Current Status of Larviculture Industry in Taiwan

Huey-Lang Yang
Institute of Biotechnology
National Cheng Kung University
Taiwan
Major Fish Fry Products in Taiwan

- Total fry production value: 35 million USD
  - Grouper: 11.9 million USD
  - Milkfish: 4.6 million USD
  - Ell: 3.5 million USD (capture)
  - Others: 15 million USD
Species of fish fingerling produced in Taiwan

By 2001

• Over 92 species of fish fry were produced for domestic use and export.

• Among them are
  – 32 species of fresh water finfish species
  – 60 marine finfish species

New species are developing by farmer all the time
### Examples of fresh water finfish larvicultured in Taiwan

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Year of first success</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arisrichthys nobilis</em></td>
<td>Bighead carp</td>
<td>1963</td>
</tr>
<tr>
<td><em>Onchorynchus mykiss</em></td>
<td>Rainbow trout</td>
<td>1964</td>
</tr>
<tr>
<td><em>Oreochromis aureus</em></td>
<td>Blue Tilapia</td>
<td>1975</td>
</tr>
<tr>
<td><em>O. mossambicus</em></td>
<td>Mozambique tilapia</td>
<td>1946</td>
</tr>
<tr>
<td><em>O. niloticus</em></td>
<td>Nile tilapia</td>
<td>1967</td>
</tr>
<tr>
<td><em>O. Mossambicus X O. niloticus</em></td>
<td>Fu-so Tilapia</td>
<td>1969</td>
</tr>
<tr>
<td><em>O. Niloticus X aureus</em></td>
<td>Hybrid Tilapia</td>
<td>1974</td>
</tr>
<tr>
<td><em>Sinsiperca chuatsi</em></td>
<td>Kuei-Fa bass</td>
<td>1987</td>
</tr>
<tr>
<td><em>Varicorhinus barbatulus</em></td>
<td>Taiwan shoveljaw carp</td>
<td>1986</td>
</tr>
</tbody>
</table>
### Examples of marine finfish larvicultured in Taiwan

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Year of first success</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Mugil cephalus</em></td>
<td>Grey mulllet</td>
<td>1969</td>
</tr>
<tr>
<td><em>Acanthopagrus australis</em></td>
<td>Australian sea bream</td>
<td>1979</td>
</tr>
<tr>
<td><em>A. berda</em></td>
<td>Grey fin sea bream</td>
<td>1979</td>
</tr>
<tr>
<td><em>A. latus</em></td>
<td>Yellow fin sea bream</td>
<td>1980</td>
</tr>
<tr>
<td><em>Argyrosomus japonica</em></td>
<td>Southern black sea bream</td>
<td>1994</td>
</tr>
<tr>
<td><em>Chanos chanos</em></td>
<td>Milk fish</td>
<td>1978</td>
</tr>
<tr>
<td><em>Cromileptes altivelis</em></td>
<td>Humpback grouper</td>
<td>1998</td>
</tr>
<tr>
<td><em>Epinephelus coioides</em></td>
<td>Orange-spotted grouper</td>
<td>1986</td>
</tr>
<tr>
<td><em>E. fuscoguttatus</em></td>
<td>Tiger grouper</td>
<td>1996</td>
</tr>
<tr>
<td>Scientific name</td>
<td>Common name</td>
<td>Year of first success</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td><em>E. lanceolatus</em></td>
<td>Giant grouper</td>
<td>1997</td>
</tr>
<tr>
<td><em>E. malabaricus</em></td>
<td>Malabar grouper</td>
<td>1987</td>
</tr>
<tr>
<td><em>Larimichthys crocea</em></td>
<td>Large yellow croaker</td>
<td>1997</td>
</tr>
<tr>
<td><em>Lethrinus nebulosus</em></td>
<td>Blue emperor</td>
<td>1983</td>
</tr>
<tr>
<td><em>Lutjanus aregentimaculatus</em></td>
<td>Red snapper</td>
<td>1998</td>
</tr>
<tr>
<td><em>L. rivulatus</em></td>
<td>Yellow fin snapper</td>
<td>1998</td>
</tr>
<tr>
<td><em>L. stellatus</em></td>
<td>White-spotted snapper</td>
<td>1998</td>
</tr>
<tr>
<td><em>Rachycentron canadum</em></td>
<td>Cobia</td>
<td>1994</td>
</tr>
<tr>
<td><em>Trachinotus ovatus</em></td>
<td>Short dorsal fin pompanos</td>
<td>1997</td>
</tr>
</tbody>
</table>

The fingerling production

Divided into two to three production operations: (grouper as example)

