Quality and representativity of different State-of-Environment (SoE) dataflows: Nutrients and Biology

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Outline

- **Nutrients: representativity, aggregation, time series**

- **Biology: representativity, aggregation**

- **Linking different data-flows together** (D**PSI**R):
  - SoE nutrients & pressures (UWWT, agri-fertiliser use)
  - SoE nutrients & SoE biology
  - SoE nutrients & biology & WFD ecological status

- **Main questions to countries**

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Nutrients data for rivers and lakes (CSI 020 and 019) - outline

- **Representativity (geographic cover / pressures)**
- **Length of time series (effect of start year)**
- **Aggregation (geographical scale, nutrient concentration class)**
- **Added value of «New» parameters reported by countries but not used by EEA so far**
- Brief assessments concerning CSI019 and 020 will made available after this workshop

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SoE Nutrients data: Representativity, example orthophosphate (PO$_4$) in rivers latest year

- **WISE-SoE maps include all recent data,**
- **Problems: missing countries or RBDs, station density difference between or within countries, stations not representative for RBD or country level**
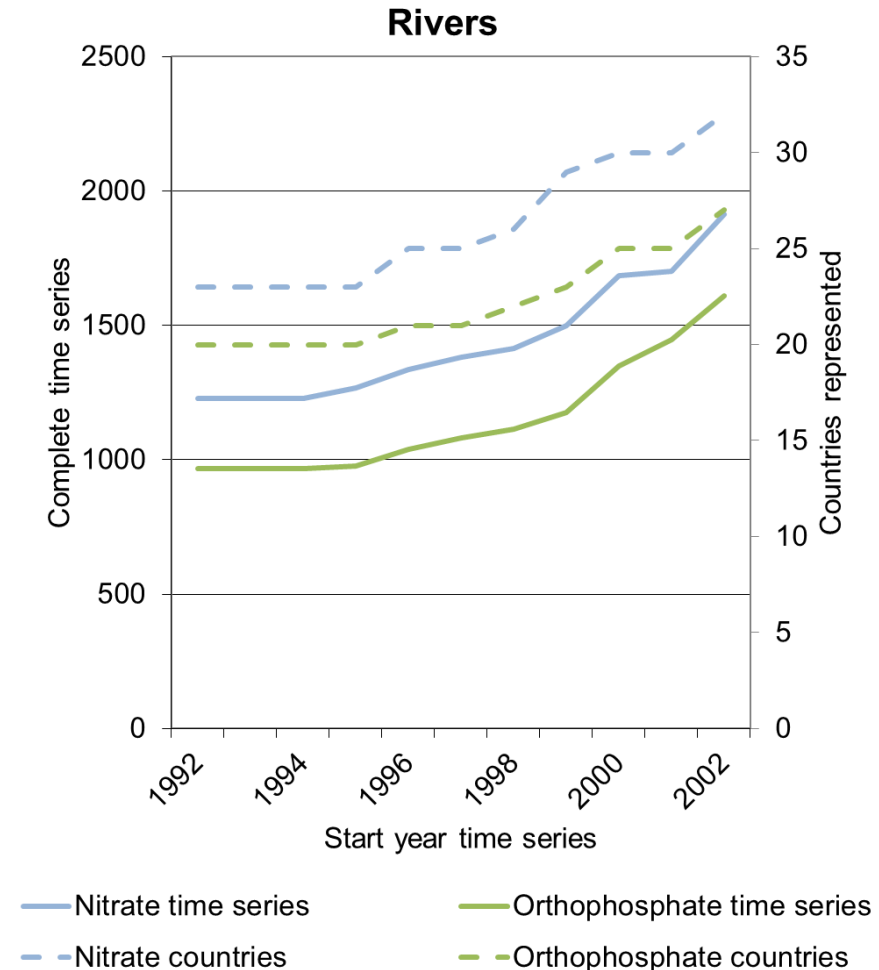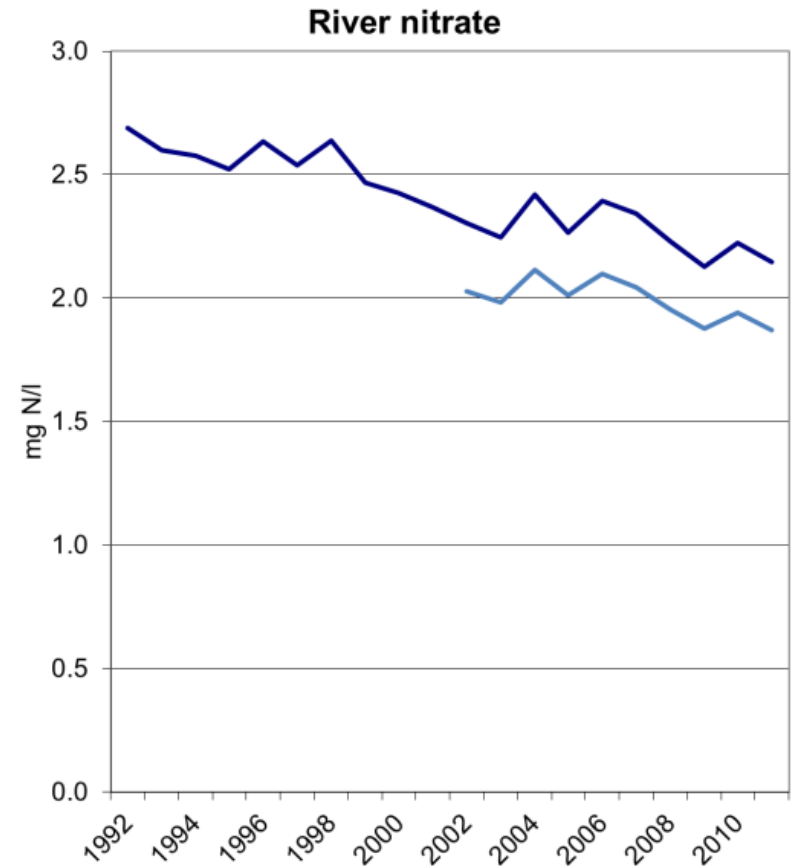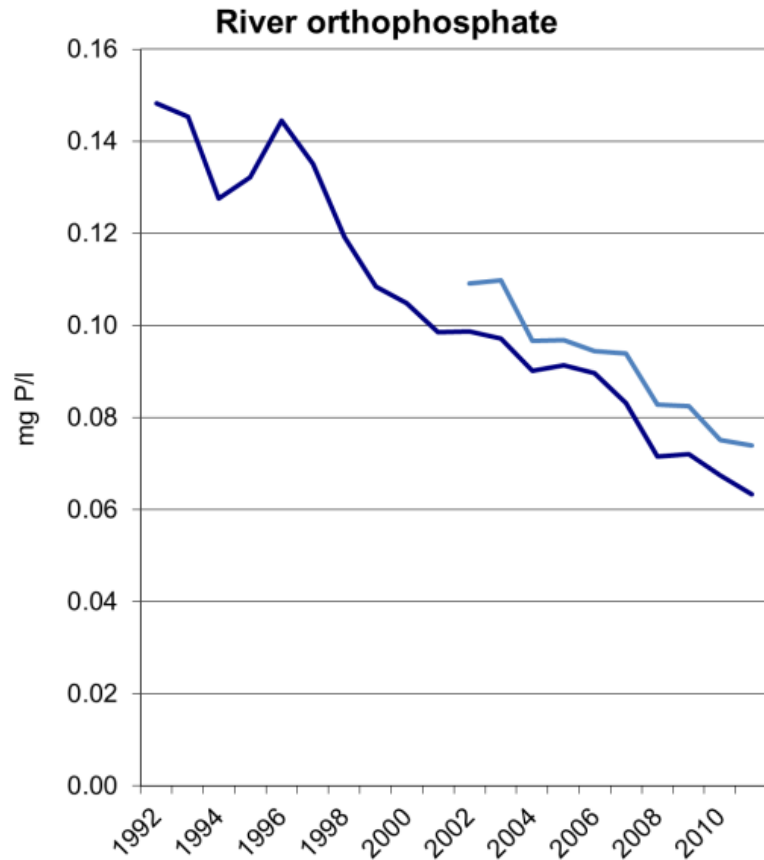
Country level

