BioSustain
BioMar Sustainability Strategy

Vidar Gundersen
BioMar Norway

Åland Aquaculture Week
9-12 Oct 2012
I will be speaking about…

- **BioSustain – BioMar sustainability framework**
- Optimizing feed on sustainability
- Raw material movements
- How BioSustain can benefit your business
BioSustain pyramid

Optimised sustainability
BioSustain provides tools and methods to measure sustainability of the whole value chain, and to enable sustainability improvement through optimisation of feeds, farming, processing and transportation to market.

Hotspots
BioSustain is a dynamic approach to hot spot sustainability issues - feed raw material sourcing in particular.

Basic
BioMar companies use certified management systems with improvement programmes and follow different guidelines; e.g. on social responsibility.

Legal compliance
All BioMar activities are founded on national, regional and international laws and regulation.

www.biosustain.no
## SD Value Chain Map: Salmon in Europe

### SD Criteria

<table>
<thead>
<tr>
<th>Climate gas emissions</th>
<th>Energy use</th>
<th>Water scarcity and pollution</th>
<th>Waste and air pollution</th>
<th>Product Stewardship &amp; Safety</th>
<th>Biodiversity &amp; renewables &amp; animal welfare</th>
<th>Labor &amp; human rights, social aspects</th>
<th>Resource consumption</th>
<th>Traceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy, Palm oil production: Deforestation, ILUC, N₂-depl. fertilizers</td>
<td>Fuel consumption at farm</td>
<td>Veg RM: use of water for irrigation, eutrophication, phosphate scarcity</td>
<td>Disposal of by-catch fish</td>
<td>Use of processed animal protein in feed inappropriate use of pesticides</td>
<td>Overfishing through feed marine raw materials Palm oil (deforestation, social issues)</td>
<td>Labor conditions: fishing (Peru), palm. App./access to land (Soy, Palm)</td>
<td>Food competition, General depletion of feed raw material resources (i.e. phosphate scarcity)</td>
<td>Traceability of raw materials</td>
</tr>
<tr>
<td>Calculation of GHG of feed Carbon footprint of the value chain</td>
<td>Sea water: discharges, algae bloom. Freshwater: water use, alteration of natural waterflows, discharges</td>
<td>Optimal feed conversion rate (FCR) to avoid water pollution, fines in feed</td>
<td>Sea water pollution through net treatment, copper, feeds, faeces</td>
<td>Undesirable substances in feed: Dioxins, PCB’s, Flame retardants, etc. GMO in feed</td>
<td>Transparency about the use of GMO raw material</td>
<td>Labor conditions in transportation (foreign truck drivers - winter)</td>
<td>Alternative use of protein FCR Fish-in fish-out ratio</td>
<td>Evidence of traceability for feed</td>
</tr>
<tr>
<td>Use of energy for water pumps, recirculation systems, etc. Record of GHG emissions in farming</td>
<td>Flesh quality: Gaping, fat, Listeria</td>
<td>Use of pharmaceuticals, antibiotics, anti-foulants (release of copper)</td>
<td>Final product certification (fish) MSC, ASC, Global GAP</td>
<td>Fish health/welfare: stress, high mortality, disease/lice transfer, Escapes –interbreeding, triploids, GM fish, Benthic impact, interference with migration routes</td>
<td>Slaughtering methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy use for cooling &amp; logistics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon footprint final fish product</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Value Chain Map

- **SD-Issue Intensity:**
  - High
  - Medium
  - Low

- **Influencers**
  - Pace setter

- **Pace setter**

- **Influencers**

- **Regulators**
  - Fish feed production
  - Fish farming Hatchery & Growing

- **Consumers**
  - Retail

- **Media / NGO**
  - Consumers
  - Media / NGO

### Value Chain Stages

- **Raw materials**
- **Fish feed production**
- **Fish farming Hatchery & Growing**
- **Processing & Distribution**
- **Retail**
- **Consumption & Disposal**

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**Full SD Value Chain Map: Salmon in Europe**

- **High**
- **Medium**
- **Low**

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**Value Chain Stages**

- **Raw materials**
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**SD-Issue Intensity**

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- **Medium**
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**Influencers**

