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Riverine inputs and direct discharges to Norwegian coastal waters – 2015

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Riverine Inputs and Direct Discharges to Norwegian Coastal Waters - 2015

Summary - sammendrag

Riverine inputs and direct discharges to Norwegian coastal waters in 2015 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 analyzed, and threshold concentration levels investigated. Rapporten presenterer resultater fra Elvetilførselsprogrammet i 2015. 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	**4 subject words**
Elvetilførsler, direkte tilførsler, norske kystområder, overvåking	Riverine inputs, direct discharges, Norwegian coastal waters, monitoring

Front page photo

Fishing from wooden rafts in River Numedalslågen. Photo: Roger Roseth

Content

Summary

This report presents the results of the 2015 monitoring of the RID Programme (Riverine Inputs and Direct discharges to Norwegian coastal waters). 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. In 2015, 47 rivers were monitored, of which 11 were sampled monthly and the remaining 36 were sampled four times. In addition, direct discharges to the sea from point sources (industry, sewage, and aquaculture) have been recorded, and inputs from unmonitored areas have been estimated or modelled.

The year 2015 had both high temperatures and precipitation; in fact the year was the 3rd warmest and the 3rd wettest since the national recordings started in 1900.

The total nutrient inputs to Norwegian coastal waters in 2015 were estimated to about 13 300 tonnes of phosphorus, 184 000 tonnes of nitrogen, 501 000 tonnes of silicate, 611 000 tonnes of total organic carbon (TOC), and 860 000 tonnes of suspended particulate matter.

The inputs of metals to the Norwegian coastal areas were estimated to 199 kg of mercury, 2.3 tonnes of cadmium, 35 tonnes of arsenic, 46 tonnes of lead, 54 tonnes of chromium, 200 tonnes of nickel, 725 tonnes of zinc and 1185 tonnes of copper. Annual average concentrations exceeding the threshold values were found for copper (five rivers), zinc (two rivers), and lead and nickel (one river each). Several more single water samples had concentrations above threshold values.

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 terms of loads in 2015 as compared to the 25 previous years (1990-2014), the nutrient loads to the Skagerrak region were higher than the long-term average in 2015, probably caused by high water discharges. In the North, Norwegian and Barents Seas, nitrogen loads increased, changes in phosphorus loads varied, and suspended sediment loads decreased. Statistically significant long-term trends in total nitrogen loads were detected in four out of nine rivers, of which one was downward (River Vefsna) and the rest upward (rivers Glomma, Drammenselva and Numedalslågen). It is likely that this increase in the three latter rivers is due to increased water discharges. Total phosphorus loads declined in River Vefsna; whereas both orthophosphate and total phosphorus increased in rivers Drammenselva and Numedalslågen.

For metals, riverine loads in 2015 of mercury, cadmium and chromium were about 40% lower than in the 25 year average. It should be noted that analytical methods have changed over the years and this may partly explain this decline, since these metals often are found in concentrations below LOQ. The total riverine inputs of arsenic, lead, copper, and zinc were relatively similar in 2015 as in the 25 year average. The only metal that increased in 2015 as compared to the 25 previous years was nickel, due to high inputs from River Pasvikelva. Zinc

concentrations remain high in River Glomma, although a reduction has occurred since the high concentrations and loads in 2012.

Statistical trend analyses for the period 1990-2015 revealed that metal loads from Norwegian rivers have mainly been reduced, and only one increase has been found; copper loads in River Drammenselva. This picture is confirmed by the fact that concentrations of metals have not increased in any rivers. In River Glomma, however, hitherto inexplicable increases in zinc have been observed the latter years (2011-2015), but the increase has not been sufficient to influence the statistical trend analyses.

Organic contaminants have been monitored in three rivers (Glomma, Alna and Drammenselva) using a combination of passive samplers (dissolved phases) and continuous flow centrifugation (particle bound phases). The dissolved and particulate phases were combined to ‘whole water’ concentrations, and tested against legislative thresholds of WFD priority pollutants. Concentrations of fluoranthene, benzo[a]pyrene, PFOS and SCCPs were close to or above WFD thresholds for all three rivers in 2015, whereas concentrations for SCCPs in the three rivers also approached threshold values. All in all, the data from 2015 generally confirms the assessment undertaken in 2013 and 2014.

The estimation of riverine discharges of contaminants to the sea in 2015 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 and 2014. Loads from rivers Drammenselva and Glomma 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. Over the three years of monitoring, some contaminants exhibit SPM concentration that can span over two orders of magnitude. Correlating the continuous turbidity measurements with SPM concentrations could, to some extent, help reduce this uncertainty.

Sensors for turbidity, pH, conductivity and temperature have been running since 2013 in rivers Glomma, Alna, and Drammenselva. An important part of the quality procedure is the calibration of the sensor data with laboratory analyses of grab samples. However, grab samples are seldom collected during the highest turbidity and conductivity conditions. This means that the correlation between grab samples and sensor data are mainly based on low values, and it may be considered to collect additional samples during events in order to improve this situation.

Sammendrag

Elvetilførselsprogrammet er en del av oppfølgingen av OSPAR-konvensjonen (www.ospar.org), som gjelder for alle europeiske land som grenser til Nord-Atlanteren. Programmet har pågått siden 1990, og gir et godt bilde av utviklingen over tid av forurensingstilførsler fra land til kyst. I 2015 ble 47 elver overvåket, hvorav 11 med månedlig prøvetaking og 36 kvartalsvis. Forurensingen som kommer med de overvåkede elvene omfatter også utslipp fra punktkilder (særlig industri og renseanlegg). Utslipp fra punktkilder som industri, renseanlegg og akvakultur inngår også i beregningene. Næringsstoffer som tilføres fra diffuse kilder i umålte felt modelleres. I Norge beregnes utslipp til de fire havområdene Skagerrak, Nordsjøen, Norskehavet og Barentshavet.

2015 var det tredje varmeste og våteste året siden de nasjonale registreringene startet i 1900. Totale tilførsler av næringsstoffer og partikler fra Norge til kystområdene i 2015 omfattet om lag 13 300 tonn fosfor, 184 000 tonn nitrogen, 501 000 tonn silikat, 611 000 tonn TOC (total organisk karbon), og 860 000 tonn suspendert partikulært stoff. Metalltilførslene til kystområdene utgjorde 199 kg kvikksølv, 2,3 tonn kadmium, 35 tonn arsen, 46 tonn bly, 54 tonn krom, 200 tonn nikkel, 725 tonn sink og 1185 tonn kobber. Metallkonsentrasjoner sjekkes mot grenseverdier, og dette året ble det funnet for høye gjennomsnittlige konsentrasjoner av kobber i fem elver (Glomma, Alna, Orreelva, Orkla og Pasvikelva), sink i Alna og Sauda, bly i Alna og nikkel i Pasvikelva.

Det har vært en økning av næringsstoffer i enkelte elver som drenerer til Skagerrak, dette gjelder for Glomma (nitrogen), samt Drammenselva og Numedalslågen (nitrogen og fosfor). Mye av denne økningen kan forklares med økt vannføring, og dette kan bety at klimaendringer med mer nedbør og avrenning kan gi større press på vassdragene. Samtidig har det blitt mindre nitrogen- og fosfortilførsler til kystområdene fra Nordlandsvassdraget Vefsna.

Tilførsler av tungmetaller har stort sett gått ned over hele landet, med unntak av Drammenselva (økning i kobbertilførsler); Glomma (økning i sink), samt at Pasvikelva i Finnmark hadde høye nikkelverdier i 2015.

Det har vært en jevn stigning i tilførsler av næringsstoffer og kobber fra fiskeoppdrett det siste tiåret, og dette har medført at totale norske utslipp av disse stoffene har økt.

Elvetilførselsprogrammet har i de senere årene tatt i bruk ny metodikk for overvåking. Sensorer overvåker nå turbiditet, ledningsevne, pH og temperatur i tre elver (Glomma, Drammenselva og Alna). Sensorene registrerer data hver time, som gir en adskillig høyere tidsoppløsning enn de månedlige prøvene.

I tre vassdrag (Glomma, Alna og Drammenselva) benyttes såkalte passive prøvetakere av silikon, som fungerer som filtere for løste miljøgifter i vannet. Den partikkelbundne fraksjonen av organiske miljøgifter måles ved å samle inn partikler med en sentrifugeteknikk. Summen av de to fraksjonene (løst og partikulært) gir et estimat av totale tilførsler. Konsentrasjoner av fluoranthene, benzo[a]pyrene (begge PAHer), PFOS og SCCP var nær eller over grenseverdien I EUs Vanndirektiv i alle de tre elvene.

Det er utarbeidet et norsk faktaark om programmets resultater i 2015.

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 http://www.ospar.org/documents?d=33689, 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 organic contaminants. 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 eastwards 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 northwards to Lofoten and Vesterålen (68°15’N)
IV. Barents Sea:	From 68°15’N (including Lofoten and Vesterålen) to the Russian Border in the north-east.

Note that the definition of the border between the Norwegian Sea and the Barents Sea was changed in 2014 to correspond with the national reporting for maritime areas. 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 2015

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 2015, 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. In the period 1990-2003, 109 rivers were monitored once a year. One of these, River Alna, has been monitored monthly since 2013.

Table 1. The Norwegian RID monitoring programme.

Type of river	Number of rivers
Rivers monitored at least monthly in 2015	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 total inputs are 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 2015:

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

In addition, Norway monitored the following parameters in 2015 (not used to calculate total loads to the sea):

- Organic contaminants in rivers Glomma, Alna and Drammenselva, in both dissolved and particulate phase.
- Turbidity, conductivity, pH (and DOM) 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.

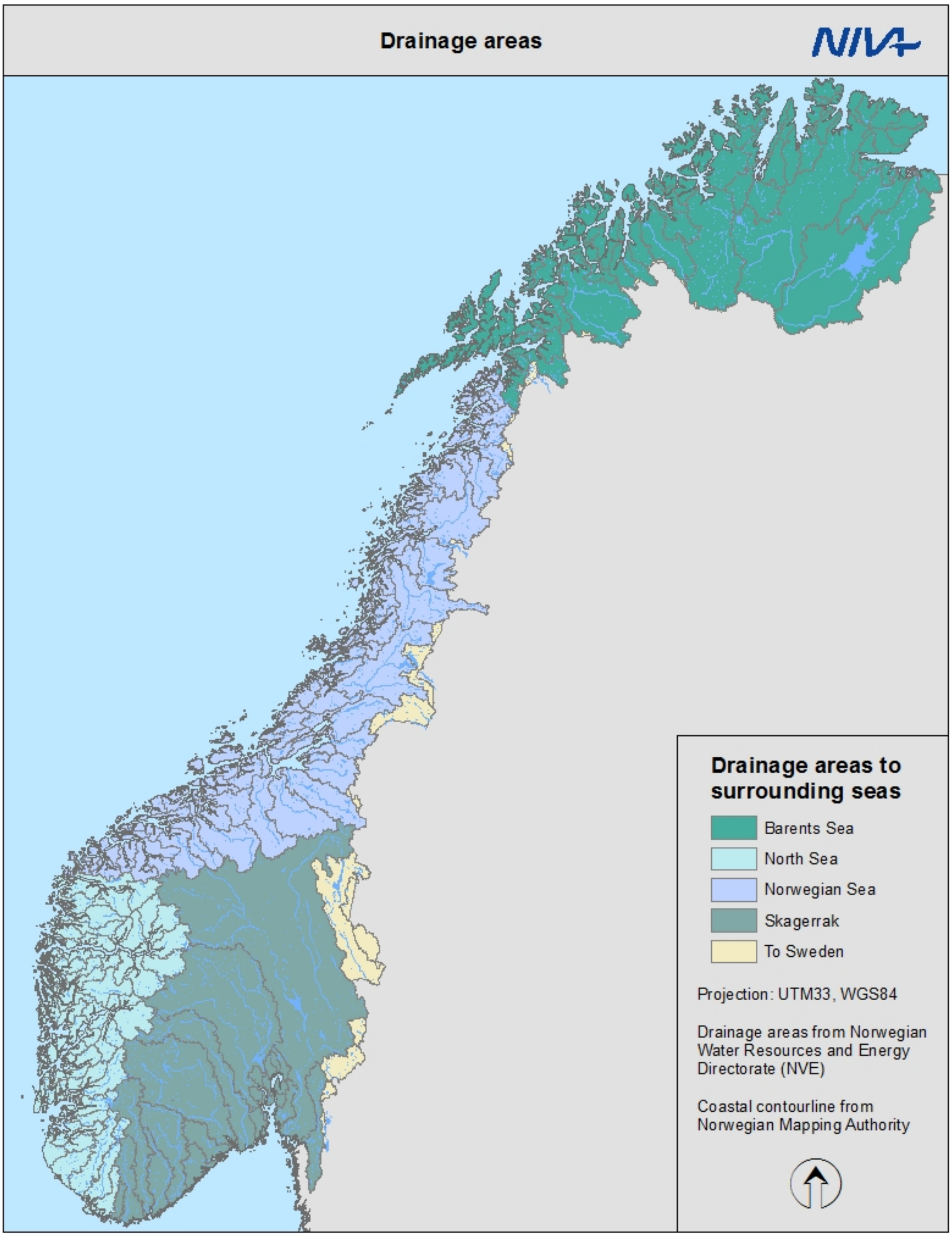

Figure 1. Norway is divided into four drainage areas, which drain into the Skagerrak, the North Sea, the Norwegian Sea and the Barents Sea. Minor parts of Norway drain to Sweden.

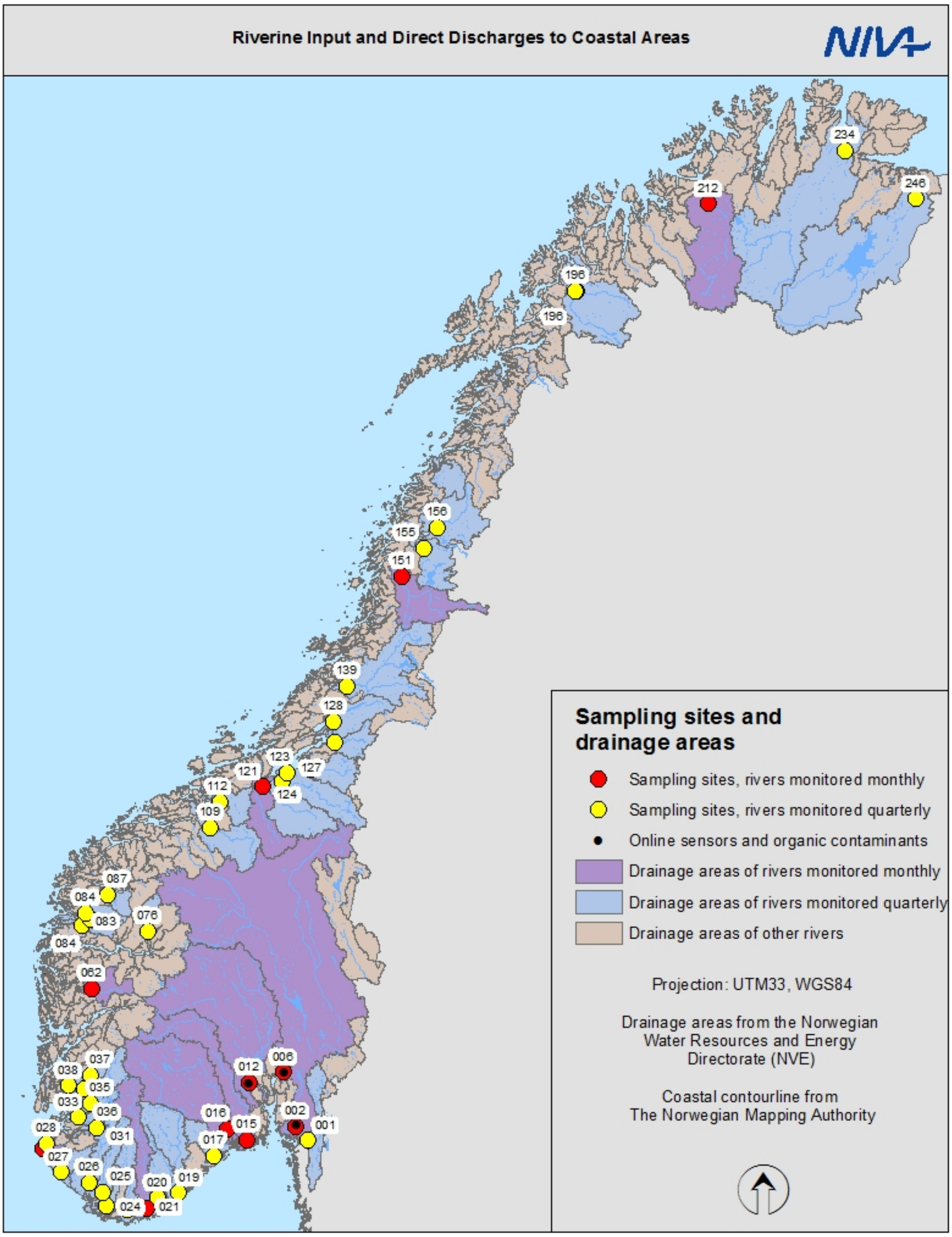

Figure 2. River sampling sites in the Norwegian RID programme. The numbers refer to the national river basin register (REGINE; www.nve.no). The river basin register system classifies the Norwegian river basins into 262 main catchment areas, of which 247 drain to coastal areas.

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 presently done each year in 11 + 36 rivers. For the 108 rivers monitored once a year before 2004, an average concentration based on former years' data is used, and 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.	In unmonitored areas, nutrient loads from diffuse runoff are estimated with the TEOTIL model. No estimates are made of loads of the other constituents.
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.	

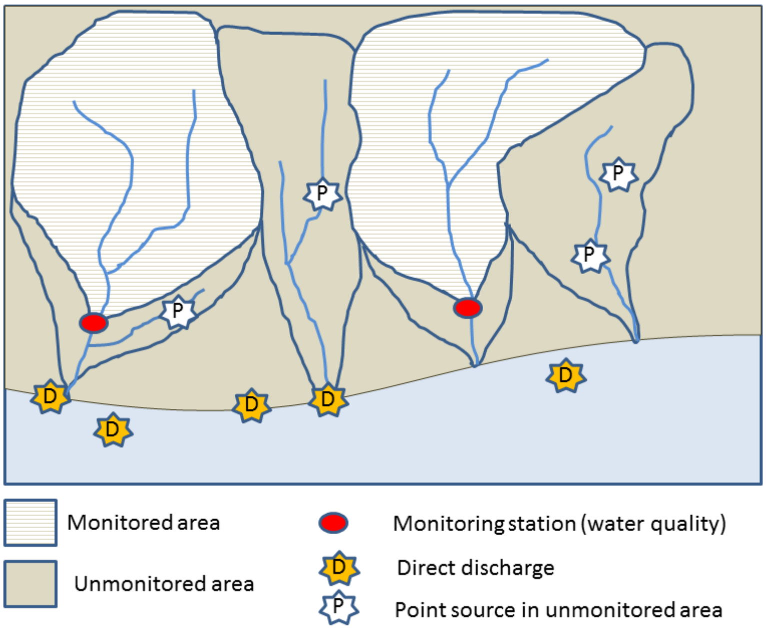

Figure 3. Illustration of RID areas, point sources and direct discharges (source: OSPAR RID Agreement 2014.04; www.ospar.org). See also Figure 8 for the Norwegian adjustments to these principles.

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.,* 2015).

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.*, 2015). Monthly sampling is done in 11 rivers, although in two of the rivers (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 the Addendum's Table 1a.

2.2.2 Chemical parameters - detection limits and analytical methods

The parameters monitored in 2015 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.

Formerly in the Norwegian RID Programme, chemical concentrations have been given as two values; i.e. upper and lower estimates; 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.

From this year's reporting onwards, only one parameter has been calculated. When the results recorded were less than the limits of quantification (LOQ) the following estimate of the concentration has been used:

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

Where A = percentage of samples below LOQ.

This procedure is in accordance with OSPAR Agreement 2014-04 (the updated RID Principles).

According to the RID Principles (http://www.ospar.org/documents?d=33689), 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 2015, orthophosphate, ammonium, 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.

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

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

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

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

For the 108[1] 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 2015 was multiplied with average concentration for the period 1990-2003.
- For metals, the modelled annual water volume in 2015 was multiplied with average concentration for the period 2000-2003 (data from earlier years were not used due to high detection limits).

Table 3. The proportion of analyses below the detection limit for all parameters included in the sampling programme in 2015. 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	284	0
Conductivity	mS/m	1	284	4
SPM	mg/l	1	283	4
TOC	mg C/l	0	284	0
TOT-P	µg P/l	2	284	7
PO_4-P	µg P/l	36	284	103
TOT-N	µg N/l	0	284	0
NO_3-N	µg N/l	2	284	5
NH_4-N	µg N/l	35	284	100
SiO_2	mg/l	0	284	0
Pb	µg/l	1	284	2
Cd	µg/l	21	284	59
Cu	µg/l	0	284	0
Zn	µg/l	4	284	11
As	µg/l	1	284	4
Hg	ng/l	75	284	214
Cr	µg/l	1	284	3
Ni	µg/l	1	284	4
Ag	µg/l	71	284	201

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[1] River Alna was monitored once a year in the period 1990-2004, but is presently monitored monthly.

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. The results presented this year focus on the actual riverine loads, without correction for water discharge.

Both the seasonal Mann-Kendall-test (Hirsch and Slack, 1984) and the partial Mann-Kendall test (Libiseller and Grimvall, 2002) have 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 explanatory variables can be included. In this report, the seasonal Mann-Kendall trends are presented, but partial Mann-Kendall tests have also been done using water discharge as explanatory variable, in order to assess the reasons for the trends. This test also includes a correction for serial correlation up to a user-defined time span; in our case a span of one year. The method also offers convenient handling of missing values.

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).

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 (2006-2015), where those differ substantially from the long-term trends. The statistical power of the applied analysis decreases when applied on shorter time-series, but the analysis may give information on recent changes.

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), suspended particulate matter (SPM), cadmium (Cd), copper (Cu), lead (Pb), zinc (Zn), and nickel (Ni). Analyses were also performed for mercury (Hg), but the analysis of Hg is affected by great analytical uncertainty, with a different analytical method used from 1999 to 2003 (Weideborg *et al.*, 2004). The same holds true for arsenic (As).

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/quantification 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 LOQ-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-LOQ values were reported in the period 1990-2003, with a general increase in frequency of below-LOQ values for some metals, SPM and total phosphorus during the period 1999-2003 (change in laboratory and therefore higher LOQs). However, this problem was reduced after 2003, due to improvements in analytical techniques.

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 from 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 contaminant loads are not estimated from unmonitored areas. Such loads are currently only estimated from three rivers, based on novel monitoring techniques, rivers Glomma, Alna and Drammenselva.

2.4 Direct discharges

The direct discharges calculated in this programme comprise effluents from point sources in the unmonitored areas and directly to the sea. 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).

