

Project 14: Long-term development in the ecological status of Lake Päijänne: pressures and responses

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Arja Palomäki

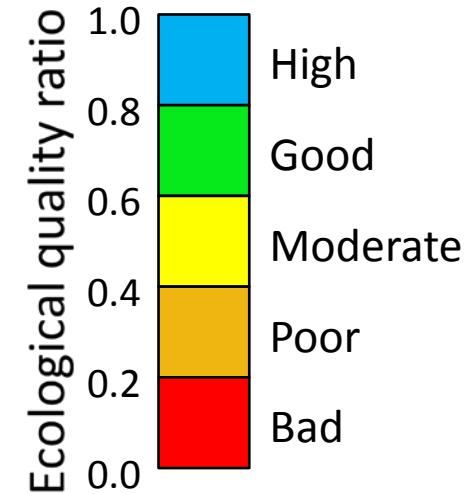
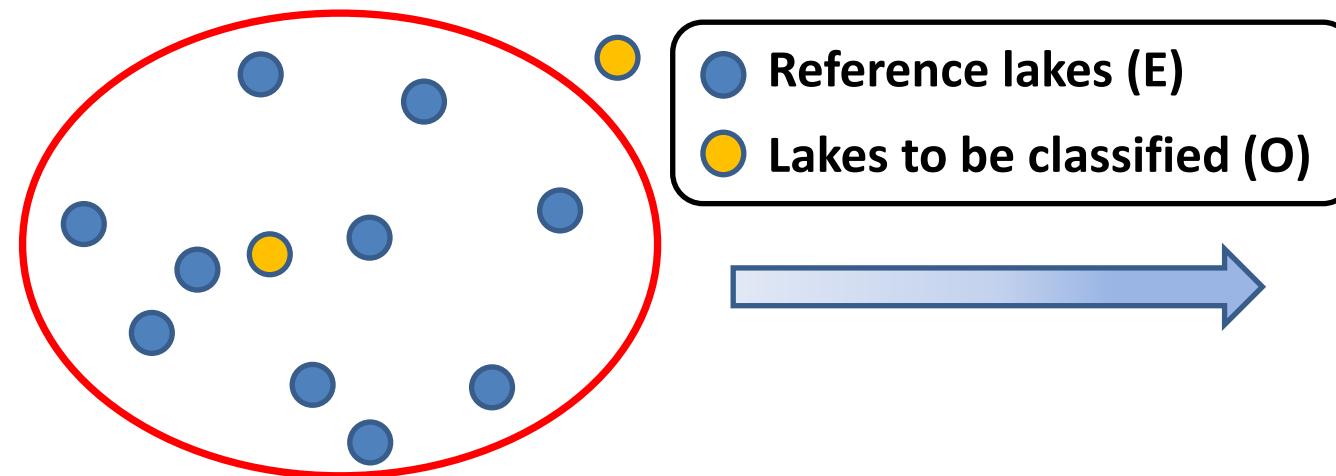
Institute for Environmental Research, University of Jyväskylä

12th EEF congress Ávila, Spain,
25-29 September 2011

Photo: Olli Urpanen

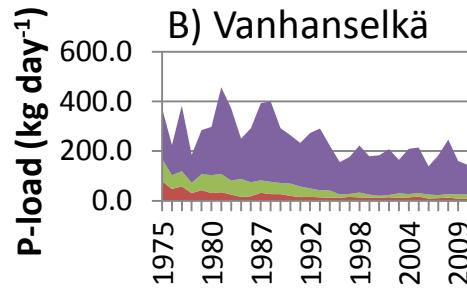
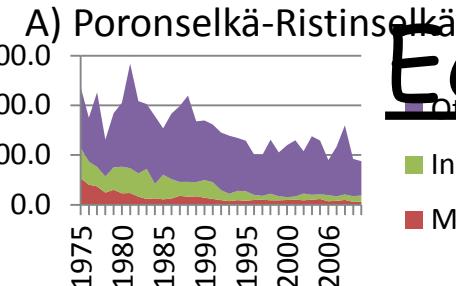
Principles of the ecological status classification defined by WFD

- Water Framework Directive (WFD) of the European union aims to achieve the good status of all surface waters (EC 2000)
- Ecological quality ratios are defined as the ratios between observed (O) and expected reference values (E) of the metrics ($EQR = O/E$)
- Expected reference values are usually based on the data from a group of reference lakes near their natural state

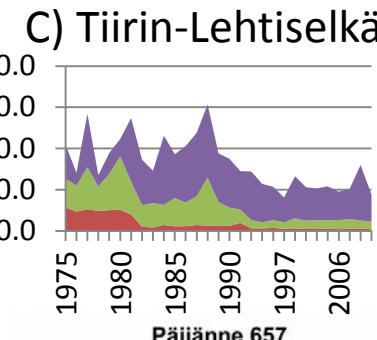


EnvEurope meeting in Kaunas,
21-24 May 2012

P-load (kg day^{-1})



