endangers other aquatic species.

The trend of development in recent years has become more technology-specific. Intensive, rather than extensive farming systems are increasingly becoming the goal both in the micro- and macro-economic levels. Fertilization techniques are gradually being refined to suit location needs in order to maximize productivity and to cut down on fertilizer expense. Traditional and agricultural waste products are increasingly used in ponds in place of imported pelleted fertilizers and chemicals. A number of stock manipulation techniques and polyculture systems have gained wide acceptance among fish farmers.

Much hope is pinned on the artificial spawning of the sabalo and the advent of a hatchery system for milkfish. Simultaneously, milkfish farming is gradually inching towards another frontier -- that of the feeding level. Within the forseeable future the nutritional requirement of the milkfish shall be established which will lead to production of economically viable fish pellets. Indications point to milkfish production in the near future surpassing even the target 2000/kg/ha/yr national average.

Seed Production

Milkfish farming depends much on the supply of fry from the wild. The 180,000 hectares of existing ponds and 5,000 hectares of fish pens require annually some 4.5 billion fry assuming a 50 percent survival of the fry from capture in the wild to harvest in ponds and pens.

There have been reports of recurring shortage in the supply of fry and fingerlings brought about by abnormal fry runs and inclement weather condition. This problem will increase as production-oriented technologies improve.

The prospect of alleviating this major problems may be glimpsed from the following:

a. Broodstock development

The Bureau of Fisheries and Aquatic Resources (BFAR) pioneered in the attempts to domesticate the sabalo in its experimental Station in Naujan, Mindoro in the late 1960's. In 1972, the UP/NSDB Inland Fisheries Project collected mature sabalo along the coast of Panay Island. Attempts to induce breeding by hormone injection failed.

To artificially spawn the milkfish, the SEAFDEC Aquaculture Department set up a breeding station in Pandan, Antique. Preliminary work in 1976 resulted in the development of methods of capturing and transporting wild adult milkfish. The spawners were domesticated in tanks. The first scientific breakthrough came in 1977 when the station succeeded in inducing the female milkfish to spawn using acetone-dried Pacific Salmon pituitary powder. In the same year, the SEAFDEC Tigbauan Station was able to fertilize hydrated eggs although only a few larvae survived up to 5 days.

In both instances the major problem identified is the larval rearing of the newly fertilized eggs. Different species of diatoms and brachionus were tried as food supplement for the developing larvae.

Refinements of the spawning method bore results in 1978 when SEAFDEC Tigbauan Station again artificially induced milkfish spawning. Fingerlings numbering a few thousands are presently confined in tanks and ponds. The latter are already about 200 g in mean weight. In addition, the SEAFDEC Igang Station has about 1000 sabalo-size milkfish in fish pens at the Island of Guimaras.

b. Collection from natural habitat

The Philippines may be considered a natural fry ground. Known fry grounds are shallow sandy coasts, tidal creeks and river mouths.

Collecting grounds extend from up north in the Ilocos and Cagayan Region, along the western coasts of Luzon and the Bicol Region, the Central, Eastern and West Visayas including Oriental Mindoro and Masbate, to as far south as Mindanao and Jolo.

Generally, the collecting season starts in March lasting until June or July. In some areas a second wave of fry occurs in October to November. Still in some regions, fry occur throughout the year. The season is usually preceded by rainfall. A study conducted in Panay Island indicate that the peak of occurrence of fry comes 1-2 days before the new and the full moon.

c. Fishing gears

Collecting gears used are generally common to all grounds consisting of stationary, pushed or dragged net and bamboo contraptions operated in coastal areas in waters knee-deep to neck-deep. Stationary gears are filtering traps provided with one-way opening and fitted with floats to rise and fall with the tide. Dragged or pushed contraptions are either simple seines or scissors net and portable traps (Bulldozer type) handled by one or two men. A rather exceptional gear is one found in Antique which consists of a large rectangular (bunted) seine operated like a beach seine.

d. Storage and transport

Fry collected by fishermen are generally sorted in the beach area and stored in pots or basins while awaiting purchase by fry dealers. In the fry dealer's establishment, the fry are picked up by fishpond owners, the rest stored in jars or basins. Care of stored fry consists of daily water exchange and feeding with mashed hard-boiled egg yolk.

