



# ICP Waters



## International Cooperative Programme on Assessment and Monitoring Effects of Air Pollution on Rivers and Lakes

Chair: Heleen de Wit.

Leader of programme centre: Kari Austnes

### Aims

- Assess the *degree* and *geographic extent* of the impact of atmospheric pollution, in *particular acidification*, on *surface waters*
- Collect information to evaluate *dose/response relationships*
- Describe and evaluate *long-term trends and variation* in *aquatic chemistry and biota* attributable to atmospheric pollution

### Progress & results

- Status participation
- Report from Task Force meeting
- Recent and planned reports



	Chemical data (last year with data)	Biological data (last year with data)	Participation in TF meetings 2019-2021	Participation in chemical intercomparison 2019-2021	Participation in biological intercalibration 2019-2021
Armenia	2019		•		
Austria	2018		•	•	
Belarus	2014				
Belgium				•	
Canada	2019		•	•	
Czech Rep.	2019	2019	•	•	
Estonia	2019		•	•	•
Finland	2019		•	•	
France			•	•	
Georgia			•		
Germany	2019	2019	•	•	
Ireland	2019	2020	•	•	
Italy	2019	2020	•	•	
Latvia	2020	2020	•		•
Lithuania			•	•	
Moldova	2017			•	
Netherlands	2014			•	
Norway	2021	2021	•	•	•
Poland	2019		•	•	
Russia	2018		•	•	
Serbia				•	
Slovakia	2019				
Spain	2013		•		
Sweden	2019	2021	•	•	•
Switzerland	2019	2018	•	•	
UK	2019	2018	•	•	
USA	2018		•		
<b>Total</b>	<b>21</b>	<b>9</b>	<b>21</b>	<b>20</b>	<b>4</b>

- 21 countries participate in various activities
- Stable participation



# Joint (hybrid) ICP Waters and ICP IM Task Force meeting Miraflores de la Sierra, Spain, May 10-12 2022



- Chemical recovery is widespread, but climate change impacts are beginning to show
- Long-term monitoring of great value to WGE–LRTAP, but also to NEC Directive and WFD
- Minutes available at [www.icp-waters.no/meetings](http://www.icp-waters.no/meetings)

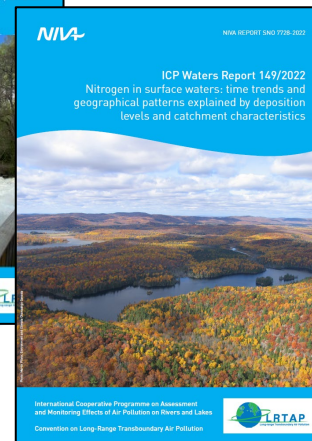
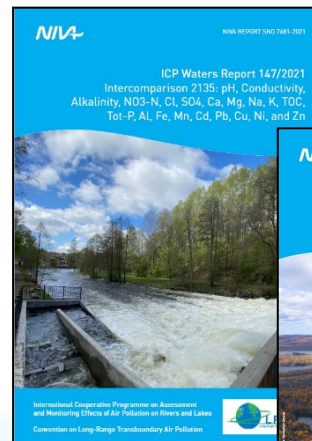
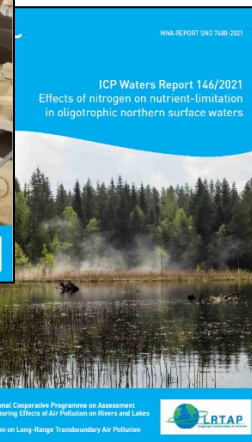
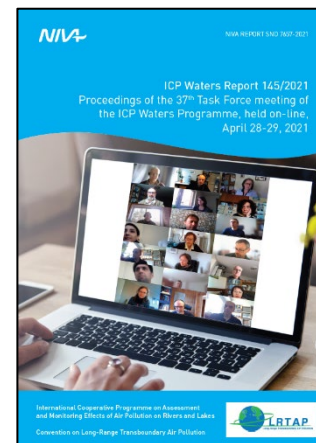


