



FISHERIES SCIENCE II

CULTURE OF FRESHWATER FISHES

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CULTURE OF FRESHWATER FISHES

Carp are various species of oily freshwater fish from the family Cyprinidae.

They are mainly used for aquaculture practices and as aquarium fishes.

Major Indian carps

- *Catla catla*(**catla**)
- *Labeo rohita*(**rohu**)
- *Cirrhinus mrigala* (**Mrigal**)

Catla catla

• **Catla** (*Catla catla*), also known as the **major (Indian) carp**.

- With large and broad head, a large protruding lower jaw, and upturned mouth. It has large, greyish scales on its dorsal side and whitish on its belly.
- Catla is a surface and midwater feeder. Adults feed on zooplankton, but young ones on both zooplankton and phytoplankton.
- Catla attains sexual maturity at an average age of two years and an average weight of 2 kg.



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Labeo rohita(rohu)


- The rohu is a large, silver-coloured fish of typical cyprinid shape, with a conspicuously arched head. Adults can reach a length of up to 2 m and a weight of up to 45 kg.
- Rohu is a bottom feeder and prefers to feed on plant matter including decaying vegetation. Rohu attains sexual maturity towards the end of the second year in ponds.

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Mrigal (*Cirrhinus mrigala*)

- Known as the **white carp**, is a species of ray-finned fish in the carp family
- Body bilaterally symmetrical and streamlined, its depth about equal to length of head; body with cycloid scales, head without scales; snout blunt, often with pores; mouth broad, transverse; upper lip entire and not continuous with lower lip, lower lip most indistinct.

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- Hatchlings of mrigal normally remain in the surface or sub-surface waters, while fry and fingerling tend to move to deeper water. Adults are bottom dwellers.
 - Detritus and decayed vegetation form its principal food components, while phytoplankton and zooplankton comprise the rest.



Exotic carps

- Silver carp (*Hypophthalmichthys molitrix*)
- Grass carp (*Ctenopharyngodon idellus*)
- Common carp (*Cyprinus carpio*)

Silver carp

- The **silver carp** is a species freshwater cyprinid fish, a variety of Asian carp native to China and eastern Siberia.
- Unusual eye positioning. Its eyes are situated far forward on the midline of the body and are slightly turned down.
- They have very tiny scales on their body but the head and the opercles are scaleless



Grass carp

- The **grass carp** (*Ctenopharyngodon idella*) is the species of fish with the largest reported production in aquaculture globally, over five million tonnes per year.
- Used as weed control.



Common carp

- The common carp is native to Europe and Asia, and has been introduced to every part of the world except the poles.
- Common carp are omnivorous. They can eat a herbivorous diet of water plants, but prefer to scavenge the bottom for insects, crustaceans (including zooplankton), crawfish, and benthic worms.



PREPARATION OF PONDS

- Making the ponds, weed and predator-free and generating adequate natural food for the survival and growth of fishes.
- Weeds have to be removed from the ponds first, after which the tank is fertilized with both organic and inorganic fertilizers, such as Oil Cake and raw cow dung @ 5,000 kg/acre.
- The PH of pond water should be 7.5 – 8.00, for which lime is added in the tanks @ 200 kg/acre per annum.

- The organic fertilizer in the form of raw cow dung is added in the tank @ 500 kg/acre per annum. This is followed by the application of inorganic fertilizers like Super Phosphate @ 120 kg/acre and Ammonium Sulphate @ 200 kg/acre, in spaced intervals.

CHOOSING BROODERS

- Both female and male brood fish should be carefully tended for 2-3 months before induced spawning operations are carried out and males and females should be segregated and kept in separate ponds.
- To be good brooders the fish must be more than one year old and 150 gm in weight.


INDUCED REPRODUCTION IN FISH

- Inject the fish with one or more naturally occurring reproductive hormones or their synthetic analogs to manipulate maturation of gonads and ovulation.
- The hormones injected include, **Gonadotropin Releasing Hormone (GnRH)** analogs, dopamine antagonists and gonadotropins. **Leutinizing Hormone Releasing Hormone (LHRH)** is a mammalian hormone that has been employed successfully to induce reproduction in fishes.
- **Dopamine** inhibits the action of LHRH and hence a dopamine antagonists are given for induced breeding.
- Ovaprin is commonly used.

OVULATION & FERTILISATION

- **Stripping** the fish is done by holding the female around the caudal fin with one hand, while applying slight pressure to the abdomen with the other hand. A stream of eggs will eject through the genital opening.
- The milt from a male fish is made to drip on the eggs by pressing the testes with fingers and pouring the water through the fine mesh cloth.
- Eggs and sperm are mixed and stirred gently. After about two minutes, water is added two or three times to cleanse the fertilized eggs and then they are transferred to the hatching happas, where most of the fertilized eggs hatch out within 24 hours.


- The yolk sac is absorbed in the body of fry in about 2 days, and then the larvae are transferred from happas to the nursery tanks, where the fries feed and grow.
- Food has to be given during the first 3 weeks and when the fries reach the size of 2–3 cm, they are distributed in the rearing tanks where they are cultured further to adult marketable stage.

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- **Nursery ponds** are constructed to rear carp fry or larvae. A normal sized nursery pond measures 5 x 10 m, with a depth of 0.5 m.
 - About 1,500 to 3,000 fries can be stocked in the nursery pond and fed with milk, wheat flour or boiled egg yolk by spreading it on the water surface.