Station level

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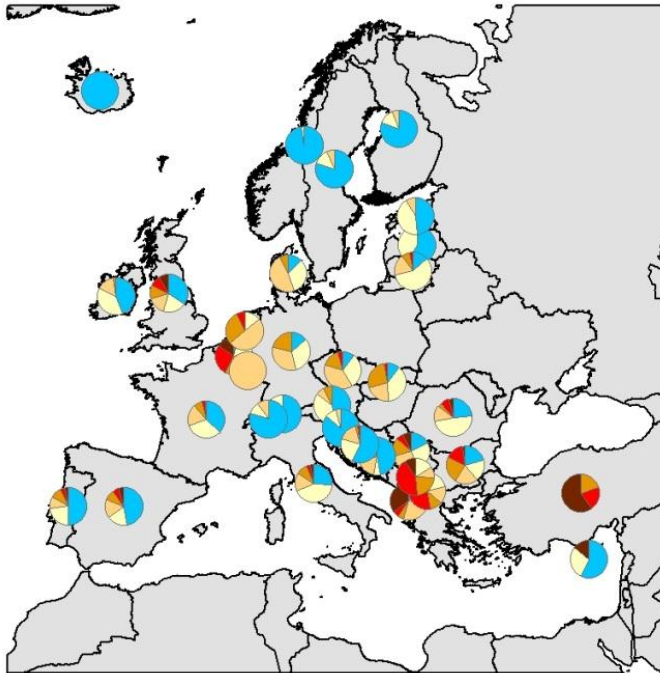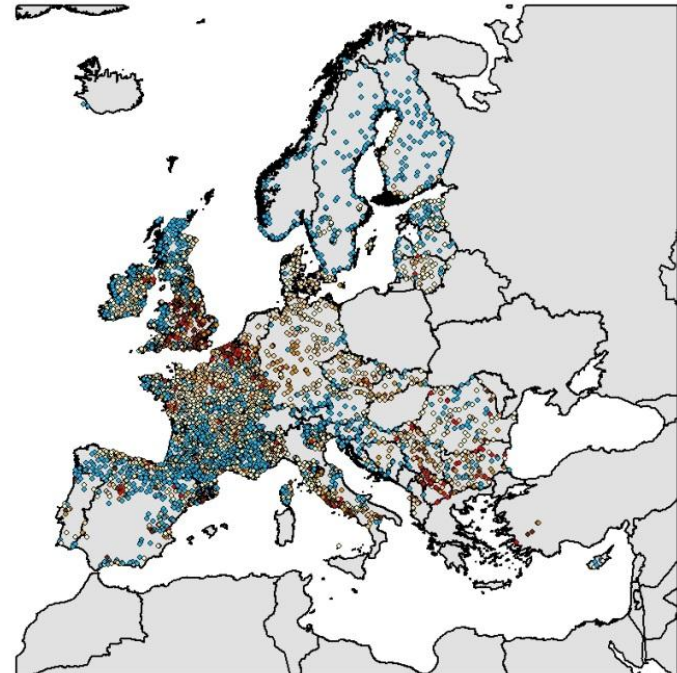
Time series analysis by EEA/ETC: Choice of series length affect results

