Simplified environmental assessment of aquaculture food supply chains using a web-based tool, the SENSE tool

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Content

- SENSE tool validation for aquaculture supply chains
- Feedback from users
Challenges linked to KEPIs
Use of feed, energy, fertilizers, pesticides, water, land, abiotic resources, waste disposal, wastewater

Aquaculture supply chain
Similar challenges and environmental impacts identified in food supply chains

Environmental impacts
- Climate change,
- Eutrophication
- Acidification,
- Ecotoxicity,
- Human toxicity,
- Land use,
- Water depletion,
- Abiotic resource depletion

- LCA methodologies do not cover challenges in aquaculture like
  - Animal welfare,
  - Escapes,
  - Use of medication

The SENSE tool facilitates harmonised data gathering of selected KEPIs by SMEs

Assessment of environmental impacts in each life cycle step and overall impact on final product
LCA of Aquaculture Salmon

System boundaries

Process diagram from SENSE

Breeding / roe production

Smolt production

Salmon farming and slaughtering

Processing and packaging

Secondary processing and packaging

Retail

By-products

System boundary for FU 1

System boundary for FU 2

Function unit – Case 1
1 kg smoked salmon fillets

Function unit – Case 2
1 kg fresh salmon HOG
LCA of aquaculture salmon

Impact assessment of 1 kg smoked salmon fillets

- GWP: Global Warming Potential
- EP: Eutrophication

Benchmarking:
- 5.0 kg CO₂-eq/kg smoked salmon fillet
- 2.7 kg CO2-eq/kg salmon, head on gutted
# KEPIs – input data SENSE tool

## KEPIs Aquaculture

<table>
<thead>
<tr>
<th>KEPIs Aquaculture</th>
<th>SENSE tool input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed use*</td>
<td>Kg/year</td>
</tr>
<tr>
<td>Fish produced*</td>
<td>Kg/year</td>
</tr>
<tr>
<td>Energy use Diesel</td>
<td>L kwh/year</td>
</tr>
<tr>
<td>Energy use Electricity (Iceland) **</td>
<td></td>
</tr>
<tr>
<td>Organic waste to sea</td>
<td>High/low</td>
</tr>
<tr>
<td>Fresh water use (Iceland) **</td>
<td>m³/year</td>
</tr>
<tr>
<td>Packaging material</td>
<td>Kg/year</td>
</tr>
<tr>
<td>Wastewater***</td>
<td>High /low***</td>
</tr>
<tr>
<td>Waste</td>
<td>Kg/year</td>
</tr>
</tbody>
</table>

**Examples of improvements:**

*Possible to insert composition of feed (plant and marine ingredients)*

* Datasets for typical Icelandic and Norwegian feed have been implemented

** Regionalised by country

*** Relevant datasets for aquaculture effluents needed to be implemented

****Data for the marine feed ingredients for the aquaculture chain were updated in collaboration with SIK and SINTEF (Norway)

## KEPI Fisheries

<table>
<thead>
<tr>
<th>KEPI Fisheries</th>
<th>SENSE tool data input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy use****</td>
<td>L of diesel/year</td>
</tr>
</tbody>
</table>
Validation of the SENSE tool

1. Functionality testing
2. Verification of the calculations (SimaPro and GaBi)
3. Comparison of simplified LCA with a complete LCA
4. Testing of the tool in SMEs
   » Checking functionality
   » Checking data
   » Checking results
   » Verification
   » Suggested improvements

Ongoing
1. Validation - Functionality testing

• For each step the function was evaluated as
  – PASS
  – FAIL
  – OBS!
  – General comments

<table>
<thead>
<tr>
<th>Information</th>
<th>FAIL</th>
<th>PASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• There are no information “pop-up” windows like we have talked about. E.g. having a (sign where a pop up window appears, e.g. explaining what is meant by “share of products” (in turnover). This is lacking in many places.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAIL</td>
<td>• All information presented needs revision.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERROR</th>
<th>FAIL</th>
<th>PASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• At times, in the middle of our work of introducing data an error occurred and all information we had previously entered disappeared (inventory and user profile). We logged out and in again, and the user profile we had saved earlier was still there but no inventory.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process tree</th>
<th>OBS!</th>
<th>OBS!</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The process tree needs to be more flexible and easy to modify. Preferably by drag and drop.</td>
<td></td>
<td></td>
</tr>
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<td>OBS!</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Delete</th>
<th>FAIL</th>
<th>FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>• When deleting inventory data the tool MUST ask if “I am sure” that I want to delete.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Ongoing:**

Iterative development of the SENSE tool
Continuously implementing changes to improve the functionality and the usability of the tool
2 Verification of SENSE tool calculations using SimaPro & GaBi

- same input data (KEPIs), methodologies and background datasets
  - RESULTS: <10 variation for the following impact categories
    - Climate change
    - Human toxicity, cancer effects, Human toxicity, non-cancer effects
    - Acidification
    - Eutrophication, terrestrial
    - Eutrophication, freshwater
    - Eutrophication, marine
    - Ecotoxicity, freshwater
    - Land use
    - Abiotic resource depletion
    - Water depletion
Validation - verification

3. Comparison of simplified LCA with a complete LCA
   - Not possible to compare for the aquaculture supply chain
   - Reasons:
     - Different databases
     - Different dataset for marine feed ingredients -> main contributor to most impact categories
     - Different handling of organic matter to sea (BOD, N and P values)
Results for smoked salmon from the SENSE tool

Benchmarking

5.8 kg CO$_2$-eq/kg smoked salmon fillet
4. Validation - Testing of the SENSE tool by companies

- 7 aquaculture companies in Iceland have so far tested the tool
  - Testing is still ongoing

- Willingness to test the SENSE tool?
  - Lack of time
  - See benefit because of requirements for carbon footprint calculations in standards
  - Data is already compiled for Green Book-keeping for aquaculture—Transparency
    - Data collection from suppliers and processing can be problematic
Feedback from companies

- Sustainability awareness?
- Inserting data - user friendliness?
- Usefulness of result?
- How to communicate the results?
- Benefits?
Let’s say that an EID would be available for your products. How do you foresee that you would communicate it?

- As a separate document EID in B2B communication / marketing
- To support green accounting / green bookkeeping
- As part of sustainability reporting
- For benchmarking with other companies
- In the annual report of the company
- To justify an eco-label for the product,
- As data represented to current clients
- All above apply!
Statements on the benefits of the SENSE tool

The SENSE tool can be applied for calculating GHG emission on the farms to fulfil requirements of certification schemes like ASC Aquaculture Stewardship Council

- Simplified data gathering
- Regionalised background data
- Harmonised methodologies
Airfreight vs Ship transport to Europe

“The SENSE-tool has allowed me to identify the main hotspots in the supply chain of my products”
Example: different transportation modes

Airfreight 54.7% of total climate change impact => 6.8 kg CO₂eq/kg product

Ship 3.27% of total climate change impact => 3.2 kg CO₂eq/kg product
Conclusion

- The SENSE tool can be used by companies for benchmarking their products environmental performances for the following impact categories:
  - Climate change
    - Human toxicity, cancer effects / Human toxicity, non-cancer effects
    - Acidification
    - Eutrophication, terrestrial
    - Eutrophication, freshwater
  - Eutrophication, marine
    - Ecotoxicity, freshwater
    - Land use
    - Abiotic resource depletion
  - Water depletion

- It is important to note that the SENSE tool is a simplified tool, and the assessment is not an alternative for the complete LCA studies.
Thank you for your attention!
References

• Public Deliverables from the SENSE project www.senseproject.eu: