THE ROLE OF THE ACADEMIC COMMUNITY IN TECHNOLOGY DEVELOPMENT FOR MILKFISH FARMING

by

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Introduction

It is not very clear when and how the culture of milkfish started in the Philippines and what factors and conditions influenced the development of culture methods. It may be assumed, though, that over countless decades the fish farmer has continually looked forward to, or tried, various techniques in search for better rewards for his efforts. Unfortunately, present-day fishery biologists and fish culturists have only a faint glimpse of the past from a handful of records describing milkfish pond designs and management practices prevalent at the turn of the 20th century. And surprisingly enough, some of these practices are still very much evident in the methods presently employed in raising milkfish in brackishwater ponds.

The existing methods may be divided into three categories, namely, (1) the "traditional" or lumut" method, (2) the "improved" or lab-lab method, and (3) the "new" or plankton method. The first is a carry-over from the past while the second became popular in the mid-sixties through the efforts of a UN-assisted project of the Bureau of Fisheries and Aquatic Resources. The USAID/Auburn University assisted UP-NSDB Inland Fisheries Project is identified with the plankton method.

From the above, it becomes very evident that the thrust of technology-oriented development in the rearing of milkfish in ponds as well as the multi-agency efforts injected in the process, goes beyond what is normally left to the private fish farmers to provide. More important, it foretells of an increase in the involvement of well-established academic and developmental institutions, local and foreign, in determining future aquaculture trends not only for milkfish but perhaps also for other pond fishes.

The Academic Community and a New-Found Role

The role of universities, colleges and technical schools with curricula in fisheries has always been conceived as primarily instructional. In some, it remains as such, but for others, there has been a partial departure from this traditionally academic function. At varying degrees

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depending upon acquired capabilities, these institutions have embarked into technology development in some selected fields of fisheries. The transition involved years of incessant capability development aimed at organizing high quality research manpower, acquisition and accumulation of vital equipment and library materials, and installation and setting-up of adequate and functional indoor-and field-type facilities.

In aquaculture, for example, it took the University of the Philippines College of Fisheries almost ten years from the time it was established in 1958 to develop an initial capability to conduct field studies on some aspects of freshwater fish farming. A few years earlier the UPCF had rightly foreseen the direction it is to follow by establishing the Institute of Fisheries Development and Research, although fullfledged status as a research institution came about only in 1971 when the UP-NSDB Inland Fisheries Project was implemented. As a co-proponent of this project, the Central Luzon State University branched out to aquaculture, and within a short span of time, has more than ably developed and organized its fisheries staff to a point that it now has one of the strongest teams of researchers and technicians in this field.

The Mindanao State University College of Fisheries was established in 1963 and gradually developed its staff by drawing materials from within its own rank and graduates. Electing to concentrate its efforts on the propagation of penaeid shrimps, the college gained national recognition when it achieved a breakthrough in the spawning in captivity of Penaeus monodon in hatcheries. Subsequently, the research staff of the college became the nucleus of the technical personnel, along with the foreign experts, of the Iloilo-based Aquaculture Department of the Southeast Asian Fisheries Development Center.

Bicol University and the University of Eastern Philippines in Legaspi City and Catarman, Northern Samar, respectively, offer collegiate level courses in fisheries. Both are relatively new and the extent of which these institutions have acquired capabilities for research and technology development for fisheries has yet to be assessed. Nevertheless, their strategic location and proximity to aquatic resources constitute more than enough influence for these institutions to engage in more meaningful and creative developmental projects in fisheries.

Further still and among those included in the fisheries academic community are sixteen technical schools and four teacher education schools supervised by the Bureau of Vocational Education. Collegiate courses offered are: marine fisheries, inland fisheries, fisheries technology and fisheries education. The last course is exclusively offered by these schools. In some, creative and research projects are reportedly being pursued in the fields of aquaculture, food processing and coastal fishing. If at all, a vigorous program will likely be needed to develop fully a selected few among these schools.

In the country today, there are significant developments surrounding the milkfish farming industry which are expected to influence the direction of research efforts in the academic community. These are, not necessarily in the order of importance, the following: (1) the shortage in the supply of milkfish fry, coupled with an accelerated increase in fishpond acreage; (2) the increasing cost of commercial fertilizers and other material inputs; (3) the persistent problems associated with tilapia infestation of milkfish ponds; and (4) the increasing danger from pollution of tidal rivers and swampland areas.

On the favorable side, the following may be cited, namely, (1) the increase in occupational opportunities in fisheries, (2) the favorable climate and other forms of incentives and assistance given by the government to research institutions and fellows and to developmental projects; and (3) the growing receptiveness of the private sector to joining efforts with research and developmental institutions.

Thus, the stage is set for members of the cast to perform the role each has determinedly accepted.

