Examples of and experiences with saltwater RAS

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Agenda:

1. Who are Billund Aquaculture
2. What to consider when dimensioning a saltwater RAS
3. Examples of and experience with saltwater RAS
4. Questions
1. Who are Billund Aquaculture
Who are Billund Aquaculture

Billund Aquaculture is a Danish company located in Billund, Denmark and in addition we have offices in Norway and Chile.

We have a large and well documented reference list which document more than 27 years of experience in design, installations, operation and service of intensive re-circulation fish farms.

Worldwide Billund Aquaculture has so far build more than 114 re-circulated systems for 24 different salt- and freshwater species in 26 different countries.

The practical know-how has been obtained through our own production facilities, where we since 1984 have produced different kind of fish in our own hatcheries- and production systems. In addition this also serve as test facilities to improve research and development

Billund Aquaculture offer the following services:

- Project development from idea to turn key realisation
- Feasibility study
- Project proposal and preparation
- Biological design
- Engineering design
- Drawings
- Construction and implementation of the fish farm
- Start-up procedures and supply of customized operational and management manuals
- Training, education and management support of the staff at all levels
- 24 hours hot-line and ongoing know-how availability
2. What to consider when dimensioning a saltwater RAS
What to consider when dimensioning a saltwater RAS

1. Salinity $\rightarrow$ Saltwater resistant equipment

2. Temperature

3. Addition of oxygen

4. Stripping of carbon dioxide (CO$_2$)

5. Bigger biological filter!!!
3. Examples of and experiences with saltwater RAS
Langsand Laks

a saltwater RAS for a yearly production of 1,000 tons 4-5 kg salmon
Conducted two Grow-Out test for *Salmo Salar* in our own RAS

Focused on the following issues:

- Handling & Logistic
- Fish densities versus fish size
- Fish densities versus tanks size
- Growth rates
- Feed Conversion Rates (FCR)
- Temperature regimes
- Salinities
- Feed composition
- Maturation (light, temperature etc.)
- Off-flavor
- Fish quality (condition, fillet yield etc.)

On the following dias, the “Langsand Laks” project will be presented…….
Langsand Laks

Location:
In the centre of Scandinavia, in a town called “Hvide Sande” in Denmark
Langsand Laks

Owners:  
Atlantic Sapphire, a former organic Salmon farming company  - 25%
Steensgaard Holding, owner of Billund Aquaculture  - 20%
Polar Salmon, a Salmon processor  - 20%
Sohn Invest, fishermen  - 10%
Langsand Dambrug, a former Trout and Eel farmer  - 15%
AquaPri, a Trout and Pike perch farming company  - 10%

Production capacity:
- Yearly production of 1,000 tons 4-5 kg salmon, can be increased to 4,000 tons.
- 4 batches per year
- First hatch July 2011 – First harvest Q4 2013
• Before an Eel-farm based on RAS and a Trout-farm based on flow-through was located in the area

• The Eel-farm are now being used as Hatchery and Smolt Production.

• The Trout-farm has been demolished and the Salmon Production has been established using the existing permits for discharge.
Langsand Laks
Langsand Laks

All building established on top of the ground.
Langsand Laks

Dimension criteria:
All building established on top of the ground.

Total building area:
• Incubation, Hatchery, Parr and Smolt-system: ~ 700 m²
• On-Growing system ~ 3.300 m² (120 m x 27,5 m)
• 4.000 m² ~ 4 m²/ton produced salmon

On-Growing System:
Total tank volume: 6.100 m³
• 4 pcs. Ø 7,8 m – water level 5,5 m – 260 m³ (off flavour)
• 4 pcs. Ø 8,5 m – water level 4,6 m – 260 m³
• 3 pcs. Ø 10,2 m – water level 5,5 m – 450 m³
• 3 pcs. Ø 14,2 m – water level 5,5 m – 870 m³
Langsand Laks

On-Growing system: Water flow through the system:
Langsand Laks

On-Growing system: Water flow through the system:
Langsand Laks

On-Growing system: Water flow through the system:
Langsand Laks

Production flow per batch (4 batches per year):

- **Smolt System**: 10 months
  - **Ø8,5m tank**
    - Max 85 kg/m³
    - 4 months
  - **Ø10,2m tank**
    - Max 85 kg/m³
    - 3 months
  - **Ø14,2m tank**
    - Max 100 kg/m³
    - 3 months

  - **Ø7,8m tank**
    - Max 100 kg/m³
  - **Ø7,8m tank**
    - Max 100 kg/m³
  - **Ø7,8m tank**
    - Max 100 kg/m³
  - Harvest every day from off flavored fish

  - 1 week to 4 weeks
  - (off flavoring takes up to two week without feeding)

- **From hatching to harvest 20 to 22 months**

First hatch July 2011 – First harvest Q4 2013 (4-5 kg salmon)
Langsand Laks

Dimension criteria and resource consumption:

On-Growing system: (input: approx. 210 gram, output 4-5 kg salmon):

• Water flow to fish tanks: 7.400 m³/h equal 48 minutes of retention time
• Biological filter capacity (maximum): 3,000 kg feed per day
• FCR: ~1,0
• Water consumption: 250 litre water per kg feed applied to the system
• Oxygen consumption: 0,5 kg oxygen/kg produced salmon
• Lime consumption: 0,1 kg Ca(OH)₂/kg produced salmon
• Coagulant & Polymer: 100 ml/litre sludgewater & 3 gram polymer per kg DM
• Energy consumption:
  • Main pumps to fish tanks: 1,05 kW/prod. salmon
  • Mechanical filters, various pumps etc.: 0,25 kW/prod. salmon
  • Cooling/heating, ventilation, wells, light, phosphor removal, de-nitrification etc: 0,95 kW/kg prod. salmon
  • GRAND TOTAL: 2,25 kW/kg produced salmon
  • Windmill capacity: 850 kW
• Production costs from egg to 4-5 kg salmon (all inclusive): 4,9 USD per kg HOG
• Sludge used for biogas
Langsand Laks

Status October 2013:

• Total numbers of batches: 9

• Already at first batch we experienced Furunculosis, today we vaccinate the fish

• Still challenges regarding early maturation, but we still improve a lot

• First hatch July 2011 – First harvest Q4 2013

• Production costs from egg to 4-5 kg salmon (all inclusive): 4,9 USD per kg HOG
Thanks for your attention