FISH FARMING IN MALAYA

(As a guide to Fish Farming in Ceylon)

by

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(With 19 photographs by the author)
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Introduction

In Chinese literature, it is stated that fishing had its beginning about three thousand years ago, when the Emperor Sun Yan taught his people how to catch fish. The earliest reference to fish cultivation is made in the first century B.C. A seventeenth century publication deals with the association of different species of fishes in the same pond, which is a characteristic feature of Chinese pond culture of the present day; this publication indicates that this practice might have had its origin during the Han dynasty (201 B.C. to 190 A.D.).

Fish farming in Malaya is practised almost exclusively by the Chinese population of that country. The Chinese are particularly fond of eating these fish, and as there are some 90 per cent. Chinese in the one million population of Singapore, and 40 per cent. in the six millions inhabiting the rest of Malaya, the demand for pond-cultured fish is considerable. There are several hundred ponds in Singapore Island, and I visited four big organizations which specialize in supplying the fish fry requirements of farmers throughout Singapore and Malaya. Outside Singapore, too, the practice is widespread, with great centres of activity in Selangor, Perak and Negri Sembilan around the important towns in these provinces, Kuala Lumpur, Ipoh and Seremban respectively.

Types of Fish used

The fish most commonly used are (Chinese names, used in Singapore, in brackets):

1. The grass carp, (Chow hu), *Ctenopharyngodon idellus* (Cuv. et Val.).
2. The big-headed carp, (Twa tow), *Aristichthys nobilis* (Richardson).
3. The silver carp, (Pey lin), *Hypophthalmichthys molitrix* (Cuv. et Val.).
4. The common carp, (Lee koh), *Cyprinus carpio* (Linnaeus).

Two other varieties are also used, but to a much lesser extent:

5. The black carp, (Oh chow), *Mylopharyngodon piceus* (Richardson).
6. The mud carp, (Leng chee), *Cirrhina molitorella* (Cuv. et Val.).

Generally four, but sometimes two, three, five, or all six, of these species of carp are reared in the same pond together in association, according to the experience or discretion of the farmer. This remarkable association is directed towards making full use of all the food resources of the pond, and is apparently the result of centuries of practical application. The industry, as it exists today, is based on a system which has evolved through a process of trial and error, and the technique has been handed on from father to son. Considering the extent of its application, and its great economic importance, there is astonishingly little published information on the subject of the Chinese methods of fish farming, and there has apparently been very little improvement in the methods practised during the last few centuries.

The common carp is the only one of the varieties named which is known to breed in Malaya. All the other varieties are collected as fry in the Yangtze, Han and West rivers of China, which are apparently their only known breeding
grounds, and many millions of fry are imported annually into Malaya from these sources to meet the requirements of the farmers; they do not breed under pond conditions even in China.

The common carp has been cultivated in China as far back as 475 B.C., since when it has become the most popular of the domesticated species, and is extensively reared. It breeds in ponds quite freely, but under natural conditions it spawns, as many other river fishes do, when the river is in spate, swimming upstream to find a suitable spawning ground where there is plenty of vegetation lying submerged under the flood waters. There are many varieties of the common carp; Ceylon already has three varieties, the Golden carp, the Mirror carp and the Leather carp. In pond culture, the fat-bellied variety is the most fancied. The common carp seldom grow to more than 3 lb. in weight. It is a hardy fish and will thrive in fresh and brackish water. It is omnivorous, feeding on anything which it can gather in the water or at the bottom of the pond, and it has a habit of burrowing into the sides and bottom of the pond, causing some damage to the bunds (Plates 3 and 4).

