

Importance of Cladocerans & culture methods

Introduction

Kingdom	Animalia
Phylum	Arthropoda
Subphylum	Crustacea
Class	Branchiopoda
Subclass	Phyllopoda
Order	Cladocera (Latreill, 1829)
Family	Daphnidae
Genus	Daphnia Moina

Introduction

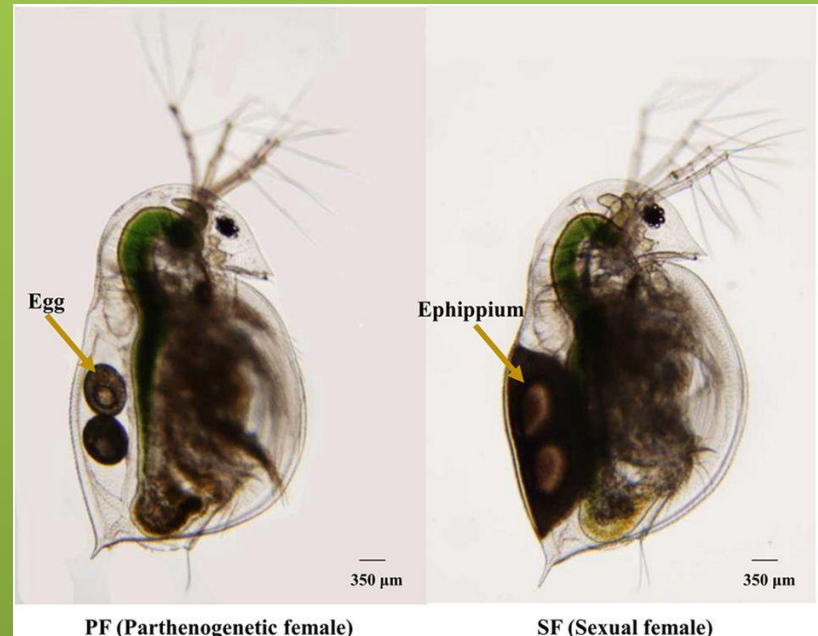
- Cladocera or cladocerans are small crustaceans commonly called **water fleas**, part of the Class Branchiopoda.
- They form a monophyletic group, which is currently divided into four suborders, 14 families, 87 genera, and about 400 species.
- Vary in size from 0.2 to 3.0 mm.
- Life expectancy between 25 and 100 days (MacArthur and Baillie 1929).

