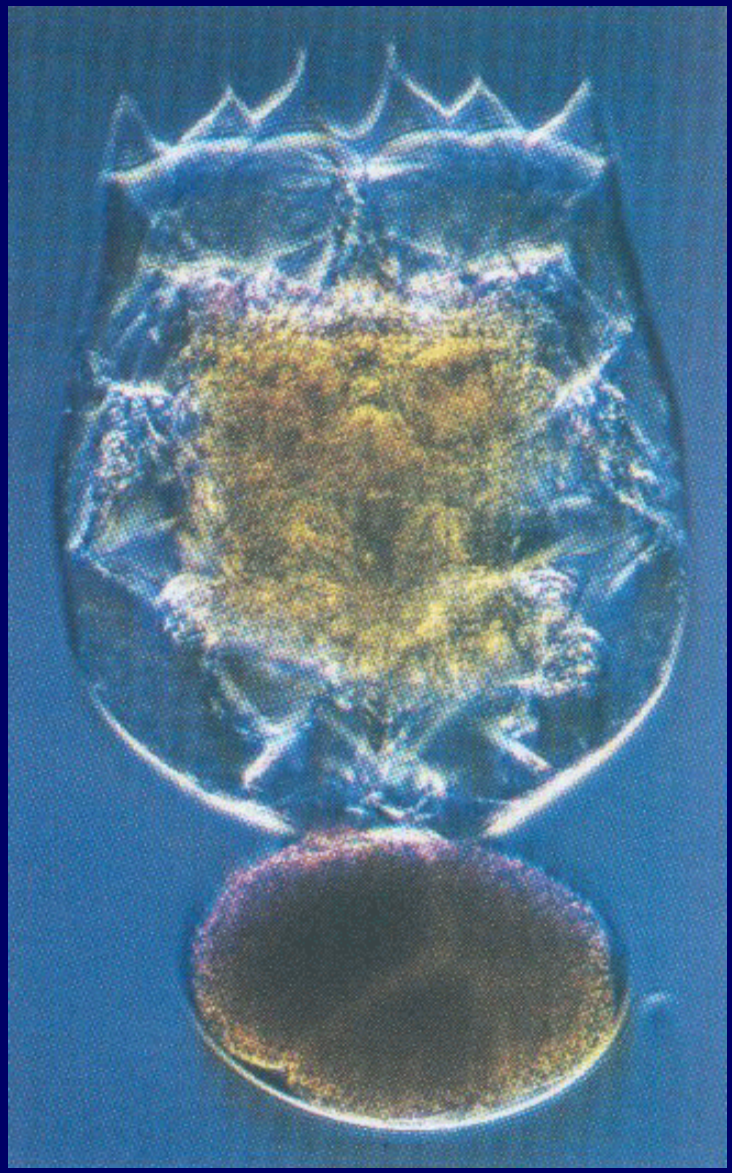
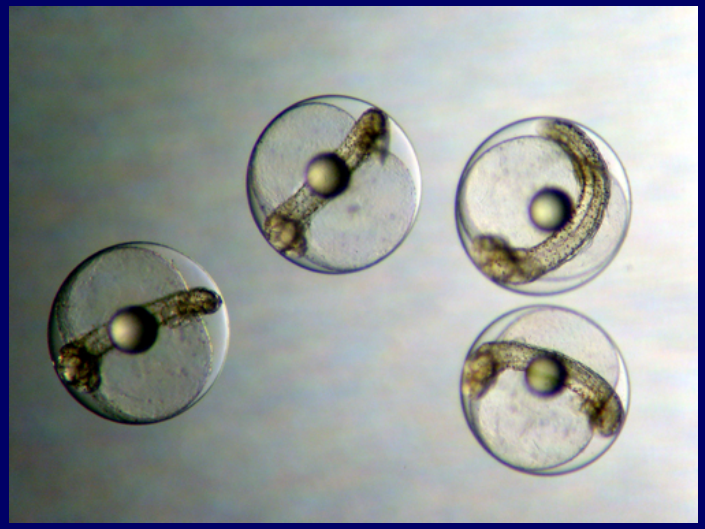
Live Feeds for Marine Fish Larvae

