

Hydrobiological methods for surface water monitoring

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S Y K E

Hydrobiological monitoring

- Since 1963
- Several separate monitoring programs were co-ordinated 2003-2005
- Demands generated by European Union directives and agreements for transboundary waters
- Monitoring methods are compatible with applicable international standards

EU and national legislation goal: all rivers, lakes and coastal areas have to be in at least good ecological and chemical status

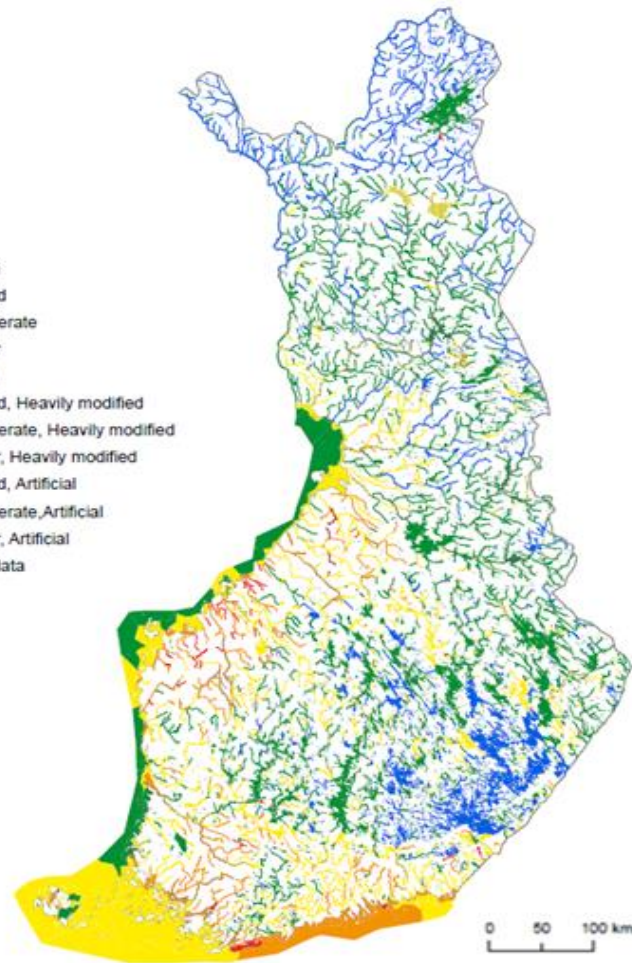
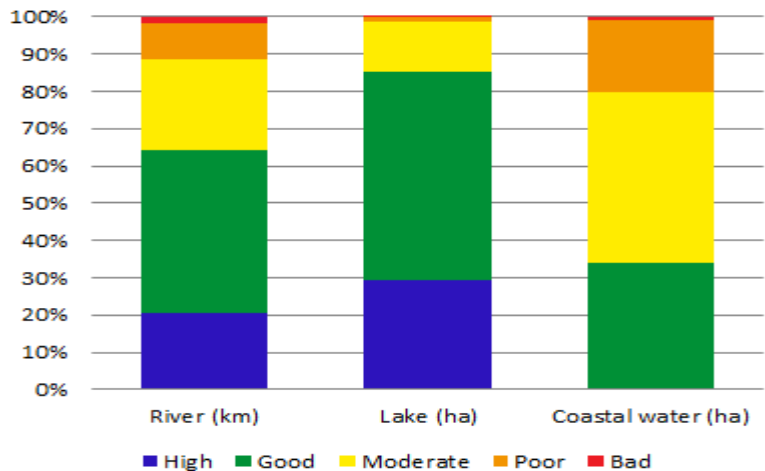
by 2015 -> 2021 -> 2027 -> ... ?



Ecological status of surface waters




by proportion of total length (rivers) or surface area (lakes, coastal waters)