The grass carp is predominantly a herbivorous fish, as is the gouramy (Osphronemus gourami, Lacep.) which is now well known in Ceylon. It will however feed on anything that comes to it at random (most fishes will), but it appears to prefer green leaves and grass to food of animal origin. It has a remarkable rate of growth. Fry hatched in April have been found to reach one foot in length and weigh one and a half pounds by the end of the year and to reach two feet in length and ten pounds after two years. In my own experiment, which I carried out in the Fish Breeding Station in Tapah, fry that were three inches in length and weighed a couple of ounces at stocking time in March, had grown to 18 inches and weighed 4 lb. in October, after seven months in the pond. Of a number of grass carp which I put into a pond in Colombo on September 15, 1948, at 5.3 to 8.5 cm. in length, three fishes were captured on August 30, 1950, which weighed 19 lb. each, and measured 73 to 74.5 cm. in length. They were not sexually mature (Plates 1 and 2). Carp farmers in Malaya state that the fish weigh over 4 lb. when they are harvested ten months or so after stocking. Grass carp of 20 and 30 lb. are common in the Chinese rivers mentioned above and sometimes a fish of 50 lb. is captured. In pond culture, as much green vegetable matter as the carp will consume is put on to the surface of the pond, and a floating framework, anchored to the side, prevents the leaves from spreading over the surface of the pond.

The big-head and the silver carp are alike in that they have much smaller scales than the other varieties; they are both plankton feeders, deriving their food chiefly from the microscopic plant and animal organisms which are found in suspension in the water. They are provided with fine straining gills; the gill rakers of the silver carp are the finer in structure and enable it to feed on smaller particles than the big-head can. The big-head, as its name implies, has the larger head, which is regarded as a special delicacy by the Chinese, and fetches a higher price than the flesh of the fish in Singapore. The big-head is said to grow faster, but the silver carp appears to reach maturity earlier than the big-head, a specimen weighing 4 lb. normally being found to contain ripe eggs or sperm, during the spawning season. So far the smallest big-head taken with ripe ovaries was found to weigh about 22 lb. The food of these two carps is provided for by maintaining an abundant supply of plankton in the pond, through the application of nitrogenous fertilizers to the water. It was observed that farmers nearer estuaries, where the water is slightly more saline, used the silver carp to a greater extent than other farmers, as the silver carp was found to give better results in slightly brackish water.

The black carp resembles the grass carp in appearance, but gradually assumes a darker colour as it grows older. It is, consequently, difficult to distinguish between the fry of these two species in the early stages, and 10 or 12 black carp fry may be found in every thousand purchased as grass carp fry. It is principally a pond-snail feeder. Though it is not very much in demand in
Malaya, it is much sought after in some districts in China, so much so that some farmers grow black carp exclusively in their ponds, and are obliged to collect pond snails from pond, stream and lake to feed their stock. The black carp usually reaches 5 or 6 feet in length and a weight of 60 lb. It is said to weigh 10 lb. in three years.

The mud carp is a bottom feeder, and lives principally on the detritus that gathers at the bottom of the pond, including the imperfectly digested faeces of the grass carp. It grows rapidly but seldom attains a weight of over 2 lb. While overcrowding in a pond will affect the rate of growth of most carps, it has no such effect on the mud carp, and large numbers can be crowded into a pond without affecting the growth rate appreciably.

It will be apparent that a pond which is stocked with all these species will have its food resources utilized to the utmost, and will bring the highest return possible. In Malaya, it is customary to find only three, or at most four, species reared in association. In some ponds the silver carp was omitted, in others the common carp, while in some large pools formed by the flooding of abandoned tin-mine excavations, where it was not convenient to provide green food, only the big-head and silver carp were reared. In some ponds there were 50 per cent. grass carp, 20 per cent. common carp and 15 per cent. each of the big-head and silver carp; where common carp were left out, 60 per cent. grass carp were associated with 20 per cent. each of big head and silver carp; and in some ponds there were 50 per cent. common carp. Combinations varied according to the environment, the availability of food and manure, and the judgment of the farmer.

Fish Ponds

Ponds are of the simplest construction. They are normally excavated in flat or low lying lands, but may be constructed in gullies by bunding. Some have access to a more or less perennial water supply, and are independent of the seasons, while others depend entirely on rainfall for their water. In most places the pond walls are of earth (Plate 5); but in Municipal areas, the sides have to be built up with planks as an anti-mosquito measure (Plates 9 and 15). It must be mentioned that ponds which are under cultivation are generally too alkaline for Anopheline mosquito-larvae to survive in, and if any mosquitoes are found they are Culicine. But ponds which are neglected can be a dangerous source of mosquito infestation. Again, when ponds are emptied for cleaning, the mud at the bottom cracks on exposure to the sun and the water in the fissures is generally full of mosquito larvae. This can be prevented by removal of the mud immediately after draining (Plate 7).

