Assessment of Temporal Trends in Quality of European Surface Waters: Towards a New Biological Indicator

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A biology data flow for aquatic ecosystems in Europe

- Biology data from surface waters in Europe are collected by the **EEA** (European Environment Agency) through the Water Information System for Europe (**WISE**), together with chemical indicators of water quality.
- The **WISE-2 Biology data** represent biological quality elements (**BQE**): phytoplankton, phytobenthos, macrophytes, macroalgae, angiosperms, macroinvertebrates and fish from rivers, lakes, transitional and/or coastal water bodies.
- The data are reported as annual averages of Ecological Quality Ratio (**EQR**) values, which indicate the deviation from reference conditions.
- The data undergo quality-checking, harmonisation, interpolation, and further processing, supported by content experts within the **ETC BE** (European Topic Centre of Biodiversity and Ecosystems).
- The processed data are published as **WISE statistics – Biology** (EEA 2023a).
- The data also represent Essential Biodiversity Variables (**EBV**) at the community level (Fig. 1).
- More info: https://cdr.eionet.europa.eu/help/WISE_SoE/wise2

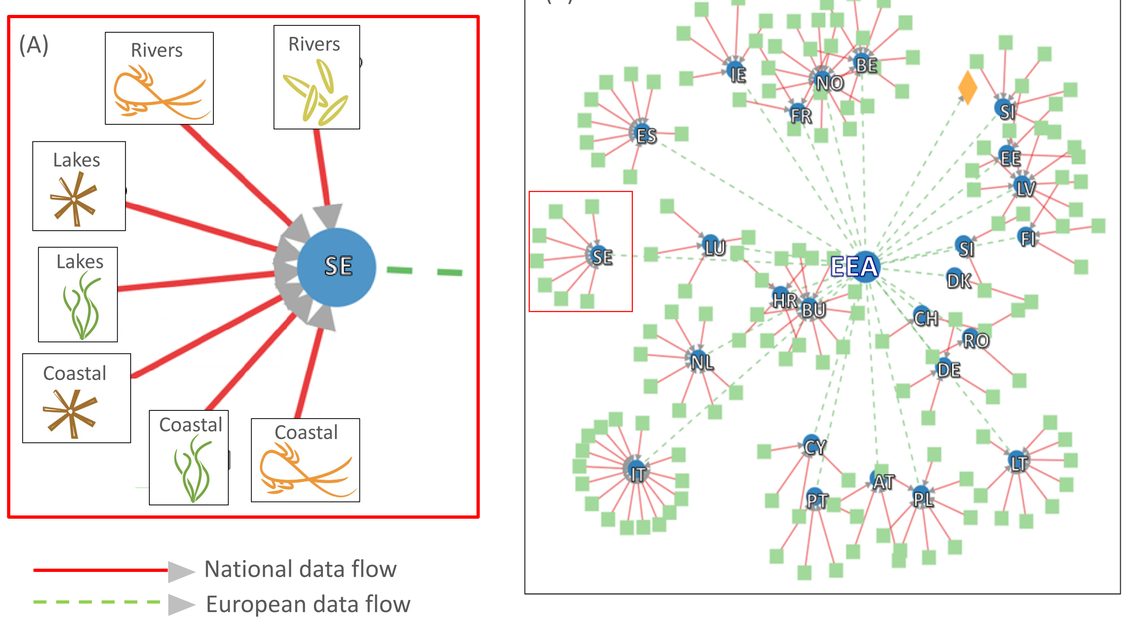

Figure 1. The European WISE-2 data flow as visualised by the EuropaBON monitoring database (https://monitoring.europabon.org). After Moe et al. (2023).
(A) Example of national data flow: EQR values for seven biological quality elements flowing into a national integration node.
(B) Overview of the 25 national integration nodes in WISE-2.

Exploration of temporal trends in ecological quality

Methodology

- Data selection: four BQEs from water bodies with complete time series for monitoring years 2015 - 2021:
  - Phytobenthos and benthic invertebrates in rivers
  - Phytoplankton and macrophytes in lakes
- Visual analysis: time series for each BQE aggregated to the European level, and grouped by the initial ecological quality class (year 2015) (Fig. 2)
- Statistical analysis: Mann-Kendall trend analysis for each BQE and water body (Fig. 3)

Results

- Time series plots (Fig. 2) indicate general tendencies for water bodies, within each group of initial ecological quality class
  - High-Good group: slight deterioration within Good class
  - Poor-Bad group: improvement towards Moderate class
- Statistical analyses (Fig. 3) confirm these trends in ecological quality:
  - High-Good group: more water bodies show decreased quality
  - Poor-Bad group: more water bodies show increased quality