- **Pace setter**

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**Pace setter**

- **Influencers**

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**Regulators**

- **Fish feed production**
- **Fish farming Hatchery & Growing**

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**Consumers**

- **Retail**

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**Media / NGO**

- **Consumers**
  - **Retail**
  - **Consumption & Disposal**

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**BioMar SUSTAINABLE DEVELOPMENT**
BASF methodology
Business partner and basic model developer
Eco-Efficiency

Collection of raw material data (eco-profiles)

Life cycle assessments based on the eco-profiles

Life Cycle Inventory

Carbon footprint is a natural part of the LCA

Total Cost of Ownership

The costs / sales price related to a product or a process

Describes the overall balance between Ecology and Economy
Weighted environmental load

TNS infratest, Germany 2009
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# Eco indexes on raw materials

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Eco index</th>
<th>Raw material</th>
<th>Eco index</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT fishmeal (NA)</td>
<td>x,x</td>
<td>Corn gluten</td>
<td>x,x</td>
</tr>
<tr>
<td>Superprime (SA)</td>
<td>x,x</td>
<td>Pea protein</td>
<td>x,x</td>
</tr>
<tr>
<td>NSM Fishmeal (NA)</td>
<td>x,x</td>
<td>DDGS</td>
<td>x,x</td>
</tr>
<tr>
<td>Trimmings fish meal (NA)</td>
<td>x,x</td>
<td><strong>Wheat</strong></td>
<td>1,0</td>
</tr>
<tr>
<td>Standard Fish oil (NA)</td>
<td>x,x</td>
<td>Fava beans (+ organic)</td>
<td>x,x</td>
</tr>
<tr>
<td>Ensilage oil (NA)</td>
<td>x,x</td>
<td>Organic peas</td>
<td>x,x</td>
</tr>
<tr>
<td>Omega oil/health oil (SA)</td>
<td>x,x</td>
<td>Lysine</td>
<td>xx,x</td>
</tr>
<tr>
<td>Trimmings fish oil (NA)</td>
<td>x,x</td>
<td>Methionine</td>
<td>xx,x</td>
</tr>
<tr>
<td>Rapeseed oil</td>
<td>x,x</td>
<td>Threonine</td>
<td>xx,x</td>
</tr>
<tr>
<td>Soy protein concentrate 60%</td>
<td>x,x</td>
<td>Astaxanthin (synthetic)</td>
<td>x,x</td>
</tr>
<tr>
<td>High protein soy 49%</td>
<td>x,x</td>
<td>Canthaxanthin (synthetic)</td>
<td>xx,x</td>
</tr>
<tr>
<td>Organic soya</td>
<td>x,x</td>
<td>Astaxanthin (yeast-based)</td>
<td>xxx,x</td>
</tr>
<tr>
<td>Sunflower expeller</td>
<td>x,x</td>
<td>Vitamin C</td>
<td>xx,x</td>
</tr>
<tr>
<td>Sunflower meal</td>
<td>x,x</td>
<td>Vitamin C&amp;E mix</td>
<td>x,x</td>
</tr>
<tr>
<td>Organic sunflower expeller</td>
<td>x,x</td>
<td>Vitamin E 20%</td>
<td>x,x</td>
</tr>
<tr>
<td>Wheat gluten</td>
<td>x,x</td>
<td>Mono calcium phosphate</td>
<td>x,x</td>
</tr>
</tbody>
</table>
## BioSustain index on product recipes

<table>
<thead>
<tr>
<th>CPK 2000</th>
<th>Regular recipe</th>
<th>Optimized BSi (lowest possible)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INGREDIENTS</strong></td>
<td>Ei</td>
<td>Cost = x,x</td>
</tr>
<tr>
<td>NA Fishmeal</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>Sunflower expeller</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>SA Blend SP/STD</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>Pea Protein</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>SPC 60</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>Carophyll Pink CWS 10%</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>Mono - kalsiumfosfat</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>DL-Metionin</td>
<td>xx,x</td>
<td></td>
</tr>
<tr>
<td>Barox</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>Std. Oil</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>Omega Oil</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td>Rapeseed Oil</td>
<td>x,x</td>
<td></td>
</tr>
<tr>
<td><strong>WATER CHANGE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product total</td>
<td>BSi</td>
<td>100</td>
</tr>
<tr>
<td>Sum RM with Ei</td>
<td>BSi adj.</td>
<td>99,175</td>
</tr>
</tbody>
</table>
# Internet-based Eco-Efficiency Analysis