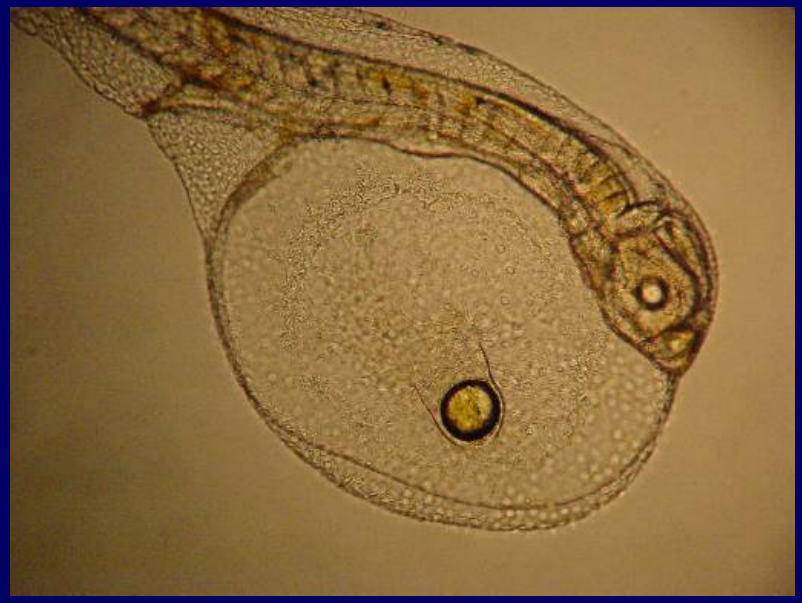
Aquaculture Center for Training, Education and Demonstration

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION



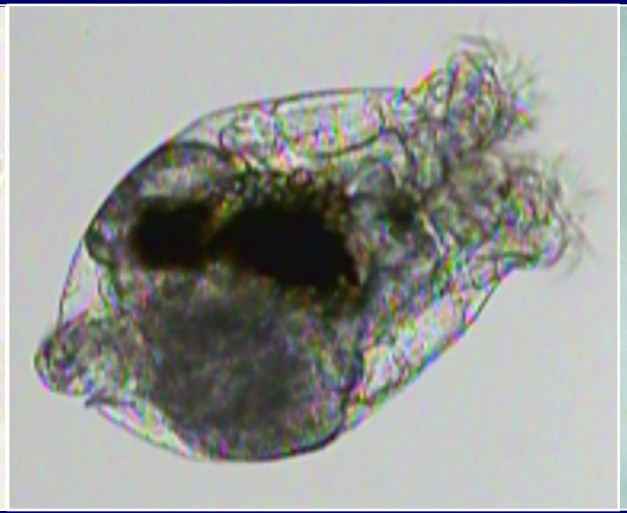
Why live feeds?





Important Criteria For Selecting Live Feeds

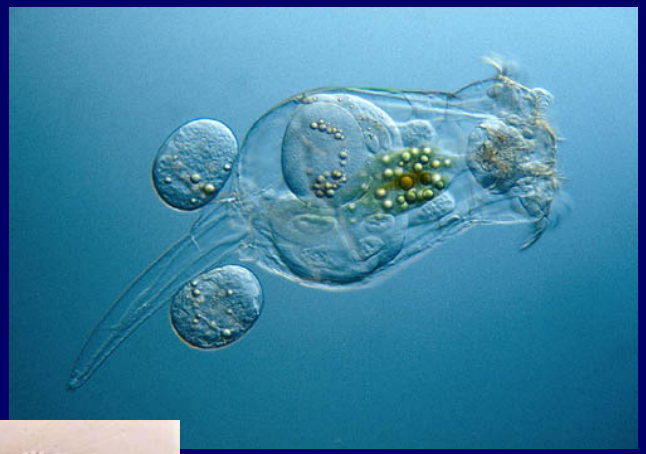
- **Is it the appropriate size for target species?**
- **Is the nutritional quality adequate for good growth and survival of the target species?**
- **Can it be produced cost effectively?**



Live Feeds

The two live feeds most commonly used are:

- **Rotifers (*Brachionus sp.)***
- ***Artemia sp.* (brine shrimp)**



Other live feeds include:

- **Molluscan trochophore larvae**
- **Ciliates**
- **Copepods**
- **Wild plankton**

What makes good prey?

Size - prey size is dependent upon fish larvae mouth size. Typical initial prey size for most fish larvae is 50-120 microns in width.

Movement - slow moving prey are more easily captured by fish larvae.

Familiarity - fish larvae must learn to locate and capture prey. The more experience the larvae have with the prey, the higher the success rate.

Larval Feeding Strategies

Larval fish consume more food per unit body weight (50 – 300%) than fish in grow-out operations (2 – 10%)