Fry are transported in oxygenated plastic bags placed inside a pandan bag for extra handling and protection. Each bag, filled to about 1/2 to 1/3 full of diluted sea water, contains from 6,000 to 10,000 fry. Transport bag salinities range from seawater level to about 18 parts per thousand.

Fry Rearing

Milkfish fry when caught in the wild measures from 10-15 mm in total length and weighs from 0.002 to 0.006 mg. Some still show traces of yolk sac indicating that fry migrate towards the coast at an early stage. Normally caught with these fry are those of other common species such as tenpounders, mullets, tarpons, and Penaeid shrimps.

Milkfish farms normally procure the whole year fry requirements in a single lot during the peak season when price is low. Others prefer buying in separate lots depending upon availability of pond space.

a. Rearing in tank

The system of raising milkfish fry to fingerlings 1-2 g in weight in indoor or semi-indoor conditions in wooden or concrete tanks has not been developed commercially in the country. The lack of suitable feed formulation has probably confined in the experimental stage the use of indoor tank for mass producing fingerlings.

b. Nursery ponds

Nursery ponds are built to receive and rear the fry into fingerlings for a period of 4-6 weeks.

Ordinarily, pond size ranges from 1,000 to 4,000 square meters. Prior to arrival of the stock, nursery ponds are carefully prepared to insure the highest possible survival. Stocking rate varies from 30 to 50 fry/m^2.

During stocking the most important consideration is to avoid salinity and temperature shock. The newly arrived fry are acclimated to pond salinity level if transport bag water salinity differs widely with that of the pond. Ordinarily, acclimation is done in plastic basins under the shade lasting for about 4 to 6 hours. Tolerance of milkfish fry to abrupt salinity changes is known but extra precaution would favor gradual acclimation as physiological stresses are not readily detectable. The fry are stocked during the colder part of the day as in late evening or early morning.

A slightly modified method is the pre-stocking of fry in a small acclimation pond built within the nursery pond proper at a rate of 5,000/m^2. Fed with patches of lablab daily (or with mashed egg yolk if they are visibly weak), the fry are released into the pond proper after about a week by breaking some sections of the dike. By this time the fry shall have grown larger and developed scales. The acclimation pond is provided with shade to keep water temperature cool especially during sunny days.

Culture in grow-out ponds

Milkfish farming here is heavily influenced by methods practised in Taiwan. However, the difference in the physical, climatic and socio-economic conditions of the two countries does not permit complete transfer of technology. As a result, innovative techniques proliferate. Intermingled with traditional practices and recent technological developments in the country and elsewhere, these developed into what may be called the milkfish culture system in the Philippines.

a. Construction and lay-out of milkfish ponds

The extensive farming system still dominates the scene with fishponds running to several tens and in some cases hundreds of hectares. A recent survey estimated the country-wide average farm size at 16 hectares.

Non- or slighly-renovated fishponds reflect the traditional practices characterized by haphazardly oriented ponds and dikes, unlevelled pond bottoms and relatively large rearing compartments. The absence of well-placed supply-drain canals or head ponds suggests a decentralized mode of operation.

Newly constructed or renovated fishponds present distinct features such as well-built peripheral and partition dikes laid out in straight patterns, regularly shaped compartments or manageable size and well-situated supply-drain canals and sluice gates to enable independent water management by compartment, and relatively levelled bottoms cleared of tree stumps.

b. Liming and fertilization

Liming is little understood by some local fish farmers as an important soil conditioning process especially among those who own long-established ponds. Perhaps it is because the immediate effects of lime are not as readily perceptible as those exhibited by fertilizers. Satisfied with their production, others simply do not find any need for it. In contrast, owners of newly excavated ponds accept the need for liming to hasten stabilization and to neutralize acid-forming compound exposed or leached out.

The use of organic and inorganic fertilizers is widely accepted. However, the technique lacks the refinements to make possible recommendations of the type, dose and methods of application of fertilizer materials area-specific as to the type of soil and desired natural food organism. The potentials, as fertilizers, of other agricultural waste products such as those coming out of rice and sugar mills have not been deeply explored.

c. Pest and pradator control

Pests and predators in ponds cause high mortality of fry and fingerlings and contribute to low yields in grow-out ponds. Included are species of fish and other aquatic animals that directly feed on or compete with the stock for food. Others like snails and polychaete worms destroy the bottom substrate preventing luxuriant growth of benthic algae.