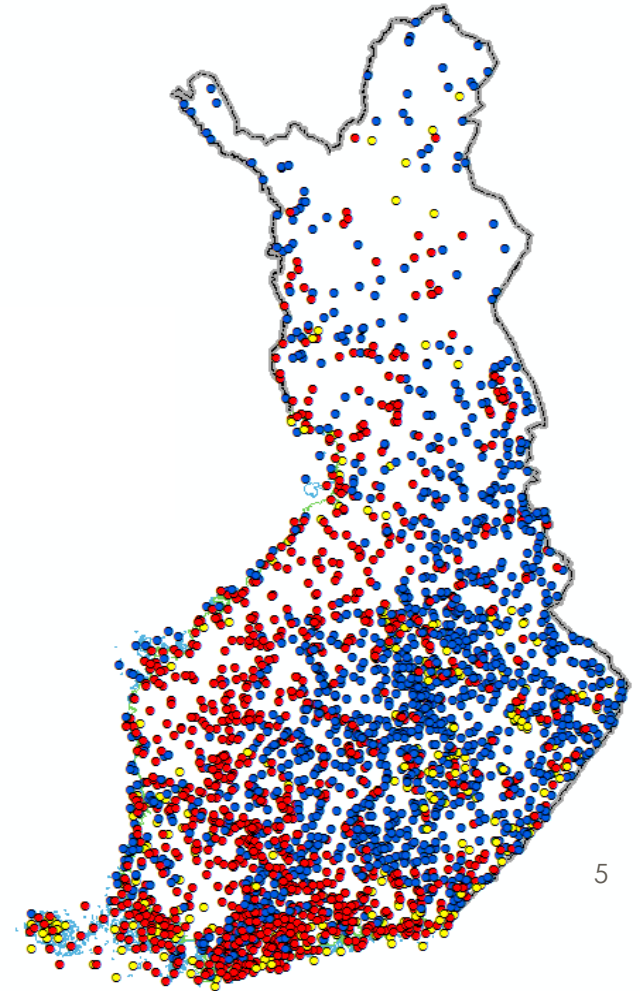
Ecological status	Rivers	Lakes	Coastal waters
High or Good	64%	85%	27%
Moderate, Poor or Bad	36%	15%	73%



Number of water bodies and monitoring stations

Surface water category	WFD reporting 2016	
	sites	water bodies
Lakes	1637	4714
Rivers	962	2028
Coastal	259	276
Total	2858	7018

	Surveillance monitoring
	Operational monitoring
	Both



Purpose of status assessment: *How large deviation in quality due to human activities?*

Detect impacts of measures



The assessment system of FI required by EU WFD

Status of a surface water body
(lake, river or coastal)

Ecological status

Chemical status

EQRs

Biological quality
elements

- Phytoplankton
- Macrophytes and fytoENTOS
- Benthic invertebrates
- Fish

-Harmful substances
(EU priority
substances)

Hydro-Morphological
quality elements
supporting the biological
elements

Chemical and physico-
chemical quality
elements
supporting the biological
elements

