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Aquaculture: Fin Fishery

Economic Importance of Fishes

- Fishes constitute an economically important group of vertebrates.
- These have influenced human life in various ways.
- These have constituted as an important source of food for man .
- To date, this has developed into a flourishing fish industry and a means of earning foreign exchange by exporting fish and fish products.
- In addition to serving as ah important item of food, fishes provide several byproducts.

Uses of Fishes

1. **As Food**:
   - The fish are being used as food in man.
   - These are consumed in almost all the countries of the world.
   - The fish is eaten fresh, salted, smoked, prickled or canned.
   - The fish diet provides proteins , **fats and vitamins A and D.**
2. **Fish Meal and Fish Cake** :
   - The scrap from canneries and the small fishes not relished as food by man are dried and ground into fish meal.
   - The **fish meal** is used as **food for poultry, pigs and cattle**.
   - The fish are **cooked** in large pots containing water.
   - The **cooked fish** are pressed to remove water and dried in the sun.
   - The dried, **sterilized** product can be stored for a long time.
   - These are called **fish cakes**.
   - The fish meal **cotains about 60%** protein and high percentage of calcium and phosphorous.
3. **Fish Manure** :
   - **Fish manure** is prepared from those fishes which are not relished by man,
   - Such fish are sun-dried and then ground.
   - The fish flour is used as manure that provides nitrogen, calcium and phosphorous.
4. **Fish Guano** :
   - It is prepared from material left after extracting oil from fish body.

- It contains **8-9% nitrogen and phosphorous** and is used as manure.

5.Fish Oil:

- A few groups of fishes yield fish oil.
- It can be body oil extracted from **fish body or liver oil** obtained from fish liver.
- Liver oil is rich in **vitamin A and D**, while body oil contains them in traces.
- The fish liver oil had medicinal use and is administered as source of vitamin A and D.
- **Liver oil** is prepared from the liver of sharks and rays, cods, halibuts and tunas.
- The liver is cut into small pieces and boiled in sufficient quantity of water.
- The oil contains 5-10% protein and vitamin A and D.
- This oil is used in poultry farming also.
- The fish body oils are used in painting, varnishing, soap, candles and in leather and steel industries.
- For preparing body oils, the fish are boiled in water and oil is washed in boiling salt water.
- It is prepared from **sardine, herring and salmon.**

6.Fish Flour:

- This is actually fish manure but is comparatively fine and of better quality.
- It is used in preparing bread, biscuits, cakes and sweets by mixing with wheat or maize flour.

7.Fish Protein:

- The fish protein is prepared by removing fats from fish flour.
- It is sold in the market as a white powder without any fishy smell.
- It contains 80-90% soluble proteins.
- This is used in the preparation of certain medicines and also for increasing the protein content of bread, ice cream and cake.

8.Glue:

- Liquid glue is prepared from the connective tissue of fish skin, fins and bones.
- The glue is used as an adhesive in book-binding, sticking labels, wood, leather, and glass and in the **manufacturing of furniture.**

9.Isinglass :

- The air bladder of certain fishes is used in the preparation of collagen of fine quality.
- It is in the form of shining white powder, used for clearing wine, beer and making edible jelly.
- The air bladder is removed from fish, washed in cold water and is flattened by beating it on a

piece of wood.

- It is dried and used in the preparation of isinglass.

10.Fish Leather :

- The thick skin of certain fishes like sharks and rays is utilized in the preparation of fish learner.
- This leather is used in the manufacture of purses, bags, ladies shoes, boxes and suitcases etc.
- Because of the presence of placoid scales, the skin of sharks and rays is rough and looks more beautiful.

11.Shagreen:

- The rough skin of sharks is used in rubbing and polishing the furniture and is called shagreen.

12.Fish fine:

- The fins of sharks are exported to China where these are greatly appreciated for preparing soup.

13.For Manufacturing of Artificial Pearls:

- The materials obtained by scrapping the silvery coating of the scales of certain fishes are called guanine.
- It is used for polishing the hollow glass beads.
- These beads are then filled with wax and marketed as artificial pearls used in jewellery.

14.For Sport and Games:

- Fishing forms an important outdoor game for millions of people, who catch various species of trouts, salmon carps and other species of fishes.

15.For Decoration:

- Several species of beautifully coloured fishes are kept in aquaria, ponds and lakes, and used for ornamentation.
- They are bred and maintained by stockists who offer numerous varieties for this purpose, and earn their livelihood from mis trade.