- **Only complete time series are used for assessments**
  - (max. 3 years inter/extrapolation)
- **Later start year gives more stations and therefore a more representative picture, but …..**
  (see next slide)

Rivers

Legend:
— Nitrate time series
— Orthophosphate time series
- - Nitrate countries
- - Orthophosphate countries

X-axis: Start year time series (1992–2002)
Left Y-axis: Complete time series (0–2500)
Right Y-axis: Countries represented (0–35)

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Time series analysis: Choice of series length

- **Later start year gives shorter time series and therefore fewer stations with significant trends relative to earlier start year**

River orthophosphate

River nitrate

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Very long time series are valuable

- **Not representative – not for European aggregation**
- **Valuable additional information**
  - **Effects of past measures**
 - **Peak concentrations**

River orthophosphate Sweden
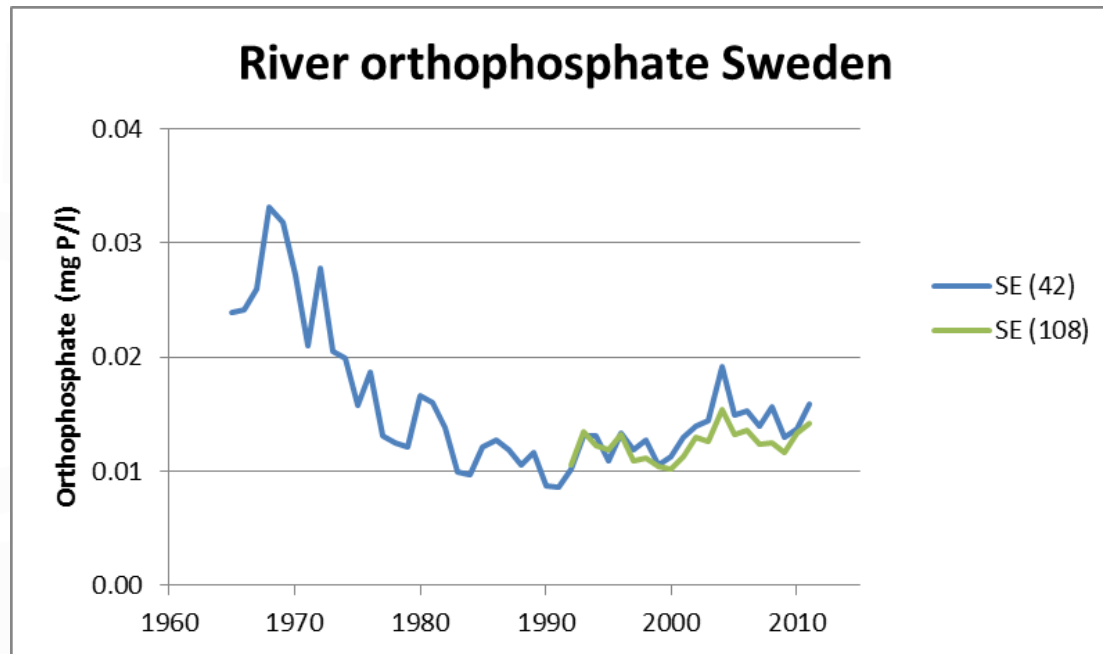
Nutrients: «New» determinands

- **Current CSI020 and CSI 019 determinands reported by countries and used by EEA/ETC:**
  - river orthophosphate (PO_4), nitrate (NO_3), ammonium (NH_4), BOD
  - lake total phosphorus (Total P)

- **Additional determinands reported by countries, but not used by EEA/ETC so far:**
  - river total phosphorus and total nitrogen,
 - lake chlorophyll a, Secchi depth, total nitrogen,

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Nutrients: added value of «New» determinands

**River time series same stations**
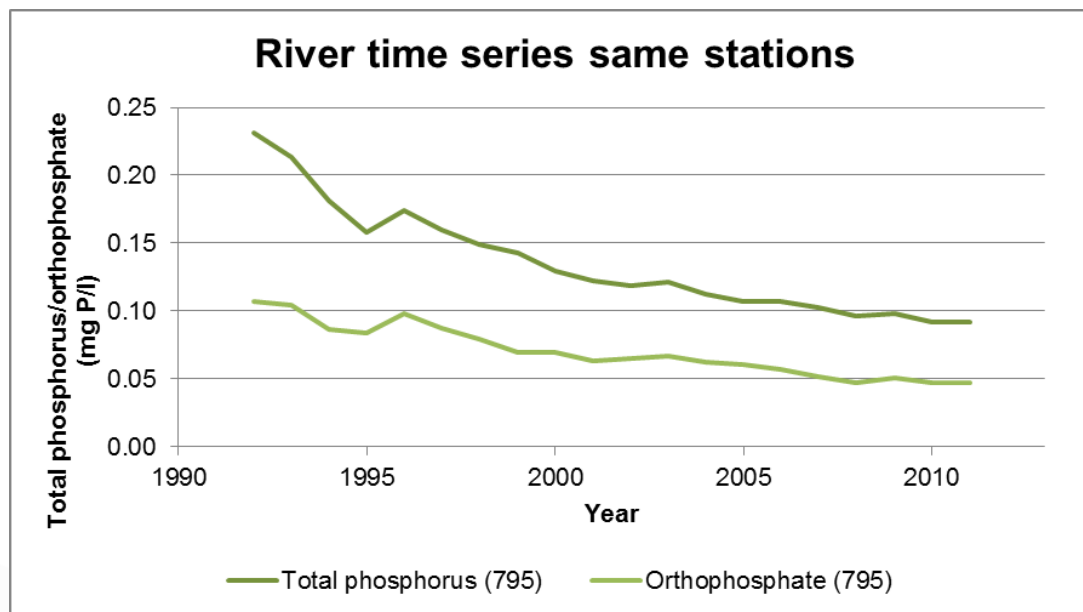
- **River Total P and Total N can provide information on:**
  - Total nutrient pressures on rivers and lakes
  - source of nutrients (waste water vs. agriculture)
- **Lake chlorophyll and secchi depth can provide information on impacts of nutrients on phytoplankton and on water clarity (that can be linked to ecosystem services: recreation value)**

