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Riverine inputs and direct discharges to Norwegian coastal waters – 2014

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Riverine Inputs and Direct Discharges to Norwegian Coastal Waters - 2014

Summary - sammendrag

Riverine inputs and direct discharges to Norwegian coastal waters in 2014 have been estimated in accordance with the OSPAR Commission's principles. Nutrients, metals and organic pollutants have been monitored in rivers; discharges from point sources have been estimated from industry, sewage treatment plants and fish farming; and nutrient inputs from diffuse sources have been modelled. Trends in riverine inputs have been analysed, and threshold concentration levels investigated. Rapporten presenterer resultater fra Elvetilførselsprogrammet i 2014. Næringsstoffer, metaller og organiske miljøgifter er overvåket i norske elver, mens punktutslipp er beregnet fra industri, renseanlegg og akvakultur. Tilførsler av næringsstoff fra diffuse kilder er beregnet ved hjelp av TEOTIL-modellen. Trender i tilførsler fra utvalgte elver er beskrevet. Konsentrasjoner over gitte grenseverdier er funnet for både metaller og organiske miljøgifter i enkelte elver.

4 emneord

Elvetilførsler, direkte tilførsler, norske kystområder, overvåking

4 subject words

Riverine inputs, direct discharges, Norwegian coastal waters, monitoring

Front page photo

River Otra, October 2015. Photo: Øyvind Kaste

Content

Summary

This report presents the results of the 2014 monitoring of riverine inputs and direct discharges to Norwegian coastal waters (RID). The monitoring is part of a joint monitoring programme under the "OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic", where the purpose is to estimate the total loads of selected pollutants to Convention waters on an annual basis. The programme also gives information on pollutant concentration levels in Norwegian rivers, and can be further used to explain pollution levels along the coast.

The year 2014 was the warmest since the nation-wide climatological recordings started in 1900. Precipitation was very close to normal for the country as a whole, although wetter than normal in the southern and eastern parts, and drier in mid-Norway and the northern parts. This was reflected in the riverine water discharges, and therefore also the geographical distribution of pollutants loads. Total inputs to coastal Norwegian waters in 2014 were estimated to about 13 200 tonnes of phosphorus, 170 100 tonnes of nitrogen, 485 000 tonnes of silicate, 556 000 tonnes of total organic carbon (TOC) and 780 000 tonnes of suspended particulate matter. Total metal inputs to the Norwegian coastal areas were estimated to 276 kg of mercury, 3 tonnes of cadmium, 8 tonnes of silver, 29 tonnes of arsenic, 50 tonnes of lead, 72 tonnes of chromium, 129 tonnes of nickel, 795 tonnes of zinc and 1139 tonnes of copper (upper estimates). Metal concentrations were compared with available threshold levels, but levels exceeding or close to the threshold value were only found for the metal copper, in rivers Glomma, Alna, Orreelva, Orkla, Tista, Stjørdalselva, and Pasvikelva. There were no significant changes in the distribution of sources for neither nutrients nor metals as compared to recent years. Fish farming continues to be a major direct source of nutrients and copper to the sea.

In 2014, the methodology introduced in 2013 for organic contaminants in Rivers Glomma, Alna and Drammenselva, was continued. An increase in loads was found for PAHs, PCBs, BPA, TBBPA and PFOS in all three rivers from 2013 to 2014, probably reflecting increased water discharges. Estimates of "whole water" concentrations for fluoranthene, benzo[a]pyrene and PFOS were close to or above the threshold levels of WFD AA-EQS for all three rivers in 2014. The estimate of "whole water" concentrations for SCCPs in River Alna also approached WFD AA-EQS values in 2014.

In 2014, nutrient and particle loads to Skagerrak were generally 25% higher than the long-term mean of 1990-2013. Similarly, loads of arsenic, lead, nickel and zinc were higher to this sea area in 2014 than in the period 1990-2013.This increase is almost solely explained by a corresponding higher water discharge in 2014 as compared to the long-term mean. For the three other maritime areas the loads were more close to the long-term mean.

Trend analyses of nutrients and some metals were performed for nine rivers for the entire monitoring period and for the last 10 years. This year, the trend analyses were not adjusted for water discharge, since the purpose was to assess actual loads to the sea. Four rivers draining to Skagerrak showed a statistical increase in water discharge, and this had a marked influence on trends in loads. Statistically significant upward trends in total nitrogen loads were detected in Rivers Glomma, Drammenselva and Numedalslågen, and a downward trend was found in River Vefsna. Reduced total phosphorus loads were detected in River Vefsna, whereas increases were found in Rivers Drammenselva and Numedalslågen. Metal loads have in general been reduced since

1990, but copper has increased in River Drammenselva. In the three northernmost rivers (Rivers Orkla, Vefsna and Altaelva) there has been a reduction in all metal compounds investigated (Cd, Cu, Ni, Pb and Zn). Increases in concentrations and loads of zinc have been detected over the last four years (2011-2014) in River Glomma.

This year, sensor data have been used to assess uncertainty in loads and mean concentration estimates, but more years of monitoring are needed before firm conclusions can be drawn.

Sammendrag

Norsk sammendrag er gitt i form av et infoark på de neste fire sidene.

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Tilførsler til norske havområder 2014

I dette faktaarket gis en oversikt over tilførsler av næringsstoff, metaller og organiske miljøgifter fra elver og direkteutslipp i 2014, sett i lys av tidligere års tilførsler. I 2014 var det høy vannføring i elvene som drenerer til Skagerrak, noe som ga økte tilførsler av næringsstoff der.

Hvert år overvåkes tilførsler til norskekysten av næringsstoff, tungmetaller og organiske miljøgifter. Overvåkingen utføres i til sammen 47 elver. I tillegg beregnes tilførsler fra umålte felt og utslipp fra punktkilder som ikke ligger oppstrøms målestasjonene. Slike punktkilder er industri, kloakkavløp og fiskeoppdrett.

I flere elver som drenerer til Skagerrak har vannføringen økt i perioden 1990-2014, og særlig i 2014 var det mye vann i elvene. Dette er en medvirkende årsak til at næringsstofftilførsler til havområdene har økt her. Metalltilførsler har stort sett gått ned over hele landet, med noen få unntak. Detaljer om dette finnes på side 2.

I elvene ble metallkonsentrasjonene sammenlignet med fastsatte grenseverdier, og i 2014 ble det kun funnet for høye gjennomsnittlige konsentrasjoner av ett metall, kobber. Dette gjaldt i elvene Glomma, Alna, Orreelva, Orkla, Tista, Stjørdalselva og Pasvikelva.

Som i 2013 ble de organiske miljøgiftene fluoranthene, benzo[a]pyrene (begge PAHer) og PFOS funnet i konsentrasjoner nær eller over grenseverdiene i de tre elvene hvor dette ble undersøkt, dvs. Glomma, Alna og Drammenselva (se s. 3).

På siste side gir en oversikt over programmet og en kort innføring i hvordan tilførslene beregnes.

Miljødirektoratet | **Telefon:** 03400/73 58 05 00 | **E-post:** post@miljodir.no | **Nett:** www.miljødirektoratet.no | **Post:** Postboks 5672 Sluppen, 7485 Trondheim

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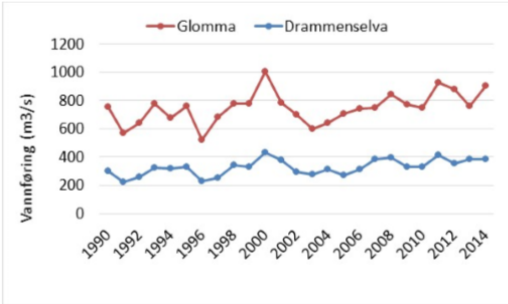
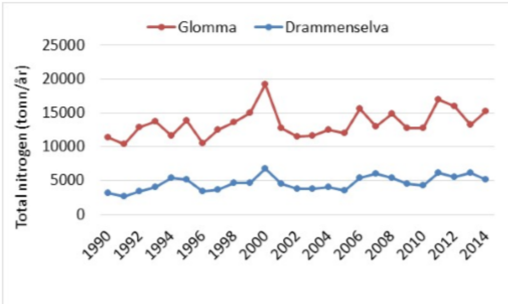
Trender over tid





Grafene illustrerer hvordan tilførsler av nitrogen til havområdene avhenger av vannføring i elvene, her illustrert for Glomma og Drammenselva.

Økt vannføring gir mer næringsstoff i elvene

Tabellen nederst på siden viser trender i metall- og næringsstofftilførsler fra ni norske elver siden 1990. Tidligere år har trendene vært basert på vannføringsnormaliserte tilførsler, men i år er trendanalysene utført på faktiske tilførsler, da dette bedre gjenspeiler utviklingen i det som tilføres kystområdene.

I fire elver som drenerer til Skagerrak økte vannføringen i 25-års perioden, og i disse elvene er det også økninger i tilførsler av næringsstoff. Dette kan vise oss hva som kan skje om klimaendringer gir våtere vær i fremtida. Hvis vi tar hensyn til økningen i vannføring, forsvinner mange av disse trendene, og kun en økning i nitrogen i Numedalslågen gjenstår.

For metalltilførsler er det nedgang i alle undersøkte vassdrag, med unntak av kobber i Drammenselva. I tillegg har det vært en økning i sink i Glomma de siste årene, men årsaken til dette er foreløpig ikke kjent.

Økning fra fiskeoppdrett

Det beregnes direkte tilførsler fra fiskeoppdrett, industri og kloakkrenseanlegg. Det har over flere år vært en stigning i tilførsler av næringsstoffer og kobber fra fiskeoppdrett.

I flere av elvene som drenerer til Skagerrak har det vært en statistisk signifikant økning i vannføring siden overvåkingsprogrammet startet i 1990, og samtidig har tilførslene av næringsstoffer økt i flere av elvene.

Tabellen viser trender i tilførsler siden 1990. Grønn farge betyr at tilførslene har gått ned, rød farge at de har gått opp. Lys grønn farge indikerer en tendens til nedgang; oransj farge en tendens til økning.

River	Q	Cd	Cu	Ni	Pb	Zn	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma												
Drammenselva												
Numedalslågen												
Skienselva												
Otra												
Orreelva												
Orkla												
Vefsna												
Altaelva												

Q: Vannføring, Cd: Kadmium, Cu: Kobber, Ni: Nikkel, Pb: Bly, Zn: Sink, Tot-N: Total nitrogen, Tot-P: Total fosfor.

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Organiske miljøgifter

Ny overvåkingsmetodikk

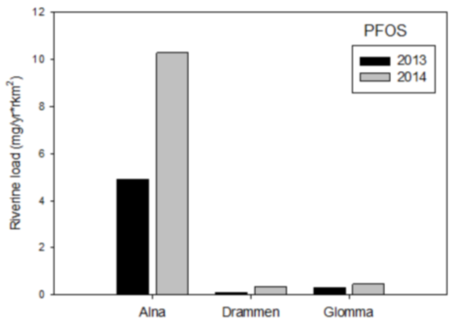
Fram til og med 2012 ble kun PCB7 og lindan overvåket i dette programmet. Ettersom konsentrasjonene stort sett var under deteksjonsgrensen, ga dette liten informasjon. Fra 2013 gikk man derfor over til å overvåke organiske miljøgifter med metoder som gjør det mulig å påvise stoffene ved langt lavere konsentrasjoner. Denne overvåkingen ble også i 2014 utført i Glomma, Alna og Drammenselva.

Den løste fraksjonen av stoffene overvåkes med passive prøvetakere. Dette er prøvetakere av silikon, som tar opp miljøgiftene fra vannet. Ved hjelp av opptakshastigheten, mengden stoff i prøvetakeren og tiden prøvetakeren har stått ute, kan man regne seg tilbake til konsentrasjonen i vann og beregne tilførslene.

Den partikkelbundne fraksjonen måles ved å samle inn partikler ved en sentrifugeteknikk. Mengden stoff i partiklene og beregnet partikkeltransport i elva brukes så til å beregne tilførsler. Summen av de to fraksjonene (løst og partikulært) gir et estimat på totale tilførsler.

Resultater

Tabellen under viser årstilførsler av de forskjellige stoffene. Tilførslene er generelt høyere i Glomma og Drammenselva (som jo har større vannføring). Men når tilførsler beregnes per areal, som vist i figuren under for PFOS, er de klart høyest i Alna. Tilførslene økte noe siden 2013, noe som sannsynligvis skyldes økt vannføring. Beregnede totale konsentrasjoner ble sammenlignet med grenseverdiene i EUs Vanndirektiv. Konsentrasjoner av fluoranthene, benzo[a]pyrene (begge PAHer) og PFOS var nær eller over grenseverdien i alle de tre elvene.



Sett i forhold til areal er tilførslene av PFOS størst i Alna. Økning fra i fjor er knyttet til vannføringsøkning.

Tabellen viser beregnede elvetilførsler av organiske miljøgifter for Alna, Drammenselva og Glomma i 2014 "a" betyr at tilførslene kun er basert på den partikkelbundne fraksjonen

Stoff	Enhet	Alna	Drammenselva	Glomma
ΣPAH_{16}	kg/yr	4,2	369-369,5	819-820
ΣPCB_7	g/yr	22,4-25,2	1058-1122	731-2834
ΣPBDE (excl, BDE28)	g/yr	3,2-3,9	183-228	282-640
BDE209	g/yr	27	741-789	406-533
ΣHBCDD (α, β, γ)	g/yr	5,8-6,4	584-843	1589-2458
SCCPs[a]	kg/yr	0,82	6,9	15,8-19,4
MCCPs[a]	kg/yr	0,31	4,2	11,8
BPA[a]	g/yr	232-267	2185	3734
TBBPA[a]	g/yr	4,3	1116-1117	5439-5454
PFOS[a]	g/yr	0,36	5,6	15,3-19,2

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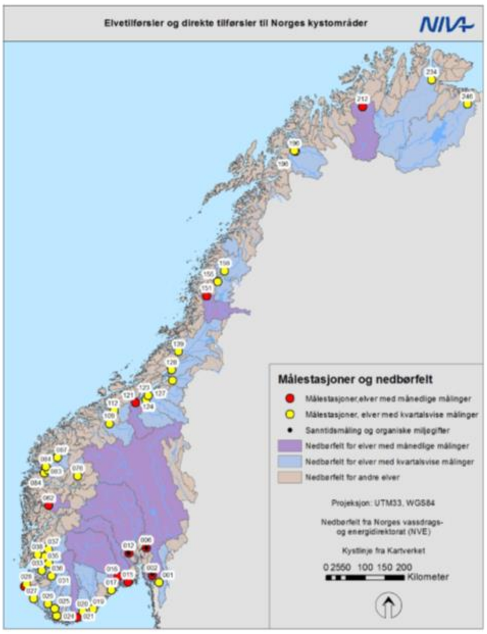
Informasjon om overvåkingen



Kartet viser de 47 elvene som ble overvåket i 2014.

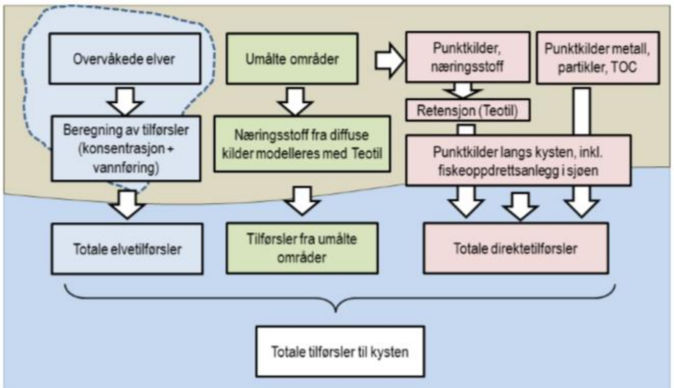
Elvetilførselsprogrammet og OSPAR

Elvetilførselsprogrammet er en del av oppfølgingen av OSPAR-konvensjonen (www.ospar.org), som gjelder for alle europeiske land som grenser til Nord-Atlanteren. Tilknyttet denne konvensjonen er også et program som måler luftforurensing og ett som måler tilstanden i kystvann.

Programmet finansieres av Miljødirektoratet, og det er NIVA, NIBIO og NVE som utfører arbeidet.

Beregningsmetoder

Innenfor dette programmet overvåkes hvert år et femtitalls norske elver (se kartet), samtidig som programmet samler inn data over utslipp fra flere ulike tilførselskilder.



Figuren til venstre viser hvordan totale tilførsler til havområdene beregnes. Den forurensingen som kommer med elvene omfatter også utslipp fra oppstrøms punktkilder (særlig industri og renseanlegg). Direktetilførsler omfatter punktkilder langs med kysten og i de umålte feltene. Næringsstoffer som tilføres fra diffuse kilder modelleres.

I Norge beregnes utslipp til de fire havområdene Skagerrak, Nordsjøen, Norskehavet og Barentshavet.

FAKTA

Mer informasjon om overvåkingen i 2014 finnes i Miljødirektoratets Rapport M-439|2015 /NIVA-Rapport 6929-2015.
Dette faktarket er utarbeidet av Eva Skarbøvik (NIBIO) i samarbeid med Øyvind Kaste (NIVA).

www.niva.no
www.nibio.no
www.nve.no

1. Introduction

1.1 The OSPAR RID Programme

The Riverine Inputs and Direct Discharges to Norwegian coastal waters (RID) is carried out as part of the obligations under the OSPAR Convention. This Convention is the current legal instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic.

Work under the Convention is managed by the OSPAR Commission, made up of representatives of the Governments of 15 Contracting Parties and the European Commission, representing the European Union. The general principles of the RID Programme are posted at www.ospar.org, the main objectives are listed in Appendix I.

The programme has been on-going since 1990 and reports loads to the sea of nutrients, metals and pesticides. Contracting parties comprise all European countries bordering the North Atlantic Sea, as well as the EU. The RID Programme, together with the programmes for monitoring of air (Comprehensive Atmospheric Monitoring Programme – CAMP) and marine environments (Co-ordinated Environmental Monitoring Programme – CEMP) are all parts of OSPAR's Joint Assessment and Monitoring Programme (JAMP).

The Norwegian mainland drains to four maritime OSPAR regions (Figure 1):

I. Skagerrak:	From the Swedish border to Lindesnes (the southernmost point of Norway), at about 57°44'N
II. North Sea:	From Lindesnes northwards to Stadt (62° N)
III. Norwegian Sea:	From Stadt up to Lofoten and Vesterålen (68°15'N)
IV. Barents Sea:	From 68°15'N (including Lofoten and Vesterålen) to the Russian border.

Note that the border between the Norwegian Sea and the Barents Sea was changed this year. In former years the border was drawn at 70°30'N, which is the county border between Troms and Finnmark.

1.2 The Norwegian RID Programme in 2014

In Norway, the RID programme is carried out through a combination of monitoring and modelling. The Norwegian Environment Agency has commissioned the Norwegian Institute for Water Research (NIVA), the Norwegian Institute for Bioeconomy Research (NIBIO), and the Norwegian Water Resources and Energy Directorate (NVE) to carry out the work. Information on personnel and sub-contractors is given in Appendix II.

A subset of Norwegian rivers has been selected for monitoring to fulfil the RID requirements (Table 1). In 2014, 11 rivers were monitored monthly or more often; and 36 rivers were monitored quarterly. The location of the sampling sites is shown in Figure 2. More information on the catchments of the monitored rivers is given in Appendix III. A number of 109 rivers were monitored once a year in the period 1990-2003. One of these, River Alna, has been monitored monthly since 2013, and is therefore now listed under that category.

Table 1. The Norwegian RID monitoring programme.

Type of river	Number of rivers
Rivers monitored at least monthly in 2014	11
Rivers monitored quarterly since 2004, and once a year in 1990-2003	36
Rivers monitored once a year in 1990-2003; estimated from 2004 onwards	108

The total load of constituents to the sea has been calculated by combining the monitored data with estimated and modelled results. In addition, direct discharges reported from sewage treatment plants, industry and fish farming are registered and included in the calculations. The result is divided into inputs from rivers, unmonitored areas and direct discharges, but it is important to understand what these terms mean. For example, the term “direct discharges” to the sea also covers effluents from point sources upstream in the unmonitored areas. Table 2 and Figure 2 have been provided to clarify some important terms within the RID Programme.

To fulfil the requirements of OSPAR, the following parameters were monitored in 2014:

- six fractions of nutrients (total phosphorus, orthophosphate, total nitrogen, ammonium, nitrate and silicate);
- nine heavy metals (silver, copper, zinc, cadmium, lead, chromium, nickel, mercury and arsenic);
- five other parameters (suspended particulate matter, turbidity, pH, conductivity, and total organic carbon).

In addition, Norway monitored the following parameters in 2014 (not used to calculate total loads to the sea):

- Organic contaminants in Rivers Glomma, Alna and Drammenselva.
- Turbidity, conductivity and pH using automatic sensors in Rivers Glomma, Alna and Drammenselva.
- Water temperature in all rivers, using several methods.

Details on changes in the RID monitoring programme throughout the years are given in Appendix IV.

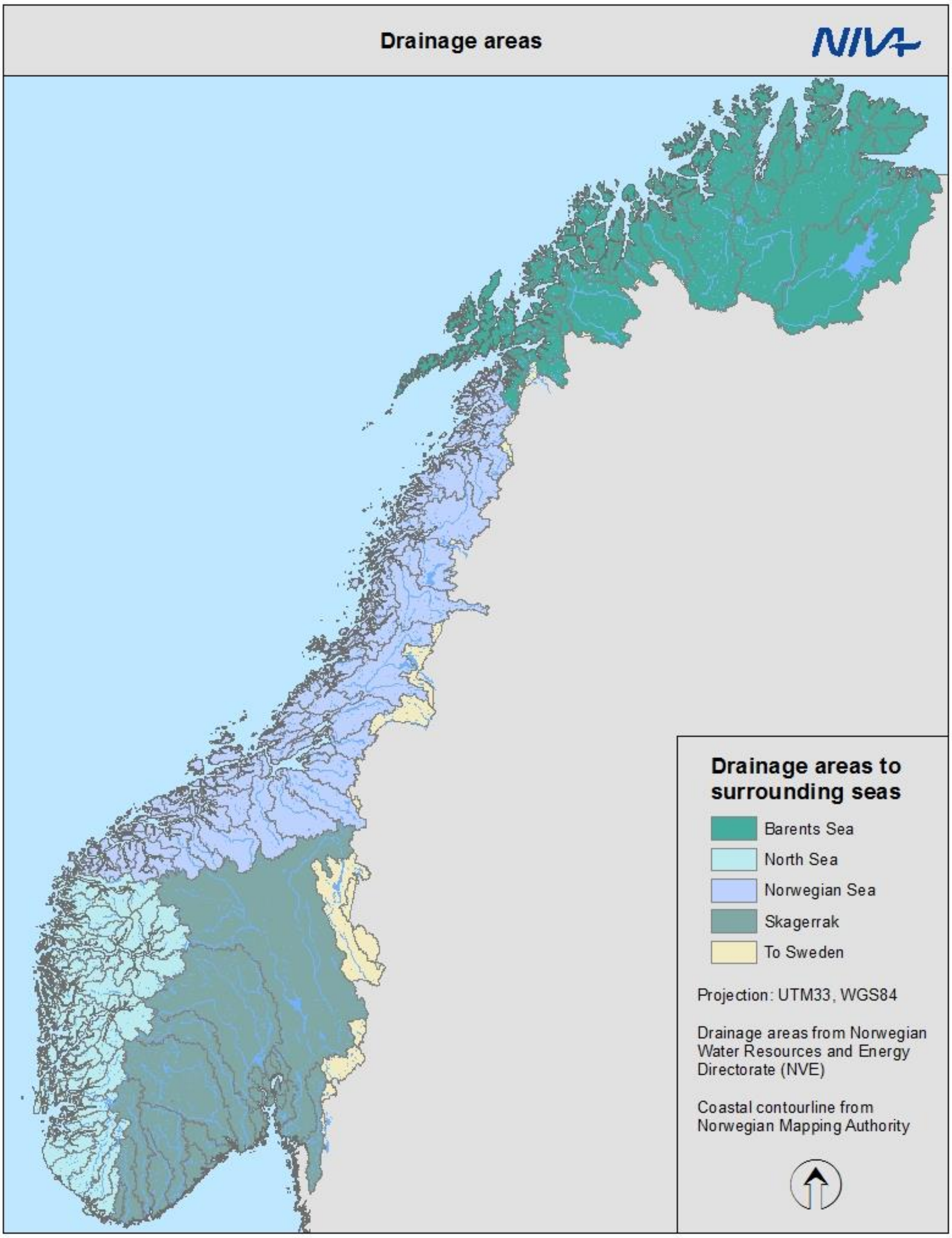


Figure 1. Norway is divided into four drainage areas, which drain into the Skagerrak, the North Sea, the Norwegian Sea and the Barents Sea. Minor parts of Norway drain to Sweden. Note that the border between the Norwegian Sea and the Barents Sea is different this year as compared to former years, when the border was drawn at 70°30'N (the county border between Troms and Finnmark).

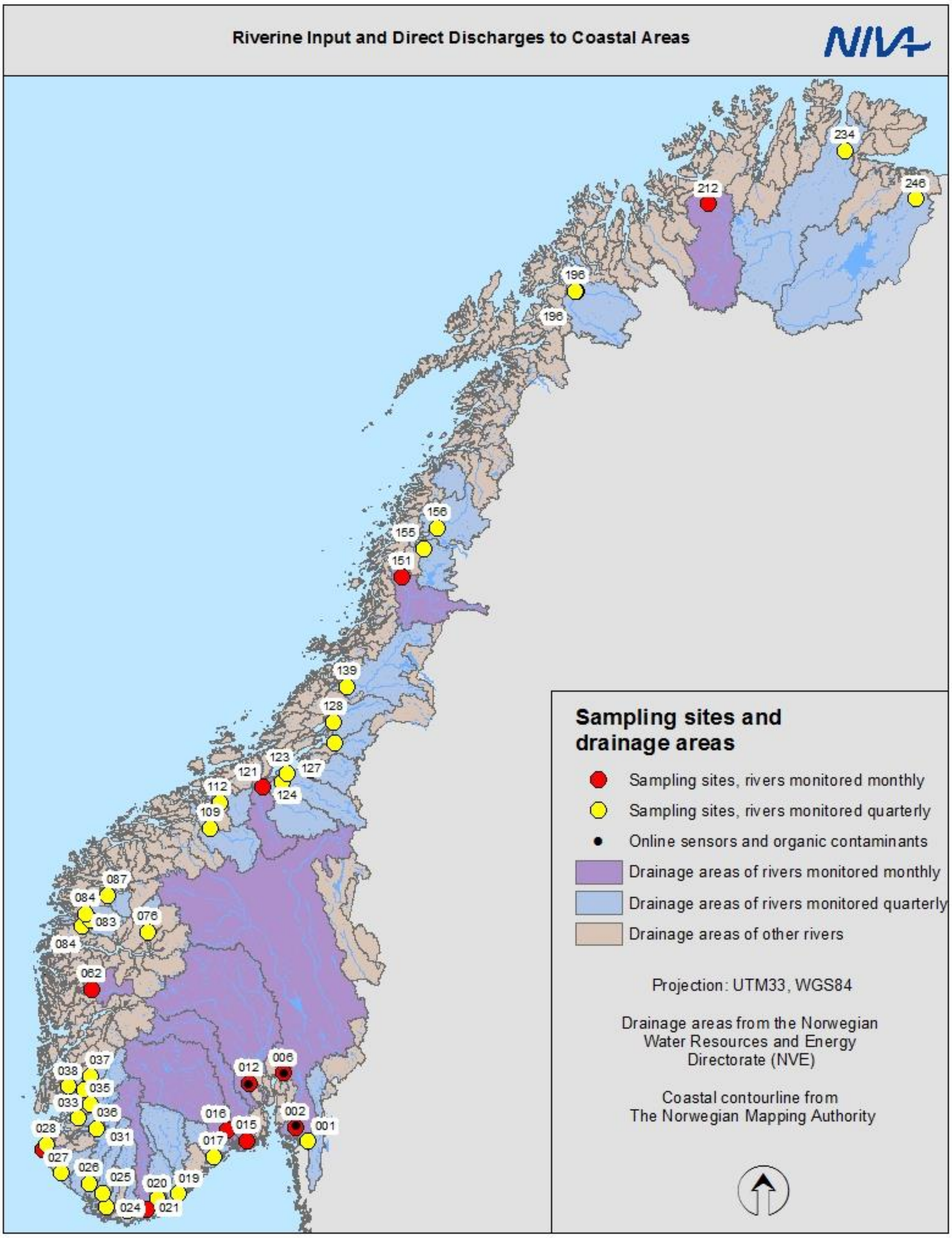


Figure 2. River sampling sites in the Norwegian RID programme. The numbers refer to the national river basin register (REGINE; www.nve.no). The river basin register system classifies the Norwegian river basins into 262 main catchment areas, of which 247 drain to coastal areas.

Table 2. Definitions of the main constituent 'sources' and the main methodology associated.

Name	Definition	Comments
Monitored area	Area upstream the sampling points of the 11+36+108 rivers (cf. Table 1).	Grab sampling is done each year in 11 + 36 rivers. For the 108 rivers monitored once a year before 2004, an average of concentrations in former years is used (but combined with the current year's water discharge to calculate loads).
Unmonitored area	Covers the entire area that is not monitored, i.e. unmonitored river catchments, coastal areas and areas downstream of the sampling points in the 11+36+108 rivers.	Only nutrient load from diffuse runoff is estimated, with the TEOTIL model.
Direct discharges	Reported emissions from point sources in the unmonitored areas. This also includes *upstream* point sources in the unmonitored area.	For point emissions of nutrients, the TEOTIL model is used to account for retention from the source to the sea. For metals it is assumed that no retention occurs.
Total loads	Loads calculated based on monitored areas + unmonitored areas + direct discharges.	

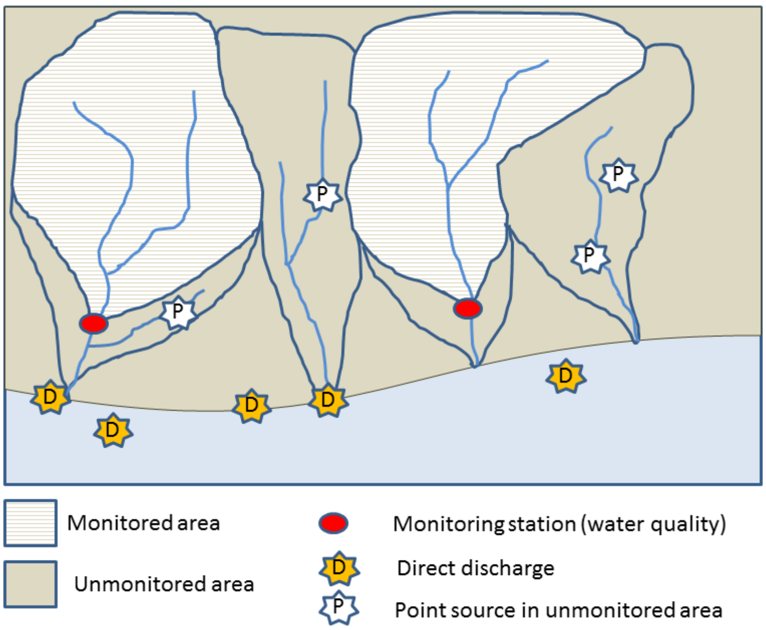


Figure 3. Illustration of RID areas, point sources and direct discharges (source: OSPAR RID Agreement 2014.04; www.ospar.org). See also Figure 8 for the Norwegian adjustments to these principles.

2. Materials and methods

2.1 Water discharge and hydrological modelling

For the rivers monitored monthly, daily water discharge measurements have been used for the calculation of loads. Except for River Alna, where discharge data has been provided by Oslo Water and Sewerage Works, discharge data have been provided by NVE. Since the hydrological stations are not located at the same site as the water quality stations, the water discharge at the water quality sampling sites have been calculated by up- or downscaling, proportional to the respective drainage areas.

For the remaining area, 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. Appendix IV gives more information on the methodology. There have been no amendments or changes in this method since last year's reporting (Skarbøvik *et al.*, 2014).

2.2 River grab samples: Sampling and calculation

2.2.1 Sampling methodology

Sampling has been carried out in the same manner as the previous year (Skarbøvik *et al.*, 2014). Monthly sampling is done in 11 rivers. However, in two of the rivers, the Glomma and Drammenselva, additional sampling is done during the spring. The quarterly sampling in 36 rivers is designed to cover four main meteorological and hydrological conditions in the Norwegian climate. These include the winter season with low temperatures, snowmelt during spring, summer low flow season, and autumn floods/high discharges. Sampling dates are shown in Addendum's Table 1a.

2.2.2 Chemical parameters - detection limits and analytical methods

The parameters monitored in 2014 are listed in section 1.2. Information on methodology and levels of detection (LOD) for all parameters included in the grab sampling programme is given in Appendix IV.

In the RID Programme, chemical concentrations are usually given as two values; i.e. the upper estimate and the lower estimate. These are defined as follows:

- For the lower estimates, samples with concentrations below the detection limit have been given a value of zero;
- For the upper estimates, samples with concentrations below the detection limit have been given a value equal to the detection limit.

This implies that if no samples are below the detection limit, the lower and upper estimates are identical. However, for compounds that have a high number of samples below the detection limit, the highest and lowest estimates may differ considerably.

According to the RID Principles (www.ospar.org), the analytical method should give at least 70% of positive findings (i.e. no more than 30% of the samples below the detection limit). In 2014, orthophosphate, mercury and silver did not reach this requirement (Table 3). Since the analytical methods have acceptably low detection limits, this reflects that the concentrations of these compounds are low in Norwegian river waters. Silver was monitored for the first time last year. In 2013 only one sample was above the detection limit, whereas in 2014 four samples were above the detection limit.

Table 3. The proportion of analyses below the detection limit for all parameters included in the sampling programme in 2013. The detection limits are shown in Appendix IV.

Parameter	Unit	% below detection limit	Total no of samples	No of samples below detection limit
pH		0	287	0
Conductivity	mS/m	0	287	0
SPM	mg/l	0	287	0
TOC	mg C/l	0	287	0
TOT-P	µg P/l	2	287	7
PO_4-P	µg P/l	31	287	88
TOT-N	µg N/l	0	287	0
NO_3-N	µg N/l	0	287	1
NH_4-N	µg N/l	14	287	39
SiO_2	mg/l	0	287	0
Pb	µg/l	1	287	3
Cd	µg/l	24	287	69
Cu	µg/l	0	287	0
Zn	µg/l	1	287	4
As	µg/l	17	287	50
Hg	ng/l	67	287	192
Cr	µg/l	24	286	70
Ni	µg/l	0	286	1
Ag	µg/l	99	287	283

2.2.3 Quality assurance and direct on-line access to data

Data from the laboratory analyses were transferred to a database and quality checked against historical data by researchers with long experience in assessing water quality data. If any anomalies were found, the samples were re-analysed. The data are available on-line at www.aquamonitor.no/rid, where users can view values and graphs of each of the 47 monitored rivers.

2.2.4 Calculating riverine loads

As outlined in Stålnacke *et al.* (2009), the RID calculation formula has been slightly modified from the original formula recommended by the RID/OSPAR Programme (PARCOM, 1988). The main improvement of this modified method is that it handles irregular sampling frequency in a better way and allows flood samples to be included in the annual load calculations.

The following formula is now used:

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

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.

For the 109 rivers monitored once a year in the period 1990-2003, but not from 2004 onwards, the calculation of loads was conducted as follows:

- For nutrients, sediments, silica and total organic carbon, the modelled annual water volume in 2014 was multiplied with average concentration for the period 1990-2003.
- For metals, the modelled annual water volume in 2014 was multiplied with average concentration for the period 2000-2003 (data from earlier years were not used due to high detection limits).

2.2.5 Statistical methodology for trends in riverine inputs

Only rivers monitored monthly are included in the statistical trend analyses, due to the lower sampling frequency for the remaining monitored rivers. As opposed to former years, the results presented this year focus on the actual riverine loads, without correction for water discharge.

Some historical concentrations were removed from the riverine datasets prior to the concentration trend analyses; an overview of these is given in Skarbøvik *et al.* (2010). For the trend analyses, the loads were estimated based on extrapolation or interpolation of the trend line wherever concentrations were missing. The bars with estimated loads (extrapolated or interpolated) have been given different colours in the charts in Appendix V, to separate them from the loads based on measured concentration values.

The trend analyses for nutrients and suspended particulate matter were performed on the upper estimates of the loads, except for orthophosphate where both upper and lower estimates were used. The trend analyses for metals were performed on both the upper and lower estimates of the loads. The trends were regarded as statistically significant at the 5%-level (double-sided test), and trend slopes were computed according to Sen (1968).

In addition to the formal statistical test, a visual inspection of all the time series was performed (cf. graphs in Appendix V).

Apart from the long-term trends, we also report on trends observed in the data of the last ten years (2005-2014), where those differ substantially from the long-term trends. We note already here that the statistical power of the applied analysis decreases when applied on shorter time-series. The same slope in two time-series trends may not prove significant in the case that is supported by a lesser number of observations.

Chemical variables analysed for trends include ammonium nitrogen (NH_4-N), nitrate nitrogen (NO_3-N), total nitrogen (TN), orthophosphate (PO_4-P), total phosphorus (TP) and suspended particulate matter (SPM), cadmium (Cd), copper (Cu), lead (Pb), zinc (Zn) and nickel (Ni). Analyses were also performed for mercury (Hg), but we note that the analysis of Hg is affected by great analytical uncertainty, and that a different analytical method was used from 1999 to 2003 (Weideborg *et al.*, 2004). The same holds true for arsenic (As). PCB7 and lindane (g-HCH) are not analysed for trends due to the shortness of the available time series, gaps in the series and/or many observations being at or below LOD (Limit of Detection). Lindane is also no more part of the monitoring programme, and PCB7 is monitored using different methodology.

Some methodological challenges when assessing the trends include:

- River Alta was sampled less than 12 times a year during the period 1990-1998.
- Some rivers have had more frequent sampling during floods in some years (e.g., Rivers Glomma and Drammenselva in 1995)
- All samples from 1990 up to 1998, and from 2004 to date, were analysed by the same laboratory, but samples in the period 1999-2003 were analysed by a different laboratory. Such changes in laboratory often mean changes in methods and detection limits.
- Some data were excluded from the dataset prior to the trend analyses; a detailed overview of excluded data is given in Skarbøvik *et al.* (2010). Examples are total phosphorus and mercury data 1999-2003 (see also Stålnacke *et al.*, 2009).
- Many concentrations were below LOD-values, especially for metals. This is partly a result of relatively low contamination levels in Norwegian rivers, and partly because of analytical techniques in the early years of the RID-Programme. Many below-LOD values were reported in the period 1990-2003, with a general increase in frequency of below-LOD values for some metals, SPM and total phosphorus during the period 1999-2003 (change in laboratory and therefore higher LODs). However, this problem was reduced after 2003, due to improvements in analytical techniques.

Both the seasonal Mann-Kendall-test (Hirsch and Slack, 1984) and the partial Mann-Kendall test (Libiseller and Grimvall, 2002) has been used to test for long-term monotonic trends (including linear trends) in annual riverine inputs and monthly concentrations measured in nine of the ten main rivers. The latter method has its methodological basis in the seasonal Mann-Kendall-test with the difference that water discharge is included as explanatory variable. The test also includes a correction for serial correlation up to a user-defined time span; in our case a span of one year was used. The method also offers convenient handling of missing values. As opposed to former years, the results presented in the main part of the report mainly focus on the actual riverine loads, without correction for water discharge.

For the sake of visualisation we also applied a trend-smoother (and corresponding 95% confidence limits) on a selected number of river and substances with statistical significant trends. This method uses cross-validation to obtain the optimal statistical compromise between good fit and a smooth function. Confidence intervals for the fitted values are computed using residual resampling (bootstrap). New datasets (bootstrap samples) are generated by adding error terms drawn by sampling with replacement from the observed model residuals. The method is described in detail in Grimvall et al (2008).

2.3 Unmonitored areas

For the unmonitored areas, nutrient and metal loads are treated as follows:

For nutrients, only loads originating from diffuse sources are reported under unmonitored areas. The nutrient loads from point sources in the unmonitored areas are reported as part of the direct discharges (see Chapter 2.4). Nutrient loads are calculated by means of the TEOTIL model (e.g. Tjomsland and Bratli, 1996; Bakken *et al.,* 2006; Hindar and Tjomsland, 2007). The model has been utilised for pollution load compilations of nitrogen and phosphorus in catchments or groups of catchments. The model estimates annual loads of phosphorus and nitrogen from point and diffuse sources. The point source estimates are based on national statistical information on sewage, industrial effluents, and aquaculture (see Chapter 2.4). Nutrient loads from diffuse sources (agricultural land and natural runoff from forest and mountain areas) are modelled by a coefficient approach (Selvik *et al.*, 2007). Area specific export coefficients for nutrients have been estimated for agricultural land in different geographical regions. The coefficients are based on empirical data from agricultural monitoring fields in Norway and are adjusted annually by NIBIO based on reported changes in agricultural practice (national statistics). For forest and mountain areas, concentration coefficients for different area types and geographical regions have been estimated based on monitoring data from reference sites. The annual loads from natural runoff vary from year to year depending on precipitation and discharge. The model adjusts for retention in lakes between the source and the sea. The inorganic fractions of phosphorus and nitrogen are estimated using different factors for the different sources.

For metals, no relevant model is available to estimate loads from diffuse sources. This means that the contribution of metals from diffuse sources in unmonitored areas has been set to zero in the RID estimates. However, point source discharges of these substances in the unmonitored areas are included in the estimates of the direct discharges to the sea (see Chapter 2.4). Organic contaminants loads are only estimated for the three rivers where these compounds are monitored.

2.4 Direct discharges

The direct discharges calculated in this programme comprise effluents from point sources in the unmonitored areas. Thus, the Norwegian RID Programme includes inland point sources under the RID term “direct discharges to the sea”. This practice has been followed for all years of the RID Programme and is kept as before in order to avoid major jumps in the data series.

The discharges of nutrients from point sources in unmonitored areas are each year estimated using the TEOTIL model, as explained in Chapter 2.3. It should be noted that for metal emissions that are not directly discharging to the sea, retention is not accounted for. Organic contaminants are not included in the estimates, as the number of point sources and compounds reported is low, and thus not representative for calculating regional and national discharges.

The estimates are based on national statistical information, including:

- Sewage: Municipal wastewater and scattered dwellings (Statistics Norway - SSB / the KOSTRA Database);
- Industry: the database “Forurensning” from the Norwegian Environment Agency.
- Aquaculture: Nutrients (from the Directorate of Fisheries / the ALTINN-database (altinn.no)) and copper (based on sales statistics of antifouling products made available by the Norwegian Environment Agency)

The details on how these data were extracted are given in Appendix IV. The location of the reporting units of point source pollution is shown in Figures 4 (industry), 5 (sewage treatment plants), and 6 (fish farming).

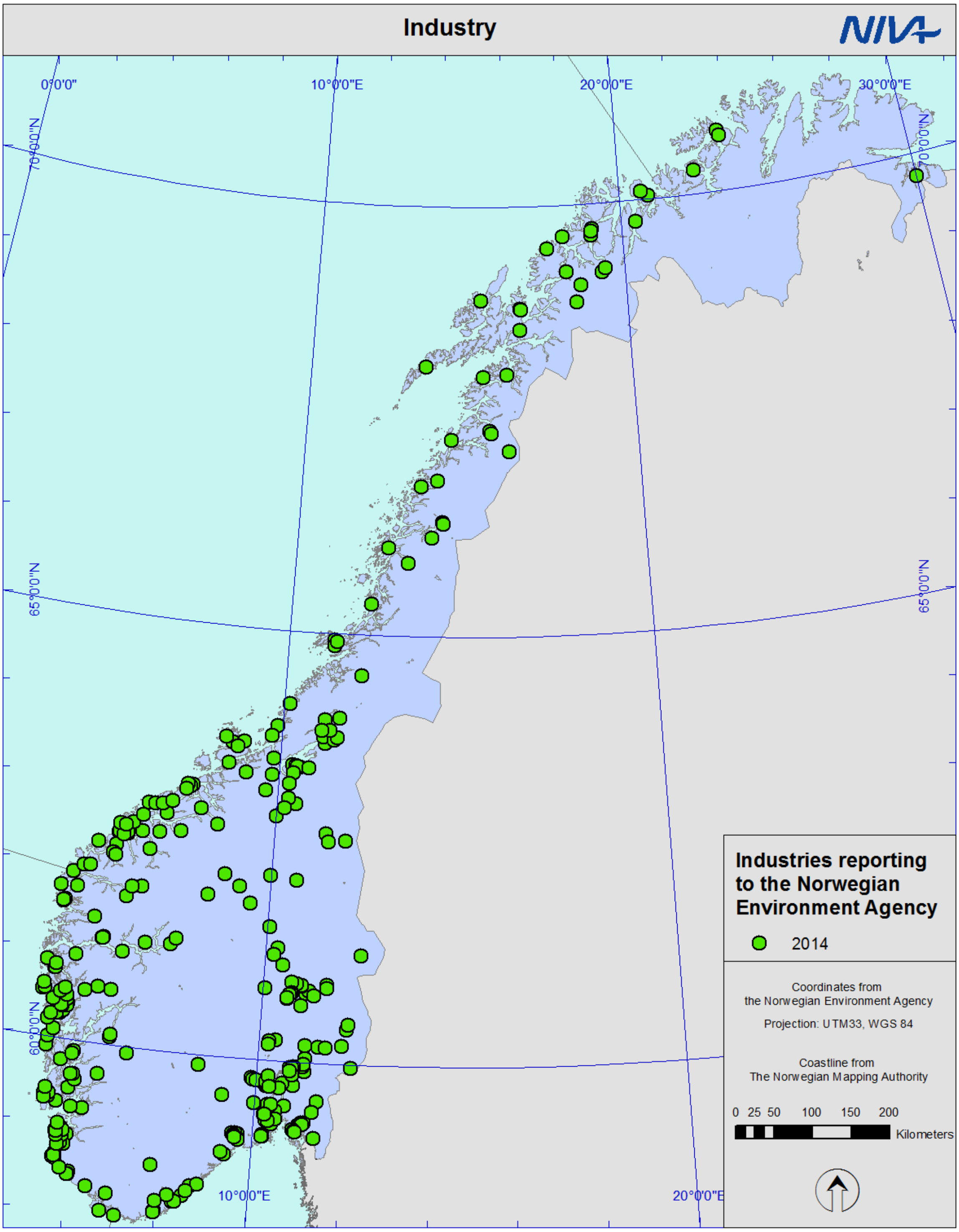


Figure 4. Industrial units reporting discharges of nitrogen and phosphorus in 2014. Data from the database 'Forurensning' (Norwegian Environment Agency).

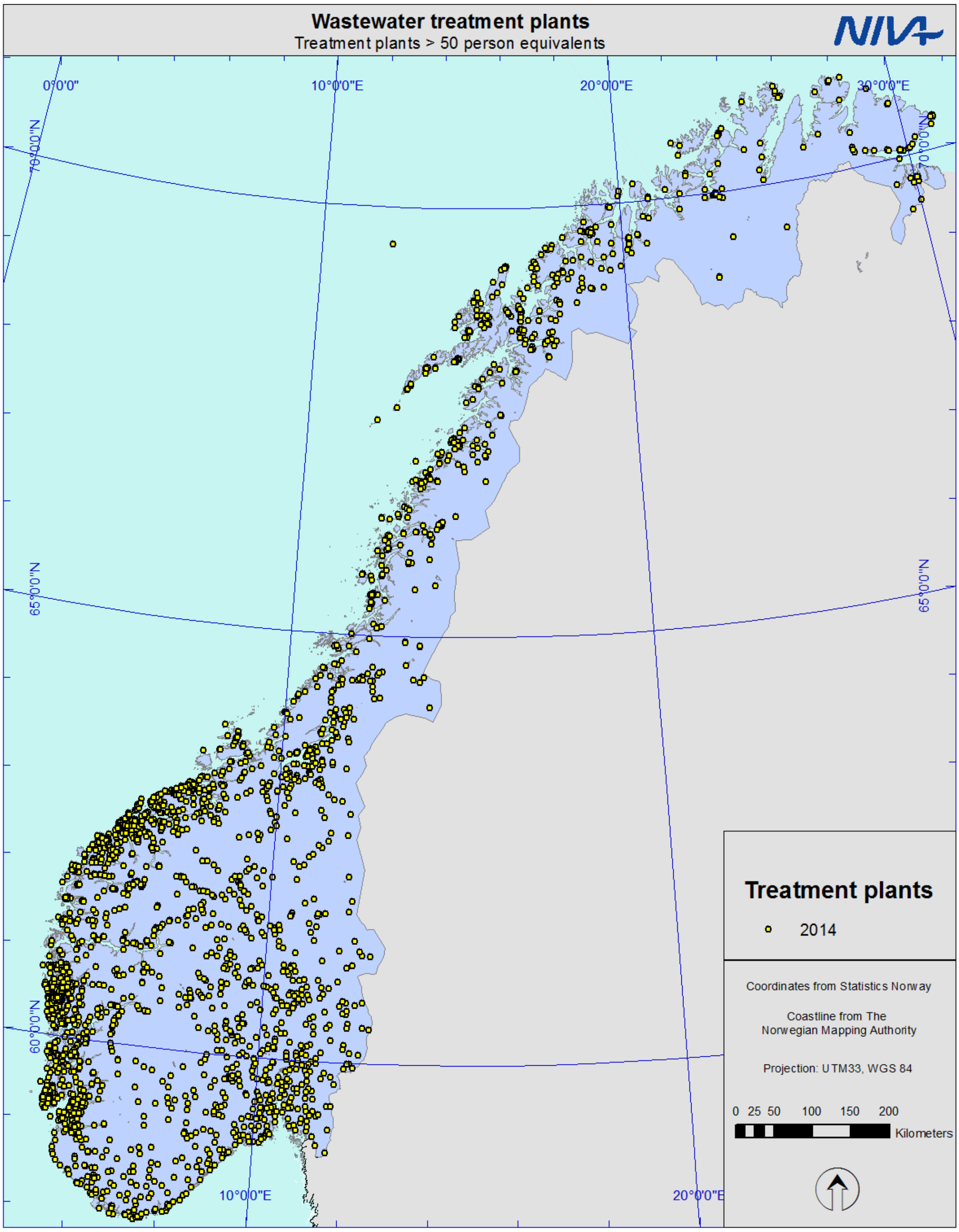


Figure 5. Sewage treatment plants > 50 p.e. in Norway in 2014. Data from SSB (Statistics Norway).

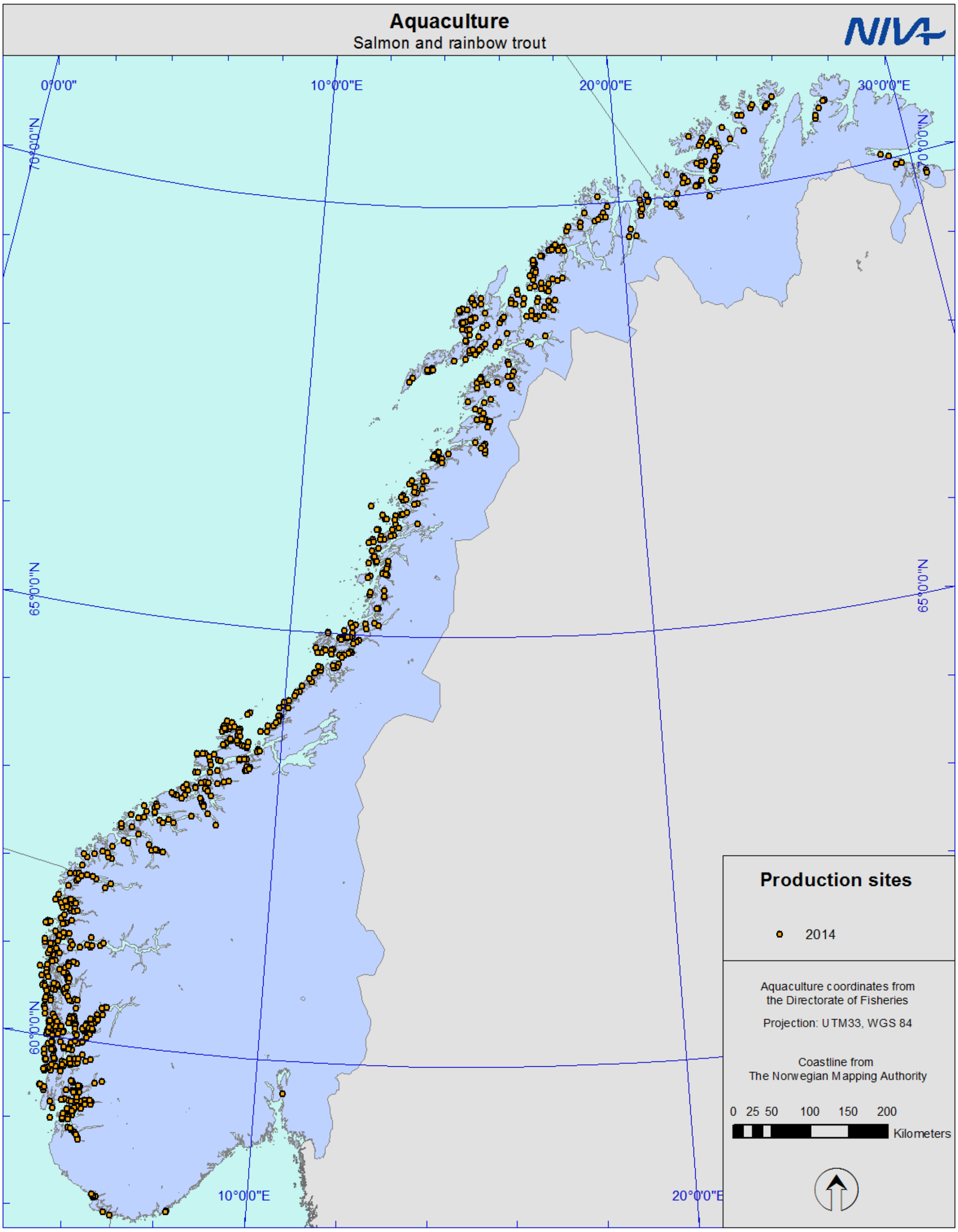


Figure 6. Fish farms for salmon and trout in Norway in 2014. Based on data from the Directorate of Fisheries.

Estimation of nutrient inputs from fish farming followed the same procedure as in recent years. The loads from fish farming were first included in the grand total values in 2000, i.e. originally these loads were not included in the input figures for the period 1990-1999. However, in the recalculation project in 2007, a time series for nitrogen, phosphorus and copper from aquaculture was established, and covered the entire period from 1990 to 2007 (Stålnacke *et* *al.*, 2009). Then, in 2011 another adjustment was made: Over the years the nutrient content in fish fodder has been reduced. In 2011 a table showing changes in nutrient content over the period 2000-2010 was established, in cooperation with The Norwegian Environment Agency (see Skarbøvik *et al.*, 2011). As a result, nutrient loads were adjusted from the year 2000 onwards. The nutrient content of the fish fodder has been kept at the same level as last year because no new information was available (see Appendix IV).

The sales statistics from Norwegian Statistics (SSB) with regard to trout and salmon show that there has been a steady increase since 1995 (see Figure 7). Updated information from 2013 showed a reduction compared to 2012, but the quantity increased again from 2013 to 2014.

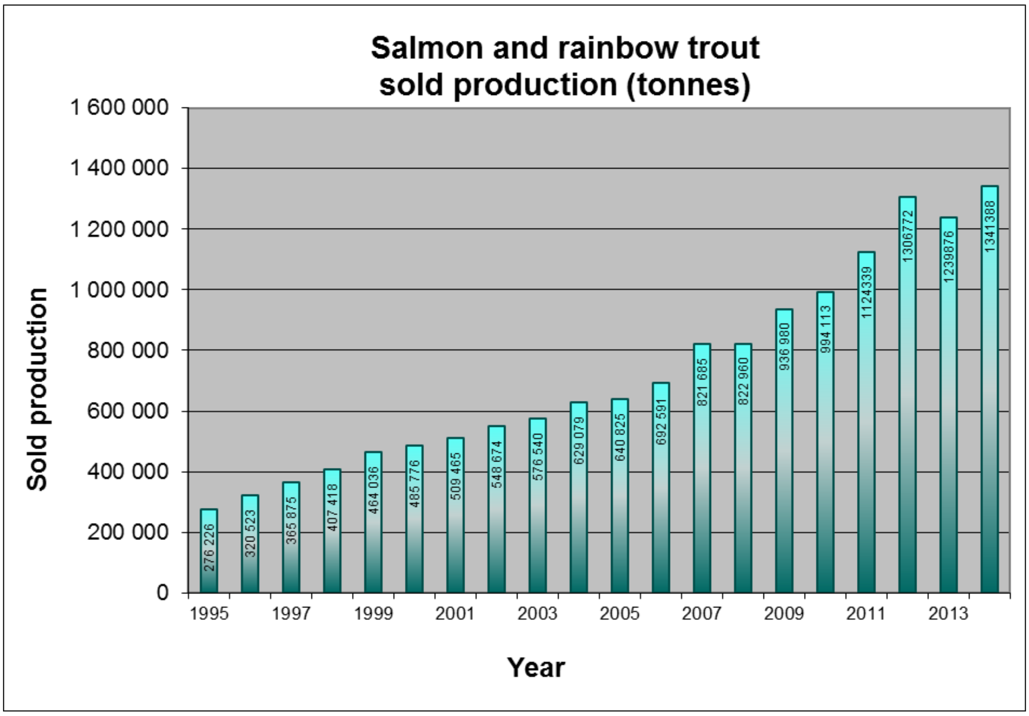


Figure 7. Quantities of sold trout and salmon for the period 1995-2014. Based on data from SSB (Statistics Norway).

In terms of copper loads from fish farming, the quantification of discharges is based on sales statistics for a number of antifouling products in regular use. The Norwegian Environment Agency assumes that 85% of the copper is lost to the environment. The quantity used per fish farm is not included in official statistics, but for the RID Programme, a theoretical distribution proportional to the fish production has been used. The sales statistics for 2014, as compared to former years, are given in Chapter 3.

2.5 Calculating total loads to the sea

The information in the above sections (2.1-2.4) has been used to calculate the total loads to the four maritime OSPAR areas, i.e., the Skagerrak, the North Sea, the Norwegian Sea and the Barents Sea. Table 2 in the introduction describes this, and Figure 8 shows an overview of how the total loads are calculated.

The deviations from the recommended procedures in the RID Programme (cf. Figure 3) are that point sources upstream in unmonitored areas are included in the direct discharges, and not as inputs from unmonitored areas. As noted above, this deviation has always been a part of the Norwegian RID Programme and it is not recommended to change this now, as it would mean an unfortunate shift in the datasets.

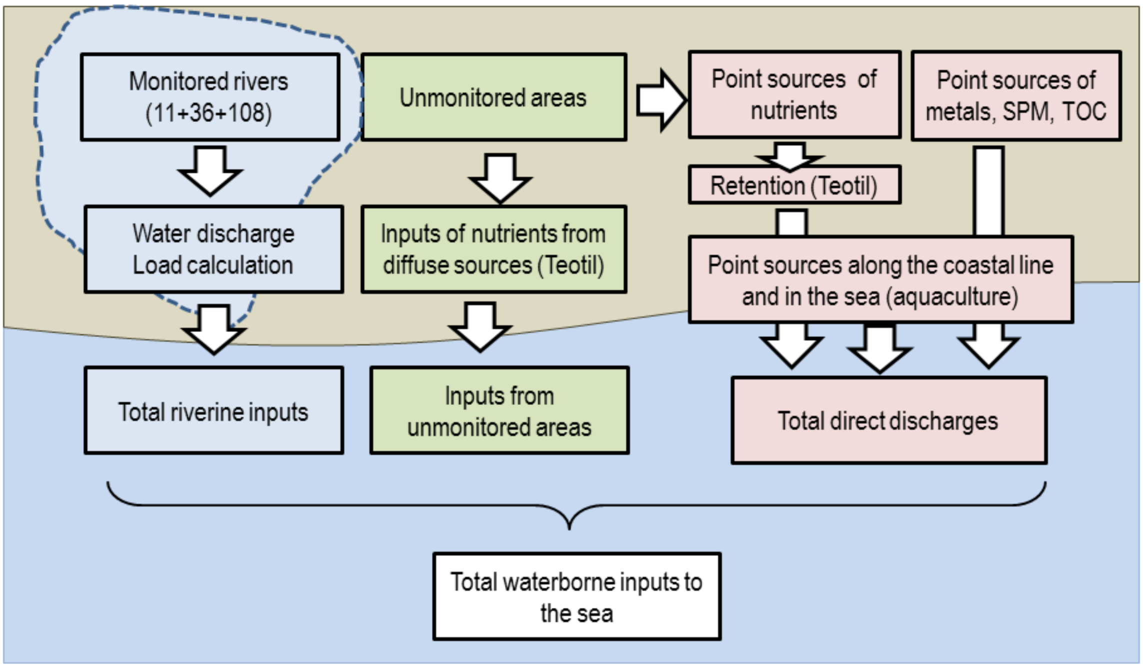


Figure 8. Overview of how total waterborne inputs to the Norwegian maritime waters are calculated. See also Figure 3.

2.6 Organic contaminants: Sampling and calculation

Organic contaminants were monitored in Rivers Alna, Glomma and Drammenselva. The monitored contaminants in 2014 included polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), hexabromocyclododecane (HBCDD), perfluoro chemicals (PFCs), bisphenol A (BPA), tetrabromobisphenol A (TBBPA) and short/medium chain chlorinated paraffins (S/MCCPs). PFCs in River Drammenselva and PAHs in general are not part of the core programme, and were included as extra in 2014.

2.6.1 Sampling methodology

Hydrophobic organic contaminants present in overlying river water are typically distributed between the freely dissolved phase, the particulate matter phase and the dissolved organic matter phase (Warren et al., 2003). The relative proportion of contaminants associated with the particulate and dissolved matter depends on the type and amount of particulate and dissolved organic matter. In this programme, organic contaminants are monitored using two different techniques: passive sampling, for sampling of freely dissolved contaminants, and continuous flow centrifugation (CFC), for sampling of suspended particulate matter-associated contaminants.

Freely dissolved concentrations of hydrophobic and non-ionised contaminants were estimated from AlteSil™ silicone rubber passive samplers deployed in situ for periods of weeks to months. Passive sampling devices accumulate contaminants from the medium they are exposed to by diffusion. The concentration of contaminants in the medium being sampled can be estimated from the masses of chemicals found in the samplers after exposure if sampler-water exchange kinetics are known. The dissipation of performance reference compounds (PRCs, labelled analogues of substances of interest, e.g. deuterated PAHs) spiked in the samplers before exposure allows the estimation of deployment-specific sampling rates (R_s, equivalent volume of water cleared by the sampler per unit of time, i.e. expressed in L/d).

A single batch of AlteSil™ silicone rubber (1000 cm^2 nominal sampling surface) passive samplers was prepared for 2014. The silicone was initially cleaned with a Soxhlet extractor to remove oligomers from the silicone. Further cleaning was done by soaking in methanol. PRCs were loaded into the samplers using a methanol:water solution (Booij, 2002). Samplers were then kept frozen until use. For each sampling period, two samplers were deployed at each site. In 2014, all three rivers were continuously monitored with passive samplers (Table 4).

Table 4. Exposure periods for silicone rubber passive samplers in 2014.			
	Alna	Drammenselva	Glomma
Sampling period 5*	105 d (20.12.13-04.04.14)	131 d (13.12.13-23.04.14)	176 d (10.10.13-04.04.2014**)
Sampling period 6	81 d (04.04.14-24.06.14)	70 d (23.04.14-02.07.14)	81 d (04.04.14-24.06.14)
Sampling period 7	98 d (24.06.13-30.09.14)	107 d (02.07.14-17.10.14)	98 d (24.06.14-30.09.14)
Sampling period 8	108 d (30.09.14-16.01.15)	91 d (17.10.14-16.01.15)	77 d (30.09.14-16.12.14)

* Continuation of numbering from 2013

** Samplers could not be collected in December due to the ice

Suspended particulate matter-associated contaminants were sampled using a CFC. Deployment of the CFC at secures sites (with electrical power supply) near the rivers allowed the continuous collection of suspended particulate matter (SPM) for periods of 4 days to over one week (Table 5). This SPM sample collected (5-50 g dry weight on average) was then extracted and analysed for the contaminants of interest (and particulate organic carbon content). More details of sampling with CFC can be found in earlier reports (Allan et al., 2011; Allan et al., 2009; Allan et al., 2010). The need for a secure site with electrical power supply for the CFC sampling means that the sampling sites in Rivers Glomma and Drammenselva were not identical to the ones for the grab samples, but slightly upstream. The same sampling sites as for the CFC sampling were used for the sensor monitoring, cf. section 2.8.

Table 5. Deployment periods for 2014 for the continuous flow centrifuge			
	Alna	Drammenselva	Glomma
Sampling event 1	10 d (25.03.14-04.04.14)	13 d (10.04.14-23.04.14)	10 d (25.03.14-04.04.14)
Sampling event 2	8 d (16.06.14-24.06.14)	8 d (24.06.14-02.07.14)	8 d (16.06.14-24.06.14)
Sampling event 3	12 d (18.09.14-30.09.14)	Failed*	12 d (18.09.14-30.09.14)
Sampling event 4	7 d (09.01.15-16.01.15)	14 d (02.01.15-16.01.15)	7 d (09.12.14-16.12.14)

*Failed sampling event as a result of repeated faults with the centrifuge

2.6.2 Chemical parameters and analytical methods

Silicone rubber passive samplers (field exposed samplers, control samplers and spiked samplers) were extracted and analysed at NIVA for performance reference compounds (deuterated PAHs and fluorinated PCBs), for PAHs, PCBs, PBDEs and HBCDD. BPA and S/MCCPs concentrations cannot be estimated from passive sampling because sampler-water partition coefficients are not available and sampling rate estimations for these substances would be uncertain. At the moment, passive sampling technology cannot be used reliably for the measurement of compounds such as TBBPA and PFCs.

Silicone rubber samplers were extracted using analytical-grade *n*-pentane. The volume of the sample was reduced to 1 ml and split into different fractions for further sample clean-up prior to analyses. Size-exclusion chromatography was used to clean-up extracts before PAH and PCB analysis by gas chromatography-mass spectrometry (GC-MS). Extracts for PBDE analysis were cleaned up with concentrated sulphuric acid and acetonitrile partitioning before GC-MS analysis in negative chemical ionization mode. Analysis for HBCDD isomers was by liquid chromatography Mass spectrometry (LC-MS).

Suspended particulate matter samples were analysed for PAHs, PCBs, PBDEs, and HBCDD at NIVA. Freeze-dried SPM samples were extracted (for PAHs, PCBs, PBDEs and HBCDD) using an ASE 200 accelerated solvent extractor using a mixture of dichloromethane and cyclohexane (50:50). Samples were extracted three times at 100 °C and 2000 PSI. For PFCs, samples were extracted twice with 90% acetonitrile. Combined extracts were diluted with LC mobile phase and analysed by LC-MS.

A subsample of SPM was sent to the Norwegian Institute for Air Research (NILU) for analysis for BPA, TBBPA and S/MCCPs. BPA and TBBPA were extracted from oven-dried and homogenized SPM samples with methanol by shaking. Further sample clean-up was undertaken prior to analysis with UPLC-HR-TOF-MS. For S/MCCPs, the samples were Soxhlet-extracted using 10% ethyl ether/hexane. Following clean-up, SCCPs and MCCPs were analysed using GC-HRMS.

2.6.3 Quality assurance

Spiked samplers (loaded with known/measured amounts of PAHs, PCBs, PBDEs and HBCDD) were used to evaluate the inter-batch variability in extraction and recovery of these substances during sample preparation and analysis. A spiked silicone rubber sampler was extracted together with every batch of passive sampling devices.

Six spiked samplers were analysed following the production of the batch of spiked samplers to obtain a reference average value for the amounts of contaminants in the spiked samplers. The deviation between the contaminant amounts measured in two spiked samplers analysed during RID sampler batch analyses and the reference values were on average -14 % (min and max values of -57 and 37 %) for PAHs, 24 % (min and max value of -3 and 46 %) for PCBs, 8 % (min and max values of -41 and 70 %) for PBDEs, and -1 % (min and max values of -30 to 41 %) for HBCDD.

The deployment of duplicate passive sampling devices is important as it provides critical information for quality assurance purpose. There was excellent agreement of the information on water-polymer exchange kinetics (from PRCs, and masses of contaminants accumulated) from duplicate samplers. This indicates that our results are not influenced significantly by the use of multiple silicone rubber polymer batches (very little is known of inter-batch variability in partition properties of polymer batches). Relative percent deviation (%RPD) between estimated freely dissolved concentrations by duplicate passive sampling devices for PAHs and PCBs and most PBDEs are well below 40% (Addendum, Table 1b). Higher %RPDs can be observed in some cases for BDE209 and HBCD, demonstrating the difficulty in sampling and analysing these chemicals.

2.6.4 Calculating riverine concentrations of freely dissolved contaminants

Sampling rates for AlteSil™ silicone rubber passive samplers were estimated using PRC data. PRC dissipation rates were estimated from the amount of PRCs remaining in the samplers after exposure (Booij et al., 1998; Huckins et al., 2002). Since the exchange of chemicals between the water and silicone is an isotropic phenomenon, the release of PRCs (analogues of chemicals of interest) provides us with information on the uptake kinetics for substances of interest. The non-linear least square method by Booij and Smedes (2010) was used to estimate sampling rates for each sampler for each deployment individually using all available PRC data. A boundary layer-controlled uptake rate model by Rusina et al. (Rusina et al., 2010) was used to estimate sampling rates for compounds for all substances of interest. The PRC data and the non-linear least square method were used to obtain estimates of an exposure-specific parameter β_{sil} for each sampler and exposure period:

$$R_s = \beta_{sil} K_{sw}^{-0.08}$$

Silicone-water partition coefficients, K_{sw} for PRCs (except for fluoroPCBs), PAHs and PCBs were from Smedes et al. (Smedes et al., 2009). These data were not corrected for temperature, and published literature values obtained at 20 °C were applied to all exposure periods. For substances for which K_{sw} values are not available (i.e. PBDEs and HBCDD), a $\log K_{sw}$-$\log K_{ow}$ (K_{ow} is the octanol-water partition coefficient) regression with a slope of 0.82 and intercept of 0.976 was used to estimate K_{sw} values from their K_{ow}. Since the model by Rusina et al. (Rusina et al., 2010) predicts only a minor drop in sampling rate with increasing $\log K_{sw}$, it is not expected that the uncertainty in K_{sw} results in substantial uncertainty (or bias) in the result.

For 2014, values of β_{sil} (see equation above) ranged from 1 to 127 depending on the river and the period of deployment. Lower values were obtained for deployments with lowest temperatures. Differences in β_{sil} values for duplicate samplers were in most cases very low. Sampling rates for substances with $\log K_{ow}$ = 5 were in the range 0.68 to 54 l/d depending on the river and exposure period.

Freely dissolved concentrations ($C_{w,free}$) were calculated using the following equation:

$$C_{w,free} = \frac{n_{acc}}{K_{sw} m_{sil} (1 - e^{-\frac{R_s t}{K_{sw} m_{sil}}})}$$

where n_{acc} is the amount of chemical absorbed into the sampler during deployment (ng), m_{sil} is the mass of the silicone rubber sampler (g) and t the deployment time (d).

Analytical limits of detection where transformed into field limits of detection using the equation above.

2.6.5 Calculating riverine loads and whole water concentrations of organic constituents

Riverine fluxes or loads of contaminants in the freely dissolved phase or associated to suspended particulate matter were estimated separately from the passive sampling data and from the CFC sampling, respectively.

The riverine load of contaminants in the freely dissolved form was estimated using the following equation:

$$F_{Freely\ diss} = Q_{average} \times t_{PS} \times C_{Free\ diss}$$

where $F_{Freely\ diss}$ is the freely dissolved contaminant load (g) per passive sampler exposure period, t_{PS} (d), $Q_{average}$ is the average riverine water discharge (m^3/s) for the passive sampler exposure (calculated from daily recording), and $C_{Freely\ diss}$ is the contaminant concentration measured with passive sampling (ng/l). $F_{Freely\ diss}$ values were estimated for each passive sampler exposure for each river and were added to estimate the yearly load (g/yr).

The riverine load of contaminants associated with suspended particulate matter was estimated using the following equation:

$$F_{SPM} = Q_{average} \times t_{SPM} \times [SPM] \times C_{SPM}$$

where F_{SPM} is the particulate matter-associated contaminant load (g), [SPM] is the SPM content of the water (flow-weighted mean, mg/l) estimated from bottle sampling for the period of time the CFC sampling is representative of, t_{SPM} (d), $Q_{average}$ is mean riverine discharge (m^3/s) for the t_{SPM} period, and C_{SPM} is the contaminant concentration in the SPM sample (ng/g dry weight (dw)). The period of time that CFC sampling is assumed to represent is from the mid-point between the sampling event and the previous sampling event to the mid-point between the sampling event and the following sampling event.

Annual average “whole water” concentrations were calculated by adding the yearly estimate of freely dissolved load of contaminants and that associated with the suspended particulate matter phase and dividing that value by the total yearly discharge of the river. This was done for each single chemical.