Outlook

The WISE-2 Biology data can be combined with other data to explore explanations for the temporal trends in ecological quality, for example:

- Chemical indicators: nutrient (EEA 2023b), pesticides (EEA 2023c) or other hazardous substances
- Local restoration and management actions
- Geographic variation
- Climate change

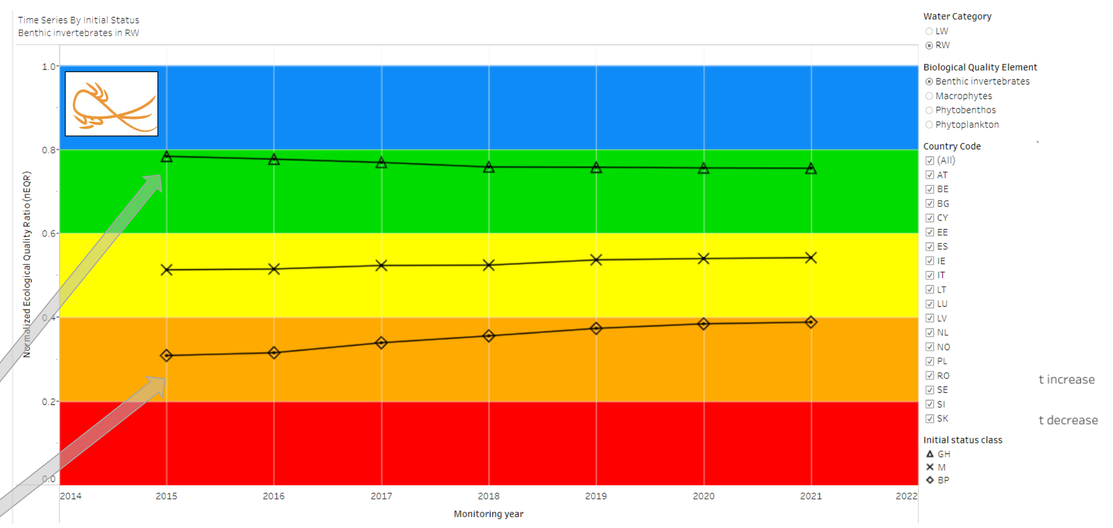

Figure 2. Example of time series: Benthic invertebrates in rivers. Annual nEQR data are aggregated for water bodies and grouped by the initial ecological quality class. After Mentzel (2024).

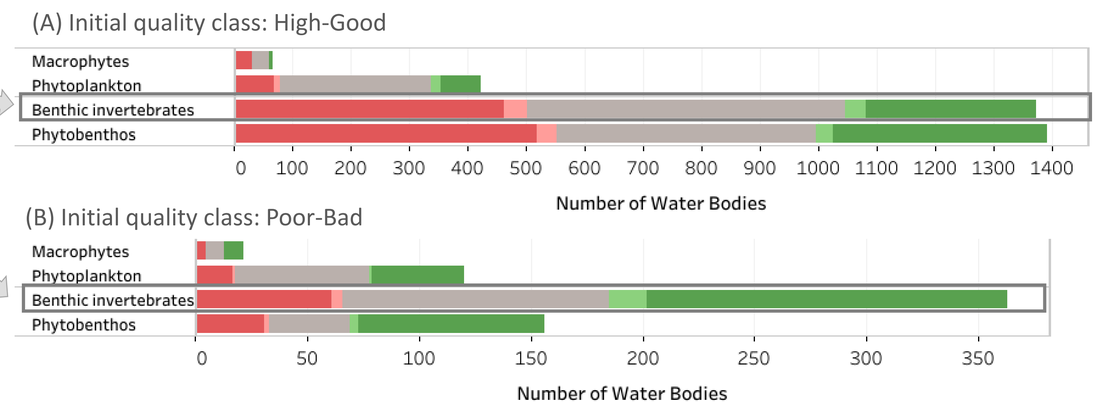

Figure 3. Count of water bodies with negative vs. positive trend in ecological quality, grouped by biological quality element and by initial ecological quality class: (A) High-Good, (B) Poor-Bad. After Mentzel (2024).

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The overview of the WISE-2 dataflow (Figure 1) was generated within the project EuropaBON (Grant agreement No. 101003553, EU Horizon 2020 Coordination and Support Action).
Species icons are copied from https://freshwaterecology.info/

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