COPEPODS CULTURE

Dr. P. SANTHANAM
Assistant Professor
Marine Planktonology & Aquaculture Lab.,
Department of Marine Science, School of Marine Sciences
Bharathidasan University, Tiruchirappalli-620 024, Tamil Nadu.
E-mail: santhanam@bdu.ac.in
Website: www.mpalbdu.weebly.com

POTENTIAL ADVANTAGES OF MARINE COPEPODS

- Rich in protein
- Rich in digestive enzymes
- Rich in EAA
- Excellent source of HUFA & ARA
- Rich in antioxidant
- Rich in astaxanthin and Vitamin C & E.

COPEPODS COLLECTION

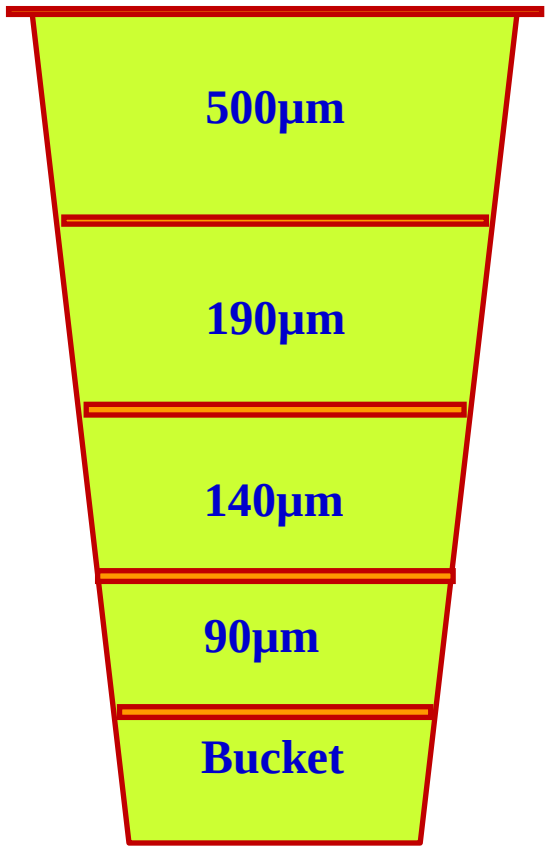
- **Horizontal hauling**
- **Plankton mesh: 158 µm.**
- **Collection time: Early morning or late evening**
- **Transported to Laboratory for identification followed by isolation**

GRADING AND SEGREGATION

Grading will be done by using a set of superimposed sieves with varying mesh sizes with decreasing mesh size from upstream to downstream

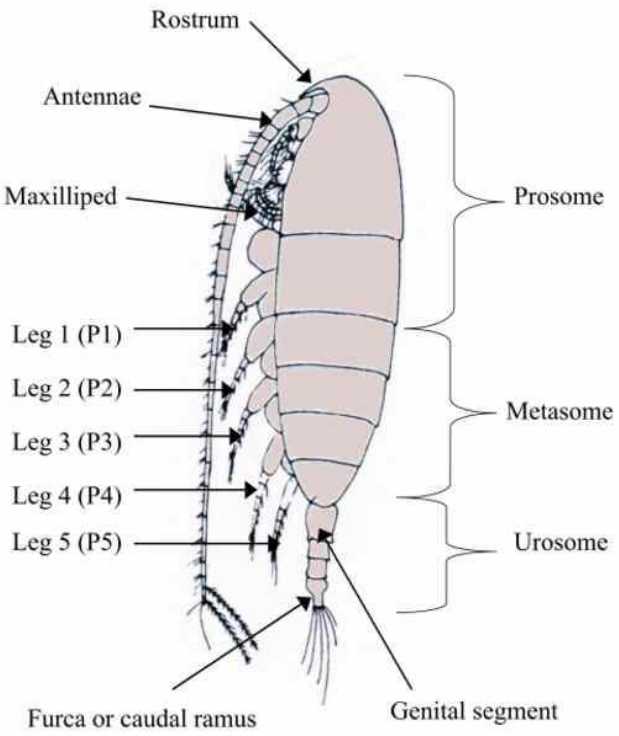
Copepod samples will be screened coarsely through a 500µm mesh to remove fish and prawn larvae

Samples will be screened through 190µm mesh screen to remove rotifers, nauplii of copepods and barnacles



COPEPODS IDENTIFICATION

Copepods will be identified under the microscope using the standard key (Kasturirangan, 1963)



