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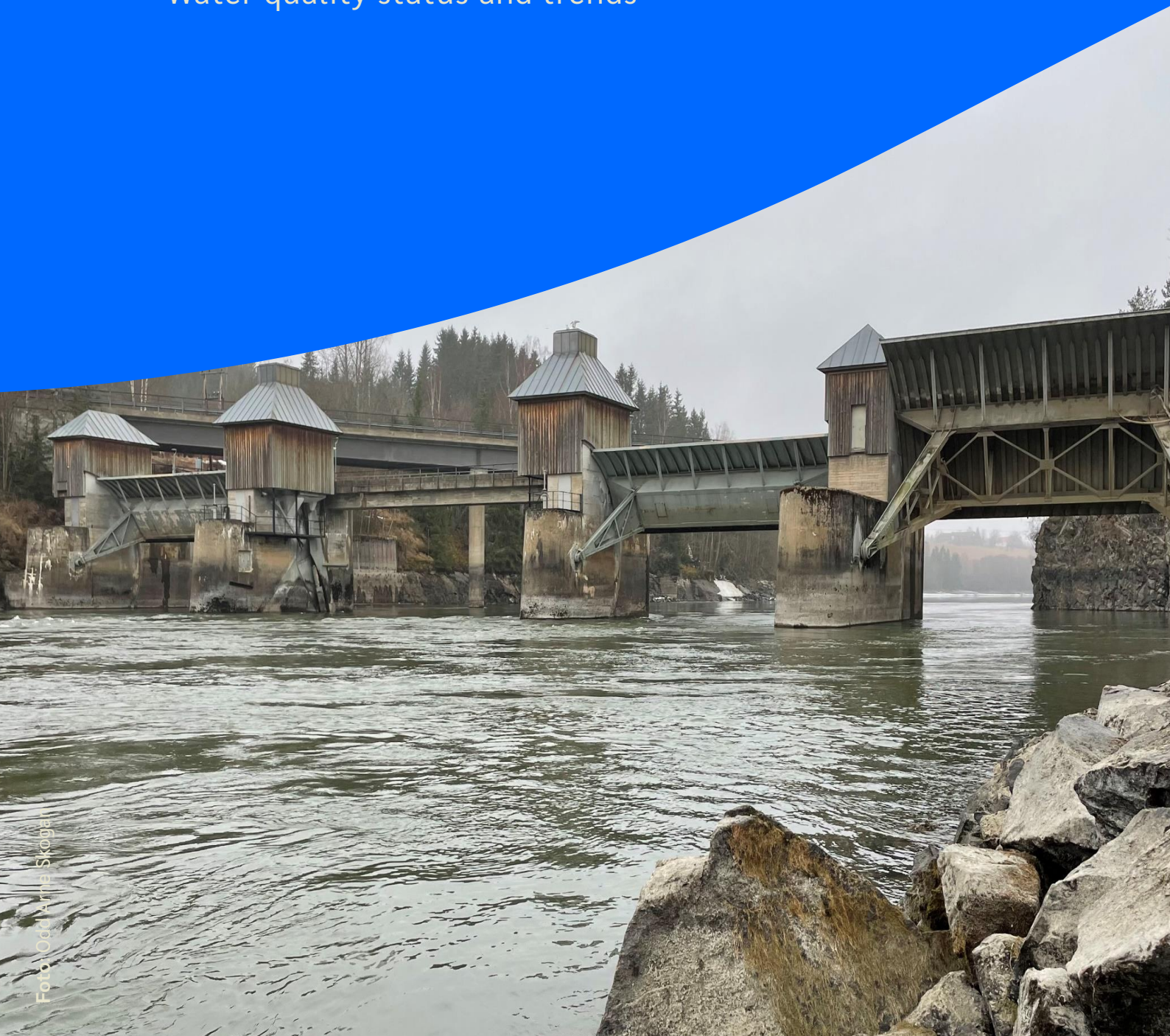
The Norwegian River Monitoring Programme 2023

Water quality status and trends



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Øyvind Kaste
Project Manager/Lead Author

Hans Fredrik Braaten
Research Manager

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Author(s)
Øyvind Kaste, Cathrine Brecke Gundersen, James Sample, Maeve McGovern, Liv Bente Skancke, Ian Allan, Marthe Torunn Solhaug Jenssen, Kine Bæk, Odd Arne Skogan.

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Abstract
Twenty rivers along the Norwegian coast are monitored for physical and chemical parameters as part of the Norwegian River Monitoring Programme. This report presents the current status (2023) and long-term (1990-2023) trends of data on suspended particles, organic matter, nutrients, and metals. Concentrations of EU Water Framework Directive priority substances and river basin-specific pollutants (trace metals and organic pollutants) from five rivers in western and middle Norway are compared with annual average environmental quality standards (AA-EQS). The report also presents light absorbance indices for characterisation of dissolved organic matter (DOM) quality in the rivers, and high-frequency measurements of water temperature, pH, conductivity, turbidity and fluorescent DOM (FDOM) at five river stations.

Keywords: Rivers, monitoring, water quality, trends
Emneord: Elver, overvåking, vannkvalitet, trender

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Preface

The Norwegian River Monitoring Programme is a main component of the Norwegian water authorities' surveillance monitoring in rivers, according to the requirements set by the EU Water Framework Directive (WFD). The monitoring also fulfils Norway's obligations under the Oslo-Paris Convention (OSPAR). This report includes results from the basic monitoring of 20 rivers across Norway in 2023. The 20 rivers are selected to represent the variability in river water quality along the Norwegian coast.

The work presented in this report is a collaboration between NIVA, the Norwegian Water Resources and Energy Directorate (NVE), Norwegian Institute of Bioeconomy Research (NIBIO), Eurofins Environment Testing Norway AS, and ALS Laboratory Group Norway AS.

Co-authors and/or contributors to the report include Cathrine Brecke Gundersen (climate status, water quality status, quality of dissolved organic matter), Maeve McGovern (quality of dissolved organic matter, compilation and presentation of sensor data), James Sample (databases, calculation of riverine loads, trends in water temperature, water discharge and water chemistry), Benno Dillinger (climate data, trends in air temperature and precipitation), Ian Allan (assessment of environmental pollutants), Marthe Torunn Solhaug Jenssen (sampling of environmental pollutants), Kine Bæk (chemical analysis of environmental pollutants), Liv Bente Skancke (coordination of local field work personnel, quality assurance of sampling and chemical analyses), Jarle Håvardstun (sensor monitoring in Storelva), Odd Arne Skogan (sensor monitoring in Vorma, Leira, Glomma, and Målselva), Marianne Stave Sekkenes (compilation and presentation of water temperature data) and Elisabeth Lie and Marit Villø (contact persons at the NIVA chemical laboratory). Quality assurance of the report has been carried out by Hans Fredrik Veiteberg Braaten.

At NVE, Trine Fjeldstad has been responsible for the local sampling personnel and Morten N. Due has been the administrative contact.

Contact persons at The Norwegian Environment Agency have been Gunn Lise Haugestøl and Pål Inge Synsfjell. Thanks to all involved for a good collaboration.

Grimstad, September 2023

Summary

The Norwegian River Monitoring Programme includes analysis of various chemical, physical, and hydrological parameters in 20 rivers along the Norwegian coast. Some of the time series extend back to 1990.

For Norway, the 2023 average air temperature and precipitation were both close to the 1991-2020 normal, but with several large regional and seasonal differences. The average annual precipitation was in large regions in the south-east and inner west impacted by the extreme weather "Hans". Within these regions 2023 was classified as *very wet* or *extremely wet*. Data from the 20 meteorological stations located near the monitored rivers showed a statistically significant increase in air temperatures from 1980 to 2023. Seven of 20 stations showed a significantly increasing trend in annual precipitation over the same time period. Regarding water temperatures, 7 of 13 rivers showed a significant increasing trend. Among the rivers with long-term data, Glomma and Drammenselva showed significantly increasing trends in water discharge from 1990 to 2023.

Glomma and Drammenselva were most affected by the extreme weather event "Hans" that occurred in August 2023. The floods following Hans gave elevated concentrations and loads of suspended particulate matter (SPM), total organic carbon (TOC), total phosphorus (Tot-P), total nitrogen (Tot-N), silica (Si), and many metals. Because of this, many of the substances measured in Glomma and Drammenselva in 2023 had annual mean concentrations that exceeded the preceding five-year mean (2018-2022). As in previous years, Alna and Orreelva stood out with high concentrations of Tot-P, Tot-N and metals. Orkla river still has high concentrations of certain metals such as cadmium (Cd), Zinc (Zn) and copper (Cu), from historic mining industry in the catchment. Nickel (Ni) concentrations in the Pasvik river continued to decrease in 2023, following the shutdown of the nearby metal smelter in Nikel, Russia, in December 2020. Still, the Ni concentrations in Pasvikelva remain higher that any of the other rivers in the programme.

Organic environmental pollutants were analysed in Vosso, Nausta, Driva, Orkla, and Nidelva in 2023. None of the rivers had annual mean concentrations of priority metals (Cd, Hg, Ni or Pb) that were above the annual average environmental quality standards (AA-EQS) of the Water Framework Directive. Vosso exceeded the AA-EQS for medium chained chlorinated paraffins (MCCP). Besides that, none of the rivers had annual concentrations of other priority substances that were above the AA-EQS.

Drammenselva showed significant increasing long-term (1990-2023) trends in loads of SPM, TOC, Si, Tot-P, Tot-N, phosphate (PO_4), and nitrate (NO_3). Also, Glomma, Numedalslågen and Orreelva showed increasing trends in loads of many of the same substances. Vefsna stands out with decreasing trends in loads of numerous substances such as SPM, Tot-P, PO_4, Tot-N, NO_3, and ammonium (NH_4).

In line with previous years, the monitored rivers show a gradient in DOM quality indices in relation to catchment characteristics such as forest cover, anthropogenic influences, etc. Unexpectedly, the "Hans" event did not affect the specific UV absorbance index (sUVa) in Glomma and Drammenselva.

The monitoring programme currently includes five sensor stations with continuous monitoring of water temperature, pH, conductivity, turbidity (particle concentration) and fluorescent dissolved organic matter (FDOM); three in the Glomma catchment, one in Storelva, and one in Målselva. Such stations are essential for capturing short-term effects from e.g., extreme weather events like "Hans". The "Hans" event in August caused distinct turbidity peaks at all the three stations in Glomma but, somewhat surprisingly, the maximum levels were not higher than turbidity peaks recorded at other times of 2023.

Sammendrag

Elveovervåkingsprogrammet omfatter månedlig overvåking av ulike kjemiske, fysiske, og hydrologiske parametere i 20 elver langs norskekysten. Noen av tidsseriene strekker seg tilbake til 1990.

For Norge som helhet var gjennomsnittlig lufttemperatur og nedbør i 2023 nær normalen for perioden 1991-2020, men med store regionale og sesongmessige forskjeller. I store områder på Østlandet og indre deler av Vestlandet var gjennomsnittlig årsnedbør påvirket av ekstremværet «Hans». Innenfor disse regionene ble 2023 klassifisert som *svært våt* eller *ekstremt våt*. Data innsamlet fra de 20 meteorologiske stasjonene lokalisert i nærheten av overvåkingselvene viste en statistisk signifikant økning i lufttemperaturer fra 1980 til 2023. Ved 7 av 20 stasjoner viste data en signifikant økende trend i årlig nedbør i det samme tidsrommet. Når det gjelder vanntemperatur, viste data fra 7 av 13 elver med tilstrekkelig lange tidsserier en signifikant økende trend. Blant elvene med langtidsdata viser data fra Glomma og Drammenselva signifikant økende trender i vannføring fra 1990 til 2023.

Glomma og Drammenselva ble mest berørt av ekstremværet «Hans» som inntraff i august 2023. Flommene etter «Hans» ga forhøyede konsentrasjoner og transport av suspendert partikulært materiale (SPM), totalt organisk karbon (TOC), total fosfor (Tot-P), total nitrogen (Tot-N), silikat (Si) og mange metaller. I Glomma og Drammenselva førte dette til at årsmiddelkonsentrasjonene for mange av stoffene i 2023 oversteg gjennomsnittet for de siste fem årene (2018-2022). Som i tidligere år skilte Alna og Orreelva seg ut med høye konsentrasjoner av Tot-P, Tot-N og metaller. Orkla har fortsatt høye konsentrasjoner av metaller som kadmium (Cd), sink (Zn) og kobber (Cu), fra tidligere gruveindustri i nedbørfeltet. Konsentrasjonen av nikkel (Ni) i Pasvikelva fortsatte å synke i 2023, etter nedstengningen av nikkelsmelteverket på russisk side av grensen i desember 2020. Likevel er Ni-konsentrasjonene i Pasvikelva fortsatt høyere enn for noen av de andre elvene i programmet.

Organiske miljøgifter ble analysert i Vosso, Nausta, Driva, Orkla og Nidelva i 2023. Ingen av elvene hadde årlige middelkonsentrasjoner av prioriterte metaller (Cd, Hg, Ni eller Pb) som lå over grenseverdiene for årlige gjennomsnitt (AA-EQS) i Vanndirektivet. Vosso overskred AA-EQS for mellomkjedete klorparafiner (MCCP). Utover det hadde ingen av elvene årlige konsentrasjoner av andre prioriterte stoffer som var over AA-EQS.

Drammenselva viste signifikant økende langtidstrend (1990-2023) i transport av SPM, TOC, Si, Tot-P, Tot-N, fosfat (PO_4) og nitrat (NO_3). Også Glomma, Numedalslågen og Orreelva viste økende trender i transport av mange av de samme stoffene. Vefsna skiller seg ut med avtakende trender i transport av en rekke stoffer som SPM, Tot-P, PO_4, Tot-N, NO_3 og ammonium (NH_4).

På linje med tidligere år, viser de overvåkede elvene en gradient i DOM-kvalitetsindekser basert på nedbørfeltegenskaper som skogdekningsgrad, antropogene kilder, etc. Noe uventet påvirket ikke ekstremværet «Hans» den spesifikke UV-absorbans-indeksen (sUVa) i Glomma og Drammenselva.

Elveovervåkingsprogrammet omfatter i dag fem sensorstasjoner med kontinuerlig overvåking av vanntemperatur, pH, ledningsevne, turbiditet (partikkelkonsentrasjon) og fluorescerende løst organisk materiale (FDOM); tre i Glommas nedbørfelt, én i Storelva og én i Målselva. Slike stasjoner er svært nyttige for å fange opp kortvarige effekter av for eksempel ekstreme værhendelser som «Hans». Ekstremværet som rammet østlandsområdet i august forårsaket tydelige topper i turbiditet på alle de tre stasjonene i Glomma, men noe overraskende så var ikke maks-nivåene høyere enn turbiditetstopper som ble registrert til andre tider i 2023.

1 Introduction

The Norwegian River Monitoring Programme (Elveovervåkingsprogrammet) was established in 2017, replacing the former RID programme (Riverine inputs and direct discharges to Norwegian coastal waters) that had been running since 1990. The programme includes monitoring of 20 rivers (Table 1, Figure 1) for various physical, chemical, and hydrological parameters.

The 20 monitored rivers were all part of the RID programme, but the monitoring frequency has changed: minimum monthly since 1990 for 11 of the rivers (with two exceptions where monitoring started later); quarterly since 1990 for 8 of the rivers; and annually from 1990 to 2003 for one river (Stålnacke et al. 2009). For more information on the differences between the current and the past programme, see Kaste et al. (2018).

1.1 Objectives

The Norwegian River Monitoring Programme is the basis for fulfilment of Norway's obligations under the Oslo-Paris Convention (OSPAR) and is also a main component of the Norwegian water authorities' surveillance monitoring in rivers, according to the requirements set by the EU Water Framework Directive (WFD).

The main objectives of the river monitoring programme, formulated by the Norwegian Environment Agency, are to:

1. Document status and long-term trends for nutrient and contaminant concentrations and loads in Norwegian rivers.
2. Obtain data for classification of Norwegian rivers according to the requirements of the WFD.
3. Reveal water quality changes that can be attributed to climate change or other human influences.
4. Increase the knowledge base on climate processes affecting water.
5. Increase current knowledge related to the fates of emerging contaminants in aquatic ecosystems.
6. Provide data that may explain changes in eutrophication and contaminant levels along the Norwegian coast.
7. Estimate riverine inputs and direct discharges of nutrients and contaminants to Norwegian coastal waters (for reporting under the OSPAR Convention).

This report mainly addresses objectives 1, 3, 4, 5 and 6. Objective 2 is addressed by the biological part of the program (Kile et al. 2024), whereas objective 7 is addressed by a separate report which is delivered to OSPAR each autumn.

2 Materials and methods

2.1 Study rivers

The 20 rivers sampled within this monitoring programme discharge to the Skagerrak Sea, the North Sea, the Norwegian Sea and the Barents Sea (Table 1). The rivers are selected based on geographical location (Table 1, Figure 1), availability of historical data, and relevance in relation to pollution pressures and land-use (Figure 2).

The rivers Alna, Storelva, Bjerkreimselva, Orreelva, Vikedalselva, Vosso, Nausta, Målselva and Tana were during 1973-2005 included in the Norwegian Protection Plan for River Systems, in order to prevent reduction of their conservation value through hydropower developments.

Table 1. Rivers included in the programme.

River name	UTM (east)	UTM (north)	UTM zone	Catchment (km^2)	Waterbody ID	Drainage basin
Glomma*	621600	6573156	32	41918	002-1519-R	Skagerrak
Alna*	600213	6642144	32	69	006-71-R	Skagerrak
Drammenselva*	556636	6624287	32	17034	012-2399-R	Skagerrak
Numedalslågen*	561346	6551822	32	5577	015-33-R	Skagerrak
Skienselva*	534726	6562938	32	10772	016-769-R	Skagerrak
Storelva**	498897	6503307	32	408	018-127-R	Skagerrak
Otra*	438737	6449755	32	3738	021-28-R	Skagerrak
Bjerkreimselva	325246	6487028	32	705	027-92-R	North Sea
Orreelva*	299152	6515475	32	105	028-16-R	North Sea
Vikedalselva	325319	6599745	32	118	038-11-R	North Sea
Vosso*	336048	6727293	32	1492	062-219-R	North Sea
Nausta	327402	6826450	32	277	084-218-R	North Sea
Driva	477383	6948637	32	2487	109-54-R	Norwegian Sea
Orkla*	237185	7018935	33	3053	121-56-R	Norwegian Sea
Nidelva	569352	7030201	32	3110	123-29-R	Norwegian Sea
Vefsna*	418710	7292351	33	4122	151-36-R	Norwegian Sea
Målselva	406570	7660047	34	3239	196-275-R	Barents Sea
Altaelva*	586586	7759686	34	7373	212-63-R	Barents Sea
Tana	543964	7791926	35	16389	234-124-R	Barents Sea
Pasvikelva	386937	7709634	36	18404	246-139-R	Barents Sea

* "Main rivers" in the previous RID programme, monthly monitoring since 1990 (except Rivers Vosso and Alna, monthly from 2008 and 2013, respectively)

** Also denoted "Vegårdselva" in the RID database

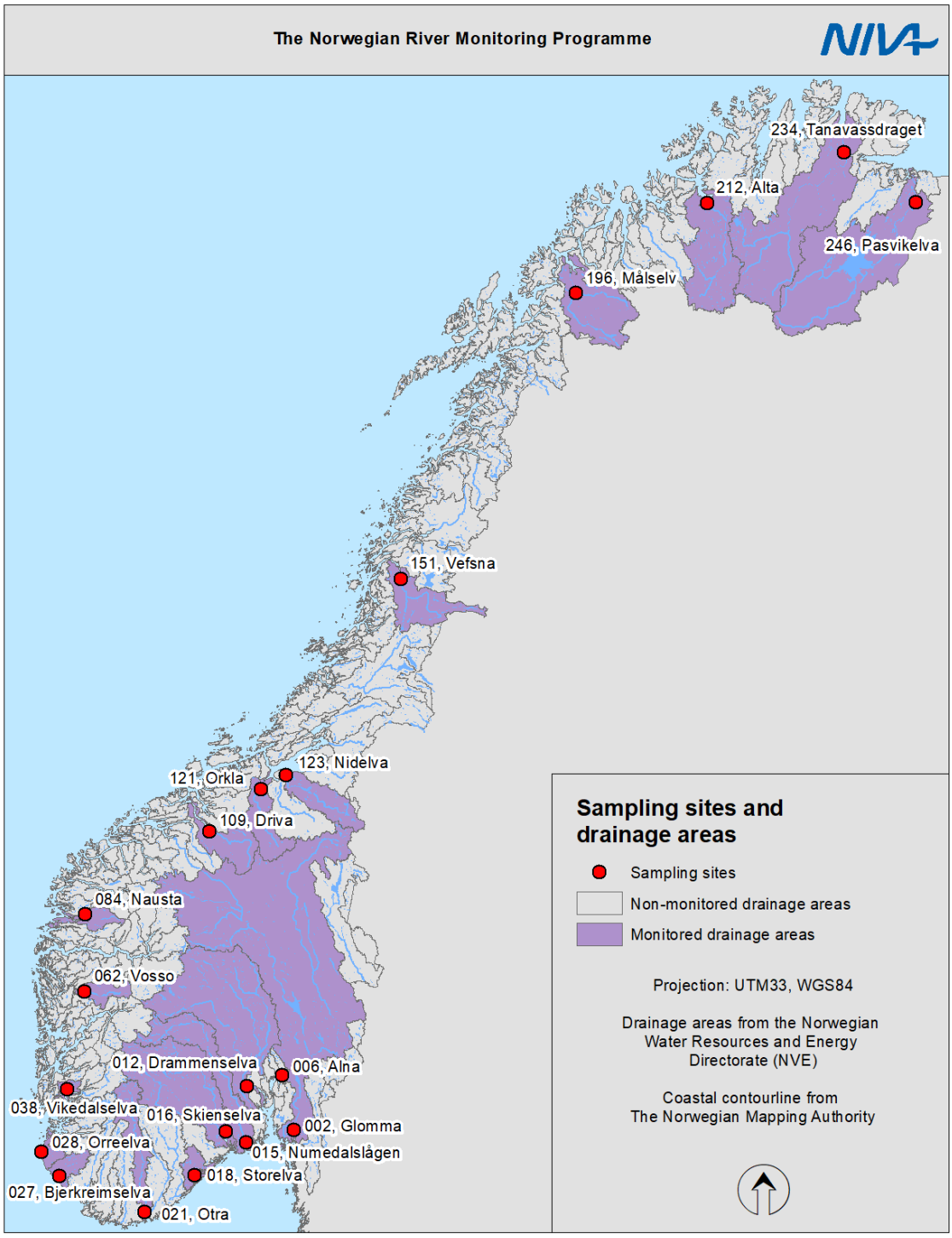

Figure 1. Map showing the location of the rivers in the Norwegian river monitoring programme, including drainage areas (purple) and the sampling sites (red dots).

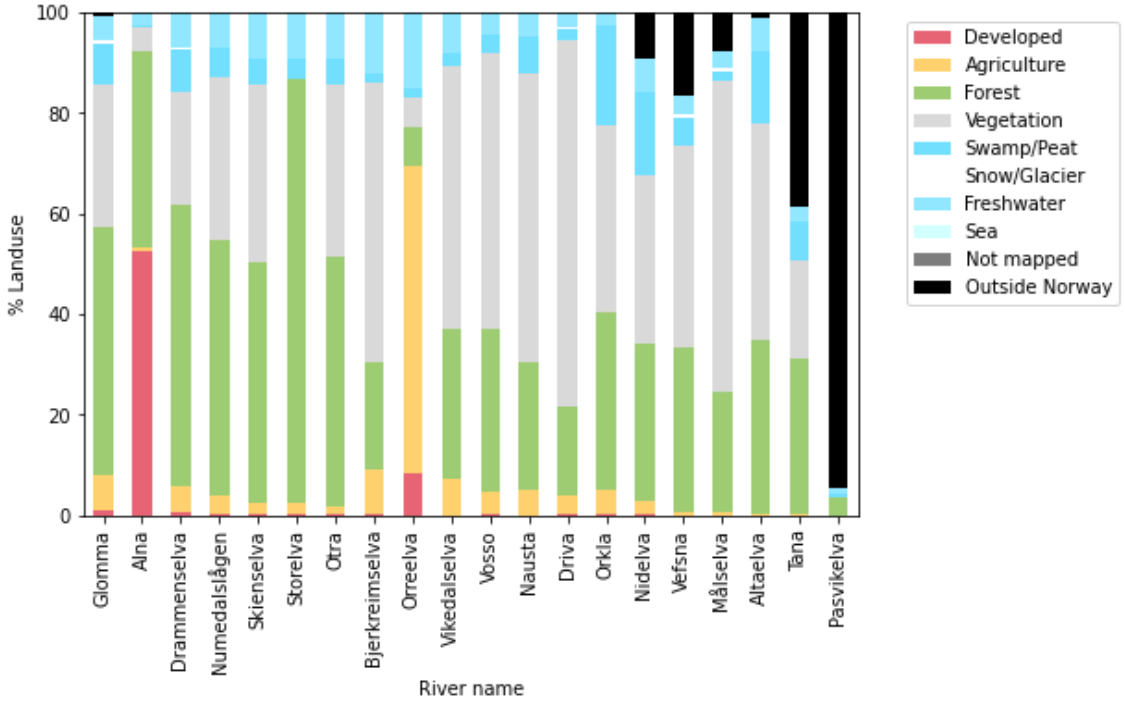

Figure 2. Land use for the 20 rivers included in the monitoring programme. Source: nevina.nve.no.

2.2 Methods

See Appendix A

3 Results and discussion

3.1 Climate: status and trends

3.1.1. Air temperature and precipitation in 2023

The national 2023 average air temperature and precipitation were both close to the 1991-2020 normal, but with several large regional and seasonal differences, as presented by the Norwegian Meteorological Institute (Gangstø et al. 2024). The average air temperature was -0.1 °C colder than normal and the average precipitation was +5% higher than normal. The highest maximum temperature was measured at 33.9 °C (Flå, Viken[1] in June) and with the lowest minimum temperature at -38.2 °C (Kautokeino, Troms og Finnmark in January). The highest 24-hour precipitation was at 221.9 mm (Vågan, Nordland in February). The year 2023 was the 37th warmest and the 13th wettest year on record since 1900.

Regional variation in air temperature and precipitation is described by categories that are based on the statistical normal condition for the specific location (statistical percentiles). In this way, differences in the local "normal" will be considered, such as expected differences between coast and inland. For details on this, see Gangstø et al. (2024). Regarding air temperature, 2023 was *warm* in parts of Finnmark, *cold* in large parts of Nordland, Trøndelag and Innlandet, and *normal* throughout the rest of the country (Figure 3, left side). The average annual precipitation (Figure 3, right side) was in large regions in the south-east and inner west impacted by the extreme weather "Hans". Within these regions 2023 was classified as *very wet* or *extremely wet*. For the remaining south, precipitation was classified as *normal*. In the north, regions in Nordland were *dry* or *very dry*, whereas the inner parts of Finnmark were *wet* or *very wet*.

The **winter** season (Dec 2022 – Feb 2023) was slightly warmer (+0.3 °C) and wetter (+10%) than normal, for the country. Relatively warmest were regions in the north, with Nordland, Troms and Finnmark classified as *warm*. One region in the south-east was *cold,* while the remaining country had *normal* winter temperatures. While most of the country had precipitation within the *normal*, regions in the south-east and in the north were classified as *wet* and *very wet*.

For the country, the **spring** average air temperature was slightly colder (-0.8 °C) and with 5% more precipitation than normal. Nearly the entire country was *cold* or *very cold*. One exception was the northernmost region, Finnmark, which had *normal* air temperatures. The spring season was *very wet* or *extremely wet* in the south-east regions due to large rainfalls in March and April.

The **summer** season was, for the country, both warmer (+ 1.1 °C) and wetter (+10%) than normal. Warm temperatures were especially prevalent in the northern regions, with large parts of Troms and Finnmark being *extremely warm*, and Nordland being *very warm* or *warm*. In southern parts of Norway, the summer was mainly *warm*. Regarding precipitation, the northern regions were classified as *extremely dry*, *dry* or *normal*. In contrast, the regions in the south were *very wet* or *extremely wet*. The remaining regions had mainly *normal* precipitation.

For the country, the **autumn** was 1.1 °C colder than normal and with 5% less precipitation than normal. Trøndelag and Nordland were categorised as *very cold* or *extremely cold*, whereas the rest of the country was *cold* or *normal cold*. The 2023 autumn ranged from *very wet* in Trøndelag and Møre and Romsdal, to *very dry* in Troms and Innlandet.

[1] *Location of the 11 counties in Norway are displayed in Figure 4*

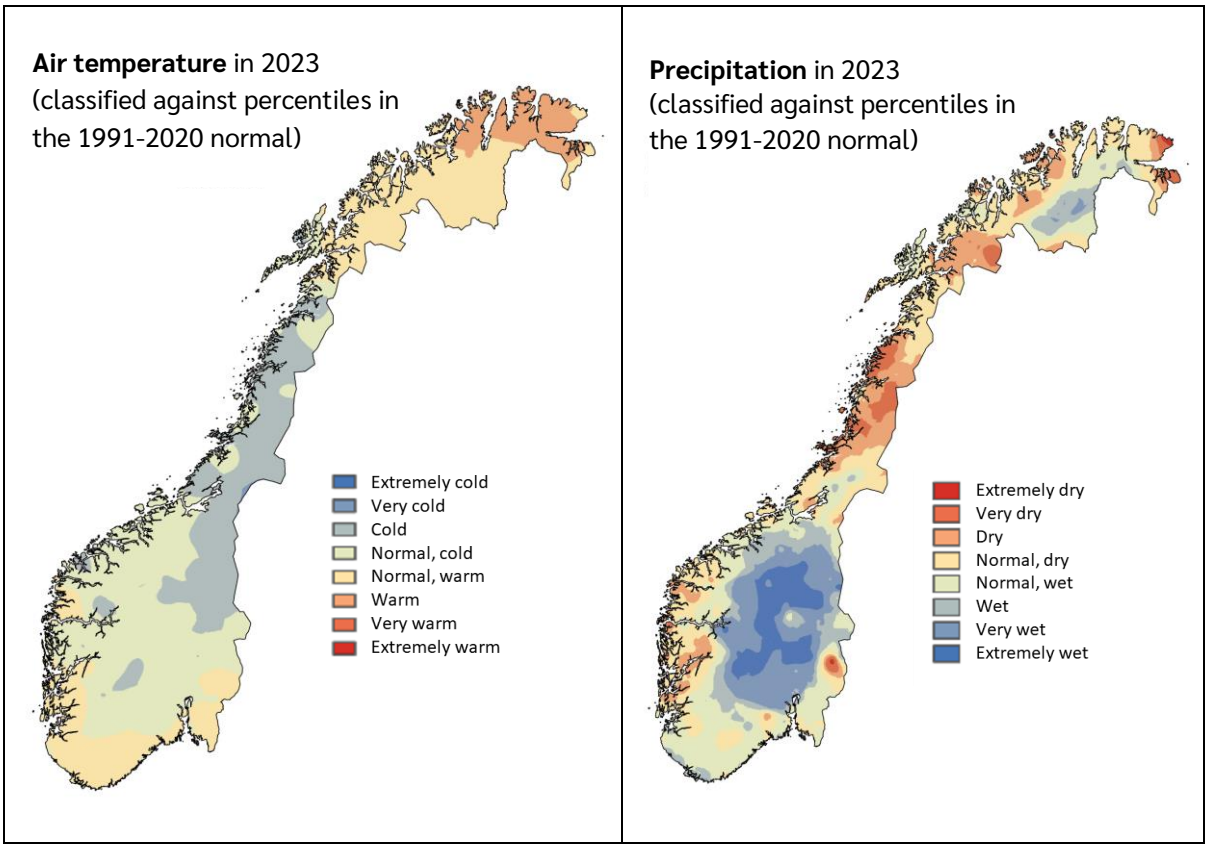

Figure 3. Air temperature (°C) and precipitation (mm) in Norway in 2023 categorised against percentiles from the distribution of normal values (1991-2020) at the location. Extremely indicates observations outside the range of observations from the normal period; very indicates the 10-percentile; cold/warm/dry/wet: between 10- and 25-percentiles; and normal within the 25- and 75-percentiles. Maps are from (Gangstø et al. 2024).

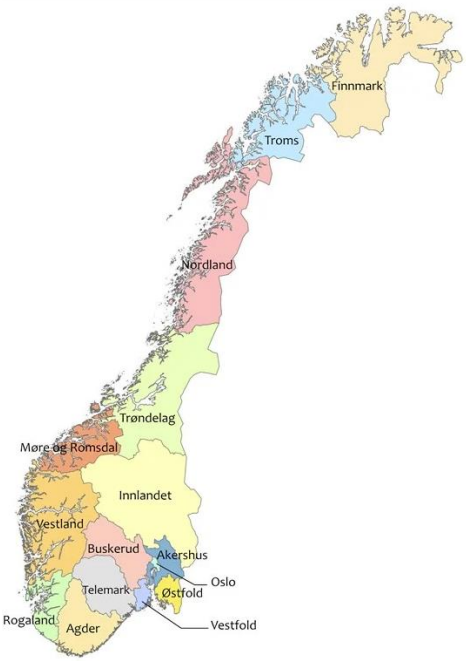

Figure 4. Map showing the location of the 15 counties in Norway. Source: no.wikipedia.org.

3.1.2. Trends in air temperature and precipitation 1980-2023

Table 2 shows trends in air temperature and precipitation since 1980 at meteorological stations located in the near vicinity of the river monitoring sites. P-values and trends were calculated using a seasonal Mann-Kendall test based on monthly data (see Appendix A, chapter 5.6).

The results show a significant increase in air temperature at all stations. For precipitation, seven stations showed a significantly increasing trend: Two in south-eastern Norway, three in western Norway and two in northern Norway.

Table 2. Climate trends 1980-2023 (some stations cover a shorter period). Statistically significant trends ($p < 0.05$) are marked in red. Change is calculated on a decadal basis (change over 10 years) using Sen slope (cf. Appendix A, chapter 5.6). Based on data from the Norwegian Meteorological Institute.

