ICP Waters
Progress in 2023-2024-2025 workplan

Extended WGE/EMEP meeting February 27-29

Geneva

Heleen de Wit and Kari Austnes

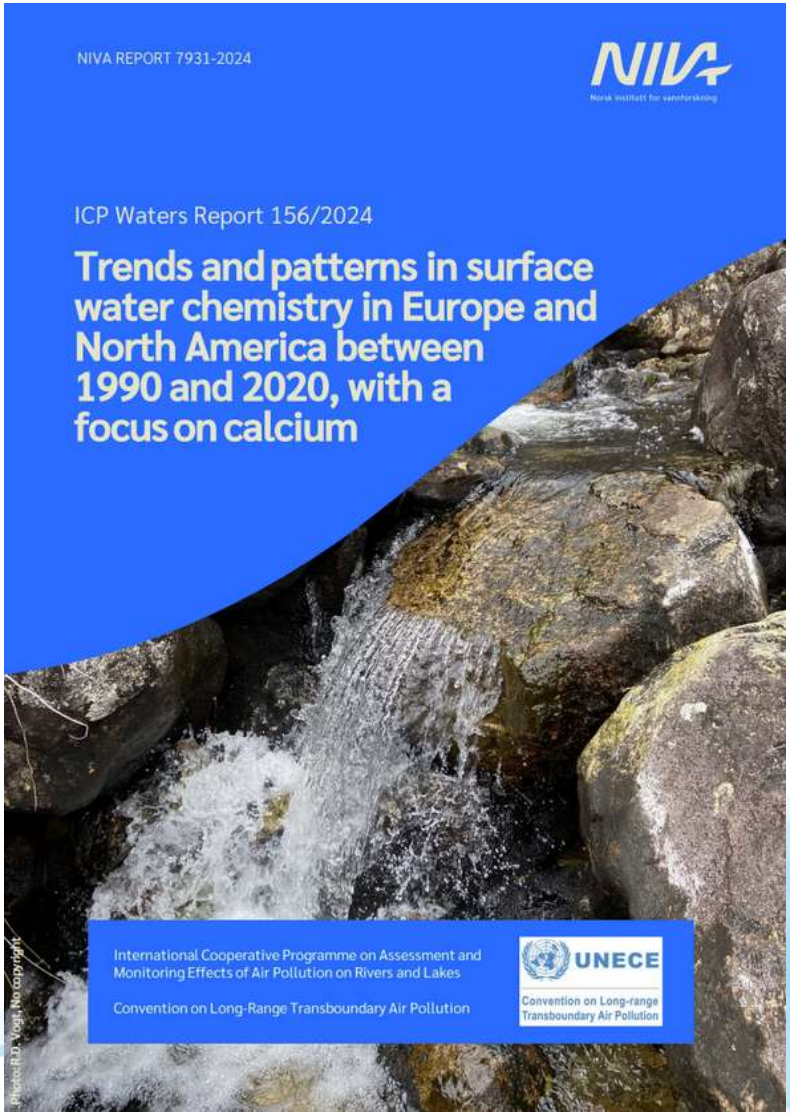
Workplan 2023-2025

- 2023 thematic report: *'Trends in Ca and Mg in surface waters recovering from acid deposition: expected and unexpected patterns'*
- 2024: update of the ICP Waters manual
- 2025: dose-response relationships (biological responses to water chemical thresholds)
- Open data policy
- Climate change and mitigation; nature restauration

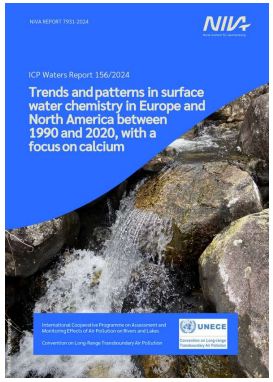
Trends in water chemistry, in particular calcium
Vogt et al. 2024

Authors

Rolf David Vogt (NIVA), Jens Arle (UBA), Kari Austnes (NIVA), Herman van Dam (Waternatuur), Martyn Futter (SLU), Jens Fölster (SLU), Cathrine Brecke Gunderse (NIVA), Scott Higgins (ILSD-ELA), Daniel Houle (ECCC), Jakub Hruška (CGS), Agnieszka Kolada (IOS), Don Monteith (UKCEH), Andrew Paterson (MOECC), Michela Rogora (CNR IRSA), James E. Sample (NIVA), John Stoddard (USEPA), Sandra Steingruber (DT-UACER), Rafał Ulańczyk (IOS), Jussi Vuorenmaa (Ymparisto), and Heleen de Wit (NIVA)



