Current status of selective breeding in European aquaculture

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FAO, F. Cardia
Fishboost

WP 6: Economic evaluation of breeding programs

First step: Review of selective breeding programs and their market share
Objectives

1. Characteristics of breeding companies
2. Market share of selective breeding in European production
Six species account for >95% of European aquaculture production

- Atlantic salmon
- Rainbow trout
- Gilthead seabream
- European seabass
- Common carp
- Atlantic salmon

Rest = 3%

EU28 + Norway + Iceland + Faroe Islands + Isle of Man

(FAO, 2015)
Approach

- Survey among breeding companies
  - Family or mass selection
  - Traits
  - Selected generations
  - Egg/juvenile production

- Market share = Production by breeding companies
  European production
Characteristics

- 7 Breeding companies
- All perform family selection
- Typically selected traits:
  - Growth
  - Processing yield
  - Product quality
  - Disease resistance
- Selected for ±10 generations

Egg production per company

![Graph showing egg production per company with values in $10^6$]
Market share 2012

Market share breeding companies: 93-95%

- Number of breeding companies
- Total egg production
- Market share of breeding companies
Characteristics

- 15 Breeding companies
  - 6 Mass selection: <20 generations
  - 9 Family selection: <14 generations
- Typically selected traits:
  - Growth
  - Morphology
  - Processing yield
  - Disease resistance
  - Reproduction

![Egg production per company chart](chart.png)
Market share 2011

Market share breeding companies: 65-68%
Characteristics

- Breeding companies
  - 2 Mass selection
  - 5 Family selection

- Typically selected traits:
  - Growth
  - Morphology
  - Product quality
  - Feed efficiency
  - Disease resistance

- Selected generations: 1-5
Market share 2012

- Number of breeding companies
- Total juvenile production
- Market share of breeding companies

Market share breeding companies: 60-66%
Characteristics

- Breeding companies
  - 2 Mass selection
  - 2 Family selection

- Typically selected traits:
  - Growth
  - Morphology
  - Processing yield
  - Disease resistance

- Selected generations: 3-8
Market share 2012

Market share breeding companies: 38-51%
Characteristics & market share 2012

- Breeding companies
  - 1 Mass selection
  - 2 Family selection

- Selected traits:
  - Growth
  - Disease resistance
  - Morphology

- Selected generations: 3-5

Market share breeding companies: 100%
Characteristics

- Longest history in domestication
- Strains maintained for >20 generations
- Minor role of selective breeding → Market share ≈ 0%
- Genetic improvement = crossbreeding
Summary

- Number of breeding companies = 36
  - 25 family selection
  - 11 mass selection
- Most commonly selected traits:
  1. Growth
  2. Morphology
  3. Disease resistance
  4. Product quality
  5. Processing yield
Over 80% of European production originates from selective breeding!

<table>
<thead>
<tr>
<th>Species</th>
<th>Market share (%)</th>
<th>Production (1000 t)</th>
<th>From breeding companies (1000 t)</th>
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<tbody>
<tr>
<td>Salmon</td>
<td>93-95</td>
<td>1 487</td>
<td>1 398</td>
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<tr>
<td>Trout</td>
<td>65-68</td>
<td>253</td>
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<tr>
<td>Seabream</td>
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<td>Seabass</td>
<td>38-51</td>
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<td>Turbot</td>
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<td>13</td>
<td>13</td>
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<tr>
<td>Carp</td>
<td>0</td>
<td>67</td>
<td>0</td>
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<tr>
<td>TOTAL</td>
<td></td>
<td>2 065</td>
<td>1 678</td>
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</tbody>
</table>
Impact of selective breeding

1. Market share > 80%
2. What is the cumulative genetic gain?

Increased bodyweight at harvest:
Thank you for your attention!
<table>
<thead>
<tr>
<th>Species</th>
<th>European egg/juvenile production (million)</th>
<th>By breeding companies (million)</th>
<th>Market share (%)</th>
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</thead>
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<tr>
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<tr>
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<td>Carp</td>
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