# Recent publications

Year	Title	Authors	Journal
2022	Response of atmospheric deposition and surface water chemistry to the COVID-19 lockdown in an alpine area.	Rogora, M., Steingruber, S., Marchetto, A., Mosello, R., Giacomotti, P., Orru', A., Tartari, G.A. & Tiberti, R.	<a href="#">Environmental Science and Pollution Research</a>
2021	Living Organisms and Sedimentary Remains from High Mountain Lakes in the Alps	Aldo, M., Boggero, A., Fontaneto, D., Lami, A., Lotter, A.F., Manca, M.M., Massafiero, J., Mosello, R., Musazzi, S., Nickus, U., Psenner, R., Rogora, M., Stundet, S.S., Stuchlik, E., Tartari, G.A., Thies, H. & Tolotti, M.	<a href="#">Journal of Limnology</a> 80 (3)
2021	Temporal Changes in Nutrients in a Deep Oligomictic Lake: the Role of External Loads versus Climate Change	Rogora, M., Austoni, M., Caroni, R., Giacomotti, P., Kamburska, L., Marchetto, A., Mosello, R., Orru', A. Tartari, G., and Dresti, C.	<a href="#">Journal of Limnology</a> 80 (3)
2021	Cleaner air reveals growing influence of climate on dissolved organic carbon trends in northern headwaters	de Wit, HA; Stoddard, JL; Monteith, DT; Sample, JE; Austnes, K; Couture, S; Folster, J; Higgins, SN; Houle, D; Hruska, J; Kram, P; Kopacek, J; Paterson, AM; Valinia, S; Van Dam, H; Vuorenmaa, J; Evans, CD	ENVIRONMENTAL RESEARCH LETTERS, 2021:16
2021	Spatial properties affecting the sensitivity of soil water dissolved organic carbon long-term median concentrations and trends	Sawicka, K; Clark, JM; Vanguelova, E; Monteith, DT; Wade, AJ	SCIENCE OF THE TOTAL ENVIRONMENT, 2021:780

Showing 1 to 5 of 127 entries

Previous 1 2 3 4 5 ... 26 Next





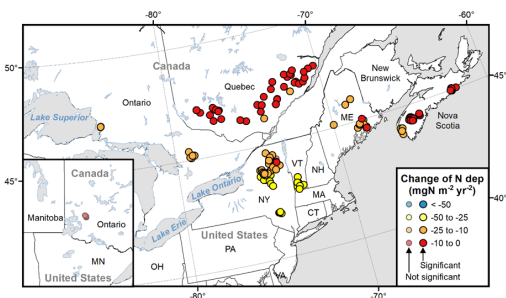
# Workplan 2021-2023(+)

- Specific to ICP Waters
  - 2022: Report on trends and regional patterns in nitrogen (published)
  - 2022: Thematic report on biological recovery and responses to changing water chemistry (in progress)
  - 2023:
    - Thematic report on trends in base cations, potential drivers and implications for acidification status and biological recovery (in preparation)
    - Update of the ICP Waters Manual (in preparation, multi-year activity)
  - 2024: Possible joint analysis on nitrogen trends (with ICP F, ICP W, ICP IM, EMEP) (under discussion)
- WGE joint items
  - Review and revision of the Gothenburg protocol
  - Inputs to the Scientific Strategy

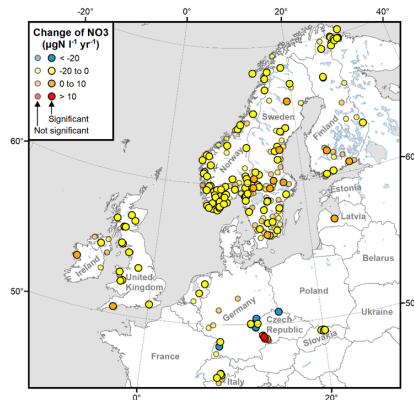
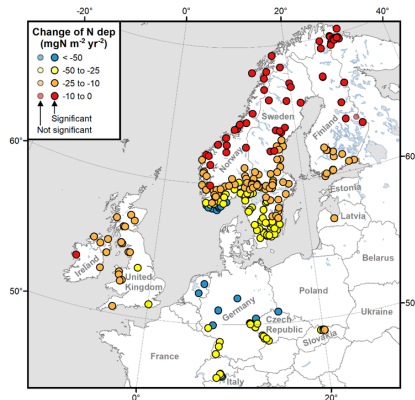
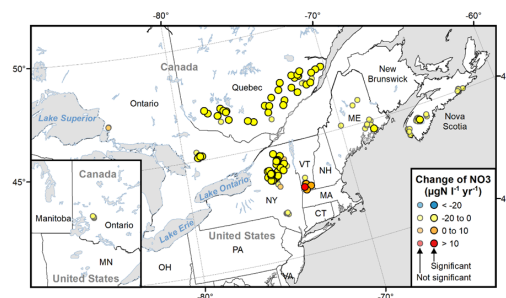