P-load (kg day^{-1})



Ecological status during recovery



ÄÄNEKOSKI

- Board mill 1899 -
- Paper mill 1906 -
- Sulphite pulp mill 1938- 1954
- Sulphate pulp mill 1961- 1985
- New sulphate pulp mill 1985-

JÄMSÄNKOSKI

- Paper mill 1899 -
- Sulphite pulp mill 1885- 1981
- TM pulp mill 1981 -

KAIPOLA

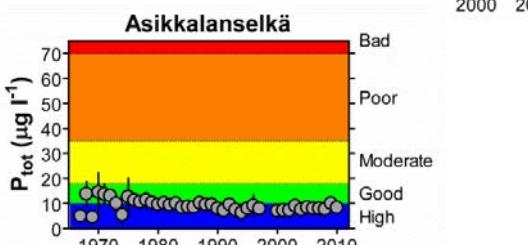
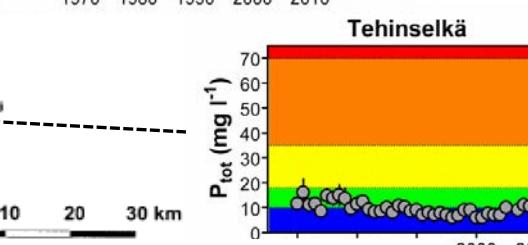
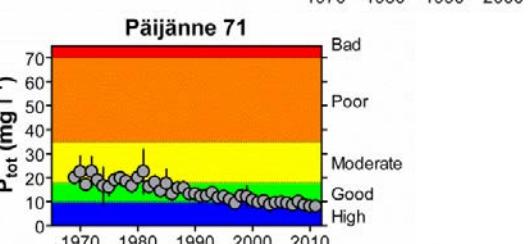
- Paper mill 1954 -
- TM pulp mill 1981 -