When freely dissolved and particulate matter data is given as a range of concentrations, this is the result of certain concentrations being below limits of detection. When datasets presented some concentrations below limits of detection, these concentrations were assumed to be either zero or at the limits of detection level for the calculation of yearly averages and of sums of concentrations of chemicals. This procedure yielded ranges of concentrations with a lower limit representative minimum expected concentrations and an upper limit representative of an expected maximum concentration.

2.7 Water temperature

Water temperature data were acquired from four different sources: Sensor monitoring (hourly), TinyTag temperature loggers (hourly), manual temperature measurements (single measurements) and NVE temperature logging (daily averages from bi-hourly measurements).

Temperature sensors were applied in the three rivers with sensor monitoring also for other parameters (cf. section 2.8). In the remaining rivers monitored monthly, except River Orkla, temperature was monitored with TinyTag temperature loggers (TG-4100 or TKC-0002 from Intab). These loggers were secured to land and deployed in the river at the grab sampling locations. The loggers are replaced each autumn, to ensure sufficient battery capacity. In River Orkla, there are two outlets from hydropower plants just upstream of the sampling point, so the temperature at the grab sampling point was not considered representative. There were also difficulties with deployment at the sampling site. Hence, NVE data from further upstream were used instead. There are no major tributary rivers between the temperature logger location and the grab sampling point.

In the rivers monitored quarterly, temperature was measured directly in the water using a thermometer at the time of sampling, as a general rule. In some rivers NVE data were used instead. In 2014 NVE-data were used for 11 of these 36 rivers.

2.8 Sensor monitoring

Sensor monitoring was applied in Rivers Alna, Drammenselva and Glomma. YSI 600 XL V2-O multiparameter sondes were installed, measuring turbidity (optical sensor number 6136), pH (probe number 6561), conductivity and temperature. All sensors were installed during April 2013.

In River Alna the sonde was installed vertically in a tube attached to a walkway alongside/above the river, about 0.5 m from the river bank at 0.5-1 m depth. In Rivers Drammenselva and Glomma the sondes could not be installed at the grab sampling locations, due to the lack of power supply. Instead they were installed at the same location as the sampling for organic contaminants was conducted (cf. section 2.6.1 and Appendix IV).

In River Glomma the sonde was installed inside the Baterød water works. The river flows under the building and is accessible through an opening in the floor. The sonde was installed in a flow cell, with water being pumped from the river. This is about 3-4 km upstream of the grab sampling station (fig. 9). It is likely that the water is more mixed in the downstream sampling station (Sarpsfossen water falls) than in the upstream station, something that may influence turbidity recordings, as larger particles may be suspended in the lower compared to the upstream station.

In the Drammenselva River the sensor is installed about 500 meters upstream of the grab sampling site, on the other side of the river (Figure 10). The sonde is placed in a tube installed diagonally into the river, about 5 m from the river bank and at 1 m depth.

A brief maintenance log for all three years is given in Appendix IV.

The sensor data closest in time with grab samples were used for correlation analysis. E.g., if a grab sample was collected at 11:15, and sensor recordings existed at 11:00 and 12:00 hrs, the sensor recording used was the one at 11:00. In this case the longest deviation in time would be half an hour. It should be noted that in Glomma and Drammenselva Rivers, no huge hourly variations were detected in the turbidity recordings.

Prior to analysis, the data were scrutinised and possible errors were identified. Also, all dates were adjusted to Norwegian winter time.

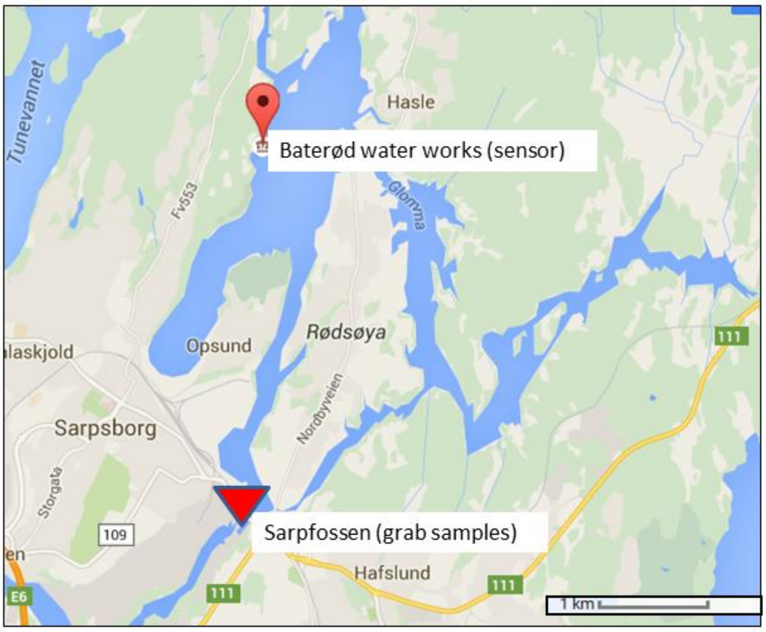


Figure 9. Location of the station for turbidity and organic matter (upstream), and the station for grab samples, in the Glomma River.

Figure 10. Location of the station for turbidity and organic matter (upstream), and the station for grab samples, in the Drammenselva River.

3. Results

3.1 Climate, water discharge and temperature

3.1.1 The climate in 2014

The average temperature in 2014 was 2.2 °C above normal (1961-1990), and the year was the warmest since the national recordings started in 1900 (Gangstø et al. 2014). The precipitation was very close to normal, although the southern and eastern parts of the country had relatively high precipitation (40-70 % above normal), whereas mid-Norway and the northern parts were drier than normal (60-75% below normal) (Figure 11).

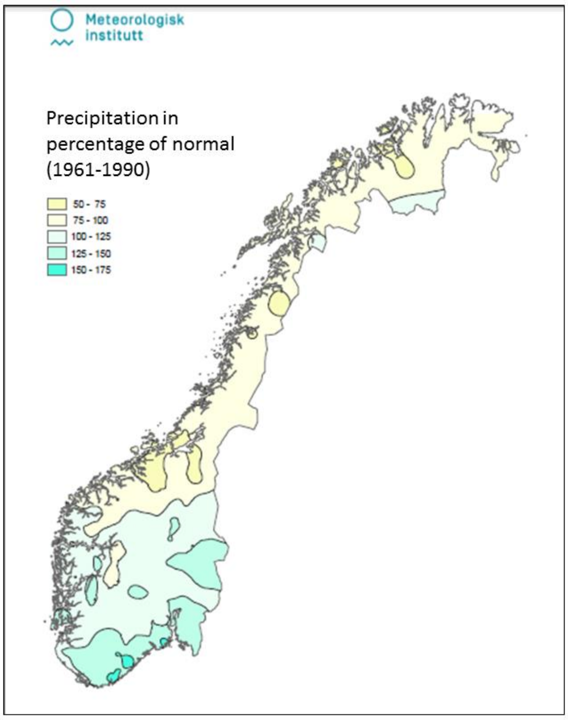


Figure 11. Precipitation in Norway in 2014 as percentage of normal values (1961-1990).

In the winter months (December 2013-February 2014) the precipitation for the entire country was 20 % above normal. This was unevenly distributed across the country, since some meteorological stations in eastern and southern Norway received more than 200% above normal, whereas several stations in Mid- and Northern Norway had less than 50% of the normal precipitation. In the spring (March-May 2014) the average precipitation for the country was 30% above normal, and especially wet in Northern Norway (the 10th wettest spring that has been recorded since 1900). For the country as a whole the summer and autumn months were warm and with 10% lower rainfall than normal, although some events with high rainfall intensity occurred.

3.1.2 Water discharge

Variations in water discharge can explain variations in both contaminant loads and concentrations. Hydrological stations in nine of the eleven rivers monitored monthly have historical data that can be used to assess long-term changes. The monthly mean water discharges in 2014 at these stations have been compared to the mean water discharges of the 30-year normal (1971-2000) (Table 6). In this table, also the results of statistical analyses of annual water discharge in the period 1990-2014 are shown.

Table 6. Average annual water discharges for nine stations in the 30-year period 1971-2000 and 2014; and statistical analyses of annual water discharge (Q) for 1990-2014 (see colour codes in the footnotes to the table).

River	30-year normal of Q (1971-2000)*	Q in 2014*	Difference (2014 vs. 1971-2000)	P-values from statistical trend analyses of Q**	Maritime area
	m^3/s	m^3/s	%	p-value	
River Glomma	678.0	903.2	+25	0.0102	Skagerrak
River Drammenselva	281.3	386.2	+27	0.0028	
River Numedalslågen	104.7	139.3	+25	0.0281	
River Skienselva	259.5	349.0	+26	0.0317	
River Otra	145.6	194.8	+25	0.7086	
River Orreelva	***	5.9	-	0.0927	
River Vosso	72.8	99.3	+27	-	North Sea
River Orkla	48.5	37.6	-29	0.8886	Norwegian Sea
River Vefsna	150.0	149.8	0	0.4548	
River Alta	75.4	93.3	+19	0.5132	Barents Sea

* These water discharges derive directly from the hydrological stations and are not modelled: Solbergfoss in Glomma; Døvikfoss in Drammenselva; Holmsfoss in Numedalslågen; Norsjø in Skienselva; Heisel in Otra; Bulken in Vosso; Syrstad in Orkla; Laksfors in Vefsna; and Kista in Alta. Pink and blue colours indicate increase and decrease, respectively, but not based on statistical trend analyses.

** The data basis for the trend analyses is water discharge scaled to the upstream area of the RID sampling stations. P-values below 0.05 are significant; P-values between 0.05-0.1 show tendencies of change. Red colour: Significant upward trend. Orange colour: Tendency of increase. These Q-values have been adjusted to the sampling sites.

*** Long-term normals not available for River Orreelva

Apart from Rivers Orkla and Vefsna, all rivers had higher water discharges in 2014 than the 30-year normal. The trend analysis revealed that there are statistically significant upward trends of water discharge in rivers Glomma, Drammenselva, Numedalslågen and Skienselva ($p<0.05$); and tendencies of upwards trends in River Orreelva. This means that the water discharge to these rivers draining to the Skagerrak have increased significantly since 1990, with subsequent risk of increased loads of pollutants. These data furthermore suggest that present climate variations has increased the pollution risk especially in the Skagerrak maritime area.

3.1.3 Water temperature

Table 7 shows the water temperature in the 11 rivers monitored monthly. Temperatures are in general recorded every hour, and the monthly averages are shown in the table. Water temperatures typically vary from the north to the south, and also according to whether or not the river's headwaters are located in mountains (with/without glaciers) or lowland forested areas (e.g., River Alna). Since temperatures were monitored for the first time in this programme in 2013, no trends can be discussed as yet.

Table 7. Water temperature as monthly means (°C) from hourly observations in 11 rivers.

River	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Glomma	1.6	2.0	2.8	5.9	8.9	13.9	19.0	17.6	14.9	10.0	6.1	2.2
Alna	1.7	3.2	3.9	6.7	9.5	12.8	15.4	14.1	11.8	9.8		3.5
Drammens-elva	1.1	1.3	2.5	4.8	8.0	15.1	20.3	19.0	15.4	9.7	6.3	2.9
Numedals-lågen	0.9	0.3	2.2	5.2	8.9	16.0	20.1	18.0	13.8	9.0	5.1	0.8
Skienselva	3.6	3.1	3.1	3.8	5.9	12.4	17.5	18.3	**			
Otra	2.1	1.2	2.9	5.1	8.4	15.6	19.1	17.7	14.2	10.4	6.6	3.1
Orre	2.6	3.5	6.0	9.8	13.1	16.6	20.2	16.6	15.1	11.0	7.2	3.5
Vosso	1.6	1.0	1.7	3.3	6.0	9.3	14.0	14.2	12.6	9.3	6.4	3.9
Orkla*	***	0.1	1.1	2.2	6.1	10.8	14.5	12.5	10.0	5.6	1.6	0.1
Vefsna	****								8.9	4.2	0.5	0
Alta	0.7	1.2	1.1	1.4	2.9	5.4	8.4	12.0	7.4	4.4	1.9	1.6

* Data from NVE's sensor, based on daily average values.
** The logger disappeared (possible stolen) in June 2015.
*** Negative figures recorded by NVE, the data from this month are therefore omitted
**** The logger disappeared (possible stolen) in September 2014, was replaced 8 September 2015.

3.2 Nutrients, particles, silicate and TOC

3.2.1 Total inputs in 2014

The total nutrient inputs to Norwegian coastal waters in 2014 were estimated to about 13 200 tonnes of phosphorus and about 170 100 tonnes of nitrogen (Figure 12). Total silicate inputs were estimated to about 485 000 tonnes and total organic carbon (TOC) to about 556 000 tonnes. The input of suspended particulate matter amounted to about 780 000 tonnes (see also Addendum's Table 3).

An overview of the inputs of the different nitrogen and phosphorus fractions per coastal area is given in Figure 12. Overall, nitrogen inputs were highest to the North Sea and lowest to the Barents Sea; whereas phosphorus inputs were highest to the Norwegian Sea and lowest to the Skagerrak.

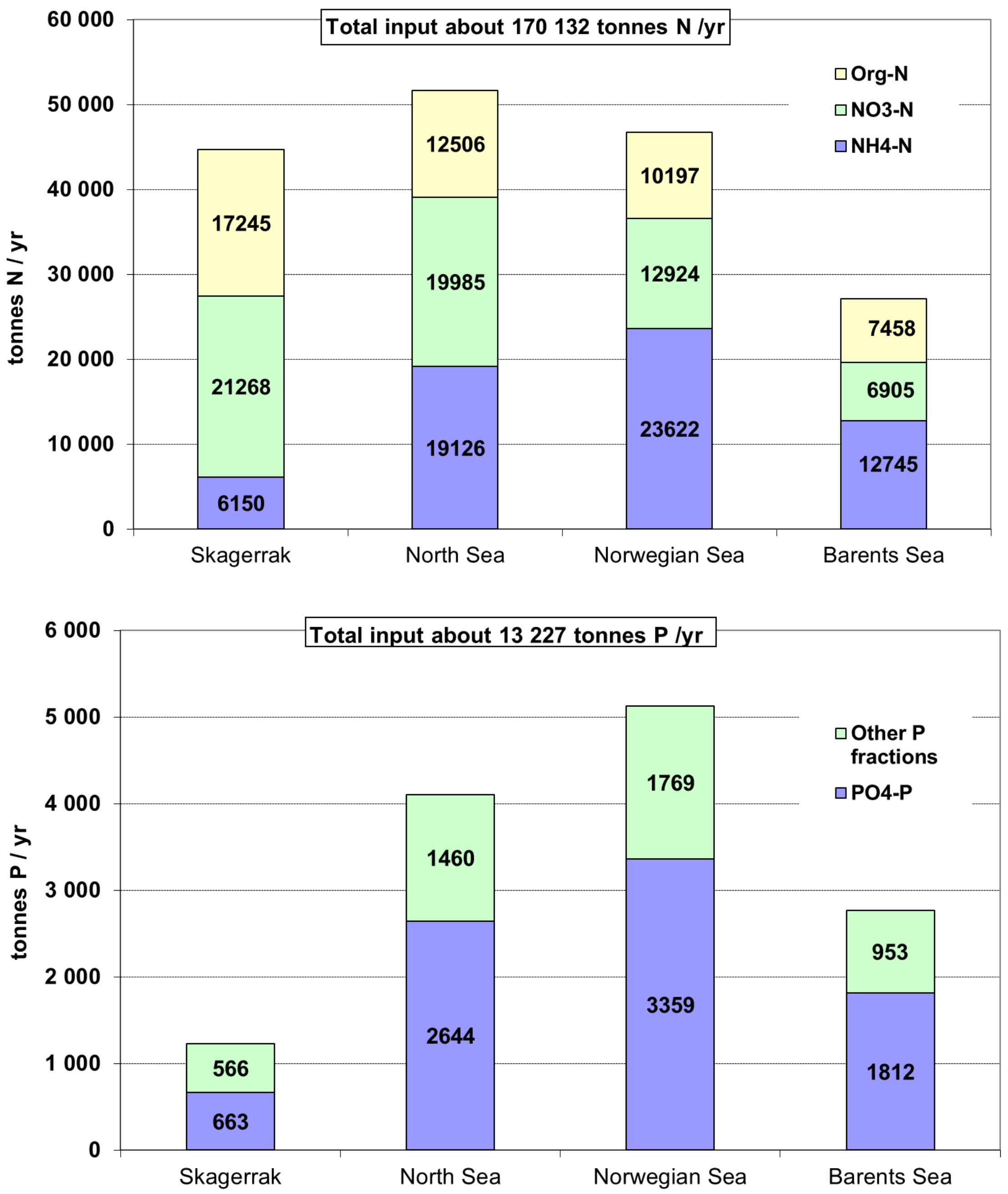


Figure 12. Total inputs to the four Norwegian maritime areas of total nitrogen (upper panel) and total phosphorus (lower panel), divided into different fractions.

The loads of silicate and SPM are not estimated for unmonitored areas due to lack of a suitable methodology. As for direct discharges, it should be noted that particulate matter is discharged from fish farming; and silicate is present in effluents from some types of industry, but neither of these are reported.

3.2.2 Trends in riverine nutrient loads and concentrations

All calculated annual SPM and nutrient loads for rivers monitored monthly from 1990 onwards are presented in charts in Appendix V; for concentrations in each station it is referred to http://vannmiljo.miljodirektoratet.no.

Table 8 shows the riverine loads of nutrients and SPM in 2014, as compared to the average for the period 1990-2013. In the Skagerrak region, all rivers had high water discharges in 2014 (Table 6), and this is reflected in the increased nutrient and sediment loads as compared to former years' averages. In the three other maritime regions, i.e., the North, Norwegian and Barents Sea, water discharges in 2014 varied, with increases in Rivers Vosso and Alta, a decrease in River Orkla and no change in River Vefsna. In all three regions, nutrient and suspended sediment loads were lower than the long-term average. Overall, the increases in the Skagerrak region resulted in an increase of loads to the sea from Norway.

Table 8. Total riverine loads (155 rivers) of total nitrogen (TN), total phosphorus (TP) and suspended particulate matter (SPM) as an average for 1990-2013 and in 2014. Increases are marked with pink and decreases blue colour.

Maritime area	Nitrogen (tonnes)		Phosphorus (tonnes)		SPM (1000 tonnes)	
	Average 1990-2013	2014	Average 1990-2013	2014	Average 1990-2013	2014
Skagerrak	30251	35278	781	982	372	453
North Sea	13813	12994	288	275	106	96
Norwegian Sea and Barents Sea combined*	13414	11227	461	319	264	219
Total Norway	57478	59499	1530	1576	742	768

* In 2014, the border between the Norwegian Sea and the Barents Sea was moved in order to coincide with Norwegian reporting regions to the WFD; hence the two sea areas have been combined to allow for comparisons in this table.

In order to analyse these trends further, statistical trend analyses (for which the methodology is described in Chapter 2.2.5) of nutrients and suspended particles loads and concentrations were carried out. The results are given in Tables 9 and 10, and further commented in the sections below.

Both trends for the last 10 years and for the entire period have been analysed. The terminology 'long-term' is used for the entire 25-year data record period of 1990-2014, while the shorter period of 2005-2014 is referred to as '10-year trends'. The 10-years trends are shown in Appendix V.

It should be noted that the trend analyses this year have been performed without flow normalisation. Hence, the trends represent actual loads to the sea.

Table 9. Long-term trends in annual water discharge (Q; estimated from daily measurements), nutrient and particle loads (upper estimates) in nine Norwegian main rivers 1990- 2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS							
River	Q	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.0102	0.0005	0.1476	0.0133	0.0759	0.5132	0.5437
Drammenselva	0.0028	0.0927	0.0250	0.0033	0.0051	0.0028	0.0051
Numedalslågen	0.0281	0.4272	0.1232	0.0015	0.0151	0.0195	0.0356
Skienselva	0.0317	0.0839	0.0033	0.9256	0.0446	0.1611	0.2827
Otra	0.7086	0.3748	0.0001	0.8153	0.6404	0.6742	0.1909
Orreelva	0.0927	0.5132	0.7086	0.4005	0.2072	0.1611	0.1611
Orkla	0.8886	0.0054	0.8153	0.6404	0.7086	0.3041	0.7437
Vefsna	0.4548	0.0000	0.0000	0.0028	0.0317	0.0015	0.0759
Altaelva	0.5132	0.1755	0.1123	0.6074	0.3041	0.2072	0.7437

	Statistically significant downward (p<0.05)
	Downward but not statistically significant (0.05<p<0.1)
	Statistically significant upward (p<0.05)
	Upward but not statistically significant (0.05<p<0.1)

Table 10. Long-term trends in nutrient and particle concentrations (upper estimates) in nine Norwegian main rivers 1990- 2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS						
River	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.0072	0.9325	0.2015	0.1064	0.5221	0.3898
Drammenselva	0.2294	0.9021	0.1646	0.6114	0.1875	0.4440
Numedalslågen	0.5427	0.0532	0.0033	0.3353	0.0235	0.4385
Skienselva	0.2434	0.0000	0.0003	0.0919	0.9269	0.8311
Otra	0.2273	0.0005	0.1926	0.0809	0.0074	0.0004
Orreelva	0.6133	0.0137	0.0720	0.1512	0.7539	0.7966
Orkla	0.0035	0.8144	0.0620	0.1110	0.1067	0.0255
Vefsna	0.0000	0.0000	0.0056	0.0890	0.0292	0.0054
Altaelva	0.0248	0.1402	0.5929	0.0255	0.2164	0.0191

	Statistically significant downward (p<0.05)
	Downward but not statistically significant (0.05<p<0.1)
	Statistically significant upward (p<0.05)
	Upward but not statistically significant (0.05<p<0.1)

Nitrogen

Statistically significant trends in total nitrogen (TN) loads were detected in four out of nine rivers (Table 9). One of those trends was downward (River Vefsna), but upward trends were found in Rivers Glomma, Drammenselva and Numedalslågen. It should though be noted that there is a corresponding statistical significant increase in water discharge in these three rivers (Table 9). In fact when the partial Mann-Kendall test using water discharge as explanatory variable was applied, the TN load trends in Rivers Glomma and Drammenselva became non-significant. It is therefore likely that the increases in nitrogen loads in the Skagerrak rivers are partly explained by the increased water discharges. Nitrogen is transported in the dissolved form, and the loads are therefore highly dependent on water discharge variations.

Three rivers showed a statistically significant downward trend for nitrate nitrogen loads (Rivers Skienselva, Otra and Vefsna) and another three for ammonium nitrogen inputs (Rivers Glomma, Orkla and Vefsna). The only statistical upward trend in nitrate loads was found in River Drammenselva.

For the concentrations of total nitrogen, two rivers (Vefsna and Skienselva) showed a statistically significant downward trend and one river (Numedalslågen) a statistically significant upward trend (Table 10).

Below, some of these trends are discussed in more detail:

In River Vefsna, statistically significant downward trends in total nitrogen loads and concentrations (as well as for the ammonium and nitrate loads and concentrations; Tables 9 and 10) have been detected (Figure 13). The decline corresponds to a total reduction of TN of around 575 tonnes over the 25 year period. As reported in earlier years (Skarbøvik et al., 2014), this river shows a rather abrupt change in loads also in other substances after 1999, including lead and copper, and to some extent ammonium (see also Chapter 3.3.2). As noted in previous years, the relatively high concentration levels of these substances in this river might indicate that the substances derive from either industrial discharges or sewage treatment effluents. This theory is further supported by the fact that high concentrations before 1999 were mainly observed at low water discharges, when dilution is at a minimum. However, in spite of efforts to reveal the reasons for this decrease, including contacts with local experts, no clear explanation has been found. The sampling site in River Vefsna is located upstream of both major industries and the major settlement (Mosjøen).

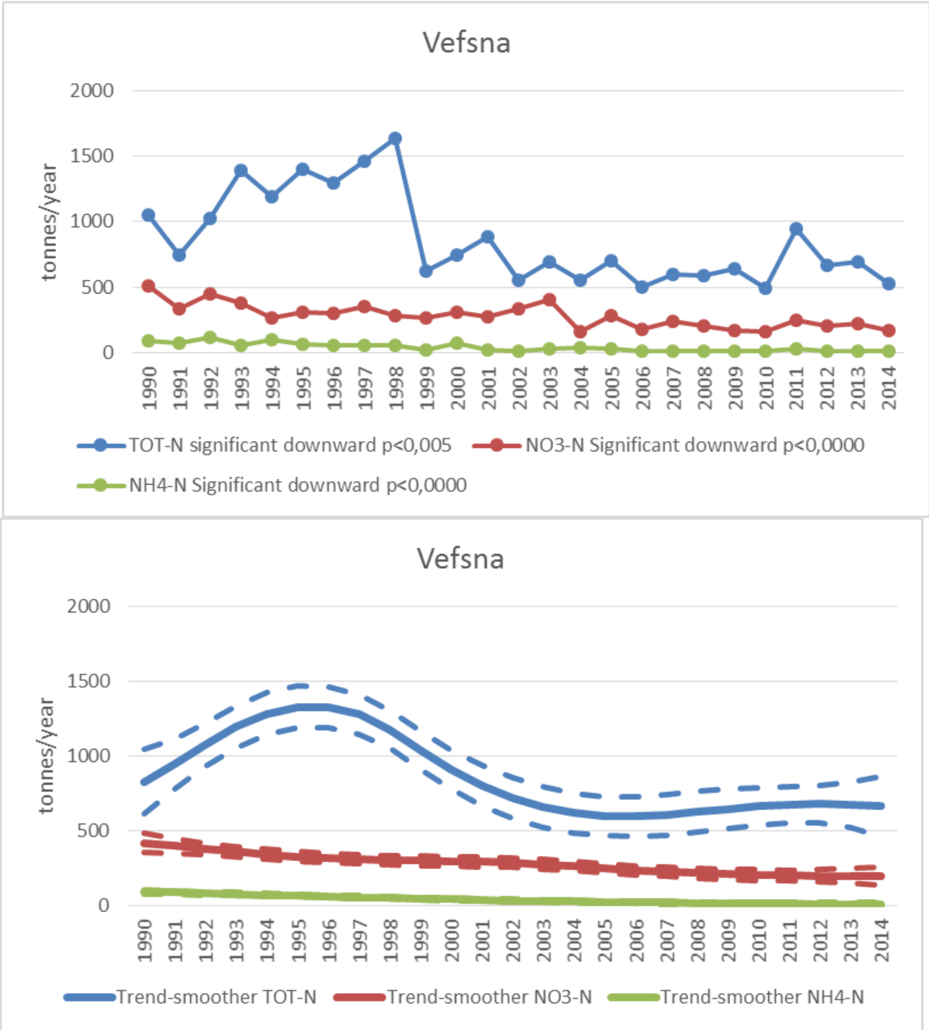


Figure 13. Annual riverine loads (upper estimates) in Vefsna of total nitrogen, nitrate nitrogen and ammonium in 1990-2014. Upper panel shows the estimated loads while the lower panel shows the flow-normalised trend-smoother including a 95% confidence interval.

In River Skienselva, only nitrate showed a statistically significant downward trend in loads (Table 9; Figure 14 upper panel). However if water discharge is taken into account, a trend in ammonium loads was detected (statistical test not shown). This mean that water discharge conceals the exisiting trend, which was difficult to identify visually (Figure 14; upper panel). However, the trend-smoother line (Figure 14; lower panel) clearly indicates a downward trend. In addition, there was also a statistically significant downward trend in concentrations of TN and NO_3-N in River Skienselva.

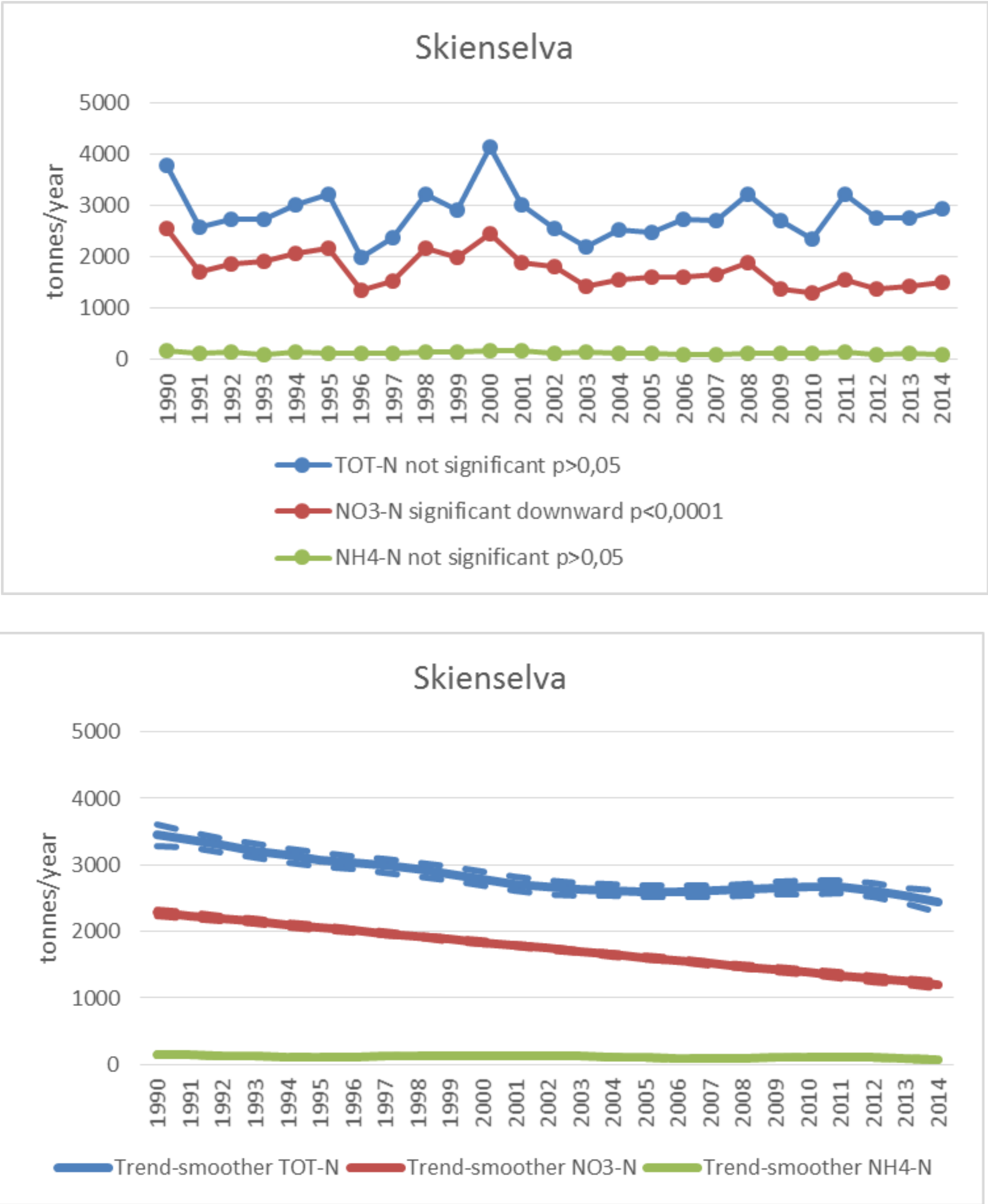


Figure 14. Annual riverine loads (upper estimates) in Skienselva of total nitrogen, nitrate nitrogen and ammonium in 1990-2014. Upper panel shows the estimated loads while the lower panel shows the flow-normalised trend-smoother including a 95% confidence interval.

In River Numedalslågen, an upward trend for total nitrogen concentrations and loads was detected, corresponding to an increase of 24 tonnes per year (Tables 10 and 11; Figure 15). This seems mainly to be related to an almost statistically significant upward trend in nitrate-N concentrations ($p<0.06$). The increase is relatively modest when compared to the total loads of nitrogen in this river.

In River Otra, a statistically significant downward trend of nitrate loads and concentrations was detected; however this was not the case with total nitrogen. The reason for this apparent increase in organic nitrogen is not yet known.

Statistically significant long-term downward trends in ammonium loads were detected in Rivers Glomma, Orkla and Vefsna (Table 9). Statistically significant downward trends for ammonium concentrations were detected in Rivers Glomma, Orkla, Vefsna and Altaelva (Table 10). Developments in ammonium loads over time are shown in charts in Appendix V. Ammonium loads in most rivers only account for 1-5 % of the total nitrogen loads. Ammonium is normally quickly assimilated by plants or converted into nitrate in river water (through nitrification processes) and therefore represents a less informative parameter for long-term trend assessments.

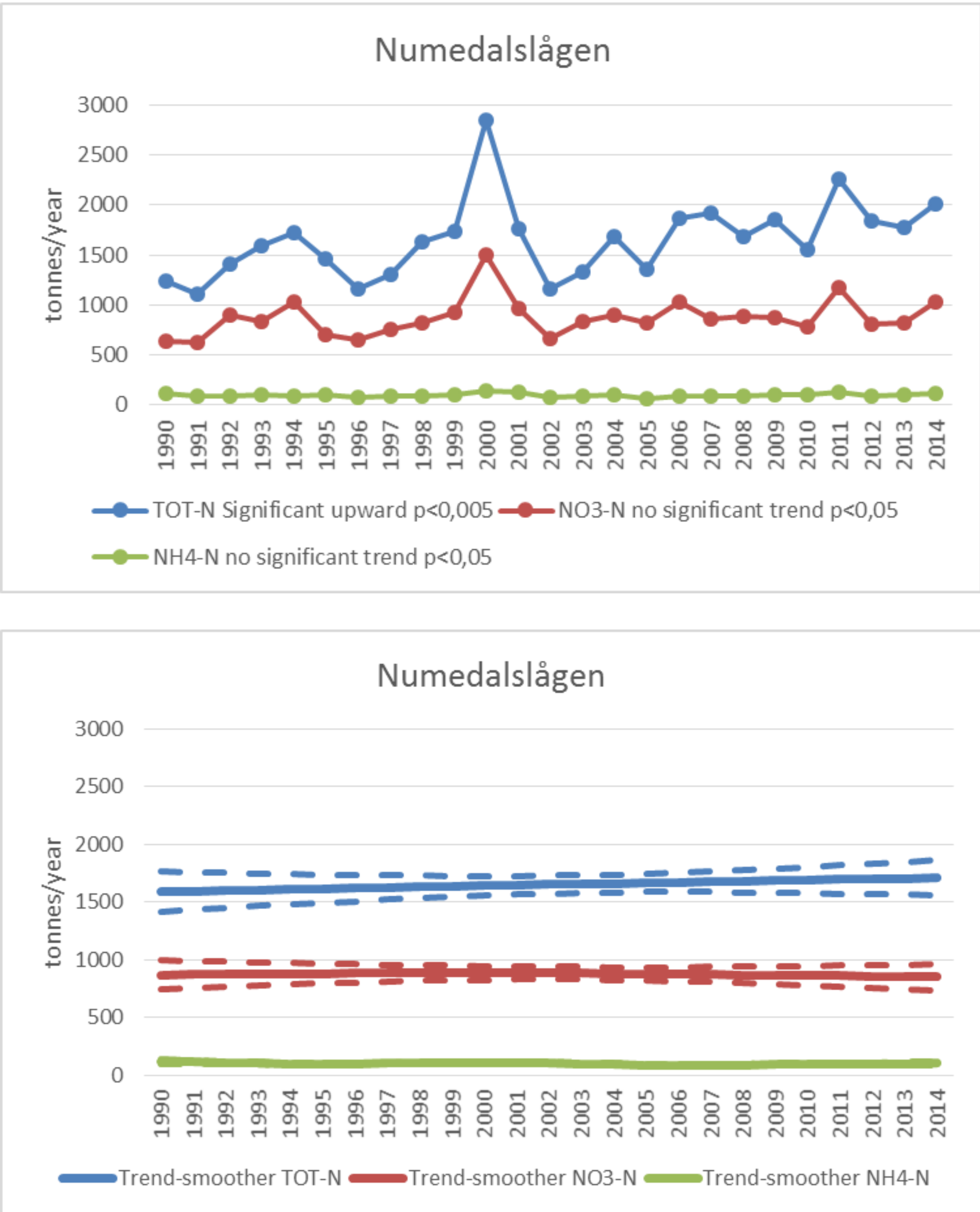


Figure 15. Annual riverine loads (upper estimates) in Numedalslågen of total nitrogen, nitrate nitrogen and ammonium in 1990-2014. Upper panel shows the estimated loads while the lower panel shows the flow-normalised trend-smoother including a 95% confidence interval.

When the last 10 years (2005-2014) of data are examined, no statistically significant trends are found in total nitrogen load or concentration (Appendix V). There is a statistically significant downward trend in nitrate concentration in River Skienselva, corresponding to the same trend in the long-term dataseries. Also there is an upward trend of ammonium loads in River Numedalslågen and an upward trend of nitrate concentration in River Altaelva. In River Altaelva, there has been an increase in the nitrate concentration the last years (2013 and 2014) compared to a ten year average. This could be an early warning sign, but the concentrations are still considerably lower than average concentrations in the 90s and early 2000s. In River Numedalslågen the most apparent explanation for the 10 year trend in ammonium is a relatively low load in 2005 and a relatively high load in 2014. If the 10 year period is shifted from 2005-2014 to 2004-2013, the trend disappears.

Phosphorus

Statistically significant long-term downward trends in total phosphorus loads were only detected in River Vefsna (Table 9, Figure 16) where the pattern looks remarkably similar as for nitrogen (see previous section).

Upward trends in total phosphorus and ortophosphate loads were statistically detected in Rivers Drammenselva and Numedalslågen for the actual transports. However, if water discharge is taken into account both trends became statistically non-significant (statistical test not shown). The same holds true for the upward trend in orthophosphate loads in Skienselva. This suggests that the trends in actual loads are closely connected to water discharge variations. The increases in water discharge in the Skagerrak rivers will most probably have resulted in increased erosion in agricultural lands, with subsequent increases in phosphorus runoff.

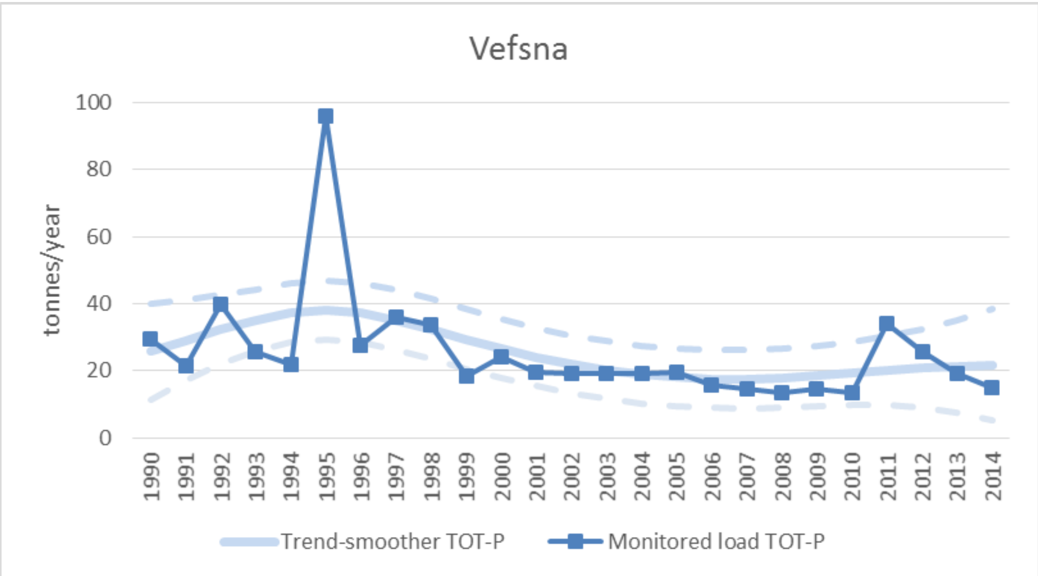


Figure 16. Annual riverine loads of total phosphorus in River Vefsna. The dark blue line is the monitored load while the light blue line is the smoothed flow-normalised trend including the corresponding 95% confidence interval (dotted lines).

For concentrations, two rivers showed statistically significant downward trends (Rivers Otra; Figure 17, and Vefsna), whereas an upward trend was found in River Numedalslågen (Table 10). In terms of orthophosphate concentrations, the River Altaelva had a statistically significant downward trend.

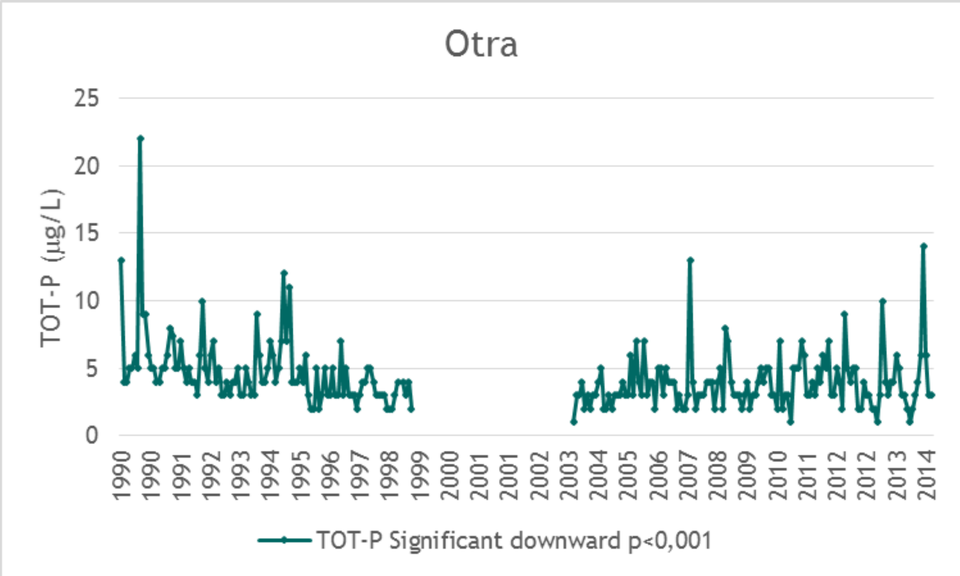


Figure 17. Monthly riverine concentrations of total phosphorus in River Otra; 1990-2014.

Examining only the last 10 years of data, there is a statistically significant downward trend in total phosphorous load in River Orreelva when water discharge is included as an explanatory variable (results not shown). However, when looking at the entire period, the last 10 years show higher total phosphorous loads than the first 15 year period (see appendix V).

It should be noted that the total phosphorus loads generally show large inter-annual variability in a majority of the nine rivers, varying by a factor of three or more over the 25-year study period (Appendix V). This hampers the statistical detection of trends over time. Peaks in phosphorus loads are often - but not necessarily always - associated with high particle (SPM) loads in the same year. Moreover, total phosphorus usually varies with water discharge, and monthly sampling will therefore imply relatively uncertain estimates of this parameter.

Particulate matter

Statistically significant upward trends in particulate matter loads were detected in two of the nine rivers (Rivers Drammenselva and Numedalslågen; Table 9). But as for TP, these trends are solely explained by increased water discharge. The increases in water discharge in the Skagerrak rivers will most probably have resulted in increased erosion, with subsequent increases in suspended sediments.

When water discharge was taken into account, one near-statistically significant downward trend in River Otra was found, and without the year 2014, this downward trend was statistically significant (Figure 18). In 2014, there were high loads of particulate matter in River Otra similar to the ones observed in the years 1994 and 1995. In 1994-1995 the explanation was installation of an industrial pipeline on the river bed from Vennesla to Kristiansand. In 2014, the high loads are mainly caused by high concentrations in the sample from September, coinciding with high water discharges. This may therefore be the natural results of erosion during autumn rains. For concentrations, four out of nine rivers show a statistically significant downward trend (Rivers Otra, Orkla, Vefsna and Alta) (Table 10). The trends are not always clearly visible, as illustrated by River Altaelva in Figure 19.

When the last 10 years are examined, there is one statistically significant downward trend found in River Orrelva in particulate matter loads. As in the case of total phosphorus, there are major inter-annual variabilities in loads of suspended particulate matter (SPM), and monthly sampling will give high uncertainties. More frequent sampling would have reduced this uncertainty. However, a common feature in the time series was the high particle loads in 2000 for several of the rivers. This is in good correspondence with the high water discharges that year, as witnessed in Appendix V. As demonstrated by Skarbøvik et al. (2012), monthly sampling in the Numedalslågen River resulted in errors in load estimates of between 15 and 75% as compared to sampling twice a day. The largest errors occurred in years with high water discharges.

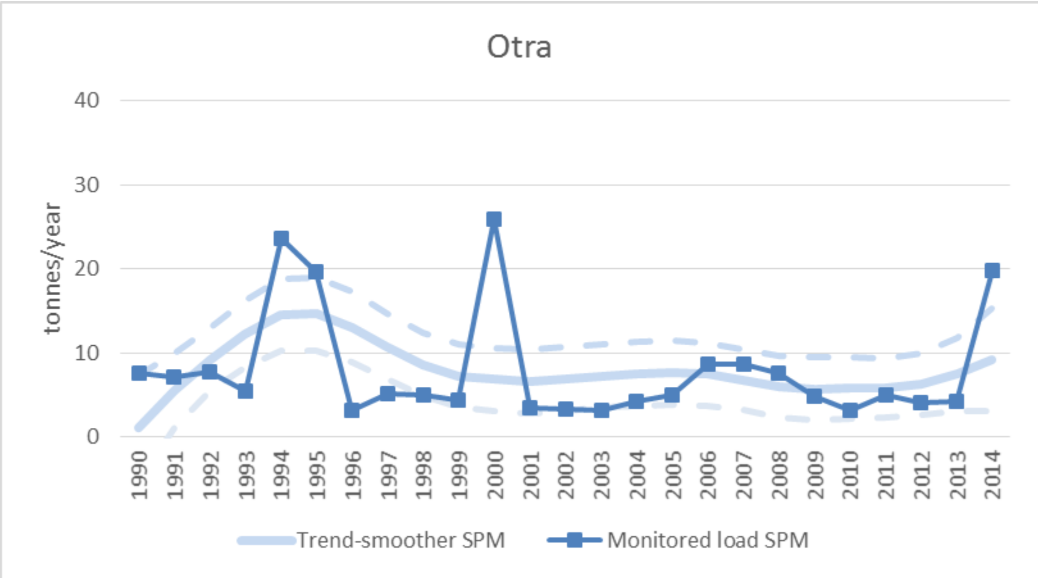


Figure 18. *Riverine loads of suspended particulate matter (SPM) in River Otra 1990-2014. The dark blue line is the monitored load while the light blue line is the smoothed trend including the corresponding 95% confidence interval (dotted lines).*

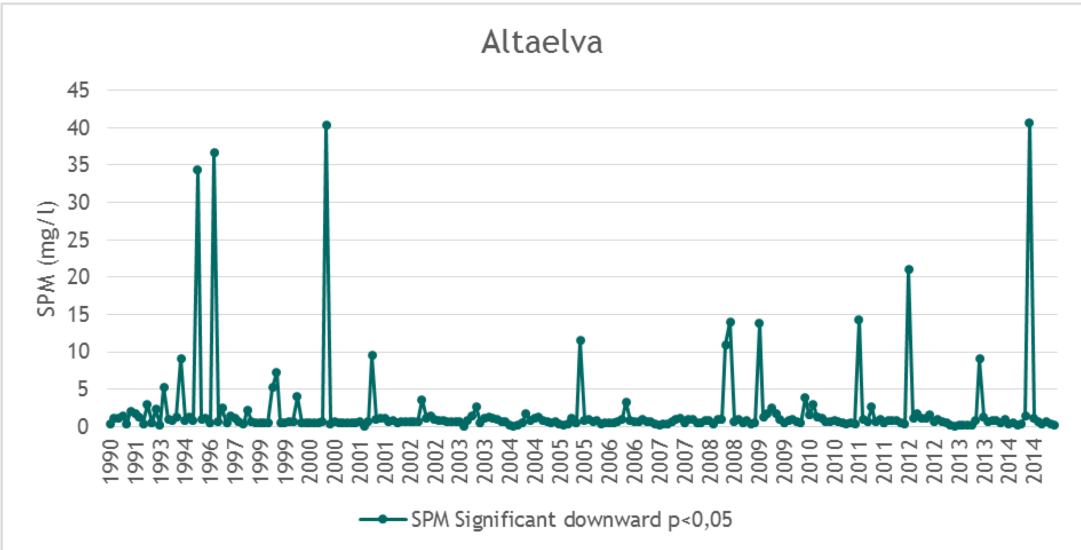


Figure 19. Monthly concentrations of suspended particulate matter (SPM) in River Altaelva 1990-2014.

3.2.3 Source apportionment of nutrients

Source apportionment is presently not a part of the RID programme, but in Norway, the TEOTIL model is run for the entire country (i.e. not using river monitoring data), and source apportionments based on this modelling are therefore shown for nitrogen (Figure 20) and phosphorus (Figure 21).

Especially for the three northernmost coastal areas, fish farming contributes to a significant part of the nutrient inputs.

For Norway as a whole, the nutrient loadings from fish farming contributed to about 70 % of the total phosphorus inputs and about 30 % of the total nitrogen inputs, cf. Table 11.

Table 11. Proportion of discharges of different nutrient fractions from fish farming in 2014.

	NH_4-N	NO_3-N	PO_4-P	TN	TP
% of total inputs	74	10	79	34	73
% of direct discharges	80	89	90	79	88

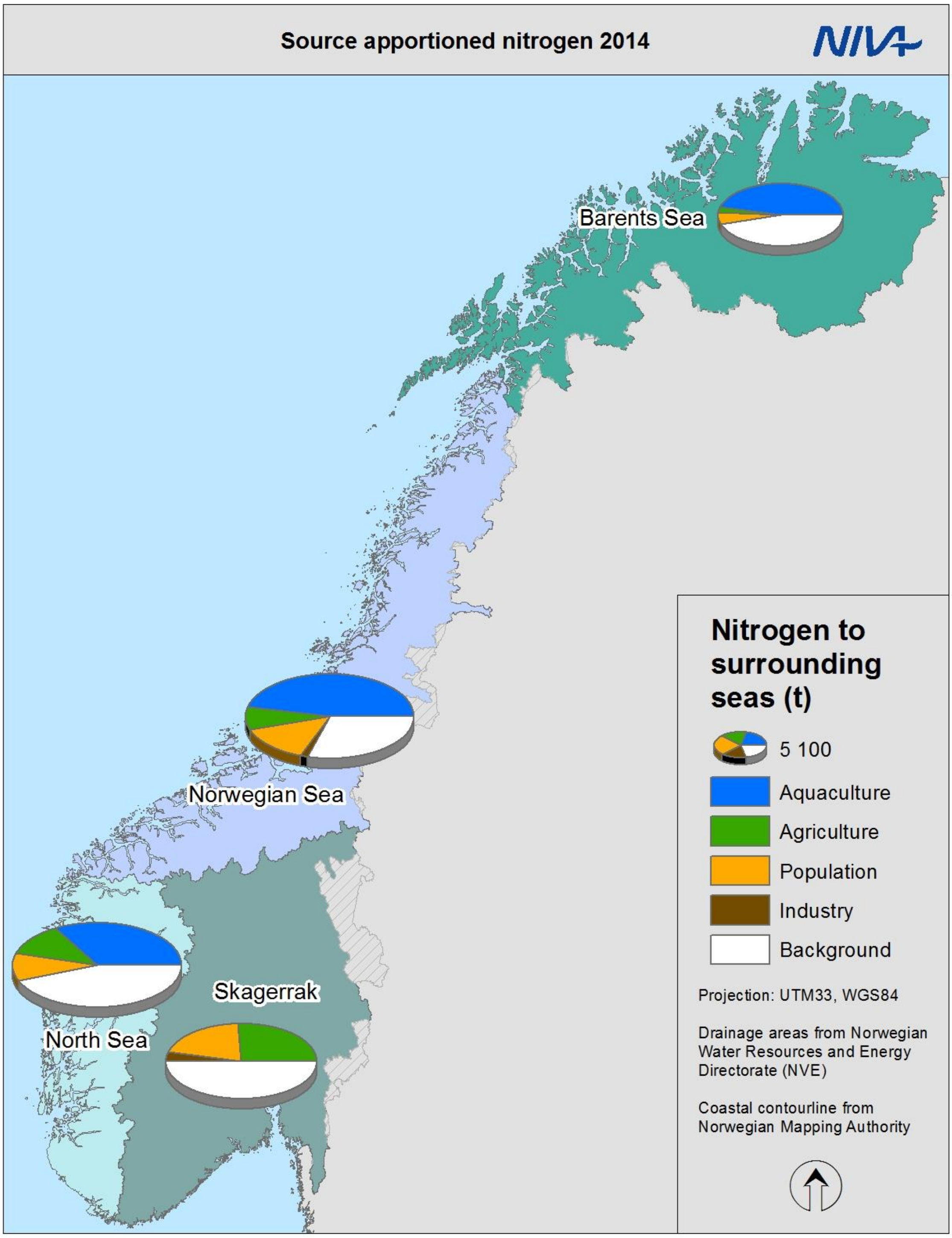


Figure 20. Source apportionment of nitrogen in 2014. Based on the TEOTIL model.

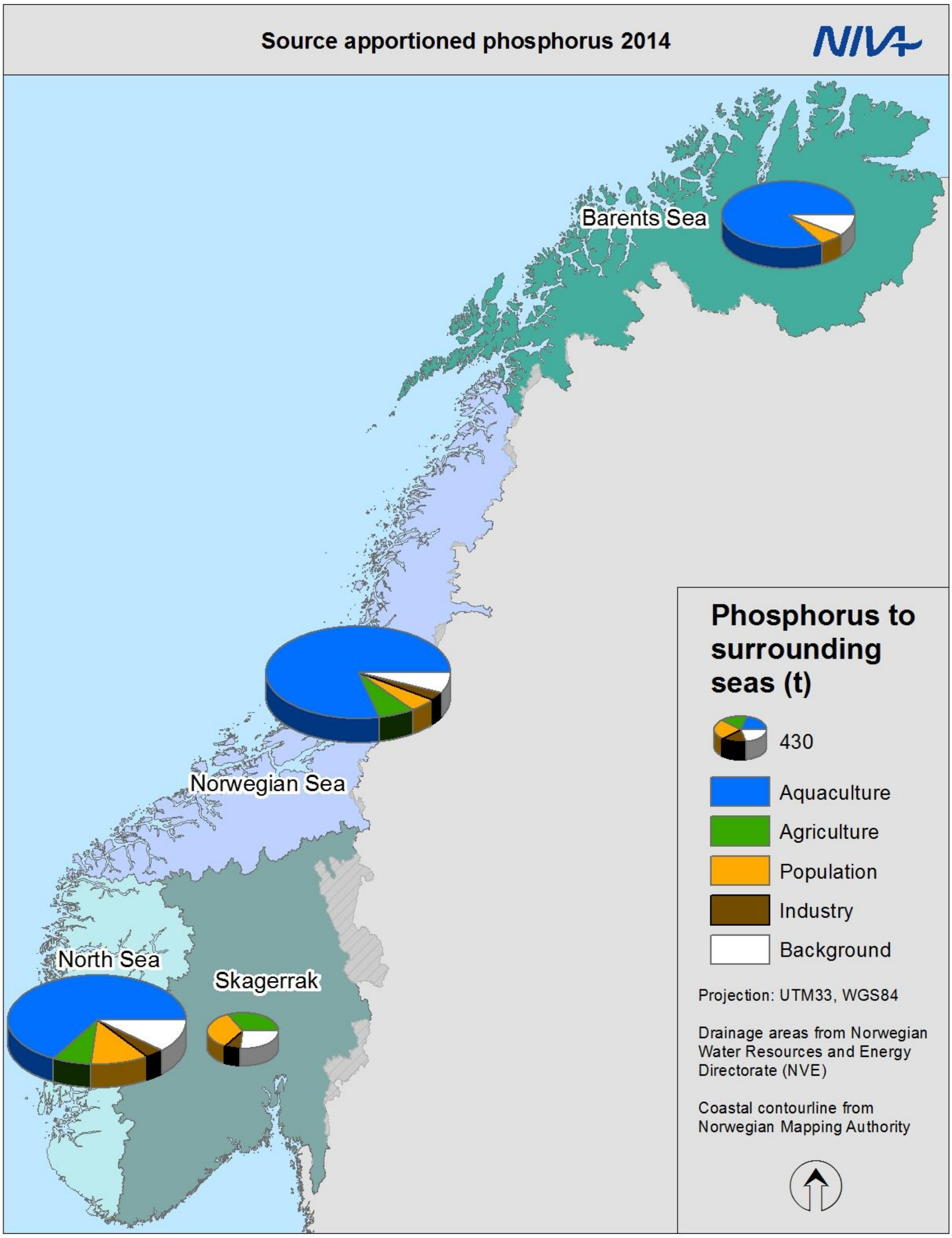


Figure 21. Source apportionment of phosphorus in 2014. Based on the TEOTIL model.

3.2.4 Direct discharges of nutrients and particles

In 2014, the total inputs from direct discharges of total nitrogen amounted to about 72 000 tonnes, of total phosphorus about 11 000 tonnes and of suspended particulate matter about 15 700 tonnes. There were few changes in nutrient and sediment inputs since last year. The majority of the nutrients derive from fish farming along the coastline.

3.3 Metals

3.3.1 Total inputs of metals in 2014

In 2014, the inputs of metals to the Norwegian coastal areas were estimated to 276 kg of mercury, 3 tonnes of cadmium, 8 tonnes of silver, 29 tonnes of arsenic, 50 tonnes of lead, 72 tonnes of chromium, 129 tonnes of nickel, 795 tonnes of zinc and 1139 tonnes of copper (upper estimates). Similar to last year, the lower estimates for silver were zero tonnes.

For all metals except copper the riverine loads account for about 85-95% of the total inputs to Norwegian coastal waters. The high proportion of copper in the direct discharges is explained by fish farming. The fish cages are protected from algae growth with copper-containing chemicals. Discharges of other metals from fish farming, including any residues from the fish fodder, are not estimated. The metal inputs per sub-region and other details are given in the Addendum's Table 3. It should be noted that no source estimates has been done for the riverine inputs, which may contain metal discharges from several different point sources.

As noted in the methods' chapter, the quantification of discharges of copper from fish farming is based on sales statistics for a number of antifouling products in regular use. The chart in Figure 22 shows the total discharges. There has been a considerable increase in 2013 and 2014 as compared to earlier years, reflecting that the number of new product declarations in the official register increased from 2012 to 2013.

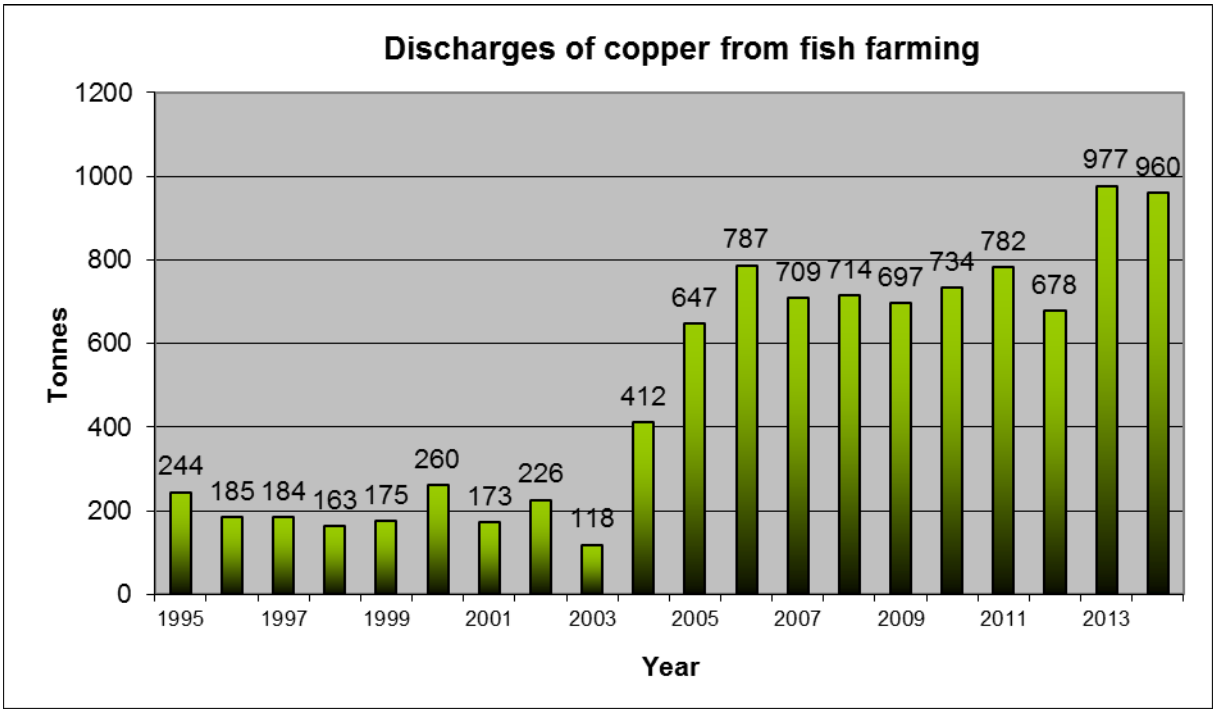


Figure 22. Discharge of copper from fish farming, deriving from antifouling impregnation of net cages, in the period 1995-2014. The data are based on total losses, including cages above the RID rivers' sampling locations (minor contribution). It should be noted that the basis for these data is uncertain.

3.3.2 Trends in metal loads and concentrations

Charts of long-term (1990-2014) metal loads are given in Appendix V. For concentrations we refer to http://vannmiljo.miljodirektoratet.no. Table 12 shows the difference in riverine inputs of metals in 2014 as compared to an average for the period 1990-2013. The two sea areas Norwegian Sea and Barents Sea have been combined since the border between them was changed in 2014. In 2014, the metal loads to the three northernmost maritime areas were lower or equal to the average load in the 24 former years. In Skagerrak, on the other hand, loads of arsenic, lead, nickel and zinc were higher in 2014 than in the period 1990-2013. Here, also the loads of suspended sediments were high in 2014, reflecting relatively high water discharges as compared to earlier years (see Chapter 3.1.2). The increase in zinc is particularly pronounced, mainly due to an increase in River Glomma. This increase has also been reported the latter years (e.g., Skarbøvik et al. 2014), and is as yet unexplained. The increase does not seem to be linked to increases in other metals, nor does it seem to be related to increased sediment loads (see chapter 3.5). Discharges from industry might be an explanation, and an investigation of possible sources is recommended if the high levels continue.

Table 12. Total riverine loads (155 rivers) of eight metals as an average for 1990-2013 and in 2014. Increases are marked in pink and decreases in green colour. Upper estimates are used.								
Metal	Skagerrak		North Sea		Norwegian and Barents Sea**		Total Norway	
	Mean*	2014	Mean*	2014	Mean*	2014	Mean*	2014
Arsenic	12	14	6	6	10.9	6.7	29	26
Lead	29	35	13	10	13.7	3.7	55	49
Cadmium	2.2	1.5	1.4	0.6	1.6	0.5	5.2	2.6
Cobber	92	90	30	23	102.8	57.8	225	171
Zinc	376	571	149	103	215.2	89.7	741	764
Nickel	43	50	17	17	83.9	53.7	144	120
Chrome	27	26	18	11	64.7	33.4	110	70
Mercury (kg)	210	99	80	69	131.3	90.5	421	259

** 1990-2013.*

** Combined, since the borders between these seas were merged in 2014.

In order to analyse these changes more in-depth, statistical trend tests (for which the methodology is described in Chapter 2.2.5) were performed for the following metals:

- Copper (Cu)
- Lead (Pb)
- Zinc (Zn)
- Cadmium (Cd)
- Nickel (Ni)

The results are summarised in Tables 13 and 14 (long-term trends, upper estimates), and will be described in detail below, but in short the analyses for the upper estimates show:

- Out of the 45 trend tests carried out (5 metals and 9 rivers), 26 showed a statistically significant downward trend in long-term loads ($p<0.05$) while one river (Cu in River Drammenselva) showed an increased trend; 36 showed statistically significant downward trends in concentrations ($p<0.05$). There are no upward detectable trends for any metal concentrations.
- When a shorter, 10 year, period was assessed, only two significant downward trends in loads were detected, both in River Orkla for copper and lead. One statistically significant upward trend was detected (Zink in River Glomma). Statistically significant short-term upward trends in concentrations were detected for copper in River Orreelva and for zink in River Glomma.
- It should be emphasised that no firm conclusions can be drawn about long-term downward changes for nickel, cadmium, and to some extent also lead. This is due to the problem with changed detection limits over time and/or large numbers of samples reported at or below the detection limit (see Skarbøvik *et al.*, 2007 and Stålnacke *et al.*, 2009 for details). Therefore, apparent trends in the data are not necessarily explained by ‘real’ changes in loads.

Table 13. Long-term trends for metal loads (upper estimates) in nine Norwegian main rivers 1990-2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS						
River	Q	Cd	Cu	Ni	Pb	Zn
Glomma	0.0102	0.0026	0.8518	0.7260	0.0250	0.7793
Drammenselva	0.0028	0.0013	0.0498	0.3748	0.4548	0.3502
Numedalslågen	0.0281	0.0298	0.0759	0.8153	0.1350	0.1755
Skienselva	0.0317	0.0004	0.0356	0.0013	0.6074	0.1755
Otra	0.7086	0.0015	0.1611	0.0033	0.1909	0.0498
Orreelva	0.0927	0.0687	0.3151	0.0471	0.1681	0.4835
Orkla	0.8886	0.0062	0.0172	0.0250	0.0078	0.0005
Vefsna	0.4548	0.0000	0.0007	0.0000	0.0001	0.0001
Altaelva	0.5132	0.0000	0.0033	0.0133	0.0281	0.4005

Significant downward (p<0.05)
Downward but not significant (0.05<p<0.1)
Significant upward (p<0.05)
Upward but not significant (0.05<p<0.1)

Table 14. Long-term trends for metal concentrations (upper estimates) in nine Norwegian main rivers 1990-2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS					
River	Cd	Cu	Ni	Pb	Zn
Glomma	0.0009	0.0328	0.0214	0.0013	0.8735
Drammenselva	0.0006	0.2011	0.1607	0.1547	0.0846
Numedalslågen	0.0004	0.0086	0.0087	0.0198	0.0061
Skienselva	0.0001	0.0192	0.0003	0.1194	0.0005
Otra	0.0002	0.1902	0.0013	0.0007	0.0000
Orreelva	0.0005	0.1457	0.0006	0.0039	0.3032
Orkla	0.0015	0.0003	0.0007	0.0000	0.0000
Vefsna	0.0000	0.0001	0.0011	0.0000	0.0000
Altaelva	0.0002	0.0008	0.0066	0.0000	0.0018

Significant downward (p<0.05)
Downward but not significant (0.05<p<0.1)
Significant upward (p<0.05)
Upward but not significant (0.05<p<0.1)

Copper (Cu)
The LOD for copper has not changed much over the monitoring period 1990-2014, and there are few samples below LOD.

Statistically significant downward trends in the copper riverine loads and concentrations were detected in four rivers: Rivers Skienselva, Orkla, Vefsna and Altaelva (Table 13). In addition, a statistically significant downward trend in the Cu concentrations in the Rivers Glomma and Numedalslågen was detected (Table 14). An upward trend in Cu-loads was statistically significant in River Drammenselva; explained by the increase in water discharge. In Rivers Altaelva and Orkla, there were downward trends in loads over time (Figure 23) that constituted an average reduction of 0.1 and 0.5 tonnes per year respectively. River Vefsna shows a sharp decline in some substances after 1999, and copper is one of these (Figure 23). The annual loads of copper in River Vefsna during the years 1990-1998 amounted to around 12-17 tonnes, while in the following period (1999-2014) the loads dropped to 2-5 tonnes (Figure 23). The decline in loads in Rivers Skienselva can be related to high loads in single years, i.e. 1990 (Figure 24). The high copper load in River Numedalslågen in 1993 (Figure 24) is explained by generally high concentrations during the entire year, with eight observations out of 13 with concentrations above 5 µg/l. In comparison, concentrations above 5 µg/l have only occurred four times during the time period 1994-2014. The high load in River Skienselva in 1990 (Figure 24) is explained by two samples with high concentrations (17 µg/l and 20 µg/l), whereas normally the values in this river are below 1 µg/l.

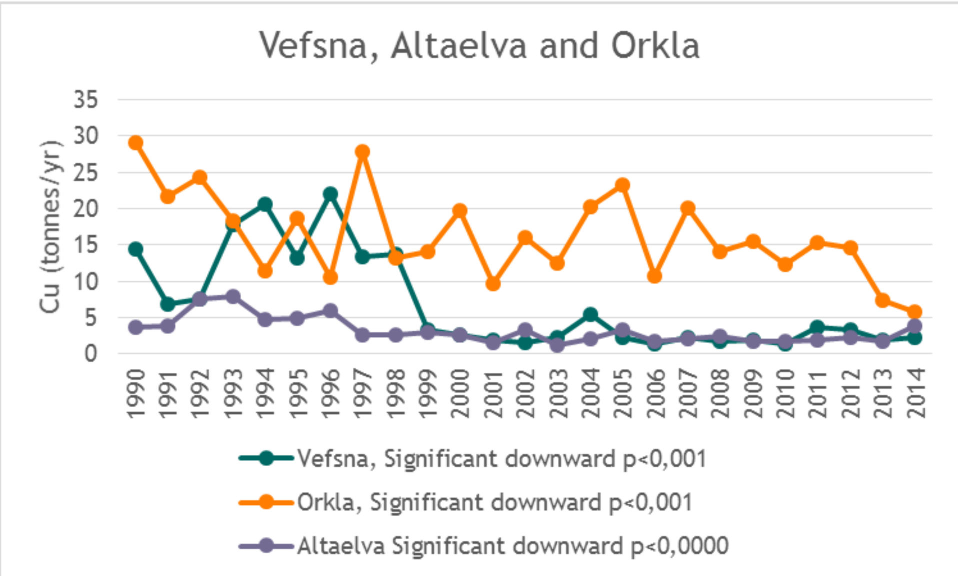


Figure 23. Annual riverine loads of copper in Rivers Vefsna, Altaelva, and Orkla, 1990-2014.

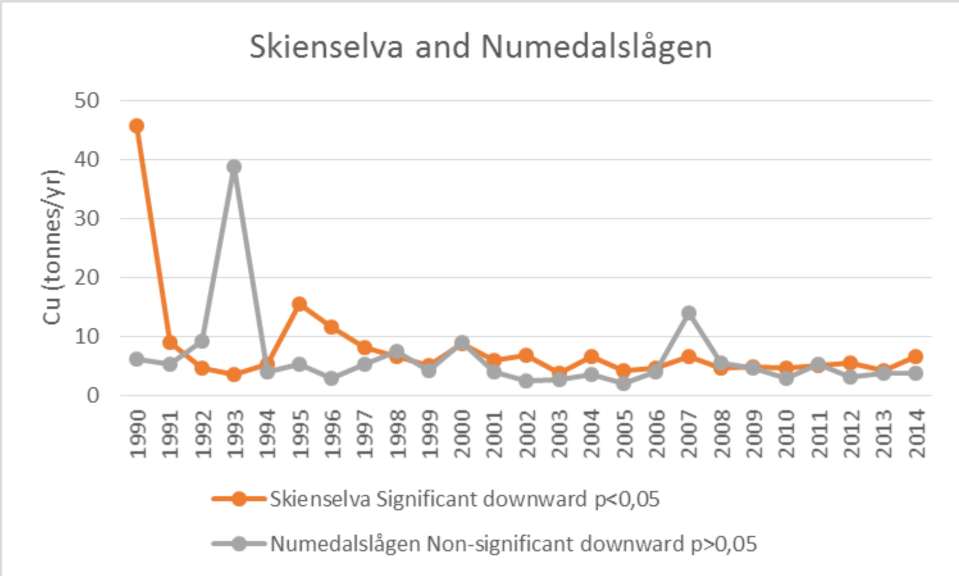


Figure 24. Annual riverine loads of copper in River Skienselva and River Numedalslågen, 1990-2014.

Lead (Pb)

Statistically significant downward trends in the lead riverine loads and concentrations were detected in six rivers; Rivers Glomma, Vefsna, Orkla and Altaelva (Tables 13 and 14). In addition, three more statistically significant downward trends in the concentrations were detected in Rivers Numedalslågen, Otra and Orreelva (Table 14). However, the inter-annual variability and downward trends in inputs of lead can be due to changes in LOD. Table 15 shows that the LOD for lead has changed by a factor of 100 during the monitoring period (1990-2014). This means that the interpretation of especially downward trends in lead loads should be done with great caution. The concerns related to LOD will not affect the trends for the last 10 years, since the LOD has not changed in this period. However, no statistically significant trend was detected in any of river the last ten years (see Appendix V).

Table 15. Changes in detection limits (LOD) for lead (µg/l).

Year	1990	1991	1992 -1998	1999	2000	2001	2002-2003	2004
LOD	0.5	0.1	0.02	0.01 (0.1)[1]	0.01	0.01-0.02 (0.1)[1]	0.02-0.05 (0.2)[1]	0.005

1) The values in parenthesis are probably due to errors, as the detection limit (LOD) may have been given in the wrong unit.

Zinc (Zn)

The LOD for zinc has not changed much over the monitoring period 1990-2014.

Statistically significant downward trends in the zink riverine loads and concentrations were detected in four rivers; River Otra, River Orkla, River Vefsna and River Altaelva (Tables 13 and 14). In addition, two statistically significant downward trends in the concentrations were detected in Rivers Numedalslågen and Skienselva (Table 14).

