

of carps due to scarce information on the culture of the species and probably low consumer demand.

There is a brighter future for business venture in carps because the fish has several favorable characteristics and uses. Carps are generally used as food. However, Japanese or 'Koi' carp is one of freshwater aquarium fishes that has been exported and has become a source of big dollar earnings to the country.

Moreover, carps thrive in large inland bodies of water such as lakes, reservoirs, and rivers in the Philippines; thus, making the prospects bright for carp culture in ponds, cages, or pens as a successful freshwater aquaculture business.

Freshwater aquaculture in the Philippines, in the past years, has been dominated by the culture of milkfish and tilapia with commercial production contributed mainly by the fishpens/cages in Laguna de Bay. Recently, however, there is a growing interest on the culture of carps arising from the interplay of the following:

1. The decline in the growth rate of milkfish and tilapia experienced in 1984–1985 due to deterioration in water quality.
2. The gaining popularity of common carp as a delicacy in the lake area.
3. The impressive growth rate of bighead carp in the lake and the promotion it is getting from the media.

The foregoing have resulted in an increased demand for carp fingerlings and the apparent shortage of bighead fingerlings and subsequently the emergence of private commercial hatcheries ranging from the sophisticated raceway type set-up to the traditional method of egg collection and hapa hatching.

While these appear to be healthy indications of a growing carp culture industry, a major set back is the

concentration of the technology and marketing outlet within the confines of the lake area.

This situation, when not properly looked into, might result to a sudden boom-bust situation. To sustain the progress of the industry, there is a need to:

1. Promote other equally suitable carp species such as rohu, silver carp, and grass carp;
2. Expand the marketing outlet by introducing the different carp species and their culture technology to the far-flung landlocked areas where there are very limited sources of fish protein;
3. Utilize the different carp species for stocking in open waters and management of communal bodies of water; and
4. Develop the technology on the handling, processing, and preparation of carps so they can be marketed "as is" and not camouflaged as "saltwater fishes."

Finally, better prospects are seen with the adoption of better culture techniques such as stock manipulation and polyculture which form the basic foundation for a high yielding freshwater aquaculture industry in countries like China, India, and Thailand.

Sources of Technologies and Information

The sources of technologies and information on carp culture are from the National Inland Fisheries Research Center of the Bureau of Fisheries and Aquatic Resources (BFAR) in Tanay, Rizal; the Freshwater Aquaculture Center (FAC) of the Central Luzon State University in Muñoz, Nueva Ecija; and the College of Fisheries of the Mindanao State University in Marawi City, Lanao del Sur.

Source:

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The Culture of Carps

Overview

Carp are among the commercially desirable and popularly cultured freshwater fish species in Asia and the Indo-Pacific region. They constitute the largest volume of cultured fish in the world.

Fish oil, fish protein concentrate, and other value-added products can also be derived from carps. The major carp species discussed here are the common carp (*Cyprinus carpio*), the grass carp (*Ctenopharyngodon idella*), and the bighead carp (*Aristichthys nobilis*).

The Breeding of Carps

Selection of Breeders

In selecting breeders, body form, fecundity, and age are considered. Healthy males and females with soft and relatively large bellies or abdomens should be selected for breeding. A gravid female has an evident soft, round, and bulging abdomen, and swollen pinkish genital pore. The male has comparatively longer and stouter pectoral fins than the female. The number of eggs to be collected in a female varies with size and proper feeding of the female broodstock.

To ensure the fertilization of the eggs, the weight of the male should be double that of the female. Carp breeders must be of the same variety and free from abnormalities. Good selection will determine the capacity for growth of the offspring.

Spawning techniques

Natural spawning - The stocking density of the breeders can be one per 10 m² with 2–3:1 male to female sex ratio. To facilitate spawning, some materials for the attachment of carp eggs should be provided. The materials may consist of submerged weeds like Hydrilla or Najas, floating weeds like the water hyacinth (*Eichornia crassipes*) or artificially made egg collectors called 'kakaban'.

The spawning usually begins shortly after bringing the two sexes together. Spawning usually occurs in the early morning. During spawning, the female and the male swim around the water surface, chasing and rubbing their bodies together for the female to lay eggs.