JYVÄSKYLÄ

- Paper mill 1872 -

LIEVESTUORE

- Sulphite pulp mill 1927- 1967
- 1971- 1985



NORWAY
RUSSIA
SWEDEN
ESTONIA
260 km
20°N
30°E

Vän-Älvön bay
Asikkalanselkä basin
Lake Vesijärvi
25°30'E

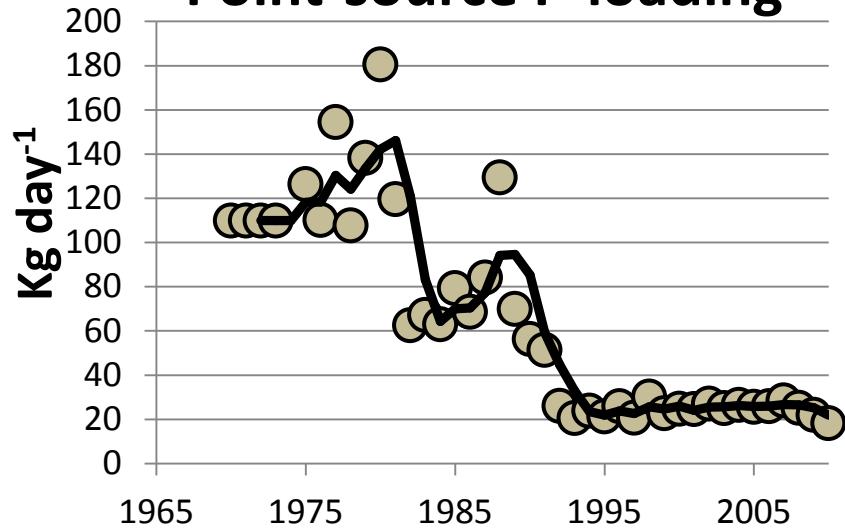
10

20

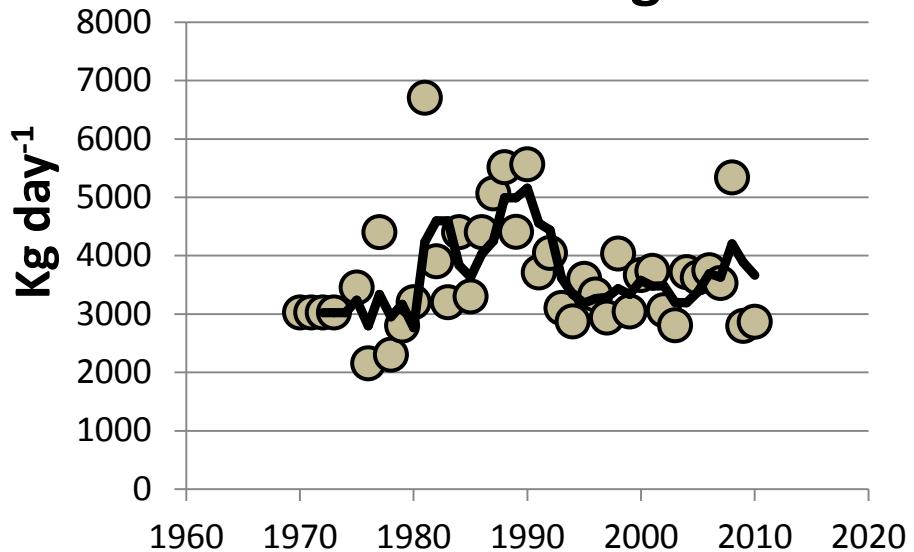
30 km

Päijänne site 675

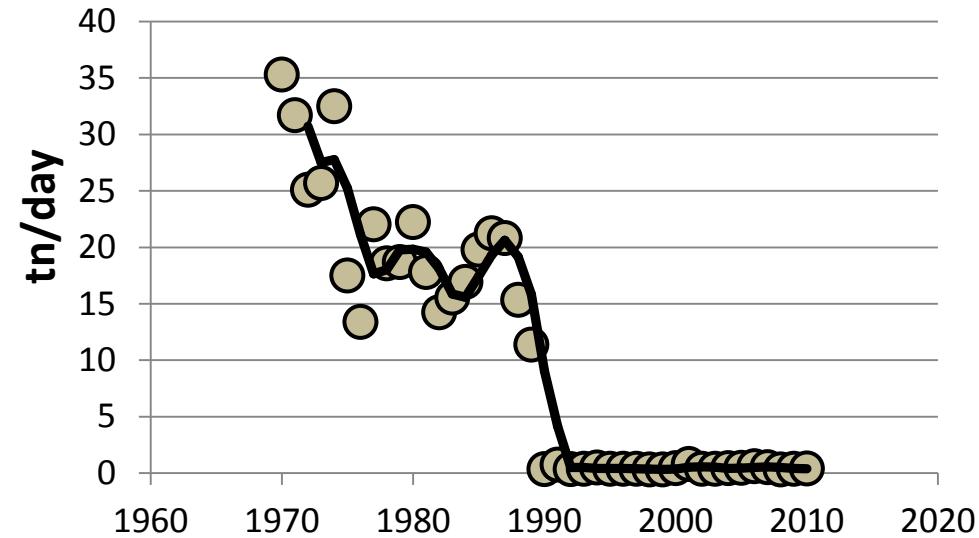