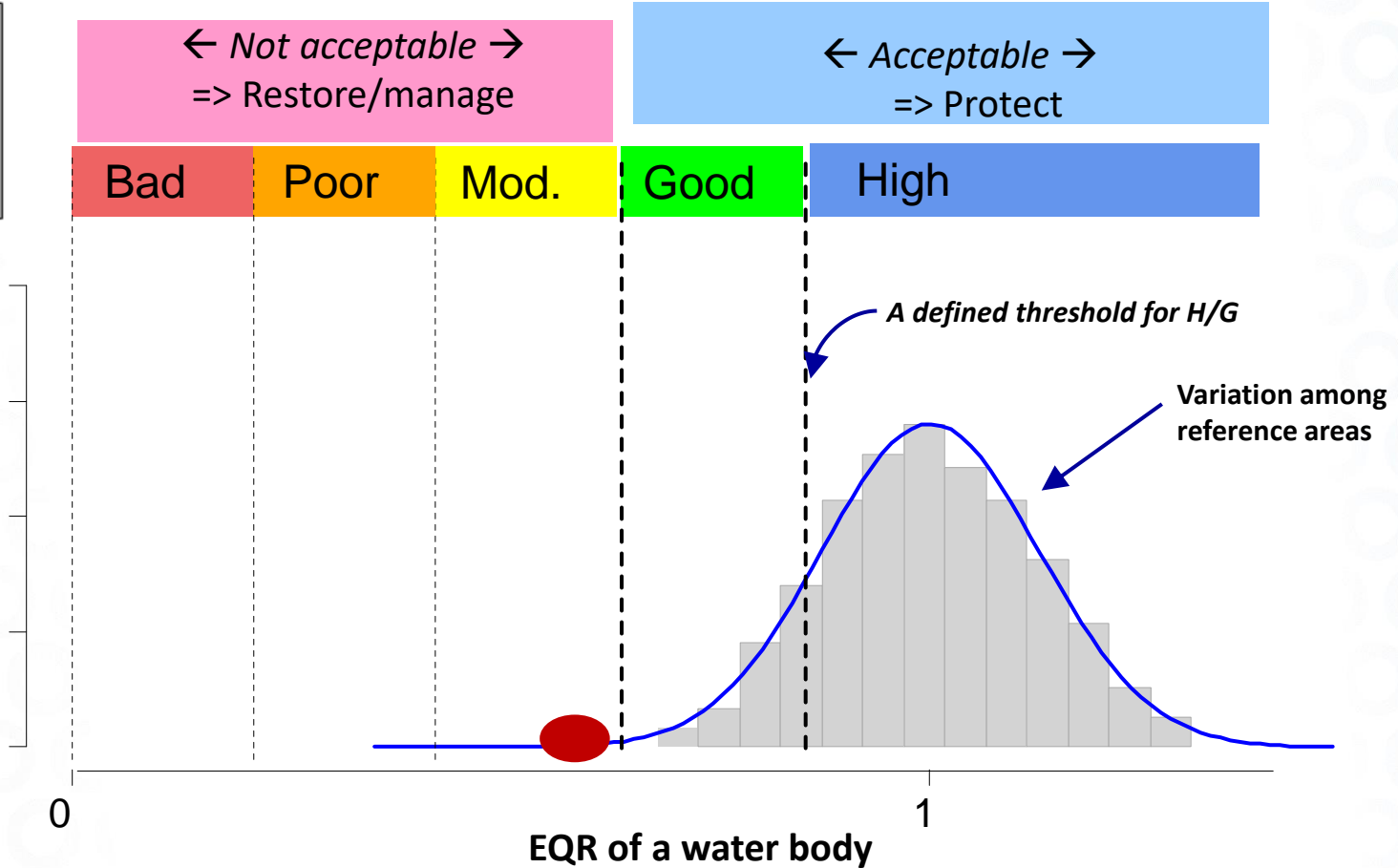
The reference conditions set the baseline for the classification

- Reference conditions are the conditions without (or very minor) human influence or disturbance = baseline => EQR
 - most important part of the system
- Can be concentrations, species list, function, ..
- How to set?
 - 1) Typology
 - 2) Modelling
 - 3) Expert judgement
- Contemporary data or historical data.