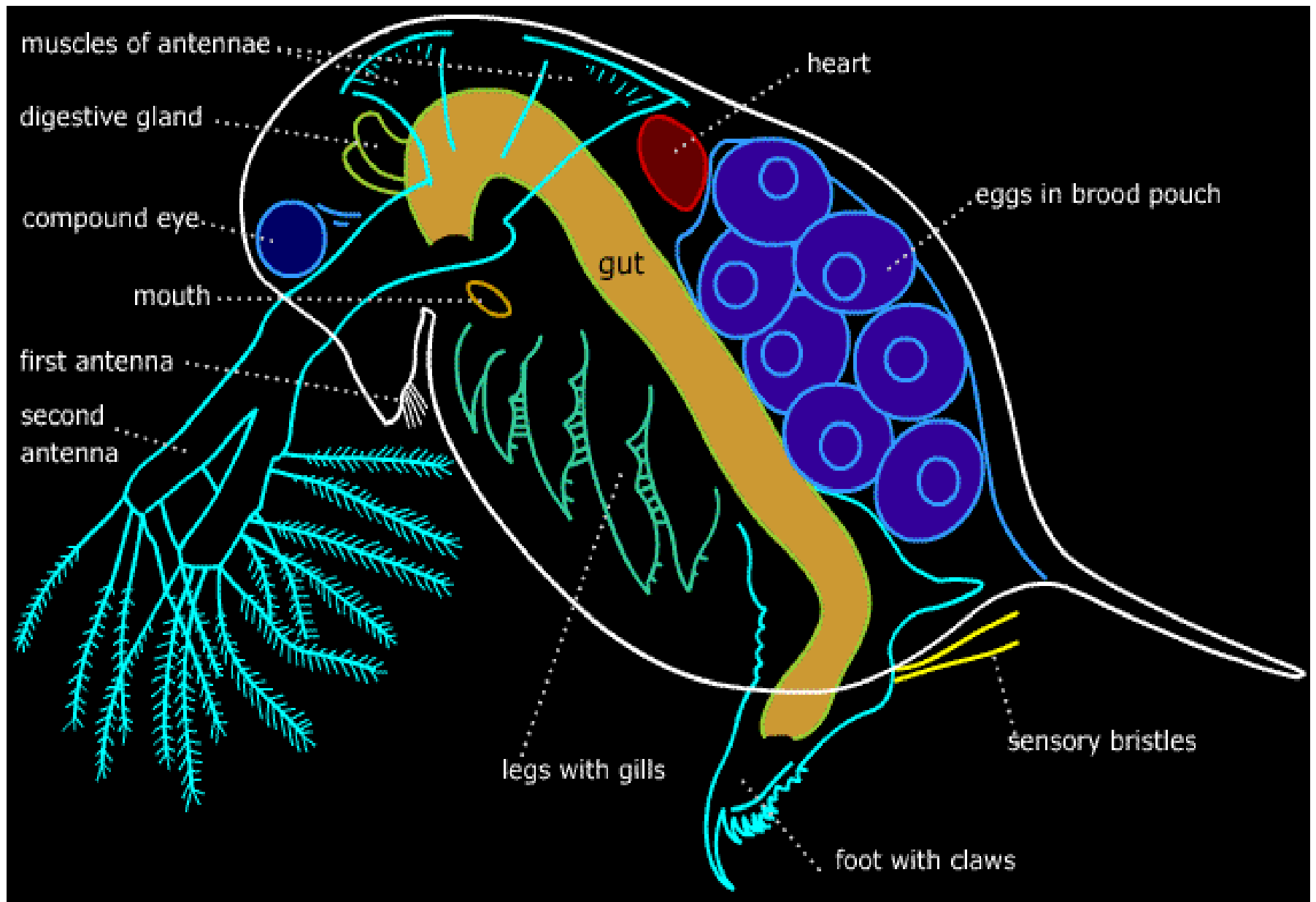
Introduction

- This is because of their easy availability in nature and easy adaptability to captive conditions.
- Owing to these traits these cladocerans Come in handy as relatively inexpensive live food in aqua-hatcheries.
- Inhabit fresh and low saline water ponds, tanks and some sewage lagoons.

Morphology

- Large biramous antennae are the chief organs of locomotion.
- *Daphnia* is distinguished from *Moina* by the presence of prominent caudal spine.





Culture

- *Moina* measures 0.5 to 1.0 mm in length and 0.2 to 0.6 mm in width whereas *Daphnia* measures 0.5 to 2.5 mm in length and 0.3 to 1.0 mm in width.
- Cladocerans are among the most easily cultured of all the freshwater invertebrates.
- Manure, cottonseed meal, dried yeast, dried milk and chopped hay are all suitable mediums.
- Capturing of cladocerans can be accomplished with the use of a plankton tow net or a Birge cone net (Pennak 1978).

Nutritive value

- The protein of *Moina* is averages 50% dry weight. The total amount of fat 20-27% for adult females and 4-6% for juveniles.
- *Moina* which can also be grown on yeast or commercial single cell proteins.

