FEASIBILITY OF SHRIMP AND TILAPIA POLY-CULTURE IN THE NORTH-WEST OF MEXICO, WITH SPECIAL REFERENCE TO AN ECONOMIC STUDY OF A HYPOTHETICAL POLY-CULTURE FARM.

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• **Shrimp-Tilapia polyculture.**
  – Increased production.
  – Maintain or improve shrimp survival.
  – Remove disease carriers from system.

• **Shrimp Farming Industry Problems.**
  – Disease outbreaks
  – Pricing problems.

Shrimp ponds in Mexico.
Disease problems
White spot syndrome virus (WSSV)

- Many disease problems.
- WSSV in Asia – 70,000 tons lost in Thailand in 1996 (Flegel and Alday-Sanz 1998)
- WSSV in Ecuador 31,000 tons of production lost from 1999 to 2000 (Illingworth-G. 2001).
- WSSV diagnosed in Mexico in 1999
  - Joins a long list of diseases affecting the industry
  - Many farms report mortalities higher than normal
US MARKET AVERAGE PRICES LATIN AMERICAN AQUACULTURE, SHELL-ON SHRIMP – SIZE 26-30
Mexican shrimp industry production

* Preliminary data for 2003.
Disease problems

- Three point approach.
  - Monitoring.
  - Movement of disease.
  - More stable growing environment.
Disease problems
Monitoring of disease.

• Farms start monitoring programmes of health of shrimp during growing cycle.
  – Indicator number of laboratories offering diagnostics increases from 5 in 1999 to 18-23 in 2004.

• Monitoring by State committees.
  – Collect data on disease losses above normal.
  – Disseminate information on spread of disease.
  – Give advise on improving farm management.
Disease problems
Movement of disease.

- Industry uses only hatchery produced PL certified free from WSSV
  - Hatcheries close biological cycle and start genetic selection programs.
- All pond water filtered to less than 500µm.
Disease problems

Improved management practices.

• Better pond preparation.
• Filtered water, < 500µm
• Less water changes or even no water changes (14%).
• Lower stocking levels from 13 PL/m² in 1999 to 11 PL/m² in 2002.
• Avoid autumn, not optimal growing conditions.
  – Problem seasonal production.
Price Problems

• Record amounts of farmed shrimp in markets, prices not expected to recover.

• Value added products.
  – Larger size.
  – Processing, remove head.
General effects on Industry.
Average Yield.
General effects on Industry.
Type of operator.

Percentage operated.

- Private
- Ejido
- Fishery

1999 2001
0 10 20 30 40 50 60 70 80 90 100
General effects on Industry.

Area under operation.

Over 5000 hectares of shrimp ponds unused or abandoned.
Feasibility of shrimp tilapia poly-culture.

- Environmental.
- Economic.
Environmental Feasibility.

• Temperature range - 16 to 36 °C.
• Salinity range – normally 35 ppt, range 25 ppt to 45 ppt, extremes 15 to 60 ppt.
• Red tilapia hybrid (with Oreochromis mossambicus)
• Large tilapia industry in Mexico capable of supplying large volumes of red hybrids but red hybrids are NOT available now.
Economic Feasibility.

- Economic model
  - 100 hectar shrimp farm
- Capital and operation costs, and revenues obtained from shrimp farms operating in Sinaloa Mexico.
- Data for tilapia polyculture obtained from CRSP studies (Fitszimmons, Bolivar and Sugue; and Yi, Saelee, Naditrom and Fitzsimmons)
Economic Feasibility.
Production cycle

• 1 Cycle per year.
• Pond preparation.
• 1 month acclimatisation and pre-ongrowing of tilapia.
• 6 month ongrowing poly-culture of shrimp and tilapia.
• Harvest.
## Economic Feasibility.
### Shrimp Production Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed price ($/1000 PL)</td>
<td>7.00</td>
</tr>
<tr>
<td>Final Survival Rate (%)</td>
<td>60</td>
</tr>
<tr>
<td>F.C.R.</td>
<td>1.80</td>
</tr>
<tr>
<td>Total pond area (Has.)</td>
<td>100</td>
</tr>
<tr>
<td>Growout cycles/year</td>
<td>1</td>
</tr>
<tr>
<td>Length growout cycle (months)</td>
<td>6</td>
</tr>
<tr>
<td>Stocking density (PL/m2)</td>
<td>15</td>
</tr>
<tr>
<td>Shrimp individual weight (head on) at harvest (gr)</td>
<td>22.62</td>
</tr>
<tr>
<td>Selling price head-off ($/kg)</td>
<td>10.00</td>
</tr>
</tbody>
</table>
## Economic Feasibility. Tilapia Production Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tilapia fry price ($/fingerling)</td>
<td>0.06</td>
</tr>
<tr>
<td>Final survival rate (%)</td>
<td>75</td>
</tr>
<tr>
<td>F.C.R. (growout)</td>
<td>1.69</td>
</tr>
<tr>
<td>Nursery time (months)</td>
<td>1</td>
</tr>
<tr>
<td>Growout cycles/year</td>
<td>1</td>
</tr>
<tr>
<td>Length growout cycle (months)</td>
<td>6</td>
</tr>
<tr>
<td>Stocking density growout (fingerling/m2)</td>
<td>0.5</td>
</tr>
<tr>
<td>Tilapia individual weight at harvest (gr)</td>
<td>500</td>
</tr>
<tr>
<td>Selling price ($/kg)</td>
<td>5.68</td>
</tr>
</tbody>
</table>
### Economic Feasibility. Profitability analysis.

<table>
<thead>
<tr>
<th></th>
<th>Polyculture shrimp/tilapia</th>
<th>Shrimp monoculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual operation costs</td>
<td>1,462,487</td>
<td>1,067,189</td>
</tr>
<tr>
<td>Total operation cost ($/ha/year)</td>
<td>14,625</td>
<td>10,672</td>
</tr>
<tr>
<td>Total Revenue</td>
<td>1,720,728</td>
<td>1,323,270</td>
</tr>
<tr>
<td>Total Profit</td>
<td>258,241</td>
<td>256,081</td>
</tr>
<tr>
<td>Operation costs/ revenues</td>
<td>0.85</td>
<td>0.806</td>
</tr>
<tr>
<td>Profit shrimp/kg shrimp</td>
<td>1.95</td>
<td></td>
</tr>
<tr>
<td>Profit tilapia/kg tilapia (fillet)</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Profit/ha./year</td>
<td>2,582</td>
<td>2,561</td>
</tr>
<tr>
<td>Ratio fixed : variable costs</td>
<td>0.18</td>
<td>0.26</td>
</tr>
<tr>
<td>Return on variable costs</td>
<td>0.72</td>
<td>0.64</td>
</tr>
<tr>
<td>20-year IRR (%)</td>
<td>18.85%</td>
<td>19.18</td>
</tr>
<tr>
<td>NPV ($)</td>
<td>956,499</td>
<td>930,242</td>
</tr>
</tbody>
</table>
Economic Feasibility.
Sensitivity to shrimp price.
Economic Feasibility.
Sensitivity to tilapia price.
Conclusions

• Large areas of shrimp ponds available for rehabilitation.
• Environmentally shrimp-tilapia poly-culture appears to be feasible.
• Tilapia included into shrimp model without substantial increases in capital costs.
• Tilapia had a small effect on the profitability of shrimp-tilapia polyculture.
• Shrimp remained the more important component to the model strongly influencing profitability of the model.
• Improved tilapia production parameter required to make economic model profitable for shrimp-tilapia polyculture.
Gracias CRSP

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