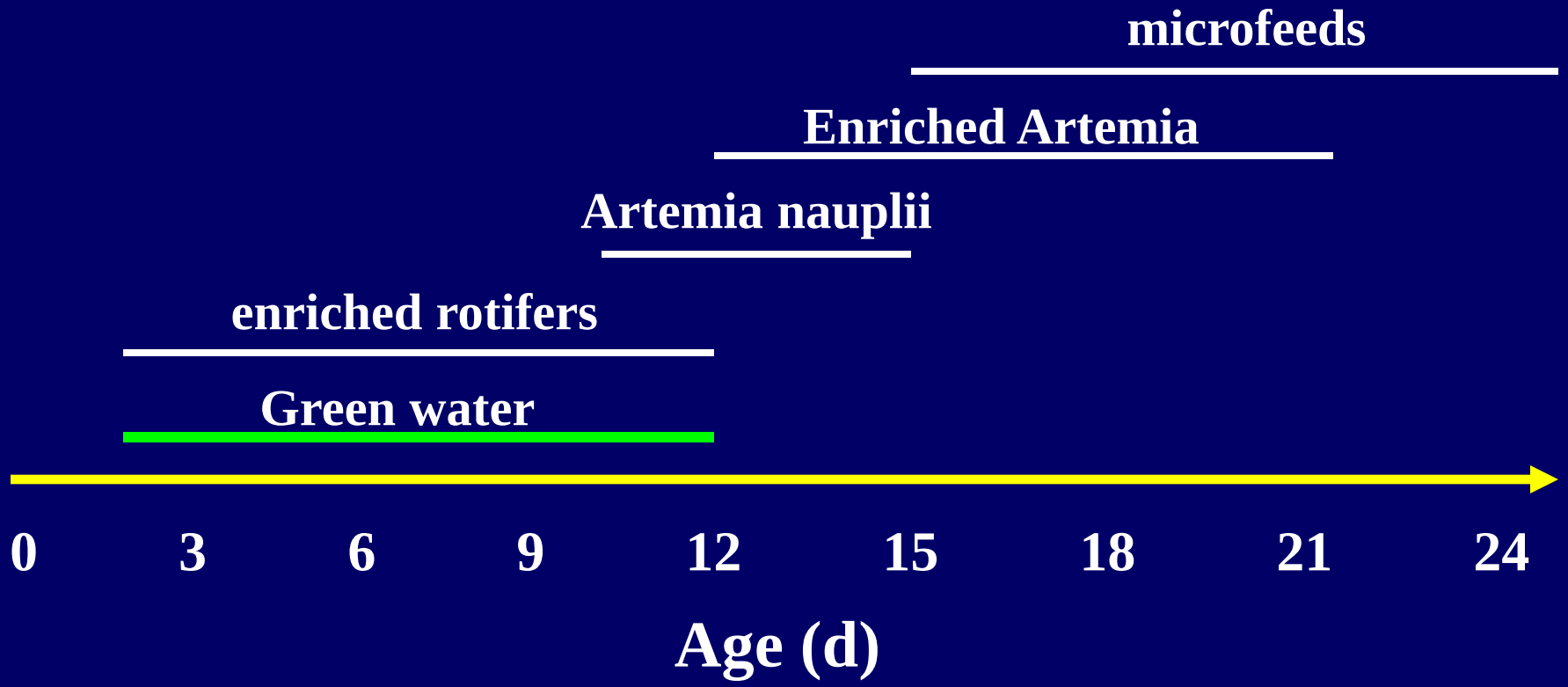
Target Densities

1 to 10 prey per ml

Average Feeding Rates

200 to 600 prey per day

Feeding Regime



Rotifers

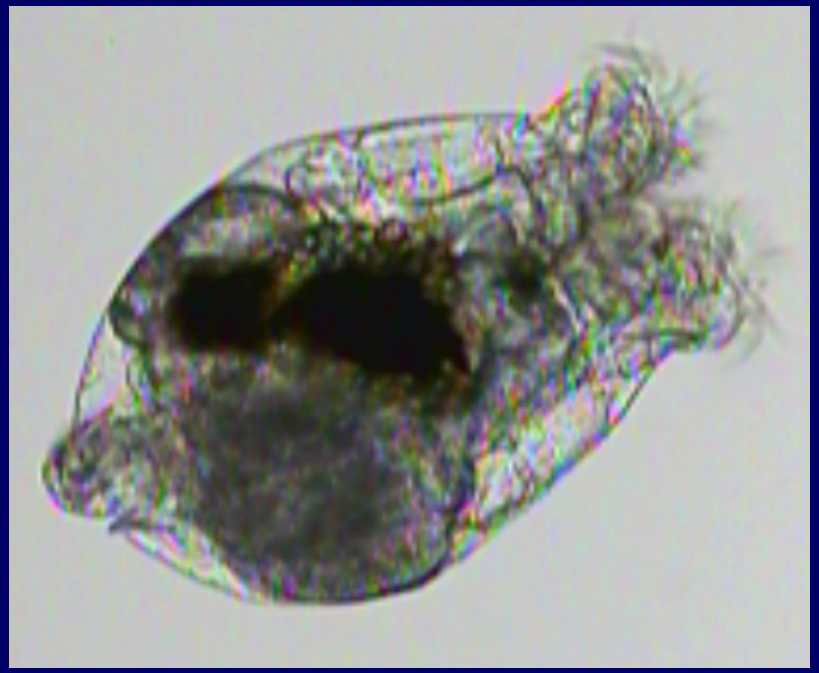
Why use rotifers as live food?