Various shapes and sizes of pond are employed. Those that are specially constructed are usually rectangular or square, with straight bunded sides, and hold about 3 or 3½ feet of water, but natural and artificial ponds such as flooded quarries and abandoned tin-mining sites are also used, and these are irregularly shaped and may be 40 feet deep or more in places.

Water supply may be obtained from a convenient stream or channel beside the pond; it is dammed when water is required for the pond, until there is a high enough head of water to divert into the pond. In rain-fed ponds, the preparation is completed in time for the rains, which serve to fill the ponds.

Preparation consists mainly in removing the mud and silt which settles at the bottom of the pond, and exposing the pond bed to the sun. In some systems, rice or a vegetable or some other short crop, is grown on the pond bed in between crops of fish, but this is rare in Malaya. The bed is generally given liberal dressings of manure and, if muddy, of lime to flocculate the clay. Sandy beds are said to produce a healthy fish crop. Organic detritus tends to cause sourness in the water due to anaerobic decomposition, and brings about conditions which are unhealthy for the fish. The mud removed from the pond bed may be used to repair the bunds, but is often utilized as manure for the
fields and vegetable gardens which surround the ponds. Cleaning may be done once in two years or so, depending on the state of the owner's finances, as it involves relatively high expenditure from a peasant point of view.

Wherever possible, ponds are so constructed that they can be emptied completely when desired. To do so, a very simple type of sluice gate is constructed, consisting of two parallel concrete walls, in which two sets of parallel slots are made opposite each other (Figs 1 and 2). Two sets of planks are slipped in into these slots, forming two barriers between the walls, and the space between the two sets of planks is filled with soil which is well pressed down. This is an effective sluice, and the depth of water can be adjusted by adding or removing planks to raise or lower the height of the barricade (Plates 10 and 11).

Fig. 1.

**Front View of Sluice Gate with Sliding Boards in Position**

Fig. 2.
In the case of deep mining pools or other excavations which cannot be emptied, or where due to difficulty of obtaining water it is not advisable to empty ponds, a scoop is used, consisting of a box with one side removed, tied to the end of a bamboo, and manipulated from a flat-bottomed boat into which the dredged mud is put.

When the pond has been cleaned and refilled, the water is prepared for the reception of the fry by the addition of quantities of farmyard manure or human excreta, to increase the nitrogen content of the water in order to promote the growth of micro-organic plant and animal life. It is almost a universal feature of all Chinese carp-rearing ponds which I visited in Malaya that they had one or more latrines constructed over the ponds for domestic use and as a mute invitation to the passer-by (Plate 6). Poultry houses are also constructed over the water, and the droppings are swept through the lattice-work floors into the ponds. Pigsties and cattle sheds stand in close proximity to the ponds so that the run-off finds ready access into the ponds. In cases where farmyard animals are not owned, the farmer purchases several hundredweight of cattle or pig manure, or human excreta, or fish waste, or rotten fish, to dress his ponds with; at one pond which I visited, a 5-acre mining pool, the farmer put in as much as a ton of organic manure each month, at a cost of about Rs. 60 per month. He said he would put in another half a ton of manure each month if he could afford it, and it would repay him in the increased growth of the fishes which would result. The leaves of strong-odoured plants of the composite family such as the Goatweed, Ageratum conyzoides, or Siegesbeckia orientalis, and of the mint family, are put into the pond, mixed with cowdung, to improve the plankton content. As a result of this treatment the pond assumes a peagreen colour and the water a pea-soupy consistency, which is regarded as the best condition for fish rearing.