Point-source P-loading

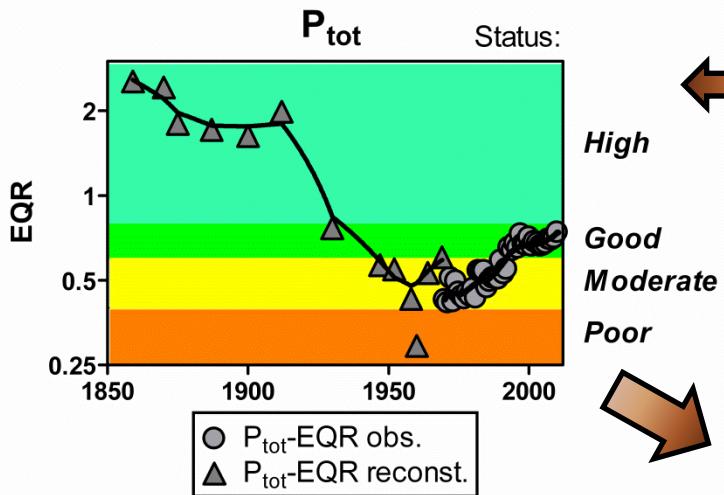


N-loading



BOD-loading

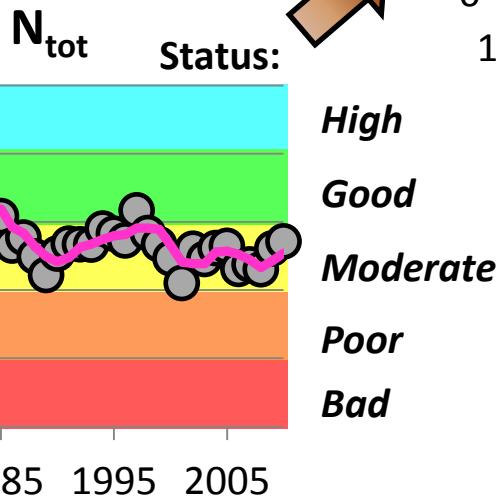
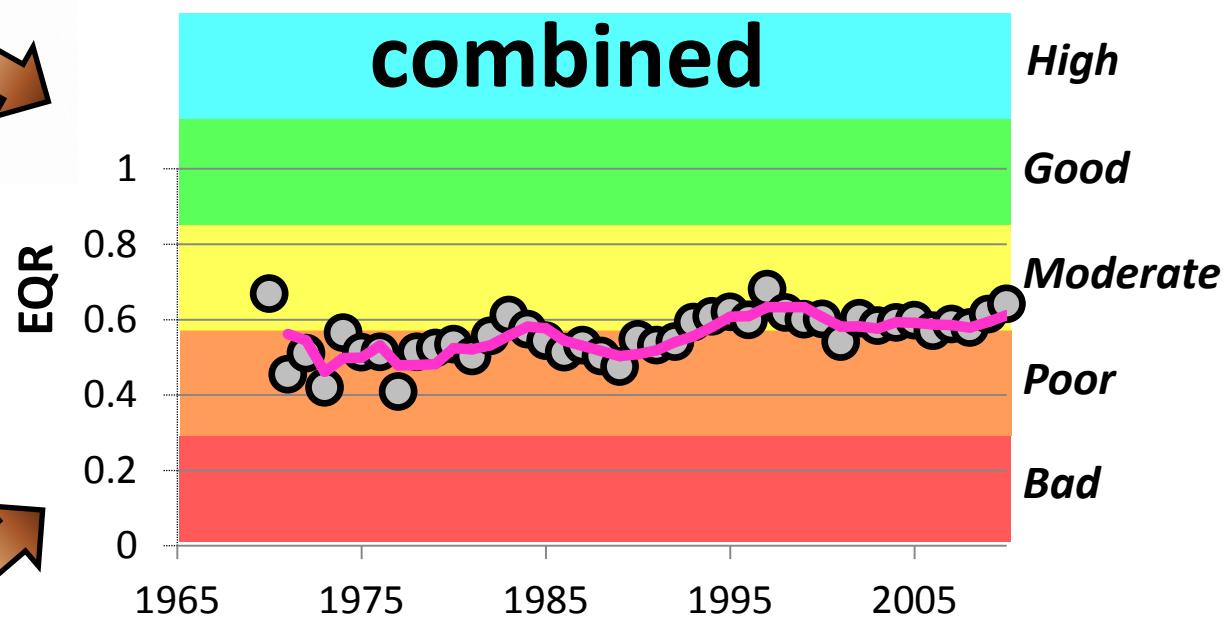




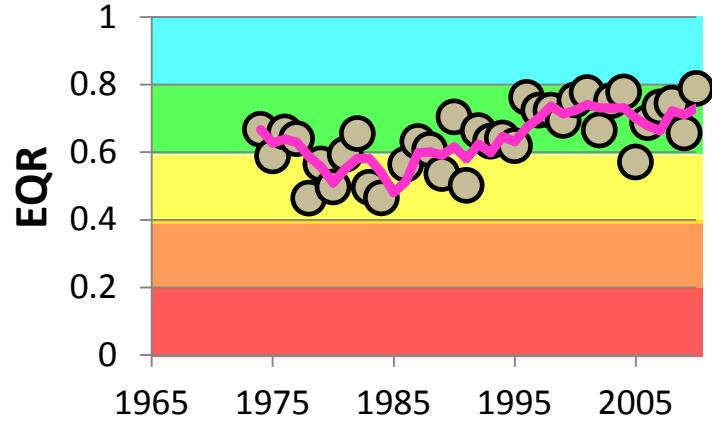
Phosphorus reconstruction based on macroinvertebrate BQI (Verbruggen et al. 2011)

Water quality Status:

