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AQUAFIMA Workshop on Integrated Coastal Zone Management (ICZM) and spatial planning to integrate aquaculture and fisheries in the coastal zone of the Baltic Sea Region

Tallin, 4th December 2012
COEXIST: Interaction in coastal waters: a roadmap to sustainable integration of aquaculture and fisheries

- Co-funded by the EC 7th Framework Programme (Call KBBE-2009-3)
- April 2010 – March 2013 (36 months)

Mission:

- To address the sustainable use of Europe’s seas and oceans
- To provide a roadmap for integration of aquaculture and fisheries in the coastal zone
- To provide valuable tools (ecosystem modelling tools, Marine Spatial Planning tools such as GIS and other scenario-based simulation and visualisation tools) to support decision-makers on maritime matters when it comes to managing our maritime space
**Case Studies:**

In COEXIST, individual processes as well as their interaction, will be investigated in case studies, representing the specific conditions and combinations of activities of European coastal areas of particular importance for aquaculture and coastal fisheries.

1. Hardangerfjord – LP: IMR (1)
2. Atlantic Sea Coast - LP: UCC (3)
3. Algarve Coast - LP: IPIMAR (5)
4. Adriatic Sea Coast – LP: CNR-ISMAR (8)
5. Coastal North Sea – LP: vTI-SFF (2)
Expected outcomes:

- Characterization of relevant European coastal marine ecosystems, their current utilisation and spatial management
- Evaluation of spatial management tools for combining coastal fisheries, aquaculture and other uses, both now and in the future
- Tools for supporting the decision-makers and other stakeholders
WP1 - Baseline: identification of interactions, conflicts and management tools in coastal waters

WP2 - Legal, institutional and policy framework

WP3 - Integration of models and processes

WP4 - Evaluation of spatial management tools

WP5 - Best practice synthesis of Coexist. WP1-4 and Case Studies

WP6 - Dissemination, communication and knowledge transfer

WP7 - Knowledge management: supporting systems, processes and methodologies

WP8 - Project management

2010

2011

2012

2013
Rainbow trout farmed in Finland

Source: kalankasvatuksen ympäristönsuojeluohje
Market growth by imported salmon

![Graph showing market growth by imported salmon](image-url)
Loading has decreased

Total nitrogen and phosphorus loading

Spesific nitrogen and phosphorus loading

Source: kalankasvatuksen ympäristönsuojeluohje
Acceptability of fish farming

Summer house dwellers

• Over 20,000 cottages in the area
• Seasons of recreational dwellers and intensive fish farming partly overlapping
• Protection of the ecosystem against eutrophication and conserving sceneries for recreation have been used as justification to hinder fish farming near summer houses

Other interest groups

• Commercial fishers usually supportive
• Most of the local inhabitants understanding and supportive
• Environmental and fisheries administration considered remote and unsupportive
Environmental regulation and attractivity of the fish farming business

Present problems:
- Bureaucratic quantity-based regulation
  - Short periods of the present licensing
  - Costs of the permission procedure and of the monitoring studies
- Image of fish farming among consumers and recreational users of the coastal area

Alternatives:
- Norm regulation
- Market-oriented loading regulations: tax, subsidies, quota trading
- Idea of net loading
- Participatory planning system, site selection
Present structure of the fish farming

Dispersed in small units
A fish farming company has usually many sites
Unit size -> higher

Tools suggested and investigated
  Spatila planning with site selection
  Net loading with removal of less valuable fish
  Use Baltic Sea feed
Site selection plan, objectives

• Recognize the areas especially suitable for aquaculture
• Diminish conflicts and nutrient loading in the inner archipelago
• Harmonize economic and environmental policies to make the aquaculture sustainable
• Make the farming more profitable
SW Finlands county as a pilot