FOOD AND FEEDING

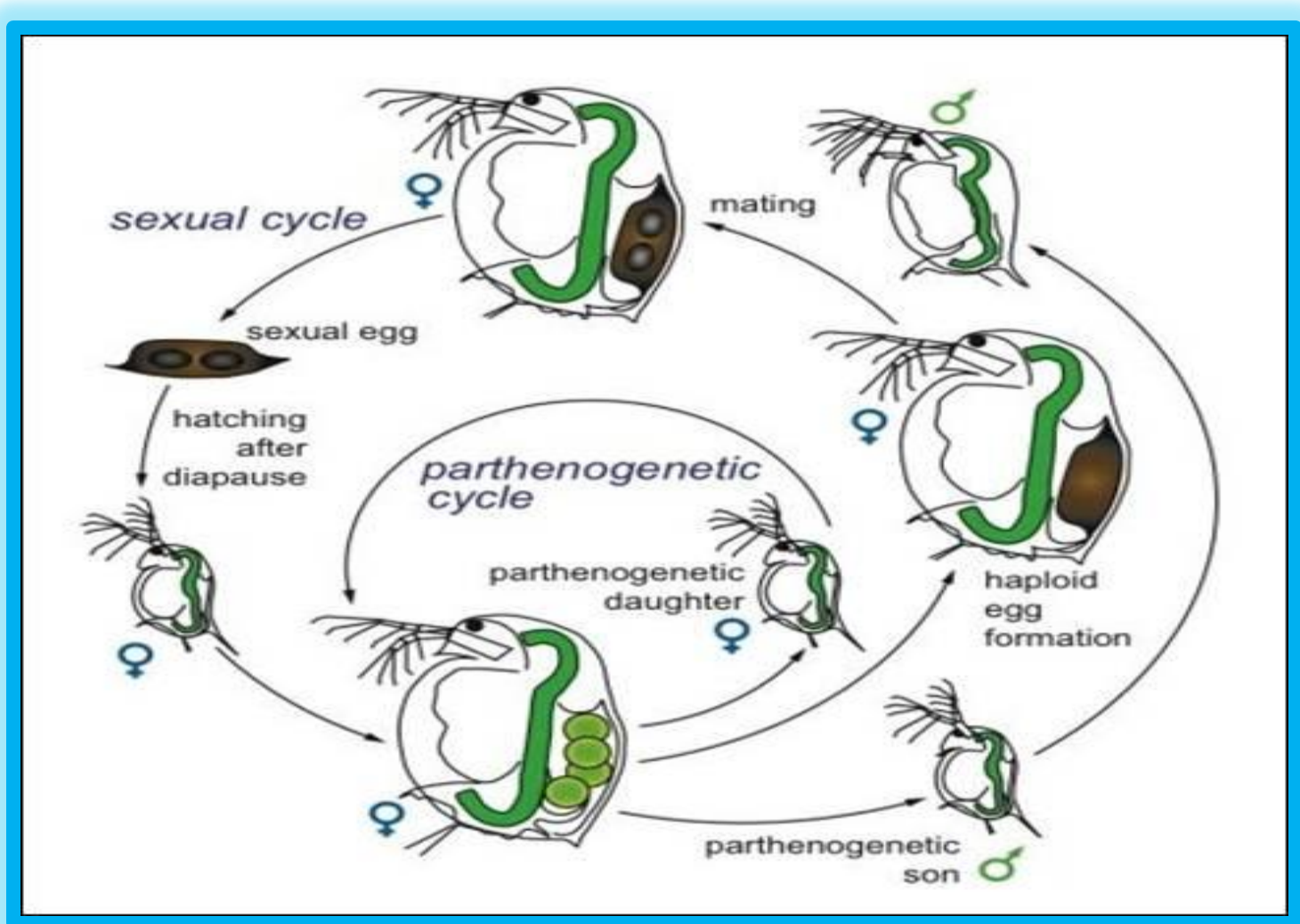
- Food and feeding habits of *Moina* and *Daphnia* are same.
- They feed on algae, bacteria , fungi , protozoans and organic debris.

Reproduction

- During most of the year, reproduction is parthenogenic/asexual, only females produces.
- The number of eggs per clutch is 10 and 20, and female produce only one clutch in her lifetime.
- In the early spring the cladocerans population consists mainly of females recently hatched from resting eggs.
- Once the water temperature reaches 6° to 12° C, reproduction resumes.
- when the environment starts to deteriorate due to overcrowding, eggs are produced that develop into males and females capable of sexual reproduction.
- The eggs that are then fertilized sexually by males are capable of surviving winters, and once spring arrives, these eggs will hatch.