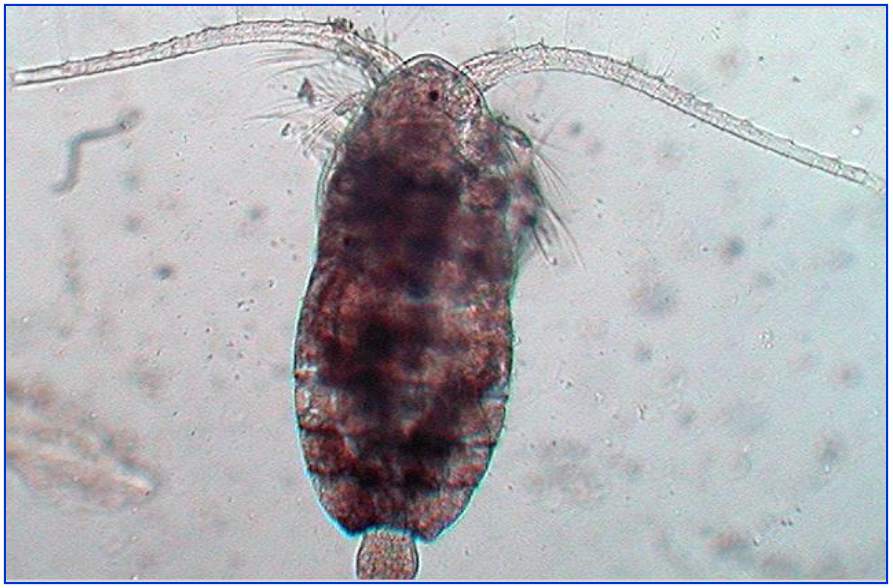
TAXONOMY AND SYSTEMATICS OF *NANNOCALANUS MINOR* (CLAUS)

Phylum	: Arthropoda
Class	: Crustacea
Order	: Copepoda
Sub-order	: Calanoida
Family	: Calanidae
Genus	: *Nannocalanus*
Species	: *N.minor*

The first antenna reaches up to caudal rami by about half of the body length.

In males, the fifth legs contained few plumose setae on the right exopodite. Left leg distinctly longer than the right leg.

The external marginal spines are greatly enlarged on the left exopodite.



TAXONOMY AND SYSTEMATICS OF *PARACALANUS PARVUS* (CLAUS)

Phylum	: Arthropoda
Class	: Crustacea
Order	: Copepoda
Sub-order	: Calanoida
Family	: Paracalanidae
Genus	: *Paracalanus*
Species	: *P.parvus*

First antennae not generally reaching beyond the caudal rami, surface of basipod 1 of legs 1 to 4 beset by hairs and bristles.

Female Urosome 4-segmented; 5th legs symmetrical, 2-segmented, genital opening oval, broader than long; length 0.8 to 1 .00 mm.

Male Urosome 5-segmented; 5th legs asymmetrical, 2-segmented on the right and 5-segmented on the left, left foot much longer; bubble like eminence on cephalosome indistinct or absent in profile view; length 0.9 to 1.00 mm.

TAXONOMY AND SYSTEMATICS OF *PSEUDODIAPTOMUS ANNANDALEI* SEWELL

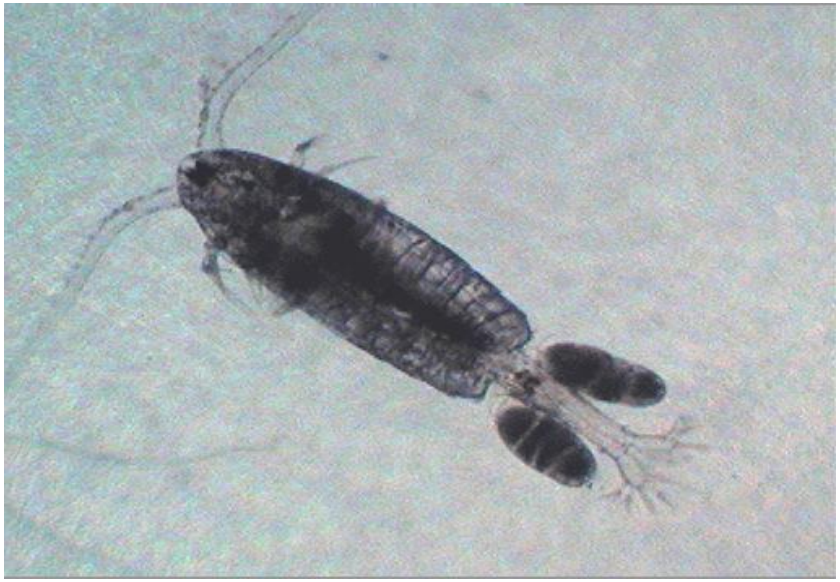
Phylum	: Arthropoda
Class	: Crustacea
Order	: Copepoda
Sub-order	: Calanoida
Family	: Pseudodiaptomidae
Genus	: *Pseudodiaptomus*
Species	: *P.annandalei*

Genital segment with prominent spine on each side.