- Criteria from a national committee
- A regional planning committee with broad participation
- Expert hearings
- Recognizing the suitable areas with background data using GIS-tools
- Modelling the future production figures
- Impact assessment
Criteria: ecological status and usefulness classification
Criteria: Water depth, Summer houses and the recreational use in the regional plan.
Criteria: Nature protection and Natura areas
Criteria: other uses, like shipping routes, military use
### The areas recognized

<table>
<thead>
<tr>
<th>Area</th>
<th>Area</th>
<th>Excluded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archipelago area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW inner archipelago</td>
<td>681 km²</td>
<td>94 %</td>
</tr>
<tr>
<td>SW middle archipelago</td>
<td>1285 km²</td>
<td>76 %</td>
</tr>
<tr>
<td>SW outer archipelago</td>
<td>4217 km²</td>
<td>53 %</td>
</tr>
<tr>
<td>Gulf of Bothnia inner coast</td>
<td>828 km²</td>
<td>95 %</td>
</tr>
<tr>
<td>Gulf of Bothnia outer coast</td>
<td>1543 km²</td>
<td>72 %</td>
</tr>
<tr>
<td>Archipelago and coastal area</td>
<td>554 km²</td>
<td>67 %</td>
</tr>
</tbody>
</table>
Modelling the nutrient flow

Currents

Nutrient load dispersion
Change in the chlorophyll

Changes in the chlorophyll contents
In the archipelago Sea, zones gathering small units together
Consequences in the Archipelago Sea according to the plan

- Amount of algae increases less than 4%  
- The number of farming units by the participating companies will be 60% less  
- More than 80% less summer houses under 0.5 km distance from the farms
Most promising areas for the future growth

• less sheltered
• offshore farming techniques
• Wind power parks?
Profitability threshold
Spatial planning benefits

- The same or less environmental impacts
- Lower number of farming units per company (-60%)
- Less summer houses in the vicinity (<0.5 km) of farms (-80%)
- Bigger units, better profitability, 0.14-0.47€/kg lower production costs
Aquabest 2012 rainbow trout trial: three diets compared

Present

Step 1

Step 2

Part financed by the European Union (European Regional Development Fund and European Neighbourhood and Partnership Instrument)
## Nutrient flows

### Present

<table>
<thead>
<tr>
<th>Feed ingredient</th>
<th>&quot;Present&quot;</th>
<th>Step 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular fish meal</td>
<td>320</td>
<td>-</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>130</td>
<td>-</td>
</tr>
<tr>
<td>Soy protein concentrate</td>
<td>170</td>
<td>-</td>
</tr>
<tr>
<td>Baltic Sea fish meal</td>
<td>-</td>
<td>320</td>
</tr>
<tr>
<td>Bream and roach silage</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mussel meal</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rapeseed protein</td>
<td>-</td>
<td>265</td>
</tr>
<tr>
<td>Field bean</td>
<td>-</td>
<td>65</td>
</tr>
<tr>
<td>Fish oil</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Wheat meal</td>
<td>170</td>
<td>140</td>
</tr>
<tr>
<td>Premix</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1000</strong></td>
<td><strong>1000</strong></td>
</tr>
</tbody>
</table>

### Step 1

- 93% to Present
- 7% to Step 1
- 0% to Present
- 39% to Step 1
- 61% to Step 1
**Nutrient flows**

<table>
<thead>
<tr>
<th>Feed ingredient</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltic Sea fish meal</td>
<td>17</td>
</tr>
<tr>
<td>Fish silage from local catches</td>
<td>16</td>
</tr>
<tr>
<td>Mussel meal</td>
<td>9</td>
</tr>
<tr>
<td>RPC</td>
<td>23</td>
</tr>
<tr>
<td>Field bean</td>
<td>6</td>
</tr>
<tr>
<td>Fish oil</td>
<td>16</td>
</tr>
<tr>
<td>Wheat meal</td>
<td>12</td>
</tr>
<tr>
<td>Premix</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Step 2