Reproduction

- The **brood pouch**, called an **ephippium**, is unique among Cladocera.
- The ephippium contains fertilized eggs, termed **winter eggs**, which provide an **extra shell layer** around the eggs.
- The extra layer preserves and protects the egg inside from harsh environmental conditions until the **more favourable times, such as spring**, when the reproductive cycle is able to take place once again.



Importance

- Important food source for many species of fish
- Capsule of valuable nutrient – protein, amino acids, lipids, fatty acids, minerals and enzymes
- Provide an inexpensive alternative to other commercial feeds.
- Cheaper source than Artemia
- Daphnia is commonly used to test the toxicity of chemicals in solution or for water pollution.

Culture type

- Batch Culture
- Semi- continuous Culture
- The **Batch culture** method uses a continuous series of cultures. Briefly, a new culture is started daily in a separate container.
- When all the fungal, bacterial, and algal cells are consumed, usually about 5-10 days after inoculation, the cladocerans are completely harvested, and the culture is restarted.
- This method is particularly applicable when a specific quantity of organisms are needed each day because daily production is much more controlled.

Culture type

- Batch culture is also useful for maintaining pure cultures because there is less chance of the cultures becoming contaminated with competitors (e.g., protozoans, rotifers, copepods) or predators of fish larvae or fry (e.g., Hydra, back-swimmers, diving beetles, dragonfly larvae).

Culture type

- **Semi-continuous cultures** can be maintained for two months or more by daily partial harvests of organism, water changes and regular feeding, keeping the population in a state of rapid growth.
- Eventually, the organism cultures will fail to respond to additional fertilization. When it is evident that they are not reproducing well, the organism should be completely harvested and a new culture started.

Steps for culture

- Collection/ Isolation
- Culture containers
- Culture medium
- Inoculation
- Harvesting