The Overall Objective: Increased Production of Milkfish Ponds

The latest fisheries statistics show the yields of milkfish ponds averaging about 600 kilograms per hectare per year. There are reasons to believe, however, that in some areas yields go as much as two to three times this national average. Nevertheless, the overwhelming concern is understandably to increase production. The rallying point is obviously the reportedly high yields obtained in neighboring Taiwan. There is a general feeling of optimism in that the Philippines is favored with better climate, let alone the fact that milkfish is an indigenous species in the country.

But while the overall objective is well-founded, the pre-occupation is so strong toward achieving it on the basis of merely increasing yield per unit area such that other alternative and equally effective methods are either forgotten or simply not recognized. For instance, shortening the actual culture period will enable one to have more number of croppings per unit time in a given area. The viability of this approach rests upon the presence of a workable pond system and methods which will permit transfer or movement of relatively large-sized fish into ponds for ultimate rearing to desired marketable size. This way, too, there is maximum utilization of propagated food since much of it does not remain long unconsumed in the pond just to deteriorate, as is often the case when small-sized fish are stocked in a pond heavily laden with food.

Other ways of improving the operation will involve minimizing wastage in the use of fertilizers and similar material inputs, and reducing the mortality of fry and fingerlings, thus resulting directly to a decrease in the cost of production.

A more or less direct approach will be the use of feeds which will lead to stocking of ponds with fry or fingerlings at higher densities. A scheme may be developed whereby fingerlings are reared to marketable size subsisting on natural food and supplemental feeds; or fingerlings kept on maintenance feed rations for a prolonged period to serve the need for stocks during off-seasons.

Perhaps one approach least given attention to as a means of improving the overall operation of a fishpond is the adoption of more efficient methods of harvesting, storing and transporting to insure high quality produce. Although not directly involved in the actual rearing of the fish, these activities are, beyond question, as important.

Polyculture is a generally accepted method in maximizing production from ponds. Such culture system for milkfish along with other commercial fishes constitutes another alternative.

A remote possibility, at least at this stage, is to develop fast-growing strains of milkfish. The current trend in improving yields for land crops exemplifies this approach. Perhaps, it was once a remote possibility even for these land crops.

Contributions Made by the Academic Community

The credit for having first attempted to apply technology farming for milkfish goes to the early biologists of the Bureau of Fisheries and Aquatic Resources. Except for a handful, these workers were men of varied disciplinary background in natural sciences and agriculture. In later years, the rank swelled, this time with men trained in aquaculture at the then Philippine Institute of Fisheries Technology. Altogether, their contributions provided much of the framework within which present research and developmental efforts are pursued.

Early Trends in Research

At the outset, pond fertilization as the primary tool for increasing milkfish pond production drew much of the research efforts. Even before a full understanding of the method was attained, the use of fertilizers, especially the inorganic type, became widely practised. The effect on the overall production was apparently favorable even when assuming that fertilization was practised indiscriminately.

Pond fertilization was followed by attempts to adopt multiple-sized stocking and the use of supplemental feeds, two systems constrained by the absence of a uniformity in the supply of milkfish fingerlings of the desired sizes and by a lack in the supply of low-cost feed materials, respectively.

One single innovative practice which produced the biggest impact on milkfish culture is the switch from "lumut" to lab-lab as source of food in the rearing pond. This practice eventually developed into a modified version of the Taiwanese method, and to many fish farmers, its success in terms of incremental increase in production is the much-awaited breakthrough.

Lab-lab and/or Plankton Method

The change from "lumut" to lab-lab gives a good example of what may be loosely termed "selective food propagation" in ponds. This technique could open new possibilities in the culture of pond fishes, that is, by selectively growing the type or group of plants or animals most suitable to the feeding habit of the fish.

The development of the plankton method is essentially another step towards this direction. This method should be considered more as a compliment to, rather than a direct refutation of, the lab-lab method since inherent physical conditions in ponds attendant to one may not necessarily fulfill the requirements of the other. This is so especially when thinking in terms of the normally deep water system for the plankton. However, one cannot entirely preclude a plankton system in shallow ponds, in which case, the plankton method becomes both alternative and complimentary to that of lab-lab. In fact, some of the field experiments conducted by the Inland Fisheries Project aim to determine the feasibility of shallow plankton ponds in the culture of milkfish.

Pond Fertilization

The lab-lab method gave rise to a number of features in the management of milkfish ponds. Three are considered most significant, namely: (1) the use of traditional organic materials to fertilize ponds and at the same time as food for fishes; (2) the eradication and control of predators and other pests, using pesticides and other agricultural chemicals; and (3) the importance of a systematically and well planned pond compartment system and of leveled ponds.

The response to the use of organic fertilizers was spontaneous and favorable. As in the case of inorganic fertilizers, the application of organic fertilizers lacks specific requirements in amounts and doses. Chicken manure and rice bran became the prime materials, and as a result, the prices of these commodities have since then gone up steadily. This brings to mind the inherent disadvantage of such forms of fertilizers in that they are bulky, slow-acting, low in contents of major plant nutrients and conducive to accumulation of harmful residual materials. Their cost is not necessarily lower than that of inorganic fertilizers, especially when the available nutrients and expense of transport and hauling are considered. However, their being locally available (or created as in the case of compost) at times makes their use more favorable.