For many of the examined rivers, the zinc loads show relatively low inter-annual variability as compared with many of the other metals. High loads in single years were almost solely explained by high single concentration values (e.g. 1993 in River Numedalslågen, 1990 in River Skienselva, 2005 in River Orreelva, and 2008 in River Altaelva). Elevated loads in 2011 to 2014 in River Glomma can be noted in Figure 25; hence, in the last ten years there is a statistically significant upward trend for zinc in Glomma (see Appendix V). The reason for these increased loads the latter years is not yet known.

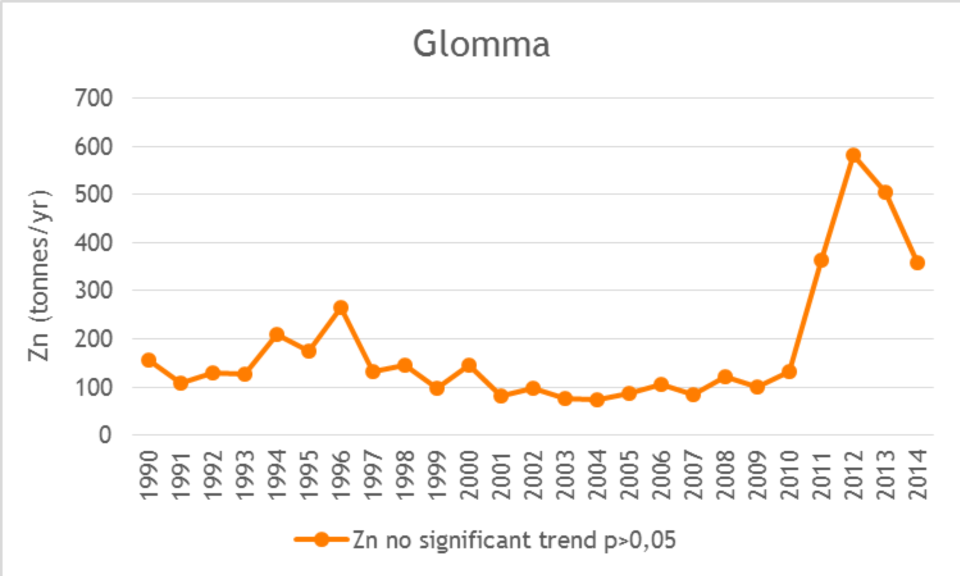


Figure 25. Annual riverine loads of zinc in River Glomma, 1990-2014.

Cadmium (Cd)

Statistically significant downward trends in the cadmium riverine loads and concentrations were detected in all nine rivers (Tables 13 and 14). However, more than 25% of the observations of cadmium in the nine main rivers were below LOD, hence weakening the length of the available time-series and the associated statistical power. Table 16 shows that the LODs have changed substantially during the course of the monitoring period; e.g., from 100 ng/l in 1990 and down to 5 ng/l in 2004-2014. This means that the interpretation of especially downward trends in cadmium loads should be done with great caution. These LOD-related concerns do not affect the 10 years' trends; as the LOD has not changed since 2004. However, no statistically significant trends were detected in any of the nine rivers the last ten years (see Appendix V).

Table 16. Changes in detection limits (LOD) for Cadmium (ng/l).

Year	1990	1991	2004-2014
LOD	100	10	5

Nickel (Ni)
Statistically significant downward trends in the nickel riverine loads were detected in six out of the nine rivers (Table 14). For the nickel concentrations, eight statistically significant downward trends were detected (Table 13). Similarly to the case of Pb and Cd, the LOD has changed over the monitoring period; hence no firm conclusions about time-trends could be drawn. The concerns related to LOD do not affect the 10 years' trends; as the LOD has not changed since 2004 (see Appendix V). One statistically significant upward trend for nickel load and concentrations was detected in Vefsna in the last ten years.

Mercury (Hg)
As mentioned in the beginning of this section, there is a high analytical uncertainty related to mercury, and there have also been changes in analytical methods during the period 1999-2003. The LODs have not changed much during the course of the monitoring period, but around 60% of the observations in the nine rivers were below LOD. Thus no meaningful trend assessment of the annual loads was possible. It should also be noted that the loads in 1999-2003 are based on estimated concentrations.

3.3.3 Metal concentrations and threshold levels

Threshold levels used for this assessment are given in Table 17, along with the annual means of those rivers (out of 47) for which annual means exceeded the threshold levels. The annual means based on upper estimates have been used in this assessment. It should be noted that for 36 of the rivers, sampling is only done four times a year. Threshold levels for lead, mercury and nickel are according to the Water Framework Directive (WFD) or the EQS daughter directive 2013/39/EU. The other thresholds are from the Norwegian guidance on classification of freshwater environment (Andersen et al. 1997).

Table 17. Exceeded threshold levels (annual means except for Hg which are annual maximum concentrations). Levels in italics are close to the threshold level.

Metal	Pb	Cu	Zn	Ni	Cr	Hg
Threshold level* (µg/l)	1.2	1.5	20	4	2.5	70
Rivers	µg/l	µg/l	µg/l	µg/l	µg/l	ng/l
Glomma		1.8				
Alna		5.2	*18.5*			
Drammenselva	*1.1*					
Orreelva		1.7				
Orkla		4.9				
Tista		1.8				
Stjørdalselva		1.8				
Pasvikelva		2.3				

* Sources: Hg: EU WFD (EU, 2000); Pb and Ni: EQS (EC 2013); Cu, Cr, and Zn: national threshold levels (Andersen et al. 1997)

Copper was the only metal whose threshold level was exceeded; this year in seven rivers (Table 17). Lead was close to the threshold level in River Drammenselva, as was zinc in River Alna. In 2013, zinc levels in River Glomma were exceeding the threshold level (20.1 µg/l), but in 2014 the mean concentration had been reduced to 12 µg/l.

For cadmium (Cd), the EQS threshold values depend on alkalinity, but alkalinity is not available within this programme. However, none of the monitored rivers had average concentration levels above the EQS for the class with the lowest threshold (i.e., Class 1: < 40 mg $CaCO_3$/l; 0.08 µg/l Cd) (EU, 2013).

3.4 Organic contaminants

3.4.1 Organic contaminant concentrations

Polycyclic aromatic hydrocarbons (PAHs)
Most PAHs were found above LODs in the freely dissolved form and associated with suspended particulate matter in 2014 (Addendum 1). In the River Alna, concentrations in 2014 were lowest for dibenzo[ah]anthracene (9 pg/l) and highest for pyrene with a concentration of 8.1 ng/l. This is a similar range of concentrations as those measured in 2013. Across the entire range of PAHs, freely dissolved concentrations in the period 2013-2014 vary by a factor of 3-38 depending on the exposure. One has to bear in mind that the equilibrium sampling was obtained for some of the lighter PAHs (data is representative of the last few days of exposure/weeks) while sampling was integrative throughout the exposure period for the more hydrophobic PAHs. For 2014, PAH concentrations in River Drammenselva were below the limit of detection (LOD) (< 5 pg/l) for dibenzo[ah]anthracene and up to 10.5 ng/l for phenanthrene. Freely dissolved concentrations for the period 2013-2014 were a little more variable than those in River Alna and varied by a factor of 3 to 35. PAH concentrations in River Glomma were slightly lower than those estimated in River Drammen in 2014 and similar to those found in the Alna. Concentrations ranged from below LOD for dibenzo[ah]anthracene (< 4 pg/l) and highest for phenanthrene (7.2 ng/l). Figure 26 presents examples of temporal variations in freely dissolved concentrations of fluoranthene, benzo[a]pyrene and benzo[ghi]perylene in River Alna for the period 2013-2014.

Freely dissolved concentrations measured in 2013-2014 in Rivers Alna, Drammenselva and Glomma are in line with those measured in previous studies from 2008-2012 (Allan et al., 2011; Allan et al., 2009; Allan et al., 2010; Allan et al., 2013b; Allan and Ranneklev, 2011).

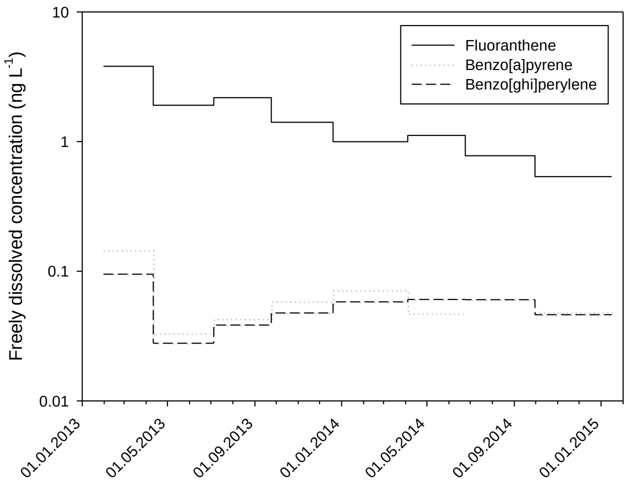


Figure 26. Freely dissolved concentrations of selected PAHs (fluoranthene, benzo[a]pyrene and benzo[ghi]perylene) in River Alna for the period from January 2013 to January 2015. Note: the log scale of the y-axis.

SPM concentrations of PAHs in River Alna were lowest for acenaphthene (< 20 ng/g dw) and highest for pyrene (1100 ng/g dw) (Addendum 1). SPM concentrations of PAHs in River Drammenselva were as low as 2 ng/g for anthracene and highest for fluoranthene (360 ng/g dw). PAHs concentrations in SPM from River Glomma were clearly lower than for the other two rivers. While in 2013, data for 9-10 PAHs were below LODs with LODs in the range 2-10 ng/g dw, data below LOD were found for only four PAHs as PAH concentrations in SPM from river Glomma were slightly higher in 2014 than in 2013.

Polychlorinated biphenyls (PCBs)

PCBs were consistently detected in the freely dissolved phase in river Alna in 2014 and often found above LODs in the two other rivers at a concentration level in the low pg/l. When PCBs were below LODs, these ranged from below pg/l level to 20 pg/l. As in 2013, PCB congeners with lower chlorination (less hydrophobic) were present in higher concentrations than the ones with a higher degree of chlorination. In River Alna, concentrations of individual PCB congeners ranged from 0.13 pg/l for CB180 to 37 pg/l for CB28. The variation in concentrations was a factor of 1 to 2 for most congeners (see Figure 27). An example of variation in PCB congener concentration in River Alna is given in Figure 27 for the period 2013-2014. PCB concentrations in River Drammenselva were a little lower than those in River Alna. PCB concentrations in River Drammenselva reached a maximum of 41 pg/l for CB28 in 2014 compared with 14 pg/l in 2013. Congeners 156 and 180 were consistently below LOD. As in 2013, concentration estimated for the different exposure times varied by a factor of 1.4 to 3. PCB concentrations in River Glomma were slightly lower than those found in River Drammenselva. Depending on the congener, concentrations varied by a factor of 1-5 over the year. CB156 and CB180 were below LOD (< 0.9-9 pg/l). Freely dissolved PCB concentrations obtained for River Alna in 2013 and 2014 are very similar to those from passive sampler exposures from 2012 (Allan et al., 2013b). As in 2013, PCB congeners were only detected in the particulate matter phase in SPM samples from River Alna. Concentrations were in the range <2-9.3 ng/g dw in 2014 and slightly higher than in 2013. Concentrations were below LOD in Rivers Drammenselva and Glomma (< 0.5-1 ng/g dw).

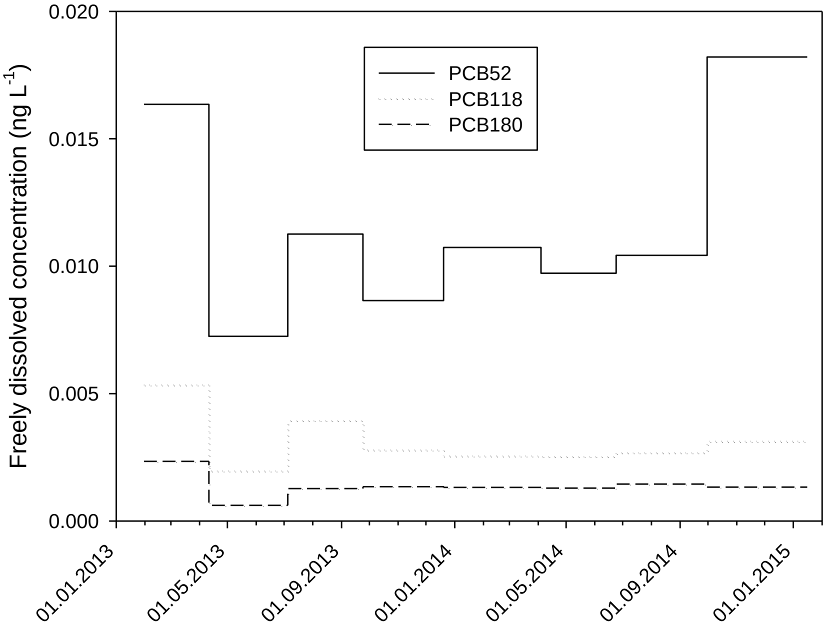


Figure 27. Freely dissolved concentrations of selected PCB congeners (52, 118 and 180) in River Alna for the period from January 2013 to January 2015.

Polybrominated diphenyl ethers (PBDEs)

PBDE concentrations in the three rivers ranged from well below pg/l level to tens of pg/l for the least hydrophobic PBDE congeners. The congeners that were mostly detected and quantified were BDE47, 99, 100, 153 and 154. Concentrations of BDE126, 183 and 196 were consistently below limits of detection in all three rivers. Similarly to 2013, PBDE concentrations in River Alna were lowest for BDE153 and BDE154 (0.025-0.03 pg/l) and highest for BDE47 with concentrations of 1-2 pg/l. Estimated PBDE concentrations were slightly higher in Rivers Drammenselva and Glomma than in River Alna. Concentrations of BDE47 were in the range 3-10 pg/l in Drammenselva. Concentrations for BDE congener 99/100 were in the range 0.9-9 pg/l and below LOD for congener 153/154. In River Glomma, concentrations of BDE congeners 47, 99 and 100 were in the range 2-5, < 2-5 and 2-6 pg/l, respectively. An example of variations in BDE47 concentrations in all three rivers over the period January 2013 to January 2015 can be found in Figure 28. PBDE concentrations in the dissolved phase in River Alna in 2013 are in a similar range to data published in 2013 (Allan et al., 2013b). The freely dissolved concentration of BDE47 in River Drammenselva is in agreement with data from silicone rubber samplers from 2008 (Allan et al., 2009).

BDE congeners 47, 99, 100, 153 and 154 were measured in the concentration range 0.13-3.2 ng/g dw in SPM from River Alna. In River Drammenselva, only congeners 47, 99 and 153 were found in some cases above LOD (range of concentration: 0.15-0.27 ng/g dw). In River Glomma, PBDEs were all below LOD with LODs between 0.1 and 0.5 ng/g dw.

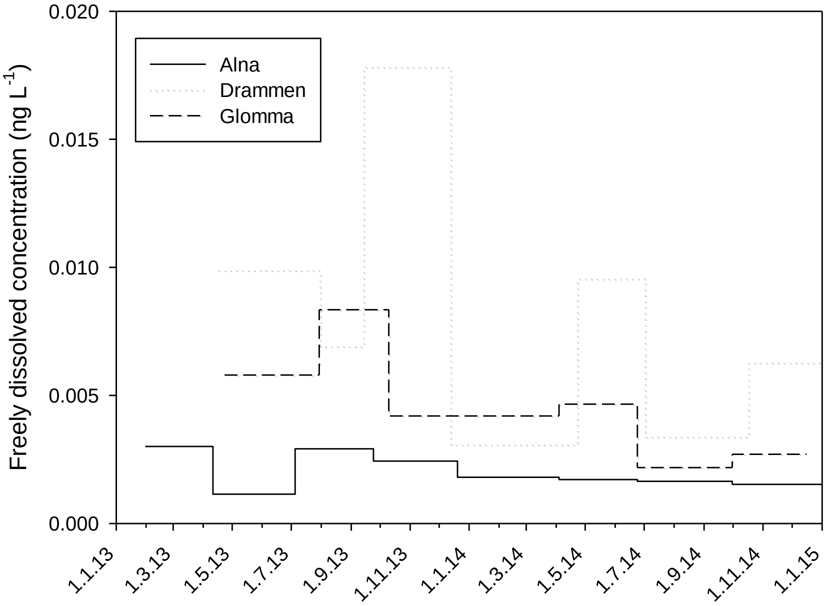


Figure 28. Freely dissolved concentrations of PBDE 47 in Rivers Alna, Drammenselva and Glomma for the period from January 2013 to January 2015.

Concentrations of BDE209 in the freely dissolved form are likely very low owing to its high hydrophobicity. More variability between duplicate silicone rubber samples was observed than for other classes of chemicals (RPDs between 0.6 and 83 %). Freely dissolved concentrations for BDE209 for 2013 were in the range 0.4-0.8, < 6-163 and < 2-10 pg/l in Rivers Alna, Drammenselva and Glomma, respectively. The final silicone rubber deployment in the River Drammenselva yielded a BDE209 concentration of 163 ng/l with RPD of duplicate samplers of 61 %. SPM concentrations of BDE209 in River Alna were slightly higher than in 2013 and in the range 36 to 76 ng/g dw. This range is similar to bed sediment concentrations measured in 2008 along the River Alna bed sediments (Ranneklev et al., 2009), and is generally higher than SPM concentrations in Rivers Drammenselva (ranging from 4.4 to 15 ng/g dw) and Glomma (<1 to 1.4 ng/gdw).

Hexabromocyclododecane (HBCDD)

HBCDD isomers were most often detected in passive samplers exposed in River Alna with concentration estimates in the range 0.3-6 pg/l. These chemicals were almost always below LOD in River Drammenselva (LODs in the range 1-25 pg/l). The alpha isomer of HBCDD was measured consistently in River Glomma with concentrations between 1.5 and 19 pg/l.

The alpha isomer of HBCDD was detected in SPM samples from River Alna at concentrations of 8.8 to 11 ng/g dw. All three isomers were mostly below LODs in SPM samples of the two remaining rivers with LOD between 0.5 and 4 ng/g dw.

Short and medium chain chlorinated paraffins (S/MCCPs)

Suspended particulate matter concentrations for SCCPs measured in 2014 were higher in River Alna than in the other two rivers and generally higher than in 2013. Concentrations of MCCPs were also generally higher in River Alna than in the other two rivers. Concentrations of S/MCCPs varied by over two orders of magnitude depending on the sample (<40-1480 ng/g dw). For River

Alna, the concentration range was similar to the range found for S/MCCPs in bed sediments sampled in 2008 (Ranneklev et al., 2009).

Bisphenol A (BPA)
SPM concentrations of BPA appeared highest in River Alna and these were between 7.7 and 665 ng/g dw which is a similar range as that obtained in 2013. In 2014, BPA concentrations in River Drammenselva SPM were above limits of detection with concentrations in the range 0.5-50 ng/g dw. In River Glomma, SPM concentrations were in a similar range to those measured in the Drammenselva (1-34 ng/g dw). For comparison, previous measurements in River Alna bed sediments were between 0.4 and 47 ng/g dw (Ranneklev et al., 2009).

Tetrabromobisphenol A (TBBPA)
TBBPA was measured above LODs in most SPM samples from all rivers in 2014. Concentrations were in the range 3.5-11 ng/g dw in River Alna. This range was wider for River Drammenselva since TBBPA concentration varied from the LOD (0.1 ng/g dw) to a concentration of 156 ng/g dw in one sample. The concentration range for 2014 in River Glomma was <0.2-38 ng/g dw.

Perfluorochemicals (PFCs)
Perfluorooctanesulfonic acid (PFOS) and perfluorodecanesulfonate (PFDS) were the only two perfluoro chemicals consistently detected and measured in River Alna SPM (<0.05-0.78 ng/g dw). Two of the SPM samples from River Alna presented quantifiable amounts of a number of PFCs including PFOA, PFDA, PFDoA, PFTrA, PFTeA, and PFOSA. Concentrations were in the range of those for PFDS and PFOS. In River Drammenselva, PFOS was found at concentrations in the range 0.27-0.37 ng/g dw. PFCs were mostly below LODs (LODs in the range 0.1-1 ng/g dw) in River Glomma. PFOS was detected in one SPM sample from River Glomma in 2014 (0.12 ng/g dw).

3.4.2 Suspended particulate matter-water distribution of contaminants

As in 2013, it was possible to calculate particulate organic carbon-water distribution coefficients ($\log K_{poc}$) for data from 2014. Values of $\log K_{poc}$ for PAHs and PCBs in River Alna are plotted in Figure 29 as a function of $\log K_{ow}$. These plots also show data from 2013 for comparison. $\text{Log}K_{poc}$ values for 2014 show similar pattern as for data from 2013. A good overlap of $\log K_{poc}$ values from 2013 and 2014 can be seen. More variability in calculated $\log K_{poc}$ can be observed for the lighter, less hydrophobic PAHs (with low $\log K_{ow}$ values). For example the mean $\log K_{poc}$ for naphthalene for 2013-2014 is 5.28 with a standard deviation of 0.61 (n= 8). A significantly lower variability in $\log K_{poc}$ can be seen for the higher molecular weight PAHs. The mean $\log K_{poc}$ for benzo[hi]perylene is 8.00 with a standard deviation of 0.10 (n=8).

$\text{Log}K_{poc}$ for PAHs in River Alna for 2013 and 2014 are consistently above the 1:1 relationship with $\log K_{ow}$, showing relatively high SPM sorption coefficients for PAHs. Such a partitioning behaviour is not unexpected for PAHs, since a stronger sorption of PAHs to carbonaceous organic carbon compared with sorption to amorphous carbon has been shown (Cornelissen et al., 2005). However, it has not often been measured in surface waters. Little is known of the temporal variability in concentrations of PAHs associated with suspended particulate matter in rivers or of the connection between particulate matter concentrations and those measured freely dissolved. Interestingly, $\log K_{poc}$ values for the Rivers Drammenselva and Glomma are much more variable than for River Alna. Standard deviation of the mean $\log K_{poc}$ values for the more hydrophobic PAHs in these two rivers over the two year period are much higher than those seen for the data from Alna. This is the result of more variable concentrations for SPM-associated PAHs in these rivers compared with the Alna.

A different behaviour of the PCBs in River Alna can be seen in 2014 (similarly to 2013). $LogK_{poc}$ values for PCBs in River Alna are close to the 1:1 relationship with $logK_{ow}$. The spread of $logK_{poc}$ data for individual PCB congeners is relatively low and similar to 2013 data. In general, these data support the correctness of the freely dissolved phase measurements made with the passive samplers.

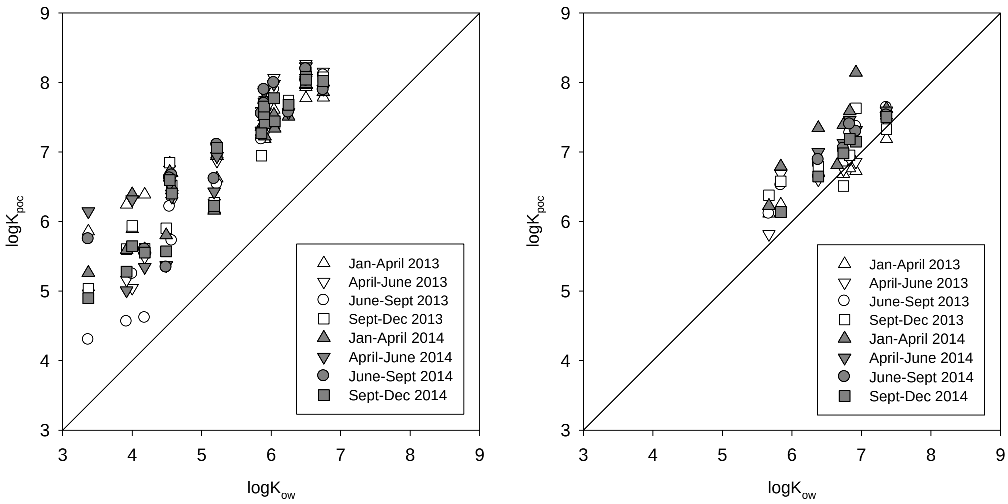


Figure 29. Particulate organic carbon-water distribution coefficients for PAHs (left) and PCBs (right) in River Alna for different periods of sampling in 2013 and 2014.

$LogK_{poc}$ were also calculated for PBDE data from the three rivers for 2013 and the data are plotted in Figure 30. Distribution coefficients for BDE47, 99, 100, 153 and 154 in River Alna are close to the 1:1 relationship of $logK_{poc}$-$logK_{ow}$ with more variable data for the more hydrophobic congeners. The data for the two other rivers are generally below the 1:1 relationship. For BDE209, particulate organic carbon-water distribution coefficients are consistently below the 1:1 relationship (and in some cases, by a few orders of magnitude). It may be that the SPM data for BDE209 is extremely variable and our continuous flow centrifuge data is not very representative of ambient BDE209 concentrations in SPM. It may also be that the passive sampling data overestimates BDE209 concentrations in the freely dissolved phase.

On Figure 30, we also plotted $logK_{poc}$ values for BDE47 for all three rivers. Consistently higher $logK_{poc}$ values can be observed for BDE47 in River Alna compared with Rivers Drammenselva and Glomma. While whole water concentrations of PBDEs are generally higher in River Alna, it can be seen on Figure 28, that freely dissolved concentrations of BDE47 are lowest in the Alna and a larger proportion of this compound in water is bound to SPM. It is likely that differences in the type of organic matter (amorphous carbon or black carbon for example) in these rivers influence the distribution of PBDEs between SPM and water.

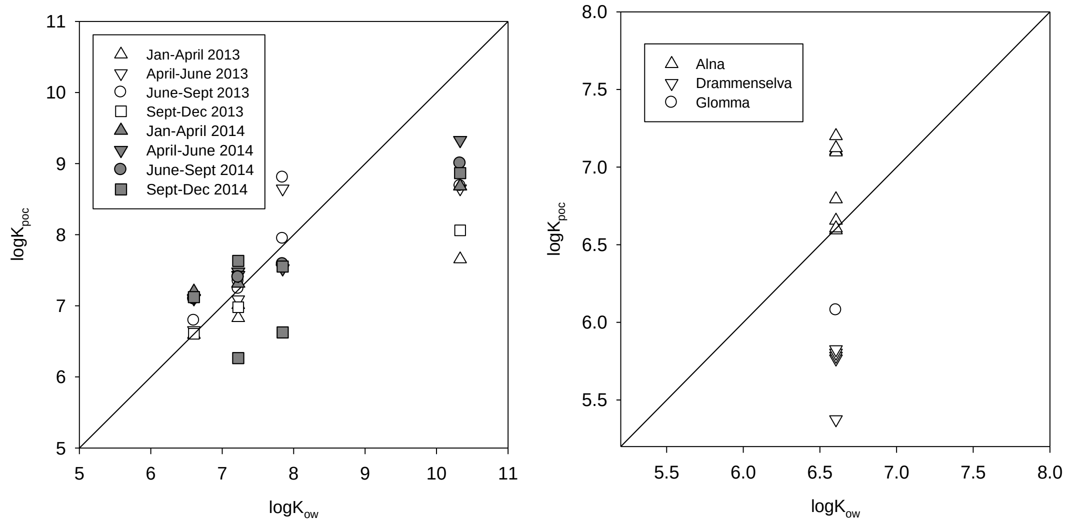


Figure 30. Particulate organic carbon-water distribution coefficients (log K_{poc}) for (i) PBDEs in River Alna for the different periods of sampling of 2013 and 2014 (left), and (ii) BDE47 for all three rivers (right).

3.4.3 Comparison with WFD environmental quality standards

Environmental Quality Standards (EQS) have been set at European level through the Water Framework Directive for a number of substances that have been monitored during this study. The latest EQS values were published in 2013 and are given in Table 18.

Table 18 presents a comparison of annual average estimates of “whole water” concentrations for 2013 and 2014 for the Rivers Alna, Drammenselva and Glomma with annual average WFD EQS (AA-EQS). Such a comparison however needs to be treated carefully since our data is based on adding the concentrations estimates given for the freely dissolved phase and that measured associated with SPM, and this may or may not be an optimum way to obtain an (annual averaged) estimate of whole water concentrations. One has to bear in mind that the present monitoring programme was not established specifically for compliance monitoring (i.e. to compare against WFD AA-EQS values).

Estimates presented below clearly indicate that concentrations of naphthalene, anthracene, PBDEs (without BDE28), HBCDD are well below WFD EQS values in all rivers for monitoring data for both 2013 and 2014. For SCCPs, concentration estimates for all rivers were well below EQS values in 2013. In 2014, the “whole water” concentration range estimated for SCCPs in River Alna is higher than in 2013 and closer to EQS level (note that these estimate suffer significant uncertainty since measurements were only in the SPM phase). As for 2013, the concentrations of fluoranthene and benzo[a]pyrene in 2014 appear to be close to or above EQS level in all three rivers. PFOS was monitored in the SPM only and the whole water concentration estimates are likely to suffer from significant uncertainty (due to K_{oc} used to estimate freely dissolved concentrations from SPM concentrations and unknown temporal variability of the concentration in river water). While our monitoring programme was not specifically aimed at compliance checking with WFD AA-EQS values, “whole water” concentration estimates close to or above AA-EQS for fluoranthene, benzo[a]pyrene and PFOS in all three rivers certainly warrant further investigation.

The overall uncertainty in estimates of annual average concentrations will be dependent on the uncertainty of (i) freely dissolved concentrations, (ii) SPM-associated concentrations and (iii) the size of the fraction of contaminants not measured by the two techniques used in the present study.

For fluoranthene, the freely dissolved concentration in 2014 represented 7.6, 89 and 79 % of the estimated “whole water” concentration in the Rivers Alna, Drammen and Glomma, respectively. For benzo[a]pyrene, these values were 1.6, 37 and 18 %, respectively. Differences in the distribution of fluoranthene and benzo[a]pyrene between the particulate and dissolved phase in the different rivers will affect the overall uncertainty of the “whole water” estimates. The standard error on the estimates of sampling rate provided by the non-linear least square method (Booij and Smedes, 2010) are in most cases between 10 and 20 %. For fluoranthene, however, in many cases, the uncertainty is not related to the sampling rate estimation but to the uncertainty in K_{sw} values since measurements with silicone samplers are made close to equilibrium with the dissolved phase. An uncertainty of 0.2 log unit can be expected for $\log K_{sw}$ values. This also means that the passive sampling of fluoranthene was not truly time-averaged over the entire period of deployment. The uncertainty resulting from this will depend on the temporal variability of the dissolved fluoranthene concentration in water. Since benzo[a]pyrene is more hydrophobic, time to equilibrium is longer than for fluoranthene and most passive sampling measurements remained time-averaged. Bias in passive sampling data can result from the temperature-dependency of K_{sw} values. Higher K_{sw} values at lower temperatures (as a result of decreasing solubility of hydrophobic chemicals in water with decreasing temperature) can be expected for deployments where the average temperature are significantly lower than that at which K_{sw} values have been measured (20 °C). Applying a temperature correction to K_{sw} values will result in the estimation of higher R_s and lower concentrations in water. Since a significant proportion of fluoranthene is found in the particulate fraction in River Alna, uncertainties in the estimation of average SPM-associated fluoranthene and benzo[a]pyrene concentrations will play a major role in the overall uncertainty of estimated “whole water” concentrations. This is also the case for benzo[a]pyrene in Rivers Alna and Drammenselva. Knowledge of temporal variability of SPM-associated concentration and factors contributing to this variability is needed.

3.4.4 Estimation of riverine loads of contaminants for 2014

Annual riverine contaminant loads are given in Table 19. Riverine loads of S/MCCPs, BPA, TBBPA and PFOS are for the suspended particulate matter fraction of contaminants. A summary of sources of uncertainty in the estimation of yearly contaminant loads can be found in Appendix IV. Generally the loads were higher in River Glomma compared to River Drammenselva, and loads from both rivers were substantially higher than in River Alna. This reflects the large difference in size and therefore annual discharge between these rivers.

Yearly loads of individual PCB congeners for River Alna for 2014 were higher than in 2013 with loads below 5 g/yr. Yearly loads of PCB congeners for Rivers Drammenselva and Glomma range from < 111 g/yr for CB153 to 421-626 g/yr for CB28 in River Glomma. These data represent a significant improvement to the use of bottle sampling for the estimation of loads of PCBs from Norwegian rivers. Estimates of loads for seven indicator PCB congeners were 22-25, 1057-1121 and 732-2834 g/yr for Rivers Alna, Drammenselva and Glomma, respectively. As for 2013, these estimates are a little more uncertain for Rivers Drammenselva and Glomma since concentrations in the suspended particulate matter phase were mostly below limits of detection.

The 2014 loads of individual PBDE congeners were below 1 g/yr for River Alna, while the loads were in the range 2.3-789 g/yr for River Drammenselva and 27-788 g/yr for River Glomma. Riverine loads for HBCDD isomers were in the range 0.026-4.2, 35-280 and 210-1079 g/yr for Rivers Alna, Drammenselva and Glomma, respectively.

Yearly loads of individual PAHs were below 1 kg/yr for River Alna and up to 198 kg/yr for naphthalene in River Glomma. Riverine loads for PAHs were far higher than those estimated for all the other contaminants. The riverine discharge of S/MCCPs in Glomma, however, was approaching the same level as PAHs. The loads of PFOS were below 20 g/yr for all rivers. For PFOS, calculated loads of freely dissolved PFOS assuming a logK_{poc} value of 4 (Ahrens *et al.*, 2011) were 36, 3871 and 4501-5665 g/yr for Rivers Alna, Drammenselva and Glomma, respectively.

Table 18. Comparison of calculated annual average contaminant concentrations for the Rivers Alna, Drammenselva and Glomma for 2013 and 2014 with Water Framework Directive annual average environmental quality standards (AA-EQS). Blue, orange and red shading are for when "whole water" concentration estimate are well below EQS, close to EQS (i.e. within a factor of 2-4 below EQS) and above EQS, respectively.

Substance	Annual average "whole water" concentration (ng/l) for 2013-2014						WFD AA-EQS
	Alna		Drammenselva		Glomma		
	2013	2014	2013	2014	2013	2014	
Naphthalene(1)	6.9	5.2	5.4	7.0	2.9	6.5	2000
Anthracene(1)	2.3	1.3	0.14	0.27	0.17	0.27	100
Fluoranthene(1)	12.6	10.0	1.9	4.5	2.9	4.2	6.3
Benzo[a]pyrene(1)	3.1	3.3	0.25	0.32	0.071	0.28	0.17
PFOS(2)	0.5-5	0.6-6.2	0.2-1.8	0.3-3.0	0.07-0.7	0.15-1.9	0.65
PBDEs (- BDE28)(3)	0.011	0.056-0.068	0.020	0.012-0.018	0.012	0.009-0.021	140
HBCDD	0.008 - 0.17	0.028-0.11	0.001 - 0.03	0.0027-0.065	0.01- 0.05	0.0069-0.080	1.6
SCCPs(4)	5.4 - 78	14-154	0.1 - 12	0.6-38	0.8 - 32	0.7-19	400

(1) Whole water refers here to the sum of the freely dissolved concentration and that of the suspended particulate matter-associated contaminant concentration.
(2) PFOS annual average concentration are based on the measured concentrations in the SPM phase and predicted freely dissolved concentration based on measured SPM concentrations and a logK_{poc} range of 3-4. Note that this chemical is primarily found in the dissolved phase and these estimates may suffer considerable uncertainty.
(3) The sum of PBDE congeners according to the WFD includes congener 28.
(4) SCCP annual average concentration are based on the measured concentrations in the SPM phase and predicted freely dissolved concentration based on measured SPM concentrations and a logK_{poc} range of 5 to 8. The upper level estimates may suffer considerable uncertainty.
Note: Contaminant sorption to DOC is not taken into account here.

Table 19. Estimated riverine contaminant loads in Rivers Alna, Drammen and Glomma, 2014

Compound	Unit	Annual contaminant load		
		Alna	Drammenselva	Glomma
ΣPAH_{16}	kg/yr	4.2	369-369.5	819-820
ΣPCB_7	g/yr	22.4-25.2	1058-1122	731-2834
ΣPBDE (excl. BDE28)	g/yr	3.2-3.9	183-228	282-640
BDE209	g/yr	27	741-789	406-533
ΣHBCDD (α, β, γ)	g/yr	5.8-6.4	584-843	1589-2458
SCCPs[a]	kg/yr	0.82	6.9	15.8-19.4
MCCPs[a]	kg/yr	0.31	4.2	11.8
BPA[a]	g/yr	232-267	2185	3734
TBBPA[a]	g/yr	4.3	1116-1117	5439-5454
PFOS[a]	g/yr	0.36	5.6	15.3-19.2

[a] Estimated loads for these substances are only for the particulate matter-associated fraction

Expressing contaminant loads relatively to the size of the drainage basins of the rivers shows a very different picture. For all sets of chemicals, annual loads per km^2 of drainage basin were highest for River Alna in both 2013 and 2014 (Figure 31). This reflects that the majority (68%) of the River Alna catchment is urban area. Loads for Rivers Drammenselva and Glomma were generally lower by a factor of 4-10. Estimated loads for Rivers Drammenselva and Glomma were similar for many classes of chemicals. An increase in loads for PAHs, PCBs, BPA, TBBPA and PFOS can be seen for all three rivers from 2013 to 2014. Increases were most significant in River Alna for PCBs, PBDEs, SCCPs, BPA and PFOS. For Rivers Drammenselva and Glomma, the most pronounced increases in loads from 2013 to 2014 were for PAHs (by a factor of 1.7-2.0), PCBs (by a factor of 2.0), HBCDD (1.9-2.5), TBBPA (by a factor of 6.3 and 9.5), and for PFOS (by a factor of 1.5-3.3). For SCCPs, one has to bear in mind the high uncertainty related to the analysis for these substances. For other substances such as BPA, TBBPA and PFOS, the estimates of loads are likely to suffer from significant uncertainty as a result of infrequent sampling.

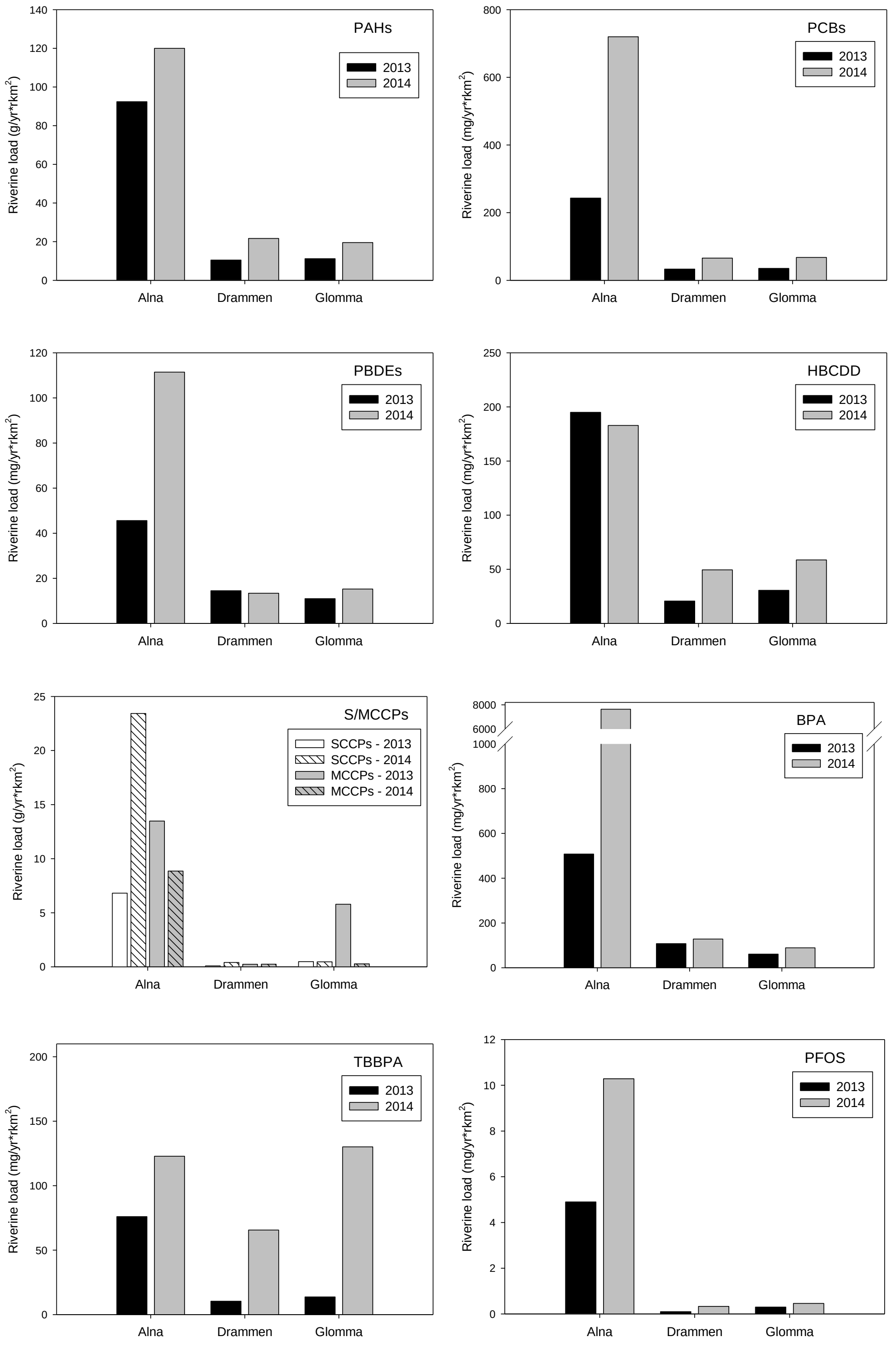


Figure 31. Estimates of river basin surface area-normalised riverine loads of contaminants in Rivers Alna, Drammenselva and Glomma for 2014. When datasets included concentrations below limits of detection, the limit of detection was used to calculate riverine loads.

3.5 Sensor data

Sensor data for turbidity, temperature, pH, and conductivity have been recorded in Rivers Glomma, Alna and Drammenselva since 2013. Such data can be presented and used in many different ways (e.g., Skarbøvik & Roseth 2014). In this report, hourly turbidity records from River Glomma have been used to quantify the uncertainty of infrequent grab samples in rivers. The reporting is based on data for the period April 2013 – summer 2015 in order to get as much data as possible for the analyses.

3.5.1 Sensor data quality as compared to grab samples

In figures 32-33, correlations between turbidity, conductivity and pH from River Glomma at Sarpsfossen waterfall (grab samples), and Baterød water works (sensor data), are shown. Similarly, Figure 34 shows the correlation for turbidity in River Drammenselva. A few grab samples were also collected from the sensor sites in rivers Glomma and Drammen; these are shown as red squares in the graphs.

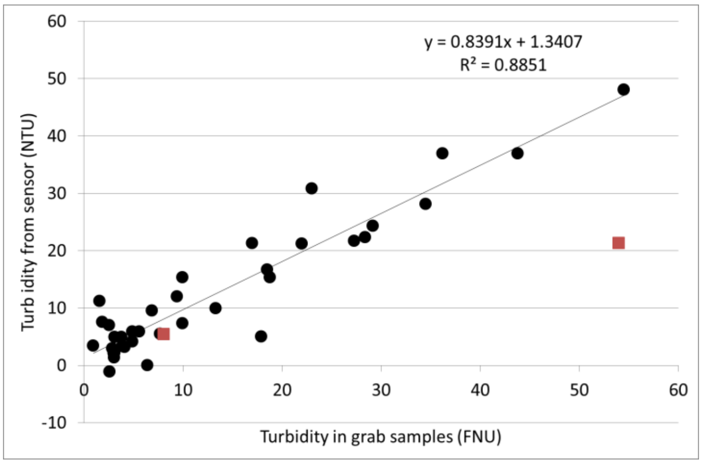


Figure 32. Glomma River: Turbidity from the sensor recordings in Baterød water works and from analyses of the grab samples taken at Sarpsfossen waterfall (black dots) and at the sensor site (red squares).

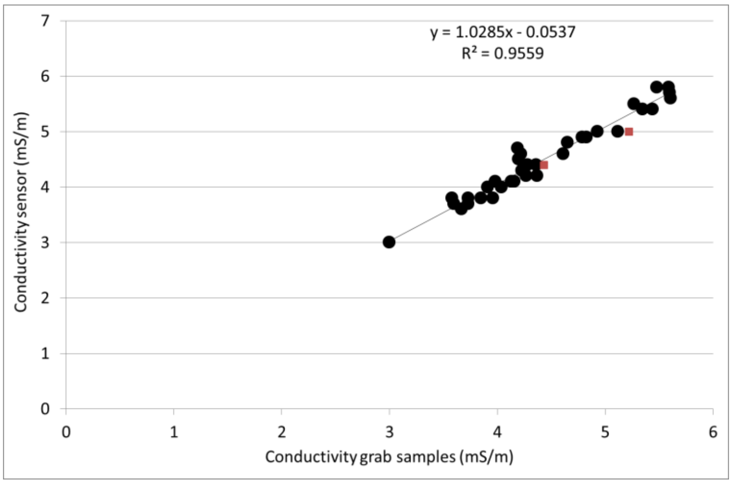


Figure 33. Glomma River: Conductivity from the sensor recordings in Baterød water works and from analyses of the grab samples taken at Sarpsfossen waterfall (black dots) and at the sensor site (red squares).

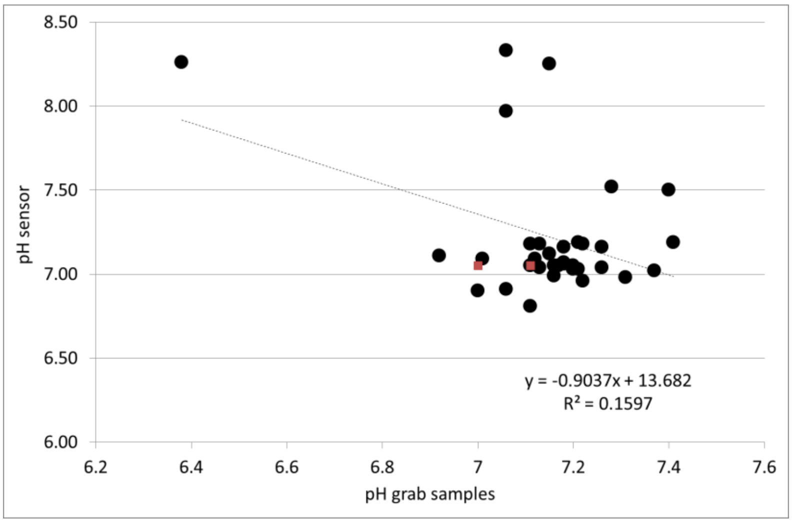


Figure 34. Glomma River: pH from the sensor recordings in Baterød water works and from analyses of the grab samples taken at Sarpsfossen waterfall (black dots) and at the sensor site (red squares).

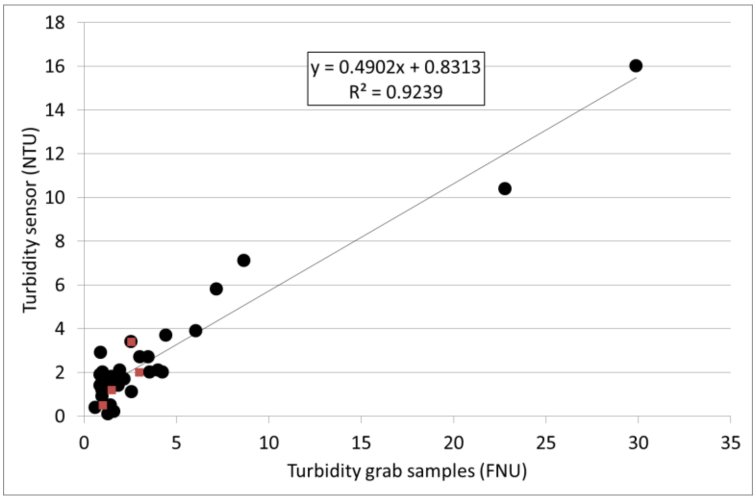


Figure 35. Drammenselva River: Turbidity from the sensor recordings and from analyses of the grab samples at the RID sampling site (black dots) and the sensor site (red squares).

The correlation for conductivity was excellent (R^2 0.96), for turbidity good (R^2 0.89 for Glomma and 0.92 for Drammen), and for pH non-existent. For pH, it should be noted that the observed lack of correlation between in situ-measurements and laboratory measurements is not unusual, since changes in pH may occur during transport and storage of the water bottles, including changes in temperature and loss of CO_2 from the water sample (Hindar et al. 2015). Furthermore, the range in pH was very small; in the grab samples mainly around 7-7.4, whereas the sensor values ranged from about 6.7-8.3.

The above indicates that analyses of conductivity in grab samples can be replaced with sensor recordings, and the same is probably also the case with turbidity. However, the turbidity meter in the Glomma River is located in a part of the river that most probable has less mixing of the water than where the grab samples are collected (at the Sarpsfossen waterfall). This, again, will mean that less suspended sediments are likely to be found in the surface waters of the river, and it is therefore not surprising that the turbidity recordings of the sensor are in general lower than in the grab samples. Also in River Drammenselva the two datasets were not 1:1, despite the R^2 of 0.92. In such large rivers as Glomma and Drammenselva, concentrations can vary from one riverbank to the other. Grab samples were also collected at the sensor locations for comparisons (red squares in the above figures) but these were not many enough to establish a correlation.

3.5.2 Correlation of turbidity data with parameters from grab samples

As shown in Table 20, turbidity as recorded by the sensor in River Glomma correlated well (defined as an R^2 >0.7) with grab samples for the following parameters: Ni, Tot-P, PO_4-P, and SPM. Such correlations reflect that some substances are associated with suspended sediments in the river water. However, substances that often are associated with sediments may not always be so, for example if they derive from industrial effluents upstream. On the other hand, orthophosphate is usually not associated with sediments, but tends to vary with total phosphorus; hence orthophosphate correlated well with turbidity in this study.

Table 20. Correlation (shown as R^2) between turbidity from sensor recordings and grab sample parameters in Glomma River.

Parameter	Correlation with sensor turbidity (R^2)	Equation
As	0.3066	
Cd	0.3412	
Cr	0.4969	
Cu	0.0068	
Ni	0.7024	y = 22.807x - 8.7419
Pb	0.3923*	y = 22.942x + 4.237*
Zn	0.1250	
TN	0.3132	
NH_4-N	0.1360	
NO_3-N	0.2465	
TP**	0.8062	y = 0.8277x - 3.1778
PO_4-P	0.8129	
SPM	0.8594	y = 1.156x - 0.0632
TOC	0.3788	
SiO2	0.3808	
TURB860	0.8851	
Conductivity		

* A better correlation between turbidity and Pb (R^2 of 0.83) was found when one, single datapoint was removed from the series.

** A test was also done between turbidity in grab samples and Tot-P in grab samples: R^2 was 0.9046.

Each correlation was checked visually in graphs and for Pb a correlation of R^2=0.83 was found by removing one, single datapoint. Such outliers can be interesting, as they show days of sampling when the contaminants seem to be less associated with suspended particulate matter.

A possible explanation can be higher effluents from point sources at these occasions, but more investigations will be needed to ascertain this. A similar test was done for an obvious outlier in the copper graph, but the removal of the outlier did not result in a good correlation in this case.

Since the concentrations of zinc have increased in River Glomma, the correlation between this metal and turbidity was tested also in River Drammenselva. R^2 in Drammenselva was 0.49 and therefore somewhat better than in River Glomma (Figure 36). Skarbøvik et al. (2012) correlated grab samples from historical data of the RID Programme in River Numedalslågen, and found an R^2 for Zn vs. SPM of 0.052 in that river. Hence, it is unlikely that Zn correlates well with either turbidity or SPM in any of these three RID rivers.

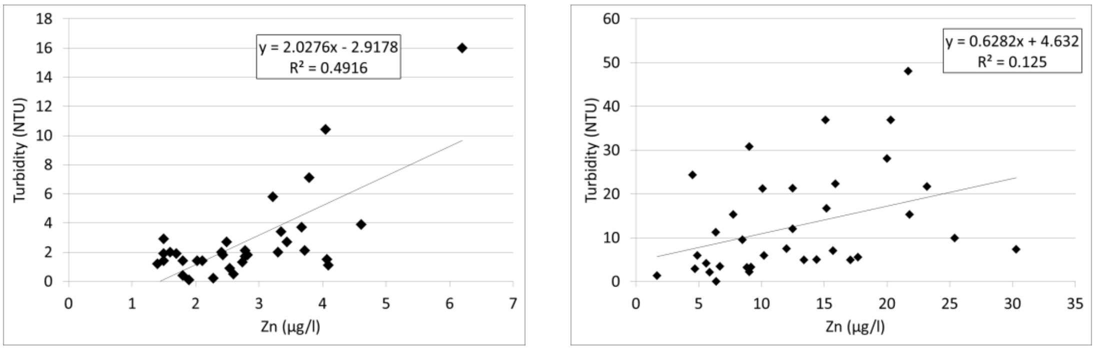


Figure 36. Correlations between turbidity from sensor and zinc concentrations (Zn) in grab samples; River Drammenselva to the left and River Glomma to the right.

3.5.3 Turbidity used to estimate loads (River Glomma)

Since turbidity data exist on an hourly basis, the equations in Table 20 could be used to calculate hourly concentrations of substances that correlate well with turbidity. For the purpose of demonstrating this method, hourly values of SMP, TP and PO_4-P were calculated in River Glomma based on 2013 data.

Where water discharge data exists as hourly values, these can be used to calculate hourly loads. However, hourly water discharge data tends to have several gaps, and it was therefore decided to use daily water discharge data. These were multiplied with daily concentration values, found as the average concentration per day based on 24 hourly concentrations, to arrive at daily load estimates. No other method returns daily load estimates, and the calculation method used in the Norwegian RID programme gives annual loads. Hence, in order to compare the loads calculated using turbidity data with loads calculated using the RID grab samples, monthly loads were calculated as follows:

- Daily loads calculated from turbidity data were added to monthly loads; but this could only be done for five months with complete data series from the turbidity meter (i.e. months with no data gaps).

- Monthly loads were calculated by linear interpolation[1] by using the grab samples from Sarpsfossen water works and daily water discharge data.

Table 21 shows calculations of SPM-, PO_4-P- and TP-load based on the two methods described above.

Table 21. Comparison of SPM-, PO_4-P- and TP-loads derived from the RID grab samples by using the linear interpolation method ("GRAB"); and by using turbidity data ("TURB").

		LOAD (tons/month)				LOAD (kg/month)	
Year	Month	SPM GRAB	SPM TURB	TOTP GRAB	TOTP TURB	PO_4-P GRAB	PO_4-P TURB
2013	5	86 625	125 104	139	189	91	127
2013	8	9 025	1 815	21	10	8	2
2013	9	3 868	488	13	6	4	1
2013	11	24 812	17 313	41	30	23	18
2013	12	25 771	45 233	40	70	22	46
Sum		150 101	189 953	254	305	148	194
% difference		**-27%**		**-20%**		**-31%**	

Preliminary results therefore indicate an overall underestimation of SPM, TP and PO_4-P loads ranging from 20-30 % when using the RID grab samples and linear interpolation, as compared to the turbidity method. Differences are especially pronounced in May and December 2013 when the loads were relatively high. On the other hand, the method based on grab samples returned higher loads in months with low load rates. A factor that needs to be taken into account is that the turbidity meter is located at a river section with lower turbulence than where the grab samples are collected. It is therefore not unlikely that these differences had been even higher if the turbidity meter had been located at the same site as the RID station. A second factor is that the turbidity meter records negative values at low flow. Calibration of the sensor may be needed to avoid these negative values.

3.5.4 Uncertainty of monthly samples for average and maximum concentrations

According to the EU Water Framework Directive (WFD), average and maximum concentrations are used to assess the environmental status of the water bodies. It is therefore of interest to examine the potential error when sampling only 1-5 times per month.

Figure 37 shows the difference between mean, maximum and minimum SPM concentration as derived from hourly turbidity data, and from the RID grab samples. For the latter, there were only one sample in the months July-December, but five samples in May and three in June. The figure illustrates the following:

[1] For more information on this method, see e.g. Skarbøvik et al. 2012.

a) In months with relatively low concentrations (July-October), it seems to be less risk of error in terms of detecting the mean concentration of SPM (and other particle-associated parameters).
b) In months with high concentrations of SPM (May, November and December), the risk of obtaining a wrong mean concentration increases. In practice, the single grab sample can be anywhere between the maximum concentration (grey triangles) and the minimum concentration (grey squares), although the number of days with high concentrations are relatively few as compared to days with lower concentrations.
c) In May, none of the five grab samples were close to the maximum concentration that month, as the maximum concentration based on turbidity was 107 mg/l, and for grab samples only 43 mg/l.

It should be added that River Glomma is a large river. In smaller rivers it is likely that concentrations vary more over time, with an increased risk of errors. The calculations done in Glomma should therefore also be repeated in a smaller river, for example River Alna.

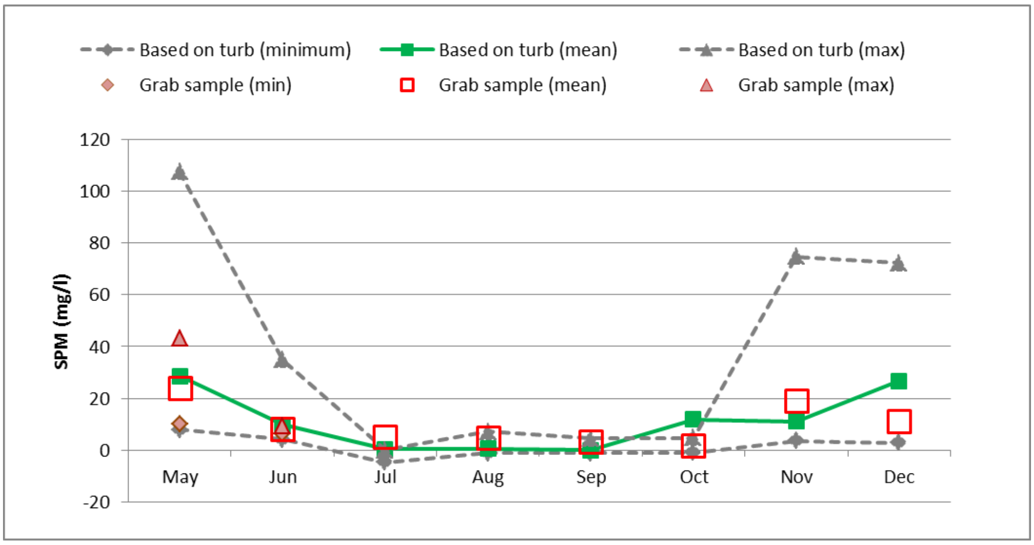


Figure 37. Mean, max and min concentrations of SPM as analysed in grab samples (red indicators) and as derived from turbidity measurements (grey (max, min) and green (mean)).

Based on the same method as described above, mean concentrations were calculated also for TP and Ni in the period May-December 2013 (Figure 38). The differences in mean concentrations were especially high in autumn, with the highest differences in December (for TP 24 µg/l difference; for Ni 0.93 µg/l). When more turbidity data have been collected, these calculations can also be done for mean, maximum and minimum concentrations per year, since annual means is more often used than monthly means when implementing the WFD.

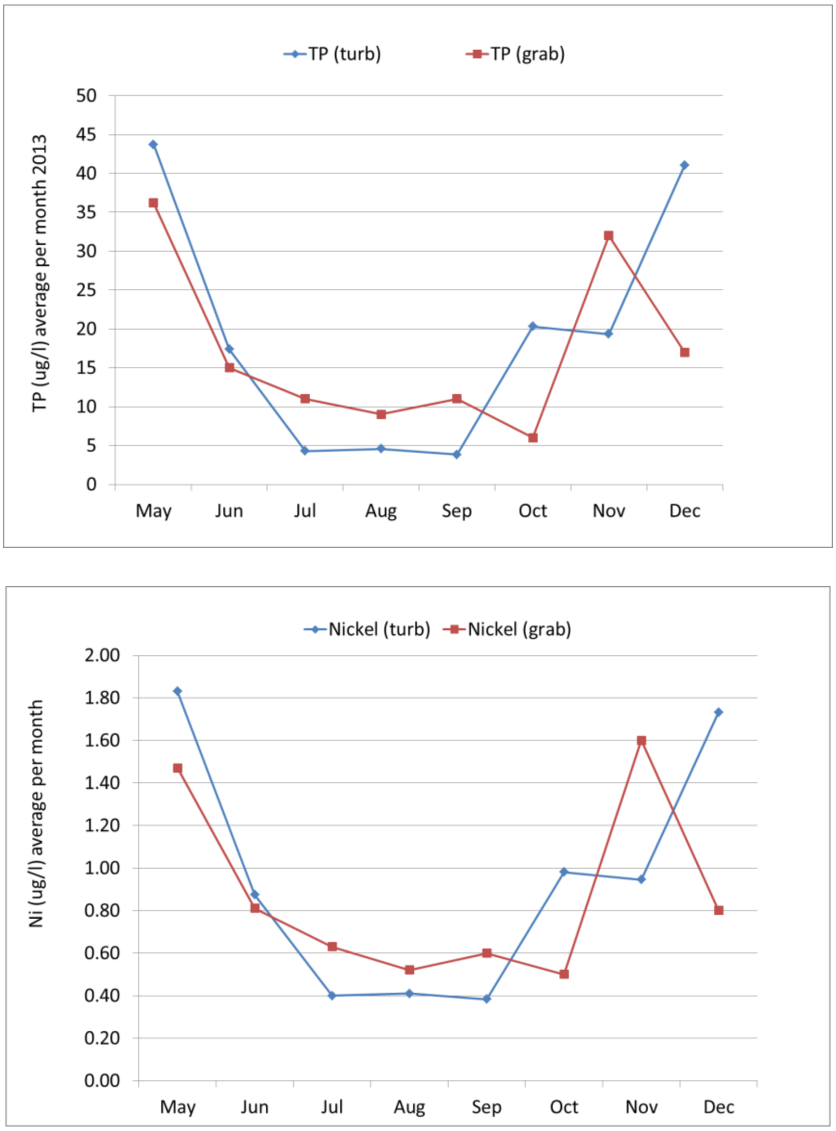


Figure 38. Monthly average concentrations of TP (upper panel) and Ni (lower panel) calculated from correlations with hourly turbidity records ("turb"; blue line) and RID grab samples ("grab"; red line) (May: 5 samples, June: 3 samples, remaining months: 1 sample/month).

4. Conclusions

Climate and water discharge

The year 2014 was the warmest since the recordings started in 1900, with average temperatures 2.2 °C above normal. The precipitation was very close to normal for the country as a whole, but wetter than normal in the southern and eastern parts, and drier than normal in mid-Norway and the northern parts (Gangstø et al. 2014). This resulted in relatively high water discharges in the southern parts of the country in 2014.

Total inputs of nutrients and metals in 2014

Total inputs to coastal Norwegian waters in 2014 were estimated to about 13 200 tonnes of phosphorus, 170 100 tonnes of nitrogen, 485 000 tonnes of silicate, 556 000 tonnes of total organic carbon (TOC) and 780 000 tonnes of suspended particulate matter.

Total metal inputs to the Norwegian coastal areas were estimated to 276 kg of mercury, 3 tonnes of cadmium, 8 tonnes of silver, 29 tonnes of arsenic, 50 tonnes of lead, 72 tonnes of chromium, 129 tonnes of nickel, 795 tonnes of zinc and 1139 tonnes of copper (upper estimates).

Metal concentrations were compared with threshold levels of the EU Water Framework Directive (WFD) or the EQS daughter directive 2013/39/EU where available, or otherwise national thresholds. Levels exceeding or close to the threshold value were only found for the metal copper (Rivers Glomma, Alna, Orreelva, Orkla, Tista, Stjørdalselva, and Pasvikelva).

There were no significant changes in the distribution of sources for neither nutrients nor metals as compared to recent years. Fish farming continues to be a major direct source of nutrients to the sea.

Trends in river nutrient and metal inputs

In 2014, nutrient and particle loads to Skagerrak were generally 25% higher than the long-term mean of 1990-2013. This is almost solely explained by a corresponding higher water discharge in 2014 as compared to the long-term mean. For the three other maritime areas the particle and nutrient loads were close to the long-term mean.

The metal loads in 2014 to the three northernmost maritime areas were lower or equal to the mean load in the 24 former years. In Skagerrak, on the other hand, loads of arsenic, lead, nickel and zinc were higher in 2014 than in the period 1990-2013. Here, also the loads of suspended sediments were high in 2014, reflecting relatively high water discharges as compared to earlier years. The increase in zinc in the Skagerrak region is particularly pronounced, mainly due to an increase in River Glomma in the years 2011-2014.

A more detailed statistical trend analyses of data for the 9 main rivers for the period 1990-2014 showed that:

- Four out of the five Skagerrak rivers showed a statistical increase in water discharge, indicating overall high water discharges in the entire region this year.

- Statistically significant trends in total nitrogen loads were detected in four out of nine rivers. One of those trends was downward (River Vefsna), whereas upward trends were found in Rivers Glomma, Drammenselva and Numedalslågen. As noted above, there is a corresponding statistical significant increase in water discharge in these three rivers.
- Three rivers showed a statistically significant downward trend for nitrate nitrogen (Rivers Skienselva, Otra and Vefsna) and another three for ammonium nitrogen inputs (Rivers Glomma, Orkla and Vefsna).
- Statistically significant long-term downward trends in total phosphorus loads were only detected in River Vefsna. Upward trends in total phosphorus and ortophosphate loads were detected in Rivers Drammenselva and Numedalslågen. However if water discharge is taken into account, no such trends were detected.
- Statistically significant trends in particulate matter loads were detected in two of the nine rivers (Rivers Drammenselva and Numedalslågen). But as for total phosphorus, these trends are explained by increased water discharge.
- Out of the 45 trend tests carried out (5 metals and 9 rivers), 26 showed a statistically significant downward trend in long-term loads while one river (Cu in River Drammenselva) showed an increased trend. In the three northernmost rivers (Rivers Orkla, Vefsna and Altaelva) all the five metal compounds investigated (Cd, Cu, Ni, Pb and Zn) showed a statistically significant downward trend.
- Notable are the clearly visible concentration and load increases in zinc in the River Glomma in the last four years (2011-2014).

Organic contaminants

Contaminant monitoring using a combination of passive sampler deployments and use of continuous flow centrifugation to measure both the freely dissolved concentration as well as the contaminant concentration associated with suspended particulate matter was successful and continued to yield an extensive dataset that was used to estimate riverine discharges of contaminants to sea in 2014. The consecutive deployment of passive sampling devices enabled continuous time-integrated monitoring of concentrations of PAHs, PCBs, PBDEs and HBCDD in water. The sensitivity of the methodology put in place here allowed the estimation of contaminant concentrations at levels below pg/l in some cases. This means a more realistic estimation of riverine fluxes of contaminants can be done than with bottle sampling and limits of detection in the low ng/l range. The monitoring of suspended particulate matter was also suitable for a range of chemicals. It demonstrated that concentrations of contaminants associated with suspended particulate matter can be relatively variable and more knowledge and understanding of these variations is needed.

Additionally, a screening of contaminant levels against legislative thresholds was undertaken by comparing calculated "whole water" concentrations (sum of freely dissolved and that sorbed to suspended particulate matter) of WFD priority pollutants with WFD annual average environmental quality standards (AA-EQS) published in 2013. Estimates of "whole water" concentrations for fluoranthene, benzo[a]pyrene and PFOS were close to or above WFD AA-EQS for all three rivers in 2014. The estimate of "whole water" concentrations for SCCPs in River Alna also approaches WFD AA-EQS values in 2014. All in all, the data from 2014 generally confirms the assessment undertaken in 2013.

The estimation of riverine discharges of contaminants to the sea in 2014 showed that for most chemicals studied, the load from the Alna River was highest when given per km^2 of drainage area. This is in agreement with estimates from 2013. Loads for the Drammen and Glomma rivers were generally similar. One major unknown factor in the estimation of fluxes is the concentration of contaminants sorbed to DOC (not quantified here). The variability in SPM-associated contaminants concentrations also adds significant uncertainty to the flux estimates. Correlating the continuous turbidity measurements with SPM concentrations could, to an extent, help reduce this uncertainty.

Sensor data analyses

Sensors for turbidity, pH, conductivity and temperature have been installed in three rivers (Glomma, Alna, and Drammenselva) since spring 2013. In this report, potential uses of these sensor data have been demonstrated, with particular focus on the use of turbidity data to assess uncertainties related to infrequent grab sampling in the RID programme. The demonstration was done for River Glomma, which is the largest river in Norway. The results showed that monitoring once a month in such a large river may result in an underestimation of loads of particle associated substances of about 25%. Furthermore, the uncertainty of estimating mean concentrations is less than the uncertainty associated with estimating maximum concentrations when sampling only 1-5 times a month. These results need to be further explored, also for smaller rivers, when more quality controlled turbidity data become available through this monitoring programme.

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Appendices

Appendix I The RID objectives

The main objectives of RID are found at www.ospar.org, and listed as follows:

To assess, as accurately as possible, all river-borne and direct inputs of selected pollutants to Convention waters on an annual basis.

To contribute to the implementation of the Joint Assessment and Monitoring Programme (JAMP) by providing data on inputs to Convention waters on a sub-regional and a regional level.

To report these data annually to the OSPAR Commission and:

a. to review these data periodically with a view to determining temporal trends;

b. to review on a regular basis, to be determined by the Hazardous Substances and Eutrophication Committee (HASEC), whether RID requires revision.

Each Contracting Party bordering the maritime area should:

a. aim to monitor on a regular basis at least 90% of the inputs of each selected pollutant. If this is not achievable due to a high number of rivers draining to the sea, modelling/extrapolation can be used to ensure sufficient coverage;

b. provide, for a selection of their rivers, information on the annual mean/median concentration of pollutants resulting from the monitoring according to paragraph 2.4a;

c. as far as possible, estimate inputs from unmonitored areas complementing the percentage monitored (see paragraph 2.4a) towards 100 %;

d. take opportunities to adapt their RID monitoring programmes to progress (cf. Section 12) and keep the monitoring effort proportionate, taking into account changes in risk.

The entire guidelines and principles of the RID Programme can be found at www.ospar.org, under Agreements.

Appendix II Personnel

In 2015, Anders Gjørwad Hagen and Øyvind Kaste (both NIVA) have co-ordinated the RID programme. Other co-workers at NIVA include John Rune Selvik (direct discharges), Tore Høgåsen (databases, calculation of riverine loads, TEOTIL), Ian Allan, Sissel Ranneklev, Marthe Torunn Solhaug Jenssen (organic contaminants), Liv Bente Skancke (quality assurance of sampling and chemical analyses; data preparation and calculations of sensor records), Øyvind Garmo (passive sampling metals), Odd Arne Segtnan Skogan (sensor monitoring) and Marit Villø, Tomas A. Blakseth and Kine Bæk (contact persons at the NIVA laboratory).

At NIBIO, Eva Skarbøvik has carried out data analyses and been the main responsible for writing the 2014 report. Per Stålnacke and Inga Greipsland have carried out and reported the statistical trend analyses.

At NVE, Trine Fjeldstad has been responsible for the local sampling programmes, Stein Beldring has carried out the hydrological modelling, and Morten N. Due has been the administrative contact.

Overall quality assurance of the annual report has been carried out by Øyvind Kaste, NIVA.

The sampling has been performed by several fieldworkers; their names are given below.

Personnel for water sampling in the rivers monitored monthly or more often:	Personnel for water sampling in the 36 rivers with quarterly sampling:
Nils Haakensen (Glomma) Jarle Molvær og Jan Magnusson (Alna) Vibeke Svenne/Trine Lise Sørensen (Drammenselva) Sigmund Lekven (Numedalslågen) Birgitte Lind/Jon Klonteig (Skienselva) Ellen Grethe Ruud Åtland (Otra) Einar Helland (Orre) Geir Ove Henden (Vosso) Joar Skauge (Orkla) Vebjørn Opdahl (Vefsna) Anders Bjordal (Altaelva)	Nils Haakensen Olav Smestad Ellen Grethe Ruud Åtland Jan Stokkeland Einar Helland Svein Gitle Tangen Odd Birger Nilsen Rune Roalkvam Vanessa Venema/Kjell Arne Granberg Leif Magnus Dale Inger Moe Øystein Nøtsund/Ronny Løland Hallgeir Hansen Bjarne Stangvik Gudmund Kårvatn Daniel Melkersen/Harald Viken Asbjørn Bjerkan/Arild Helberg Vebjørn Opdahl Egil Moen Øystein Iselvmo Einar Pettersen

Sub-contractors and data sources include the Norwegian Meteorological Institute (met.no) for precipitation and temperature data; Statistics Norway (SSB) for effluents from wastewater treatment plants with a connection of > 50 p.e. (person equivalents); the Norwegian Environment Agency for data on effluents from industrial plants; the Directorate of Fisheries (Fdir) for data on fish farming.

Appendix III: Catchment information for 47 monitored rivers

Maps of land cover

The main types of land cover in Norway are forest, agriculture and other surfaces impacted by human activities, mountains and mountain plateaus, and lakes and wetlands (Figure A-III-1). Mountains and forests are the most important land cover categories, and this is reflected in the land cover distribution of the 11 rivers monitored monthly (Figure A-III-2).