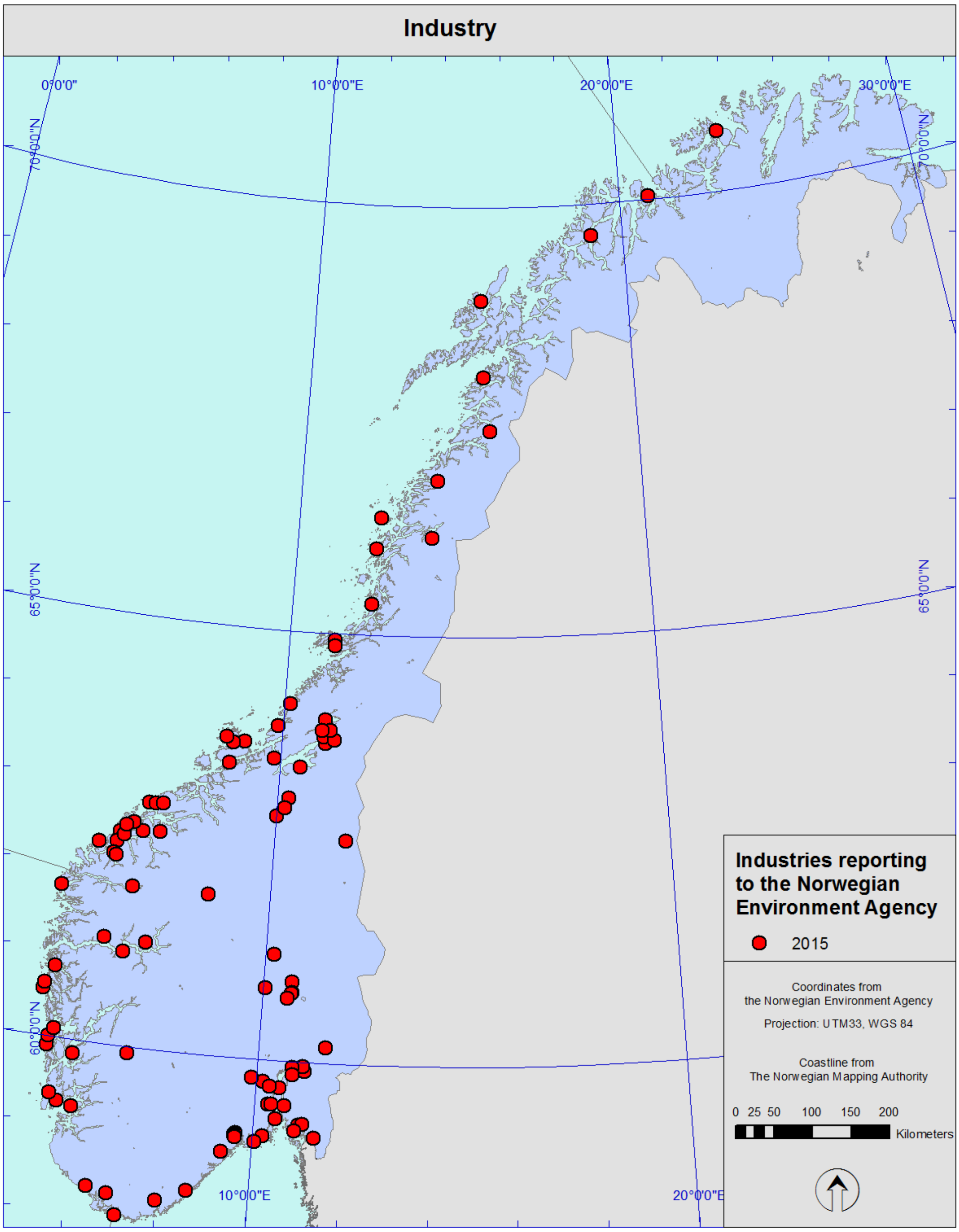

Figure 4. Industrial units reporting discharges of nitrogen and phosphorus in 2015. Data from the database 'Forurensning' (Norwegian Environment Agency).

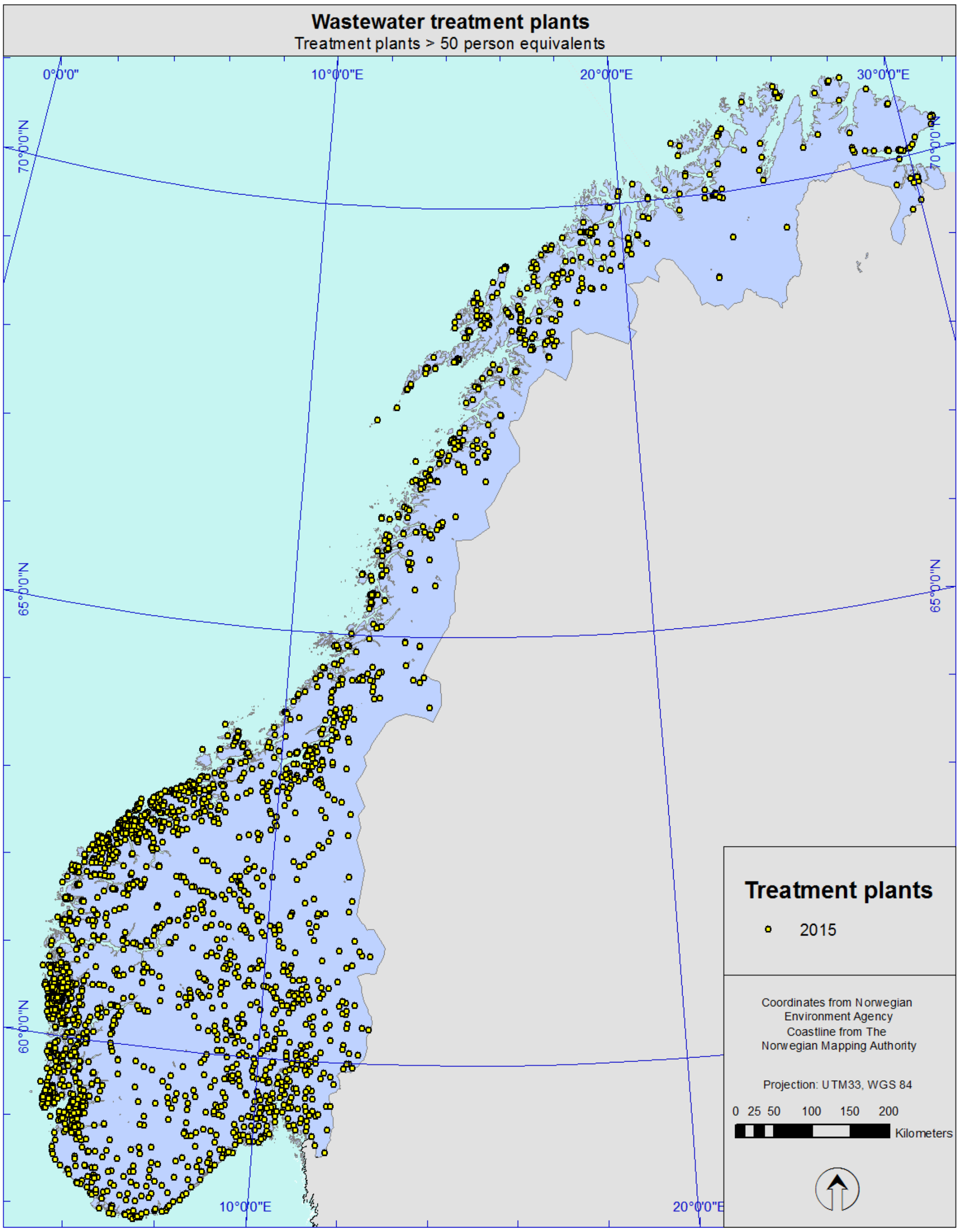

Figure 5. Sewage treatment plants > 50 p.e. in Norway in 2015. Data from SSB (Statistics Norway).

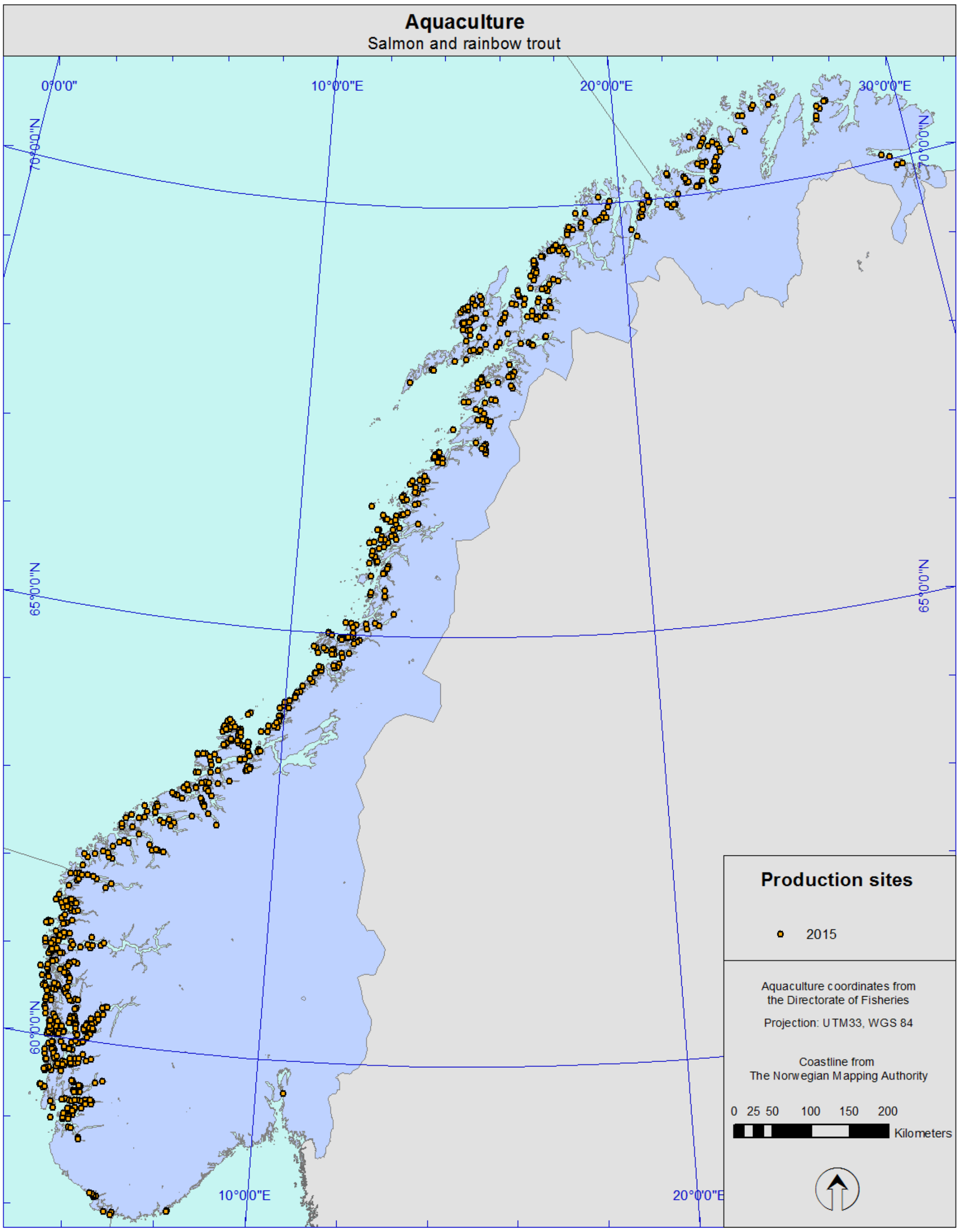

Figure 6. Fish farms for salmon and trout in Norway in 2015. Based on data from the Directorate of Fisheries.

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). In 2011, another adjustment was made, since the nutrient content in fish fodder has been reduced over the years. 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 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). The increase from 2014 to 2015 was 4%.

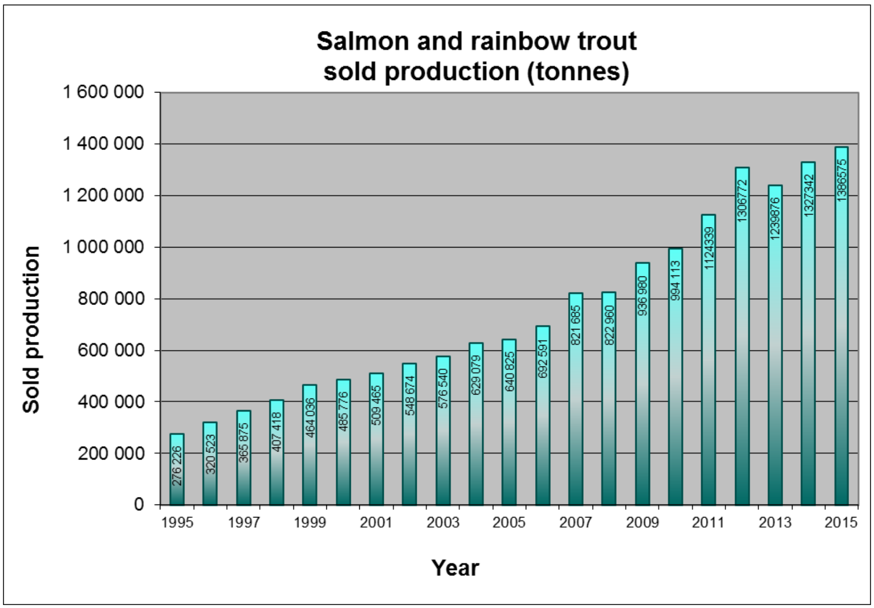

Figure 7. Quantities of sold trout and salmon for the period 1995-2015. Based on data from SSB (Statistics Norway).

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.

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 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.

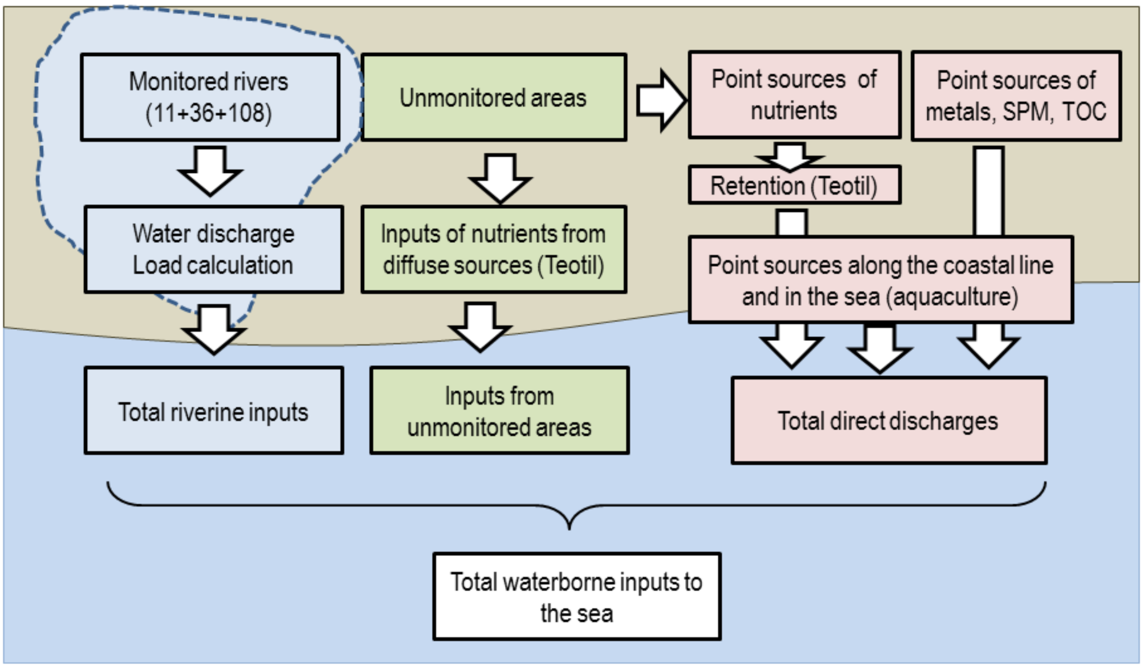

Figure 8. Overview of how total waterborne inputs to the Norwegian maritime waters are calculated. See also Figure 3.

2.6 Organic contaminants: Sampling and calculation

Organic contaminants have been monitored in rivers Alna, Glomma and Drammenselva since 2013, by a combination of passive samplers and continuous flow centrifugation. Earlier, in the period 1990-2012, only PCB and Lindane were monitored, and then by grab sampling and laboratory analyses. The monitored contaminants in 2015 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).

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:

i. *passive sampling*, for sampling of freely dissolved contaminants, and

ii. *continuous flow centrifugation* (CFC), for sampling of suspended particulate matter-associated contaminants.

Passive samplers

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 2015. 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 et al., 2002). Samplers were then kept frozen until use. For each sampling period, two samplers were deployed at each site. All three rivers were continuously monitored with passive samplers (Table 4).

Table 4. Exposure periods for silicone rubber passive samplers in 2015.

	Alna	Drammenselva	Glomma
Sampling period 9	91 d (16.01.15-17.04.15)	94 d (16.01.15-20.04.15)	122 d (16.12.14-17.04.15)
Sampling period 10	89 d (17.04.15-15.07.15)	70 d (20.04.15-29.05.15)	76 d (17.04.15-02.07.15)
Sampling period 11	92 d (15.07.15-15.10.15)	106 d (29.06.15-13.10.15)	106 d (02.07.15-16.10.15)
Sampling period 12	113 d (15.10.15-05.02.16)	122 d (13.10.15-12.02.16)	Samplers lost

Continuous flow centrifugation

Suspended particulate matter-associated contaminants were sampled using a *continuous flow centrifugation* (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 5-9 days (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 passive samplers (and for the sensor monitoring, cf. section 2.8).

Table 5. Deployment periods for 2015 for the continuous flow centrifuge

	Alna	Drammenselva	Glomma
Sampling event 1	7 d (09.01.15-16.01.15)	9 d (07.01.15-16.01.15)	7 d (09.12.14-16.12.14)
Sampling event 2	7 d (10.04.15-17.04.15)	7 d (20.04.15-27.04.15)	8 d (08.04.15-16.04.15)
Sampling event 3	5 d (10.07.15-15.07.15)	7 d (29.06.15-06.07.15)	8 d (02.07.15-10.07.15)
Sampling event 4	7 d (08.10.15-15.10.15)	7 d (06.10.15-13.10.15)	8 d (08.10.15-16.10.15)

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. Moreover, 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. The last sampling event for PFCs was based on bottle sampling rather than using SPM.

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 absolute deviations between the contaminant amounts measured in two spiked samplers analysed during RID sampler batch analyses and the reference values were on average 7.5 % (absolute deviations in the range of 1.5 to 51 %) for PAHs, 17 % (absolute deviations in the range of 0.3 to 38 %) for PCBs, 16 % (absolute deviations in the range of 0.1 to 48 %) for PBDEs, and 9.3 % (absolute deviation in the range of 1.5 to 18 %) 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.

2.6.5 Calculating riverine loads and whole water concentrations of organic constituents

Sampling rates for AlteSil™ silicone rubber passive samplers were estimated using PRC data (performance reference compounds). 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 2015, values of β_{sil} (see equation above) ranged from 2 to 128 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 1 to 51 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.

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). For River Glomma, passive samplers deployed for the final period of 2015 were lost. Data for the period 08.10.2016 to 31.12.2016 is therefore not available. Loads calculated for the period 01.01 to 08.10.2016 were corrected by upscaling to the entire year based of discharge data.

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 2015 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 in April 2013, measuring turbidity (optical sensor number 6136), pH (probe number 6561), conductivity, and temperature.

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 (cf. 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 rivers Glomma and Drammenselva, 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.

3. Results

3.1 Climate, water discharge and temperature

3.1.1 The climate in 2015; a wet and warm year

The summer of 2015 was colder than normal, but the rest of the year warmer; and this resulted in an average annual temperature that was 1.8 °C above normal (1961-1990). The year was the third warmest since the national recordings started in 1900 (Gangstø et al. 2015). The precipitation was 25 % above normal, and the year was therefore also the third wettest since 1990. High precipitation was especially significant in the southwestern parts of the country and some areas in the north, whereas the far north and the areas around Trøndelag (mid-Norway) had less precipitation than normal (Figure 9).

January-April were relatively mild months, with precipitation above normal. In May, the northern parts had higher temperatures than normal, whereas the southern parts of the country had cooler weather; and the precipitation was 75 % above normal for the entire country. June and July were colder and wetter than normal, whereas the temperature rised again in August. In September the precipitation for the country as a whole was almost normal, but it was extremely wet conditions in the south-eastern parts with more than three times more rain than normal at some stations. October was very dry, and November and December were milder than normal.

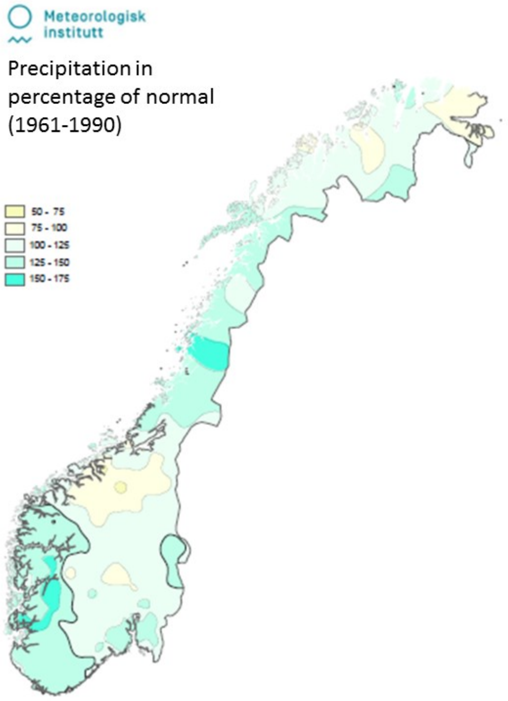

Figure 9. Precipitation in Norway in 2015 as percentage of normal values (1961-1990)[2]

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[2] http://met.no/Forskning/Publikasjoner/MET_info/2015/filestore/2015-Aaret.pdf

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 2015 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 1990-2015 are shown. See also Table 8 and 12 for data on changes in water discharge per sea area.

Table 6. Average annual water discharges (Q_a) for nine hydrological stations in the 30-year period 1971-2000 and in 2015; and results of statistical analyses of annual water discharge scaled to the RID monitoring stations (Q_s) for the period 1990-2015. NA: Not available.

River	30-year normal of Q_a (1971-2000)*	Q_a in 2015*	Difference Q_a (2015 vs. 1971-2000)	P-values for Q_s**	Maritime area
	m^3/s	m^3/s	%	p-value	
River Glomma	678	808	19	0.0059	Skagerrak
River Drammenselva	281	364	29	0.0022	
River Numedalslågen	105	131	25	0.0206	
River Skienselva	260	351	35	0.0127	
River Otra	146	187	28	0.4670	
River Orreelva	NA	6.3	NA	0.0498	
River Vosso	73	133	82	-	North Sea
River Orkla	49	47	-2	0.7409	Norwegian Sea
River Vefsna	150	211	41	0.8084	
River Alta	75	90	19	0.5816	Barents Sea
Legend:					
🟥	Significant upward (P-values < 0.05) based on statistical analyses.				
67	More than 5% increase in 2015 as compared to 1971-2000.				

* Qa is water discharge directly at the hydrological stations: 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.

** Q_s is water discharge scaled to the upstream area of the RID sampling stations, available for the period 1990-2015.

Apart from River Orkla, all rivers had higher water discharges in 2015 than the 30-year normal. Especially River Vosso had high water discharges in 2015.

The trend analysis revealed that there are statistically significant upward trends of water discharge in rivers Glomma, Drammenselva, Numedalslågen, Skienselva and Orreelva, with subsequent risk of increased loads of pollutants.

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 (e.g., River Vosso) or lowland forested areas (e.g., River Alna). Temperatures have only been monitored for two years and there are presently no Norwegian analyses of long-term data series of water temperature[3]. Hence, no discussion on trends is possible.

