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FISHERIES AND AQUACULTURE

In the world, India is amongst the top three producers of rice, wheat, liquid milk, poultry products, fruits, vegetables, coconut, tea, spices, marine and fresh water products including fish and shrimp. Fishes are rich in protein, vitamins and mineral salts and are also known as valuable protective food. Fish forms an important item of the diet in many areas of the world. The development of fisheries is therefore, one of the most promising industry. In this lesson, you will learn about many varieties of fish, their collection, rearing, breeding and their economic importance.

OBJECTIVES

After completing this lesson, you will be able to:

- *define the term fisheries;*
- *list some important fresh and marine fish found in India;*
- *list the economic importance of fish, some molluscs and sea weeds;*
- *mention the effect of environmental pollution on fish;*
- *describe fishing technology and equipments used for fishing;*
- *define fish migration and fish diseases;*
- *define aquaculture.*

34.1 FISHERIES

India has a coastline of about 8,129 km, 5 million km of continental shelf and 2.02 million of exclusive economic zone. India is a major marine fish producer and ranks seventh in the world.

Areas where fish are reared commercially, are known as artificial fisheries. The fishes are bred, reared and later harvested. The fishery may be a natural water body or an artificial one. A variety of fish may be reared together.

In addition to fish, aquatic crustaceans and molluscs are included in fisheries. In India the economically most important crustacean fisheries are those of prawns,

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shrimps and crabs. Among molluscs, edible oysters and pearl oysters are also of economic importance.

34.2 COMMON EDIBLE FISH FOUND IN INDIA

Depending on the nature of water in which fish is reared, fisheries are divided into three categories:

1. **Marine Fisheries**: These deal with fishing operations along seacoasts. The Indian subcontinent approximately has a 5600 kms long coastline. About 80% of India's marine fish are supplied by the west coast and the remaining 20% by the east coast. The premier varieties are mackerels, sardines, sharks, and catfish.
2. **Fresh Water Fisheries or inland Fisheries :** They include fish found in rivers, irrigation canals, reservoirs, lakes, tanks and ponds. Rohu, Catla, Mystus,Gourami, and Gambusia are some of the best varieties of fresh water fish.
3. **Estuarine or Brackish Water Fisheries:** They operate in estuaries (where river water and sea water get mixed), delta channels, backwaters, lagoons and coastal lakes. Estuarine fish are more common in Bengal and Kerala. The tidal water collects the fish in the enclosures. The main varieties are Pearl spot, Milkfish and Mullet.

Table 34.1 Common Indian edible fish

Fish	Occurrence
A. Fresh water fish (inland fish)	
Carp (Herbivorous Fishes)	Throughout India in its Northern, Eastern and Southern parts,
(i) Catla	
(ii) Rohu (Fig. 34.1)	
Cat fishes (Carnivorous)	Throughout India
(iii) Mystus	Entire Indian coast
(iv) Hilsa	Maharashtra coast
(v) Bombay duck	Maharashtra coast
B. Marine Fish	
(i) Pomfrets	Indo-pacific coast
(ii) Salmon	Eastern and Western coast
(iii) Sardines (Fig. 34.2)	Southern and Western coast
C. Estuarine or Brackish water fish	
(i) Mullet	Lagoons and coastal areas
(ii) Pearl Spot (Fig. 34.3)	Coastal lakes of Bengal and Kerala