In any case, it would be best to think of methods developed not merely to identify potential fertilizer materials but also to maximize their effectiveness when applied in ponds, be it organic only, inorganic only or their combination. As an example, the use of platforms may be cited. The method was introduced by the Inland Fisheries Project. The idea is to prevent contact between inorganic fertilizer and soil, otherwise, some of the useful elements in the fertilizer may become chemically tied up in the soil and unavailable to plants. Similarly, preliminary studies have indicated that the use of phosphate fertilizers compares favorably with the use of nitrogen-phosphate fertilizers in ponds that have consistently received organic fertilizers in previous croppings. If such is the case, this practice will considerably lessen the required amount of fertilizer input.

Polyculture

To date, there is no culture system in brackishwater ponds that will qualify as polyculture. Penaeid shrimps normally grow with milkfish out of wild fry gaining entry into the ponds during water freshening or flooding. Fry of tiger shrimps (*Penaeus monodon*) are occasionally stocked with milkfish, but no specific management practice is undertaken for this purpose.

Among the many commercial species of fish found in brackishwater, tilapia probably offers the best probability of combining with milkfish in a polyculture system. It thrives and grows well in brackishwater ponds, but its very high reproductive capacity makes it undesirable. Current studies at the Freshwater Aquaculture Center (FAC/IFP), at Central Luzon State University have come up with a near perfect method for controlling reproduction in tilapia. By applying the technique called "sex reversal", which involves subjecting the fry to a diet treated with synthetic hormone, production of monosex tilapia is made possible. In ponds, it means an all-male or all-female tilapia population will not reproduce resulting in bigger and fatter fish. It was also established that generally, for tilapia, males grow better than females. A polyculture system of, say, all-male tilapia stocked with milkfish at optimum densities would mean more yield.

Field trials on milkfish-tilapia culture are already underway at the Brackishwater Aquaculture Center (BAC). Mention may also be made of an experiment on the efficacy of milkfish-shrimp (Penaeus semisulcatus) culture.

Fish Mortality or Survival

As implied earlier, the rate of survival or mortality of milkfish fry and fingerlings during transport and culture directly affects the overall cost of operation. The reasons are very obvious. In spite of the very important nature of this problem, more so in the light of the present critical supply of milkfish fry and fingerlings, there is a dearth of research studies aimed at specific solutions. Often the conduct of research develop effective rearing methods simply makes use of the rate of survival or mortality as one of the indices in evaluating results. Such use is of course valid, but what is stressed here is that in many instances, reasons for obtaining high or low survival (or mortality) are not analyzed, if at all identified. Doing so will lend more meaningful interpretation of results.

On the subject of survival or mortality, the Inland Fisheries Project followed up an earlier study on the salinity tolerance of milkfish fry and fingerlings. The experiment was modified by subjecting fry and fingerling to various ranges of increasing or decreasing salinities from a number of salinity bases. Onset and incidence of stress or detahs were measured. The results now provide fishery biologists and fish farmers a guide in acclimating or transferring milkfish from one salinity level to another.

Equally important is the only known investigation made so far on the periodical occurrence of fish kills in brackishwater ponds. This phenomenon is usually associated with moderate to heavy rains and has long been a dread to fishpond owners and a puzzle to fishery biologists. Itself a witness to a fish kill, the BAC was able to monitor as best as it could, meteorological, limnological and fish conditions in a number of experimental ponds. It was concluded that stress and kills were caused by rapid and lethal changes in pH and salinity. The result, however, could have been influenced by local conditions specific to the BAC ponds, so that it is quite premature at this stage to generalize that these findings apply to all cases. At most pH and salinity were identified as potential danger factors if allowed to fluctuate rapidly. Practical measures may then be applied to prevent the same to happen.

Thus far, these are the general areas of research and development on milkfish pond production which involve much of the efforts of the academic community. To summarize briefly, they are: (1) pond fertilization to maximize use of organic and inorganic fertilizers; (2) selective food propagation to determine the most suitable type of food for milkfish; (3) intensive culture system through fish nutrition; (4) polyculture for increasing total yield; and (5) pond limnology to insure high survival.

A Retrospect

For generations the fish farmer ruled it alone over the milkfish. For all and sundry, he is the maestro of the art; nobody questioned his skills and the ways they were applied. The new generation did just that--to learn more than to offend. For a long while the farmer watched with detached feeling. Finally both came to speak of a common goal. Science and technology have won a new frontier.

To the fish farmer the motivation is generally toward economic gains; to the biologist and technologist, to pursue a life career; and to the administrator, to maximize utilization of men, science, public funds and nature's resources for the benefit of society. Each has a goal and all blend in harmony. So be it.