Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

TOPICS:

1. **Introduction to Fisheries**
2. **Habit, Habitat & Culture Aspects of Freshwater Fishes**
3. **Harvesting of Marine-water Fishes**
4. **Crafts and Gears**

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TOPIC: FISHERIES (PART I)

Introduction to fisheries

1. Describe Freshwater Fisheries/ Inland Fisheries

- Fishery production both capture and culture from fresh water bodies.
- Fish that spend most or all of their life in freshwaters, such as rivers and lakes, having a salinity of less than 0.5 ppt.
- Around 40% of all known species of fish are found in freshwater.
- The aim is to culture fishes in small impoundments and to exploit fish resources from the great river systems of the country and from the vast networks of irrigation canals, lakes, tanks and reservoirs.
- In India, there is in addition to extensive river systems, a large variety and extent of standing inland waters, ranging from the icy cold lakes of the higher altitudes to the tropical fresh water pound of the plains.
- Inland water bodies include freshwater bodies like rivers, canals, streams, lakes, flood plain wetlands or beels (ox-bow lakes, back swamps, etc.), reservoirs, ponds, tanks and other derelict water bodies, and brackish water areas like estuaries and associated coastal ponds, lagoons (Chilka lake, Pulicat lake) and backwaters (Vembanad backwaters), wetlands (bheries), mangrove swamps, etc
- Indian Major Carps are the most cultured freshwater fish followed by Exotic Carps, Minor Carps, Catfish and Trout.
- Freshwater Fisheries can be divided into following types:

1. Riverine Fisheries:

A river is a natural watercourse usually freshwater, flowing towards an ocean, a lake, a sea, or another river. In a few cases, a river simply flows into the ground or dries up completely before reaching another body of water.

5 Major River systems in India.

The Ganga, the Brahmaputra, the Indus, the east coast, and the West coast river systems.

Fish catch from riverine resources comprises mainly cat fishes and local minor fishes.

TOPIC: FISHERIES (PART I)

2. Pond Fisheries:

- Ordinary fresh water fish culture ponds are still-water ponds.
- They vary a great deal in water spread area and depth. Some are seasonal and some perennial.
- The ponds may be rain fed (also called sky ponds) and/or may have inlet and outlet systems.
- The water supply may be from a stream or a canal or from an underground source such as wells, tube wells etc.

2. Describe Marine Water Fisheries

Ans

- A marine fishery is that branch of fisheries which deals primarily with marine fishes and other sea products.
- Close to 90% of the world's fishery catches come from oceans and seas, as opposed to inland waters.
- India has a long coastline of resources in terms of an 8,129 kms, 0.5 million sq. km of continental shelf. Its marine resources are spread over in the Indian Ocean, Arabian Sea, and Bay of Bengal.
- The marine fishery resources have been broadly divided into two categories:
  a) Coastal Fishery or Inshore Fishery – Coastal line is rich in producers and plankton and other favourable feeding grounds for fishes.
  b) Offshore Fisheries/ Deep Sea Fishery - It could be classified as any fishing done more than 20-30 miles from the shoreline.
- The important Marine Fisheries can be grouped into the following categories:
  1. Surface-water Fish (Pelagic): Sardines, Anchovies, Ribbonfish, Mackerel, Seerfish, Tuna, etc.
  2. Mid-water Fish (Pelagic): Bombay Duck, Cobia, Silver Bellies, Horse Mackerel, etc.
  3. Bottom-water Fish (Demersal): Perches, Catfish, Pomfrets, Flatfish, Eels, etc.

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

3. Describe Brackish Water Fisheries

- Brackish water normally naturally occurs in estuaries, deltas of rivers, lagoons and backwaters, which are under tidal regime.
- The salinity of the water fluctuates widely between negligible to 35 ppt, depending on the phase of the tide and volume of fresh water discharged through the river into the sea.
- Estuaries and estuarine lakes have saline waters.
- Only those fishes which can withstand changes in salty conditions thrive best.
- Some species of sardines and anchovies, Catfishes, perches, pearls pot or Etroplus are the most common.
- Estuarine fisheries are located in the mouths of the rivers Ganges, Mahanandi, Godavari, Krishna, Kaveri, Narmada and Tapi.
- Lakes like Chilka and Pulicat are also among these.
- These water bodies lying between the freshwater and marine regimes have certain characteristics:
  - (i) fluctuating water level synchronizing with the tides,
  - (ii) wide salinity range of 0-35 ppt,
  - (iii) higher nutrient content and productivity,
  - (iv) serve as nursery grounds for numerous marine organisms,
  - (v) harbour a rich diversity of flora and fauna, and
  - (vi) support artisanal capture fisheries and provide livelihood to the coastal fishers.

4. Coastal Fisheries

- A marine fishery is that branch of fisheries which deals primarily with marine fishes and other sea products.
- The marine fishery resources have been broadly divided into two categories:

a) Coastal Fishery

b) Offshore Fisheries/ Deep Sea Fishery

TOPIC: FISHERIES (PART I)

- Coastal fishery is also called as inshore fishery.
- Fish provide 4.3 billion people with about 15 percent of their animal protein and essential nutrients for growth and maternal health.
- Coastal fisheries is defined as all fisheries within exclusive economic zones (EEZ) — provide food, nutrition and livelihoods, particularly in developing countries.
- Gujarat is closely followed by Kerala in the south-west which contributed around 30 percent of national production.
- The other west coast states of Maharashtra and Karnataka, in addition to offshore Islands contribute the remaining 33 percent of west coast production.

5. Offshore Fisheries/ Deep Sea Fisheries

- A marine fishery is that branch of fisheries which deals primarily with marine fishes and other sea products.
- The marine fishery resources have been broadly divided into two categories:

a) Coastal Fishery

b) Offshore Fisheries/ Deep Sea Fishery

Offshore Fisheries/ Deep Sea Fishery

- It could be classified as any fishing done more than 20-30 miles from the shoreline.
- The important offshore fisheries can be grouped into the following categories:

1. Surface-water Fish (Pelagic): Sardines, Anchovies, Ribbonfish, Mackerel, Seerfish, Tuna, etc.
2. Mid-water Fish (Pelagic): Bombay Duck, Cobia, Silver Bellies, Horse Mackerel, etc.
3. Bottom-water Fish (Demersal): Perches, Catfish, Pomfrets, Flatfish, Eels, etc.

