Origin and dynamics of the bacterial microbiome associated with Black tiger and Banana prawn culture and how it influences productivity

Sandra Infante Villamil
Roger Huerlimann
Professor Dean Jerry
Potential for the development of economically and environmentally sustainable aquaculture in NA

Broad scale site analysis

- Study area
  - 13,200,000 m ha
- Potentially suitable
  - 1,700,000 m ha

Prawn farms

- Current
  - 1,000 ha; 4,000 MT; $75 M
- Target
  - 5,000 – 10,000 ha; 25,000 MT; $375 M
Introduction

Productivity is very variable

Microbiome and productivity
Correlation between microbiota and growth in Mangrove Killifish (*Kryptolebias marmoratus*) and Atlantic cod (*Gadus morhua*)

Torunn Forberg, Eli Bjarne Sjulstad, Ingrid Bakke, Yngvar Olsen, Atsushi Hagiwara, Yoshitaka Sakakura & Olav Vadstein

Correlations of age and growth rate with microbiota composition in Atlantic cod (*Gadus morhua*) larvae

Ly T. T. Trinh, 1,2 Ingrid Bakke, 1 and Olav Vadstein 1,2

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**Introduction**

**Difference in size/weight**
Bacterial signatures of productivity decay in *Penaeus monodon* ponds infected with PirA toxin

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At harvest but what about earlier in the farming cycle?

Study the dynamic of the shrimp and environmental bacterial microbiome along the farming cycle to detect potential changes associated with productivity and productivity indicator strains in shrimp hatcheries and production ponds.
Experiments
Major production stages

Aims

1. Hatchery
   Characterization of the microbiome associated with female broodstock and early developmental stages of *P. monodon* and *F. merguiensis*

2. Nursery
   Characterize the early response of *P. monodon* and *F. merguiensis* microbiomes when transferred from the hatchery to production ponds

3. Growout
   Study spatial and temporal microbiome dynamic in *P. monodon* and *F. merguiensis* in production ponds

Outcomes

- Broodstock
- Eggs
- Nauplii
- PL
- Environment
- ≠ Between species

- Early Response
- Temporal
- ≠ Between species

- Productivity prediction
- Weight indicators
- Temporal
- ≠ Between species
Project outcomes

Expected PhD outcomes

• Identify the dynamic of the commensal bacterial microbiome in the two shrimp species along the entire farm cycle.

• Discriminate between age and productivity associated taxa along the farming cycle

• Detection of bacterial indicators of high and low productivity

Expected industry outcomes

• Bacterial microbiome analysis as productivity predictive tool (monitor).

• Selection of potential candidates (probiotics)

• Adjustment of management practices
Thank you!

Commercial Partner
Farm managers
Technician
QUESTIONS?
Methods
Experimental design

Hatchery
- Broodstock (Gut, GM and hepatopancreas) and water
- Spawning tanks. Eggs and water
- Hatching tanks. Nauplii and water
- Hatchery tanks. PL and water

Nursery
- Water and sediment before PL are stocked
- Weekly samples. PL, water and sediment

Growout
- Water, sediment
- Animals: Gut, hepatopancreas and GM
Introduction

ORIGINAL ARTICLE

Water fleas require microbiota for survival, growth and reproduction

Marilou P Sison-Mangus, Alexandra A Mushegian and Dieter Ebert

Zoological Institute, University of Basel, Basel, Switzerland

![Graphs and images related to the article content]
### Expected project outcomes

- Diversity and structure of commensal bacterial microbiome in female broodstock, environment and offspring
- Differences between shrimp species & developmental stages
- Is there vertical transfer of the bacterial microbiome?
- Bacterial microbiome derived from the environment

### Expected industry outcomes

- Baseline information of commensal bacterial communities in hatchery
- Quality control of water. Equipment (Filters and UV) meeting expectations?
- Unexpected, potentially pathogenic bacteria?
- Adjustments to current management practices or biosecurity measures
<table>
<thead>
<tr>
<th>Expected project outcomes</th>
<th>Expected industry outcomes</th>
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<tbody>
<tr>
<td>- Differences in water from hatchery to pond. Abrupt shift?</td>
<td>- Is pond preparation and management delivering expected result to PL (e.g. low in potential pathogenic bacteria)</td>
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<td>- Early response: restructuring of bacterial community</td>
<td>- Potential early productivity predictive tool (according to temporal changes in commensal bacteria and animal weight)</td>
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<td>- Temporal changes (bacterial community assemblage)</td>
<td>- Potential selection of growth promoters in nurseries</td>
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<tr>
<td>- Differences between two species</td>
<td>- Potential selection of candidates (e.g. growth promoters)</td>
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<td>- Potential differences in weight that correlate with bacterial community structure</td>
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### Outcomes

#### Grow-out

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<td>• Differences between nurseries and grow-out (more stressful; summer)</td>
<td>• Is pond preparation and management delivering expected result to juveniles. Microbially matured environment</td>
</tr>
<tr>
<td>• Temporal changes in microbiome &amp; response to environment (3 months)</td>
<td>• Potential productivity predictive tool (according to temporal changes in commensal bacteria associated and animal weigh)</td>
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<td>• Differences between two species</td>
<td>• Potential selection of growth promoters in a more stressful conditions</td>
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