RECIRCULATION (RAS) VS FLOW THROUGH (FT) SYSTEMS DURING YOLK SAC AND FIRST FEEDING STAGES: EFFECTS ON REARING SYSTEM BACTERIOLOGY, SURVIVAL, QUALITY AND GROWTH OF ATLANTIC HALIBUT (HIPPOGLOSSUS HIPPOGLOSSUS) LARVAE.

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The commercial production of halibut fry is currently carried out in flow through systems (FT), while there is a growing consensus that a recirculation system (RAS) would offer more stable environmental and chemical water parameters that would lead to improved larval performance.

At the Institute of Marine Research (IMR) it is standard practice to treat the larvae with antibiotics the first three days of the start feeding period, in case of dropping appetite during this period. To avoid use of antibiotics, establish a microbial environment with probiotic effects, and potentially decrease mortality, use of RAS was tested during yolk sac incubation and first feeding.

Probiotics is a way of improving survival of fish larvae, which is presently gaining increased interest. It is not clear whether the intestinal microflora of halibut larvae is determined by the feed or by water quality.
Yolksac stage

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2015: Water temperature adjustment between the siloes.

2017: Water temperature adjustment in silo C.
Jaw deformed larvae

<table>
<thead>
<tr>
<th></th>
<th>Recirc.</th>
<th>Flow.</th>
</tr>
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<tbody>
<tr>
<td>2015:</td>
<td>14%</td>
<td>9%</td>
</tr>
<tr>
<td>2017:</td>
<td>11%</td>
<td>17%</td>
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First feeding:
Tropical Marine centre

Reservoir (650 liter) (1)
Filter bags (2)
Sand filter (3)
Re-gassing / Trickling biofilter (4)
Protein skimmer (5)
-UV (6)

Parallel-construction,
Not in-line.
Triplicate tanks

Artemia
“grey water” technique

Distinct meals of Artemia
Paste

Clay

Photo: IMR
Larval growth

Days after first feeding

Wet weight (g)

Flow 2016
Recirc 2016

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Survival during first feeding 2016

- Recirc.
- Flow.

Survival (%)

<table>
<thead>
<tr>
<th>Tank</th>
<th>Survival (%)</th>
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<tbody>
<tr>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>43</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
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</tbody>
</table>

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Larval growth

Days after first feeding

Wet weight (g)

Flow 2016
Recirc 2016
Flow 2017
Recirc 2017
Survival during first feeding 2017

Recirc.  Flow.

Survival (%)

Tank 1  Tank 2  Tank 3  Tank 4  Tank 5  Tank 6

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Microbiome characterization:

Bacteriological samples were taken through the experimental periods:
• from yolk-sac and first-feeding larvae
• from all incubation and first-feeding systems

DNA has been isolated
Sequence analyses (HiSeq) are underway