Fifth leg is modified, right leg has claw on its terminal segment.

Left fifth leg of male has two segments modified into forceps like structure.

Length of the female is 1.18 mm and male is 0.9 mm.



TAXONOMY AND SYSTEMATICS OF *NITOCRA AFFINIS*

Phylum	: Arthropoda
Class	: Crustacea
Order	: Copepoda
Sub-order	: Harpacticoida
Family	: Ameiridae
Genus	: *Nitocra*
Species	: *N.affinis*

Body slender and laterally compressed.

The antennule reaches as far back as the genital segment.

Rostrum prominent.

Caudal setae cylindrical nearly one and half again as long as caudal rami.

Swimming legs long and narrow.

TAXONOMY AND SYSTEMATICS OF *NITOCRA AFFINIS*

Phylum	**: Arthropoda**
Class	**: Crustacea**
Order	**: Copepoda**
Sub-order	**: Harpacticoida**
Family	**: Tisbidae**
Genus	**: *Tisbe***
Species	**: *Tisbe* sp.**

Urosome 5-segmented. First urosomite (P5-bearing somite) without ornamentation; Caudal rami nearly as long as wide with 7 setae each and small spinules at base of each caudal seta except for seta V. Antennae biramous, with separate coxa and basis, latter well-developed, as long as proximal segment of endopod, ornamented with rows of spinules on surface, with 1 bipinnate abexopodal seta at inner distal corner.

TAXONOMY AND SYSTEMATICS OF *EUTERPINA ACUTIFRONS* (DANA)

Phylum	: Arthropoda
Class	: Crustacea
Order	: Copepoda
Sub-order	: Harpacticoida
Family	: Tachidiidae
Genus	: *Euterpina*
Species	: *E.acutifrons*

It is a monospecific genus as it has the only species.

The body is subpyriform or attached and the cephalosome is drawn out in front into a greatly prominent rostral projection which is acute at the tip.

Fifth pair of legs formed by two undivided juxtaposed plates

TAXONOMY AND SYSTEMATICS OF *OITHONA RIGIDA* GIESBRECHT

Phylum	: Arthropoda
Class	: Crustacea
Order	: Copepoda
Sub-order	: Cyclopoida
Family	: Oithonidae
Genus	: *Oithona*
Species	: *O.rigida*

The anterior end is bluntly rounded.

The first antennae reached upto end of 3rd metasome only and it is twice geniculated and the sheathing base appears to be present.

The body is broader at the centre than at either end and the four segments are found behind head.

Body usually with much pigments.

Paired egg sacs may sometimes be seen attached on the anterior end of the upper abdomen.

Urosome nearly as long as metasome. Caudal setae coarsely plumose which forming a fan.

INTENSIVE STOCK CULTURE OF COPEPODS

A known number of copepods including male and female or gravid females will be isolated using fine brush, needles and stemphel pipette

Isolated copepods will be stocked initially in 250 ml glass beakers & conical flasks provided with microalgae without aeration

Latter copepods will be sub-cultured into 7 litres of plastic containers filled with filtered seawater and vigorous aeration will be given

INTENSIVE STOCK CULTURE OF COPEPODS

Then copepods will be transferred to oval shaped, flat-bottomed fiberglass tank filled with 100 litres of filtered seawater and vigorous aeration for mass culture

The water quality parameters such as temperature, salinity, pH and dissolved oxygen will be maintained in the ranges of: 26-30^{o} C; 28-32 ‰; 7.5-8.5; 5.0-7.5 ml/l respectively

Copepods will be fed with a daily ration of mixed microalgae *viz.*, *C.marina*, *D.salina*, *I.galbana*, and *Nannochloropsis* sp. in the concentration of 25,000cells/ml.