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Nutrients: Aggregation options for time series

Groundwater nitrate
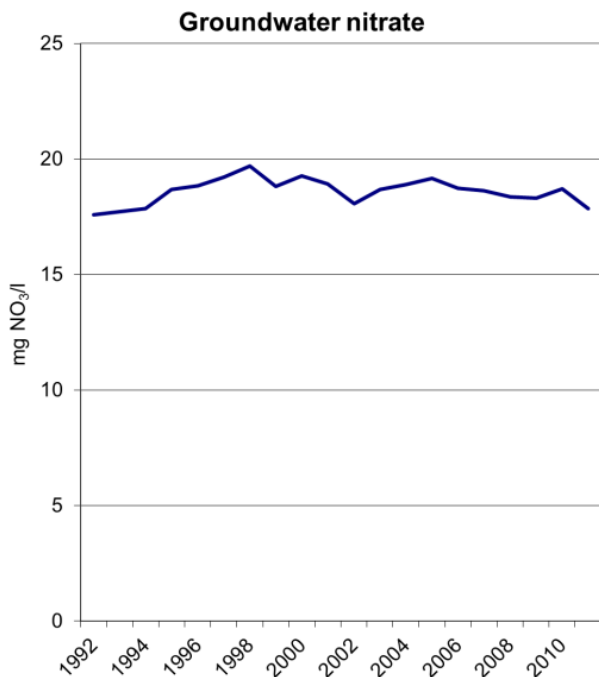
No trend is visible at European level. Aggregation hides real differences by averaging stations with opposing trends. Current aggregation used in CSI020 is also done for geographic regions and sea regions.

Groundwater nitrate

NO_3, mg/l (stations)
- <10 (205)
- 10-25 (130)
- 25-50 (76)
- >50 (28)
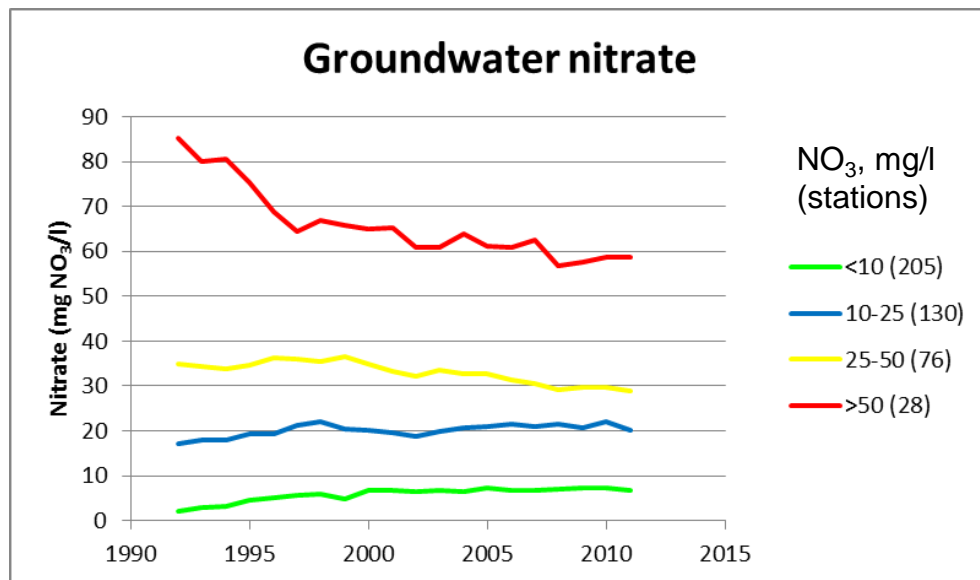
New option is to aggregate stations by their nutrient concentration classes:
- **Highlights the most problematic stations**
- **Shows increasing trend for the best stations**

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SoE Biology data - Outline

New data flow starting in 2011 for
Rivers: Macroinvertebrates and phytobenthos
Lakes: Phytoplankton and macrophytes