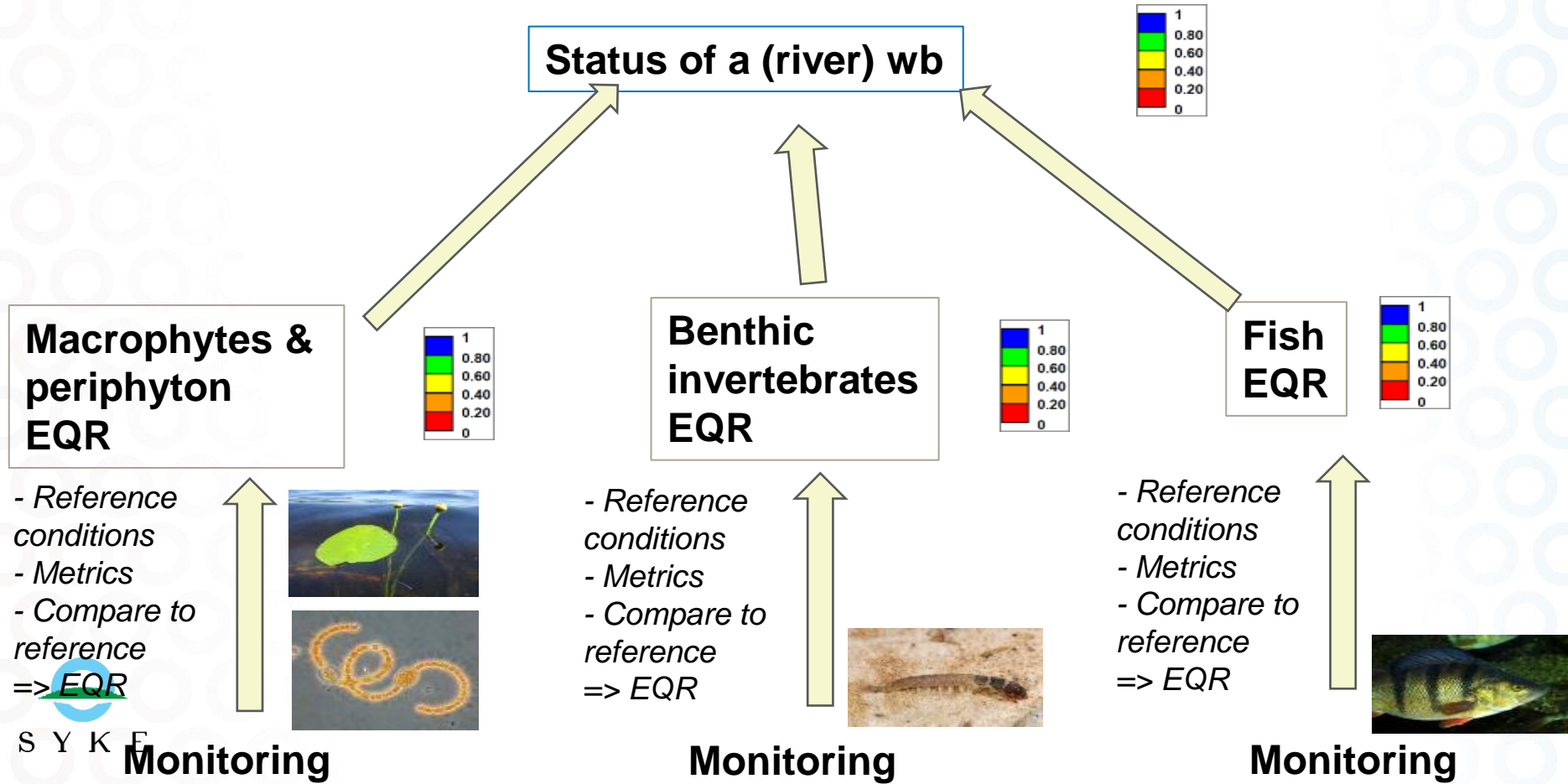


The principle of status assessment and classification:

$$\text{EQR} = \frac{\text{Observed biological value}}{\text{Reference biological value}}$$

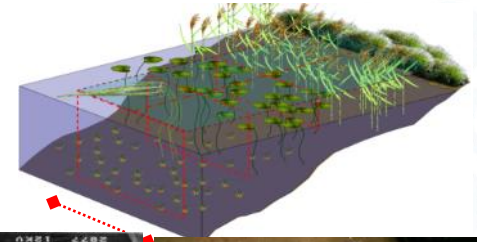


The assessment technique for ecological quality



Monitoring for ecological classification

- Phytoplankton
- Macrophytes and phytobenthos
- Benthic invertebrates
- Fishes

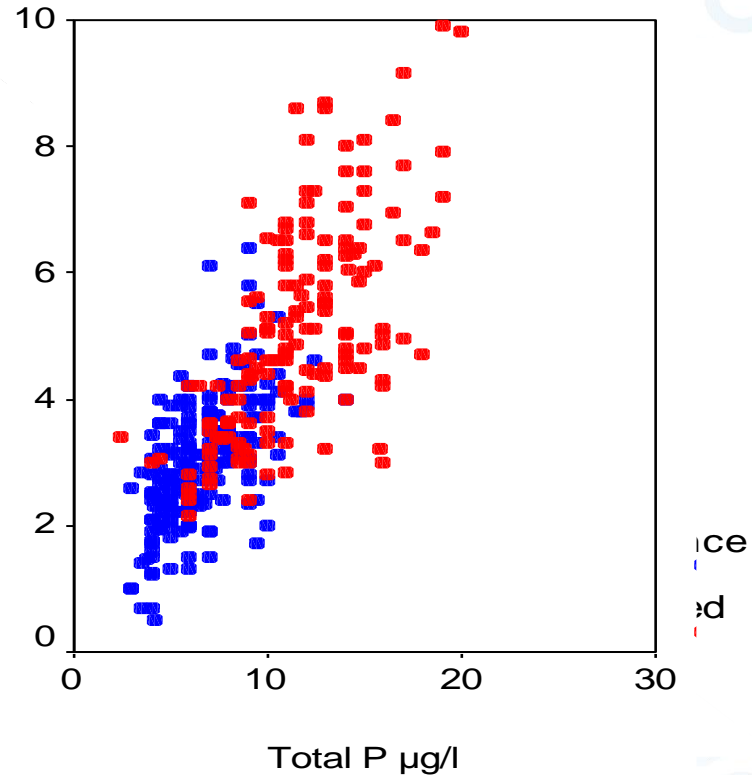
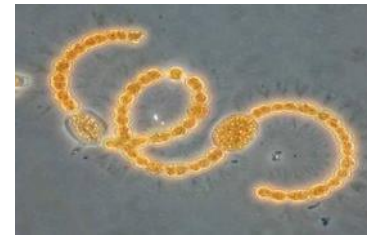
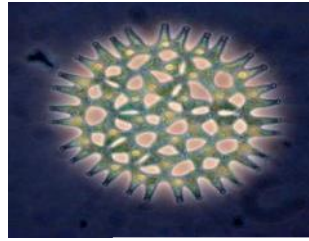


