A quantitative genetic study of carcass quality traits in Atlantic salmon recorded both at a fixed age and fixed body weight.

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Important breeding objective traits

– Growth
  • Reduce number of days to target weight.

– Fat
  • Keep stable or reduce.

– Pigment
  • Increase colour level in the fillet.
Genetic and phenotypic correlations recorded at same age

<table>
<thead>
<tr>
<th></th>
<th>Fat</th>
<th>Colour</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td></td>
<td>0.03</td>
<td>0.48 to 0.63</td>
</tr>
<tr>
<td>Colour</td>
<td>-0.39</td>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td>Weight</td>
<td>0.42 to 0.82</td>
<td>-0.21 to 0.31</td>
<td></td>
</tr>
</tbody>
</table>
Objective

• Obtain estimates of genetic parameters for growth, filet fat and filet colour when measured both at:

  • **Same age**(SA)
  • **Same weight**(SW)
Material

• Two year classes.

• 206 families, offspring of 206 females and 103 males
  • 10-15 individuals per family in SA group
  • 13-15 individuals per family in SW group.
Methods

• SA group
  – Growth, fat and colour measured at average weight of 4.7 kg, in total 2437 measures.

• SW group
  – Growth measured at the start.
  – Growth measured on individuals around and above the target weight 4.4 kg ~ monthly.
  – Fat and colour measured at slaughter.
  – 7561 growth measures, 2693 fat and colour measures.
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Multivariate censored animal model in DMU

• Censoring data.
  – Start growth ~ when average weight was 2.7 kg.
  – Growth on individuals who reach threshold 4.4 kg.
    • Imputes growth values for remaining fish in tank using Gibbs sampler.
    • Total 13102 growth values used.

• The animal model for the 6 traits, growth, fat and colour SA and SW.
  • \( y = X\beta + Zu + Mr + e \)
    – Fixed effects: sex, year class, slaughter date

• Estimated using MCMC with 2,400,000 rounds.
Results
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Phenotypic correlations

Year class 1

Fat % SW fish vs Growth

Fat % SA fish vs Growth

Year class 2

Fat % SW fish vs Growth

Fat % SA fish vs Growth

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<table>
<thead>
<tr>
<th>Trait</th>
<th>$h^2$ SA (±SE)</th>
<th>$h^2$ SW (±SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>$0.25±0.08$</td>
<td>$0.17±0.04$</td>
</tr>
<tr>
<td>Colour</td>
<td>$0.10±0.04$</td>
<td>$0.10±0.004$</td>
</tr>
<tr>
<td>Growth</td>
<td>$0.36±0.09$</td>
<td>$0.38±0.10$</td>
</tr>
</tbody>
</table>
Genetic correlations between the same trait in SA and SW

<table>
<thead>
<tr>
<th>Trait</th>
<th>Genetic correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>0.59±0.08</td>
</tr>
<tr>
<td>Colour</td>
<td>0.44±0.26</td>
</tr>
<tr>
<td>Growth</td>
<td>0.92±0.04</td>
</tr>
</tbody>
</table>
## Genetic correlations between traits within SA and SW

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>SW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat and colour</td>
<td>-0.34±0.25</td>
<td>-0.26±0.26</td>
</tr>
<tr>
<td>Fat and growth</td>
<td>0.63±0.13</td>
<td>-0.21±0.23</td>
</tr>
<tr>
<td>Growth and colour</td>
<td>-0.36±0.24</td>
<td>0.25±0.32</td>
</tr>
</tbody>
</table>
Conclusions

- Magnitude of genetic correlations of growth with fat and colour depend on when the traits are measured.
- When measured at same weight instead of at same age genetic correlations change from being unfavourable to favourable.
- Possible to improve growth while at the same time reduce fat and increase colour as increased growth is utilized to perform earlier slaughter.
Thank you!

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SF ICELAND
STOFNFISKUR

Nofima