- Coastal fish, also called offshore fish or neritic fish, inhabit the sea between the shoreline and the edge of the continental shelf.

TOPIC: FISHERIES (PART I)

- The continental shelf is usually less than 200 meters deep.
- Off shore fishing comprises gill net operations in surface and mid-waters, lining conducted from Mother-ship operations and trawling in bottom waters.

7. Riverine Fisheries

- A river is a natural watercourse usually freshwater, flowing towards an ocean, a lake, a sea, or another river. In a few cases, a river simply flows into the ground or dries up completely before reaching another body of water.
- 5 Major river systems in India-
    1. The Ganga,
    2. The Brahmaputra,
    3. The Indus,
    4. The east coast, and
    5. The West coast river systems.
- Production figures from different riverine systems are not available, estimates made for major rivers showed yield varying from 0.64 to 1.64 tonnes per km with an average of 1 tonne per km.
- The important fish species in the northern rivers are:
    - The Carps, Catla catla, Labeo rohita, Cirrhinus mrigala and Labeo calbasu
    - The eels, Anabas etc.
- The fishes seen in the southern rivers are:
    - The carps, Labeo fimbriatus, Cirrhinus cirrhosa,
    - The mahseers, Tor khudree.
    - The tributaries of the Cauvery from the Nilgiris have cold water fishes like the trout and tench.
- Fish catch from riverine resources comprises mainly cat fishes and local minor fishes.

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

Habit, Habitat and Cultural Methods of Freshwater Fishes.

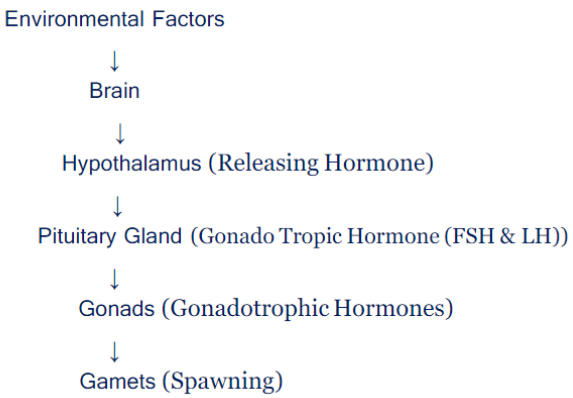
1. Induced breeding Technique

- Induced breeding is a technique where organism is stimulated by particular hormone or other synthetic hormone or by providing condition, introduced to breed in captive condition.
- The stimulation promotes timely release of sperms and eggs from gonads of fishes.

Need of Induced Breeding:

- The main source of the India's fish seed supply comes from the riverine collection and certain percentage of it comes from the bundh type breeding places.
- In these collections it becomes quite difficult to sort out the fries of major carps, as large number of uneconomical fish fries and predatory forms also accompany the collection.
- Besides this the farmers have to wait for the arrival of monsoon and the time of breeding of different species of fishes also varies. to overcome these problems several persons successfully tried the process of induced breeding.

Principle of Induced Breeding:



Steps of Induced Breeding:

1. Collection of pituitary extract:

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Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

- From the matured fishes of both sexes either belonging the same species(Homo plastic)or a closely related(Hetero Plastic)the pituitary glands are collected.
- The pituitary glands can be taken out from the posterior end of the cranium through the foramen magnum after cleaning the brain tissue.
- After the collection of the pituitary glands are kept in absolute alcohol for dehydration. After 24 hours, the alcohol is changed for further dehydration and defattening
- The glands are then weighed and preserve in fresh alcohol in dark colored phials. It may be stored at room temperature or in a refrigerator.
- At the time of injection to carps for the induced breeding, the required quantity of pituitary glands are taken out of the phials and the alcohol is allowed to evaporate.
- The glands are then macerated with a tissue homogenizer either in distilled water or 0.3percent of saline water. The gland suspension is then centrifuged and the supernatantfluid is drawn into a hypodermic syringe for the injection.

2. Selection of Breeders:

- Medium sized fully ripe and healthy fish of around 2 to 4 years of age is preferred forinduced breeding. The weight should be 1 to 5 kg. Healthy male and female breedersshould be identified and netted out before the breeding season and should be kept inspawning pools.

3. Method of Injection:

- Just before evening, per one female with two males of the approximate same body weight are to be injected the pituitary extract by hypodermic syringe.
- In case of male carps the pituitary extracts are introduced once and in case of femalecarps it is introduced twice. At first, at the rate of 2 to 3 mg of pituitary extract per kg of body weight is introduced inthe muscle of the caudal

peduncle or near the dorsal fin of the female carp.The needle of the syringe is to be introduced between thescales but with an angle of 45° with the body. After six hours of first injection, the second injection is given to the samefemale at the rate of 5 to 8 mg of pituitary extract per kg of body weight.There is no need of injecting dose to the male breederif it in a state of milt oozing.

4. Use of Synthetic Hormones:

- HCG (human chorionic gonadotropin hormone), Synahorin, Ovatide, Ovaprin. It is thenew inducing hormone for fish and absolute substitute of pituitary extract though it'scostly.Ovaprim is far superior to carp pituitary in inducing spawning in several species of carps.These synthetic drugs arebetter than the pituitary extract andeasiertoadministrate. Only single dose injection is enough to induced craps.

5. Spawning

- Then the carps,one female and two male are placed in a breeding hapa for spawning.Inside of the breeding hapa both the female and male carps are exited. After the excitation the female carps lays eggs. The eggs are externally fertilized by thespermatozoa(milt)that are discharged by the males.

2. Habit, Habitat and Culture Aspect of Labeo rohita/ L. rohita/ Rohu

- It is the quick growing carp, known as Rohu or Rui in Bengal, Bihar, Assam, Uttar Pradesh and Punjab, Rohi in Orissa: Bonha gandumeenu in Andhra Pradesh.
- It is found in Pakistan, Bangladesh and Burma.
- Labeo rohita is the fish of northem Indian rivers.