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	0.4	0.5	2.3	5.0	8.2	12.4	**	16.2	13.6	9.5	6.1	3.1
Alna	2.4	2.8	3.9	**	8.9	11.9	13.9	13.9	12.1	8.4	5.7	3.8
Drammenselva	1.4	1.3	2.2	4.4	7.0	11.5	**	17.2	13.6	9.4	5.8	2.9
Numedalslågen	0.3	1.5	***	6.2	9.1	14.3	17.6	16.4	12.2	7.8	3.9	1.7
Skienselva****							16.2	15.8	13.0	10.9	8.3	5.5
Otra	1.9	1.3	2.7	5.1	7.4	12.5	17.1	16.7	13.1	9.3	6.4	4.3
Orre	3.1	2.7	5.4	8.0	10.5	12.6	14.7	16.8	14.0	9.6	7.0	5.5
Vosso	1.5	1.1	1.8	3.1	5.0	6.1	7.5	9.0	9.6	8.0	6.3	3.1
Orkla*	0.7	0.7	0.9	1.5	3.5	7.6	10.9	9.8	8.7	6.6	3.7	1.2
Vefsna	0.1	0.2	0.7	2.7	4.5	6.5	9.3	11.7	10.0	5.3	2.2	0.7
Alta	2.8	3.4	1.2	0.8	2.4	5.5	10.8	12.2	10.1	5.7	1.5	0.1

* Data from NVE's sensor, based on daily average values.

** Too few data.

*** River Numedalslågen: Construction works in the river in March gave unstable recordings.

**** Skienselva: The logger disappeared (possibly stolen), new logger installed in July.

3.2 Nutrients, particles, silicate and TOC

3.2.1 Total inputs in 2015

The total nutrient inputs to Norwegian coastal waters in 2015 were estimated to about 13 300 tonnes of phosphorus and about 184 000 tonnes of nitrogen (Figure 10). Total silicate inputs

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[3] Pers. comm. Ånund Kvambekk, NVE.

were estimated to about 501 000 tonnes and total organic carbon (TOC) to about 611 000 tonnes. The input of suspended particulate matter amounted to about 860 000 tonnes (see also Addendum's Table 3).

It should be noted that the actual loads can be higher. The loads of silicate and SPM are not estimated for unmonitored areas due to lack of suitable methodologies. Furthermore, particulate matter is discharged from fish farming; and silicate is present in effluents from some types of industry, but since neither of these are reported they are not estimated in this programme. The loads of TOC from unmonitored areas only represent point sources, while diffuse discharges are likely to be higher.

An overview of the inputs of the different nitrogen and phosphorus fractions per coastal area is given in Figure 10. 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.

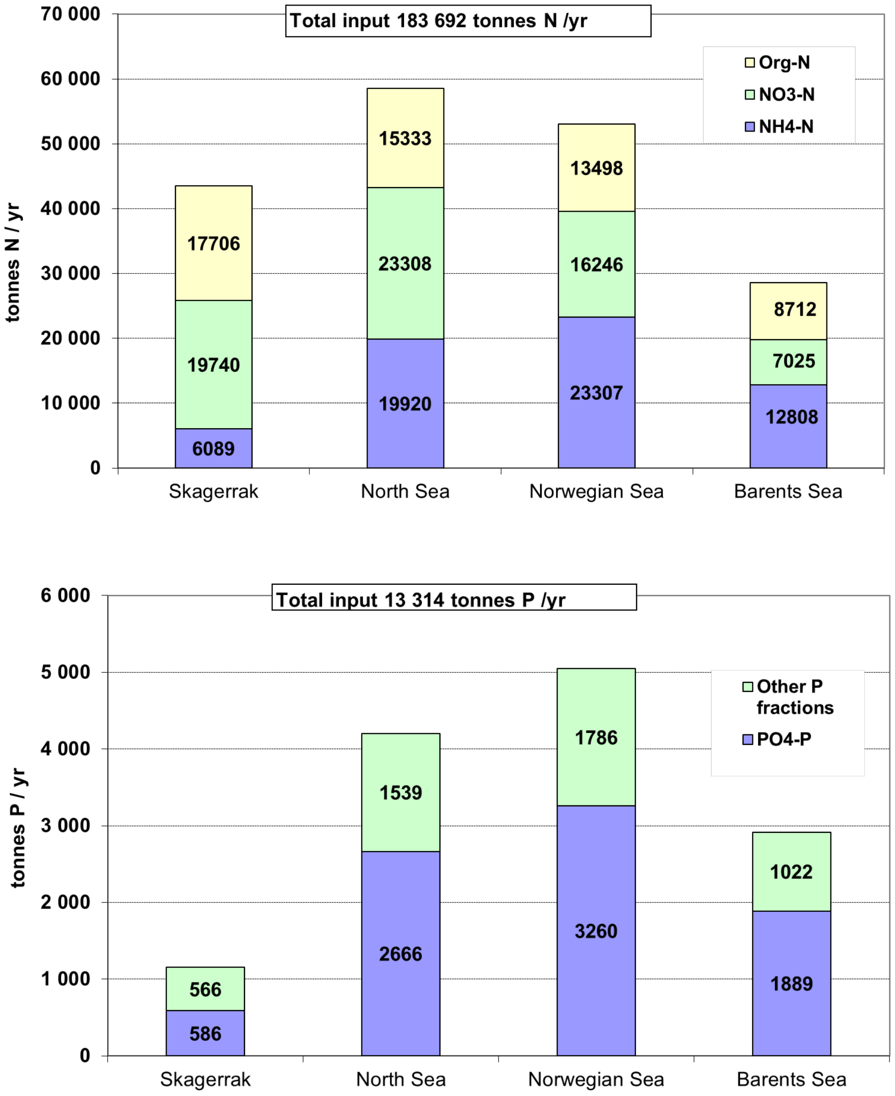

Figure 10. Total inputs to the four Norwegian maritime areas of total nitrogen (upper panel) and total phosphorus (lower panel), divided into different fractions.

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 at each station it is referred to http://vannmiljo.miljodirektoratet.no.

Table 8 shows the riverine loads of nutrients and SPM in 2015, as well as water discharges, compared to the averages for the period 1990-2014. Water discharges to all sea areas were in general higher in 2015 than in the average for the 25 previous years. Furthermore, in the Skagerrak region, all rivers had high water discharges in 2015 (Table 6), and these high flows are reflected in the increased nutrient and sediment loads in 2015 in this southernmost sea area. In the three sea regions north of Skagerrak, nitrogen loads generally increased, and suspended sediment loads decreased, as compared to the average of the 25 former years. The changes in phosphorus loads, however, varied, with little changes from the long-term average in the North Sea, a decrease in the Norwegian Sea and an increase in the Barents Sea.

Table 8. Total riverine loads (155 rivers) of total nitrogen (TN), total phosphorus (TP), suspended particulate matter (SPM), and water discharge as an average for 1990-2014 and in 2015. More than 10% change is marked with bold font and colour (red: higher; green: lower than the average)*.

Maritime area	Water discharge (m^3/s)		Nitrogen (tonnes)		Phosphorus (tonnes)		SPM (1000 tonnes)	
	Mean 1990-2014	2015	Mean 1990-2014	2015	Mean 1990-2014	2015	Mean 1990-2014	2015
Skagerrak	2443	**2708**	30439	**33725**	790	**902**	375	**465**
North Sea	3477	**4407**	13738	**15884**	285	279	104	**85**
Norwegian Sea	3657	**4128**	8883	9679	267	**195**	176	**109**
Barents Sea	2220	2343	4421	**5747**	181	**233**	83	**59**
Total Norway	11797	13587	57481	**65035**	1523	1609	738	718

* Note that these observations of changes are not the result of statistical trend analyses.

In addition to the above, statistical trend analyses of nutrients and suspended particles loads and concentrations have been carried out. The results are given in Tables 9 and 10, and further discussed 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 1990-2015, while the shorter period of 2006-2015 is referred to as ‘10-year trends’. The 10-year trends are shown in Appendix V.

The trend analyses this year have been performed on total loads, without water discharge as a co-variate.

Table 9. Long-term trends in annual water discharge (Q_s is water discharge scaled to the RID stations); nutrient and particle loads in nine Norwegian rivers 1990- 2015. The table shows the p-values.

LOADS 1990-2015

River	Q_s	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	🟥 0.0059	🟩 0.0002	0.1176	🟥 0.0077	🟥 0.0404	0.3213	0.4148
Drammenselva	🟥 0.0022	🟩 0.0325	🟥 0.0325	🟥 0.0022	🟥 0.0019	🟥 0.0009	🟥 0.0022
Numedalslågen	🟥 0.0206	0.3213	0.2254	🟥 0.0012	🟥 0.0077	🟥 0.0099	🟥 0.0184
Skienselva	🟥 0.0127	🟢 0.0552	🟩 0.0010	0.9824	0.1519	0.1283	0.3002
Otra	0.4670	0.2090	🟩 0.0001	0.9473	0.2254	0.5518	0.2801
Orreelva	🟥 0.0498	0.5227	0.9473	0.2801	0.2254	0.1649	0.2090
Orkla	0.7409	🟩 0.0016	0.7745	0.8774	0.8428	0.2254	0.7409
Vefsna	0.8084	🟩 0.0000	🟩 0.0000	🟩 0.0051	🟩 0.0184	🟩 0.0019	🟢 0.0673
Altaelva	0.5816	0.1176	0.1176	0.6754	0.2090	0.1649	0.8084

🟩	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 in nine Norwegian main rivers 1990- 2015. The table shows the p-values.

CONCENTRATIONS 1990-2015

River	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	🟩 0.0002	0.2695	0.2360	🟥 0.0066	0.2507	🟧 0.0768
Drammenselva	🟩 0.0052	0.3699	0.1013	0.2792	0.1753	0.6624
Numedalslågen	0.2258	0.2693	🟥 0.0068	🟧 0.0674	🟥 0.0049	🟧 0.0657
Skienselva	🟩 0.0051	🟩 0.0000	🟩 0.0000	0.4909	0.7773	0.6418
Otra	🟢 0.0914	🟩 0.0001	🟢 0.0925	🟩 0.0281	🟩 0.0035	🟩 0.0005
Orreelva	0.4716	🟩 0.0253	0.1706	🟧 0.0806	0.4046	0.3767
Orkla	🟩 0.0010	0.8982	🟥 0.0328	0.2902	🟢 0.0649	🟩 0.0227
Vefsna	🟩 0.0000	🟩 0.0000	🟩 0.0037	🟩 0.0013	🟩 0.0195	🟩 0.0080
Altaelva	🟩 0.0166	0.1540	0.3031	🟩 0.0459	0.2453	0.1793

🟩	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

There was a statistically significant upward trend in the **total nitrogen load** in rivers Glomma, Drammenselva and Numedalslågen. However, the water discharge in the three rivers also increased significantly in the same period. For rivers Glomma and Drammenselva, the upward trend in nitrogen load disappeared when water discharge was used as a covariate. In River Numedalslågen, the increase in water discharge could not fully explain the increase in nitrogen loads. A statistically significant downward trend in total nitrogen loads was found in River Vefsna, which was not related to water discharge.

Of the nine rivers, rivers Numedalslågen and Otra were the only ones with a statistically significant upward trend in **total nitrogen concentration**. Statistically significant downward trends in total nitrogen concentrations were detected in rivers Skienselva and Vefsna.

Statistically significant long-term downward trends in **nitrate loads** were detected in rivers Skienselva, Otra and Vefsna. These trends could not be explained by changes in water discharge. However, in River Drammenselva, the statistically significant long-term upward trend in nitrate loads coincided with a statistically significant increase in water discharge. A statistically significant downward trend in **nitrate concentrations** was detected in rivers Skienselva, Otra, Orreelva and Vefsna.

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. Statistically significant long-term downward trends in **ammonium loads** were detected in rivers Glomma, Drammenselva, Orkla and Vefsna. In addition, a nearly statistical significant downward trend was detected in River Skienselva. These trends could not be explained by changes in water discharge. Statistically significant downward trends for **ammonium concentrations** were detected in rivers Glomma, Drammenselva, Skienselva, Orkla, Vefsna and Altaelva. 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.

When the last 10 years (2006-2015) of data were examined, no statistically significant trends were found in **total nitrogen load** (Appendix V). There was, however, a statistically significant upward trend in the **ammonium load** in River Numedalslågen which could not be explained by water discharge. There was also a statistically significant upward trend the last ten years in **total nitrogen concentrations** in rivers Orkla and Altaelva. Statistically significant downward trends in **nitrate concentration** were found in rivers Drammenselva and Skienselva, and a statistically significant upward trend in nitrate concentration in River Altaelva. Ten years is a relatively short time for detecting trends, and results should be used with caution.

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

In River Numedalslågen, an upward trend for total nitrogen concentrations and loads was detected, corresponding to an increase of 23 tonnes per year (Figure 11). However, no statistically significant trend was found in nitrate or ammonium concentrations or loads. The increase is relatively modest when compared to the total loads of nitrogen in this river. The highest loads of both total nitrogen, nitrate and ammonia were detected in the year 2000 when there was a major flood in the region.

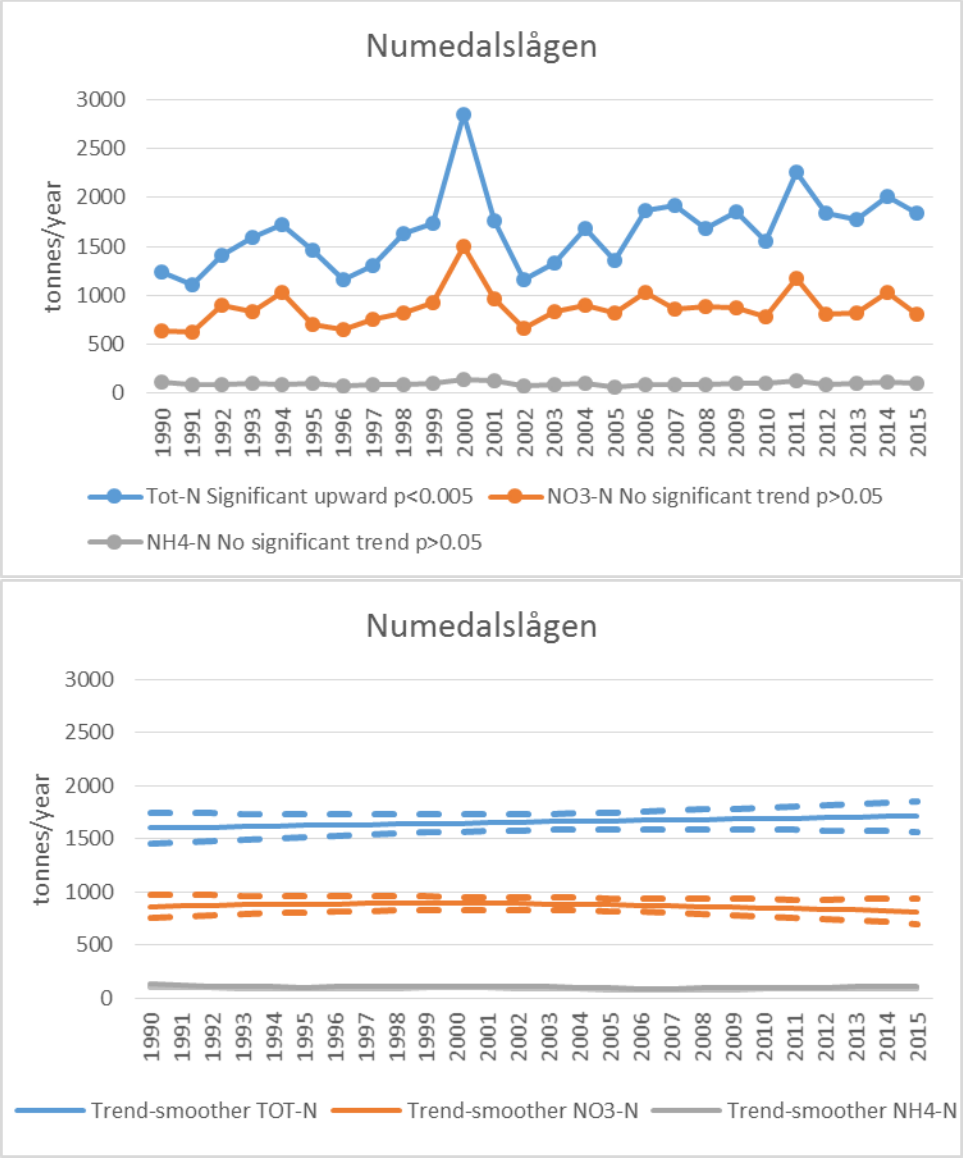

Figure 11. Annual riverine loads in River Numedalslågen of total nitrogen, nitrate nitrogen and ammonium in 1990-2015. The upper panel shows the estimated loads while the lower panel shows the flow-normalised trend-smoother including a 95% confidence interval.

In River Drammenselva, an upward trend for total nitrogen and nitrate loads was detected, corresponding to an increase of 80 tonnes of total nitrogen and 30 tonnes of nitrate per year (Figure 12). However, when water discharge was taken into account, the trends disappeared; which indicates that water discharge is the main contributor to the increase in load. Over the same period the load and concentration of ammonia decreased significantly, regardless of water discharge.

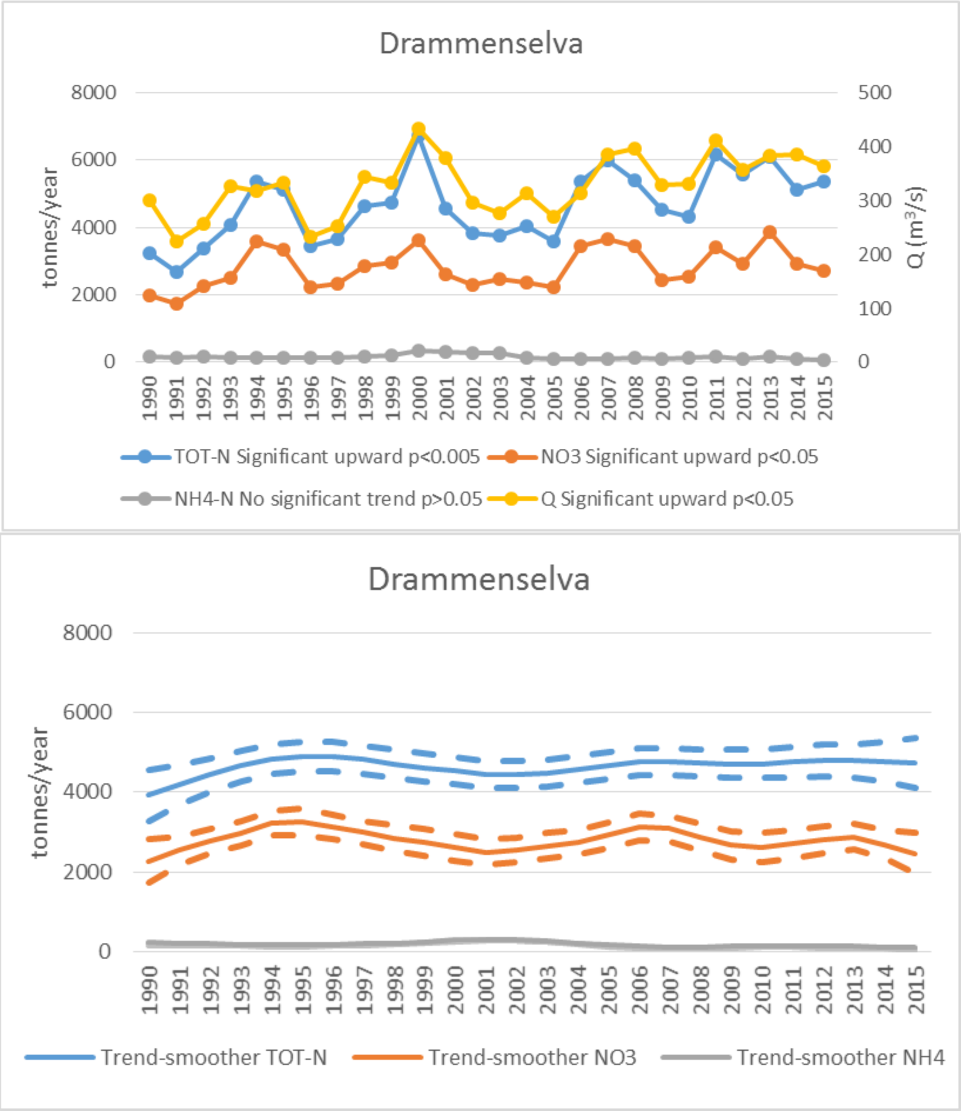

Figure 12. Annual riverine loads in River Drammenselva of total nitrogen, nitrate nitrogen and ammonium in 1990-2015. The upper panel shows the estimated loads and the water discharge each year; while the lower panel shows the flow-normalised trend-smoother including a 95% confidence interval.

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). As reported in earlier years (Skarbøvik et al., 2015), 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 Chapter 3.3.2), however the reason for these changes has not been identified.

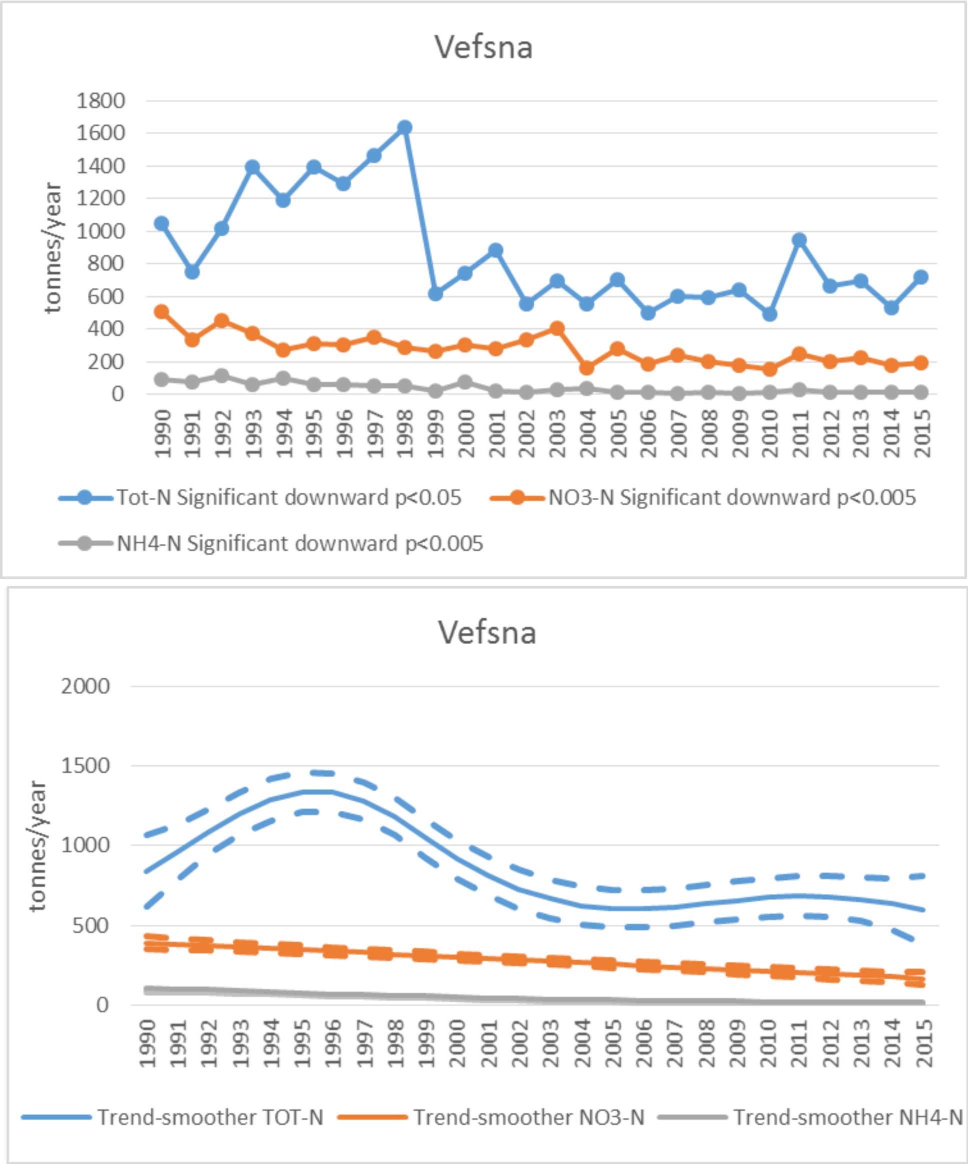

Figure 13. Annual riverine loads in Vefsna of total nitrogen, nitrate nitrogen and ammonium in 1990-2015. Upper panel shows the estimated loads while the lower panel shows the flow-normalised trend-smoother including a 95% confidence interval (for Tot-N).