16.Biological Control:

- Several species of fishes are **larvivorous** in habit and feed upon insect larvae, e.g. **Chela, Puntius. Berilius, Danio, Coliso, Rasbora, Esomas, Ambassis, Aplopoheilus, etc**.
- Several diseases are spread by **mosquitoes**, hence the **larvivorous** fishes are introduced in the waters of the area.

- They feed upon larvae and help in reducing the population of mosquitoes.

17.Evolutionary Significance:

- The Choanichthyses or Crossopterygian fishes are very important as these provide evidence for the evolution of tetrapods, the land vertebrates.
- The lung fishes are spoken of as the **' land dwellers'.**
- These and first amphibians have a common grandfather having arisen from some common primitive ancestral fish stock.

Harmful Fishes

- Certain fishes are harmful in the following ways :

1.Host for Certain Parasites: Some fish species act as intermediate host of many human parasites and thus help in the dispersal of many human diseases.

2.Predators: Sharks attack man and prove fatal. These injure fisherman and damage their nets.

3.Poisonous Fishes: Certain species of fishes have poisonous sting or spine (sting ray) and cause painful wounds, which are found to be fatal, though not always. Flesh of some fishes is poisonous.

4.Electric Fish: Some fishes have electric organ and produce electric shock. The shock may prove to be fatal to small animals and sometimes even to man.

Importance of Edible Fishes in Diet

Give a list of major carps.

- The fish are eaten fresh, salted, smoked, prickled or canned.
- The fish diet provides proteins, fats and vitamins A and D.
- It contains 13-30% proteins, and provides 300-1600 calories of energy per gram.
- These are also good source of phosphorous and some other inorganic elements.

Edible Fishes of India

The important edible fishes of India are :

I. Freshwater Fishes

A. Major Carps

1. Rohu - Labeo rohita
2. Calabasu - Labeo calabas

3. Kurchi Bata - Labeogonius
4. Catla - Catlacatla
5. Tor - Tor tor
6. Mirgal - Cirrhina mrigala
7. Punti - Barbus stignna

B. Cat fishes

1. Boal - Wallogoattu
2. Singi - Heteropneustis
3. Mahgur - Clarias batrachus
4. Goonch - Bagarius bagarius
5. Bachwa - Eutopichtkyes vacha
6. Singhala - Mystus (Macrones)
7. Puffta - Ompok bimaculatus

C. Murrels

1. Sal or pumair - Ophicephalus marulius
2. Phool-dhok or Taki - Ophicephalus punctatus

D. Feather backs

1. Chital - Notopterus chitala
2. Pholi - Notopterus notopterus

E. Mullets

1. Mugil - Mugilcorsula

II. Marine Fishes

1. Hilsa - Hilsa hilsa
2. Bindi - Setipinria phasa
   Chupea sp.

PISCICULTURE

Aim of Fish Culture

Following are the aims of fish culture :

1. To obtain maximum **yield of fish**.
2. To obtain highly **nutritive fish.**
3. To obtain **byproducts** of **fishing industry.**

Characteristics of Culturable Fishes

The culturable fishes should be :

(a) Able to feed on natural food.

(b) Able to feed on artificial diet.

(c) Herbivorous in nature.

(d) Able to tolerate a sudden change in climatic conditions and nature of water in ponds.

(e) Fast growing and attains a good weight and height.

(f) Able to live in ponds with other fishes without any disturbance,

(g) Able to consume small quantity of food,

(h) Able to resist against diseases.

(i) A prolific breeder

(j) Palatable and nutritive.

Types of Cultivable Fishes of India

These are of three types :

1. Indigenous freshwater fishes like carps. These include Catla catla, Cir-rhinus mrigala, C. reba, Labeo gonitis, Labeo rohita, etc.
2. Salt water fishes acclimatised to live in freshwater like mullets and chanos.
3. Exotic fishes introduced from other countries like Chinese carp, Common carp, Crucian carp and Mirror carp.

Types of Culture Fish in India

Major carps have been found to be the best culturable fish because :

1. These feed on zoo - and phytoplanktons, decaying weeds and other aquatic plants and debris.
2. These can survive temperature variations and also the turbid water.
3. These can tolerate oxygen variation in water.
4. These can be transported from one place to other easily.
5. These are polatable and nutritive.
6. These have fast growth rate.

Factors that Affect Fish Culture

Fish culture programmes are affected by several environmental factors. These factors are light, rain, temperature, water and water current, turbidity of water. Diseases, pH, hardness, toxic polluntants, dissolved oxygen and hardness of water different species of fish have a temperature above and below which they cannot breed.

Management of Pisciculture or Fish Culture Programme

Management of ponds is of great significance since it involves breeding, hatching, nursing, rearing and stocking ponds. Different stages offish are kept in different types of ponds.