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

Habit:

- Rohu is a column bottom feeder fish.
- Its interior fringed-lipped mouth is adopted for browsing habits.
- Hatchlings feed on Zoo-plankton including rotifers, Cladocera and copepod.
- The nibbling type of mouth with soft fringed lips, sharp cutting edges and absence of teeth in the bucco-pharyngeal region helps the fish to feed on soft aquatic vegetation which do not require seizure and crushing.

Habitat:

- It is common in temperate and tropical regions.
- It is found in freshwater ponds, lakes, rivers and reservoirs.
- Labeo rohita is Indo-Gangetic riverine species also found in Pakistan, Bangladesh and Myanmar.
- It has also established in freshwater of Andaman and introduced in Srilanka, USSR, Japan, China, Philippines, Malaysia, Nepal and some African countries.

Culture aspects:

- Rohu breeds in flooded river during monsoon.
- Fertilization takes place externally.
- Female lays about 2 million eggs at a time.
- Young fishes grow up to 45cm length and 675 gm weight.
- It grows very fast but slower than catla.
- They attain sexual maturity when about 2 years old.

3. Habit, Habitat and Culture Aspect of Catla catla/ Catla

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

- Catla catla is the fastest growing carp and is commonly called as Catla in Assam, Bengal, Maharashtra, Bihar and Uttar Pradesh, Bhakur in Orissa, Thila in Punjab, Bocha in Andhra Pradesh and Thappamoen in Chennai.
- Catla is found in Northern rivers of India and Krishna and Cauvery.
- It is also found in the rivers of Pakistan, Bangladesh, Burma and Thailand.
- It has been transported in Srilanka and Israel.
- The fish is distributed throughout India.

Habit:

- It is surface-column feeder fish and non-predatory.
- Exclusively feeds on plankton.
- It has upturned mouth and the large gill rackers which are adapted to feeding on the floating organisms like plankton.
- Catla spawn and early fry feed on rotifers – daphnia, cyclops, diatoms and phytoplankton.
- Catla fry and fingerlings feed on cladocera; copepod and phytoplankton.
- Catla adult feeds on copepod, cladocera, rotifers and Naupleus.

Habitat:

- It is endemic to riverine system in northern India, Indus Plain and adjoining hills of Pakistan, Bangladesh, Nepal and Myanmar.
- This fish is now introduced all over India.
- It grows in Freshwater ponds, lakes etc.

Culture aspects:

- It is fastest growing carp.
- It is the largest carp.
- Breeding season is monsoon.
- After 16 -18hrs of fertilization, the hatched larvae are 4-5 mm.

- The young ones measure up to 12-15 cm.
- They feed on daphnia.
- They attain sexual maturity when about 2 years old.

4. Habit, Habitat and Culture Aspect of *C. mrigala*

- Cirrhina mrigala is commonly called as More in Punjab; Naini in Uttar Pradesh and Bihar; Mrigal in Bengal and Assam, Mirikali in Orissa and Yerrameen in Andhra Pradesh.
- The fish originally found in northern Indian rivers but also established in southern rivers of India.
- It is also found in Pakistan, Bangladesh & Burma.

Habit:

- It is a bottom feeder and omnivorous.
- The terminal lips are adopted for picking up things from the bottom (mud).
- Hatchlings feed on Rotifers and Phytoplankton
- Adults feed on phytoplankton detritus, debris, sand and mud.
- The proportion of animal matter is very poor in food.
- In emergency, it takes higher plant matter.

Habitat:

- It is cultivated widely in south east Asian countries.
- It is cultivated mainly for food.
- It is found in freshwater ponds, lakes, rivers and reservoirs.
- It commands good market price.

Culture aspects:

- It is widely cultured in India.
- It grows fast and hatchlings grow to 25-30 mm in length in 15 days.

- The fingerlings grow up to 55-65 cm in length.
- It weighs 1 – 2 kg in one year.
- They attain sexual maturity when about 2 years old.

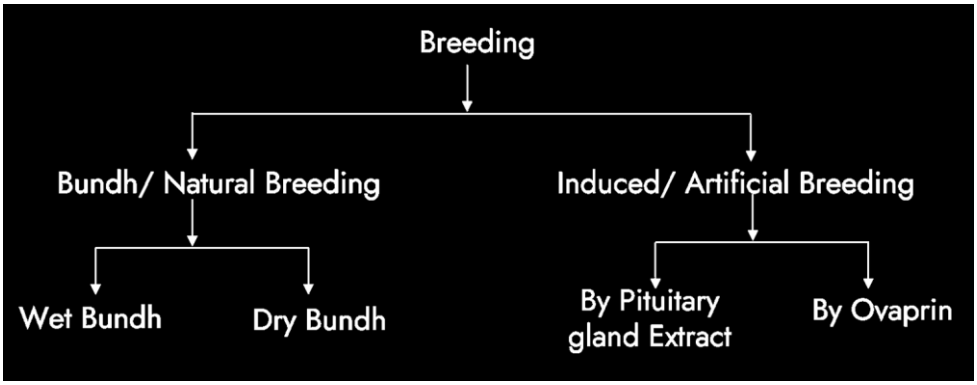
5. Cultural methods of Fresh water fishes

The culture methods of fresh water fishes include following steps:

1. Collection of fish seed
2. Management of brooders
3. Spawning
4. Transportation of fries
5. Pond Management

1. Collection of fish seed:

- Post larvae or spawn are collected from reivers using funnel shaped, fine mesh nets
- These nests are fixed in marginal waters with the help of wooden poles against the water current.
- The spawns enter the fine mesh nets and removed every 20 minutes.
- The collected spawns are allowed to hatch and transferred to nurseries.



2. Management of brooders:

- In fish farms male and female brooders are kept separately.

TOPIC: FISHERIES (PART I)

- These tanks should be properly managed before and afte stocking of fish.
- Fishes are fed with oil cake and rice bran regularly mixed with dry fish and shrimp from month of January.
- Regular manuring is needed for maintaining zooplankton population.