Excellent for larval fish and shellfish

- **High nutritional quality**
- **Small body size**
- **Slow swimming rate**
- **High rate of reproduction**
- **Low rate of mortality**

What is a Rotifer?

- Microscopic protozoan
- Saltwater and fresh water environments
- Asexual and sexual reproduction



Phylum Rotifera

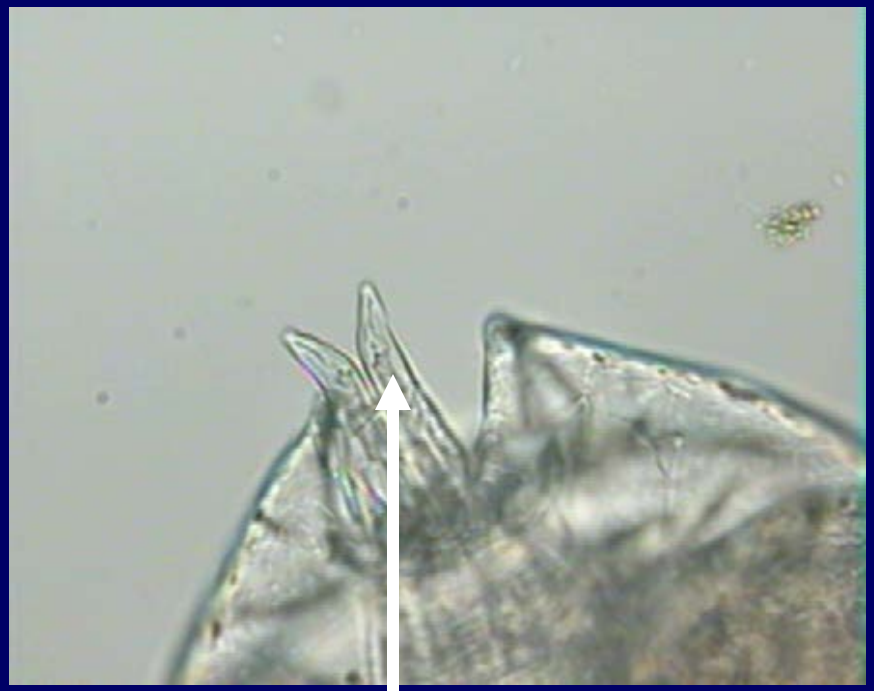
“wheel-bearer”

(> 2000 species)

Rotifer Corona

Planktonic rotifers swim continuously and rarely attach. The foot is used to attach when needed. At the base of the foot are the toes used to attach to the substrate.

Foot



Toes

Species & Strains

Marine Species	**Freshwater**
Brachionus plicatilis	***Brachionus rubens***
Brachionus rotundiformis	***Brachionus calycflorus***

Three Strains

- **L-type (large type, *B. plicatilis)***
  - **Body length = 200 - 360 µm**
- **S-type (small type , *B. rotundiformis*)**
  - **Body length = 150 - 220 µm**
- **SS-type (special small, *B. rotundiformis*)**
  - **Body length = 70 - 160 µm**

Optimal Conditions

- Salinity below 35 ppt
- Temperature range 27- 32^{o}C
- 15 hour photoperiod
- Moderate to low aeration
- pH range from 6.5 - 8.0
- Unionized ammonia concentrations: not to exceed 1 mg/liter

When the conditions are right

Female with eggs

Juvenile

Production Methods

- Cultures can be started by inoculations with live rotifers or by using cysts (resting eggs)
- Cysts have a shelf life of over one year
- Rotifers can be produced using algae, yeast, specialized products, or a combination
- Acceptable rotifer production ranges from 100 - 500 per ml
- Super-intensive culture requires specialized labor, equipment and techniques

Culture Methods

Continuous

- Lasts 20 to 30 days
- Harvest 20 to 30% per day
- Refill with sterilized water daily

Batch (Our Method)

