

# Breeding and seed production of sea cucumber

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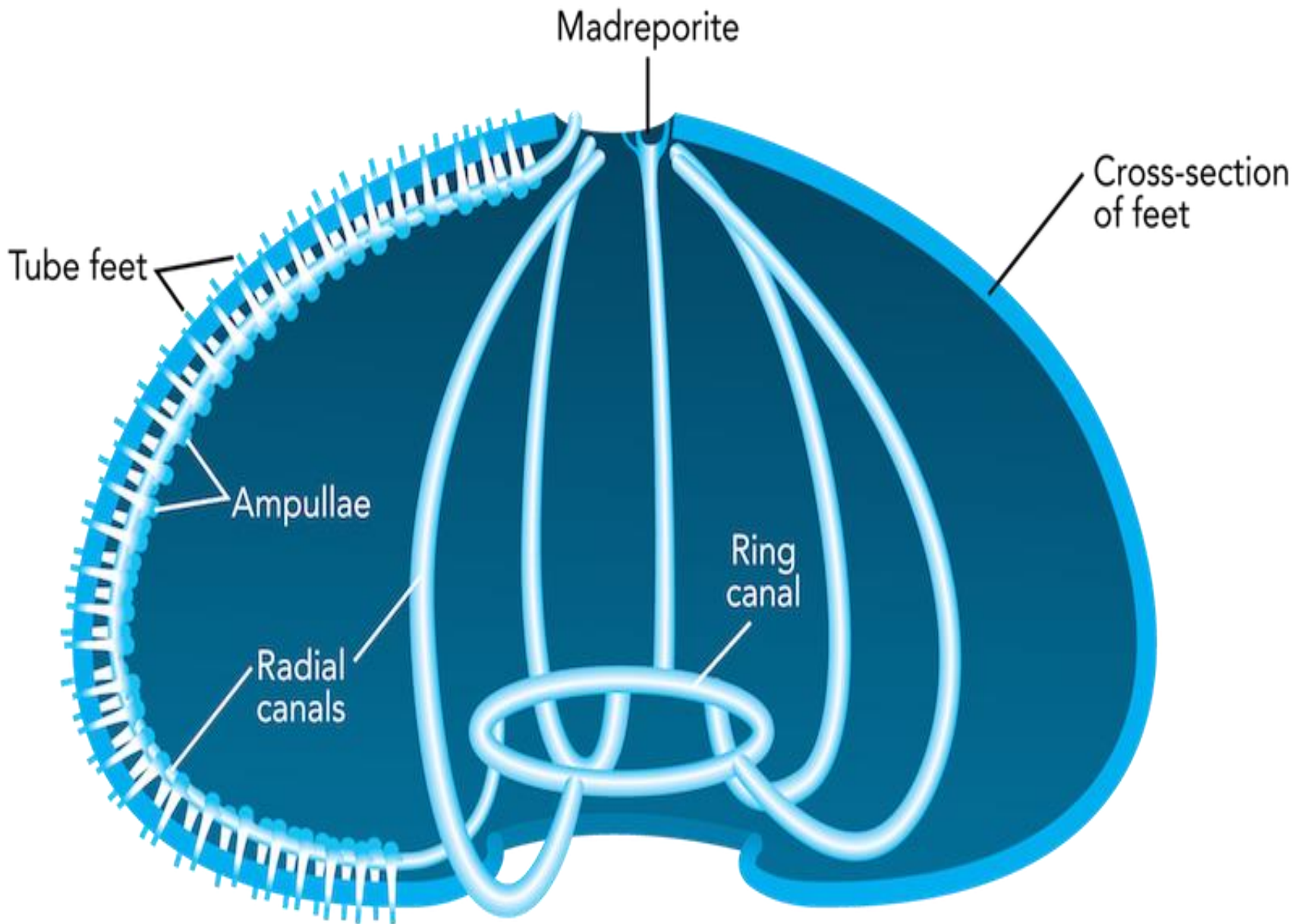
# Introduction

- Holothurians also called as sea slug or sea cucumber distributed widely and throughout the world and very high economic value.
- Sea cucumbers are echinoderms from the class holothuroidea
- Body: oval, arched dorsally (bivium) and flattened ventrally (trivium).
- Bivium with characteristics wrinkles, covered by sediment when the animal is coming out of the bottom.
- Along India coast the dominant species is *Holothuria scabra* commonly called as sand fish.