Phosphorus

Statistically significant long-term downward trends in total phosphorus loads were detected in River Vefsna, where the pattern looked remarkably similar as for nitrogen (see Figure 13).

Statistically significant long-term upward trends in total phosphorus and ortophosphate loads were detected in rivers Drammenselva and Numedalslågen (see figure 14 for the latter river). However, when water discharge was taken into account both trends became statistically non-significant (statistical test not shown), indicating that water discharge was the main reason for this trend. The same was true for the upward trend in orthophosphate loads in Glomma. Total phosphorus load are closely related to particulate matter, and in both River Drammenselva and River Numedalslågen the transport of particulate matter has increased. The increases in water discharge in the Skagerrak rivers will most probably have resulted in increased erosion in agricultural lands, with subsequent increases in particulate matter and phosphorus runoff.

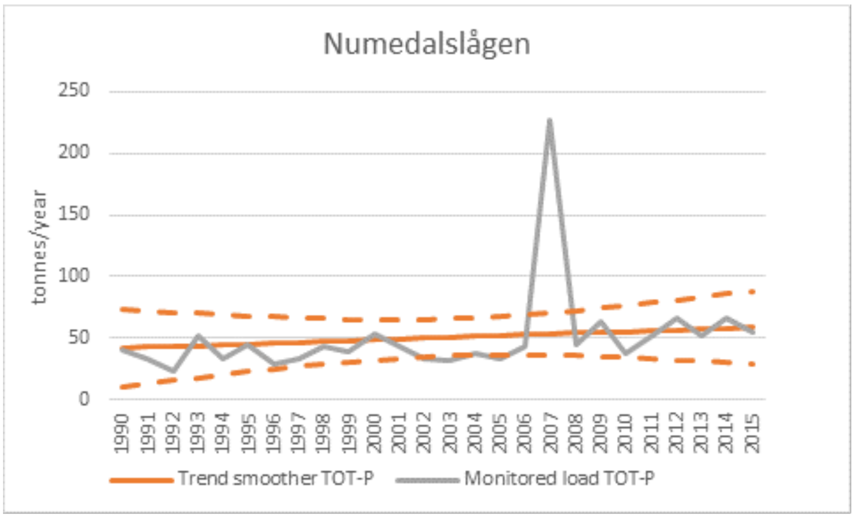

Figure 14. Annual riverine loads of total phosphorus in River Numedalslågen in 1990-2015 and the flow-normalised trend-smoother, including a 95% confidence interval.

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. The sensor data for turbidity compared to turbidity in monthly grab samples (Figure 35) illustrate this issue.

For concentrations, two rivers showed statistically significant downward trends in total phosphorous (rivers Otra and Vefsna; see illustration of River Vefsna in Figure 15), whereas an upward trend was found in River Numedalslågen (Table 10). In terms of orthophosphate concentrations, rivers Otra, Vefsna and Altaelva had a statistically significant downward trend while River Glomma had a statistically significant upward trend.

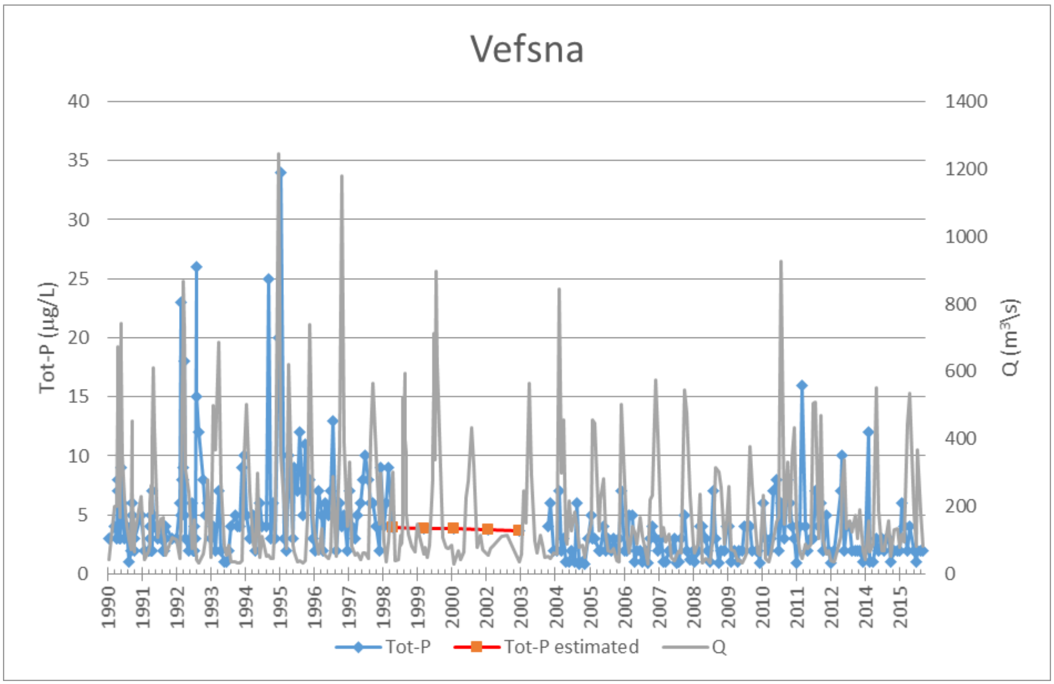

Figure 15. Water discharge and monthly riverine concentrations of total phosphorus (Tot-P) in River Vefsna; 1990-2015.

Examining only the last 10 years of data (Appendix V), there was a statistically significant downward trend in total phosphorus load in River Orreelva, when water discharge was included as a covariate. However, when looking at the entire period, the last 10 years showed higher total phosphorous loads than the first 15 year period (see Appendix V). There was also a statistically significant upward trend in total phosphorous concentration in River Altaelva, regardless if water discharge was taken into account or not (Figure 16). Here, it should be noted that the average phosphorus concentration the last ten years was actually lower than the previous 15 years, but as shown in Figure 16 there have been some high peaks in the last ten years. Some of these coincide with high water discharges. Since phosphorus is adsorbed to particles, this substance tends to vary significantly over time, and the ‘trend’ may therefore merely be caused by an arbitrary chance to sample at high water discharge and concentration levels in the last years.

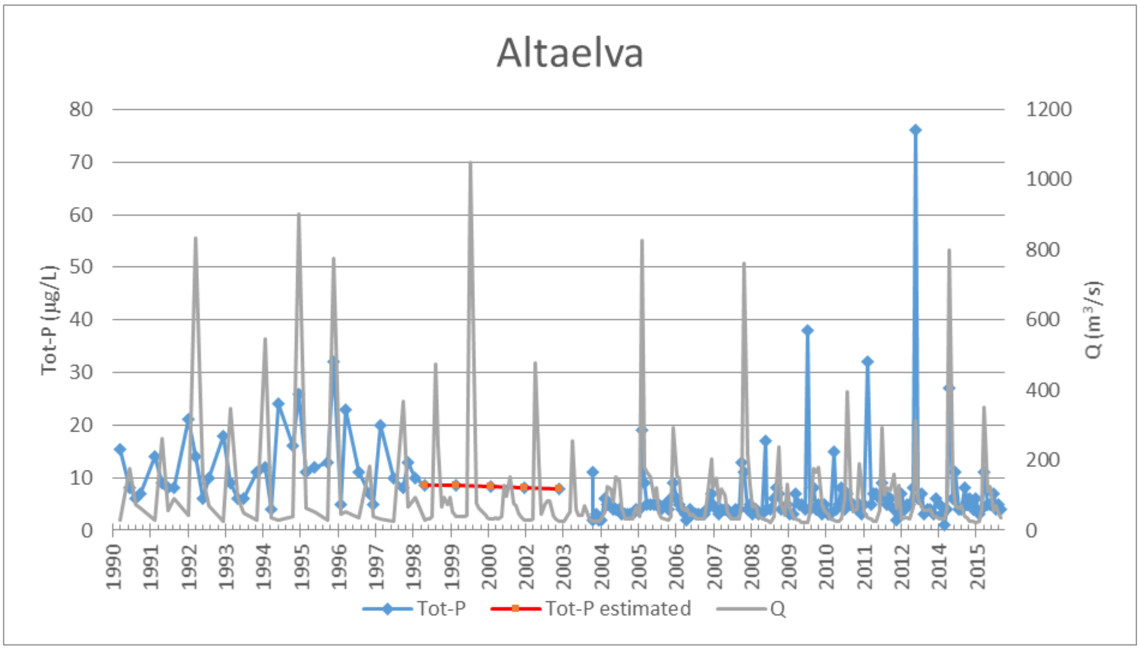

Figure 16. Water discharge (Q) and monthly riverine concentrations of total phosphorus in River Altaelva; 1990-2015.

Particulate matter

Statistically significant upward trends in particulate matter loads were detected in two of the nine rivers (rivers Drammenselva and Numedalslågen; Figure 17 llustrates this for River Drammenselva). But as for TOT-P, these trends can be 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 particulate matter. In River Drammenselva the year 2012 had especially high loads of particulate matter, almost 7 times more than the average year. The reason is one sample in august with high concentrations of both SPM, TOT-P, PO4, TOT-N, NO3-N, Pb, Cr and Zn. Because the sampling frequency is relatively low (monthly), this one sample has a large effect on the annual load. There is major inter-annual variability in loads of suspended particulate matter (SPM), and monthly sampling will generally give high uncertainties. More frequent sampling would have reduced this uncertainty.

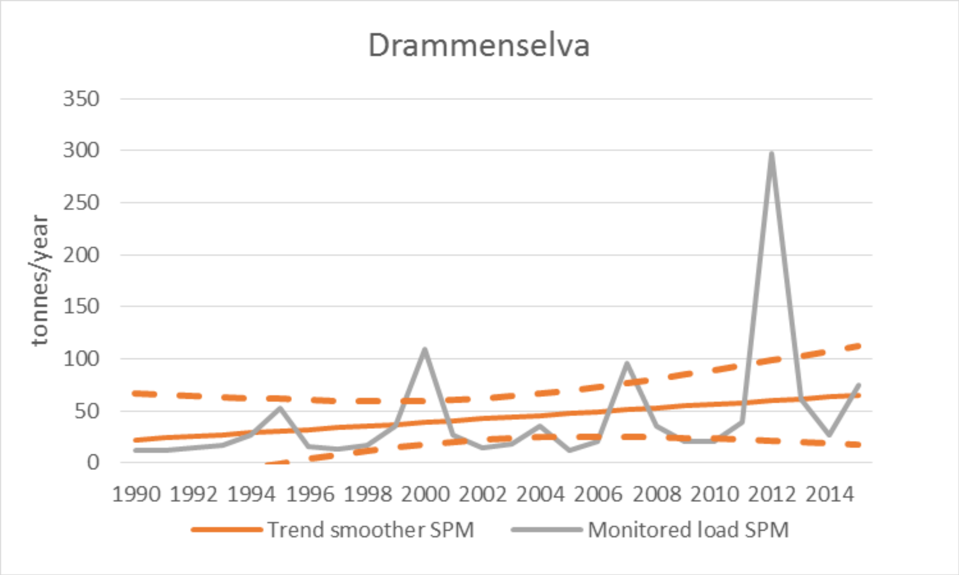

Figure 17. *Riverine loads of suspended particulate matter (SPM) in River Drammenselva 1990-2015. The grey line is the monitored load while the orange line is the flow-normalised trend-smoother, including the corresponding 95% confidence interval (dotted lines).*

Three out of nine rivers showed statistically significant downward trends in particulate matter concentrations (rivers Otra, Vefsna, and Orkla; illustrated for Otra in Figure 18). A possible explanation for the high peaks in River Otra in 1994-95 is the installation of an industrial pipeline on the river bed from Vennesla to Kristiansand. When the last 10 years were examined, there was no statistically significant trend found in concentrations or loads of particulate matter.

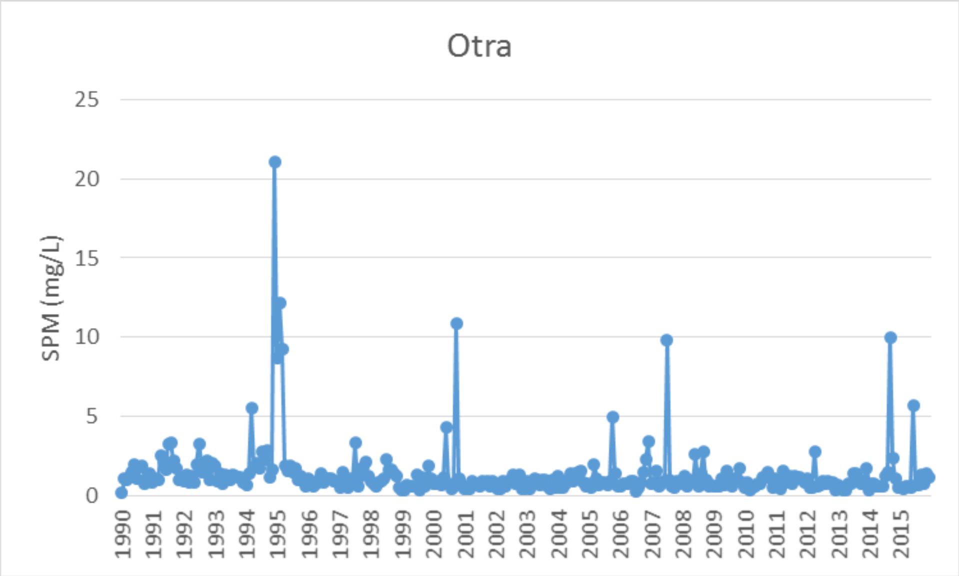

Figure 18. Monthly concentrations of suspended particulate matter (SPM) in River Otra 1990-2015.

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 19) and phosphorus (Figure 20).

Especially for the three northern coastal areas, fish farming contributed 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 in 2015, cf. Table 11. The proportion has not changed much the latter years (cf. Skarbøvik et al. 2014 and 2015).

Table 11. Proportion of discharges of different nutrient fractions from fish farming in 2015.

	NH_4-N	NO_3-N	PO_4-P	TN	TP
% of total inputs	74	9	79	31	73
% of direct discharges	79	89	90	78	89

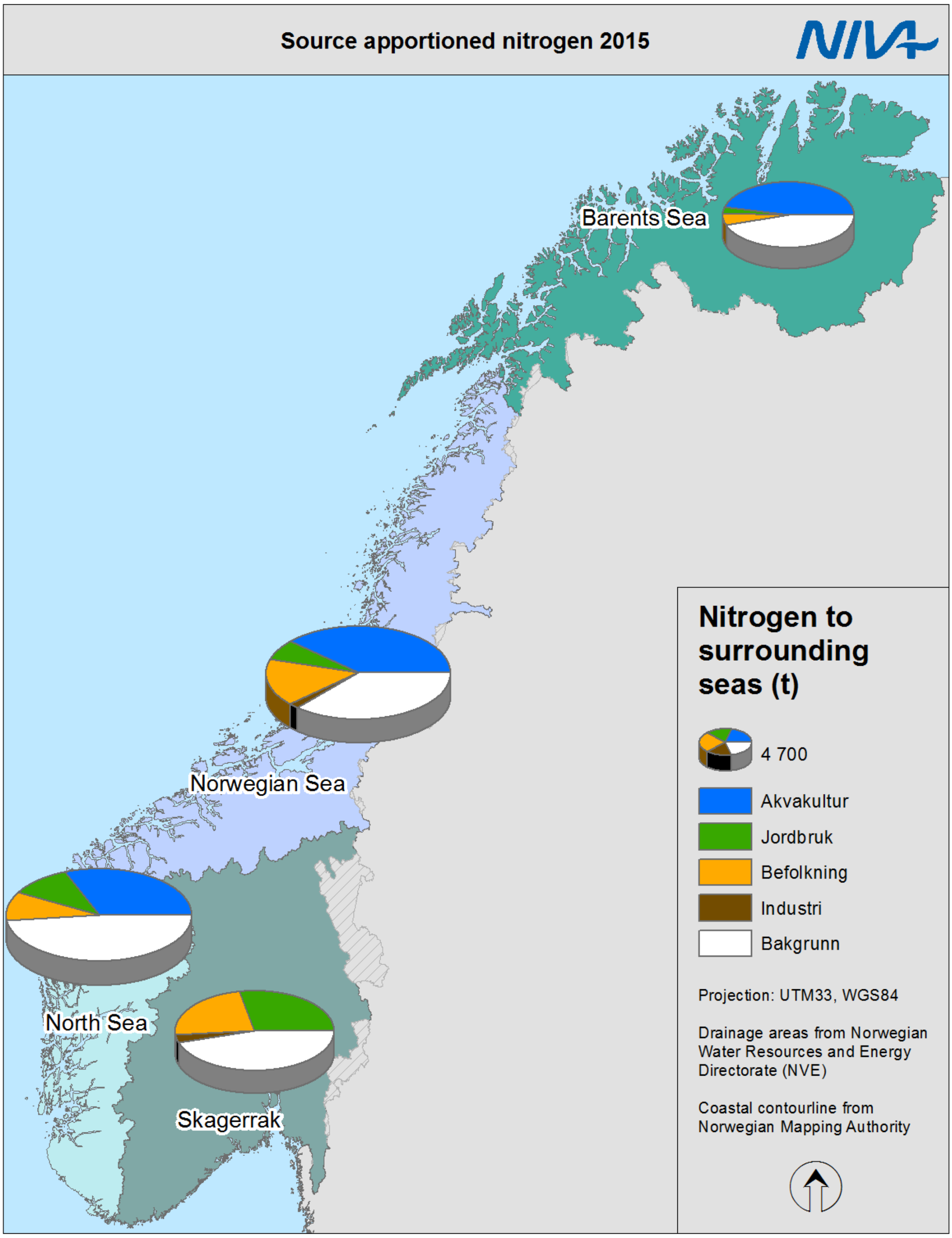

Figure 19. Source apportionment of nitrogen in 2015. Based on the TEOTIL model.

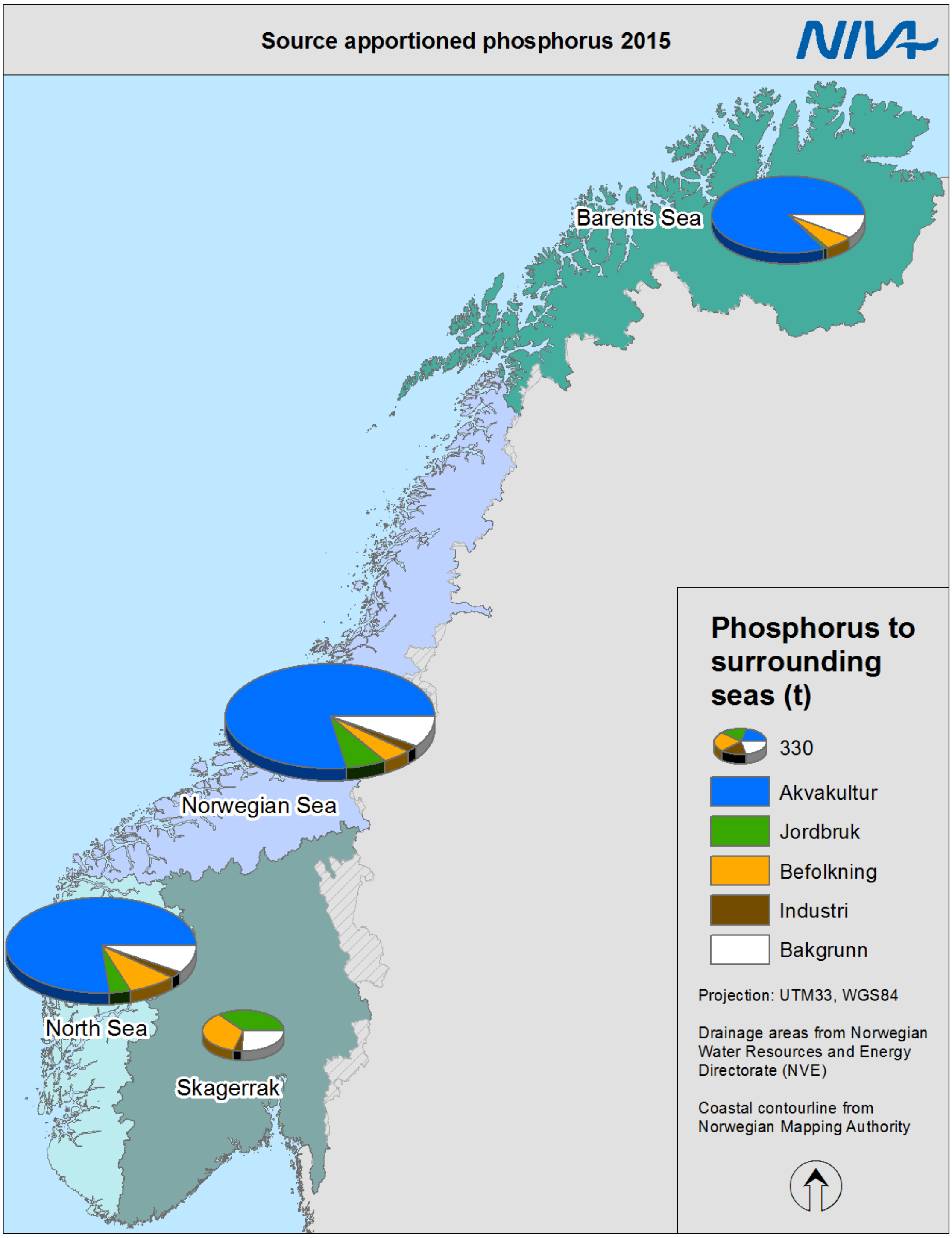

Figure 20. Source apportionment of phosphorus in 2015. Based on the TEOTIL model.

3.2.4 Direct discharges of nutrients and particles

In 2015, the total inputs from direct discharges of total nitrogen amounted to about 73 000 tonnes, of total phosphorus about 11 000 tonnes and of suspended particulate matter about 858 660 tonnes. There were few changes in nutrient inputs since last year, and the majority of the nutrients derive from fish farming along the coastline. The total input of sediments increased substantially, due to one, single effluent from a company refining fish waste into new products.

3.3 Metals

3.3.1 Total inputs of metals in 2015

In 2015, the inputs of metals to the Norwegian coastal areas were estimated to 199 kg of mercury, 2.3 tonnes of cadmium, 35 tonnes of arsenic, 46 tonnes of lead, 54 tonnes of chromium, 200 tonnes of nickel, 725 tonnes of zinc and 1185 tonnes of copper.

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 algal 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 have been made 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 21 shows the total discharges. A considerably higher quantity is registered from 2013 onwards, compared to previous years. The number of new product declarations in the official register increased from 2012 to 2013.