	Air temperature				Annual precipitation			
River name	Station number	Years	Trend (p-value)	Change (°C/10 yr)	Station number	Years	Trend (p-value)	Change (mm/10 yr)
Glomma	SN700	1980-2023	0.0001	0.3	SN3780	1980-2023	0.063	2.3
Alna	SN18700	1980-2023	<0.0001	0.4	SN18700	1980-2023	0.036	2.6
Drammenselva	SN19710	1983-2023	<0.0001	0.3	SN19710	1983-2023	0.140	2.7
Numedalslågen	SN27470	1980-2023	0.0022	0.3	SN30000	1980-2023	0.460	1.2
Skienselva	SN27470	1980-2023	0.0022	0.3	SN30260	1980-2016	0.830	0.6
Storelva	SN36560	1980-2023	<0.0001	0.3	SN36560	1980-2023	0.011	5.1
Otra	SN39040	1980-2023	<0.0001	0.3	SN39040	1980-2023	0.350	2.1
Bjerkreimselva	SN44560	1980-2023	<0.0001	0.4	SN43360	1980-2018	0.150	4.4
Orreelva	SN44560	1980-2023	<0.0001	0.4	SN44080	1980-2023	0.970	0.0
Vikedalselva	SN46910	1980-2012	<0.0001	0.5	SN46850	1980-2023	0.004	12.2
Vosso	SN52290	1980-2008	0.0056	0.3	SN51250	1980-2023	0.024	9.7
Nausta	SN58070	1980-2023	0.0002	0.2	SN57480	1980-2023	0.049	7.0
Driva	SN64550	1980-2008	0.0005	0.4	SN63530	1980-2023	0.440	0.9
Orkla	SN69100	1980-2023	0.0001	0.3	SN66210	1980-2010	0.590	1.5
Nidelva	SN69100	1980-2023	0.0001	0.3	SN68270	1980-2023	0.053	3.4
Vefsna	SN85380	1980-2023	<0.0001	0.4	SN78850	1980-2008	0.500	3.1
Målselva	SN89350	1980-2023	0.0004	0.3	SN89350	1980-2023	0.150	1.3
Altaelva	SN93140	1980-2023	<0.0001	0.3	SN93140	1980-2023	0.001	2.5
Tana	SN96800	1980-2013	<0.0001	0.5	SN96970	1980-2019	0.980	0.0
Pasvikelva	SN99370	1980-2023	<0.0001	0.5	SN99500	1980-2023	0.014	1.4

Red – significantly upward $p<0.05$. There were no significantly decreasing trends.

3.1.3. Water temperature – status 2023 and trends

Monthly water temperatures in the monitored rivers are showed in Table 3. As expected, water temperatures show a strong seasonal pattern (Figure 5) which gradually changes when moving from the south towards the north in Norway.

The stations included in the trend analysis are given in Table 4 and with details on the time series in Appendix A, chapter 5.2. Note that seven of the rivers are not included in the trend analysis due to incomplete long-term data, or long distance to the nearest temperature station with appropriate data. According to the trend analysis, 7 of 13 rivers showed a significant increase in water temperatures. This was one less than in the previous analysis that applied data until 2022 (Kaste et al. 2023).

Table 3. Monthly water temperature measured in the monitored rivers in 2023. Sources for water temperature data are documented in Appendix A, Chapter 5.2.

River name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Glomma	0.4	0.0	0.1	3.0	8.6	15.1	17.7	16.5	15.4	11.0	5.5	0.1
Alna	2.5	2.0	1.5	4.3	6.3	12.0	14.0	14.6	13.3	11.9	6.4	0.1
Drammenselva	0.7	0.7	-	2.3	7.1	14.7	18.1	18.2	16.2	12.6	5.5	0.1
Numedalslågen	0.9	0.8	0.8	2.7	7.3	16.1	16.9	15.5	13.9	7.5	1.9	0.0
Skienselva	4.5	3.1	3.0	3.7	5.6	12.3	-	-	16.7	13.3	8.5	5.7
Storelva	1.1	1.1	1.4	3.6	12.0	19.6	19.0	18.2	16.3	9.6	2.7	0.5
Otra	1.3	1.3	1.2	3.8	7.9	15.7	17.1	17.2	14.9	9.4	4.0	1.6
Bjerkreimselva	4.1	7.1	-	-	10.5	15.3	17.6	18.7	14.7	9.0	10.2	3.0
Orreelva	3.5	4.6	4.2	8.1	10.5	17.7	17.9	17.1	15.7	8.5	3.8	1.6
Vikedalselva	0.8	1.0	0.3	3.4	6.6	15.0	13.5	13.2	12.1	6.9	2.3	0.0
Vosso	1.5	1.4	1.5	2.7	4.9	9.2	12.3	13.3	12.5	8.3	4.6	1.6
Nausta	0.4	1.3	0.0	2.9	4.6	8.2	13.4	14.8	12.6	9.9	0.1	0.0
Driva	0.5	0.9	0.9	1.6	4.4	5.7	12.3	14.0	12.5	10.2	6.1	0.7
Orkla	0.7	0.6	0.9	2.3	4.4	11.6	12.2	11.4	9.5	5.2	1.7	0.8
Nidelva	1.1	1.8	1.4	2.7	2.8	4.5	12.0	14.9	14.3	11.0	5.1	2.7
Vefsna	0.3	0.3	0.3	1.0	4.2	8.8	14.6	14.7	10.8	4.0	0.3	0.3
Målselva	0.0	0.0	0.0	0.0	1.0	5.5	9.2	14.2	12.6	7.4	0.0	0.0
Altaelva	0.0	0.0	0.0	0.0	1.9	8.4	14.0	15.5	12.5	6.2	1.5	0.2
Tana	0.0	0.0	0.0	0.1	0.5	8.1	14.4	16.6	13.1	1.7	0.0	0.0
Pasvikelva	3.0	3.1	3.1	1.0	0.5	7.1	14.9	18.0	14.0	5.6	3.1	3.1

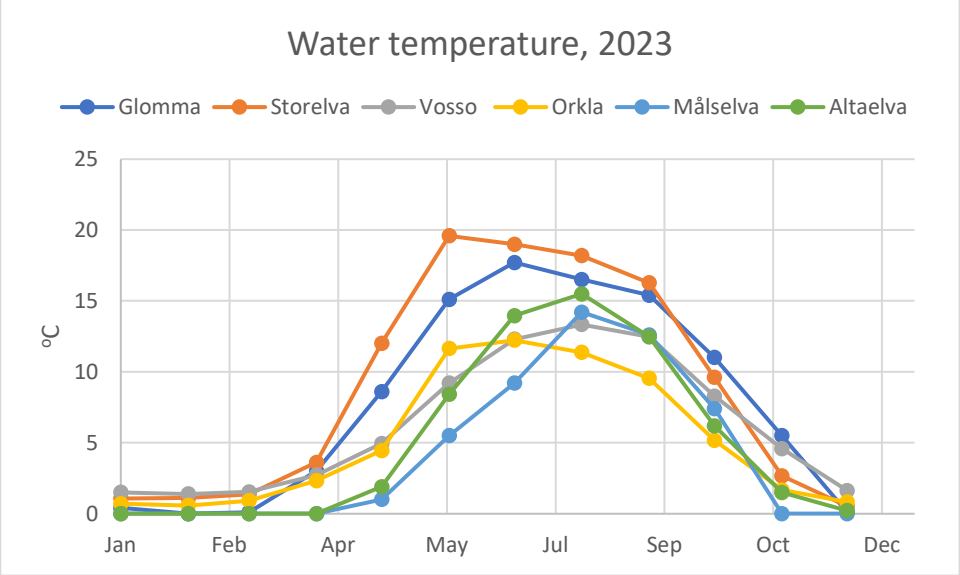

Figure 5. Monthly measured water temperature in rivers representing different regions in Norway. Based on data presented in Table 3.

Table 4. Trends in annual mean water temperature until 2023, in rivers with available long-term data.

River name	Years with data	Annual change*	p-value
Drammenselva	25	0.03	0.002
Numedalslågen	17	0.03	0.266
Skienselva	26	0.03	0.005
Otra	27	0.02	0.012
Bjerkreimselva	33	0.04	0.001
Vikedalselva	34	0.02	0.010
Vosso	23	0.02	0.073
Nausta	19	0.01	0.675
Orkla	26	0.01	0.201
Målselva	17	0.02	0.343
Altaelva	29	0.02	0.001
Tana	19	-0.01	0.780
Pasvikelva	27	0.04	0.002

Red – significantly upward $p<0.05$. There were no significantly decreasing trends.

* Based on Sen slope (cf. Appendix A, chapter 5.6)

3.1.4. Water discharge – status 2023 and trends

Figure 6 illustrates the large gradients in annual runoff from rivers throughout Norway. The area-specific runoff (in mm/yr) increases from east to west in southern Norway and decreases towards the north. Vefsna and Målselva have a slightly higher annual runoff than their "neighboring" rivers due to higher percentage of mountainous areas within the catchments.

Figure 6 shows that especially the rivers in the south-east, but also in south-west had higher annual runoff in 2023 compared to the five-year mean 2018-2022. In western, middle and northern Norway the rivers generally had lower annual runoff compared to the mean of preceding five-years. This coincides largely with the precipitation patterns displayed in Figure 3.

It should also be noted that most of the rivers included in the programme are regulated (listed in Braaten et al. 2020). Storage and subsequent release of water from large reservoirs will affect flow patterns and may explain why water discharge does not always follow the precipitation patterns. Another factor is that precipitation data are collected from local stations and do not cover whole catchments.

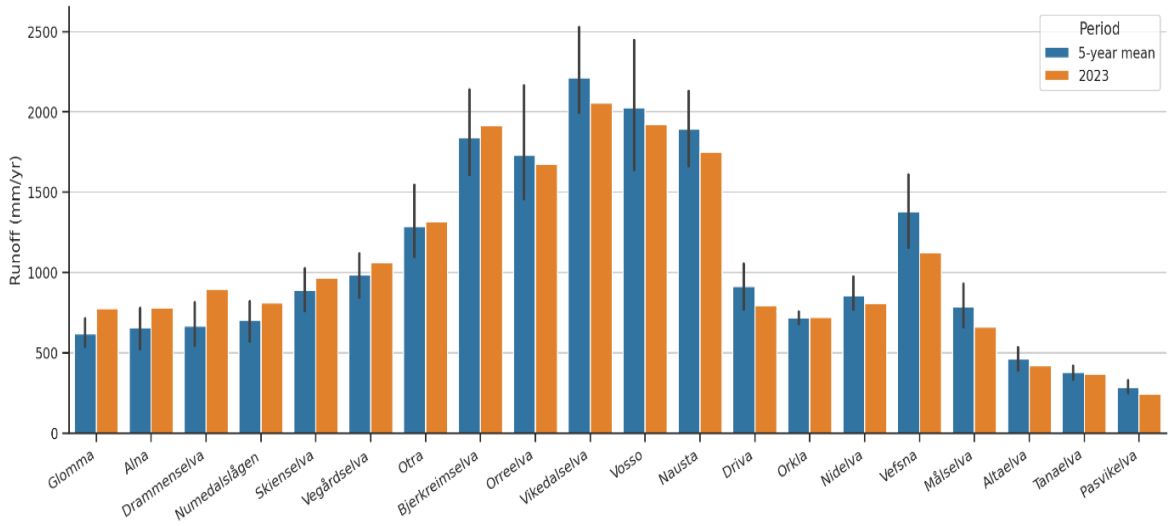

Figure 6. Mean water discharges in 2023, compared with the preceding five-year mean (2018-2022). Error bars indicate standard deviation from the mean.

Long-term trend analysis (1990-2023) of water discharge in rivers with monthly monitoring since 1990 is presented in Table 5. Glomma and Drammenselva show a significant increasing trend over the 34-year period. In a previous analysis based on data until 2020, also Skienselva and Orreelva had significant increasing trends (Kaste et al. 2021). Among the rivers with shorter time series (left panel in Table 5), only Tana shows a significant increasing trend.

Table 5. Trends in annual water discharge. Showing p-values.

River	Long-term 1990-2023	River	Short-term 2004-2023
Glomma	0.019	Bjerkreimselva	0.922
Drammenselva	0.011	Vikedalselva	0.538
Numedalslågen	0.123	Vosso	1.000
Skienselva	0.109	Nausta	0.456
Otra	0.495	Driva	0.538
Orreelva	0.138	Nidelva	0.581
Orkla	0.859	Målselva	0.974
Vefsna	0.657	Tana	0.021
Altaelva	0.116	Pasvikelva	0.381

Red – significantly increasing $p<0.05$. There were no significantly decreasing trends.

3.2 Water quality status 2023

In the following, the 2023 mean is compared with the average of the mean of the preceding five years (2018-2022). Note that the error bar of the 2023 mean represents inter-annual variation (*i.e.,* seasonal variation) while the error bar of the five-year mean illustrates year-to-year variation.

3.2.1. pH and calcium

Levels of both pH and calcium (Ca) in 2023 were very similar to the five-year mean (Figure 7 and Figure 8). The highest levels are typically in the most human-influenced rivers, Alna and Orreelva, followed by the rivers in the middle and northern parts of Norway. The lowest levels were in the southern and western parts of Norway, although several rivers in this region are limed to counteract acidification from deposition of long-range transported air pollution (Norwegian Environment Agency 2023).

3.2.2. Turbidity and suspended particulate matter (SPM)

The lowland rivers, Glomma, Alna, and Orreelva differ from the others by having higher particle content, measured as turbidity (Figure 9) and SPM (Figure 10). Both parameters are typically associated with hydrological events, and often show high inter-annual variability. In 2023, mean values were largely close to the five-year mean, but with a few exceptions. In Drammenselva, the 2023 mean turbidity was higher than the five-year mean due to substantial flow events in April (during snowmelt) and in August (following the extreme weather Hans). In Vefsna, the elevated SPM was caused by a peak (38 mg L^{-1}), which occurred during low-flow in April. The reason for the high SPM at that time is not clear.

3.2.3. Organic carbon

The highest levels of total organic carbon (TOC) are typically found in the rivers draining catchments dominated by forest (e.g., Glomma, Drammenselva, Numedalslågen) or agriculture (Orreelva), whereas the lowest levels are found in areas with thin and patchy soils (e.g., Vikedalselva, Vosso, Driva) (Figure 11). The 2023 mean TOC levels were for most rivers close to the mean of the five preceding years. However, for a few rivers (Glomma, Drammenselva, Skienselva, Bjerkreimselva, and Vefsna), the 2023 mean was higher than the natural variation of the five preceding years (error bar in figure). This coincides with the general tendency of increasing TOC levels in surface waters across the northern hemisphere (de Wit et al. 2016). None of the rivers had lower than normal mean TOC.

Organic carbon is, in all rivers, dominated by the dissolved fraction (Figure 12). A relatively higher contribution of particulate organic carbon can be seen in River Orreelva which results from its strong influence by runoff from agriculture.

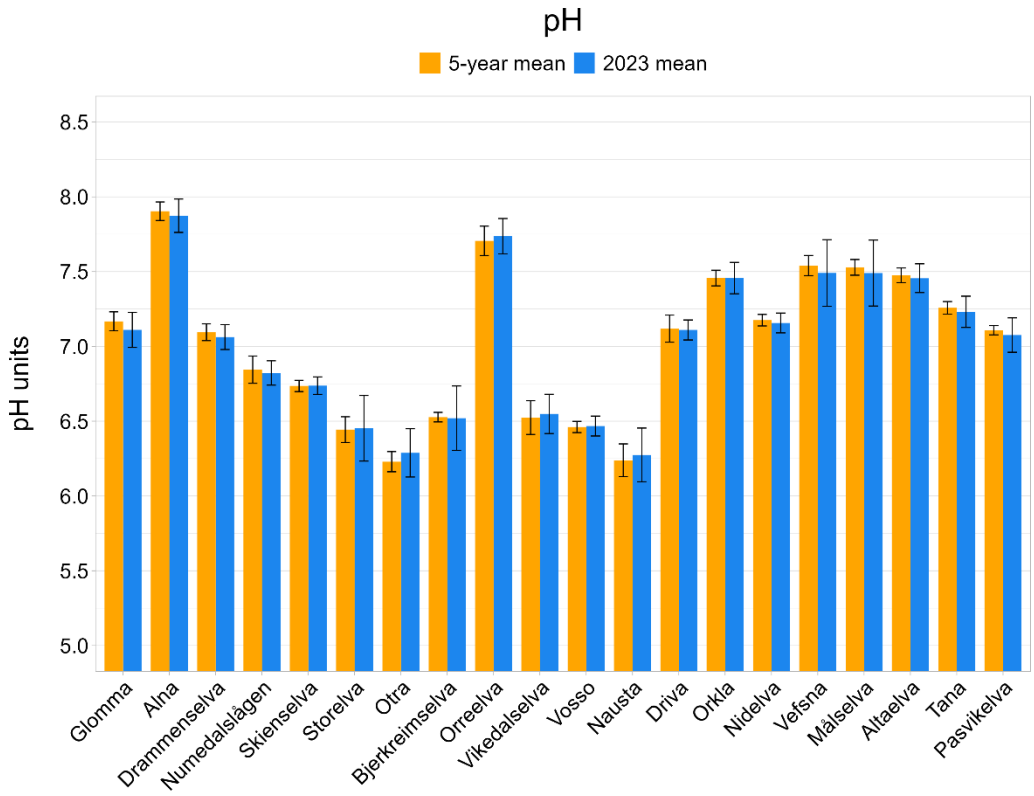

Figure 7. Mean pH values in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

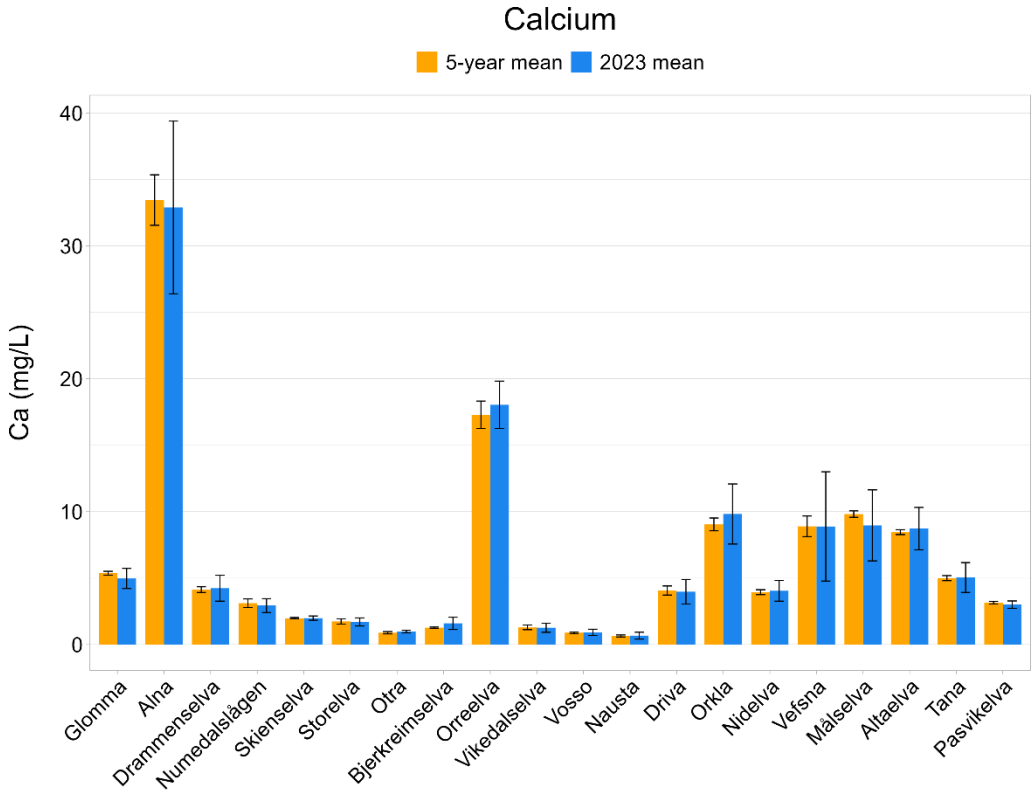

Figure 8. Mean concentrations of calcium in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

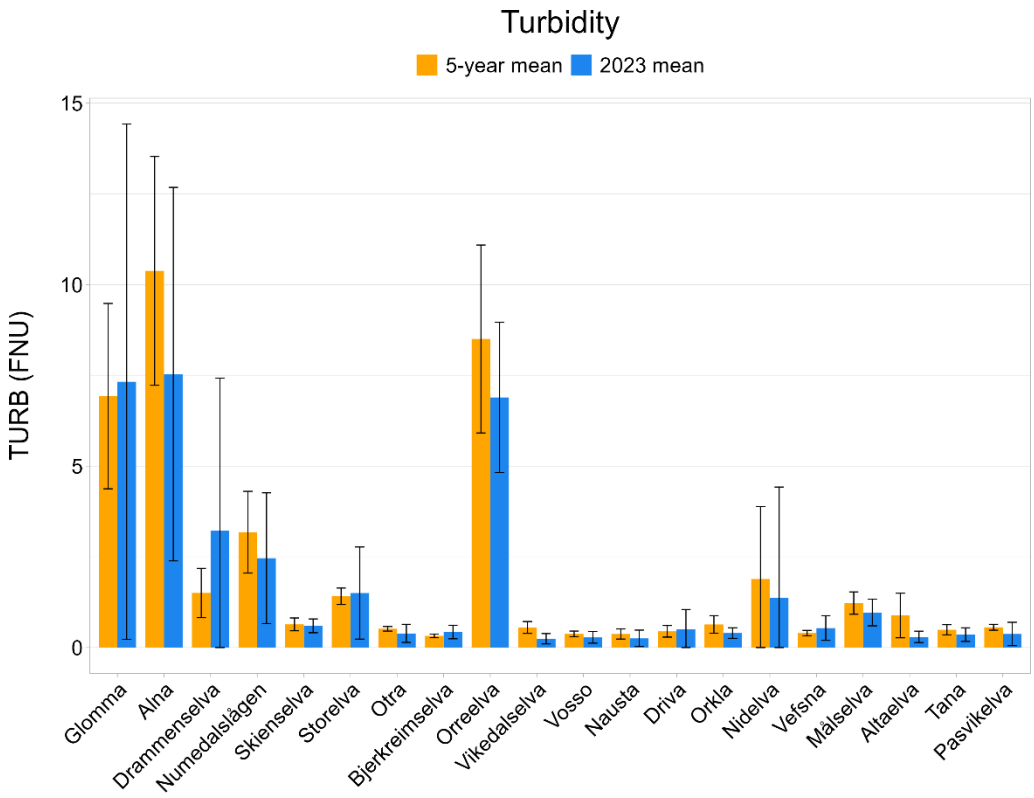

Figure 9. Mean turbidity values in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

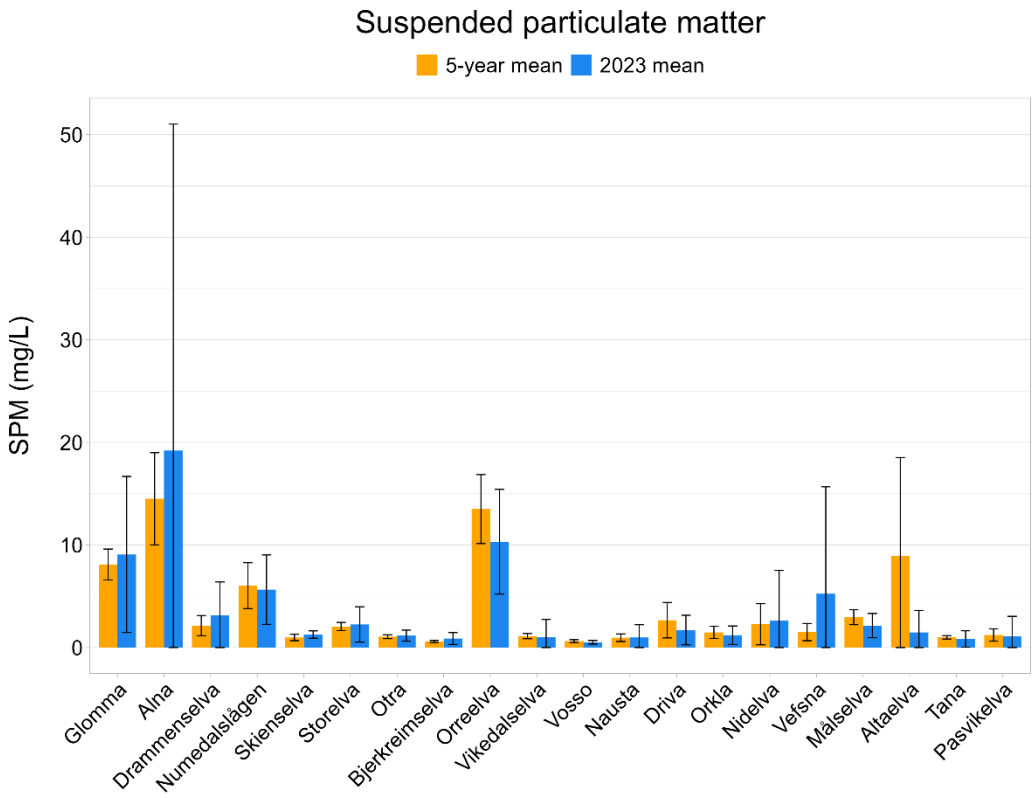

Figure 10. Mean concentrations of suspended particulate matter (SPM) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

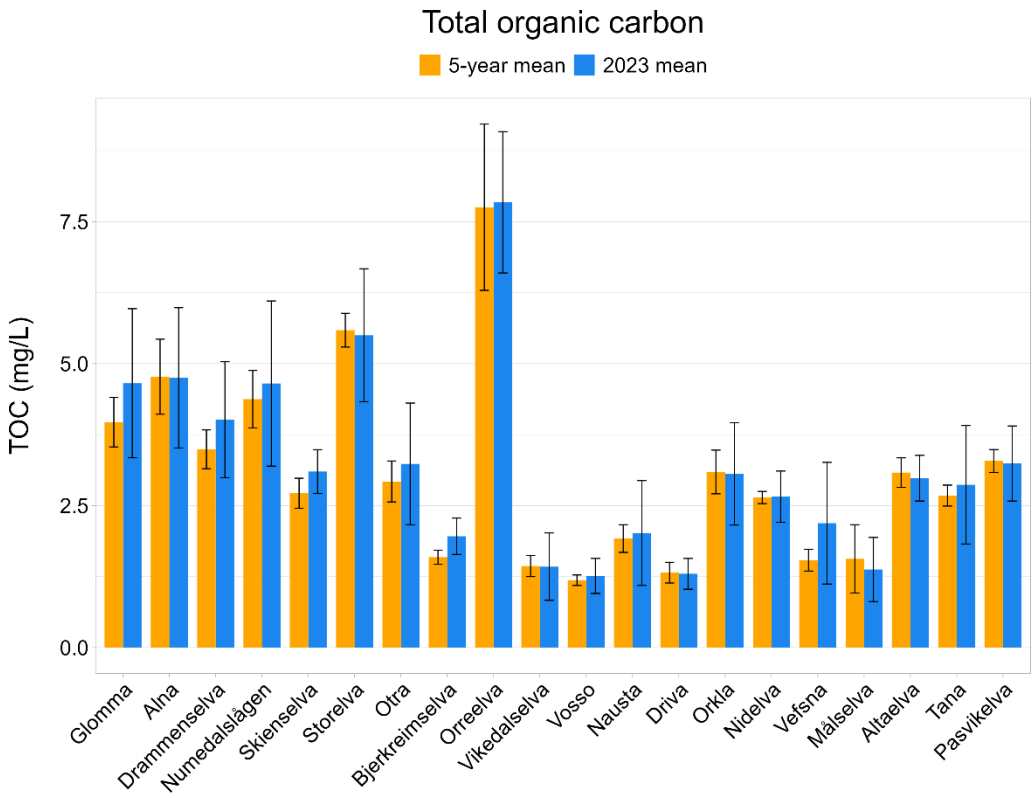

Figure 11. Mean concentrations of total organic carbon (TOC) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

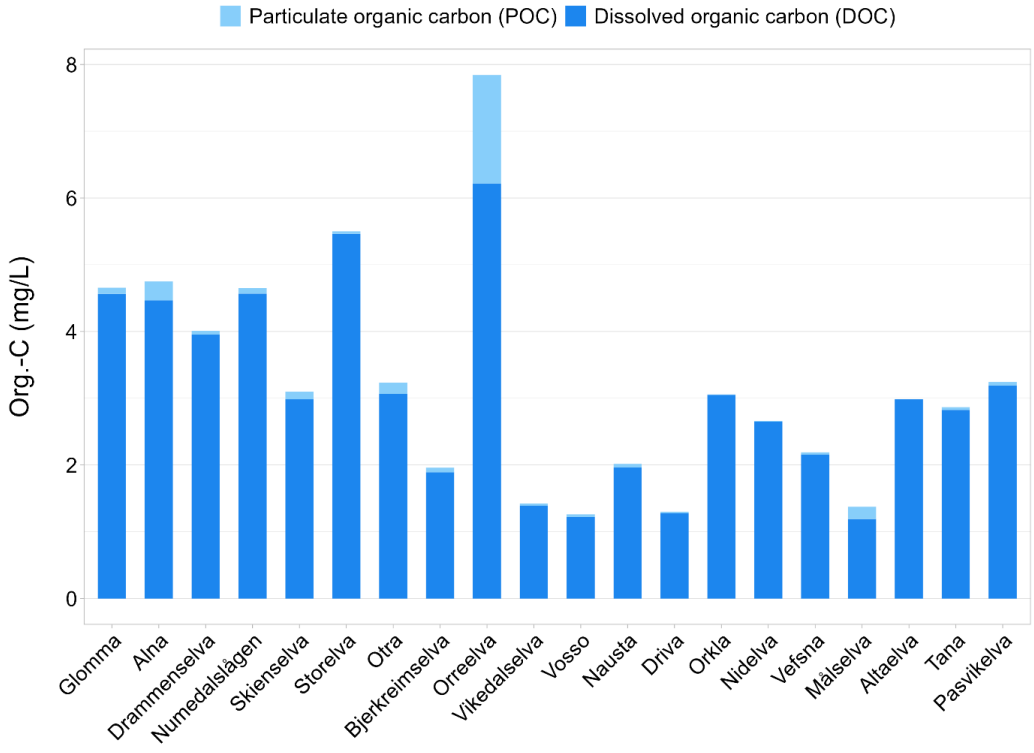

Figure 12. Mean concentrations of particulate organic carbon (POC) and dissolved organic carbon (DOC) in 2023. Any deviation between TOC and DOC + POC is caused by uncertainty in the measurements.

3.2.4. Nutrients

Phosphorus

The highest concentrations of total phosphorus (Tot-P) and phosphate (PO_4) are typically found in Alna and Orreelva, followed by Glomma and Numedalslågen (Figure 13 and Figure 14). The 2023 mean concentrations were for most rivers relatively like their five-year mean. Exceptions included rivers Glomma, Drammenselva, and Vefsna for which the 2023 mean levels were elevated. In Glomma and Drammenselva the large floods in august contributed to the high mean Tot-P and PO_4 levels this year. In Vefsna, an elevated Tot-P measurement in April (23 µg L^{-1}) coincided with the abovementioned elevated SPM concentration.

In most rivers, P is dominantly present as particulate P, in close association with SPM (Figure 15). Particulate P has a lower bioavailability than the total dissolved P. River Alna typically has a higher contribution of dissolved P than most other rivers, and in 2023 it averaged at 50% of the total P.

Nitrogen

The total nitrogen concentration (Tot-N) is typically highest in Alna and Orreelva, mainly due to urban pollution and agricultural runoff, respectively (Figure 16). The 2023 means were close to normal for most rivers, but with slightly elevated levels in Bjerkreimselva and Målselva. This was caused by peak levels (700 – 1000 µg L^{-1}) in February and July in Bjerkreimselva, and in February through April for Målselva. A similar increase in Tot-N was also seen in 2022 for River Målselva (Kaste et al. 2023).

Total nitrogen consists of nitrate (NO_3), ammonium (NH_4) and organic nitrogen[2]. NO_3 and organic N are usually the dominating fractions in Norwegian rivers, whereas significant amounts of NH_4 are restricted to rivers that are heavily affected by anthropogenic sources (e.g., Alna) (Figure 17). Notably, River Målselva displayed a relatively high contribution of organic N in 2023, compared to the other rivers. For most rivers, the nitrogen is dominantly present on a dissolved form (Figure 18), except for rivers that are high in particles, e.g. Orreelva (cf. Figure 10)

Silica

Silica (SiO_2) concentrations in the rivers showed a tendency of a slight increase in most rivers in 2023 compared to the five-year mean (Figure 19). This follows into the series of observations from 2021 and 2022 (Kaste et al. 2022, 2023). Weathering of bedrock is the primary source of SiO_2 in Norwegian soils, and the increase in SiO_2 in water is hypothesized to be linked to increased terrestrial productivity (enhanced root exudation of organic acids) under climate change (de Wit et al. 2023).