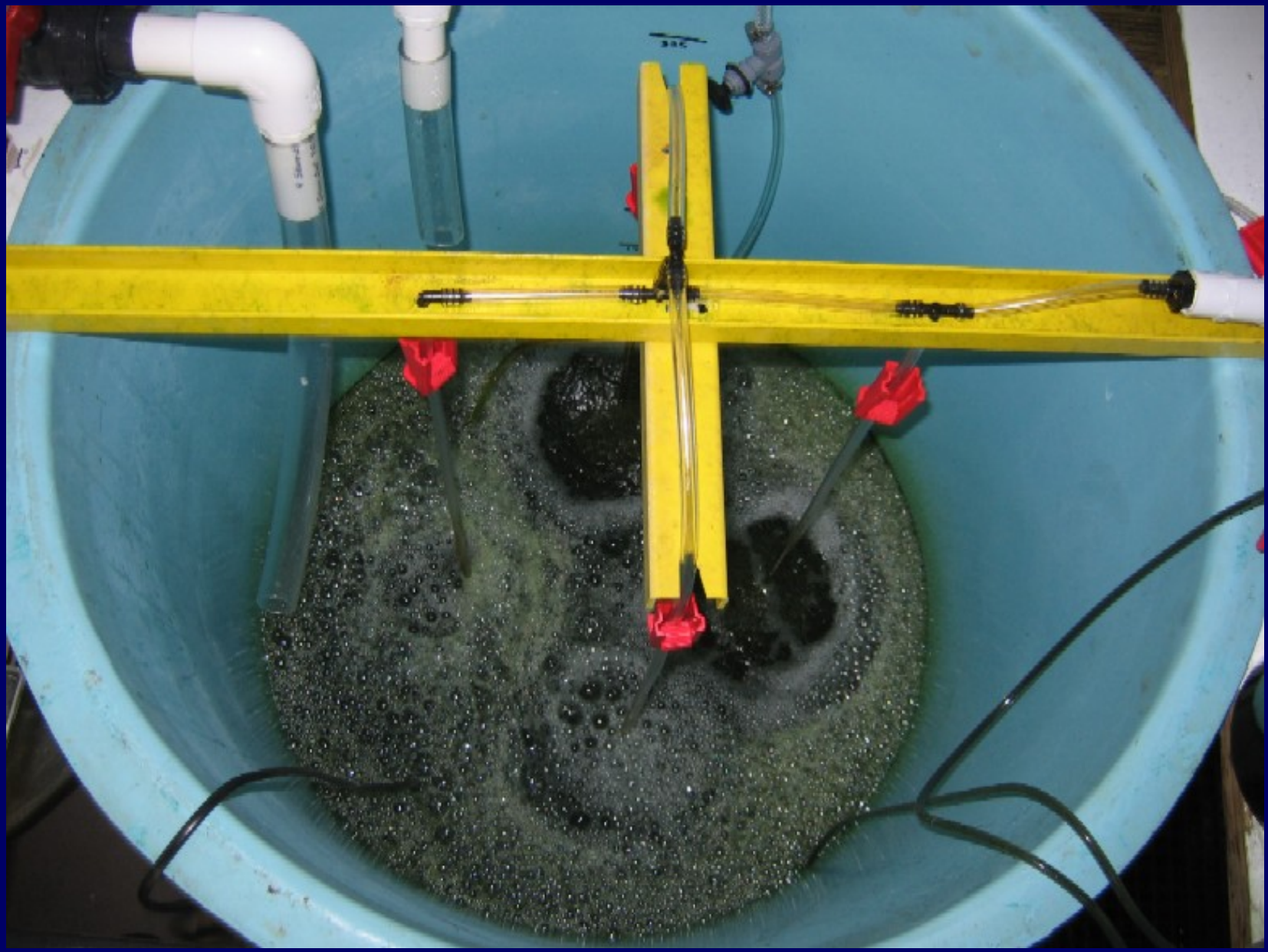
- Harvest all rotifers at 3 to 5 days
- Discard water
- Re-stock with new water and rotifers

Intensive Production Methods

Requires:

- –Continuous supply of algae
- –De-foaming agents
- –Filtration of water
- –pH adjustments
- –Oxygen gas
- –Nylon filtration mats

Diligent & Constant Management!



Inside Rotifer Tank

Culture Condition

- **Rotifer cultures are healthy if:**
  - **Rotifers are swimming rapidly**
  - **Females with eggs : female ratio of about 1.2 :1**
  - **Little or no bacteria or ciliates present**
- **Cloudy water is a good sign of imminent crash**
- **Crashing cultures will have a bad odor**


CAUTION
1

Our Rotifer Formula

- **Fill tank with seawater adjusted to 25 - 35 ppt**
- **Add liquid chlorine (10%) & mix**
- **Add sodium thiosulfate to neutralize chlorine and areate.**
- **Add inoculating rotifers - a minimum of 150 to 250 per ml**

Production Methods

- Use light aeration
- Keep light intensity to a minimum
- Feed live algae/algae paste and rotifer diet daily
- After 3 - 5 days rotifers will reach 500 to 750 per ml
- Harvest and enrich for feeding and use to inoculate new tanks