2023 report



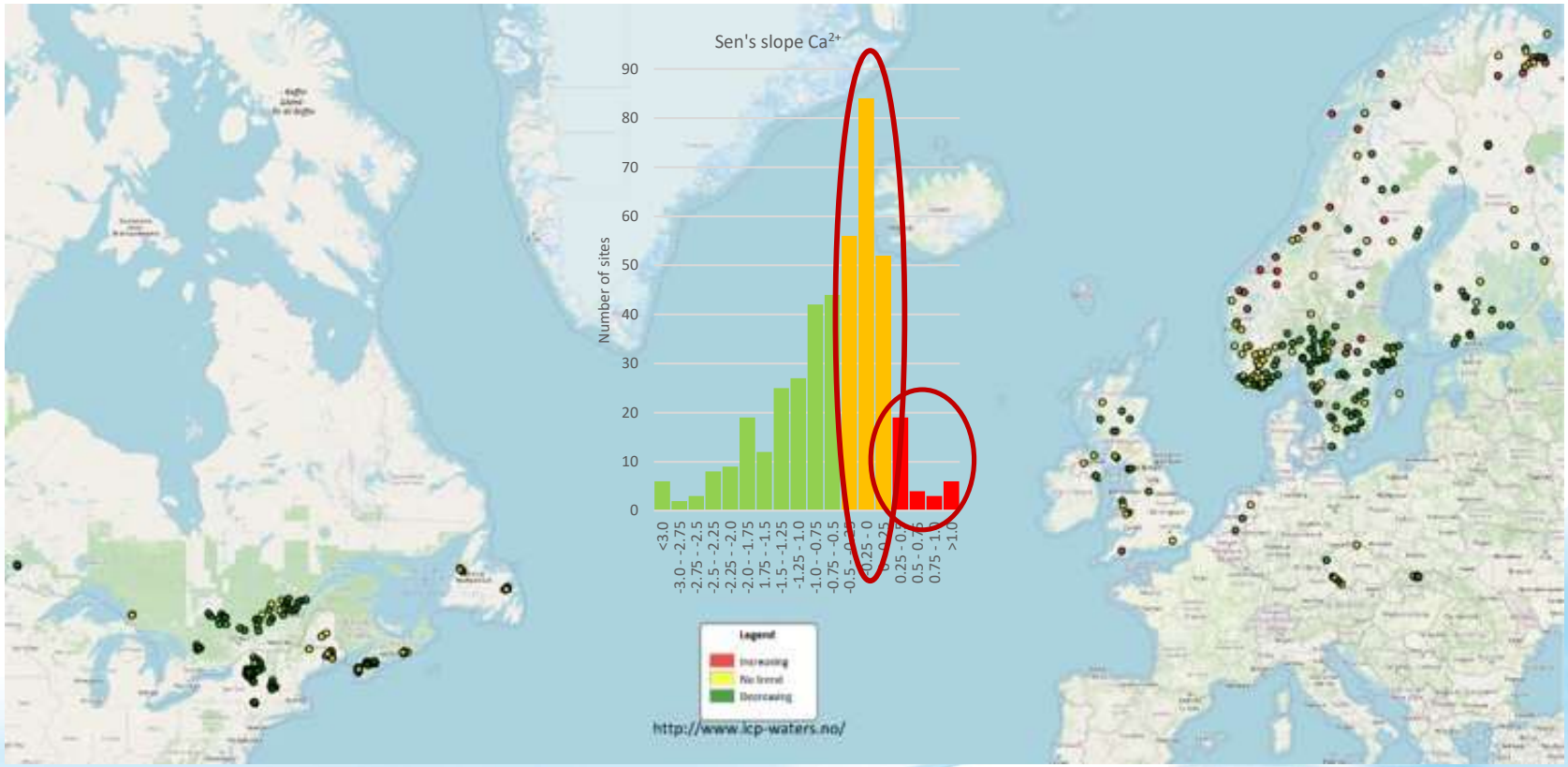
Background

- Sulphate in surface waters declines in response to reductions in S deposition
- Chemical recovery: increases in pH and ANC
- Base cations are expected to follow the decline in SO_4 because of electroneutrality
- Recent evidence from Norway:
  - Less decline in Ca than expected, resulting in larger-than-expected increase in ANC
- Is this trend found elsewhere in Europe and North America?