3. Spawning:

- Spawning occurs in hapa.
- Breeding hapa is rectangular box made up of mosquito net or cloth.
- It is suspended inside the with help of bamboo poles.
- After spawning breeds are removed.
- Eggs are either hatched in hapa or transported to nursery bond.

4. Transportation of fries:

- Transfer of the hatchlings is done within the first three weeks of spawning but not until 3 days.
- Newly hatched larvae attach to the walls or plants.
- Use of large earthen-wares hundis and metal containers.
- Proper oxygen level should me maintained using various devices such as semi-rotatory pump.
- Temperature should be maintained below 20°C.

5. Pond Management:

- Nursery Ponds - rearing of Spawn to Fry stage (approx. Size 4- 15 mm)for about 15 days.
- Rearing Ponds - rearing of fry to fingerling stage (approx. Size: 16-40 mm)for about 2-3 months.

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

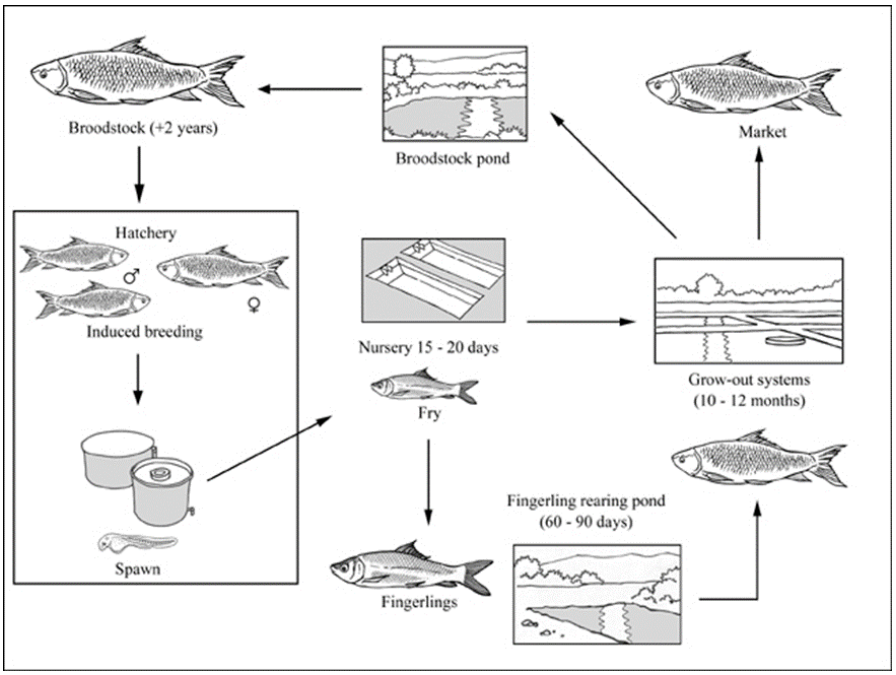
Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

- Stocking Ponds - rearing of fingerling (approx. Size 41- 150 mm) to marketable sizes/ adult fishes.
- The area percentage of these ponds in a fish-farming complex can be:

a. Nursery pond - 3%
b. Rearing pond - 11%
c. Production pond - 60%
d. Segregation pond - 1%
e. Breeding pond - 25%

- Nursery ponds are shallow, while the others are moderately deep.



Culture methods of freshwater fishes.

6. Nursery Ponds

- Nursery Ponds are pond system for rearing of Spawn to Fry stage.
- Three-day old hatchlings are reared in a nursery system for a period of 15-20 days till they become fry of 20-25 mm.

- Small earthen ponds of 0.02-0.1 ha are normally employed, though brick-lined or cement tanks are used in certain areas.
- Though monoculture is advocated for nursery rearing, farmers often raise mrigal along with the other two Indian major carps.
- The other management measures include organic manuring and fertilization, and the provision of a mixture of rice bran and oil cake (1:1 w/w) as a supplementary feed.
- Survival normally ranges from 30-50 percent. Good pre-stocking nursery pond preparation includes control over predatory and weed fish, and insects.

7. Rearing Ponds

- Rearing Ponds are pond system for rearing of fry to fingerling stage.
- The fry from the nursery system is further raised to fingerling size (80-100 mm; 5-10 g).
- Earthen ponds ranging from 0.05 to 0.2 ha are commonly used.
- Feeding and fertilization regimes are similar to the nursery phase but vary according to the intensity of culture and the natural productivity.
- Overall survival in the fingerling rearing stage ranges from 60 to 70 percent.
- Fish are reared in this phase for 2-3 months, after which they are transferred to grow-out production systems.

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

Harvesting methods of marine fishes

1. Describe harvesting methods of Harpodon/ H. nehereus/ Bombay duck

- Common name: Hamilton Buchana, Bombay Duck, Bummalo
- Scientific name: Harpodon nehereus
- It is native to the waters between Mumbai (formerly Bombay) and Kutch in the Arabian Sea, and a small number are also found in the Bay of Bengal.
- The Bombay duck fishery, contributes to about 10% of the estimated average annual marine landings of India.
- Over 98% of the all-India Bombay duck catches are landed from Maharashtra and Gujarat.
- It is cannibalistic.

Characters:

- Body is soft elongated, gelatinous and slender.
- Head is large with small eyes.
- Minute scales present.
- Caudal fin is trilobed.

Harvesting methods:

- Initially, sailing boats were used as Crafts but now mechanical boats are used.
- Fish catching is done in the period of July to November in Andhra Pradesh.
- Various types of nets are used such as:

1. **Dol Net:**

- It is operated at varying depths from 15 to 50m.
- The mesh size is 200mm which gradually decreases to 10mm.

2. **Gill Net:**

- It is mostly used in Gujarat coast from the month of June to September.

3. Bag Net:

- It is mostly used in Orissa coast and some areas of West Bengal.

Disposal:

- Bombay duck is a perishable fish due to high water content.
- Hence, they are freshly used for sale in local markets.
- Rest of fishes are sun dried which are called as bombil.
- Rejected fishes are used as manure.