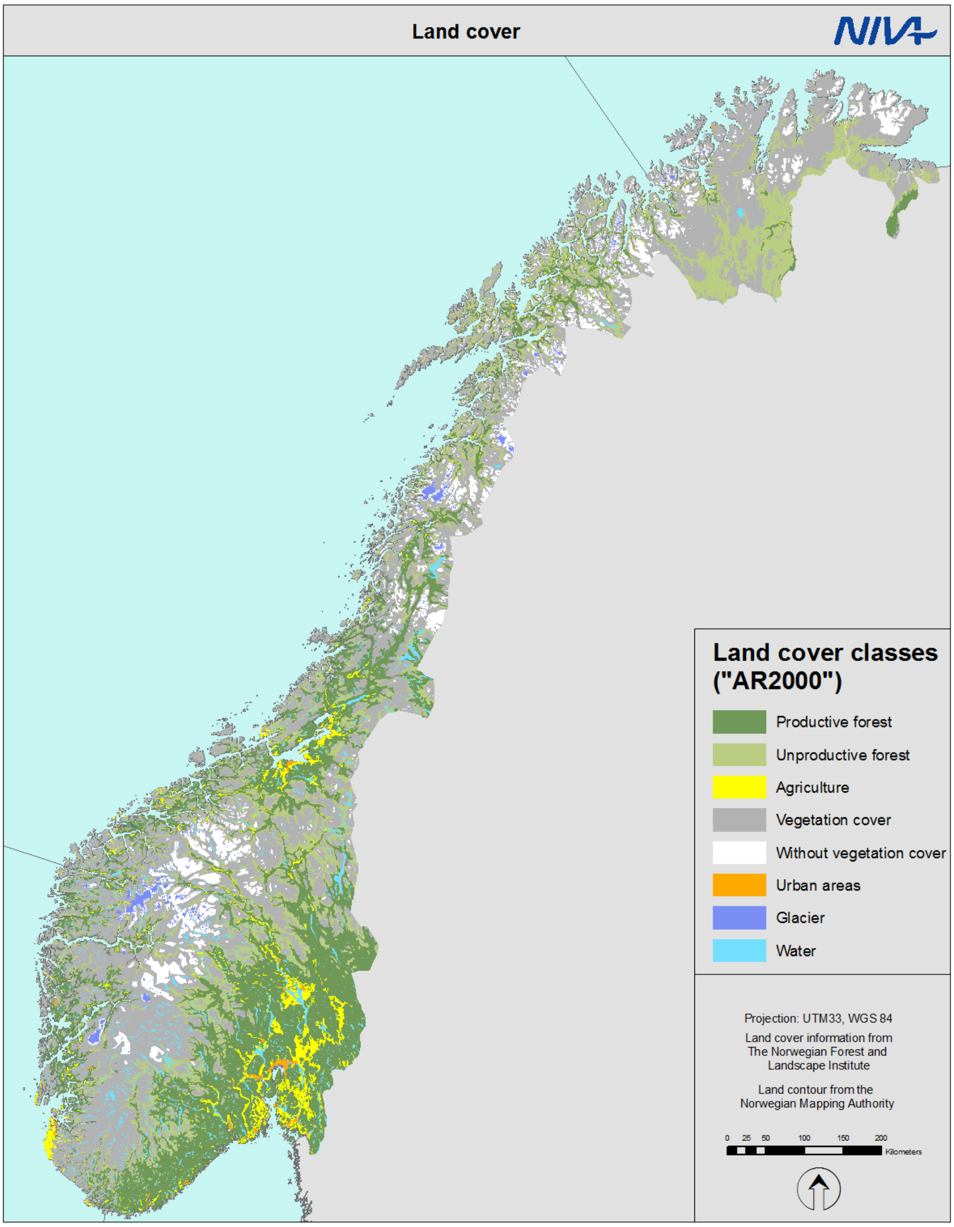

Figure A-III-1. Land cover map of Norway. See also Figure A-III-2 in which the land use in the catchments of the 11 rivers monitored monthly is shown.

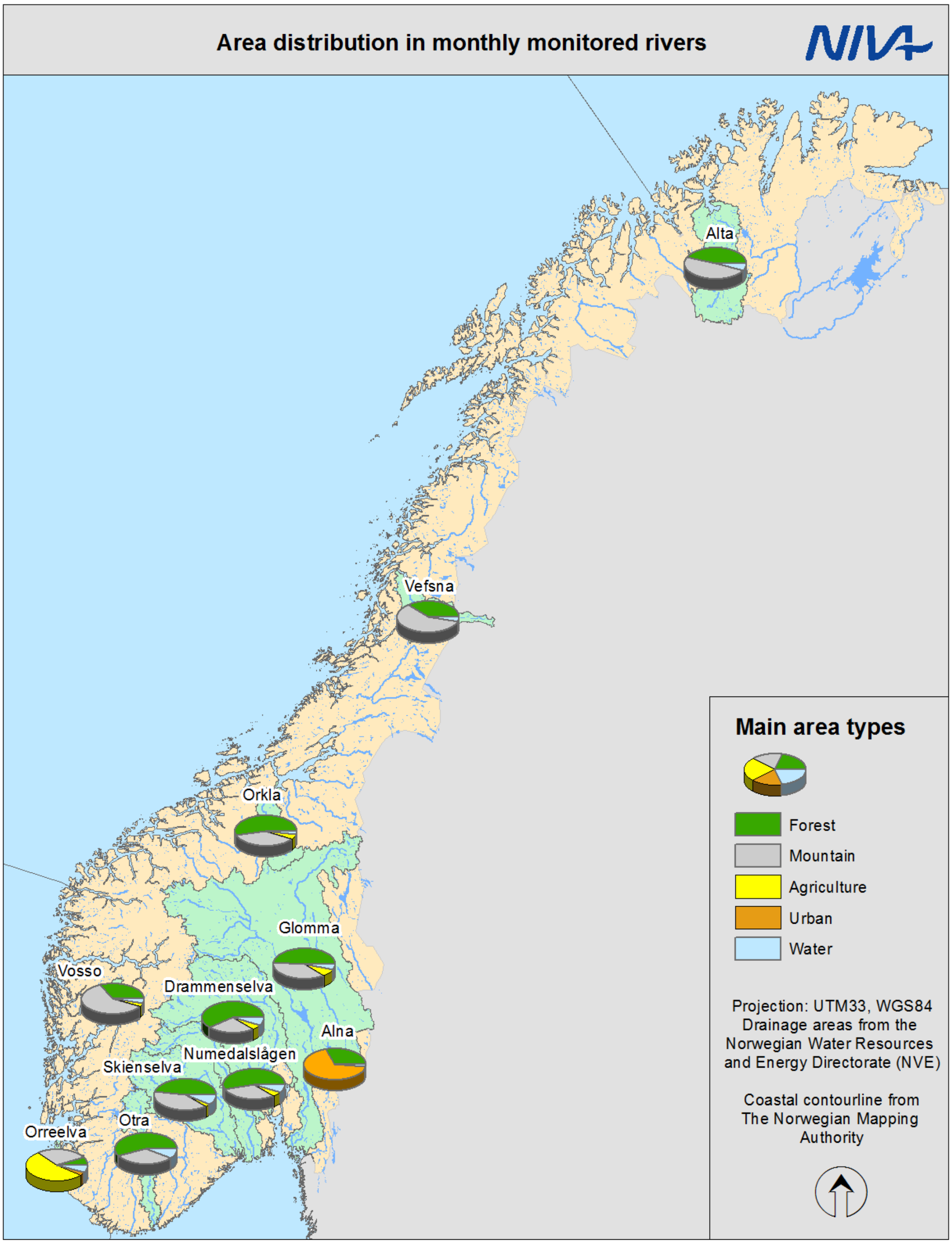

Figure A.III-2. Land use in the catchment areas of the 11 rivers monitored monthly. 'Water' refers to lakes in the catchment; 'Mountain' includes moors and mountain plateaus not covered by forest. Based on data from NIBIO.

Catchment information for rivers monitored monthly

The rivers are listed in Table A-III-1. Rivers Glomma, Alna, Drammenselva, Numedalslågen, Skienselva, and Otra drain into the Skagerrak, the part of the North Sea which is considered to be most susceptible to pollution. Apart from River Alna, that was added to the programme in 2013, these rivers also represent the major load bearing rivers in Norway. Of these, River

Glomma is the largest river in Norway, with a catchment area of about 41 200 km^2, or about 13 % of the total land area in Norway. River Drammenselva has the third largest catchment area of Norwegian rivers with its 17 034 km^2.

Rivers Orreelva and Vosso drain into the coastal area of the North Sea (Coastal area II). River Orreelva is a relatively small river with a catchment area of only 105 km^2, and an average flow of about 4 m^3/s, but it is included in the RID Programme since it drains one of the most intensive agricultural areas in Norway. More than 30% of its drainage area is covered by agricultural land, and discharges from manure stores and silos together with runoff from heavily manured fields cause eutrophication and problems with toxic algal blooms.

River Vosso has been in the RID Programme since its start in 1990. Until 2004 it was sampled once a year, and in the period 2004-2007 four times a year. From 2008 it was exchanged with River Suldalslågen (see below) as a main river with monthly samplings. River Vosso was chosen due to the low levels of pressures in the catchment. It has a low population density of 1.1 persons/km^2, and only 3 % of the catchment area is covered by agricultural land. The rest of the catchment is mainly mountains and forested areas.

River Suldalslågen was sampled as a main river up until 2007, but from 2008 this river has been sampled only four times a year. The reason for this is that the river is heavily modified by hydropower developments, and water from large parts of the catchment has been diverted to an adjacent catchment. The decision to change the sampling here was taken based on a weighing of advantages of long time series and disadvantages of continuing to sample a river which is very uncharacteristic. Since it was one of the main rivers from 1990-2007, its catchment characteristics are nevertheless given here: It has a drainage area of 1457 km^2 and a population density of only 2.4 persons/km^2. There are no industrial units reporting discharges of nitrogen or phosphorus from the catchment. The pressures are, thus, mainly linked to the aforementioned hydropower.

River Alna was sampled monthly for the first time in 2013. This is a relatively small river with only 69 km^2 catchment area, but it drains urban areas and is therefore of interest, not least in terms of metals and organic pollutants. The majority of the catchment area (68%) is urban, the rest is covered by forest. Changes in the rivers monitored monthly have implications for the comparisons of this group of rivers with former years, and for the long-term database. However, most year-to-year comparisons are done on all rivers or all inputs, and will therefore not be much affected by this change.

Rivers Orkla and Vefsna drain into the Norwegian Sea (Coastal area III). Agricultural land occupies 4 and 8 % of their catchment areas, respectively. Farming in this part of the country is less intensive as compared to the Orre area. More important are abandoned mines in the upper part of the River Orkla watercourse. Several other rivers in this area may also receive pollution from abandoned mines (heavy metals). These two rivers have, however, no reported industrial activity discharging nitrogen or phosphorus.

The last of the main rivers, River Alta is with its population density of only 0.3 persons per km^2 and no industrial plants reporting discharges, selected as the second of the two unpolluted river systems, although it is, as River Suldalslågen, affected by hydropower development. The river drains into the Barents Sea.

The ten watercourses represent river systems typical for different parts of the country. As such they are very useful when estimating loads of comparable rivers with less data than the main rivers. All rivers except River Orreelva are to varying degrees modified for hydropower production.

Table A-III-1. The 11 main rivers, their coastal area, catchment size and long-term average flow.

Discharge area	Name of river	Catchment area (km^2)	Long-term average flow (1000 m^3/day)*
I. Skagerrak	Glomma	41918	61347
	Alna	69	43**
	Drammenselva	17034	26752
	Numedalslågen	5577	10173
	Skienselva	10772	23540
	Otra	3738	12863
II. North Sea	Orreelva	105	430
	Vosso (from 2008)	1492	2738
III. Norwegian Sea	Orkla	3053	3873
	Vefsna	4122	14255
IV. Barents Sea	Alta	7373	7573

** For the 30-year normal 1961-1990; at the water quality sampling points.*

** 30-year normal is not available, the figure for Alna is therefore based on an annual mean reported by NVE (The Norwegian Water Resources and Energy Directorate).

Catchment information for rivers monitored quarterly - Tributary Rivers
A list of the tributary rivers is given in Table A-III-2.

The average size of the catchment area of the rivers monitored four times a year is 2380 km^2, but the size varies from River Vikedalselva with its 118 km^2, to the second largest drainage basin in Norway, River Pasvikelva with a drainage basin of 18404 km^2.

Land use varies considerably, as shown in Figure A-III-1. As an example, Rivers Figgjo and Tista have the highest coverage of agricultural land (31 and 12%, respectively), whereas some of the rivers have no or insignificant agricultural activities in their drainage basins (e.g. Rivers Ulla, Røssåga, Målselv, Tana and Pasvikelva). Some catchments, such as Rivers Lyseelva, Årdalselva and Ulla in the west; and River Pasvikelva in the north, are more or less entirely dominated by mountains, moors, and mountain plateaus.

There is also considerable variation in population density, from rivers in the west and north with less than one inhabitant per km^2, to rivers with larger towns and villages with up to 100 or more inhabitants per km^2. Population density decreases in general from south to north in Norway. The average population density of the 36 river catchments amounts to about 14 inhabitants per km^2, whereas the average density in the main river catchments is about 20 inhabitants per km^2.

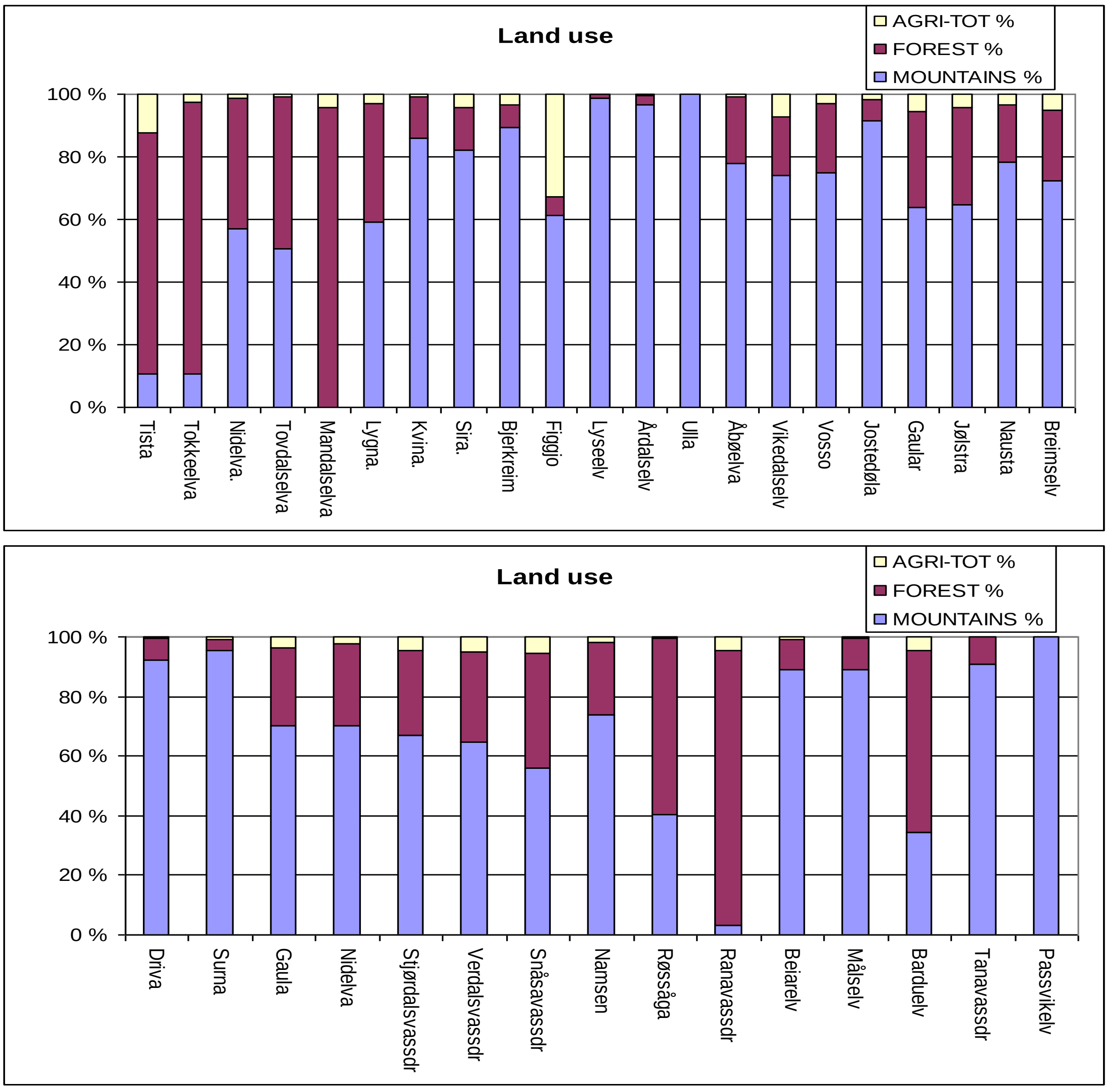

Figure A-III-1. Land use distribution in the catchment areas of the 36 rivers monitored quarterly. "Agri-tot" means total agricultural land. "Mountains" include moors and mountain plateaus not covered by forest.

Table A-III-2. River basin characteristics for the 36 rivers monitored quarterly. Discharge Q is based on the 1961-1990 mean (from NVE).

Official Norwegian river code (NVE)	River	Basin area (km^2)	Area upstream samplings site (km^2)	Normal Q (10^6 m^3/yr)
001	Tista	1588	1582	721
017	Tokkeelva	1238	1200	1042
019	Nidelva	4025	4020	3783
020	Tovdalselva	1856	1854	1984
022	Mandalselva	1809	1800	2624
024	Lygna	664	660	1005
025	Kvina	1445	1140	2625
026	Sira	1916	1872	3589
027	Bjerkreimselva	705	704	1727
028	Figgjo	229	218	361
031	Lyseelva	182	182	425
033	Årdalselva	519	516	1332
035	Ulla	393	393	1034
035	Saudaelva	353	353	946
036	Suldalslågen	1457	1457	6690
038	Vikedalselva	118	117	298
062	Vosso	1492	1465	2738
076	Jostedøla	865	864	1855
083	Gaular	627	625	1568
084	Jølstra	714	709	1673
084	Nausta	277	273	714
087	Breimselva	636	634	1364
109	Driva	2487	2435	2188
112	Surna	1200	1200	1816
122	Gaula	3659	3650	3046
123	Nidelva	3110	3100	3482
124	Stjørdalsvassdraget	2117	2117	2570
127	Verdalsvassdraget	1472	1472	1857
128	Snåsavassdraget	1095	1088	1376
139	Namsen	1124	1118	1376
155	Røssåga	2092	2087	2995
156	Ranavassdraget	3847	3846	5447
161	Beiaren	1064	875	1513
196	Målselv	3239	3200	2932
196	Barduelva	2906	2906	2594
234	Tanavassdraget	16389	15713	5944
244	Pasvikelva	18404	18400	5398

Appendix IV Methodology, supplementary information

Maritime areas

In 2014, the Norwegian Environment Agency decided to change the borders between the two northernmost seas, to coincide with Norwegian management regions. Hence, from the 2014 data reporting onwards, the border between the Norwegian sea and the Barents Sea was moved from the county border between Troms and Finnmark to south of Lofoten and Vesterålen (68°15'N). However, the data reported to OSPAR follow the same borders as earlier.

Selection of rivers and sampling frequency

For practical and economic reasons it is not possible to monitor all rivers that drain into the coastal waters of Norway. Hence, the Norwegian RID programme operates with three main groups of monitored rivers:

- Rivers monitored monthly or more often;
- Rivers monitored quarterly (since 2004);
- Rivers monitored once a year in the period of 1990-2003.

Ten rivers have been monitored monthly or more often in the entire monitoring period (1990-2013). These include the assumedly eight most load-bearing rivers in the country, which are Rivers Glomma, Drammenselva, Numedalslågen, Skienselva, Otra, Orreelva, Orkla and Vefsna. In addition, two relatively "unpolluted" rivers have been included for comparison purposes. Presently these are Rivers Vosso and Alta. Of these, River Vosso was only included in the 'group' of monthly monitored rivers in 2008/2009, when it replaced River Suldalslågen. In 2013 an additional river, River Alna, was included in this group, as an example of a river draining mainly urban areas. Consequently, 11 rivers were monitored monthly in 2013.

The number of rivers monitored four times a year since 2004 is 36. These rivers have not changed in the period of 2004-2013. The number of rivers monitored once a year in the period of 1990-2003 varies between 126 and 145. One of these rivers was River Alna, which has been monitored monthly since 2013. Since it has been of special importance to estimate the major loads to the Skagerrak maritime area, a proportionally higher number of rivers have been chosen for this part of the country.

Sampling methodology and sampling sites

The sites are located in regions of unidirectional flow (no back eddies). In order to ensure as uniform water quality as possible, monitoring is carried out at sites where the water is well mixed, e.g. at or immediately downstream a weir, in waterfalls, rapids or in channels in connection with hydroelectric power stations. Sampling sites are located as close to the freshwater limit as possible, without being influenced by seawater.

Table A-IV-1 gives the coordinates of the sampling stations. For quality assurance reasons, the sampling sites have been documented by use of photographs. This, together with the coordinates, will ensure continuity in the event that sampling personnel changes.

Table A-IV-1. Coordinates of the 47 sampling points.					
Regine No	RID-ID	Station name	Latitude	Longitude	RID-Region
002.A51	2	Glomma at Sarpsfoss*	59.27800	11.13400	Skagerrak
006.2Z	8	Alna	59.90461	10.79164	
012.A3	15	Drammenselva*	59.75399	10.00903	
015.A1	18	Numedalslågen	59.08627	10.06962	
016.A221	20	Skienselva	59.19900	9.61100	
021.A11	26	Otra	58.18742	7.95411	
028.4A	37	Orreelva	58.73143	5.52936	North Sea
062.B0	64	Vosso (Bolstadelvi)	60.64800	6.00000	
121.A41	100	Orkla	63.20100	9.77300	Norwegian Sea
151.A4	115	Vefsna	65.74900	13.23900	
212.A0	140	Altaelva	69.90100	23.28700	Barents Sea
001.A6	1	Tista	59,12783	11.44436	Skagerrak
017.A1	21	Tokkeelva	58.87600	9.35400	
019.A230	24	Nidelv (Rykene)	58.40100	8.64200	
020.A12	25	Tovdalselva	58.21559	8.11668	
022.A5	28	Mandalselva	58.14300	7.54604	
024.B120	30	Lyngdalselva	58.16300	7.08798	North Sea
025.AA	31	Kvina	58.32020	6.97023	
026.C	32	Sira	58.41367	6.65669	
027.A1	35	Bjerkreimselva	58.47894	5.99530	
028.A3	38	Figgjoelva	58.79168	5.59780	
031.AA0	44	Lyseelva	59.05696	6.65835	
032.4B1	45	Årdalselva	59.08100	6.12500	
035.A21	47	Ulladalsåna (Ulla)	59.33000	6.45000	
035.721	49	Saudaelva	59.38900	6.21800	
036.A21	48	Suldalslågen	59.48200	6.26000	
038.A0	51	Vikedalselva	59.49958	5.91030	
076.A0	75	Jostedøla	61.41333	7.28025	
083.A0	78	Gaular	61.37000	5.68800	
084.A2	79	Jølstra	61.45170	5.85766	
084.7A0	80	Nausta	61.51681	5.72318	
087.A221	84	Gloppenelva (Breimselva)	61.76500	6.21300	
109.A0	95	Driva	62.66900	8.57100	Norwegian Sea
112.A0	98	Surna	62.97550	8.74262	
122.A24	103	Gaula	63.28600	10.27000	
123.A2	104	Nidelva(Tr.heim)	63.43300	10.40700	
124.A21	106	Stjørdalselva	63.44900	10.99300	
127.A0	108	Verdalselva	63.79200	11.47800	
128.A1	110	Snåsavassdraget	64.01900	11.50700	
139.A50	112	Namsen	64.44100	11.81900	
155.A0	119	Røssåga	66.10900	13.80700	
156.A0	122	Ranaelva	66.32300	14.17700	
161.B4	124	Beiarelva	66.99100	14.75000	
196.B2	132	Målselv	69.03600	18.66600	Barents Sea**
196.AA3	133	Barduelva	69.04300	18.59500	
234.B41	150	Tanaelva	70.23000	28.17400	Barents Sea ***
246.A5	153	Pasvikelva	69.50100	30.11600	

* Stations for sensors and organic contaminants (only CFC in Drammenselva) have the following co-ordinates: River Drammenselva: 59.75570; 9.99438; River Glomma at Baterød: 59.30725; 11.13475
** Border from 2014 onwards; *** Former border (as found in the 1990-2013-reporting)

Analytical methods and detection limits

Table A-IV-3 gives the analytical methods and detection limits used.

Table A-IV-3. Analytical methods and limits of detection for parameters included in the sampling programme in 2013.

Parameter	Detection limit	Analytical Methods (NS: Norwegian Standard)
pH		NS 4720
Conductivity (mS/m)	0.05	NS-ISO 7888
Turbidity (FNU)	0.05	NS-EN ISO 7027
Suspended particulate matter (SPM) (mg/L)	0.2	NS 4733 modified
Total Organic Carbon (TOC) (mg C/L)	0.1	NS-ISO 8245
Total phosphorus (µg P/L)	1	NS 4725 - Peroxidisulphate oxidation method
Orthophosphate (PO4-P) (µg P/L)	1	NS 4724 - Automated molybdate method
Total nitrogen (µg N/L)	10	NS 4743 - Peroxidisulphate oxidation method
Nitrate (NO_3-N) (µg N/L)	1	NS-EN ISO 10304-1
Ammonium (NH_4-N) (µg N/L)	2	NS-EN ISO 14911
Silicate (SiO_2) (Si/ICP; mg Si/L)	0.02	ISO 11885 + NIVA's accredited method E9-5
Silver (Ag) (µg Ag/L)	0.05	NS-EN ISO 17294-1 and NS EN ISO 17294-2
Arsenic (As) (µg As/L)	0.05	NS-EN ISO 17294-1 and NS EN ISO 17294-2
Cadmium (Cd) (µg Cd/L)	0.005	NS-EN ISO 17294-1 and NS EN ISO 17294-2
Chromium (Cr) (µg Cr/L)	0.1	NS-EN ISO 17294-1 and NS EN ISO 17294-2
Copper (Cu) (µg Cu/L)	0.01	NS-EN ISO 17294-1 and NS EN ISO 17294-2
Mercury (Hg) (µg Hg/L)	0.001	NS-EN ISO 12846
Nickel (Ni) (µg Ni/L)	0.05	NS-EN ISO 17294-1 and NS EN ISO 17294-2
Lead (Pb) (µg Pb/L)	0.005	NS-EN ISO 17294-1 and NS EN ISO 17294-2
Zinc (Zn) (µg Zn/L)	0.05	NS-EN ISO 17294-1 and NS EN ISO 17294-2

Water discharge and hydrological modelling

For the 11 main rivers, daily water discharge measurements were, as in former years, used for the calculation of loads. Since the discharge monitoring stations are not located at the same site as the water sampling is conducted (except in River Alna), the water discharge at the water quality sampling sites were calculated by up- or downscaling, proportional to the drainage areas.

For the 36 rivers monitored quarterly, as well as the remaining 108 rivers from the former RID studies, water discharge was simulated with a spatially distributed version of the HBV-model (Beldring *et al.*, 2003). The use of this model was introduced in 2004. Earlier, the water discharge in the then 145 rivers was calculated based on the 30-year average, and adjusted with precipitation data for the actual year. The results from the spatially-distributed HBV are transferred to TEOTIL for use in the load estimates. Smaller response units ('regine-units') have been introduced in TEOTIL in order to improve load estimates for smaller basins (tributaries).

The gridded HBV-model performs water balance calculations for square grid-cell landscape elements characterised by their altitude and land use. Each grid cell may be divided into two land-use zones with different vegetation cover, a lake area and a glacier area. The model is run with daily time steps, using precipitation and air temperature data as inputs. It has components for accumulation, sub-grid scale distribution and ablation of snow, interception storage, sub-grid scale distribution of soil moisture storage, evapotranspiration, groundwater storage and runoff response, lake evaporation and glacier mass balance. Potential evapotranspiration is a function of air temperature; however, the effects of seasonally varying vegetation characteristics are considered. The algorithms of the model were described by Bergström (1995) and Sælthun (1996). The model is spatially distributed in that every model element has unique characteristics which determine its parameters, input data are distributed, water balance computations are performed separately for each model element, and finally, only those parts of the model structure which are necessary are used for each element. When watershed boundaries are defined, runoff from the individual model grid cells is sent to the respective basin outlets.

The parameter values assigned to the computational elements of the precipitation-runoff model should reflect the fact that hydrological processes are sensitive to spatial variations in topography, soil properties and vegetation. As the Norwegian landscape is dominated by shallow surface deposits overlying rather impermeable bedrock, the capacity for subsurface storage of water is small (Beldring, 2002). Areas with low capacity for soil water storage will be depleted faster and reduced evapotranspiration caused by moisture stress shows up earlier than in areas with high capacity for soil water storage (Zhu and Mackay, 2001). Vegetation characteristics such as stand height and leaf area index influence the water balance at different time scales through their control on evapotranspiration, snow accumulation and snow melt (Matheussen *et al.*, 2000). The following land-use classes were used for describing the properties of the 1-km^2 landscape elements of the model: (i) areas above the tree line with extremely sparse vegetation, mostly lichens, mosses and grasses; (ii) areas above the tree line with grass, heather, shrubs or dwarf trees; (iii) areas below the tree line with sub-alpine forests; (iv) lowland areas with coniferous or deciduous forests; and (v) non-forested areas below the tree line. The model was run with specific parameters for each land use class controlling snow processes, interception storage, evapotranspiration and subsurface moisture storage and runoff generation. Lake evaporation and glacier mass balance were controlled by parameters with global values.

A regionally applicable set of parameters was determined by calibrating the model with the restriction that the same parameter values are used for all computational elements of the model that fall into the same class for land surface properties. This calibration procedure rests on the hypothesis that model elements with identical landscape characteristics have similar hydrological behaviour, and should consequently be assigned the same parameter values. The grid cells should represent the significant and systematic variations in the properties of the land surface, and representative (typical) parameter values must be applied for different classes of soil and vegetation types, lakes and glaciers (Gottschalk *et al.*, 2001). The model was calibrated using available information about climate and hydrological processes from all gauged basins in Norway with reliable observations, and parameter values were transferred to other basins based on the classification of landscape characteristics. Several automatic calibration procedures, which use an optimisation algorithm to find those values of model parameters that minimise or maximise, as appropriate, an objective function or statistic of the residuals between model simulated outputs and observed watershed output, have been developed. The nonlinear parameter estimation method PEST (Doherty *et al.*, 1998) was used. PEST adjusts the parameters of a model between specified lower and upper bounds until the sum of squares of residuals between selected model outputs and a complementary set of observed data are reduced to a minimum. A multi-criteria calibration strategy was applied, where the residuals between model simulated and observed monthly runoff from several basins located in areas with different runoff regimes and landscape characteristics were considered simultaneously.

Precipitation and temperature values for the model grid cells were determined by inverse distance interpolation of observations from the closest precipitation stations and temperature stations. Differences in precipitation and temperature caused by elevation were corrected by precipitation-altitude gradients and temperature lapse rates determined by the Norwegian Meteorological Institute. There is considerable uncertainty with regard to the variations of precipitation with altitude in the mountainous terrain of Norway, and this is probably the major source of uncertainty in the stream flow simulations. The precipitation-altitude gradients were reduced above the altitude of the coastal mountain ranges in western and northern Norway, as drying out of ascending air occurs in high mountain areas due to orographically induced precipitation (Daly *et al.,* 1994). These mountain ranges release most of the precipitation associated with the eastward-migrating extra tropical storm tracks that dominate the weather in Norway. Figure A-IV-1 shows the spatial distribution of mean annual runoff (mm/year) for Norway for the period 1961-1990. The Norwegian Water Resources and Energy Directorate (NVE) performs this modelling.

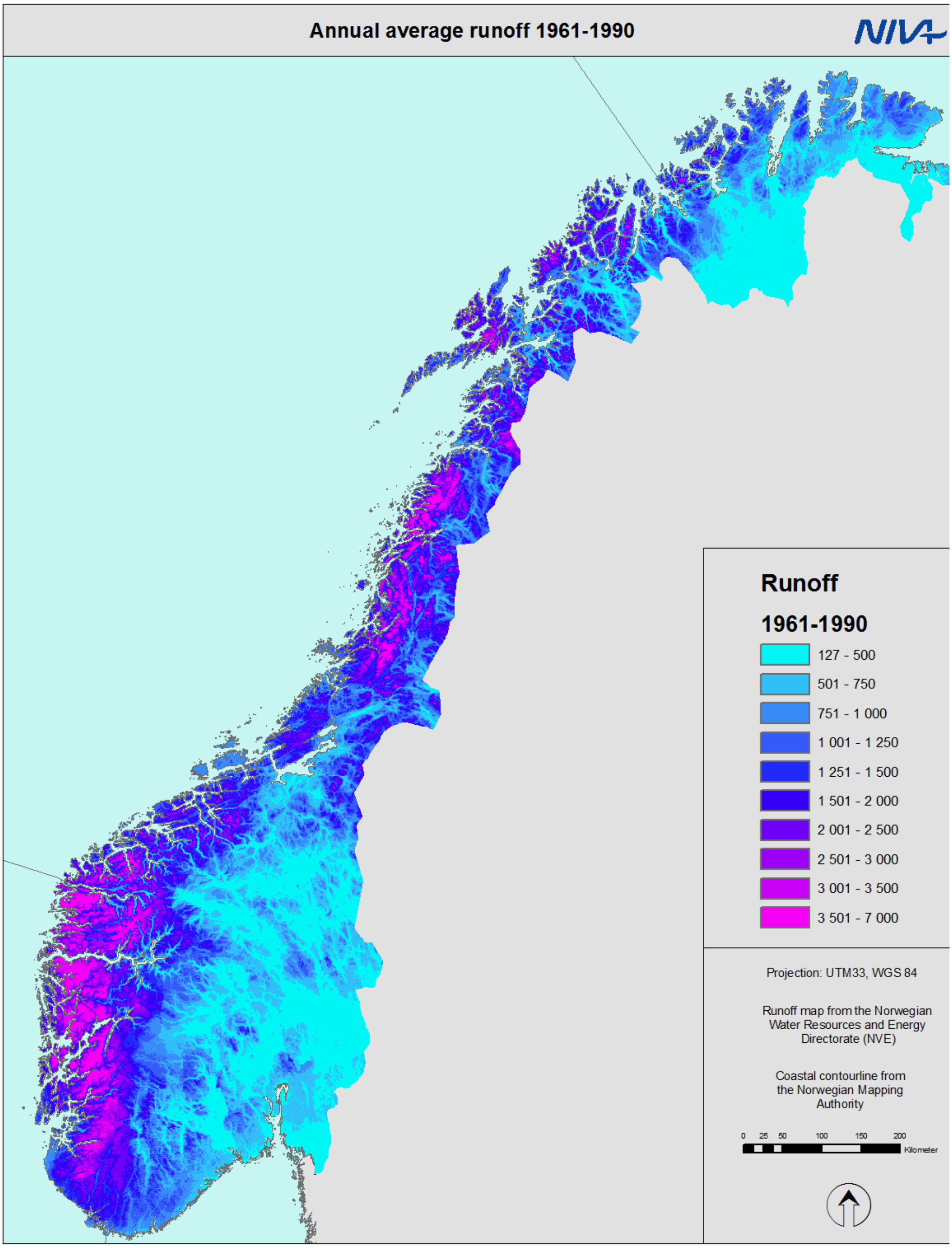

Figure A-IV-1. Average annual runoff (mm/year) for Norway for the period 1961-1990.

Direct discharges to the sea

The direct discharges comprise point source discharges in unmonitored areas. The estimates are based on national statistical information, including:

- Sewage: Municipal wastewater and scattered dwellings (Statistics Norway - SSB / the KOSTRA Database);
- Industry: the database "Forurensning" from the Norwegian Environment Agency.
- Aquaculture: Nutrients (from the Directorate of Fisheries / the ALTINN-database (altinn.no)) and copper (based on sales statistics of antifouling products made available by the Norwegian Environment Agency)

Sewage effluents

Statistics Norway (SSB) is responsible for the annual registration of data from wastewater treatment plants in the country. Approximately 50% of the Norwegian population is connected to advanced treatment plants with high efficiency of phosphorus or both phosphorus and nitrogen treatment. The rest of the population is connected to treatment plants with simpler primary treatment (42%) or no treatment (8%) (SSB, 2002). Most of the treatment plants with only primary treatment serve smaller settlements, while the majority of advanced treatment plants (plants with chemical and/or biological treatment) are found near the larger cities. Of the total hydraulic capacity of 5.74 million p.e. (person equivalent), chemical plants account for 37%, chemical/biological treatment for 27%, primary treatment for 24%, direct discharges for 8%, biological treatment for 2% and others for 2% (2002 data). In the region draining to the North Sea, most of the wastewater (from 83% of the population in the area) is treated in chemical or combined biological-chemical treatment plants, whereas the most common treatment methods along the coast from Hordaland county (North Sea) and northwards are primary treatment or no treatment. The fifty percent reduction target for anthropogenic phosphorus has been met for the Skagerrak coast as a result of increased removal of phosphorus in treatment plants.

Statistics Norway (SSB) and the Norwegian Environment Agency jointly conduct annual registration of data on nutrients from all wastewater treatment plants in the country with a capacity of more than 50 person equivalents (p.e.). The data are reported each year by the municipalities. The electronic reporting system KOSTRA is used for reporting of effluent data from the municipalities directly to SSB. For the plants with no reporting requirements (<50 p.e.), the discharge is estimated by multiplying the number of people with standard Norwegian per capita load figures and then adjusting the estimate according to the removal efficiency of the treatment plants. The "Principles of the Comprehensive Study of Riverine Inputs and Direct Discharges" (PARCOM, 1988) recommends the derived per capita loads listed in the table below. The Norwegian per capita loads are based on studies of Norwegian sewerage districts (Farestveit *et al.*, 1995), and are listed in the same table. The latter are used in the Norwegian reporting.

Table A-IV-4. Per capita loads used for estimation of untreated sewage discharges.

Parameter	OSPAR	Norway
BOD (kg O/person/day)	0.063	0.046
COD (kg O/person/day)		0.094
TOC (kg TOC /person/day)		0.023
SPM (kg SPM./person/day)	0.063	0.042
Tot-N (kg N/person/day)	0.009	0.012
Tot-P (kg P/person/day)	0.0027	0.0016

The metal loads from wastewater treatment plants reflect the sum of the *reported* load from wastewater treatment plants in unmonitored areas and along the coast. Reporting of metals is required only for the largest treatment plants (>20.000 p.e.). No assumptions on loads from other plants than those reporting have been considered.

Industrial effluents

Estimates of discharges from industry are based on data reported to the database "Forurensning" (Norwegian Environment Agency) and the share of municipal wastewater considered to derive from industry (see above). Sampling frequency for industrial effluents varies from weekly composite samples to random grab samples. Sampling is performed at least twice a year. Nutrient loads from industry in unmonitored areas are estimated using the TEOTIL model, based on the reported data. Metal loads, where reported, are summed.

Fish farming effluents

Fish farmers report monthly data for fish fodder, biomass, slaughtered fish and slaughter offal down to net cage level. These are reported by The Directorate of Fisheries. Raw data are available at altinn.no.

Statistics Norway has sales statistics for farmed trout and salmon. These show an increase in fish farming activities since 1995, which have led to increases in discharges from fish farming despite improvements in treatment yield and production procedures.

The waste from aquaculture facilities is predominantly from feed (De Pauw and Joyce, 1991: Pillay, 1992; Handy and Poxton, 1993), and includes uneaten feed (feed waste), undigested feed residues and faecal/excretion products (Cripps, 1993). The main pollutants from aquaculture are organic matter, nitrogen and phosphorus (Cho and Bureau, 1997).

NIVA estimates nitrogen and phosphorus discharges from fish farming according to the HARP Guidelines (Guideline 2/method 1, see Borgvang and Selvik, 2000). The estimates are based on mass balance equations, i.e. feed used (based on P or N content in feed), and fish production (based on P or N content in produced fish).

For more information about details in data reporting and availability see Selvik *et al.* (2007) and Skarbøvik *et al.* (2011). The total nutrient loads from fish farming are estimated using the TEOTIL model, based on the input data described above.

Organic contaminants, information on uncertainties

The method for estimating loads and concentrations of organic contaminants is described in detail in the main report, chapter 2.6.

Estimates of riverine loads of contaminants are the subject of some uncertainty. The issues listed below are all expected to contribute to the overall uncertainty of the estimates in contaminant loads.

- Water discharge data may suffer from some uncertainty and/or bias
- Measurements of the SPM content of the water are based on monthly spot/bottle sampling. In these circumstances, it is expected that values measured at the time of sampling are representative of a much longer period of time. The SPM content of the water can vary substantially and much higher concentrations can sometimes be expected/observed during periods of high flow, i.e. after heavy rainfall events. The

type and amount of particulate organic carbon may also vary substantially with time and river flow and this may induce further uncertainty. The type of particulate organic carbon can affect the sorption of organic contaminant to particulate organic matter in surface waters and impact the freely dissolved concentration. Organic carbon normalisation would tend to reduce the variability in contaminant concentrations in SPM.

- Depending on contaminant exchange kinetics between the sampler and water, the concentration of mildly hydrophobic substances in silicone samplers may reach equilibrium with that in water. This means that sampling for these substances is not time-integrative anymore and concentrations measured are not necessarily representative of the entire passive sampler exposure time
- Sampling rates of passive samplers may not be constant throughout the exposure period. Biofouling layer build-up and changes in water hydrodynamics around the samplers may result in sampling rates that vary over the course of the deployment.
- Passive sampling data is not corrected to account for differences in temperature between exposure periods. Deployment temperatures vary between 0 and 20 °C over the course of a year. Higher polymer-water partition coefficients can be expected at lower temperatures.
- The SPM accumulation/pre-concentration step performed by the continuous flow centrifuge may result in SPM samples with a particle size distribution that deviates from that of the water being sampled. It may be that the smallest particles are not retained as efficiently as larger particles by the CFC. This would induce a slight bias in SPM-associated contaminant concentrations and percentage OC measured in the SPM.
- Particle retention in the CFC may not be constant throughout time
- Uncertainty in the extraction and analysis of SPM and silicone rubber samples
- Uncertainty in the estimation of silicone rubber sampling rates

Sensors and loggers in Rivers Glomma, Drammenselva and Alna

Data are logged using an Observator OMC-045-III data logger and transferred directly to NIVA's server via GPRS. The data are then immediately available online at www.aquamonitor.no/rid. A QA routine was set up, flagging data which were obviously wrong, due to e.g. interrupted power supply, maintenance and in the case of River Glomma, interruptions of the flow through the flow cell. Flagged data are not visible online and are not included when downloading data, but are kept in the database.

Maintenance record for the sensors in the Rivers Glomma, Drammenselva, and Alna, for the period 2013-2015 (July):

- 2013: In River Drammenselva there was missing power supply for parts of August. In River Glomma the flow cell and tubes had to be replaced, and the pumping frequency adjusted in order to get sufficient flow through the flow cell. Especially in June and July several days of data had to be deleted. The sensors in Rivers Alna and Drammenselva were maintained and calibrated once after installation, while the sensor in River Glomma had several maintenance visits.
- 2014: In January, data transfer from the Alna sensor to NIVA's server was occasionally disrupted, but the problems were solved within a few weeks' time. In early February, the YSI sonde in River Glomma was placed directly into the water stream in the water works, and general maintenance of the station was performed. A few weeks after the YSI sonde was situated above the water surface and had to be moved deeper into the

water. The same happened in July, and the sensor was again moved to a deeper position. Routine maintenance was performed at all three stations in early June and in October/November. In November, the Alna station was damaged, probably due to vandalism.
- 2015 (until July): The disrupted equipment at River Alna was replaced in January. The water pump in River Glomma stopped in May, but was fixed soon after. Routine maintenance was performed at all three stations in May/June.

Changes in the Norwegian RID programme over the years

Since the Norwegian RID Programme started in 1990, several changes have been introduced. For this reason, in 2009 the entire Norwegian database was upgraded in order to better reflect the same methodology (Stålnacke *et al.*, 2009). However, not all methodological changes could be adjusted (such as the changes in LOD values over time). Below is an overview of the main changes in the RID methodology.

Changes in the selection and monitoring frequency of the rivers monitored monthly
Earlier, the term 'main river' was used for rivers monitored monthly or more often.

Up until 2013, 10 rivers were samples mainly monthly. In 2008, River Suldalslågen was removed from this selection of rivers, and instead River Vosso was introduced as a new river for monthly monitoring. The main reason was that River Suldalslågen is heavily modified by hydropower developments, and the load in this river does therefore not represent an unmodified watershed in this region. River Vosso, on the other hand, fitted well into the category of 'relatively unpolluted river' with a population density of 1.1 persons/km^2, and only 3% of the catchment area used for agriculture. The river is situated in the same maritime region as River Suldalslågen.

In 2008, data from another sampling programme were included in the database for River Glomma, and the number of samples in this river is therefore increased in some, few years. This parallel dataset contains only data for some nutrients and TOC.

In 2013, River Alna in Southern Norway, draining to the Skagerrak Area (Oslo Fjord) was introduced as the 11th river monitored monthly. This river was previously part of the RID programme under the name River Loelva, monitored once a year from 1990 to 2003.

Changes in the selection and monitoring frequency of the rivers monitored four times a year
Earlier, the term 'tributary river' was used for these rivers. The term was only used to signify that these rivers were sampled less frequently than the rivers monitored monthly, as they all drain directly into the sea.

In the period 1990-2003, 145 rivers were sampled once a year only. In 2004, the number of 'tributary rivers' was reduced from 145 (sampled once a year) to 36 rivers, which were sampled four times a year. The remaining 109 rivers, formerly monitored once a year since 1990, were no longer sampled. One of these, River Alna, was included again in 2013 as a river monitored monthly.

Changes in load calculation methods
Several changes have been made in the calculation of loads; these are thoroughly described in Stålnacke *et al.* (2009). The present database is now based on a common method that is now the standard method in the Norwegian RID Programme.

The former method multiplied a flow-weighted annual concentration with the total annual discharge (i.e., total annual water volume) in accordance with the OSPAR JAMP Guidelines. For various reasons, the sampling is not always conducted at regular time intervals and in some cases also monthly data are missing. Thus, it was decided that it would be better to weight each sample not only by water discharge but also to the time period the sample represented. These time periods were defined by the midpoints between the samples. Note that the formula is used only within one year, i.e., the time period for a sample is never extended into another year. The modified load calculation formula is shown below.

$$Load = Q_r \frac{\sum_{1}^{n} Q_i \bullet C_i \bullet t_i}{\sum_{1}^{n} Q_i \bullet t_i}$$

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;
Q_r is the annual water volume.

Changes in laboratories, parameters, methods and detection limits
During 1990-1998 the chemical analyses for the RID Programme were conducted at the NIVA-lab. In the period 1999-2003 the analyses were carried out by Analycen (now: EuroFins). In 2004 NIVA-lab resumed analysing the samples.

Changes in detection limits and laboratory analysis methods have been reported in each annual report and are not included here. However, changes in detection limits have been duly taken into account in the trend analyses.

In 2013, silver (Ag) was introduced as a new parameter in the programme. The same year, lindane and PCB (which had been monitored in the rivers sampled monthly) were omitted from regular the programme.

From 2013, also, Rivers Alna, Glomma and Drammenselva were monitored for organic contaminants, as well as high-frequency turbidity, conductivity, temperature and pH recordings through sensor data. Temperature monitoring was also started in the remaining 44 rivers, using different types of methodology.

Changes in methods concerning direct discharges
In 2008 a new method to calculate the direct discharges was introduced, and used on all years since 1990, as described in Stålnacke *et al.* (2009). Basically, the new method calculates the

discharges from a plant whenever data are lacking and there is no information that the plant has been shut down. This calculation is based on a trend line that is made from data on the former years' discharges. The missing value in the last year will be set equal to the value of the trend line in the former year (or the year with the most recent data).

Several industrial point sources that had huge discharges of sediments were excluded from the reporting in 2008. The reason was that these did not represent particle pollution to the coastal areas since the sediments were disposed in very restricted dumping tips. This significantly reduced sediment inputs to the Norwegian maritime areas as compared to former years.

The loads from fish farming were first included in the grand total values in 2000, i.e. originally these loads were not included in the input figures for the period 1990-1999. However, in the recalculation project in 2007 a time series for nitrogen, phosphorus and copper from aquaculture, was established, covering the entire period from 1990 to 2007 (see Stålnacke *et al.*, 2009). Then, in 2011 another adjustment was made: Over the years the nutrient content in fish fodder has been reduced. In 2011 a table showing changes in nutrient content over the period 2000-2010 was established (see Skarbøvik *et al.*, 2011). As a result, nutrient loads were adjusted from the year 2000 onwards.

From 2013 onwards, direct discharges of organic contaminants are no longer reported. Previously such estimates were reported for sewage effluents of PCB7, but these estimates were considered highly uncertain, as only the largest treatment plants (>50.000 p.e.) are required to report this.

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Appendix V Long-term trends in riverine loads and concentrations.

Complementary charts to Chapter 3; and overview of all trend tables for loads and concentrations (including lower estimates). For data on concentrations in each river since 1990, it is referred to http://vannmiljo.miljodirektoratet.no/.

Trend charts for loads are shown both for upper and lower estimates. Some of these charts are also shown in the report but they are collated here for the purpose of visualising an overview of the trends. First the trend charts for long term estimates are shown, and then trend charts for the last 10 years.

The charts cover the following substances in consecutive order:

- Water discharge (Q)
- Total-N
- Nitrate-N (NO_3-N)
- Ammonium-N (NH_4-N)
- Total-P
- Orthophosphate (PO_4-P)
- Suspended particulate matter (SPM)
- Copper (Cu)
- Lead (Pb)
- Zinc (Zn)
- Cadmium (Cd)
- Mercury (Hg)
- Arsenic (As)
- PCB7
- Lindane (g-HCH)

Extra- or interpolated values are indicated with different colours. The substances where such extra- or interpolation has been performed include total-P, ammonium-N (NH_4-N), mercury (Hg), arsenic (As) and PCB7.

The common legend for the trend tests in the tables below is shown here:

	Significant downward ($p<0.05$)
	Downward but not significant ($0.05<p<0.1$)
	Significant upward ($p<0.05$)
	Upward but not significant ($0.05<p<0.1$)

Table V1. Long-term trends in annual water discharge (Q; estimated from daily measurements), nutrient and particle loads (upper estimates) in nine Norwegian main rivers 1990- 2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS, 1990-2014 (upper estimate)							
River	Q	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.0102	0.0005	0.1476	0.0133	0.0759	0.5132	0.5437
Drammenselva	0.0028	0.0927	0.0250	0.0033	0.0051	0.0028	0.0051
Numedalslågen	0.0281	0.4272	0.1232	0.0015	0.0151	0.0195	0.0356
Skienselva	0.0317	0.0839	0.0033	0.9256	0.0446	0.1611	0.2827
Otra	0.7086	0.3748	0.0001	0.8153	0.6404	0.6742	0.1909
Orreelva	0.0927	0.5132	0.7086	0.4005	0.2072	0.1611	0.1611
Orkla	0.8886	0.0054	0.8153	0.6404	0.7086	0.3041	0.7437
Vefsna	0.4548	0.0000	0.0000	0.0028	0.0317	0.0015	0.0759
Altaelva	0.5132	0.1755	0.1123	0.6074	0.3041	0.2072	0.7437

Statistically significant downward (p<0.05)
Downward but not statistically significant (0.05<p<0.1)
Statistically significant upward (p<0.05)
Upward but not statistically significant (0.05<p<0.1)

Table V2. Long-term trends for metal loads (upper estimates) in nine Norwegian main rivers 1990-2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS metals. 1990-2014 (upper estimate)						
River	Q	Cd	Cu	Ni	Pb	Zn
Glomma	0.0102	0.0026	0.8518	0.7260	0.0250	0.7793
Drammenselva	0.0028	0.0013	0.0498	0.3748	0.4548	0.3502
Numedalslågen	0.0281	0.0298	0.0759	0.8153	0.1350	0.1755
Skienselva	0.0317	0.0004	0.0356	0.0013	0.6074	0.1755
Otra	0.7086	0.0015	0.1611	0.0033	0.1909	0.0498
Orreelva	0.0927	0.0687	0.3151	0.0471	0.1681	0.4835
Orkla	0.8886	0.0062	0.0172	0.0250	0.0078	0.0005
Vefsna	0.4548	0.0000	0.0007	0.0000	0.0001	0.0001
Altaelva	0.5132	0.0000	0.0033	0.0133	0.0281	0.4005

Significant downward (p<0.05)
Downward but not significant (0.05<p<0.1)
Significant upward (p<0.05)
Upward but not significant (0.05<p<0.1)

Table V3. Long-term trends in annual water discharge (Q; estimated from daily measurements). nutrient and particle loads (lower estimates) in nine Norwegian main rivers 1990- 2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS. 1990-2014 (lower estimate)

River	Q	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.0102	0.0005	0.1476	0.0133	0.0839	0.5132	0.5437
Drammenselva	0.0028	0.0927	0.0250	0.0033	0.0044	0.0033	0.0044
Numedalslågen	0.0281	0.4005	0.1232	0.0015	0.0172	0.0195	0.0356
Skienselva	0.0317	0.0685	0.0033	0.9256	0.4272	0.2246	0.3266
Otra	0.7086	0.4005	0.0001	0.8153	0.2623	0.6742	0.2623
Orreelva	0.0927	0.5132	0.7086	0.4005	0.2072	0.1611	0.1611
Orkla	0.8886	0.0016	0.8153	0.6404	0.6404	0.2827	0.8153
Vefsna	0.4548	0.0000	0.0000	0.0028	0.0117	0.0007	0.0685
Altaelva	0.5132	0.1350	0.1021	0.6074	0.1755	0.2072	0.7793

Significant downward ($p<0.05$)

Downward but not significant ($0.05<p<0.1$)

Significant upward ($p<0.05$)

Upward but not significant ($0.05<p<0.1$)

Table V4. Long-term trends for metal loads (lower estimates) in nine Norwegian main rivers 1990-2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS metals. 1990-2014 (lower estimate)

River	Q	Cd	Cu	Ni	Pb	Zn
Glomma	0.0102	0.1350	0.8518	0.7260	0.1123	0.7793
Drammenselva	0.0028	0.0317	0.0498	0.2246	0.3748	0.3502
Numedalslågen	0.0281	0.1830	0.0759	0.3041	0.2623	0.1755
Skienselva	0.0317	0.0095	0.0399	0.1755	0.6742	0.1755
Otra	0.7086	0.1348	0.1611	0.0033	0.3041	0.0498
Orreelva	0.0927	0.4562	0.3151	0.0471	0.1988	0.4835
Orkla	0.8886	0.0614	0.0172	0.0250	0.0083	0.0005
Vefsna	0.4548	0.0003	0.0007	0.0003	0.0001	0.0003
Altaelva	0.5132	0.0030	0.0033	0.0281	0.6913	0.3748

Significant downward ($p<0.05$)

Downward but not significant ($0.05<p<0.1$)

Significant upward ($p<0.05$)

Upward but not significant ($0.05<p<0.1$)

Table V5. Trends in annual water discharge (Q; estimated from daily measurements). nutrient and particle loads (upper estimates) in nine Norwegian main rivers in the last 10 years (2005- 2014). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS. 2005-2014 (upper estimate)							
River	Q	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.0157	0.1797	0.7884	0.2449	0.3252	0.4208	0.3252
Drammenselva	0.0603	0.4208	0.6547	0.3252	0.0892	0.2449	0.1284
Numedalslågen	0.5312	0.0056	0.9287	0.4208	0.1284	0.1797	0.5312
Skienselva	0.3252	0.9287	0.2449	0.1797	0.1797	0.5312	0.9287
Otra	0.1797	0.6547	0.9287	0.2449	0.2449	0.2449	0.3252
Orreelva	0.4208	0.4208	0.3252	0.5312	0.4208	0.1797	0.1284
Orkla	0.1797	0.5312	0.3252	0.4208	0.6547	0.7884	0.1797
Vefsna	0.6547	0.4208	0.3252	0.7884	0.5312	0.9287	0.9287
Altaelva	0.5312	0.3252	0.3252	0.5312	0.4208	0.1797	0.5312

Significant downward ($p<0.05$)
Downward but not significant ($0.05<p<0.1$)
Significant upward ($p<0.05$)
Upward but not significant ($0.05<p<0.1$)

Table V6. Trends for metal loads (upper estimates) in nine Norwegian main rivers in the last 10 years (2005-2014). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS metals. 2005-2014 (upper estimate)						
River	Q	Cd	Cu	Ni	Pb	Zn
Glomma	0.0157	0.9287	0.9287	0.3252	0.5312	0.0095
Drammenselva	0.0603	0.4208	0.9287	0.1284	0.0892	0.5312
Numedalslågen	0.5312	0.6547	0.7884	0.3252	0.4208	0.6547
Skienselva	0.3252	0.0603	0.2449	0.7884	0.0603	0.5312
Otra	0.1797	0.5900	0.5312	0.5312	0.6547	0.3252
Orreelva	0.4208	0.4563	0.9287	0.9287	0.1060	0.6547
Orkla	0.1797	0.1284	0.0397	0.4208	0.0253	0.0892
Vefsna	0.6547	0.7845	0.4208	0.1797	0.5312	0.0892
Altaelva	0.5312	0.7868	0.6547	0.5312	0.6547	0.5312

Significant downward ($p<0.05$)
Downward but not significant ($0.05<p<0.1$)
Significant upward ($p<0.05$)
Upward but not significant ($0.05<p<0.1$)

Table V7. Trends in annual water discharge (Q; estimated from daily measurements). nutrient and particle loads (lower estimates) in nine Norwegian main rivers in the last 10 years (2005- 2014). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS. 2005-2014 (lower estimate)

River	Q	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.0157	0.1797	0.7884	0.2449	0.3252	0.4208	0.3252
Drammenselva	0.0603	0.4208	0.6547	0.3252	0.0892	0.2449	0.1284
Numedalslågen	0.5312	0.0056	0.9287	0.4208	0.1284	0.1797	0.5312
Skienselva	0.3252	0.9287	0.2449	0.1797	0.1284	0.3252	0.9287
Otra	0.1797	0.6547	0.9287	0.2449	0.3252	0.2449	0.3252
Orreelva	0.4208	0.4208	0.3252	0.5312	0.4208	0.1797	0.1284
Orkla	0.1797	0.4208	0.3252	0.4208	0.6547	0.7884	0.1797
Vefsna	0.6547	0.9287	0.3252	0.7884	0.2449	0.9287	0.9287
Altaelva	0.5312	0.3252	0.3252	0.5312	0.3252	0.1797	0.5312

(dark green)	Significant downward ($p<0.05$)
(light green)	Downward but not significant ($0.05<p<0.1$)
(red)	Significant upward ($p<0.05$)
(orange)	Upward but not significant ($0.05<p<0.1$)

Table V8. Trends for metal loads (lower estimates) in nine Norwegian main rivers in the last 10 years (2005-2015). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS metals. 2005-2014 (lower estimate)

River	Q	Cd	Cu	Ni	Pb	Zn
Glomma	0.0157	0.9287	0.9287	0.3252	0.5312	0.0095
Drammenselva	0.0603	0.4208	0.9287	0.1284	0.0892	0.5312
Numedalslågen	0.5312	0.6547	0.7884	0.3252	0.4208	0.6547
Skienselva	0.3252	0.0397	0.2449	0.7884	0.0603	0.5312
Otra	0.1797	0.7884	0.5312	0.5312	0.6547	0.3252
Orreelva	0.4208	0.4563	0.9287	0.9287	0.1060	0.6547
Orkla	0.1797	0.1284	0.0397	0.4208	0.0253	0.0892
Vefsna	0.6547	0.2411	0.4208	0.1284	0.5312	0.0892
Altaelva	0.5312	0.0515	0.6547	0.5312	0.6547	0.5312

(dark green)	Significant downward ($p<0.05$)
(light green)	Downward but not significant ($0.05<p<0.1$)
(red)	Significant upward ($p<0.05$)
(orange)	Upward but not significant ($0.05<p<0.1$)

Table V9. Long-term trends in nutrient and particle concentrations (upper estimates) in nine Norwegian main rivers 1990- 2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS. 1990-2014 (upper estimate)						
River	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.0072	0.9325	0.2015	0.1064	0.5221	0.3898
Drammenselva	0.2294	0.9021	0.1646	0.6114	0.1875	0.4440
Numedalslågen	0.5427	0.0532	0.0033	0.3353	0.0235	0.4385
Skienselva	0.2434	0.0000	0.0003	0.0919	0.9269	0.8311
Otra	0.2273	0.0005	0.1926	0.0809	0.0074	0.0004
Orreelva	0.6133	0.0137	0.0720	0.1512	0.7539	0.7966
Orkla	0.0035	0.8144	0.0620	0.1110	0.1067	0.0255
Vefsna	0.0000	0.0000	0.0056	0.0890	0.0292	0.0054
Altaelva	0.0248	0.1402	0.5929	0.0255	0.2164	0.0191

Statistically significant downward (p<0.05)
Downward but not statistically significant (0.05<p<0.1)
Statistically significant upward (p<0.05)
Upward but not statistically significant (0.05<p<0.1)

Table V10. Long-term trends for metal concentrations (upper estimates) in nine Norwegian main rivers 1990-2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS metals. 1990-2014 (upper estimate)					
River	Cd	Cu	Ni	Pb	Zn
Glomma	0.0009	0.0328	0.0214	0.0013	0.8735
Drammenselva	0.0006	0.2011	0.1607	0.1547	0.0846
Numedalslågen	0.0004	0.0086	0.0087	0.0198	0.0061
Skienselva	0.0001	0.0192	0.0003	0.1194	0.0005
Otra	0.0002	0.1902	0.0013	0.0007	0.0000
Orreelva	0.0005	0.1457	0.0006	0.0039	0.3032
Orkla	0.0015	0.0003	0.0007	0.0000	0.0000
Vefsna	0.0000	0.0001	0.0011	0.0000	0.0000
Altaelva	0.0002	0.0008	0.0066	0.0000	0.0018

Significant downward (p<0.05)
Downward but not significant (0.05<p<0.1)
Significant upward (p<0.05)
Upward but not significant (0.05<p<0.1)

Table V11. Long-term trends in nutrient and particle concentrations (lower estimates) in nine Norwegian main rivers 1990- 2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS. 1990-2014 (lower estimate)						
River	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.0072	0.9325	0.2015	0.1095	0.5221	0.3898
Drammenselva	0.2391	0.9021	0.1646	0.5761	0.1862	0.5676
Numedalslågen	0.5427	0.0532	0.0033	0.3861	0.0235	0.3943
Skienselva	0.2362	0.0000	0.0003	0.6166	0.9269	0.6719
Otra	0.2077	0.0005	0.1926	0.0019	0.0074	0.0011
Orreelva	0.6185	0.0109	0.0720	0.1537	0.7539	0.7966
Orkla	0.0029	0.8144	0.0620	0.0437	0.1075	0.0256
Vefsna	0.0000	0.0000	0.0056	0.0005	0.0298	0.0140
Altaelva	0.0783	0.1402	0.5929	0.0167	0.2164	0.5904

Dark green	Significant downward ($p<0.05$)
Light green	Downward but not significant ($0.05<p<0.1$)
Red	Significant upward ($p<0.05$)
Orange	Upward but not significant ($0.05<p<0.1$)

Table V12. Long-term trends for metal concentrations (lower estimates) in nine Norwegian main rivers 1990-2014. The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS metals. 1990-2014 (lower estimate)					
River	Cd	Cu	Ni	Pb	Zn
Glomma	0.4648	0.0328	0.0214	0.0821	0.8735
Drammenselva	0.1513	0.2011	0.2580	0.7249	0.0840
Numedalslågen	0.3698	0.0086	0.2623	0.0654	0.0061
Skienselva	0.0156	0.0192	0.1043	0.8999	0.0005
Otra	0.2682	0.1902	0.0022	0.0599	0.0000
Orreelva	0.3769	0.1457	0.0006	0.0138	0.3318
Orkla	0.0345	0.0003	0.0007	0.0081	0.0000
Vefsna	0.0010	0.0001	0.0028	0.0010	0.0000
Altaelva	0.0235	0.0011	0.0393	0.0438	0.0180

Dark green	Significant downward ($p<0.05$)
Light green	Downward but not significant ($0.05<p<0.1$)
Red	Significant upward ($p<0.05$)
Orange	Upward but not significant ($0.05<p<0.1$)

Table V13. Trends in nutrient and particle concentrations (upper estimates) in nine Norwegian main rivers in the last 10 years (2005- 2014). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS. 2005-2014 (upper estimate)						
River	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.2672	0.1720	0.9203	0.8439	0.9147	0.9880
Drammenselva	0.1927	0.1433	0.8012	0.8049	0.1702	0.3747
Numedalslågen	0.1779	0.1079	0.0773	0.1795	0.1899	0.6446
Skienselva	0.4864	0.0069	0.9053	0.2493	0.7009	0.1873
Otra	0.2630	0.6775	0.2008	0.2300	0.8684	0.1115
Orreelva	0.5838	0.1183	0.2033	0.1276	0.7252	0.9662
Orkla	0.2995	0.9922	0.1716	0.7637	0.7095	0.4577
Vefsna	0.2224	0.8970	0.1575	0.0245	0.1606	0.6496
Altaelva	0.7704	0.0439	0.0162	0.0851	0.0612	0.2202

(dark green)	Significant downward ($p<0.05$)
(light green)	Downward but not significant ($0.05<p<0.1$)
(red)	Significant upward ($p<0.05$)
(orange)	Upward but not significant ($0.05<p<0.1$)

Table V14. Trends for metal concentrations (upper estimates) in nine Norwegian main rivers in the last 10 years (2005-2014). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS metals. 2005-2014 (upper estimate)					
River	Cd	Cu	Ni	Pb	Zn
Glomma	0.5431	0.0966	0.6149	0.2302	0.0438
Drammenselva	0.8783	0.1351	0.4361	0.6289	0.0968
Numedalslågen	0.8139	0.5458	0.3237	0.6320	0.4551
Skienselva	0.5335	0.3899	0.1747	0.3974	0.2615
Otra	0.6839	0.2244	0.3606	0.9575	0.2197
Orreelva	0.0910	0.0366	0.2808	0.5418	0.2028
Orkla	0.2301	0.1193	0.7916	0.1167	0.0852
Vefsna	0.1147	0.4262	0.0333	0.9136	0.2563
Altaelva	0.5475	0.4664	0.5710	0.3893	0.9037

(dark green)	Significant downward ($p<0.05$)
(light green)	Downward but not significant ($0.05<p<0.1$)
(red)	Significant upward ($p<0.05$)
(orange)	Upward but not significant ($0.05<p<0.1$)

Table V15. Trends in nutrient and particle concentrations (lower estimates) in nine Norwegian main rivers in the last 10 years (2005- 2014). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS. 2005-2014 (lower estimate)						
River	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0.2672	0.1720	0.9203	0.8439	0.9147	0.9880
Drammenselva	0.1831	0.1433	0.8012	0.7247	0.1682	0.3747
Numedalslågen	0.1779	0.1079	0.0773	0.1801	0.1899	0.6446
Skienselva	0.4765	0.0069	0.9053	0.2821	0.7009	0.1873
Otra	0.2630	0.6775	0.2008	0.4825	0.8684	0.1115
Orreelva	0.4979	0.1261	0.2033	0.1276	0.7252	0.9662
Orkla	0.3311	0.9922	0.1716	0.6041	0.7095	0.4577
Vefsna	0.8774	0.8970	0.1575	0.1224	0.1380	0.6496
Altaelva	0.1601	0.0439	0.0162	0.0634	0.0612	0.2202

Significant downward ($p<0.05$)
Downward but not significant ($0.05<p<0.1$)
Significant upward ($p<0.05$)
Upward but not significant ($0.05<p<0.1$)

Table V16. Trends for metal concentrations (lower estimates) in nine Norwegian main rivers in the last 10 years (2005-2014). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS. 2005-2014 (lower estimate)					
River	Cd	Cu	Ni	Pb	Zn
Glomma	0.5431	0.0966	0.6149	0.2302	0.0438
Drammenselva	0.8752	0.1351	0.4361	0.6289	0.0968
Numedalslågen	0.8139	0.5458	0.3237	0.6320	0.4551
Skienselva	0.5335	0.3899	0.1747	0.3974	0.2615
Otra	0.6839	0.2244	0.3606	0.9575	0.2197
Orreelva	0.0962	0.0366	0.2808	0.5418	0.2028
Orkla	0.2301	0.1193	0.7916	0.1228	0.0852
Vefsna	0.1264	0.4262	0.0319	0.9136	0.2563
Altaelva	0.4845	0.4664	0.5710	0.4363	0.9147

Significant downward ($p<0.05$)
Downward but not significant ($0.05<p<0.1$)
Significant upward ($p<0.05$)
Upward but not significant ($0.05<p<0.1$)

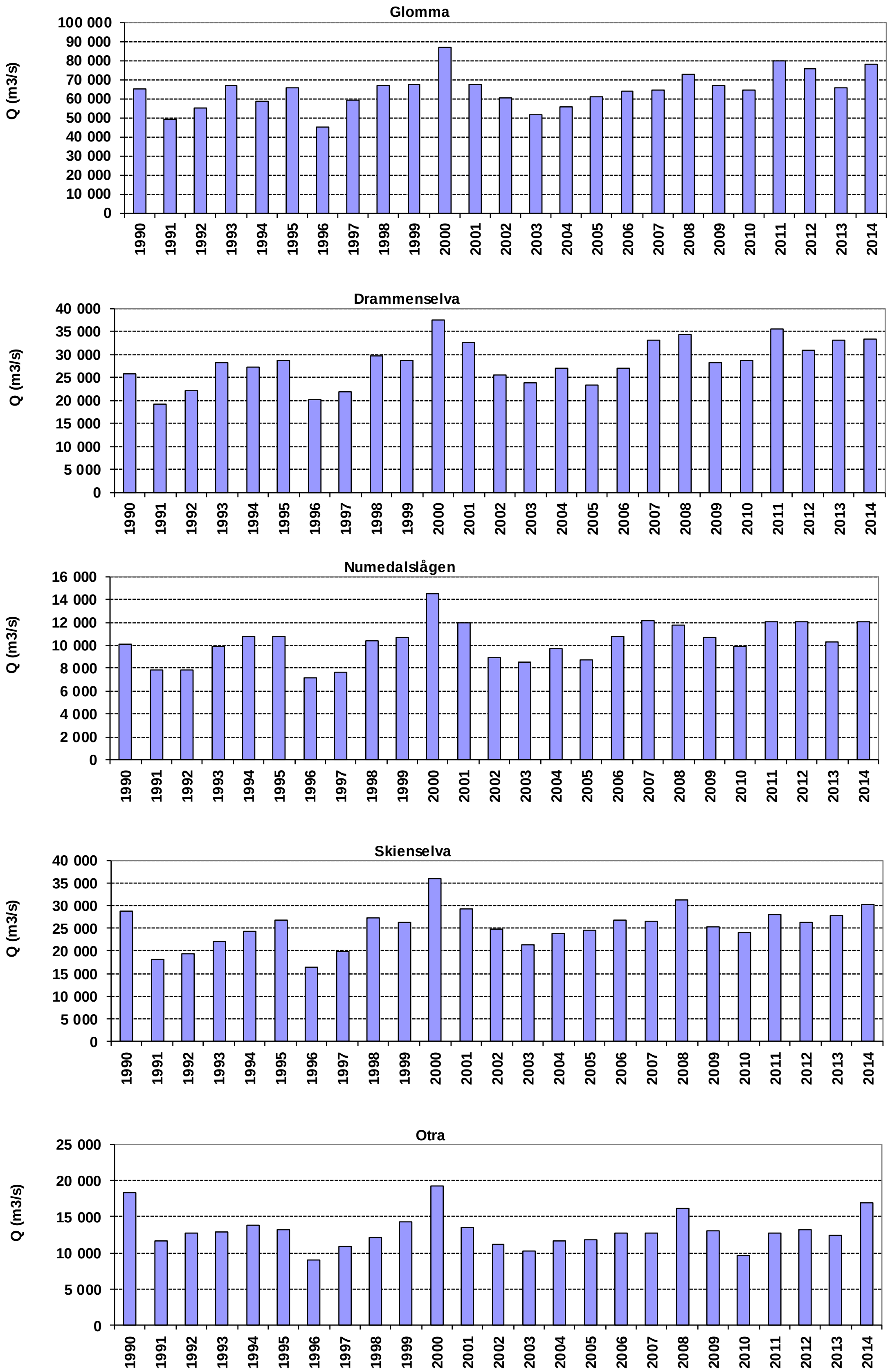

Figure A-V-1a. Annual water discharge (Q) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

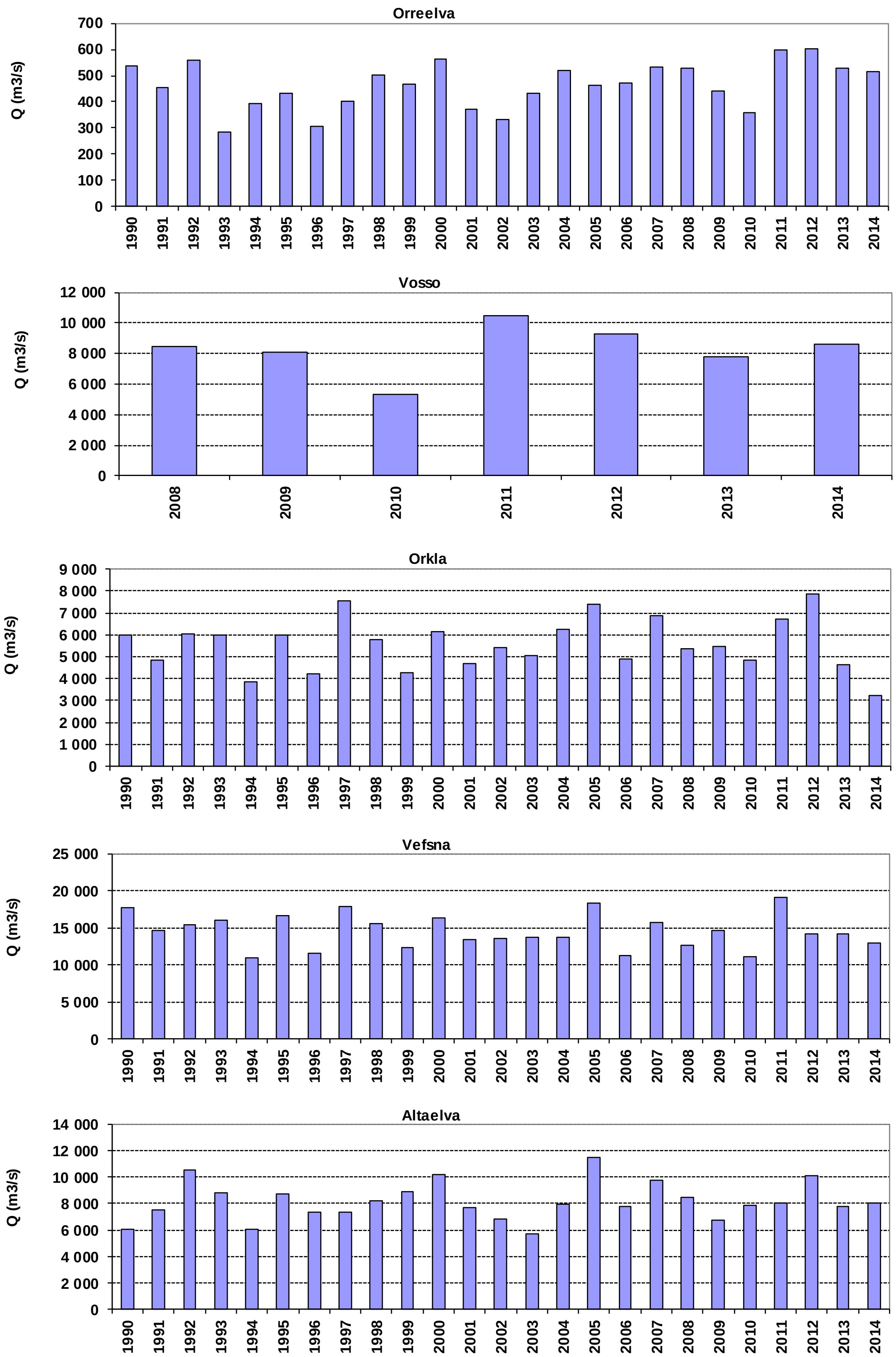

Figure A-V-1b. Annual water discharge (Q) in the five main rivers draining to the North Sea, the Norwegian Sea, and the Barents Sea, Norway, 1990-2013 (2008-2014 for River Vosso).