Objectives

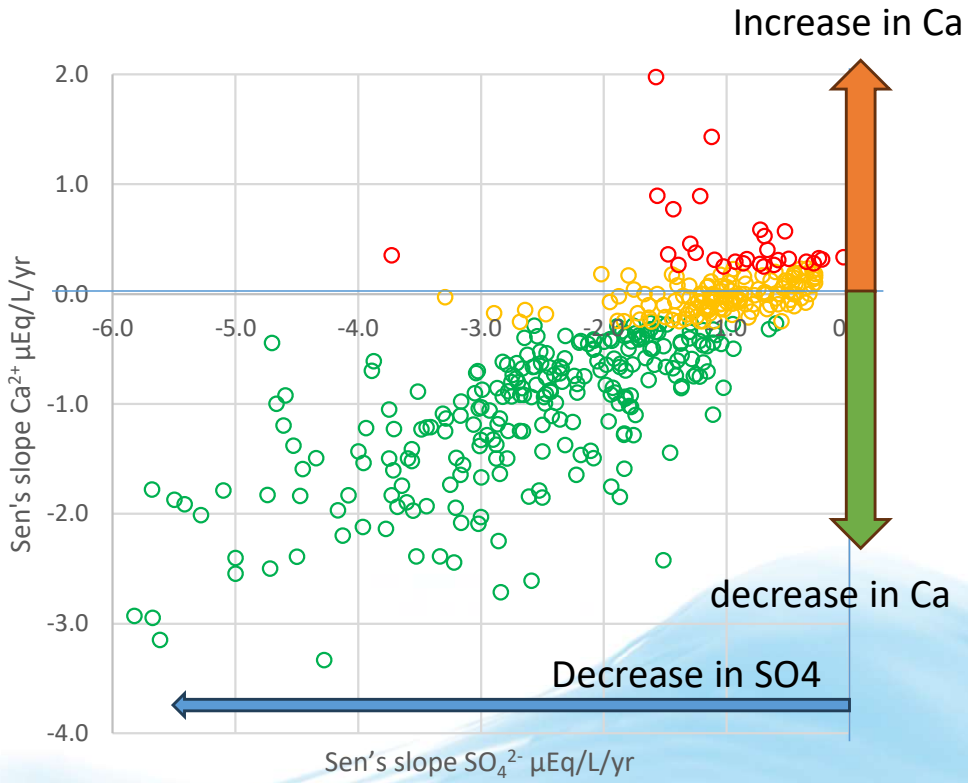
1. Quantify trends analysis of water chemistry in acid-sensitive regions from 1990 to 2020, in particular focusing on calcium
2. Explore calcium trends
3. Which anions can explain trends in calcium?
   1. SO_4^{2-}
   2. organic anions
   3. Bicarbonate (HCO_3^-)

Increasing and neutral Ca trends



Results

- Upward change in Ca in
  - Less acidic, and less acidified, sites
  - Sites with higher bicarbonate and lower organic acidity
- Increases in calcium are associated with increases in bicarbonates
  - This requires pH>5.5



Conclusion: increases in Ca related to bicarbonates

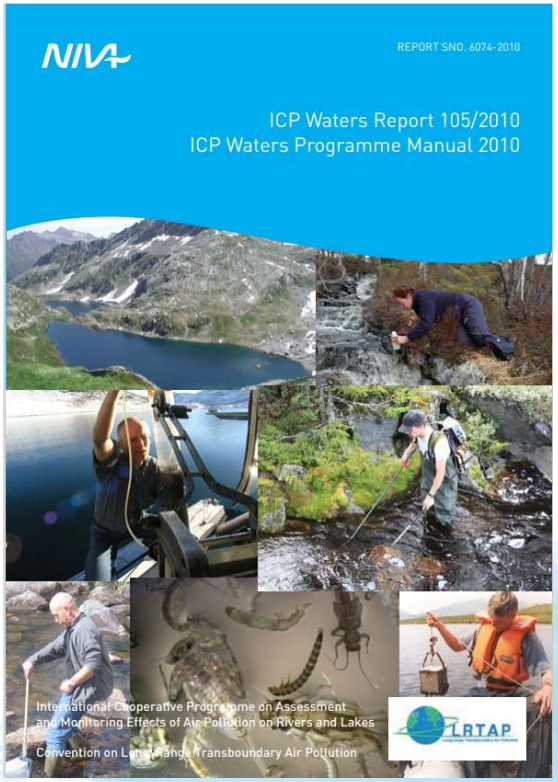
- Bicarbonates are a weathering product - higher weathering rates than assumed previously?
- Possible mechanisms:
  - More active biomass pumping more CO_2 into soils (and therefore waters) because of longer growing season?
  - Warmer climate – warmer soils?
- Policy-relevance:
  - Higher weathering rates may lead to quicker recovery
  - But: highly acid-sensitive sites have low weathering rates, unclear whether these will accelerate
  - Continue monitoring!
  - Test if dynamic models reproduce current recovery rates – are parameters for weathering rates properly constrained?