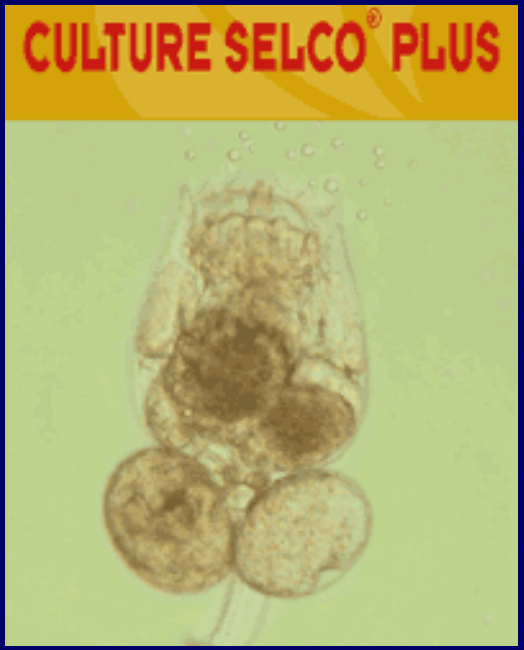
Feeding Algae

Nannochloropsis oculata & Isochrysis galbana

Live Algae

Instant Algae

Rotifer Diets



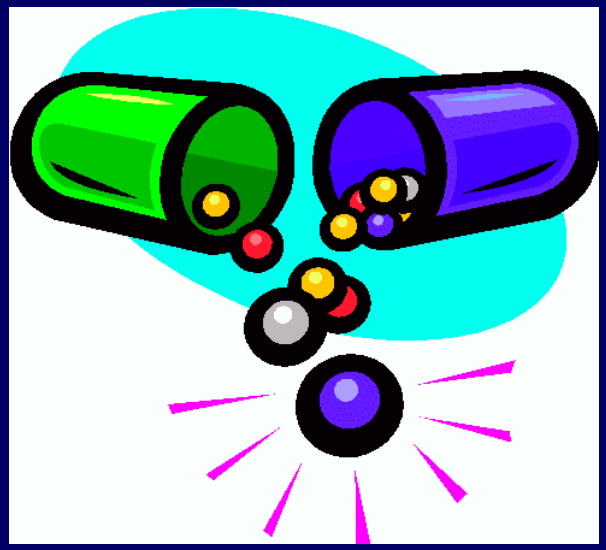
Rotifer Enrichment

- **Bioencapsulation – feed rotifers nutrients essential for larval fish**
- **Enrichment increases the Omega 3 fatty acids in the rotifers.**
- **Common enrichment products:**
  - **Algae - live, frozen, or dried**
  - **Emulsion products - liquid or dry**
    - **Selco (culture and DHA protein), Microfeast, Algamac, RotiRich**

Enrichment

What??

Why??



- Fatty Acids
- Amino acids
- Vitamins
- Pigments
- Probiotics

Water bath (28 ºC) for 3 h

Harvesting

20 million rotifers (10 am)


Cold storage (5-10 ºC)
T. Iso
Pavlova
P. Seco


15 5:18PM


15 5:17PM

Rotifer Schedule

8:30 AM	Feed larvae enriched rotifers
9:00 AM	Assess rotifer populations
9:30 AM	Harvest tank, prepare enrichment containers, restart clean tank
10:00 AM	Enrich rotifers(2-4 hour contact time)
10:30 AM	Refill algae containers, AM rotifer feeding
1:00 PM	Harvest, rinse, feed, and cold store rotifers
5:00 PM	Feed larvae enriched rotifers
9:00 PM	Feed larvae enriched rotifers

Artemia

What is an Artemia?

- Microscopic crustacean (brine shrimp)
- Saltwater environments
- Sold as cysts

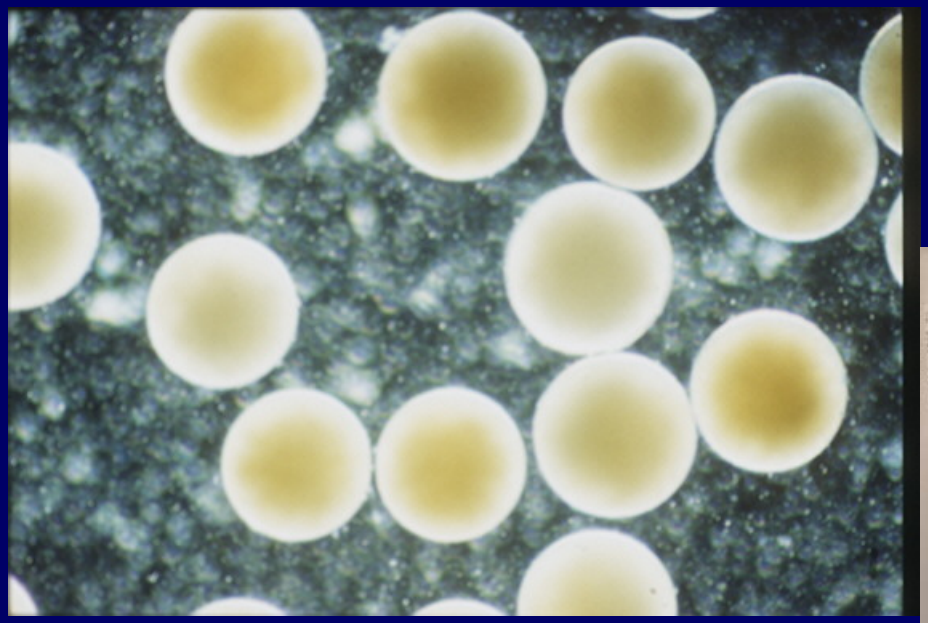

SALT CREEK
SELECT
BRINE
SHRIMP
EGGS
(100% Artemia Cysts)

