Pond Culture Of Tilapia

Annual yields from ponds of over one ton per acre have been recorded of Tilapia, an easily-bred edible fish that thrives equally well in fresh, brackish, or salt water.

By H. VAN PEL

FISH farming is practised in many countries, and is a very ancient art in some areas. In the last 25 years it has become increasingly popular in tropical countries. Since the last war, it has been stimulated by a number of Governments and, where the techniques were not known, specialists have sometimes been engaged to teach them.

For various reasons, not all attempts at fish culture have been successful. These included the introduction of species that were unsuitable because they were either predatory or incapable of acclimatization in the locality chosen, and insufficient knowledge of proper farming methods.

Tilapia mossambica Peters seems to be an answer to the first of these difficulties. This is an entirely harmless fish, and it seems adaptable to a very wide range of climates and conditions. Other species of Tilapia are also used in fish farming, mostly in Africa, but this article will deal only with the above-mentioned species.

First Pacific Appearance

The Tilapia is an African fish and belongs to the same group (Cichlid) as the Perch. There is no record of its introduction into Java, but it was found there in 1939. From this point it has spread to many Asian countries. It first appeared in the South Pacific in January, 1954, in Fiji, where it was introduced from Singapore. Recently it was introduced into Guam from the Philippines.

While it is not generally considered a first-class food fish, it contains few bones and is excellent for human consumption. It is sometimes raised for pig food.

Tilapia is about the easiest fish to raise in the tropics, even by unskilled fish farmers. It thrives in fresh and brackish water provided the pH is suitable.

The following will give an idea of their capacities of resistance: I took ten Tilapia from Fiji to Nouméa by air in a one-gallon (4.5-litre) glass jar, without any special provision for aeration, etc. When I received them, they had already spent two days in the jar, yet all but one reached Nouméa in good condition. A large earthenware vessel has been their home since.

But that is not all. These fish had been born in fresh water. I brought the water in the vessel to a salinity of 20 parts per thousand by gradual stages, and then changed it in one stage back to fresh water again. Then I increased the salinity again in three stages to 35 parts per thousand, giving water of the same salinity as the ocean. Thus, it cannot be claimed that Tilapia is not a sturdy fish.

Commercial production of fish species sensitive to environment changes would be very difficult for unskilled farmers. Another point in favour of Tilapia is that one need not worry about fry. They attain maturity at about four months, and are able to reproduce all the year round at intervals of from two to three months, in both fresh and brackish water. They have also been observed to breed in really salty water (approximately 35 parts per thousand). One pair of adult fish may produce as many as 10,000 fry in a year.

High Yields

As for yield, productions of over one ton per acre per year have been recorded from cultivation ponds. These are greatly in excess of those obtained in Europe with carp or other fishes of the temperate zone. In nearly all cases, however, these high yields have been due to the presence of enormous quantities of "trash" (small fish of unmarketable size), fry and fingerlings resulting from unrestricted breeding with its attendant degeneration of the population. This creates no difficulty where the fish is intended for pig food. For human consumption, however, one good-sized fish is preferable to many small ones. It is therefore preferable to use only good fry from adult genners.

Male Tilapias grow larger and heavier than the females, so that whenever possible it is advisable to raise only males for consumption. It is obvious that fish farmers can perform only a quick examination before separating the sexes.

External differences can fortunately be observed: the tail, fins, back and breast are of a darker reddish colour in the male than in the female, and this colouring also covers a greater surface. In addition, the back of the male is darker and its mouth broader than that of the female. These differences can be observed from the fingering stage on. The validity of this sexing method has been checked by the author. Upon dissecting a number of Tilapia selected by this simple technique, the results were found to be 100% correct.

In order to permit the selection of fish, the ponds must be so arranged that the farmer can regulate the flow of water into and out of his ponds, with the help of sluices, monks or other devices, in order to control the water level. Otherwise it is the fish which manages the farmer, and not the other way around.

Tilapia is at home in ditches, swamps, reservoirs, large and small ponds and even rice paddies. However, waters already containing predatory fish are unsuitable.

In order to undertake commercial fish farming, one needs proper ponds. The
first requirement is that the bottom should not be porous, and a good water supply must be available. The supply should be capable of raising the level at least four inches in twenty-four hours, calculated from mid-water level. The draining arrangements should be such that the pond can be drained out in one day.

I do not propose to elaborate in this short article on the construction of ponds, since much depends on the particular circumstances of the proposed site: slope of the ground, tidal influences, etc. The South Pacific Commission will be glad to supply further information to those interested in building ponds, if full details about site, water supply, production required, general situation, etc., are provided.