1. Breeding Pond

Some food fishes specially the carps are cultured in ponds or tanks or in special breeding grounds near the river banks. The fish farms are built of a chain of ponds or tanks fed by running water.

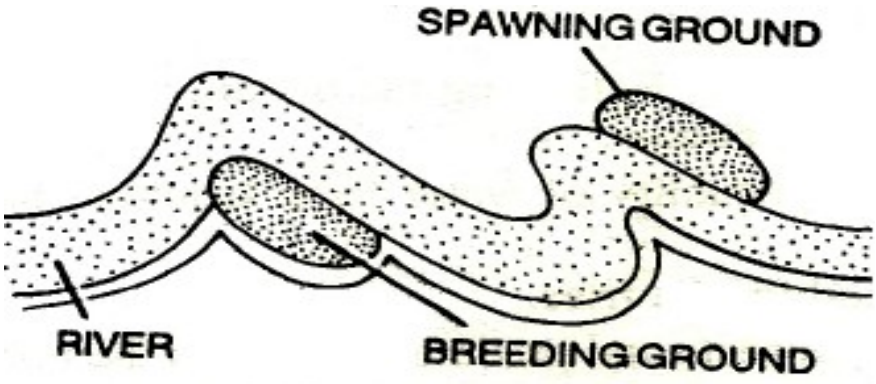
2. Fish Seed

Fish seed is collected from the breeding ponds. The best suited places for the collection of fish seeds are on the curve area of the rivers. The spawn collecting net is called as **Benchi Jal.** It is a funnel shaped structure 10-20 ft in length open at both the ends. At the posterior end of the net is attached a rectangular piece (2'x 1' x 1') called **gamcha.** All stages of fish can be collected in this gamcha from where they are scooped or transferred to the hatching pits.

3. Hatching Pits

The fertilised eggs are kept into hatching pits for hatching. The following points should be kept in mind while making hatching pits;

1. These should be nearer to the breeding grounds.
2. Should be small in size.
3. Should contain only that much water which may dry within a month or two.
4. Hatching pits should be more in number.



Breeding ground of carps in rivers.

Types of Hatching Pits : These are of two types :

1. Hatcharies : These are small-sized ponds in which fertilised eggs are transferred within 2-15 hours hatching takes place. Such hatcharies have following drawbacks :

(a) Sudden variation in temperature.

(b) Predators entrance in ponds.

(c) Mortality of eggs due to drying of pond water.

Thus specially designed hatcheries and hatching hapas are made.

2. Hatching Hapas : These are rectangular, trough-shaped tanks made up of cloth supported by

bamboo poles fixed in the river. In the hapas, fish eggs are aerated by continuous flow of water current. Hapa measures 3' xl-5'xl'. Two types of hapas are made :

(1)Fixed type hapa by fixing the perpendicular poles, and

(2)Floating type hapa made in hard bottoms. Such hapas are made in large number in series attached with the bamboo and floated on water surface.

The hatchlings are kept for 36-48 hours in hapas and then transferred to the nurseries.

4. Transport of Fish-fry to Nursery Ponds

The fish-fries are collected and transported to nurseries. Before transportation, fries are subjected to conditioning by keeping them in water for a certain period of time and then transported in open or closed vessels. Temperature of water of the vessels is kept low to avoid mortality. Dead fries should be removed to avoid the pollution and infections. These days fries are transported in sealed metal containers with oxygen. Alkathene bags are also used for the transportation offish-fries from hapas to nursery ponds.

5.Nursery Pond

Newly hatched fries are very tender. Therefore, their transportation needs utmost care. It's better to have nursery ponds near the hatching hapas. The ideal nursery ponds are 50' x 30' x 4-5'. The ponds should be prepared well before the hatching of fries. The inflow and outflow of water should be under control.

In nursery ponds the resources of food are scarce. Thus all the predatory and weed fishes should be removed from the pond. Chemical fertilisers like ammonium sulphate, sodium nitrate and superphosphate should be added along with 5 to 7 tonnes of cowdung per hectare. Within 10-20 days of adding manure, phytoplanktons and zooplanktons develop in the pond. This provides enough food to the fish-fries.

Mortality in Nursery Ponds : Following factors are responsible for heavy mortality of fish fries in nursery ponds :

1. Sudden change in the quality of water from hatching hapa to nursery ponds.
2. Lack of suitable food for the fries.
3. Presence of predary insects and predatory fishes in the pond.
4. Overgrowth of plankton, thereby depleting oxygen content in the pond water.
5. Cannibalism.