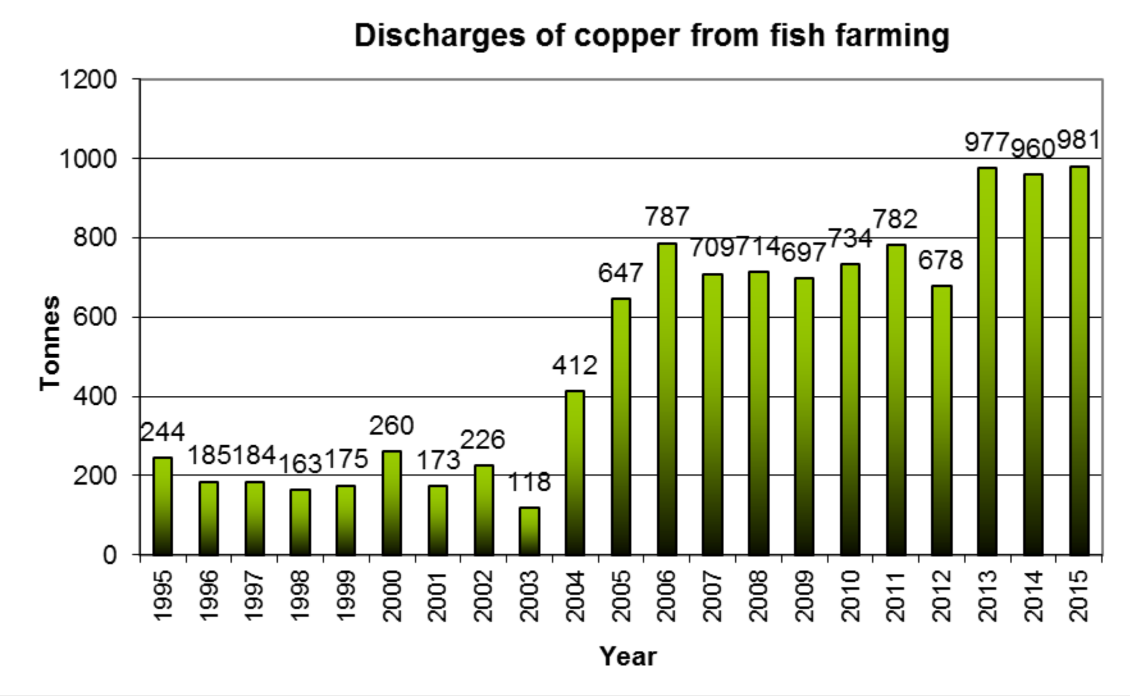

Figure 21. Discharge of copper from fish farming, deriving from antifouling impregnation of net cages, in the period 1995-2015. The data are based on total losses, including cages above the RID rivers' sampling locations (minor contribution). It should be noted that the basis for these data is uncertain.

3.3.2 Trends in metal loads and concentrations

Charts of long-term (1990-2015) 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 2015 as compared to an average for the 25 year period 1990-2014. Water discharge in these periods are also included.

For all maritime regions combined, the riverine inputs of arsenic, lead, cobber, and zinc were relatively similar in 2015 as in the 25 year average (less than 20% change). Loads of cadmium, chromium and mercury were about 40% of the 25 year average. It must be noted that this decline can partly be due to changes in analytical methods and quantification limits since 1990. The only metal that was markedly higher in 2015 compared to the 25-year average was nickel.

When studying the separate maritime areas, it becomes clear that the increase in nickel is located in the northernmost maritime area (Barents Sea); this was due to one sample in May in River Pasvikelva in 2015, with high concentrations of both nickel and copper. Furthermore, zinc concentrations remain high in River Glomma, although they have declined since the high concentrations and loads in 2012 (Figure 25). The reason that zinc seems stable on a country-wide basis is that the loads to the northernmost seas were reduced, bringing the total load down to an average level. Lower loads of cadmium, chromium and mercury in 2015 as compared to the former 25 years seem to be evenly distributed throughout Norway, with a few exceptions.

Table 12. Total riverine loads (155 rivers) of eight metals as an average for 1990-2014 and in 2015; and water discharge in m^3/s. In kg for Hg, in tonnes for the rest. Changes at og higher than 10 % marked with bold font and colour (red: higher; green: lower than the average).*

Metal	Skagerrak		North Sea		Norwegian Sea		Barents Sea		Total Norway	
	Mean	2015	Mean	2015	Mean	2015	Mean	2015	Mean	2015
Arsenic	12	**14**	5	**6**	6	**5**	4	**5**	27	**30**
Lead	28	**25**	12	12	8	**3**	4	4	52	**44**
Cadmium	1.9	**1.1**	0.8	**0.6**	0.7	**0.2**	0.3	0.3	3.7	**2.2**
Cobber	92	**77**	29	27	66	**30**	34	**64**	221	**198**
Zinc	384	**442**	146	150	157	**71**	45	**33**	732	696
Nickel	42	41	16	**19**	31	**25**	50	**106**	139	**191**
Chromium	21	**15**	13	**6**	34	**21**	24	**10**	92	**52**
Mercury (kg)	181	**71**	44	45	52	**41**	31	**21**	308	**178**
Water discharge (m^3/s)	2443	**2708**	3477	4407	3657	**4128**	2220	2343	11797	**13587**

* Note that these observations of changes are not the result of statistical trend analyses.

For more in-depth analysis of these changes, 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), and will be described in detail below, but in short, the analyses indicate:

- Out of the 45 trend tests carried out (5 metals and 9 rivers), 22 showed statistically significant downward trends in long-term **loads** while one test (copper in River Drammenselva) showed an increased trend. 36 tests showed statistically significant downward trends in **concentrations**, while there was no detectable upward trend for any metal **concentrations**.
- When a shorter, 10 year, period was assessed, no significant downward trends in **loads** were detected. One statistically significant upward trend was detected (zinc in River Glomma). Statistically significant short-term upward trends in **concentrations** were detected for nickel in River Vefsna and for zinc in River Glomma, whereas seven trend tests showed statistically significant short-term downward trends. As was commented above, there were high values of nickel and copper in River Pasvikelva in 2015, but statistical trend analyses are not performed on the data from this river since only four samples are collected each year.
- It should be emphasised that no firm conclusions can be drawn about the long-term downward changes for nickel, cadmium, and to some extent also lead. This is due to changed detection or quantification 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 do not necessarily mean that there have been ‘real’ changes.

Table 13. Long-term trends for metal loads in nine Norwegian main rivers 1990-2015. The table shows the p-values. Q_s: Water discharge scaled to he RID sampling station.

LOADS metals. 1990-2015

River	Q_s	Cd	Cu	Ni	Pb	Zn
Glomma	0.0059	0.0498	0.9473	0.7913	0.0673	0.5518
Drammenselva	0.0022	0.0092	0.0291	0.1649	0.2254	0.1934
Numedalslågen	0.0206	0.0448	0.0498	0.4404	0.1519	0.0983
Skienselva	0.0127	0.0004	0.0260	0.0232	0.7409	0.3432
Otra	0.4670	0.0578	0.2254	0.0025	0.3900	0.0498
Orreelva	0.0498	0.3923	0.2170	0.0706	0.1932	0.3662
Orkla	0.7409	0.0031	0.0059	0.0184	0.0045	0.0002
Vefsna	0.8084	0.0007	0.0005	0.0003	0.0001	0.0002
Altaelva	0.5816	0.0028	0.0012	0.0163	0.4535	0.1649

🟩 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 in nine Norwegian main rivers 1990-2015. The table shows the p-values.

CONCENTRATIONS metals. 1990-2015

River	Cd	Cu	Ni	Pb	Zn
Glomma	0.1103	0.0048	0.0032	0.0068	0.2929
Drammenselva	0.0002	0.0108	0.0051	0.0743	0.0029
Numedalslågen	0.0038	0.0019	0.0767	0.0131	0.0018
Skienselva	0.0000	0.0005	0.0043	0.0218	0.0000
Otra	0.1902	0.3987	0.0007	0.0267	0.0000
Orreelva	0.7381	0.0663	0.0004	0.0234	0.1826
Orkla	0.0038	0.0002	0.0013	0.0000	0.0000
Vefsna	0.0017	0.0000	0.0020	0.0001	0.0000
Altaelva	0.0387	0.0003	0.0381	0.0248	0.0005

🟩 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 LOQ for copper has not changed much over the monitoring period 1990-2015, and there are few samples below LOQ.

Statistically significant downward trends in the copper riverine loads and concentrations were detected in five rivers: Rivers Skienselva, Numedalslågen, Orkla, Vefsna and Altaelva (Table 13). Neither of the trends could be explained by changes in the water discharge. In addition, a statistically significant downward trend in the Cu concentrations in rivers Glomma and Drammenselva was detected and a nearly statistical significant upward trend was detected in River Orreelva (Table 14). The upward trend in River Orreelva was not related to water discharge. A statistically significant upward trend in Cu loads was found in River Drammenselva. However, when water discharge was included as a covariate a slight non-significant downward trend was detected (Figure 22).

The downward trend per year in rivers Skienselva, Numedalslågen, Orkla, Vefsna and Altaelva was between 0.1 and 0.5 tonnes per year. The largest reduction (0.5 tonnes per year) was in River Orkla (Figure 23). 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 (1999-2015) the loads dropped to 2-5 tonnes.

The statistically significant downward trends in rivers Skienselva, Numedalslågen, Orkla, Vefsna and Altaelva varied between 0.1 and 0.5 tonnes per year. The largest reduction (0.5 tonnes per year) has been in River Orkla (Figure 23). River Vefsna shows a sharp decline after 1999 (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 (1999-2015) the loads dropped to 2-5 tonnes.

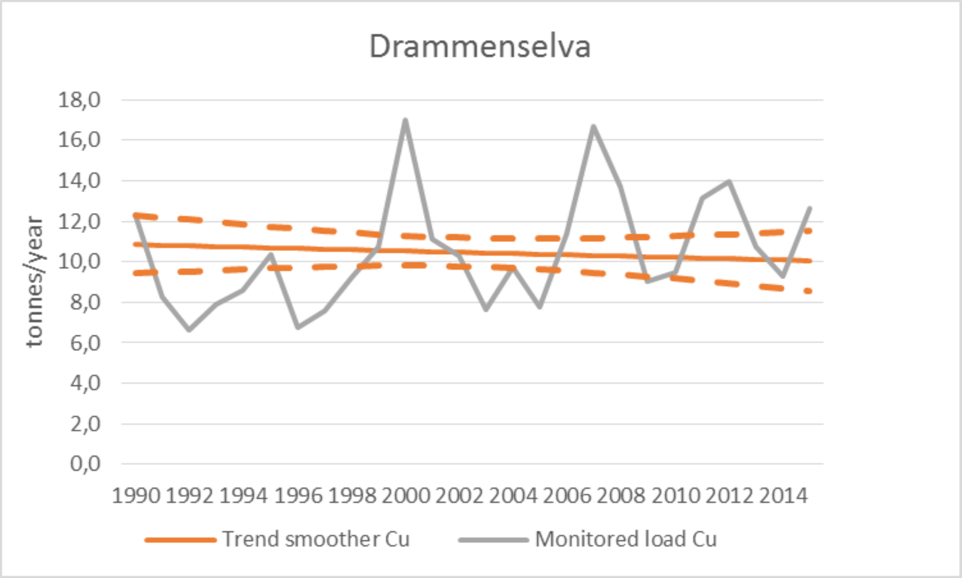

Figure 22. Annual riverine loads of copper in River Drammenselva, 1990-2015. The grey line is the monitored load while the orange line is the flow-normalised, smoothed trend-smoother, including the corresponding 95% confidence interval (dotted lines).

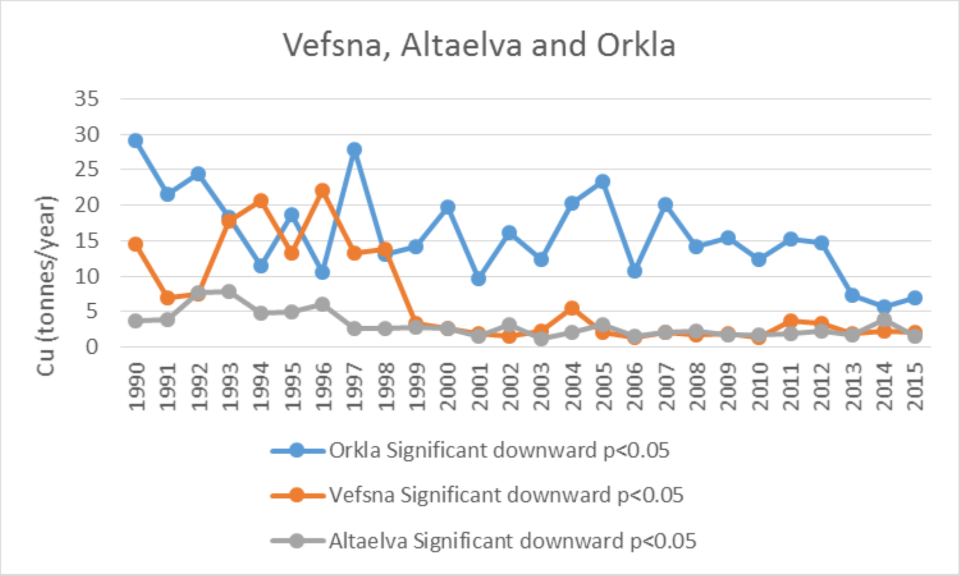

Figure 23. Annual riverine loads of copper in rivers Vefsna, Altaelva, and Orkla, 1990-2015.

Lead (Pb)

Statistically significant downward trends in lead riverine loads were detected in two rivers; rivers Orkla and Vefsna (Tables 13 and 14). Statistically significant downward trends in concentrations were detected in all rivers except River Drammenselva, where there was a nearly statistically significant downward trend. However, the inter-annual variability and downward trends in inputs of lead can be due to changes in LOQ. Table 15 shows that the LOQ for lead has changed by a factor of 100 during the monitoring period (1990-2015). This means that the interpretation of especially downward trends in lead loads should be done with great caution. These concerns related to LOQ will not affect the trends for the last 10 years, since the LOQ has not changed in this period. In this short-term period, a statistically significant downward trend in lead concentration was detected in River Orkla (Figure 24). This trend corresponds to the long term trend in load and concentrations in this river, and the chart demonstrates clearly that there have been less high peaks the last 10 years than the previous 15. The high peaks are not affected by changes in LOQ.

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

Year	1990	1991	1992 -1998	1999	2000	2001	2002-2003	**2004-2015**
LOQ	**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 quantification limit may have been given in the wrong unit.

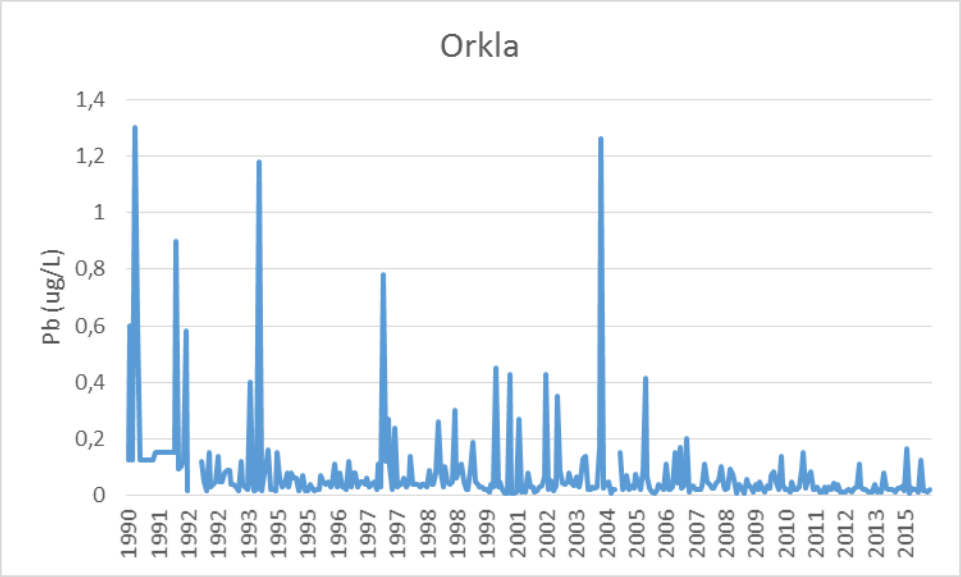

Figure 24. Monthly concentrations of lead (Pb) in River Orkla 1990-2015.

Zinc (Zn)

The LOQ for zinc has not changed much over the monitoring period 1990-2015. Statistically significant downward trends in zinc riverine **loads** were detected in three rivers; rivers Otra, Orkla, and Vefsna (Tables 13 and 14). Zinc **concentrations** have decreased (statistically significant) in all but two rivers; rivers Glomma and Orreelva.

When the last ten years was examined, a statistically upward trend for both concentrations and loads were found in River Glomma. The average load of zinc in the period 1990–2010 was 127 tonnes per year, but increased to 410 tonnes per year in the period 2011-2015 (Figure 25). The reason for these increased loads the latter years is not yet known, but there seems to be a peak in 2012 and a reduction thereafter. On the other hand, analyses of the last ten years show a statistically significant downward trend for zinc concentrations in River Drammenselva.

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).

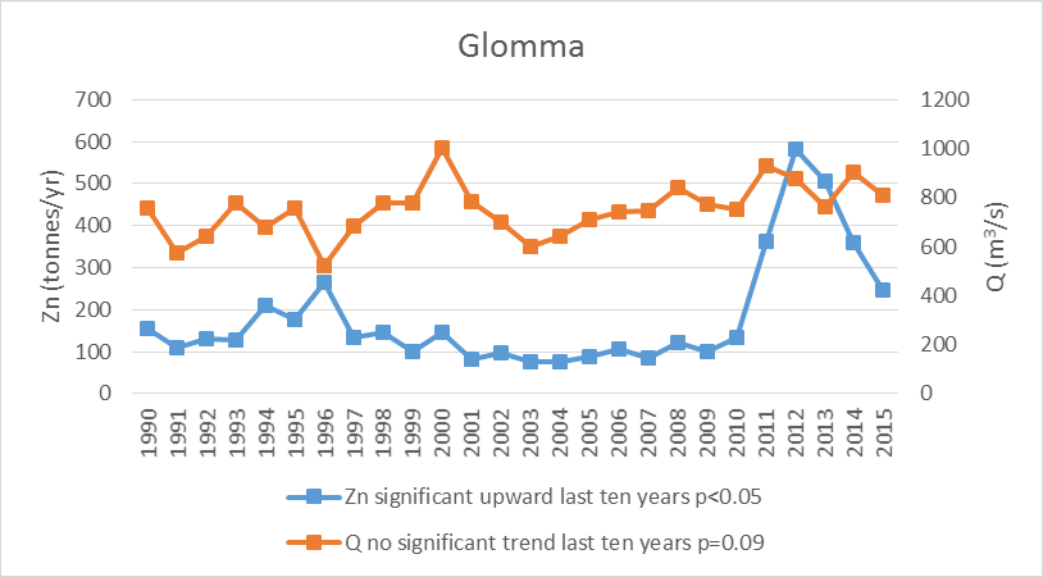

Figure 25. Annual riverine loads of zinc and water discharge in River Glomma, 1990-2015.

Cadmium (Cd)

Statistically significant downward trends in cadmium riverine loads were detected in seven out of nine rivers (Tables 13 and 14). Statistically significant downward trends in cadmium riverine concentrations were detected in six out of nine rivers (Tables 13 and 14). However, more than 25% of the cadmium observations in the nine main rivers were below LOQ, hence weakening the length of the available time series and the associated statistical power. Table 16 shows that the LOQs have changed substantially over the course of the monitoring period; e.g., from 100 ng/l in 1990 and down to 5 ng/l in 2004-2015. This means that the interpretation of especially downward trends in cadmium loads should be done with great caution. These LOQ-related concerns do not affect the 10 years' trends; as the LOQ 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 (LOQ) for Cadmium (ng/l).

Year	1990	1991	**2004-2015**
LOQ	**100**	**10**	**5**

Nickel (Ni)

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

Mercury (Hg)

As mentioned in the beginning of this section, there is a high analytical uncertainty related to mercury, and there have been changes in analytical methods during the period 1999-2003. The LOQs have not changed much over the course of the monitoring period, but around 60 % of the observations in the nine rivers were below LOQ. 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

The threshold levels used for this assessment are given in Table 17, along with the six out of 47 rivers for which the annual mean concentrations exceeded the threshold levels. 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).

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		1.6				
Alna	2.4	5.1	20.8			
Orreelva		1.6				
Orkla		5.2				
Saudaelva			22.2			
Pasvikelva		5.32		10.76		

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

Copper concentrations exceeded the threshold level in five rivers (Table 17). Concentrations of lead only exceeded the threshold in River Alna, and nickel only in River Pasvikelva. Zinc concentrations exceeded the threshold in rivers Alna and Saudaelva. Many more rivers had *single* values exceeding the threshold, and in Addendum Table 1, these values have been marked with red; whereas single values close to the threshold have been marked with pink colour. No rivers exceeded the threshold value for mercury.

For cadmium (Cd), the EQS threshold values depend on alkalinity, but alkalinity is not available through the RID programme. The lowest threshold is in Class 1, where waters with < 40 mg $CaCO_3$/l have a threshold value of 0.08 µg Cd/l (EU, 2013). One single sample in River Alna had an average Cd concentration of 0.09 µg/l, which is just above the EQS for Class 1; otherwise Cd concentrations in all samples were below this threshold value.

3.4 Organic contaminants

3.4.1 Organic contaminant concentrations

Polycyclic aromatic hydrocarbons (PAHs)

Most PAHs were found above LODs both in the freely dissolved form and associated with suspended particulate matter in 2015 (Addendum Table 1b). In River Alna, concentrations in 2015 were lowest for dibenzo[ah]anthracene (4 pg/l) and highest for pyrene with a concentration of 10.4 ng/l. This is a similar range of concentrations as those measured in 2013 and 2014. Across the entire range of PAHs, freely dissolved concentrations in the period 2013-2015 vary by a factor of 3-40 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 for naphthalene for example) while sampling was integrative throughout the exposure period for the more hydrophobic PAHs (e.g. for benzo[ghi]perylene). For 2015, PAH concentrations in River Drammenselva were below the limit of detection (LOD) (< 5 pg/l) for dibenzo[ah]anthracene and up to 8.5 ng/l for naphthalene. Freely dissolved concentrations for 2015 were a little more variable than those in River Alna and varied by up to one order of magnitude. PAH concentrations in River Glomma were slightly lower than those estimated for River Drammenselva in 2015. Concentrations ranged from below LOD for dibenzo[ah]anthracene (< 6 pg/l) to 6.8 ng/l for phenanthrene. 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 2013-2015.

Freely dissolved concentrations measured in 2013-2015 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., 2013; Allan and Ranneklev, 2011).

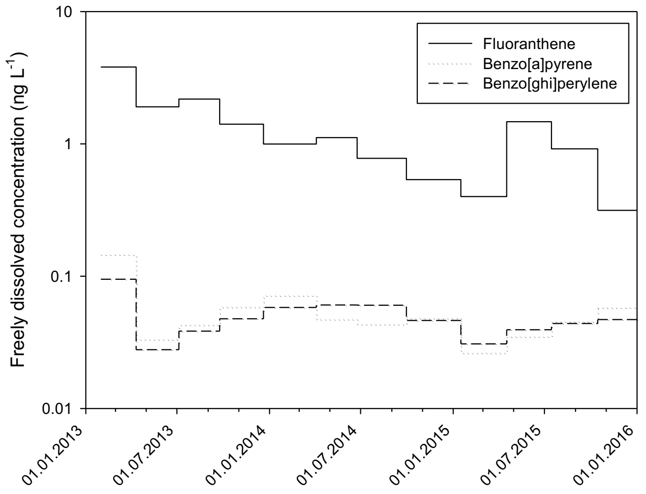

Figure 26. Freely dissolved concentrations of selected PAHs (fluoranthene, benzo[a]pyrene and benzo[ghi]perylene) in River Alna for the period from January 2013 to January 2016. Note the log scale of the y-axis.