A properly-built pond will provide enough food for the planned quantity of Tilapia if fertilized, say, with the effluent from a piggery, or with manure. This promotes the growth and multiplication of small aquatic plants and animals, the plankton, on which the fish feed. The quantity of manure to be used depends on several factors, but two imperial gallons (nine litres) of cow dung per rood of surface (0.1 hectare) per week is a safe quantity in the beginning. The colour of the water indicates whether fertilization is adequate or not. Once it has become a soupy green, applications of manure should be spaced out in order to keep it at the same stage.

If the pond does not produce enough plankton, additional food such as rice, bran, coconut meal, kitchen leftovers such as cooked rice, bread, etc., can be given, although when the fish are still at the fry and fingerling stages, these foods should be ground fine. One to two percent of the estimated weight of the fish should be given daily. Tilapias also feed on insects, larvae and worms. The stocking rate for a pond depends on its surface and depth, and on the amount of food available for it. Overstocking is undesirable, since the growth rate of the fish is thereby reduced. Under favourable conditions, with a fertilized pond, a yield of 1 lb. of fish for each 64 c. ft. (one kg. for each 4m.$^3$) of water can be expected in a pond where depths range from 11 to 3 feet (0.50 to 1.00 metre). In unfertilized ponds, without any additional food, the yield should be around 1 lb. of fish per 160 c. ft. (1 kg. per 10m.$^3$) of water. In such ponds the depth should not exceed 11 feet (0.50 metre).

When a fishpond is being stocked its carrying capacity in numbers and weight of fish must be assessed. For instance, a fertilized pond may carry, for each 40 c. ft. of water, one fish weighing 10 oz., or ten fish weighing 1 oz. each (one fish of 250 grammes or ten fish of 25 grammes for each cubic metre). An average mortality of 20% should be allowed for.

These data are valid only for raising *Tilapia mossambica*, and only up to a length of 8 inches (20 cms.). In fact, it is not economical to carry the effort further and raise larger fish since, from that point on, the weight gain becomes lower for a given amount of food.

A great many physical, biological and chemical factors play a part in fish farming, but they fall outside the scope of this article, which is especially intended for those who want to make a start in fish cultivation.

PLANT COLLECTION AND INTRODUCTION IN THE PACIFIC—Expert Discussions At Canberra

PLANT introduction is not new to the islands of the South Pacific. When, centuries ago, the Polynesians entered the region, they brought with them the plants which still provide their main food crops—yams, taro, breadfruit and bananas. With the Europeans came rice, maize, the pineapple and many other plants which were new to the region. Some of them, such as cocoa and coffee, are important sources of export income today.

Governments, missions and private citizens, all played a part in this enrichment of the flora of the islands, but in more recent years territorial departments of agriculture have been the chief agencies of plant introduction. At present the main stations are at Laloki, near Port Moresby, which serves the territory of Papua and New Guinea, and at Naduruloulo near Suva, which serves Fiji and, with the support of the South Pacific Commission, is acting more and more as a central station for other territories.

In order to plan a future programme of plant introduction for the islands, the South Pacific Commission held consultations at Canberra from May 2-7 last. The Commonwealth Scientific and Industrial Research Organization made available full facilities for the holding of the meeting, and Officers of the Organization made a valuable contribution to the discussions. The Principal Plant Introduction Officer of C.S.I.R.O., Mr. William Hartley, was Chairman of the meeting.

The consultations, which were arranged by the Commission, were held under the chairmanship of Mr. W. Hartley, Principal Plant Introduction Officer, C.S.I.R.O. Those attending were Mr. Carl L. Erlanson from the Plant Introduction Section of the U.S. Department of Agriculture, and a leading world authority in this field; Mr. B. E. V. Parham, Deputy Director of Agriculture, Fiji, who has been associated with the development of the Naduruloulo Plant Introduction and Quarantine Station; Mr. G. P. Keleny, Plant Introduction Officer of the Papua and New Guinea Department of Agriculture, Stock and Fisheries; Mr. J. F. Miles, Principal Plant Introduction Officer for Queensland and Northern Territory, and Dr. E. Phillis, from the Land Research and Regional Survey Section of C.S.I.R.O.; Mr. Harbhajan Singh of the Indian Agricultural Research Institute; and the Commission's Executive Officer for Economic Development, Dr. A. H. J. Kroon, and Technical Officer, Subsistence Agriculture, Mr. J. Barrau.

The consultations benefited much from the presence of Mr. Carl O. Erlanson, who explained the way in which plant introduction is organized in the United States and gave an account of the lines of research upon which the Federal Service is concentrating at the present time, in collaboration with the agencies of the State governments. For example, in recent years hundreds of varieties of bamboo have been collected and tested in the search for an alternative to forest trees in the manufacture of paper pulp. Satisfactory results have been obtained and the most suitable varieties are being propagated in preparation for the day when the United States will no longer be able to meet its