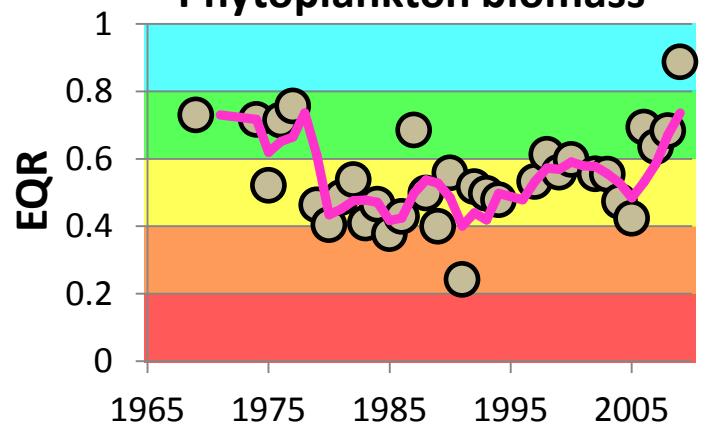
combined



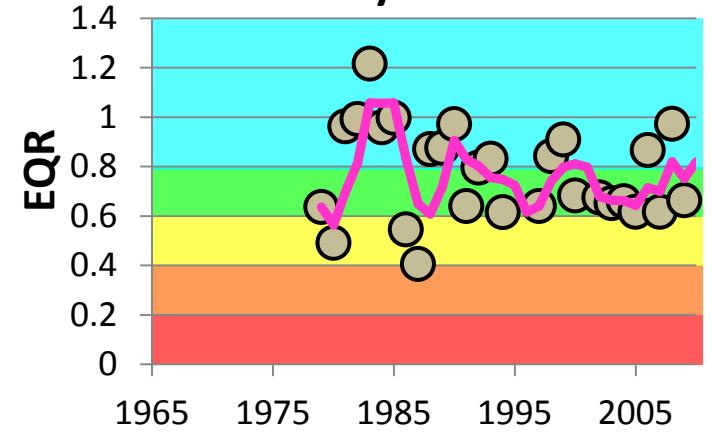
Chl- α



Phytoplankton biomass

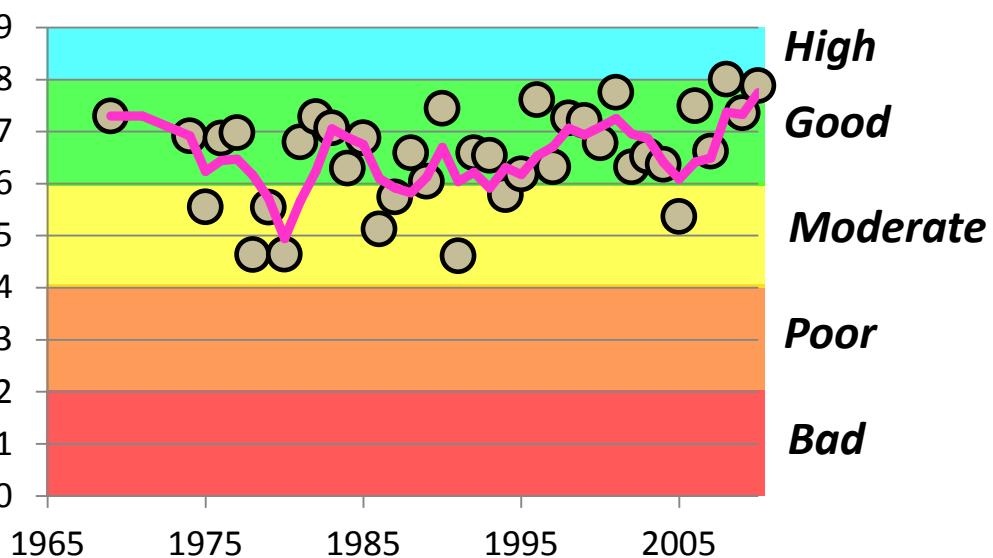


Harmful cyanobacteria%

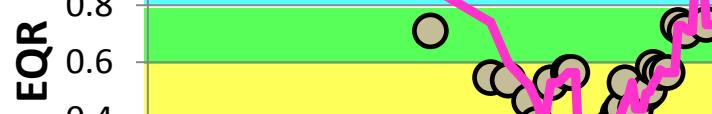


Phytoplankton combined

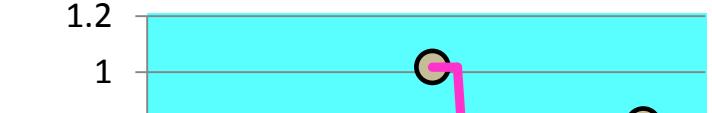
EQR



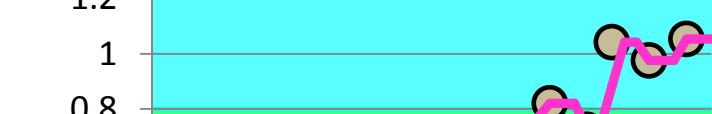
Benthic quality index (BQI)



