Scale Aquaculture

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Vice President Landbased - Aquaoptima
Scale Aquaculture
DEFINING AQ INDUSTRY THROUGH 40 YEARS OF EXPERIENCE
We deliver a complete value chain
WE ARE AQUACULTURE

Service:

Digital

Landbased:

Barges:

Feeding Systems:

Cages

Mooring Systems

Camera Systems

Moen Marin
Turn-key system for optimal water quality
About ScaleAQ Landbased

History of AquaOptima

• Based on comprehensive research activities in SINTEF in the period 1985-1993
• Developed industry products and own technology for intensiv landbased farming
Landbased farming

**Traditional flow through system (FT)**

- Large inlet of new water → Fish tank → Large outlet of wastewater

**Resirculating aquaculture systems (RAS)**

- Small inlet of new water → Fish tank → Water treatment (99% recirculation) → Small outlet of wastewater
Why RAS?

- Reduced water consumption
- Collection of sludge and waste
- Control of water quality
- Biosecure production
- Predictable production
- Shorter time in the sea, less parasites and diseases
- Large production on a small footprint
- Production near the consumer
# Water quality demands

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Safe level (salmonids)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS (particles)</td>
<td>&lt; 15 mg/L</td>
</tr>
<tr>
<td>TAN (NH$_4^+$-N and NH$_3$-N)</td>
<td>&lt; 2 mg/L</td>
</tr>
<tr>
<td>NH$_3$ – N</td>
<td>&lt; 0.012 – 0.025 mg/L</td>
</tr>
<tr>
<td>NO$_2^-$ - N</td>
<td>&lt; 0.1 mg/L</td>
</tr>
<tr>
<td>NO$_3^-$ - N</td>
<td>&lt; 100 mg/L</td>
</tr>
<tr>
<td>Dissolved O$_2$</td>
<td>80 - 100% saturation</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>&lt; 15 mg/L</td>
</tr>
<tr>
<td>pH</td>
<td>7 – 7.5</td>
</tr>
<tr>
<td>Density</td>
<td>&lt; 80 kg/m$^3$</td>
</tr>
<tr>
<td>Temperature</td>
<td>12-14 °C for Atlantic salmon, 15-17 °C for rainbow trout</td>
</tr>
</tbody>
</table>
Focus on:

- Optimal and efficient production of fish
- Particle removal and good water quality
- Efficient and stable CO₂ removal
- Optimal tank hydrodynamic
- Knowledge transfer – innovative methods for training
Particle removal

Particles and organic material lead to:

- Reduced efficiency in bioreactor
- Reduced efficiency in CO$_2$ – stripper
- Leakage of nutrients
- Increased biofilm growth and risk of sludge accumulation
  - H$_2$S risk and unstable microflora
- Increased risk for pathogens
- Increased O$_2$ demand
- Reduced clarity (and control)
RAS – rearing tanks and water treatment

Bioreactor
- Ammonia - and nitrite removal

Degasser
- CO₂ and N₂

Protein skimmer with ozone
- Fine particles and dissolved organic material

Mechanical filter
- Suspended particles

Particle trap
- Sedimented particles

pH and alkalinity

Oxygen

- CO₂ and N₂
Particle trap in the centre of the tank

Size distribution:
- Dissolved < 0.001 um
- Colloidal 0.001 – 1
- Super-colloidal 1 – 100
- Sedimented > 100
Mechanical filter
- Suspended particles
Protein skimmer with ozone

- Fine particles and dissolved organic material
Bioreactor - nitrification

Bioreactor - Ammonia and nitrite removal

$\text{NH}_3/\text{NH}_4^+ \xrightarrow{\text{Bacteria}} \text{NO}_2^- \xrightarrow{\text{Bacteria}} \text{NO}_3^-$

Toxic for fish

Less toxic for fish
CO₂ - stripper

- The most important factor for stable and high degasser effect is a clean aeration media
- Scale has developed a self-cleaning CO₂ stripper
ScaleAQ Landbased, delivers worldwide

- For more than 25 years AquaOptima has delivered RAS facilities worldwide, for a variety of species, in tropical and arctic environments, in freshwater and seawater.
VIKAN

- RAS from hatching to post-smolt
- Salmon (300 g) and trout (150 g)
- Total rearing volume of 7 000 m³
- 6 200 kg feed per day
- Finished in April 2020
Potential for Black Sea Region - RAS- Salmon and Trout

- Seacage production between June and November is difficult
  - High mortality of fish in the warm period
  - Producer is out of the market for many months

- RAS based production will achieve several benefits
  - Don’t need risky dam and lake production for smolt
  - Optimal production conditions
  - Better fish welfare and lower FCR
  - Good planning for market supply of fish
2 potential strategies

- SMOLT RAS → GROWOUT RAS
- POSTSMOLT RAS → SEACAGE
«But, isn`t RAS very expensive..?»

• Initial investment is higher than Seacage and small Flow Trough systems

• But, the end profit through time is higher due to better production planning, fish welfare and mortality, low FCR etc.

• ScaleAQ can provide financing from Norway at very low interest rates

Welcome to contact us for a good discussion
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