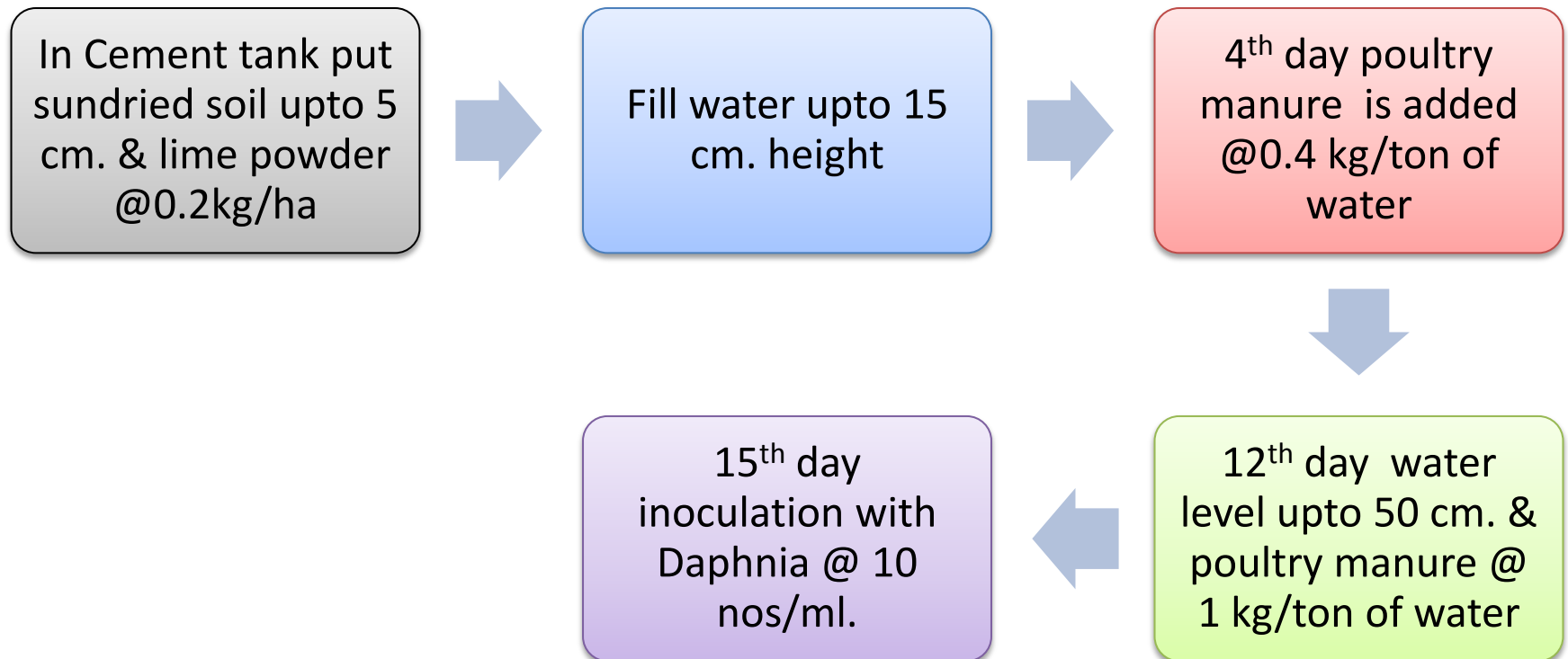
Daphnia culture

- *Daphnia magna*
- *Daphnia pulex*
- Daphnia – most commonly cultured species among 420 cladocerans for feeding young stages of shellfish and finfish.
- low content of essential fatty acids, particularly (n-3) HUFA.
- Contains a broad spectrum of digestive enzymes such, as proteinases, peptidases, amylases, lipases and even cellulase, that can serve as exoenzymes in the gut of the fish larvae.