1. First operation: **broodstock farm**  
   product: fertilized eggs

2. Second operation: **hatchery**: from fertilized egg to 1 cm  
   product: 1 cm larvae

3. Third operation: **nursery**: from 1 cm to 3 cm and up  
   product: 3-6 cm fingerling
Outdoor Culture

• The traditional but still the most common method in Taiwan
• In concrete or earthen pond up to 0.5 ha
• Fast growing and low cost, but unstable harvest highly depending on nature and environmental factors
• Difficult to control diseases, nutrition
• Non-reproducible
• Low quality, and cheaper
Outdoor ponds
Outdoor concrete tanks
Outdoor concrete tanks with shades
Indoor Culture

• Number of indoor hatcheries is increasing, but still in small proportion

• Usually in concrete tanks up to 60 tons of water capacity

• Although indoor culture is high in cost and slow in growth, but its high survival rate in the rearing stage,

• and stable performance in subsequent grow out stage makes fingerlings of indoor culture more popular and higher priced in the market
## Comparison of Indoor & Outdoor Larval Rearing Systems in general

<table>
<thead>
<tr>
<th></th>
<th>Indoor</th>
<th>Outdoor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank/pond depth</td>
<td>1.0-2.0 m</td>
<td>1.0-1.5 m</td>
</tr>
<tr>
<td>Water volume</td>
<td>&lt; 100 tons</td>
<td>&gt; 100 tons</td>
</tr>
<tr>
<td>Survival rate</td>
<td>High</td>
<td>Unstable</td>
</tr>
<tr>
<td>Feed supply &amp; water control</td>
<td>Poor</td>
<td>Easy</td>
</tr>
<tr>
<td>Larval growth</td>
<td>Slow</td>
<td>Fast</td>
</tr>
<tr>
<td>Fry quality</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Production cost</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

Liao, 1996
## Comparison of larviculture of different species

<table>
<thead>
<tr>
<th>Characters</th>
<th>Milk fish</th>
<th>Grouper</th>
<th>Cobia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broodstock</td>
<td>Fairly controllable</td>
<td><strong>Difficult</strong></td>
<td>Easy</td>
</tr>
<tr>
<td>Induction of maturation</td>
<td>Spontaneous</td>
<td><strong>Spontaneous</strong></td>
<td>Easy</td>
</tr>
<tr>
<td>Induction of spawning</td>
<td>Spontaneous</td>
<td><strong>Spontaneous &amp; Hormone management</strong></td>
<td>Spontaneous</td>
</tr>
<tr>
<td>Larvae food</td>
<td>Simple</td>
<td><strong>Complicated, difficult</strong></td>
<td>Fairly complicated</td>
</tr>
<tr>
<td>Larvae rearing</td>
<td>Easy</td>
<td><strong>Difficult</strong></td>
<td>Easy</td>
</tr>
<tr>
<td>Limiting factor</td>
<td>Low price</td>
<td><strong>Egg quality, Cannibalism, NNV infection</strong></td>
<td>Cannibalism, Need space</td>
</tr>
<tr>
<td>Rate of survival to grow out</td>
<td>30-50%</td>
<td>&gt; 3%</td>
<td>5-10%</td>
</tr>
<tr>
<td>Rearing period (day)</td>
<td>20-25</td>
<td><strong>50-60</strong></td>
<td>40-50</td>
</tr>
</tbody>
</table>

Bottleneck

• **Non-reproducible**: *eg.* The success frequency of Grouper larvae production is less than 3%.

• Poor **quality** in outdoor farm

• Still depends on **starting feeds** produced in outdoor ponds, and all contaminated with pathogens

• Most of farm are family operation, produces less than 500 thousands *pcs* /year

• Frequent disease infection, no good effective prevention treatment or disease monitor system.

Inconsistent supply and unstable quality are major drawbacks to aquaculture
Current progress of grouper larviculture

• Produce highly disease-resistant, reliable quality SPR or SPT fry (specific pathogen resistant or special pathogen tolerant).

• SPR fry product will facilitate the industrialization of larviculture and aquaculture
  – Higher survival rate in later grow out stage; lower in cost of fry, feed and management
  – Better quality control and traceability
  – Eliminating the use of antibiotics
Method: Production of SPR Fingerlings

• SPF (*specific pathogen free*) environment and standard operation procedures

• Production of pathogen free starting feed
  – Constant monitoring of all incoming raw materials of larviculture for potential pathogens, and eliminate pathogen

• *Disease Prevention System:*
  – diagnostics use and vaccination program.

**Result:** Production of SPR or SPT (Special pathogen resistant, special pathogen tolerant) fingerlings
Scale up production of algae
SPF Larva in indoor hatchery
References


Thank you for your attention