Precautions for Nursery Ponds: To avoid heavy mortality of fish fries, following precautions are to be taken for nursery ponds :

1. Circultion of water should be under control.

2. Ponds should be near the hatching ponds.

3. Fries should be kept in limited number.

4. Proper supply of food material.

5. Ponds should be free of predators.

On attaining a length of 10—15 cm, fries are transferred in the rearing ponds. They are now called fingerlings.

6. Rearing Ponds

The rearing ponds are longer but narrower ponds to provide fingerlings long distance for swimming. The rearing ponds are kept free from toxicants and predators. The depdi of the pond should not be more than 6 feet and contains food material in accordance with the population of fingerlings. On attaining a length of about 20 cm, fingerlings are transferred to **stocking ponds.**

7. Transport of Fingerlings

Fingerlings are transported from rearing ponds to stocking ponds in containers of about 1,000 litre capacity. Such containers are lined internally with foam to avoid physical injury. Proper aeration in die tank is essential during transport. The fingerlings are made inactive during the transport by giving them sedatives like sodium amylate or barbifurate. This helps in less consumption of dissolved oxygen by the fingerlings during transport.

The fingerlings should be properly washed before transperting them. Use of antibiotics, methyll blue, copper sulphate, potassium permanganate, common salt gives the fingerlings protection from parasites, diseases and predators.

8. Stocking Ponds

Before transferring the fingerlings, the stocking ponds should be cleaned of weeds and free of predatory fishes. Proper maturing should be done to increase the growth of phyto and zooplanktons. This provides enough food for the growth of fishes in a stocking pond. For manuring, cowdung is the best. It is added at the rate of 20-25 tonnes per hectare. Chemical fertilisers like superphosphate, ammonium nitrate and ammonium sulphate are also added at the rate of 1000-1500 kg/hectare.

The best time for feeding the fishes is the morning hours. Powdered rice, paddy, mustard, groundnut, and oil cakes are commonly used artificial food for the fishes. These are easily digestible and economically cheap. The quantity of artificial food and die amount of fertilisers added depends on the fertility of the soil, number of fishes and the types of fishes in the stocking pond.

9. Harvesting

The fishes are harvested when they attain maximum length and weight. The smaller fishes are again released into stocking ponds for their growth.

Although, pond culture arose in Bengal and Bihar, is now practised in all other states through

Central and State Fisheries Departments. In addition to carps, mullets, milk fish, pearlspot, tilapia etc., are also reared for sale. Young larvae are transferred to this tank from the hatchery.

BREEDING TYPES

Types of Breeding

The first step in pisciculture is the breeding of fishes. For breeding, special ponds called tht breeding ponds are prepared.

According to the mode, breeding of is two types:

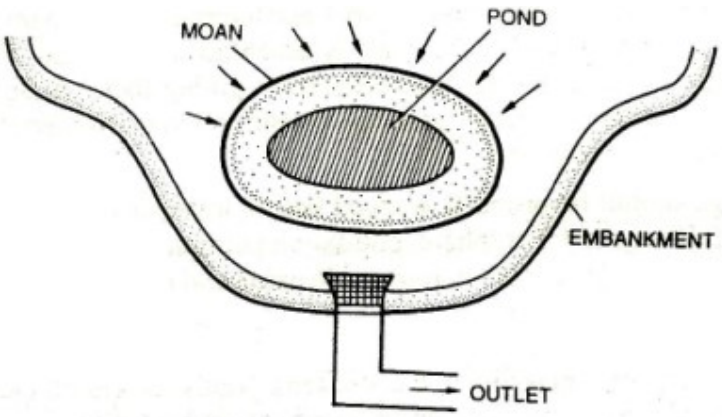
1. **Natural breeding**
2. **Induced breeding**

1. Natural Breeding or Bundh Breeding

- Natural bundhs are special types of ponds where natural riverine conditions are maintained for the breeding of fishes.
- Such bundhs are constructed in low lying areas where large amount of rain water can be accomodated.
- Such bundhs have an outlet for excess rain water.
- These bundhs are used as spawing ground and are of three types:
  1. **Wet bundhs**
  2. **Dry bundhs**
  3. **Modern bundhs**

1.Wet Bundhs :

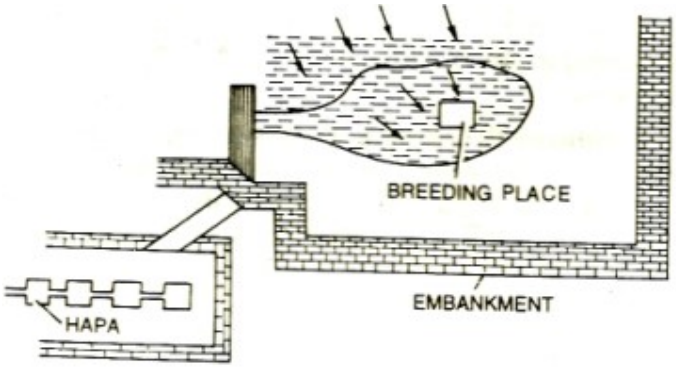
- These are permanent bundhs which have water throughout the year.