PICM-index

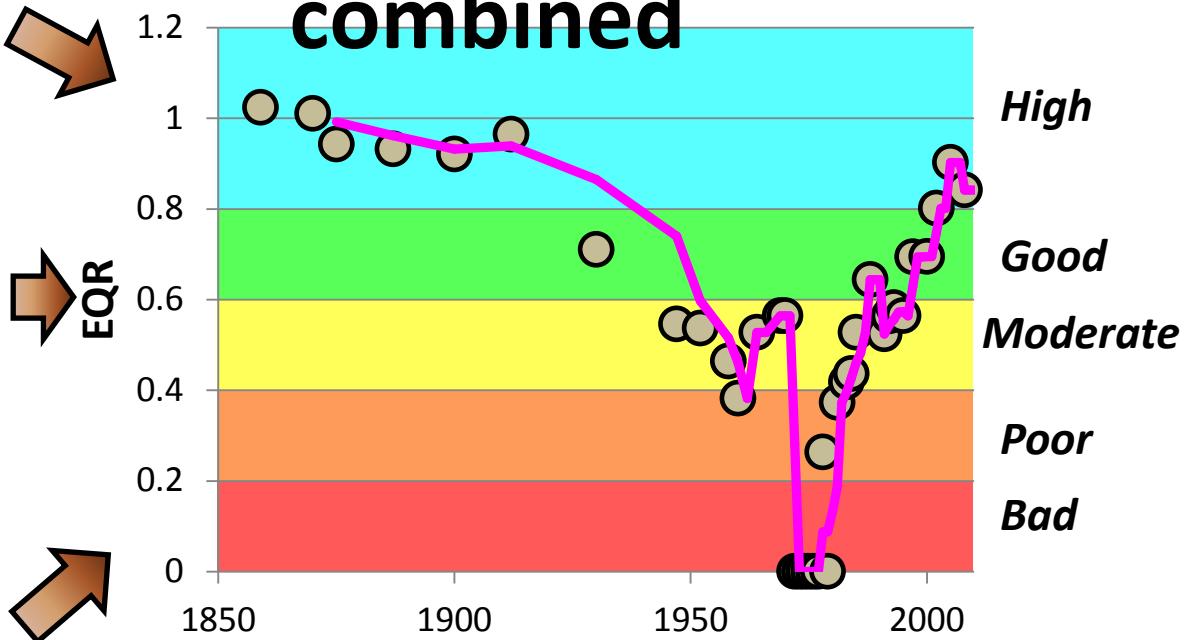


Percent model affinity



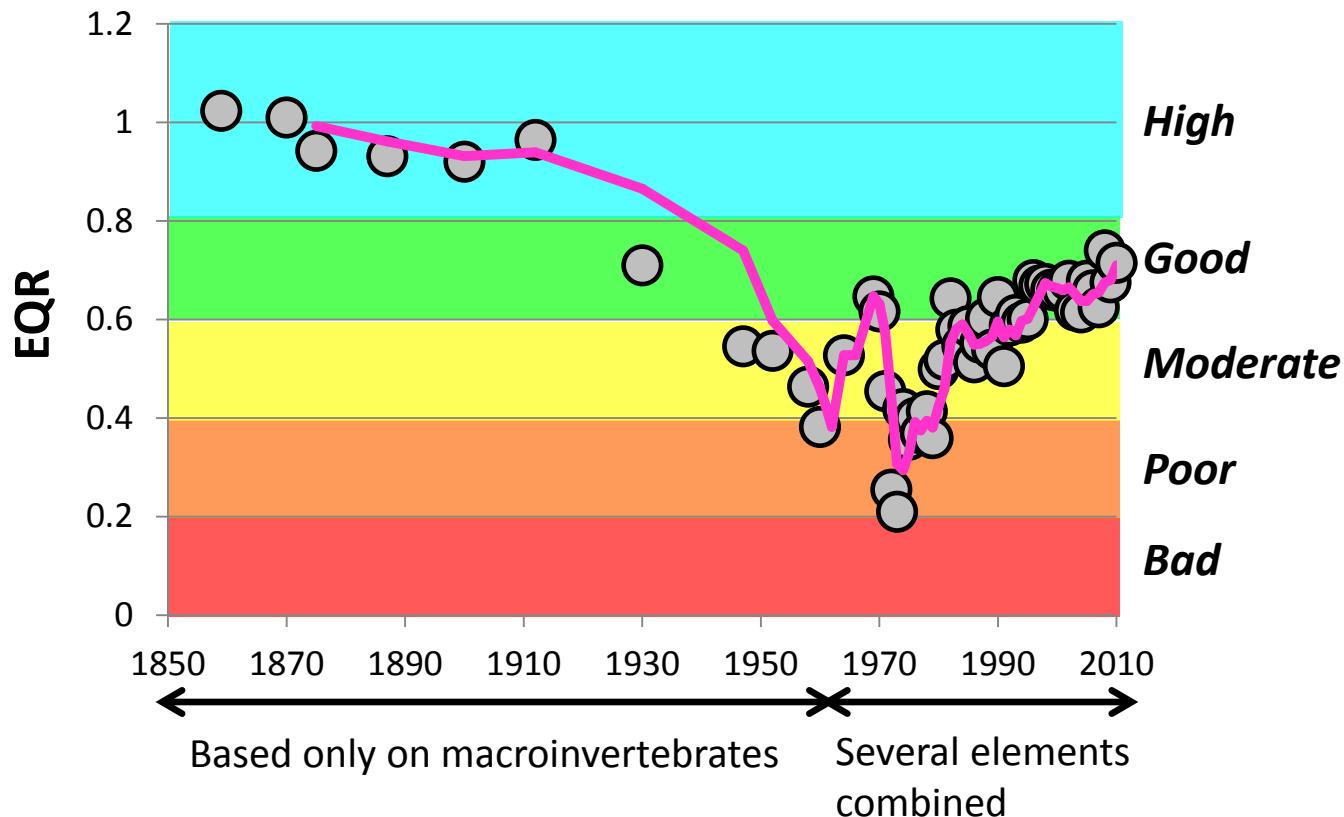
Paleolimnological (subfossil remains, Meriläinen et al. 2001) and contemporary (living invertebrate) samples combined