*Holothuria scabra*

- Found in shallow waters, rarely in depths of more than 10 m; mostly on inner reef flats.
- Burrows in mud and sandy-muddy bottoms.
- The **water vascular system** is characteristic organ of this phylum which is a complex series of canals running through an echinoderm's body. It is a hydraulic pressure system that aids in movement.
- **Tube feet** are small, delicate projections attached along the side of a water-filled tube called a radial canal.



Cross section of holothuria

- The canals lead to **podia**, or tube feet, which are sucker-like appendages that the echinoderm can use to move, grip the substrate, or manipulate objects.
- Echinoderm skeletons are made up of interlocking calcium carbonate plates and spines. This skeleton is enclosed by the epidermis and is thus an endoskeleton.
- Their skeletal structures are microscopic **spicules** embedded in the animal's skin. Because the **spicules** differ by species, they are useful in identification.
- Very high demand due to their taste and several dishes like beach-de-mer (trepang) are made.
- The processing method is particular of this species: the sea cucumbers are buried overnight, and the next day the numerous spicules are removed by brushing the tegument.

# Classification

- Kingdom: Animalia
- Phylum: Echinodermata
- Class: Holothuroidea
- Order: Holothuriida
- Family: Holothuriidae
- Genus: Holothuria
- Species: scabra

- Found in silty sand, often near low saline areas from the intertidal to a depth of 10 m.
- Sexual reproduction takes place during warm season.
- A species with a high potential fecundity and early sexual maturity.
- Spawning occurs on August to September and December to January.



# Reproduction

- Growth in terms of length 400 mm, weight 500 g and 18 months. First sexual maturity at 210 mm length.
- No distinct sexual dimorphism.
- Ovary and testes are in the form of a tuft of tubules attached to the dorsal mesentery.
- It leads to gonoduct and ultimately gonopore situated on the dorsal side near the oral region.
- In general ripe testes are milky white whereas the ovaries are translucent.

# Maturity stages

- **Female;**
- Five stages
- 1. Immature: Ovarian tubules are transparent, short and thin.
- 2. Resting
- 3. Growing
- 4. Mature
- 5. Post spawning

- During **growing** phase the tubules are having opaque spherical oocytes 20-120 microns in diameter . Partially filled with oocytes.
- During **mature** phase, the tubules are swollen containing ripe oocytes of 150-200  $\mu\text{m}$
- During post spawning phase some tubules are seen as in mature stage, others are shorter showing atresia a few ripe oocytes are in the tubules and signs of resorption/atresia are seen.

## **Maturity stages of males**

- In males during stages I and II testes is hardly distinguishable from ovary,
- During stage III, the testis tubules become more branched and whitish, length and diameter also grow, spermatids develop inside the tubules,
- During stage IV, tubules grow larger in size, more whitish with swellings and spermatozoa are seen in tubules,
- During stage V the tubules appear evacuated in appearance with only a few spermatozoa remaining in the tubules.

# Spawning behaviour

- **Breeding season:-** It has been reported to breed twice in a year first spawning season in from March to May and second during October-December in gulf of Mannar
- Holothurians usually spawn in the late afternoon or evening or during night.
- During spawning, the males release the spermatozoa first and then female releases the eggs.
- The males first lift the anterior end and perform swaying movements for sometime after which they start releasing sperm and it continues for 1-2 hours.
- Ripe females, if any are present nearby, exhibit responsive behavior. The anterior region of the female gets bulged and eggs are released through the gonopore forcefully in a continuous jet.

- The mass of eggs so released appear light yellow and mucus like. The fertilization is external, taking place in the water.
- **Fecundity**:-One adult female releases about 1 million eggs.
- Eggs are spherical in size about 180-200  $\mu\text{m}$  in diameter.