2. Describe harvesting methods of Mackerel/ Rastrelliger kanagurta

- Scientific name: Rostrelliger kanagurta
- Common name: Bangda
- Amongst the marine bony fishes of India, mackerels enjoy the first position in importance as a commercial group contributing-high tonnage per year.
- It is pelagic and planktophagus.

Characters:

- Body is soft elongated, gelatinous and slender.
- Head is large with small eyes.
- Minute scales present.
- Caudal fin is trilobed.

Harvesting methods:

- Fishing season extends from October to February, after which the shoals break up and disappear for a short period.
- Fishing is carried out up to a depth of 25 m and mostly consists of juveniles ranging from 160-180 mm.
- The fish move in shoals from offshore to inshore waters, possibly for feeding on plankton.

- The craft used are dug-out canoes with boat-seines or rampani nets.
- The mesh size of the rampani net is 12mm at central portion and 30mm at the sides.
- To the head ropes, wooden floats are attached.
- To the foot ropes, sinkers are attached.
- The net is spread in semi-circular manner and the ends of the ropes.

3. Describe harvesting methods of Pearl oysters/ Pinctada sp.

- Pearl is known to human beings since ancient times.
- Pearls are of animal origin and are obtained from Pearl oyster belonging to phylum Mollusca.
- Six species of pearl oysters, Pinctada fucata (Gould), P. margaritifera (Linnaeus), P. chemnitzii (Philippi), P. sugillata (Reeve), P. anomioides (Reeve) and P. atropurpurea (Dunker) occur along the Indian coasts.
- Widely distributed in Gulf of Mannar, Palk Bay, Gulf of Kutch and Persian Gulf.

Characters:

- Bivalve – 2 valved attached at the hinge
- Outer surface of shell – irregular & rough
- On both sides of umbo, ear like projections can be seen
- Mantle - thin membrane is present beneath shell & covers visceral mass.
- Visceral mass – consists of foot, gill, mouth, respiratory simphon, gonads etc.
- They are unisexual.
- Can grow up to 65 mm in about 5-6 years.
- They are attached to substratum by shell.

Harvesting methods:

- Harvesting of pearls is done in winters from December to February.

- The oysters are brought to the dock, cleaned and harvested.
- It takes 2-4 years for developing a good-sized pearl.
- Harvesting of the cultured pearls is usually carried out manually.
- In the case of manual extraction, the pearls are collected by initially separating the two shell valves, by cutting the adductor muscle, making an incision on the gonad and squeezing the pearl out.
- The process can be automated with the use of simple machines.
- The machines used for pearl extraction usually work by dissolving the oyster soft body parts with the use of chemicals while the pearls remain as they are and become easily extractable.
- A seeding technician (often the same one that did the initial implant) makes an incision in the pearl sack and removes the pearl.
- The pearl is examined and if it is of a high quality, a new, larger nucleus is inserted into the pearl sac and the oyster is returned to the farm.
- The oysters are then returned to the culture site for recovery, and after a certain length of time they can be operated for a second time to produce additional pearls.
- Finally, the harvested pearls are washed in distilled water, polished with refined salt and sorted for sale according to size, colour, shape, lustre

4. Pearl Formation

- Pearl is also known as moti or mukta.
- It is white, highly shining, globular natural animal product found within the shell of oyster which is a mollusc.
- The formation of pearl occurs as a result of the defensive response of the oyster.
- It occurs in 3 stages:
    1. Primary Stage
    2. Progressive Stage

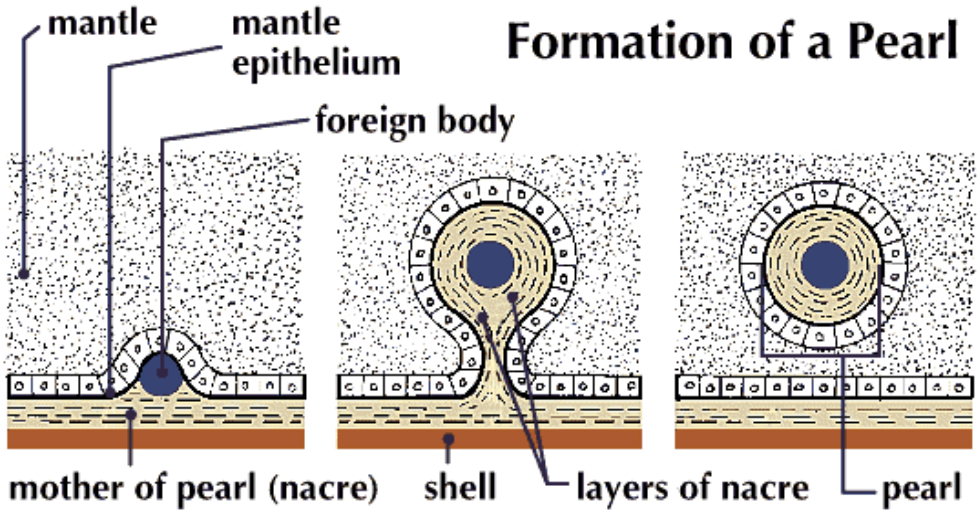
TOPIC: FISHERIES (PART I)

3. Final Stage

- Pearl formation can occur naturally or by culturing.

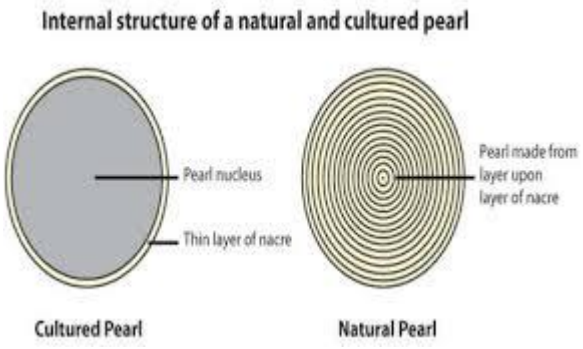
Natural Pearl Formation:

- The mantle is an organ that produces the oyster's shell, using minerals from the oyster's food.
- The material created by the mantle is called nacre.
- Nacre lines the inside of the shell.
- Whenever any foreign object such as a sand grain or a microorganism enters between mantle and shell, the oyster's natural reaction is to cover up that irritant to protect itself.
- The mantle epithelium sets stimulated and surrounds intruder completely.
- Now the mantle epithelium starts secreting concentric layers and nacre around the intruder.
- In due course of time, several layers of nacre are secreted resulting into the formation of pearl.