Macroinvertebrates combined



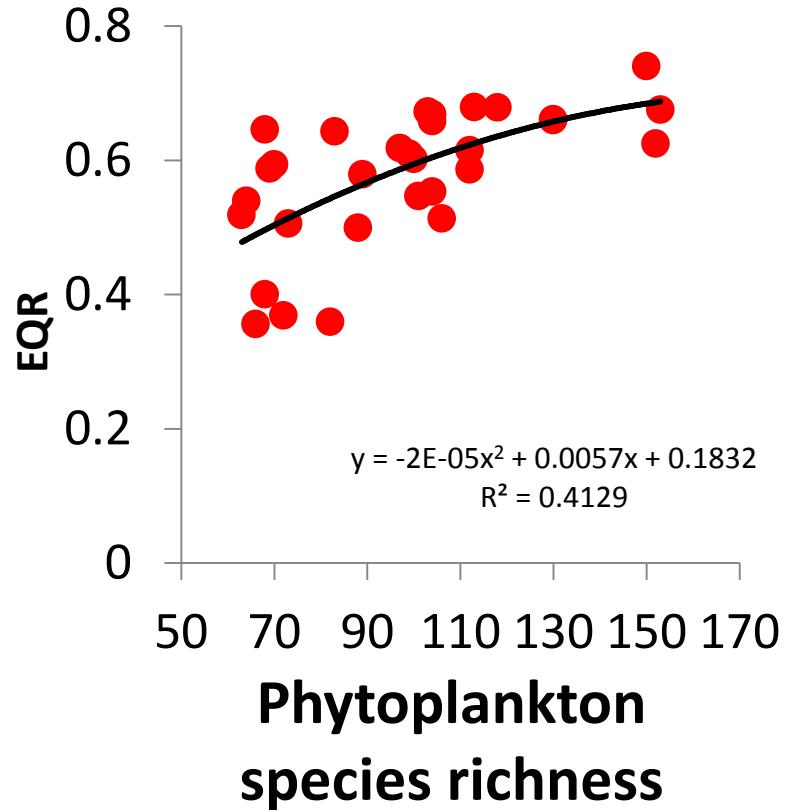
Quality elements combined

(water chemistry, phytoplankton & macroinvertebrates)

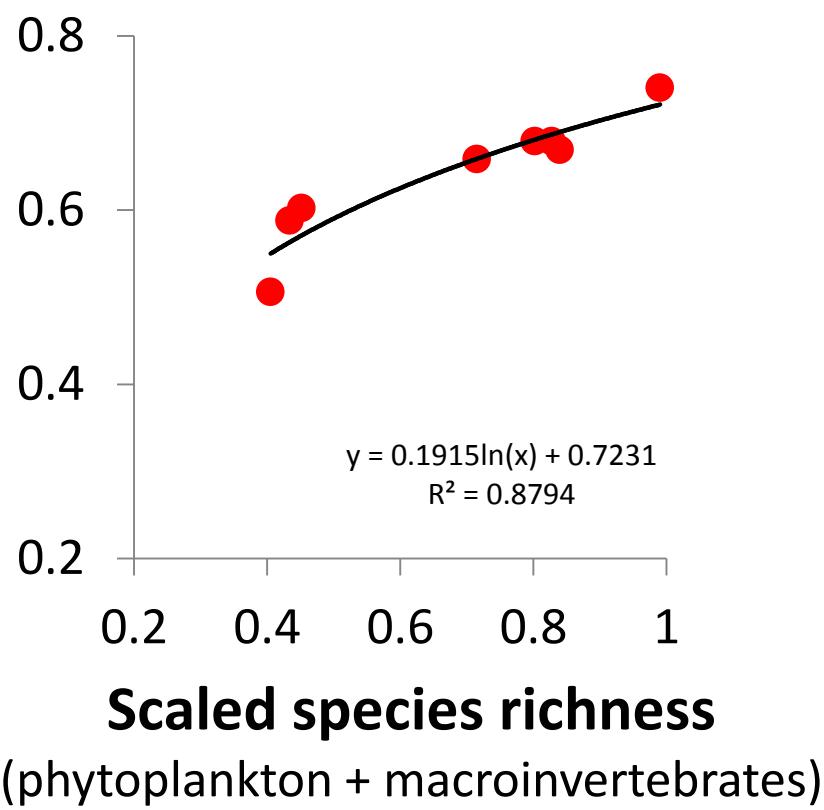


Biodiversity vs. Ecological status

Ecological status EQR
(Quality elements combined)