0% 40%

22% 38%

**coexist**

Interaction in coastal waters
Chemicals production

Fuels production

Heat production

Electricity production

Materials production

Fish meal and oil production

Processing
- Soy meal & concentrate
- Wheat flour
- Rape seed oil

Feed manufacturing

Fish farming

Smolt production

Fertilisers

Pesticides

Antifouling
Environmental indicators

- Climate change (carbon footprint, \( \text{CO}_2 \)-equiv.)
- Eutrophication of the waters (\( \text{PO}_4 \)-equiv.)
- Primary energy consumption (GJ)

Fish farming options

0. Present situation

1. Net loading option (fisheries of low-valued stocks for nutrient removal to justify aquaculture licenses)

2. Baltic Sea feed (nutrient recycling within the Archipelago fisheries and aquaculture)

3. Rationalized farming site location strategy (fewer, bigger and better located farms)
Current case: results

Graph showing energy consumption (GJ per 1000 kg of fish) for different categories:
- Soy products
- Wheat
- Fish meal and oil
- Other feed raw materials
- Fish feed manuf.
- Hatchery
- Fish farming
- Transports
- Packages

Energy consumption peaks for Fish meal and oil.
Comparison: energy consumption

[Diagram showing energy consumption across various processes with relative scales and categories including LVF catching, Packages, Transports, Fish farming, Hatchery, Fish feed manuf., Other feed raw materials, Fish meal and oil from BS, Fish meal and oil, Wheat, and Soy products.]
Comparison: climate and eutrophication

Relative scale (Current = 1)

Current | Net loading | Offshore | BS BS-fe

0.03%

0.8%
Conclusions, environment

- Present system:
  - Decrease nutrient load from fish farming (practically & technically)
  - Use renewable energy and utilize organic wastes maximally
  - Be awake to the environmental impacts of feed raw materials production

- Net loading: present system and…
  - Result is very sensible for the end use of LVF: if not used in BD production but replaces fish used in fur animal feeding $\Rightarrow$ net effect $\leq 0$
  - Minimise fuel consumption of LVF fishing

- Offshore: see present system

- BS feed: see present system, and…
  - Minimise fuel consumption of fishing
  - A new alternative $\Rightarrow$ composition of the fish feed is not known yet $\Rightarrow$ may (significantly) affect to the final results
Conclusions

• The rainbow trout produced using Baltic Sea Feed in more open sea areas is the most sustainable way to produce animal protein
  • The environmental impacts can be lower than the impacts of broiler, cow or pig meat production
• Effects on the health of the people
• Global market as the playing field, no direct production subsidies
Fish farming governance goals in the Baltic Sea area

Decreasing adverse ecological effects;
Optimization of the use of coastal areas at regional, nation-wide and the Baltic Sea level;
Creating and maintaining firm jobs opportunities to private fish farmers in the rural archipelago areas;
Supporting regional fisheries and economic development.
## Production 2011

<table>
<thead>
<tr>
<th></th>
<th>Sweden</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production (million kg)</td>
<td>12.0</td>
<td>11.3</td>
</tr>
<tr>
<td>Value of production, (million €)</td>
<td>36.8</td>
<td>47.1</td>
</tr>
<tr>
<td>Share of rainbow trout of the production</td>
<td>89.8 %</td>
<td>87.6 %</td>
</tr>
<tr>
<td></td>
<td>The rest mainly arctic char</td>
<td>The rest mainly whitefish</td>
</tr>
<tr>
<td>Number of farms (food fish)</td>
<td>79</td>
<td>178</td>
</tr>
<tr>
<td>of which in the Baltic Sea coast</td>
<td>18</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>(only rainbow trout)</td>
<td></td>
</tr>
<tr>
<td>Farms producing more than 100 tons/a</td>
<td>15</td>
<td>only few</td>
</tr>
<tr>
<td></td>
<td>Producing 95 % of the Swedish production</td>
<td></td>
</tr>
</tbody>
</table>

(Statistics Sweden (SCB), Statistics Finland (SVT))
Swedish Production 1983-2011
Swedish production and number of farms in 2011