- **Representativity (SoE vs. WFD)**

- **Data quality: national Ecological Quality Ratio (EQR), normalised EQR,**

- **Trends (possible ways to show trends after some future years of reporting)**

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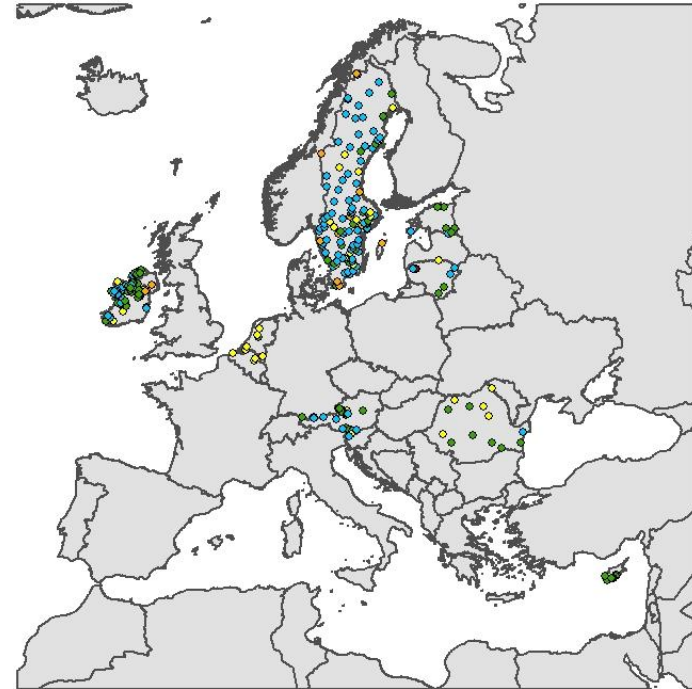Inland, coastal, marine waters

Maps based on data reported in 2012

Problems: missing countries, station density difference between countries, stations not always representative at country level

Macroinvertebrates in rivers
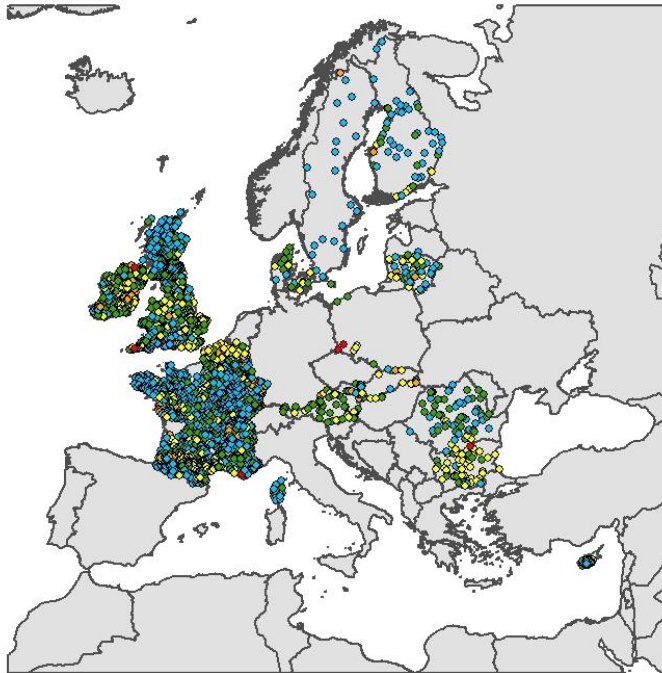
Phytoplankton in lakes

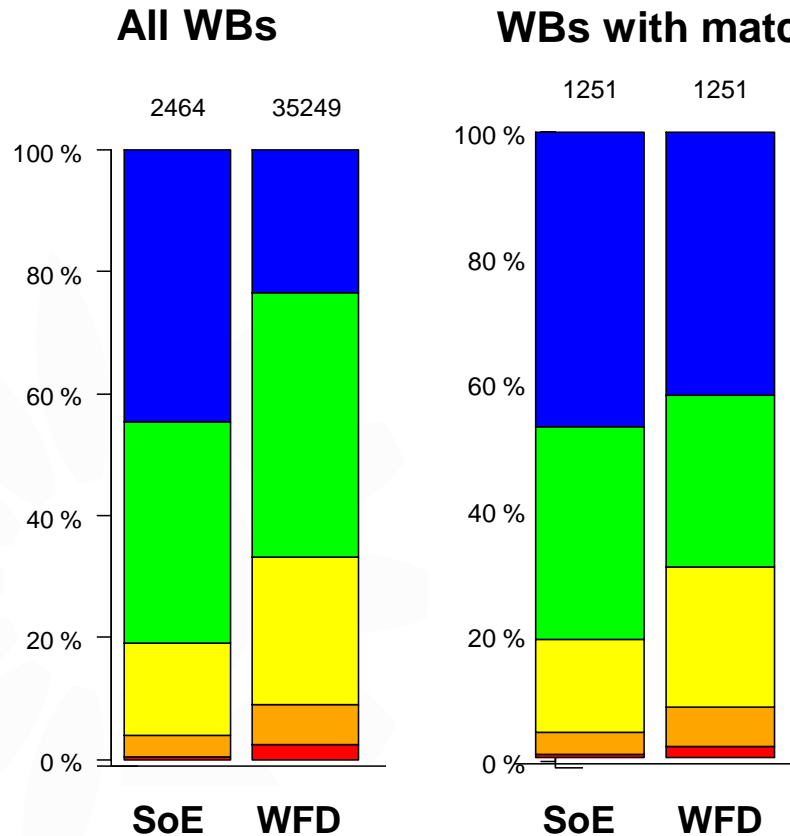**Countries reporting status class, but not EQR values: Germany, Scotland (UK), Norway, Poland**

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Importance of normalised EQR values

- Normalised EQR values are needed for trend analyses
- ETC has calculated normalised EQR from reported national EQR values. Some problems:
  - Class boundaries missing
  - Waterbody type missing or not identical in Biology and Classification tables
- Countries can now report normalised EQRs instead of national EQRs
  - Reporting of class boundaries is then not needed

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Comparison of SoE vs. WFD data: Ecological status for each __BQE__