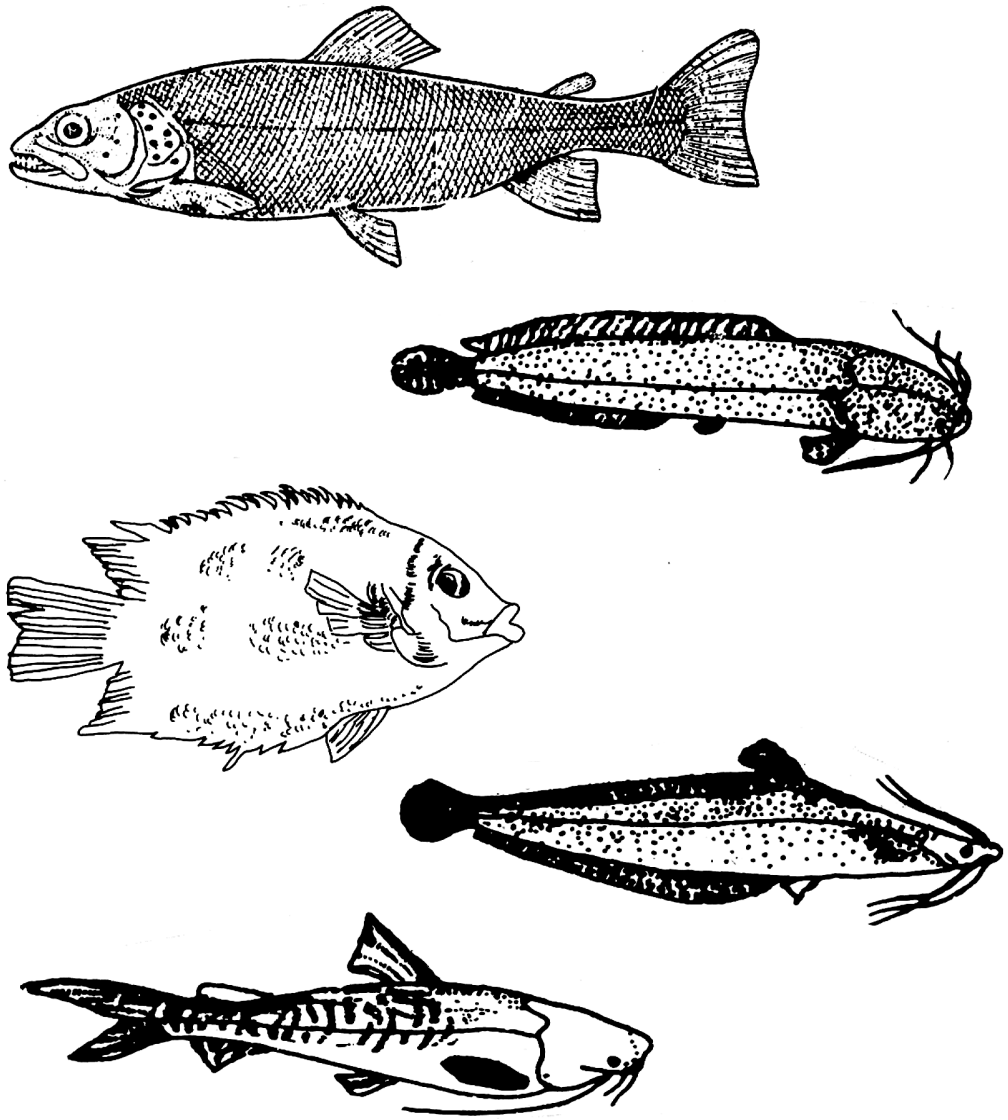

Fig. 34.1 Rohu, **34.2** Sardines, **34.3** Pearl spot

There are several other aquatic resources such as molluscs, echinoderms and seaweeds. Some of which have been exploited for aquaculture. These are as follows :

34.3 CULTURE OF MOLLUSCS

Molluscs comprising oysters, clams, mussels, squids, cuttlefish, octopus etc. form important resources of food. The edible oyster (*Crassostrea* species), Mussels (*Perna* species), Clams (*Meretrin* species, *Arca* species, *Donax* species, *Circa gibba*, *Solen* species, *cardium* species), Cuttle fish (*Sepia* species), Squid (*Loligo* species) and Octopus are all utlized as food resource (Fig. 34.4).

Pearl osysters, the sacred ehank, *Turbo*, *Trochus* and window pane oysters (*Placenta placenta*) are all of commercial importance (Fig. 34.5).