SPM concentrations of PAHs in River Alna were lowest for acenaphthene (11-25 ng/g dw) and highest for pyrene (740-1000 ng/g dw) (Addendum Table 1b). SPM concentrations of PAHs in River Drammenselva were as low as 2.9 ng/g for acenaphthene and highest for fluoranthene (307 ng/g dw). PAHs concentrations in SPM from River Glomma were clearly lower than for the other two rivers. As for 2013 and 2014, SPM concentrations of PAHs were lowest for River Glomma. Naphthalene and acenaphthalene were almost not detected in the four SPM samples collected in 2015. Anthracene and dibenzo[ah]anthracene were only detected on two occasions with LODs in the range 2-10 ng/g dw.

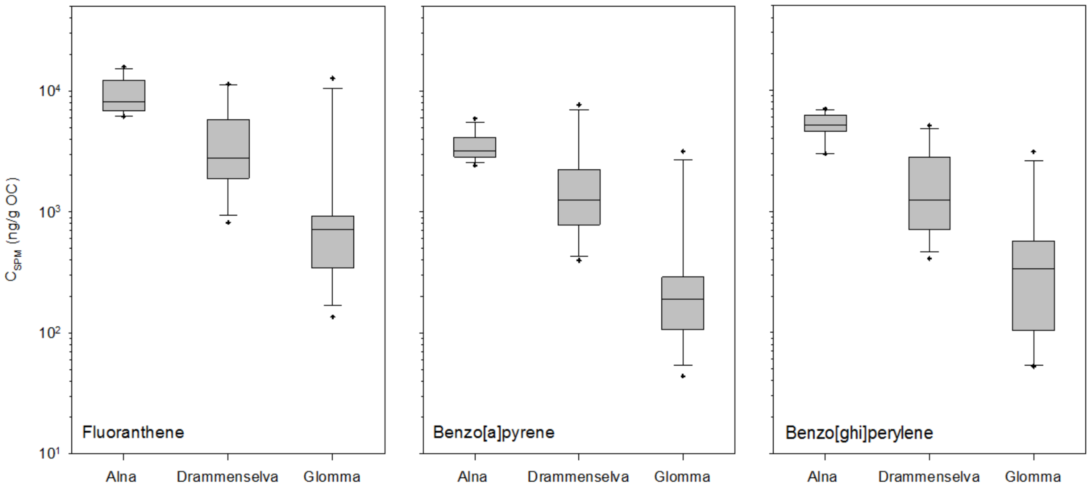

Figure 27. Organic carbon-normalised suspended particulate matter concentrations of selected PAHs (fluoranthene, benzo[a]pyrene and benzo[ghi]perylene) in rivers Alna, Drammenselva and Glomma for the period from January 2013 to January 2016. Note: the log scale of the y-axis.

Boxplots of organic carbon-normalised SPM concentrations of fluoranthene, benzo[a]pyrene and benzo[ghi]perylene for the period 2013-2015 (n=12) are presented in Figure 27. On an organic carbon content basis, concentrations remained clearly higher for River Alna than for rivers Drammenselva and Glomma. In addition, the variability in SPM concentrations for these three compounds was clearly lower for River Alna than for the two other rivers. For rivers Drammenselva and Glomma, there was more spread of the data including sampling events/samples that clearly deviated from the rest of the data (identified as outliers in the box plots). The highest SPM concentrations were at the same level as those found for River Alna (Figure 27). It would be interesting to know whether these results are the consequence of some sampling or analytical artefacts or whether these higher concentrations are the result of emissions to these rivers of particulate matter with higher PAH concentrations. It would also be useful to know how regular this is. It would be useful in the future to characterise the organic carbon present in suspended particulate matter in more detail. Higher PAH concentrations could be associated with emission of refractory carbon such as black carbon, so a deeper characterisation of organic carbon with method such as Rock-Eval could be interesting.

Polychlorinated biphenyls (PCBs)

PCBs in the freely dissolved phase were consistently detected in River Alna in 2015 and found more sparsely above LODs in the two other rivers. When PCBs were below LODs, these ranged from 2 to 20 pg/l. As for previous years (2013 and 2014), 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 0.6 pg/l for CB180 to 50 pg/l for CB28. The variation in concentrations was a factor of 1 to 4 for most congeners (see Figure 28).

An example of variation in PCB congener concentration in River Alna is given in Figure 28 for the period 2013-2015. As for previous years (2013 and 2014), PCB concentrations in River Drammenselva were a little lower than those in River Alna. PCB concentrations in River Drammenselva reached a maximum of 34 pg/l for CB28 in 2015 compared with 41 pg/l in 2014. Congeners 101, 118, 153 and 180 were below LOD for three passive sampler exposures out of four. As for previous years, PCB concentrations in River Glomma were slightly lower than those found in River Drammenselva. Depending on the congener, concentrations varied by a factor of 1-3 over the year. CB congeners 101, 118, 138, and 180 were often below LOD (< 1-6 pg/l). Freely dissolved PCB concentrations obtained for River Alna in the period 2013-2015 were very similar to those from 2012 (Allan et al., 2013).

As in 2013 and 2014, PCB congeners in the particulate matter phase were only detected in samples from River Alna. Due to changes in the programme, only two SPM samples from the two other rivers were analysed for PCBs. Concentrations were in the range <2-6.2 ng/g dw in 2015 in River Alna. Concentrations were below LOD in rivers Drammenselva and Glomma (< 0.5-1 ng/g dw) in the two sets of SPM samples analysed for each of the rivers.

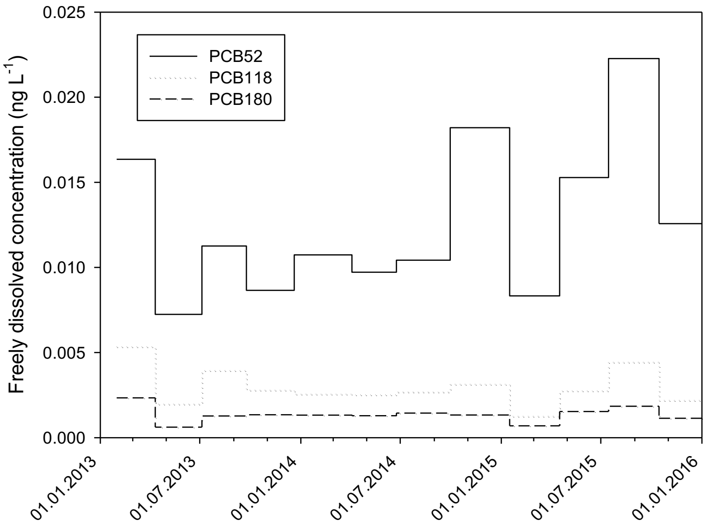

Figure 28. Freely dissolved concentrations of selected PCB congeners (52, 118 and 180) in River Alna for the period from January 2013 to January 2016.

Polybrominated diphenyl ethers (PBDEs)

PBDE concentrations in the three rivers ranged from below limits of detection below pg/l level up to 15 pg/l for BDE47 in River Drammenselva. The congeners that were mostly detected and quantified were BDE47, 99, 100, 153 and 154. Concentrations of BDE100, 153, 154, 126, 183 and 196 were mostly below LOD in all three rivers. Concentrations of PBDEs above LOD in River Alna were lowest for BDE99 (0.8-1.2 pg/l) and slightly higher for BDE47 with concentrations of 0.8-1.5 pg/l. Estimated PBDE concentrations were slightly higher in rivers Drammenselva and Glomma than in River Alna. Concentrations of BDE47 in rivers Drammenselva and Glomma were in the range 1-15 pg/l. Concentrations for BDE congener 99 were in the range <0.8-3 pg/l and below LOD for congener 100/153/154. As an example, variations in BDE47 concentrations in all three rivers over the period January 2013 to January 2015 can be found in Figure 29. PBDE concentrations in the dissolved phase in River Alna in 2015 were in a similar range to data published in 2013 (Allan et al., 2013). The concentration of freely dissolved BDE47 in River Drammenselva was 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 0.13-11 ng/g dw in SPM from River Alna. In River Drammenselva, only congeners 47, 99 and 153 were found above LOD on some occasions (range of concentration: 0.16-0.48 ng/g dw). In River Glomma, PBDEs were mostly below LOD with LODs between 0.1 and 0.3 ng/g dw. BDEs 47, 99, 100 and 153 were sporadically detected in River Glomma in the concentration range 0.13-6 ng/g dw SPM.

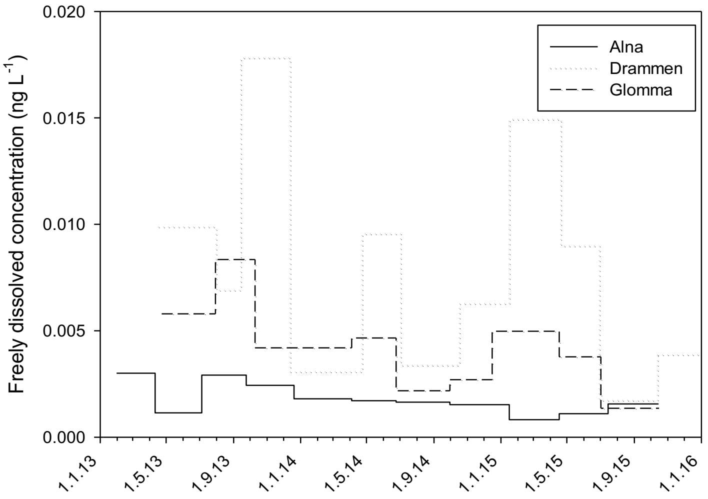

Figure 29. Freely dissolved concentrations of PBDE 47 in rivers Alna, Drammenselva and Glomma for the period from January 2013 to January 2016.

Concentrations of BDE209 in the freely dissolved form are likely very low owing to its high hydrophobicity. Freely dissolved concentrations for BDE209 for 2015 were in the range 0.6-2.4, < 5-32 and < 0.7-7 pg/l in rivers Alna, Drammenselva and Glomma, respectively. BDE209 was consistently detected in all suspended particulate matter samples from all three rivers. SPM concentrations of BDE209 in River Alna in 2015 were generally similar to those measured previous years and in the range 42 to 61 ng/g dw. This range was similar to bed sediment concentrations measured in 2008 along the River Alna bed sediments (Ranneklev et al., 2009), and was generally higher than SPM concentrations in rivers Drammenselva (ranging from 2.6 to 14.7 ng/g dw) and Glomma (1 to 9.6 ng/g dw). On an organic carbon basis, BDE209 concentrations were also clearly higher for River Alna (Figure 30). The boxplot in Figure 30 also shows that organic carbon-normalised concentrations for BDE209 in River Alna SPM were surprisingly consistent.

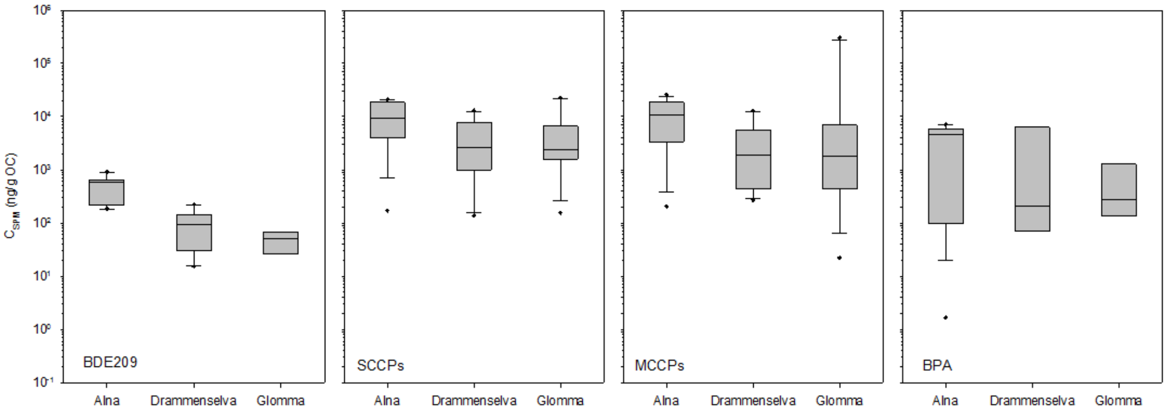

Figure 30. Organic carbon (OC) normalised suspended particulate matter concentrations of selected BDE209, PFOS, S/MCCPs and BPA in rivers Alna, Drammenselva and Glomma for the period from January 2013 to January 2016. Note the log scale of the y-axis.

Hexabromocyclododecane (HBCDD)

In 2015, HBCDD isomers were most often detected in passive samplers exposed in River Alna with concentration estimates in the range 0.4-14 pg/l, which is a similar range to previous years. In 2015 the alpha isomer of HBCDD was found above LOD in River Drammenselva at concentrations in the range 2-15 ng/l. The alpha isomer of HBCDD was measured consistently in River Glomma with concentrations between 2.3 and 7.2 pg/l.

The alpha isomer of HBCDD was detected in SPM samples from River Alna at concentrations of 8.8 to 23.3 ng/g dw. The beta and gamma isomers were sporadically found at concentrations in the range 2.6-6.8 ng/g dw. All three isomers were mostly below LODs in SPM samples of the two remaining rivers with LOD between 0.5 and 2 ng/g dw. Alpha and gamma HBCDD were measured above LOD on one occasion in River Drammenselva at concentrations of 0.7 and 0.6 ng/g dw SPM respectively.

Short and medium chain chlorinated paraffins (S/MCCPs)

Suspended particulate matter concentrations for SCCPs measured in 2015 were higher in River Alna than in the other two rivers and generally higher than in 2013. Boxplots of organic carbon-normalised SPM concentrations shown in Figure 30 also show that S/MCCP concentrations over the period 2013-2015 were slightly higher for River Alna than for rivers Drammenselva and Glomma. However, these boxplots also show that concentrations were relatively variable with the presence of “outliers”. 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 651 ng/g dw which is a similar range as that obtained in 2013 and 2014. For comparison, measurements of BPA in bed sediments in River Alna in 2008 were between 0.4 and 47 ng/g dw (Ranneklev et al., 2009). In 2015, BPA concentrations in River Drammenselva SPM were above limits of detection with concentrations in the range 0.5-21 ng/g dw. In River Glomma, SPM concentrations were lower than those measured in River Drammenselva (1-8 ng/g dw). In Figure 30, boxplots of organic carbon-normalised SPM concentrations of BPA (above LOD) for data from the 2013-2015 period show that these are very variable and can span two orders of magnitude. Data from 2015 for River Alna tend to contribute to the median value being close to the 75 percentile on the boxplot shown in Figure 30. Concentrations in the hundreds of ng/g dw may indicate a source of BPA along River Alna.

Tetrabromobisphenol A (TBBPA)

TBBPA was only measured above LODs in some SPM samples from all rivers in 2015. TBBPA was more consistently detected in previous years. Concentrations were in the range < 1-9.5 ng/g dw in River Alna. This range was wider for River Drammenselva where TBBPA concentration varied from the LOD (1 ng/g dw) to a concentration of 156 ng/g dw. The concentration range in River Glomma was < 2-38 ng/g dw.

Perfluorochemicals (PFCs)

For PFC, the first three samples analysed were suspended particulate matter while the final samples were bottle samples. Perfluorooctanesulfonic acid (PFOS) was the only perfluoro chemical consistently detected and measured in River Alna SPM (0.15-2 ng/g dw and 3 ng/l). The whole water sample from River Alna presented quantifiable amounts of a number of PFCs including PFHxA, PFHpA, PFNA, PFOA, PFDA, PFBS, PFHxS, and 6:2 FTS at concentrations between 0.5 and 3.1 ng/l. PFOS and PFOSA were the most consistently detected PFCs in River Drammenselva. PFOS was detected in two SPM samples from River Glomma at concentrations of 0.15 and 0.19 ng/g dw.

3.4.2 Suspended particulate matter-water distribution of contaminants

As for the two previous years, it was possible to calculate particulate organic carbon-water distribution coefficients ($\log K_{poc}$) for data from 2015. Mean values of $\log K_{poc}$ for PAHs and PCBs in all three rivers for the period 2013-2015 are plotted in Figure 31 as a function of $\log K_{ow}$. For PAHs error bars are not shown since it would make the graph difficult to read. For River Alna, $\log K_{poc}$ values for 2015 were very similar to data from 2013 and 2014. More variability in calculated $\log K_{poc}$ was observed for the lighter, less hydrophobic PAHs (with low $\log K_{ow}$ values) in 2015. For example the mean $\log K_{poc}$ for naphthalene for 2013-2015 was 5.31 with a standard deviation of 0.50 (n= 12), while a significantly lower variability in $\log K_{poc}$ was seen for the higher molecular weight PAHs, e.g. the mean $\log K_{poc}$ for benzo[ghi]perylene was 8.03 with a standard deviation of 0.13 (n=12). For PAHs in River Alna, standard deviations of mean $\log K_{poc}$ (n= 12 for most compounds except for benzo[e]pyrene and perylene) ranged from 0.12 to 0.50 with a median value of 0.19. The situation was slightly different for rivers Drammenselva and Glomma. Mean $\log K_{poc}$ values were on average lower than those found for River Alna, and the calculated $\log K_{poc}$ values were more variable. The median of standard deviations of $\log K_{poc}$ values was 0.58 and 0.52 for rivers Drammenselva and Glomma, respectively.

$\mathrm{Log}K_{poc}$ for PAHs in River Alna for the period 2013-2015 were consistently above the 1:1 relationship with $\log K_{ow}$, showing relatively high SPM sorption coefficients for PAHs. The slope and intercept of the linear regression with $\log K_{ow}$ were 0.93 and 1.92, indicating that $\log K_{poc}$ values were consistently almost two log units higher than $\log K_{ow}$. Such a partitioning behaviour is not unexpected for PAHs, since a stronger sorption of PAHs to carbonaceous material (e.g. black 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 rivers Drammenselva and Glomma are closer to the 1:1 relationship with $\log K_{ow}$, indicating that suspended particulate matter in these rivers comprises a smaller proportion of black carbon-like organic matter.

A different behaviour of the PCBs in River Alna can be seen for the same 2013-2015 period. $\mathrm{Log}K_{poc}$ values for PCBs in River Alna are close to the 1:1 relationship with $\log K_{ow}$. The spread of $\log K_{poc}$ data for individual PCB congeners is low (median of all standard deviations for $\log K_{poc}$ for individual PCB congeners is 0.26). In general, these data support the correctness of the freely dissolved phase measurements made with the passive samplers.

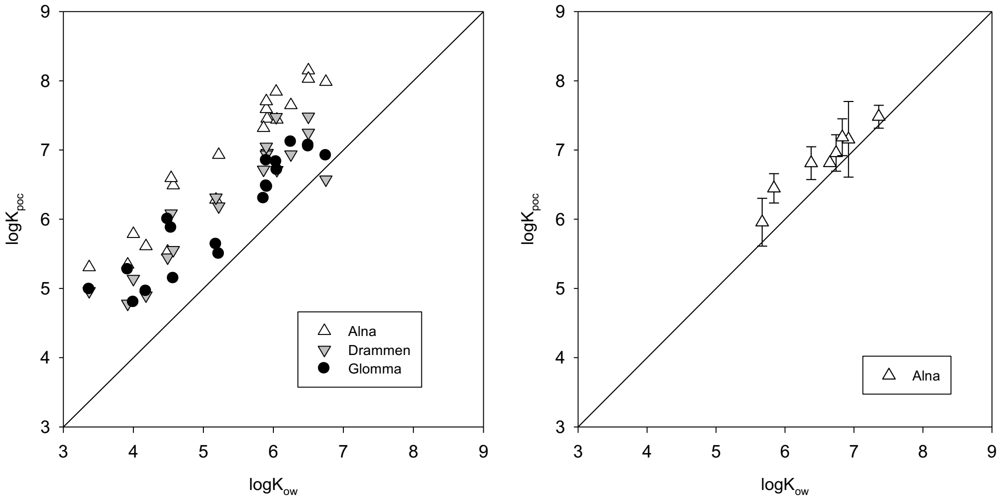

Figure 31. Mean particulate organic carbon-water distribution coefficients as a function of K_{ow} for PAHs (left) and PCBs (right) in rivers Alna, Drammenselva and Glomma for different periods of sampling in 2013-2015.

LogK_{poc} were also calculated for PBDE data from the three rivers for 2015, and the mean values from all data from 2013-2015 are plotted in Figure 32. Distribution coefficients for BDE47, 99, 100, 153 and 154 in River Alna were 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 were generally below the 1:1 relationship. For BDE209, particulate organic carbon-water distribution coefficients were consistently below the 1:1 relationship (in some cases by a few orders of magnitude). It may be that the SPM data for BDE209 was 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.

In Figure 32, logK_{poc} values for BDE47 for all three rivers are plotted. Consistently higher logK_{poc} values can be observed for BDE47 in River Alna (at logK_{ow} of 6.6) compared with rivers Drammenselva and Glomma. While whole water concentrations of PBDEs were generally higher in River Alna, it can be seen in Figure 29 that freely dissolved concentrations of BDE47 were lowest in River Alna and a larger proportion of this compound in water was 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.

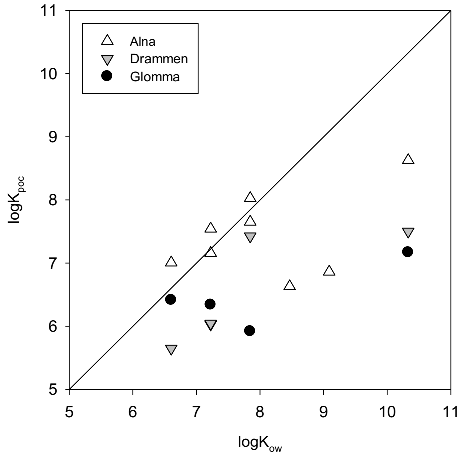

Figure 32. Mean particulate organic carbon-water distribution coefficients as a function of K_{ow} for PBDEs in rivers Alna, Drammenselva and Glomma for the different periods of sampling during 2013-15.

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 2014 and 2015 for 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 (for rivers Drammenselva and Glomma) were well below WFD EQS values in all rivers for monitoring data for both 2014 and 2015. For SCCPs, concentration estimates for all rivers were well below EQS values in 2013. As in 2014, the “whole water” concentration range estimated for SCCPs in River Alna in 2015 was higher than in 2013 and closer to EQS level (note that these estimate suffer significant uncertainty since measurements were only in the SPM phase). The range of estimated “whole water” concentrations for rivers Drammenselva and Glomma were also closer to EQS values in 2015. As for 2013 and 2014, the concentration of fluoranthene and benzo[a]pyrene in 2015 appeared to be close to or above EQS level in all three rivers. In River Alna, the annual average concentrations of these two chemicals was higher in 2015 than in 2014. PFOS was mostly monitored in the SPM 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). The final sampling event relied on bottle sampling and whole water concentrations measured in these samples were within the range of reported whole water concentrations calculated from SPM data. 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, PFOS and SCCPs in all three rivers certainly warrant further investigation.

The overall uncertainty in estimates of annual average “whole water” concentrations will be dependent on the uncertainty of (i) freely dissolved concentrations; (ii) SPM-associated concentrations; (iii) the size of the fraction of contaminants not measured by the two techniques used in the present study; and (iv) annual water and SPM discharge estimates. While the monitoring programme set-up here was not specifically aimed at comparisons with WFD EQS, we believe the data obtained here is far more robust that the information that can be obtained through “whole water” bottle sampling with a low frequency. For the PAHs detected in the dissolved form and associated with particulate matter, the estimates of annual average whole water concentrations are likely to be robust and much of the uncertainty might result from the low frequency of SPM sampling as well as from the data on water discharge and load of particulate matter. Another relevant factor is that the concentration of contaminants sorbed to DOC and other colloids not sampled by passive sampling or measured when sampling SPM is not included in the estimation. Most likely, some modelling based on literature values of DOC-water partition coefficients would be needed. For other substances, only sampled four times a year in the suspended particulate, this sampling strategy is not likely to be sufficient for obtaining accurate “whole water” concentration estimates. The steps we envisage are as follows: First there is a need to decide whether the current methodology based on sampling the freely dissolved and SPM-associated concentrations separately and adding the two is an acceptable procedure for estimating annual average whole water concentrations for comparison with EQS. Second, we need to estimate the uncertainties associated with annual water discharge and fluxes of SPM.