2024: Update of the ICP Waters manual

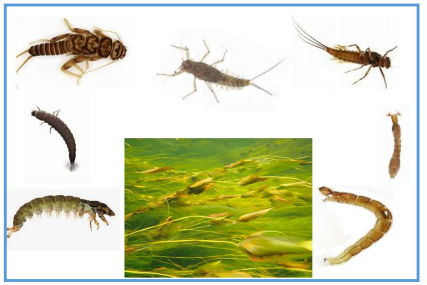
- Guide for monitoring
  - Sampling
  - Analysis
  - Reporting
- Harmonization of methodology
- Last updated in 2010

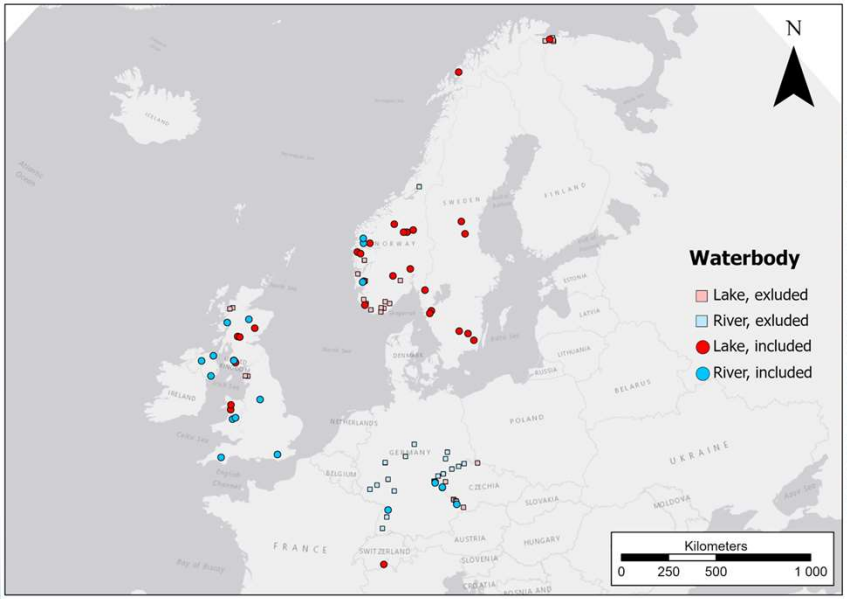
<u>Ongoing update:</u>

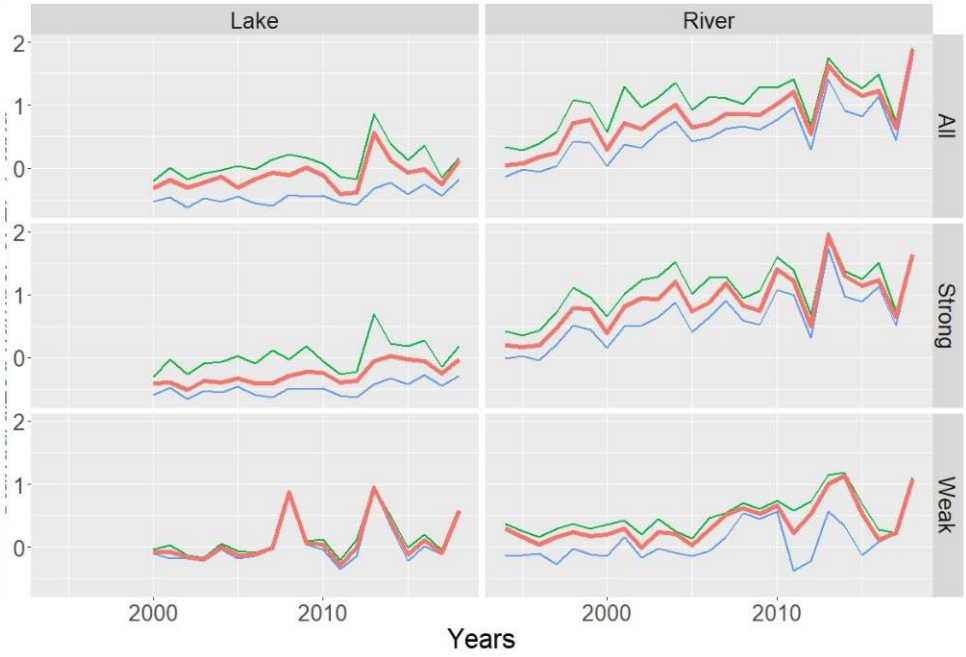
- Re-evaluate the topics covered
- Ensure up-to-date recommendation for methodology
- A team of experts have been established
- Draft version planned for TF meeting in May 2024



2023 report: General patterns in biological recovery – increases in **species richness** over time, often related to ANC.