In the smaller fry-ponds, which are drained and refilled in preparation for the arrival of the fry, water is treated with tea cake or tuba root extract, ten days to a fortnight before stocking, to kill any murrel (Ophicephalus sp.) or other predatory fishes, and snakes, that may have got into the pond with the water. This is necessary because, if present, they would quickly eat up all the fry introduced into the pond. The process is quite simple. Tuba root is obtained from a common mangrove plant, Derris elliptica, and is found to contain alkaloids among which the most potent is Rotenone (from the Japanese name for the plant, which is Roten), a hydrocarbon which has been isolated and is found to possess marked insecticidal properties. The root is crushed by beating it with a hammer and the smashed material is squeezed in water, when a milky extract is obtained, like strong Jeyes fluid. (Plate 12). This is diluted about ten times with pond water and scattered on the sides of the pond and on the surface of the water. About 5 lb. of root so treated was used on a pond 50 × 100 ft. in size, and within an hour a number of fish were taken out as they struggled weakly on the surface. Among them was a 2½ lb. murrel which would have done much damage had it remained there; also a number of carp, which had evaded the last harvesting, or had been put in from time to time by the farmer’s children (Plate 13). Research in the United States has shown that Rotenone is harmless when eaten by man and animals (dogs, cats, sheep, chickens) though it is an effective insecticide in the proportion of 1 part to 300,000 of water. The pond requires no further attention and is quite safe for stocking in 10 days, by which time the effects of the poison have disappeared completely.

The Fry Trade

In Singapore there were four large importing firms engaged in the import from China of carp fry to serve local demands. The operatives at these ponds told me that, in China, during the flood months of April and May, the minute fry drift down passively in the river water and are collected in fine-meshed cloth traps set in the river. The fry may be ¼ inch or less in size. They are now sifted carefully to remove the fry of unwanted and predacious forms. This is done by a process of ‘watering’ which is a specialist’s job. Water is poured into the tub in which the fry are kept, and let out through a screened hole in
the bottom, whereupon the fry are said to separate into layers, the silver and big-head carp in the top layer, grass carp and black carp in the next layer, and mud carp in the bottom layer. The layers are not quite distinct from each other where they meet, and a further process of passing them through specially constructed seives made of bamboo roots or rattan follows, to make the separation complete.

The fry are transferred into separate ponds, with one species in each pond, and sold to the farmers and shippers by the saucer-full. The purchaser is required to do the measuring, and a good deal of skill is said to be required to get full value for money. The Singapore fry importers have their own representatives who do the collection of fry in China. The fry are shipped down to Honkong, generally in boats which are themselves filled with water to hold the fry, and from Honkong they are sent by steamer in big wooden tubs, five and a half feet high, each of which may contain 20,000 fry. The tubs have to be aerated ceaselessly all the way from Honkong to Singapore. This is accomplished by having a simple rocker mounted over five or six tubs with four square splashing-blocks of wood suspended from the ends of cross-bars, two of which are situated over each tub. One man standing on the rocker can thus cause the blocks to splash the water in a series of tubs, which creates sufficient aeration of the water for practical purposes. Relays of workers keep up the motion throughout the voyage (Plate 18).

On arrival at Singapore the fry are transferred by bucket into hang-nets, suspended in junk which are partly filled with fresh water, and the process is reversed on arrival at the quay-side when the fish are transferred into tubs in waiting lorries, which rush them to the fry ponds of the dealers (Plate 17). Mortality of fry is generally high; 30 to 60 per cent. may be lost in the first week after capture, and anything up to 5 per cent. loss thereafter is not uncommon in this method of transport.

A more recent introduction is air transport. Four-gallon cans similar to kerosene tins are used. Two tubes reaching down to half the depth of the tin are soldered into one end, and short rubber tubes attached to the exposed ends. The tin is filled with water and the consignment of fry amounting to as many as 1,500 one-inch fry or a lesser number of larger fry is introduced. A cover, which is generally fitted with a glass window, is screwed firmly on, and then oxygen from a cylinder is slowly passed in through one tube, at atmospheric pressure, until it displaces about half the quantity of water in the tin, through the other tube. The out-going water is collected in another can of the same size, to indicate the quantity of water which has been displaced by oxygen. The rubber ends are tied securely and the package is ready for transport. It will stand 16 hours of travel without any attention. The fry are generally starved for 24 hours prior to packing so that their intestines are empty when they are packed and they do not foul the water in the container during the journey. Losses during air transport by this method are negligible. This practice appeared to be finding much favour among importers in Singapore, judging from the numbers of consignments which I saw arriving by air during my last week in Singapore. Consignments have been sent from Singapore to Ceylon by this method and the fish arrived in good condition (Plate 19).