- Frequency and abundance
- Biomass, blooming (phytoplankton)
- Sensitive and non-sensitive relationship –missing of important species group (benthic invertebrates)
- Age groups etc. (fishes)



Phytoplankton

- Suitable in lakes and coastal sites
 - Not valid in rivers
- Easy to sample => time demanding to identify
- Rapid reaction to eutrophication
- Chlorophyll a value is a proxy of phytoplankton production

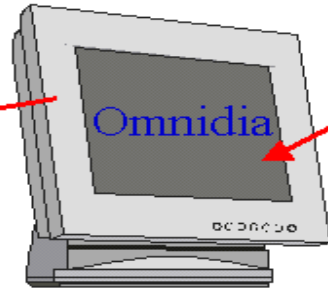
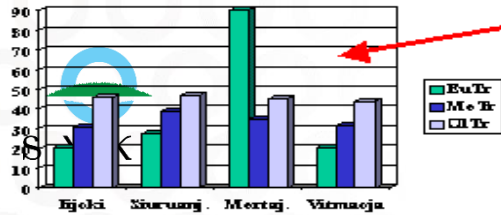
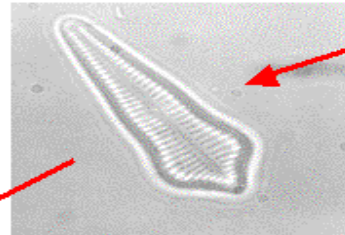
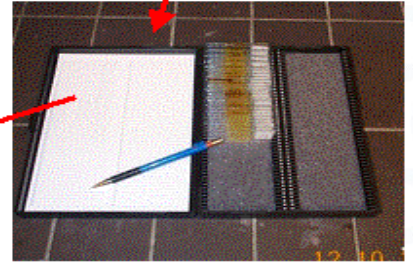
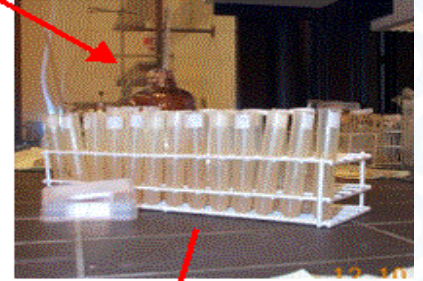
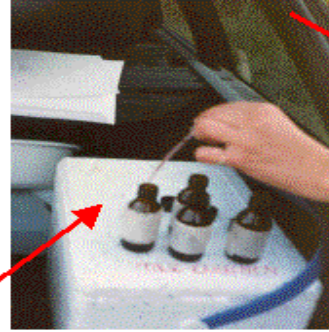
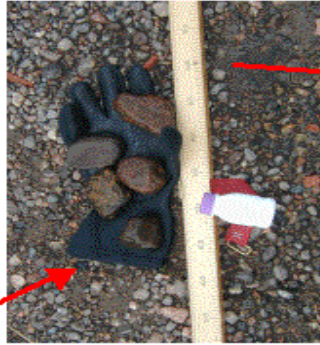


Phytobenthos (periphyton, diatoms)

- Aquatic benthic algae, grow attached to surfaces such as rocks or larger plants, primary producers
- Ubiquitous in lotic systems (esp. small rivers)
 - Lake littoral habitats
 - High number of species
- Assemblages integrate physical and chemical disturbances to a stream reach
- A rapid response time to both exposure and recovery
 - Popular organisms in bioindication in rivers
- Sampling easy and relatively cheap
- Identification requires expertise