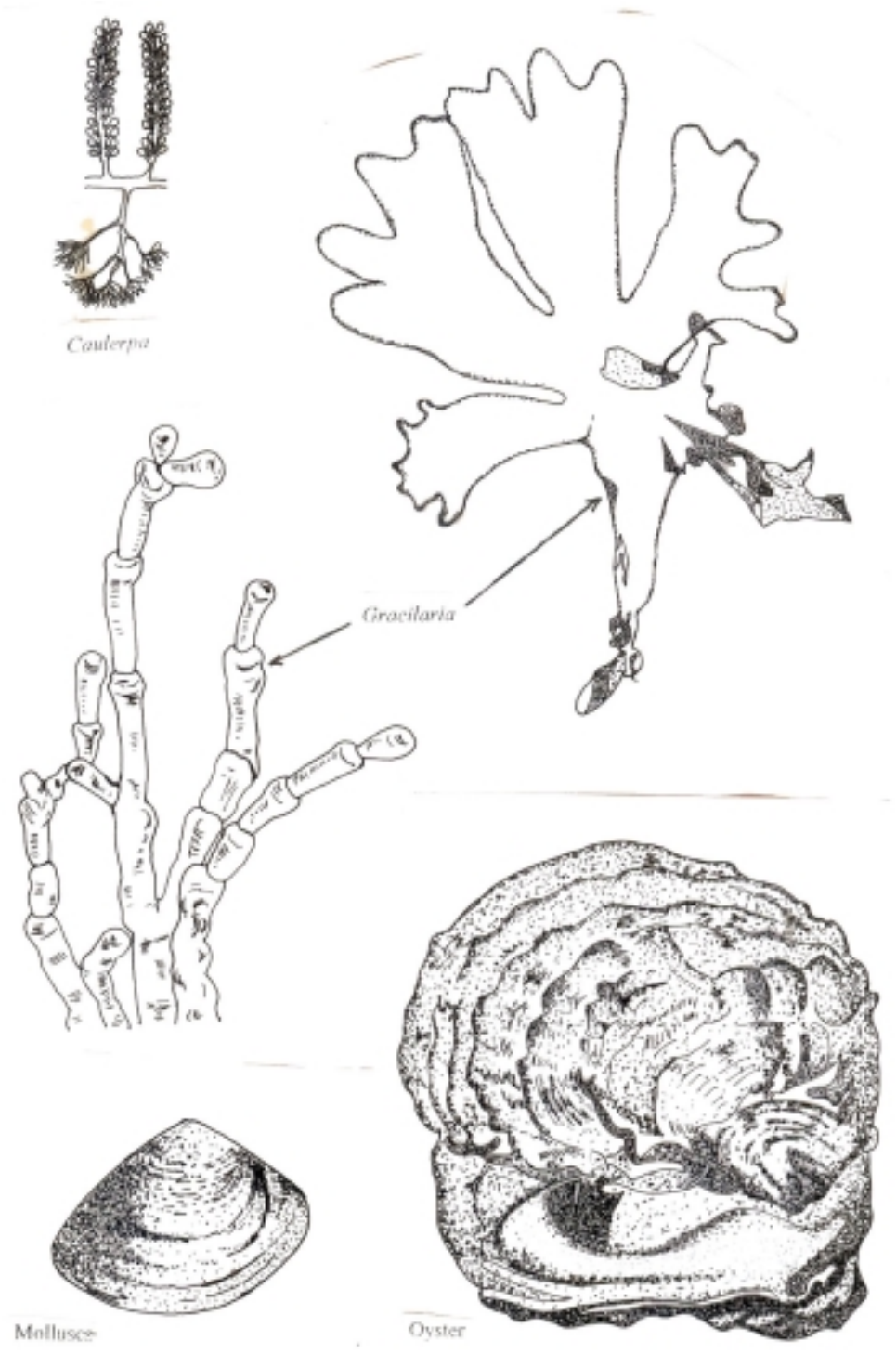

Fig. 34.4 Molluscs, **34.5** Oyster, **34.6** *Gracilaria*, **34.7** *Caulerpa*

34.4 SEA WEEDS

Sea weeds are also an importance marine resource and are found along the rocky intertidal and sub-tidal regions of the coast of India. The Sunderbans, the Chilka lake, the deltas of Godavari and Krishna, the rocky shore of Vishakhapatnam, Mahabalipuram, Gulf of Mannar, Gujarat coasts and Lakshadeep, Andaman and Nicobar islands are rich in sea weeds. Seeweeds are used for human consumption as cattle and poultryfeed, as manure and for industrial purpose as a source of agar-agar and algin. Species of *Gelidiella* and *Gracilaria* (the red sea weeds) are source for manufacture of agar-agar (Fig. 34.6).

The brown sea weeds like *Sargassum, Turbinaria Dictyota* contains alginic acid. *Ulva*, *Entromorphas*, *Caulerpa*, *Porphyra* are varieties used in human food (Fig. 34.7).

INTEXT QUESTIONS 34.1

1. Name two fresh water fishes.

   .....