The fry dealer stunts his fry by over-crowding them in small ponds, thereby reducing as far as possible the cost of upkeep and the cost of transport. Though the fry season is in April-May, and fry are most plentiful and cheapest at that time, fry are nevertheless available throughout the year, and shipments continue to arrive all the year round.

In Singapore, fingerlings are sold by the piece. They cost in the neighbourhood of 50 cents each, during the spawning season, for those imported by air, but when the seawhore stocks arrive the price would drop to about 25 cents each. In pre-war times fingerlings cost 2 to 5 cents each. During the rest of the year prices may soar to 60 cents per fish. (Prices quoted are in Malayan currency.) (Plates 14 & 15.)
Stocking the Ponds

It is customary in Malaya for the supplier to deliver a consignment of carp fry at the buyer's ponds and to wait for one hour, replacing any casualties which may occur within that time. Thereafter, losses are the buyer's affair. The young fry are fed on wheat flour, soya bean cake, bean curd, rice bran, peanut cake, and duckweed (Wolffia), and the yolk of hard boiled eggs is given in special cases where the fry are observed to be weak. The growth is affected both by the amount of feeding and by the amount of space allowed. For instance, well fed fish kept in an aquarium tank have shown hardly any growth, while those liberated in a pond have grown to three-and-a-half times their original length within one month.

Some farmers buy their fish as fry, and stock their carefully prepared ponds with them. Others who cannot rid their ponds of the numerous enemies that lurk therein are obliged to buy fish that have been grown to 6 inches or so. To cater for their requirements, there are farmers who specialize in buying small fry which they force-feed so that they reach 6 to 7 inches in length within 10 days or a fortnight (Plate 16). These are sold at an enhanced price, depending on the ruling price of fry at the time. Due to the great demand for duckweed, there are people who specialize in the supply of this plant, which they grow in ponds enriched with pig manure, selling it by the basketful.

Once the ponds have been stocked, attention will be limited almost entirely to the daily supply of an adequate quantity of green leaves, that is, as much as the fish will eat, and monthly dressings of manure. Leaves used vary from Manioc, Kankung (Ipomoea aquatica) and grass to vegetable clippings from the market gardens. They are usually put within a floating rectangular bamboo frame, to prevent the leaves from being blown against the bank, to facilitate the removal of the stalks after the fish have fed, and to give the farmer a means of observing the feeding rate and growth of his stock so that he might know whether he is giving them sufficient food. If the farmer thinks his water is not green enough in colour, additional dressings of nightsoil and manure are applied, and, if he feels that the fish are not fat enough on periodical inspection, he will feed them with fattening foods such as bean cake and peanut cake. Coconut cake (poonac) can be given. It is usually suspended in a bag made of fine-meshed material or in a rattan basket, at the surface of the water, and the fish pick at the poonac through the holes in the material. This food is given as an extra when it is desired to fatten stocks or improve their rate of growth. The faeces of the grass carp, consisting of partly digested leaves, appears on the surface and floats there for sometime before disintegrating. The shape and size of these masses is regarded as an index of the growth of this fish. The fertility of the pond is maintained at its highest level by the complete stagnation of the water. The less flow-in and run-off there is, the better will be the condition of the fish. Stagnation of the water is very carefully ensured in this system of farming. The surface of the water may be beaten with poles, when necessary, to increase the oxygen content of the water, if the fish are observed to be crowding at the surface, or fresh water may be let into the pond.