# Trends and spatial patterns in reactive nitrogen (data period 1990-2016) (Austnes et al. 2020)

Trends in N deposition



NO<sub>3</sub> trends in surface water

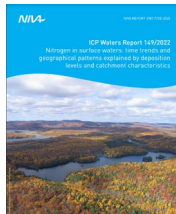


Blue = largest declines  
Yellow  
Orange  
Red = little change





# Main conclusions



- Nitrogen deposition declines steeper than surface water  $\text{NO}_3$ 
  - Catchments retain > 90% of N deposition
- Surface water  $\text{NO}_3$  levels and trends are mainly controlled by N deposition
  - % forest and climate play a role at site level, but not possible to identify consistent effects because of large variation in site characteristics
- Long-term accumulation of N deposition may lead to nitrogen enrichment of soils and nitrogen saturation
- No evidence for ongoing nitrogen saturation
- Climate change and ecosystem disturbances can cause higher N leaching in the future



# Biological recovery of surface waters

- Aquatic macroinvertebrates are insects, snails and worms, many of which are sensitive to acidic waters (EPT Taxa)

## Aims of report

- Describe trends in aquatic macroinvertebrate communities
  - Link these to changes in water chemical recovery
- Link the changes in communities to functional diversity
  - Diverse in terms of *feeding mode*: filter-feeders, grazers, predators







# Data sets: biological communities in 6 countries

- Czech Republic 2000-2019
- UK 1988-2019
- Germany 1982-2020
- Italy 1991-2020
- Norway 1997-2021
- Sweden 1986-2021





