Designation of heavily modified water bodies in Finland

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Outline of presentation

- Designation process of heavily modified water bodies

- Heavily modified water bodies in Finland (1st planning period 2010-2015)

- Did we manage to identify heavily modified water bodies?
Introduction - defining hydromorphological status

- Hydromorphological status is evaluated with so called HyMo-criteria.

- In this method water bodies are given points according to the level of anthropogenic changes in their hydrological and morphological pattern.

- Water bodies can be classified as heavily modified either according to the direct criteria or with the more specific evaluation with the HyMo-criteria.
Direct criteria for classification as heavily modified water bodys

- **Regulated lakes**
  - Water-level draw down during winter
    - is over 3 m, or at least half of the average depth or
    - decreases the water covered area to at least half of the regular size

- **Rivers**
  - River has been changed by damming, cleaning, embanking or moving for at least half of its length or at least half of its natural head loss is dammed

- **Dammed coastal bays**
  - No natural connection to the sea exists
Defining hydromorphological status in rivers with HyMo-criteria

Criteria for hydro-morphological changes:
- Upstream migration barriers (% of river length)
- Constructed head loss (%)
- Constructed part (%) of the river length (cleaning, embankments, new channels, dry stretches)
- The daily discharge variation compared with mean discharge \((HQwk - NQwk)/MQ\) under normal water conditions
- Change (%) in the spring HQ compared with the natural discharge or the occurrence of the critical low flows
## Criteria for evaluation of hydromorphological changes in rivers (HyMo)

<table>
<thead>
<tr>
<th></th>
<th>1. Upstream migration barriers</th>
<th>2. Constructed head loss (%)</th>
<th>3. Constructed part (%) of river length (cleaning, embanking, new channels, dry stretches) and its effects</th>
<th>4. The magnitude of short-time regulation (HQwk - NQwk)/MQ under normal water conditions or frequency of 0-discharge</th>
<th>5. Change (%) in the spring HQ compared with the natural discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high (4 points)</td>
<td>Completely closed (90-100 %)</td>
<td>Over 50</td>
<td>over 50, This has caused destruction/significant negative changes in natural underwater habitats (e.g. rapids)</td>
<td>Case-specific evaluation</td>
<td>Over 75</td>
</tr>
<tr>
<td>High (3 points)</td>
<td>50-90 % closed</td>
<td>&gt;30-50</td>
<td>30-50 Natural underwater habitats largely destroyed / significantly changed</td>
<td>Case-specific evaluation</td>
<td>&gt;50-75</td>
</tr>
<tr>
<td>Moderate (2 points)</td>
<td>25-50 % closed</td>
<td>&gt;15-30</td>
<td>15-30 At maximum third of natural habitats destroyed/ significantly changed</td>
<td>Case-specific evaluation</td>
<td>&gt;25-50</td>
</tr>
<tr>
<td>Slight (1 point)</td>
<td>10-25 % closed</td>
<td>5-15</td>
<td>5-15 Minor negative changes in natural habitats</td>
<td>Case-specific evaluation</td>
<td>10-25</td>
</tr>
<tr>
<td>No change (0 points)</td>
<td>Less than 10 %</td>
<td>Less than 5</td>
<td>Less than 5 Natural habitats</td>
<td>Case-specific evaluation</td>
<td>Less than 10</td>
</tr>
</tbody>
</table>

1) Short-time regulation contains weekly and annual regulation. HQ-NQ can be calculated from a weeks period.
2) The effects on the water levels on down stream water courses shall be taken into account.
3) Excluding the short period possibilities to upstream migration. Can be evaluated in several discharge situations if necessary.
Defining hydromorphological status in lakes with HyMo-criteria

- Average winter draw down (m) or average winter draw down compared with the average depth (%) or change in water covered area (%)
- Raising or decreasing the mean water level (m)
- The proportion of constructed shore line of the lakes shore line (%)
- The effects of bridges and embankments
- Migration barriers
### Criteria for evaluation of hydromorphological changes in lakes (HyMo)