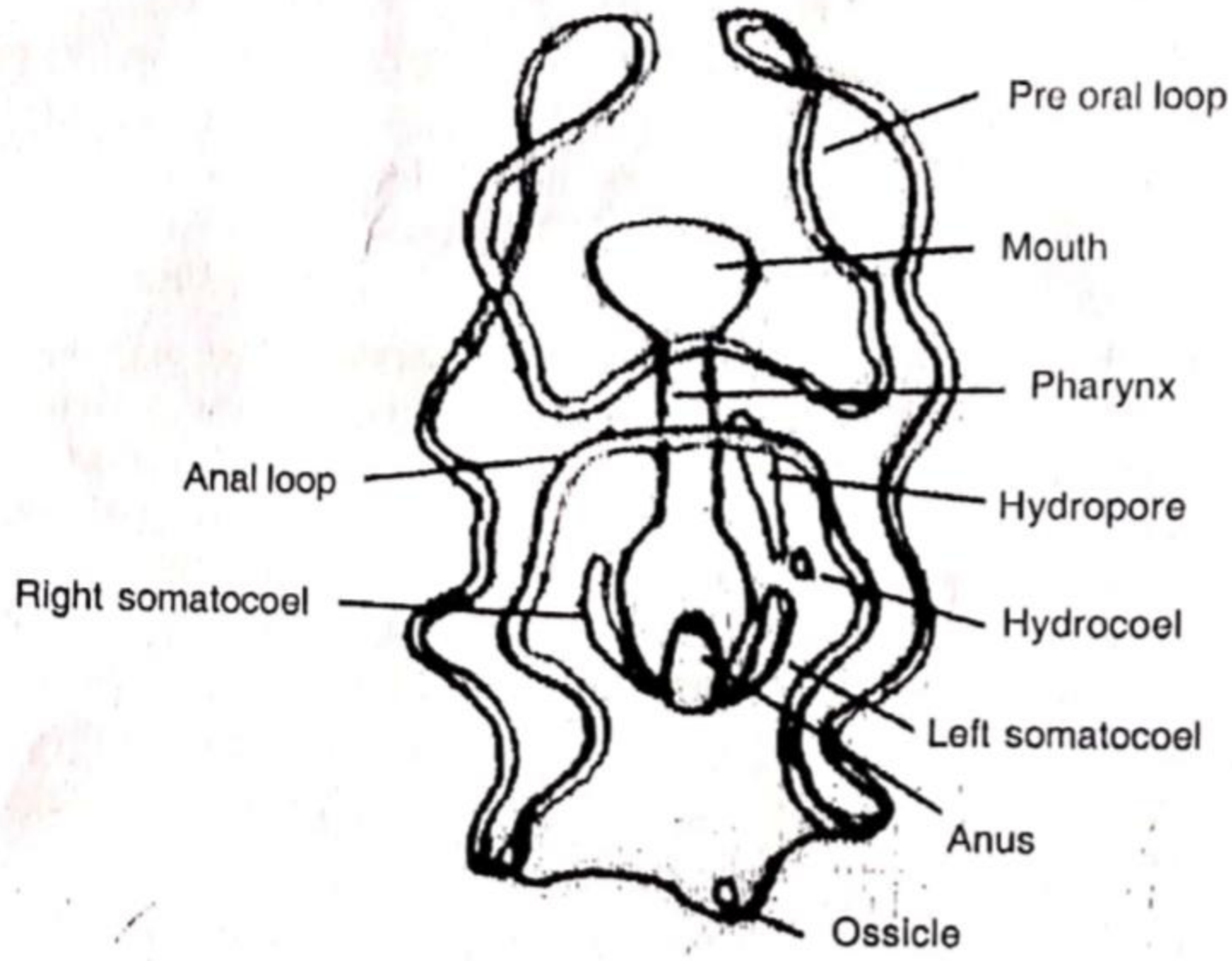
## Life cycle

- The first cleavage takes place after 15 min of fertilization and after 3 hrs blastula is fully formed.
- The gastrula is fully formed after 24 hrs.
- **Auricularia** larvae hatches out after 48 hours.
- The auricularia larvae is transparent, pelagic and perform locomotion by movement of flagella of ectodermal cells along sides of larvae.
- It has a well developed mouth, gut and anus. And have multiple coelomic sacs.