A survey of 1175 fishfarms showed that among the various methods of eradicating pests and predators, the chemical method was the most popular, followed by "catch and kill" and pond drying. Endrin was the most widely used followed by Brestan, Gusathion, Aquatin, tobacco dust and Thiodan in that order. The same survey revealed that fish production of chemical users was about twice that of non-users which indicates the substantial effect of pest and predator control. Oblivious or aware of the possible dangers of continued use of chemical poison in ponds, the farmers do not have much choice since plant-based or organic forms of pesticides are hardly available in commercial quantities.

This is a critical and immediate dilemma confronting the milkfish farming industry.

d. Natural food in ponds

Lablab is the main natural food propagated in milkfish ponds. The relatively narrow tidal range of the Philippine waters favors propagating this type of food base which requires shallow depth. Besides, studies have shown that lablab is more palatable and nutritious than the traditional grass green filamentous algae. The free-floating plankton method was recently demonstrated as a likely alternative but for its requirement of deep water (about 1 m) which is not possible in most areas. The same plankton method in shallow ponds was demonstrated as feasible. The present practice calls for preparing the pond to grow lablab and resorting to plankton when lablab is completely grazed before the stock reaches marketable size.

e. Nutrition and feed formulation in milkfish

Supplemental feeding of milkfish raised in ponds is being practised but resorted to only when the natural food organisms being propagated have been prematurely grazed. Commonly used are single-ingredient feed materials such as rice bran, bread crumbs and corn bran. Dried grass green filamentous algae and "gulaman" (*Gracillaria sp.*) are reportedly being used. Other forms but less used are copra meal, hog mash, dried rice straw and ipil-ipil (*Leucaena leucocephala*) leaf meal.

Formulated feeds specifically for milkfish has yet to be developed. A preliminary study in a controlled environment indicates that a dietary level of 40 percent protein is required by milkfish fry for maximum growth, efficient feed conversion, and high survival rate.

f. Monoculture and Polyculture

Polyculture, in its true sense, is virtually absent. In fact, except for Penaeid shrimps all other species of fish in the milkfish pond are regarded as pests or predators. However, the potential is recognized for such a system using tilapia, spade fish and mullet, among others. Much research work has yet to be done to insure mass production of seedlings and establish culture techniques.

Local fish farmers practise a semblance of polyculture. When available, fry of *Penaeus monodon* are stocked directly in grow-out ponds with milkfish fingerlings. Rate of stocking varies with previous experiences or the availability of fry, but normally at a rate equal to that of milkfish. No extra care is given to the prawn except occasional feeding with chopped flesh of water snakes and slices of carabao or cow hides. Some fishfarmers stock their ponds with mud crab juveniles.

g. Stocking rate

Ordinarily, the grow-out pond is stocked with a mono-sized stock of fingerlings to be grown into marketable-sized for a culture period of 60 to 120 days depending on the size of fingerlings initially stocked, the type of food grown, and the abundance of food. Density ranges from 1000-1500/ha in "lumot" ponds, 2000-3000/ha in lablab ponds, and about 5000/ha in deep plankton ponds.

Size of fingerlings varies from about 2-3 grams to as high as 20 grams. In a normal year-long operation, the late stocks are composed of larger and stunted fingerlings.

h. Mixed size-group culture

This method is essentially a form of stock manipulation technique. The pond is stocked with three sizes -- 1500/ha of 2-35 g, and 3000/ha of 2-3 g fingerlings. Selective harvesting is done after the first 45 days and every 15 days thereafter. Two culture periods will be possible in this method and claimed to produce from 2200-2700 kg/ha/yr. BFAR demonstrated the technique in one of its experimental fishfarms in 1967 through 1969 obtaining a net production of about 1300 kg/ha for a culture period averaging 150 days.

The technique however has three major limitations:

1) selective harvesting by gill nets entails extra cost for additional manpower

2) quality of harvest relatively poor as gilled fish bear marks and are often scaled

3) uncertainty of availability of fingerlings of desired size at appropriate time.

i. Modular method of culture

One technique of stock manipulation that gained wide popularity among milkfish farmers in recent years is the so-called modular method, sometimes referred to as progression system.