Wet bundh.

2.Dry Bundhs:

- These are temporary bundhs with shallow water areas.
- These bundhs have earthen walls on three sides and open on one side.
- During monsoon, rain water fills the pond.
- After monsoon these bundh get dried after a month or two.



Dry bundh.

3.Modern Bundhs:

- These are permanent bundhs.
- These are provided with a sluice gate at the lower level of bundhs.
- After each spawning, bundh is cleared of water.

2. Induced Breeding in Fishes

- Fish seeds are generally collected from natural breeding grounds in rivers.

- But such a collection, is a **mixture of economic**, **uneconomic** and **predatory fishes**.
- It Is also mixed with eggs of predatory species and it is difficult to separate them.
- -Keeping this in view, several techniques have been evolved to obtain fish seed by artificial methods.
- These include artificial fertilisation and induced breeding.
- In induced breeding, sexually mature fishes are induced to lay eggs in captitivity (in special ponds or bundhs) by hypophysation or by regulating external factors.

Methods of Induced Breeding in Fishes

Based on the breeding habits, cultivated species of fishes are divided into two groups:

1. Pond breeding fish species.
2. Fish species that do not breed in ponds.

1. Methods of Induced Breeding in Pond Breeding Fishes :

- The pond breeding fishes are well adapted for laying eggs in maintained ponds.
- But they avoid wild and excessive spawning, the pond breeding species are segregated sex-wise and are induced to lay eggs by one of the following mehtods:

1. A few selected brood fishes are introduced in specially maintained breeding ponds.
2. The ponds are introduced with fresh and well oxygeneatd water.
3. Pond water may be replaced with fresh rain water to induce spawning.
4. By providing suitable material for clinging the eggs.
5. By regulation of physical factors (like temperature, light and population density, etc.).
6. By injecting pituitary hormone.

❖ Induced Pond Breeding in India :

- In India common carp, Cyprinus, carpio, is induced to breed several times in a year in ponds.
- But in European breeds only once a year.
- Separate ponds are constructed for brood fishes for spawning and for hatching.
- Breeders are carefully selected, segregated sex-wise and fed with artificial food.
- These are introduced in the spawning ponds.
- Spawning ponds are hard bottomed.
- These are dried and then filled with oxygen-rich water.
- Freshly introduced oxygen rich water induces spawning.

- **Hydrilla and Naja** are also introduced in the ponds.
- Fishes **breed** within 10-12 hours after introduction and eggs are transferred to hatching ponds.
- Fishes like **Clarias batrachus, Heteropneustisfossilis and Anabas testudineus** are also induced to breed in ponds and cement cisterns by mere replacement of old water by fresh rain water.

2. Methods of Induced Breeding innle Fishes which do not Breed in Ponds :

- The most important of edible fishes like Indian carps (**Labeo, Catla, cirrhina), Chinese carps** and a few commercial catfishes and brackish water fishes like **mullets, rnilkfish, etc.,** do not prefer to breed in ponds.

- **Two methods are evolved for induced breeding in these forms:**

1. **Breeding in bundhs.**
2. **Breeding by hormones.**

Bundh breeding :

- Bundhs are specilaised types of ponds where riverine conditions are provided for the breeding fishes.
- These are constructed in the middle of low lying area with proper embankments and where large quantities of rain water accumulates after heavy, shower.
- ***Indian carps*** prefer to breed in running water of rivers during floods.
- Bundhs provide conditions similar to river after continuous heavy rains.
- Spawning is stimulated by heavy rains, water currents, temperature between 24 to 32°C and cloudy condition.
- Bundh breeding is being practised in India in West Bengal, Bihar, U.P. and Madhya Pradesh.

Induced breeding by hypophysation:

- The gonadotropic hormones FSH and LH secreted by anterior pituitary influence maturation of gonads and spawning.
- Induced breeding by hypophysation is being practised in Brazil, America, Russia and China.
- In India spawning was induced in Cirrhina mrigala by **Khan** (1938), in Esomus danricus by **Chaudhari** (1955) and in Heteropneustisfossilis and Clarias bartachus by

Ramas-wamy and **Sundararaj** (1956).