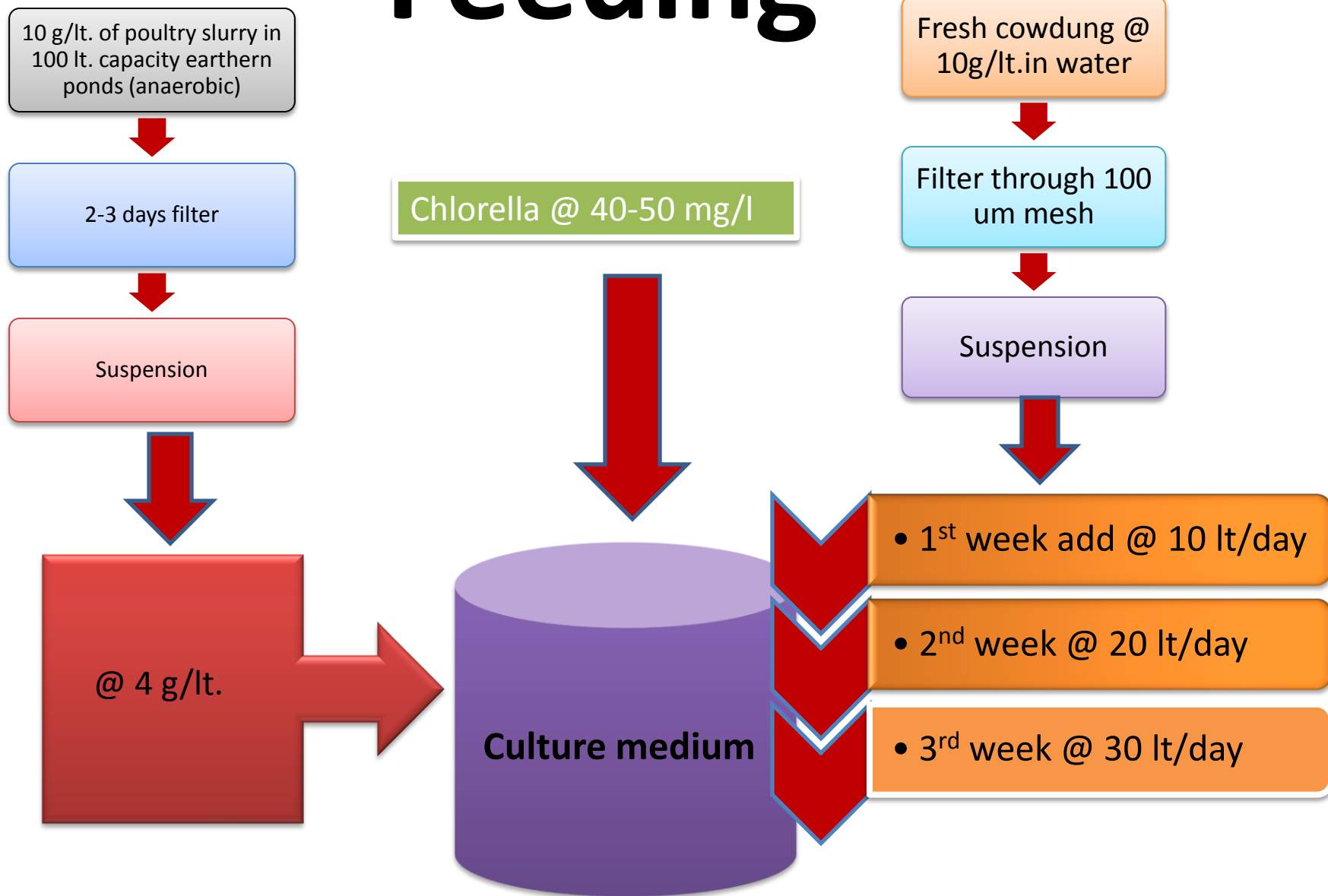
Collection

- Isolation of Daphnia from water samples (natural water bodies) by 250-500 micron mesh size used to collect zooplankters.
- Daphnia sorted out under microscope and picked up by pipettes or fine dropper.

Inoculation



Feeding



Harvesting

- Before harvesting, necessary to ascertain the asymptote phase of growth in the population of Daphnia.
- Biomass of Daphnia is calculated by periodic sampling at 5-7 days interval and counting the number in a plankton counting chamber.

Moina culture



Moina culture

- *Moina* is of a smaller size than *Daphnia*, with a higher protein content, and of comparable economic value.
- Males (0.6-0.9 mm)
- Females (1.0-1.5 mm)
- Produced biomass is successfully used in the larviculture of fish.
- The partial replacement of *Artemia* by *Moina micrura* was also reported to have a positive effect during the larviculture of the freshwater prawn *Macrobrachium rosenbergii* (Alam, 1992).

Water

- Moina are extremely sensitive to pesticides, metals (e.g., copper and zinc), detergents, bleaches and other toxins
- Well water should be aerated for at least two hours. Municipal water should be aerated for at least two days to neutralize the chlorine.
- Rain water is also excellent for Moina cultures.
- The optimum water temperature for Moina is (24-31° C).

Culture

Culture tank is filled with water

G.N.O.C.(250gm/ton)+urea(8gm/lt)+SSP(4gm/ton)

Inoculate with chlorella and do aeration

2nd day water becomes green , inoculate with moina @ 100 moina/gallon

6-7 days , 20-30 thousand individual/lt. Now harvest $\frac{1}{2}$ or $\frac{1}{3}$ of the culture volume

Appearance of males in the culture heralds the decline of the population by formation of resting eggs. It is better to remove all the water leaving only the sediments at the bottom and filling up the tanks with *Chlorella* water again.

Monitoring

- The culture should be inspected daily to determine its health.
- Green or brown-red Moina with full intestinal tracts and active movement indicate a healthy culture.
- Cultures ready for harvest should contain 45-75 Moina in the 1-teaspoon sample (3-5/ml).
- The cultures should be fed or fertilized with approximately 50-100% of the initial quantity whenever the transparency is greater than about 12-16 inches (0.3-0.4 m).

Harvesting

- Draining or siphoning
- For semi-continuous culture never harvest more than 20-25% of the population each day.