First seen in practice in a large fish farm in Pangasinan, the method consists of a series of grow-out ponds linked to one another in operation and performing as unit, thus dividing the whole farm into sub-units or modules. The system is termed progression because in a module, the stock is transferred in succession from one pond to the next until harvest -- fish size and pond area progressively increasing. Correspondingly, density decreases after every transfer. Culture period in a pond leasts from 30-45 days; any one pond vacated is immediately prepared to receive an incoming stock. Commonly seen are modular units comprising three ponds with areas progressing in a 1:2:4 ratio.

j. Parasites and diseases of milkfish

The extent and kinds of diseases and parasitism in milkfish raised in brackishwater ponds have not been deeply studied. Preliminary work showed presence of fungus and bacterial infection in adult milkfish primarily in the eye membranes, fins, and in lesions in the body region. The observations, however, were made on fish which had been subjected to severe physical and physiological stresses. Indications are that the occurrence of the parasites and diseases is more consequential than phenomenal. External symptoms of a deseased fish are aberrations of the fins, rhizoid growth clouding the eye membrane, and inflamation and lesions at fin bases and peduncle regions.

There is no other documented report of mass kills of milkfish in ponds attributed to disease or parasitism except those that occurred in Central Luzon in 1969 to 1972 which were believed caused by parasitic isopods.

An unidentified species of ectoparasite (*Caligus sp.*) was found heavily infesting a number of sabalo spawner caught from the wild.

k. Harvesting

Harvest may be partial or total. With partial harvesting, only part of the stock is collected and the remainder is allowed to grow further. Total harvest means the whole stock is sold and the pond readied to receive a new batch of fingerlings.

Decision to harvest is dictated by economic and operational considerations such as: 1) prevailing market price; 2) phase of the tide; 3) weather conditions; 4) state of food supply in the pond; and 5) desired size.

Culture in Freshwater Fishpens

The large-scale culture of milkfish in pens in Laguna Lake adds a new dimension to world aquaculture. Portions of the lake are enclosed using semi-permanent structures and stocked with milkfish fingerlings at densities reaching as high as 10-12 times those used in brackishwater ponds. Feeding only on the natural planktonic life of the lake water, the fish attain market size in 5-6 months. Studies estimate that the yields obtained range from 2-4 tons per hectare and in some cases as much as 10 tons. Considering the productivity of natural open waters, these yields are phenomenally high which is attributed to the unusually rich and unique environmental conditions in the lake.

Pen culture in the lake is a fairly recent development. Successfully demonstrated in 1970 by the Laguna Lake Development Authority in a 38-hectare enclosure, the pens proliferated rapidly. Recent estimates place the total pen area at about 5000 hectares with potentials for expansion 3 to 4 times as much.

However, objections have been aired over such expansion, arising from social and ecological considerations. Pen enclosures are gradually displacing natural grounds for open water fisheries which affects the means of livelihood of thousands of fishermen in the area. There has been an increasing fear of an eventual and total ecological imbalance. Periodic occurrences of mass or near-mass kills have been experienced.

Post Harvest Handling

About 90 percent of the catch from milkfish ponds and pens go to the domestic market as fresh fish with a minor volume as marinated or smoked. The local major market outlets are concentrated in Metro Manila and a few other population centers. Bringing the catch to these centers takes from a few hours to about 2 days depending on the mode of transportation used. Handling of the catch includes pre-chilling, packing and actual transport.

Pre-chilling or immersion of fish immediately after harvest in iced water accomplishes the following: 1) serves as a convenient killing medium, thus preventing excessive physical damage and resulting to attractive looking fish; 2) slows down autolysis or enzymatic breakdown activities; and 3) removes blood, slime, dirt and bacteria from the skin of the fish, thus minimizing further deterioration.

A recent study on handling, icing and transport of milkfish found no advantage in chilling to 0°C over the 4°C if icing is applied immediately after harvest. The latter requires about 450 kg of ice to a ton of fish in two hours of immersion as against 900 kg of ice and four hours of immersion in the former. The same study recommended types of containers and ice to fish ratios to insure good quality fish reaching the market.

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