- Now induced breeding is being practised in several carp species.

Process of Hypophysation

- Pituitary gland is taken out from healthy, fully mature and freshly killed fishes.
- Then the pitutary preserved in absolute alcohol in sealed tubes in a desiccator at room temperature or in acetone in sealed phails in refrigerator.
- The donor fish of the same species are most preferred for mis purpose.
- Just before injection, previously weighed glands are homogenized in distilled water or 0.3% saline.
- The suspension is centrifuged and supernatant is collected.
- It is injetcted intramuscularly on the back or base of the caudal fin or in the peritoneum the base of pectoral fins.
- An initial or stimulating dose of 2 - 3 mg pituitary per kg body weight is injected first.
- After an interval of 6 hours, a second higher dose of 5 - 8 mg/kg body weight is injected to the female fishes.
- The males are given a lower dose.
- These are released in cloth hapa fixed to bamboo poles.
- After about 24 hours of injection the eggs are laid and fertilised.
- These are transferred to hatching hapas.

FISH IN RELATION TO PUBLIC HEALTH

Q. How fishes can be useful in maintaining public health. How larvivorous fishes help in keeping away certain diseases. Name at least two exotic and four indigenous larvivorous fishes.

Shallow water infested ponds, swamps, marshes and other inland waterbodies provide habitat and shelter to mosquitoes, snails **and** micro-organisms **which** are the vectors of malaria, filaria, helminthiasis. Though the use of insecticides such as DDT and other chlorinated hydrocarbons for control of insects and other pests gained momentum around the mid-20th century, by the seventies their ill effects on human system became apparent. The biological control of pests and vectors is now recognised as an effective tool for check on vector populations without any harmful effect on human system.

There are a number of exotic and indigenous species of fish which at one stage or the other feed on mosquito larvae. These are :

A. Exotic Species :

1. Ctenopharyngodon idella

2. Carassius auratus 3.Lebistesspp.

4. Gambusia

B, Indigenous Species :

1. Notopterus 2. Oxygaster

3. Laubuca 4. Bariluis

5. Wallago 6. Oryzias

7. Aphonias 8. Anabas

9. Channa 10. Esomus

For mosquito control, larvivorous fish should be introduced into a water body after cleaning any dense surface vegetation and removing predatory fish so as to allow the larvicidal fish to propagate itself.

The control of emergent and submerged aquatic vegetation helps to check mollusc populations. Certain types of weeds in a water body can be controlled by means of selected herbivorous fishes. The important herbivorous fishes are grass carp, common carp, Chinese carp, etc. An ideal herbivorous fish is the one which is able to consume a wide variety of weeds as its food, is easy to handle and does not biologically interferes with other fishes. Gastropods and lamellibranchs in the ponds can be controlled by the indigenous catfish, Pangasiuspangasius.

DISEASES OF FISH

Q. Describe various diseases found in fishes and the their control measures.

Diseases in fishes are caused by bacterial, fungal and protozoan infection. Worms, copepods and other parasites also infect fishes.

I. Fungal Diseases

Various kinds of fungal diseases are:

1. Dermatomycoses

It is caused by various members of the class Oomycetes moer particularly by the genus saprolegnis. The fungi attack and grow on the outer surface of the body, involving the skin, gills, fins, mouth and the eyes of the fish.

Symptoms: The disease is diagnosed at an early stage by fine hair-like the fts hanging from the infected areas. Atthe later stage of infection, fins become infected and haemorragic. Fish beome weak, lithargic, blind and eventually dies.

2. Branchiomycoses

Branchiomycoses is the fungal disease of gills caused by the fungus Branchio mycoses demigrans and B. sanguinis. Fungus grows into the respiratory epithelium of me gills and damages their blood vessels.

Symptoms: Gill filaments become reddish and subsequently fade. The infected gills drop out and fish die due to suffocation.

3. Ichthyophonosis

Ichthyophonosis or reeling disease is characterised by swinging movement of the infected fish. It is caused by the fungus Ichthyophonosis hoferim which gains entry in the body of the fish along with food. The spores of the fungus ingested with contaminated food, infect various various oragns, like liver, kidney, gonads, brain. In severe cases, infection spreads out to the skin which may repture at several places.

Control Measures

1. Incorporation of medicines like terramycin, erythromycin, thiocyanate, sulfamethanin and calomel in the food supplied to the fish.