<table>
<thead>
<tr>
<th></th>
<th>1. Average winter draw down ¹ (m)</th>
<th>2. Average winter draw down compared with the average depth (%) or change in water covered area (%) ²</th>
<th>3. Raising or decreasing meanf water level (m) Average depth</th>
<th>4. The proportion of constructed shore line of the lakes shore line(%)</th>
<th>5. The effects of bridges and embankments</th>
<th>6. Migration barriers ³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high (4 points)</td>
<td>&gt; 3,0</td>
<td>&gt;50</td>
<td>&gt;1</td>
<td>&gt;1,5</td>
<td>&gt;50</td>
<td>Case-specific evaluation</td>
</tr>
<tr>
<td>High (3 points)</td>
<td>&gt;1,5-3</td>
<td>&gt;30-50</td>
<td>&gt;0,5-1</td>
<td>&gt;1-1,5</td>
<td>&gt;20-50</td>
<td>Case-specific evaluation</td>
</tr>
<tr>
<td>Moderate (2 points)</td>
<td>&gt;1,0-1,5</td>
<td>&gt;10-30</td>
<td>0,1– 0,5</td>
<td>0,5-1</td>
<td>10-20</td>
<td>Case-specific evaluation</td>
</tr>
<tr>
<td>Slight (1 point)</td>
<td>0,5- 1,0</td>
<td>1- 10</td>
<td>&lt; 0,1</td>
<td>&lt; 0,5</td>
<td>&lt;10</td>
<td>Case-specific evaluation</td>
</tr>
<tr>
<td>No change (0 points)</td>
<td>&lt; 0,5</td>
<td>&lt;1</td>
<td>0</td>
<td>0</td>
<td>&lt;5</td>
<td>Case-specific evaluation</td>
</tr>
</tbody>
</table>

¹The water depth at the time of the ice cover formation - the lowest water level during the period of ice cover. Calculate average e.g. from years 1995-2005.

² Both factors shall be estimated. Points shall however be given for only one of the factors.

³ Can be evaluated in several discharge situations if necessary. Also the impacts of the migration barrier on the fish stocks can be taken into account.
# Evaluation of hydromorphological status – total score

<table>
<thead>
<tr>
<th>Level of hydro-morphological change</th>
<th>Changes in the hydro-morphological status</th>
<th>HyMo-points</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No change</td>
<td>0 – 1</td>
</tr>
<tr>
<td>1</td>
<td>Slight change</td>
<td>2 – 3</td>
</tr>
<tr>
<td>2</td>
<td>Quite significant change</td>
<td>4 – 5</td>
</tr>
<tr>
<td>3</td>
<td>Significant change</td>
<td>6 – 9</td>
</tr>
<tr>
<td>4</td>
<td>Very significant change</td>
<td>10 -</td>
</tr>
</tbody>
</table>

HyMo-points

- **0-1 p.**
  - Excellent status
- **2-3 p.**
- **4-5 p.**
- **6-9 p.**
  - Moderate or worse status
- **10- p.**
  - Heavily modified
Principles of ecological classification system

Biology
- Lakes
  - phytoplankton, vegetation
  - bottom fauna and fish
- Rivers
  - bottom fauna, diatoms and fish

Priority substances
- quality criteria

Hydro-morphology
- quality criteria

Water quality
- nitrogen, phosphorus, chlorofyl (lakes), pH (rivers)

Overall status of water bodies
- estimation of impacts of different human pressures
- reliability, representativeness and credibility of results on water body level

Ecological status

Expert judgment
Comparison of HyMo- criteria - FIN / SWE

- In general, Swedish criteria (preliminary designation of heavily modified water bodies) resembles Finnish direct designation criteria.
- In Finland values of criteria are based on current situation, in Sweden permit conditions.
- Hydrological criteria are not as important in Sweden.
- In Finland, threshold values of criteria is often 50 %, in Sweden 70 %.
- Hydrological criteria for lakes are quite similar.
  - SWE: regulation amplitude 3 meters
  - FIN: water-level draw down in winter more than 3 meters
  - SWE: Constructed head loss 80 %
  - FIN: Constructed head loss more than 50 %
Heavily Modified Water Bodies in Finland

- Until now, we have 6165 water bodies of which ecological status was possible to classify in 2600 water bodies
  - Rivers 1604, Lakes 4286 and Coastal waters 275

- There are altogether 126 heavily modified water bodies
  - Lakes 32
  - Rivers 79
  - Coastal waters 13

- There are altogether 29 artificial water bodies
  - Lakes 25
  - Rivers 4

- The number of heavily modified and artificial water bodies is 5 % of the total number of classified water bodies and 2 % of total number of all water bodies
Location of artificial and heavily modified water bodies

- Artificial Lakes Porttipahta and Lokka
- Lake Kemijärvi
- River Oulujoki
- Lake Kiantajärvi and Vuokkijärvi
- Lake Ontojärvi
How we achieve to identify those water bodies which really are HMWB’s

- Water body doesn’t achieve good ecological status and the reason for that is physical alteration/changes by human activity
  - We designated those water bodies as HMWB’s where HyMo-changes are high, but we don’t know ecological response exactly

- Water body can be designated, if it is not possible to meet good ecological status without significant adverse effects on environment or specific use like,
  - Assessments have been done partly. In those places where large hydropower dam exist, answer is often easy. Those places where many small physical pressures exist, assessments are missing.

- The beneficial objectives of the water body cannot for the reason of technical feasibility or disproportionate costs, reasonable achieved in other way, which are a significantly better environment option
  - Hydropower – Windpower (technical feasibility)?
  - Flood protection – more flood damages (disproportionate costs)?