Fishery Science - Paper - XIII . B.Sc. III Year

Paper Name :- Aquaculture Technique & Fish Nutrition

Unit - I - Fish culture

Fishes cultured for the purpose of food, aquarium, scientific reason, obtain the vitamin & mineral & Protein,

some organism are useful for ornaments.

fishes are cultured their different feeding and survive habitat.

1) Culture of Indian major carps :-

i) General Biology :-

→ Amongst the group of cyprinids known as the Indian carps, three species are of greatest economic importance. They are catla (Catla catla), rohu (Labeo rohita) and mrigal (Cirrhinus mrigala).

Some lesser importance are calbasu (Labeo calbasu), reba (Cirrhinus reba), white carp (Cirrhinus cirrhosa) bata (Labeo bata) and fringe-lipped carp (Labeo fimbriatus).

The original habitats of the three Indian major carps are the rivers and backwaters of Northen India, Pakistan and Burma.

The major carps have also been introduced into many other areas and countries.

Though the Indian major carps are widespread cosmopolitan acceptance as the major carps, which are more adaptable and tolerant to a wider temperature range. So, they are the most important cultured fish species in India, Pakistan and Burma.

Under farm conditions the Indian major carps grow rapidly, reaching marketable size within one year in tropical and subtropical countries.

'Catla is the fastest growing species in natural water it frequently attains 300 - 400g in the first year, over 2kg at the end of second year and 5 - 6 kg after three years.

Rohu do not grow as rapidly as catla, often attaining 500 - 1000 g in the first year under good farm

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The growth of mrigal is poorer than that of catla & rohu.

As is the case for all cultured fish species, growth of farmed Indian major carps is a function of stocking density, availability of natural and supplementary food, competition with other species in the same pond and environmental conditions.

The food and feeding habits differ between the three Indian major carp species. Catla are "surface" feeders, mainly collecting the zooplankton [illegible]. They occasionally also feed on the bottom, utilizing organic detritus, remnants of aquatic plants, and mud rich in organic matter.

Rohu is a mainly bottom and column feeder, preferring plant material including decaying vegetation.

Mrigal have a narrower range of acceptable food, being bottom feeders living mainly on decaying vegetation. [illegible]

The Indian carps do not breed naturally in ponds or other confined waters. They are all river spawners, having semi floating, non-adhesive eggs.

The eggs have a perivitelline space, and during swelling they increase their size by about ten times. Swollen water-hardened eggs are rather delicate and do not tolerate physical shocks. This sensitivity to mechanical damage is a very important consideration when Indian carp eggs are to be incubated artificially.

The Indian major carps normally attain sexual maturity in their second year.

The fecundity and breeding habits are similar in all the Indian major carps. Fecundity depends on the nutrition and living conditions of each individual. Generally females spawning for the second and third time produce relatively the most ova, i.e. 1,00,000 to 2,00,000 eggs / 1 kg of body weight. Major carps are spawned in start of rainy season.

Artificial and Semi-Artificial Propagation :-

→ **Bundh breeding :-**

Bundh is a local term which means a dike or an embankment. Bundhs are special [illegible] categorized into two types i.e. perennial types which are commonly -

referred to as wet bundhs and the seasonal ones, called dry bundhs.

Wet bundhs are ponds located in the slope of a vast catchment area. They have proper embankments equipped with inlets at the up-land side and outlets towards the low-land zone. During heavy rain, a greater portion of bundh fill by water. The excess water flows out through the outlet. A wet bundh can be of any shape and dimension. The area of the bundh is considered ideal for breeding.

A dry bundh is a shallow seasonal pond, or just a depression in the land, bounded by embankments on three sides which impounds freshwater from the catchment area during the monsoon season. It remains dry of the greater part of the year.

The seed produced in wet bundhs is not as pure as that obtained from dry bundhs because in addition to carps the perennial ponds of wet bundhs also harbour many varieties of unwanted fishes which breed along with the major carps. The wet bundhs being larger and deeper are also more difficult to manage than dry bundhs.

Rohu & mrigal will spawn naturally in bundhs because river like conditions are simulated during the spawning season. Fully broodfish are stocked into the bundh either immediately after the first rain water has accumulated or when more water is present but levels are still low. When the monsoon begins, bringing torrential rain, the water level in the bundh rapidly increases, which stimulate natural spawning. The fertilized eggs are either allowed to hatch in the bundh or are collected with fine-mesh nets. The bundh spawning system might be considered primitive, but it has the advantage that it does not require hypophysation or specialized infrastructure.

Some places the bundh ~~breeding~~ spawning system combine traditional methods with the use of hypophysation. The proper selection of breeders, sex ratio and a definite stocking rate in dry bundh breeding.

In certain places some of the breeders from the selection of breeders, ~~sex ratio and a definite stocking rate to dry bundhs breeding~~. from the selected lot are kept in separate hapas according to sex.

Artificial propagation and Production :-

→ The Indian carps are in every respect suitable also for artificial propagation. The broodstock can easily be raised in ponds if provided with the required space, healthy environment, natural and sometimes artificial feeds.

Indian major carp brooders are normally raised in polyculture with other carps. Sufficient natural food can be provided by manuring the brood fish ponds.

The selection of male and female fish with good potential for use as brood fish is easy during or shortly before the normal spawning season. Females "ripe" for hypophysation have soft, bulging, but elastic abdomens, the sexual opening and anus are swollen and pink or red coloured. Males are more slender and usually ooze milt. The dorsal sides of the pectoral fins are rough, as are the scales and head.

Ideally, selected brooders should be injected and placed separately in ward tanks immediately after measuring or estimating their body weight.

Obtaining fertilized eggs :-

The period during which Indian major carps can be induced to spawn is fairly long, for example in northern India from April to June, and in the Southern part from June to August. In both cases these periods mark the start of the monsoon.

Indian major carps can also be induced to spawn in "Breeding hapas" box-shaped containers made of close-meshed mosquito net cloth, kept stretched by ropes at each of their four top and bottom corners tied to bamboo poles.

Incubation of the eggs :-

Many different incubation techniques have been practised with Indian major carps, with varying success. Where no water current is available, incubation hapas are used, but in these many eggs frequently suffocate and die.

Now a days the fertilized eggs are incubated in adjoining small round tanks receiving a continous supply of water.

Requirement of the developing eggs :-

→ Suitable water temperature. For Indian carps 27°C is optimal (range 24°-30°C).

→ Continuous supply of oxygen to every egg in the incubator. Following water should contain

→ Removal of toxic metabolites (Co2, ammonia, etc) which is effected automatically by the continuous water flow.
→ The water inflow should be regulated so that it does not cause mechanical damage to the eggs. which are especially sensitive in the early stages of development.

Nursing Post-larvae :-

When 3-4 days old, larvae are stocked into a well prepared nursing pond.

Fertilization of the nursery pond is commonly done with 10000-15000 kg of organic manure such as cowdung, and 300 kg of lime per hectare.

- The fish feed will provide as per requirement. The stocking density is according to capacity of pond & species.

Two to three crops can be easily harvested in one breeding season.

Fry rearing :-

Rearing of fry of about 20 mm length up to fingerling size (about 150 mm) is done in slightly bigger ponds of 0.1 ha.

Preparation of these ponds involves clearance of weed, eradication of aquatic insects and undesirable fish, and fertilization with organic manure.

The stocking density of 0.3 million / ha. the fry grow up to about 70-100 mm fingerlings in 3-4 months, with 70 to 80% survival.

Stocking pond rearing :-

Indian carps are often stocked in polyculture with chinese carp. examples are as follows

i) Catla and silver carp :- Catla and silver carp are both planktonophagous surface feeders, though catla eat predominantly zooplankton and silver carp phytoplankton.

ii) Mrigal and common carp :- Mrigal and common carp appear to similar, when supplementary feeds are given in large quantities, common carp stocked density perform much better than mrigal.

iii) Grass carp and other fishes :- Grass carp is stocked with rohu mrigal and common carp. This combination utilize the rice bran & oil cake with aquatic weed.

Stocking ratio :-

Catla and silver carp is stocked by 30 to 35%. Both catla & silver carp feed mainly on the surface and thus they grouped as surface feeder.

The Rohu stocked with 15 to 20%.

The mrigal and common carp stocked about 40-45%.

For utilizing aquatic weed the grass carp stocked 5 to 10%.

Supplementary feeding :-

The Indian major carps readily accept various kinds of feeds offered by the farmer in a systematic and organized way.