[2] *Organic nitrogen is defined as the difference between Tot-N and the sum of NO_3 and NH_4*

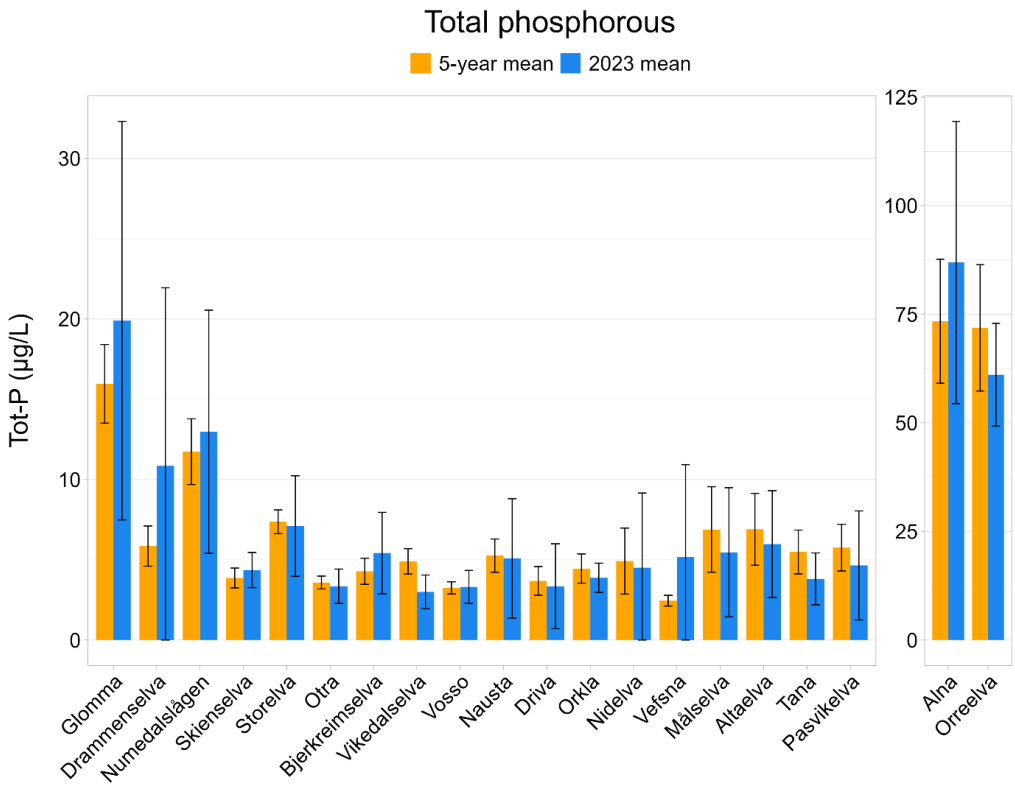

Figure 13. Mean concentrations of total phosphorus (Tot-P) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean. Note different y-scale on the right panel.

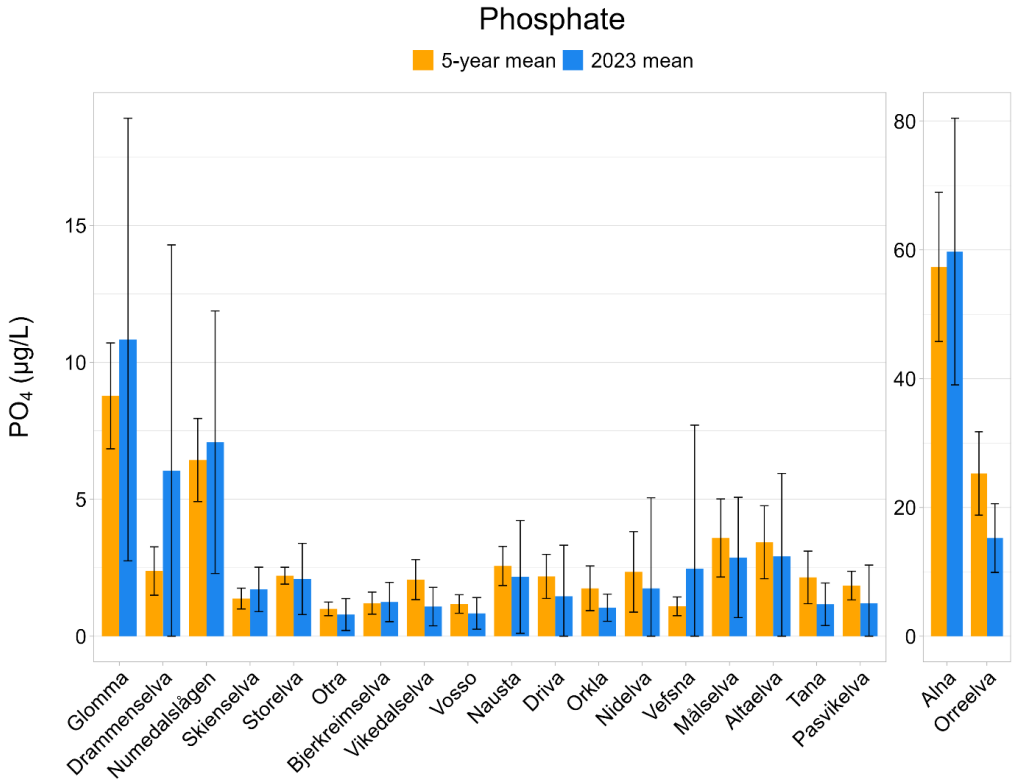

Figure 14. Mean (unfiltered) concentrations of phosphate (PO_4) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean. Note different y-scale on the right panel.

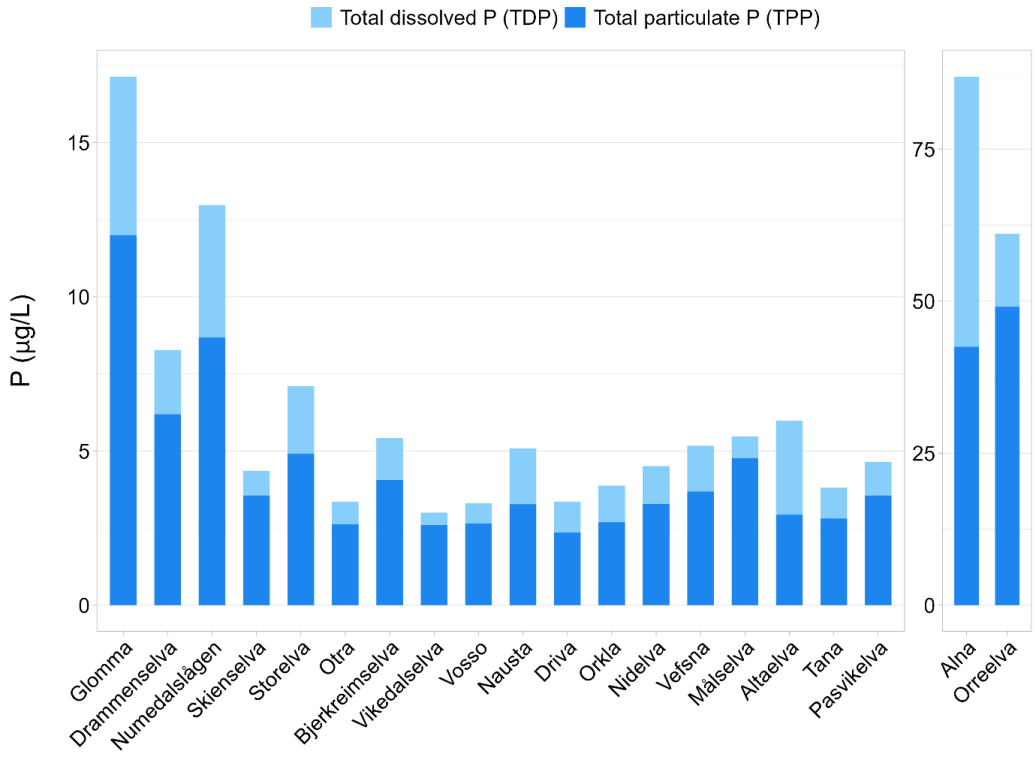

Figure 15. Mean concentrations of total dissolved (TDP) and particulate (TPP) phosphorus in 2023. Note different y-scale on the right panel. TDP is calculated as the difference between Tot-P and TPP.

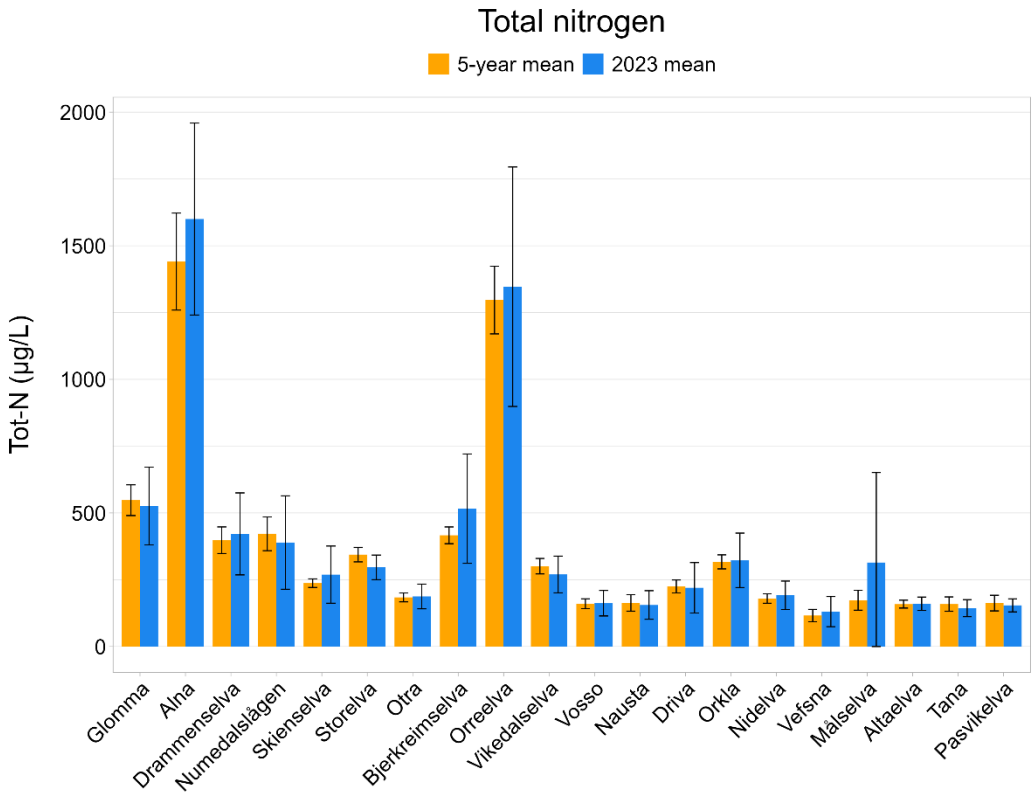

Figure 16. Mean concentrations of total nitrogen (Tot-N) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

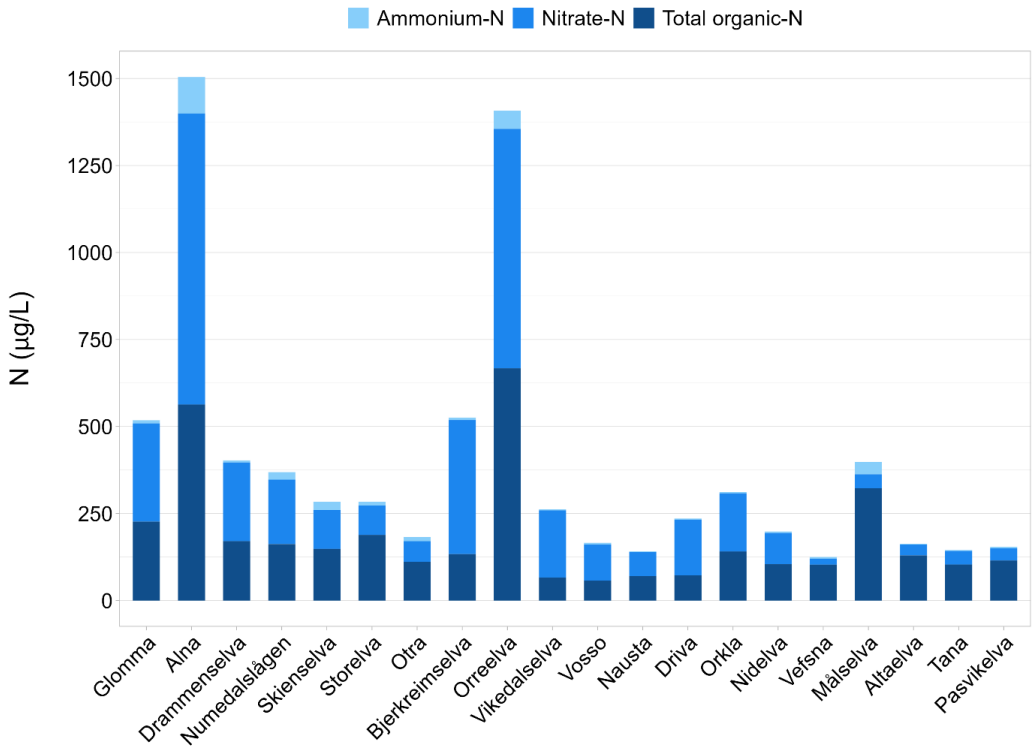

Figure 17. Mean concentrations of ammonium (NH_4), nitrate (NO_3) and total organic nitrogen (TON) in 2023. TON is calculated as the difference between Tot-N and the sum of NH_4 and NO_3.

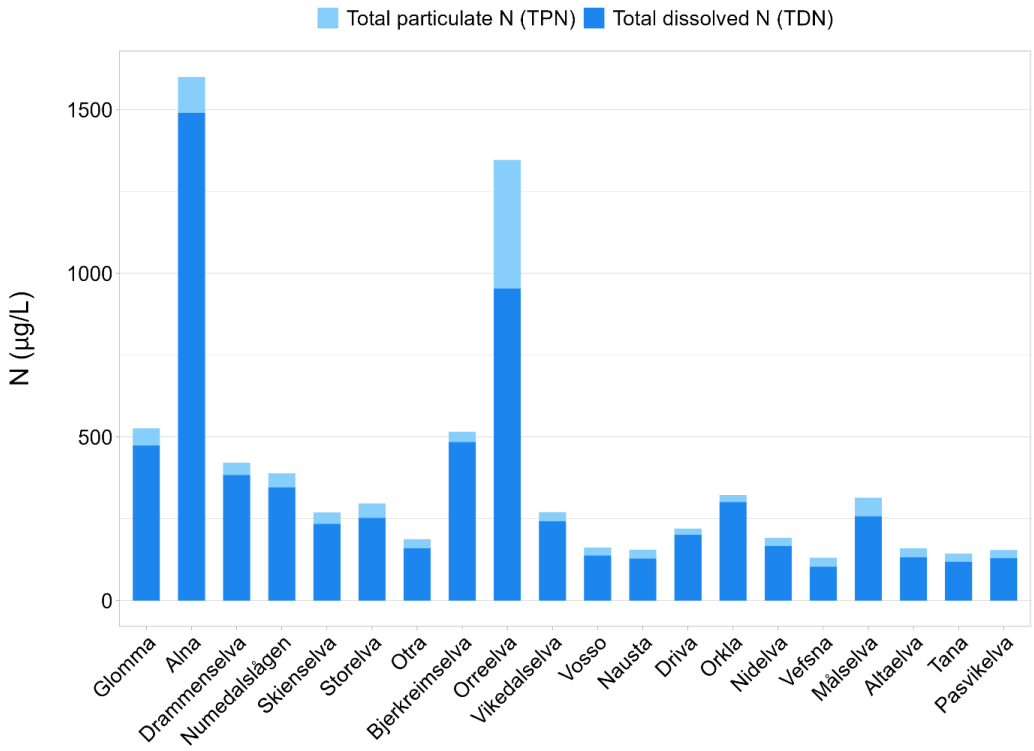

Figure 18. Mean concentrations of total particulate nitrogen (TPN) and total dissolved nitrogen (TDN) in 2023. TDN is calculated as the difference between Tot-N and TPN.

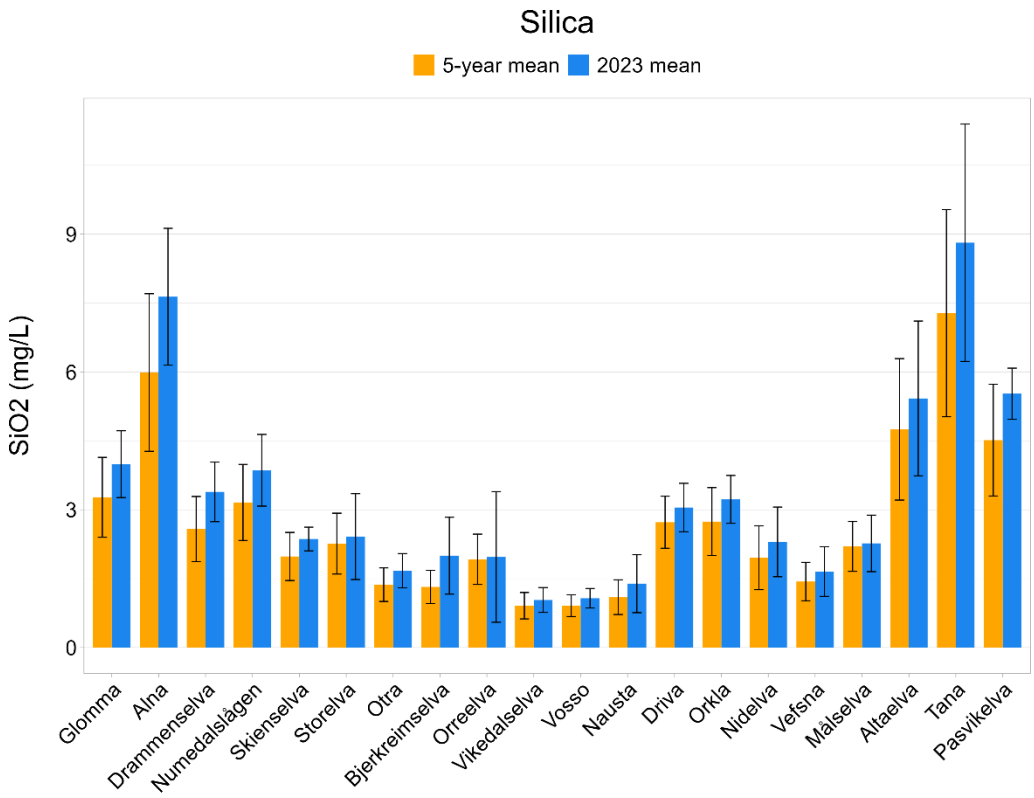

Figure 19. Mean concentrations of silica (SiO_2) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

3.2.5. Metals

The presence of low levels of metals in river water can result from natural deposits and thereby constitute background levels. Elevated levels most often result from anthropogenic activities such as mining and metallurgical activities, different types of industries, vehicular traffic, etc. Metals are not readily soluble in water, but their dissolution is enhanced by binding to particles (quantified e.g., as SPM) and/or to dissolved organic matter (DOM). Concentrations of particles, and thereby also metals, can show large inter-annual variation since the particle levels are governed largely by hydrological events. Here, with only four samples per year (every third month) the annual mean concentrations can be affected by single samples with extraordinary high (or low) SPM levels. This introduces an uncertainty when comparing metal concentrations between years.

Arsenic (As)

The 2023 As concentrations were for most of the rivers similar to their respective five-year mean (Figure 20). One exception was Drammenselva which showed about twice as high levels during the flood in august than during the rest of the year. This is as expected given the typical higher particle load with increased water flow. Alna was also higher than normal, which was caused by peak levels in February and August. In Pasvik, the As levels were lower than normal, which falls in to the pattern of the downward trend for most metals following the shutdown of the nearby metal smelter in Nikel, Russia in December 2020.

Lead (Pb)

The highest levels of Pb are typically found in the urban river Alna and in the agricultural influenced river Orreelva (Figure 21). In 2023, higher than normal mean Pb concentration was observed in Glomma,

Alna, and Drammenselva, which were all likely impacted by the flood in August. In Pasvikelva, the 2023 mean Pb concentration was lower than the previous years, similarly to the pattern seen for As.

Cadmium (Cd)
The two rivers with the highest levels of Cd were Alna and Orkla (Figure 22). While Alna is an urban influenced river, the cause for the higher Cd concentrations in Orkla is probably the former mining activities taking place in the catchment. In both rivers, the 2023 mean was higher than their respective five-year mean. This was also the case in Målselva. In Målselva the higher annual mean was the result of one single measurement above the quantification limit (0.019 µg L^{-1}). In the remaining rivers, the 2023 Cd mean was close to normal.

Copper (Cu)
In the 2023 Cu data, the most notable change compared to the five-year mean was the decrease observed for Pasvikelva (Figure 23). Again, this is a consequence of the closing of the nearby metal smelter. Also deviating from the five-year mean was Skienselva, showing a slight increase in 2023 compared to previous years. This was mainly caused by one extreme observation in August (3.05 µg L^{-1}). Rivers that are typically higher in Cu includes the urban river Alna, the agriculture-influenced Orreelva, and the mining-influenced river Orkla.

Zinc (Zn)
The Zn concentrations in 2023 were for most rivers similar to their five-year mean (Figure 24). Elevated levels were observed in Alna, Orreelva, Orkla, and Målselva. In Alna and Orreelva the maximum concentrations were measured in August (21.6 and 14.4 µg L^{-1}, respectively). Levels of Zn higher than the preceding five-year mean were also observed in Orreelva in 2021 and 2022 (Kaste et al. 2022, 2023). In Målselva the highest Zn concentration was observed in February (16.5 µg L^{-1}).

Chromium (Cr)
The 2023 mean concentrations of Cr were for most rivers similar to the five-year mean (Figure 25). Exceptions were Glomma, Alna and Skienselva with elevated Cr concentrations. Alna had a peak level in August (1.3 µg L^{-1}) while Skienselva had more stable levels throughout the year. The highest reduction compared to the five-year mean was found i Målselva.

Nickel (Ni)
River Pasvik still contains considerably more Ni than the other rivers evaluated in the program (Figure 26). However, the Ni levels continue to decrease following the abovementioned shutdown of the nearby metal smelter. For the rivers Glomma, Alna, Drammenselva, and Otra, the 2023 mean was slightly higher than normal. Alna and Drammenselva were influenced by peak levels related to the flooding in August (2.03 and 2.24 µg L^{-1}, respectively), while for Glomma and Otra there were no distinct peaks explaining the elevated mean Ni levels this year.

Mercury (Hg)
The geographical distribution of Hg concentrations in the rivers (Figure 27) corresponds largely to the level of organic carbon. The highest levels of Hg (> 1 ng L^{-1}) prevail in the south-eastern forested river catchments, while lower concentrations usually occur in rivers in mid- and northern regions (< 1 ng L^{-1}). This reflects the importance of DOM as a transport vector for Hg in waters (Ravichandran 2004). While the 2023 mean Hg concentration for most of the rivers was close to normal, an increase compared to the preceding five-year mean can be seen for Glomma, Drammenselva, and Skienselva.

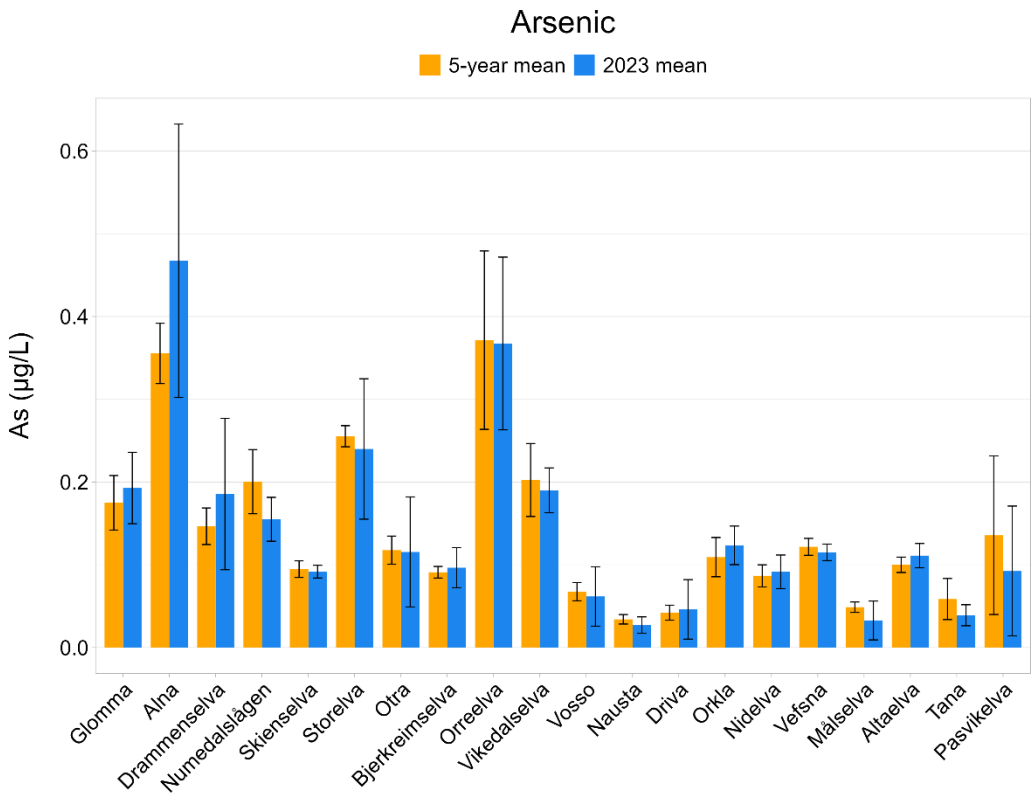

Figure 20. Mean (unfiltered) concentrations of arsenic (As) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

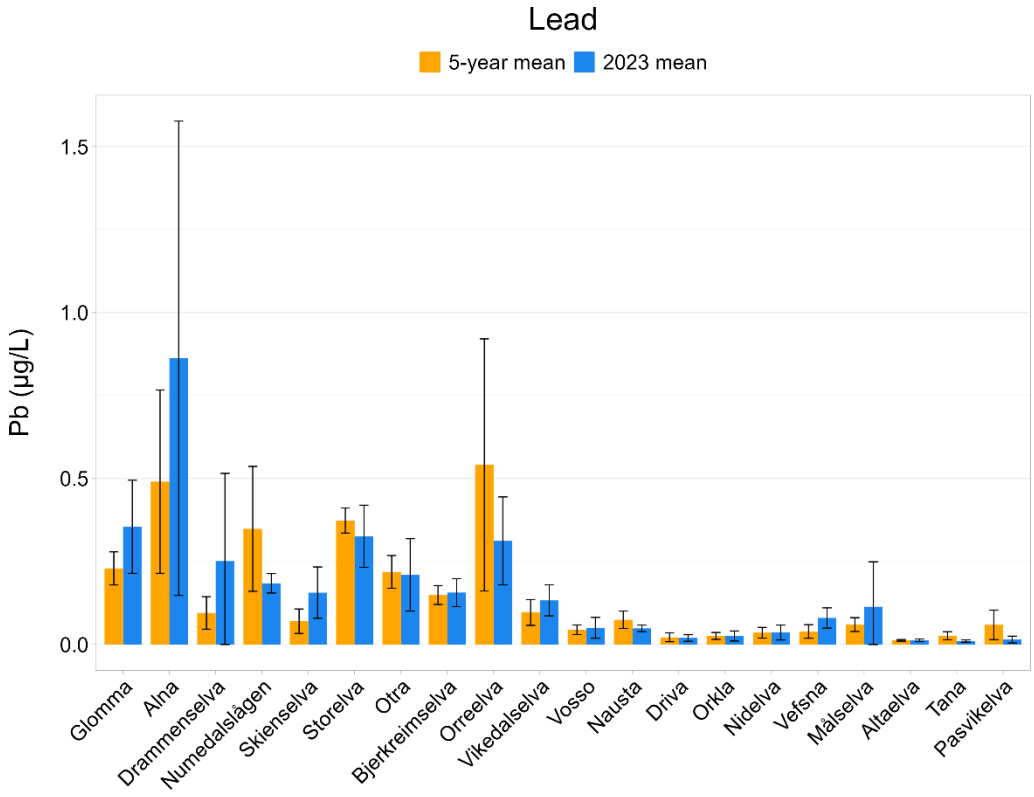

Figure 21. Mean (unfiltered) concentrations of lead (Pb) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

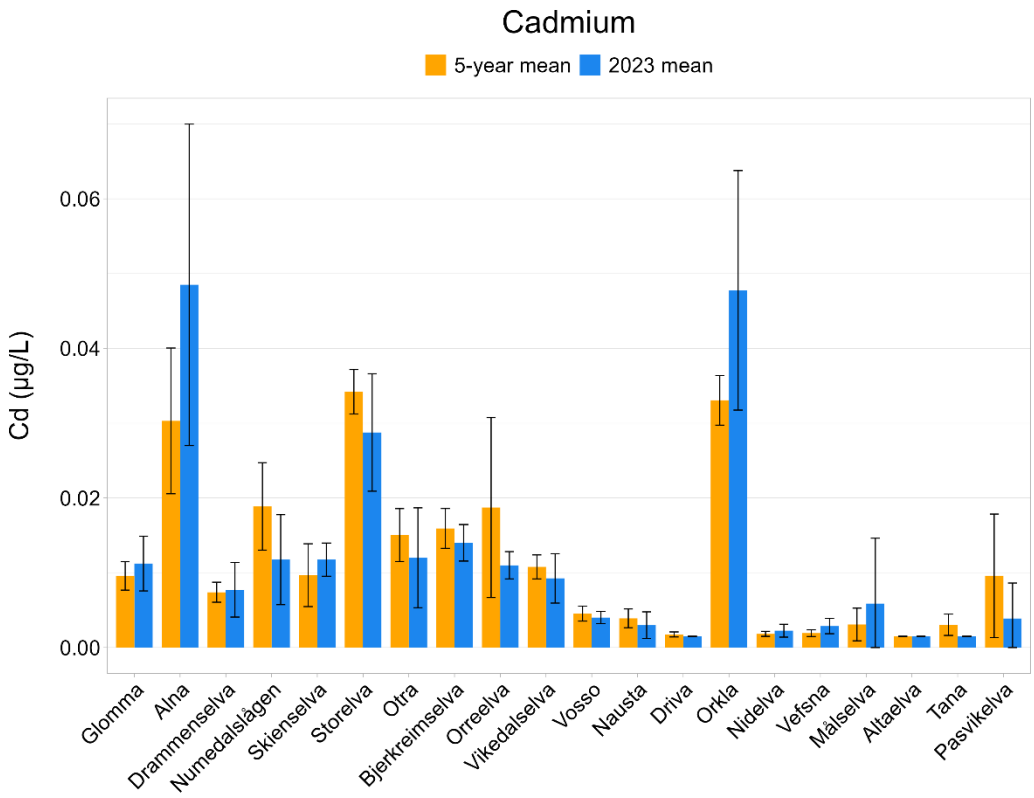

Figure 22. Mean (unfiltered) concentrations of cadmium (Cd) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

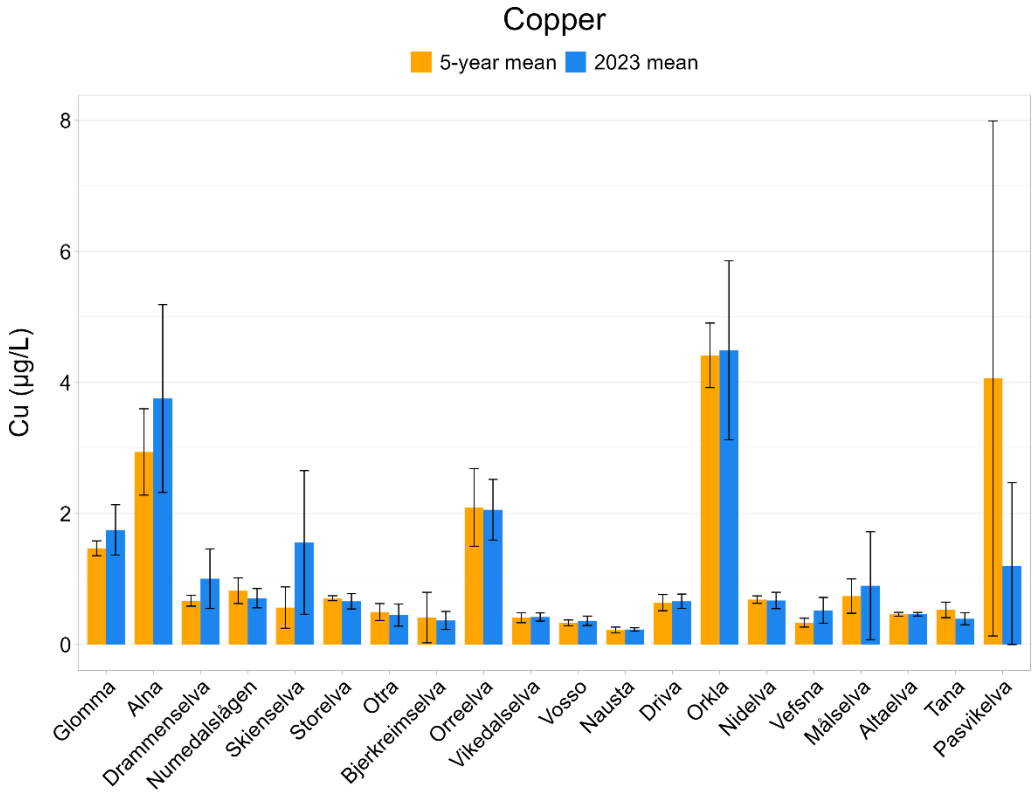

Figure 23. Mean (unfiltered) concentrations of copper (Cu) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

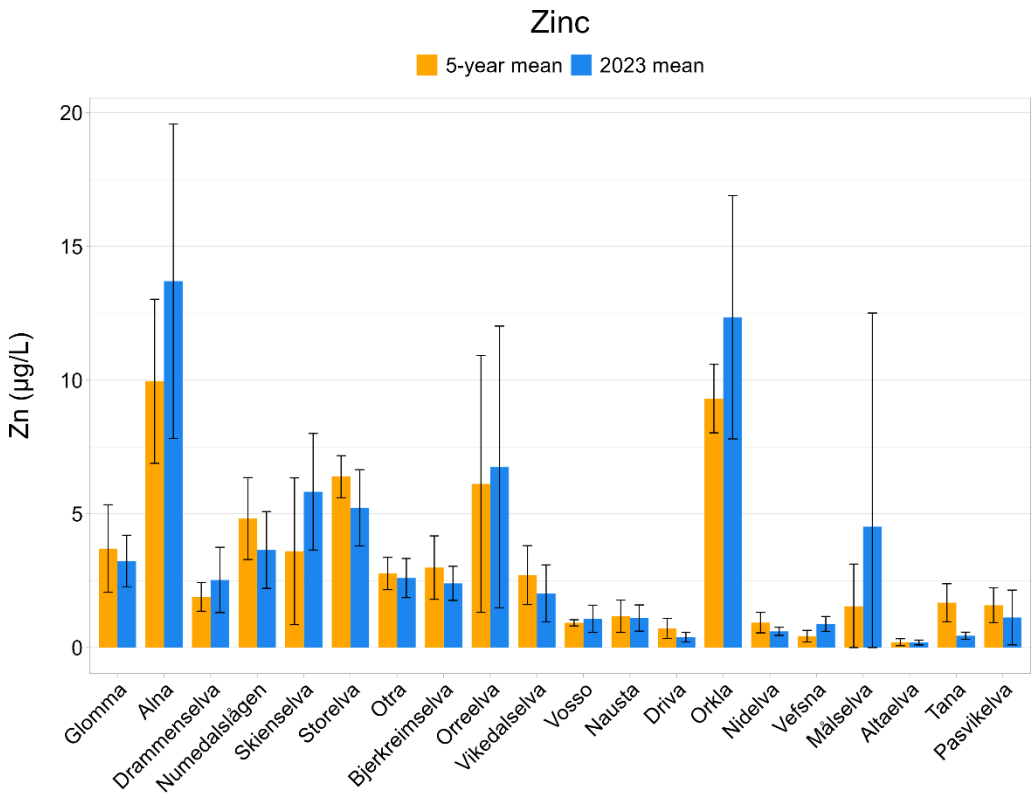

Figure 24. Mean (unfiltered) concentrations of zinc (Zn) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