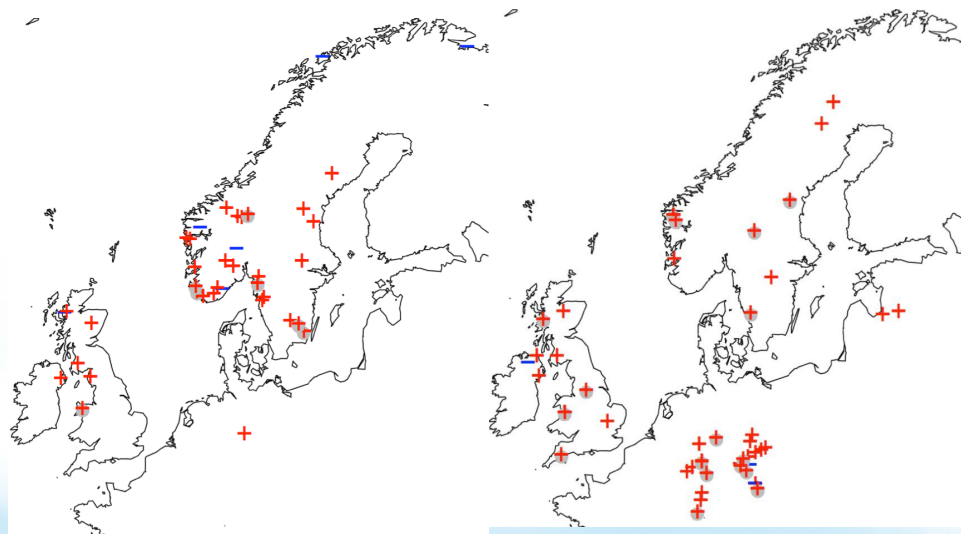


# Preliminary results

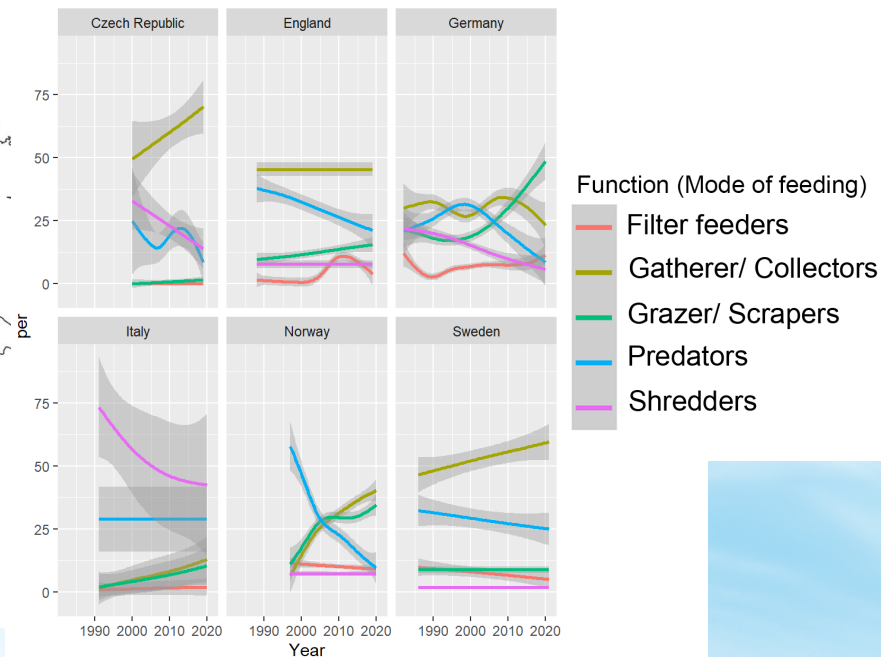
## Positive trends in biological recovery

Lakes

Rivers



## Varying trends in functional diversity







# Tentative conclusions

## Biological recovery

- Biological recovery occurs in both lakes and rivers and is correlated to chemical recovery.
- Recovery is slower in lakes than in rivers

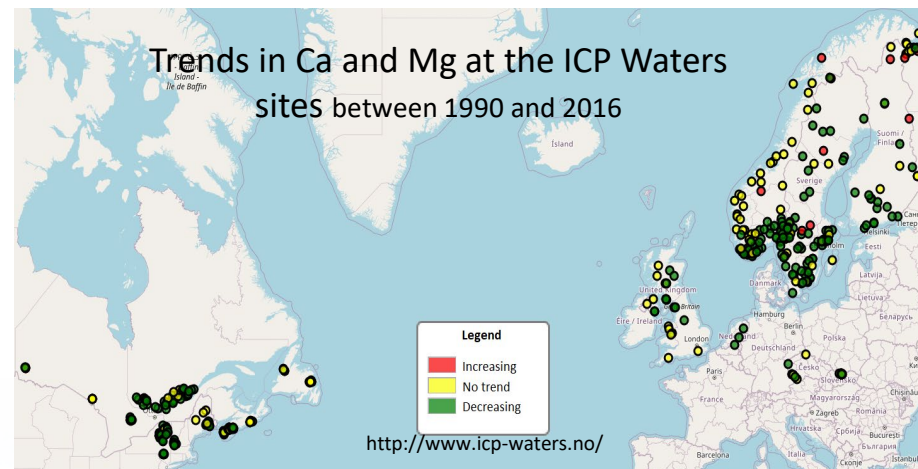
## Functional diversity

- Large changes in some communities, but patterns differ between countries
- Possibly decline in predator-species
- Implications for:
  - Biodiversity
  - Foodweb dynamics and bioaccumulation of heavy metals
- Report ready in 2022



# Base cation report in 2023

- Base cations are important for acid-buffering capacity of surface waters and co-determine critical loads for surface waters
- Poorly understand changes in base cations challenge predictions of recovery from acidification for surface waters
  - In an era of low sulfur deposition, our understanding of base cation responses to change needs validation
- Aims of report
  - Test if changes in base cations can be explained with current process understanding (cation exchange, charge balance, weathering, deposition, climate change)
  - Compare empirical data with dynamic modelling of water chemistry