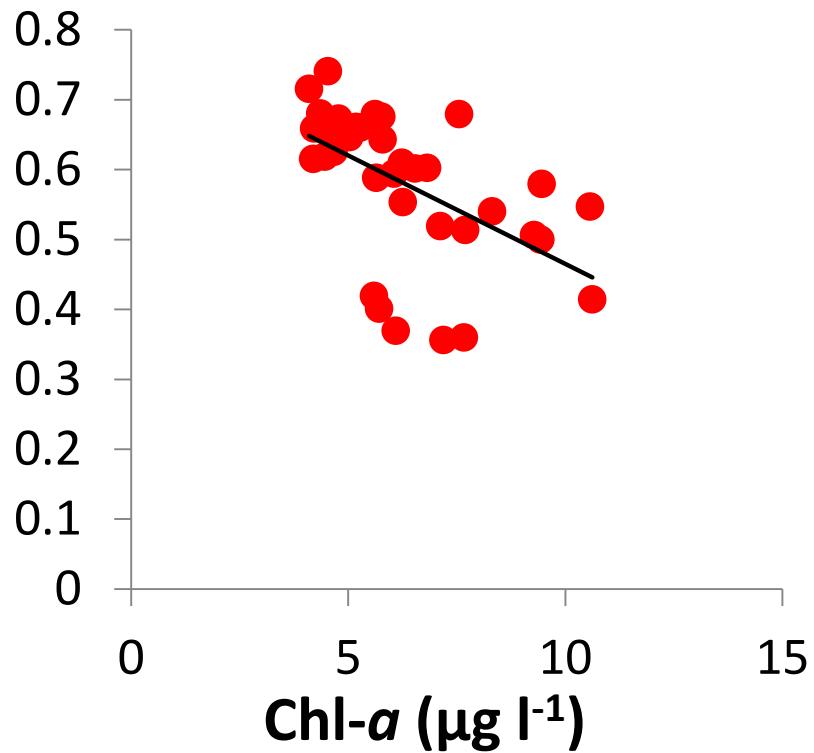


Ecological status EQR
(Quality elements combined)

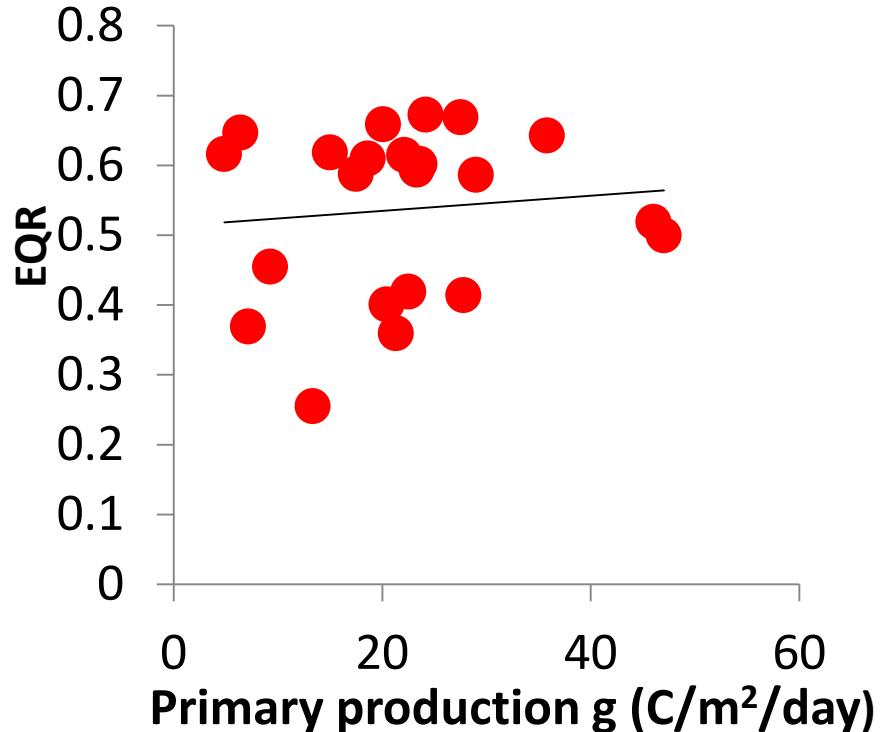


Primary production vs. Ecological status

Ecological status
(Quality elements combined)



Ecological status
(Quality elements combined)



Project 14: Long-term development in the ecological status of European large lakes

Additional data from the other EnvEurope lakes ?:

- with pollution - recovery development and with similar time-series data from nutrients, phytoplankton and macroinvertebrates
- existing classification of the lake ecological status based on this data (and instructions for status classification and setting of the boundaries between status classes)
- data on primary production and biodiversity (e.g. species richness)