Cultured Pearl Formation:

- Cultured pearls are created by the same process as natural pearls, but are given a slight nudge by pearl harvesters.
- To create a cultured pearl, the harvester opens the oyster shell and cuts a small slit in the mantle tissue.
- Small irritants are then inserted under the mantle.
- In freshwater cultured pearls, cutting the mantle is enough to induce the nacre secretion that produces a pearl -- an irritant doesn't have to be inserted.



5. Pearl Oyster Culture Process

The process of pearl culture includes the follwing steps which are very crucial for obtaining high grade of pearls with good commercial value.

Step 1: Construction of pearl farm

- Construction of a pearl farm includes three steps as follows -

1. Selection of farm site
2. Construction of farm
3. Well-planned work schedule

Step 2: Collecting oysters

- After the construction of pearl farm, the divers set out to the bottom of the sea, to collect the oysters.
- Oysters are generally located on a flat rock bottom and are usually covered with marine animals and a thin layer of silt.

TOPIC: FISHERIES (PART I)

- The shells collected, are cleaned, sized, and placed into baskets for storage until they are transferred to the pearl farm.

Step 3: Seeding

Two to three-year-old healthy oysters are considered for surgical implantation known as seeding.

This is a very delicate operation and involves three stages:

1. Preparation of graft: A donor oyster is sacrificed to obtain mantle. Mantle is needed by the host oyster to accept the nucleus. Before a graft is taken from the mantle, the oysters are starved for several days to slow down the metabolism of the oyster.
2. Attaching the graft: The oyster is opened with special equipment's. A scalpel slit is made in the soft tissue near the reproductive organ and a graft of living mantle is inserted into the slit.
3. Inserting the core: A nucleus is placed in the scalpel slit and the oyster is then returned back to the water. The inserted core irritates the oyster, provoking it to gradually coat the core with thin layers of mother of pearl nacre.

Step 4: Caring the oyster

- The shells which have been collected and transferred to the pearl farm are placed in baskets or panels which are attached to long lines connected to the floating rafts.
- The rafts are dropped down into the ocean with the oyster securely inside the basket, where they remain until they become operated on for further seeding.

Step 5: Harvesting of pearls

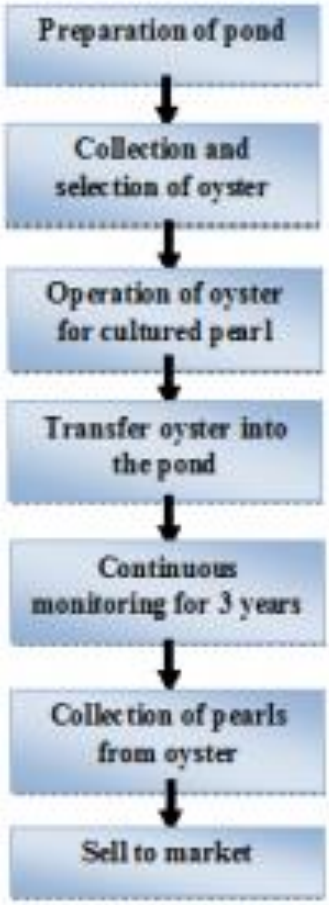
- After 2-3 years, the oysters are harvested.
- It is necessary to make a trial harvest to determine whether the pearls have a sufficient coating.

TOPIC: FISHERIES (PART I)

- The oysters are split open and pearl bags are cut by the scalpel to remove the pearls.
- Collected pearls should be thoroughly dried after the harvest to prevent loss of luster.

Step 6: Sorting of pearls

- There are many different steps involved with the sorting of pearls.
- The pearls are sorted according to whether they can be used for the cultured pearl industry or not.



Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

Crafts and Gears

1. Describe various types of crafts used in fisheries

- There are two main types of devices used to capture fishes in both marine and inland fisheries:
  (1) Nets or gear — these are instruments used for catching fish.
  (2) Crafts or Boats — It provides platform for fishing operations, carrying the crew and fishing gears.
- Fishing crafts are most essential for catching the fish in large scale water bodies.
- A large variety of crafts have been designed for marine and inland fishing.
- Following are the various crafts used for fishing:

1. Catamarans:

- The word catamaran is originated from a Tamil word Kattumaram which means 'lashing timber'.
- It is used mainly on the east costs of Orissa from Kanyakumari.
- It is also used on northeast cost of Kerala.
- It is the most primitive, traditional, economical and efficient craft.
- It is made by tying many wood logs in such a way that it takes the shape of a canoe, which consists of two main logs and two side logs cut into boat shape and held together with rope.

2. Dinghi:

- Dinghi boats are small boats with round bottom.
- Fishing dingis are also called Jalia dingis.
- The crafts are plank built, made up locally using Shisham wood.
- The fore and the hind part of the boat are high above the water level.
- The stem and the bow are long and pointed.

TOPIC: FISHERIES (PART I)

3. **Machwa:**

- Non-motorized wooden sailboats known as Machwas have been used in India for transportation and fishery for centuries.
- It is provided with broad hull, straight keel and pointed bow.
- These are mostly used in Gujarat and Maharashtra.
- Various types of machwa boats are used such as haler machwa, Bombay machwa,

2. Describe various types of gears used in fisheries

- There are two main types of devices used to capture fishes in both marine and inland fisheries:

(1) Nets or gear — these are instruments used for catching fish.

(2) Crafts or Boats — It provides platform for fishing operations, carrying the crew and fishing gears.

- Following are various types of fishing gears:

1. **CAST NET:**

- It is a circular and cone shaped net. It is spread from the edges of water.
- Its circumference is attached to lead line while its centre is attached with a rope.
- The net assumes shape of umbrella when it is spread on the water.
- When the net sinks to the bottom it is pulled and fishes are collected.