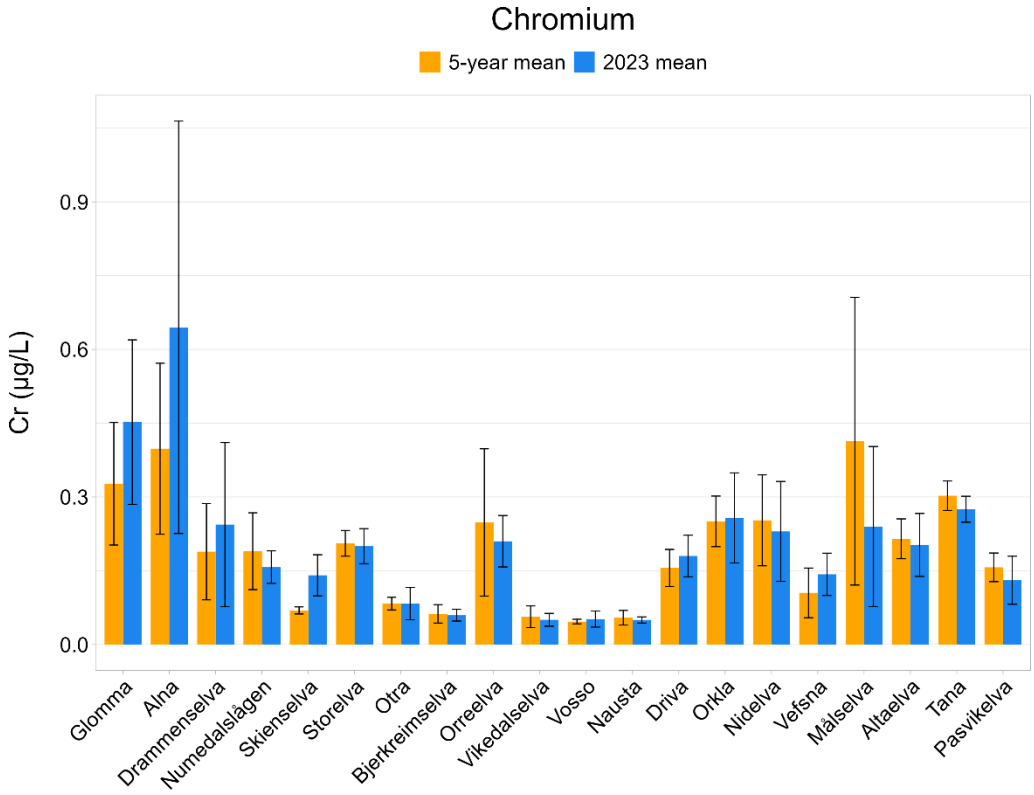

Figure 25. Mean (unfiltered) concentrations of chromium (Cr) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

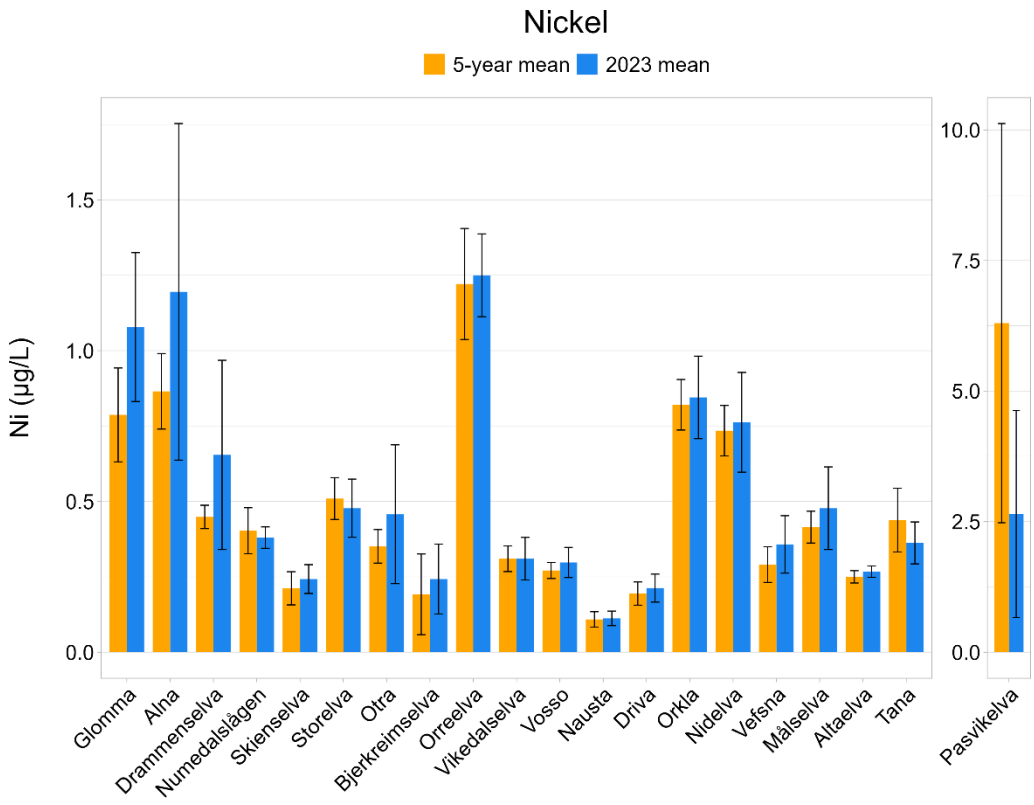

Figure 26. Mean (unfiltered) concentrations of nickel (Ni) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean. Note different y-scale on the right panel.

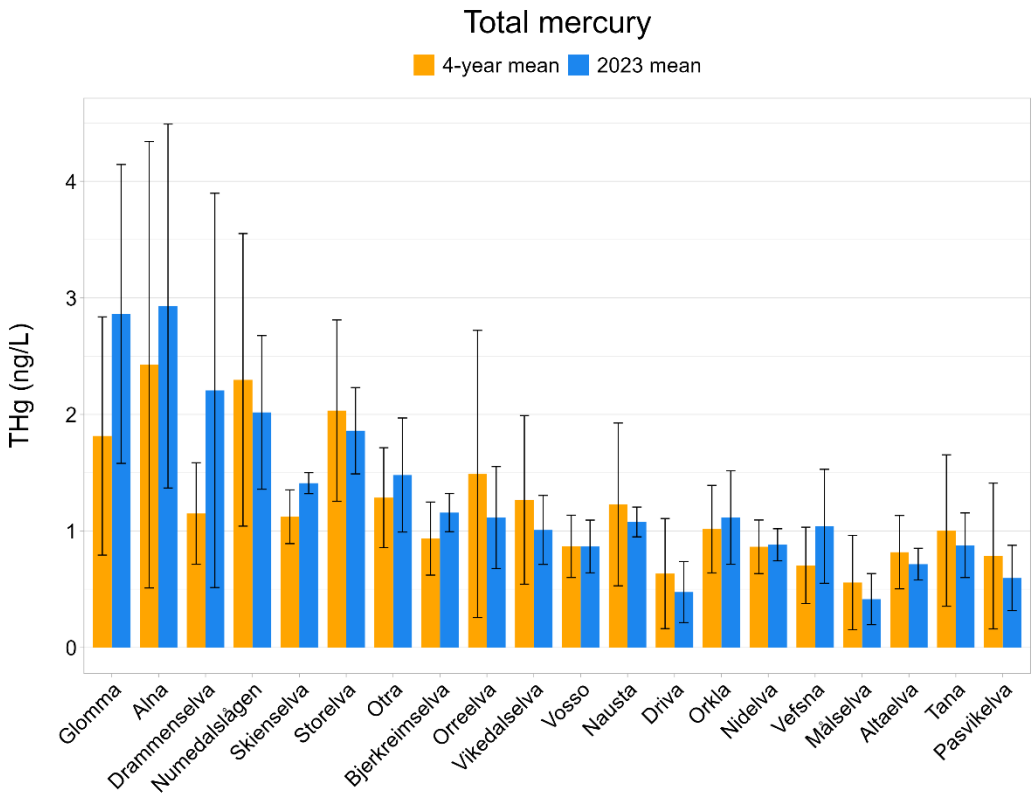

Figure 27. Mean (unfiltered) concentrations of mercury (Hg) in 2023 compared with the preceding four-year mean 2019-2022. Error bars indicate one standard deviation from the mean.

3.2.6. Priority substances and river basin specific pollutants

In 2023, priority substances and river basin specific pollutants were analysed in Vosso, Nausta, Driva, Orkla, and Nidelva. Metals were analysed in filtered water samples, whereas polycyclic aromatic hydrocarbons (PAHs) and other priority substances were analysed in unfiltered ("whole water") samples. The annual averages were calculated based on four samples from each river and compared with the annual average environmental quality standards (AA-EQS) of the Water Framework Directive (Direktoratsgruppen vanndirektivet 2018). Primary data for analysed priority substances are found in Appendix B (section 6.3).

Metals

None of the 5 investigated rivers had annual average (filtered) concentrations of priority metals (Cd, Hg, Ni or Pb) that were above the AA-EQS in 2023 (Table 6).

Table 6. Annual average concentrations 2023 of priority metals in filtered water samples (N=4) from five rivers compared with WFD AA-EQS (displayed in column to the right). Values below LOQ are set to half the LOQ before the mean is calculated.

		Vosso	Nausta	Driva	Orkla	Nidelva	**AA-EQS**
Cadmium (Cd)	µg/l	0.003	0.003	0.002	0.039	0.002	**0.08**
Mercury (Hg)	ng/l	0.65	0.89	0.41	0.80	0.66	**47**
Nickel (Ni)	µg/l	0.29	0.10	0.18	0.80	0.64	**4**
Lead (Pb)	µg/l	0.019	0.039	0.010	0.013	0.012	**1.2**

Polycyclic aromatic hydrocarbons (PAHs)

No exceedances were recorded for any of the prioritized PAHs (Table 7). The percentages of values above LOQ (% detects) are specified for each substance in the last column of the table. Ten of the sixteen PAH congeners had no values above LOQ in any of the rivers that were monitored in 2023.

Other priority substances and river basin specific pollutants

Analysed substances included organochlorinated compounds, chlorinated paraffins, alkylphenols, chlorfenvinfos, cybutryne and DEHP (Table 8). Vosso exceeded the AA-EQS for medium chained chlorinated paraffins (MCCP). Besides that, none of the rivers had annual concentrations of other priority substances that were above the AA-EQS. It should be noted, however, that the average concentration of hexachlorobenzene (HCB) in Nidelva was quite high compared to the other rivers (no AA-EQS value exists for this substance). Alpha/gamma HCH levels are representative and in line with global background concentrations, global distribution and long-range transport of these legacy pollutants, so it is not surprising to see them in detectable levels in water.

The percentage of values above LOQ is specified for each substance in the last column of Table 8. There were no detections of beta-hexachlorocyclohexane (b-HCH), 4-iso-nonylphenol, 4-n-nonylphenol, chlorfenvinfos, and cybutryne 2023.

Table 7. Annual average concentrations 2023 of PAH in unfiltered water samples (N=4) from five rivers compared with WFD AA-EQS. Values below LOQ are set to half the LOQ before the mean is calculated. Detection frequencies for each substance in all collected water samples are given in the far-right column (% detect).

		Vosso	Nausta	Driva	Orkla	Nidelva	**AA-EQS**	% detect
Acenaphthene	ng/l	0.23	0.46	<LOQ*	0.50	<LOQ	**3800**	21
Acenaphthylene	ng/l	0.15	<LOQ	<LOQ	<LOQ	<LOQ	**1280**	5
Anthracene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**100**	0
Benzo[a]anthracene	ng/l	0.11	<LOQ	<LOQ	<LOQ	<LOQ	**12**	5
Benzo[a]pyrene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**0.17**	0
Benzo[b,j]fluoranthene	ng/l	0.14	<LOQ	<LOQ	<LOQ	<LOQ	**-**	5
Benzo[ghi]perylene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**-**	0
Benzo[k]fluoranthene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**-**	0
Chrysene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**70**	0
Dibenzo[ac/ah]anthracene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**0.6**	0
Fluoranthene	ng/l	0.30	0.15	0.26	0.20	0.30	**6.3**	42
Fluorene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**1500**	0
Indeno[1,2,3-cd]pyrene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**-**	0
Naphthalene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**2000**	0
Phenanthrene	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**500**	0
Pyrene	ng/l	<LOQ	<LOQ	0.19	0.27	0.30	**23**	21

* "< LOQ" means that results from all 4 samples were below LOQ

Table 8. Annual average concentrations 2023 of other priority substances and river basin specific pollutants in unfiltered water samples (N=4) from five rivers compared with WFD AA-EQS. Values below LOQ are set to half the LOQ before the mean is calculated. Values above the AA-EQS are marked with red colour. Detection frequencies for each substance across all collected water samples are given in the far-right column (% detect).

		Vosso	Nausta	Driva	Orkla	Nidelva	**AA-EQS**	% detect
Organochlorinated compounds								
Pentachlorobenzene (QCB)	ng/l	<LOQ	<LOQ	<LOQ	0.01	0.02	**7**	11
Hexachlorobenzene (HCB)	ng/l	0.39	0.38	0.39	0.02	1.80	-	32
Alpha-Hexachlorocyclohexane (a-HCH)	ng/l	0.02	0.02	0.01	0.01	0.03	-	74
Beta-Hexachlorocyclohexane (b-HCH)	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	-	0
Gamma-Hexachlorocyclohexane (g-HCH)	ng/l	0.02	0.01	0.01	0.01	0.02	**20**	42
Chlorinated paraffins								
Short chain chlorinated paraffins (SCCP)	ng/l	110	<LOQ	<LOQ	<LOQ	<LOQ	**400**	5
Medium chain chlorinated paraffins (MCCP)	ng/l	173	<LOQ	<LOQ	<LOQ	<LOQ	**50**	5
Alkylphenols								
4-iso-nonylphenol	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	-	0
4-n-nonylphenol	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**300**	0
4-tert-octylphenol	ng/l	25	13	14	<LOQ	<LOQ	**100**	20
Other substances								
Chlorfenvinfos	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**100**	0
Cybutryne	ng/l	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**2.5**	0
Di(2-ethylhexyl)phthalate (DEHP)	ng/l	8.1	9.4	15.7	12.4	10.3	**1300**	47

* "< LOQ" means that results from all 4 samples were below LOQ

3.3 Long-term trends in riverine concentrations and loads

The trend analyses include an evaluation of both riverine loads and concentrations. Loads are important for assessing total transport of elements to coastal waters, whereas concentrations characterise the water quality in the rivers themselves. By evaluating trends in loads in combination with water discharge, it is possible to reveal whether trends are related to changes in mobilisation of chemical substances from the catchment or in water discharge. Both these factors can be impacted by climate change. Trends in water discharge (Q) are discussed in Chapter 3.1.4.

3.3.1. SPM, silica, and TOC (1990-2023)

Concentrations

None of the rivers had significant increasing trends in suspended particulate matter (SPM) concentrations during 1990-2023, whereas Orkla and Vefsna showed decreasing trends (Table 9). Skienselva showed an increase in both silica and TOC concentrations, whereas Numedalslågen Orkla had an increase in silica.

Loads

Glomma and Drammenselva showed an increasing trend in water discharge over the period 1990-2023 (Table 10). During the period 1990-2020 also Skienselva and Orreelva displayed significant increasing trends (Kaste et al. 2021). Regarding SPM loads, which is strongly related to water flow (and especially large floods), Drammenselva, Numedalslågen and Orreelva showed increasing trends, whereas Vefsna was the only river with a decreasing trend. Six rivers, including four in the south, one in the south-west and one in the north, showed increasing loads of silica. Only Drammenselva show an increasing trend in TOC, but for some rivers this can be due to shorter time series for TOC[3].

3.3.2. Nutrients (1990-2023)

Concentrations

Although five rivers showed significant increases in PO_4 concentrations (Glomma, Drammenselva, Numedalslågen, Skienselva, and Orreelva) none of these rivers had increasing trends in Tot-P. On the other hand, three rivers showed decreasing trends in Tot-P concentrations (Otra, Vefsna, Altaelva). All rivers showed either no trends or downward trends in concentrations of inorganic nitrogen species (NO_3 and NH_4) and Tot-N.

Loads

Glomma, Drammenselva, Numedalslågen and Orreelva showed significant increasing trends in PO_4 loads and the same rivers (except Glomma) also showed increasing trends in loads of Tot-P. Both PO_4 and Tot-P are highly correlated with SPM, which tend to increase in a wetter climate with more frequent and more intense flood episodes. Vefsna was the only river with a decreasing trend in Tot-P loads. Glomma, Drammenselva, and Numedalslågen had increasing trends in Tot-N loads, whereas Skienselva and Vefsna showed decreasing trends. Except for Glomma and Drammenselva, which showed significant upward trends in NO_3 loads, all the other rivers showed either no trend or downward trends in loads of inorganic nitrogen species. Worth noting is that all rivers, except Numedalslågen, show decreasing trends in NH_4.

[3] *For Numedalslågen, Skienselva, Orreelva, Vefsna, and Altaelva, the TOC time series start in 1999.*

Table 9. Long-term trends (1990-2023) in concentrations of suspended particulate matter (SPM), silica (Si), total organic carbon (TOC), total phosphorus (Tot-P), phosphate (PO_4) total nitrogen (Tot-N), ammonium (NH_4) and nitrate (NO_3). p-values are shown.

River	SPM	Si	TOC	Tot-P	PO_4	Tot-N	NH_4	NO_3
Glomma	0.056	0.870	0.698	0.895	0.000	0.514	0.000	0.313
Drammenselva	0.213	0.147	0.074	0.364	0.050	0.150	0.000	0.022
Numedalslågen	0.068	0.022	0.314*	0.142	0.015	0.406	0.072	0.941
Skienselva	0.449	0.006	0.006*	0.968	0.032	0.000	0.001	0.000
Otra	0.075	0.674	0.320	0.001	0.631	0.000	0.049	0.000
Orreelva	0.050	0.528	0.374*	0.138	0.012	0.109	0.003	0.018
Orkla	0.000	0.007	0.292	0.102	0.846	0.130	0.000	0.130
Vefsna	0.001	0.148	0.981*	0.001	0.021	0.000	0.000	0.000
Altaelva	0.504	0.441	0.343*	0.015	0.067	0.247	0.000	0.514

Red – significantly increasing p<0.05, green – significantly decreasing p<0.05

*Trend analysis started in 1999 due to limited TOC data in the preceding period

Table 10. Long-term trends (1990-2023) in water discharge (Q) and loads (transport) of suspended particulate matter (SPM), silica (Si), total organic carbon (TOC), total phosphorus (Tot-P), and phosphate (PO_4), total nitrogen (Tot-N), ammonium (NH_4), nitrate (NO_3). p-values are shown.

River	Q	SPM	Si	TOC	Tot-P	PO_4	Tot-N	NH_4	NO_3
Glomma	0.019	0.299	0.085	0.097	0.313	0.012	0.008	0.000	0.016
Drammenselva	0.011	0.013	0.004	0.002	0.003	0.002	0.026	0.000	0.026
Numedalslågen	0.123	0.030	0.033	0.441*	0.003	0.001	0.008	0.213	0.213
Skienselva	0.109	0.406	0.006	0.414*	0.173	0.116	0.044	0.022	0.000
Otra	0.495	0.514	0.248	0.131	0.553	0.299	0.091	0.028	0.000
Orreelva	0.138	0.016	0.041	0.047*	0.033	0.038	0.790	0.024	0.155
Orkla	0.859	0.813	0.299	0.635	0.594	0.929	0.657	0.000	0.534
Vefsna	0.657	0.044	0.313	0.870*	0.002	0.011	0.000	0.000	0.000
Altaelva	0.116	0.146	0.085	0.797*	0.953	0.976	0.836	0.000	0.635

Red – significantly increasing p<0.05, green – significantly decreasing p<0.05

*Trend analysis started in 1999 due to limited TOC data in the preceding period

3.3.3. Metals (2004-2023)

For the metals Pb, Cd, Cu, Zn, and Ni time series exist from 2004. The shorter period was selected due to an increase in the sensitivity of the analytical methods (lower LOQ) over time, i.e., it has become possible to detect lower concentrations. If data prior to 2004 were not excluded, the trend analysis could potentially have showed false decreasing trends (Stålnacke et al. 2009). Additionally, caution should be paid when evaluating the data as the sampling frequency has been reduced from monthly to quarterly since 2017. This can introduce uncertainty to the trend analysis, especially for polluted rivers where the seasonal variability is expected to be substantial.

Concentrations

Most river show no trends or decreasing trends for metal concentrations, except for Vefsna and Altaelva that displayed increasing trends in Ni and Orreelva that showed increasing trends in Pb, Cu, and Ni (Table 11). In Orreelva especially Zn stands out with elevated concentrations from 2020 onwards. It may be related to increased use of fertilizer products containing zinc, but this is something that should be investigated in more detail before conclusions can be drawn. Possible sources for the increasing Ni concentrations in Vefsna and Altaelva are not known, but it should be noted that the concentrations are low (cf. Figure 26) and that the increases in later years are moderate.

Loads

No rivers show increasing trends in metal loads during 2004-2023 (Table 12). Four rivers showed decreasing trends for some elements, Otra (Cu, Zn, Ni), Orkla (Pb, Cu, Zn), Vefsna (Zn), and Altaelva (Pb, Cu, Zn). The remaining rivers, mostly located in southeastern Norway, showed no significant trends in metal loads.

Table 11. Short-term trends (2004-2023) in unfiltered concentrations of lead (Pb), cadmium (Cd), copper (Cu), zinc (Zn) and nickel (Ni). P-values are shown.

River	Pb	Cd	Cu	Zn	Ni
Glomma	1.000	0.094	0.003	0.496	0.845
Drammenselva	0.032	0.002	0.000	0.001	0.126
Numedalslågen	0.381	0.896	0.044	0.135	0.625
Skienselva	0.435	0.040	0.091	0.795	0.080
Otra	0.230	0.033	0.001	0.000	0.001
Orreelva	0.041	0.282	0.003	0.243	0.002
Orkla	0.047	0.144	0.000	0.002	0.163
Vefsna	0.183	0.000	0.119	0.080	0.002
Altaelva	0.717	0.000	0.000	0.001	0.000

Red – significantly upward p<0.05, green – significantly downward p<0.05.

Table 12. Short-term trends (2004-2023) in water discharge (Q) and loads of lead (Pb), cadmium (Cd), copper (Cu), zinc (Zn) and nickel (Ni) based on unfiltered samples. p-values are shown.

River	Q	Pb	Cd	Cu	Zn	Ni
Glomma	0.183	0.974	0.163	0.098	0.820	0.922
Drammenselva	0.496	0.581	0.284	0.144	0.056	0.315
Numedalslågen	1.000	0.538	0.626	0.127	0.581	0.770
Skienselva	0.871	0.922	0.538	0.871	0.074	0.230
Otra	0.315	0.538	0.163	0.002	0.005	0.018
Orreelva	0.820	1.000	0.626	0.347	0.721	0.347
Orkla	0.673	0.005	0.127	0.003	0.004	0.871
Vefsna	1.000	0.347	0.974	0.381	0.030	0.284
Altaelva	0.673	0.048	0.060	0.035	0.021	0.496

Red – significantly upward p<0.05, green – significantly downward p<0.05.

3.4 Quality of dissolved organic matter

Dissolved organic matter (DOM), here defined as particles small enough to pass through a 0.45 µm filter, is a mixture of natural organic molecules which contain, among other things, organic carbon and organically bound nutrients. DOM is formed through transformation of terrestrial organic materials or through production by primary producers in lakes and rivers. Thus, catchment characteristics, for example, the presence of mires, forest, and agriculture, are important for the spatial variability in DOM quantity and quality in surface waters. In addition, variations in climate and hydrology can affect DOM transport and quality. For example, rainfall events can increase mobilization of DOM from catchment soils, leading to enhanced transportation to nearby freshwater and coastal systems.

In aquatic systems, DOM can have both positive and negative impacts on water quality and ecosystem productivity. DOM acts as a source of carbon and nutrients to lower trophic level microorganisms, but it can also be a source of contaminants by adsorbing e.g., POPs and metals. DOM is quantified by the amount of carbon, i.e., by measuring dissolved organic carbon (DOC) concentration. Because of the dynamic nature and molecular complexity of DOM, it is difficult and expensive to define its specific structure and composition. Instead, optical characteristics and proxies are often used to indirectly characterize the quality of DOM (Table 13). The specific UV absorbance (SUVA) is one such proxy used as an indicator of aromatic molecular structure. In addition, E2_E3, which is the ratio of absorption at 250nm and 365nm, is also linked to molecular size. These two proxies combined can provide information on the quality of the DOM present in a water sample and its likely impacts on the environment (Peuravuori & Pihlaja, 1997; Weishaar et al. 2003).

Table 13. Overview of the absorbance indices used to describe DOM quality.

Name		Definition	Characteristic
sUVa	Specific UV absorbance	(Abs 254nm / DOC) *100	Aromaticity (positive relationship)
E2_E3	(Peuravuori & Pihlaja, 1997)	Abs 250nm / Abs 365nm	Aromaticity (negative relationship) Molecular size (negative relationship)

Spatially, and in line with data from previous years, the monitored rivers show a gradient in DOM quality in relation to catchment composition. Alna, Orreelva, Driva and Målselva have consistently lower sUVa and higher E2_E3 compared to the other rivers (Figure 28 and Figure 29) which reflects the low aromaticity and molecular size of the DOM in these rivers. In Alna and Orreelva, this is likely linked to human activities. Meanwhile, Nausta has the highest sUVa and the lowest E2_E3, reflecting higher aromaticity and molecular size, which is typical for humic DOM transported from forest- and peatland-dominated catchments.

In August 2023, the extreme weather event Hans impacted Eastern Norway. The impacted rivers (Alna, Glomma, Drammenselva) do not have increased values of sUVa, as might have been expected. However, since only one sample is collected monthly for water chemistry, the timing of the sample collection in relation to the extreme event determines whether the impacts of the event on in-stream and downstream water chemistry are captured. In this case, one sample was not enough to capture the impacts of Hans. This is an example of how high-frequency sensor data is essential for capturing rainfall and flooding events. Aside from Hans, 2023 was not an unusually wet or dry year in Norway, and we see this in the cDOM results which fall largely within their 5-year means for all rivers.

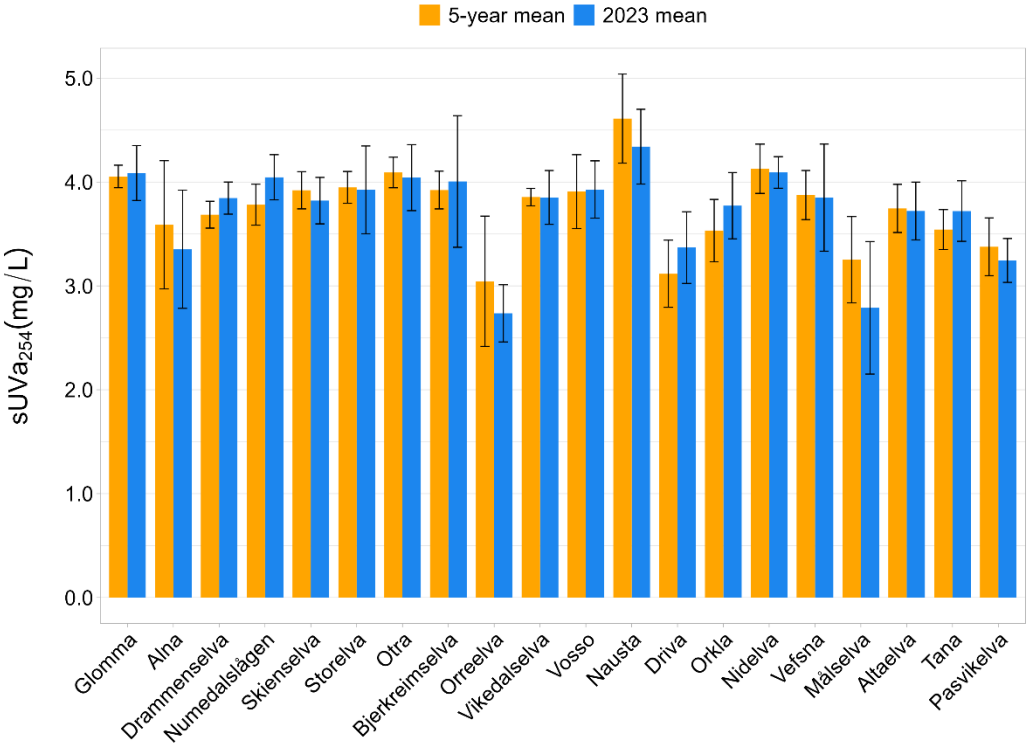

Figure 28. Mean values for Specific UV absorbance at wavelength 254 nm ($sUVa_{254}$) in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

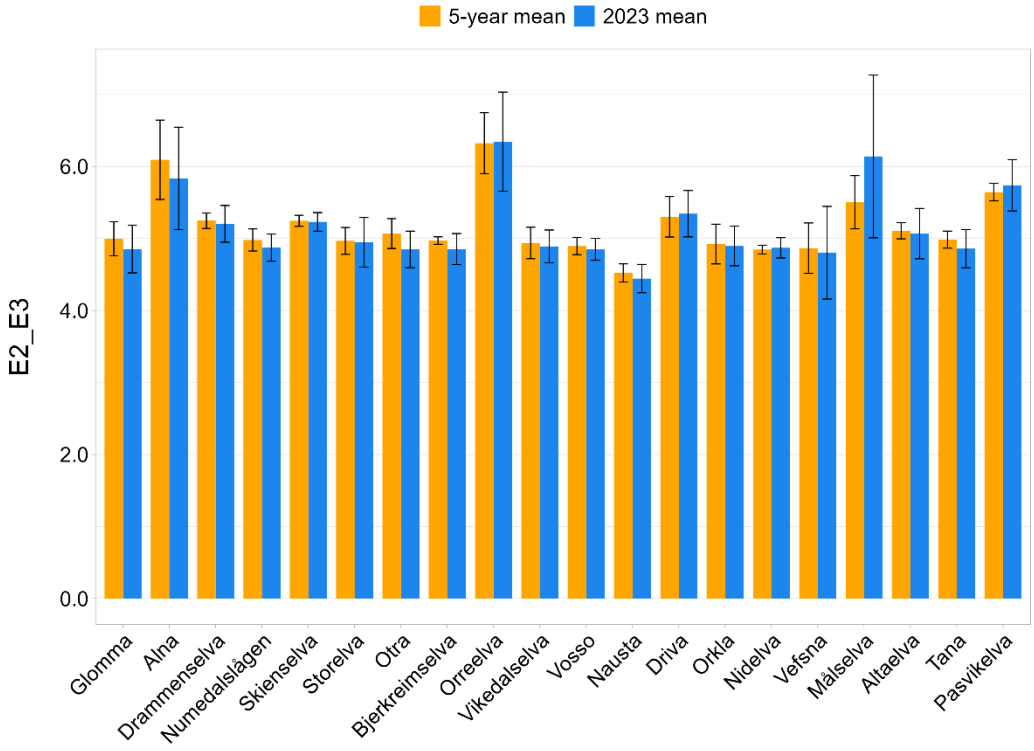

Figure 29. Mean values for the E2_E3 index in 2023 compared with the preceding five-year mean (2018-2022). Error bars indicate one standard deviation from the mean.

3.5 High-frequency monitoring

This section includes a brief description of results from the sensor monitoring at Svanfoss/Vorma, Kråkfoss/Leira, Baterød/Glomma, Storelva, and Målselva in 2023. See Appendix A, chapter 5.7 for geographical positions of all stations. Vorma is the outlet river from Lake Mjøsa and constitutes one of Glomma's two main branches. Leira is a relatively small sub-catchment that discharges into Glomma upstream Lake Øyeren. The sensor station at Baterød is located in the lower part of Glomma, about 3 km upstream of Sarpsfossen and close to the main river monitoring station.

For a more detailed description of the parameters and their relation to climatic conditions, see also Poste et al. (2021, 2023) and Kaste et al. (2021). The data can be viewed online from this website: Elveovervåking (niva.no).

The figures in the following sections display both the sensor data and lab data based on monthly samples. This serves two purposes; to show that the sensor data are in the same range as the lab data, but also to demonstrate that manual monthly sampling often fails to capture short-term and climate-related episodes that can have a large influence on river ecology and estimates of annual riverine loads to the coast.

3.5.1. Vorma (at Svanfoss)

Data for 2023 are showed in Figure 30 and Figure 31.

The water flow pattern in 2023 was characterized by high-flow conditions from mid-May until mid-October, with the most predominant flood occurring after the Hans extreme weather event on 7-9 August. The relatively large fluctuations in water temperatures during summer are probably due to hydropower regulations (periodic release of water from Svanfoss dam). The water quality parameters were surprisingly little affected by the Hans event, probably due to the large lake volume and the dampening effect of Mjøsa, which is located right upstream of the sensor station. There was an increase in turbidity and FDOM in August, but the levels were not particularly high compared to other events that occurred during spring and later in the autumn.

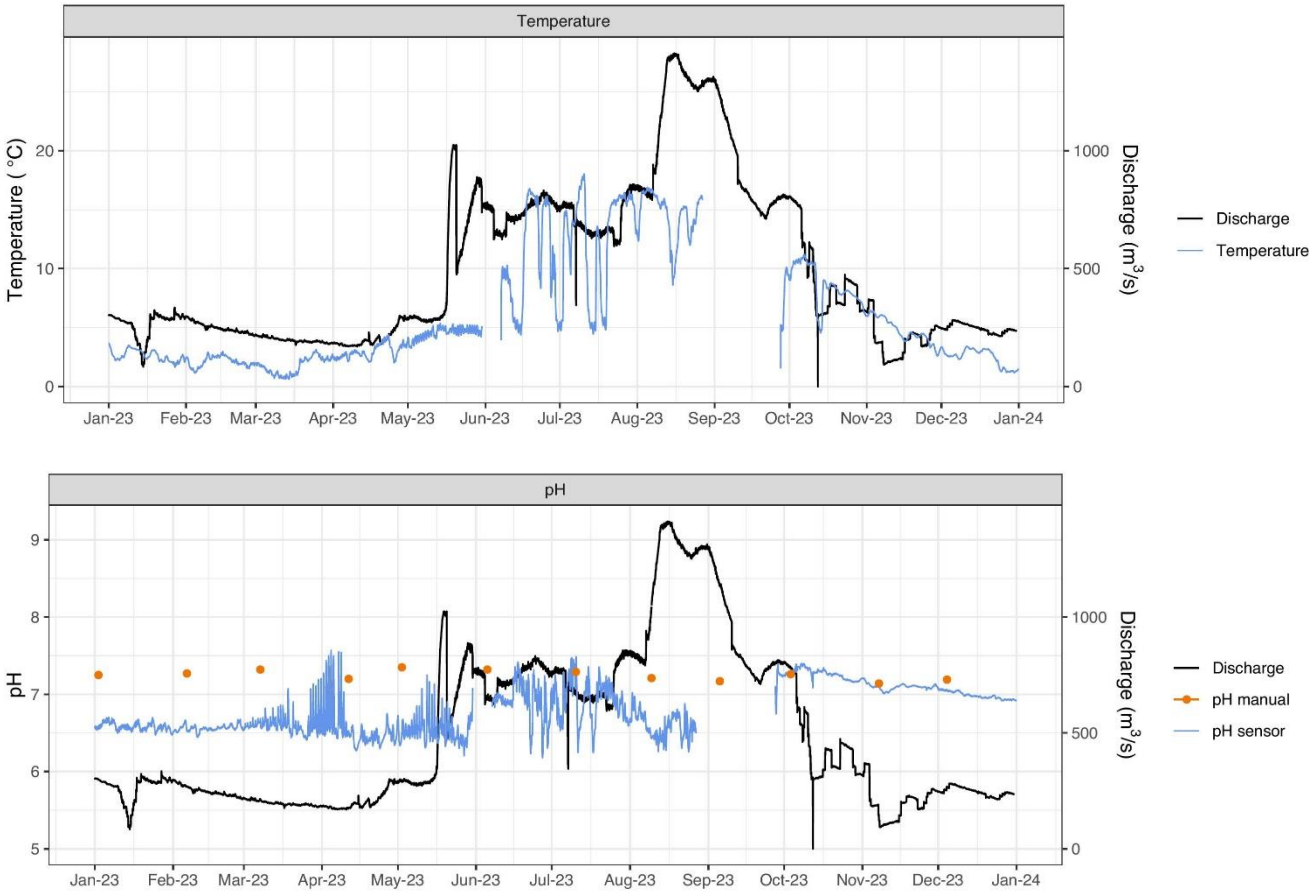

Figure 30. Vorma at Svanfoss in 2023. Water temperature (upper panel) and pH (lower panel) plotted together with water flow data from NVE's station 2.197.0 Ertesekken.

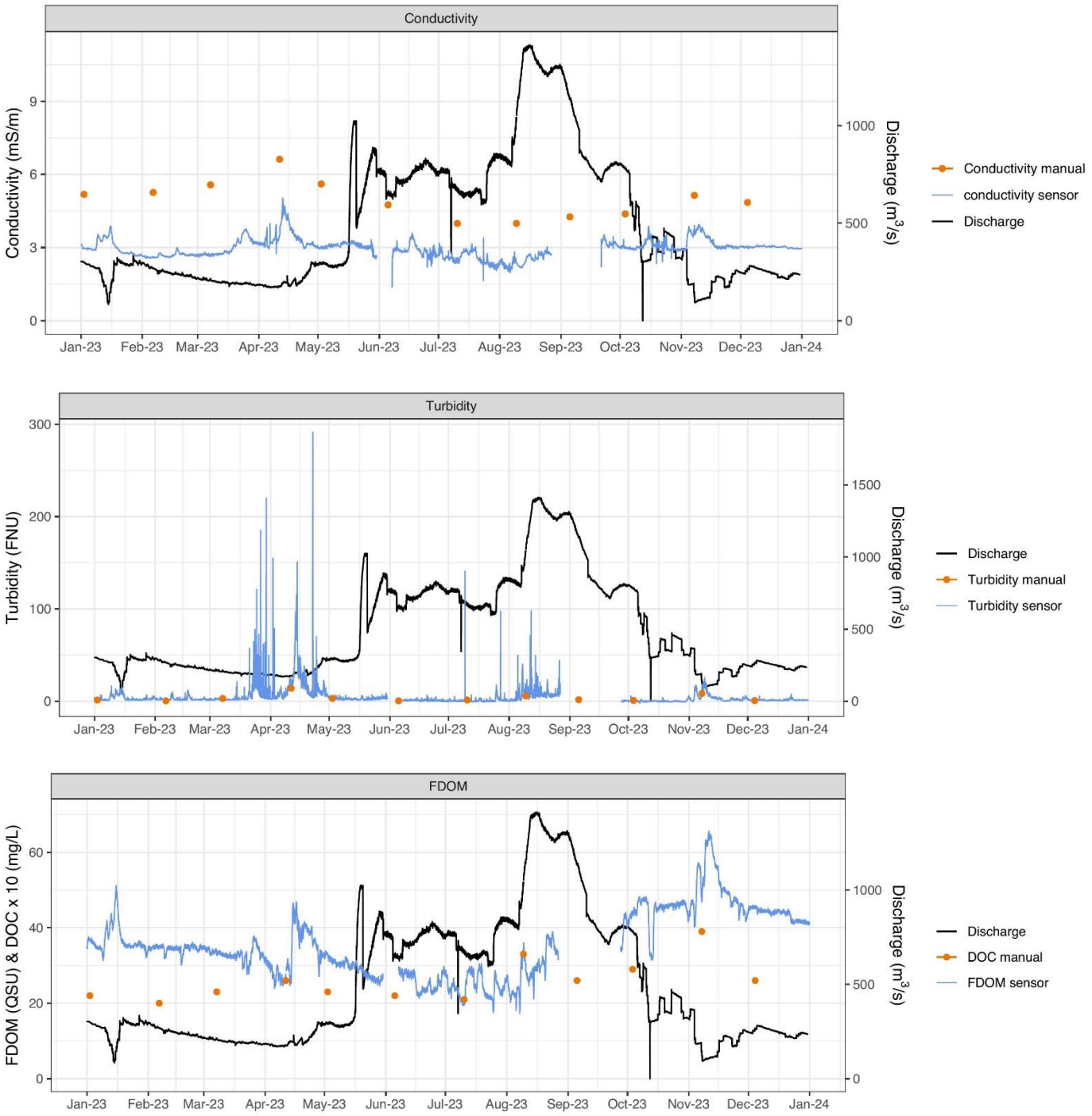

Figure 31. Vorma at Svanfoss in 2023. Conductivity (upper panel), turbidity (middle panel) and fluorescent dissolved organic matter (FDOM) (lower panel) plotted together with water flow data from NVE's station 2.197.0 Ertesekken.

3.5.2. Leira (at Kråkfoss)

Data for 2023 showed in Figure 32 and Figure 33.

Leira is responding quickly to precipitation events, and the extreme weather under Hans caused a distinct flood peak that was almost twice as large as other flood events this year. Leira is heavily influenced by clay soils and turbidity values are often high, especially during flood episodes. In 2023, the turbidity values were modest during spring but considerably higher under high-flow events from July onwards. A drop in conductivity (concentrations of electrolytes) suggests that the high flows in April-May were largely caused by snowmelt.

Turbidity values under the Hans event were, somewhat surprisingly, not much higher than values recorded during smaller floods before and after the extreme weather event. In contrast to turbidity, both conductivity and FDOM values showed an inverse relationship with water flow, suggesting a dilution of electrolytes and dissolved organic matter under high-flow conditions.

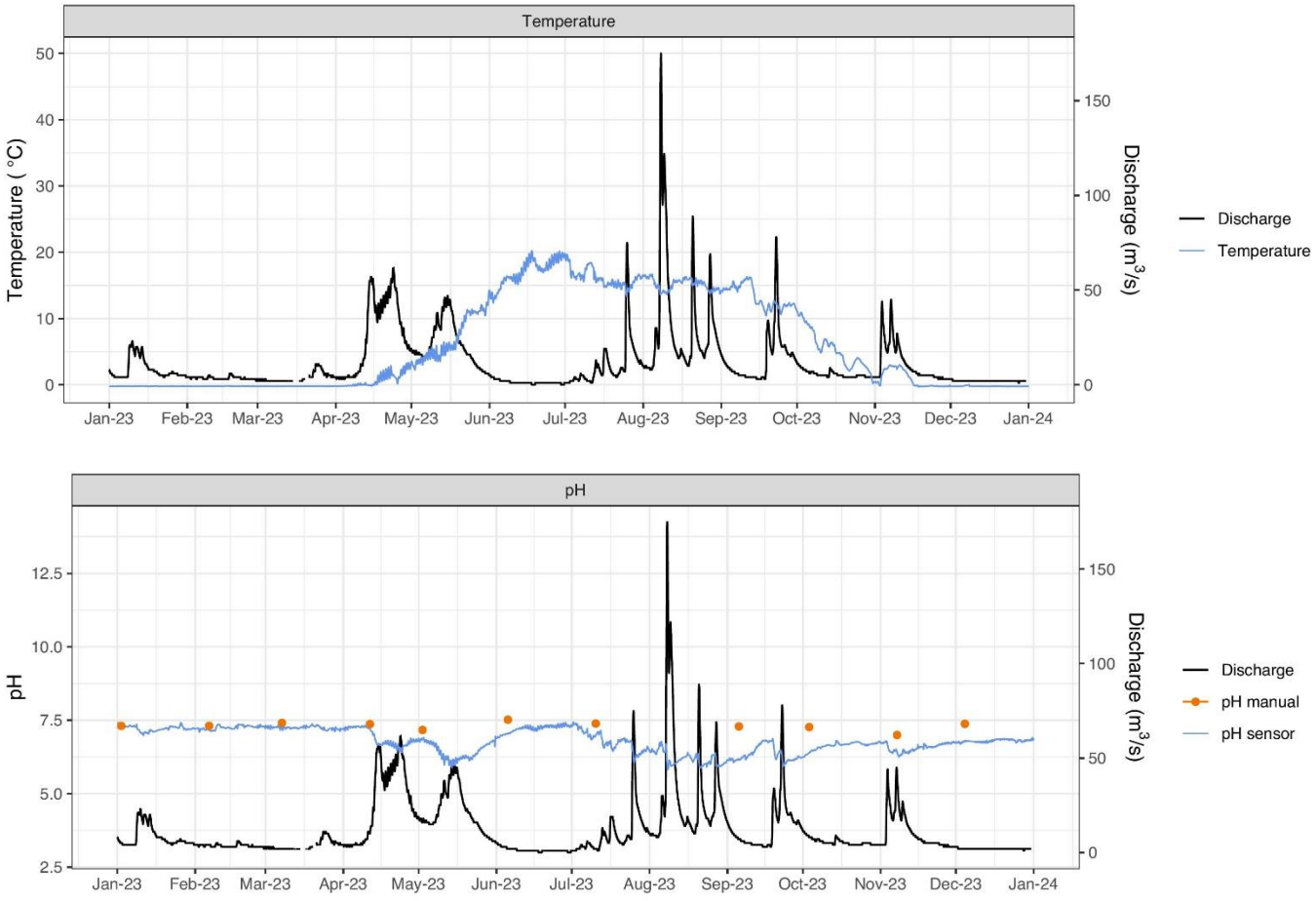

Figure 32. Leira at Kråkfoss in 2023. Water temperature (upper panel) and pH (lower panel) plotted together with water flow data from NVE's station 2.279.0 Kråkfoss.

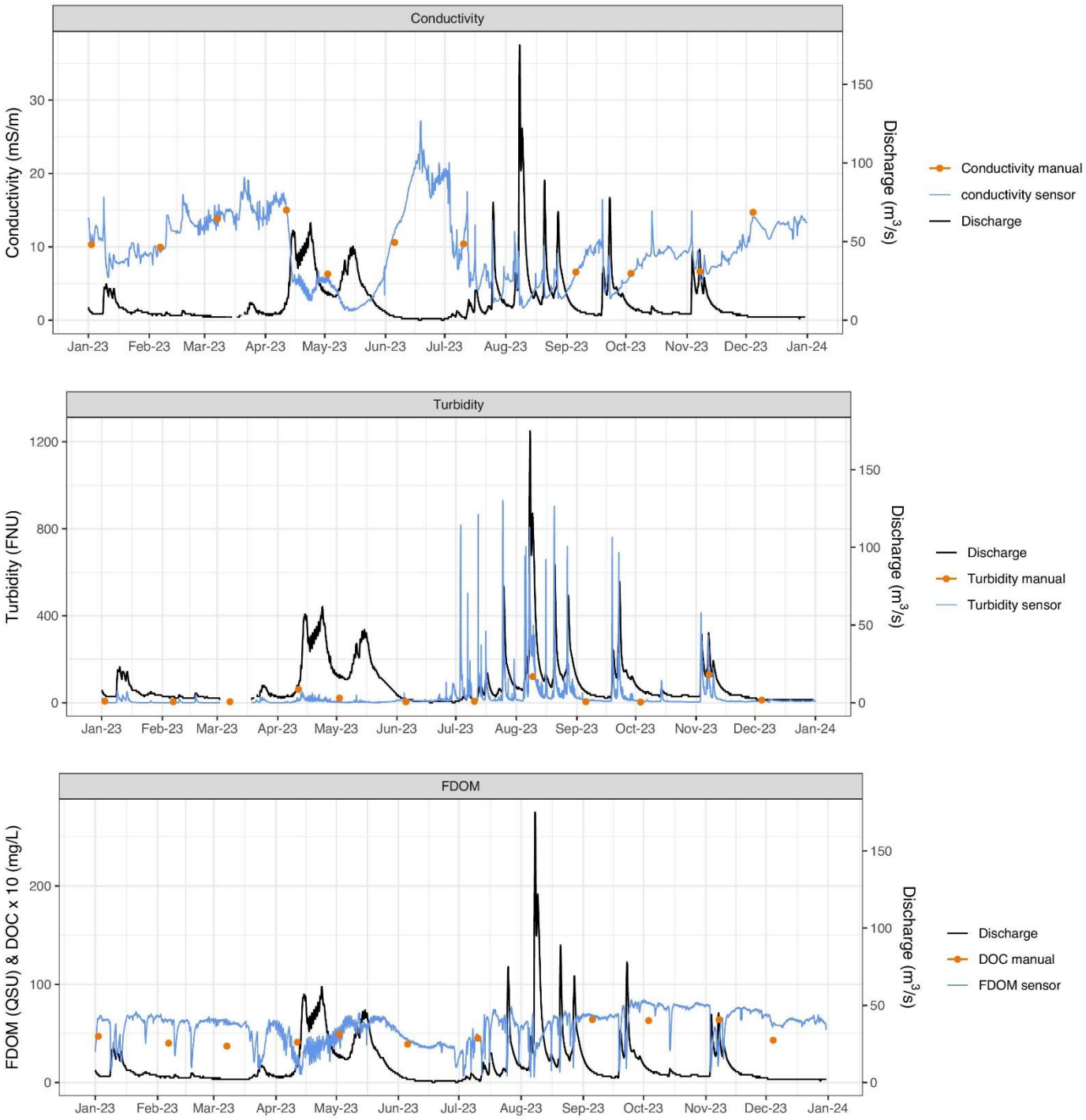

Figure 33. Leira at Kråkfoss in 2023. Conductivity (upper panel), turbidity (middle panel) and fluorescent dissolved organic matter (FDOM) (lower panel) plotted together with water flow data from NVE's station 2.279.0 Kråkfoss.

3.5.3. Glomma (at Baterød)

Data for 2023 showed in Figure 34 and Figure 35

The water flow pattern in 2023 was characterized by two snowmelt floods: one in late April (melting at low altitudes) and the largest one in late May (melting at higher altitudes). The most predominant flood this year occurred after the Hans event in August. pH depressions recorded during floods in 2023 are probably real, but the average pH-level from April onwards is probably underestimated (cf. pH measured in manual samples).

Turbidity usually shows a positive relationship with water flow, but there were also occasions (especially in spring) when turbidity values peaked without a prior increase in water flow. This may be related to local rainfall episodes causing erosion, but without affecting water flow in the main river. The Hans event in August caused a distinct turbidity peak, but still the maximum level was lower than other turbidity peaks recorded throughout the year.

Conductivity in most cases showed an inverse relationship with water flow, whereas FDOM largely followed a seasonal pattern with a minimum during the growing season in summer.

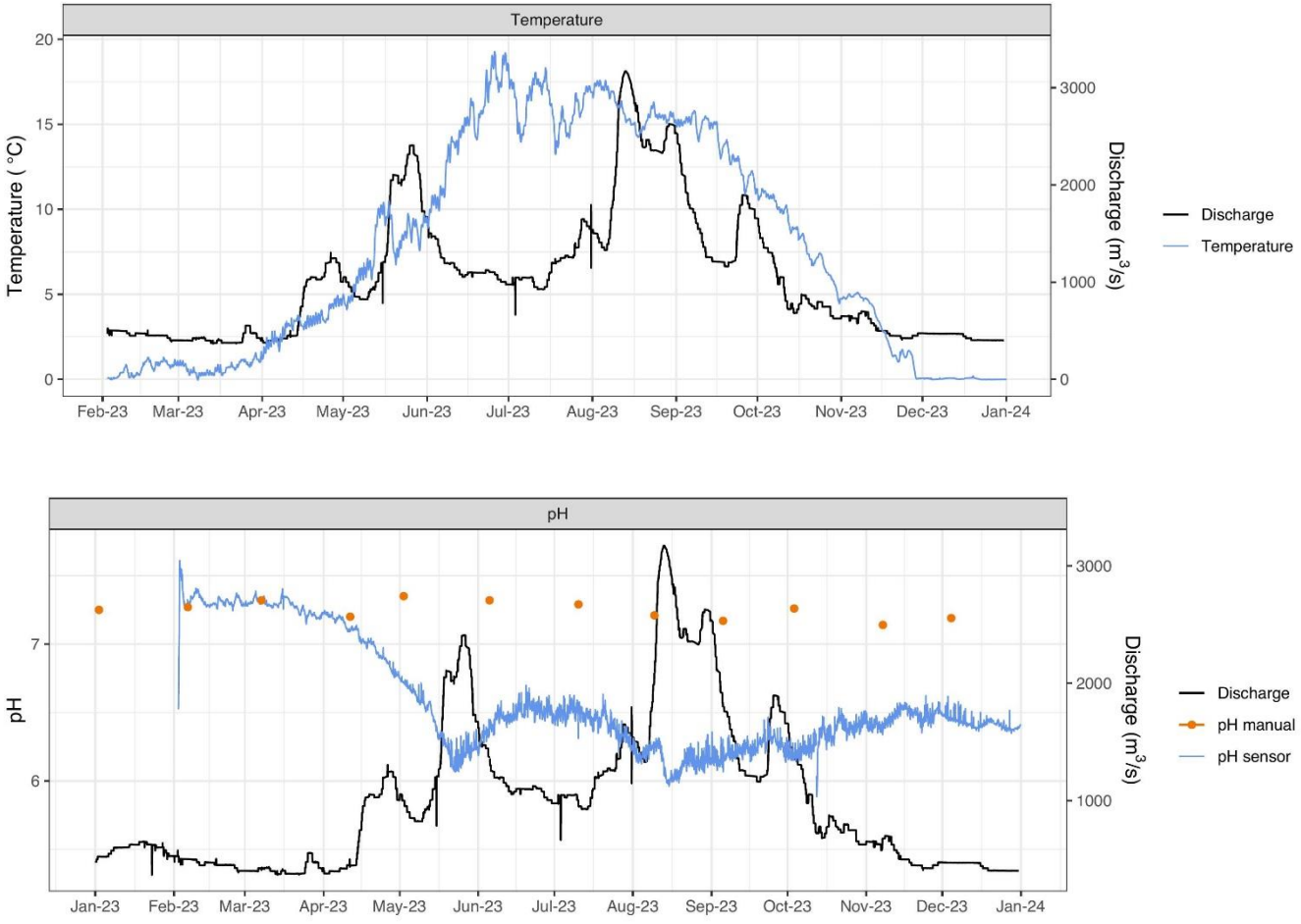

Figure 34. Glomma at Baterød in 2023. Water temperature (upper panel) and pH (lower panel) plotted together with water flow data from NVE's station 2.605.0 Solbergfoss.

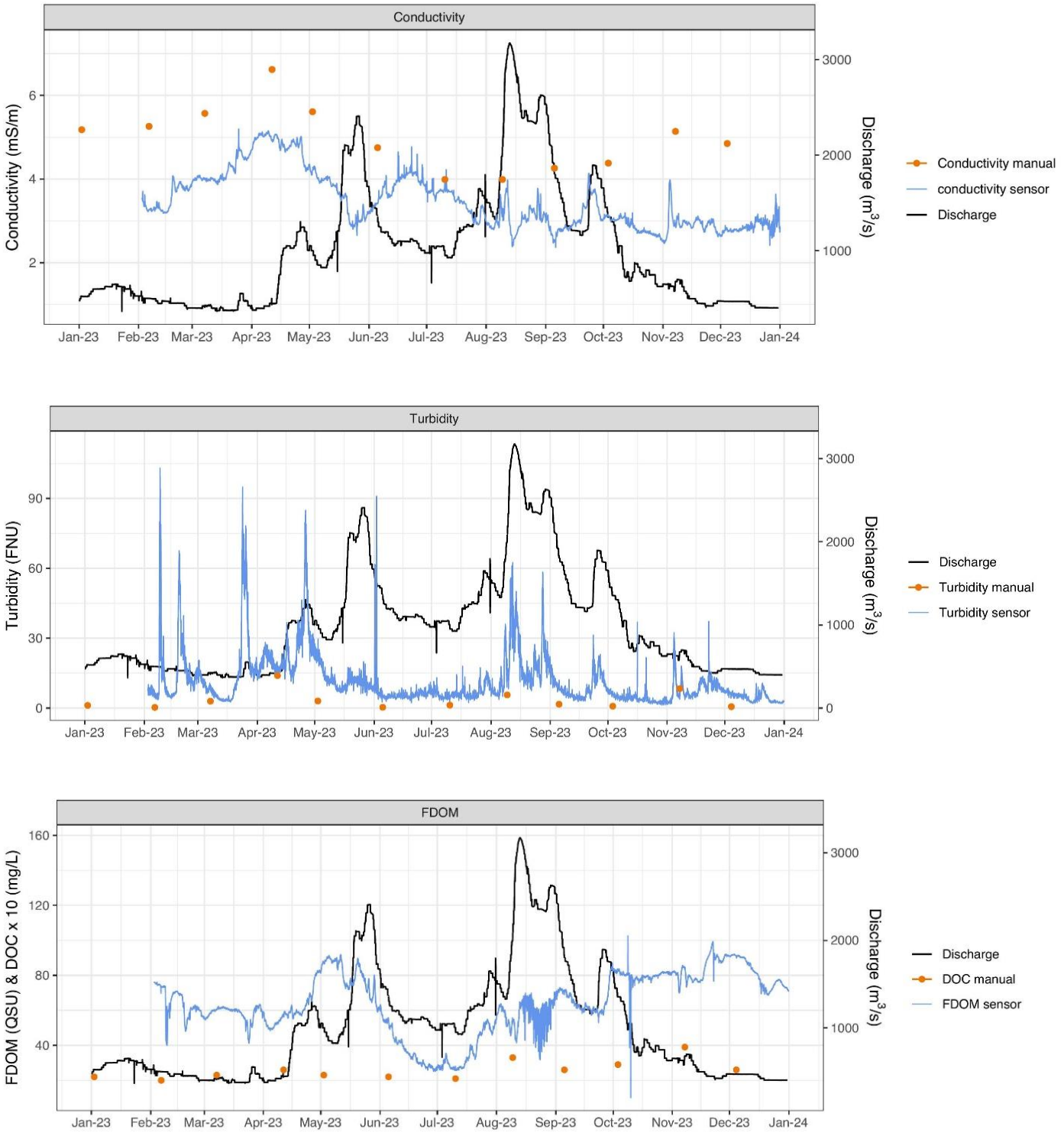

Figure 35. Glomma at Baterød in 2023. Conductivity (upper panel), turbidity (middle panel) and fluorescent dissolved organic matter (FDOM) (lower panel) plotted together with water flow data from NVE's station 2.605.0 Solbergfoss.

3.5.4. Storelva

Data for 2023 showed in Figure 36 and Figure 37.

The water flow pattern in 2023 was characterized by a high-flow period in January, a few minor floods during spring, and a relatively large flood in early November. Storelva is limed to protect the river's Atlantic salmon population and measured pH values are usually above 6.2-6.3. The monitoring in 2023 revealed a few occasions when pH dropped below 6.0, which is regarded as potentially harmful for salmon. With the lower parts of the catchment influenced by clay soils, there is usually a positive relationship between turbidity and water flow. In 2023, the relationship was especially evident in the autumn. FDOM in Storelva usually follows a seasonal pattern with the highest concentrations during high-flow periods in autumn and slightly lower values during the low-flow period in summer. There was no distinct summer minimum in FDOM in 2023, but several FDOM peaks during autumn associated with flood events.

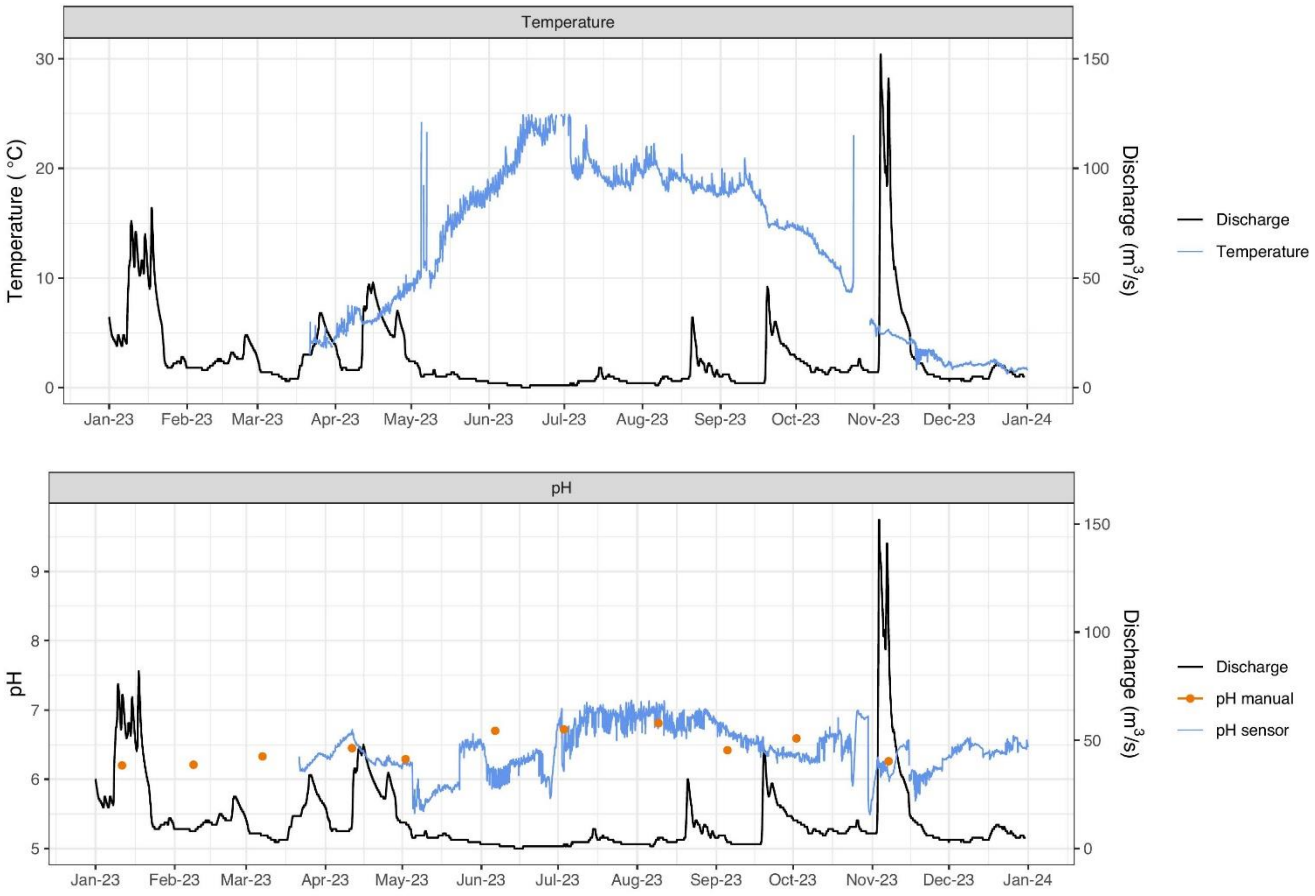

Figure 36. Storelva at Lundevatn in 2023. Water temperature (upper panel) and pH (lower panel) (lower panel) plotted together with water flow data from NVE's station 18.4.0 Lundevann. Note: The water temperature is occasionally overestimated during heating of the instrument cabinet during winter and during summer due to heating of pipeline between the water intake and the sensor station.

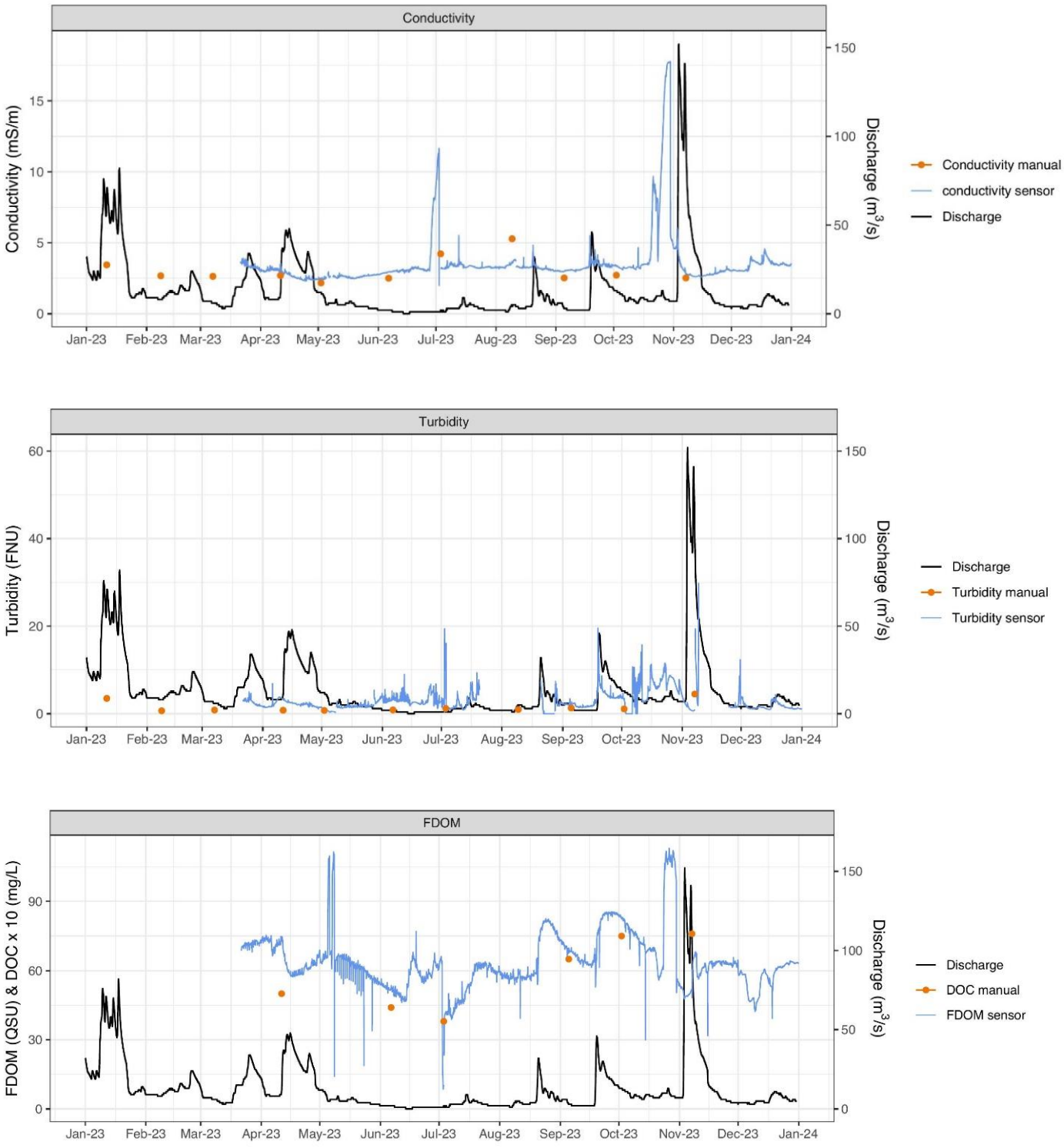

Figure 37. Storelva at Lundevatn in 2023. Conductivity (upper panel), turbidity (middle panel) and fluorescent dissolved organic matter (FDOM) (lower panel) plotted together with water flow data from NVE's station 18.4.0 Lundevann.

3.5.5. Målselva

Data for 2023 showed in Figure 38 and Figure 39.

The flow conditions in Målselva are highly seasonal, with very low water levels during the winter half-year. There are often two distinct flow peaks during spring/early summer: one in May following snowmelt at low altitudes, and another in June following snowmelt in the high mountains. This was also the case in 2023.

The snowmelt floods in 2023 were accompanied by drops in conductivity (dilution with ion-poor melting water), peaks in turbidity (particle erosion from the river plain) and FDOM (a proxy for TOC in water). During the snowmelt period, FDOM largely follows the same pattern as conductivity; increasing values during the early melting phase and decreasing values as the spring flood progresses with successively increasing inputs of dilute meltwater. The second flood peak that occurred in late June had lower FDOM values than the one in May, suggesting input of more dilute and TOC-poor meltwater from mountainous areas in the upper parts of the catchment.

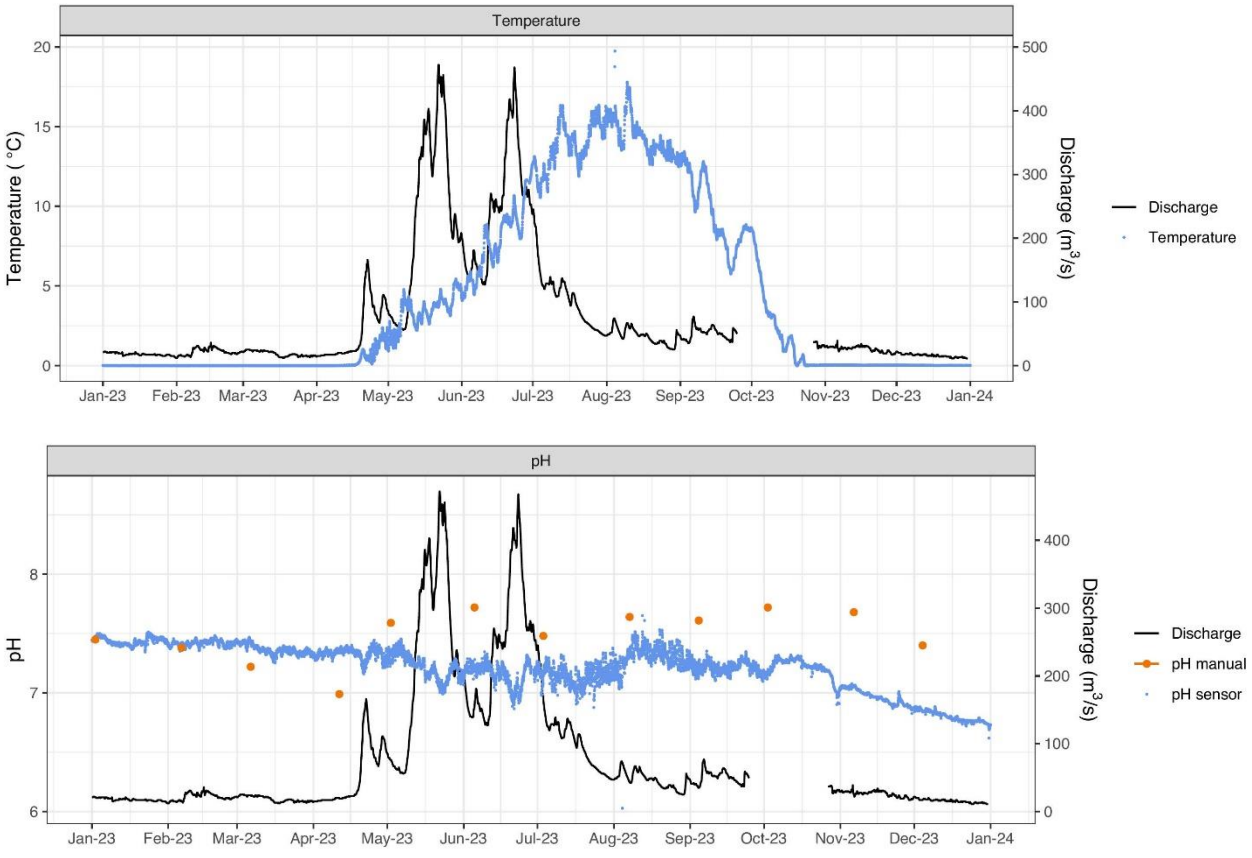

Figure 38. Målselva in 2023. Water temperature (upper panel) and pH (lower panel) plotted together with water flow data from NVE's station 196.35.0 Målselvfossen.

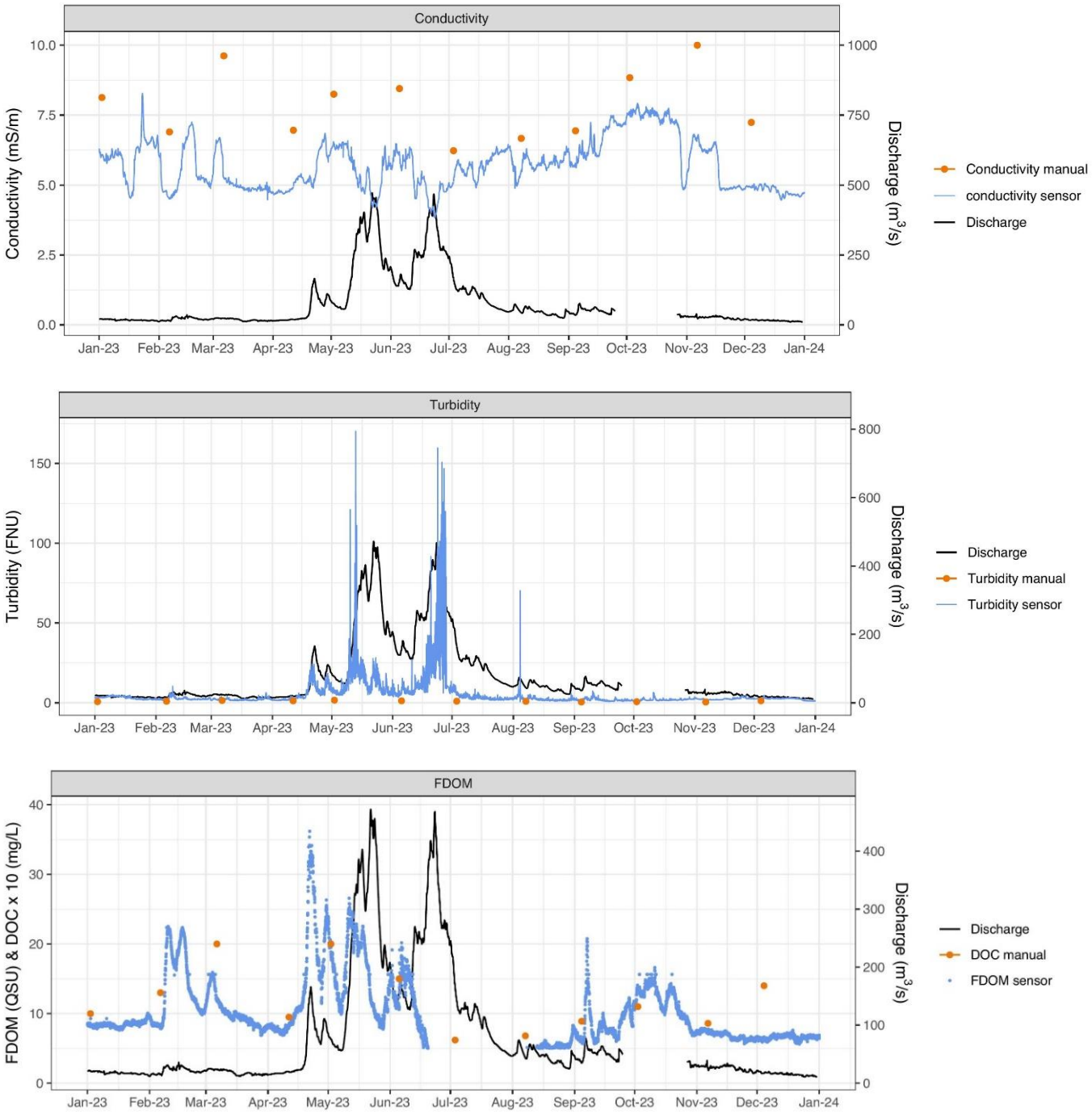

Figure 39. Målselva in 2023. Conductivity (upper panel), turbidity (middle panel) and fluorescent dissolved organic matter (FDOM) (lower panel) plotted together with water flow data from NVE's station 196.35.0 Målselvfossen.

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5 Appendix A – Methods

5.1 Water discharge

For the 11 "main rivers" of the previous RID programme (Table 1) discharge data is obtained from hydrological stations operated by NVE – the Norwegian Water Resources and Energy Directorate (Table 14). The data were downloaded from NVE's Hydra-II database. Since the hydrological stations are usually not located exactly at the same place where the water samples are collected, the water discharge has been re-calculated by up- or downscaling, proportional to the respective drainage area.

For the remaining 9 rivers, water discharge has been simulated with a spatially distributed version of the HBV model (Beldring et al. 2003). The use of this model was introduced in 2004, and Skarbøvik et al. (2017) gives more information on the methodology.

Table 14. Hydrological stations assigned to the 11 "main rivers" from the former RID programme. All stations are operated by NVE.

River name	NVE station	Station id
Glomma	Solbergfoss	2.605.0
Alna	Alna v/Kvernerbyen	6.78.0
Drammenselva	Døvikfoss	12.285.0
Numedalslågen	Holmfoss i Numedalslågen	15.61.0
Skienselva	Skotfoss	16.133.0*
Otra	Heisel	21.11.0
Orreelva	Haugland	28.7.0
Vosso	Bulken (Vangsvatnet)	62.5.0
Orkla	Syrstad	121.22.0
Vefsna	Laksfors	151.28.0
Altaelva	Kista	212.11.0

* Should be station 16.133 + station 16.153 (Totalavløp Norsjø), but 16.153 is no longer monitored. To compensate for this, the long-term mean for station 16.153 (10 m^3/s) is added to the measured discharge at station 16.133.

5.2 Water temperature

Data on water temperature is acquired from four different sources (Table 15): Sensor monitoring (hourly time-step), TinyTag temperature loggers (hourly time-step), manual measurements with a thermometer in connection with the monthly water quality sampling, and NVE temperature logging (daily means from hourly measurements). For the first three, measurements are done at the water quality sampling sites, while the NVE data are from NVE stations located in close vicinity to the sampling sites. The TinyTag loggers are routinely replaced each autumn to ensure enough battery capacity.

Since temperature measurements have only been part of the river monitoring programme since 2013, data from NVE has been used for long-term trend analysis. Details on the time series from the closest NVE station in each river are presented in Table 16. Long-term data series of water temperature typically contain some missing data. Prior to trend analysis, the data was filtered to remove years for which >10% of the daily observations were missing.

Table 15. Sources for water temperature data in monitored rivers.

Data source	Sites
Sensor-based	Storelva, Målselva
TinyTag loggers	Numedalslågen, Skienselva, Otra, Orreelva, Vosso, Vefsna, Altaelva
NVE station	Orkla, Vikedalselva
Manual measurement	Glomma, Alna, Drammenselva, Bjerkreimselva, Nausta, Driva, Nidelva, Tana, Pasvikelva

Table 16. Stations with available long-term data on water temperature. The stations are operated by the Norwegian Water Resources and Energy Directorate (NVE).

St. ID	River name	Water temperature station	Start
29617	Glomma	n.a.	
36225	Alna	n.a.	
29612	Drammenselva	12.298.0.1003.4 Drammenselva v/Døvikfoss	1987
29615	Numedalslågen	15.115.0.1003.1 Numedalslågen v/Brufoss	2005
29613	Skienselva	16.207.0.1003.2 Skienselva ndf. Norsjø	1991
30019	Storelva	n.a.	
29614	Otra	21.79.0.1003.1 Otra v/Mosby	1988
29832	Bjerkreimselva	27.29.0.1003.1 Bjerkreimselvi v/Bjerkreim	1987
29783	Orreelva	n.a.	
29837	Vikedalselva	38.2.0.1003.1 Vikedalselva utløp	1987
29821	Vosso	62.30.0.1003.3 Vosso ovf. Evangervatnet	1993
29842	Nausta	84.23.0.1003.3 Nausta v/Hovefossen	1999
29822	Driva	n.a.	
29778	Orkla	121.62.0 Orkla v/Merk Bru	1992
29844	Nidelva	n.a.	
29782	Vefsna	n.a.	
29848	Målselv	196.43.0.1003.1 Malangfoss	1991
29779	Altaelva	212.68.0.1003.1 Alta v/Gargia	1982
29820	Tanaelva	234.19.0.1003.1 Tana ovf. Polmakelva	2000
29819	Pasvikelva	246.11.0.1003.1 Pasvikelva v/Skogfoss kraftstasjon	1992

5.3 General water quality – sampling and analyses

5.3.1. Sampling methodology

Monthly sampling was conducted by grab sampling, undertaken by local fieldworkers. In Glomma and Drammenselva, both receiving a substantial part of their water discharge from high-elevation areas, additional sampling was conducted during May and June to get a better representation of the high-flow period following snowmelt.

5.3.2. Chemical parameters –quantification limits and analytical methods

The parameters monitored in 2022, including information on methodology and limits of quantification (LOQ) are given in Table 17. The metals, including silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), and zinc (Zn) were analysed every three months (i.e., four times per year). All metals are analysed on unfiltered samples, whereas the priority metals Cd, Pb, Ni and Hg also are analysed on filtered samples.

Since 2019, mercury (Hg) has been analysed by the USEPA method 1631; oxidation, purge and trap, and cold vapor atomic fluorescence spectrometry (CVAFS) with an LOQ of 0.2 ng/L (hereafter: the CVAFS method). Hg was analysed monthly in 2019-2020 and quarterly (every 3rd month) from 2021.

Table 17. Analytical methods with limits of quantification (LOQ)

Parameter	LOQ	Analytical Method
pH	3.5	NS-EN ISO 10523
Alkalinity (mmol/L)	0.03	NS-EN ISO 9963-1
Conductivity (mS/m)	0.1	NS-ISO 7888
Turbidity (FNU)	0.3	NS-EN ISO 7027-1, modified
Suspended particulate matter (SPM) (mg/L), using the laboratory methods named TSM and STS.	0.1 mg/l when 1 L is filtered (TSM) 0.1 mg/L when 4 L is filtered (STS)	NS 4733 modified (Nuclepore capillary filter with nominal pore width 0.4 µm and diameter 47 mm) NS 4733 modified and NS-EN 872 modified (Whatman GF/C filters)
Total Organic Carbon (TOC) and Dissolved Organic Carbon (DOC) (mg C/L)	0.1 0.5	NS-EN 1484 modified – UV peroxodisulphate NS-EN 1484 modified – catalytic combustion
Total phosphorus (Tot-P) and particulate phosphorus (PP) (µg P/L)	1.0 For PP: dep. on vol. filtered	NS 4725 – Peroxodisulphate oxidation method modified (automated)
Orthophosphate (PO4-P) (µg P/L) (on unfiltered samples)	1	NS 4724 – Automated molybdate method modified (automated)
Total nitrogen (Tot-N) (µg N/L)	20	NS 4743 and NS-EN ISO 11905, modified
Nitrate (NO_3-N) (µg N/L) **Nitrite-nitrate (NO_3-N+NO_2-N) (µg N/L)[4]**	2 1	NS-EN ISO 10304-1, modified NS 4745, modified (automated)
Chloride (Cl) (mg/L)	0.01	NS-EN ISO 10304-1, modified
Sulphate (SO4) (mg/L)	0.005	NS-EN ISO 10304-1, modified
Ammonium (NH_4-N) (µg N/L)	2	NS-EN ISO 14911, modified
Potassium (K) (mg K/L)	0.01	NS-EN ISO 14911, modified
Magnesium (Mg) (mg Mg/L)	0.01	NS-EN ISO 14911, modified
Sodium (Na) (mg Na/L)	0.01	NS-EN ISO 14911, modified

[4] *Analysed in samples from September to December in 2023*

Particulate Organic Carbon (POC) (µg C/L) and particulate Nitrogen (PN) (µg N/L)	Dep. on blank & vol. filtered	Internal method, combustion at 1800°C
UV-visible absorbance spectrum	n.a.	Internal method (200-900 nm)
Colour (mg Pt/L)	2	NS-EN ISO 7887, modified
Soluble silicates (SiO2) (µg SiO2/L)	25	NS-EN ISO 16264 modified
Calcium (Ca) (mg/L)	0.005	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Silicone (Si) (mg Si/L)	0.005	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Silver (Ag) (µg Ag/L)	0.002	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Arsenic (As) (µg As/L)	0.025	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Cadmium (Cd) and total dissolved cadmium (µg Cd/L)	0.003	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Chromium (Cr) (µg Cr/L)	0.025	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Copper (Cu) (µg Cu/L)	0.04	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Mercury (Hg) and total dissolved mercury (ng Hg/L)	0.3	USEPA 1631 (CVAFS method)
Nickel (Ni) and total dissolved nickel (µg Ni/L)	0.04	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Lead (Pb) and total dissolved lead (µg Pb/L)	0.005	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Zinc (Zn) (µg Zn/L)	0.15	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified

5.3.3. Presentation and plotting

The annual mean water chemistry data was plotted using the R programming language (https://www.r-project.org/) with the package ggplot2. Observations below the method LOQ were replaced with 0.5 x LOQ.

5.4 Priority substances and river basin specific pollutants

For information about methodology for sampling and chemical analysis, see Allan et al. (2022).

5.5 Calculation of riverine loads

Estimates of annual riverine loads were done according to the formula below, which follows recommendations in OSPAR Agreement 2014:04; §6.13b. The method handles irregular sampling frequency and allows flood samples to be included in the annual load calculations.

$$Load = Q_r \frac{\sum_1^n Q_i \bullet C_i \bullet t_i}{\sum_1^n Q_i \bullet t_i}$$

where:

Q_i represents the water discharge at the day of sampling (day i);
C_i the concentration at day i;
t_i the time period from the midpoint between day i-1 and day i to the midpoint between day **i** and day i+1, i.e., half the number of days between the previous and next sampling; and
Q_r is the annual water volume.

When the results recorded were less than the limits of quantification (LOQ) the following estimate of the concentration has been used:

Estimated concentration = ((100%-A) • LOQ)/100

Where A = percentage of samples below LOQ.

This procedure is in accordance with OSPAR Agreement 2014:04 (the updated RID Principles). According to these principles (http://www.ospar.org/documents?d=33689) no more than 30% of the samples should be below the LOQ).

5.6 Trend analyses and data comparison

Trend analysis has been conducted for air temperature, precipitation, water temperature, water flow, and selected water chemical parameters. Since the location of weather stations usually differs from the water sampling sites, trends in weather data are presented together with information on stations and time ranges used. Details for water chemistry trend analysis are given below. The general trend analysis methodology described is applied also for the weather data and water flow/temperatures.

When monitoring data collected in 2023 is presented, results are compared with the preceding five-year mean (2018-2022). The 2023 data are presented with the annual mean (based on monthly values) ± one standard deviation, while 2018-2022 data are presented as the five-year mean (based on annual values) ± one standard deviation.

5.6.1. Trend analysis methodology

The Mann-Kendall test (Hirsch and Slack, 1984) has been used to test for monotonic trends (including Sen slope) in annual riverine concentrations. Trends are regarded as statistically significant at the 95% significance level ($p < 0.05$, double-sided test).

5.6.2. Selection of rivers for trend analysis

Trend analysis for water chemical parameters was conducted for nine of the former "main rivers" where monthly monitoring data are available since 1990 (Table 18). The remaining two rivers included as "main rivers" in the former RID programme, Alna and Vosso, did not have enough years with monthly monitoring. Storelva was not monitored at the current sampling site during 2004-2016, and only once a year from 1990-2003. The remaining rivers all had lower than monthly sampling frequency during 1990-2016.

5.6.3. Selection of parameters and time-periods

The water chemical parameters included in the trend analyses were suspended particulate matter (SPM), silica (SiO_2), total organic carbon (TOC), total nitrogen (Tot-N), ammonium (NH_4), nitrate (NO_3), total phosphorus (Tot-P), phosphate (PO_4), Cu, Pb, Zn, Cd, and Ni. Trends for the remaining metals have not been calculated due to the combination of a large proportion of the samples having levels below LOQ and changes in the analytical methods during the monitoring period, see Skarbøvik et al. (2010) for details.

Trend analyses for water chemical parameters cover the period 1990-2023, while the analyses for metals are only based on short-term (2004-2022) data, because changes in the analytical methods led to successive reductions in LOQ levels from 1990 until 2003 (i.e., a false declining trend). Another change in the monitoring of metals is that the sampling frequency was reduced from monthly to quarterly (4 times per year) from 2017 and onwards.

Note that the trend analysis for TOC started in 1999 for Numedalslågen, Skienselva, Orreelva, Vefsna, and Altaelva, due to infrequent measurement in the early years of the monitoring. The statistical power of the trend analysis decreases when applied to shorter time-series.

Table 18. An overview over the rivers, parameters, and historical frequency of measurement for the nine rivers included in the trend analysis.

Short name	Rivers/parameters	Parameters***	Sampling frequency (times yr^{-1})		
			1990-2003	2004-2016	2017-pt
"Monthly monitored since 1990"	Glomma*, Drammenselva*, Numedalslågen, Skienselva, Otra, Orreelva, Orkla, Vefsna and Altaelva**	Nutrient fractions, SPM, TOC, silicate	12	12	12
-«-	-«-	Metals	12	12	4

* Glomma and Drammenselva sampled 16 times per year, or even more frequently (e.g., during the 1995-flood).

** In Altaelva, the sampling was less frequent during 1990-1998.

*** In 1999-2003 samples were analysed at a different laboratory, and for this reason, concentrations of total phosphorus and mercury in 1999-2003 are excluded from the time series. A more detailed overview of excluded data from historical records is given in Skarbøvik et al. (2010).

5.7 High-frequency monitoring (sensor stations)

In 2023, the programme included five sensor stations:

- Vorma (in the Glomma catchment) (60.2142 °N, 11.3566 °E)
- Leira (in the Glomma catchment) (60.1330 °N, 11.0801 °E)
- Baterød (lower part of the Glomma river) (59.3077 °N, 11.1354 °E)
- Storelva (58.6680 °N, 8.9754 °E)
- Målselva (69.1389 °N, 18.6013 °E)

The sensor stations in Storelva, Målselva, and Glomma at Baterød are located at approximately the same spot as the manual sampling sites (Table 1). Monthly water samples are also collected at the sensor stations in Vorma and Leira but results from these are only shown in together with the sensor data in chapter 3.5.

NVE water discharge stations located in the near vicinity of the sensor stations:

- Svanfoss: NVE station 2.197.0 Ertesekken ndf. (1.6 km downstream)
- Kråkfoss: NVE station 2.279.0 Kråkfoss (same location)
- Baterød: NVE station 2.605.0 Solbergfoss (43 km upstream)
- Storelva: NVE station 18.4.0 Lundevann (150 m downstream)
- Målselva: NVE station 196.35.0 Målselvfossen (15 km upstream)

Technical details

In Storelva, water from the river is pumped a few meters to an instrument container with flow cells equipped with sensors that measure water temperature, pH, conductivity, turbidity and fluorescent dissolved organic matter (FDOM). At the other stations, the sensors are mounted in a rig that is immersed in the river water. Data are recorded on an hourly basis, transferred to NIVA's server and made available online.

Quality assurance (QA)

A QA routine has been set up by flagging data that are obviously wrong, e.g., due to interrupted power supply, clogging, etc. Flagged data are not visible online or downloadable but are kept in the database. To ensure good and continuous data, the stations are visited at regular intervals for service and maintenance. Temperature correction of the FDOM data was done in accordance with Ryder et al. (2012). The intercept constant was set to 100, and the slope intercept was chosen as to give the best correlation between temperature corrected FDOM and dissolved organic carbon (DOC) concentration for the given time period.

6 Appendix B – Primary data

6.1 Riverine concentrations in 2023

Tables start on next page.

Glomma ved Sarpsfoss

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	7.10	5.61	20.00	24.10	4.6	4.4	853.0	26	43	30.0	590	2	800	106.0	4.24									
06.02.2023	6.99	5.11	3.90	3.56	4.2	4.2	272.0	5	11	7.0	380	43	550	30.6	4.28	<0.00	0.15	0.17	0.01	1.11	2.50	0.73	0.23	1.54
07.03.2023	7.14	5.52	5.40	5.04	3.6	3.6	269.0	5	12	6.9	360	40	550	<32.5	4.24									
11.04.2023	7.10	5.98	8.90	9.96	3.9	3.9	371.0	11	19	14.0	420	35	650	66.8	4.71									
02.05.2023	6.92	4.97	14.00	19.00	6.2	6.2	443.0	19	32	20.0	490	6	790	55.3	5.69	0.00	0.22	0.42	0.02	1.76	4.90	1.31	0.60	3.83
22.05.2023	6.87	3.19	4.20	4.60	6.0	6.0	559.0	10	21	13.0	120	<2	370	66.3	3.79									
30.05.2023	6.98	3.21	4.00	11.90	4.3	4.1	544.0	7	17	11.0	130	<2	340	47.8	3.22									
05.06.2023	7.17	3.72	2.40	5.52	3.7	3.7	654.0	4	10	9.5	170	<2	370	21.8	3.28									
14.06.2023	7.15	4.07	1.40	4.15	3.0	2.8	319.0	4	10	7.2	120	<2	380	41.9	3.27									
26.06.2023	7.34	4.41	2.50	4.49	2.5	2.5	204.0	7	10	7.7	150	<2	380	26.4	2.99									
10.07.2023	7.28	4.50	1.90	3.21	2.3	2.2	231.0	3	8	7.9	130	<2	390	63.3	2.75									
09.08.2023	7.15	4.28	7.70	27.00	4.8	4.7	697.0	16	26	17.0	260	<2	560	79.4	3.92	<0.00	0.21	0.50	0.01	1.98	3.20	1.25	0.59	2.02
11.08.2023	7.17	4.76	28.00		5.1	4.9	698.0	32	52		350	20	640	85.1	4.90	<0.00	0.15	0.41	0.01	1.58	2.70	1.07	0.48	2.96
29.08.2023	7.17	4.14	11.00		6.7	6.4	627.0	19	33		270	<2	520	77.8	3.79	<0.00	0.27	0.46	0.01	2.25	3.70	1.31	0.57	4.77
05.09.2023	7.15	3.91	3.60	7.96	5.4	5.6	398.0	8	15	12.0	215	3	400	50.4	3.81									
03.10.2023	7.13	4.28	2.90	4.98	6.2	6.0	339.0	7	13	10.0	325	<2	510	37.6	4.02	<0.00	0.17	0.19	0.01	1.84	2.30	0.85	0.26	1.96
07.11.2023	7.03	4.90	5.40	5.82	5.6	5.4	359.0	7	16	12.0	445	<2	640	41.9	4.28									
04.12.2023	7.13	5.26	4.30	3.87	5.8	5.6	296.0	6	12	6.8	415	<2	620	38.8	4.65									
Lower avg.	7.11	4.55	7.31	9.07	4.7	4.6	451.8	11	20	12.0	297	8	526	52.1	3.99	0.00	0.19	0.36	0.01	1.75	3.22	1.09	0.45	2.85
Upper avg..	7.11	4.55	7.31	9.07	4.7	4.6	451.8	11	20	12.0	297	10	526	53.9	3.99	0.00	0.19	0.36	0.01	1.75	3.22	1.09	0.45	2.85
Minimum	6.87	3.19	1.40	3.21	2.3	2.2	204.0	3	8	6.8	120	2	340	21.8	2.75	0.00	0.15	0.17	0.01	1.11	2.30	0.73	0.23	1.54
Maximum	7.34	5.98	28.00	27.00	6.7	6.4	853.0	32	52	30.0	590	43	800	106.0	5.69	0.00	0.27	0.50	0.02	2.25	4.90	1.31	0.60	4.77
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	18.00	18.00	18.00	16.00	18.0	18.0	18.0	18	18	16.0	18	18	18	18.0	18.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
St.dev	0.12	0.79	7.04	7.61	1.3	1.3	191.3	8	13	6.1	144	14	145	22.9	0.74	0.00	0.05	0.14	0.00	0.39	0.97	0.25	0.17	1.25

Alna

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	7.82	54.50	11.00	11.80	3.7	3.6	912.0	52	67	33.0	750	180	1200	99.8	7.85									
06.02.2023	7.80	96.30	6.20	11.80	6.2	4.3	1650.0	79	120	55.0	650	330	1400	158.0	7.70	0.08	0.63	0.58	0.04	3.08	14.60	0.86	0.48	2.58
06.03.2023	7.95	65.30	3.90	5.01	2.9	2.9	666.0	53	78	34.0	950	370	1500	88.4	8.10									
11.04.2023	7.72	54.50	21.00	117.00	4.1	4.0	1350.0	93	155	84.0	890	220	1600	130.0	11.70									
02.05.2023	7.79	43.10	5.30	8.47	4.3	4.1	1140.0	41	48	30.0	640	<2	1200	158.0	6.89	0.00	0.28	0.51	0.04	2.82	10.20	0.94	0.46	1.96
05.06.2023	7.97	52.60	3.10	5.64	3.5	3.4	868.0	53	90	45.0	1230	<2	2000	110.0	5.51									
03.07.2023	7.96	50.30	8.60	8.03	4.4	4.4	951.0	96	124	55.0	1130	<2	2100	113.0	7.10									
09.08.2023	7.83	26.30	12.00	33.90	7.0	6.5	1230.0	38	75	48.0	450	<2	1300	131.0	6.35	0.00	0.58	1.93	0.08	5.89	21.60	2.03	1.27	5.23
04.09.2023	8.04	40.60	4.50	6.95	5.5	5.6	889.0	66	93	40.0	1300	<2	1900	108.0	7.90									
02.10.2023	8.04	36.90	3.90	5.39	5.1	4.8	527.0	44	57	30.0	1060	75	1500	68.3	7.23	<0.00	0.38	0.43	0.03	3.23	8.40	0.95	0.37	1.95
06.11.2023	7.76	34.10	7.20	13.20	6.1	5.9	636.0	35	49	24.0	830	74	1300	67.7	7.21									
04.12.2023	7.80	44.80	3.70	3.28	4.2	4.1	550.0	67	87	32.0	1080	2	2200	77.4	8.10									
Lower avg.	7.87	49.94	7.53	19.21	4.8	4.5	947.4	60	87	42.5	913	104	1600	109.1	7.64	0.02	0.47	0.86	0.05	3.75	13.70	1.19	0.65	2.93
Upper avg..	7.87	49.94	7.53	19.21	4.8	4.5	947.4	60	87	42.5	913	105	1600	109.1	7.64	0.02	0.47	0.86	0.05	3.75	13.70	1.19	0.65	2.93
Minimum	7.72	26.30	3.10	3.28	2.9	2.9	527.0	35	48	24.0	450	2	1200	67.7	5.51	0.00	0.28	0.43	0.03	2.82	8.40	0.86	0.37	1.95
Maximum	8.04	96.30	21.00	117.00	7.0	6.5	1650.0	96	155	84.0	1300	370	2200	158.0	11.70	0.08	0.63	1.93	0.08	5.89	21.60	2.03	1.27	5.23
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.11	18.03	5.15	31.83	1.2	1.1	343.0	21	32	16.5	259	137	359	31.1	1.49	0.04	0.17	0.71	0.02	1.43	5.88	0.56	0.42	1.56

Drammenselva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
03.01.2023	7.00	3.85	0.81	0.83	3.3	3.2	239.0	1	4	3.0	250	<2	390	25.8	3.22									
06.02.2023	7.03	4.06	0.50	0.88	2.9	2.9	204.0	<1	3	2.7	270	15	410	20.0	3.17	<0.00	0.11	0.06	0.00	0.53	1.80	0.39	0.11	0.87
07.03.2023	7.02	3.82	0.68	1.80	2.4	2.5	161.0	2	4	3.6	250	24	360	13.4	3.00									
11.04.2023	7.12	5.53	13.00	14.70	3.4	3.4	752.0	27	39	26.0	720	20	870	96.9	5.47									
02.05.2023	7.05	4.19	1.40	2.08	4.1	4.1	125.0	2	5	3.5	310	6	460	14.1	3.43	<0.00	0.14	0.10	0.01	0.96	2.90	0.58	0.17	1.66
22.05.2023	6.96	3.24	2.00	4.33	3.7	3.7	366.0	4	9	7.6	170	<2	370	37.1	3.22									
30.05.2023	6.96	3.46	1.30	2.96	3.6	3.5	286.0	3	6	4.3	200	<2	370	30.5	3.09									
05.06.2023	7.16	3.57	0.86	2.26	3.6	3.5	370.0	2	6	4.7	200	<2	360	<13.0	3.20									
12.06.2023	7.05	3.59	1.20	3.24	3.8	3.8	345.0	3	7	4.9	170	<2	350	27.7	3.26									
26.06.2023	7.06	3.12	0.87	1.40	3.4	3.3	340.0	1	5	3.7	81	<2	310	51.4	2.65									
03.07.2023	7.19	3.54	2.30	2.72	3.5	3.3	288.0	3	6	6.5	46	<2	330	55.8	2.77									
06.08.2023	7.16	3.25	0.88	1.60	3.6	3.6	210.0	1	4	3.9	140	<2	320	59.3	2.68	<0.00	0.13	0.06	0.00	0.60	0.93	0.41	0.10	0.98
11.08.2023	6.94	2.79	12.00		4.8	4.7	632.0	26	38		130	12	340	57.6	4.04	<0.00	0.20	0.65	0.01	1.24	3.20	0.70	0.43	2.66
29.08.2023	6.99	3.12	9.70		6.7	6.7	797.0	17	28		175	<2	420	71.5	4.00	<0.00	0.35	0.63	0.01	1.78	4.50	1.21	0.50	5.08
11.09.2023	7.07	3.66	2.00	3.66	5.4	5.0	221.0	4	9	6.7	215	4	390	29.0	3.38									
02.10.2023	7.11	3.70	1.80	2.58	4.9	5.1	181.0	3	7	5.2	240	7	400	35.2	3.40	<0.00	0.17	0.11	0.01	0.93	2.00	0.57	0.18	1.66
06.11.2023	7.23	5.53	4.60	3.90	5.3	5.1	270.0	7	14	9.8	580	6	790	34.7	4.17									
04.12.2023	7.01	3.55	0.73	1.13	4.0	3.9	161.0	2	5	3.0	255	<2	370	20.5	3.25									
Lower avg.	7.06	3.75	3.15	3.13	4.0	4.0	330.4	6	11	6.2	245	5	423	37.8	3.41	0.00	0.18	0.27	0.01	1.01	2.56	0.64	0.25	2.15
Upper avg..	7.06	3.75	3.15	3.13	4.0	4.0	330.4	6	11	6.2	245	6	423	38.5	3.41	0.00	0.18	0.27	0.01	1.01	2.56	0.64	0.25	2.15
Minimum	6.94	2.79	0.50	0.83	2.4	2.5	125.0	1	3	2.7	46	2	310	13.0	2.65	0.00	0.11	0.06	0.00	0.53	0.93	0.39	0.10	0.87
Maximum	7.23	5.53	13.00	14.70	6.7	6.7	797.0	27	39	26.0	720	24	870	96.9	5.47	0.00	0.35	0.65	0.01	1.78	4.50	1.21	0.50	5.08
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	18.00	18.00	18.00	16.00	18.0	18.0	18.0	18	18	16.0	18	18	18	18.0	18.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
St.dev	0.08	0.73	4.03	3.27	1.0	1.0	198.5	8	12	5.6	164	7	153	22.7	0.67	0.00	0.09	0.29	0.00	0.46	1.25	0.30	0.17	1.57

Numedalslågen

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
01.01.2023	6.75	4.61	6.10	9.38	5.4	5.2	557.0	10	18	14.0	500	35	680	40.4	4.86									
06.02.2023	6.78	3.38	0.93	2.02	3.5	3.5	248.0	2	5	3.7	180	63	350	28.4	3.94	<0.00	0.13	0.15	0.01	0.57	4.80	0.35	0.12	1.30
06.03.2023	6.83	3.30	1.30	1.81	3.1	3.1	226.0	4	6	3.7	170	43	330	22.6	3.88									
10.04.2023	7.01	3.85	2.70	9.16	3.0	2.9	397.0	13	20	20.0	240	27	410	57.3	4.40									
02.05.2023	6.73	3.27	2.50	3.01	6.2	6.2	298.0	4	8	4.9	250	9	470	34.3	4.39	0.01	0.19	0.22	0.02	0.90	4.90	0.43	0.20	2.85
05.06.2023	6.73	2.05	1.30	4.45	4.6	4.6	480.0	4	10	6.3	88	12	270	26.7	3.06									
02.07.2023	6.89	2.18	1.60	9.92	3.1	2.9	590.0	10	15	11.0	<2	<2	210	72.2	2.91									
06.08.2023	6.84	2.24	1.60	3.60	4.3	4.2	352.0	3	7	6.3	54	<2	250	33.8	2.85	<0.00	0.14	0.18	0.01	0.62	2.00	0.36	0.15	1.75
03.09.2023	6.84	2.16	1.50	4.16	5.7	5.8	367.0	4	9	7.0	58	9	240	50.8	3.22									
01.10.2023	6.87	2.58	1.50	2.25	5.9	6.1	293.0	3	7	5.4	122	20	310	28.4	3.64	<0.00	0.16	0.20	0.01	0.74	2.90	0.38	0.16	2.17
05.11.2023	6.85	4.04	6.20	10.60	7.4	7.1	569.0	12	24	16.0	480	28	770	64.5	5.31									
03.12.2023	6.75	2.62	2.30	7.36	3.6	3.2	440.0	16	27	5.8	136	9	380	58.2	3.84									
Lower avg.	6.82	3.02	2.46	5.64	4.7	4.6	401.4	7	13	8.7	190	21	389	43.1	3.86	0.00	0.15	0.18	0.01	0.71	3.65	0.38	0.16	2.02
Upper avg..	6.82	3.02	2.46	5.64	4.7	4.6	401.4	7	13	8.7	190	22	389	43.1	3.86	0.00	0.15	0.18	0.01	0.71	3.65	0.38	0.16	2.02
Minimum	6.73	2.05	0.93	1.81	3.0	2.9	226.0	2	5	3.7	2	2	210	22.6	2.85	0.00	0.13	0.15	0.01	0.57	2.00	0.35	0.12	1.30
Maximum	7.01	4.61	6.20	10.60	7.4	7.1	590.0	16	27	20.0	500	63	770	72.2	5.31	0.01	0.19	0.22	0.02	0.90	4.90	0.43	0.20	2.85
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.08	0.85	1.80	3.39	1.5	1.5	126.5	5	8	5.3	158	18	175	16.8	0.78	0.00	0.03	0.03	0.01	0.15	1.43	0.04	0.03	0.66

Skienselva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	6.70	2.10	0.79	1.11	3.2	3.1	306.0	1	5	3.0	170	14	270	32.6	2.58									
06.02.2023	6.65	1.93	0.38	0.87	2.9	2.8	486.0	1	3	2.5	140	9	230	51.1	2.50	<0.00	0.08	0.09	0.01	0.72	3.00	0.20	0.08	1.35
06.03.2023	6.69	1.89	0.36	0.86	2.8	2.8	159.0	1	3	2.5	130	9	230	13.9	2.51									
11.04.2023	6.78	2.19	0.92	2.05	3.0	3.0	373.0	3	7	6.3	140	7	270	44.3	2.83									
08.05.2023	6.76	1.99	0.47	1.33	2.7	2.7	282.0	1	4	3.2	140	<2	260	14.8	2.53	<0.00	0.10	0.13	0.01	1.71	8.30	0.22	0.14	1.40
05.06.2023	6.73	2.00	0.50	1.29	3.6	3.3	400.0	2	5	3.9	120	180	600	43.5	2.42									
03.07.2023	6.80	1.82	0.43	1.48	2.8	2.7	512.0	3	5	2.7	<2	<2	260	80.5	2.08									
07.08.2023	6.83	1.45	0.70	1.70	2.6	2.5	348.0	2	6	5.2	52	18	200	38.0	1.91	<0.00	0.09	0.27	0.01	3.05	5.80	0.31	0.18	1.54
04.09.2023	6.78	1.71	0.55	1.27	3.1	3.1	318.0	2	3	2.8	91	19	200	23.5	2.06									
02.10.2023	6.73	1.77	0.81	1.16	3.8	3.6	243.0	2	4	3.1	97	18	240	29.2	2.25	<0.00	0.10	0.14	0.01	0.75	6.20	0.24	0.16	1.35
06.11.2023	6.76	1.97	0.77	1.25	3.6	3.3	213.0	2	4	4.2	133	9	250	<21.7	2.39									
04.12.2023	6.64	1.83	0.49	0.81	3.1	2.9	293.0	<1	3	3.3	133	<2	220	35.8	2.29									
Lower avg.	6.74	1.89	0.60	1.26	3.1	3.0	327.8	2	4	3.6	112	24	269	33.9	2.36	0.00	0.09	0.16	0.01	1.56	5.83	0.24	0.14	1.41
Upper avg..	6.74	1.89	0.60	1.26	3.1	3.0	327.8	2	4	3.6	112	24	269	35.7	2.36	0.00	0.09	0.16	0.01	1.56	5.83	0.24	0.14	1.41
Minimum	6.64	1.45	0.36	0.81	2.6	2.5	159.0	1	3	2.5	2	2	200	13.9	1.91	0.00	0.08	0.09	0.01	0.72	3.00	0.20	0.08	1.35
Maximum	6.83	2.19	0.92	2.05	3.8	3.6	512.0	3	7	6.3	170	180	600	80.5	2.83	0.00	0.10	0.27	0.01	3.05	8.30	0.31	0.18	1.54
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.06	0.19	0.19	0.36	0.4	0.3	104.2	1	1	1.2	46	49	107	18.3	0.26	0.00	0.01	0.08	0.00	1.10	2.18	0.05	0.04	0.09

Vegårdselva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
11.01.2023	6.20	3.44	3.50	5.09	5.3	5.4	412.0	4	10	7.0	130	16	330	39.8	3.29									
08.02.2023	6.21	2.67	0.68	0.77	4.9	4.9	214.0	1	4	3.0	130	18	290	19.3	3.07	<0.00	0.18	0.33	0.03	0.55	6.10	0.45	0.20	1.93
07.03.2023	6.33	2.63	0.85	0.90	5.1	5.1	245.0	1	4	2.4	120	16	290	23.4	3.17									
11.04.2023	6.45	2.69	0.79	1.49	5.1	5.0	317.0	1	7	4.3	130	22	320	47.2	3.13									
02.05.2023	6.29	2.17	0.76	1.29	4.9	4.8	320.0	1	5	1.2	110	12	310	37.5	2.69	<0.00	0.18	0.35	0.03	0.58	5.70	0.41	0.18	2.14
06.06.2023	6.70	2.50	0.87	1.83	4.4	4.4	501.0	2	6	4.6	30	<2	220	37.8	0.94									
03.07.2023	6.72	4.22	1.20	2.35	4.1	3.8	474.0	2	8	5.3	<2	<2	240	75.8	0.73									
09.08.2023	6.81	5.28	0.96	1.26	5.1	5.1	363.0	2	7	5.4	25	<2	270	48.2	1.64	<0.00	0.24	0.20	0.02	0.71	3.10	0.43	0.17	1.32
05.09.2023	6.42	2.52	1.30	1.79	6.6	6.5	506.0	2	6	4.8	39	8	270	47.5	2.07									
02.10.2023	6.59	2.71	1.10	1.92	7.3	7.5	490.0	2	7	5.0	74	18	340	52.4	2.67	0.01	0.36	0.42	0.03	0.80	6.00	0.62	0.25	2.05
07.11.2023	6.26	2.52	4.50	6.07	7.7	7.6	483.0	5	15	11.0	125	7	380	51.0	3.17									
Lower avg.	6.45	3.03	1.50	2.25	5.5	5.5	393.2	2	7	4.9	83	11	296	43.6	2.42	0.00	0.24	0.33	0.03	0.66	5.22	0.48	0.20	1.86
Upper avg..	6.45	3.03	1.50	2.25	5.5	5.5	393.2	2	7	4.9	83	11	296	43.6	2.42	0.00	0.24	0.33	0.03	0.66	5.22	0.48	0.20	1.86
Minimum	6.20	2.17	0.68	0.77	4.1	3.8	214.0	1	4	1.2	2	2	220	19.3	0.73	0.00	0.18	0.20	0.02	0.55	3.10	0.41	0.17	1.32
Maximum	6.81	5.28	4.50	6.07	7.7	7.6	506.0	5	15	11.0	130	22	380	75.8	3.29	0.01	0.36	0.42	0.03	0.80	6.10	0.62	0.25	2.14
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	11.00	11.00	11.00	11.00	11.0	11.0	11.0	11	11	11.0	11	11	11	11.0	11.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.22	0.93	1.27	1.72	1.2	1.2	107.2	1	3	2.6	50	7	46	15.2	0.93	0.00	0.08	0.09	0.01	0.12	1.43	0.10	0.04	0.37

Otra

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	6.11	1.97	0.49	0.85	3.8	3.7	353.0	<1	4	4.0	110	24	240	35.7	2.06									
06.02.2023	6.21	1.52	0.33	0.66	2.8	2.7	233.0	<1	3	2.2	71	15	170	18.6	1.95	<0.00	0.10	0.18	0.01	0.35	2.20	0.38	0.07	1.22
06.03.2023	6.21	1.39	<0.30	0.64	3.1	2.7	133.0	<1	3	2.0	88	12	240	13.6	1.93									
11.04.2023	6.34	1.44	<0.30	0.91	2.4	2.3	193.0	<1	3	2.1	64	10	170	35.0	1.93									
15.05.2023	6.40	1.43	0.37	0.99	3.0	2.9	182.0	<1	3	2.4	56	29	220	22.9	1.67	<0.00	0.10	0.19	0.01	0.41	3.00	0.34	0.08	1.86
05.06.2023	6.55	1.21	<0.30	1.04	2.3	2.2	485.0	<1	3	1.7	42	5	140	31.2	1.49									
02.07.2023	6.44	1.29	0.37	2.13	2.4	2.2	271.0	1	2	1.9	24	<2	150	29.5	1.28									
07.08.2023	6.39	1.23	0.46	2.06	2.3	2.2	245.0	<1	3	2.2	21	10	140	29.3	0.95	<0.00	0.05	0.10	0.01	0.34	1.80	0.31	0.05	0.92
04.09.2023	6.39	1.21	0.41	1.13	3.3	3.2	245.0	<1	3	2.0	31	6	140	24.0	1.15									
02.10.2023	6.17	1.50	0.64	1.30	5.6	5.3	383.0	2	5	3.9	57	10	240	36.9	1.77	0.01	0.21	0.36	0.02	0.70	3.40	0.80	0.13	1.92
06.11.2023	5.97	1.95	1.00	1.68	5.0	4.7	413.0	2	6	5.5	89	13	250	35.6	2.10									
04.12.2023	6.28	1.25	<0.30	0.50	2.8	2.7	178.0	<1	2	1.6	66	13	150	20.6	1.78									
Lower avg.	6.29	1.45	0.34	1.16	3.2	3.1	276.2	0	3	2.6	60	12	188	27.7	1.67	0.00	0.12	0.21	0.01	0.45	2.60	0.46	0.08	1.48
Upper avg..	6.29	1.45	0.44	1.16	3.2	3.1	276.2	1	3	2.6	60	12	188	27.7	1.67	0.00	0.12	0.21	0.01	0.45	2.60	0.46	0.08	1.48
Minimum	5.97	1.21	0.30	0.50	2.3	2.2	133.0	1	2	1.6	21	2	140	13.6	0.95	0.00	0.05	0.10	0.01	0.34	1.80	0.31	0.05	0.92
Maximum	6.55	1.97	1.00	2.13	5.6	5.3	485.0	2	6	5.5	110	29	250	36.9	2.10	0.01	0.21	0.36	0.02	0.70	3.40	0.80	0.13	1.92
More than 70% >LOD	yes	yes	no	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.16	0.26	0.20	0.54	1.1	1.0	108.5	0	1	1.2	27	8	46	7.7	0.37	0.00	0.07	0.11	0.01	0.17	0.73	0.23	0.03	0.49

Bjerkreimselva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	6.37	3.40	0.34	0.68	1.7	1.6	278.0	1	5	4.0	320	8	410	20.7	1.74									
07.02.2023	6.05	5.29	<0.30	0.34	1.5	1.4	121.0	<1	3	2.5	910	9	1000	14.9	3.15	<0.00	0.10	0.12	0.02	0.24	2.90	0.40	0.05	1.01
09.05.2023	6.78	4.55	0.36	0.72	2.0	2.1	251.0	1	5	4.0	210	<2	370	26.7	1.66	<0.00	0.09	0.21	0.01	0.46	2.40	0.19	0.05	1.39
06.06.2023	6.67	2.91	<0.30	0.68	1.5	1.4	326.0	1	4	3.5	190	8	290	21.6	1.19									
04.07.2023	6.43	3.58	0.54	0.93	2.3	2.1	230.0	3	11	5.9	450	<2	700	41.1	1.64									
22.08.2023	6.60	2.75	0.54	0.76	2.3	2.2	235.0	1	5	3.6	230	<2	370	32.8	1.27	<0.00	0.07	0.13	0.01	0.26	1.50	0.13	0.06	1.09
18.09.2023	6.64	3.20	0.65	1.11	2.3	2.3	294.0	1	5	4.1	355	13	470	45.6	1.73									
17.10.2023	6.40	2.98	0.39	<0.50	2.2	2.2	144.0	1	4	3.0	385	<2	480	22.9	1.64	<0.00	0.13	0.17	0.01	0.51	2.80	0.25	0.08	1.14
20.11.2023	6.72	5.58	0.48	0.94	2.0	2.0	207.0	1	3	2.4	435	<2	520	23.0	3.80									
13.12.2023	6.54	3.55	0.69	2.34	1.8	1.6	599.0	2	9	7.6	425	26	550	66.6	2.17									
Lower avg.	6.52	3.78	0.40	0.85	2.0	1.9	268.5	1	5	4.1	391	6	516	31.6	2.00	0.00	0.10	0.16	0.01	0.37	2.40	0.24	0.06	1.16
Upper avg..	6.52	3.78	0.46	0.90	2.0	1.9	268.5	1	5	4.1	391	7	516	31.6	2.00	0.00	0.10	0.16	0.01	0.37	2.40	0.24	0.06	1.16
Minimum	6.05	2.75	0.30	0.34	1.5	1.4	121.0	1	3	2.4	190	2	290	14.9	1.19	0.00	0.07	0.12	0.01	0.24	1.50	0.13	0.05	1.01
Maximum	6.78	5.58	0.69	2.34	2.3	2.3	599.0	3	11	7.6	910	26	1000	66.6	3.80	0.00	0.13	0.21	0.02	0.51	2.90	0.40	0.08	1.39
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	10.00	10.00	10.00	10.00	10.0	10.0	10.0	10	10	10.0	10	10	10	10.0	10.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.22	1.01	0.14	0.55	0.3	0.4	132.2	1	3	1.6	206	8	205	15.6	0.84	0.00	0.02	0.04	0.00	0.14	0.64	0.12	0.01	0.16

Orreelva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	7.60	20.40	7.60	9.42	7.4	5.9	2170.0	20	76	59.0	1140	96	1800	330.0	4.13									
06.02.2023	7.65	18.90	6.10	10.40	8.0	6.6	1940.0	23	65	53.0	1610	14	2000	309.0	3.24	<0.00	0.27	0.38	0.01	1.91	4.00	1.19	0.26	1.75
07.03.2023	7.88	18.80	7.70	7.99	8.9	6.2	2620.0	16	69	45.0	1200	<2	1900	344.0	0.42									
11.04.2023	7.65	19.60	2.30	5.80	5.9	5.4	1530.0	9	43	34.0	990	<2	1500	261.0	0.13									
02.05.2023	7.73	20.70	6.80	9.67	8.5	5.8	3090.0	20	72	59.0	480	6	1400	469.0	0.30	0.00	0.30	0.40	0.01	1.56	2.70	1.10	0.17	1.06
05.06.2023	7.90	21.90	6.80	6.24	8.1	6.6	2210.0	5	38	31.0	<2	<2	620	246.0	0.27									
03.07.2023	7.82	23.70	5.90	7.27	7.5	5.9	2340.0	16	60	52.0	81	<2	740	399.0	2.28									
07.08.2023	7.80	21.20	10.00	25.00	6.7	5.9	5740.0	15	74	63.0	<2	99	1100	744.0	2.38	<0.00	0.50		0.01	2.67	14.40	1.42	0.25	0.84
04.09.2023	7.87	20.20	9.00	11.50	9.9	6.8	3960.0	12	60	50.0	19	260	1000	488.0	3.08									
02.10.2023	7.75	19.40	9.20	7.37	9.6	6.8	2660.0	15	58	49.0	365	120	1200	461.0	3.53	0.00	0.40	0.16	0.01	2.09	5.90	1.29	0.16	0.81
07.11.2023	7.55	19.50	6.30	10.00	6.3	5.7	1960.0	11	53	45.0	410	22	1200	336.0	1.42									
04.12.2023	7.64	20.30	5.00	13.10	7.3	7.0	2190.0	21	65	49.0	1020	<2	1700	325.0	2.48									
Lower avg.	7.74	20.38	6.89	10.31	7.8	6.2	2700.8	15	61	49.1	610	51	1347	392.7	1.97	0.00	0.37	0.31	0.01	2.06	6.75	1.25	0.21	1.11
Upper avg..	7.74	20.38	6.89	10.31	7.8	6.2	2700.8	15	61	49.1	610	52	1347	392.7	1.97	0.00	0.37	0.31	0.01	2.06	6.75	1.25	0.21	1.11
Minimum	7.55	18.80	2.30	5.80	5.9	5.4	1530.0	5	38	31.0	2	2	620	246.0	0.13	0.00	0.27	0.16	0.01	1.56	2.70	1.10	0.16	0.81
Maximum	7.90	23.70	10.00	25.00	9.9	7.0	5740.0	23	76	63.0	1610	260	2000	744.0	4.13	0.00	0.50	0.40	0.01	2.67	14.40	1.42	0.26	1.75
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.12	1.39	2.07	5.10	1.2	0.5	1143.9	5	12	9.5	558	79	448	135.8	1.42	0.00	0.10	0.13	0.00	0.46	5.27	0.14	0.05	0.44

Vikedalselva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	6.37	2.45	0.35	6.38	1.1	1.1	552.0	2	4	4.0	220	9	260	45.8	1.03									
06.02.2023	6.50	3.00	<0.30	0.77	1.1	1.0	138.0	1	3	2.2	340	7	380	<9.3	1.26	<0.00	0.17	0.09	0.01	0.40	2.20	0.40	0.04	0.74
06.03.2023	6.61	3.16	<0.30	0.30	1.0	1.0	106.0	1	2	1.8	290	6	340	<12.5	1.44									
11.04.2023	6.32	2.34	<0.30	0.81	1.3	1.2	169.0	<1	2	2.2	170	2	240	26.8	1.04									
02.05.2023	6.47	2.41	<0.30	0.51	1.3	1.2	206.0	<1	2	2.4	150	<2	240	30.2	1.01	<0.00	0.18	0.10	0.01	0.37	1.90	0.29	0.04	1.07
05.06.2023	6.56	2.15	<0.30	<0.50	1.0	1.0	244.0	<1	2	1.5	93	<2	150	<14.1	0.78									
03.07.2023	6.53	1.99	<0.30	0.65	1.3	1.2	232.0	2	3	2.8	40	<2	160	44.0	0.54									
07.08.2023	6.78	2.49	<0.30	<1.00	1.5	1.5	146.0	<1	3	2.8	240	<2	330	33.9	0.83	<0.00	0.23	0.17	0.01	0.40	0.71	0.23	0.05	0.83
04.09.2023	6.65	2.23	0.49	1.03	3.1	3.0	280.0	2	5	3.6	185	<2	300	22.1	0.94									
02.10.2023	6.48	1.82	0.51	<1.00	2.0	2.2	380.0	2	4	3.7	139	9	250	60.1	0.87	<0.00	0.18	0.17	0.01	0.51	3.30	0.32	0.07	1.40
06.11.2023	6.68	2.68	0.35	0.47	1.2	1.2	142.0	<1	3	2.4	230	<2	280	13.9	1.26									
04.12.2023	6.63	2.84	<0.30	<0.50	1.2	1.1	161.0	<1	2	1.9	270	<2	310	31.4	1.42									
Lower avg.	6.55	2.46	0.14	0.91	1.4	1.4	229.7	1	3	2.6	197	3	270	25.7	1.03	0.00	0.19	0.13	0.01	0.42	2.03	0.31	0.05	1.01
Upper avg..	6.55	2.46	0.34	1.16	1.4	1.4	229.7	1	3	2.6	197	4	270	28.7	1.03	0.00	0.19	0.13	0.01	0.42	2.03	0.31	0.05	1.01
Minimum	6.32	1.82	0.30	0.30	1.0	1.0	106.0	1	2	1.5	40	2	150	9.3	0.54	0.00	0.17	0.09	0.01	0.37	0.71	0.23	0.04	0.74
Maximum	6.78	3.16	0.51	6.38	3.1	3.0	552.0	2	5	4.0	340	9	380	60.1	1.44	0.00	0.23	0.17	0.01	0.51	3.30	0.40	0.07	1.40
More than 70% >LOD	yes	yes	no	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.13	0.40	0.08	1.66	0.6	0.6	126.7	0	1	0.8	85	3	69	15.6	0.27	0.00	0.03	0.05	0.00	0.06	1.06	0.07	0.01	0.30

Vosso
(Bolstadelvi)

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	6.43	1.41	0.45	0.47	1.1	1.0	207.0	<1	4	3.0	120	7	170	9.8	1.02									
06.02.2023	6.40	1.68	0.32	0.46	1.4	1.3	132.0	1	4	3.1	150	10	210	15.3	1.27	<0.00	0.07	0.05	0.01	0.36	0.97	0.33	0.06	1.05
06.03.2023	6.48	2.10	<0.30	0.44	1.2	1.2	117.0	2	6	2.4	180	8	220	25.8	1.23									
11.04.2023	6.50	1.94	<0.30	0.61	1.0	1.0	127.0	<1	3	2.1	110	<2	180	25.0	1.16									
02.05.2023	6.59	2.12	<0.30	0.78	1.2	1.2	137.0	<1	2	2.7	150	9	230	25.6	1.32	<0.00	0.04	0.01	0.00	0.34	1.80	0.34	0.05	0.76
06.06.2023	6.33	1.67	0.36	<0.58	1.2	1.2	158.0	<1	3	2.4	87	<2	160	52.6	1.22									
03.07.2023	6.43	0.92	<0.30	<1.00	0.9	0.7	144.0	<1	2	2.0	9	<2	79	37.0	0.73									
07.08.2023	6.52	1.00	<0.30	<1.00	1.0	0.9	197.0	<1	3	2.2	25	6	85	27.8	0.66	<0.00	0.03	0.06	0.00	0.29	0.61	0.23	0.03	0.60
05.09.2023	6.51	1.11	0.31	<0.67	1.7	1.8	166.0	1	3	3.8	60	5	130	22.9	0.96									
02.10.2023	6.48	1.26	0.64	0.88	1.9	1.9	177.0	2	4	3.5	87	6	170	16.1	1.23	<0.00	0.11	0.09	0.00	0.46	0.92	0.29	0.07	1.06
06.11.2023	6.50	1.49	0.38	0.42	1.5	1.5	111.0	<1	2	2.4	113	<2	170	19.1	1.13									
05.12.2023	6.44	1.39	<0.30	0.40	1.1	1.0	114.0	<1	3	2.2	99	<2	140	14.4	0.94									
Lower avg.	6.47	1.51	0.20	0.37	1.3	1.2	148.9	0	3	2.6	99	4	162	24.3	1.07	0.00	0.06	0.05	0.00	0.36	1.07	0.30	0.05	0.87
Upper avg..	6.47	1.51	0.35	0.64	1.3	1.2	148.9	1	3	2.6	99	5	162	24.3	1.07	0.00	0.06	0.05	0.00	0.36	1.07	0.30	0.05	0.87
Minimum	6.33	0.92	0.30	0.40	0.9	0.7	111.0	1	2	2.0	9	2	79	9.8	0.66	0.00	0.03	0.01	0.00	0.29	0.61	0.23	0.03	0.60
Maximum	6.59	2.12	0.64	1.00	1.9	1.9	207.0	2	6	3.8	180	10	230	52.6	1.32	0.00	0.11	0.09	0.01	0.46	1.80	0.34	0.07	1.06
More than 70% >LOD	yes	yes	no	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.07	0.41	0.10	0.22	0.3	0.4	32.3	0	1	0.6	50	3	48	11.5	0.21	0.00	0.04	0.03	0.00	0.07	0.51	0.05	0.02	0.23

Nausta

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.01.2023	5.95	1.69	0.47	0.83	2.3	2.3	271.0	2	6	3.0	160	5	200	23.4	1.71									
07.02.2023	6.15	2.25	<0.30	1.13	1.8	1.8	152.0	5	8	3.6	160	6	220	17.6	1.73	<0.00	0.03	0.06	0.00	0.24	1.50	0.13	0.06	1.06
07.03.2023	6.35	2.99	<0.30	<0.50	1.2	1.2	96.2	<1	2	1.5	110	4	160	11.3	2.03									
11.04.2023	6.27	2.27	<0.30	1.73	2.5	2.4	154.0	3	6	3.3	60	<2	150	31.3	1.80									
02.05.2023	6.36	2.08	<0.30	0.52	2.1	2.1	159.0	<1	3	2.2	56	6	160	22.0	1.40	<0.00	0.03	0.04	0.01	0.22	1.10	0.13	0.05	1.13
05.06.2023	6.21	1.28	<0.30	0.58	1.1	1.0	253.0	<1	2	1.9	<2	<2	56	19.3	0.69									
03.07.2023	6.32	1.01	<0.30	0.64	1.3	1.2	214.0	1	2	2.2	<2	<2	70	43.2	0.38									
07.08.2023	6.58	1.23	<0.30	<1.00	1.8	1.8	218.0	1	5	3.7	<2	<2	120	38.4	0.57	<0.00	<0.03	0.04	<0.00	0.20	0.41	0.08	0.04	0.91
05.09.2023	6.07	0.86	0.89	4.67	4.3	4.1	576.0	7	15	11.0	40	<2	180	64.8	1.09									
02.10.2023	6.16	1.05	0.34	<1.00	3.0	2.9	169.0	3	5	3.5	48	<2	140	21.8	1.11	<0.00	0.03	0.05	<0.00	0.26	1.40	0.11	0.05	1.21
06.11.2023	6.52	1.63	<0.30	<0.33	1.4	1.4	92.6	<1	2	1.6	134	<2	180	15.3	1.72									
04.12.2023	6.35	2.11	<0.30	0.30	1.4	1.4	113.0	2	4	1.8	195	<2	230	16.2	2.45									
Lower avg.	6.27	1.70	0.14	0.87	2.0	2.0	205.6	2	5	3.3	80	2	156	27.1	1.39	0.00	0.02	0.05	0.00	0.23	1.10	0.11	0.05	1.08
Upper avg..	6.27	1.70	0.37	1.10	2.0	2.0	205.6	2	5	3.3	81	3	156	27.1	1.39	0.00	0.03	0.05	0.00	0.23	1.10	0.11	0.05	1.08
Minimum	5.95	0.86	0.30	0.30	1.1	1.0	92.6	1	2	1.5	2	2	56	11.3	0.38	0.00	0.03	0.04	0.00	0.20	0.41	0.08	0.04	0.91
Maximum	6.58	2.99	0.89	4.67	4.3	4.1	576.0	7	15	11.0	195	6	230	64.8	2.45	0.00	0.03	0.06	0.01	0.26	1.50	0.13	0.06	1.21
More than 70% >LOD	yes	yes	no	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.18	0.65	0.17	1.19	0.9	0.9	130.1	2	4	2.6	69	2	54	15.2	0.63	0.00	0.00	0.01	0.00	0.03	0.49	0.02	0.01	0.13

Driva Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.01.2023	7.10	4.15	<0.30	0.35	0.9	1.0	158.0	<1	2	1.0	220	11	270	1.6	3.36									
06.02.2023	6.99	4.55	<0.30	0.27	1.0	0.9	59.7	<1	1	1.1	280	2	320	6.1	3.83	<0.00	0.03	0.02	<0.00	0.56	0.35	0.17	0.15	<0.30
06.03.2023	7.10	3.66	<0.30	0.57	1.1	1.1	114.0	<1	2	2.1	160	3	220	10.9	2.89									
11.04.2023	7.09	5.41	<0.30	2.75	1.3	1.2	82.2	<1	3	1.3	330	6	410	26.4	3.98									
02.05.2023	7.12	5.26	0.50	1.54	1.5	1.5	213.0	<1	2	2.3	230	7	320	31.4	2.55	<0.00	0.05	0.02	<0.00	0.74	0.38	0.27	0.20	0.57
06.06.2023	7.06	2.60	2.10	5.02	1.5	1.5	387.0	7	11	7.7	31	<2	130	27.5	2.43									
03.07.2023	7.08	2.30	0.67	2.73	1.6	1.5	116.0	2	5	3.1	10	<2	110	30.6	2.33									
02.08.2023	7.20	2.50	0.52	2.62	1.6	1.6	208.0	2	4	3.6	16	<2	110	23.5	2.84	0.01	0.10	0.03	<0.00	0.77	0.63	0.23	0.23	0.77
04.09.2023	7.25	3.64	0.64	2.39	1.7	1.5	81.0	2	3	2.3	143	3	210	21.0	3.51									
02.10.2023	7.15	3.66	0.36	<1.00	1.1	1.2	80.6	1	1	1.4	113	<2	150	14.8	3.08	<0.00	<0.03	0.01	<0.00	0.57	0.20	0.18	0.14	0.41
06.11.2023	7.11	3.61	0.54	1.29	1.2	1.2	200.0	<1	2	<2.0	175	<2	210	26.6	2.96									
04.12.2023	7.07	3.31	<0.30	0.41	1.1	1.1	65.6	<1	3	1.3	149	<2	180	11.1	2.81									
Lower avg.	7.11	3.72	0.44	1.66	1.3	1.3	147.1	1	3	2.3	155	3	220	19.3	3.05	0.00	0.04	0.02	0.00	0.66	0.39	0.21	0.18	0.44
Upper avg..	7.11	3.72	0.57	1.74	1.3	1.3	147.1	2	3	2.4	155	4	220	19.3	3.05	0.00	0.05	0.02	0.00	0.66	0.39	0.21	0.18	0.51
Minimum	6.99	2.30	0.30	0.27	0.9	0.9	59.7	1	1	1.0	10	2	110	1.6	2.33	0.00	0.03	0.01	0.00	0.56	0.20	0.17	0.14	0.30
Maximum	7.25	5.41	2.10	5.02	1.7	1.6	387.0	7	11	7.7	330	11	410	31.4	3.98	0.01	0.10	0.03	0.00	0.77	0.63	0.27	0.23	0.77
More than 70% >LOD	yes	yes	no	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.07	1.00	0.50	1.41	0.3	0.2	94.3	2	3	1.8	102	3	94	10.1	0.53	0.00	0.03	0.01	0.00	0.11	0.18	0.05	0.04	0.20