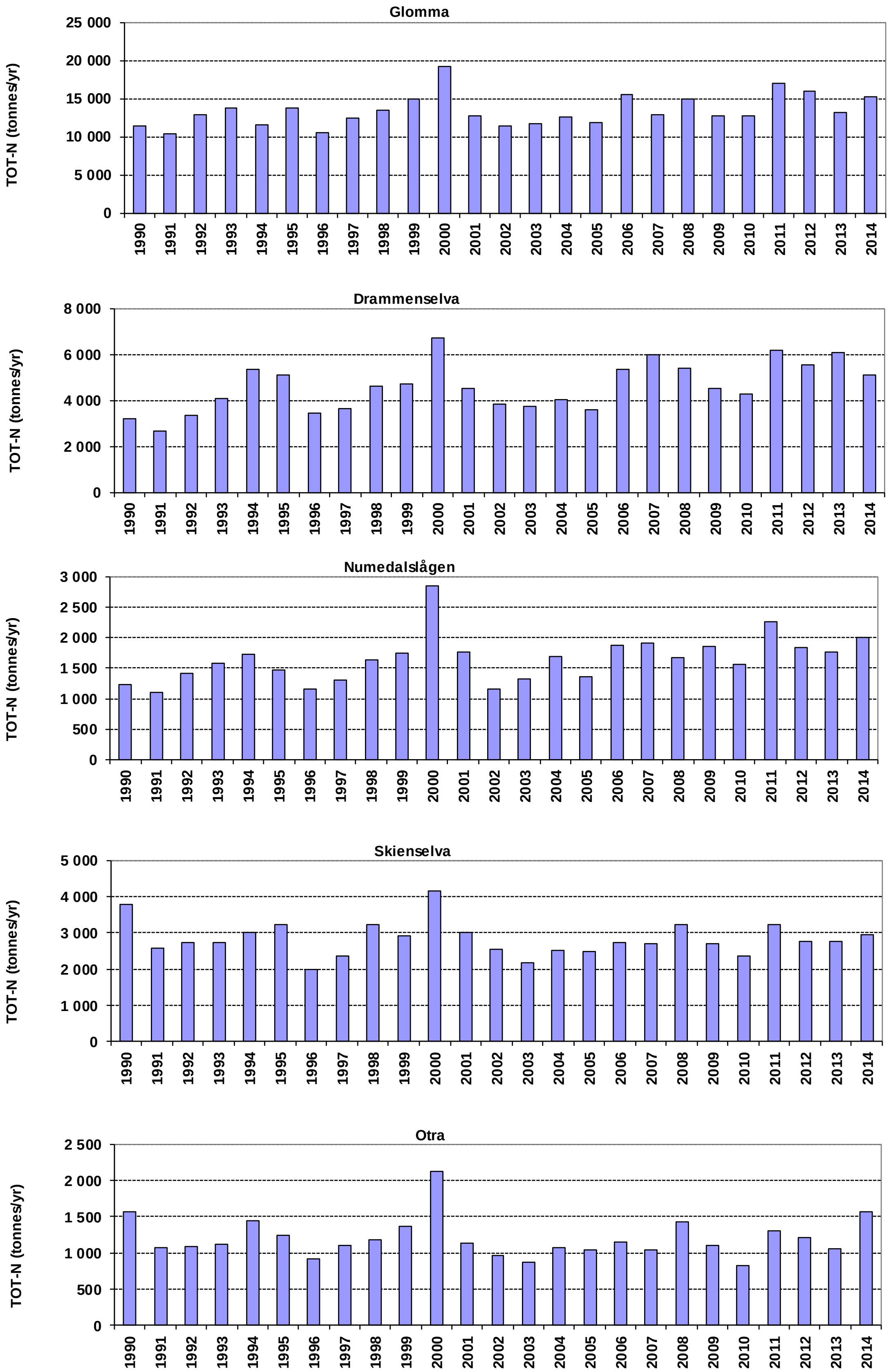

Figure A-V-2a. Annual riverine loads of total nitrogen (Tot-N) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

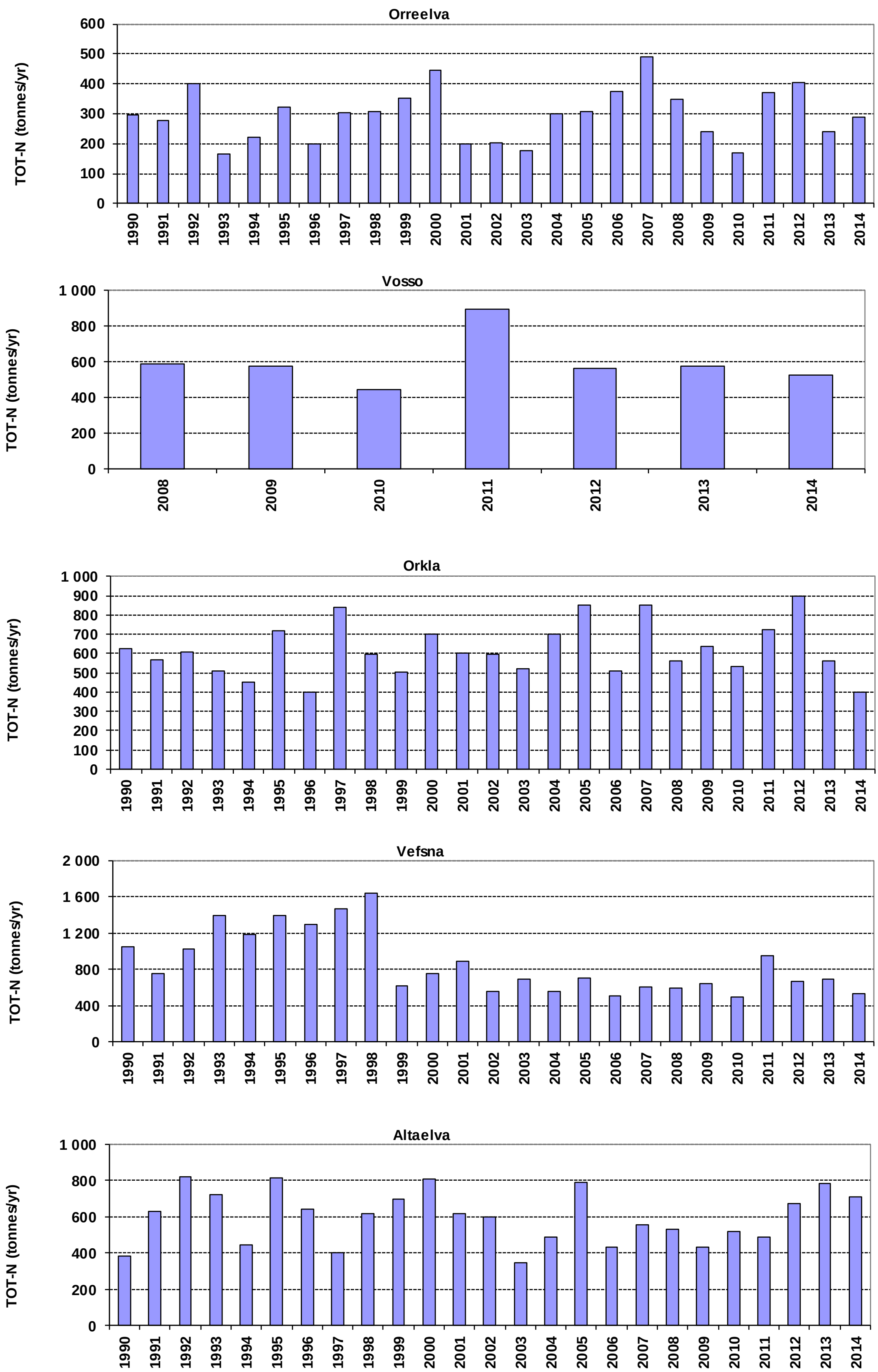

Figure A-V-2b. Annual riverine loads of total nitrogen (Tot-N) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso).

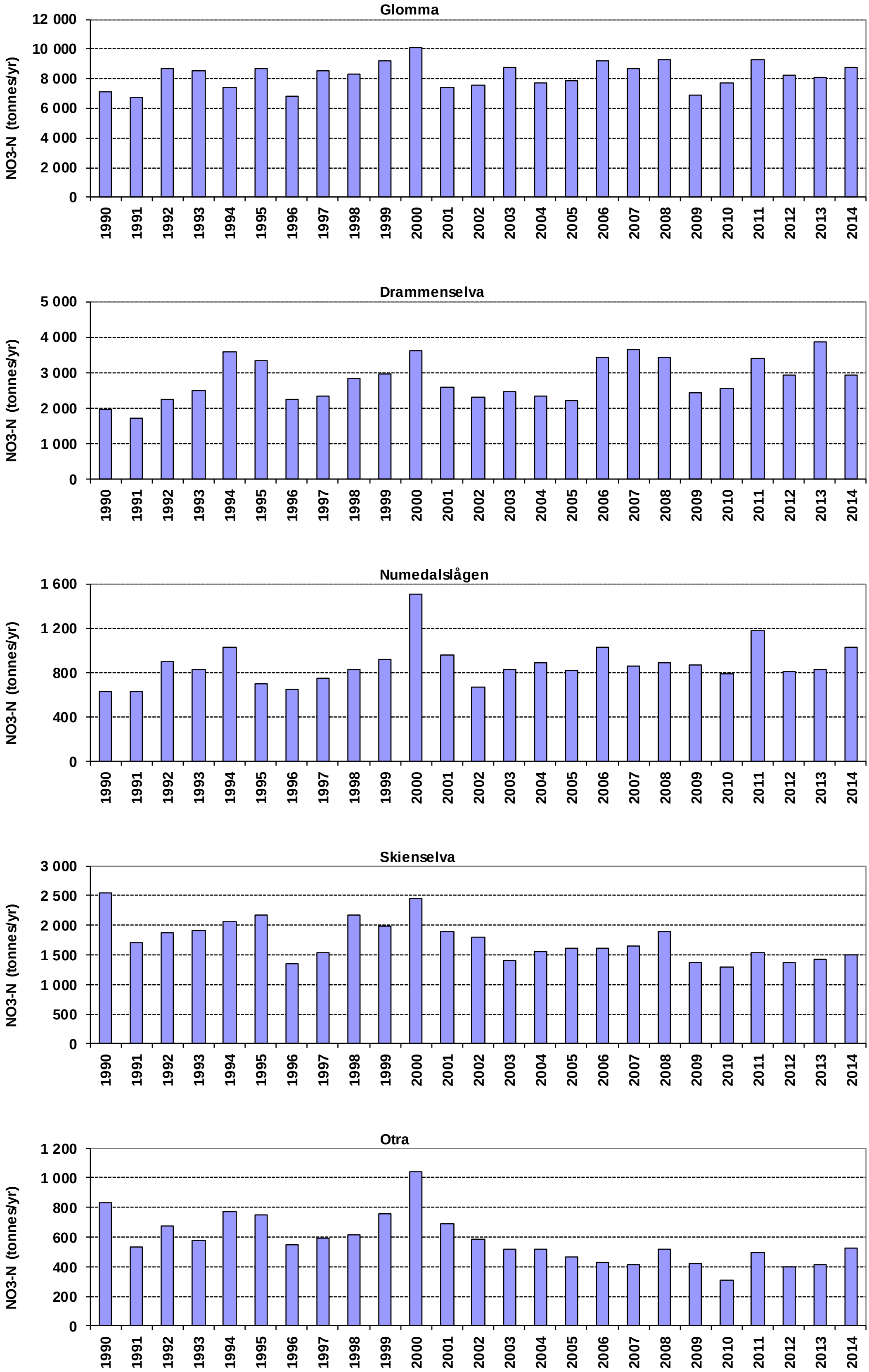

Figure A-V-3a. Annual riverine loads of nitrate-nitrogen (NO_3-N) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

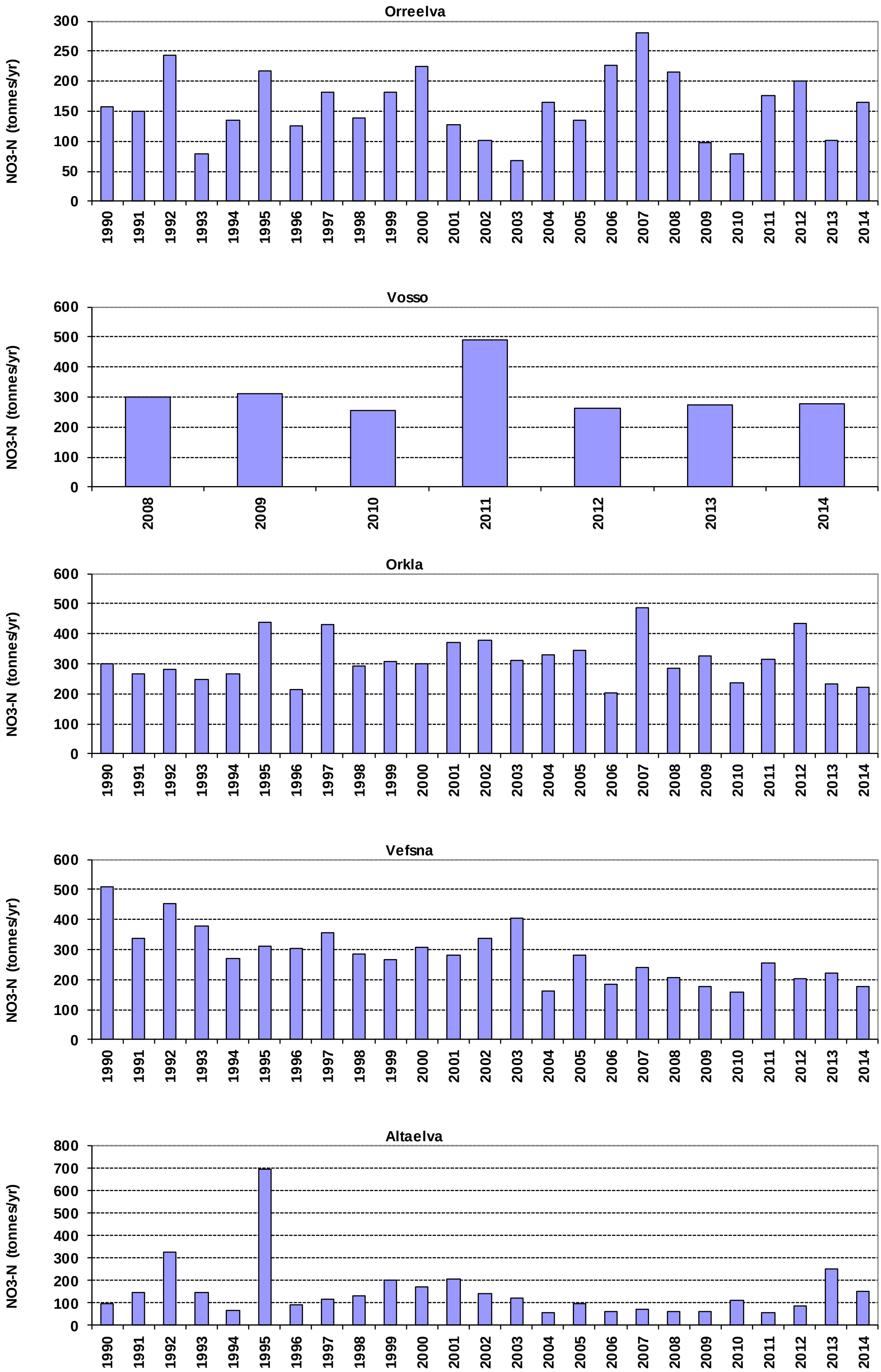

Figure A-V-3b. Annual riverine loads of nitrate-nitrogen (NO_3-N) from four main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso).

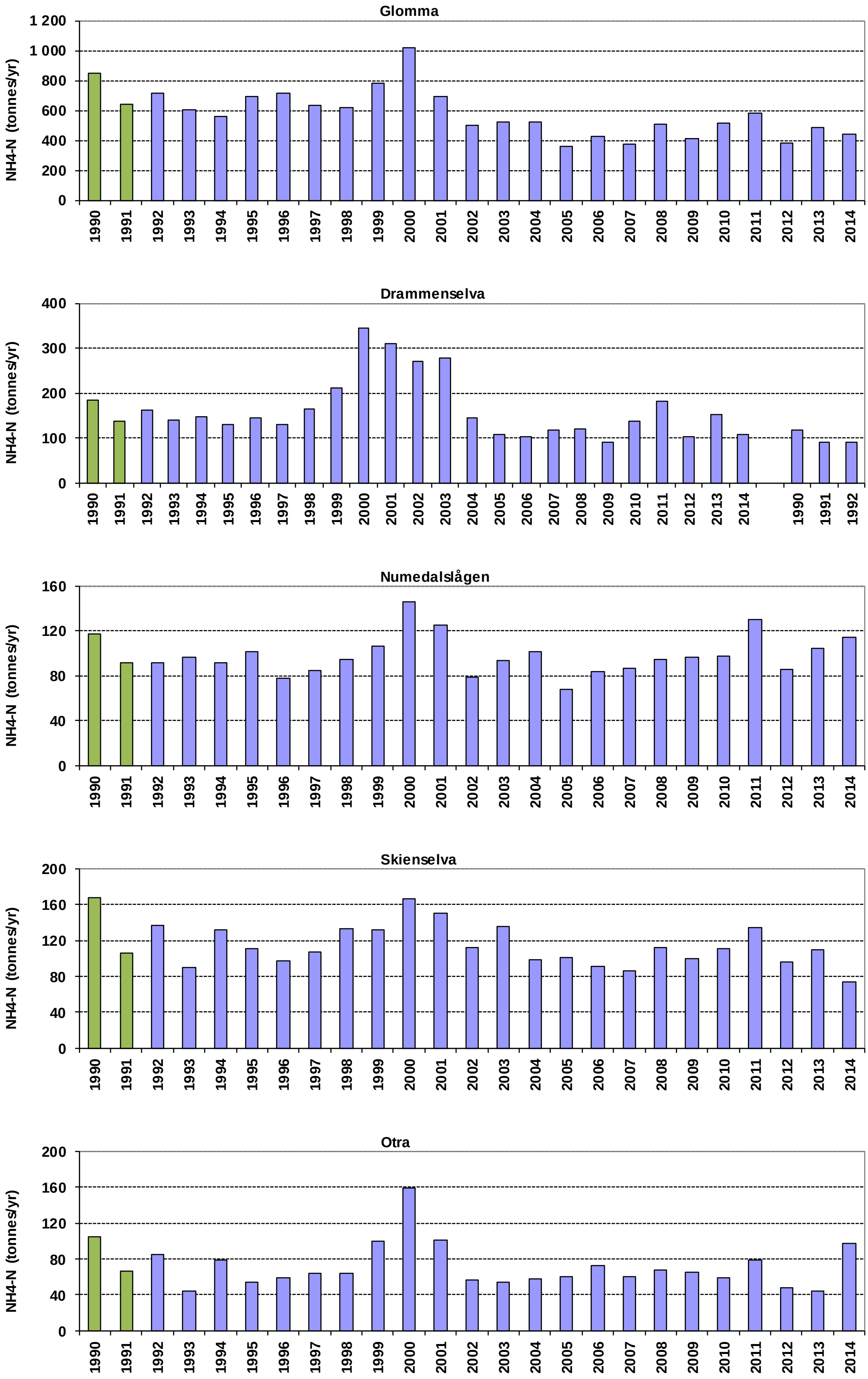

Figure A-V-4a. Annual riverine loads of ammonium-nitrogen (NH_4-N) in the five main rivers draining to Skagerrak, Norway, 1990-2014. Years with extra- or interpolated values are given in green.

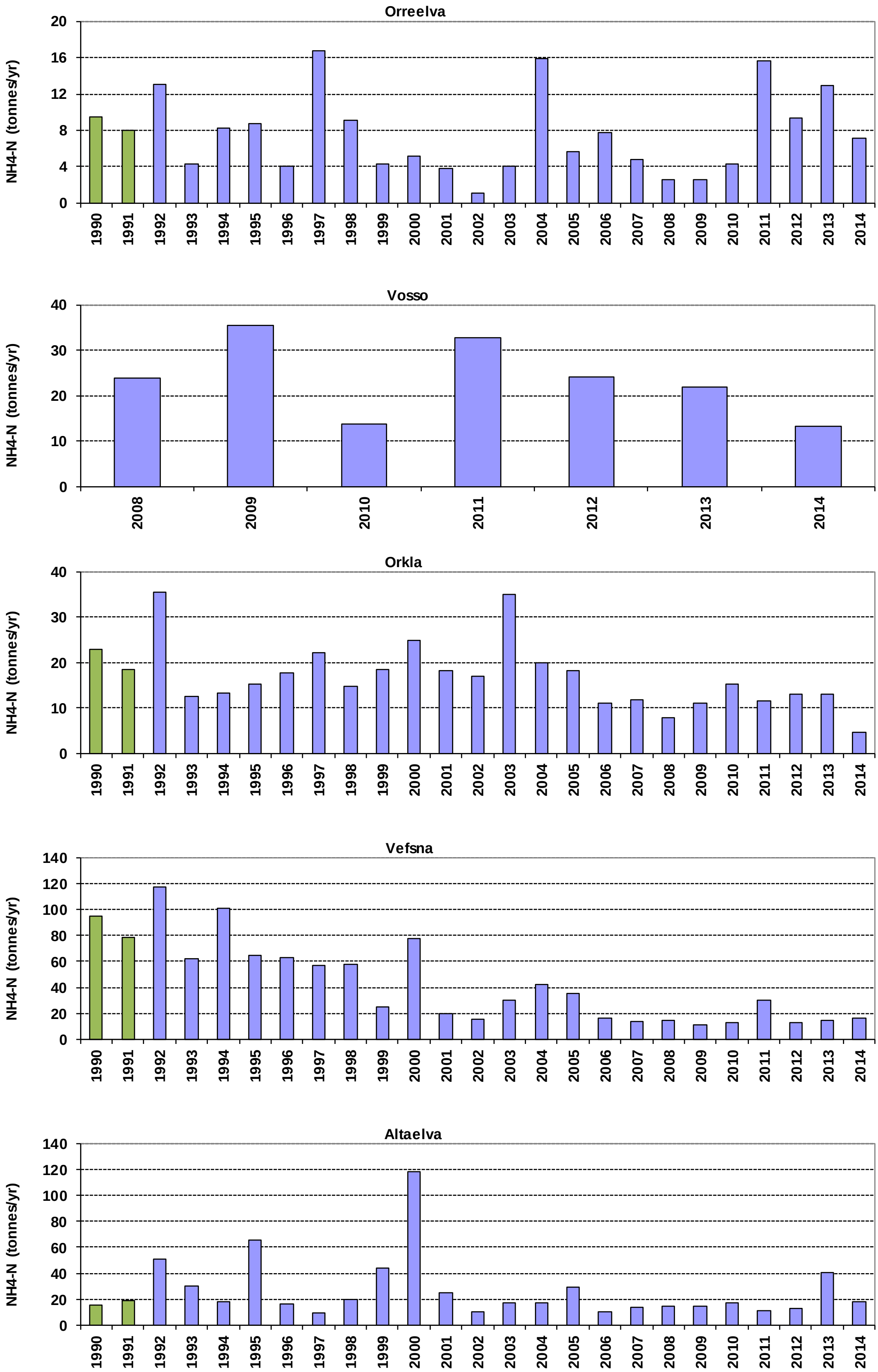

Figure A-V-4b. Annual riverine loads of ammonium-nitrogen (NH_4-N) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso). Years with extra- or interpolated values are given in green.

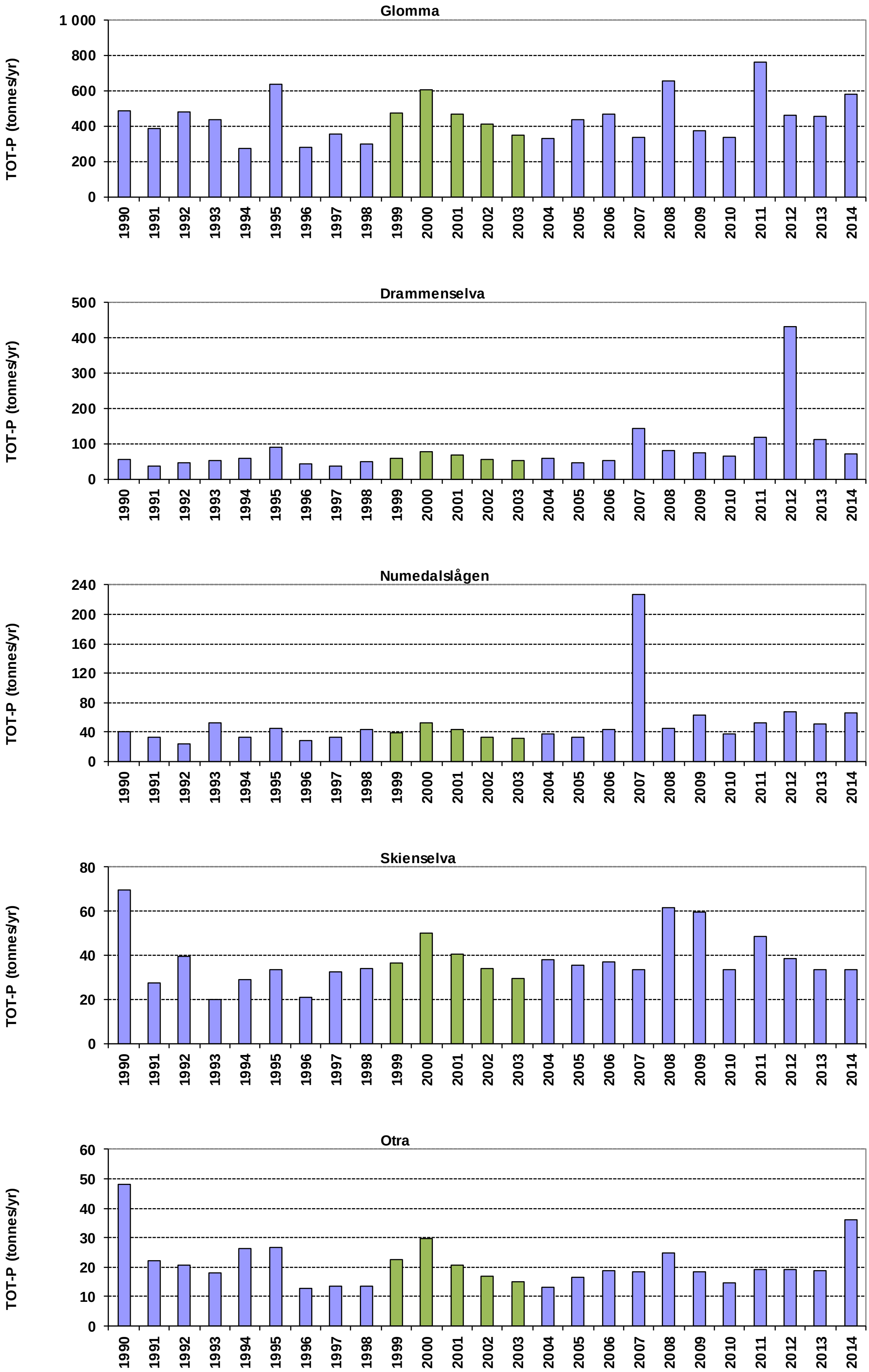

Figure A-V-5a. Annual riverine loads of total phosphorus (Tot-P) in the five main rivers draining to Skagerrak, Norway, 1990-2014. Years with extra- or interpolated values are given in green.

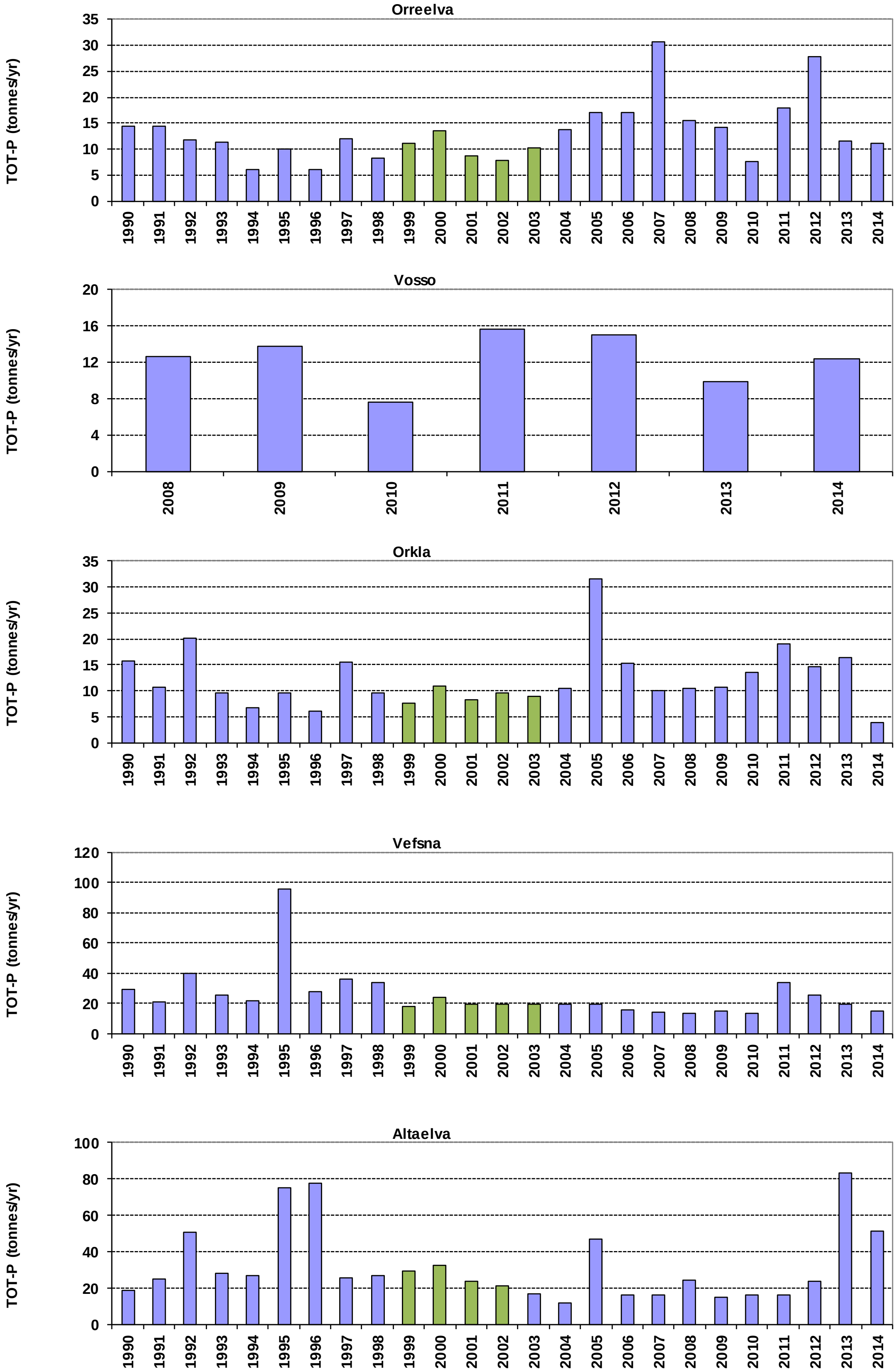

Figure A-V- 5b. Annual riverine loads of total phosphorus (Tot-P) in the five main rivers draining to the North Sea, the Norwegian Sea, and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso). Years with extra- or interpolated values are given in green.

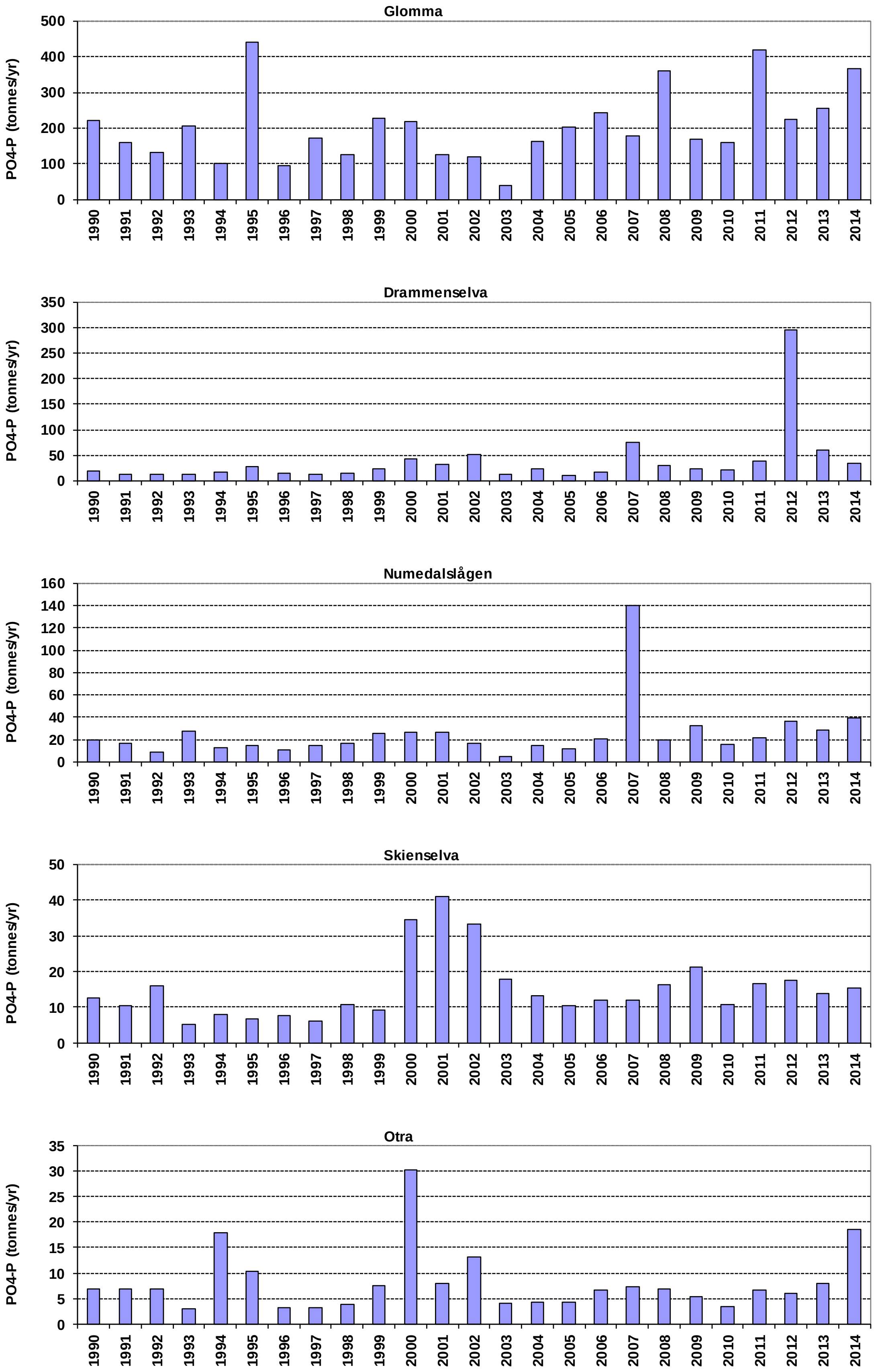

Figure A-V-6a. Annual riverine loads of orthophosphate-phosphorus (PO_4-P) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

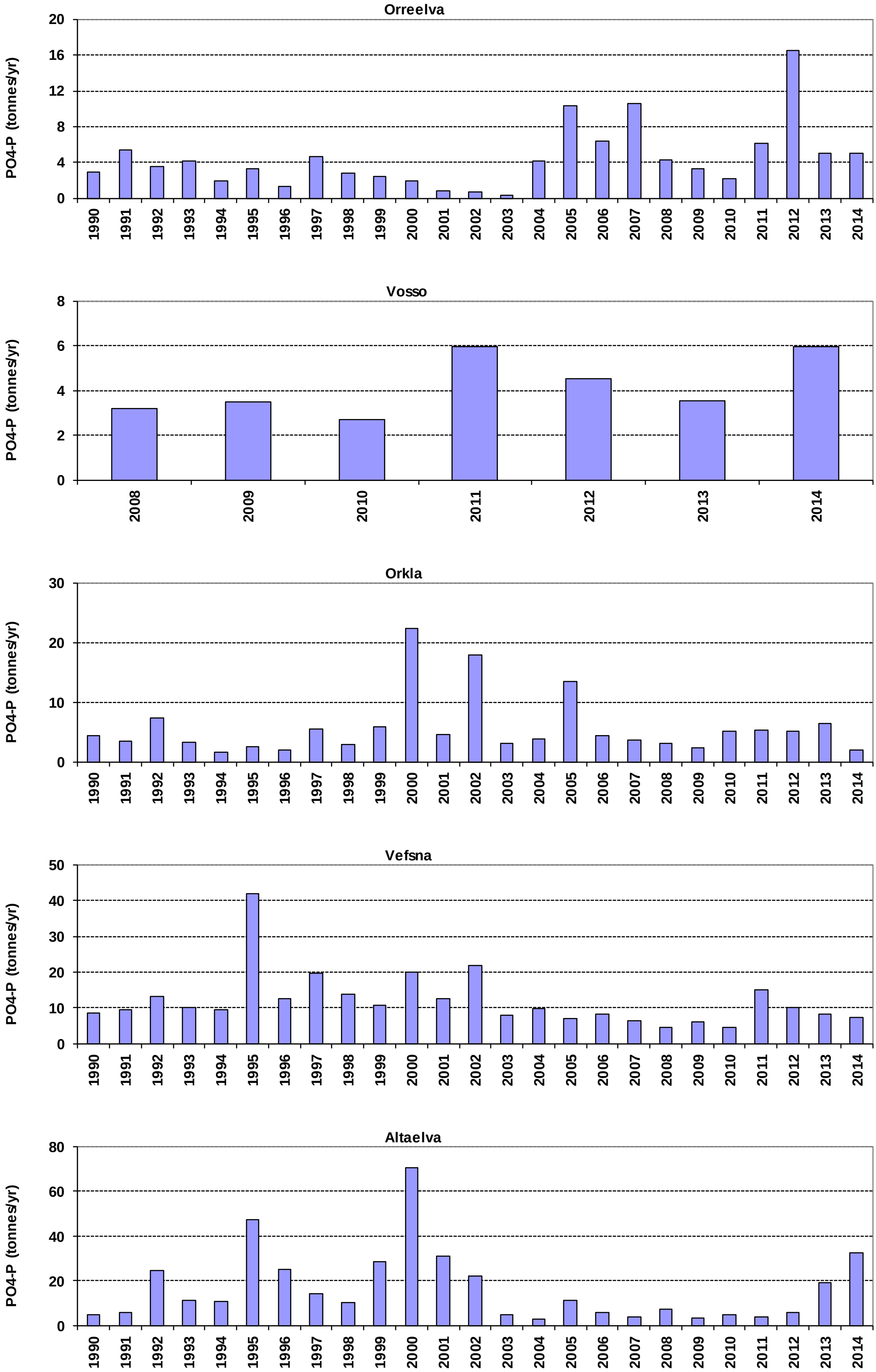

Figure A-V-6b. Annual riverine loads of orthophosphate-phosphorus (PO_4-P) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway. 1990-2014 (2008-2014 for River Vosso).

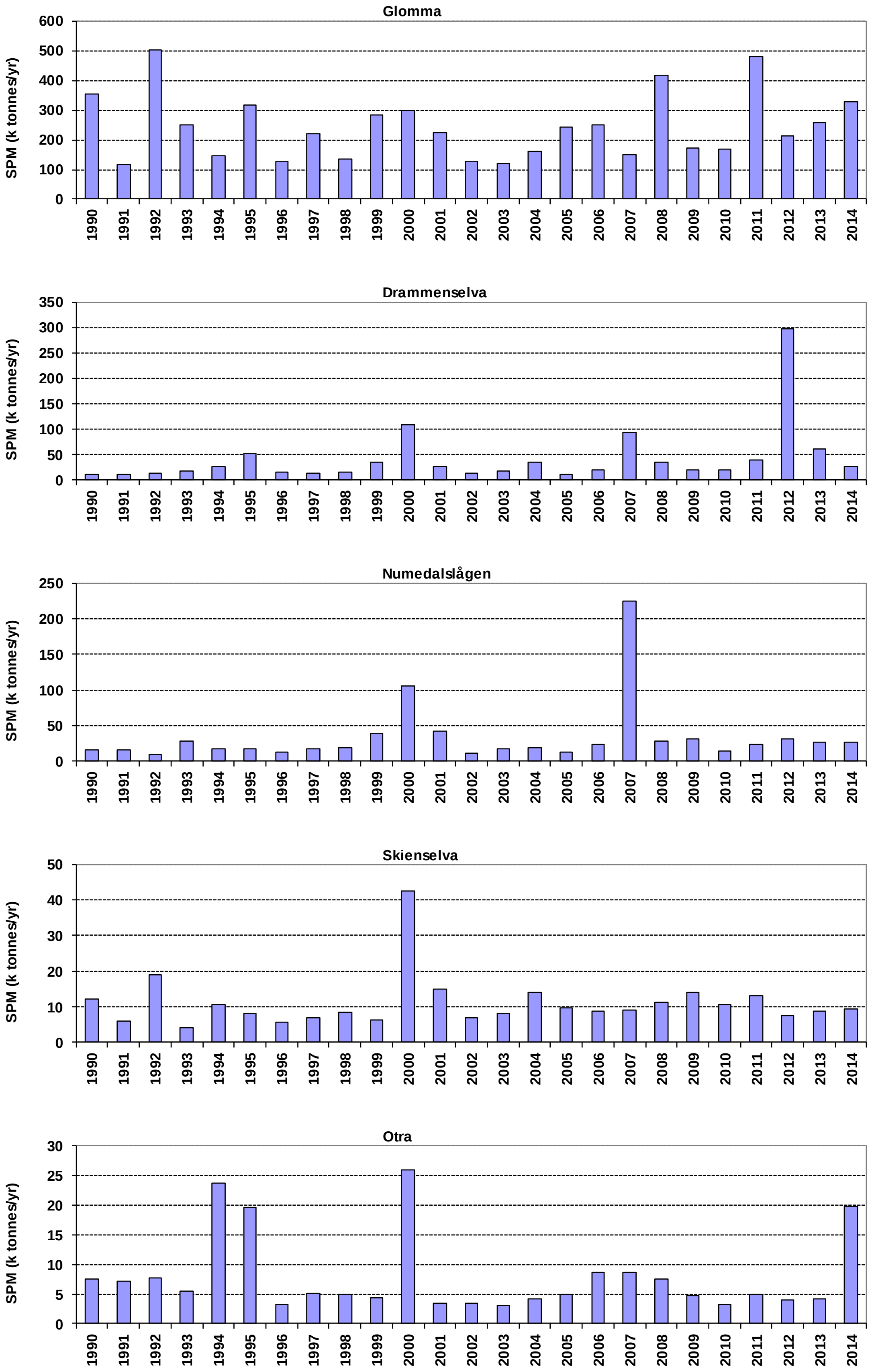

Figure A-V-7a. Annual riverine loads of suspended particulate matter (SPM) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

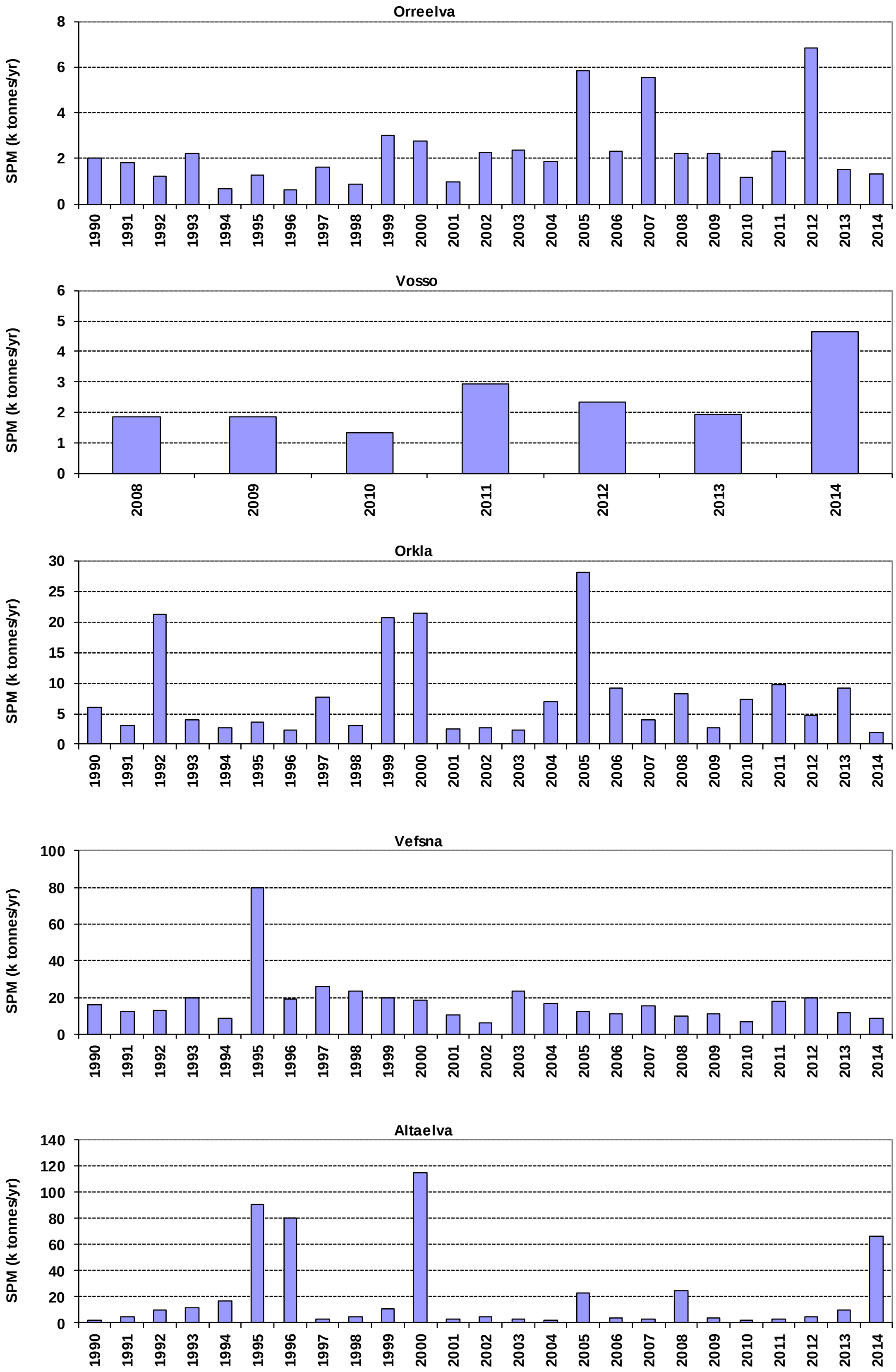

Figure A-V-7b. Annual riverine loads of suspended particulate matter (SPM) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, *Norway, 1990-2014 (2008-2014 for River Vosso).*

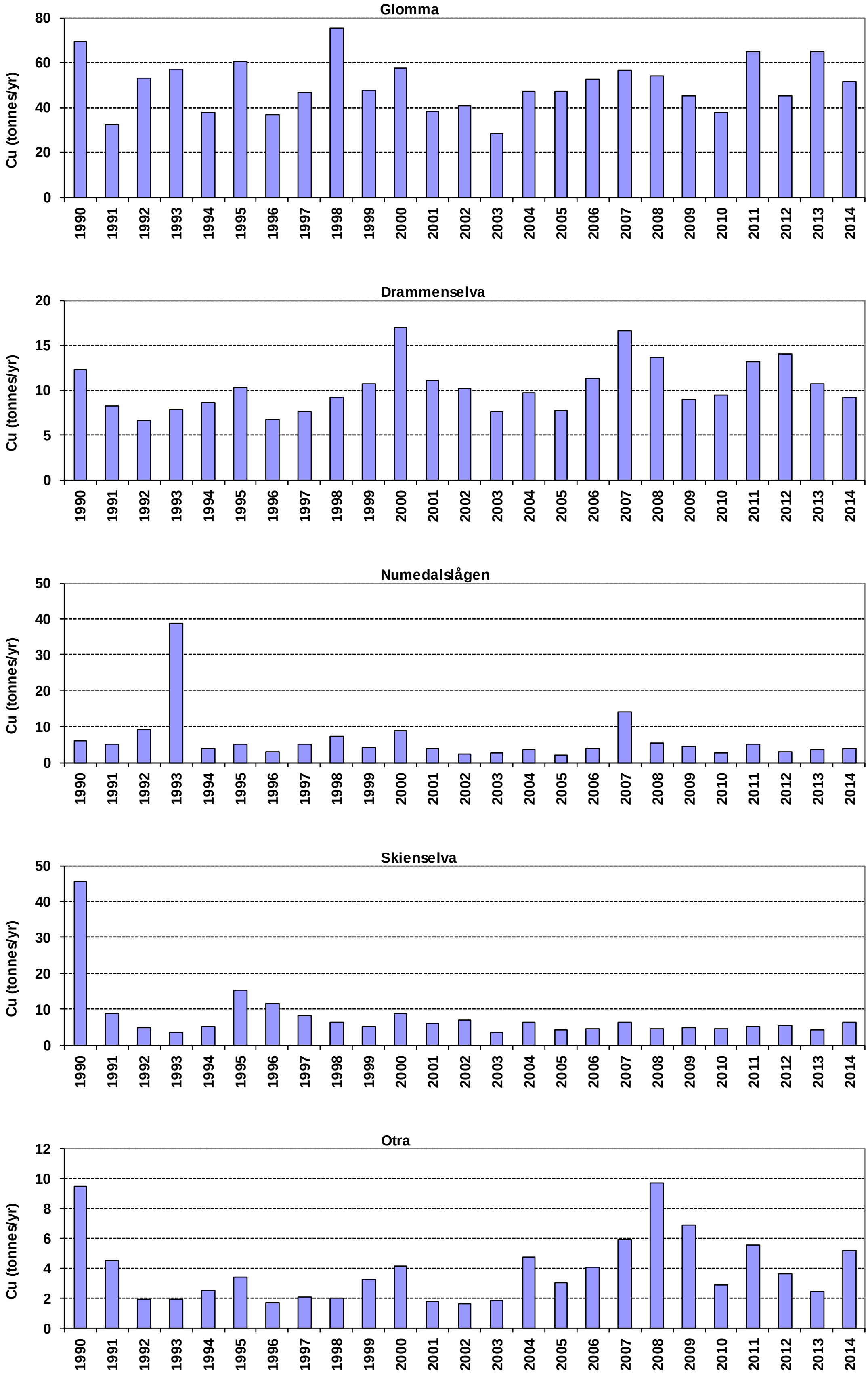

Figure A-V-8a. Annual riverine loads of copper (Cu) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

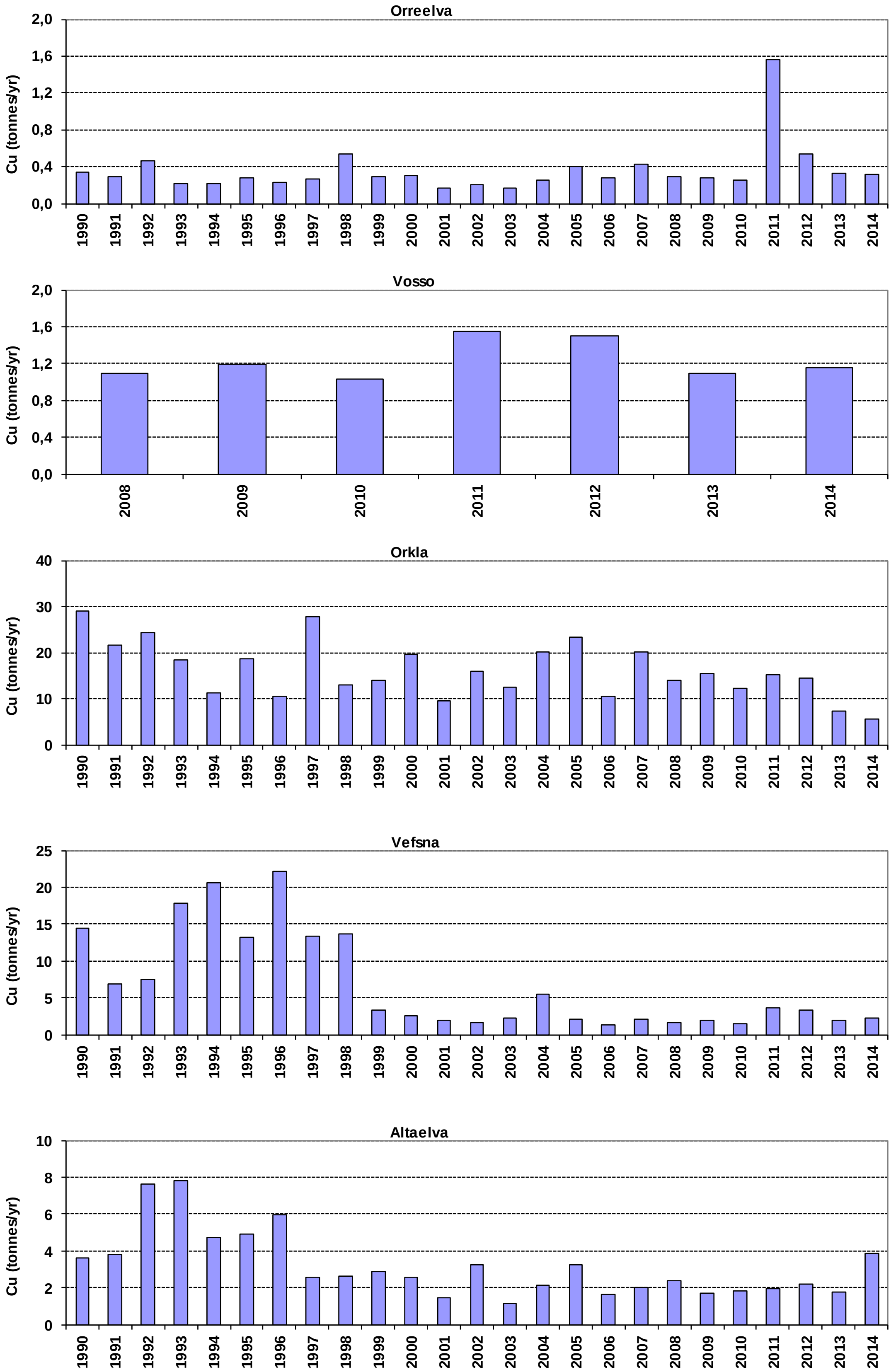

Figure A-V-8b. Annual riverine loads of copper (Cu) in the five main rivers draining to the North Sea, the Norwegian Sea, and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso).

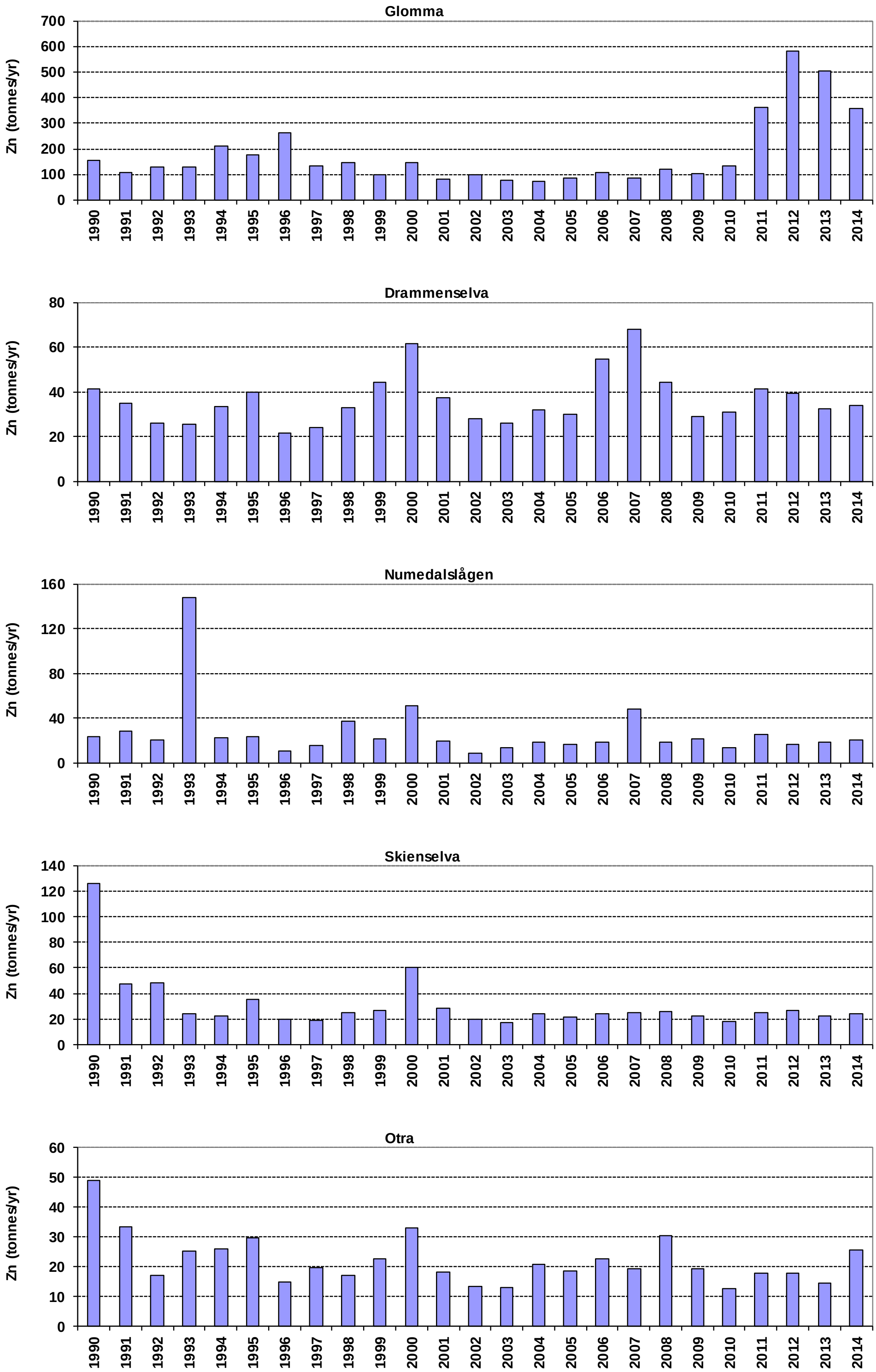

Figure A-V-9a. Annual riverine loads of zinc (Zn) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

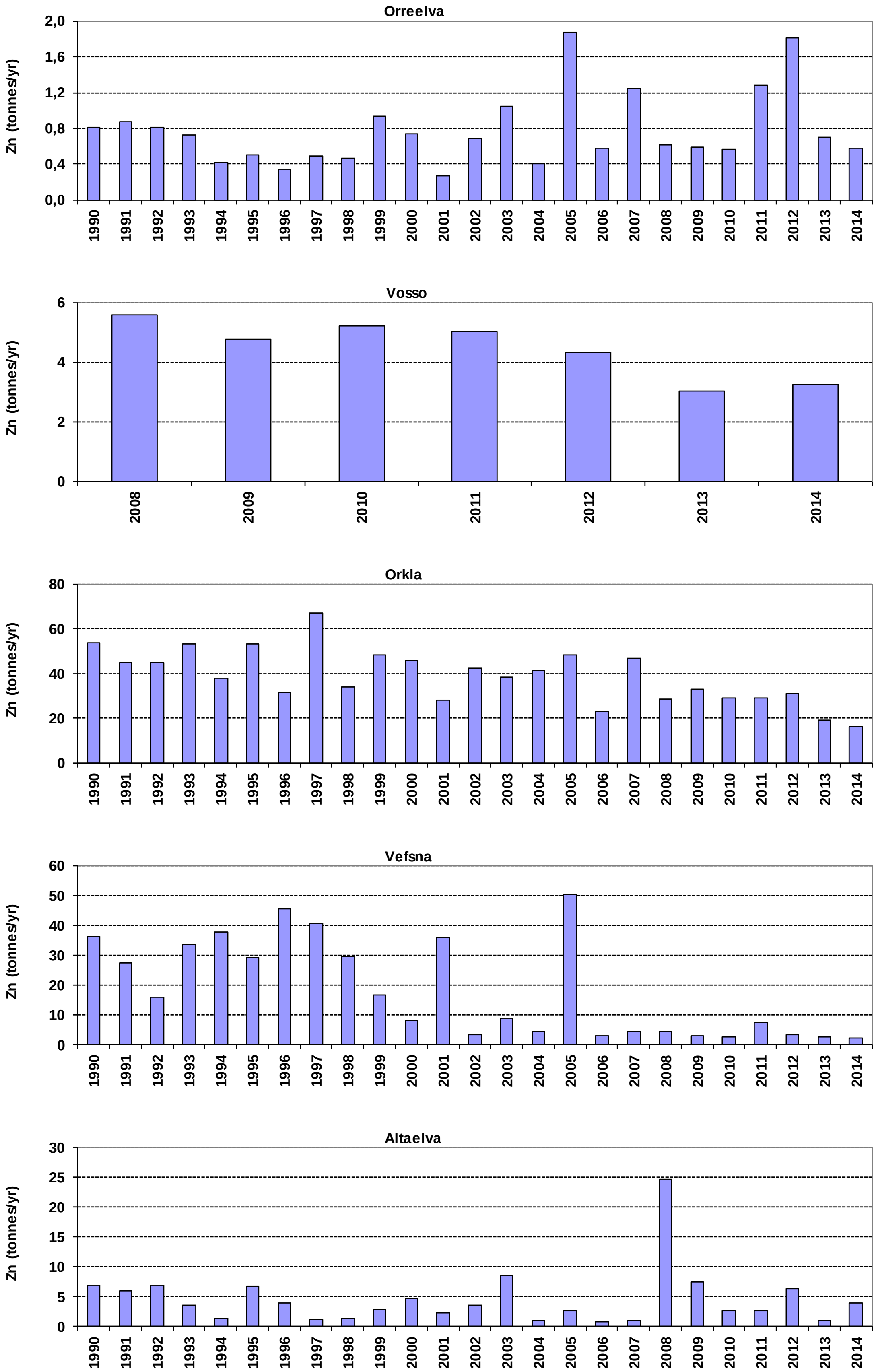

Figure A-V-9b. Annual riverine loads of zinc (Zn) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso).

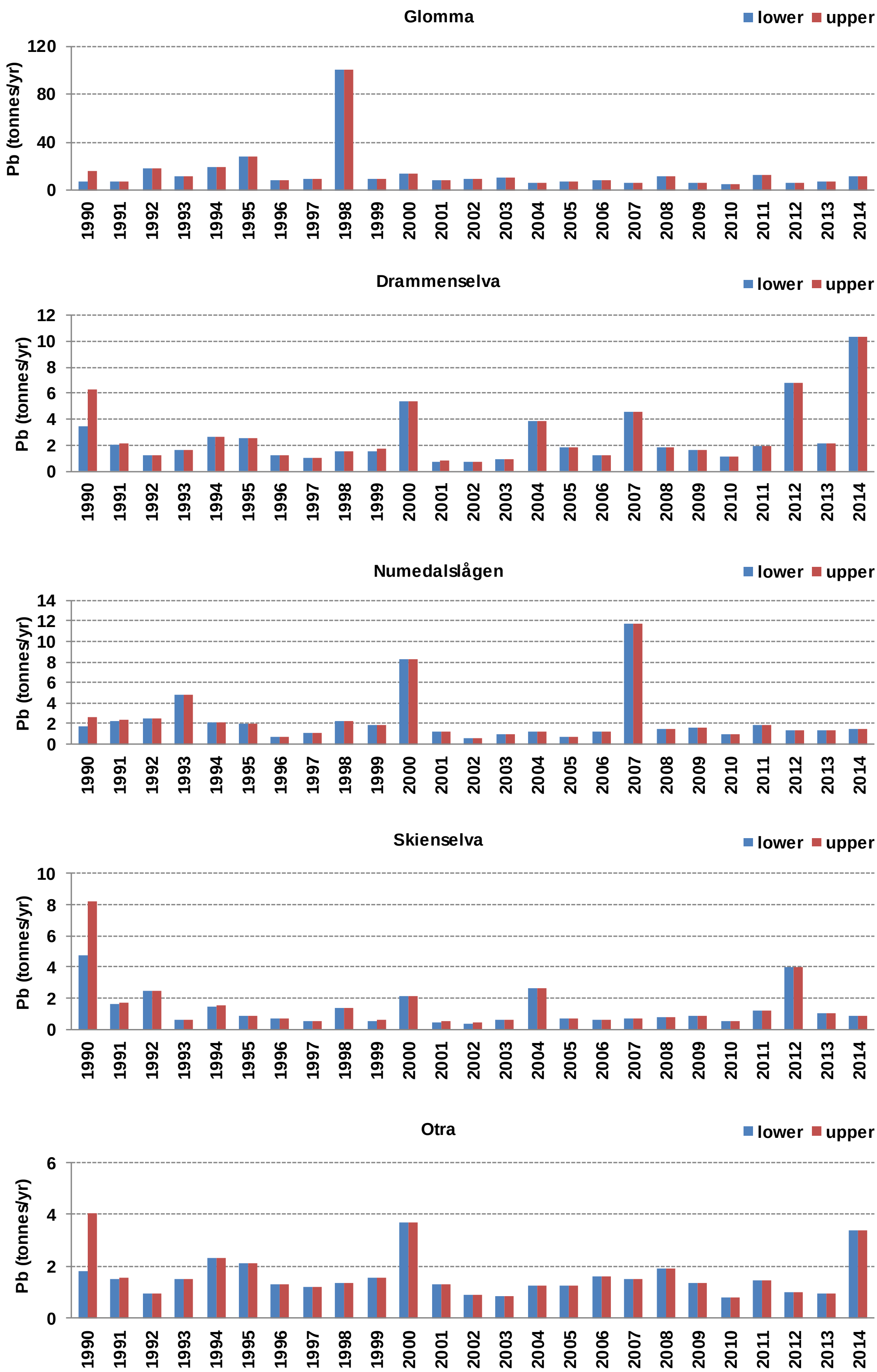

Figure A-V-10a. Annual riverine loads (upper and lower estimates) of lead (Pb) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

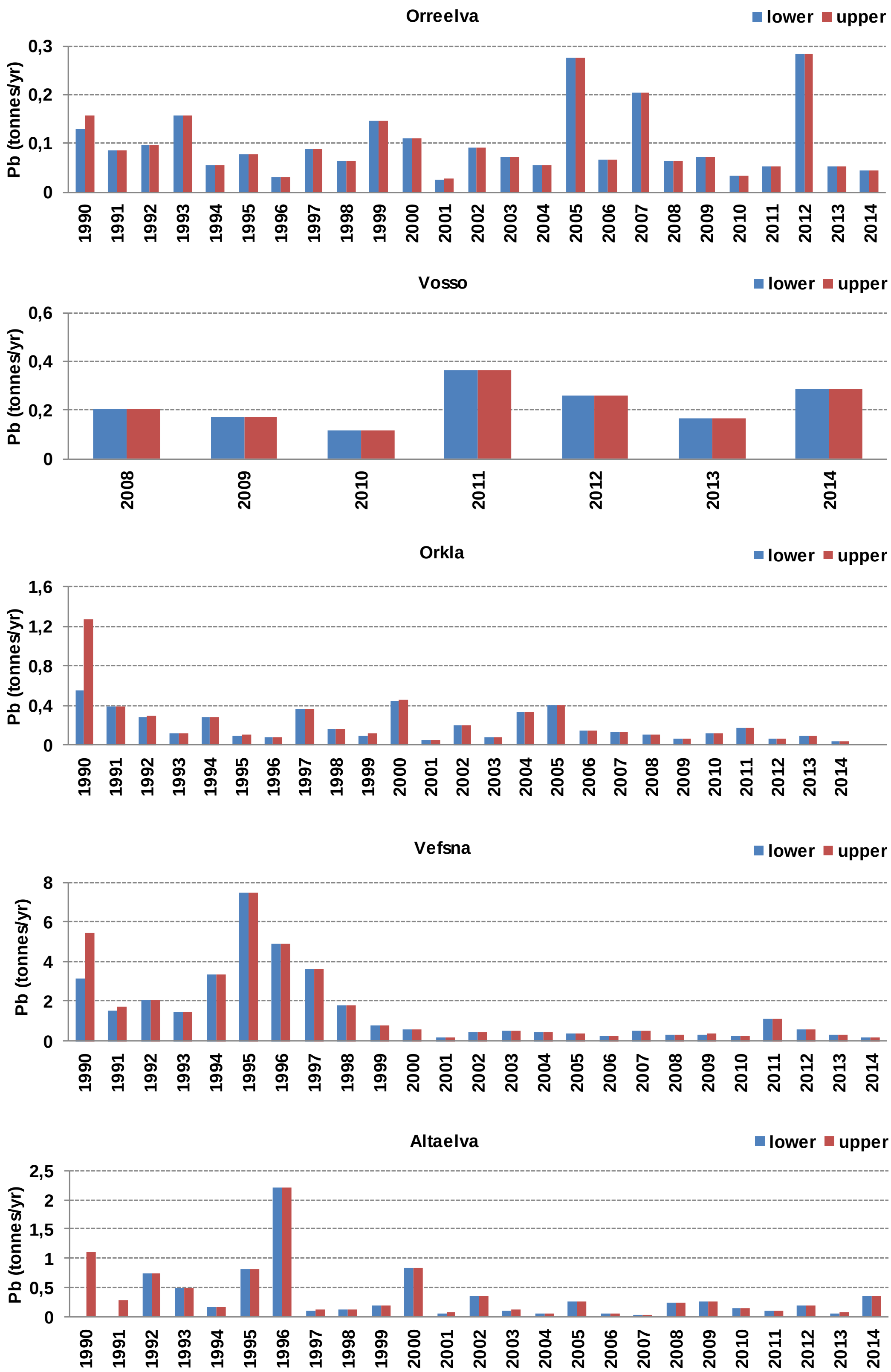

Figure A-V-10b. Annual riverine loads (upper and lower estimates) of lead (Pb) in the five main rivers draining to the North Sea, the Norwegian Sea, and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso).