It has been experienced that through systematic supplementary feeding the production of the pond can be doubled or tripled.

Such feeding is also beneficial in ponds where the soil and water are too poor.

The most important supplementary feeds used for the Indian carps are.

1) Agro-industrial by-Products such as brans (Wheat and rice) and oil cakes (groundnut and mustard)

2) Industrial wastes from tomato and juice factories, beer-breweries etc.

3) Grains and coarse flours from part of fish edibles only when they have deteriorated or burnt, making them unsuitable for human or warm blooded animal consumption.

For special purposes such as farming broodstock, feeds of animal origin are used such as fish-meal, blood meal and silkworm pupae.

Harvesting :-

The catla, grass carp, silver carp and common carp under proper management can attain the marketable size of 1 kg in about 4-5 months.

After harvesting the new fingerlings stocked by periodic it helps in raising more than one crop of a species in the same pond in single year.

The surface feeders are easy caught with a seine net or drag net.

2. Culture of air-breathing fishes :-

Culturable species :-

1. Channa straitus - Bis or striped murrel or snake head fish
2. Channa punctatus - spotted murrel.
3. Channa marulius - Giant murrel
4. Clarias batrachus - Magur
5. Heteropneustes fossils - Singhi
6. Anabas testudineus - Koi or climbing perch.

→ Out of these, Channa striatus has highest demand in the market and is also commands a higher price.
→ Next best are Clarias batrachus and Heteropneustes fossils.
The culture of the above species is profitable.

Culturable Areas :-

The culture of air breathing fishes needs shallow waters with a depth of 50 - 75 cm.

Ponds for air-breathing fish culture need not be fertilized by chemicals.

Air breathing fishes may also be cultured in cases in running water systems like streams, canals and unmanagable waters like reservoirs.

The air breathing fish culture is equally adaptable in waters unsuitable for conventional culturable species of carps as well as in carp culture ponds.

Shallow ponds are useful for fishes, in which the fish has to spend less energy in travelling to surface for intake of atmospheric oxygen.

Seed collection :-

The seed of murrel, magur and singhi are collected from the natural resources, inspite of success achieved in induced breeding.

Even today, seed collected from nature continues to be the most dependable source of material for stocking.

Murrels attain maturity in two years are known to breed throughout the year.

The fry of 2-4 cm can be collected all round the year and from rainted ditches and shallow water bodies with abundant weeds. However peak spawning is known to occur just before the monsoon.

The young ones emerging from the eggs move in shoals (group of fishes) and their collection in large numbers is always easy.

The fingerlings may not tend to move in shoals.

Fry of giant murrel can be identified by their dark grey body and a lateral orange yellow band from eye to the caudal fin.

Fry of stripped murrel have bright red body with reddish golden band and a dark black band from eye to the caudal fin.

The spotted murrel fry can be recognised by their dark brown body with a golden yellow lateral band and a mid dorsal yellow line on the back.

The fry reach the fingerling stage of 4-6 cm length within a month. The catfishes breed twice in a year with the peak breeding season during rainy season.

Magur fingerlings can be identified with their longer dorsal fin and slate colour.

Singhi fingerlings are having a short dorsal fin and pink colour.

Koi fingerlings can be identified by the dark spot on the caudal peduncle and greenish hue on the dorsal surface of the body.

The magurs make a hole of 25 cm depth in the bundh below the water surface.

The fertilised eggs adhere to grass and are guarded by the males. 2000 - 15,000 fry can be collected from each hole with the help of small fine meshed hand nets and reared in nurseries until they reach fingerlings stage with about 5 cm in length.

⇒ Magur can be cultured in ponds for the production of fry by making a compartment in pond. At the centre of each compartment, a hole of 30 cm diameter is dug and is provided with few aquatic plants.

After releasing both the sexes, about 5000 fry can be collected from each compartment within 10 days.

The peak season for the collection of seed of singhi is pre-winter period when paddy is harvested.

Seed Transport :-

The fry or fingerlings of air breathing fishes can be transported without oxygen packing.

Polythene drums or iron drums are used for transport of fry or fingerlings.

The carrier must have enough space for their habitat surfacing to breath atmospheric air.

The carrier should have a small amount of aquatic weeds like Vallisneria, Hydrilla, Myriophyllum and Ceratophyllum. The weeds may help to avoid jumping of the fish during transportation. If the distance is more, it is better to transport them in oxygen packed polythene containers.