## Fish Feed 2011

<table>
<thead>
<tr>
<th>General</th>
<th>Feed</th>
<th>Salmon Production</th>
<th>Superuser</th>
<th>Case Studies</th>
<th>About</th>
</tr>
</thead>
<tbody>
<tr>
<td>case study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Customer Benefit

- **fish product (end consumer)**: kg 1000

### Names of Alternatives

- **name**:
- **enabled**:

### Last Step to be Considered

- **salmon production**

### Costs or Price

- **Costs or price of last step considered**:
  - Alt. 1: CPK 4464.00, CPK Q 4464.00, Power 4464.00
  - Alt. 4: 
  - Alt. 5: 
  - Alt. 6: 

- **results overview** | **export results** | **restore default values** | **save** | **save as**
Eco-Efficiency Analysis test results

Environmental fingerprint

Eco-Efficiency Portfolio

Global Warming Potential (Carbon Footprint)

- CO2 equivalent/kt
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Use of fish meal and oil in salmon diets

Source: Nofima report 2012
World fishmeal consumption
By region

2009: 4,840,000 mt
- Asia (Exc. China): 31%
- China: 21%
- Europe: 29%
- Latin America: 4%
- North America: 6%
- Oceania: 1%
- Other: 8%

2010: 4,541,000 mt
- Asia (Exc. China): 31%
- China: 27%
- Europe: 20%
- Latin America: 10%
- North America: 5%
- Oceania: 7%
- Other: 2%

Source: IFFO
World fishmeal consumption
By industry segment

2000
- Aqua: 35%
- Poultry: 29%
- Swine: 24%
- Ruminants: 3%
- Others: 9%

2011
- Aqua: 73%
- Poultry: 20%
- Swine: 5%
- Ruminants: 2%
- Others: 2%

Source: IFFO
World fish oil consumption
By industry segment

2011
- Aqua: 76%
- Omega-3: 16%
- Tech/hard: 7%
- Burning: 1%

2012
- Aqua: 74%
- Omega-3: 18%
- Tech/hard: 7%
- Burning: 1%

2013
- Aqua: 73%
- Omega-3: 19%
- Tech/hard: 7%
- Burning: 1%

Source: IFFO
GM development

Soy Protein Concentrate (SPC)

Brazil total harvest 20 787 592 tons
Total segregated NGMO 11 725 016 tons
### Main product RMs vs. by-product RMs

<table>
<thead>
<tr>
<th>RM main products</th>
<th>MT</th>
<th>RM by-products</th>
<th>MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish meal (NA+SA)</td>
<td>xx</td>
<td>Fish meal trimmings</td>
<td>xx</td>
</tr>
<tr>
<td>Fish oil (NA+SA)</td>
<td>xx</td>
<td>Silage oil</td>
<td>x</td>
</tr>
<tr>
<td>Krill</td>
<td>xxx</td>
<td>Sunflower meal</td>
<td>xx</td>
</tr>
<tr>
<td>Rapeseed oil</td>
<td>xx</td>
<td>Wheat gluten</td>
<td>x</td>
</tr>
<tr>
<td>Wheat</td>
<td>xx</td>
<td>Corn gluten</td>
<td>x</td>
</tr>
<tr>
<td>Pea starch</td>
<td>xx</td>
<td>Soy protein (SPC)</td>
<td>xx</td>
</tr>
<tr>
<td>Beans</td>
<td>x</td>
<td>Pea protein</td>
<td>xxx</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>202</td>
<td><strong>Total</strong></td>
<td>115</td>
</tr>
<tr>
<td></td>
<td>387</td>
<td></td>
<td>540</td>
</tr>
</tbody>
</table>

64% RM main products

36% RM by-products

BioMar Norway 2011
I will be speaking about…

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How BioSustain can benefit your business
BioSustain through the value chain
Sustainability risk reduction and branding opportunities

Value chain

- Raw materials
- RM transportation
- Feed production

BioMar responsibility

- Feed transportation

Slaughtering, Processing & Packaging
Retail logistics

Farming & Harvesting
Transparency through the value chain
– a necessity for sustainable aquaculture development