2. In which part of India is pearl spot found

   .....

3. Define the term fisheries.

   .....

4. Give two examples of marine fish.

   .....

5. Name two common edible fish commonly consumed in India.

   .....

34.5 ECONOMIC IMPORTANCE OF FISH

Fish is a valuable source of food that is rich in proteins. Fish proteins are easily digestible. Apart from being a good source of food, Fish also have the following uses:

1. **Medicinal use** – fish liver oil is a natural source of vitamin A and Vitamin D.
2. **Industrial use** – Body oils of sardines, herrings and salmons are used for the manufacture of edible oils and margarine. This oil is used in soap, paint, and varnish industries.
3. **Feed for farm animals** – Fish meal (dried fish) provides proteins to farm animals.
4. **Agricultural use** – As organic manure in the fields.
5. **Adhesive** – Skins and bones are also used in making high quality glues and adhesives.

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6. **Shark skin**- Shark skin is also used in the manufacture of handbags, wallets, shoes etc. after tanning. Hide (leather) is also used to make parchment sheets.

34.6 AQUACULTURE AS AN OCCUPATION

Aquaculture is an occupation of many living near rivers and the sea and most aquaculture jobs are located in coastal community.

Aquaculture involves the rearing and management of useful aquatic plant and animal resources such as fish and shell fish, (prawn, molluscs, crabs etc.) It is also known as fish farming and accounts for about ten percent of the world's commercial fish harvest. China leads all countries in aquaculture production. Fish farms range from simple ponds or flooded rice fields to highly engineered hatcheries in which the environment is monitored and kept under control. Environment control eliminates harmful environmental conditions and helps fish flourish and grow fast. Fish are provided with proper nutrients as per a regulated plan and are protected from the harmful animals that prey on them. Aquaculture is utilised for culturing pearls on a commercial scale as well as in:

(i) rebuilding of salmon and trout stocks that have been severely reduced, and

(ii) raising fishes for consumption as food such as carp, cat fish, gourami, milk fish, salmon, tilapia etc.

Practice of aquaculture also includes **Pisciculture** and **Pond culture** (fish cultivation in large water bodies).

(i) **Pisciculture** (Fish Farming)

Is concerned with the production of fish in lakes, rivers, large ponds, canals and is called fresh water or inland fisheries. In Pisciculture young fishes are reared in nursery ponds, transferred to lakes or rivers and finally harvested as fish for table food.

(ii) **Pond culture** (Kitchen Fisheries)

This involves culturing fish in small ponds. This practice is quite common in Bengal. Proper management is carried on till fish attains full size. They are also protected from diseases.

INTEXT QUESTONS 34.2

1. At the present times, which country leads in fish production.

   .....

2. What does aquacultrue include other than culturing fish?

   .....

3. What is meant by pisciculture?

   .....

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4. Give one difference between pisciculture and pond culture.

.....

5. Why is regulation of the environment in which fish are nearest important?

.....

34.7 EFFECT OF CHANGING ENVIRONMENT ON AQUACULTURE

Fish population is adversely affected by a number of environmental factors. These are as follows.

- **Water Pollution**

The problem of water pollution mainly affects marine water fish. A variety of insecticides, pesticides, industrial effluents and domestic sewage find their way into many rivers and pose a serious problem for fisheries. The magnitude of pollution varies with the size of the river, the flow of water etc. Let us take few examples.

(i) The paper mills located on the bank of a river in Orissa consume nearly 270 million litres of water per day. This heavy withdrawal of water together with the discharge of high toxic effluents causes considerable harm to the fisheries for a stretch of nearly 24 km downstream.

(ii) The effluents from Sindhri fertilizer factory have been found to have adverse effects on fish and prawn. Vast investigations in respect of effluents of paper pulp-textile industries, tannery manufacturing units, sugar distillery, coal, etc. have shown adverse effects on fisheries while sewage used as a fertilizer for fish farm has been found to cause extreme damage to fish culture.

(iii) Thermal pollution caused by the discharge of hot water used for cooling reactors and generators can be a serious problem in tropical waters where the normal temperature itself is high and further increase would be lethal to the fish which are already living in the higher ranges of temperature tolerance.At present, a potential source of pollution is the atomic reactor wastes. Consequences of water pollution are given below.

