Aquaculture:

- Ten million people die every year, the world over, either of starvation or of malnutrition.
- The teeming population in the world is responsible for the food shortage.
- To overcome this problem, man is trying to implement new techniques in food production. Aquaculture is one of the important practices in this direction.
- The concept of **blue revolution** (capturing or capturing of aquatic organisms) is gaining importance.
- Govt of India and Govt. of Andhra Pradesh have been providing infrastructural, financial and technical support to encourage aquaculture in India in general and Andhra Pradesh in particular.
- The available aquatic resources are rivers, canals, reservoirs, lakes, brackish waters (estuaries) and marine waters. The freshwater habitats include lotic (running water) and lentic (stagnant water) habitats.
- The aquatic organisms of economic importance to man are fishes, prawns, crabs, lobsters, mussels, oysters, squids, sea weeds etc. These organisms are exploited either for food or for other commercial products.

FISHERY

- The term fishery denotes the exploitation of fish and other related aquatic organisms. Several **terms** are used to describe the nature of fishery.
- They either indicate the habitat, the type of organisms or method of obtaining the resource. The following are some of the important terms.

i. Capture fishery :

- Fishery resource is obtained with the use of suitable craft and gear from the natural body of water. If the capture is from the sea, it is called **marine fishery.**
- In the sea if the resource is captured from open waters, it is called **offshore fishery.** If the resource is captured from coastal waters, it is called **in shore fishery.**
- If the capture is from estuaries or freshwater bodies like ponds, lakes etc., it is termed **inland** fishery.

ii. Culture fishery or aquaculture

- The second method of obtaining fishery resource is to culture selected aquatic organisms **under** regulated conditions in conditioned waters to achieve **better** production.
- It is **called culture fishery or aquaculture.**
- If the organisms are grown in sea water, it is called **mariculture.** In the same way in brackish water, it is called **brackish water aquaculture,** in the fresh water it is called **freshwater aquaculture.**
- For all these cultures the necessary seed is obtained either from a natural body of water or hatchery.
- Similarly if the organism cultured is a fish it is called **pisciculture,** if **it** is a prawn/ shrimp it is called **prawn/shrimp culture,** if it is a crab it is called **crab culture,** if it **is a pearl** oyster or edible oyster it is called **oyster culture** and if it is a sea weed it is called **sea weed culture.**
- Capturing and culturing of fin fishes is called **fin fishery.**
- Capturing and culturing of other aquatic organisms with shells like crabs, molluscs etc. is termed **shell fishery.**
- Aquaculture is a worldwide practice. It is fast increasing in India in general and Andhra Pradesh in particular. India has more than 8000 km of long coastline covering nine maritime states.
- Andhra Pradesh is one of these states having 932 km coastline, 32000 square miles of marine waters, 4,120 km of riverine area, 60 reservoirs, 50 lakh acres of lakes, 40,000 ponds and 0.5 **million** hectares of brackish waters.
- It is gifted with mighty rivers like the Godavari, the Krishna etc., lakes like Kolleru, Pulicat and Rallapadu.

IMPORTANT ORGANISMS OF AQUACULTURE

- **Name of the organism Common name / vernacular name**

i. Fishes

1. Freshwater fishes

**Catla catla*	Catla (Krishna bocche)
**Labeo rohita*	Rohu (ragandi)
**Cirrhinus mrigula*	Mrigal (erramosu)
Cyprinus carpio	Common carp (china carp)

Ctenopharyngodon idella	Grass carp (gaddichepa)
Hypophthalmichthys molitrix	Silver carp (vendichepa)
**Clarias batrachus*	Cat fish (marpu)
**Heteropneustes fossilis*	Singhi (pamujella)
**Tilapia mossambica*	Tilapia (guraka)

2. Brackish water fishes

**Chanos chanos*	Milk fish (palachepa)
**Lates calcarifer*	Sea perch (pandugoppa)
**Mugil cephalus*	Grey mullet (bontalu)

ii. Crustaceans

Prawns/ shrimp:

**Penaeus monodon*	Tiger shrimp (katla royya)
**Penaeus indicus*	White shrimp (Telia royya)
**Macrobrachium rosenbergii*	Giant river prawn(scampy)
Macrobrachium malcomsoni	Monsoon river prawn

iii. Crabs

**Scylla tranquibarica*	Green crab, mud crab
**Scylla serrata*	*Red Crab,* mud crab
Scylla oceanica	mud crab

iv. Pearl oysters

**Pinctada fucata, Pinctada vulgaris*

v. Sea weeds

Gelidiella, Gelidium *Gracettaria* etc.	Red algae
Sargassum, Lamineria, Macrocystis etc.	Brown algae