# 2023+ – other planned activities

- Update of the ICP Waters manual
  - Methodology for surface water monitoring:
    - General guidance and recommended methods
    - Harmonization for joint analyses
  - Why update?
    - Last update 2010: New methods/requirements/uses since then
    - Reconsider structure/content/coverage
    - Align with related policies (WFD, NECD etc): Draw on recent developments, complement
  - Tentative time plan
    - Winter/spring 2023: Review of current manual by topic by groups of NFCs
    - TF 2023: Discussion
    - TF 2024: Revised manual ready
- Possible collaboration with on nitrogen trends with ICP Forests, ICP IM, EMEP
  - Is being discussed with interested parties



# Possible collaboration on nitrogen with ICP Forests, ICP IM & EMEP

## Background

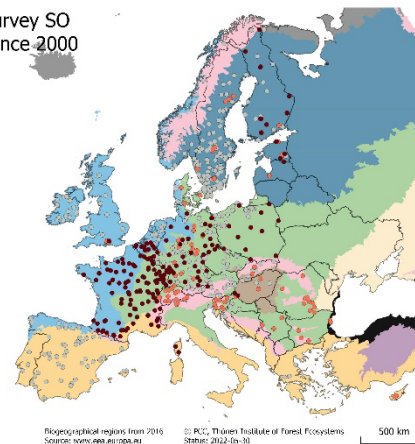
- Changes in reactive nitrogen poorly understood, yet very important for critical loads and ecosystem health
- WGE+EMEP collect data on deposition, throughfall, foliage, soil water and surface waters; joint analysis is potentially valuable
- Short discussion in Extended Bureau (WGE+EMEP) March meeting 2022
- September 1 2022, Teams meeting with ICP F, ICP IM (EMEP also invited, expressed interest)

Data availability in survey SO  
Period: Before and since 2000

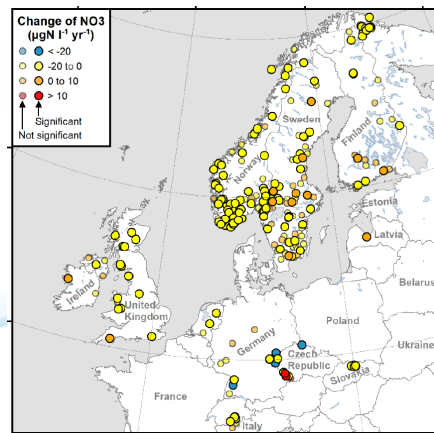
SO-SOM submission  
● Before and since 2000  
● Only since 2000  
● Only before 2000

Biogeographical regions  
alpine  
anatolian  
arctic  
atlantic  
blackSea  
boreal  
continental  
macaronesia  
mediterranean  
pannonian  
steppic

Azores (Portugal)  
Canary Islands (Spain)



Soil solution data ICP Forests (Courtesy ICP Forests, Kai Schwärzel)



Surface water data ICP Waters (Austnes et al. 2022)



# Rationale & approach



- ICPs & EMEP have regionally extensive datasets in Europe
- Mutual interest to jointly analyse trends and levels in deposition & ecosystem responses
- Bottom-up approach: scientific questions in LRTAP policy context
  - Focus on changes in nitrogen levels/concentrations
  - Limited need for coordination (as opposed to joint report highlighting all activities related to nitrogen in WGE-EMEP)

## Example questions (to be discussed):

- Are changes (or lack of change) in nitrogen in deposition, throughfall, soil solution and surface waters consistent in biogeographical regions in Europe?
- (where) is nitrogen a limiting nutrient?

## Approach

- Using existing datasets for 2000-2020
- Collaboration between experts, resulting in scientific paper(s) and short report to WGE
- Preparatory discussions can start, but actual work will wait until 2024 because databases need to be updated and resources available
- Mostly on-line and possible some physical meetings
- Key persons (so far):
  - Heleen de Wit (ICP Waters), Kai Schwärzel (ICP Forests), Ulf Grandin (ICP IM)
  - Curious? Come talk to us in the coffee breaks or drop us an email
  - hwi@niva.no



# Task Force meeting 2023

- Joint with ICP Integrated Monitoring
- Austria, May 11-13