Decapsulation

Dehydrated cysts

Hydrated cysts

+ chemicals

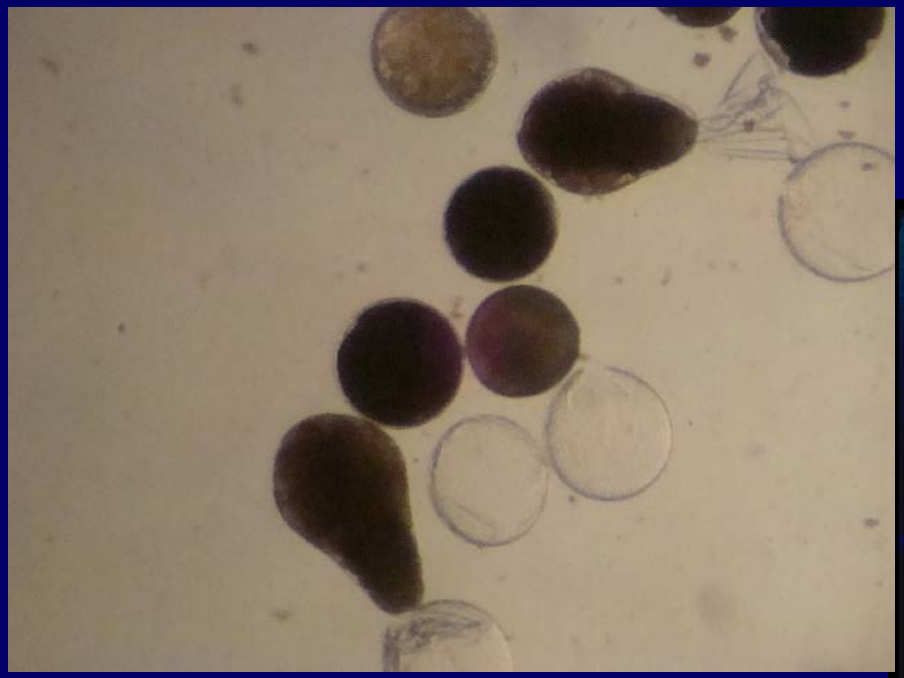


Decapsulated cysts

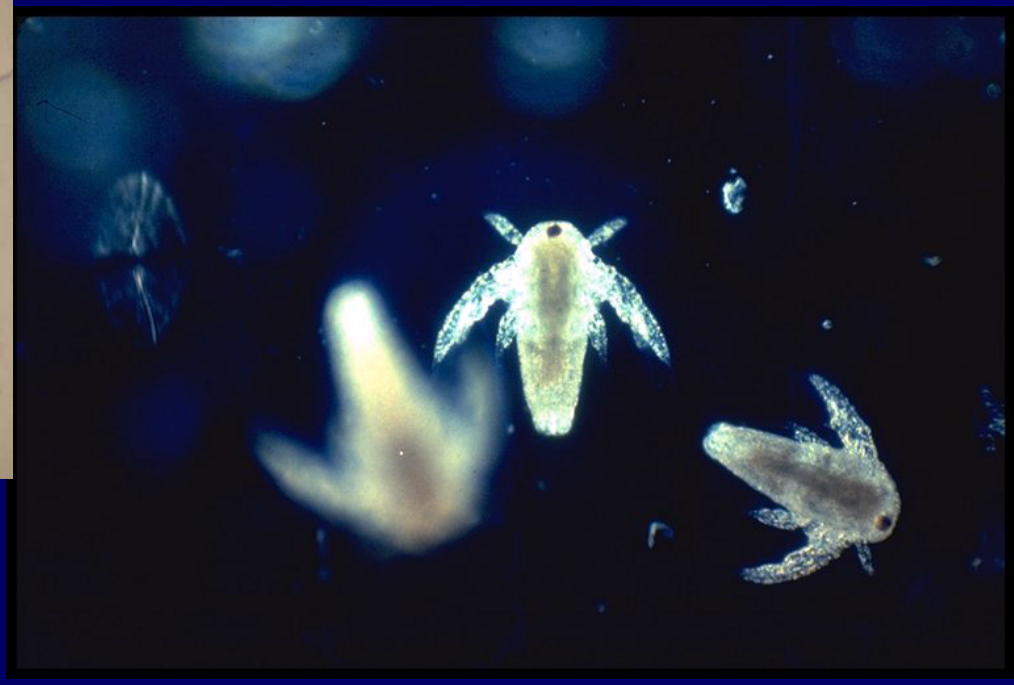
Incubation

- Sterilized water
- 25-30 g/L salinity
- 28-30 C
- Vigorous aeration

15-20 h = hatching

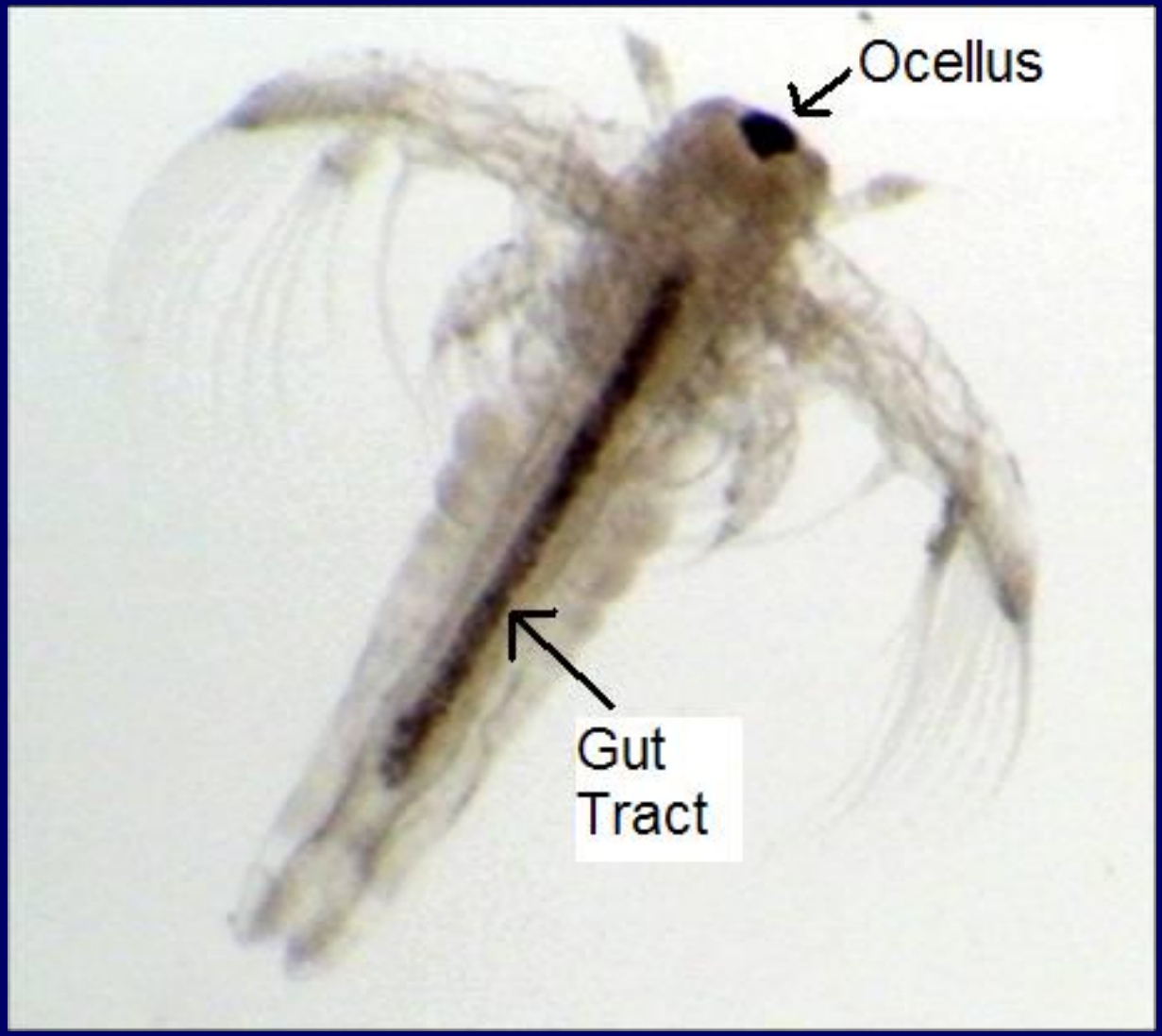


“Umbrellas”



First instar

Enrichment



Second instar


DC DHA SELCO
INVE Aquaculture Nutrition


A1 DHA SELCO


Artemia

- Sterilized water
- 25-30 g/L salinity
- 26-27 C
- Moderate aeration
- Enrichment contact 24 hrs.

Artemia Schedule

8:30 AM	**Feed larvae nauplii and/or enriched Artemia**
9-11:00 AM	**Harvest Artemia tanks**
11:30 AM	**Cold store harvested nauplii, start enrichment tank**
1:00 PM	**Start next day enrichment, feed larvae**
5:00 PM	**Feed larvae**
9:00 PM	**Feed larvae**

Feedings should be spaced out during 24 period ~ 4-6 hrs.