For fluoranthene, the fraction of the chemical present in the freely dissolved form in 2015 represented 4.6, 81 and 89 % of the estimated “whole water” concentration in rivers Alna, Drammenselva and Glomma, respectively. For benzo[a]pyrene, these values were 0.6, 25 and 20 %, 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 in the estimates of sampling rate provided by the non-linear least square method (Booij and Smedes, 2010) were in most cases between 10 and 20 %. For fluoranthene, however, in many cases, the uncertainty was 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 is 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.

Table 18. Comparison of calculated annual average contaminant concentrations for Rivers Alna, Drammenselva and Glomma for 2014 and 2015 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 2014 and 2015						WFD AA-EQS
	Alna		Drammenselva		Glomma		
	2014	2015	2014	2015	2014	2015	
Naphthalene(1)	5.2	3.0	7.0	4.7	6.5	2.8	2000
Anthracene(1)	1.3	2.2	0.27	0.16	0.27	0.14	100
Fluoranthene(1)	10.0	16.1	4.5	3.1	4.2	2.5	6.3
Benzo[a]pyrene(1)	3.3	6.8	0.32	0.37	0.28	0.03-0.13	0.17
PFOS(2)	0.6-6.2	1.2-12	0.3-3.0	0.05-0.5	0.15-1.9	0.1-2	0.65
PBDEs (- BDE28)(3)	0.056-0.068	0.20-0.24	0.012-0.018	0.01-0.03	0.009-0.021	0.019-0.029	140
HBCDD	0.028-0.11	0.53	0.0027-0.065	0.024	0.0069-0.080	0.001-0.022	1.6
SCCPs(4)	14-154	18-97	0.6-38	6-132	0.7-19	3-88	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 dissolved organic matter is not taken into account here.

3.4.4 Estimation of riverine loads of contaminants for 2015

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. 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 annual discharge and differences in size of the river catchments.

Yearly loads of individual PCB congeners for River Alna for 2015 were higher than in 2014 with loads below 10 g/yr. Yearly loads of PCB congeners for rivers Drammenselva and Glomma range from < 12 g/yr for CB138 in River Drammenselva to 4315-410 g/yr for CB28 in River Glomma. As noted in Skarbøvik et al. (2015), 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 33, 672-1515 and 654-1580 g/yr for rivers Alna, Drammenselva and Glomma, respectively. As for 2013 and 2014, 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 2015 loads of individual PBDE congeners were below 10 g/yr for River Alna, while the loads were in the range 2.4-404 g/yr for River Drammenselva and 18-569 g/yr for River Glomma. Riverine loads for HBCDD isomers were in the range 31-32, 132-296 and 286-612 g/yr for rivers Alna, Drammenselva and Glomma, respectively.

Yearly loads of individual PAHs were below 1 kg/yr for River Alna. These were up to 103 kg/yr for phenanthrene in River Glomma. Riverine loads for PAHs were far higher then those estimated for all the other contaminants. The total load of PAHs from River Alna in 2015 was higher than that estimated for 2014 (6.9 kg against 4.2 kg/yr).

As for previous years, the SPM-associated loads of PFOS for 2015 were below 20 g/yr for all rivers. For PFOS, calculated loads of freely dissolved PFOS assuming a $\log K_{poc}$ value of 4 (Ahrens et al., 2011) were 72, 575 and 3110-4846 g/yr for rivers Alna, Drammenselva and Glomma, respectively. Loads reported for SPM-associated PFOS only in Table 19 are generally lower than these values. Particularly for Drammenselva and Glomma with low SPM concentration when compared with Alna, a higher proportion of PFOS is present dissolved in water than sorbed to SPM.

Table 19. Estimated riverine contaminant loads in Rivers Alna, Drammenselva and Glomma, 2015

Compound	Unit	Annual contaminant load		
		Alna	Drammenselva	Glomma
ΣPAH_{16}	kg/yr	6.9	210-267	351-469
ΣPCB_7	g/yr	32.5	672-1515	654-1580
ΣPBDE (excl. BDE28)	g/yr	12-14	130-341	510-804
BDE209	g/yr	71	367-404	560-569
ΣHBCDD (α, β, γ)	g/yr	31-32	132-296	286-612
SCCPs[a]	kg/yr	1.1	72	80
MCCPs[a]	kg/yr	0.61	17	21
BPA[a]	g/yr	442	1039-1106	1628-2005
TBBPA[a]	g/yr	0.7-2.7	332-449	243-681
PFOS[a, b]	g/yr	1.6	2.2-2.6	10.6-16.6

[a] Estimated loads for these substances are only for the particulate matter-associated fraction; [b] The final sampling event for PFOS was based on bottle sampling rather than SPM sample

Expressing contaminant loads relative to the size of the drainage basins of the rivers shows a very different picture. In general, data from 2015 tend to support data obtained for previous years. For all sets of chemicals, annual loads per km^2 of drainage basin were highest for River Alna in both 2015 and in previous years (Figure 33). This reflects that the majority (68%) of the River Alna catchment is urban area. Loads for rivers Drammenselva and Glomma were generally lower. Estimated area specific loads for rivers Drammenselva and Glomma were similar for many classes of chemicals. An increase in loads for most contaminants can be seen for River Alna from 2013 to 2015. This increase is partly due to the increases in water discharge and SPM load in that period. The increases were most significant for PBDEs, HBCDD, SCCPs, BPA and PFOS. However, when data are from SPM monitoring only conducted four times a year they have to be assessed carefully, particularly when contaminant concentrations have been shown to span two orders of magnitude. While remaining in the same order of magnitude as previous years, area specific loads for rivers Drammenselva and Glomma were slightly lower than in 2014 for PAHs, HBCDD, BPA, TBBPA and PFOS. For the situation when data was below LOD, loads were calculated using concentrations set to either 0 or to the LOD and these are shown in Figure

33. The impact of this procedure can be seen for loads for the sum of 7 indicator PCBs, the sum of HBCDD isomers or for TBBPA for example.

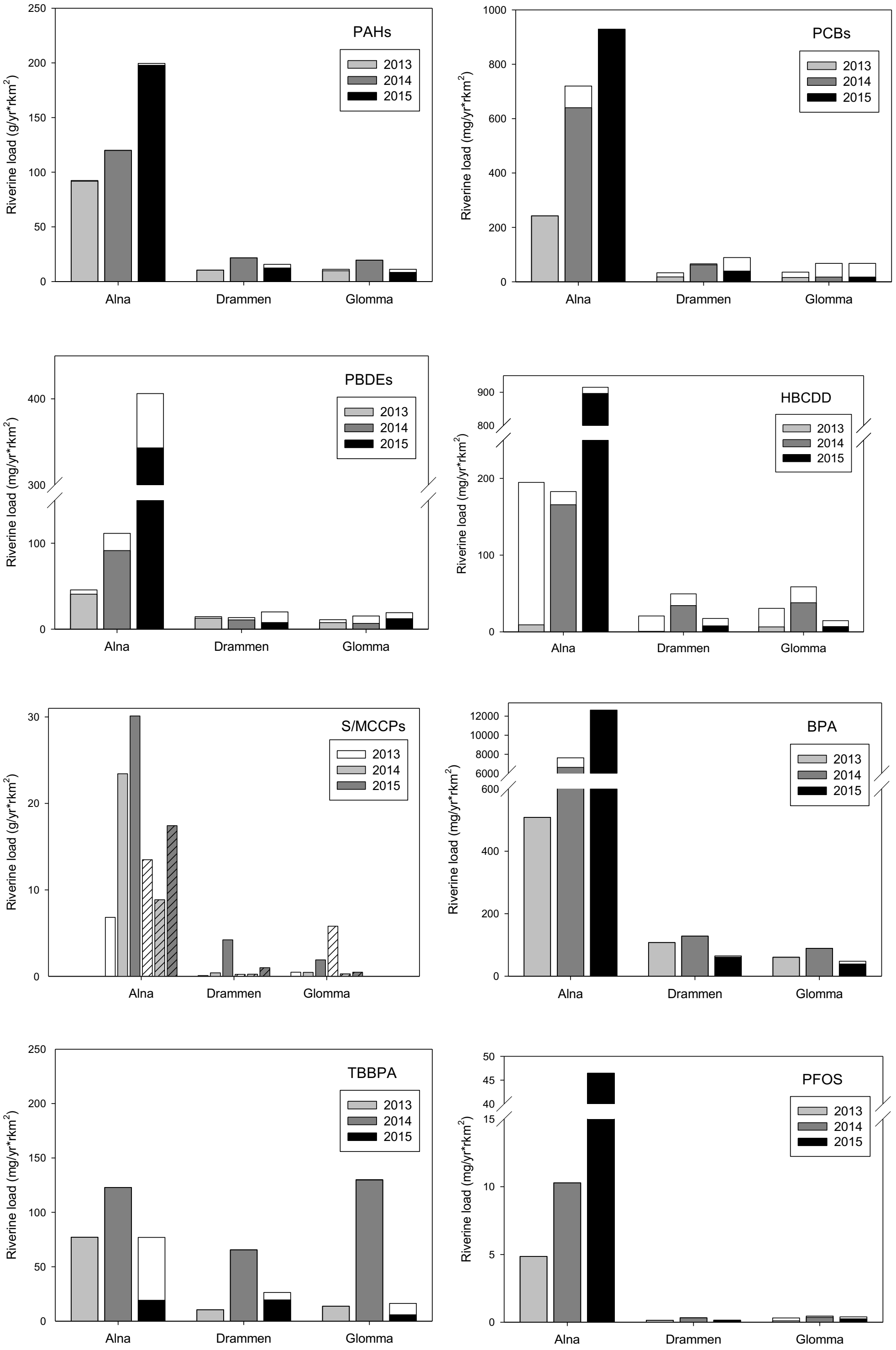

Figure 33. Estimates of river basin surface area-normalised riverine loads of contaminants in rivers Alna, Drammenselva and Glomma for 2013-2015. SCCPs and MCCPs are represented by bars without and with shading, respectively. Filled bars indicate riverine loads estimated based on data above limits of detection only. When datasets included data below limits of detection, estimated loads using LOD as concentration are shown as white stacked bars.

3.5 Sensor data

Sensor data for turbidity, temperature, pH, and conductivity have been recorded in rivers Glomma, Alna and Drammenselva since 2013. In last year's report (Skarbøvik et al. 2015), turbidity data from River Glomma were used to assess uncertainty in estimations of load, maximum and average concentrations. This year, the experiences on sensor operation and maintenance in all three rivers have been highlighted, together with their correlation, or lack of such, with grab samples.

3.5.1 Operation and maintenance

In Appendix IV, the maintenance log since 2013 is given in detail, but a short summary is given here for the period January 2015 - summer 2016:

River Alna: The equipment that was vandalised in November 2014 was replaced in January 2015. Since then, the sensor has been routinely visited and maintained on several occasions. The pH sensor has caused some concern due to occasionally high recordings.
River Drammenselva: Also this station has been routinely visited several times for maintenance. In the autumn 2015, data transfer stopped a couple of times; the battery was first exchanged, but later also the logger. In March, some ice damage was recorded at the site.
River Glomma: The water pump in River Glomma stopped in May 2015, but was repaired soon afterwards. The site has been visited several times for maintenance, but no more problems have been reported.

In addition to the maintenance visits to the stations, there is a need to manually inspect the data and 'flag' suspicious (unlikely) values. The maintenance log is consulted during this work. A typical problem with turbidity sensor data, for example, is periods with high variations in recordings from one hour to the next. Figure 34 illustrates this. Such rapid variations are usually erroneous, and can be a result of film or debris clinging to the lens of the sensor, or an error in the instrument.

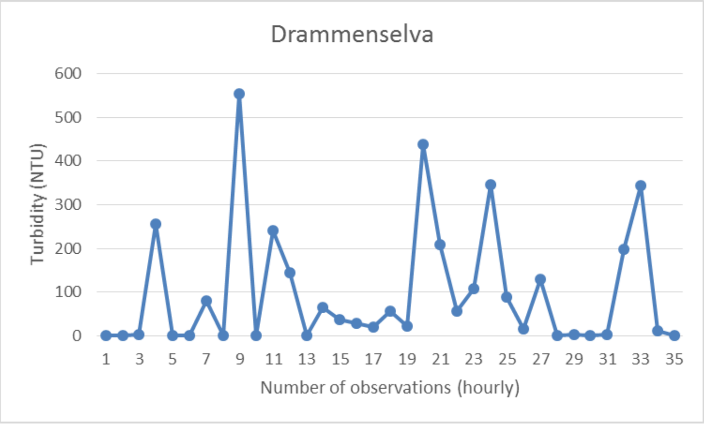

Figure 34. A typical problem with turbidity sensors, where the recorded values vary considerably from one hour to the next.

3.5.2 Turbidity from sensors compared to grab samples

The turbidity sensor measures the amount of light that is scattered by particles in water. It is therefore used as a measure on suspended solids, although calibration is necessary.

Table 20 compares the mean, maximum and minimum turbidity in grab samples and sensor data for the three rivers in 2015. For all three rivers, the differences in maximum recorded turbidity between the two methods are huge. In River Glomma, the turbidity was 2.4 times higher in sensor data than in the maximum value found in grab samples; in River Alna 4.5 times higher, and in River Drammenselva 7 times higher. The reason is that grab samples are not collected during the peaks. In River Alna also the mean turbidity was much higher in sensor data than in the grab samples. In last year's report (Skarbøvik et al. 2015), it was demonstrated that several substances correlated well with turbidity (nickel, total phosphorus, orthophosphate, suspended particulate matter and to a degree lead). Hence, the differences seen in Table 20 can mean that estimates of both mean and maximum concentration, as well as calculations of loads, may be strongly underestimated for such substances.

Table 20. Mean, maximum and minimum turbidity in grab samples and sensor data for the three rivers in 2015.

Glomma	Min	Mean	Max
Grab samples	1.0	11	55
Sensor	1.4	15	131
Alna	Min	Mean	Max
Grab samples	1.7	12	99
Sensor	2.2	32	446
Drammenselva	Min	Mean	Max
Grab samples	0.7	2.3	17
Sensor	0.0	2.9	120

Figure 35 shows turbidity data for all three rivers monitored with sensors in 2015. Grab samples are shown in the same charts, including those collected at the location of the sensor for rivers Glomma and Drammenselva (in River Alna, the sensor is located where the grab sampling is done).

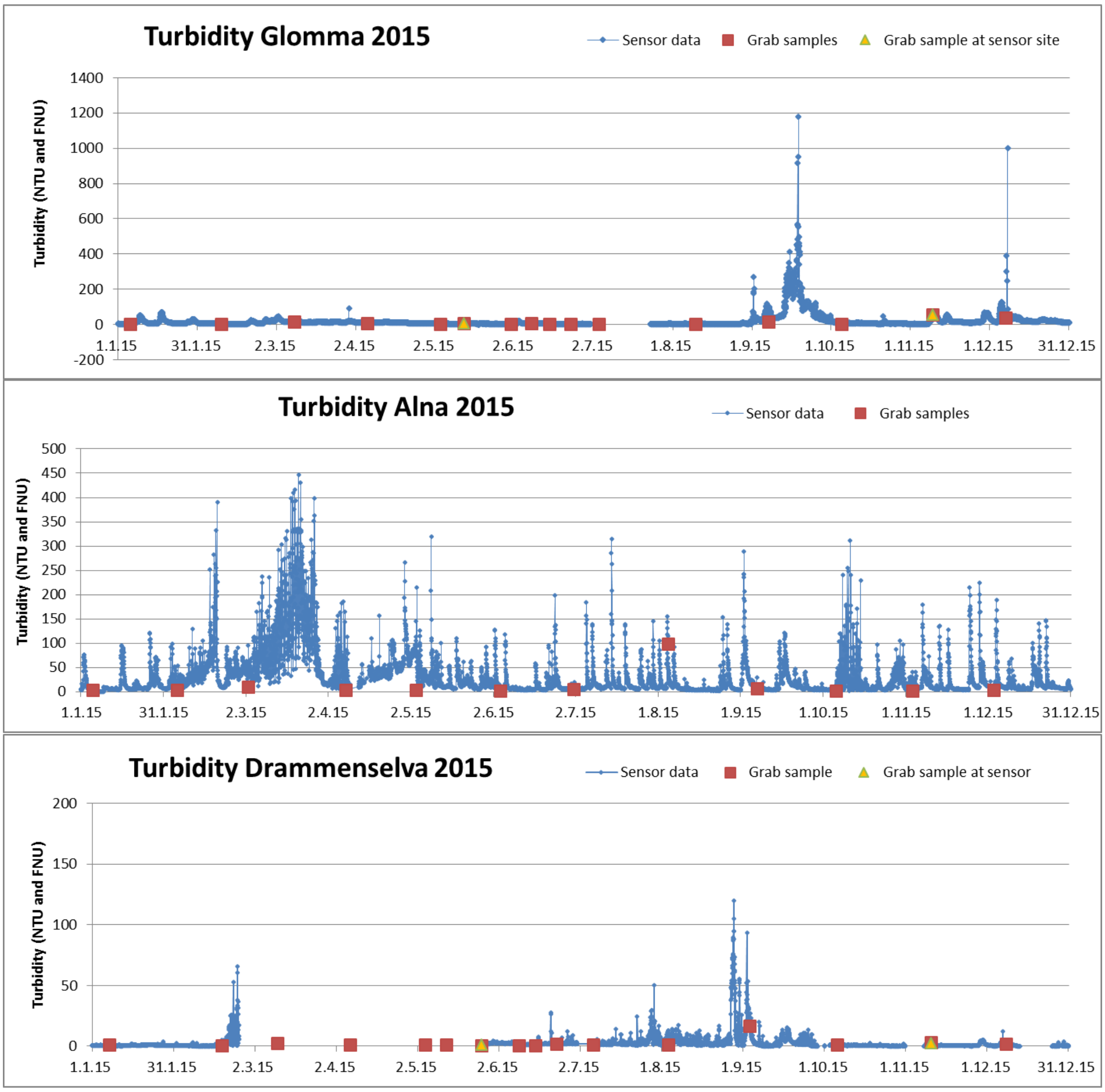

Figure 35. Variations in turbidity in 2015 in the three rivers with sensor data.

Correlations between turbidity in grab samples and from sensors are shown for all three rivers in Figure 36. For River Alna, two charts are shown, where the second only shows the lower values (one high turbidity value removed). The correlation between turbidity values in grab and sensor data was good for rivers Glomma and Drammenselva, although a single high value in the sensor was not matched by the grab sample in Glomma. Such discrepancies must be expected, especially since the two stations are not located at exactly the same site. In River Alna, the correlation was good thanks to one sample with high values in both grab and sensor data. When this sample was removed from the dataset, the correlation became considerably poorer. However, experiences from other rivers have shown that it is not unusual that the correlation is poor at low turbidity values (e.g., Skarbøvik and Roseth 2014).

The charts in Figures 35 and 36 also illustrate that grab samples do not seem to be collected during the highest turbidity conditions. The correlation between turbidity in grab samples and sensor data are therefore mainly based on low values. In order to improve this, it is recommended that grab samples are collected specifically during events of high turbidity and conductivity, which most probably would be during high discharges.

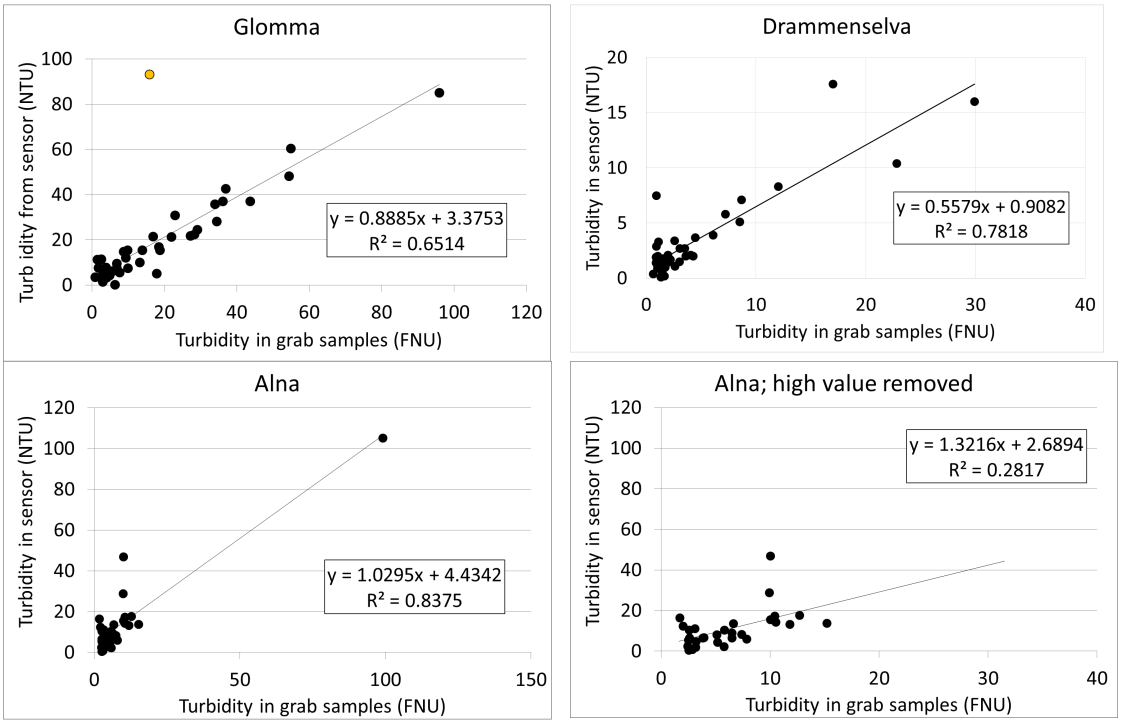

Figure 36. Turbidity from sensor recordings and grab samples, compared for the three rivers with sensor recordings (2013-2016). In Glomma, the spurious sample from 7. Sept. 2015 is marked in orange; and for Alna two diagrammes are shown; one with and one without the single high value.

3.5.3 Conductivity from sensors compared to grab samples

Electrical conductivity is used to monitor the amount of dissolved substances in the water. It is measured by sending a constant voltage between two electrodes, resulting in an electric current through the water. The more dissolved substances in the water, the more conductive will the water be, and hence the higher conductivity.

Table 21 compares the mean, maximum and minimum conductivity recordings in grab samples and sensor data for the three rivers in 2015. Rivers Glomma and Drammenselva had relatively small discrepancies between the two sampling methods. In River Alna, on the other hand, the maximum conductivity was more than 5 times higher in the sensor data.

Figure 37 shows conductivity data for all three rivers monitored with sensors in 2015. Conductivity in grab samples are shown in the same charts, including those collected at the location of the sensor for rivers Glomma and Drammenselva. Of the three rivers, River Alna clearly had the highest conductivity levels, with 283 mS/m at the highest.

In contrast to turbidity, the range of conductivity in grab samples are much more in proportion to the range in the sensor data, but there are some exceptions:

- In River Alna, rather high conductivity levels were found in sensor data during winter, and this was not observed in the grab samples.

- In River Drammenselva the sensor data showed increased conductivity during summer, which was not detected in two grab samples taken in that period. However, a grab sample taken in September had conductivity levels at the same level as the sensor data in July and August.

Table 21. Mean, maximum and minimum conductivity in grab samples and sensor data for the three rivers in 2015.