Harvesting

In from six to ten months after stocking, the fish are ready for the market. The farmer will not harvest them until the purchaser or his agent is present. For small orders of a hundredweight or so a castnet is used, but for bigger orders the pond is partially emptied, where this is possible, and a seine net is dragged across it. Where the ponds are close to the market, an effort is made to take the fish to the market in a live state, in small barrels of water. Live fish may be seen in most markets on any day of the week and they fetch a relatively higher price. The farmer disposes of his stock at wholesale rates to the fish dealer, who may take the fish as much as 250 miles away to sell it. There is always a demand for carp from the Chinese public, hence the rearing of these fish is a profitable undertaking.
From an economic point of view, a farmer who stocks his ponds at the rate of two to three thousand fry per acre of pond, at an average cost of say 25 cents per fish, will spend five to seven hundred dollars on stocking per acre. His feeding expenses are almost reduced to the cost of manuring which varies from five to six hundred dollars for the season and he will sell his stock at the flat rate of a dollar a catty (1½ lb.) realizing about four to five thousand dollars per acre per year. Cost of labour to clean and repair and maintain pond is high, but the farmer lives a simple life and makes a fair profit from his undertaking.

There are upsets, however, as when fry are devoured by kingfishers or snakes or by the stray ingress of a predatory murrel or a catfish; and again, sudden sickness may overtake the fish, which die by the hundred, though this is by no means a frequent occurrence. The factors which play the greatest part in the success of this method of pond culture are its simplicity, the utilization of all waste matter, and the ready market for the produce.

Conclusion

The methods used in Malaya are in some respects objectionable; the utilization of raw night soil and farmyard manure, in a stagnant pond, is unesthetic and unhygienic. The Malayan Fisheries Department has sought to eliminate this undesirable feature by encouraging the system of composting of farmyard and other natural wastes, which reduces them into a wholesome form without affecting their manurial value. This recommendation has however failed to find wide acceptance. The methods born of centuries of experience still hold sway. In Ceylon, however, composting will undoubtedly be practised.

As for the prospects of fish farming in Ceylon, it is abundantly clear that the methods described above must undergo modification before they can assume a form which will not offend local susceptibilities. Furthermore, it is well-known that the town dwellers will choose sea fish in preference to fresh water fish, so that a ready market, which is a matter of supreme importance in a venture of this nature, is by no means a certainty in urban areas. The fact that, in spite of efforts that have been made in the past to get these varieties of carp to breed, they are so far not known to spawn except in their natural haunts in three rivers in China, will make it necessary that other varieties than those used in Malaya will have to be used in Ceylon. It is freely admitted in Malaya that the man who succeeds in breeding Chinese carp in that country will make a fortune. The expense of purchasing fry from China every year will tend to make the rearing of Chinese carp in this country uneconomical. These carp have been introduced into local tanks and rivers as a useful addition to the fresh water food fishes of Ceylon, but the success of these efforts will depend on whether these fishes will establish themselves in our rivers as successfully as the Gouramy has done.

In the meantime, encouraging results have been achieved by the use of *Tilapia mossambica* and Gourami in association, in local ponds, with and without the inclusion of the common carp. Other fishes which lend themselves readily to farming in ponds are the Grey mullet (*Mugil* sp.; *S.*, *Godaya*, *T.*, *Manalai*) the Pearl spot (*Etroplus* sp.; *S.*, *Korali*, *T.*, *Setthel*), and the Milk fish (*Chanos chanos*, *S.*, *Wekka*, *T.*, *palai meen*), and supplies of the fry of these species are plentiful and easily collected along the sea coast (*Chanos*), in estuaries and near the mouths of rivers (*Chanos, Mugil*), and in lagoons (*Etroplus*), particularly during the monsoon months (May-June and November-December). Fish farming could provide a solution to the protein deficiency in the diets of rural populations, if the Ceylon peasant could be persuaded to adopt the practice as the peasant in the rest of South-East Asia has done. If fish rearing ponds can be developed as a part of each farmer’s holding throughout the rural areas of Ceylon, a supply of much-needed protein food will be produced in the areas.
where it is needed most, and people who do not now include fish in their diets, due to distance from fishing areas or inaccessibility from present markets, will be able to grow sufficient fish both for use in the fresh condition and for conversion into the dried form for use during periods of dry weather when their ponds run dry. In the dry zone, pond farming will have to follow the general pattern of the weather, ponds being stocked with the rains, and harvested when the drought sets in. And the peasant can achieve all this with little more effort than that of using the waste products of his present-day agricultural practices.

Department of Fisheries,
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