2. **DOL NET:**

- Fixed/ stationary bag net
- Conical or rectangular
- Used in Mumbai & Gujarat area
- Fixed in sea by stakes or buoys.
- Used in waters with strong currents
- High tide brings fishes which are trapped

TOPIC: FISHERIES (PART I)

3. RAMPANI NET:

- Large nets for active fishing
- Operated from sea shore
- Contains a bag with wings and scare lines – used for driving fish into bag
- Position is held by wooden floats and stone sinkers on head & foot ropes
- One end remains on the shore.

4. GILL NET:

- The gillnet is named after its catching principle, as fish are usually caught by "gilling".
- The fish is caught in one of the meshes of the gillnet, normally by the gill region (between the head and the body).
- Thus, fish capture by gillnets is based on fish encountering the gear during feeding or migratory movements.
- They are vertical walls of netting kept erect in water column by means of floats and sinkers and set perpendicular to the direction of movement of target fish.

3. Write short notes on Catamaran

- The word catamaran is originated from a Tamil word Kattumaram which means 'lashing timber'.
- It is used mainly on the east costs of Orissa from Kanyakumari.
- It is also used on northeast cost of Kerala.
- It is the most primitive, traditional, economical and efficient craft.
- It is made by tying many wood logs in such a way that it takes the shape of a canoe, which consists of two main logs and two side logs cut into boat shape and held together with rope.
- The logs are held in position by loose rubber called Teppa.
- Generally, the Catamaran is 5-10 metre long, 0.5 metre wide and 0.3 metre deep.
- Following are the types of Catamarans:

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

1. **Orissa and Ganjam type**

- It is made by five logs pegged with wood.
- The logs are cut in boat shape and are not tied with rope.

2. **Coromandal type**

- It is used in Tamil Nadu to capture flying fish of Nagapattanam.
- It is made by 3-5 logs.
- A modified type of Coromandal type is called Kolamaram, which is made by 7 logs.

3. **Andhra type**

- It is the modified form of Orissa type, larger in size—about 5-7 metres long, hence made by nine heavy side wood logs that are fitted with a median log.

4. **The boat-Catamaran**

- It is made of three wood logs tied in boat shape.
- It is used in Mandapam and Mukkun coastal regions.

4. Write short notes on Machwa Boat

- Non-motorized wooden sailboats known as Machwas have been used in India for transportation and fishery for centuries.
- It is provided with broad hull, straight keel and pointed bow.

Following are the types:

1. **Haler machwa:**

- It is used in Gujarat coast.
- Length varies from 8-10 m
- Broad beam and square stern
- Open boat except for short decking in the fore and aft.
- Carvel planking with unusually large and heavy frames

- Tall mast carries on large lateen sail of Arab pattern
- It is used for gillnet fishing.

2. Bombay machwa (Karanja boat)

- Used in Maharashtra coast.
- Length 15 m, breadth 3-5 m and depth 1 m
- Long raking bow with great over hang and sheer. The actual keel is short in relation to the overall length.
- There are two masts, sails are of lateen type.

3. Satpati type (Gal boat)

- Used in Maharshtra Coast
- Length ranges from 10-15 m
- Carvel planking
- Medium pointed bow, broad stem, straight keel, high gunwale, and transom stern
- Used for gill netting

5. Write short notes on Dinghi

- Dinghi boats are small boats with round bottom.
- Fishing dingis are also called Jalia dingis.
- The crafts are plank built, made up locally using Shisham wood.
- The fore and the hind part of the boat are high above the water level.
- The stem and the bow are long and pointed.
- In smaller boats there are no deck but the bigger ones usually possess one.
- The hood is usually lacking, but when present, is located in the posterior part of the boat.
- The oars are long and paddle-like.
- The size of boat varies from 42 – 45 cm in length and 8 - 10 cm in width.

- The boat preservatives ie. painting with bitumen, act as water-resistant and protect crafts from decay and destruction.
- It also gives long life to the craft besides making the boat leak proof.
- The manufacturing cost of the boat is estimated around Rs. 8000-10000 with a life span of 8-10 years.
- The dingis are named on the basis of the fishing nets operated by them; for instance, Bhesail Dingi, Patam Dingi, Shangla Dingi, and Talal Dingi.

6. Write short notes on Gill Net

- The gillnet is named after its catching principle, as fish are usually caught by "gilling".
- The fish is caught in one of the meshes of the gillnet, normally by the gill region (between the head and the body).
- Thus, fish capture by gillnets is based on fish encountering the gear during feeding or migratory movements.
- As fish may avoid the gillnet if they notice the gear, catches are normally best at low light levels or in areas with turbid water.
- They are vertical walls of netting kept erect in water column by means of floats and sinkers and set perpendicular to the direction of movement of target fish.
- Depending on the method of operation gill nets are classified into drift gill nets, set gill nets and encircling gill nets.
- Based on the structure, there are simple gill nets and multi layered netting called trammel nets. Entangling nets are loosely hung and catch is entangled in the net.
- They are of following types:

1. SET GILL NETS:

- It gets set in water surface, mid water or at bottom by means of an anchor and floats to provide proper shape.