• **Rearing ponds**, where adult carps are cultured until they reach marketable size, are needed, which have dimensions of 15 x 50 m and depth of 1.5 to 2 m.

• Rearing ponds should also be thoroughly cleaned before filling them with water. This is done by exposing the bottom and letting it dry thoroughly.

• Next step involves application of fertilizers, which encourages growth of aquatic plants, moss and algae, which are important natural food and also lead to growth of micro fauna

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- Manure in the form of chicken dropping is the most commonly used being cheaper and more readily available in large quantities.
 - When carp fry reaches the length of about 5 to 7 cm, they are transferred from the nursery pond to the rearing pond and allowed to grow to adult stage.

STOCKING OF PONDS

- Ponds are stocked with fish fries of appropriate size. Fingerlings of over 10 cm in size are recommended for stocking in culture ponds.
- Generally, a density of 5,000 fingerlings is kept as a standard stocking rate per ha for carp polyculture, which will give a yield of 3-5 ton/ha/yr.

POST-STOCKING POND MANAGEMENT

- While fertilizing the carp ponds, 20-25% of the total amount of organic manures is applied a fortnight before stocking and the remaining amount is applied in equal instalments on a bimonthly basis.
- Other commonly used organic manures include poultry manure, pig dung, duck droppings, cow dung, domestic sewage, etc.
- *Azolla*, a nitrogen-fixing fern is used as a bio-fertilizer for aquaculture at the rate of 40 tonnes/ha/yr, which supplements nutrients required for intensive carp culture.

HARVESTING

- Harvesting of fishes is usually done after a culture period of 10 months to one year.

Polyculture

- **Polyculture is the practice of culturing more than one species of fish in the same pond.**
- **The basic principal of polyculture is that the cultivation of various fish species having different food habits.**
- **To maximize the total production per unit area with the proper utilization of available food in a pond.**
- **There should be a compatible combination of species with diversified feeding habit that should include surface/column feeders to bottom feeders as well as omnivorous to macrovegetation feeding fish species.**

Polyculture or mixed fish farming or composite fish culture is the culture of fast growing compatible species of fishes of different feeding habits (or different weight classes of the same species) in the same pond so as to utilise the various available ecological niches in order to obtain high production per hectare of water body.

A pond according to its depth can be divided into three distinct zones — upper surface zone, middle column zone and bottom zone. A particular species exploits food of a particular zone. For example — *Catla catla* is a surface feeder, *Labeo rohita* a column feeder and *Cirrhinus mrigala* is a bottom feeder.

Principle of Polyculture:

When different species of fast growing compatible fishes, occupying different ecological niches of a pond or any water body, are cultured together, they most efficiently utilise all the food sources available in the pond for fish production without harming each other.

Objectives of Polyculture:

- (1) To obtain maximum yield or fish production.
- (2) To utilise all the available niches.
- (3) The fishes cultured should not cause any ecological disbalance.
- (4) The fish species cultured should not have any serious competition between them but each species may have a beneficial influence on growth and production of the other.
- (5) Some species of fishes are cultured which have specific roles to play in maintaining water quality in ponds by feeding on wastes accumulated in it.
- (6) Recent combination of fish species cultured are based on one or two species as the main ones and the others as subsidiary compatible species which would be utilising those parts of the food resources that would have been wasted.

The combinations practised in Indian polyculture system

- (1) The surface feeder, catla (*Catla catla*) which feeds on planktonic organisms particularly zooplankton. The larvae and young fry feed on planktonic unicellular algae.
- (2) The column feeder, rohu (*Labeo rohita*) consuming vegetable matter including decaying aquatic plants, algae, etc. Larvae and fry feed on unicellular algae and zooplanktonic organisms.
- (3) The bottom feeder, mrigal (*Cirrhinus mrigala*) preferring decayed plant and animal matter, algae, detritus, organic matter, etc. The larvae and fry feed on planktonic unicellular algae and zooplankton.

(4) The bottom feeder, calbasu (*Labeo calbasu*), feeds selectively on benthic and epiphytic organisms and organic debris.

(5) Modern culturists and scientists have developed composite carp culture by the addition of exotic carps such as grass carp, silver carp and common carp.

(6) New species combinations for polyculture have been developed through the introduction of benthic-feeding grey mullets (*Mugil cephalus*). The introduction of carnivorous fish, chital (*Notopterus chitala*), has been done for the control of weed fishes.

Drawbacks in Polyculture System:

1. Generally the lesser number of species combinations with clearly understood specific roles are widely accepted. However, in case of larger species combinations, the question has arisen as to the value of some of the species in such combinations.
2. Although there are clear-cut differences in food preferences in natural conditions, the relevance of such feeding differences is yet to be assessed when the stocks are fed with formulated feeds.
3. It is not very easy to adopt supplementary feeding in an economical way.

4. Special skilled knowledge and efforts are required by the farmers to produce or purchase the appropriate numbers of seed stocks of the different species selected to maintain optimum balance of the species.
5. Additional labour is required for sorting out the different species after harvest.
6. In many instances, consumer acceptance of the different species varies in most areas. Difficulties have also been experienced in finding markets for certain species like the silver carp.

It has been found and proved that modern monoculture with proper feeding can be more productive than polyculture. Thus, it is opined that the value of polyculture depends very much on the situation and needs in a particular area. Polyculture probably is not widely applicable as was generally considered.