- It grows to **doliolaria** larvae within 10 days.
- It is barrel shaped measures about 620  $\mu\text{m}$ .
- Characterized by flagellated rings and presence of water canals.
- Within 2 to 3 days it develops into **pentactula** stage.

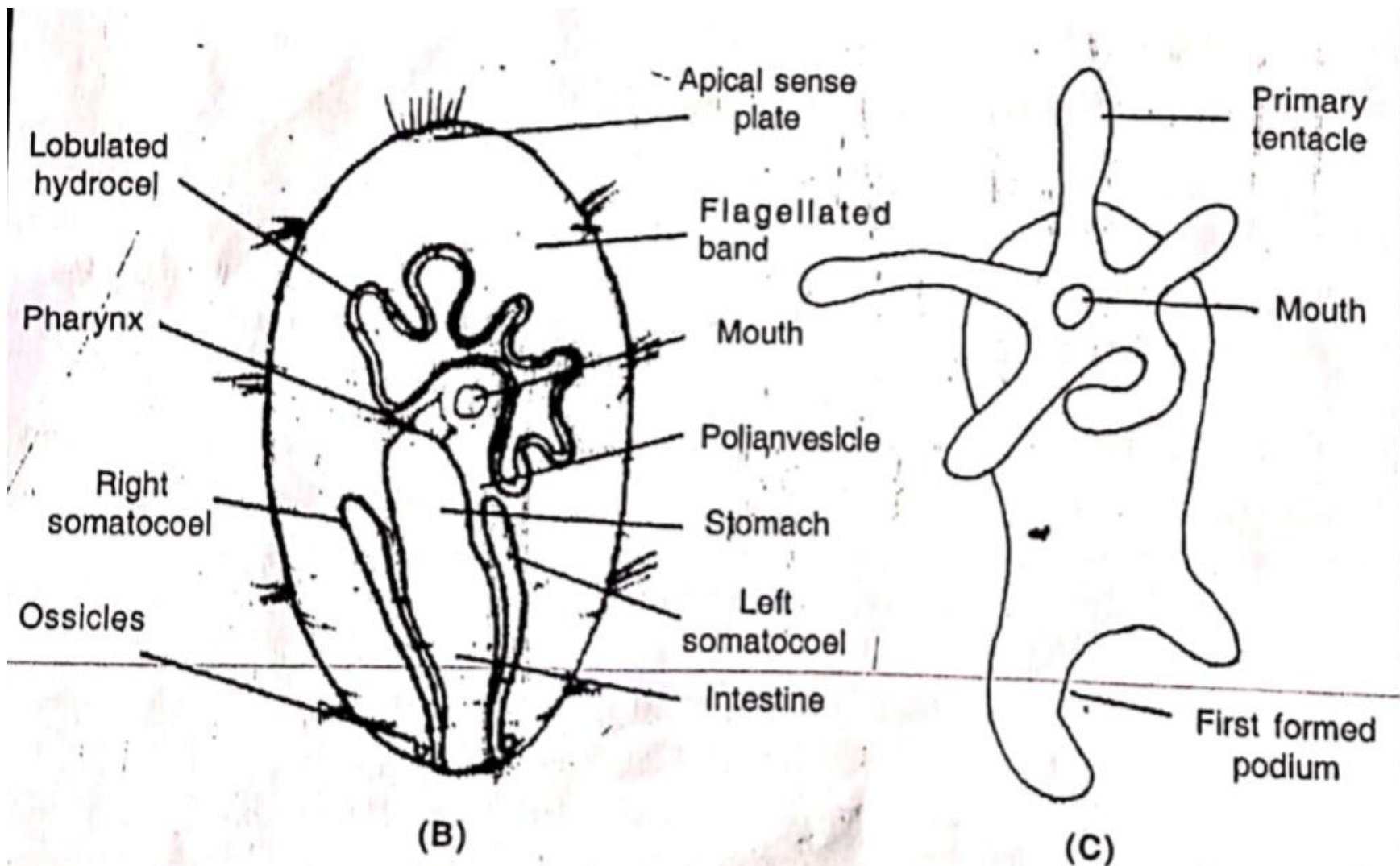


- **Pentatula stage:**
- It is tubular and creeps over sides of bottom .
- It measures 600-700  $\mu\text{m}$  in size.
- It has 5 tentacles at the anterior end and a single tube feet at the posterior which helps in its locomotion.
- They feed on benthic algae and detritus.
- They transformed into juvenile within one month.



Auricularia

(A)



Doliolaria

Pentactula

# Hatchery technology

- Following components
  - 1. Brood stock maintenance unit
  - 2. Spawning unit
  - 3. Larval rearing unit
  - 4. Algal culture unit

# Brood stock maintenance

- Healthy specimen should not be injured or eviscerated from commercial caches during spawning season.
- Tank of 1 ton capacity with 6 inch thick sand in the bottom and stocked with 20 -30 adults.
- Clean filtered sea water with daily water exchange and sand exchange fortnightly.
- Salinity 32 – 35 ppt.
- Feeding with algal paste once in a week.
- Water fouling should be avoided so feed quantity has to be monitored.
- Air condition room with temperature 18 – 25 °C.

- **Spawning unit**
- Spawning is carried out in rectangular FRP tanks 100 L capacity.
- Provision of immersion heater with thermostat and aerator for thermal stimulation.
- Tank is filled with filtered clear sea water, the temperature of water is raised by 3-5°C by using the immersion heater.
- This the most widely used and reliable method of spawning of the holothurians.

- Apart from thermal stimulation other techniques of spawning is also available.
- **Natural spawning** – no artificial stimulation
- **Stripping**
- This is done mainly on experimental scale. Animals are cut opened and their gonads are taken out. From this sperms and ova are taken out mixed in beaker with seawater with mild aeration.
