

CAPTURE AND CULTURE FISHERIES IN CHINESE LAKES

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Introduction

This article is part of the report of the Philippine Study Team, headed by the author, which observed China's freshwater fish culture techniques, during May 1980.

China's freshwater resources, probably the largest in the world, contribute significantly to the country's fish supply. At present, production levels from fish farms and natural lakes are remarkable. Fish yields per unit area of natural lakes are perhaps the highest in the world. A brief account of the fish cultivation techniques in some of the lakes visited is presented here.

China's vast waterways cover an estimated 77 million ha, 5 million ha of which are being developed into fish farms. There are about 800 freshwater fish species, 40 to 50 of which are of economic value. Some 1.05 million t, or 25% of the country's total fish production (4.66 million t), were derived

Table 1. Characteristics of some lakes in China.

| Lake/Province | Total Area (ha) | Depth (m) | | Visibility cm | Total Production Year | kg |
|---------------------------------|-----------------|-----------|-----|---------------|-----------------------|--|
| | | Ave | Max | | | |
| 1. Chinqing/Soochow | 720 | 1.5 | 4.0 | 100 | 1979 | 650,000 (900 kg/ha) |
| 2. Taihu/Jiangsu and Chekiang | 200,000 | 2.0 | 10 | 50 to 100 | Annual | 10,000,000 (50 kg/ha) |
| 3. Mochaun (Stone Lake)/Jiangsu | 37 | 1.2 | 2.5 | - | Annual | 35,000 (1,750 kg/ha)** |
| 4. Shang-Wu/Jiangsu | 330 | 1.5 | - | 40 | 1979 | 1,000,000 (3,030 kg/ha) (1,736 kg/ha)* |
| 5. Tong-Hu (East Lake)/Hupei | 1,466 | 3.4 | 6.0 | 60-70 | 1978 | 800,000 (600 kg/ha)** (375 kg/ha)* |

* Average for several years

** Refer to fish production area in Table 2.



Above: Manure from ducks farmed at the Soochow state fish farm, Lake Chinqing, provides nutrients for the adjacent fish pens.

from freshwater fisheries in 1978. The national average from fishpond culture is 750 kg/ha/yr. This low average yield is attributed to regional differences in climate.

Lake fisheries

China is endowed with numerous freshwater lakes, categorized as small,

from 1,000 to 10,000 mu (about 67 to 667 ha), medium, between 10,000 to 100,000 mu (667 to 6670 ha), and large, more than 100,000 mu. Lakes less than 1,000 mu are considered ponds. There are over 130 medium to large lakes. We visited five representative lakes, as shown in Table 1.

State farms and hatcheries

Nearly every small and medium lake has a state farm that stocks fish and manages it. In larger lakes fishing is open to the members of the commune that control the lake. Fishing, therefore, is done by the same people who are responsible for stocking and managing the lake.

Since intensive fish stocking is being done, spawning of Chinese carps and other species is a routine activity in the state farms. Excess fry are sold to nearby communes, adjacent to ponds or lakes, which do not yet have the capability to produce their own. Carp fingerlings larger than 15 cm are stocked, so there is up to 80% survival, despite predators and adverse environmental conditions. Hatcheries require ponds, cages or blocked-off portions of lakes, for rearing fry to fingerling size. Annual fingerling requirements of the lakes visited are presented in Table 2.

Table 2. Annual fingerling requirements for some Chinese lakes.

| Lake | Year | Fish prod. area*, ha | Stocking no./ha | Total in millions |
|---------------|--------|----------------------|-----------------|-------------------|
| Chinqing lake | 1979 | 720 | 3,194 | 2.30 |
| Taihu lake | — | 200,000 | — | — |
| Mochaun lake | Annual | 20 | 6,000 | 0.12 |
| Shang-Wu | 1979 | 300 | 6,060 | 2.00 |
| Tong-Hu | 1978 | 1,331 | 3,000 | 3.99 |

*Some parts of the lake are used for fingerling production, boating and other recreational activities.

Fish cultivation and productivity

The fingerlings stocked are mainly carp with other species, such as breams. In Shang-Wu lake, for example, the stocking proportions are: silver carp, 50%; bighead carp, 20%; wuchang (bream), 12%; grass carp, 8%, and common, crucian and black carps, 10%.

The lakes visited are relatively shallow and have fertile waters, as indicated by the shallow depth of visibility, and high productivity of fish (Table 1) and plankton. In Shang-Wu Lake, a phytoplankton count of 20.4 million /l was recorded, while in Tong-Hu Lake the average was 2 million/l. With such information available, technicians of the state farms, in cooperation with ecologists of the Institute of Hydrobiology, Academia Sinica, can adjust the stocking density of a lake, depending on the availability of food organisms.

In addition to natural food, the fish are also fed grasses and vegetables. It was said that 1.25 to 1.5 million kg/yr of vegetables and grasses are fed to carps in Shang-Wu Lake. The food conversion rate for grass carp is about 1 kg of fish per 60 kg fresh weight of grasses.

Integration with animal production is also practiced in some lakes, such as Chinqing Lake. Pig and duck manures supply nutrients to the water which increase plankton growth. Approximately 10,000 ducks and 1,000 pigs are housed along an 8 to 10-m wide embankment, extending roughly 2 km into the lake. Lakes which are also used for parks and recreation, such as Shang-Wu, Mochaun and Tong-Hu, do not receive animal manure or other

wastes to preserve sanitation.

In addition to direct stocking of fish in open waters, some of the lakes we visited, such as Chinqing, Taihu and Shang-Wu, also have fish pens or cages. A pen has an area of about 13 ha, while cages vary in size from 24 to 72 m². The area covered by pen and cages at Chinqing lake is about 61 ha. In this lake, post-fry of 3-4 cm are grown in cages at 200/m² up to fingerling size, 13-15 cm, in about 6 mo. Fingerlings are grown to harvestable size in cages at a density of 20 to 80/m².

Similar cages, (1.5 m deep) are stocked with carps and *Tilapia mossambica* in Shang-Wu Lake. In 1979, carp fry (3 cm) were raised in cages to fingerling size in 3 mo, then from fingerlings to harvestable size at stocking density of 300-400/m². At 70% survival, the carp averaged about 0.7 kg after one year. The average yield was 10 kg/m², with a maximum of 19 kg/m². For *T. mossambica*, average yield was 64 kg in 100 d, at stocking density of 600 fish/m² and without any supplementary feeding. Survival was more than 80%.

Harvesting fish

In Tong-Hu Lake, a special method of concentrating fish in a narrow portion of the lake has been devised, which tremendously increased fish recovery and hence, yield. By using this technique in 1973, the state farm was able to harvest about 500,000 kg of fish in a single operation. The total yield that year was 800,000 kg as against 230,000 kg in 1972.

The technique uses one to two

dozen motor boats, about 32 pieces of roughly 2,000 m-long gill nets, and at least 70 people to carry out the fishing operation, which usually lasts 25 to 30 d. The idea is to drive the fish into a selected area. Beginning from the farthest point, the motor boat crews go back and forth in one portion of the lake to scare the fishes by beating the water and driving them towards the concentration area. The exercise is repeated until all the fish are contained within the concentration area, from which they can be seined.

This harvesting method, however, is just one of many management techniques contributing to the present high production.

Management

In large lakes fishing is banned from March to May to protect broodstock during the breeding season. For those species which attach their eggs to grasses or plants, clusters of floating aquatic plants are properly anchored and arranged at intervals over a wide area of the lake to serve as spawning sites and to increase the chance of success in spawning.

Aside from stocking only large fingerlings to reduce predation, control of predators in lakes is also being done in small and medium-sized lakes. Knowing the spawning seasons of predators and their schooling characteristics, control is exercised by destroying spawning grounds and by seining out the schools of their fry.

There are also prescribed months of fishing for certain species and regulation on the size of net mesh.

Some lakes have even been subdivided by embankments of size passable by vehicles. An example is lake Tong-Hu. The construction feat in lake Tong-Hu does not only add beauty to the lake, but, in effect, has also subdivided the lake into several areas for better management. These areas are used for various purposes, such as fry rearing, fish production, and recreation. The waters of the lake remain connected by channels to permit continuous water exchange. Screens are installed to avoid entry of fish from one area to another.