Macroinvertebrates in rivers

All WBs

2464   35249

WBs with matching codes

1251   1251

Comparison of SoE biology with WFD ecological status class for the same WBs requires coupling of databases by WaterbodyID: We lose half of the stations due to missing or non-matching codes (2464 vs. 1251 WBs)

To be further discussed in group sessions

Linking different data flows together

DPSIR:

- Pressures (UWWT, agri-fertiliser) & SoE nutrients

- SoE nutrients & SoE biology

- SoE nutrients & WFD ecological status

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Linking pressures with nutrient concentration

- Nutrient concentrations in rivers are going down

- This is caused by
  - improved urban waste water treatment (most important so far)
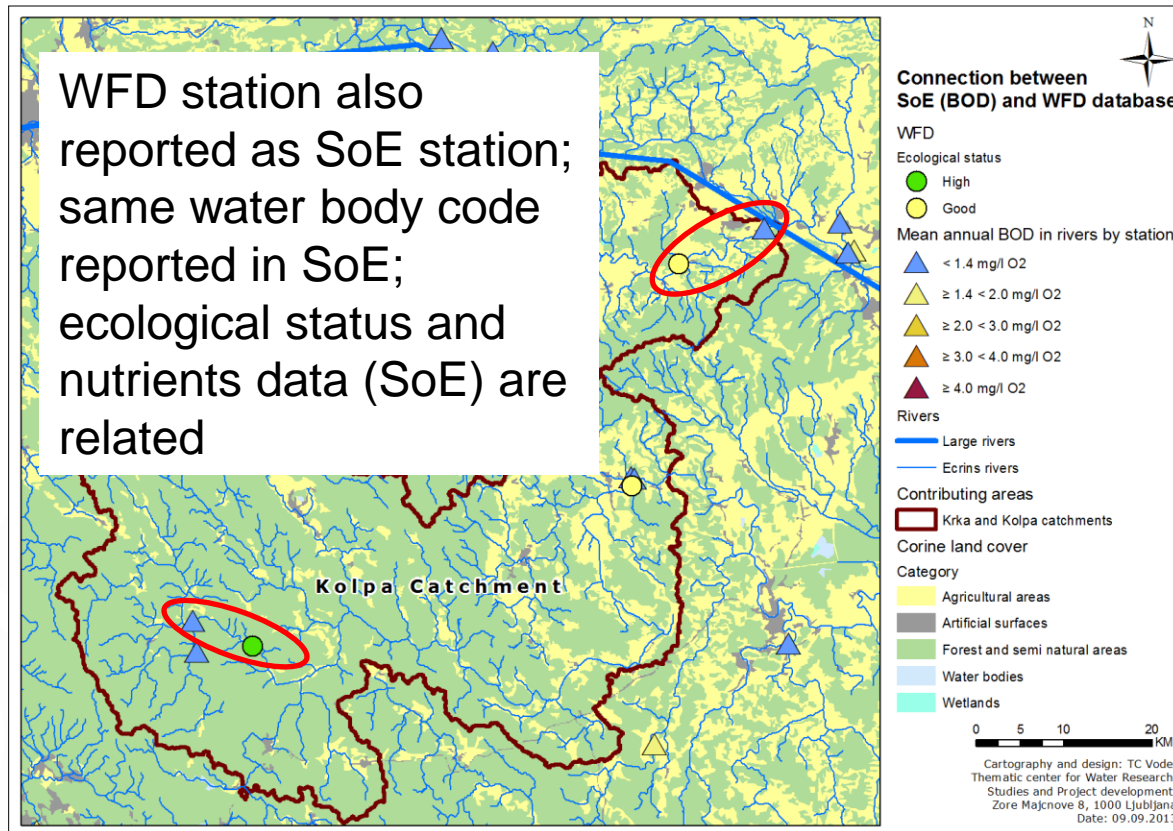 - reduced fertililser consumption

- Measures taken in both sectors have more effects on P than on N

River nutrients

Population connected to tertiary waste water treatment


Fertiliser consumption EU15
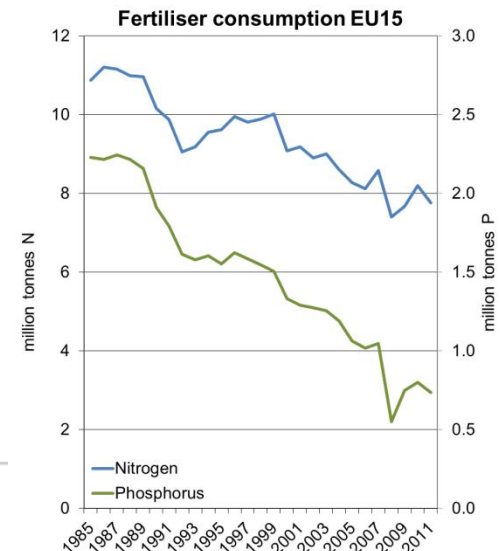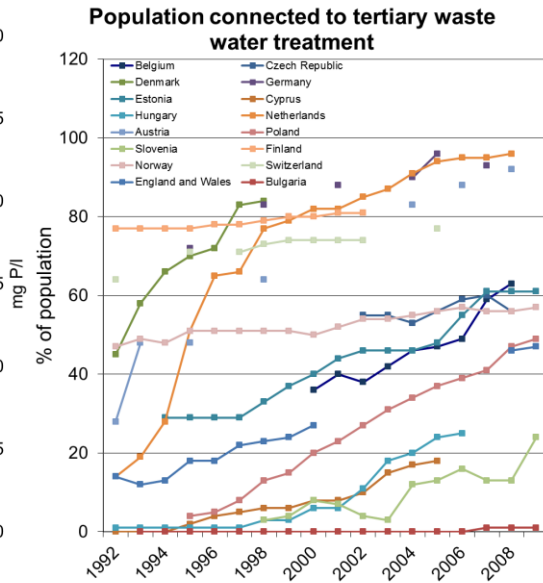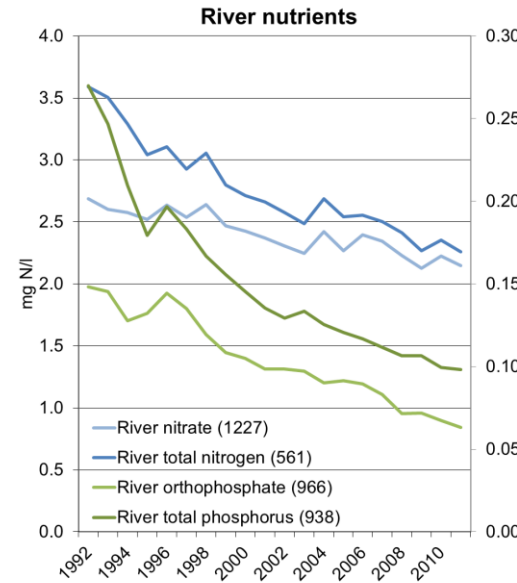
Coupling SoE data and WFD data