Pond management :-

Nurseries are about 10-15 m^2 having a water column of 50cm.

These are stocked with 0.2-1.5 million fry/ha.

Prior to stocking, manuring is done with raw cattle dung at the rate of 500kg/ha alone.

The soap-oil emulsion to eradicate insects is applied to the nursery water.

Fry and fingerlings of magur and singhi collected from natural resources require nursery management, BW, murrels have to be trained in nursery ponds before stocking.

After nursery management the fingerlings are to be transferred in stocking ponds.

Stocking :-

Uniform sized fingerlings are chosen for stocking.

The fingerlings are disinfected with 2% $KMnO_4$ solution for 5 minutes or dipped in 200 ppm formalin solution for 50 seconds before stocking.

Wounded fingerlings are treated with 0.3% acriflavine for 5 minutes. These fishes may escape through climbing or burrowing.

Cat fishes can be stocked by 40,000 to 60,000 fingerlings/ha or cat fishes can be stocked in monoculture systems.

In polyculture systems 20,000 to 30,000 fingerlings/ha of cat fishes may be stocked.

In monoculture systems, 15000 fingerlings/ha of giant murrels, 20,000/ha in case of stripped murrel and 20,000-30,000/ha in case of spotted murrel are stocked.

In polyculture systems, stripped and spotted murrel may be stocked at a rate of 20,000 fingerlings/ha in the ratio of 1:1, Polyculture of murrels - carps and catfishes - carps is also possible with proper care and management.

Feeding :-

To maintain an abundant food supply for growing air breathers, the stocking pond must be rich in animal food source like frog tadpoles and trash fish.

If this food source is not sufficient tilapia may also be grown in murrel and cat fish ponds.

Dried marine trash fish also used in fish culture and is more economical.

Feeding can be given to catfishes with fish offal or slaughter house waste, dried silkworm pupae mixed with rice bran and oil cake in the ratio of 1:1:1:1.

A mixture of oil cake, rice bran and bio-gas slurry in the ratio of 1:1:1 has provided successful low cost feed for singhi.

Rice bran and poultry feed in 3:1 and biogas slurry and rice bran in 1:2 also be given at the rate of 5-8% of body weight.

The feed may serve in the pond in small amounts from the bundh or may served in feed baskets lowered near the bank in addition to feed for fishes.

Trained murrel fingerlings will also accept cheap dried marine trash fish soaked in water, slaughter house waste and silkworm pupae as a source animal protein can also be used.

Growth and Production :-

If the management practices are proper, giant and striped murrels can attain a growth of 1-2 kg/yr and 0.75 kg/yr respectively, whereas spotted murrels grow to 160 grams in 8 months.

Cat fishes are known to grow slowly when compare to murrels. Magur and singhi grow to 0.2 kg and 0.1 kg respectively. The conversion rate with recommended feed is approximately 2:1

Murrels with forage fish as supplementary food yield about 4 tonnes/ha/yr.

Magur with dried trash fish and rice bran supplementary feed, give the production of 10 tonnes/ha/yr. Singhi gives a yield of 4.4 tons/ha/yr.

Polyculture of murrel and koi; fed with rice bran, mustard oil cake and trash fish, gives a production of 11.8 tons/ha/yr. While magur and singhi fed with rice bran and trash fish give an yield of 5 tons/ha/yr.

Mixed culture of 3 species of murrels produce 4 tonnes/ha/yr when fed with soaked and dried marine trash fish

and fresh fresh silkworm's pupae as food. In the intensive culture magur can give 7 tonnes/ha/5 months.

Culture with Carps :-

With a stocking density of 5000/ha of Indian and chinese carps and 1.000 magur fingerlings produce 2.518 kg/ha/yr of carps and 3,711 kg/ha/yr of magur.

With a stocking density of 20,000/ha of magur along with left over carps production of 3.96 tonnes/ha/yr is obtained with 50:30:17:3 ratios of rice bran, fish meal, ground nut oil cake and minerals as supplementary feed.

Harvesting :-

Summer season is ideal for harvesting air-breathing fishes from ponds.

The pond is drained and the fishes are harvested with the help of scoop nets or hand nets.

Due to their high demand and marked price, the culture of this air-breathers provide profitable income to fish farmers with simple management techniques.