Diatoms



Benthic fauna

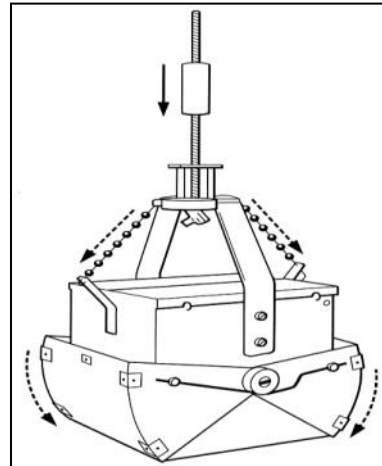
= benthic fauna, benthos, zoobenthos

- Macroz. / Macroinv.: 0.5 mm sieve
- Invertebrates, common in standing and flowing waters
- Heterogenic group (worms, shells, insects etc.)
- Feeding algae, fungis, organic matter, predators etc.)
- At least part time aquatic environment
 - Attached to stones and plants.
 - In the sediment
 - Freely floating near bottom
- Good indicator values
 - Eutrophication
 - Acidification
 - Hydromorphology



Sampling and identification

- Semiquantitative methods
 - Kick-net sampling is common in lakes and rivers
- Quantitative methods
 - Ekman grab in lakes
- Qualitative methods
 - Collecting examples of species
- Identification needs expertise



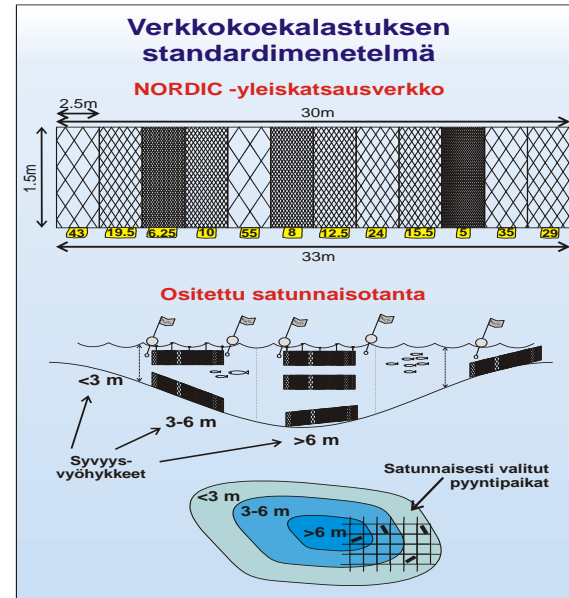
Fishes

- Common in lakes and rivers
- Easy to identify
- Easily understandable by public
 - Good indicator
- Huge monetary value of fishery and recreational fishery
- Uses different trophic levels
 - Plankton, benthic invertebrates, plants, fishes



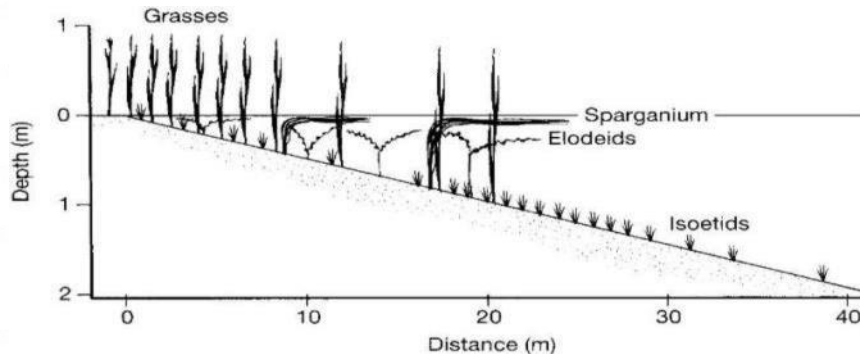
Constrains in use

- Fish population almost always manipulated by fishery and stocking
 - Difficult to distinguish effect of eutrophication and human use
- Sampling is relatively expensive and time demanding



Aquatic macrophytes

- Growing in water or at littoral near by
- Lakes: emergent, submergent, or floating
- River: aquatic mosses are important
- Important refuge for fish, macroinvertebrates and birds, food for some fish and wildlife
-> ecosystem function role



- Stable – best indicator of littoral zone
- Respond to e.g. (-) turbidity, herbicides, metals, salinisation, water level change and (+) eutrophication
- Sampling: littoral transects (identification in the field) and aerial photography
- Max. colonization depth an important lake characteristic



Thank You