***Organisms of both capture and culture fishery.**

Organisations concerned with aquaculture in India :

- Organisations like :
  1. Central Marine Fisheries Research Institute **-CMFRI,** head quarters at Cochin,
  2. Central Institute of Freshwater Aquaculture **-CIFA,** Kausalyaganga, Orissa,
  3. Central Institute of Brackish water Aquaculture **- CIBA, Chennai,**
  4. Central Inland Capture Fisheries Research **Institute -CICFRI,** Barrackpore, Kolkata,
  5. Marine Products Export Development Authority **- MPEDA** are promoting the culture - fishery activities in India

Nutritional and commercial values of aquatic organisms :

- Fishes, prawns, lobsters, crabs, mussels, oysters and squids are edible.
- On an average, food value of fish meat is **considered** to be **high;** 100 gram offish meat contains 15 to 22% proteins, 0.5 to 20% fats, 150 to 800 mg of calcium, 230 to 700 mg of phosphorus, 4 to 20 mg of iron and other minerals, vitamins and 100 to 900 k.cal of energy.
- Fish meat is rich in essential amino acids **methionine** and **lysine,** which are important for brain. **Shark liver oil** contains vitamin A and **cod liver oil** contains vitamin D. ω_3 **fatty acid** (cholesterol reducing) is more in marine fish particularly in the oil of sardines and tunas. Among shell fishes shrimps, scampy and crabs are edible.
- Shrimps and scampy have high export value. Cartilaginous fishes are not generally used as food fishes because they store urea in their tissues as an adaptation to marine life. That urea gives foul smell.
- Oil extracted from **oil sardine** is used industrially. Tuna and sardine industries are the big fishing industries in the world.
- **Fish guano** (solid waste) is used as fertiliser. **Fish-meal** prepared from scrap fish is used as a source of animal protein in poultry feed.
- **Shagreen** (skin of shark) is used as an abrasive. Pearl oysters are cultured for the production of pearls, which have high commercial value.

Craft and gear :

i. Craft :

- All the vessels used for catching and the transport of fish are referred to as **fishing craft.**
- Simple craft with circular frame work of bamboo or cane **Coracle**
- Catamaran, masula boat, kakinada nava-and odam, donga, sangadam (dug out canoes) are the non-mechanised craft used in in shore fishing and inland fishing.
- Mechanised boats, trawlers and ships are used in offshore fishing.

ii. Gear :

Different types of nets used for capturing fish are included under gear.

1. Traps, cast nets and stake **nets** are mostly used in inland fishing. Bag nets are used for capturing the small fishes

2. Long lines are used to capture tuna and **gill nets** to capture the oil sardines. **Boat seines** and **shore seines** are used in inshore fishing. **Trawl nets** are used in mechanised craft. These are used to capture the bottom fishes.

3. Stake nets are used to capture the fish in brackish waters.

FISH CULTURE AND REARING METHODS :

- Fish culture is taken up to get the maximum yield by culturing selected species of aquatic organisms in water bodies through regulated physico-chemical and biological factors.

I. Culture practices :

- Different methods are used for successful culture.
- Based on number of species, the culture practices are :

1. **Monoculture:** Culture of single species in one pond, e.g: culture of a cat fish.
2. **Polyculture:** Culture of compatible species together in one pond, e.g: Culture of Indian major carps, *catla, rohu* and *mrigal* at a time or the culture of Indian major carps along with exotic carps like *common carp, silver carp* and *grass carp.*

- Exotic organisms are not native to the reffered region. They are introduced from other geographical regions into that region

3. **Integrated culture:** It is a multi commodity farming. Two or more economically important organisms are farmed together on a common infrastructure base, e.g: fish-poultry culture.

- **Based on the management methods the culture practices are:**

1. Traditional method: Simple and nonscientific method, in which culture ponds are more like natural ecosystems. No water and feed management practices are followed. Stocking density and production are very low.

2.Extensive method: Water and fed management methods are followed at a low level. Culture ponds are fertilised for the growth of plankton. Stocking density, and production are greater than those of traditional method.