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

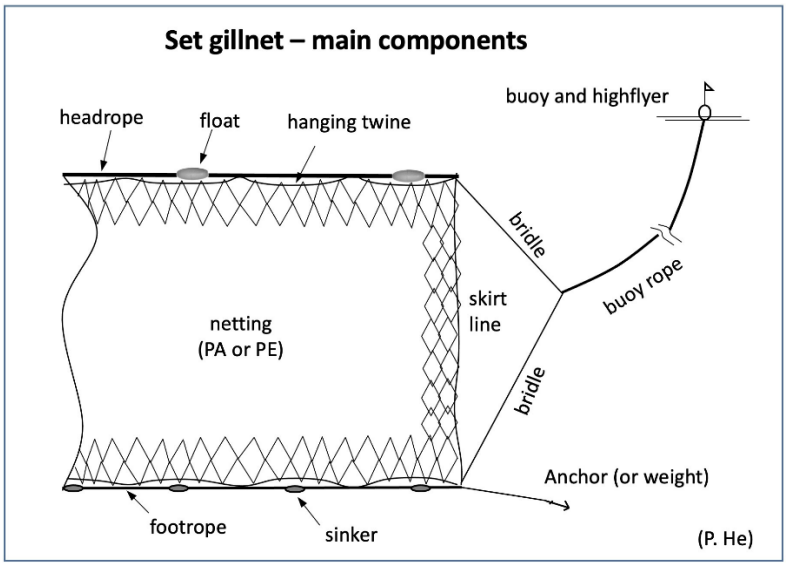
Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)

2. DRIFT GILL NETS:

- The gill net which is allowed to drift along with water current.
- The one end of net either get attached with boat or both the ends get marked with buoys or any floating object.



7. Write short notes on Dol Net

- Dol net is a fixed tapering bag net which resembles a trawl net which are set in tidal streams and the net is held in place by attaching it to anchors.
- Dol netting is a very popular traditional, passive technique of fishing practiced along the north-west coast of India, in the states of Gujarat and Maharashtra.
- Dol nets were operated at a maximum depth of 20-24m which were close to the shore prior to mechanisation, but after mechanization of the crafts fishermen now set their nets at depths of 40m.
- These are attached to the anchors for holding the net in place and floats are used to maintain the mouth opening of the gear.
- The dominant species caught in Dolnets along the north-west coast include Bombay duck, clupeids, elasmobranchs, catfishes, croakers, eels, ribbonfishes, threadfins, pomfrets, flat fishes, penaeid shrimps, non-penaeid shrimps and lobsters.

- Dol net is divided into seven parts.

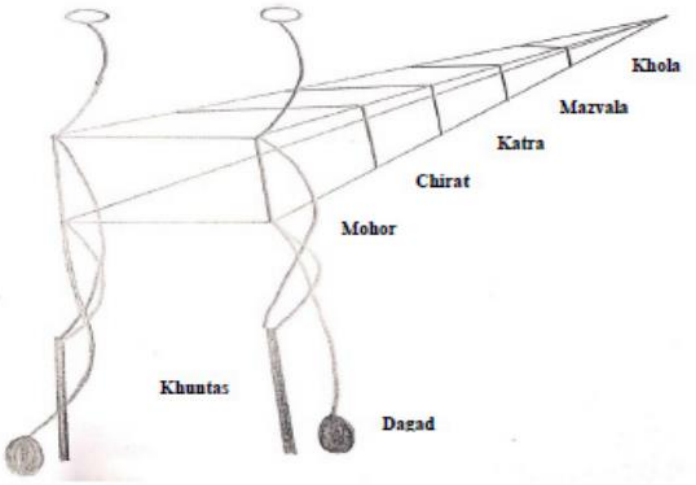


Fig. 1 Dol net in set position

8. Write short notes on Rampani Net

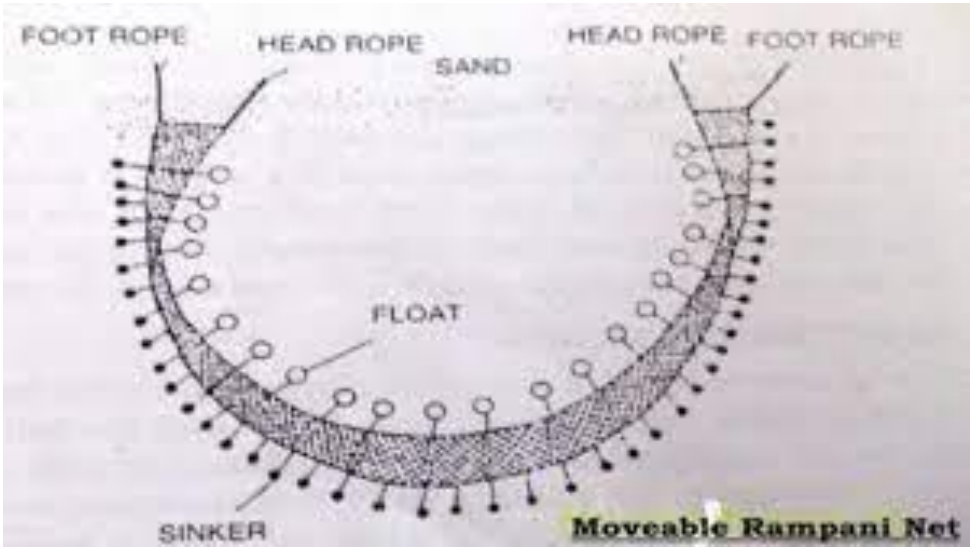
- Rampani net is along wall of netting with or without a bag, supported by float and sinkers, which are operated by surrounding areas of water with potential catch.
- The net is operated by ropes attached to the end of wings which are used for hauling and for herding the fish.
- They are usually operated in the coastal or shallow waters where bottom and / or surface acts as natural barriers.
- These nets are operated from the shores.
- The mesh size of the rampani net is 12mm at central portion and 30mm at the sides.
- To the head ropes, wooden floats are attached.
- To the foot ropes, sinkers are attached.
- The net is spread in semi-circular manner and the ends of the ropes.

Rayat Shikshan Sanstha's
Annasaheb Awate College, Manchar
Department of Zoology

Class: S.Y.B.Sc. **Semester: IV**

Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)



9. Write short notes on Cast Net

- A casting net, also called a throw net, is a net used for fishing.
- It is a circular net with small weights distributed around its edge.
- The net is cast or thrown by hand in such a manner that it spreads out while it's in the air before it sinks into the water.
- This technique is called net casting or net throwing.
- Fish are caught as the net is hauled back in.
- It is a circular net get operated from shore or from boat.
- The net is thrown in such a way that it falls flat on water surface.
- It uses to cover fish from surrounding due to heavy weight. Great skill is required to cast the gear.

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Paper: Applied Zoology II (ZO-242)

TOPIC: FISHERIES (PART I)