Orkla

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.01.2023	7.43	6.09	0.31	2.48	1.7	1.6	255.0	2	5	3.0	200	12	240	17.8	2.93									
06.02.2023	7.45	8.15	<0.30	0.48	2.5	2.4	142.0	1	4	2.5	260	7	360	13.8	3.45	<0.00	0.09	0.02	0.07	3.78	17.40	0.70	0.17	0.63
06.03.2023	7.49	7.34	0.41	1.14	2.4	2.3	166.0	2	4	2.1	170	5	280	20.9	3.42									
11.04.2023	7.54	9.60	0.39	0.79	2.2	2.4	125.0	<1	3	2.3	230	<2	430	17.4	3.58									
02.05.2023	7.49	9.23	0.49	1.58	4.2	4.1	305.0	<1	4	3.3	310	8	480	27.8	3.26	<0.00	0.13	0.03	0.05	6.47	14.80	1.03	0.27	1.48
05.06.2023	7.17	4.90	<0.30	1.08	3.0	3.0	253.0	1	3	2.4	84	<2	230	16.6	2.55									
02.07.2023	7.54	5.69	0.47	<1.00	3.8	3.8	233.0	1	4	3.4	49	<2	250	34.7	2.53									
07.08.2023	7.36	4.92	0.67	3.44	4.1	4.1	398.0	1	6	5.1	36	<2	230	42.6	2.82	<0.00	0.15	0.05	0.05	3.42	9.70	0.83	0.38	1.41
04.09.2023	7.54	6.64	0.43	0.76	3.9	3.9	134.0	1	4	2.3	185	<2	310	19.3	3.17									
02.10.2023	7.52	7.88	0.39	<1.00	4.1	4.2	115.0	1	3	1.6	260	<2	370	16.9	3.67	<0.00	0.12	0.01	0.03	4.30	7.50	0.82	0.21	0.94
06.11.2023	7.50	9.25	0.41	0.92	2.5	2.5	139.0	<1	3	2.2	405	<2	490	<21.0	4.37									
04.12.2023	7.45	6.19	0.51	0.73	2.3	2.3	134.0	1	3	2.1	111	<2	200	19.9	2.96									
Lower avg.	7.46	7.16	0.37	1.12	3.1	3.0	199.9	1	4	2.7	192	3	322	20.6	3.23	0.00	0.12	0.03	0.05	4.49	12.35	0.84	0.26	1.12
Upper avg..	7.46	7.16	0.42	1.28	3.1	3.0	199.9	1	4	2.7	192	4	322	22.4	3.23	0.00	0.12	0.03	0.05	4.49	12.35	0.84	0.26	1.12
Minimum	7.17	4.90	0.30	0.48	1.7	1.6	115.0	1	3	1.6	36	2	200	13.8	2.53	0.00	0.09	0.01	0.03	3.42	7.50	0.70	0.17	0.63
Maximum	7.54	9.60	0.67	3.44	4.2	4.2	398.0	2	6	5.1	405	12	490	42.6	4.37	0.00	0.15	0.05	0.07	6.47	17.40	1.03	0.38	1.48
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.10	1.67	0.10	0.85	0.9	0.9	88.9	0	1	0.9	110	3	102	8.5	0.52	0.00	0.02	0.02	0.02	1.37	4.55	0.14	0.09	0.40

Nidelva (Tr.heim)

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
03.01.2023	7.15	3.50	0.37	0.95	2.3	2.3	180.0	1	4	2.5	100	2	160	8.6	2.10									
08.02.2023	7.17	4.26	<0.30	0.93	2.5	2.6	110.0	<1	3	2.4	110	4	190	24.1	3.41	<0.00	0.07	0.02	0.00	0.58	0.51	0.66	0.16	0.85
08.03.2023	7.12	3.57	0.46	0.50	2.3	2.3	96.2	<1	3	1.9	86	3	160	<10.0	2.07									
11.04.2023	7.29	6.08	11.00	17.40	2.6	2.5	313.0	12	19	10.0	190	17	350	56.3	4.26									
02.05.2023	7.11	3.91	1.20	2.29	2.5	2.5	189.0	1	3	2.8	100	6	200	20.8	2.32	<0.00	0.08	0.03	<0.00	0.67	0.63	0.75	0.24	0.86
05.06.2023	7.20	3.34	<0.30	0.62	2.4	2.4	247.0	<1	3	2.0	69	<2	160	16.0	2.07									
03.07.2023	7.16	3.01	0.40	0.80	2.1	2.1	163.0	<1	2	2.3	28	<2	210	33.6	1.84									
07.08.2023	7.21	3.30	0.45	<1.00	2.4	2.5	201.0	<1	3	2.9	35	2	160	32.8	1.70	<0.00	0.09	0.03	0.00	0.59	0.47	0.64	0.15	0.74
04.09.2023	7.18	3.32	0.51	0.77	3.3	3.2	210.0	<1	4	2.7	53	6	160	27.7	1.77									
02.10.2023	7.18	3.42	1.20	5.84	3.6	3.7	305.0	3	6	6.1	82	5	200	34.6	2.11	<0.00	0.12	0.07	<0.00	0.85	0.81	1.00	0.37	1.07
06.11.2023	7.07	3.40	0.37	<0.50	3.0	3.0	117.0	<1	3	2.1	101	<2	180	17.9	1.96									
04.12.2023	7.04	3.16	<0.30	0.55	2.9	2.7	96.6	<1	3	1.8	104	<2	170	22.3	1.98									
Lower avg.	7.16	3.69	1.33	2.55	2.7	2.6	185.6	1	5	3.3	88	4	192	24.6	2.30	0.00	0.09	0.04	0.00	0.67	0.60	0.76	0.23	0.88
Upper avg..	7.16	3.69	1.41	2.68	2.7	2.6	185.6	2	5	3.3	88	4	192	25.4	2.30	0.00	0.09	0.04	0.00	0.67	0.60	0.76	0.23	0.88
Minimum	7.04	3.01	0.30	0.50	2.1	2.1	96.2	1	2	1.8	28	2	160	8.6	1.70	0.00	0.07	0.02	0.00	0.58	0.47	0.64	0.15	0.74
Maximum	7.29	6.08	11.00	17.40	3.6	3.7	313.0	12	19	10.0	190	17	350	56.3	4.26	0.00	0.12	0.07	0.00	0.85	0.81	1.00	0.37	1.07
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.07	0.82	3.04	4.87	0.5	0.4	75.1	3	5	2.4	42	4	53	13.0	0.76	0.00	0.02	0.02	0.00	0.12	0.15	0.17	0.10	0.14

Vefsna

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	7.14	4.46	<0.30	<0.29	4.5	4.5	211.0	<1	4	2.0	27	6	120	12.5	1.70									
04.02.2023	7.59	7.79	<0.30	0.74	2.9	2.9	192.0	<1	3	2.9	57	<2	140	30.1	1.91	<0.00	0.10	0.07	0.00	0.37	0.70	0.24	0.16	1.62
28.02.2023	7.08	5.75	0.61	1.37	3.4	3.4	257.0	<1	6	3.2	28	20	220	26.9	1.59									
11.04.2023	7.68	11.70	1.30	37.70	2.8	2.8	350.0	19	23	15.0	5	<2	180	35.7	2.76									
02.05.2023	7.69	8.86	0.64	5.49	2.3	2.4	180.0	2	3	2.2	7	<2	130	30.2	1.70	<0.00	0.12	0.11	<0.00	0.81	1.30	0.44	0.15	1.15
05.06.2023	7.34	4.31	<0.30	2.00	1.6	1.5	157.0	1	3	1.7	7	<2	75	41.9	1.20									
03.07.2023	7.31	2.90	0.42	0.83	0.9	0.8	65.3	<1	2	1.6	<2	<2	51	28.2	0.79									
07.08.2023	7.52	4.31	0.66	<1.00	1.2	1.2	133.0	<1	3	2.5	5	<2	78	17.0	1.04	<0.00	0.12	0.04	0.00	0.44	0.79	0.32	0.08	0.44
04.09.2023	7.69	5.82	0.37	3.48	1.2	1.1	127.0	<1	5	2.7	32	5	96	20.3	1.32									
28.09.2023	7.50	4.83	0.88	3.57	2.4	2.4	190.0	2	3	3.5	21	<2	100	23.9	1.60	<0.00	0.12	0.10	0.00	0.47	0.74	0.43	0.18	0.95
05.11.2023	7.63	8.14	0.41	0.60	1.7	1.7	98.4	<1	2	1.7	106	<2	150	13.6	1.97									
10.12.2023	7.72	10.10	0.70	6.52	1.4	1.2	432.0	2	5	5.2	155	19	230	49.4	2.26									
Lower avg.	7.49	6.58	0.50	5.19	2.2	2.2	199.4	2	5	3.7	38	4	131	27.5	1.65	0.00	0.11	0.08	0.00	0.52	0.88	0.36	0.14	1.04
Upper avg..	7.49	6.58	0.57	5.30	2.2	2.2	199.4	3	5	3.7	38	6	131	27.5	1.65	0.00	0.11	0.08	0.00	0.52	0.88	0.36	0.14	1.04
Minimum	7.08	2.90	0.30	0.29	0.9	0.8	65.3	1	2	1.6	2	2	51	12.5	0.79	0.00	0.10	0.04	0.00	0.37	0.70	0.24	0.08	0.44
Maximum	7.72	11.70	1.30	37.70	4.5	4.5	432.0	19	23	15.0	155	20	230	49.4	2.76	0.00	0.12	0.11	0.00	0.81	1.30	0.44	0.18	1.62
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.22	2.70	0.30	10.40	1.1	1.1	104.6	5	6	3.7	47	7	57	11.1	0.54	0.00	0.01	0.03	0.00	0.20	0.28	0.10	0.04	0.49

Målselva v/gml E6-brua

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	7.45	8.13	0.68	1.68	1.5	1.0	775.0	1	4	3.9	82	96	360	107.0	2.87									
06.02.2023	7.38	6.90	0.92	2.82	1.3	1.3	743.0	6	12	9.6	59	64	1000	119.0	2.66	<0.00	0.05	0.32	0.02	2.13	16.50	0.67	0.48	0.54
06.03.2023	7.22	9.62	1.40	3.22	2.7	2.0	617.0	8	14	10.0	56	67	750	83.8	1.90									
11.04.2023	6.99	6.96	1.20	1.75	1.6	0.9	846.0	2	8	8.9	96	150	790	149.0	0.93									
02.05.2023	7.59	8.25	1.60	3.15	2.0	2.0	209.0	4	6	5.9	18	<2	140	41.2	2.89	<0.00	0.06	0.06	<0.00	0.56	0.66	0.48	0.20	0.64
05.06.2023	7.72	8.45	1.20	4.51	1.5	1.5	236.0	3	5	4.2	4	<2	100	13.9	2.45									
03.07.2023	7.48	6.23	0.96	1.97	0.7	0.6	110.0	2	3	3.1	<2	<2	59	37.9	1.85									
07.08.2023	7.64	6.67	0.86	2.76	0.7	0.7	82.3	2	2	2.8	6	<2	82	12.9	1.79	<0.00	<0.03	0.04	<0.00	0.49	0.58	0.37	0.13	<0.30
04.09.2023	7.61	6.94	0.46	1.33	0.9	0.9	110.0	1	2	2.1	23	<2	66	25.1	1.87									
02.10.2023	7.72	8.84	0.64	1.12	1.2	1.1	88.1	2	2	2.1	40	<2	84	12.0	2.35	<0.00	<0.03	0.04	<0.00	0.41	0.34	0.39	0.15	0.33
06.11.2023	7.68	10.00	0.45	0.34	1.1	0.9	<129.0	<1	1	1.0	78	<2	100	<21.0	3.05									
04.12.2023	7.40	7.24	1.20	1.03	1.3	1.4	449.0	3	6	3.7	69	48	240	73.7	2.60									
Lower avg.	7.49	7.85	0.96	2.14	1.4	1.2	355.4	3	5	4.8	44	35	314	56.3	2.27	0.00	0.03	0.11	0.00	0.90	4.52	0.48	0.24	0.38
Upper avg..	7.49	7.85	0.96	2.14	1.4	1.2	366.2	3	5	4.8	44	37	314	58.0	2.27	0.00	0.04	0.11	0.01	0.90	4.52	0.48	0.24	0.45
Minimum	6.99	6.23	0.45	0.34	0.7	0.6	82.3	1	1	1.0	2	2	59	12.0	0.93	0.00	0.03	0.04	0.00	0.41	0.34	0.37	0.13	0.30
Maximum	7.72	10.00	1.60	4.51	2.7	2.0	846.0	8	14	10.0	96	150	1000	149.0	3.05	0.00	0.06	0.32	0.02	2.13	16.50	0.67	0.48	0.64
More than 70% >LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	no	yes	no	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.22	1.22	0.37	1.18	0.6	0.5	300.9	2	4	3.1	33	49	337	47.2	0.61	0.00	0.02	0.14	0.01	0.82	7.99	0.14	0.16	0.17

Altaelva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.01.2023	7.42	7.61	0.33	<0.32	3.3	3.3	197.0	3	8	2.0	61	3	150	16.5	6.26									
06.02.2023	7.37	8.05	<0.30	1.97	3.0	3.0	99.4	3	5	1.9	63	<2	160	8.7	7.40	<0.00	0.13	0.02	<0.00	0.45	0.29	0.28	0.27	0.63
06.03.2023	7.36	8.11	<0.30	1.05	2.9	2.9	64.0	2	4	1.7	73	2	160	7.5	7.50									
11.04.2023	7.45	8.20	<0.30	1.33	2.8	2.8	109.0	1	4	2.4	12	<2	160	23.9	7.81									
02.05.2023	7.57	11.00	<0.30	0.99	2.6	2.7	188.0	12	14	4.9	41	<2	230	40.6	7.27	<0.00	0.11	0.02	<0.00	0.49	0.22	0.28	0.24	0.91
05.06.2023	7.30	6.25	0.67	8.10	4.0	3.8	406.0	4	11	6.5	<2	<2	170	71.3	4.24									
03.07.2023	7.57	7.73	0.31	0.40	2.6	2.6	148.0	1	4	2.2	<2	<2	130	41.6	3.60									
07.08.2023	7.47	6.37	<0.30	<1.00	2.5	2.5	155.0	1	3	2.7	<2	<2	140	23.9	3.57	<0.00	0.09	0.01	<0.00	0.48	0.16	0.24	0.13	0.70
04.09.2023	7.50	6.44	0.34	1.19	2.9	3.1	229.0	2	4	3.2	20	<2	140	35.0	3.82									
02.10.2023	7.54	7.19	0.39	0.85	3.2	3.2	124.0	2	5	3.0	33	<2	150	16.3	4.31	<0.00	0.11	0.01	<0.00	0.43	<0.15	0.27	0.17	0.62
05.11.2023	7.57	7.61	0.41	0.44	3.1	3.0	150.0	1	4	2.6	76	<2	160	21.2	4.84									
04.12.2023	7.35	7.10	0.32	0.73	2.9	2.9	151.0	3	5	2.1	75	<2	170	23.6	4.46									
Lower avg.	7.46	7.64	0.23	1.42	3.0	3.0	168.4	3	6	2.9	38	0	160	27.5	5.42	0.00	0.11	0.01	0.00	0.46	0.17	0.27	0.20	0.72
Upper avg..	7.46	7.64	0.36	1.53	3.0	3.0	168.4	3	6	2.9	38	2	160	27.5	5.42	0.00	0.11	0.01	0.00	0.46	0.21	0.27	0.20	0.72
Minimum	7.30	6.25	0.30	0.32	2.5	2.5	64.0	1	3	1.7	2	2	130	7.5	3.57	0.00	0.09	0.01	0.00	0.43	0.15	0.24	0.13	0.62
Maximum	7.57	11.00	0.67	8.10	4.0	3.8	406.0	12	14	6.5	76	3	230	71.3	7.81	0.00	0.13	0.02	0.00	0.49	0.29	0.28	0.27	0.91
More than 70% >LOD	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.10	1.26	0.11	2.12	0.4	0.3	87.2	3	3	1.4	30	0	25	17.6	1.69	0.00	0.01	0.00	0.00	0.03	0.06	0.02	0.06	0.14

Tanaelva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.01.2023	7.11	5.67	<0.30	<0.33	2.0	2.1	248.0	<1	2	1.4	55	<2	120	14.3	11.00									
06.02.2023	7.21	6.21	<0.30	<0.45	1.8	1.8	96.0	<1	3	1.9	72	7	150	20.2	12.00	<0.00	0.04	0.01	<0.00	0.27	0.64	0.26	0.25	0.51
13.03.2023	7.14	6.48	<0.30	<0.50	1.7	1.7	53.6	<1	2	1.0	95	3	140	8.1	11.80									
13.04.2023	7.25	7.86	<0.30	0.81	1.8	1.8	141.0	<1	3	1.9	85	<2	230	31.1	11.20									
08.05.2023	7.28	5.44	0.40	0.74	3.4	3.5	164.0	2	6	4.0	<2	<2	130	19.9	7.62	<0.00	0.06	0.01	<0.00	0.45	0.39	0.38	0.26	1.07
05.06.2023	7.09	3.62	0.47	3.13	3.5	3.2	357.0	3	8	5.9	<2	<2	130	58.5	5.56									
03.07.2023	7.38	4.94	<0.30	0.53	2.0	1.9	118.0	1	3	2.7	<2	<2	95	45.5	5.70									
16.08.2023	7.34	4.34	0.55	1.07	4.3	4.2	223.0	2	5	4.1	<2	<2	160	21.5	5.79	<0.00	0.03	0.01	<0.00	0.47	0.38	0.41	0.31	1.11
04.09.2023	7.27	4.18	0.47	1.32	4.4	4.4	228.0	1	4	3.9	3	<2	150	35.3	6.60									
10.10.2023	7.08	4.37	0.48	<0.67	4.1	4.0	124.0	1	4	2.1	20	<2	140	15.7	7.48	<0.00	0.03	0.01	<0.00	0.38	0.35	0.40	0.28	0.82
06.11.2023	7.35	7.68	0.54	0.70	3.0	3.0	205.0	1	4	2.9	64	<2	140	19.2	9.90									
04.12.2023	7.27	5.62	0.60	0.68	2.4	2.3	148.0	1	3	1.9	59	11	140	19.0	11.10									
Lower avg.	7.23	5.53	0.29	0.75	2.9	2.8	175.5	1	4	2.8	38	2	144	25.7	8.81	0.00	0.04	0.01	0.00	0.39	0.44	0.36	0.28	0.88
Upper avg..	7.23	5.53	0.42	0.91	2.9	2.8	175.5	1	4	2.8	38	3	144	25.7	8.81	0.00	0.04	0.01	0.00	0.39	0.44	0.36	0.28	0.88
Minimum	7.08	3.62	0.30	0.33	1.7	1.7	53.6	1	2	1.0	2	2	95	8.1	5.56	0.00	0.03	0.01	0.00	0.27	0.35	0.26	0.25	0.51
Maximum	7.38	7.86	0.60	3.13	4.4	4.4	357.0	3	8	5.9	95	11	230	58.5	12.00	0.00	0.06	0.01	0.00	0.47	0.64	0.41	0.31	1.11
More than 70% >LOD	yes	yes	no	no	yes	yes	yes	no	yes	yes	no	no	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.10	1.35	0.11	0.75	1.0	1.0	81.6	1	2	1.4	37	3	32	14.5	2.58	0.00	0.01	0.00	0.00	0.09	0.13	0.07	0.03	0.28

Pasvikelva

Date	pH	KOND	TURB860	SPM	TOC	DOC	Part. C	PO4-P	TOTP	Tot. Part. P	NO3-N	NH4-N	TOTN	Tot. Part. N	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[]	[mS/m]	[FNU]	[mg/l]	[mgC/l]	[mgC/l]	[µgC/l]	[µgP/l]	[µgP/l]	[µgP/l]	[µgN/l]	[µgN/l]	[µgN/l]	[µgN/l]	[mgSiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
01.01.2023	7.06	3.20	<0.30	<0.39	2.8	2.9	198.0	<1	2	2.0	57	14	150	10.3	5.92									
05.02.2023	7.03	3.24	<0.30	<0.28	2.7	2.7	102.0	<1	2	1.5	49	3	140	14.4	5.96	<0.00	0.05	0.01	<0.00	0.37	0.35	0.64	0.09	0.34
06.03.2023	7.00	3.20	<0.30	<0.33	2.7	2.7	53.6	<1	2	1.4	58	4	130	9.7	5.99									
10.04.2023	6.97	3.62	<0.30	0.80	2.5	2.5	140.0	<1	2	1.6	66	7	180	21.7	5.56									
01.05.2023	7.12	3.16	<0.30	0.50	2.9	3.0	153.0	1	4	2.7	37	<2	160	15.6	5.63	<0.00	0.05	0.02	<0.00	0.59	1.50	1.48	0.13	0.58
05.06.2023	7.21	3.67	1.20	7.19	4.2	4.0	498.0	3	11	7.4	<2	<2	180	36.2	5.01									
03.07.2023	7.12	3.33	0.41	0.93	3.6	3.4	203.0	1	6	4.5	<2	<2	170	53.2	4.75									
07.08.2023	7.26	3.37	0.38	<1.00	2.9	2.9	154.0	<1	3	3.6	9	<2	120	21.8	4.58	<0.00	0.06	0.01	<0.00	0.76	0.24	3.42	0.10	0.47
04.09.2023	7.18	3.27	0.52	1.15	3.4	3.0	196.0	1	5	4.4	<1	<2	130	31.8	4.90									
03.10.2023	6.84	3.78	0.73	1.11	4.7	4.8	368.0	5	12	9.3	12	6	200	44.5	5.96	<0.00	0.21	0.03	0.01	3.09	2.40	5.05	0.20	0.99
13.11.2023	7.10	3.32	0.35	<0.47	3.4	3.5	109.0	<1	3	2.6	38	7	150	17.7	6.05									
08.12.2023	7.02	3.26	<0.30	<0.28	3.1	2.9	135.0	<1	3	1.7	49	7	140	20.5	6.00									
Lower avg.	7.08	3.37	0.30	0.97	3.2	3.2	192.5	1	5	3.6	31	4	154	24.8	5.53	0.00	0.09	0.01	0.00	1.20	1.12	2.65	0.13	0.60
Upper avg..	7.08	3.37	0.45	1.20	3.2	3.2	192.5	2	5	3.6	32	5	154	24.8	5.53	0.00	0.09	0.01	0.01	1.20	1.12	2.65	0.13	0.60
Minimum	6.84	3.16	0.30	0.28	2.5	2.5	53.6	1	2	1.4	1	2	120	9.7	4.58	0.00	0.05	0.01	0.00	0.37	0.24	0.64	0.09	0.34
Maximum	7.26	3.78	1.20	7.19	4.7	4.8	498.0	5	12	9.3	66	14	200	53.2	6.05	0.00	0.21	0.03	0.01	3.09	2.40	5.05	0.20	0.99
More than 70% >LOD	yes	yes	no	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes
n	12.00	12.00	12.00	12.00	12.0	12.0	12.0	12	12	12.0	12	12	12	12.0	12.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
St.dev	0.11	0.21	0.27	1.91	0.7	0.7	123.5	1	3	2.5	25	4	24	13.8	0.56	0.00	0.08	0.01	0.00	1.27	1.02	1.98	0.05	0.28

6.2 Riverine loads in 2023

River	Estimate	Flow rate	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
		1000 m3/d	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[kg]
Glomma ved Sarpsfoss	avg.	89282.48	341107.83	163901.9	384	692	9500	232	17080	131462.76	0.03	6.51	11.49	0.37	59.90	105.37	35.67	14.74	89.93
Alna	avg.	147.05	1470.66	286.5	3	5	43	3	81	395.03	0.00	0.03	0.07	0.00	0.24	0.85	0.08	0.05	0.20
Drammenselva	avg.	41781.89	46620.61	66699.1	121	210	3661	93	6432	53550.92	0.00	2.90	3.72	0.13	15.85	39.76	10.19	3.72	34.21
Numedalslågen	avg.	12399.05	24591.85	22153.2	31	58	808	90	1722	17303.49	0.01	0.72	0.86	0.06	3.29	15.87	1.73	0.73	9.52
Skienselva	avg.	28511.21	13015.81	32197.1	18	44	1180	207	2686	24541.04	0.00	0.96	1.57	0.12	15.04	61.10	2.49	1.46	14.58
Vegårdselva	avg.	1246.89	2087.29	3080.4	2	5	54	5	160	1375.44	0.00	0.10	0.16	0.01	0.29	2.50	0.21	0.09	0.90
Otra	avg.	13456.77	5191.63	16478.1	3	17	314	64	943	8617.51	0.01	0.66	1.19	0.07	2.41	14.05	2.49	0.46	8.15
Bjerkreimselva	avg.	3690.50	979.10	2629.2	2	7	568	7	748	2600.55	0.00	0.14	0.22	0.02	0.54	3.37	0.33	0.08	1.56
Orreelva	avg.	481.16	1610.26	1366.5	3	11	122	8	238	438.83	0.00	0.06	0.05	0.00	0.35	0.93	0.22	0.04	0.22
Vikedalselva	avg.	658.80	283.38	347.1	0	1	47	1	65	246.33	0.00	0.04	0.03	0.00	0.11	0.60	0.08	0.01	0.27
Vosso (Bolstadelvi)	avg.	7711.78	1699.20	3834.2	2	9	221	11	424	3076.09	0.00	0.26	0.21	0.01	1.20	2.78	0.82	0.18	2.79
Nausta	avg.	1307.87	673.71	1103.2	1	3	32	1	71	601.35	0.00	0.01	0.02	0.00	0.12	0.59	0.05	0.02	0.54
Driva	avg.	5308.77	5053.66	2765.6	5	10	189	4	342	5469.45	0.01	0.10	0.04	0.00	1.29	0.78	0.41	0.36	1.04
Orkla	avg.	6044.71	3447.49	6966.9	2	9	323	5	626	6848.28	0.00	0.30	0.08	0.10	8.92	23.17	1.87	0.69	2.79
Nidelva (Tr.heim)	avg.	6854.56	6040.46	6641.1	4	10	195	9	471	5471.74	0.00	0.25	0.12	0.00	1.82	1.67	2.09	0.69	2.34
Vefsna	avg.	12683.18	15449.64	8348.4	7	17	101	13	468	6391.07	0.00	0.55	0.42	0.01	2.33	3.82	1.83	0.73	4.42
Målselva v/gml E6-brua	avg.	10295.60	9423.87	4442.1	10	17	79	53	669	8057.93	0.00	0.11	0.28	0.01	2.49	8.35	1.67	0.74	1.60
Altaelva	avg.	8500.18	7795.91	9739.3	9	20	90	2	495	15172.37	0.00	0.34	0.04	0.00	1.41	0.50	0.83	0.58	2.14
Tanaelva	avg.	15823.74	7846.03	19495.1	10	28	98	8	798	41402.66	0.00	0.21	0.07	0.00	2.44	2.27	2.24	1.64	5.57
Pasvikelva	avg.	12253.80	8253.19	15544.2	8	28	103	15	722	24220.66	0.00	0.49	0.08	0.02	6.63	6.84	13.41	0.66	3.09

6.3 Priority substances and river basin specific pollutants

Metals

StationName	SampleDate	Cd (filtered)	Hg (filtered)	Ni (filtered)	Pb (filtered)
		µg/l	ng/l	µg/l	µg/l
Vosso	06/02/2023	0.005	0.80	0.32	0.024
Vosso	02/05/2023	0.003	0.55	0.33	0.011
Vosso	07/08/2023	< 0,003	0.47	0.21	0.018
Vosso	02/10/2023	0.004	0.80	0.29	0.022
Nausta	07/02/2023	0.004	0.88	0.13	0.040
Nausta	02/05/2023	0.003	0.88	0.11	0.036
Nausta	07/08/2023	< 0,003	0.72	0.08	0.030
Nausta	02/10/2023	< 0,003	1.09	0.10	0.050
Driva	06/02/2023	< 0,003	0.31	0.14	0.011
Driva	02/05/2023	< 0,003	0.62	0.24	0.011
Driva	02/08/2023	< 0,003	0.55	0.17	0.012
Driva	02/10/2023	< 0,003	< 0,3	0.17	0.007
Orkla	06/02/2023	0.069	0.37	0.71	0.010
Orkla	02/05/2023	0.047	1.06	0.99	0.019
Orkla	07/08/2023	0.013	1.05	0.67	0.015
Orkla	02/10/2023	0.027	0.72	0.82	0.009
Nidelva	08/02/2023	< 0,003	0.80	0.60	0.008
Nidelva	02/05/2023	0.003	0.65	0.65	0.014
Nidelva	07/08/2023	< 0,003	0.50	0.53	0.012
Nidelva	02/10/2023	< 0,003	0.69	0.78	0.013

Polycyclic Aromatic Hydrocarbons (PAH)

		Acenaphthene	Acenaphthylene	Anthracene	Benzo[a]anthracene	Benzo[a]pyrene	Benzo[b,j]fluoranthene	Benzo[ghi]perylene	Benzo[k]fluoranthene	Chrysene	Dibenzo[ac/ah]anthracene	Fluoranthene	Fluorene	Indeno[1,2,3-cd]pyrene	Naphthalene	Phenanthrene	Pyrene
Station name	**Sample date**	**ng/L**	**ng/L**	**ng/L**	**ng/l**	**ng/l**	**ng/l**	**ng/l**	**ng/l**	**ng/l**	**ng/l**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
Vosso	06/02/2023	0.35	0.36	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	0.62	< 2	< 0.2	< 7	< 2	< 0.6
Vosso	02/05/2023	< 0.3	< 0.3	< 0.1	0.11	< 0.2	0.28	< 0.2	< 0.2	< 0.3	< 0.2	0.35	< 2	< 0.2	< 7	< 2	< 0.6
Vosso	07/08/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	< 0.1	< 0.6	< 0.2	< 3	< 2	< 0.1
Vosso	02/10/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	0.20	< 0.6	< 0.2	< 3	< 2	< 0.1
Nausta	07/02/2023	1.05	< 0.3	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	0.34	< 2	< 0.2	< 7	< 2	< 0.6
Nausta	02/05/2023	0.40	< 0.3	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	< 0.3	< 2	< 0.2	< 7	< 2	< 0.6
Nausta	07/08/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	< 0.1	< 0.6	< 0.2	< 3	< 2	< 0.1
Nausta	02/10/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	< 0.1	< 0.6	< 0.2	< 3	< 2	< 0.1
Driva	06/02/2023	< 0.3	< 0.3	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	0.80	< 2	< 0.2	< 7	< 2	< 0.6
Driva	02/05/2023	< 0.3	< 0.3	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	< 0.3	< 2	< 0.2	< 7	< 2	< 0.6
Driva	02/08/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	< 0.1	< 0.6	< 0.2	< 3	< 2	0.1
Driva	02/10/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	< 0.1	< 0.6	< 0.2	< 3	< 2	< 0.1
Orkla	06/02/2023	< 0.3	< 0.3	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	< 0.3	< 2	< 0.2	< 7	< 2	< 0.6
Orkla	02/05/2023	1.16	< 0.3	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	< 0.3	< 2	< 0.2	< 7	< 2	< 0.6
Orkla	07/08/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	0.30	< 0.6	< 0.2	< 3	< 2	0.2
Orkla	02/10/2023	*															
Nidelva	08/02/2023	< 0.3	< 0.3	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	< 0.3	< 2	< 0.2	< 7	< 2	< 0.6
Nidelva	02/05/2023	< 0.3	< 0.3	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2	< 0.3	< 2	< 0.2	< 7	< 2	< 0.6
Nidelva	07/08/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	0.30	< 0.6	< 0.2	< 3	< 2	0.2
Nidelva	02/10/2023	< 0.4	< 0.1	< 0.1	< 0.3	< 0.8	< 0.2	< 0.3	< 0.7	< 0.2	< 0.2	0.60	< 0.6	< 0.2	< 3	< 2	0.4
		* Prøveflaske knust															

Other priority substances and river basin specific pollutants

		QCB	HCB	a-HCH	b-HCH	g-HCH	SCCP	MCCP	4-iso-nonylfenol	4-n-nonylfenol	4-tert-octylfenol	Klorfenvinfos	Cybutryne	DEHP
Station name	**Sample date**	**ng/L**	**ng/l**	**ng/l**	**ng/l**	**ng/l**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
Vosso	06/02/2023	< 0,02	< 0,02	0.02	< 0,1	< 0,02	< 100	< 200	< 100	< 10	18	< 0,2	< 0,2	< 20
Vosso	02/05/2023	< 0,02	< 0,02	0.02	< 0,1	< 0,02	< 100	< 100	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Vosso	07/08/2023	< 0,01	0.02	0.03	< 0,01	0.03	290	490	< 100	< 10	< 10	< 0,01	< 0,01	3.4
Vosso	02/10/2023	< 0,04	< 3	0.03	< 0,01	0.02	< 100	< 100	< 100	< 10	73	< 0,01	< 0,01	9.1
Nausta	07/02/2023	< 0,02	< 0,02	0.01	< 0,1	< 0,02	< 100	< 100	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Nausta	02/05/2023	< 0,02	< 0,02	< 0,01	< 0,1	< 0,02	< 100	< 100	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Nausta	07/08/2023	< 0,01	0.01	0.02	< 0,01	0.02	< 100	< 100	< 100	< 10	< 10	< 0,01	< 0,01	4.5
Nausta	02/10/2023	< 0,04	< 3	0.02	< 0,01	0.01	< 100	< 100	< 100	< 10	37	< 0,01	< 0,01	13.2
Driva	06/02/2023	< 0,02	< 0,02	< 0,01	< 0,1	< 0,02	< 100	< 200	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Driva	02/05/2023	< 0,02	< 0,02	< 0,01	< 0,1	< 0,02	< 100	< 100	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Driva	02/08/2023	< 0,01	0.02	0.01	< 0,01	0.01	< 100	< 100	< 100	< 10	< 10	< 0,01	< 0,01	17.6
Driva	02/10/2023	< 0,04	< 3	0.01	< 0,01	< 0,01	< 100	< 100	< 100	< 10	40	< 0,01	< 0,01	25.1
Orkla	06/02/2023	< 0,02	< 0,02	< 0,01	< 0,1	< 0,02	< 100	< 300	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Orkla	02/05/2023	< 0,02	< 0,02	< 0,01	< 0,1	< 0,02	< 100	< 100	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Orkla	07/08/2023	0.01	0.03	0.03	< 0,01	0.02	< 100	< 100	< 100	< 10	< 10	< 0,01	< 0,01	17.3
Orkla	02/10/2023	*					< 100	< 100	< 100	< 10	< 10			
Nidelva	08/02/2023	< 0,02	< 0,02	0.02	< 0,1	< 0,02	< 100	< 300	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Nidelva	02/05/2023	< 0,02	< 0,02	0.02	< 0,1	< 0,02	< 100	< 100	< 100	< 10	< 10	< 0,2	< 0,2	< 20
Nidelva	07/08/2023	< 0,01	0.02	0.05	< 0,01	0.04	< 100	< 100	< 100	< 10	< 10	< 0,01	< 0,01	7.0
Nidelva	02/10/2023	0.06	7.14	0.05	< 0,01	0.02	< 100	< 100	< 100	< 10	< 10	< 0,01	< 0,01	14.1
		* Prøveflaske knust												

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