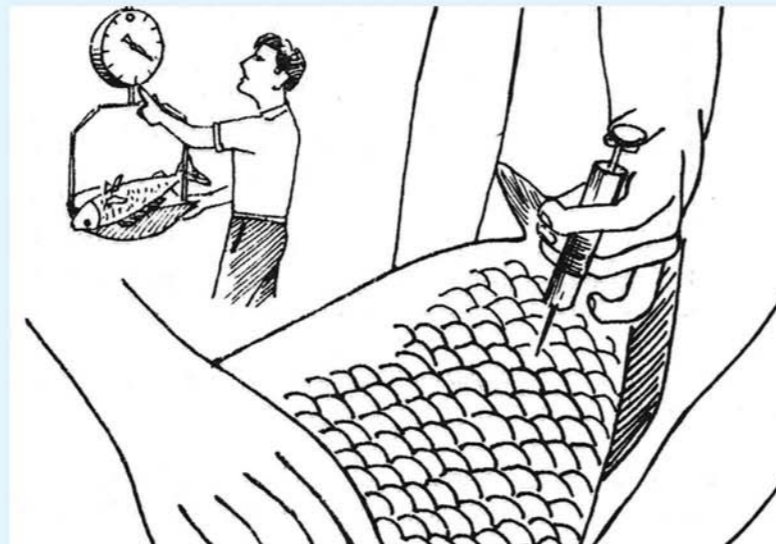
Artificial spawning - The mature fish is induced to spawn by injection with hormones derived either from fish pituitary glands or from other sources.

During injection, the broodfish is weighed to determine the hormone dosage required to induce spawning.

The hormone is injected intra-muscularly behind the dorsal fin.

Injections can be done either as single dose or double doses. In the double method, the injection is given in two doses with an interval of several hours between the preliminary and final doses. In the single method, the inducing agent is given in one complete dose.

The male to female sex ratio of 2:1 or 3:2 is used for induced spawning.



Culture Systems

Healthy carp fingerlings that are free from body deformities should be considered for culture. The fish can be cultured either in monoculture or polyculture. In monoculture, the pond contains only a single species. In polyculture, the pond contains one major fish species combined with different species to fully utilize the available natural food in the pond.

The most common method of growing carps is by pond culture. The size and shape of fishponds can vary. A water depth of 1.5 m is ideal for carp culture. Prior to stocking, the pond bottom should be leveled and exposed until it is completely dry. Thorough conditioning of the pond bottom helps eradicate fish predators.

The common carp (a bottom feeder) is usually grown in combination with other fish like tilapia.

The grass carp is a plant-eating fish that can subsist on low-cost and available vegetative materials.

The bighead carp is commercially cultured in pens and cages in Laguna de Bay and Lake Buhi. It feeds on zooplankton or microscopic animals in the water.

Combined Culture System

Under pond conditions, the fishes that can be cultured in combination are:

Species	Stocking Rates
Phytoplankton-feeder (silver carp)	20%
Zooplankton-feeder (bighead carp)	20%
Column feeder (rohu)	15%
Bottom feeder (common carp)	30%
Macrovegetation feeder (grass carp)	15%

This system of combined culture utilizing species of fish with stratified and complementing feeding habits is widely practiced in China (polyculture) and India (composite fish culture). This enables maximum

utilization of all the available space and natural food and maintains a balance in the pond ecosystem.

Polyculture ponds should not be less than 0.5 ha and a minimum water depth of 1 m should be maintained. Prior to stocking, ponds must be properly prepared and fertilized with organic manure at a rate of 1,000 kg/ha and the growth of natural food sustained by periodic application of the same. The recent practice is the incorporation of animal husbandry (pig or chicken) with fish culture, a system known as integrated farming to ensure supply of cheap organic fertilizer to the pond.

The stocking density of fish in polyculture ponds practiced in China is 15,000 to 20,000/ha.

Although a polyculture system can depend only on the natural productivity of the pond, supplemental feeds such as bean cake, rice bran, and rice bran-fish meal at a rate of 2% body weight for bighead carp, silver carp, and rohu; and 5% body weight for common carp may be given. However, grass carp should always be supplied with macrovegetation at 100% body weight per day.

Growth rate is a function of the species cultured, stocking rate, nutrition, and competition. Grass carp grows to 650 g and 30 cm in the first year, 2–3 kg and 60 cm in the second year and can grow up to 35 kg. Silver and bighead carps grow to 0.5–1.5 kg and 40 cm in the first year, attain maximum growth of about 75 cm in length in the second year and can grow up to 40 kg.

Prospects of Carp Culture and Hatchery

The Philippines is rich in natural resources, particularly in endemic fish species. However, several fish species were introduced in inland bodies of water and among these are several species of carps. Carps have been recognized to have great potential for the aquaculture industry. In spite of this, few farmers have engaged in the commercial culture