Perspectives for mussel farming in the Baltic Sea Region – with focus on feed mussels

Odd Lindahl
The Royal Swedish Academy of Sciences at Kristineberg, Sweden
The Agro-Aqua recycling of nutrients by mussel farming

A harvested mussel contains ca:
1 % N and 0.1 % P

Mussel farming – a nutrient recycling engine

Nutrients to the sea:
80% diffuse sources,
20% point sources.

Why recycle nutrients?
Nitrogen (N) is energy demanding and climate driving to produce.
Phosphorus (P) is a limited resource on a global scale.
Mussel farming in the Baltic

= food mussel production
The possible uses of mussels

- Market
- Food
- Feed
- Fertilizer
- Biogas?

Illustration: Maj Persson
The possible uses of mussels

- Market
- Food
- Feed
- Fertilizer and energy

Illustration: Maj Persson
Pilot plant for the production of mussel meal

The entrance of the pilot, situated in Ellös, Sweden

A part of the rotating dryer and surrounding equipment
Two options to process fresh mussels into mussel meal

Mussels are steamed open, followed by mechanical separation of meat and shells. Meat pieces are dried.

- Easy to separate meat and shells.
- High quality of meal.
- High energy demand.
- Expensive equipment.
- Difficult to try meat.

Biochemical dissolution of the soft tissues, followed by filtration/separation from shells. A suspension is dried.

- Easy to run at a large scale.
- Valuable dried shell/meat/meal mixtures as "biproducts".
- Lower energy demand.
- Difficult to separate out the shells.
- The quality of products somewhat uncertain.
Products as a result of the dissolution method

1. Pure mussel meal, more or less without shell pieces (for all kinds of feeds, especially fish feed).

2. Various mixtures of mussel meal, meat pieces and shell pieces with dried meat attached or shell meal (especially useful in feeds for poultry).

3. Dried mussel shell pieces of certain sizes with variable amounts of dried mussel meat attached (is presently tested on laying hens, mainly for improving the social behaviour of the hens).

4. Wet mussel feed, with or without shell pieces (this product is not yet tested).
Added values of dried shells

1. Mussel meal and dried shells are produced in a weight ratio of 1 to 10.

2. The economic value between meal and shells is the opposite, or ca 10 to 1.

3. The sum of above involves that the shells may more or less double the total income.
First attempt to process Baltic mussels

It should be pointed out that it is technically more difficult to process the thin-shelled and fragile Baltic mussels.

It is for the moment not clear if and how it is possible to completely separate the shells from the meal. Trials are ongoing but will require some time and resources.
### Comparison of Aquabest, west coast and Åland mussel meals

<table>
<thead>
<tr>
<th></th>
<th>Ash g/kg</th>
<th>Protein g/kg</th>
<th>Ca g/kg</th>
<th>P g/kg</th>
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</thead>
<tbody>
<tr>
<td>Aquabest mussel meal</td>
<td>105</td>
<td>656</td>
<td>4.6</td>
<td>9.5</td>
</tr>
<tr>
<td>(steamed)</td>
<td></td>
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<tr>
<td>West coast mussels</td>
<td>162</td>
<td>480</td>
<td>27.7</td>
<td>9.0</td>
</tr>
<tr>
<td>(dissolved)</td>
<td></td>
<td></td>
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<tr>
<td>Åland mussels</td>
<td>307</td>
<td>384</td>
<td>77.8</td>
<td>7.5</td>
</tr>
<tr>
<td>(dissolved)</td>
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Approvement of processing method

The developed dissolution method is under ongoing approval to meet the standards of the EU legislation for feed production.

Most likely, the method will be approved under 2012.
Mussel meal
Mussel meal can replace fish meal

Steamed mussel meat  Standard feed
Mussel feed gives a strong yolk colour

<table>
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<tr>
<th>Colour on LaRoche scale</th>
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<tr>
<td>6 - 9</td>
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<td>12 - 14</td>
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<td>15 -</td>
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</tbody>
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Mussel meal is presently tested on artic char, trout, and atlantic salmon.
Filets of Salmon trout, fed on mussel meal for 45 days

Control  50 % mussel meal  100 % mussel meal
100 % fish meal  50 % fish meal  0 % fish meal

(From NiCe-project: Local fish feed ingredients for competitive and sustainable production of high-quality aquaculture feed).
Some basic mussel feed economics

- Fish meal costs about 2 euro on the market.
- To be competitive, mussel meal can not cost more than 3 euro.
- 5 % (weight) of a fresh mussel becomes mussel meal, which means that the ”mussel cost” increases 20 times going from fresh mussels to meal.
- Processing cost of making 1 kg of mussel meal is between 0.5 and 1 euro.
- The sum of above is that a mussel meal producer cannot pay more than about 10 cent per kg mussels.
Production cost of feed mussels

- Production cost of feed mussels along the Swedish Skagerak coast is roughly between 20 and 40 cents per kg.

- Production cost of feed mussels in the Baltic is presently not known.
Feed and environmental mussels - a ruling condition:

The mussel farmer must get paid for the environmental benefit performed.

A win-win situation can thereby be created between society, environment and aquaculture.

But how shall the mussel farmer get paid?
Mussel farming is comparable with environmental measures in agriculture.

Cost = 10 – 30 euro/kg N

Corresponds to 0.1 – 0.3 euro/kg mussels. This is the payment to the mussel farmer for the environmental service provided.
Mussel farming – a win-win measure for environment, society and industry and hopefully also for the Baltic.

Thank you for attention!