WGE/EMEP extended ICP Waters
February 2024

2025 report – dose response relationships

Existing thresholds linking biological responses (fish) to water chemical thresholds are from (large!) spatial surveys

- Do the same thresholds apply to benthic invertebrates?
- Is biological recovery statistically linked to existing water chemical thresholds?
  - Change-point analysis
- Is it possible to identify lag times in responses to improving water chemistry?
- Can we identify climate (droughts, floods) as a factor that delays recovery?

Approach:

- Use case studies with long-term combined monitoring of water chemistry and invertebrates, and preferably information on climate (discharge, temperature)

Examples of dose-response relationships for fish species

- Extinct – damaged – not damaged for ANC in lakes

(Hesthagen et al., 2008)

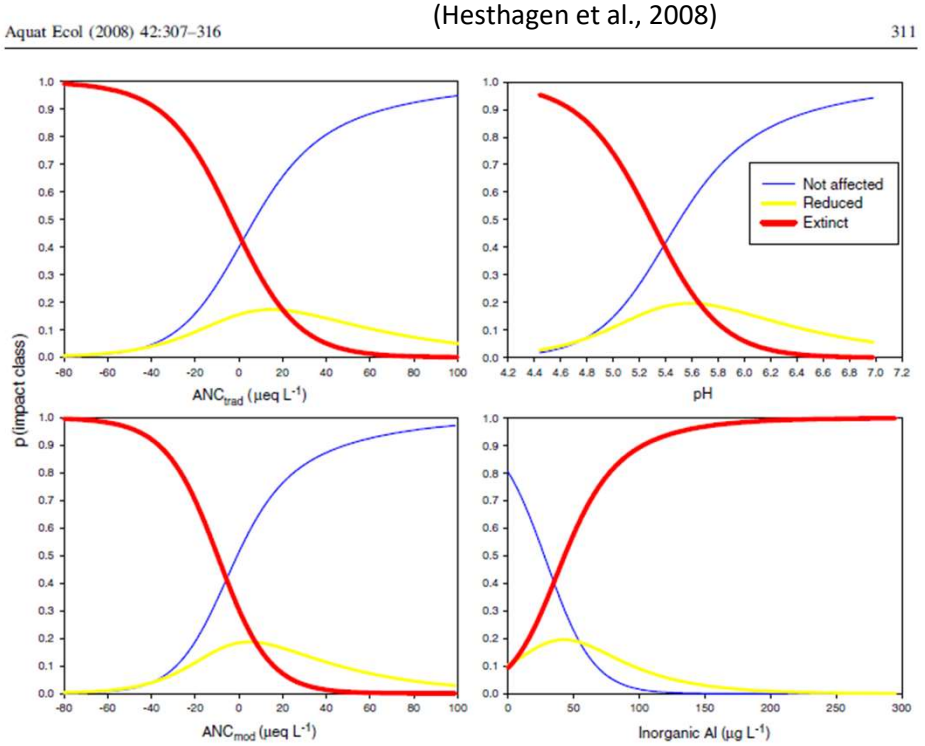


Fig. 4 Estimated probabilities from multinomial logistic regressions of a brown trout population belonging to either of three different impact classes (unaffected, reduced or extinct) in relation to traditional ANC$_{trad}$ (µeq l^{-1}), ANC$_{mod}$ (µeq l^{-1}), pH and inorganic Al (µg l^{-1})

Climate change and mitigation; nature restauration

Climate mitigation: forestry and increased forest management

- Forest harvest usually leads to a short-term (some years) acidification in acid-sensitive areas

Nature restauration

- Active liming happens in several countries

Other progress

- Development of open data policy
  - Letter of agreement, license (f ex Creative Commons)
  - Export to data repository, data paper
- Chemical and biological intercalibration
- Task Force meeting in Praha, Czechia, with ICP Integrated Monitoring (May 28-30)

2024/2025 Workplan

- Updated ICP Waters Manual in 2024
- (Possible (bilateral?) collaboration with ICP Forests on nitrogen trends)
- Possible continued focus on biological recovery
  - Very important in effect-based work, also outside convention (NEC Directive, Water Framework Directive)
- Possibility for focus on dynamic modelling (with CDM)
- Joint WGE/EMEP items
- Other items to be discussed at Task Force meeting
  - Follow-up of GP review
  - Dynamic modelling
  - Biodiversity
  - (Heavy metals)