Freshwater Prawn Hatchery and Nursery Production

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Why Prawns?

- Freshwater - can be raised inland away from the coast
- Not susceptible to common shrimp diseases
- Environmentally sustainable
Trends in U.S. Shrimp Production and Consumption

Billions of Pounds of Shrimp

- Total Consumption
- Imported
- Domestic (Farmed + Wild)

$1.5 Billion Trade Deficit
Macrobrachium rosenbergii

- The freshwater prawn is native to tropical countries along the Pacific ocean.

- Although freshwater as adults – they require salt water to reproduce.

- Widely cultured within its native range and has been shown to have culture potential even in temperate inland areas of the US.
Biology and Life History
Life History

- Prawns have a hard outer skeleton that is shed regularly for growth.
- Weight and size increases occur after each molt.
- Growth is incremental rather than continuous.
Adults

- Older juveniles and some adults often have a blue-green or brown color.

- Color is related to the quality and type of diet.

- Adult males are larger than females. They are easily distinguished by larger heads and claws.
Larvae

- At 80 °F, approximately 20 days are required for the eggs to hatch. Larvae swim upside down and tail first.

- Larvae cannot survive in freshwater beyond 2 days and must migrate to brackish water (10-14 ppt).

- Larvae undergo 11 molts before transforming into post-larvae, which takes 25-45 days.
Morphotypes

- Male
  - Blue claw
  - Orange claw
  - Small male

- Female
  - Open (Breeding)
  - Berried (Eggs)
  - Virgin
Orange Claw Male
Temperate Production

- Production in temperate regions of the US has increased rapidly in recent years.

- Production includes four distinct phases; hatchery, nursery, growout, and broodstock holding.

- Hatchery, nursery and brood holding are generally conducted indoors.

- Pond growout is conducted in the summer growing season (100-150 days).
Cycle

- Hatchery – March
- Nursery – April / May
- Growout – June – September
- Broodstock – October - April
Considering Shrimp Production?

- Skip the hatchery and possibly the nursery phase – purchase from supplier.
- As you become successful at pond growout consider a nursery.
- Break-even on a hatchery >1 million PL. Knowledge intensive.
Hatchery Production
Broodstock Holding

- At pond harvest, broodstock are stocked in heated tanks and maintained throughout the winter.

- Broodstock are stocked at 1:4 male to female ratio in heated tanks at one prawn ft$^2$ or 7.5 gallons.
Larvae

- Egg development takes two weeks at 84°F, a 40 g female can produce approx. 20,000 larvae.

- Prawn larvae requires brackish water (12 ppt salt) for the 30 day larval period.

- Larvae are extremely small (<0.01 g) and are fed live food (Artemia) at frequent intervals.
Salt mixtures

Commercially available sea water mixes are major expense in hatchery production, approximately $30.00 to treat 450 gal.
Biofiltration

- 4-6 week break-in period to develop bacteria colonies.

- Requires daily maintenance for:
  - Solids removal
  - Ammonia / Nitrite monitoring.
Water Quality

- Temperature 80-86ºF
- Salinity 12 ppt
- Ammonia < 1 ppm
- Nitrite < 0.5 ppm
- Nitrate < 50 ppm
- pH 6.5-8.5
Oxygen

- Maintained at saturation (6-8 mg/L)
- Should Have Back-up Blower and Generator
The larval collector allows better control of stocking density in larval tanks.

It is important to have larvae as close to the same age as possible – no more than 2-3 days apart.
Larvae are initially stocked in small tanks at high density (>1,000/L) for the first 6-10 days and fed *Artemia* twice a day.
Artemia

- Prawn larvae require live feed - Artemia
- Artemia require 24 hours to hatch
- Artemia cost $70/lb.
Second Stage

- After approx. 1 week, larvae are moved to larger tanks (450-1,000 gal) and the density reduced to 50-100/L.

- Supplemental feeding is initiated.
Supplemental Diet

- By day 10 larvae should be fed a supplemental diet. In addition to artemia.
  - 1lb. Squid or fish
  - 4 eggs
  - Tsp cod liver oil
  - Tsp Vit C
Survival

- Survival in larval culture ranges from 0-50%!

- At 30 days, post-larvae are harvested and remaining larvae are sacrificed (<5%) when acclimated to freshwater.
Nursery Production
Nursery

- Growth from 0.01g to 0.3g in 45 days.
- The nursery stage improves survival by stocking larger animals.
- Developed to reduce pond growout time in temperate production.
Nursery Period

- Beyond 60 days, the rate of mortality increases significantly and reaches maximum at 2.5g of animals per L.

- Following 30-60 days, juveniles should be >0.25g
Feeding

- Feed a commercial salmonid starter diet approx. 10% of biomass daily.

- Best to feed to satiation – observe feeding based on left over feed on tank bottom.
Recirculation Systems
Heating Water

- Heating the water is the major expense in culturing tropical animals in a temperate climate.

- Electric emersion heaters work well to maintain temperature but are expensive to operate.

- A building should be designed to have a sufficient heat source to maintain ambient temperature.
Recycle Systems

- Primarily used to have control over the culture environment.
- The only option when culturing tropical animals outside their native range.
Efficient Feeding

• Proper feeding is the most critical aspect of managing a prawn nursery.

• If larvae or post-larvae are underfed they will eat each other. If they are overfed, water quality will deteriorate and they will die.

• Feed cost insignificant
  – 20,000 juveniles for 60 days require approx. 25 lbs.
Round Tanks

- Small tanks may be advantageous for simplicity when stocking and harvesting.
- Large tanks more efficient
- 20,000 PLs per 1,000 gal.
Stocking Density?

- Survival during the nursery phase has been highly variable (40-100%).

- Juvenile prawns are territorial and cannibalistic and are limited by available two-dimensional space.

- Survival in nursery culture may be related to the amount of substrate provided.
Nursery Percent Survival
number of shrimp stocked ft$^2$
## Economics of nursery to stock
### 1 acre pond

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Cost</th>
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<tbody>
<tr>
<td>25,000 pls from hatchery</td>
<td>@ $0.03 each</td>
<td>$750</td>
</tr>
<tr>
<td>Utilities</td>
<td>$75 per month, $25 for blower</td>
<td>$150</td>
</tr>
<tr>
<td>Feed</td>
<td>$25/ 50lb. bag</td>
<td>$50</td>
</tr>
<tr>
<td><strong>Assuming 80% survival</strong></td>
<td>Sell 20,000 @ $0.10 each</td>
<td><strong>Gross $2,000</strong>&lt;br&gt;<strong>Net $1,050</strong></td>
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Pond Stocking

- When the water temperatures are consistently > 68°F (early June) prawns are stocked in growout ponds at 12 - 30,000 per acre.
Stocking Density

- Densities of 12,000 – 32,000 acre depending on the desired size, total ponds, and use of substrate.

- Generally lighter densities produce larger prawns, where higher densities produce more total pounds.

- Increased feeding rates and inclusion of substrate have consistently achieved 2,000 lbs/acre of 40g animals in small research ponds.