2. Various dip treatments involving different chemicals are suggested for infected fishes. Thus a 24 hour dip in 0-3 mg per litre of malchite green, 10-30 minutes dip in 100 mg/litre of copper sulphate solution, a dip in 15-25 ppm of formalin, dip in 3-5% sodium chloride or an hour dip in 1-4 ppm of benzalkonium chloride are recommended.

3. Quarantine measures should to taken to prevent the incidence of disease. The infected fishes may be isolated from the stock and kept for treatment in separate ponds.

II. Bacterial Diseases

Bacteria and viruses, affect various organs of fishes giving rise to a number of fish diseases.

1. Cotton Mouth Disease

This disease is caused by filamentous bacteria such as Fexibacteria. It is characterised by the appearance of fungus like tufts around the mouth.

The disease can be treated by the addition of antibiotics like chloramphenicol (10 ppm) and Furanace (01 - 0-33 ppm) in water.

2. Furunculosis

This disease in found among fishes living in dirty water, containing a large amount of decaying matter. The bacterium responsbile for the disease is Aeromonas salmonicida.

The disease in marked by the appearance of bloody boils on the skin and the visceral organs of fish. Bursting of boils allow the spread of disease among other fishes. Severly infected fishes die in great numbers.

The treatment is done by removing the severaly infected fishes from the pond and by supplying food containing antibiotics like the sulphonarnids or nitrofurans etc.

3. Tail or Fin Rot

It is a common disease of young and adult fishes caused by bacteria. It is characterised by the appearance of white lines along the margins of fins which gradually move towards the base of the fins. The fin rays at first become brittle and later break, leading to the complete destruction of the fins.

The tail or fin not may be checked by keeping fishes for two minutes in 0-5% copper sulphate solution. In severe infection, the effected parts are surgically removed and the fishes are then kept in 0004% potassium dichromate solution for about a week.

4. Dropy

It is a serious infection of major carps. The bacterium, Pseudomonas punctata is the causative agent of this disease. It is characterised by accumulation of yellow coloured fluid inside the body cavity, scales protrusion and inlfamation of the intestinal parts. Dropsy is one of the most feared diseas in carp culture.

The fishes may be cured by a 2 minute dip in 5ppm KMNO4 solution. No food should be given during this pearoid. Removal and complete destruction of fishes, followed by draining, drying and disinfecting the pond with quicklums is suggested to prevent spread of disease.

5. Columnaris

This disease is caused by bacterium chondrococcus columnaris. This disease is marked the appearance of discoloured patches on the body. The patches spread later causing loss of scales and eventual death of the fish.

Various curative measures include treatment of pond with 1 ppm of copper sulphate solution (1: 2000) or for 10-30 seconds in malachite green (1: 15,000).

III. Protozoan Diseases

Several protozoan parasites live on the body of fish. They may be found externally on the body surface or internally living in the visceral organs.

1. Ichthyophthirusiasis

This is a common disease of fresh water fishes, caused by aciliated protozoan, Ichthyophthirius multifillis. Affected fishes develop small white spots on the skin and gills. It affects respiration in infected fishes resulting in loss of all the fishes of a pond.

Dip treatment in 15 ppm of malachile green or in 5-10 ppm of acriflavin solution is suggested A 3% NAC1 solution or 1 : 5000 formalin solution is recommended for the cure.

2. Costisis

This disease is caused by the flagellate, costia necatrix. It attacks fishes of all the ages and lives in large numbers on the skin, fins and gills.

Symptoms include appearance of grey blue film with large amount of mucus. Fishes become weak, lose appetite and finally die.

IV. Diseases caused by Flukes

Two types of flukes parasitise the fishes. These may be monogenetic i.e., complete their life cycle on a single hort, or digenetic, i.e., complete their life cycle in two hosts. These are primarily external and become internal only secondarily.

1. External Flukes

Gyrodactylus and Dactylogyrus infect fishes in a big way. Gyrodactylus infects skin and gills, whereas Dactylogyrus affects only gills. Fish infected with flukes respond by rubbing their body against sand. Their colour fades, scales droop and skin peels.

Treatment involves dip-treatment for 5 minutes in 5% common salt or in 1 to 5,000 formalin solution. Alternatively, they may also be left for 2-3 days in water tanks containing 10 ppm acriflavin or 2-4 ppm methyl blue duy.

2. Gill Flukes

Dactylogyrus vastalor in the common gill fluke found on the gills of carps. It causes severe damage to fry and finger lings. Rapid respiration, inflamed gills and scratching against the bottom are common symptoms. In later stages, the gills are completely destroyed leading to heavy mortality of the fish. Treatment is the same as for the external flukes.