SYSTEM AND EQUIPMENT PREPARATION

The FRP tank will be washed with a low residue laboratory detergent (e.g. Alconox or Sparkleen) and water followed by through rinsing

Then tanks will be treated with 100% muriatic acid (HCl) solution outdoors followed by through rinsing with filtered seawater

Tanks will be leached three times (24 h each time) to remove all water-soluble remnants of the manufacturing process

Tanks will be filled to the rim with filtered, UV-treated seawater and adjusted the salinity as needed, and water will be chlorinated with 60 ml (0.2 ml/L) commercial 10% Hypochlorite solution per liter

The treated system will be allowed to stand for 24 h. Thereafter, system will be de-chlorinated with 60 ml of stock Thiosulfate solution. The vigorous aeration will be started

After an hour, ‘free chlorine’ test strip will be dipped and zero ‘free chlorine’ remaining will be verified. The treated seawater will be aerated to at least 6 mg/L DO

Filter system

COPEPODS PILOT SCALE PRODUCTION (WATER QUALITY CONTROL)

The seawater conditions like salinity, pH, DO, color, and scent (particularly the "rotten egg" smell of H_2S) will be checked prior to collection and treatment

The seawater will be serially filtered through 50µm, 10µm, and 1µm mesh bags then pass through an ultraviolet sterilizer

Filter bags will be cleaned, then sanitized overnight in hypochlorite solution once a week under normal usage. Filtered, UV treated seawater will be used directly to culture copepods

The filtered seawater will be treated with 10% commercial hypochlorite solution at 0.2 ml/L and stand for overnight without aeration

After that, seawater will be dechlorinated with thiosulfate solution volume for volume (V/V) at 0.2 ml/L.

The dechlorinated water will be used for filling all wash bottles, stacked sieve holders, harvest samples, population counts, etc.

Filter set and ultraviolet sterilizer

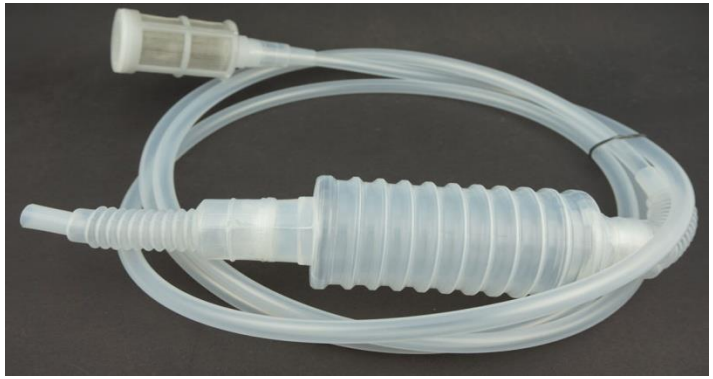
COPEPODS PILOT SCALE PRODUCTION

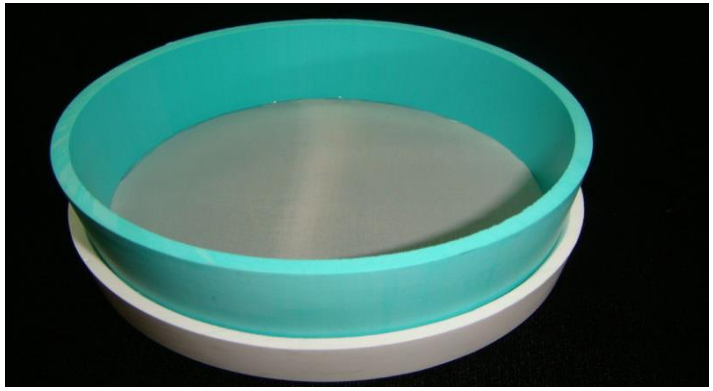
Pilot scale copepods culture will start with a clean FRP tanks, algae and filtered, UV-treated seawater

Tanks will be stocked with a known numbers of Gravid females. Gravid females will release the nauplii within 36-42 hours

The detritus will be removed daily using graded sieves connected with siphon hose, then return adults and nauplii to the tank

The sequential batch cultures will start at 5-7 day intervals for continuous copepods production





COPEPODS PILOT SCALE PRODUCTION (AIR QUALITY CONTROL)

Cool, filtered, interior air will be used for aeration

The disposable in-line 0.2µm pore anti-bacterial air filters will be used for all aeration

Aeration will be used to maintain algae culture, CO_2 saturation, pH stability and uniform mixing

COPEPODS HARVEST STIPULATIONS

The stacked-sieve holder and wash bottles will be washed with treated seawater at culture tank temperature

The siphon hose will be connected to the siphon head and the stacked sieves

The copepods will be harvested filtered onto a wet freestanding sieve

As the tank water level drops, frequent rinsing will be done to down copepods stuck to the sidewalls

30% of the tank volume will be exchanged weekly with new treated seawater