Implementation of the EU WFD in Finland

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Fortum Power and Heat Oy
Implementation of the EU WFD in Finland

• Designation of Heavily Modified Water Bodies
• Identification of HMWBs
• Ecological Classification
• Classification of HMWBs
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 designated as heavily modified either according to the direct criteria or with the more specific evaluation with the HyMo-criteria
Direct criteria for designation as heavily modified water bodies

- 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
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
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The River Oulujoki

- Length 110 km
- Mean flow 250 m$^3$/s
- Catchment area 22 800 km$^2$
- 8 hydropower plants
- Annual production 2 TWh
  - Flexible power 50-450 MW
  - Storage co-efficient 60%
    (annual flow/available storage in upstream reservoirs)
    - Flexible power available even during spring flood period
Identification of water bodies

- **Bodies of Water**
  - River before construction of hydropower plants
    - Type: very large humic river
      - Lowland river < 200m
  - 2 bodies of water
    - First step identification according to original situation (no HPPs)
    - Different kind of land use and slope of local catchment area
    - Different kind of valley shape
    - Different mean water slope
    - Different kind of form and shape of main river bed
    - Different kind of substratum composition

- **HMWBs**
  - Second step designation of HMWBs and possible revision of Waterbody identification
    - 100 % of original head has been built
      - Impact area of HPPs is the whole main stem
      - Main stem Heavily Modified
    - Most of differences of original river WBs still relevant
      - No need to revise identification
  - 2 HMWBs
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Biological quality elements

Rivers

• Fish
  *Finnish Fish Index*

• Benthic Invertebrates
  Three metrics: PMA (Percent Model Affinity), Type Specific Taxa and Type Specific EPT-Taxa

• Diatoms
  *Two metrics: PMA (Percent Model Affinity) and Type Specific Taxa*

Lakes

• Fish
  *EQR4 - index*

• Benthic Invertebrates
  *Benthic Quality Index*

• Macrophytes
  *Three metrics: PMA, Type Specific Taxa, Reference Index*

• Diatoms
  *Two metrics: PMA (Percent Model Affinity) and Type Specific Taxa*

• Phytoplankton
  *Three metrics: Biomass, Chlorophyll a, % of blue-green alga*
FiFI – Finnish Fish Index

-WFD - Composition, abundance and age structure of fish fauna must be monitored when assessing the ecological status

-Finnish Fish Index compiles five fish metrics, selected from large group of candidate metrics, which gave best response to human impact on the environment (rivers)

These five metrics are:

A. Proportion of intolerant species
B. Proportion of tolerant species
C. Density of 0+ salmonid juveniles
D. Density of “Cyprinid”-group
E. Number of fish species

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The approach - content

- The aim is to identify for which of the following three categories the WB belongs:
  - Water body is already in GEP
  - Unclear situation: water body may or may not be in good ecological potential
  - Water body is not yet in GEP

- The process includes the identification of potential hydro-morphological mitigation measures and the assessment how much they improve the current status

- The biological conditions are not described in EQRs. The focus is to assess the order of magnitude of the mitigation measures’ impacts

- It is possible to carry out the process using experts’ judgments about the order of magnitude for HyMo measures’ impacts
**HYDROMORPHOLOGICAL "TEST"**

**TASK 1:** Identify all hydro-morphological mitigation measures which improve the ecological status and do not have significant adverse effect on uses.

**TASK 2:** Assess the impacts of chosen mitigation measures on relevant biological quality elements, different uses of water course and costs.

**TASK 3:** Develop a reasonable combination(s) of mitigation measures which do not have significant adverse impacts on uses and which improve ecological status as much as possible.

**TASK 4:** Define the cumulative ecological overall impacts of the chosen measures, and assess which is the most appropriate group:

1. No or slight positive ecological impact
2. Moderate positive ecological impact
3. Significant positive ecological impact

- **Group 1**
  - GEP is already achieved
  - No mitigation measures are required

- **Group 2**
  - Uncertain situation
  - GEP may be not achieved
  - Undertake the further assessment or wait for the results of monitoring

- **Group 3**
  - GEP is probably not achieved
  - Undertake cost-efficient mitigation measures
<table>
<thead>
<tr>
<th>Ecological Status</th>
<th>Ecological Potential</th>
</tr>
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<tbody>
<tr>
<td>Natural Waters</td>
<td>Heavily Modified or Artificial Waters</td>
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<td></td>
<td>Maximum or Good</td>
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The composition and abundance of fish species differ moderately from the type-specific communities attributable to anthropogenic impacts on physico-chemical or hydro-morphological quality elements.

The age structure of the fish communities shows major signs of anthropogenic disturbance, to the extent that a moderate proportion of the type specific species are absent or of very low abundance.
- Abundance of local fish is about good
- 2-3 long distance migratory species missing or of low abundance
- Only limited areas for breeding upstream, only in small tributaries
- Simplified population model calculation > no improvement expected from fish ways
- **Upstream HMWB is already in GEP**
Significant rivers for migratory fish

• The Finnish Guidance Document for HMWBs
  – The rivers, in which it is possible to restore sustainable self productive population of migratory fish species, can be nominated as significant migratory fish river
  – In significant migratory fish river the body of water cannot be classified to good status or potential, if fish migration is not arranged

• It is essential to use population models to transparently evaluate possibility to restore self-sustainable migratory fish population

• There is still lack of knowledge needed for population models
  – Mortality and losses during migration
  – Possibilities to improve downstream migration
    • Efficiency of structures
    • Technical feasibility and costs, especially in big rivers
Salmon, population model: Case Kemijoki-Ounasjoki

http://www.ymparisto.fi/fi-FI/Vesistokunnostusverkosto/Vaelluskalaforumi/Pohjolan_vaelluskala_ja_kalatiesymposio

Supporting measures implemented

“Business as usual”

<table>
<thead>
<tr>
<th>Estimate for smolt production</th>
<th>300 000</th>
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<tbody>
<tr>
<td>Natural river stretch</td>
<td>- 5 %</td>
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<td>Turbines + river between HPPs</td>
<td>- 50 %</td>
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<tr>
<td>Sea migration, smolts</td>
<td>- 92 %</td>
</tr>
<tr>
<td>Mortality of adults</td>
<td>- 15 %</td>
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<tr>
<td>Fishing, open sea</td>
<td>- 40 %</td>
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<tr>
<td>Predation of seals</td>
<td>- 13 %</td>
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<tr>
<td>Fishing, at coastal</td>
<td>- 25 %</td>
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<tr>
<td>Fishing as estuary</td>
<td>- 36 %</td>
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<tr>
<td>Losses in fishways</td>
<td>- 31 %</td>
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<tr>
<td>Fishing in the river</td>
<td>- 10 %</td>
</tr>
</tbody>
</table>

Salmon smolts to new cycle 84 000

Supporting fish release (parr) to river 450 000

Salmons remaining

14 500
9 900
6 000
3 900
2 500
1 700
1 600
9 100
8 200
5 600
5 100

Fortum
Class Status of the Heavily Modified and Artificial Rivers

River Basin District

Ecological status classification is missing
Thank you!