V. Diseases caused by cestodes

Bothriocephalus gowkongensis is the common tape worm parasite of the grass carp and silver carp. It is found in the intestine. Ligula intestinalis is another tapeworm infecting a number of fishes. It is marked by swollen intestine often choked by cestodes cysts or the worms.
Dip-treatment in 3 to 1, 00,000 of picric acid solution for one hour may cure the fishes.

VI. Diseases caused by nematodes

Common nematodes infecting the fishes belong to genera Philometra and Camallanus. Infected fishes become dull and sickly and their instine get choked with the parasites. Curing by diptreatment in 3 to 1, 00,000 parts of picric acid for one hour is recommended.

VII. Diseases caused by annelids

Leeches infect major carps and feed on the blood of the host fish. After having their bloody meal, they deatch from the fish leaving a would open for secondary infection.

Dip in 1: 1000 solution of acetic acid and disinfect with 1 : 1,00,000 KMNO4 solution. Infected ponds are drained, dried and limed to destory the eggs and leaches living these.

VIII. Diseases caused by crustaceans

Crustracean diseases are caused by Argulus, Lernaea and Ergasilus. These are ectoparasites of fishes.

Argulus spp. are the fish-lice common crustacean parasites of fish. The parasites attache then selves below the eyes of the fish of their hooks or two suckers, and suck blood with the help of its piercing organ. These also attach to the skin, gills, fins and mouth of the fish. Due to loss of blood fish become weak and show signs of nervousness.

Treatment can be made by putting, the infected fish in 3-5% salt solution or in 250 ppm formalin solution for one hour. KMNO4 may be added to eradicate parasites from the larger ponds.

Larnaea, the anchor worm, is anectoparasite. It burrows into the flesh of the fish, only the posterior region remains visible. Infected fish bear small holes and wounds on their body. These grow thinner and their market value is greatly reduced.

Ergasilus is generally found attached to the gills of fishes. Its infection is marked by red spots on the body of the fish.

The methods recommended for the removal of almost all the crustacean parasites include half hour bath in 500 ppm formalin solution, 5 minutes bath in 1-1000 glacial acetic acid solution followed by one hour bath in 1% common salt solution. Drained and dried ponds mahy be disinfected by applying Lindane at the rate of 8 ml/1000 litres.

PROPHYLACTIC MEASURES

Q. 10. What propylactic measures you will suggest in the **prevention of fish diseases.**

Following prophylactic measures can prevent most of the fish diseases :

1. Diseases should be detected early and proper treatment initiated immediately.

2.If the pond was infected before harvesling, disinfection should be doen with KMON4 solution.

3.The bottom of the pond should be throughly ploughed and drying is done to crack the soil leave the ponds dry for about 50 days before refilling with water.

4.Before filling the pond, the quality of water should be throughly checked.

SHORT NOTES

1. Exotic Fishes

Exotic **fishes** are fishes imported into our country from other countries for fish culture, A large number of fishes are introduced in India from various countries for food and for eradication of insects or for other commercial purposes. Some of these are listed ahead:

Name of Fish	Source
A. Game Fishes	
1. Salmo irrideus (Rainbow	Europe

2. Salmo trutta (Brown trout)	England
3. Salmo gairdnerrii	Ceylon
4. Oncorhynchuys nerka	Japan
B. Food Fishes	
1. Carassius carassius (Crucian	Central Europe
2. Cyprinus carpio (Mirror	Prussia
3. Tinea tinea (Tench)	England
4. Osphronemus goramy	Mauritius and
5. Tilapia mossambica	Bangkok
6. Puntius javanicus	Indonesia
C. Larvicidal Fishes	
1. Gambusia affinitis	Italy
2. Lebistes reticulatus	S. America

2. Larvivorous Fishes

Fishes feeding on the larvae of mosquitoes are called **larvivorous fishes** or **larvicidal fishes.** Therefore, larvivorous fishes are cultured for the eradication of mosquitoes that are vectors for several human parasites (like those of malaria, yellow fever). Several species of freshwater fishes are larvicidal but only those fishes are cultured as larvivorous which have following characters:

1. That are small in size and capable of moving freely among weeds.
2. That are hardy and can be transported to long distances.
3. That are able to survive in shallow as well as in deep waters. .
4. That can reproduce in captivity.
5. That have no food value.

Indigenous larvicide fishes are Notopterus, Barilius, Oxygaster, Puntius daniconius, Labuca, Anabas, Mugil and Channa etc.

The exotic larvicide fishes are Salmo irrideus (Rainbow trout), Salmo trutta (Brown trout) etc.