WFD station also reported as SoE station; same water body code reported in SoE; ecological status and nutrients data (SoE) are related

Connection between SoE (BOD) and WFD database

WFD
Ecological status
- 🟢 High
- 🟡 Good

Mean annual BOD in rivers by station
- 🔺 < 1.4 mg/l O2
- 🔺 ≥ 1.4 < 2.0 mg/l O2
- 🔺 ≥ 2.0 < 3.0 mg/l O2
- 🔺 ≥ 3.0 < 4.0 mg/l O2
- 🔺 ≥ 4.0 mg/l O2

Rivers
- ▬ Large rivers
- — Ecrins rivers

Contributing areas
- ▭ Krka and Kolpa catchments

Corine land cover
Category
- Agricultural areas
- Artificial surfaces
- Forest and semi natural areas
- Water bodies
- Wetlands

0 5 10 20 KM

Cartography and design: TC Vode, Thematic center for Water Research, Studies and Project development, Zore Majcnove 8, 1000 Ljubljana
Date: 09.09.2013

Kolpa Catchment

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Linking time series of nutrients to WFD ecological status classes:

Aggregation based on WFD status class requires database coupling: Correct reporting and/or updating of water body ID in WISE-SoE is essential! (few stations coupled = not representative)

- Lakes in bad status have improved, but still have high Total-P

- **No improvement can be seen for lakes currently in moderate /poor status**

- Lakes in high and good status had low total P also before the WFD

Total phosphorus

— Bad (8)   — Poor (22)   — Moderate (67)   — Good (143)   — High (46)
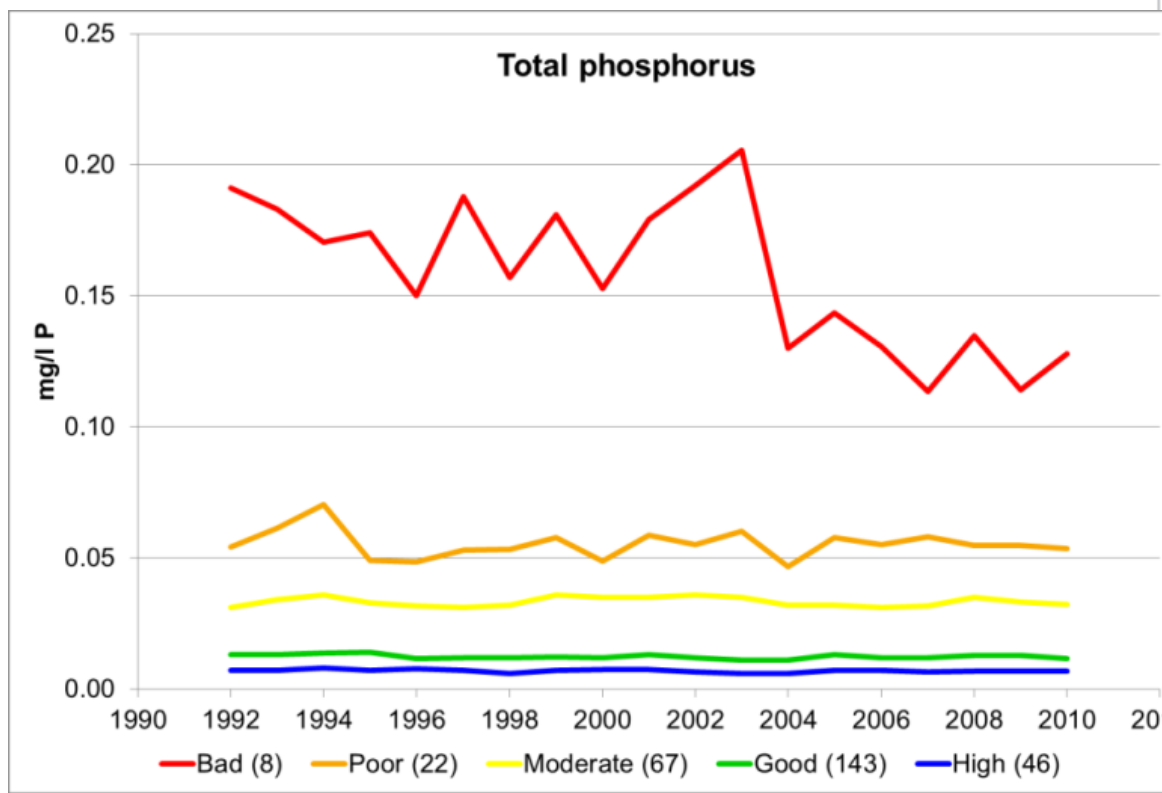
Linking SoE Biology and Nutrients