Annual production (tons) / number of farms

Counties with production >100 tons:
Norrbotten
Västerbotten
Västernorrland
Jämtland
Dalarna
Värmland
Västra Götaland
Skåne

Statistics Sweden (SCB)
A permit needed when,

Sweden
- When use of dry feed exceeds 40 tons/a, a permit from regional county is needed. If it is between 1,5-40 tons/a, a notification to the local municipality serves (the environmental legislation)
- According to the Fishery Act all aquaculture needs a permit from the regional county

Finland
- When production (=plusgrowth) exceeds 2 tons/a or use of dry feed 2 tons/a
- Or if the size of a pond culture is at least 20 ha
### Swedish application system

| Consultations | County Administrative Board  
| Regulatory authority (municipality)  
| Individuals specially affected by the project |
| Environmental impact? | County Administrative Board  
| makes a decision whether an application can be prepared and sent forward |
| Broader Consultations | County Administrative Board  
| Supervisory/regulatory authorities  
| Individuals specially affected by the project  
| Other state authorities, municipalities, organizations, groups affected by the project |
| Application with MKB | Application  
| MKB (Environmental Impact Description) including report of consultations  
| Information to the general public |
| Decision | County Administrative Board decides if MKB is valid  
| County Administrative Board accepts the application |

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### Finnish application system

| Application | Regional State Administrative Agencies |
| Possible supplements and consultations | Regional State Administrative Agencies  
| Centre for Economic Development, Transport and the Environment management (ELY-central)  
| Information to general public |
| Comments | Regulatory authority (ELY-center, 2 departments)  
| Municipality  
| Individuals specially affected by the project |
| Possible consultations | Regulatory authority (ELY-center)  
| Regional State Administrative Agencies |
| Decision | Regional State Administrative Agencies |

Sweden according to Jens Andersson
Swedish system / Finnish system

**Actors.**

no differences, more or less the same actors

**Institutions:**
the role of the local level (municipality) is stronger in Sweden

**Governance:**

Sweden: more interaction, collaboration and public-private partnership
Finland: more hierarchical governance, less communication

**Principles/main focus:**

Sweden: local society and environment
Finland: effluent loads of nitrogen and phosphorus
Monitoring

Sweden

Counties often delegate monitoring to the municipalities
Mainly similar as in Finland:
- Annual and loading reports prepared by farmers
- Inspector’s visits depending on the case (may in some cases be several times a year)

Finland

The Centre for Economic Development, Transport and the Environment is supervising the monitoring carried out by certified consultants
Annual and loading reports prepared by farmers
Inspector visits every second year
The Swedish governance practice*:

- Large farms in Sweden (over 1000 tons) in the lake area,
- In the sea area the capacity of the farms owned by Finns are 400-600 tons
- Farm sites are excellent, oligotrophic areas, depth 40-60m, no registered complains although the farms are located near shores
- More difficult to get permits for sea than for lake areas,
  - for sea areas permits are usually for 10-15 years,
  - for lake areas permits are for an indefinite time
- Spatial plan is generally not yet in use in Sweden as it is going to be in Finland in 2013

*interview of a Chief executive of a Fish farming enterprise in Åland islands
Finnish farmers going "to exile" into Sweden*

Over 5 million kg annually "Finnish" production in Sweden

Big farms, big plans:

"We have now a million kg farm but it is planned to produce 4 million kgs on that farm in the near future. This plan is prepared in understanding with the local environmental authorities and with their consultative help."

The Production is exported to Finland

"There is no market for big rainbow trout in Sweden"

Sometimes the fish goes first to Estonia to be processed before exportation to Finland

*The chief executive of a Finnish fish farming company
Are the governance goals in the Baltic Sea area in balance between the regions?

Decreasing adverse ecological effects;
Optimization of the use of coastal areas regionally, nation wide and at the Baltic Sea level;
Creating and maintaining firm jobs opportunities to private fish farmers in the rural archipelago areas;
Supporting regional fisheries and economic development
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Thank you for your attention

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