- Many of favourite fishes like the Bombay Duck have almost disappeared from the Kalu river near Mumbai. This has been due to the release of a number of toxic wastes from the chemical industries into the river.
- Excessive use of chemical fertilisers may lead to the phenomenon of **Eutrophication** (enrichment of the water body with nutrients). This results in **algal bloom**, (excessive growth of algae which use up available oxygen) followed by oxygen depletion in water and ultimately the death of fish.
- Thermal (heat) pollution from various heavy industries causes fish mortality.

- Utra violet radiations affect fish eggs that become non-viable, that is, they fail to develop.
- Leakage of petroleum from ships and off-shore oil wells forms an oil slick on the surface of the water and thus fishes are unable to breathe due to non-availability of dissolved Oxygen in the water.

34.8 FISHING TECHNOLOGY

Fish constitutes the most important part of the diet of many people. Fishing has been carried out since ages and human beings have developed various gadgets and technologies for catching all varieties of fish from all regions and masses of water, at all depths as well as in large quantities to take care of the ever increasing population and demands. Today it constitutes one of the largest traded food items.

Organised fishing is practised with the help of equipment specially designed for easy capture of fish. Equipment differs according to the nature of water bodies, and the characteristics of the fish species to be captured.

Principal equipment for fishing includes

1. Sea fishing gears

The various equipment used in fishing are called fishing gears. Most of the large scale fishing is done at sea. Sea fishing gears are of the following types.

Nets: The main gears are made of cotton yarn hemp or other special man-made fibres. Nets are fixed in the tidal region during the low tide. High tide brings the fish along with water flow into the net. (Fig. 34.8).

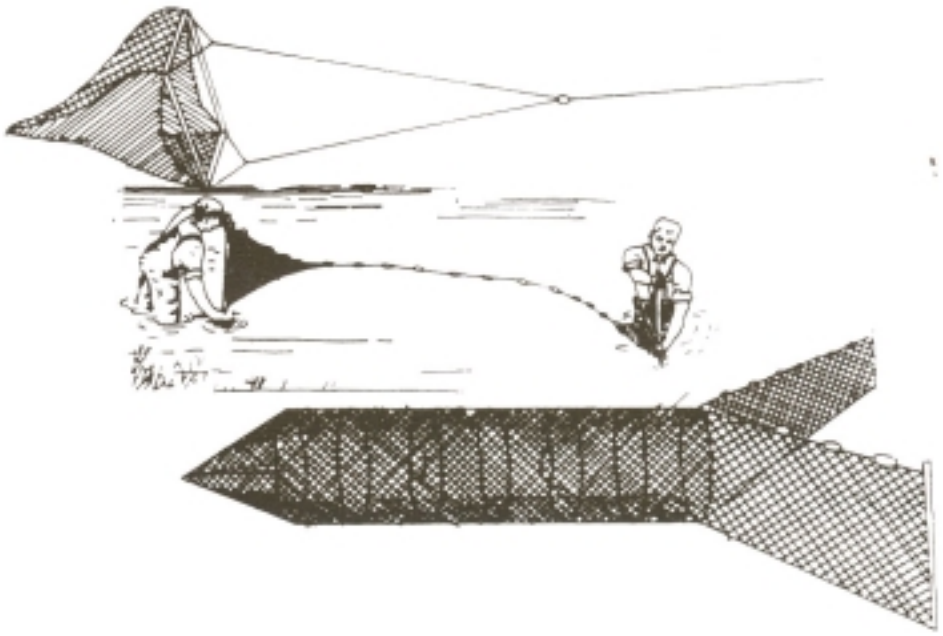

Fig. 34.8 Various types of nets for fishing.

2. Seines

These are very large nets for active fishing. The net encircles a large part of water believed to contain a lot of fish. A Seine is used in running water. Depending upon the nature of water body, different types of Seines (Pure Seine, Shore Seine, etc) are used.

3. Hooks and Lines

Metallic hooks of various sizes and designs are provided with a bait to catch different types of fish. The line is a wire, which carries the hook to various depths and distances from the fishing raft or boat.