- Comparison of maps showing current situation
  - (next slide)

- Further ideas:
  - Comparison of ecological status for a BQE with nutrient concentration ranges (box plots), e.g.
    - macroinvertebrates and BOD in rivers or
    - phytobenthos and PO_4 in rivers
    - phytoplankton and total-P in lakes
  - Comparison of normalised EQR values with nutrient concentrations (scatter plots, regression)

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Linking current state for nutrients and biology all stations

River phosphate   and   Phytobenthos

(concentration class)   (ecological status class)

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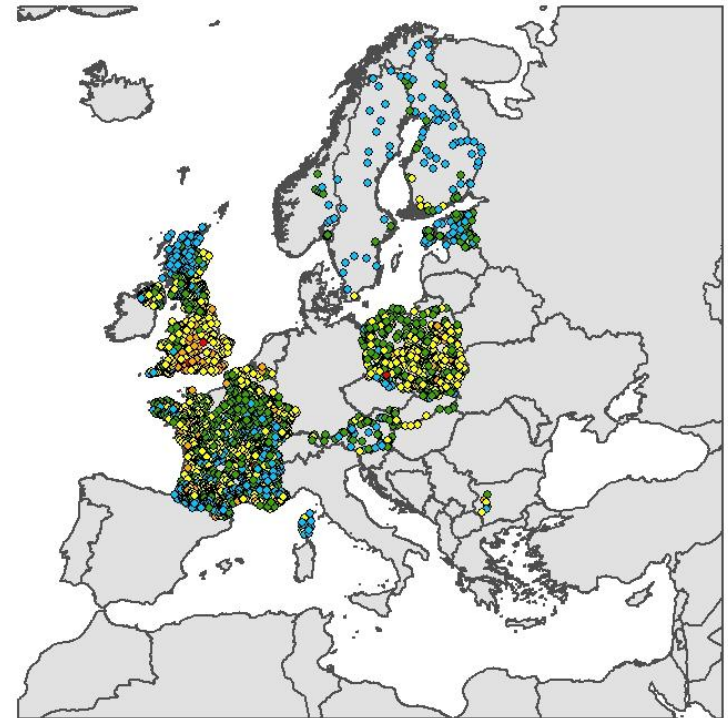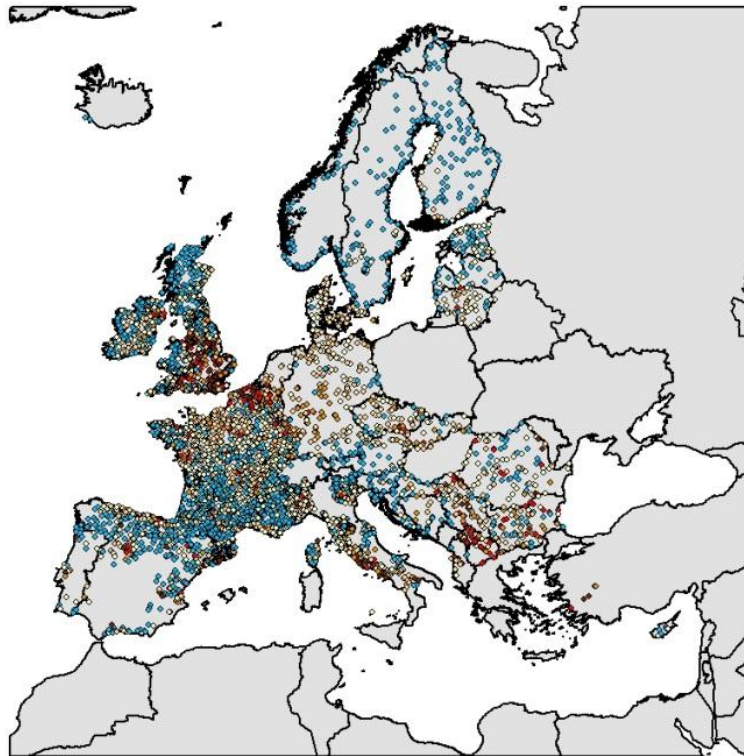
Biology stations with nutrients data

BQE	Station Match
Macroinvertebrates rivers	57 %
Phytobenthos rivers	50 %
Phytoplankton lakes	97 %
Macrophytes lakes	84 %

- Match within countries is either close to 100% or close to 0% (esp. for rivers)
- Coupling biology and nutrients data requires consistent NationalStationID
- Better match for lakes can be caused by:
  - different traditions for river monitoring (often biology without nutrients) than for lakes (mostly both biology and nutrients).
  - Nutrients can be sampled at different stations than biology, but can be within the same WB

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Main questions to countries

- **Can representativity be improved?**
  - Geographically: more countries and / or more stations
  - Covering complete pressure gradients for relevant pressures
- **How should the data be analysed to get the most informative picture of status and trends?**
  - Length of time series
  - Aggregation (geographic, status classes)
- **How to improve biological data quality?**
  - More reporting of national EQR values (not only status class)
  - Alternatively report normalised EQRs

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