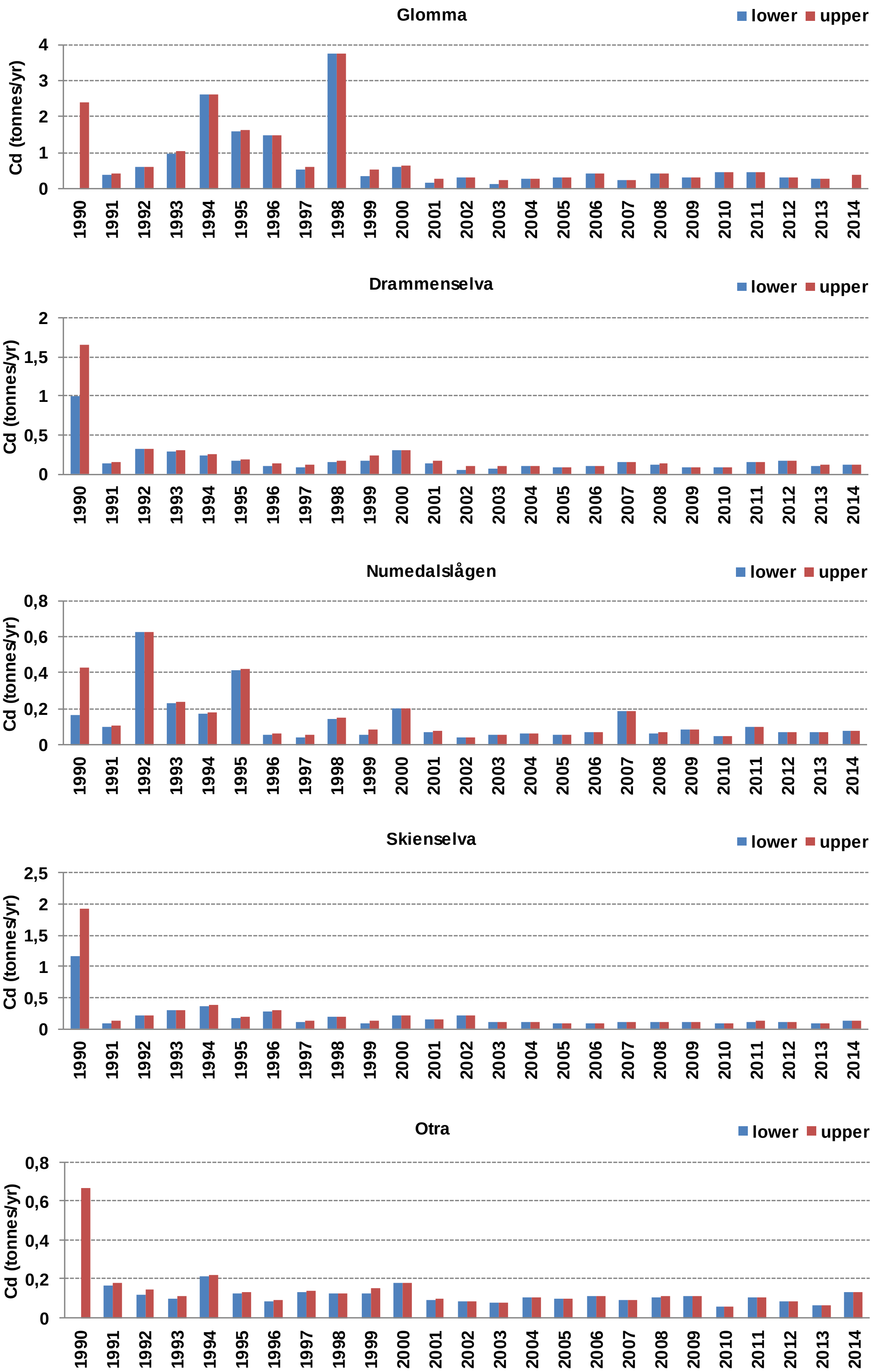

Figure A-V-11a. Annual riverine loads (upper and lower estimates) of cadmium (Cd) in the five main rivers draining to Skagerrak, Norway, 1990-2014.

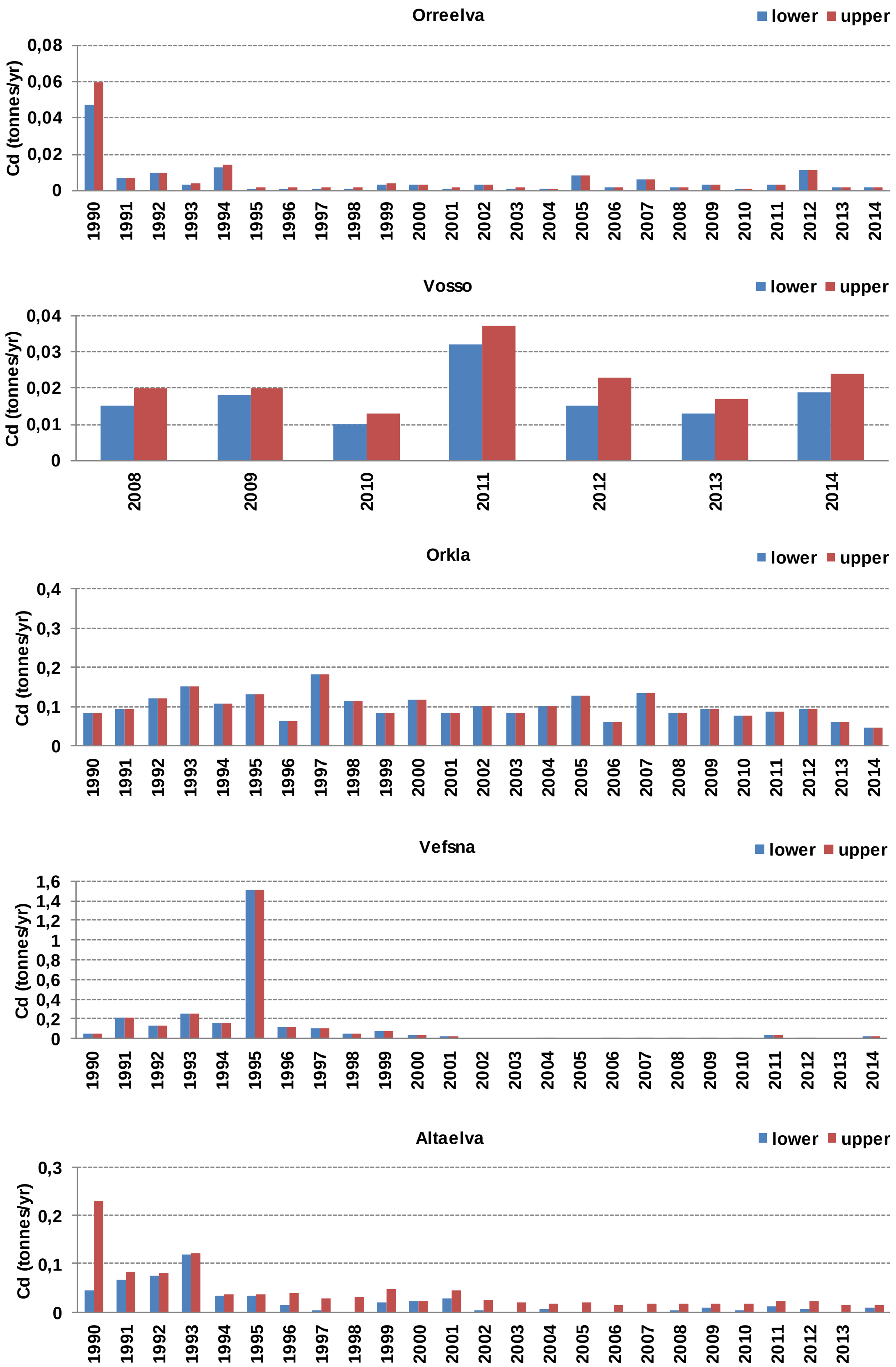

Figure A-V-11b. Annual riverine loads (upper and lower estimates) of cadmium (Cd) in the five main rivers draining to the North Sea, the Norwegian Sea, and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso).

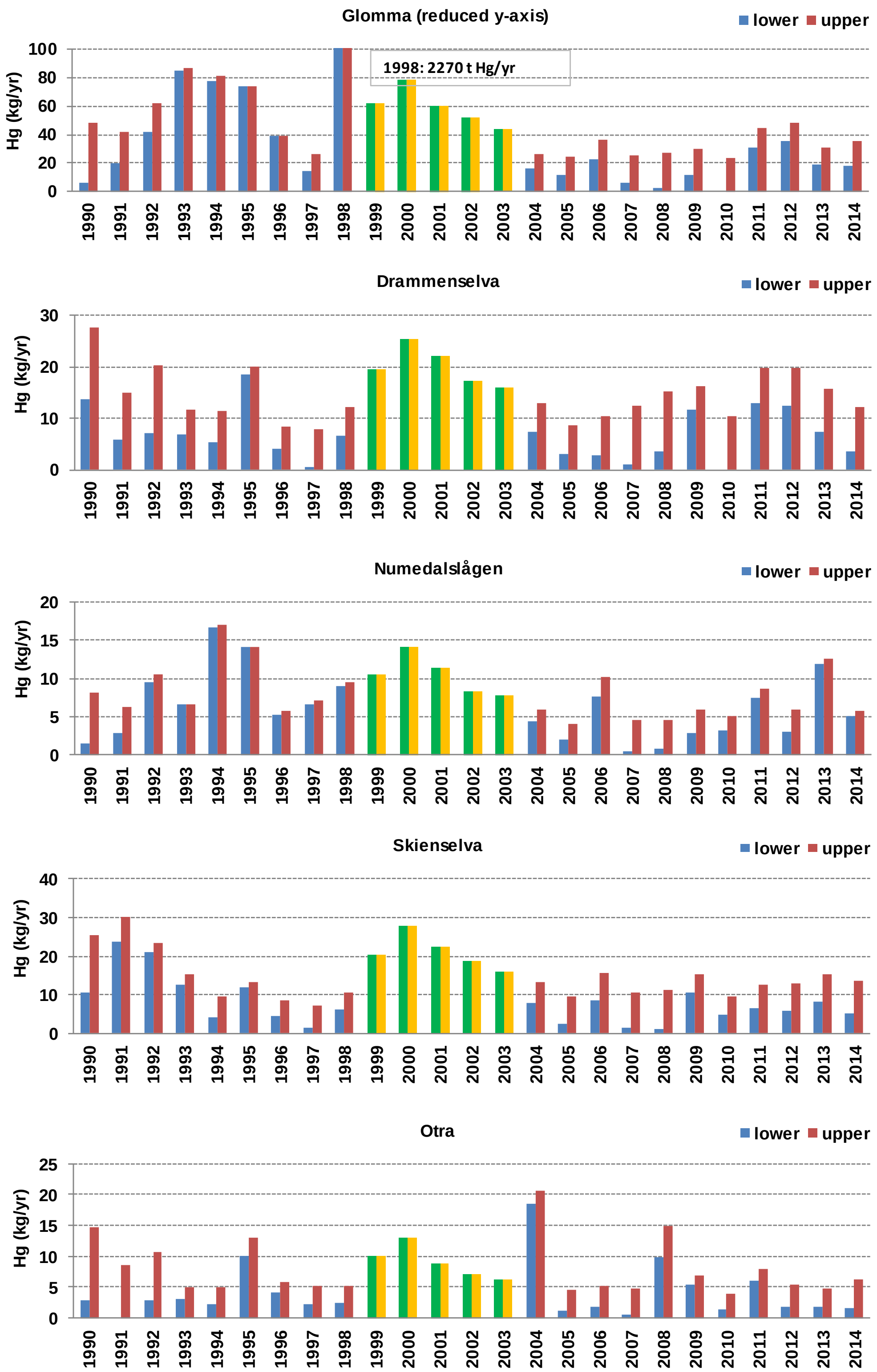

Figure A-V-12a. Annual riverine loads (upper and lower estimates) of mercury (Hg) in the five main rivers draining to Skagerrak. Norway, 1990-2014. Years with interpolated loads are given in green (lower estimates) and yellow (upper estimates). Note Glomma with reduced y-axis.

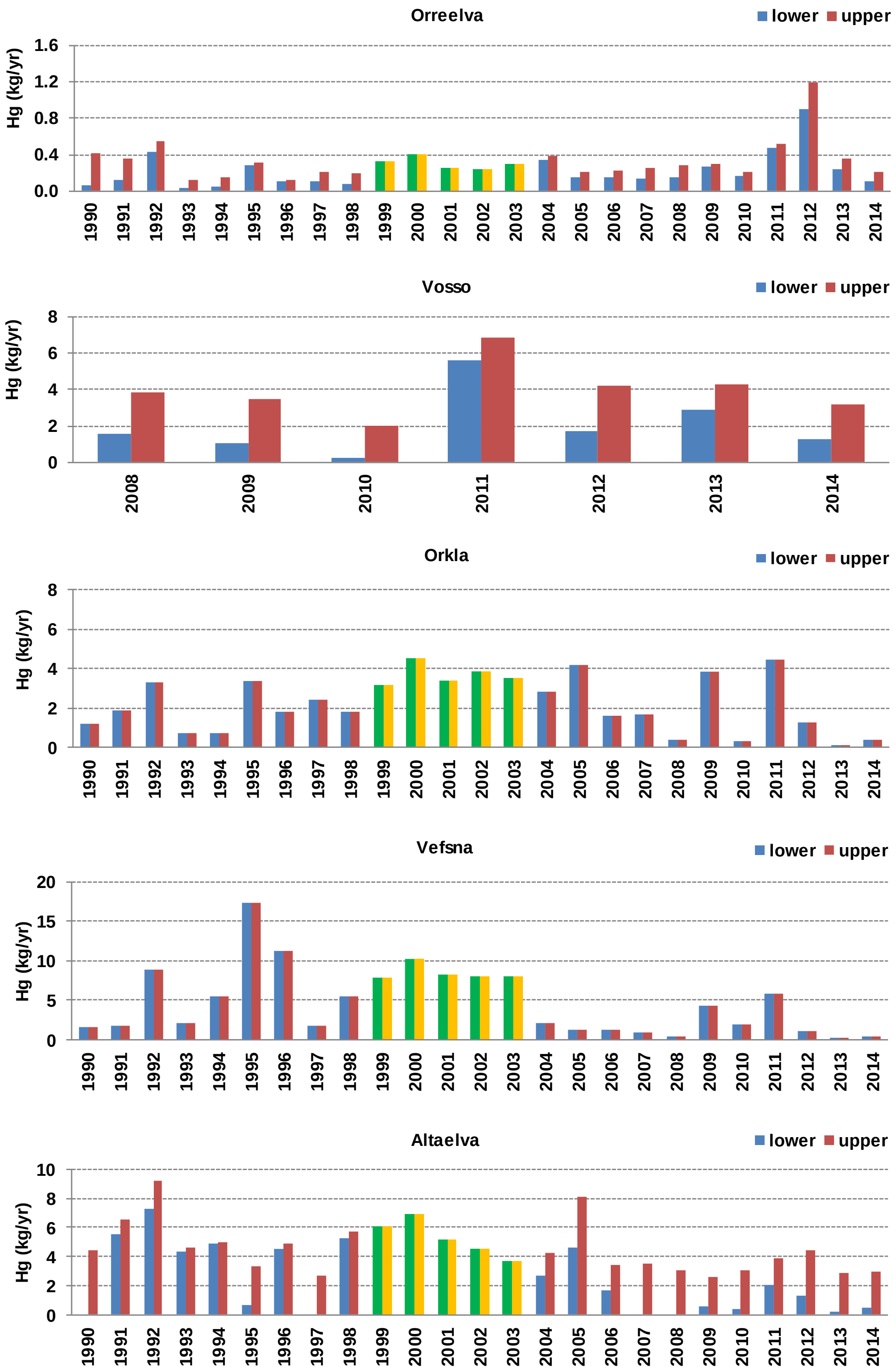

Figure A-V-12b. Annual riverine loads (upper and lower estimates) of mercury (Hg) in the five main rivers draining to the North Sea, the Norwegian Sea, and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso). Years with interpolated loads are given in green (lower estimates) and yellow (upper estimates).

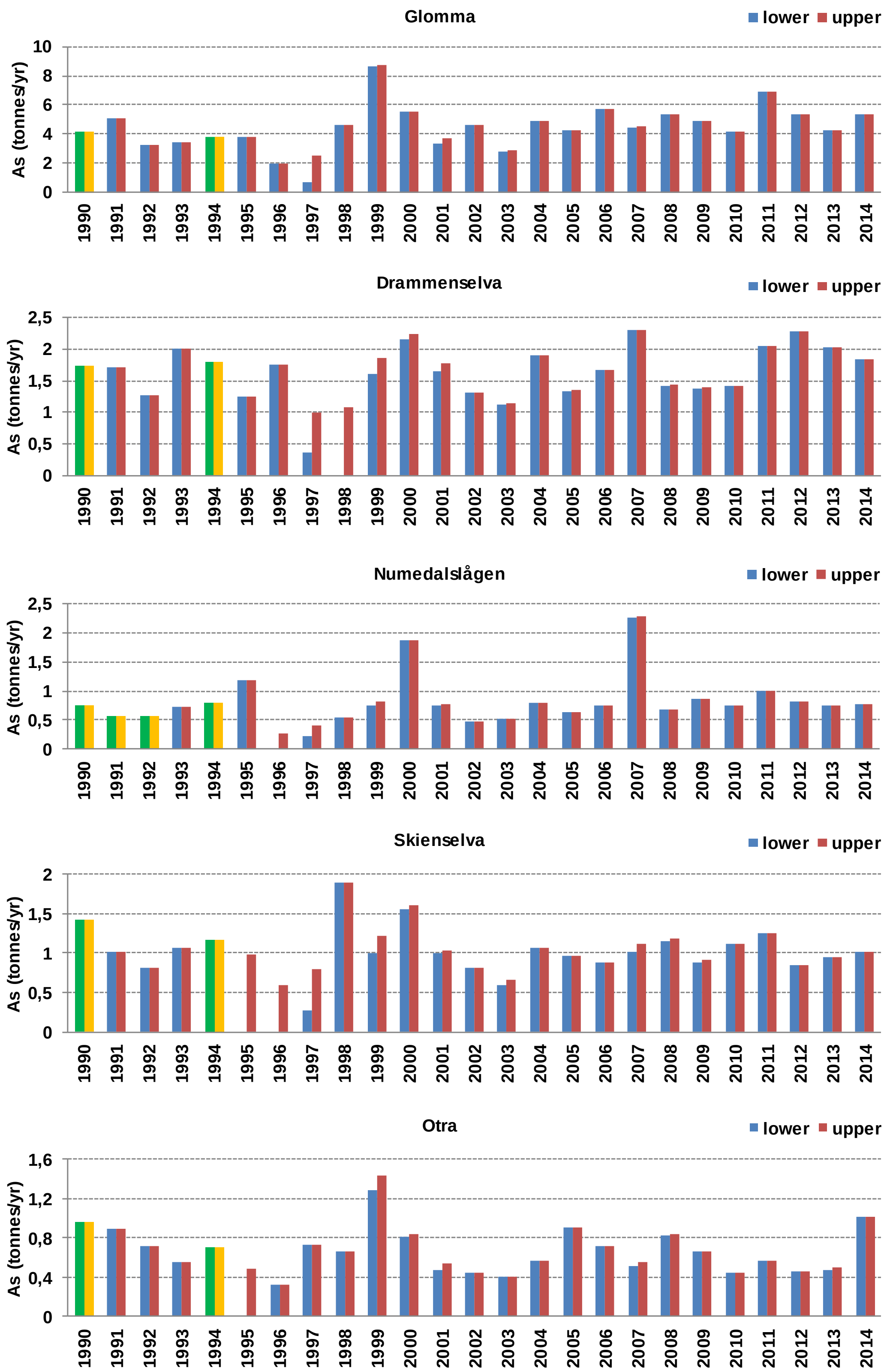

Figure A-V-13a. Annual riverine loads (upper and lower estimates) of arsenic (As) in the five main rivers draining to Skagerrak. Norway, 1990-2014. Years with extra- or interpolated loads are given in green (lower estimates) and yellow (upper estimates).

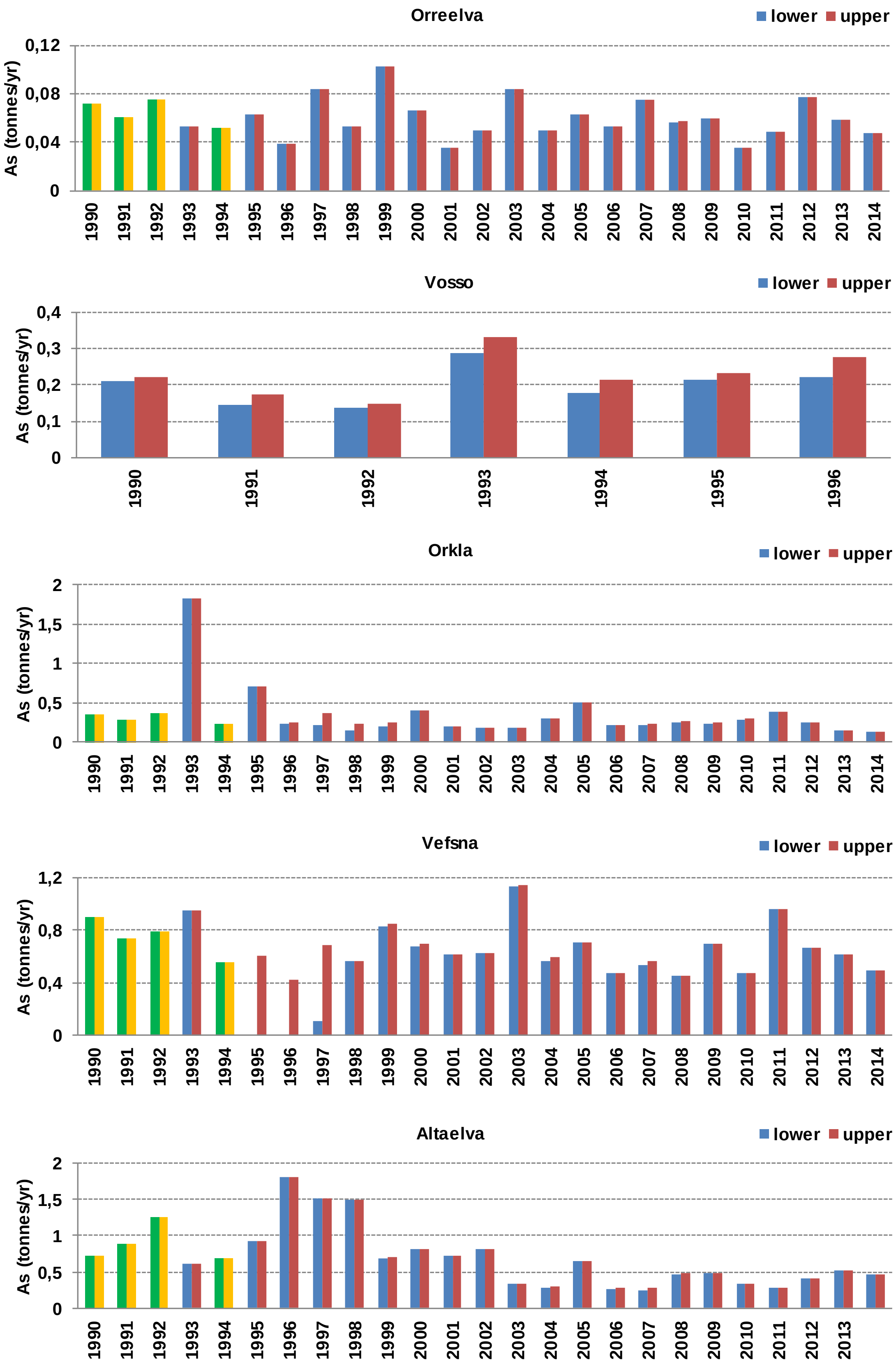

Figure A-V-13b. Annual riverine loads (upper and lower estimates) of arsenic (As) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2014 (2008-2014 for River Vosso). Years with extra- or interpolated loads are given in green (lower estimates) and yellow (upper estimates).

Addendum: Data from the 2014 RID Programme

Table 1 Concentration data in 2014

Table 1a. Concentration data with statistics for the 47 monitored rivers in 2014

Note that values above threshold values (cf. Chapter 3.3.3) are marked with red (exceeding threshold level) or light pink (almost at threshold level). Threshold levels used are shown in Table 17.

Glomma ved Sarpsfoss

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
06.01.2014 14:30:00	853	6.38	5.35	43.80	28.10	5.20	30	44	450	10	710	5.58	<0.05	0.26	0.77	0.01	2.11	15.10	1.50	0.81	<1.00
10.02.2014 11:15:00	638	7.06	5.60	18.50	15.10	4.40	18	22	485	27	775	4.77	<0.05	0.20	0.43	0.02	1.82	15.20	1.30	0.76	2.00
10.03.2014 11:00:00	992	7.18	5.61	28.40	21.60	5.00	24	32	485	25	755	5.18	<0.05	0.30	0.54	0.02	2.33	15.90	1.60	1.60	2.00
07.04.2014 13:15:00	572	7.09	4.66	6.41	4.54	4.50	6	7	345	24	575	4.69	<0.05	0.20	0.20	0.01	1.31	6.40	0.68	0.37	1.00
05.05.2014 14:30:00	990	7.01	3.85	7.71	5.99	4.70	6	11	220	11	440	3.83	<0.05	0.20	0.22	0.01	1.44	17.70	0.57	0.34	<1.00
19.05.2014 15:10:00	1064	7.20	4.37	3.90	3.36	4.20	4	8	340	15	535	3.47	<0.05	0.21	0.18	0.01	1.44	9.17	0.71	0.61	<1.00
30.05.2014 13:20:00	2801	7.11	3.00	18.80	17.40	4.00	17	24	205	15	405	3.10	<0.05	0.25	0.75	0.02	2.98	21.80	1.20	0.41	1.00
04.06.2014 16:30:00	1930	7.16	3.67	17.90	9.59	3.90	23	39	245	15	535	3.27	<0.05	0.31	1.59	0.03	3.16	14.40	1.40	0.52	<1.00
12.06.2014 16:30:00	1791	7.22	4.04	4.11	4.76	3.00	5	10	285	10	400	2.91	<0.05	0.10	0.13	0.01	1.46	8.86			<1.00
25.06.2014 11:30:00	781	7.29	4.21	3.00	3.43	2.70	4	8	215	9	415	2.52	<0.05	0.20	0.10	0.01	1.29	5.89	0.59	0.20	<1.00
07.07.2014 14:00:00	860	7.37	4.27	3.12	3.80	2.60	3	8	205	11	390	2.74	<0.05	0.20	0.09	0.01	1.14	9.05	0.49	0.48	1.00
04.08.2014 12:50:00	807	7.26	4.19	1.89	2.40	2.70	2	9	166	23	390	2.46	<0.05	0.10	0.12	0.01	1.27	12.00	0.49	<0.10	<1.00
06.09.2014 15:00:00	652	7.31	4.22	2.56	1.57	3.80	2	6	143	17	340	2.57	<0.05	0.09	0.09	0.01	1.84	15.70			<1.00
06.10.2014 13:15:00	381	7.21	4.20	1.59	1.51	3.00	2	6	189	12	370	2.29	<0.05	0.09	0.06	0.01	1.25	6.37	0.39	0.10	<1.00
10.11.2014 14:50:00	1021	7.11	4.36	22.00	18.00	6.30	19	29	345	<2	605	4.98	<0.05	0.10	0.45	0.01	1.89	10.10	1.10	<0.10	<1.00
08.12.2014 14:45:00	655	6.92	4.65	23.00	21.10	6.40	23	38	405	21	685	4.92	<0.05	0.25	0.56	0.02	1.73	9.05	1.30	0.63	2.00
Lower avg.	1049	7.12	4.39	12.92	10.14	4.15	12	19	296	15	520	3.71	0.00	0.19	0.39	0.01	1.78	12.04	0.95	0.49	0.56
Upper avg..	1049	7.12	4.39	12.92	10.14	4.15	12	19	296	15	520	3.71	0.05	0.19	0.39	0.01	1.78	12.04	0.95	0.50	1.19
Minimum	381	6.38	3.00	1.59	1.51	2.60	2	6	143	2	340	2.29	0.05	0.09	0.06	0.01	1.14	5.89	0.39	0.10	1.00
Maximum	2801	7.37	5.61	43.80	28.10	6.40	30	44	485	27	775	5.58	0.05	0.31	1.59	0.03	3.16	21.80	1.60	1.60	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	14	14	16
St.dev	620	0.23	0.69	12.24	8.68	1.20	10	14	115	7	148	1.14	0.00	0.08	0.40	0.01	0.61	4.64	0.43	0.40	0.40

Alna

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.01.2014 11:10:00	4	7.39	36.10	11.80	14.70	4.90	40	55	940	110	1390	7.72	<0.05	0.33	0.91	0.19	4.76	33.40	1.30	1.80	2.00
04.02.2014 13:35:00	1	7.77	118.00	10.40	14.30	4.50	61	74	1050	352	1760	6.78	<0.05	0.20	1.04	0.05	6.23	27.80	1.10	3.05	3.00
04.03.2014 11:00:00	3	7.84	47.40	7.36	10.60	4.40	40	51	980	140	1440	7.62	<0.05	0.40	0.64	0.05	3.85	16.50	0.96	1.70	2.00
03.04.2014 12:30:00	1	7.78	39.10	7.83	6.93	3.80	34	40	720	170	1230	5.56	<0.05	0.29	0.62	0.03	2.34	8.90	0.52	1.00	<1.00
05.05.2014 09:20:00	0	8.10	41.70	1.62	3.02	3.50	40	55	890	270	1660	4.02	<0.05	0.20	0.21	0.03	2.26	5.69	0.54	2.60	<1.00
04.06.2014 10:00:00	1	7.80	41.80	30.80	37.70	14.90	131	204	1350	210	2530	5.97	<0.05	0.59	3.93	0.15	20.10	56.50	2.46	1.50	<1.00
03.07.2014 10:00:00	1	7.99	38.20	5.75	4.55	4.70	54	65	860	100	1350	5.75	<0.05	0.29	0.52	0.04	3.82	10.30	0.73	0.56	1.00
05.08.2014 10:15:00	1	7.85	32.00	15.20	8.63	4.80	79	93	1299	126	1580	7.32	<0.05	0.41	1.10	0.04	4.87	15.20	1.20	0.56	<1.00
01.09.2014 10:05:00	0	8.04	36.10	2.86	2.98	3.40	68	73	1193	93	1570	6.87	<0.05	0.20	0.36	0.02	2.62	6.63	0.43	0.30	<1.00
07.10.2014 09:50:00	1	7.92	36.30	2.53	2.35	3.60	59	71	1350	38	1700	6.57	<0.05	0.20	0.22	0.03	2.53	7.29	0.37	0.30	<1.00
03.11.2014 10:50:00	5	7.85	22.80	13.10	23.20	6.30	59	68	645	20	1090	7.85	<0.05	0.45	1.20	0.05	5.77	19.40	1.30	0.36	1.00
03.12.2014 10:30:00	1	7.92	50.80	3.80	6.89	4.70	51	58	895	100	1390	7.72	<0.05	0.20	0.57	0.04	3.39	13.90	0.72	0.57	3.00
Lower avg.	2	7.85	45.03	9.42	11.32	5.29	60	76	1014	144	1558	6.65	0.00	0.31	0.94	0.06	5.21	18.46	0.97	1.19	1.00
Upper avg..	2	7.85	45.03	9.42	11.32	5.29	60	76	1014	144	1558	6.65	0.05	0.31	0.94	0.06	5.21	18.46	0.97	1.19	1.50
Minimum	0	7.39	22.80	1.62	2.35	3.40	34	40	645	20	1090	4.02	0.05	0.20	0.21	0.02	2.26	5.69	0.37	0.30	1.00
Maximum	5	8.10	118.00	30.80	37.70	14.90	131	204	1350	352	2530	7.85	0.05	0.59	3.93	0.19	20.10	56.50	2.46	3.05	3.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
St.dev	1	0.18	24.06	8.06	10.31	3.13	26	43	238	95	364	1.15	0.00	0.13	1.00	0.05	4.87	14.71	0.58	0.94	0.80

Drammenselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.01.2014 10:45:00	390	6.93	4.85	6.07	5.39	3.70	6	10	390	6	630	3.87	<0.05	0.20	0.20	0.02	1.01	4.61	0.62	0.36	<1.00
04.02.2014 11:30:00	372	7.05	3.58	1.31	0.99	2.60	1	3	240	10	385	2.80	<0.05	0.10	0.07	0.01	0.57	1.90	0.42	0.44	1.00
04.03.2014 11:00:00	372	7.14	5.19	3.57	3.15	3.10	6	7	425	9	620	3.53	<0.05	0.20	0.11	0.01	1.07	3.30	0.69	0.41	<1.00
01.04.2014 13:30:00	369	7.13	4.01	1.44	1.16	3.30	2	4	265	9	450	3.02	<0.05	0.10	0.13	0.01	0.68	2.60	0.46	0.20	1.00
07.05.2014 11:15:00	534	7.03	3.10	1.88	2.09	3.20	3	7	195	6	375	2.74	<0.05	0.10	0.11	0.01	0.63	2.11	0.39	0.34	<1.00
15.05.2014 11:30:00	624	7.01	2.81	1.95	1.87	3.30	6	6	175	3	335	2.52	0.10	0.39	0.49	0.01	0.72	2.78	0.41	<0.10	<1.00
27.05.2014 10:20:00	957	6.87	2.63	2.59	3.03	3.30	3	7	165	5	335	2.78	<0.05	0.20	2.43	0.01	0.68	4.09	0.44	0.20	1.00
04.06.2014 08:15:00	560	7.16	3.15	1.50	1.63	3.40	2	6	190	4	350	2.67	<0.05	0.10	1.21	0.01	0.72	2.43	0.45	<0.10	1.00
16.06.2014 07:30:00	460	7.16	3.09	1.12	1.43	3.10	<1	8	165	5	385	2.50	<0.05	0.20	2.16	0.01	0.84	2.82			1.00
24.06.2014 09:00:00	235	7.09	3.43	0.98	1.31	3.00	1	4	175	4	295	2.48	<0.05	0.10	3.97	0.01	0.62	4.07	0.43	<0.10	<1.00
09.07.2014 12:00:00	268	7.15	3.06	2.19	4.88	3.10	4	9	135	8	320	2.33	<0.05	0.20	1.84	0.01	0.88	2.78	0.43	0.50	<1.00
08.08.2014 13:00:00	209	7.19	3.15	0.62	1.01	3.00	2	5	113	22	290	2.08	<0.05	0.20	0.08	0.01	0.77	1.80	0.46	<0.10	<1.00
03.09.2014 07:30:00	271	7.01	2.92	1.02	0.94	2.90	<1	2	106	21	270	2.04	<0.05	0.10	1.39	<0.01	0.61	1.60			<1.00
13.10.2014 11:30:00	381	7.15	3.79	3.50	4.28	4.80	4	10	335	11	560	3.17	<0.05	0.20	1.07	0.02	0.94	3.44	0.50	0.20	<1.00
03.11.2014 12:00:00	566	7.27	4.07	1.50	1.75	3.70	3	5	295	10	460	2.97	<0.05	0.10	1.03	0.01	0.82	2.74	0.41	<0.10	<1.00
08.12.2014 09:20:00	376	6.97	3.41	1.00	0.96	3.60	1	4	225	5	385	2.91	<0.05	0.10	0.68	0.01	0.63	2.54	0.42	0.10	<1.00
Lower avg.	434	7.08	3.51	2.02	2.24	3.32	3	6	225	9	403	2.78	0.01	0.16	1.06	0.01	0.76	2.85	0.47	0.20	0.31
Upper avg..	434	7.08	3.51	2.02	2.24	3.32	3	6	225	9	403	2.78	0.05	0.16	1.06	0.01	0.76	2.85	0.47	0.23	1.00
Minimum	209	6.87	2.63	0.62	0.94	2.60	1	2	106	3	270	2.04	0.05	0.10	0.07	0.01	0.57	1.60	0.39	0.10	1.00
Maximum	957	7.27	5.19	6.07	5.39	4.80	6	10	425	22	630	3.87	0.10	0.39	3.97	0.02	1.07	4.61	0.69	0.50	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	14	14	16
St.dev	186	0.11	0.72	1.38	1.47	0.49	2	2	95	6	113	0.48	0.01	0.08	1.10	0.00	0.15	0.86	0.09	0.15	0.00

Numedalslågen

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
06.01.2014 12:00:00	190	6.70	3.96	14.30	16.90	5.30	21	33	370	16	605	5.18	<0.05	0.31	0.77	0.04	1.32	9.11	0.81	0.70	1.00
05.02.2014 11:30:00	91	6.70	4.66	4.44	6.49	2.90	5	9	400	46	575	4.45	<0.05	0.20	0.27	0.01	0.70	4.30	0.35	0.49	1.00
05.03.2014 11:00:00	107	6.84	4.59	6.07	6.11	3.70	6	13	435	32	655	4.66	<0.05	0.20	0.24	0.02	0.83	5.69	0.41	0.38	2.00
07.04.2014 10:45:00	133	6.83	3.01	1.69	1.80	3.40	2	4	205	22	375	3.34	<0.05	0.10	0.14	0.01	0.58	3.63	0.32	0.20	1.00
07.05.2014 10:30:00	160	6.87	2.49	1.62	1.98	3.50	2	6	165	19	350	2.87	<0.05	0.10	0.15	0.02	0.61	2.94	0.29	0.40	<1.00
04.06.2014 11:00:00	105	6.89	2.15	1.56	1.39	3.40	2	5	125	17	275	2.63	<0.05	0.10	0.14	0.01	0.71	2.60	0.31	0.10	1.00
08.07.2014 10:15:00	110	7.04	2.46	1.84	1.88	2.40	2	6	75	25	245	2.31	<0.05	0.09	0.12	0.01	0.47	1.60	0.29	0.43	1.00
06.08.2014 07:30:00	67	7.02	2.58	1.19	0.94	2.60	1	3	83	35	260	2.16	<0.05	0.10	0.10	0.01	0.49	1.40	0.23	<0.10	<1.00
08.09.2014 09:15:00	133	6.80	3.94	35.00	19.10	7.30	41	55	306	30	735	4.30	<0.05	0.41	1.03	0.03	2.16	9.61			2.00
06.10.2014 09:00:00	67	6.86	2.73	1.59	1.54	3.10	1	5	102	31	310	2.65	<0.05	0.09	0.12	0.01	0.55	2.34	0.29	0.10	2.00
05.11.2014 11:15:00	199	6.88	3.43	7.70	8.53	7.40	11	19	270	16	545	4.94	<0.05	0.22	0.45	0.03	1.00	6.15	0.48	0.10	1.00
08.12.2014 10:00:00	119	6.55	2.87	1.60	2.16	3.90	3	6	180	40	380	3.91	<0.05	0.10	0.15	0.01	0.58	3.06	0.39	0.20	2.00
Lower avg.	123	6.83	3.24	6.55	5.74	4.07	8	14	226	27	443	3.62	0.00	0.17	0.31	0.02	0.83	4.37	0.38	0.28	1.17
Upper avg..	123	6.83	3.24	6.55	5.74	4.07	8	14	226	27	443	3.62	0.05	0.17	0.31	0.02	0.83	4.37	0.38	0.29	1.33
Minimum	67	6.55	2.15	1.19	0.94	2.40	1	3	75	16	245	2.16	0.05	0.09	0.10	0.01	0.47	1.40	0.23	0.10	1.00
Maximum	199	7.04	4.66	35.00	19.10	7.40	41	55	435	46	735	5.18	0.05	0.41	1.03	0.04	2.16	9.61	0.81	0.70	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	11	12
St.dev	42	0.14	0.86	9.76	6.24	1.70	12	16	127	10	171	1.08	0.00	0.10	0.30	0.01	0.48	2.75	0.16	0.20	0.49

Skienselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.01.2014 10:00:00	452	6.82	2.11	1.26	1.36	2.70	2	3	170	2	295	2.44	<0.05	0.09	0.27	0.03	2.15	5.00	0.73		<1.00
11.02.2014 10:00:00	397	6.80	2.24	0.91	0.81	2.50	2	4	170	5	300	2.44	<0.05	0.09	0.07	0.01	0.69	1.97	0.21	0.20	3.00
11.03.2014 10:00:00	382	6.69	2.04	1.02	0.62	2.40	1	3	175	6	295	2.37	<0.05	0.09	0.05	0.01	0.38	2.22	0.20	<0.10	1.00
09.04.2014 09:00:00	568	6.67	2.06	1.28	1.68	3.00	<1	4	170	4	295	2.42	<0.05	0.10	0.10	0.02	0.43	2.68	0.23	0.20	<1.00
12.05.2014 08:30:00	389	6.89	2.00	0.58	0.68	2.50	1	2	145	4	255	2.22	<0.05	0.08	0.04	0.01	0.42	1.90	0.10	0.20	<1.00
03.06.2014 09:30:00	354	6.79	1.82	0.60	0.42	2.40	<1	4	145	5	240	2.09	<0.05	0.09	0.04	0.01	0.43	1.80	0.20	0.20	<1.00
01.07.2014 08:00:00	228	6.76	1.72	0.53	0.47	2.40	<1	1	85	7	245	1.76	<0.05	0.10	0.04	0.01	0.33	1.50	0.20	<0.10	<1.00
05.08.2014 08:30:00	166	6.88	1.68	0.48	0.58	2.40	<1	<1	64	16	220	1.65	<0.05	0.05	0.03	0.01	0.34	1.40	0.51	<0.10	<1.00
09.09.2014 10:00:00	436	6.86	1.70	0.76	0.67	2.40	<1	2	74	14	220	1.74	<0.05	0.10	0.05	0.01	0.62	1.80			<1.00
06.10.2014 09:30:00	209	6.73	1.70	0.50	0.41	2.40	1	3	89	19	220	1.82	<0.05	0.08	0.03	0.01	0.32	1.70	0.10	0.10	2.00
11.11.2014 09:30:00	544	6.62	1.89	0.66	0.92	3.10	2	4	130	<2	250	2.27	<0.05	0.10	0.08	0.01	0.41	2.01	0.20	<0.10	<1.00
16.12.2014 09:45:00	319	6.50	1.86	0.66	0.70	3.10	2	3	140	10	320	2.25	<0.00	0.10	0.06	0.01	0.46	1.80	0.17	0.08	<1.00
Lower avg.	370	6.75	1.90	0.77	0.78	2.61	1	3	130	8	263	2.12	0.00	0.09	0.07	0.01	0.58	2.15	0.26	0.10	0.50
Upper avg..	370	6.75	1.90	0.77	0.78	2.61	1	3	130	8	263	2.12	0.05	0.09	0.07	0.01	0.58	2.15	0.26	0.14	1.25
Minimum	166	6.50	1.68	0.48	0.41	2.40	1	1	64	2	220	1.65	0.00	0.05	0.03	0.01	0.32	1.40	0.10	0.08	1.00
Maximum	568	6.89	2.24	1.28	1.68	3.10	2	4	175	19	320	2.44	0.05	0.10	0.27	0.03	2.15	5.00	0.73	0.20	3.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	10	12
St.dev	125	0.12	0.19	0.28	0.38	0.29	0	1	41	6	36	0.30	0.01	0.01	0.07	0.01	0.51	0.96	0.19	0.05	0.62

Otra

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
20.01.2014 11:00:00	193	6.12	1.47	0.44	0.40	2.10	<1	3	96	15	215	1.62	<0.05	0.10	0.18	0.01	0.50	2.97	0.46	0.36	1.00
05.02.2014 15:20:00	202	6.26	1.73	0.76	0.75	2.30	2	3	115	20	245	1.84	<0.05	0.09	0.18	0.02	0.38	3.29	0.28	0.36	1.00
04.03.2014 11:55:00	294	5.91	2.07	0.74	0.76	2.70	1	2	165	28	310	1.69	<0.05	0.09	0.27	0.03	0.62	5.40	0.84	0.35	1.00
07.04.2014 10:10:00	227	6.27	1.37	0.48	0.58	2.10	<1	1	105	10	210	1.57	<0.05	0.09	0.17	0.01	0.44	3.34	0.37	0.10	<1.00
06.05.2014 10:45:00	185	6.32	1.29	0.59	0.59	2.00	<1	2	84	7	195	1.41	<0.05	0.09	0.16	0.01	0.72	3.97	0.43	0.34	<1.00
05.06.2014 14:40:00	133	6.36	1.23	0.60	0.62	2.10	<1	3	90	<2	190	1.16	0.08	0.10	1.12	0.01	1.32	5.83	0.41	0.10	<1.00
09.07.2014 15:01:00	114	6.29	1.23	0.63	1.24	2.10	<1	4	81	8	225	0.88	<0.05	0.09	0.14	0.01	0.42	3.29	0.25	0.38	<1.00
04.08.2014 11:45:00	130	6.30	1.13	1.13	1.54	2.30	<1	6	13	7	245	0.83	<0.05	0.09	0.20	0.02	0.44	2.36	0.27	<0.10	<1.00
08.09.2014 11:18:00	695	6.18	1.30	6.07	10.00	4.00	8	14	56	21	290	1.37	<0.05	0.38	1.18	0.03	1.49	4.82			<1.00
08.10.2014 07:30:00	317	6.13	1.50	2.04	2.35	3.70	2	6	86	17	265	1.51	<0.05	0.10	0.44	0.03	0.63	4.23	0.45	0.20	<1.00
04.11.2014 15:01:00	376	6.08	1.58	1.10	1.06	4.30	2	3	79	12	260	1.91	<0.05	0.10	0.47	0.03	0.65	3.45	0.57	<0.10	<1.00
08.12.2014 10:12:00	134	6.07	1.52	0.41	0.49	3.40	1	3	88	17	250	1.76	<0.05	0.10	0.30	0.03	0.71	3.77	0.59	0.20	1.00
Lower avg.	250	6.19	1.45	1.25	1.70	2.76	1	4	88	14	242	1.46	0.01	0.12	0.40	0.02	0.69	3.89	0.45	0.22	0.33
Upper avg..	250	6.19	1.45	1.25	1.70	2.76	2	4	88	14	242	1.46	0.05	0.12	0.40	0.02	0.69	3.89	0.45	0.24	1.00
Minimum	114	5.91	1.13	0.41	0.40	2.00	1	1	13	2	190	0.83	0.05	0.09	0.14	0.01	0.38	2.36	0.25	0.10	1.00
Maximum	695	6.36	2.07	6.07	10.00	4.30	8	14	165	28	310	1.91	0.08	0.38	1.18	0.03	1.49	5.83	0.84	0.38	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	11	12
St.dev	163	0.13	0.26	1.58	2.67	0.85	2	3	35	7	37	0.35	0.01	0.08	0.37	0.01	0.35	1.02	0.17	0.12	0.00

Orreelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
12.01.2014 13:30:00	8	6.74	16.10	11.80	10.90	6.20	61	98	1500	75	2330	5.37	<0.05	0.38	0.57	0.03	1.97	6.67	1.10	1.00	1.00
04.02.2014 10:00:00	2	7.54	18.80	4.00	3.62	5.20	29	41	1650	49	2140	5.58	<0.05	0.23	0.25	0.01	1.74	2.15	1.00	1.10	2.00
04.03.2014 13:00:00	5	7.54	17.10	5.79	8.12	5.20	8	57	1500	49	2120	3.81	<0.05	0.23	0.26	0.01	1.84	3.28	1.10	0.87	1.00
01.04.2014 09:00:00	2	7.59	16.50	3.27	6.37	5.20	11	36	1150	23	1840	0.49	<0.05	0.20	0.19	0.01	1.81	2.58	1.00	0.44	<1.00
06.05.2014 12:00:00	1	7.71	18.20	7.16	11.70	4.80	15	44	535	57	1150	0.24	<0.05	0.29	0.90	0.03	2.64	8.45	1.20	0.48	2.00
03.06.2014 09:10:00	0	7.99	19.80	3.84	5.30	5.20	5	35	1	110	570	0.11	<0.05	0.22	0.08	0.01	2.03	1.40	1.10	<0.10	<1.00
01.07.2014 12:00:00	0	7.91	22.40	3.58	5.59	7.00	16	55	1	86	810	0.90	<0.05	0.24	0.07	0.01	1.72	1.30	1.10	0.20	<1.00
06.08.2014 12:00:00	1	7.98	20.90	1.02	2.16	6.00	5	27	<2	13	365	2.65	<0.05	0.26	0.05	0.01	1.21	1.40	1.00	<0.10	<1.00
03.09.2014 12:15:00	3	7.75	19.10	2.88	3.17	6.10	11	35	374	85	935	3.51	<0.05	0.21	0.04	0.01	1.66	1.50	1.20	0.30	<1.00
01.10.2014 12:40:00	2	7.68	19.50	4.99	5.18	6.10	8	46	116	60	780	3.17	<0.05	0.24	0.09	0.01	1.23	1.70	0.92	<0.10	<1.00
04.11.2014 12:40:00	12	7.86	19.30	11.00	7.29	6.20	31	62	545	4	1220	2.82	<0.05	0.23	0.15	0.01	1.53	2.00	1.00	<0.10	<1.00
02.12.2014 10:00:00	1	7.64	18.20	8.30	4.63	6.00	14	44	1050	18	1590	3.81	<0.05	0.20	0.11	0.01	1.48	1.80	0.96	0.20	2.00
Lower avg.	3	7.66	18.82	5.64	6.17	5.77	18	48	702	52	1321	2.70	0.00	0.24	0.23	0.01	1.74	2.85	1.06	0.38	0.67
Upper avg..	3	7.66	18.82	5.64	6.17	5.77	18	48	702	52	1321	2.70	0.05	0.24	0.23	0.01	1.74	2.85	1.06	0.42	1.25
Minimum	0	6.74	16.10	1.02	2.16	4.80	5	27	1	4	365	0.11	0.05	0.20	0.04	0.01	1.21	1.30	0.92	0.10	1.00
Maximum	12	7.99	22.40	11.80	11.70	7.00	61	98	1650	110	2330	5.58	0.05	0.38	0.90	0.03	2.64	8.45	1.20	1.10	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
St.dev	4	0.33	1.79	3.32	2.92	0.64	16	19	637	33	667	1.90	0.00	0.05	0.26	0.01	0.38	2.30	0.09	0.37	0.45

Vosso(Bolstadelvi)

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
06.01.2014 11:50:00	43	7.11	1.83	0.71	0.50	1.20	2	4	165	6	265	1.16	<0.05	0.06	0.05	0.01	0.37	1.10	0.36	0.30	<1.00
04.02.2014 09:50:00	30	6.66	1.63	0.54	0.39	0.92	1	3	155	5	215	1.01	<0.05	0.07	0.04	<0.01	0.35	0.96	0.27	0.51	2.00
04.03.2014 11:00:00	29	6.78	1.76	0.84	0.68	1.00	1	3	170	2	230	1.07	<0.05	0.07	0.06	0.01	0.55	1.80	0.33	0.30	1.00
07.04.2014 16:10:00	49	6.26	2.18	0.84	0.60	1.40	2	3	225	3	320	1.35	<0.05	0.07	0.06	0.01	0.47	1.30	0.45	0.10	<1.00
06.05.2014 07:00:00	58	6.83	2.20	0.59	0.59	1.30	1	3	160	4	260	1.24	<0.05	0.10	0.04	<0.01	0.35	1.20	0.34	<0.10	1.00
03.06.2014 10:45:00	227	6.66	1.31	0.53	0.32	0.82	<1	3	87	<2	137	0.88	<0.05	0.06	0.05	<0.01	0.28	0.96	0.25	0.10	<1.00
07.07.2014 10:10:00	296	6.46	0.86	0.42	0.43	0.71	<1	3	43	3	107	0.56	<0.05	<0.05	0.04	0.01	0.25	0.86	0.21	0.10	1.00
04.08.2014 12:15:00	103	6.59	0.85	0.56	0.49	1.20	<1	<1	36	10	129	0.64	<0.05	<0.05	0.07	0.01	0.31	0.94	0.24	<0.10	<1.00
01.09.2014 13:30:00	24	6.41	0.90	0.34	0.23	0.72	<1	2	32	7	98	0.47	<0.05	0.06	0.02	0.01	0.21	0.58	0.55	0.70	<1.00
06.10.2014 09:50:00	61	6.38	1.33	1.53	2.30	1.20	1	5	71	12	185	0.88	<0.05	0.07	0.16	0.01	0.36	1.10	0.33	0.10	<1.00
03.11.2014 12:00:00	246	6.64	1.33	5.20	5.24	1.70	5	8	105	4	215	1.39	<0.05	0.20	0.25	0.01	0.62	1.20	0.47	<0.10	<1.00
01.12.2014 10:00:00	21	6.48	1.35	1.10	1.11	1.50	3	4	115	3	205	1.16	<0.05	0.10	0.09	0.01	0.42	1.30	0.36	0.20	1.00
Lower avg.	99	6.60	1.46	1.10	1.07	1.14	1	3	114	5	197	0.98	0.00	0.07	0.08	0.01	0.38	1.11	0.35	0.20	0.50
Upper avg..	99	6.60	1.46	1.10	1.07	1.14	2	4	114	5	197	0.98	0.05	0.08	0.08	0.01	0.38	1.11	0.35	0.23	1.08
Minimum	21	6.26	0.85	0.34	0.23	0.71	1	1	32	2	98	0.47	0.05	0.05	0.02	0.01	0.21	0.58	0.21	0.10	1.00
Maximum	296	7.11	2.20	5.20	5.24	1.70	5	8	225	12	320	1.39	0.05	0.20	0.25	0.01	0.62	1.80	0.55	0.70	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
St.dev	99	0.23	0.47	1.33	1.42	0.31	1	2	62	3	69	0.30	0.00	0.04	0.06	0.00	0.12	0.30	0.10	0.20	0.29

Orkla

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
06.01.2014 11:00:00	38	6.76	6.76	0.67	0.66	2.00	1	3	245	6	415	2.93	<0.05	0.09	0.01	0.04	5.00	15.00	0.72	0.34	1.00
04.02.2014 09:15:00	36	7.41	6.13	0.83	0.79	1.80	1	2	215	5	310	2.61	<0.05	0.07	0.02	0.02	2.11	4.52	0.55	0.52	1.00
04.03.2014 09:00:00	30	7.15	5.76	0.55	0.67	1.80	<1	3	195	<2	305	2.37	<0.05	0.06	0.01	0.02	2.42	4.55	0.65	0.33	<1.00
09.04.2014 07:45:00	68	7.10	6.91	2.59	5.96	3.70	4	5	225	<2	410	3.34	<0.05	0.20	0.08	0.05	5.87	17.80	1.10	0.76	<1.00
08.05.2014 08:15:00	63	7.41	5.65	1.16	1.39	3.40	1	3	96	<2	255	2.50	<0.05	0.08	0.02	0.05	5.20	14.50	0.76	0.20	<1.00
05.06.2014 09:00:00	33	7.57	6.06	0.66	0.59	2.00	<1	5	135	2	260	2.14	<0.05	0.10	0.02	0.01	2.67	3.34	0.55	<0.10	<1.00
07.07.2014 07:45:00	22	7.58	6.94	0.55	1.02	2.20	<1	4	170	6	340	2.48	<0.05	0.10	0.02	0.05	5.15	13.50	0.78	0.32	<1.00
04.08.2014 10:00:00	22	7.61	7.25	0.64	0.67	3.60	<1	<1	144	6	320	2.67	<0.05	0.10	0.02	0.07	6.58	26.30	0.93	<0.10	<1.00
08.09.2014 08:15:00	25	7.66	8.30	0.64	0.28	2.70	<1	2	256	5	420	2.97	<0.05	0.20	0.01	0.04	5.00	10.40			<1.00
06.10.2014 07:45:00	21	7.50	7.95	0.45	0.38	3.10	<1	3	216	4	385	3.04	<0.05	0.10	0.02	0.06	6.63	21.10	0.69	0.30	<1.00
10.11.2014 08:50:00	23	7.46	8.69	0.64	0.44	2.30	2	3	265	<2	395	3.34	<0.05	0.07	0.03	0.07	8.27	25.80	0.61	<0.10	<1.00
03.12.2014 14:00:00	29	7.39	6.64	0.46	0.46	2.10	2	3	150	10	280	2.93	<0.05	0.09	0.03	0.03	3.99	10.40	0.65	0.35	2.00
Lower avg.	34	7.38	6.92	0.82	1.11	2.56	1	3	193	4	341	2.78	0.00	0.11	0.02	0.04	4.91	13.93	0.73	0.28	0.33
Upper avg..	34	7.38	6.92	0.82	1.11	2.56	1	3	193	4	341	2.78	0.05	0.11	0.02	0.04	4.91	13.93	0.73	0.31	1.08
Minimum	21	6.76	5.65	0.45	0.28	1.80	1	1	96	2	255	2.14	0.05	0.06	0.01	0.01	2.11	3.34	0.55	0.10	1.00
Maximum	68	7.66	8.69	2.59	5.96	3.70	4	5	265	10	420	3.34	0.05	0.20	0.08	0.07	8.27	26.30	1.10	0.76	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	11	12
St.dev	16	0.26	0.98	0.59	1.56	0.71	1	1	53	2	62	0.38	0.00	0.05	0.02	0.02	1.86	7.84	0.17	0.20	0.29

Vefsna

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.01.2014 10:00:00	69	6.61	8.29	0.46	0.39	1.40	<1	1	85	<2	175	1.87	<0.05	0.10	0.01	<0.01	0.25	0.26	0.20	0.20	
10.02.2014 14:00:00	44	7.75	10.20	0.43	0.19	1.00	1	2	115	<2	205	2.31	<0.05	0.10	0.01	<0.01	0.35	<0.05	0.20	0.20	<1.00
10.03.2014 09:00:00	158	7.21	6.97	9.54	10.10	2.30	7	12	38	14	170	1.95	<0.05	0.10	0.18	0.01	0.81	1.70	0.57	0.70	1.00
31.03.2014 13:00:00	64	7.46	8.58	0.53	0.50	1.60	<1	1	70	3	147	1.78	<0.05	0.10	0.02	<0.01	0.34	0.38	0.26	0.20	<1.00
05.05.2014 09:00:00	88	7.52	8.25	0.40	0.58	1.60	<1	1	31	<2	117	1.35	<0.05	0.20	0.02	<0.01	0.37	0.39	0.22	0.42	<1.00
11.06.2014 08:30:00	552	7.19	3.51	1.48	2.05	0.88	<1	3	30	<2	83	0.98	<0.05	0.09	0.04	0.01	0.70	0.54			<1.00
02.07.2014 08:15:00	187	7.27	3.43	0.44	0.56	0.70	<1	2	15	<2	83	0.88	<0.05	0.08	0.02	<0.01	0.17	0.20	0.23	0.32	<1.00
13.08.2014 10:00:00	70	7.53	4.31	0.75	0.60	0.73	<1	3	26	6	79	0.92	<0.05	0.10	0.04	<0.01	0.27	0.20	0.20	<0.10	<1.00
08.09.2014 09:30:00	69	7.39	4.26	0.66	0.73	1.10	<1	2	18	5	90	1.07	<0.05	0.10	0.06	0.01	0.68	0.44			<1.00
07.10.2014 08:00:00	114	7.45	5.67	0.93	0.95	1.40	<1	3	23	4	94	1.37	<0.05	0.10	0.04	<0.01	0.30	0.41	0.27	<0.10	<1.00
04.11.2014 11:30:00	159	7.28	5.33	0.48	1.05	2.70	2	3	28	<2	133	1.45	<0.05	0.09	0.04	0.01	0.33	0.10	0.20	<0.10	<1.00
02.12.2014 12:00:00	52	7.57	9.56	<0.30	0.12	1.40	<1	1	115	<2	200	2.08	<0.05	0.20	0.01	0.01	0.29	0.37	0.20	0.20	<1.00
Lower avg.	135	7.35	6.53	1.34	1.48	1.40	1	3	50	3	131	1.50	0.00	0.11	0.04	0.00	0.40	0.42	0.26	0.22	0.09
Upper avg..	135	7.35	6.53	1.37	1.48	1.40	2	3	50	4	131	1.50	0.05	0.11	0.04	0.01	0.40	0.42	0.26	0.25	1.00
Minimum	44	6.61	3.43	0.30	0.12	0.70	1	1	15	2	79	0.88	0.05	0.08	0.01	0.01	0.17	0.05	0.20	0.10	1.00
Maximum	552	7.75	10.20	9.54	10.10	2.70	7	12	115	14	205	2.31	0.05	0.20	0.18	0.01	0.81	1.70	0.57	0.70	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	yes	no	no
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	10	10	11
St.dev	139	0.29	2.41	2.59	2.76	0.61	2	3	37	3	47	0.49	0.00	0.04	0.05	0.00	0.21	0.43	0.11	0.19	0.00

Altaelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
06.01.2014 10:50:00	38	6.48	8.70	0.34	0.31	2.40	3	6	89	<2	230	5.22	<0.05	0.10	0.01	<0.01	0.41	0.20	0.20	0.30	1.00
10.02.2014 10:00:00	34	6.59	10.30	0.57	0.47	2.30	4	5	88	<2	230	5.67	<0.05	0.10	0.01	<0.01	0.52	<0.05	0.10	0.34	1.00
10.03.2014 08:50:00	33	7.45	8.68	0.54	0.28	2.40	2	3	74	<2	195	5.73	<0.05	0.10	0.01	<0.01	0.45	0.21	0.10	0.39	<1.00
07.04.2014 12:15:00	33	7.43	8.28	0.44	0.35	2.40	1	1	50	10	190	4.83	<0.05	0.10	0.01	<0.01	0.45	0.20	0.20	0.30	1.00
06.05.2014 12:15:00	63	7.76	10.93	0.49	1.48	2.20	2	4	84	5	220	6.38	<0.05	0.10	0.01	<0.01	0.56	0.20	0.08	0.34	<1.00
03.06.2014 10:00:00	800	7.40	5.91	17.30	40.70	4.00	18	27	46	6	265	6.67	<0.05	0.20	0.21	0.01	1.91	2.16	1.40	2.30	<1.00
03.07.2014 12:00:00	144	7.42	7.19	0.65	1.12	3.10	1	6	43	7	205	3.51	<0.05	0.10	0.02	<0.01	0.65	0.23	0.25	0.77	1.00
05.08.2014 11:50:00	70	7.52	6.83	0.41	0.63	3.20	8	11	39	15	195	3.51	<0.05	0.10	0.01	<0.01	1.07	0.39			<1.00
08.09.2014 08:00:00	64	7.55	7.20	0.32	0.32	2.90	1	4	30	5	185	3.59	<0.05	0.10	<0.01	<0.01	0.64	0.48			<1.00
06.10.2014 08:10:00	69	7.58	8.20	0.36	0.63	2.80	<1	4	37	5	200	3.70	<0.05	0.10	0.01	0.01	0.44	0.10	0.20	<0.10	<1.00
06.11.2014 11:00:00	38	7.26	8.84	0.54	0.43	2.90	5	8	98	<2	245	4.41	<0.05	0.10	<0.01	<0.01	0.48	0.47	0.10	<0.10	<1.00
09.12.2014 11:30:00	35	7.39	9.45	0.36	0.22	2.90	3	5	115	4	270	4.71	<0.05	0.10	<0.01	<0.01	0.49	0.20	0.20	0.30	<1.00
Lower avg.	118	7.32	8.38	1.86	3.91	2.79	4	7	66	5	219	4.83	0.00	0.11	0.02	0.00	0.67	0.40	0.28	0.50	0.33
Upper avg..	118	7.32	8.38	1.86	3.91	2.79	4	7	66	5	219	4.83	0.05	0.11	0.02	0.01	0.67	0.41	0.28	0.52	1.00
Minimum	33	6.48	5.91	0.32	0.22	2.20	1	1	30	2	185	3.51	0.05	0.10	0.01	0.01	0.41	0.05	0.08	0.10	1.00
Maximum	800	7.76	10.93	17.30	40.70	4.00	18	27	115	15	270	6.68	0.05	0.20	0.21	0.01	1.91	2.16	1.40	2.30	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	yes	yes	no
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	10	10	12
St.dev	217	0.39	1.45	4.86	11.59	0.51	5	7	28	4	29	1.13	0.00	0.03	0.06	0.00	0.43	0.57	0.40	0.65	0.00

Tista utløp Femsjøen

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 12:10:00	44	6.82	5.09	3.84	2.74	9.00	8	14	410	7	750	4.04	<0.05	0.34	0.28	0.01	1.28	6.08	0.75	0.43	<1.00
12.05.2014 13:45:00	31	6.98	5.09	5.02	4.98	8.80	9	17	485	8	830	4.47	<0.05	0.32	0.35	0.02	1.41	15.70	0.90	1.10	2.00
04.08.2014 14:20:00	7	6.63	5.03	33.70	30.20	8.10	3	52	590	89	1180	3.40	<0.05	0.38	1.81	0.03	3.39	19.40			<1.00
06.09.2014 13:45:00	16	7.03	5.17	2.13	1.93	8.10	2	9	353	15	770	2.78	<0.05	0.27	0.18	0.02	1.47	9.54			1.00
06.10.2014 14:10:00	7	6.97	5.19	2.97	3.34	8.40	4	11	366	49	680	2.72	<0.05	0.30	0.22	0.01	1.47	6.52	0.68	0.30	<1.00
Lower avg.	21	6.89	5.11	9.53	8.64	8.48	5	21	441	34	842	3.48	0.00	0.32	0.57	0.02	1.80	11.45	0.78	0.61	0.60
Upper avg..	21	6.89	5.11	9.53	8.64	8.48	5	21	441	34	842	3.48	0.05	0.32	0.57	0.02	1.80	11.45	0.78	0.61	1.20
Minimum	7	6.63	5.03	2.13	1.93	8.10	2	9	353	7	680	2.72	0.05	0.27	0.18	0.01	1.28	6.08	0.68	0.30	1.00
Maximum	44	7.03	5.19	33.70	30.20	9.00	9	52	590	89	1180	4.47	0.05	0.38	1.81	0.03	3.39	19.40	0.90	1.10	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	5
St.dev	16	0.16	0.07	13.55	12.11	0.41	3	18	98	35	196	0.77	0.00	0.04	0.70	0.01	0.89	5.88	0.11	0.43	0.45

Tokkeelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 17:47:00	114	6.32	3.45	0.90	0.85	5.30	2	5	200	21	445	3.34	<0.05	0.21	0.28	0.04	1.13	7.56	0.90	0.42	3.00
07.05.2014 10:40:00	41	6.35	1.96	0.79	1.06	5.00	<1	4	165	3	340	2.89	<0.05	0.20	0.20	0.03	0.43	5.00	0.34	0.40	2.00
06.08.2014 08:10:00	14	6.52	2.10	0.94	1.52	4.90	<1	8	100	16	245	2.61	<0.05	0.20	0.14	0.03	0.62	4.38	0.43	0.20	<1.00
06.10.2014 12:50:00	12	6.57	2.32	0.93	0.65	4.60	1	4	79	10	310	2.40	<0.05	0.10	0.13	0.03	0.95	5.19	0.61	0.20	<1.00
Lower avg.	45	6.44	2.46	0.89	1.02	4.95	1	5	136	13	335	2.81	0.00	0.18	0.19	0.03	0.78	5.53	0.57	0.30	1.25
Upper avg..	45	6.44	2.46	0.89	1.02	4.95	1	5	136	13	335	2.81	0.05	0.18	0.19	0.03	0.78	5.53	0.57	0.30	1.75
Minimum	12	6.32	1.96	0.79	0.65	4.60	1	4	79	3	245	2.40	0.05	0.10	0.13	0.03	0.43	4.38	0.34	0.20	1.00
Maximum	114	6.57	3.45	0.94	1.52	5.30	2	8	200	21	445	3.34	0.05	0.21	0.28	0.04	1.13	7.56	0.90	0.42	3.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	47	0.12	0.68	0.07	0.37	0.29	1	2	56	8	83	0.41	0.00	0.05	0.07	0.00	0.32	1.40	0.25	0.12	0.96

Nidelva(Rykene)

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
12.02.2014 12:20:00	214	6.12	2.71	1.34	0.96	3.70	2	4	210	26	425	2.72	<0.05	0.20	0.35	0.05	0.71	6.69	0.39	0.20	1.00
07.05.2014 07:40:00	191	6.64	1.76	1.16	1.08	2.80	5	10	155	30	335	1.82	<0.05	0.10	0.22	0.02	0.60	3.32	0.20	0.20	<1.00
06.08.2014 06:45:00	115	6.41	1.29	0.51	0.82	2.80	<1	4	106	16	235	1.59	<0.05	0.10	0.13	0.02	0.78	3.05	0.22	<0.10	<1.00
06.10.2014 08:25:00	63	6.43	1.34	0.88	1.15	3.80	<1	3	98	15	270	1.88	<0.05	0.10	0.23	0.02	0.60	3.30	0.20	<0.10	<1.00
Lower avg.	146	6.40	1.78	0.97	1.00	3.28	2	5	142	22	316	2.00	0.00	0.12	0.23	0.03	0.67	4.09	0.25	0.10	0.25
Upper avg..	146	6.40	1.78	0.97	1.00	3.28	2	5	142	22	316	2.00	0.05	0.12	0.23	0.03	0.67	4.09	0.25	0.15	1.00
Minimum	63	6.12	1.29	0.51	0.82	2.80	1	3	98	15	235	1.59	0.05	0.10	0.13	0.02	0.60	3.05	0.20	0.10	1.00
Maximum	214	6.64	2.71	1.34	1.15	3.80	5	10	210	30	425	2.72	0.05	0.20	0.35	0.05	0.78	6.69	0.39	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	69	0.21	0.66	0.36	0.15	0.55	2	3	52	7	84	0.49	0.00	0.05	0.09	0.01	0.09	1.74	0.09	0.06	0.00

Tovdalselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
05.02.2014 16:20:00	68	6.12	2.86	1.21	1.07	3.90	1	4	225	26	400	2.35	<0.05	0.20	0.46	0.06	0.38	9.06	0.44	0.44	2.00
06.05.2014 11:30:00	62	6.62	1.85	0.81	1.11	3.20	2	4	105	8	265	1.43	<0.05	0.10	0.34	0.02	0.31	3.73	0.20	0.20	<1.00
04.08.2014 13:15:00	61	6.93	2.14	0.48	0.79	3.00	<1	3	89	20	195	0.66	<0.05	0.20	0.17	0.01	0.53	2.49	0.24	0.20	<1.00
08.10.2014 08:20:00	170	5.35	2.84	1.69	1.98	9.50	2	10	65	15	410	2.18	<0.05	0.30	1.12	0.08	0.73	9.78	0.65	0.30	2.00
Lower avg.	90	6.26	2.42	1.05	1.24	4.90	1	5	121	17	318	1.66	0.00	0.20	0.52	0.04	0.49	6.26	0.38	0.29	1.00
Upper avg..	90	6.26	2.42	1.05	1.24	4.90	2	5	121	17	318	1.66	0.05	0.20	0.52	0.04	0.49	6.26	0.38	0.29	1.50
Minimum	61	5.35	1.85	0.48	0.79	3.00	1	3	65	8	195	0.66	0.05	0.10	0.17	0.01	0.31	2.49	0.20	0.20	1.00
Maximum	170	6.93	2.86	1.69	1.98	9.50	2	10	225	26	410	2.35	0.05	0.30	1.12	0.08	0.73	9.78	0.65	0.44	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	53	0.69	0.51	0.52	0.52	3.09	1	3	71	8	105	0.78	0.00	0.08	0.42	0.03	0.19	3.69	0.21	0.11	0.58

Mandalselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.02.2014 18:45:00	166	6.00	2.89	1.39	1.35	3.50	2	5	220	20	385	1.74	<0.05	0.10	0.49	0.04	0.35	7.21	0.28	0.20	<1.00
07.05.2014 08:30:00	123	6.69	2.26	0.84	1.40	2.80	2	4	160	23	340	1.13	<0.05	0.10	0.44	0.02	0.33	3.72	0.10	<0.10	<1.00
05.08.2014 08:50:00	67	6.43	1.39	0.82	0.93	2.40	1	8	108	24	270	0.43	<0.05	0.10	0.23	0.02	0.28	2.36	0.10	<0.10	<1.00
07.10.2014 10:07:00	75	6.19	1.37	1.25	1.42	3.90	2	5	81	31	295	0.96	<0.05	0.20	0.51	0.03	0.42	3.54	0.20	<0.10	<1.00
Lower avg.	108	6.33	1.98	1.08	1.27	3.15	2	6	142	25	323	1.06	0.00	0.12	0.42	0.03	0.35	4.21	0.17	0.05	0.00
Upper avg..	108	6.33	1.98	1.08	1.27	3.15	2	6	142	25	323	1.06	0.05	0.12	0.42	0.03	0.35	4.21	0.17	0.12	1.00
Minimum	67	6.00	1.37	0.82	0.93	2.40	1	4	81	20	270	0.43	0.05	0.10	0.23	0.02	0.28	2.36	0.10	0.10	1.00
Maximum	166	6.69	2.89	1.39	1.42	3.90	2	8	220	31	385	1.74	0.05	0.20	0.51	0.04	0.42	7.21	0.28	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	46	0.30	0.74	0.29	0.23	0.68	1	2	61	5	51	0.54	0.00	0.05	0.13	0.01	0.06	2.09	0.09	0.05	0.00

Lyngdalselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.02.2014 15:50:00	69	6.12	3.75	2.00	4.45	2.60	5	9	345	22	490	1.67	<0.05	0.10	0.72	0.06	0.31	8.57	0.23	0.30	3.00
07.05.2014 10:34:00	32	6.71	2.78	0.72	0.98	2.80	1	4	200	3	345	1.24	<0.05	0.10	0.34	0.02	0.23	3.95	0.10	0.33	2.00
05.08.2014 10:15:00	24	6.46	2.07	1.28	1.60	4.00	1	9	134	13	405	0.94	<0.05	0.20	0.59	0.02	0.26	3.15	0.09	<0.10	<1.00
07.10.2014 11:40:00	21	6.01	2.40	1.19	1.46	5.10	3	5	131	6	355	1.69	<0.05	0.20	0.37	0.04	0.30	5.59	0.10	<0.10	<1.00
Lower avg.	37	6.32	2.75	1.30	2.12	3.62	3	7	203	11	399	1.39	0.00	0.15	0.51	0.04	0.28	5.32	0.13	0.16	1.25
Upper avg..	37	6.32	2.75	1.30	2.12	3.62	3	7	203	11	399	1.39	0.05	0.15	0.51	0.04	0.28	5.32	0.13	0.21	1.75
Minimum	21	6.01	2.07	0.72	0.98	2.60	1	4	131	3	345	0.94	0.05	0.10	0.34	0.02	0.23	3.15	0.09	0.10	1.00
Maximum	69	6.71	3.75	2.00	4.45	5.10	5	9	345	22	490	1.69	0.05	0.20	0.72	0.06	0.31	8.57	0.23	0.33	3.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	22	0.32	0.73	0.53	1.57	1.16	2	3	100	8	66	0.36	0.00	0.06	0.18	0.02	0.04	2.40	0.07	0.13	0.96

Kvina

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.02.2014 14:57:00	99	6.02	3.31	2.02	4.01	2.90	7	14	320	20	485	1.66	<0.05	0.20	0.64	0.04	0.58	6.81	0.25	0.20	<1.00
07.05.2014 11:30:00	72	6.72	2.75	0.65	0.98	2.70	1	4	160	<2	310	0.53	<0.05	0.10	0.29	0.02	0.43	3.42	0.10	0.10	<1.00
05.08.2014 11:30:00	85	6.21	2.07	1.77	3.69	6.40	3	15	42	18	340	0.81	<0.05	0.30	0.96	0.04	1.25	4.23	0.10	<0.10	<1.00
07.10.2014 12:25:00	42	6.12	5.29	1.00	2.34	6.20	2	8	83	11	355	1.37	<0.05	0.32	0.85	0.04	1.07	4.89	0.20	0.20	1.00
Lower avg.	75	6.27	3.36	1.36	2.76	4.55	3	10	151	12	373	1.09	0.00	0.23	0.68	0.03	0.83	4.84	0.16	0.12	0.25
Upper avg..	75	6.27	3.36	1.36	2.76	4.55	3	10	151	13	373	1.09	0.05	0.23	0.68	0.03	0.83	4.84	0.16	0.15	1.00
Minimum	42	6.02	2.07	0.65	0.98	2.70	1	4	42	2	310	0.54	0.05	0.10	0.29	0.02	0.43	3.42	0.10	0.10	1.00
Maximum	99	6.72	5.29	2.02	4.01	6.40	7	15	320	20	485	1.66	0.05	0.32	0.96	0.04	1.25	6.81	0.25	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	24	0.31	1.39	0.64	1.39	2.02	3	5	123	8	77	0.51	0.00	0.10	0.30	0.01	0.39	1.45	0.08	0.06	0.00

Sira

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.02.2014 14:00:00	189	5.44	1.62	0.57	0.50	1.90	1	3	105	20	210	0.92	<0.05	0.08	0.26	0.02	0.24	2.45	0.10	0.10	<1.00
07.05.2014 12:50:00	103	5.58	1.58	0.62	0.40	1.60	<1	2	115	16	205	0.86	<0.05	0.05	0.22	0.01	0.16	2.32	0.09	<0.10	<1.00
05.08.2014 13:03:00	148	5.93	1.21	0.54	0.51	1.50	<1	2	94	19	205	0.62	<0.05	<0.05	0.20	0.01	0.20	2.00	0.10	<0.10	<1.00
07.10.2014 13:40:00	71	5.74	1.20	0.49	0.39	1.80	<1	3	82	20	200	0.68	<0.05	0.09	0.22	0.02	0.22	1.90	0.09	<0.10	<1.00
Lower avg.	128	5.67	1.40	0.55	0.45	1.70	0	3	99	19	205	0.77	0.00	0.06	0.23	0.02	0.20	2.17	0.10	0.02	0.00
Upper avg..	128	5.67	1.40	0.55	0.45	1.70	1	3	99	19	205	0.77	0.05	0.07	0.23	0.02	0.20	2.17	0.10	0.10	1.00
Minimum	71	5.44	1.20	0.49	0.39	1.50	1	2	82	16	200	0.62	0.05	0.05	0.20	0.01	0.16	1.90	0.09	0.10	1.00
Maximum	189	5.93	1.62	0.62	0.51	1.90	1	3	115	20	210	0.92	0.05	0.09	0.26	0.02	0.24	2.45	0.10	0.10	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	51	0.21	0.23	0.05	0.06	0.18	0	1	14	2	4	0.14	0.00	0.02	0.03	0.01	0.03	0.26	0.01	0.00	0.00

Bjerkreimselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 12:00:00	126	6.52	3.89	1.18	1.37	1.40	3	6	435	12	545	1.72	<0.05	0.10	0.33	0.03	0.36	3.59	0.21	0.30	<1.00
06.05.2014 10:20:00	30	6.71	3.14	0.51	0.19	1.30	<1	3	315	9	395	1.28	<0.05	0.05	0.13	0.02	0.16	2.52	0.10	<0.10	<1.00
04.08.2014 09:25:00	38	6.78	3.43	0.56	0.65	1.70	<1	6	397	36	475	1.24	<0.05	0.10	0.16	0.02	0.34	1.40	0.10	0.10	<1.00
06.10.2014 09:00:00	30	6.69	3.39	2.37	4.26	2.00	3	12	348	4	575	1.47	<0.05	0.10	0.83	0.03	0.47	3.56	0.20	<0.10	3.00
Lower avg.	56	6.68	3.46	1.16	1.62	1.60	2	7	374	15	498	1.43	0.00	0.09	0.36	0.03	0.33	2.77	0.15	0.10	0.75
Upper avg..	56	6.68	3.46	1.16	1.62	1.60	2	7	374	15	498	1.43	0.05	0.09	0.36	0.03	0.33	2.77	0.15	0.15	1.50
Minimum	30	6.52	3.14	0.51	0.19	1.30	1	3	315	4	395	1.24	0.05	0.05	0.13	0.02	0.16	1.40	0.10	0.10	1.00
Maximum	126	6.78	3.89	2.37	4.26	2.00	3	12	435	36	575	1.72	0.05	0.10	0.83	0.03	0.47	3.59	0.21	0.30	3.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	47	0.11	0.31	0.87	1.83	0.32	1	4	53	14	80	0.22	0.00	0.03	0.32	0.01	0.13	1.04	0.06	0.10	1.00

Figgjoelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
04.02.2014 09:30:00	4	7.12	11.60	7.39	12.70	2.50	40	49	1050	46	1380	4.32	<0.05	0.20	0.97	0.03	1.11	7.66	0.47	1.10	1.00
06.05.2014 11:30:00	4	7.48	12.10	2.92	3.80	2.80	10	20	965	34	1210	1.93	<0.05	0.10	0.32	0.01	1.75	5.22	0.51	0.10	<1.00
06.08.2014 11:20:00	6	7.33	9.63	0.89	1.88	2.80	2	11	465	6	675	1.30	<0.05	0.20	0.18	0.01	0.74	2.11	0.25	0.10	<1.00
01.10.2014 12:10:00	4	7.39	10.30	1.61	2.15	3.60	7	18	773	59	1140	2.63	<0.05	0.09	0.20	0.01	0.82	2.57	0.39	0.20	<1.00
Lower avg.	5	7.33	10.91	3.20	5.13	2.92	15	25	813	36	1101	2.55	0.00	0.15	0.42	0.01	1.11	4.39	0.40	0.38	0.25
Upper avg..	5	7.33	10.91	3.20	5.13	2.92	15	25	813	36	1101	2.55	0.05	0.15	0.42	0.01	1.11	4.39	0.40	0.38	1.00
Minimum	4	7.12	9.63	0.89	1.88	2.50	2	11	465	6	675	1.31	0.05	0.09	0.18	0.01	0.74	2.11	0.25	0.10	1.00
Maximum	6	7.48	12.10	7.39	12.70	3.60	40	49	1050	59	1380	4.32	0.05	0.20	0.97	0.03	1.75	7.66	0.51	1.10	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	1	0.15	1.14	2.92	5.12	0.47	17	17	259	23	302	1.30	0.00	0.06	0.37	0.01	0.46	2.58	0.12	0.49	0.00

Lyseelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
16.02.2014 12:30:00	40	6.56	2.07	0.28	0.37	1.10	<1	<1	155	<2	235	1.89	<0.05	<0.05	0.15	0.01	0.63	4.48	0.20	0.20	3.00
04.05.2014 09:15:00	11	6.90	2.30	0.50	0.47	0.77	<1	1	210	5	275	1.07	<0.05	<0.05	0.08	0.01	0.22	1.10	0.10	<0.10	<1.00
10.08.2014 14:00:00	9	6.52	1.15	0.33	0.37	1.90	<1	2	124	7	245	1.28	<0.05	0.06	0.20	<0.01	0.33	2.63	0.20	0.30	<1.00
19.10.2014 12:30:00	9	6.18	1.70	<0.30	0.28	2.20	<1	1	63	5	170	1.50	<0.05	<0.05	0.19	0.01	0.55	4.13	0.20	<0.10	<1.00
Lower avg.	17	6.54	1.80	0.28	0.37	1.49	0	1	138	4	231	1.44	0.00	0.02	0.16	0.01	0.43	3.08	0.18	0.12	0.75
Upper avg..	17	6.54	1.80	0.35	0.37	1.49	1	1	138	5	231	1.44	0.05	0.05	0.16	0.01	0.43	3.08	0.18	0.18	1.50
Minimum	9	6.18	1.15	0.28	0.28	0.77	1	1	63	2	170	1.07	0.05	0.05	0.08	0.01	0.22	1.10	0.10	0.10	1.00
Maximum	40	6.90	2.30	0.50	0.47	2.20	1	2	210	7	275	1.89	0.05	0.06	0.20	0.01	0.63	4.48	0.20	0.30	3.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	15	0.29	0.50	0.10	0.08	0.67	0	1	61	2	44	0.35	0.00	0.01	0.05	0.00	0.19	1.55	0.05	0.10	1.00

Årdalselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
17.02.2014 09:17:00	83	6.58	2.58	0.51	0.41	1.70	<1	3	165	5	295	1.54	<0.05	<0.05	0.15	0.01	0.28	1.84	0.10	0.10	2.00
20.05.2014 08:20:00	44	6.35	1.97	0.51	0.23	1.00	<1	1	93	4	170	0.79	<0.05	<0.05	0.10	0.01	1.40	4.78	0.39	<0.10	<1.00
18.08.2014 08:23:00	25	6.50	1.99	0.38	0.33	2.90	<1	2	78	6	215	1.33	<0.05	0.10	0.18	0.01	0.52	2.00	0.33	<0.10	<1.00
17.11.2014 08:25:00	31	6.38	2.32	5.40	8.13	2.10	12	15	270	<2	395	2.10	<0.05	0.07	0.54	0.01	0.97	4.31	0.28	0.33	<1.00
Lower avg.	46	6.45	2.22	1.70	2.28	1.92	3	5	152	4	269	1.44	0.00	0.04	0.24	0.01	0.79	3.23	0.28	0.11	0.50
Upper avg..	46	6.45	2.22	1.70	2.28	1.92	4	5	152	4	269	1.44	0.05	0.07	0.24	0.01	0.79	3.23	0.28	0.16	1.25
Minimum	25	6.35	1.97	0.38	0.23	1.00	1	1	78	2	170	0.79	0.05	0.05	0.10	0.01	0.28	1.84	0.10	0.10	1.00
Maximum	83	6.58	2.58	5.40	8.13	2.90	12	15	270	6	395	2.10	0.05	0.10	0.54	0.01	1.40	4.78	0.39	0.33	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	26	0.11	0.29	2.47	3.90	0.79	6	7	88	2	99	0.54	0.00	0.02	0.20	0.00	0.50	1.53	0.13	0.12	0.50

Ulladalsåna (Ulla)

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
17.02.2014 11:18:00	42	6.53	3.48	0.36	0.16	1.60	<1	3	165	<2	255	1.77	<0.05	0.06	0.08	0.02	0.23	4.05	0.22	0.10	1.00
20.05.2014 11:00:00	33	6.74	1.72	0.23	0.23	1.30	<1	1	20	4	82	1.01	<0.05	0.08	0.07	<0.01	0.56	1.80	0.28	0.58	1.00
18.08.2014 10:21:00	25	6.78	2.54	0.56	0.44	3.50	1	2	87	8	205	1.97	<0.05	0.09	0.10	0.01	0.62	2.10	0.80	<0.10	<1.00
17.11.2014 10:00:00	28	6.60	2.28	0.34	0.19	2.10	2	2	120	<2	205	2.22	<0.05	0.05	0.09	0.01	0.67	4.11	0.85	<0.10	<1.00
Lower avg.	32	6.66	2.50	0.37	0.26	2.12	1	2	98	3	187	1.74	0.00	0.07	0.09	0.01	0.52	3.01	0.54	0.17	0.50
Upper avg..	32	6.66	2.50	0.37	0.26	2.12	1	2	98	4	187	1.74	0.05	0.07	0.09	0.01	0.52	3.01	0.54	0.22	1.00
Minimum	25	6.53	1.72	0.23	0.16	1.30	1	1	20	2	82	1.01	0.05	0.05	0.07	0.01	0.23	1.80	0.22	0.10	1.00
Maximum	42	6.78	3.48	0.56	0.44	3.50	2	3	165	8	255	2.23	0.05	0.09	0.10	0.02	0.67	4.11	0.85	0.58	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	7	0.12	0.74	0.14	0.13	0.97	1	1	61	3	74	0.53	0.00	0.02	0.01	0.01	0.20	1.24	0.33	0.24	0.00

Suldalslågen

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
04.02.2014 13:00:00	56	6.52	1.95	0.51	0.20	0.80	<1	2	230	<2	270	1.20	<0.05	0.06	0.03	0.01	0.24	1.30	0.10	0.29	1.00
05.05.2014 09:30:00	73	6.61	1.70	0.36	0.35	0.64	<1	1	150	3	210	0.86	<0.05	0.06	0.03	0.01	0.23	1.90	0.10	<0.10	2.00
04.08.2014 08:30:00	144	6.55	1.34	0.42	0.69	1.40	<1	2	94	7	160	0.79	0.10	0.20	0.12	0.01	0.33	1.70	0.22	0.20	<1.00
06.10.2014 08:15:00	67	6.62	1.45	0.33	0.41	1.10	<1	1	101	4	170	0.79	<0.05	0.06	0.05	0.01	0.19	1.20	0.20	<0.10	<1.00
Lower avg.	85	6.58	1.61	0.40	0.41	0.98	0	2	144	4	203	0.91	0.02	0.10	0.06	0.01	0.25	1.52	0.16	0.12	0.75
Upper avg..	85	6.58	1.61	0.40	0.41	0.98	1	2	144	4	203	0.91	0.06	0.10	0.06	0.01	0.25	1.52	0.16	0.17	1.25
Minimum	56	6.52	1.34	0.33	0.20	0.64	1	1	94	2	160	0.79	0.05	0.06	0.03	0.01	0.19	1.20	0.10	0.10	1.00
Maximum	144	6.62	1.95	0.51	0.69	1.40	1	2	230	7	270	1.20	0.10	0.20	0.12	0.01	0.33	1.90	0.22	0.29	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	40	0.05	0.27	0.08	0.21	0.34	0	1	63	2	50	0.20	0.03	0.07	0.04	0.00	0.06	0.33	0.06	0.09	0.50

Saudaelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
05.03.2014 11:50:00	39	6.41	2.25	0.22	0.26	0.75	2	8	250	5	355	1.33	<0.05	<0.05	0.04	0.01	0.26	1.70	0.10	0.20	1.00
05.06.2014 11:15:00	36	6.35	0.91	0.31	0.10	0.45	<1	2	67	<2	84	0.41	<0.05	<0.05	0.07	<0.01	0.16	0.57	0.06	<0.10	<1.00
02.09.2014 12:50:00	11	6.36	1.00	0.52	0.27	0.85	<1	3	60	3	121	0.58	<0.05	<0.05	0.07	0.01	0.25	0.60	0.10	0.20	<1.00
Lower avg.	29	6.37	1.39	0.35	0.21	0.68	1	4	126	3	187	0.77	0.00	0.00	0.06	0.01	0.22	0.96	0.09	0.13	0.33
Upper avg..	29	6.37	1.39	0.35	0.21	0.68	1	4	126	3	187	0.77	0.05	0.05	0.06	0.01	0.22	0.96	0.09	0.17	1.00
Minimum	11	6.35	0.91	0.22	0.10	0.45	1	2	60	2	84	0.41	0.05	0.05	0.04	0.01	0.16	0.57	0.06	0.10	1.00
Maximum	39	6.41	2.25	0.52	0.27	0.85	2	8	250	5	355	1.33	0.05	0.05	0.07	0.01	0.26	1.70	0.10	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	no	yes	no	yes	yes	yes	no	no
n	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
St.dev	15	0.03	0.75	0.15	0.10	0.21	1	3	108	2	147	0.49	0.00	0.00	0.01	0.00	0.06	0.64	0.02	0.06	0.00

Vikedalselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 09:33:00	10	6.37	3.59	6.10	11.20	2.00	20	30	535	30	745	0.94	<0.05	0.64	1.02	0.05	1.25	5.73	0.86	0.32	<1.00
12.05.2014 08:30:00	5	6.93	2.88	0.37	0.41	0.84	<1	3	140	3	215	0.83	<0.05	0.20	0.07	0.01	0.37	1.90	0.25	0.84	1.00
11.08.2014	8	6.59	2.04	0.70	1.20	1.70	2	5	107	8	175	0.51	<0.05	0.25	0.14	0.02	0.43	1.90			<1.00
06.10.2014 11:15:00	6	6.62	2.49	0.54	1.13	1.70	2	4	195	5	320	0.83	<0.05	0.23	0.10	0.02	0.41	2.00	0.36	<0.10	<1.00
Lower avg.	7	6.63	2.75	1.93	3.48	1.56	6	11	244	12	364	0.78	0.00	0.33	0.33	0.03	0.61	2.88	0.49	0.39	0.25
Upper avg..	7	6.63	2.75	1.93	3.48	1.56	6	11	244	12	364	0.78	0.05	0.33	0.33	0.03	0.61	2.88	0.49	0.42	1.00
Minimum	5	6.37	2.04	0.37	0.41	0.84	1	3	107	3	175	0.51	0.05	0.20	0.07	0.01	0.37	1.90	0.25	0.10	1.00
Maximum	10	6.93	3.59	6.10	11.20	2.00	20	30	535	30	745	0.94	0.05	0.64	1.02	0.05	1.25	5.73	0.86	0.84	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	2	0.23	0.66	2.79	5.16	0.50	9	13	197	13	261	0.19	0.00	0.21	0.46	0.02	0.43	1.90	0.33	0.38	0.00

Jostedøla

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
04.02.2014 10:30:00	20	6.65	4.16	0.81	0.61	0.57	<1	2	275	3	330	4.60	<0.05	0.08	0.02	<0.01	0.53	0.78	<0.05	1.30	1.00
06.05.2014 12:15:00	27	6.99	2.72	0.91	0.65	1.20	<1	2	125	4	180	2.89	<0.05	<0.05	0.03	<0.01	0.49	0.46	0.10	<0.10	<1.00
09.09.2014 12:30:00	94	6.51	0.63	12.30	12.20	0.24	18	19	29	2	63	2.01	<0.05	<0.05	0.27	<0.01	1.12	3.77			<1.00
07.10.2014 12:30:00	74	6.61	1.56	20.60	22.10	0.51	22	23	82	5	135	4.13	<0.05	<0.05	0.36	0.01	1.34	4.32	1.10	1.40	<1.00
Lower avg.	54	6.69	2.27	8.66	8.89	0.63	10	12	128	4	177	3.41	0.00	0.02	0.17	0.00	0.87	2.33	0.40	0.90	0.25
Upper avg..	54	6.69	2.27	8.66	8.89	0.63	11	12	128	4	177	3.41	0.05	0.06	0.17	0.01	0.87	2.33	0.42	0.93	1.00
Minimum	20	6.51	0.63	0.81	0.61	0.24	1	2	29	2	63	2.01	0.05	0.05	0.02	0.01	0.49	0.46	0.05	0.10	1.00
Maximum	94	6.99	4.16	20.60	22.10	1.20	22	23	275	5	330	4.60	0.05	0.08	0.36	0.01	1.34	4.32	1.10	1.40	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	no	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	36	0.21	1.52	9.62	10.36	0.41	11	11	106	1	113	1.18	0.00	0.02	0.18	0.00	0.43	1.99	0.59	0.72	0.00

Gaular

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 09:55:00	34	6.32	1.83	0.37	0.34	1.20	2	4	195	2	255	1.37	<0.05	<0.05	0.03	<0.01	0.25	1.20	0.10	0.10	2.00
09.05.2014 09:15:00	44	6.42	1.65	0.49	0.55	1.40	2	4	73	2	160	0.86	<0.05	<0.05	0.03	0.01	0.31	1.10	0.10	0.37	<1.00
03.09.2014 12:10:00	27	6.52	1.17	0.43	0.40	1.40	1	4	35	6	118	0.58	<0.05	<0.05	0.02	<0.01	0.36	0.84			<1.00
22.10.2014 08:00:00	83	6.25	1.62	0.56	0.88	2.40	4	8	79	<2	215	0.94	<0.05	<0.05	0.07	<0.01	0.35	1.00	0.10	<0.10	<1.00
Lower avg.	47	6.38	1.57	0.46	0.54	1.60	2	5	96	3	187	0.94	0.00	0.00	0.04	0.00	0.32	1.03	0.10	0.16	0.50
Upper avg..	47	6.38	1.57	0.46	0.54	1.60	2	5	96	3	187	0.94	0.05	0.05	0.04	0.01	0.32	1.03	0.10	0.19	1.25
Minimum	27	6.25	1.17	0.37	0.34	1.20	1	4	35	2	118	0.58	0.05	0.05	0.02	0.01	0.25	0.84	0.10	0.10	1.00
Maximum	83	6.52	1.83	0.56	0.88	2.40	4	8	195	6	255	1.37	0.05	0.05	0.07	0.01	0.36	1.20	0.10	0.37	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	25	0.12	0.28	0.08	0.24	0.54	1	2	69	2	60	0.33	0.00	0.00	0.02	0.00	0.05	0.15	0.00	0.16	0.50

Jølstra

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 12:30:00	31	6.37	1.93	0.46	0.35	0.95	2	4	195	2	255	1.30	<0.05	<0.05	0.03	<0.01	0.32	1.50	0.10	0.10	1.00
09.05.2014 11:25:00	46	6.48	1.79	0.35	0.44	1.10	<2	3	110	<2	180	1.03	<0.05	<0.05	0.02	<0.01	0.32	1.50	0.10	0.20	<1.00
03.09.2014 13:00:00	28	6.54	1.57	0.52	0.51	1.10	<1	1	81	5	147	0.68	<0.05	<0.05	0.01	<0.01	0.21	0.81	0.08	0.20	<1.00
22.10.2014 10:15:00	77	6.32	1.80	0.78	0.69	1.90	2	6	115	2	230	1.05	<0.05	<0.05	0.03	0.01	0.27	0.90	0.10	<0.10	<1.00
Lower avg.	45	6.43	1.77	0.53	0.50	1.26	1	4	125	2	203	1.02	0.00	0.00	0.02	0.00	0.28	1.18	0.10	0.12	0.25
Upper avg..	45	6.43	1.77	0.53	0.50	1.26	2	4	125	3	203	1.02	0.05	0.05	0.02	0.01	0.28	1.18	0.10	0.15	1.00
Minimum	28	6.32	1.57	0.35	0.35	0.95	1	1	81	2	147	0.69	0.05	0.05	0.01	0.01	0.21	0.81	0.08	0.10	1.00
Maximum	77	6.54	1.93	0.78	0.69	1.90	2	6	195	5	255	1.31	0.05	0.05	0.03	0.01	0.32	1.50	0.10	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	22	0.10	0.15	0.18	0.14	0.43	1	2	49	2	49	0.26	0.00	0.00	0.01	0.00	0.05	0.37	0.01	0.06	0.00

Nausta

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 13:35:00	12	6.50	2.30	0.53	0.53	1.10	5	9	170	4	270	2.03	<0.05	<0.05	0.03	<0.01	0.24	1.00	0.10	0.10	2.00
09.05.2014 10:20:00	18	6.34	1.57	0.35	0.49	1.20	<1	4	23	3	87	0.81	<0.05	<0.05	0.04	0.01	0.35	1.10	0.20	0.20	1.00
03.09.2014 11:00:00	11	6.61	1.22	0.39	0.56	2.20	1	3	29	4	133	0.90	<0.05	<0.05	0.03	<0.01	0.23	0.62	0.10	0.20	<1.00
22.10.2014 11:00:00	30	6.29	1.80	0.36	0.65	2.80	5	8	77	<2	230	1.30	<0.05	<0.05	0.07	0.01	0.30	1.10	0.20	<0.10	<1.00
Lower avg.	17	6.44	1.72	0.41	0.56	1.82	3	6	75	3	180	1.26	0.00	0.00	0.04	0.00	0.28	0.96	0.15	0.12	0.75
Upper avg..	17	6.44	1.72	0.41	0.56	1.82	3	6	75	3	180	1.26	0.05	0.05	0.04	0.01	0.28	0.96	0.15	0.15	1.25
Minimum	11	6.29	1.22	0.35	0.49	1.10	1	3	23	2	87	0.81	0.05	0.05	0.03	0.01	0.23	0.62	0.10	0.10	1.00
Maximum	30	6.61	2.30	0.53	0.65	2.80	5	9	170	4	270	2.03	0.05	0.05	0.07	0.01	0.35	1.10	0.20	0.20	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	9	0.15	0.45	0.08	0.07	0.82	2	3	68	1	85	0.56	0.00	0.00	0.02	0.00	0.06	0.23	0.06	0.06	0.50

Gloppenelva(Breimselva)

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
06.03.2014 06:20:00	33	6.59	2.12	0.63	0.34	0.94	1	2	235	<2	295	1.50	<0.05	<0.05	0.01	<0.01	0.34	0.94	0.10	0.20	<1.00
04.06.2014 20:30:00	54	6.59	1.97	0.70	0.78	0.84	<1	4	175	4	240	1.28	<0.05	<0.05	0.03	<0.01	0.36	0.74	0.10	<0.10	<1.00
15.09.2014 18:15:00	30	6.77	1.51	0.58	0.47	0.76	<1	4	61	4	133	0.77	<0.05	<0.05	0.02	<0.01	0.43	0.41			<1.00
29.10.2014 16:30:00	229	6.71	1.83	1.40	4.05	1.20	8	8	145	<2	245	1.45	<0.05	<0.05	0.10	<0.01	0.46	0.90	0.22	0.10	<1.00
Lower avg.	86	6.66	1.86	0.83	1.41	0.94	2	5	154	2	228	1.25	0.00	0.00	0.04	0.00	0.40	0.75	0.14	0.10	0.00
Upper avg..	86	6.66	1.86	0.83	1.41	0.94	3	5	154	3	228	1.25	0.05	0.05	0.04	0.00	0.40	0.75	0.14	0.13	1.00
Minimum	30	6.59	1.51	0.58	0.34	0.76	1	2	61	2	133	0.77	0.05	0.05	0.01	0.01	0.34	0.41	0.10	0.10	1.00
Maximum	229	6.77	2.12	1.40	4.05	1.20	8	8	235	4	295	1.50	0.05	0.05	0.10	0.01	0.46	0.94	0.22	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	no	yes	no	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	96	0.09	0.26	0.39	1.77	0.19	4	3	72	1	68	0.33	0.00	0.00	0.04	0.00	0.06	0.24	0.07	0.06	0.00

Driva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
18.02.2014 10:00:00	26	7.18	3.30	0.31	0.25	0.94	<1	<1	135	<2	220	2.40	<0.05	<0.05	0.01	<0.01	0.46	0.20	0.10	0.10	1.00
06.05.2014 10:00:00	47	7.33	4.60	0.68	0.63	1.40	<1	2	195	4	280	3.12	<0.05	<0.05	0.02	<0.01	0.75	0.57	0.20	<0.10	<1.00
12.08.2014 11:00:00	57	7.37	3.35	0.70	1.52	0.79	<1	2	79	6	112	2.42	<0.05	<0.05	0.02	<0.01	0.59	1.40	0.29	0.42	<1.00
27.10.2014 10:30:00	40	7.26	4.76	0.65	1.04	1.10	1	<1	185	<2	275	3.91	<0.05	<0.05	0.02	<0.01	0.66	0.30	0.20	0.10	<1.00
Lower avg.	43	7.28	4.00	0.58	0.86	1.06	0	1	149	3	222	2.96	0.00	0.00	0.02	0.00	0.62	0.62	0.20	0.16	0.25
Upper avg..	43	7.28	4.00	0.58	0.86	1.06	1	2	149	4	222	2.96	0.05	0.05	0.02	0.00	0.62	0.62	0.20	0.18	1.00
Minimum	26	7.18	3.30	0.31	0.25	0.79	1	1	79	2	112	2.40	0.05	0.05	0.01	0.01	0.46	0.20	0.10	0.10	1.00
Maximum	57	7.37	4.76	0.70	1.52	1.40	1	2	195	6	280	3.92	0.05	0.05	0.02	0.01	0.75	1.40	0.29	0.42	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	no	no	yes	no	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	13	0.08	0.79	0.18	0.55	0.26	0	1	53	2	78	0.72	0.00	0.00	0.01	0.00	0.12	0.55	0.08	0.16	0.00

Surna

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
26.02.2014 17:30:00	31	6.60	2.12	1.29	1.41	1.50	1	10	60	4	121	1.84	<0.05	<0.05	0.02	<0.01	0.38	0.62	0.20	0.20	<1.00
07.05.2014 14:30:00	44	7.17	4.32	0.55	0.89	3.20	1	4	105	<2	230	1.97	<0.05	<0.05	0.02	<0.01	0.83	0.44	0.55	0.43	<1.00
26.08.2014 18:00:00	42	6.92	3.26	0.72	0.60	3.30	1	2	95	4	210	1.74	<0.05	<0.05	0.02	0.01	0.64	0.53			<1.00
13.10.2014 10:15:00	22	7.09	3.09	0.80	1.98	2.00	1	4	114	6	235	1.75	<0.05	<0.05	0.03	<0.01	0.45	0.46	0.22	<0.10	2.00
Lower avg.	35	6.94	3.20	0.84	1.22	2.50	1	5	94	4	199	1.82	0.00	0.00	0.02	0.00	0.57	0.51	0.32	0.21	0.50
Upper avg..	35	6.94	3.20	0.84	1.22	2.50	1	5	94	4	199	1.82	0.05	0.05	0.02	0.01	0.57	0.51	0.32	0.24	1.25
Minimum	22	6.60	2.12	0.55	0.60	1.50	1	2	60	2	121	1.74	0.05	0.05	0.02	0.01	0.38	0.44	0.20	0.10	1.00
Maximum	44	7.17	4.32	1.29	1.98	3.30	1	10	114	6	235	1.97	0.05	0.05	0.03	0.01	0.83	0.62	0.55	0.43	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	11	0.25	0.90	0.32	0.61	0.89	0	3	24	2	53	0.11	0.00	0.00	0.01	0.00	0.20	0.08	0.20	0.17	0.50

Gaula

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
12.02.2014 09:15:00	35	7.33	6.72	2.45	2.66	2.50	2	4	215	47	400	2.80	<0.05	0.10	0.04	<0.01	0.75	1.30	1.20	0.48	<1.00
06.05.2014 07:35:00	79	7.46	11.00	2.36	1.32	4.00	1	4	115	46	285	3.06	<0.05	0.10	0.07	0.01	1.36	2.17	1.30	0.30	1.00
25.08.2014 07:35:00	129	6.38	8.81	2.39	2.08	4.80	2	4	64	9	250	3.08	<0.05	0.07	0.07	0.01	1.71	2.01			<1.00
14.10.2014 08:50:00	59	7.62	16.75	6.93	13.90	3.50	10	11	91	18	275	4.19	<0.05	<0.05	0.12	0.01	1.55	3.59	1.80	0.73	2.00
Lower avg.	76	7.20	10.82	3.53	4.99	3.70	4	6	121	30	303	3.28	0.00	0.07	0.07	0.01	1.34	2.27	1.43	0.50	0.75
Upper avg..	76	7.20	10.82	3.53	4.99	3.70	4	6	121	30	303	3.28	0.05	0.08	0.07	0.01	1.34	2.27	1.43	0.50	1.25
Minimum	35	6.38	6.72	2.36	1.32	2.50	1	4	64	9	250	2.80	0.05	0.05	0.04	0.01	0.75	1.30	1.20	0.30	1.00
Maximum	129	7.62	16.75	6.93	13.90	4.80	10	11	215	47	400	4.19	0.05	0.10	0.12	0.01	1.71	3.59	1.80	0.73	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	40	0.56	4.32	2.27	5.97	0.96	4	4	66	19	67	0.62	0.00	0.02	0.04	0.00	0.42	0.96	0.32	0.22	0.50

Nidelva(Tr.heim)

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
12.02.2014 09:50:00	30	7.11	3.30	2.27	0.87	2.30	4	7	94	4	215	1.88	<0.05	0.10	0.03	0.01	0.69	0.25	0.68	0.20	<1.00
06.05.2014 08:30:00	69	7.28	3.49	1.65	1.43	2.40	1	3	115	4	215	1.90	<0.05	<0.05	0.04	0.01	0.72	4.48	0.76	<0.10	<1.00
25.08.2014 08:40:00	98	7.20	3.22	0.70	0.75	3.10	<1	3	46	9	180	1.58	<0.05	0.08	0.02	0.02	2.06	1.50			<1.00
14.10.2014 10:00:00	46	7.30	3.26	0.67	0.80	2.70	<1	3	67	11	195	1.62	<0.05	0.06	0.03	0.01	0.68	0.66	0.63	0.10	1.00
Lower avg.	61	7.22	3.32	1.32	0.96	2.62	1	4	81	7	201	1.75	0.00	0.06	0.03	0.01	1.04	1.72	0.69	0.10	0.25
Upper avg..	61	7.22	3.32	1.32	0.96	2.62	2	4	81	7	201	1.75	0.05	0.07	0.03	0.01	1.04	1.72	0.69	0.13	1.00
Minimum	30	7.11	3.22	0.67	0.75	2.30	1	3	46	4	180	1.58	0.05	0.05	0.02	0.01	0.68	0.25	0.63	0.10	1.00
Maximum	98	7.30	3.49	2.27	1.43	3.10	4	7	115	11	215	1.90	0.05	0.10	0.04	0.02	2.06	4.48	0.76	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	30	0.09	0.12	0.78	0.32	0.36	2	2	30	4	17	0.17	0.00	0.02	0.01	0.01	0.68	1.91	0.07	0.06	0.00

Stjørdalselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
12.02.2014 10:50:00	18	7.06	3.05	31.60	31.30	2.40	25	28	68	19	270	2.55	<0.05	0.20	0.49	0.02	1.89	9.36	1.60	1.60	<1.00
06.05.2014 09:25:00	43	6.48	3.97	1.83	1.38	3.80	1	4	110	5	245	1.65	<0.05	<0.05	0.04	0.01	1.27	2.61	0.51	<0.10	<1.00
25.08.2014 09:30:00	74	7.19	3.66	2.02	1.90	5.20	1	5	80	4	245	1.33	<0.05	0.08	0.05	0.01	2.26	2.78			<1.00
14.10.2014 10:55:00	35	7.20	3.67	1.34	1.79	3.90	2	4	64	6	215	1.49	<0.05	0.07	0.05	0.01	1.93	4.04	0.44	0.20	2.00
Lower avg.	42	6.98	3.59	9.20	9.09	3.82	7	10	81	9	244	1.75	0.00	0.09	0.16	0.01	1.84	4.70	0.85	0.60	0.50
Upper avg..	42	6.98	3.59	9.20	9.09	3.82	7	10	81	9	244	1.75	0.05	0.10	0.16	0.01	1.84	4.70	0.85	0.63	1.25
Minimum	18	6.48	3.05	1.34	1.38	2.40	1	4	64	4	215	1.33	0.05	0.05	0.04	0.01	1.27	2.61	0.44	0.10	1.00
Maximum	74	7.20	3.97	31.60	31.30	5.20	25	28	110	19	270	2.55	0.05	0.20	0.49	0.02	2.26	9.36	1.60	1.60	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	23	0.34	0.39	14.94	14.81	1.14	12	12	21	7	23	0.55	0.00	0.07	0.22	0.01	0.41	3.17	0.65	0.84	0.50

Verdalselva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
12.02.2014 12:40:00	13	7.57	14.80	1.63	2.90	3.10	13	23	295	42	540	3.36	<0.05	0.23	0.34	0.02	1.92	22.90	0.83	0.44	<1.00
06.05.2014 10:50:00	29	7.26	4.26	1.84	1.69	3.80	2	3	82	2	210	1.92	<0.05	0.10	0.04	<0.01	0.68	0.91	0.57	0.10	2.00
25.08.2014 11:45:00	49	7.49	5.56	1.80	1.42	4.90	1	4	112	3	285	1.39	<0.05	0.10	0.04	0.01	0.85	0.70			1.00
14.10.2014 12:50:00	25	7.39	5.99	0.58	0.54	4.00	2	3	126	4	275	1.90	<0.05	0.07	0.02	<0.01	0.60	0.58	0.40	0.10	1.00
Lower avg.	29	7.43	7.65	1.46	1.64	3.95	5	8	154	13	328	2.14	0.00	0.12	0.11	0.01	1.01	6.27	0.60	0.21	1.00
Upper avg..	29	7.43	7.65	1.46	1.64	3.95	5	8	154	13	328	2.14	0.05	0.12	0.11	0.01	1.01	6.27	0.60	0.21	1.25
Minimum	13	7.26	4.26	0.58	0.54	3.10	1	3	82	2	210	1.39	0.05	0.07	0.02	0.01	0.60	0.58	0.40	0.10	1.00
Maximum	49	7.57	14.80	1.84	2.90	4.90	13	23	295	42	540	3.36	0.05	0.23	0.34	0.02	1.92	22.90	0.83	0.44	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	15	0.13	4.82	0.60	0.97	0.74	6	10	96	20	146	0.85	0.00	0.07	0.15	0.01	0.61	11.09	0.22	0.20	0.50

Snåsavassdraget

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
12.02.2014 15:15:00	12	7.29	11.50	1.25	0.72	4.00	2	4	175	11	345	1.66	<0.05	0.10	0.02	<0.01	0.61	0.30	0.45	0.36	1.00
06.05.2014 12:05:00	25	7.30	5.00	1.73	1.56	4.00	2	5	170	5	315	1.52	<0.05	0.08	0.04	<0.01	0.56	0.85	0.43	<0.10	1.00
25.08.2014 12:40:00	27	7.28	4.52	1.27	1.17	4.60	1	5	86	5	260	0.98	<0.05	0.07	0.03	0.01	0.68	0.60			1.00
14.10.2014 14:15:00	14	7.31	4.90	0.87	1.23	4.10	1	4	146	4	310	1.22	<0.05	0.07	0.01	0.01	0.59	0.63	0.34	0.20	1.00
Lower avg.	20	7.30	6.48	1.28	1.17	4.18	2	5	144	6	308	1.35	0.00	0.08	0.02	0.00	0.61	0.60	0.41	0.19	1.00
Upper avg..	20	7.30	6.48	1.28	1.17	4.18	2	5	144	6	308	1.35	0.05	0.08	0.02	0.01	0.61	0.60	0.41	0.22	1.00
Minimum	12	7.28	4.52	0.87	0.72	4.00	1	4	86	4	260	0.98	0.05	0.07	0.01	0.01	0.56	0.30	0.34	0.10	1.00
Maximum	27	7.31	11.50	1.73	1.56	4.60	2	5	175	11	345	1.66	0.05	0.10	0.04	0.01	0.68	0.85	0.45	0.36	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	no	yes
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	8	0.01	3.35	0.35	0.35	0.29	1	1	41	3	35	0.30	0.00	0.01	0.01	0.00	0.05	0.23	0.06	0.13	0.00

Namsen

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 10:00:00	17	7.02	4.23	1.40	1.89	2.50	7	9	120	23	695	1.28	<0.05	0.10	0.11	0.01	2.01	8.72	0.56	0.30	<1.00
05.05.2014 10:00:00	34	7.00	4.81	3.40	2.36	2.90	2	4	96	9	220	1.91	<0.05	0.10	0.05	<0.01	0.63	1.20	0.51	0.33	1.00
11.08.2014 09:30:00	29	7.19	5.01	2.16	3.49	3.60	4	8	36	11	147	1.26	<0.05	0.10	0.11	0.01	0.97	1.30	0.94	0.73	<1.00
06.10.2014 11:00:00	32	7.01	3.85	4.40	7.57	3.30	6	9	18	4	185	1.62	<0.05	0.20	0.15	0.01	0.71	1.50	0.49	0.20	<1.00
Lower avg.	28	7.06	4.47	2.84	3.83	3.08	5	8	68	12	312	1.52	0.00	0.12	0.11	0.01	1.08	3.18	0.62	0.39	0.25
Upper avg..	28	7.06	4.47	2.84	3.83	3.08	5	8	68	12	312	1.52	0.05	0.12	0.11	0.01	1.08	3.18	0.62	0.39	1.00
Minimum	17	7.00	3.85	1.40	1.89	2.50	2	4	18	4	147	1.26	0.05	0.10	0.05	0.01	0.63	1.20	0.49	0.20	1.00
Maximum	34	7.19	5.01	4.40	7.57	3.60	7	9	120	23	695	1.91	0.05	0.20	0.15	0.01	2.01	8.72	0.94	0.73	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	8	0.09	0.53	1.33	2.58	0.48	2	2	48	8	257	0.31	0.00	0.05	0.04	0.00	0.64	3.70	0.21	0.23	0.00

Røssåga

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 10:45:00	43	7.34	3.80	0.48	0.20	0.70	<1	2	56	<2	106	0.90	<0.05	0.10	0.01	<0.01	0.32	0.65	0.46	<0.10	<1.00
05.05.2014 11:00:00	61	7.25	4.29	0.30	0.22	0.85	<1	1	54	<2	105	0.88	<0.05	0.08	0.01	<0.01	0.31	1.30	0.42	0.30	<1.00
11.08.2014 12:00:00	102	7.39	3.78	0.46	0.37	0.85	<1	2	49	12	98	0.71	<0.05	0.06	0.02	<0.01	0.31	0.65	0.42	0.20	<1.00
07.10.2014 09:15:00	81	7.37	4.19	0.70	0.64	1.10	<1	2	40	4	109	0.86	<0.05	0.08	0.03	<0.01	0.33	1.60	0.40	<0.10	<1.00
Lower avg.	72	7.34	4.01	0.48	0.36	0.88	0	2	50	4	105	0.83	0.00	0.08	0.02	0.00	0.32	1.05	0.43	0.12	0.00
Upper avg..	72	7.34	4.01	0.48	0.36	0.88	1	2	50	5	105	0.83	0.05	0.08	0.02	0.00	0.32	1.05	0.43	0.18	1.00
Minimum	43	7.25	3.78	0.30	0.20	0.70	1	1	40	2	98	0.71	0.05	0.06	0.01	0.01	0.31	0.65	0.40	0.10	1.00
Maximum	102	7.39	4.29	0.70	0.64	1.10	1	2	56	12	109	0.90	0.05	0.10	0.03	0.01	0.33	1.60	0.46	0.30	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	25	0.06	0.26	0.16	0.20	0.17	0	1	7	5	5	0.09	0.00	0.02	0.01	0.00	0.01	0.48	0.03	0.10	0.00

Ranaelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 11:40:00	64	7.53	6.50	0.75	0.42	0.59	<1	2	115	13	200	1.81	<0.05	0.07	0.02	0.01	0.38	0.52	0.36	0.10	<1.00
05.05.2014 11:30:00	92	7.38	5.27	0.45	0.51	0.95	<1	2	54	4	128	1.22	<0.05	0.06	0.01	<0.01	0.33	0.30	0.28	0.10	<1.00
11.08.2014 13:00:00	360	7.43	4.25	0.55	0.77	0.58	<1	2	48	8	107	1.01	<0.05	0.08	0.02	0.01	0.29	0.40	0.20	0.32	<1.00
07.10.2014 10:10:00	266	7.43	4.49	2.30	17.30	0.95	13	17	41	4	136	1.96	<0.05	0.10	0.21	0.01	0.86	2.57	0.85	0.64	<1.00
Lower avg.	196	7.44	5.13	1.01	4.75	0.77	3	6	65	7	143	1.50	0.00	0.08	0.07	0.00	0.46	0.95	0.42	0.29	0.00
Upper avg..	196	7.44	5.13	1.01	4.75	0.77	4	6	65	7	143	1.50	0.05	0.08	0.07	0.01	0.46	0.95	0.42	0.29	1.00
Minimum	64	7.38	4.25	0.45	0.42	0.58	1	2	41	4	107	1.01	0.05	0.06	0.01	0.01	0.29	0.30	0.20	0.10	1.00
Maximum	360	7.53	6.50	2.30	17.30	0.95	13	17	115	13	200	1.96	0.05	0.10	0.21	0.01	0.86	2.57	0.85	0.64	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	142	0.06	1.01	0.87	8.37	0.21	6	8	34	4	40	0.46	0.00	0.02	0.10	0.00	0.27	1.09	0.29	0.26	0.00

Beiarelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
03.03.2014 12:35:00	21	7.50	9.26	0.72	0.87	1.30	2	3	87	20	250	4.09	<0.05	0.10	0.03	0.01	0.64	4.36	0.62	0.31	<1.00
26.05.2014 12:25:00	88	7.19	6.41	4.85	8.38	1.10	<1	6	34	5	93	2.06	<0.05	0.10	0.10	<0.01	0.67	1.80	0.98	0.72	1.00
11.08.2014 12:15:00	65	7.37	3.38	14.90	18.20	0.35	8	9	13	6	74	2.46	<0.05	0.29	0.16	0.01	1.03	2.12	1.00	0.57	<1.00
14.10.2014 08:50:00	28	7.47	7.41	<0.30	0.30	0.84	<1	<1	39	<2	84	3.00	<0.05	0.10	0.01	<0.01	0.36	0.21	0.48	<0.10	<1.00
Lower avg.	50	7.38	6.62	5.12	6.94	0.90	3	5	43	8	125	2.90	0.00	0.15	0.07	0.00	0.67	2.12	0.77	0.40	0.25
Upper avg..	50	7.38	6.62	5.19	6.94	0.90	3	5	43	8	125	2.90	0.05	0.15	0.07	0.01	0.67	2.12	0.77	0.43	1.00
Minimum	21	7.19	3.38	0.30	0.30	0.35	1	1	13	2	74	2.06	0.05	0.10	0.01	0.01	0.36	0.21	0.48	0.10	1.00
Maximum	88	7.50	9.26	14.90	18.20	1.30	8	9	87	20	250	4.09	0.05	0.29	0.16	0.01	1.03	4.36	1.00	0.72	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	32	0.14	2.46	6.79	8.36	0.41	3	4	31	8	84	0.88	0.00	0.10	0.07	0.00	0.28	1.71	0.26	0.28	0.00

Målselv

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 10:00:00	17	7.59	9.73	0.60	0.25	0.75	<1	1	100	6	165	3.10	<0.05	<0.05	0.15	<0.01	0.56	<0.05	0.22	0.20	<1.00
06.05.2014 11:30:00	47	7.62	10.00	0.85	0.92	1.70	<1	3	115	3	220	3.12	<0.05	<0.05	0.03	<0.01	0.62	0.26	0.26	0.20	<1.00
10.08.2014 19:30:00	78	7.64	7.78	0.86	0.56	0.90	<1	1	33	7	124	2.08	<0.05	0.07	0.02	<0.01	0.48	0.20	0.26	<0.10	<1.00
07.10.2014 09:30:00	70	7.72	9.13	0.66	0.65	1.00	<1	1	34	4	98	2.40	<0.05	<0.05	0.01	<0.01	0.41	0.10	0.20	0.10	<1.00
Lower avg.	53	7.64	9.16	0.74	0.60	1.09	0	2	71	5	152	2.68	0.00	0.02	0.05	0.00	0.52	0.14	0.24	0.12	0.00
Upper avg..	53	7.64	9.16	0.74	0.60	1.09	1	2	71	5	152	2.68	0.05	0.06	0.05	0.00	0.52	0.15	0.24	0.15	1.00
Minimum	17	7.59	7.78	0.60	0.25	0.75	1	1	33	3	98	2.08	0.05	0.05	0.01	0.01	0.41	0.05	0.20	0.10	1.00
Maximum	78	7.72	10.00	0.86	0.92	1.70	1	3	115	7	220	3.12	0.05	0.07	0.15	0.01	0.62	0.26	0.26	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	27	0.06	0.99	0.13	0.28	0.42	0	1	43	2	53	0.52	0.00	0.01	0.07	0.00	0.09	0.10	0.03	0.06	0.00

Barduelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2014 11:00:00	15	7.40	5.70	0.49	0.43	1.00	1	2	68	3	135	2.18	<0.05	<0.05	0.01	<0.01	0.38	<0.05	0.20	0.20	<1.00
06.05.2014 10:00:00	43	7.63	6.99	3.40	4.47	1.20	4	5	100	10	205	2.50	<0.05	<0.05	0.05	<0.01	0.51	0.42	0.31	0.20	<1.00
10.08.2014 20:00:00	71	7.64	6.48	1.61	1.53	0.78	1	2	26	9	118	1.64	<0.05	0.07	0.03	<0.01	0.45	0.26	0.33	0.10	<1.00
07.10.2014 10:30:00	64	7.67	7.63	0.94	0.83	1.10	<1	2	27	4	100	1.99	<0.05	<0.05	0.01	<0.01	0.45	0.95	0.21	0.10	<1.00
Lower avg.	48	7.59	6.70	1.61	1.82	1.02	2	3	55	7	140	2.08	0.00	0.02	0.02	0.00	0.45	0.41	0.26	0.15	0.00
Upper avg..	48	7.59	6.70	1.61	1.82	1.02	2	3	55	7	140	2.08	0.05	0.06	0.02	0.00	0.45	0.42	0.26	0.15	1.00
Minimum	15	7.40	5.70	0.49	0.43	0.78	1	2	26	3	100	1.64	0.05	0.05	0.01	0.01	0.38	0.05	0.20	0.10	1.00
Maximum	71	7.67	7.63	3.40	4.47	1.20	4	5	100	10	205	2.50	0.05	0.07	0.05	0.01	0.51	0.95	0.33	0.20	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	25	0.12	0.82	1.28	1.83	0.18	2	2	36	4	46	0.36	0.00	0.01	0.02	0.00	0.05	0.38	0.07	0.06	0.00

Tanaelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
11.02.2014 15:00:00	41	7.22	7.84	0.81	0.95	1.70	4	14	110	46	380	10.38	<0.05	0.07	0.23	0.01	1.57	9.05	0.36	0.48	<1.00
05.05.2014 12:30:00	72	7.56	6.35	0.70	0.56	2.10	1	4	5	4	119	7.72	<0.05	<0.05	0.02	0.01	0.46	0.43	0.29	0.30	<1.00
11.08.2014 06:45:00	172	7.36	4.93	0.61	0.62	3.10	1	4	11	25	190	5.28	<0.05	0.08	0.02	<0.01	0.84	0.70			<1.00
06.10.2014 08:30:00	130	7.43	4.98	1.54	1.34	3.10	1	3	6	12	160	6.82	<0.05	<0.05	0.03	0.01	0.57	1.60	0.32	0.36	2.00
Lower avg.	104	7.39	6.02	0.92	0.87	2.50	2	6	33	22	212	7.55	0.00	0.04	0.08	0.01	0.86	2.94	0.32	0.38	0.50
Upper avg..	104	7.39	6.02	0.92	0.87	2.50	2	6	33	22	212	7.55	0.05	0.06	0.08	0.01	0.86	2.94	0.32	0.38	1.25
Minimum	41	7.22	4.93	0.61	0.56	1.70	1	3	5	4	119	5.28	0.05	0.05	0.02	0.01	0.46	0.43	0.29	0.30	1.00
Maximum	172	7.56	7.84	1.54	1.34	3.10	4	14	110	46	380	10.38	0.05	0.08	0.23	0.01	1.57	9.05	0.36	0.48	2.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
St.dev	59	0.14	1.38	0.43	0.36	0.71	2	5	51	18	116	2.14	0.00	0.02	0.10	0.00	0.50	4.10	0.04	0.09	0.50

Pasvikelva

Date	Qs	pH	KOND	TURB860	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	Ag	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[FNU]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
11.02.2014 09:00:00	37	6.97	3.66	1.12	2.23	3.30	2	5	56	10	355	5.56	<0.05	0.10	0.09	0.01	4.15	3.79	2.03	0.80	<1.00
11.05.2014 20:30:00	183	7.23	4.01	1.44	0.69	2.80	2	3	20	5	165	4.69	<0.05	0.29	0.05	0.01	2.74	1.20	3.75	<0.10	<1.00
10.08.2014 09:00:00	147	7.15	3.53	0.53	0.76	3.60	1	5	7	40	235	3.68	<0.05	0.20	0.02	0.01	1.41	0.75	4.79	0.10	<1.00
06.10.2014 13:00:00	106	7.32	3.61	0.62	0.77	3.20	<1	5	5	10	165	4.34	<0.05	0.08	0.02	<0.01	0.84	0.85	3.08	<0.10	<1.00
Lower avg.	118	7.17	3.70	0.93	1.11	3.22	1	5	22	16	230	4.57	0.00	0.17	0.05	0.01	2.29	1.65	3.41	0.22	0.00
Upper avg..	118	7.17	3.70	0.93	1.11	3.22	2	5	22	16	230	4.57	0.05	0.17	0.05	0.01	2.29	1.65	3.41	0.28	1.00
Minimum	37	6.97	3.53	0.53	0.69	2.80	1	3	5	5	165	3.68	0.05	0.08	0.02	0.01	0.84	0.75	2.03	0.10	1.00
Maximum	183	7.32	4.01	1.44	2.23	3.60	2	5	56	40	355	5.56	0.05	0.29	0.09	0.01	4.15	3.79	4.79	0.80	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	63	0.15	0.21	0.43	0.75	0.33	1	1	24	16	90	0.78	0.00	0.10	0.03	0.00	1.48	1.44	1.16	0.35	0.00

Table 1b. Organic contaminants – concentrations

Explanations:

Cw. free: Freely dissolved concentrations estimated from silicone rubber passive samplers

Cspm: contaminant concentrations for compounds associated with SPM

Grey shaded cells are for concentrations below LOD (LOD reported)

Repeated centrifuge/sampling failure at river Drammen on one occasion

n.a.: Analysis for PFCs not undertaken on 3 SPM samples as a result of miscommunication

ALNA RIVER								
Freely dissolved concentrations (mean of replicate measurements, relative percent difference)								
Sample ID	Alna P5		Alna P6		Alna P7		Alna P8	
Deployed	20.12.2013		04.04.2014		24.06.2014		30.09.2014	
Retrieved	04.04.2014		24.06.2014		30.09.2014		16.01.2015	
Exposure time(d)	105		81		98		108	
	MEAN	% RPD	MEAN	% RPD	MEAN	% RPD	MEAN	% RPD
Cw,free (ng/L)								
NAP	4.5643292	3.6	2.3381146	16.1	1.2944237	11.0	6.3065484	9.2
ACY	0.0901279		0.4599328	7.5	0.5719456	1.0	0.5081313	4.2
ACE	0.7359154	12.5	2.2548288	22.3	1.8088363	4.5	0.7187861	14.2
FLUE	1.9694031	2.7	2.0196535	15.4	1.1496964	1.9	0.8696784	16.7
DBTHIO	1.2159058	4.3	1.4482568	7.5	1.6526277	6.2	0.5341712	11.1
PHE	2.3182869	1.2	1.8090416	4.9	1.0537377	2.1	1.2179892	8.6
ANT	0.1699349	5.1	0.3484836	1.0	0.2512496	5.8	0.1740311	3.4
FLUOR	0.9961757	2.4	1.113273	1.5	0.7771141	6.5	0.536668	0.2
PYR	8.0779592	1.4	4.2324519	3.3	2.6882993	13.9	5.4928128	1.4
BaA	0.1638709	5.2	0.1075862	20.3	0.0759743	12.8	0.1015677	7.7
CHRY	0.1821309	6.1	0.2508097	32.4	0.1380129	11.1	0.1535923	0.6
BbjF	0.2017617	4.3	0.1726133	28.1	0.1594883	9.5	0.1553669	2.0
BkF	0.0499774	11.8	0.0345451	24.1	0.0301072	2.6	0.0330706	4.3
BeP	0.2042076	5.8					0.1765103	1.2
BaP	0.0712275	5.7	0.0471067	30.5	0.0431605	11.8	0.0479736	1.3
PER	0.0456723	3.1	0.0326816	24.0	0.0258548	13.3	0.0260265	1.3
In123cdPYR	0.0252163	3.5	0.0206437	31.9	0.0212424	7.0	0.0175198	3.2
BDahANT	0.0099228	6.0	0.0090677	23.8	0.008666	14.9	0.0071137	3.9
BghiPER	0.0580017	6.0	0.0605294	26.3	0.0602668	15.6	0.046213	1.9
PCB31+28	0.0282901	12.0	0.014853	17.7	0.0126352	17.3	0.0370493	1.6
CB52	0.0107365	14.2	0.0097207	25.3	0.0104238	12.0	0.0182077	1.2
CB101	0.0034551	34.6	0.0050003	26.9	0.0067289	9.8	0.0083767	9.4
CB118	0.0025484	8.6	0.0025181	26.0	0.0026748	14.3	0.0031263	0.1
CB153	0.0007082	13.4	0.0038288	26.4	0.0041525	3.0	0.0045853	0.1
CB105	0.0039196	18.0	0.0008914	24.0	0.0009772	12.9		
CB138	0.0030166	3.8	0.0028389	28.5	0.0026938	54.8	0.0039686	4.5
CB156	0.0002673		0.0004165		0.000337			
CB180	0.0013203	14.1	0.001291	30.0	0.0014459	13.0	0.0013283	0.0
CB209	0.0003695		0.0005752		0.0004647			
BDE47	0.0018016	7.9	0.0017132	25.4	0.0016436	9.1	0.0015259	4.1
BDE99	0.0016439	6.1	0.0011253	33.2	0.0012455	24.7	0.001015	5.8
BDE100	0.0001443		0.0002105	27.5	0.0002501	13.0	0.0002413	1.3
BDE153	0.0001209		0.0001411		0.000114		0.0003828	4.3
BDE154	0.0001269	6.1	7.585E-05		8.571E-05	15.7	5.928E-05	10.8
BDE183	0.0001326		0.0001032		8.341E-05		0.0001626	
BDE196	0.0001457		0.0002834		0.000229		0.0001786	
BDE209	0.0007934	16.5	0.0004316	39.6	0.0005802	83.2	0.000784	0.6
BDE126	0.0001103		0.0001289		0.0001042			
aHBCD	0.0054511	5.1	0.0050408	37.4	0.0043643	24.3	0.0040112	13.7
bHBCD	0.0010456	4.8	0.0011523	71.1	0.0015005	12.0	0.0013208	
gHBCD	0.0009645	5.5	0.0005087	6.6	0.0003724	26.4	0.001201	

DRAMMEN RIVER								
Freely dissolved concentrations (mean of replicate measurements, relative percent difference)								
Sample ID	Drammen P5		Drammen P6		Drammen P7		Drammen P8	
Deployed	13.12.2013		23.04.2014		02.07.2014		17.10.2014	
Retrieved	23.04.2014		02.07.2014		17.10.2014		16.01.2015	
Exposure time(d)	131		70		107		91	
Cw,free (ng/L)								
NAP	2.749274073	34.9	4.139384124	9.4	3.617406106	1.0	19.40669377	7.5
ACY	1.4307334	2.2	0.485746379	6.4	0.704567118	1.0	3.918832425	0.0
ACE	1.195845364	2.2	1.028573133	5.8	0.894338507	6.5	2.308761932	5.0
FLUE	2.308182058	2.7	1.229638142	11.6	0.919319867	1.0	2.958645078	3.1
DBTHIO	0.423241683	0.4	0.321351688	9.0	0.369762449	1.0	0.389548692	3.0
PHE	8.194627643	8.0	3.746080343	7.5	1.930885975	1.6	10.44115906	1.6
ANT	0.364673014	7.6	0.127676632	13.4	0.090258967	0.8	0.406538966	1.1
FLUOR	6.046335411	8.8	2.862571298	8.5	0.72636644	2.1	6.213744943	0.4
PYR	4.84228857	6.9	1.4064709	11.4	0.39205915	0.1	4.541499354	0.2
BaA	0.791340292	8.1	0.175922636	9.3	0.037916683	1.0	0.573833454	0.4
CHRY	1.194846529	22.0	0.602821714	14.6	0.065689069	1.3	1.250962724	2.6
BbjF	1.2172352	7.6	0.58598876	11.9	0.081578836	0.7	0.831694596	5.2
BkF	0.319406583	9.6	0.115313091	15.8	0.015356016	0.7	0.222658897	7.7
BeP	0.557468538	7.1					0.398611065	2.2
BaP	0.237523492	11.6	0.040175662	15.3	0.009118495	6.8	0.162264653	5.3
PER	0.156175214	9.7	0.096224497	11.9	0.020132579	6.9	0.137227271	6.3
In123cdPYR	0.162151979	9.9	0.073527533	13.9	0.011022131	0.7	0.101297681	1.8
BDahANT	0.032014382	3.9	0.040561236		0.005154573		0.071695918	
BghiPER	0.188939723	9.0	0.090012674	17.2	0.016436956	4.7	0.12191694	2.3
PCB31+28	0.025726126	25.2	0.018925009	9.5	0.002826025	9.3	0.041012609	10.0
CB52	0.01078714	8.4	0.007496247		0.003140515	5.5	0.017872869	4.9
CB101	0.007329359		0.021772386		0.002998715	1.6	0.017332734	
CB118	0.006187727	21.1	0.009143624	0.2	0.001752758	3.3	0.014819287	
CB153	0.004511727		0.008763096	5.9	0.001911834	6.8	0.014819287	
CB105	0.008358376	13.1	0.012071673	28.4	0.001119664			
CB138	0.007253594	29.4	0.00893734		0.00175133	5.0	0.015802557	
CB156	0.004767041		0.00885573		0.001119664			
CB180	0.005009651		0.00930587		0.001175297		0.016454966	
CB209	0.011048464		0.012313348		0.001553403			
BDE47	0.003070202	7.2	0.009548305	17.3	0.003373913	0.7	0.006267612	4.7
BDE99	0.001399213	12.0	0.002789	9.9	0.000943399	12.6	0.006477364	0.0
BDE100	0.002441293		0.008473599	10.9	0.003124414	5.6	0.002267092	
BDE153	0.002681256		0.003017318		0.000380795		0.001778519	
BDE154	0.002681256		0.002011546		0.000253863		0.001778519	
BDE183	0.002944996		0.002209376		0.00027875		0.005860394	
BDE196	0.003906833		0.006066834		0.000765372		0.006436968	
BDE209	0.005659447		0.008277664		0.000972223	2.0	0.1626106	60.8
BDE126	0.002441293		0.002747429		0.000347086			
aHBCD	0.023967585		0.006719867		0.001565971	33.7	0.035413268	
bHBCD	0.024125925		0.006760166		0.000943686		0.035648508	
gHBCD	0.025319104		0.007074061		0.00093831		0.037417973	

GLOMMA RIVER								
Freely dissolved concentrations (mean of replicate measurements, relative percent difference)								
Sample ID	Glomma P4-5		Glomma P6		Glomma P7		Glomma P8	
Deployed	10.10.2013		04.04.2014		24.06.2014		30.09.2014	
Retrieved	04.04.2014		24.06.2014		30.09.2014		16.12.2014	
Exposure time(d)	176		81		98		77	
Cw,free (ng/L)								
NAP	6.555557056	0.7	2.50849659	4.2	1.16542808	5.1	17.4984512	2.1
ACY	1.167084247	3.7	0.36736822	1.1	0.39703133	2.6	1.84974909	6.0
ACE	1.561704936	8.8	1.69472404	2.7	1.19180833	1.1	2.24564202	2.9
FLUE	3.139159794	1.9	1.91925789	0.7	0.75703443	1.4	2.57854725	2.6
DBTHIO	1.29855374	8.2	0.71121864	0.2	0.2995129	2.9	0.53499555	8.4
PHE	8.192754249	5.0	5.47672121	2.7	1.95025163	5.0	7.16353863	0.9
ANT	0.326517337	6.7	0.16478675	4.3	0.04163663	3.0	0.21653355	0.3
FLUOR	5.148707478	8.7	3.98470337	1.3	0.81275566	14.1	4.19592137	0.0
PYR	3.792925725	4.9	2.1197088	0.3	0.32232848	15.3	2.80342148	0.3
BaA	0.42048206	13.2	0.1582085	0.1	0.0166513	19.0	0.27556392	0.5
CHRY	0.536472411	3.7	0.35972918	0.3	0.03723925	24.5	0.55728091	1.0
BbjF	0.511370177	11.8	0.33579964	1.0	0.04441807	22.7	0.36008534	3.3
BkF	0.135247497	15.0	0.06610095	1.0	0.00757817	21.8	0.0856394	1.5
BeP	0.23322449	14.1					0.18237928	3.4
BaP	0.106367824	17.0	0.0306875	0.9	0.00388967		0.07714333	1.4
PER	0.132961475	14.8	0.55123852	2.7	0.04002105	22.1	0.18656246	4.0
In123cdPYR	0.05738464	18.7	0.03806184	2.3	0.005049	26.4	0.03834179	2.4
BDahANT	0.011365182	17.0	0.02891877		0.0041753		0.02966108	
BghiPER	0.065625749	19.5	0.05278673	1.5	0.00822842	28.7	0.0501674	1.8
PCB31+28	0.014126282	7.5	0.01096749	5.1	0.00178232	22.2	0.03138671	3.0
CB52	0.005274389	9.0	0.0053498		0.00197627	22.3	0.0113961	2.5
CB101	0.003554482	14.8	0.01723282		0.00157075	16.7	0.00623983	8.8
CB118	0.002533075	6.6	0.00597542		0.00085996		0.00612896	
CB153	0.000926247		0.00597542		0.00125306	22.2	0.00701323	9.3
CB105	0.005022872	1.3	0.00631166		0.00090563			
CB138	0.003435452	10.0	0.00636972		0.00100503	18.2	0.00653357	
CB156	0.000977861		0.00631166		0.00090563			
CB180	0.001609368	24.6	0.006632		0.00095033		0.00680266	
CB209	0.002264711		0.00877468		0.00125566			
BDE47	0.004194559	151.6	0.00466138	1.6	0.00218072	20.4	0.00270285	2.6
BDE99	0.005141877	181.7	0.00195804		0.00028067		0.00162871	7.0
BDE100	0.003248181		0.00339605	6.8	0.00229903	51.4	0.00059278	
BDE153	0.00608886		0.00215024		0.00030784	18.2	0.00356149	13.5
BDE154	0.003563017	133.7	0.00143349		0.00020523		0.0007352	
BDE183	0.00423938		0.00157444		0.00022533		0.00242246	
BDE196	0.003760208		0.00432332		0.00061867		0.00266077	
BDE209	0.003693056		0.00566341	12.0	0.00121949	37.7	0.01035541	50.7
BDE126	0.003651513		0.00195804		0.00028067			
aHBCD	0.019474252		0.00912211	17.6	0.00150484	41.9	0.01483228	
bHBCD	0.005116808		0.0048508		0.00078483		0.01491185	
gHBCD	0.005277601		0.00505822		0.00076932		0.01555752	

Concentration of contaminants associated with suspended particulate matter (SPM)													
Sample code		Alna SPM 5	Alna SPM 6	Alna SPM 7	Alna SPM 8	Drammen SPM 5	Drammen SPM 6	Drammen SPM 7	Drammen SPM 8	Glomma SPM 5	Glomma SPM 6	Glomma SPM 7	Glomma SPM 8
Deployed		25.03.2014	16.06.2014	18.09.2014	09.01.2015	10.04.2014	24.06.2014	*Centrifuge*	02.01.2015	25.03.2014	16.06.2014	18.09.2014	09.12.2014
Retrieved		04.04.2014	24.06.2014	30.09.2014	16.01.2015	23.04.2014	02.07.2014	*failure*	16.01.2015	04.04.2014	24.06.2014	30.09.2014	16.12.2014
Exposure time(d)		10	8	12	7	13	8		14	10	8	12	7
TOC ug/g		94.5	82.7	63.4	80.5	61.1	128		66.4	21.5	39	47.4	18.6
%OC		9.45	8.27	6.34	8.05	6.11	12.8		6.64	2.15	3.9	4.74	1.86
NAP	ng/g dw	79	270	46	40	7	29		30	9.1	10	9.4	11
ACY	ng/g dw	21	79	20	18	2.5	200		11	2	5	5	2
ACE	ng/g dw	27	19	20	11	5.1	10		4.6	5.9	3	5	14
FLUE	ng/g dw	74	37	29	25	4	7.3		9.7	4	3.1	2.9	13
DBTHIO	ng/g dw	73	28	23	16	2.6	7.4		7.7	2	2	2	10
PHE	ng/g dw	680	340	310	248	43	100		143	19	19	22	160
ANT	ng/g dw	83	100	67	55	4.8	15		15	2	2.1	2.4	26
FLUOR	ng/g dw	830	800	630	496	87	360		307	20	29	33	237
PYR	ng/g dw	1100	940	700	740	75	310		280	16	21	25	200
BaA	ng/g dw	260	330	250	215	36	140		132	6.3	8.3	10	110
CHRY	ng/g dw	400	420	310	229	46	160		150	12	16	21	103
BbjF	ng/g dw	470	640	500	439	69	280		244	18	23	33	129
BkF	ng/g dw	150	210	150	120	24	94		84	5.7	5.7	8.7	48
BeP	ng/g dw	420	510	370	391	35	160		138	8.7	13	17	66
BaP	ng/g dw	230	370	270	229	33	160		134	4.1	7	11	59
PER	ng/g dw	140	100	61	100	34	81		68	25	69	52	32
In123cdPYR	ng/g dw	220	290	210	170	37	130		110	7.4	7.8	12	46
BDahANT	ng/g dw	68	61	43	60	7.5	23		23	2	3	3	12
BghiPER	ng/g dw	520	580	410	409	43	160		133	9.3	12	16	58
PCB31+28	ng/g dw	4.5	3	3	2	1	3		0.6	1	1	1	0.5
CB52	ng/g dw	6.3	4	5	2	1	1		0.6	0.5	1	1	0.5
CB101	ng/g dw	7.2	4.1	3.3	3	0.5	1		0.5	0.5	1	1	0.5
CB118	ng/g dw	5.9	2.8	1.9	2.4	0.5	1		0.5	0.5	1	1	0.5
CB153	ng/g dw	9.3	6.5	5.2	5.2	0.5	1		0.55	0.5	1	1	0.5
CB105	ng/g dw	2.4				0.5				0.5			
CB138	ng/g dw	11	6.8	4.3	4.9	0.5	1		0.52	0.5	1	1	0.5
CB156	ng/g dw	1.4				0.5				0.5			
CB180	ng/g dw	5.2	4.2	3.1	3.4	0.5	1		0.5	0.5	1	1	0.5

Concentration of contaminants associated with suspended particulate matter (SPM)													
Sample code													
BDE47	ng/g dw	2.7	1.8	1.3	1.63	0.15	0.25		0.15	0.1	0.2	0.2	0.1
BDE99	ng/g dw	3.2	2.8	2	0.15	0.27	0.3		0.1	0.1	0.3	0.3	0.1
BDE100	ng/g dw	1	0.47	0.4	0.83	0.2	0.3		0.23	0.2	0.3	0.3	0.2
BDE153	ng/g dw	1	0.3	0.3	0.13	0.2	0.3		0.1	0.2	0.3	0.3	0.1
BDE154	ng/g dw	0.5	0.21	0.21	0.17	0.1	0.2		0.1	0.1	0.2	0.2	0.1
BDE183	ng/g dw	1	0.5	0.5	0.5	0.2	0.5		0.3	0.2	0.5	0.5	0.3
BDE196	ng/g dw		0.5	0.5			0.5				0.5	0.5	
BDE209	ng/g dw	36	76	37	46.34	4.4	12		14.68	1.2	1	1.4	0.89
BDE126	ng/g dw				0.5				0.3				0.3
aHBCD	ng/g dw	i	10.7	10.3	8.8	4	1.3		2.2	4	0.5	0.6	2
bHBCD	ng/g dw	i	3.8	4.8	2	2	1.3		2	2	0.5	0.6	2
gHBCD	ng/g dw	i	1.3	1.2	2	2	1.3		2	2	0.5	0.6	2
SCCP	ng/g dw	1740	1480	1220	436	82	580		112	57	70	82	40
MCCP	ng/g dw	320	1260	300	1496	25	180		123	42	17	21	6
BPA	ng/g dw	665	375	377	7.7	50.3	16.7		0.5	34	8.5	11	1.0
TBBPA	ng/g dw	3.6	3.5	11	9.5	9.5	0.1		156	0.2	11	34	38
PFBA	ng/g dw	1			n.a.	1			n.a.	1			n.a.
PFPA	ng/g dw	0.4	0.5	0.5	n.a.	0.4	0.5		n.a.	0.4	0.5		n.a.
PFHxA	ng/g dw	0.4	0.5	0.5	n.a.	0.4	0.5		n.a.	0.4	0.5	0.5	n.a.
PFHpA	ng/g dw	0.4	0.5	0.5	n.a.	0.4	0.5		n.a.	0.4	0.5	0.5	n.a.
PFOA	ng/g dw	0.4	0.834	0.5	n.a.	0.4	0.5		n.a.	0.4	0.5	0.5	n.a.
PFNA	ng/g dw	0.4	0.5	0.5	n.a.	0.4	0.599		n.a.	0.4	0.5	0.5	n.a.
PFDA	ng/g dw	0.48	1.611	0.553	n.a.	0.4	0.4		n.a.	0.4	0.4		n.a.
PFUdA	ng/g dw	0.4	0.4	0.4	n.a.	0.4	0.4		n.a.	0.4	0.4		n.a.
PFDoA	ng/g dw	0.4	1.387	0.897	n.a.	0.4	0.429		n.a.	0.4	0.4		n.a.
PFTrA	ng/g dw	0.4	0.368	0.32	n.a.	0.4	0.3		n.a.	0.4	0.3		n.a.
PFTeA	ng/g dw	0.4	0.887	0.508	n.a.	0.4	0.3		n.a.	0.4	0.3		n.a.
PFBS	ng/g dw	0.05	0.1	0.1	n.a.	0.05	0.1		n.a.	0.05	0.1	0.1	n.a.
PFHxS	ng/g dw	0.05	0.1	0.1	n.a.	0.05	0.1		n.a.	0.05	0.1		n.a.
PFOS	ng/g dw	0.23	0.78	0.534	n.a.	0.37	0.27		n.a.	0.12	0.1	0.1	n.a.
ip-PFNS	ng/g dw				n.a.				n.a.				n.a.
PFDS	ng/g dw	0.05	0.355	0.222	n.a.	0.05	0.2		n.a.	0.05	0.2		n.a.
PFDoS	ng/g dw	0.05	0.2	0.2	n.a.	0.05	0.2		n.a.	0.05	0.2		n.a.
PFOSA	ng/g dw	0.1	0.117	0.1	n.a.	0.1	0.188		n.a.	0.1	0.1	0.1	n.a.
me-PFOSA	ng/g dw	0.1	0.3	0.3	n.a.	0.1	0.3		n.a.	0.1	0.3		n.a.
et-PFOSA	ng/g dw	0.1	0.3	0.3	n.a.	0.1	0.3		n.a.	0.1	0.3		n.a.
me-PFOSE	ng/g dw	1	3	3	n.a.	1	3		n.a.	1	3		n.a.
et-PFOSE	ng/g dw	1	3	3	n.a.	1	3		n.a.	1	3		n.a.
6:2 FTS	ng/g dw	0.1	0.3	0.3	n.a.	0.1	0.3		n.a.	0.1	0.3		n.a.
4:2 F53B	ng/g dw				n.a.				n.a.			0.2	n.a.
6:2 F53B	ng/g dw				n.a.	0.2	0.2		n.a.			0.2	n.a.

Table 2 Riverine inputs

Table 2a. Riverine inputs from 155 Norwegian rivers in 2014

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]
MAIN RIVERS (11)																			
Glomma ved Sarpsfoss	lower avg.	78 034	328 225	124 150	368	579	8 722	439	15 259	110 234	0.000	5.390	11.319	0.381	51.633	357.970	28.066	13.635	18.266
	upper avg.	78 034	328 225	124 150	368	579	8 722	445	15 259	110 234	1.424	5.390	11.319	0.381	51.633	357.970	28.066	14.273	35.080
Alna	lower avg.	148	768	289	3	4	50	6	77	393	0.000	0.019	0.052	0.004	0.277	1.101	0.059	0.063	0.076
	upper avg.	148	768	289	3	4	50	6	77	393	0.003	0.019	0.052	0.004	0.277	1.101	0.059	0.063	0.089
Drammenselva	lower avg.	33 371	26 945	41 315	34	72	2 935	107	5 116	34 781	0.052	1.842	10.367	0.113	9.256	34.043	5.671	2.357	3.532
	upper avg.	33 371	26 945	41 315	35	72	2 935	107	5 116	34 781	0.635	1.842	10.367	0.117	9.256	34.043	5.671	2.729	12.180
Numedalslågen	lower avg.	12 032	27 319	19 378	39	65	1 024	114	2 005	16 564	0.000	0.771	1.457	0.078	3.825	20.515	1.713	1.205	5.114
	upper avg.	12 032	27 319	19 378	39	65	1 024	114	2 005	16 564	0.220	0.771	1.457	0.078	3.825	20.515	1.713	1.237	5.777
Skienselva	lower avg.	30 155	9 492	29 451	11	33	1 496	71	2 939	24 000	0.000	1.009	0.845	0.136	6.533	24.473	2.765	1.207	5.046
	upper avg.	30 155	9 492	29 451	15	34	1 496	74	2 939	24 000	0.509	1.009	0.845	0.136	6.533	24.473	2.765	1.605	13.597
Otra	lower avg.	16 838	19 799	19 371	16	36	527	97	1 573	9 272	0.023	1.017	3.354	0.134	5.132	25.327	2.955	1.201	1.617
	upper avg.	16 838	19 799	19 371	18	36	527	97	1 573	9 272	0.316	1.017	3.354	0.134	5.132	25.327	2.955	1.341	6.146
Orreelva	lower avg.	513	1 341	1 108	5	11	165	7	288	644	0.000	0.048	0.046	0.002	0.315	0.579	0.195	0.076	0.104
	upper avg.	513	1 341	1 108	5	11	165	7	288	644	0.009	0.048	0.046	0.002	0.315	0.579	0.195	0.084	0.211
Vosso(Bolstadelvi)	lower avg.	8 583	4 653	3 426	4	12	278	12	527	2 899	0.000	0.223	0.288	0.019	1.158	3.252	0.982	0.323	1.270
	upper avg.	8 583	4 653	3 426	6	12	278	13	527	2 899	0.157	0.276	0.288	0.024	1.158	3.252	0.982	0.424	3.209
Orkla	lower avg.	3 253	1 982	3 213	2	4	221	4	400	3 326	0.000	0.134	0.037	0.047	5.733	16.119	0.910	0.394	0.395
	upper avg.	3 253	1 982	3 213	2	4	221	5	400	3 326	0.059	0.134	0.037	0.047	5.733	16.119	0.910	0.420	1.299
Vefsna	lower avg.	12 947	8 831	6 136	4	15	176	9	530	6 100	0.000	0.494	0.203	0.017	2.265	2.233	1.231	1.129	0.386
	upper avg.	12 947	8 831	6 136	7	15	176	16	530	6 100	0.236	0.494	0.203	0.027	2.265	2.240	1.231	1.290	4.726
Altaelva	lower avg.	8 062	66 625	10 180	32	51	153	17	708	16 516	0.000	0.456	0.355	0.009	3.894	3.826	2.414	4.115	0.516
	upper avg.	8 062	66 625	10 180	33	51	153	18	708	16 516	0.147	0.456	0.357	0.015	3.894	3.830	2.414	4.152	2.943

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]
TRIBUTARY RIVERS (36)																			
Tista utløp Femsjøen	lower avg.	2 668	4 694	8 547	7	16	425	15	771	3 847	0.000	0.319	0.357	0.015	1.417	9.914	0.783	0.679	0.708
	upper avg.	2 668	4 694	8 547	7	16	425	15	771	3 847	0.049	0.319	0.357	0.015	1.417	9.914	0.783	0.679	1.297
Tokkeelva	lower avg.	3 725	1 261	6 987	2	7	236	21	536	4 210	0.000	0.268	0.325	0.045	1.245	8.873	0.966	0.517	3.108
	upper avg.	3 725	1 261	6 987	2	7	236	21	536	4 210	0.068	0.268	0.325	0.045	1.245	8.873	0.966	0.517	3.326
Nidelva(Rykene)	lower avg.	14 523	5 317	17 311	12	31	837	127	1 805	11 172	0.000	0.719	1.330	0.155	3.544	23.692	1.437	0.724	1.885
	upper avg.	14 523	5 317	17 311	14	31	837	127	1 805	11 172	0.265	0.719	1.330	0.155	3.544	23.692	1.437	0.892	5.301
Tovdalselva	lower avg.	8 143	4 598	20 202	5	21	294	48	1 062	5 616	0.000	0.714	2.290	0.179	1.730	23.069	1.466	0.870	4.231
	upper avg.	8 143	4 598	20 202	5	21	294	48	1 062	5 616	0.149	0.714	2.290	0.179	1.730	23.069	1.466	0.870	5.088
Mandalselva	lower avg.	10 300	4 980	12 207	7	19	589	90	1 265	4 573	0.000	0.461	1.682	0.114	1.329	17.840	0.703	0.268	0.000
	upper avg.	10 300	4 980	12 207	7	19	589	90	1 265	4 573	0.188	0.461	1.682	0.114	1.329	17.840	0.703	0.510	3.759
Lyngdalselva	lower avg.	3 273	3 228	3 973	4	9	289	16	502	1 763	0.000	0.160	0.660	0.051	0.340	7.406	0.187	0.246	2.116
	upper avg.	3 273	3 228	3 973	4	9	289	16	502	1 763	0.060	0.160	0.660	0.051	0.340	7.406	0.187	0.286	2.518
Kvina	lower avg.	7 704	8 084	12 241	10	30	468	36	1 073	3 142	0.000	0.628	1.895	0.099	2.258	13.987	0.468	0.353	0.534
	upper avg.	7 704	8 084	12 241	10	30	468	38	1 073	3 142	0.141	0.628	1.895	0.099	2.258	13.987	0.468	0.424	2.812
Sira	lower avg.	13 644	2 297	8 556	2	13	498	94	1 025	3 917	0.000	0.276	1.148	0.077	1.044	10.984	0.478	0.176	0.000
	upper avg.	13 644	2 297	8 556	5	13	498	94	1 025	3 917	0.249	0.339	1.148	0.077	1.044	10.984	0.478	0.498	4.980
Bjerkreimselva	lower avg.	4 869	2 883	2 736	4	12	707	25	924	2 748	0.000	0.166	0.654	0.049	0.623	5.531	0.315	0.313	0.955
	upper avg.	4 869	2 883	2 736	4	12	707	25	924	2 748	0.089	0.166	0.654	0.049	0.623	5.531	0.315	0.369	2.414
Figgjoelva	lower avg.	623	1 087	677	3	5	181	8	248	571	0.000	0.033	0.089	0.003	0.243	0.947	0.091	0.080	0.050
	upper avg.	623	1 087	677	3	5	181	8	248	571	0.011	0.033	0.089	0.003	0.243	0.947	0.091	0.080	0.227
Lyseelva	lower avg.	1 473	200	707	0	0	78	1	125	870	0.000	0.004	0.081	0.005	0.276	1.956	0.099	0.079	0.896
	upper avg.	1 473	200	707	1	1	78	2	125	870	0.027	0.028	0.081	0.005	0.276	1.956	0.099	0.097	1.135

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]
Årdalselva	lower avg.	4 255	2 541	2 733	3	7	238	6	421	2 214	0.000	0.039	0.322	0.014	1.079	4.618	0.357	0.157	1.432
	upper avg.	4 255	2 541	2 733	4	7	238	7	421	2 214	0.078	0.093	0.322	0.014	1.079	4.618	0.357	0.215	2.269
Ulladalsåna (Ulla)	lower avg.	3 281	286	2 396	1	2	124	3	228	2 048	0.000	0.082	0.102	0.014	0.581	3.724	0.579	0.217	0.707
	upper avg.	3 281	286	2 396	1	2	124	4	228	2 048	0.060	0.082	0.102	0.015	0.581	3.724	0.579	0.266	1.197
Suldalslågen	lower avg.	11 311	1 937	4 398	0	6	530	18	784	3 576	0.153	0.462	0.282	0.035	1.064	6.414	0.704	0.484	2.428
	upper avg.	11 311	1 937	4 398	4	6	530	19	784	3 576	0.283	0.462	0.282	0.035	1.064	6.414	0.704	0.682	5.036
Saudaelva	lower avg.	3 342	252	812	1	6	182	4	263	1 050	0.000	0.000	0.069	0.006	0.273	1.333	0.105	0.160	0.558
	upper avg.	3 342	252	812	2	6	182	4	263	1 050	0.061	0.061	0.069	0.008	0.273	1.333	0.105	0.202	1.220
Vikedalselva	lower avg.	901	1 412	540	2	4	91	4	134	263	0.000	0.119	0.133	0.010	0.223	1.044	0.166	0.105	0.059
	upper avg.	901	1 412	540	3	4	91	4	134	263	0.016	0.119	0.133	0.010	0.223	1.044	0.166	0.118	0.329
Jostedøla	lower avg.	6 293	30 473	1 194	35	38	194	8	300	7 294	0.000	0.015	0.571	0.008	2.432	7.403	1.838	2.559	0.189
	upper avg.	6 293	30 473	1 194	36	38	194	8	300	7 294	0.115	0.121	0.571	0.015	2.432	7.403	1.849	2.604	2.297
Gaular	lower avg.	4 865	1 145	3 228	5	10	162	3	347	1 678	0.000	0.000	0.079	0.003	0.577	1.844	0.178	0.196	0.592
	upper avg.	4 865	1 145	3 228	5	10	162	4	347	1 678	0.089	0.089	0.079	0.010	0.577	1.844	0.178	0.303	2.072
Jølstra	lower avg.	5 032	998	2 610	2	8	223	3	383	1 896	0.000	0.000	0.045	0.006	0.521	2.107	0.179	0.181	0.286
	upper avg.	5 032	998	2 610	3	8	223	4	383	1 896	0.092	0.092	0.045	0.011	0.521	2.107	0.179	0.260	1.837
Nausta	lower avg.	1 937	406	1 422	2	5	50	1	130	868	0.000	0.000	0.035	0.005	0.210	0.720	0.121	0.070	0.416
	upper avg.	1 937	406	1 422	2	5	50	2	130	868	0.035	0.035	0.035	0.006	0.210	0.720	0.121	0.100	0.817
Gloppenelva(Breimselva)	lower avg.	3 972	4 064	1 561	8	9	224	1	351	2 000	0.000	0.000	0.101	0.000	0.621	1.221	0.277	0.135	0.000
	upper avg.	3 972	4 064	1 561	8	9	224	4	351	2 000	0.072	0.072	0.101	0.007	0.621	1.221	0.277	0.158	1.450
Driva	lower avg.	4 277	1 513	1 652	0	2	229	5	338	4 691	0.000	0.000	0.030	0.000	0.989	1.107	0.334	0.274	0.227
	upper avg.	4 277	1 513	1 652	2	2	229	6	338	4 691	0.078	0.078	0.030	0.008	0.989	1.107	0.334	0.316	1.561
Surna	lower avg.	2 652	1 090	2 543	1	5	91	3	195	1 780	0.000	0.000	0.021	0.002	0.587	0.492	0.351	0.234	0.352

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]
	upper avg.	2 652	1 090	2 543	1	5	91	4	195	1 780	0.048	0.048	0.021	0.006	0.587	0.492	0.351	0.264	1.144
Gaula	lower avg.	5 859	9 823	8 625	8	12	215	55	602	7 048	0.000	0.141	0.164	0.016	3.148	4.995	3.209	1.085	1.573
	upper avg.	5 859	9 823	8 625	8	12	215	55	602	7 048	0.107	0.165	0.164	0.017	3.148	4.995	3.209	1.085	2.621
Nidelva(Tr.heim)	lower avg.	5 213	1 870	5 151	1	7	147	14	377	3 277	0.000	0.102	0.054	0.023	2.274	3.966	1.326	0.129	0.412
	upper avg.	5 213	1 870	5 151	3	7	147	14	377	3 277	0.095	0.131	0.054	0.023	2.274	3.966	1.326	0.217	1.903
Stjørdalselva	lower avg.	3 283	5 599	5 069	4	8	100	7	288	1 888	0.000	0.081	0.111	0.012	2.248	4.426	0.735	0.346	0.574
	upper avg.	3 283	5 599	5 069	4	8	100	7	288	1 888	0.060	0.098	0.111	0.012	2.248	4.426	0.735	0.397	1.485
Verdalselva	lower avg.	2 362	1 241	3 608	2	5	109	6	250	1 613	0.000	0.092	0.059	0.004	0.739	2.694	0.454	0.125	1.005
	upper avg.	2 362	1 241	3 608	2	5	109	6	250	1 613	0.043	0.092	0.059	0.006	0.739	2.694	0.454	0.125	1.098
Snåsavassdraget	lower avg.	1 752	800	2 689	1	3	90	4	193	840	0.000	0.050	0.017	0.002	0.388	0.415	0.257	0.083	0.639
	upper avg.	1 752	800	2 689	1	3	90	4	193	840	0.032	0.050	0.017	0.004	0.388	0.415	0.257	0.114	0.639
Namsen	lower avg.	3 084	4 947	3 534	5	8	66	11	287	1 786	0.000	0.153	0.121	0.006	1.028	2.611	0.677	0.411	0.336
	upper avg.	3 084	4 947	3 534	5	8	66	11	287	1 786	0.056	0.153	0.121	0.008	1.028	2.611	0.677	0.411	1.126
Røssåga	lower avg.	8 140	1 217	2 725	0	5	142	15	310	2 439	0.000	0.228	0.064	0.000	0.944	3.327	1.243	0.368	0.000
	upper avg.	8 140	1 217	2 725	3	5	142	17	310	2 439	0.149	0.228	0.064	0.015	0.944	3.327	1.243	0.513	2.971
Ranaelva	lower avg.	20 251	56 779	5 765	41	62	374	46	950	11 038	0.000	0.631	0.734	0.041	3.996	9.696	3.659	3.053	0.000
	upper avg.	20 251	56 779	5 765	45	62	374	46	950	11 038	0.370	0.631	0.734	0.046	3.996	9.696	3.659	3.053	7.392
Beiarelva	lower avg.	3 820	12 074	1 218	3	7	50	9	148	3 612	0.000	0.212	0.127	0.003	0.988	2.682	1.185	0.694	0.587
	upper avg.	3 820	12 074	1 218	4	8	50	9	148	3 612	0.070	0.212	0.127	0.007	0.988	2.682	1.185	0.719	1.394
Målselv	lower avg.	7 620	1 816	3 070	0	4	156	13	381	6 978	0.000	0.059	0.074	0.000	1.357	0.440	0.647	0.274	0.000
	upper avg.	7 620	1 816	3 070	3	4	156	13	381	6 978	0.139	0.156	0.074	0.014	1.357	0.449	0.647	0.358	2.781
Barduelva	lower avg.	6 920	4 557	2 570	3	7	115	17	330	5 075	0.000	0.054	0.058	0.000	1.158	1.411	0.675	0.325	0.000
	upper avg.	6 920	4 557	2 570	4	7	115	17	330	5 075	0.126	0.142	0.058	0.013	1.158	1.420	0.675	0.325	2.526

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]
Tanaelva	lower avg.	15 541	5 222	15 906	7	26	95	103	1 038	38 332	0.000	0.193	0.247	0.028	4.150	9.917	1.795	2.024	4.437
	upper avg.	15 541	5 222	15 906	7	26	95	103	1 038	38 332	0.284	0.353	0.247	0.038	4.150	9.917	1.795	2.024	7.891
Pasvikelva	lower avg.	17 475	5 384	20 126	7	27	96	100	1 256	28 034	0.000	1.231	0.240	0.035	12.512	7.499	23.582	0.538	0.000
	upper avg.	17 475	5 384	20 126	9	27	96	100	1 256	28 034	0.319	1.231	0.240	0.044	12.512	7.499	23.582	0.966	6.378
TRIBUTARY RIVERS(108)																			
Mosselva	lower avg.	1 225	3 008	3 450	1	12	195	7	408	187		0.168	0.116	0.002	0.670	0.666	0.455	0.000	0.670
	upper avg.	1 225	3 008	3 450	1	12	195	7	408	187		0.168	0.116	0.002	0.670	0.666	0.455	0.004	0.670
Hølenelva	lower avg.	168	409	611	2	5	87	2	118	543		0.041	0.032	0.001	0.150	0.266	0.174	0.000	0.154
	upper avg.	168	409	611	2	5	87	2	118	543		0.041	0.032	0.001	0.150	0.266	0.174	0.000	0.154
Årungelva	lower avg.	64	66	136	0	1	65	0	80	57		0.004	0.002	0.000	0.044	0.022	0.028	0.000	0.035
	upper avg.	64	66	136	0	1	65	0	80	57		0.004	0.002	0.000	0.044	0.022	0.028	0.000	0.035
Gjersjøelva	lower avg.	109	33	284	0	0	45	1	60	197		0.011	0.002	0.000	0.060	0.016	0.084	0.000	0.090
	upper avg.	109	33	284	0	0	45	1	60	197		0.011	0.002	0.000	0.060	0.016	0.084	0.000	0.090
Ljanselva	lower avg.	71	155	137	1	2	24	1	31	164		0.014	0.006	0.001	0.063	0.000	0.065	0.012	0.077
	upper avg.	71	155	137	1	2	24	1	31	164		0.014	0.006	0.001	0.063	0.000	0.065	0.012	0.077
Akerselva	lower avg.	387	164	578	1	3	30	5	59	502		0.036	0.089	0.002	0.195	0.706	0.045	0.009	0.601
	upper avg.	387	164	578	1	3	30	5	59	502		0.036	0.089	0.002	0.195	0.706	0.045	0.009	0.601
Frognerelva	lower avg.	34	38	55	0	1	15	1	21	76		0.006	0.000	0.000	0.059	0.023	0.019	0.002	0.044
	upper avg.	34	38	55	0	1	15	1	21	76		0.006	0.000	0.000	0.059	0.023	0.019	0.002	0.044
Lysakerelva	lower avg.	332	126	677	0	0	22	2	36	281		0.040	0.012	0.000	0.000	0.057	0.006	0.013	0.242
	upper avg.	332	126	677	0	0	22	2	36	281		0.040	0.012	0.000	0.001	0.057	0.006	0.013	0.242
Sandvikselva	lower avg.	345	148	655	1	3	22	2	40	586		0.045	0.000	0.000	0.074	0.000	0.042	0.059	0.000
	upper avg.	345	148	655	1	3	22	2	40	586		0.045	0.001	0.000	0.074	0.001	0.042	0.059	0.000

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]
Åroselva	lower avg.	208	958	538	1	2	120	2	137	511		0.050	0.073	0.003	0.168	0.281	0.083	0.090	0.133
	upper avg.	208	958	538	1	2	120	2	137	511		0.050	0.073	0.003	0.168	0.281	0.083	0.090	0.133
Lierelva	lower avg.	485	6 554	1 286	2	8	139	0	162	1 260		0.145	0.248	0.008	0.438	2.386	0.218	0.335	0.631
	upper avg.	485	6 554	1 286	2	8	139	0	162	1 260		0.145	0.248	0.008	0.438	2.386	0.218	0.335	0.631
Sandeelva	lower avg.	361	1 099	589	1	2	55	2	86	484		0.101	0.181	0.016	0.435	4.776	0.165	0.093	0.198
	upper avg.	361	1 099	589	1	2	55	2	86	484		0.101	0.181	0.016	0.435	4.776	0.165	0.093	0.198
Aulielva	lower avg.	703	3 583	1 619	12	43	374	28	444	2 181		0.238	0.132	0.015	0.695	1.292	0.700	0.188	1.122
	upper avg.	703	3 583	1 619	12	43	374	28	444	2 181		0.238	0.132	0.015	0.695	1.292	0.700	0.188	1.122
Farriselva-Siljanvassdraget	lower avg.	1 460	368	2 540	1	2	179	3	265	2 016		0.080	0.000	0.023	0.000	5.432	0.045	0.011	0.000
	upper avg.	1 460	368	2 540	1	2	179	3	265	2 016		0.080	0.003	0.023	0.004	5.432	0.045	0.011	0.533
Gjerstadelva	lower avg.	1 630	716	3 252	1	3	105	16	208	1 011		0.143	0.278	0.006	0.300	2.807	0.353	0.036	0.892
	upper avg.	1 630	716	3 252	1	3	105	16	208	1 011		0.143	0.278	0.006	0.300	2.807	0.353	0.036	0.892
Vegårdselva	lower avg.	1 689	798	3 347	2	3	85	6	193	604		0.168	0.173	0.014	0.370	0.136	0.335	0.062	0.616
	upper avg.	1 689	798	3 347	2	3	85	6	193	604		0.168	0.173	0.014	0.370	0.136	0.335	0.062	0.616
Søgneelva-Songdalselva	lower avg.	1 099	388	1 764	1	5	158	9	236	256		0.104	0.158	0.021	0.217	2.144	0.210	0.000	0.401
	upper avg.	1 099	388	1 764	1	5	158	9	236	256		0.104	0.158	0.021	0.217	2.144	0.210	0.003	0.401
Audnedalselva	lower avg.	1 628	564	2 169	1	3	179	7	287	543		0.116	0.256	0.016	0.181	3.406	0.202	0.000	0.743
	upper avg.	1 628	564	2 169	1	3	179	7	287	543		0.116	0.256	0.016	0.181	3.406	0.202	0.005	0.743
Soknedalselva	lower avg.	2 136	982	1 458	2	6	196	13	277	920		0.125	0.225	0.018	0.390	2.499	1.875	0.057	0.974
	upper avg.	2 136	982	1 458	2	6	196	13	277	920		0.125	0.225	0.018	0.390	2.499	1.875	0.057	0.974
Hellelandselva	lower avg.	1 660	653	1 415	2	4	178	9	260	631		0.091	0.236	0.013	0.224	2.014	0.192	0.047	0.757
	upper avg.	1 660	653	1 415	2	4	178	9	260	631		0.091	0.236	0.013	0.224	2.014	0.192	0.047	0.757
Håelva	lower avg.	457	446	790	2	6	164	12	285	429		0.074	0.027	0.002	0.146	0.671	0.090	0.000	0.250

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]
	upper avg.	457	446	790	2	6	164	12	285	429		0.074	0.027	0.002	0.146	0.671	0.090	0.001	0.250
Imselva	lower avg.	370	127	459	0	1	72	2	98	5		0.013	0.012	0.001	0.070	0.257	0.065	0.000	0.135
	upper avg.	370	127	459	0	1	72	2	98	5		0.013	0.012	0.001	0.070	0.257	0.065	0.001	0.135
Oltedalselva.utløp Ragsvatnet	lower avg.	903	224	546	0	0	93	4	112	675		0.022	0.049	0.006	0.132	0.978	0.136	0.036	0.000
	upper avg.	903	224	546	0	0	93	4	112	675		0.022	0.049	0.006	0.132	0.978	0.136	0.036	0.330
Dirdalsåna	lower avg.	1 413	200	851	0	1	129	1	172	512		0.055	0.094	0.004	0.137	0.660	0.379	0.000	0.645
	upper avg.	1 413	200	851	0	1	129	1	172	512		0.055	0.094	0.004	0.137	0.660	0.379	0.004	0.645
Frafjordelva	lower avg.	1 592	287	919	0	2	113	6	145	538		0.041	0.132	0.006	0.180	0.556	0.029	0.053	0.581
	upper avg.	1 592	287	919	0	2	113	6	145	538		0.041	0.132	0.006	0.180	0.556	0.029	0.053	0.581
Espedalselva	lower avg.	1 234	244	627	1	2	79	2	126	643		0.023	0.057	0.003	0.026	0.304	0.079	0.088	0.451
	upper avg.	1 234	244	627	1	2	79	2	126	643		0.023	0.057	0.003	0.026	0.304	0.079	0.088	0.451
Førrelva	lower avg.	1 361	248	873	1	2	31	1	46	801		0.030	0.071	0.002	0.054	0.212	0.114	0.043	0.000
	upper avg.	1 361	248	873	1	2	31	1	46	801		0.030	0.071	0.002	0.054	0.212	0.114	0.043	0.993
Åbøelva	lower avg.	776	120	255	0	1	26	0	36	93		0.020	0.019	0.001	0.038	0.266	0.054	0.077	0.354
	upper avg.	776	120	255	0	1	26	0	36	93		0.020	0.019	0.001	0.038	0.266	0.054	0.077	0.354
Etneelva	lower avg.	1 468	406	625	1	1	167	2	213	369		0.093	0.041	0.007	0.208	0.587	0.440	0.616	0.938
	upper avg.	1 468	406	625	1	1	167	2	213	369		0.093	0.041	0.007	0.208	0.587	0.440	0.616	0.938
Opo	lower avg.	4 656	4 816	1 415	5	4	160	17	269	2 020		0.342	0.680	0.000	0.427	2.710	0.580	0.000	0.000
	upper avg.	4 656	4 816	1 415	5	4	160	17	269	2 020		0.342	0.680	0.000	0.427	2.710	0.580	0.014	1.699
Tysso	lower avg.	3 073	426	1 828	3	0	167	6	226	823		0.125	0.057	0.006	0.950	3.864	0.740	0.143	1.682
	upper avg.	3 073	426	1 828	3	1	167	6	226	823		0.125	0.057	0.006	0.950	3.864	0.740	0.143	1.682
Kinso	lower avg.	1 379	498	286	2	0	13	5	45	98		0.051	0.025	0.000	0.000	0.037	0.055	0.138	0.503

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]
	upper avg.	1 379	498	286	2	0	13	5	45	98		0.051	0.025	0.000	0.000	0.037	0.055	0.138	0.503
Veig	lower avg.	2 434	533	876	2	2	25	2	80	1 188		0.041	0.041	0.002	0.073	0.000	0.378	0.205	0.888
	upper avg.	2 434	533	876	2	2	25	2	80	1 188		0.041	0.041	0.002	0.073	0.009	0.378	0.205	0.888
Bjoreio	lower avg.	2 905	758	2 232	1	3	44	5	112	1 091		0.097	0.077	0.000	0.373	0.247	0.636	0.000	1.060
	upper avg.	2 905	758	2 232	1	3	44	5	112	1 091		0.097	0.077	0.000	0.373	0.247	0.636	0.008	1.060
Sima	lower avg.	712	198	110	0	1	22	1	34	585		0.019	0.007	0.000	0.026	0.188	0.079	0.011	0.260
	upper avg.	712	198	110	0	1	22	1	34	585		0.019	0.007	0.000	0.026	0.188	0.079	0.011	0.260
Austdøla	lower avg.	655	153	75	0	0	19	2	27	73		0.014	0.014	0.002	0.029	0.108	0.026	0.011	0.299
	upper avg.	655	153	75	0	0	19	2	27	73		0.014	0.014	0.002	0.029	0.108	0.026	0.011	0.299
Nordøla /Austdøla	lower avg.	196	71	14	0	0	8	0	10	87		0.007	0.004	0.000	0.009	0.001	0.035	0.004	0.000
	upper avg.	196	71	14	0	0	8	0	10	87		0.007	0.004	0.000	0.009	0.001	0.035	0.004	0.072
Tysselvi Samnangervassdraget	lower avg.	1 762	399	1 088	1	2	54	5	113	153		0.059	0.105	0.009	0.187	0.900	0.154	0.000	0.643
	upper avg.	1 762	399	1 088	1	2	54	5	113	153		0.059	0.105	0.009	0.187	0.900	0.154	0.005	0.643
Oselva	lower avg.	793	310	948	1	3	41	2	94	274		0.045	0.075	0.005	0.289	0.000	0.154	0.000	0.000
	upper avg.	793	310	948	1	3	41	2	94	274		0.045	0.075	0.005	0.289	0.003	0.154	0.002	0.289
DaleelviBergsdalsvassdraget	lower avg.	1 561	394	641	1	1	47	4	100	292		0.047	0.108	0.007	0.193	0.946	0.140	0.000	0.000
	upper avg.	1 561	394	641	1	1	47	4	100	292		0.047	0.108	0.007	0.193	0.946	0.140	0.005	0.570
Ekso -Storelvi	lower avg.	3 425	875	1 859	3	5	67	9	199	240		0.043	0.156	0.013	0.000	0.000	0.213	0.081	0.000
	upper avg.	3 425	875	1 859	3	5	67	9	199	240		0.043	0.156	0.013	0.009	0.013	0.213	0.081	1.250
Modalselva -Moelvi	lower avg.	3 284	599	1 026	1	4	104	5	155	662		0.036	0.156	0.012	0.000	0.283	0.249	0.219	0.000
	upper avg.	3 284	599	1 026	1	4	104	5	155	662		0.036	0.156	0.012	0.008	0.283	0.249	0.219	1.199
Nærøydalselvi	lower avg.	1 729	507	383	1	2	46	4	94	1 513		0.032	0.000	0.000	0.144	0.544	0.056	0.136	0.631

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]
	upper avg.	1 729	507	383	1	2	46	4	94	1 513		0.032	0.003	0.000	0.144	0.544	0.056	0.136	0.631
Flåmselvi	lower avg.	1 004	452	157	1	1	21	2	37	226		0.036	0.009	0.000	0.040	0.228	0.103	0.070	0.000
	upper avg.	1 004	452	157	1	1	21	2	37	226		0.036	0.009	0.000	0.040	0.228	0.103	0.070	0.366
Aurlandselvi	lower avg.	2 917	1 027	638	2	1	94	4	139	1 134		0.085	0.160	0.000	0.353	0.903	0.257	0.052	0.000
	upper avg.	2 917	1 027	638	2	1	94	4	139	1 134		0.085	0.160	0.000	0.353	0.903	0.257	0.052	1.065
Erdalselvi	lower avg.	330	63	115	0	0	0	0	10	70		0.007	0.005	0.000	0.010	0.010	0.010	0.029	0.000
	upper avg.	330	63	115	0	0	0	0	10	70		0.007	0.005	0.000	0.010	0.010	0.010	0.029	0.120
Lærdalselva /Mjeldo	lower avg.	2 804	640	808	2	2	87	4	171	1 131		0.069	0.061	0.000	0.327	0.412	0.222	0.168	0.000
	upper avg.	2 804	640	808	2	2	87	4	171	1 131		0.069	0.061	0.000	0.327	0.412	0.222	0.168	1.023
Årdalselvi	lower avg.	3 461	859	884	1	3	85	7	143	2 091		0.051	0.024	0.006	1.263	0.442	0.333	0.000	3.790
	upper avg.	3 461	859	884	1	3	85	7	143	2 091		0.051	0.024	0.006	1.263	0.442	0.333	0.000	3.790
Fortundalselva	lower avg.	2 506	2 489	416	1	3	83	3	116	1 311		0.140	0.055	0.011	0.789	1.047	0.242	0.128	1.830
	upper avg.	2 506	2 489	416	1	3	83	3	116	1 311		0.140	0.055	0.011	0.789	1.047	0.242	0.128	1.830
Mørkrisdalselvi	lower avg.	1 391	2 203	218	1	1	30	2	54	938		0.036	0.066	0.000	0.278	0.883	0.256	0.180	0.000
	upper avg.	1 391	2 203	218	1	1	30	2	54	938		0.036	0.066	0.000	0.278	0.883	0.256	0.180	0.508
Årøyelva	lower avg.	2 671	1 202	741	1	3	66	6	126	1 404		0.055	0.074	0.000	0.065	0.694	0.130	0.166	0.000
	upper avg.	2 671	1 202	741	1	3	66	6	126	1 404		0.055	0.074	0.000	0.065	0.694	0.130	0.166	0.975
Sogndalselva	lower avg.	1 030	251	454	2	2	31	3	59	154		0.034	0.038	0.005	0.074	0.612	0.023	0.143	0.000
	upper avg.	1 030	251	454	2	2	31	3	59	154		0.034	0.038	0.005	0.074	0.612	0.023	0.143	0.376
Oselva	lower avg.	2 256	560	2 059	0	4	43	12	127	486		0.136	0.080	0.000	0.263	1.400	0.258	0.000	1.235
	upper avg.	2 256	560	2 059	0	4	43	12	127	486		0.136	0.080	0.000	0.263	1.400	0.258	0.007	1.235
Hopselva	lower avg.	680	187	174	0	0	22	1	32	60		0.013	0.022	0.002	0.007	0.257	0.017	0.102	0.248
	upper avg.	680	187	174	0	0	22	1	32	60		0.013	0.022	0.002	0.007	0.257	0.017	0.102	0.248

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]
Åaelva (Gjengedalselva)	lower avg.	1 566	452	852	1	2	34	3	69	174		0.047	0.035	0.000	0.105	0.447	0.053	0.108	1.115
	upper avg.	1 566	452	852	1	2	34	3	69	174		0.047	0.035	0.000	0.105	0.447	0.053	0.108	1.115
Oldenelva	lower avg.	1 374	727	389	0	2	64	5	101	574		0.105	0.053	0.005	0.150	0.327	0.071	0.054	0.000
	upper avg.	1 374	727	389	0	2	64	5	101	574		0.105	0.053	0.005	0.150	0.327	0.071	0.054	0.501
Loelvi	lower avg.	1 587	898	290	0	2	50	2	80	797		0.127	0.042	0.005	0.166	0.085	0.046	0.142	0.000
	upper avg.	1 587	898	290	0	2	50	2	80	797		0.127	0.042	0.005	0.166	0.085	0.046	0.142	0.579
Stryneelva	lower avg.	3 236	1 515	591	1	4	113	8	208	1 389		0.130	0.070	0.007	0.715	1.063	0.229	0.206	1.181
	upper avg.	3 236	1 515	591	1	4	113	8	208	1 389		0.130	0.070	0.007	0.715	1.063	0.229	0.206	1.181
Hornindalselva(Horndøla)	lower avg.	2 169	594	950	1	4	96	6	140	920		0.090	0.023	0.004	0.227	0.636	0.243	0.000	0.792
	upper avg.	2 169	594	950	1	4	96	6	140	920		0.090	0.023	0.004	0.227	0.636	0.243	0.006	0.792
Ørstaelva	lower avg.	767	232	438	3	6	28	4	58	469		0.026	0.005	0.000	0.090	0.264	0.078	0.000	0.280
	upper avg.	767	232	438	3	6	28	4	58	469		0.026	0.005	0.000	0.090	0.264	0.078	0.002	0.280
Valldøla	lower avg.	1 414	310	266	0	1	0	3	0	376		0.026	0.003	0.001	0.098	0.363	0.046	0.028	0.000
	upper avg.	1 414	310	266	0	1	0	3	5	376		0.026	0.003	0.001	0.098	0.363	0.046	0.028	0.516
Rauma	lower avg.	4 235	881	935	1	3	26	8	86	1 181		0.088	0.052	0.000	0.470	0.781	0.262	0.000	0.000
	upper avg.	4 235	881	935	1	3	26	8	86	1 181		0.088	0.052	0.000	0.470	0.781	0.262	0.012	1.546
Isa	lower avg.	623	181	124	0	1	3	1	4	356		0.012	0.000	0.000	0.071	0.008	0.050	0.055	0.227
	upper avg.	623	181	124	0	1	3	1	4	356		0.012	0.001	0.000	0.071	0.008	0.050	0.055	0.227
Eira	lower avg.	3 484	0	747	1	2	134	6	189	2 534		0.127	0.016	0.000	0.363	0.337	0.153	0.318	1.907
	upper avg.	3 484	64	747	1	2	134	6	189	2 534		0.127	0.016	0.000	0.363	0.337	0.153	0.318	1.907
Litledalselva	lower avg.	580	121	127	0	0	30	1	33	758		0.012	0.000	0.000	0.007	0.010	0.140	0.059	0.000
	upper avg.	580	121	127	0	0	30	1	33	758		0.012	0.001	0.000	0.007	0.010	0.140	0.059	0.212
Ålvunda	lower avg.	440	233	283	0	1	21	1	37	310		0.006	0.013	0.000	0.134	0.120	0.032	0.009	0.201

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]
	upper avg.	440	233	283	0	1	21	1	37	310		0.006	0.013	0.000	0.134	0.120	0.032	0.009	0.201
Toåa	lower avg.	555	117	254	0	1	4	1	19	218		0.006	0.009	0.000	0.091	0.045	0.009	0.000	0.000
	upper avg.	555	117	254	0	1	4	1	19	218		0.006	0.009	0.000	0.091	0.045	0.009	0.002	0.202
Bøvra	lower avg.	537	147	500	0	0	24	2	51	265		0.016	0.005	0.001	0.046	0.045	0.034	0.008	0.000
	upper avg.	537	147	500	0	0	24	2	51	265		0.016	0.005	0.001	0.046	0.045	0.034	0.008	0.196
Børselva	lower avg.	161	258	325	0	0	19	2	35	79		0.012	0.003	0.000	0.082	0.000	0.082	0.009	0.205
	upper avg.	161	258	325	0	0	19	2	35	79		0.012	0.003	0.000	0.082	0.001	0.082	0.009	0.205
Vigda	lower avg.	241	925	327	0	1	17	1	32	175		0.016	0.005	0.000	0.081	0.000	0.000	0.000	0.198
	upper avg.	241	925	327	0	1	17	1	32	175		0.016	0.005	0.000	0.081	0.001	0.001	0.001	0.198
Homla	lower avg.	264	66	646	0	0	4	2	21	154		0.047	0.002	0.001	0.063	0.000	0.048	0.000	0.193
	upper avg.	264	66	646	0	0	4	2	21	154		0.047	0.002	0.001	0.063	0.001	0.048	0.001	0.193
Gråe	lower avg.	144	120	289	0	1	23	1	38	10		0.017	0.000	0.000	0.057	0.000	0.020	0.014	0.000
	upper avg.	144	120	289	0	1	23	1	38	10		0.017	0.000	0.000	0.057	0.001	0.020	0.014	0.053
Figgja	lower avg.	454	1 051	1 266	1	2	62	1	77	248		0.047	0.027	0.001	0.182	0.108	0.141	0.061	0.000
	upper avg.	454	1 051	1 266	1	2	62	1	77	248		0.047	0.027	0.001	0.182	0.108	0.141	0.061	0.166
Årgårdselva	lower avg.	1 231	1 255	2 996	1	8	44	8	167	683		0.019	0.043	0.000	0.305	0.142	0.201	0.000	1.427
	upper avg.	1 231	1 255	2 996	1	8	44	8	167	683		0.019	0.043	0.000	0.305	0.142	0.201	0.004	1.427
Moelva(Salsvatenelva)	lower avg.	1 287	242	934	0	0	27	3	58	470		0.047	0.009	0.002	0.000	0.482	0.059	0.000	0.000
	upper avg.	1 287	242	934	0	0	27	3	58	470		0.047	0.009	0.002	0.003	0.482	0.059	0.004	0.470
Åelva(Åbjøra)	lower avg.	1 887	514	708	1	2	21	6	64	277		0.051	0.032	0.000	0.110	0.448	0.167	0.070	0.000
	upper avg.	1 887	514	708	1	2	21	6	64	277		0.051	0.032	0.000	0.110	0.448	0.167	0.070	0.689
Skjerva	lower avg.	382	258	467	1	2	13	10	61	183		0.034	0.043	0.003	0.147	0.280	0.208	0.008	0.279
	upper avg.	382	258	467	1	2	13	10	61	183		0.034	0.043	0.003	0.147	0.280	0.208	0.008	0.279

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]
Fusta	lower avg.	2 000	646	648	1	3	10	15	83	331		0.094	0.013	0.015	0.100	0.504	0.164	0.000	0.730
	upper avg.	2 000	646	648	1	3	10	15	83	331		0.094	0.013	0.015	0.100	0.504	0.164	0.006	0.730
Drevja	lower avg.	648	354	176	0	0	4	1	20	73		0.006	0.000	0.004	0.054	0.088	0.014	0.000	0.000
	upper avg.	648	354	176	0	0	4	1	20	73		0.006	0.001	0.004	0.054	0.088	0.014	0.002	0.237
Bjerkaelva	lower avg.	1 502	517	1 044	1	0	13	5	56	450		0.024	0.046	0.001	0.276	0.374	0.347	0.019	1.370
	upper avg.	1 502	517	1 044	1	0	13	5	56	450		0.024	0.046	0.001	0.276	0.374	0.347	0.019	1.370
Dalselva	lower avg.	1 111	258	634	0	2	3	3	28	327		0.000	0.014	0.000	0.152	0.004	0.196	0.033	1.115
	upper avg.	1 111	258	634	0	2	3	3	28	327		0.004	0.014	0.000	0.152	0.004	0.196	0.033	1.115
Fykanåga	lower avg.	1 653	1 119	302	1	2	21	4	49	210		0.115	0.000	0.000	0.069	0.310	0.069	0.000	0.000
	upper avg.	1 653	1 119	302	1	2	21	4	49	210		0.115	0.003	0.000	0.069	0.310	0.069	0.005	0.603
Saltelva	lower avg.	4 649	6 973	827	3	0	38	8	142	3 181		0.165	0.000	0.000	0.396	1.970	0.475	3.885	0.000
	upper avg.	4 649	6 973	827	3	1	38	8	142	3 181		0.165	0.008	0.000	0.396	1.970	0.475	3.885	1.697
SulitjelmavassdragetUtl Øvrevt	lower avg.	2 987	0	1 145	2	0	12	9	65	703		0.000	0.000	0.000	0.000	0.000	0.170	6.919	2.453
	upper avg.	2 987	55	1 145	2	0	12	9	65	703		0.011	0.005	0.000	0.008	0.011	0.170	6.919	2.453
Kobbelva	lower avg.	1 856	505	271	1	0	19	2	47	733		0.061	0.004	0.010	0.034	0.008	0.105	0.000	0.000
	upper avg.	1 856	505	271	1	0	19	2	47	733		0.061	0.004	0.010	0.034	0.008	0.105	0.005	0.677
Elvegårdselva	lower avg.	3 502	2 835	1 419	1	4	12	10	81	2 297		0.093	0.161	0.018	0.543	1.162	0.799	0.863	2.237
	upper avg.	3 502	2 835	1 419	1	4	12	10	81	2 297		0.093	0.161	0.018	0.543	1.162	0.799	0.863	2.237
Spanselva	lower avg.	511	116	105	0	0	5	1	17	273		0.010	0.013	0.003	0.087	0.091	0.186	0.000	0.000
	upper avg.	511	116	105	0	0	5	1	17	273		0.010	0.013	0.003	0.087	0.091	0.186	0.001	0.186
Salangselva	lower avg.	1 947	371	753	1	1	12	6	44	557		0.000	0.025	0.014	0.178	0.213	0.323	0.455	0.000
	upper avg.	1 947	371	753	1	1	12	6	44	557		0.007	0.025	0.014	0.178	0.213	0.323	0.455	0.711

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]
Lakselva(Rossfjordelva)	lower avg.	452	144	288	0	0	0	1	16	100		0.008	0.006	0.001	0.025	0.030	0.067	0.000	0.330
	upper avg.	452	144	288	0	0	0	1	16	100		0.008	0.006	0.001	0.025	0.030	0.067	0.001	0.330
Nordkjoselva	lower avg.	517	154	217	0	0	4	1	14	384		0.023	0.008	0.002	0.049	0.079	0.000	0.142	0.000
	upper avg.	517	154	217	0	0	4	1	14	384		0.023	0.008	0.002	0.049	0.079	0.002	0.142	0.189
Signaldalselva	lower avg.	1 391	489	939	2	1	9	4	31	1 050		0.044	0.000	0.005	0.264	0.008	0.208	0.000	0.000
	upper avg.	1 391	489	939	2	1	9	4	31	1 050		0.044	0.003	0.005	0.264	0.008	0.208	0.004	0.508
Skibotnelva	lower avg.	1 700	436	1 024	1	0	15	3	38	999		0.038	0.009	0.009	0.269	0.000	0.643	0.434	1.552
	upper avg.	1 700	436	1 024	1	0	15	3	38	999		0.038	0.009	0.009	0.269	0.006	0.643	0.434	1.552
Kåfjordelva	lower avg.	885	129	226	0	0	19	1	37	485		0.009	0.017	0.005	0.315	0.027	0.210	0.066	0.000
	upper avg.	885	129	226	0	0	19	1	37	485		0.009	0.017	0.005	0.315	0.027	0.210	0.066	0.323
Reisaelva	lower avg.	5 276	1 595	3 317	3	4	69	12	197	4 660		0.146	0.148	0.022	1.392	1.468	1.334	0.000	6.740
	upper avg.	5 276	1 595	3 317	3	4	69	12	197	4 660		0.146	0.148	0.022	1.392	1.468	1.334	0.015	6.740
Mattiselva	lower avg.	366	86	478	0	0	1	0	13	196		0.016	0.000	0.003	0.088	0.026	0.040	0.161	0.000
	upper avg.	366	86	478	0	0	1	0	13	196		0.016	0.001	0.003	0.088	0.026	0.040	0.161	0.134
Tverrelva	lower avg.	263	96	552	0	0	4	1	20	205		0.009	0.001	0.001	0.074	0.046	0.034	0.013	0.000
	upper avg.	263	96	552	0	0	4	1	20	205		0.009	0.001	0.001	0.074	0.046	0.034	0.013	0.096
Repparfjordelva	r avg.	2 664	574	4 916	1	1	15	10	118	1 125		0.065	0.000	0.010	1.284	0.308	0.292	0.057	1.945
	upper avg.	2 664	574	4 916	1	1	15	10	118	1 125		0.065	0.005	0.010	1.284	0.308	0.292	0.057	1.945
Stabburselva	lower avg.	1 650	139	1 445	1	1	10	4	38	1 291		0.032	0.005	0.004	0.069	0.341	0.060	0.250	0.000
	upper avg.	1 650	139	1 445	1	1	10	4	38	1 291		0.032	0.005	0.004	0.069	0.341	0.060	0.250	0.602
Lakseelv	lower avg.	1 535	1 574	1 625	1	3	6	4	58	1 156		0.031	0.021	0.006	0.308	0.000	0.333	0.306	0.000
	upper avg.	1 535	1 574	1 625	1	3	6	4	58	1 156		0.031	0.021	0.006	0.308	0.006	0.333	0.306	0.560
Børselva	lower avg.	1 216	444	444	0	0	2	6	35	1 260		0.002	0.049	0.003	0.089	0.234	0.096	0.280	0.000

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]
	upper avg.	1 216	444	444	0	0	2	6	35	1 260		0.002	0.049	0.003	0.089	0.234	0.096	0.280	0.444
Mattusjåkka	lower avg.	142	25	67	0	0	3	0	4	62		0.003	0.021	0.002	0.021	0.199	0.042	0.125	0.000
	upper avg.	142	25	67	0	0	3	0	4	62		0.003	0.021	0.002	0.021	0.199	0.042	0.125	0.052
Stuorrajåkka	lower avg.	971	0	248	0	0	9	1	32	835		0.032	0.078	0.009	0.000	0.301	0.058	0.153	0.000
	upper avg.	971	18	248	0	0	9	1	32	835		0.032	0.078	0.009	0.002	0.301	0.058	0.153	0.354
Soussjåkka	lower avg.	129	0	61	0	0	1	0	4	129		0.001	0.004	0.001	0.004	0.019	0.002	0.034	0.000
	upper avg.	129	2	61	0	0	1	0	4	129		0.001	0.004	0.001	0.004	0.019	0.002	0.034	0.047
Adamselva	lower avg.	993	24	580	0	0	0	2	34	811		0.045	0.014	0.007	0.039	0.297	0.000	0.000	1.087
	upper avg.	993	24	580	0	0	0	2	34	811		0.045	0.014	0.007	0.039	0.297	0.004	0.003	1.087
Syltefjordelva(Vesterelva)	lower avg.	1 187	0	347	1	1	3	4	26	951		0.070	0.000	0.007	0.025	0.078	0.000	0.762	0.866
	upper avg.	1 187	22	347	1	1	3	4	26	951		0.070	0.002	0.007	0.025	0.078	0.004	0.762	0.866
Jakobselv	lower avg.	1 147	152	1 172	1	1	0	3	52	1 485		0.032	0.000	0.004	0.031	0.000	0.004	0.014	0.000
	upper avg.	1 147	152	1 172	1	1	0	3	52	1 485		0.032	0.002	0.004	0.031	0.004	0.004	0.014	0.419
Neidenelva	lower avg.	2 949	1 238	5 162	2	2	19	13	205	2 153		0.070	0.000	0.022	0.560	0.000	0.242	0.624	0.000
	upper avg.	2 949	1 238	5 162	2	2	19	13	205	2 153		0.070	0.005	0.022	0.560	0.011	0.242	0.624	1.076
Grense Jakobselv	lower avg.	279	77	367	0	0	0	1	13	303		0.018	0.006	0.002	0.229	0.193	0.791	0.302	0.305
	upper avg.	279	77	367	0	0	0	1	13	303		0.018	0.006	0.002	0.229	0.193	0.791	0.302	0.305

Table 2b. Organic contaminants – loads (three rivers)

Table 2b i. Estimated riverine load for polycyclic aromatic (PAHs) in the rivers Alna. Drammen and Glomma for 2014

Compound	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (kg year^{-1})	Yearly load (kg year^{-1})
Naphthalene	301	91.1	198
Acenaphthylene	39	22.0	26.2-27.0
Acenaphthene	73	16.9	50.3-50.7
Fluorene	112	23.7	61.6
Phenanthrene	422	81.1	181.6
Anthracene	75	3.5	8.1
Fluoranthene	581	58.4	129.7
Pyrene	967	42.7	87.0
Benz[a]anthracene	204	7.9	17.9
Chrysene	260	13.3	23.8
Benzo[bj]fluoranthene	359	14.0	26.3
Benzo[k]fluoranthene	114	3.9	8.1
Benzo[a]pyrene	191	4.2	8.4-8.5
Indeno[1.2.3-cd]pyrene	155	3.5	7.5
Dibenzo[a.h]anthracene	40	5.8-9.4	1.3-2.3
Benzo[ghi]perylene	327	4.2	9.6
Note: units are different for the different rivers			

Table 2b ii. Estimated riverine load for polychlorinated biphenyls (PCBs) in the rivers Alna. Drammen and Glomma for 2014

	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (g year^{-1})	Yearly load (g year^{-1})
PCB31 (+28)	2.7-3.9	326	421-626
CB52	2.3-4.0	101-149	125-416
CB101	3.3	59-174	76-446
CB118	2.6	56-118	15-332
CB153	4.5	36-111	58-331
CB138	4.5	34-125	27-345
CB180	2.7	< 118	9.7-338

Table 2b iii. Estimated riverine load for polybrominated diphenyl ethers (PBDEs) in the rivers Alna. Drammen and Glomma for 2014

	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (g year^{-1})	Yearly load (g year^{-1})
BDE47	1.3	**73**	110-147
BDE99	1.6	39-42	48115
BDE100	0.18-0.42	42-56	69-144
BDE153	0.04-0.36	2.3-31	27-150
BDE154	0.083-0.21	< 26	27-84
BDE183	< 0.44	< 45	< 163
BDE196	< 0.22	< 60	< 148
BDE209	27.0	788.871	533
BDE126	< 0.06	< 22	< 80
*Data for BDE28 not available			

Table 2b iv. Estimated riverine load for hexabromoyclododecane (HBCDD) in the rivers Alna. Drammen and Glomma for 2014

	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (g year^{-1})	Yearly load (g year^{-1})
α-HBDD	4.2	35-294	210-1079
β-HBCDD	1.6-1.7	< 270	< 686
δ-HBDD	0.026-0.53	< 280	< 693

Table 2b v. Estimated riverine load for suspended particulate matter-associated short and medium chain chlorinated paraffins (S/MCCPs). bisphenol A (BPA). tetrabromobisphenol A (TBBPA). PFOS and PFDS in the rivers Alna. Drammen and Glomma for 2014

	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (g year^{-1})	Yearly load (kg year^{-1})
SCCPs	817	6925	15.8-19.4
MCCPs	309	4187	11.8
BPA	231-267	2185	3.7
TBBPA	4.3	1115-1116	5.45
PFOS	0.36	5.6	15-19
PFDS	0.12-0.13	< 2.2	< 17

Table 3. Total inputs to the sea from Norway in 2014

TOTAL NORWAY	Estimate	Flow rate 1000 m3/d	SPM tonnes	TOC tonnes	PO4-P tonnes	TOTP tonnes	NO3N tonnes	NH4-N tonnes	TOTN tonnes	SiO2 tonnes	Ag tonnes	As tonnes	Pb tonnes	Cd tonnes	Cu tonnes	Zn tonnes	Ni tonnes	Cr tonnes	Hg kg
Riverine Inputs																			
Main Rivers	low. avg.	203 935	495 981	258 017	519	883	15 747	884	29 422	224 728	0	11.40	28.32	0.94	90.02	489.44	46.96	25.70	36
	upp.avg.	203 935	495 981	258 017	532	884	15 747	904	29 422	224 728	4	11.46	28.33	0.97	90.02	489.45	46.96	27.62	85
Tributary Rivers(36)	low.avg.	224 384	196 075	199 292	200	445	8 695	943	19 618	183 747	0	7.69	14.37	1.06	58.14	210.31	51.63	18.53	31
	upp. avg.	224 384	196 075	199 292	232	446	8 695	959	19 618	183 747	4	8.83	14.37	1.18	58.14	210.32	51.64	21.01	94
Tributary Rivers(109)	low. avg.	151 678	75 751	97 448	107	243	5 724	482	10 454	76 553	0	6.09	5.97	0.49	22.68	64.51	21.70	20.96	54
	upp.avg.	151 678	75 911	97 448	108	247	5 725	482	10 459	76 553	0	6.11	6.02	0.49	22.71	64.57	21.71	21.10	79
Total Riverine Inputs	low. avg.	579 997	767 807	554 757	826	1 570	30 166	2 309	59 494	485 028	0	25.18	48.67	2.49	170.83	764.25	120.29	65.20	121
	upp.avg.	579 997	767 967	554 757	872	1 576	30 166	2 345	59 499	485 028	8	26.39	48.72	2.64	170.87	764.35	120.31	69.73	259
Direct Discharges																			
Sewage Effluents	low. avg.				635	1 059	647	9 704	12 938			0.28	0.36	0.02	4.46	14.64	2.00	0.58	8
Sewage Effluents	upp.avg.				635	1 059	647	9 704	12 938			0.28	0.36	0.02	4.46	14.64	2.00	0.58	8
Industrial Effluents	low.avg.		15 786	820	135	225	117	1 755	2 340			1.83	1.27	0.09	6.17	15.87	6.94	1.89	9
Industrial Effluents	upp.avg.		15 786	820	135	225	117	1 755	2 340			1.83	1.27	0.09	6.17	15.87	6.94	1.89	9
Fish Farming	low. avg.				6 661	9 653	6 289	45 741	57 176						957.06				
Fish Farming	upp.avg.				6 661	9 653	6 289	45 741	57 176						957.06				
Total Direct Inputs	low. avg.		15 786	820	7 431	10 936	7 053	57 199	72 454			2.11	1.64	0.11	967.70	30.51	8.93	2.48	18
	upp.avg.		15 786	820	7 431	10 936	7 053	57 199	72 454			2.11	1.64	0.11	967.70	30.51	8.93	2.48	18
Unmonitored																			
	low. avg.	376 999			176	715	23 862	2 100	38 179										
	upp.avg.	376 999			176	715	23 862	2 100	38 179										
Region total																			
	low. avg.	956 996	783 594	555 577	8 432	13 221	61 081	61 608	170 127	485 028	0	27	50	3	1 139	795	129	68	139
	upp.avg.	956 996	783 753	555 577	8 478	13 227	61 082	61 644	170 132	485 028	8	29	50	3	1 139	795	129	72	276

SKAGERRAK		Flow rate 1000 m3/d	SPM tonnes	TOC tonnes	PO4-P tonnes	TOTP tonnes	NO3N tonnes	NH4-N tonnes	TOTN tonnes	SiO2 tonnes	Ag tonnes	As tonnes	Pb tonnes	Cd tonnes	Cu tonnes	Zn tonnes	Ni tonnes	Cr tonnes	Hg kg
Riverine Inputs																			
Main Rivers	low. avg.	170 578	412 548	233 955	472	790	14 754	835	26 968	195 243	0	10.05	27.40	0.85	76.66	463.43	41.23	19.67	34
	upp.avg.	170 578	412 548	233 955	479	790	14 754	844	26 968	195 243	3	10.05	27.40	0.85	76.66	463.43	41.23	21.25	73
Tributary Rivers(36)	low.avg.	39 358	20 849	65 255	33	94	2 381	302	5 440	29 418	0	2.48	5.98	0.51	9.27	83.39	5.35	3.06	10
	upp. avg.	39 358	20 849	65 255	36	94	2 381	302	5 440	29 418	1	2.48	5.98	0.51	9.27	83.39	5.35	3.47	19
Tributary Rivers(109)	low. avg.	11 998	19 176	23 686	27	98	1 900	95	2 870	11 459	0	1.51	1.76	0.13	4.12	24.42	3.23	0.91	7
	upp.avg.	11 998	19 176	23 686	27	98	1 900	95	2 870	11 459	0	1.51	1.76	0.13	4.12	24.42	3.23	0.92	7
Total Riverine Inputs	low. avg.	221 934	452 573	322 895	532	982	19 034	1 231	35 278	236 120	0	14.04	35.14	1.48	90.04	571.23	49.81	23.64	50
	upp.avg.	221 934	452 573	322 895	542	982	19 034	1 241	35 278	236 120	4	14.04	35.14	1.49	90.04	571.23	49.81	25.64	99
Direct Discharges																			
Sewage Effluents	low. avg.				74	123	265	3 976	5 302			0.19	0.22	0.01	3.16	10.76	1.43	0.27	7
Sewage Effluents	upp.avg.				74	123	265	3 976	5 302			0.19	0.22	0.01	3.16	10.76	1.43	0.27	7
Industrial Effluents	low.avg.		1 678	53	26	44	50	745	993			0.18	0.58	0.02	5.19	9.35	2.62	1.23	5
Industrial Effluents	upp. avg.		1 678	53	26	44	50	745	993			0.18	0.58	0.02	5.19	9.35	2.62	1.23	5
Fish Farming	low. avg.				3	4	3	20	25						0.44				
Fish Farming	upp.avg.				3	4	3	20	25						0.44				
Total Direct Inputs	low. avg.		1 678	53	103	171	317	4 741	6 320			0.38	0.80	0.03	8.79	20.11	4.05	1.51	12
	upp.avg.		1 678	53	103	171	317	4 741	6 320			0.38	0.80	0.03	8.79	20.11	4.05	1.51	12
Unmonitored																			
	low. avg.	10 120			19	77	1 916	169	3 066										
	upp.avg.	10 120			19	77	1 916	169	3 066										
Region total																			
	low. avg.	232 054	454 251	322 948	653	1 229	21 268	6 141	44 663	236 120	0	14	36	2	99	591	54	25	62
	upp.avg.	232 054	454 251	322 948	663	1 230	21 268	6 150	44 663	236 120	4	14	36	2	99	591	54	27	111

NORTH SEA		Flow rate 1000 m3/d	SPM tonnes	TOC tonnes	PO4-P tonnes	TOTP tonnes	NO3N tonnes	NH4-N tonnes	TOTN tonnes	SiO2 tonnes	Ag tonnes	As tonnes	Pb tonnes	Cd tonnes	Cu tonnes	Zn tonnes	Ni tonnes	Cr tonnes	Hg kg
Riverine inputs																			
Main Rivers	low. avg.	9 096	5 994	4 534	9	23	443	19	816	3 543	0	0.27	0.33	0.02	1.47	3.83	1.18	0.40	1
	upp.avg.	9 096	5 994	4 534	11	24	443	21	816	3 543	0	0.32	0.33	0.03	1.47	3.83	1.18	0.51	3
Tributary Rivers(36)	low.avg.	76 775	61 294	49 786	82	164	4 239	233	7 237	35 898	0	1.98	6.27	0.38	12.36	71.24	6.14	5.51	11
	upp.avg.	76 775	61 294	49 786	95	164	4 239	245	7 237	35 898	1	2.58	6.27	0.41	12.36	71.24	6.15	6.66	33
Tributary Rivers(109)	low.avg.	72 917	28 595	31 332	45	86	2 983	192	4 941	27 571	0	2.70	3.29	0.17	9.14	28.28	9.44	3.51	21
	upp.avg.	72 917	28 595	31 332	45	87	2 983	193	4 941	27 571	0	2.70	3.29	0.17	9.16	28.30	9.44	3.56	33
Total Riverine Inputs	low.avg.	158 788	95 882	85 652	136	274	7 665	445	12 994	67 012	0	4.96	9.89	0.57	22.98	103.35	16.76	9.42	34
	upp.avg.	158 788	95 882	85 652	152	275	7 665	458	12 994	67 012	2	5.61	9.89	0.61	22.99	103.37	16.77	10.73	69
Direct Discharges																			
Sewage Effluents	low. avg.				244	407	182	2 731	3 641			0.07	0.12	0.00	0.59	2.73	0.45	0.09	1
Sewage Effluents	upp.avg.				244	407	182	2 731	3 641			0.07	0.12	0.00	0.59	2.73	0.45	0.09	1
Industrial Effluents	low.avg.		7 346	348	47	78	21	311	415			1.64	0.67	0.07	0.46	6.40	4.19	0.65	2
Industrial Effluents	up.avg.		7 346	348	47	78	21	311	415			1.64	0.67	0.07	0.46	6.40	4.19	0.65	2
Fish Farming	low. avg.				2 142	3 105	2 027	14 738	18 423						308.41				
Fish Farming	upp.avg.				2 142	3 105	2 027	14 738	18 423						308.41				
Total Direct Inputs	low. avg.		7 346	348	2 434	3 591	2 229	17 780	22 479			1.71	0.78	0.07	309.46	9.13	4.64	0.74	3
	upp.avg.		7 346	348	2 434	3 591	2 229	17 780	22 479			1.71	0.78	0.07	309.46	9.13	4.64	0.74	3
Unmonitored																			
	low. avg.	140 131			59	238	10 090	888	16 144										
	upp.avg.	140 131			59	238	10 090	888	16 144										
Region total																			
	low.avg.	298 920	103 229	86 000	2 629	4 103	19 985	19 113	51 617	67 012	0	7	11	1	332	112	21	10	37
	upp.avg.	298 920	103 229	86 000	2 644	4 104	19 985	19 126	51 617	67 012	2	7	11	1	332	113	21	11	72

NORWEGIAN SEA*		Flow rate 1000 m3/d	SPM tonnes	TOC tonnes	PO4-P tonnes	TOTP tonnes	NO3N tonnes	NH4-N tonnes	TOTN tonnes	SiO2 tonnes	Ag tonnes	As tonnes	Pb tonnes	Cd tonnes	Cu tonnes	Zn tonnes	Ni tonnes	Cr tonnes	Hg kg
Riverine inputs																			
Main Rivers	low.avg.	16 200	10 813	9 349	5	19	397	13	930	9 426	0	0.63	0.24	0.06	8.00	18.35	2.14	1.52	1
	upp.avg.	16 200	10 813	9 349	9	19	397	21	930	9 426	0	0.63	0.24	0.07	8.00	18.36	2.14	1.71	6
Tributary Rivers(36)	low.avg.	60 694	96 952	42 579	67	123	1 613	174	3 936	40 012	0	1.69	1.50	0.11	17.33	36.41	13.43	6.80	6
	upp.avg.	60 694	96 952	42 579	77	124	1 613	178	3 936	40 012	1	1.89	1.50	0.15	17.33	36.41	13.43	7.21	23
Tributary Rivers(109)	low.avg.	35 091	17 283	16 678	19	39	620	106	1 518	14 754	0	1.07	0.34	0.04	3.48	6.69	3.27	11.50	11
	upp.avg.	35 091	17 401	16 678	19	41	620	106	1 523	14 754	0	1.09	0.36	0.04	3.49	6.70	3.27	11.54	18
Total Riverine Inputs	low.avg.	111 985	125 048	68 606	91	181	2 630	293	6 384	64 192	0	3.39	2.08	0.21	28.81	61.45	18.84	19.82	17
	upp.avg.	111 985	125 166	68 606	106	184	2 631	306	6 389	64 192	1	3.60	2.10	0.26	28.82	61.47	18.84	20.46	47
Direct Discharges																			
Sewage Effluents	low.avg.				218	363	139	2 089	2 785			0.02	0.03	0.00	0.72	1.14	0.11	0.22	0
Sewage Effluents	upp.avg.				218	363	139	2 089	2 785			0.02	0.03	0.00	0.72	1.14	0.11	0.22	0
Industrial Effluents	low.avg.		2 439	148	58	97	43	641	855			0.01	0.03	0.00	0.51	0.12	0.13	0.01	2
Industrial Effluents	upp.avg.		2 439	148	58	97	43	641	855			0.01	0.03	0.00	0.51	0.12	0.13	0.01	2
Fish Farming	low.avg.				2 912	4 220	2 741	19 938	24 922						416.78				
Fish Farming	upp.avg.				2 912	4 220	2 741	19 938	24 922						416.78				
Total Direct Inputs	low.avg.				3 188	4 680	2 923	22 668	28 562										
	upp.avg.				3 188	4 680	2 923	22 668	28 562										
Unmonitored																			
	low.avg.	113 126			65	263	7 370	649	11 792										
	upp.avg.	113 126			65	263	7 370	649	11 792										
Region total																			
	low.avg.	225 111	125 048	68 606	3 344	5 125	12 924	23 610	46 738	64 192	0	3	2	0	29	61	19	20	17
	upp.avg.	225 111	125 166	68 606	3 359	5 128	12 924	23 622	46 743	64 192	1	4	2	0	29	61	19	20	47

* Note new maritime borders this year for this sea area; cf. Chapter 1.1

BARENTS SEA*		Flow rate 1000 m3/d	SPM tonnes	TOC tonnes	PO4-P tonnes	TOTP tonnes	NO3N tonnes	NH4-N tonnes	TOTN tonnes	SiO2 tonnes	Ag tonnes	As tonnes	Pb tonnes	Cd tonnes	Cu tonnes	Zn tonnes	Ni tonnes	Cr tonnes	Hg kg
Riverine inputs																			
Main Rivers	low. avg.	8 062	66 625	10 180	32	51	153	17	708	16 516	0	0.46	0.35	0.01	3.89	3.83	2.41	4.12	1
	upp.avg.	8 062	66 625	10 180	33	51	153	18	708	16 516	0	0.46	0.36	0.01	3.89	3.83	2.41	4.15	3
Tributary Rivers(36)	low.avg.	47 556	16 980	41 672	18	63	462	234	3 005	78 419	0	1.54	0.62	0.06	19.18	19.27	26.70	3.16	4
	upp.avg.	47 556	16 980	41 672	23	63	462	234	3 005	78 419	1	1.88	0.62	0.11	19.18	19.28	26.70	3.67	20
Tributary Rivers(109)	low. avg.	31 672	10 698	25 752	17	19	221	89	1 125	22 769	0	0.80	0.59	0.16	5.94	5.12	5.76	5.04	15
	upp.avg.	31 672	10 740	25 752	17	20	221	89	1 125	22 769	0	0.81	0.61	0.16	5.94	5.15	5.77	5.07	21
Total Riverine Inputs	low. avg.	87 289	94 303	77 604	67	133	836	340	4 838	117 704	0	2.79	1.56	0.23	29.01	28.21	34.88	12.32	20
	upp.avg.	87 289	94 345	77 604	73	135	836	341	4 838	117 704	1	3.14	1.58	0.28	29.01	28.26	34.89	12.89	43
Direct Discharges																			
Sewage Effluents	low.avg.				99	165	60	907	1 210										
Sewage Effluents	upp.avg.				99	165	60	907	1 210										
Industrial Effluents	low.avg.		4 323	272	3	5	4	58	77			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Industrial Effluents	upp.avg.		4 323	272	3	5	4	58	77			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Fish Farming	low.avg.				1 604	2 324	1 519	11 045	13 806						231.42				
Fish Farming	upp.avg.				1 604	2 324	1 519	11 045	13 806						231.42				
Total Direct Inputs	low.avg.				1 706	2 494	1 583	12 010	15 093										
	upp.avg.				1 706	2 494	1 583	12 010	15 093										
Unmonitored																			
	low.avg.	113 621			33	136	4 486	395	7 177										
	upp.avg.	113 621			33	136	4 486	395	7 177										
Region Total																			
	low.avg.	200 911	94 303	77 604	1 806	2 764	6 904	12 745	27 108	117 704	0	3	2	0	29	28	35	12	20
	upp.avg.	200 911	94 345	77 604	1 812	2 765	6 905	12 745	27 108	117 704	1	3	2	0	29	28	35	13	43

* Note new maritime borders this year for this sea area; cf. Chapter 1.1

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The Norwegian Environment Agency is working for a clean and diverse environment. Our primary tasks are to reduce greenhouse gas emissions, manage Norwegian nature, and prevent pollution.

We are a government agency under the Ministry of Climate and Environment and have 700 employees at our two offices in Trondheim and Oslo and at the Norwegian Nature Inspectorate's more than sixty local offices.

We implement and give advice on the development of climate and environmental policy. We are professionally independent. This means that we act independently in the individual cases that we decide and when we communicate knowledge and information or give advice.

Our principal functions include collating and communicating environmental information, exercising regulatory authority, supervising and guiding regional and local government level, giving professional and technical advice, and participating in international environmental activities.