34.9 FISH MIGRATION

A number of fish show a periodic movement form one dwelling place to another. This periodic movement is called **migration**. Fish migrate to other places for spawning (egg laying) or to avoid unfavourable climatic conditions. Many fish migrate from one part of the ocean to another at times. Marine fish like Hilsa swim up from sea to fresh water for spawning e.g. cel. Some fresh water fish migrate from lakes to sea for spawning. During winters in the cold part of the globe, water at the surface freezes. The fish migrate to the bottom and remain there till the end of the cold season.

INTEXT QUESTIONS 34.3

1. Mention two way by which gets polluted water.

   .....

2. What do you mean by thermal pollution?

   .....

3. What causes “algal bloom”?

   .....

4. How does UV radiation cause loss of fish?

   .....

5. What is “seine”?

   .....

34.10 FISH DISEASES

Like other animals, fishes are also affected by various diseases. These diseases can be broadly classified under bacterial, viral, fungal, protozoan and those caused by large parasites like tapeworms and roundworms. Diseases like tuberculosis, eye infection, kidney diseases and various types of tumours – benign and malignant are reported from both freshwater as well as marine fish.

Furunculosis, a common disease of fresh water fish is caused by bacteria and can be treated with tetracyclines and the **vibrio infections** respond to sulphonamide therapy.

Tail rot, another common disease caused by bacteria can be controlled by administering a mixture of penicillin and streptomycin.

Food poisoning caused by fish and fishery products may be due to a variety of causes. Some fish and shellfish (prawns, shrinps etc.) possess poisons or biotoxins. These biotoxins are not destroyed by cooking and cause illness when fish containing them are eaten. Some people are allergic to fish, molluscs or crustaceans.

Some poisons affect the central nervous system, while others cause gastrointestinal and skin disorders. Food poisoning can also be caused by eating spoiled or rotting fish. Toxic principles in the flesh of such fish cause gastroenteritis. Bites and strings caused by varieties of fishes and invertebrates like jelly fish result in serious inflammatory conditions. Dermatitis can be caused by irritants found in the skin of fishes belonging to the tuna fish group.

WHAT YOU HAVE LEARNT

- The areas used for rearing, breeding and catching of fish constitute fisheries
- Fish and shell fish, that is, molluscs and crustaceans such as crab, prawn and shrimp are reared in fisheries.
- Mackerels, sardines, sharks and catfish are some marine edible fish.
- Fresh water edible fish include rohu, catla, Mystus, gourami, and Gambusia.
- Estuarine fish such as pearl spol, milk fish and mullet are found in back water lagoons (areas where sea water comes and cover a part of land).
- Fish are a good and cheap source of animals proteins, and Vitamins A and D.
- Aquaculture involves rearing and management of useful aquatic plants and animals.
- Aquaculture or fish farming provides controlled environment, protection and nutrients to the fish.
- Aquaculture includes Pisciculture and Pond culture.
- Fish are used for animal feed, agricultural manure, making of adhesives, soaps, paints and varnishes.
- Environment changes adversely affect the fish population.
- Water pollution due to chemicals released from industry and agriculture, fertilisers, release of hot water, UV rays and oil spills cause fish mortality and affect fish production.

TERMINAL QUESTIONS

1. Classify different fish on the basis of their natural habitat. Also mention two examples of each.
2. List any four uses of fish for mankind.
3. Define aquaculture mentioning its importance.
4. Discuss briefly the effect of changing environment on fish population.
5. What is meant by migration? Why do fish migrate?
6. What can happen if rotton fish is consumed?

ANSWER TO INTEXT QUESTIONS

34.1 1. Rohu, Catla, Mystus (any two).
2. Estuarine areas
3. Areas where fish are reared for commercial purposes.
4. Pomfret, sardine, salmon (any two)
5. Rohu, Catla, Pomfret

34.2 1. China
2. Culturing ediable oysters, pearl oysters, crabs, shrimps, sea weeds.
3. Produciton of fish in ponds, lakes, rivers and canals.
4. In fisciculture, fish are reared in nursery ponds, then transferred to lakes or rivers and finally harvested while in pond culture, fish are reared and grown in small ponds and harvested.
5. It eliminates harmful conditions and helps the fish grow fast.

34.3 1. Addition of pesticides/effluents from factories/domestic sewage/hot water (any two)
2. By discharge of hot water used for cooling reactors and generators.
3. Chemicals from factories that find their way into water bodies result in excessive growth of algae or algal bloom.
4. Make fish eggs inviable
5. large fishing nets.