3. Semi-intensive method: Water management practices like aeration and water exchange methods are followed. Formulated feed is provided along with natural food. Stocking density, and production are greater than those of extensive method.

4. Intensive method: Pond size is small. Water management methods like efficient aeration and water exchange methods are to be followed. The total food is supplied in the formulated form. Stocking density, and production are highest in this practice.

II. Management in culture fishery :

i. Fish Culture :

- The important cultivable fishes in India are major carps like *Catla, Labeo, Cirrhinus* and exotic craps like common carp, silver carp, grass carp.
- Cat fishes like *Clarias halrachus* are also cultured. Murrels like *Channa punctatus, Channa maruiius, Channa striatus* are also extensively used for culture.
- Culture of Murrels is discontinued due to heavy losses incurred by **epizootic ulcerative syndrome**

1. **Breeding:** Brood fishes are used for the seed production. Brooders arc collected from natural waters and are kept in hapas.

- Hatcheries are used for artificial breeding. **Induced Breeding** or **hypophysation** technique is followed in artificial breeding.
- The pituitary extract containing the gonadotropin hormones FSH and LH are injected to stimulate the brood fish.
- Chemical **Ovaprim** is also used in induced breeding. **Chinese circular** halchery or **jar hatchery** is used for fish breeding.

2. Pond management: The ponds used in culture are nursery ponds, rearing ponds and stocking ponds. In the **nursery pond** fish spawn is grown for the first fifteen days or until they reach 5 to 7mm.

- **Rearing ponds** are used to grow the spawn into fry (2.5 cm long) and **fingerlings** (4 to 5 cm long). This takes 2 to 3 months. **Stocking pond** is used to produce the marketable fish from the fingerling.
- This takes 8 to 12 months. The management methods in these ponds are represented as prestocking, stocking and poststocking methods
- **Prestocking management** involves drying of pond, eradication of weed plants and fish, liming of pond, water storing and maintenance. **Stocking management** involves judicious combination of species and their ratios according to the size of the pond.
- **Poststocking management** includes the fertilisation of pond water, supplementary feeding to stocked fish and maintenance of optimum water parameters.

ii. Prawn Culture :

- The giant fresh water prawn, *Macrobrachium rosenbergii* is commonly called scampy, It is most suitable for culture due to its fast growth rate and its tolerance to wide ranges of temperature and salinity (eurythermal and euryhaline organism).
- It is more common in the lower to upper reaches of rivers where there is tidal influence. It grows to a size of 320 mm, weight of 200 grams.
- Mature males are larger than females with enlarged second pair of walking legs.

iii. Crab Culture :

- They grow to 130 to 200 mm in width and 0.5 to 2 kg in weight. Young mud crabs arc collected from the wild habitats and are introduced to the culture ponds.
- These organisms grow fast and this process is called **fattening**. Crabs are exported in live condition.

iv. Mariculture :

- The culture of marine organisms is called mariculturc. Coastal shallow sea water, estuaries, lagoons and back waters are used for mariculture.
- Green mussels, edible oysters, pearl oysters and sea weeds are generally cultured in these waters.
- For the culture of mussels, edible oysters and pearl oysters, rafts are constructed using solid bamboos or wood logs.
- Antifouling paints are applied to avoid fouling. Float are used to keep the raft afloat on the water.
- These rafts are tied to the poles on the shore to avoid any drifting due to waves. 5 to 7 meter deep water column is used to place these rafts.
- The larval forms of these organisms are called spat. **Spat** is collected from natural seas.
- These spat feed on plankton and grow to a size of three inches,
- *Pinctada fucata* and *Pinctada vulgaris* are the pearl oysters generally used for pearl oyster culture.
- Pear! oyster culture in India is common in **Tuticorn** coast of Tamil Nadu. Scientists at CIFA are actively undertaking the culture of fresh water mussel *Lammelidens marginalis* for pearls.
- **Seaweed culture:** Marine algae has medicinal and nutritional values. **Red algae** like *Gelidiella, Gelidium, Pterocarpus* and *Gracellaria* are cultured for agar.
- Brown algae like *Sargassum, Turbinaria, Macrocystis* and *Laminaria* are used to produce **algin.**
- *Ulva* of sea waters and *Spirulina* of freshwaters are used for the production of **single celled proteins.**