- **Stimulation through drying and powerful jet of sea water.**
- One weak conditioned brooders are used for this purpose.
- The animals are dried in shade for half an hour and then powerful jet is spread over the specimen for few minutes.
- Then animals are again kept back in tanks filled with seawater.
- After 1-2 hrs they will spawn.

- **Larval rearing unit**
- Fertilized eggs are moved to rearing tanks.
- The auricularia larvae hatch out after 48 hrs.
- The healthy larvae occupies at the surface but dead one settles at the bottom.
- The larvae are collected using sieve and counted.
- Then the larvae are released into rearing tank filled with clean sea water at a density 300-700nos per liter
- Regular cleaning of tank once in a three days.
- The larvae is fed on micro algae *Isochrysis galbana*, two times a day.
- About 20000-20000 cells per ml water.
- After 4-5 days, the larvae can be fed upon mixed culture of phytoplankton mainly having *Chaetoceros*..



- Water quality parameters
- Temperature – 27 – 29 C
- DO at saturation
- pH 7.5 – 8.5
- Salinity – 32- 35 ppt
- Total ammonia nitrogen – less than 0.5 mg/L

- In the optimum water quality conditions, the auricularia develops into doliolaria on 10th day.
- Doliolaria transform to pentatula within 2-3 days.
- Hard substrate is needed to doliolaria to settle.
- **Two types of substrate is used**
- 1. Polythene sheets kept in sea water in outdoor tanks for 4-5 days. Water is circulated and so benthic algae and diatoms get settled on it.
- 2. Polythene sheets are kept in sea water and algal extract is added after filtering with 50  $\mu\text{m}$  sieve
- The algae *Sargassum* is used for 4-5 days with daily water exchange

For settled larvae algal extract is continued as feed. 40 micron filter is used for first month and 80 micron filter is used for second month.

After 1 month larger sized juveniles are separated 15 - 20 mm size. And kept in tank containing very fine sand.

Density of juveniles 200-400 individuals per sq m.

Thank You

We are at the end of syllabus

Enjoy....