Glomma	Min	Mean	Max
Grab samples	3.7	4.6	5.6
Sensor	3.6	5.0	6.7
Alna	Min	Mean	Max
Grab samples	19.6	37.7	52
Sensor	0.1	40.6	283
Drammenselva	Min	Mean	Max
Grab samples	3.1	3.8	6.1
Sensor	2.3	3.4	6.6

Conductivity in grab samples in River Glomma and, to a certain degree, River Alna, corresponded well with sensor data conductivity (Figure 38). In River Drammenselva, however, no correlation was found. The reason for this is not known. The range in conductivity in River Drammenselva is very low, but this is also the case for River Glomma, so the low range cannot be the only explanation.

For conductivity, the same lesson learned as for turbidity data can be noted; i.e., the need to sample during high levels. For River Alna, this seemed to occur mainly during winter, and a possible theory is that this can be linked to runoff of road salt (see e.g., Skarbøvik and Roseth 2014). In River Drammenselva, the higher values during summer can be linked to reduced water flow and higher temperatures.

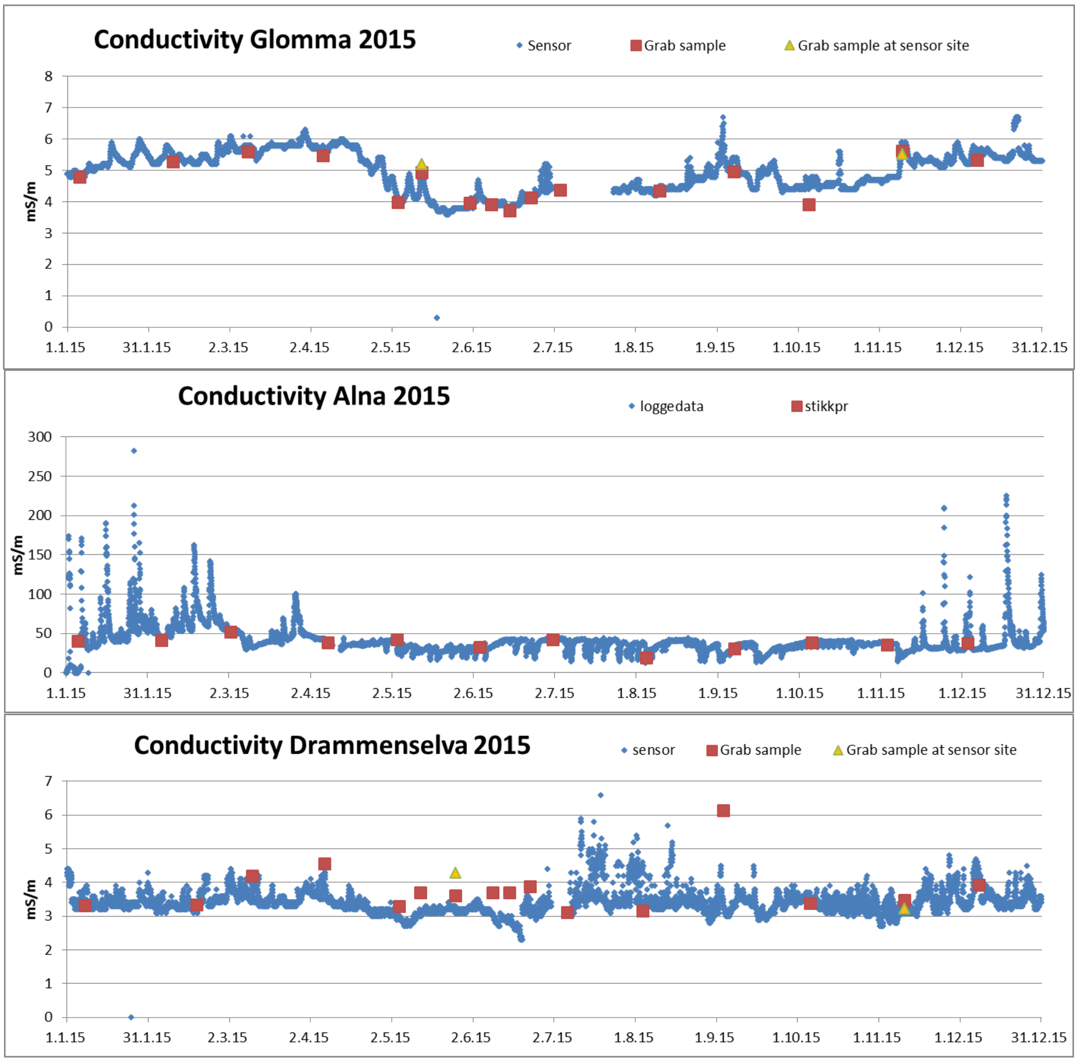

Figure 37. Variations in conductivity in 2015 in the three rivers with sensor data.

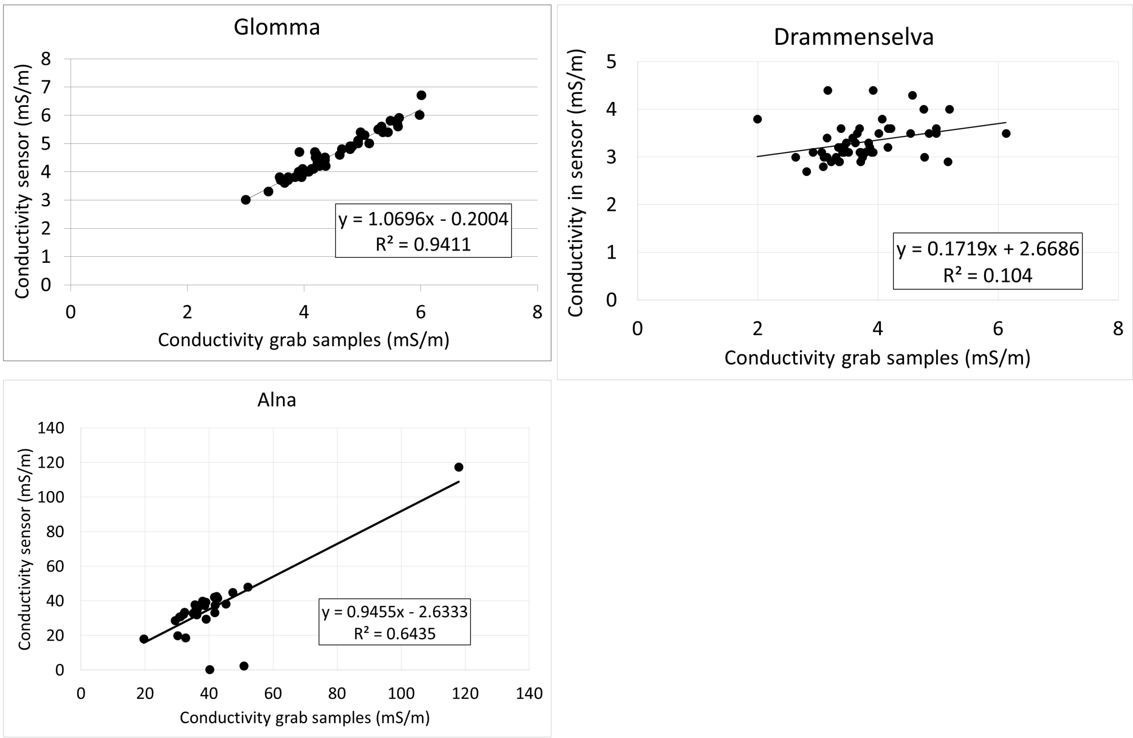

Figure 38. Conductivity from sensor recordings and grab samples, compared for the three rivers with sensor recordings (2013-2016).

3.5.4 pH from sensors compared to grab samples

The pH is a measure of the acidity of the water, based on its hydrogen ion concentration. It is defined as the negative logarithm of the hydrogen ion concentration. The pH of a material ranges on a logarithmic scale from 1-14, where pH 1-6 are acidic, pH 7 is neutral, and pH 8-14 are basic.

Table 22 compares the mean, maximum and minimum pH recordings in grab samples and sensor data for the three rivers in 2015. There were relatively small discrepancies, although for River Alna, the maximum pH was considerably higher than in the grab samples.

Table 22. Mean, maximum and minimum pH recordings in grab samples and sensor data for the three rivers in 2015.

Glomma	Min	Mean	Max
Grab samples	7.1	7.21	7.41
Sensor	6.8	7.10	7.31
Alna	Min	Mean	Max
Grab samples	7.8	8.0	8.1
Sensor	7.2	8.0	9.5
Drammenselva	Min	Mean	Max
Grab samples	7.1	7.2	7.5
Sensor	6.9	7.1	7.6

As also shown in last year's report, the pH in grab samples and the pH in sensor data did not correlate well (Figure 39). This lack of correlation can be expected, 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 relatively small, in particular in rivers Glomma and Drammenselva.

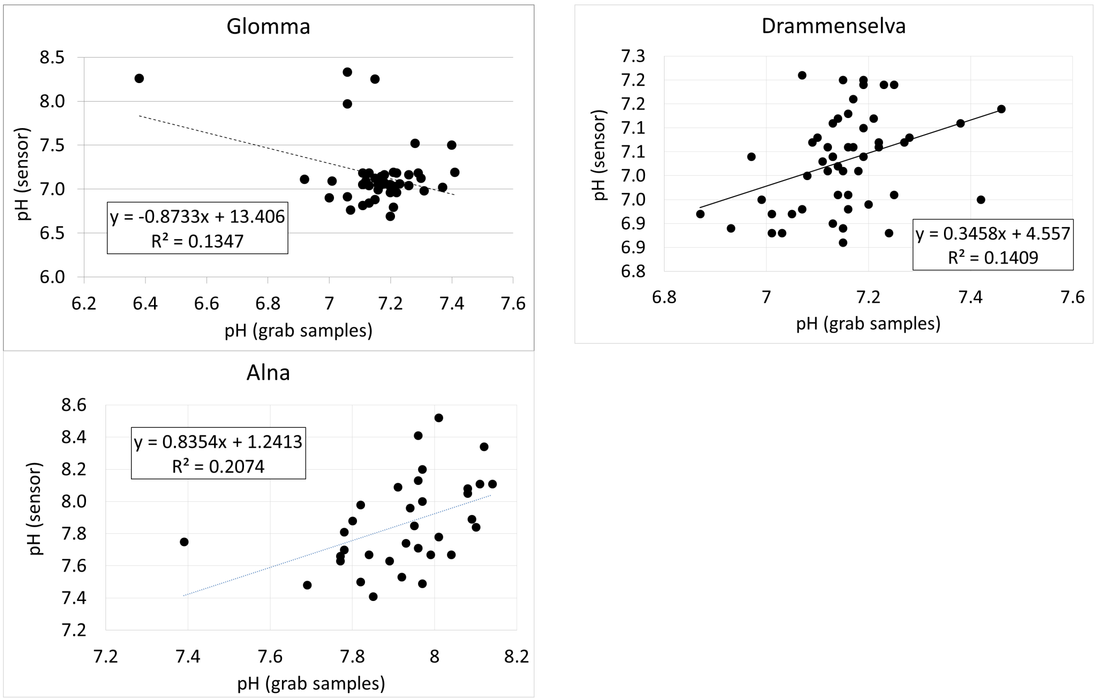

Figure 39. Correlations between pH in grab samples and sensor data (2013-2016).

The pH range was somewhat higher in River Alna. Figure 40 shows that this is due to elevated pH-values in April and May 2015. Even if some of these values can be caused by errors in the instrument, a sensor can give managers a possibility to check for extreme values and thereby discover possible sources for such events, which may be very harmful to the biota. As such, sensor data can also be used to explain effects on the biota that could have remained unsolved if only grab samples were collected.

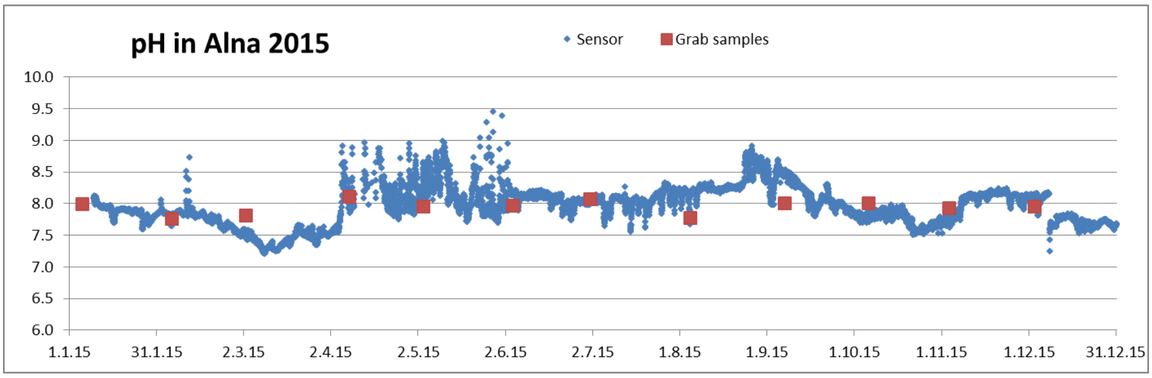

Figure 40. pH-values in Alna in 2015, with sensor and grab samples.

3.5.5 Further use of sensors and sensor data

A major advantage with sensor data is obviously the high frequency of recordings, allowing for discoveries of high concentrations or values, which grab samples would not detect. However, sensor records also give a huge amount of data that need to be processed and quality controlled. In combination with the maintenance costs, as well as the need to collect grab samples for correlations, they do not come free of charge. Hence, it is important to use the data as efficiently as possible. An improved data basis for calibrations, for example by sampling more often during floods (turbidity data) or snowmelt events (conductivity data in River Alna), is recommended. This will give a better basis for continuing the calculations that were demonstrated in last year’s report, with estimates of uncertainty when calculating loads, and maximum and average concentrations.

4. Conclusions

Climate and water discharge
The year 2015 was both the third warmest and the third wettest since the national recordings started in 1900. Despite a relatively cold summer, the average annual temperature was 1.8 °C above normal (1961-1990); and the precipitation was 25 % above normal. High precipitation was especially significant in the southwestern parts of the country and some areas in the north, whereas the far north and the areas around Trøndelag (mid-Norway) had less precipitation than normal.

Total inputs of nutrients and metals in 2015
The total nutrient inputs to Norwegian coastal waters in 2015 were estimated to about 13 300 tonnes of phosphorus, 184 000 tonnes of nitrogen, 501 000 tonnes of silicate, 611 000 tonnes of total organic carbon (TOC), and 860 000 tonnes of suspended particulate matter. Inputs of metals to the Norwegian coastal areas were estimated to 199 kg of mercury, 2.3 tonnes of cadmium, 35 tonnes of arsenic, 46 tonnes of lead, 54 tonnes of chromium, 200 tonnes of nickel, 725 tonnes of zinc and 1185 tonnes of copper.

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. Average concentrations exceeding the threshold value were found for copper (five rivers), zinc (two rivers), and lead and nickel (one river each). Several more single water samples had concentrations above threshold values.

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.

Trends in river nutrient and metal inputs
In the Skagerrak region, all rivers had high water discharges in 2015, which is reflected in higher nutrient and sediment loads than the average load for the previous 25 year period (1990-2014). In the North, Norwegian and Barents Seas, nitrogen loads were higher, whereas phosphorus loads varied little from the long-term average, and suspended sediment loads were lower in 2015. In total, the high loads in 2015 to the Skagerrak region resulted in higher nutrient loads to the coastal seas from Norway as compared to the average loads, whereas suspended particulate matter loads were slightly lower.

For metals, the total riverine inputs of arsenic, lead, cobber, and zinc were relatively similar in 2015 as in the 25 year average. For metals, riverine loads in 2015 of mercury, cadmium and chromium were about 40% lower than in the 25 year average. It should be noted that analytical methods have changed over the years and this may partly explain this decline, since these metals often are found in concentrations below LOQ. The only metal that increased in 2015 as compared to the 25 previous years was nickel, due to high inputs from River Pasvikelva.

A more detailed statistical trend analyses of data for the 9 main rivers for the period 1990-2015 showed that:

- Four out of the five Skagerrak rivers showed a statistically significant increase in **water discharge**, indicating overall high water discharges in the entire region the latter years.
- 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. It is likely that this increase is due to increased water discharges.
- Three rivers showed statistically significant downward trends for **nitrate nitrogen** loads (rivers Skienselva, Otra and Vefsna) and another four for **ammonium nitrogen** loads (rivers Glomma, Drammenselva, Orkla and Vefsna).
- Statistically significant long-term downward trends in **total phosphorus** loads were only detected in River Vefsna. Upward trends in **total phosphorus**, **ortophosphate** and **SPM** loads were detected in rivers Drammenselva and Numedalslågen. The two latter trends are related to increases in water discharge.
- For **metal loads**, 22 of 45 trend tests showed statistically significant downward trends in long-term loads, while one test (Cu in River Drammenselva) showed an increased trend. However, the trend can be explained with an increase in water discharge. For **metal concentrations**, 36 of the 45 trend tests showed statistically significant downward trends in concentrations. No upward trends for any metal concentrations were detected.
- There are still high concentration and loads for **zinc** in the River Glomma, although the loads seem to be declining after the peak load in 2012.

Organic contaminants

Organic contaminants were analysed in the three rivers Glomma, Alna and Drammenselva. 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 2015. 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 that 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, as for previous years, 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 2015. The estimate of “whole water” concentrations for SCCPs in the three rivers also approaches WFD AA-EQS values in 2015. All in all, the data from 2015 generally confirms the assessment undertaken in 2013 and 2014.

The estimation of riverine loads of contaminants to the sea in 2015 showed that for most chemicals studied, the load from River Alna was highest when given per km^2 of drainage area. This is in agreement with estimates from 2013 and 2014. Loads for rivers Drammenselva and Glomma were generally similar to each other. One major unknown factor in the estimation of fluxes is the concentration of contaminants sorbed to dissolved organic matter (not quantified here). The variability in SPM-associated contaminants concentrations also adds significant uncertainty to the flux estimates. Over the three years of monitoring, some contaminants exhibit SPM concentration that can span over two orders of magnitude. Correlating the continuous turbidity measurements with SPM concentrations could, to some extent, help reduce this uncertainty.

Sensor data analyses

Sensors for turbidity, pH, conductivity and temperature have been installed in three rivers (rivers Glomma, Alna, and Drammenselva) since spring 2013. The comparison between sensor data and grab samples reveal that grab samples often miss the highest concentrations or values, and that also the mean values can be underestimated. This will have impacts on the estimations of mean and maximum concentrations and also on calculations of loads, with a risk of underestimation, especially for substances that are associated with particulate matter.

An important part of the quality procedure is the calibration of the sensor data with laboratory analyses of grab samples. However, in a scheme of only monthly sampling, grab samples are seldom collected during the highest turbidity and conductivity conditions. This means that the correlation between grab samples and sensor data are mainly based on low values. An improved data basis for calibrations, for example by sampling more often during floods (turbidity data) or snowmelt events (conductivity data in River Alna), is therefore recommended. This will give a better basis for continuing the calculations that were demonstrated in last year’s report, with estimates of uncertainty when calculating loads, and maximum and average concentrations.

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Appendices

Appendix I	**The RID Objectives**
Appendix II	**Water sampling personnel**
Appendix III	**Catchment information for 47 monitored rivers**
Appendix IV	**Methodology, supplementary information and changes over time**
Appendix V	**Long-term trends in riverine loads and concentrations**

Appendix I The RID objectives

The main objectives of RID (Agreement 2014-04; www.ospar.org) are 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 Agreement 2014-04.

Appendix II Personnel

In 2015, Øyvind Kaste (NIVA) has 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), 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 2015 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 Kari Austnes, 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) Trine Lise Sørensen/Vibeke Svenne (Drammenselva) Sigmund Lekven (Numedalslågen) 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 og Rolf Inge Valheim Rune Roalkvam Kjell Arne Granberg Leif Magnus Dale Inger Moe Ronny Løland Bjarne Stangvik Gudmund Kårvatn Harald Viken Asbjørn Bjerkan Vebjørn Opdahl Frøydis Forsmo 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).

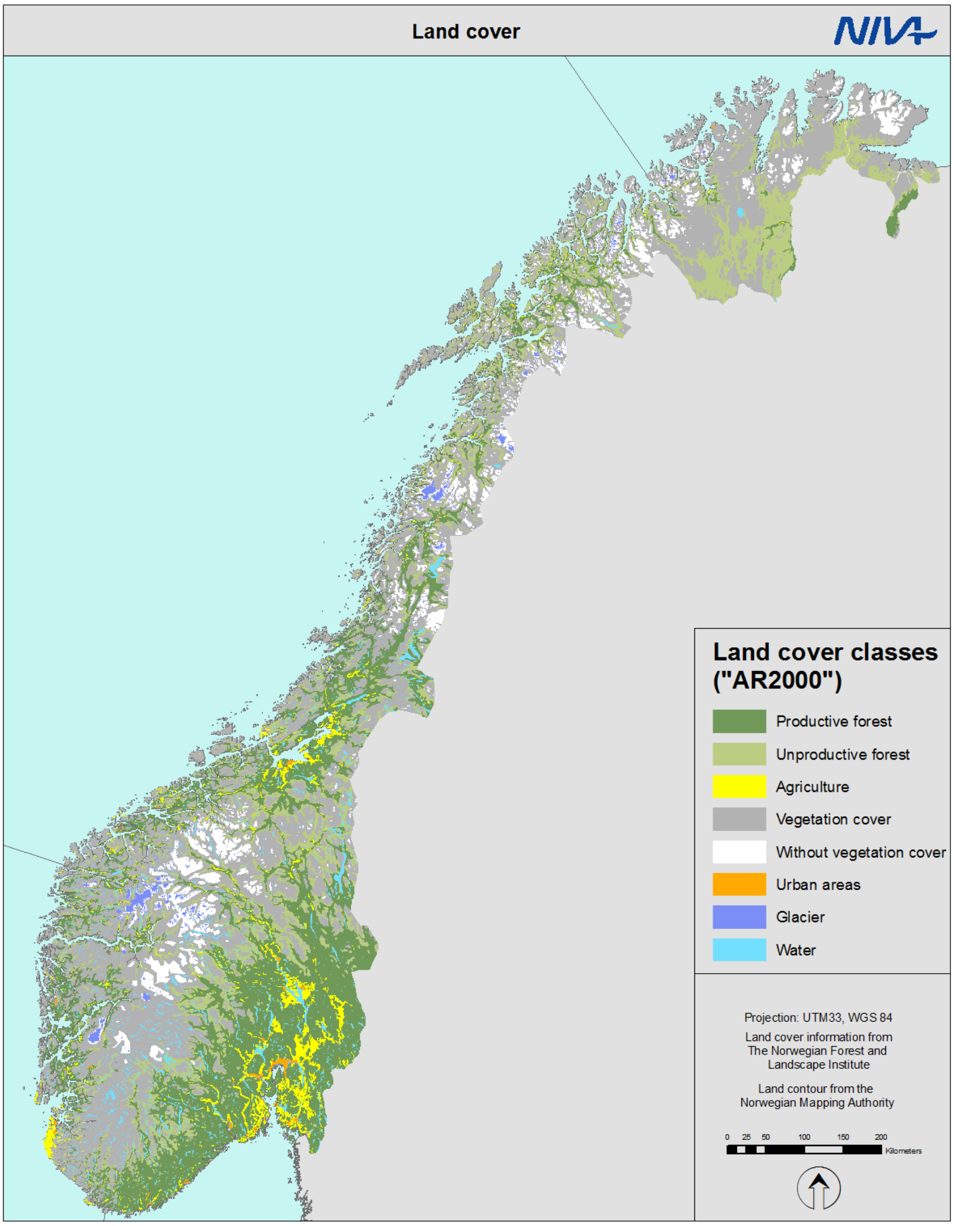

Figure A-III-1. Land cover map of Norway. See also Figure A-III-2 in which the land use in the catchments of the 11 rivers monitored monthly is shown.

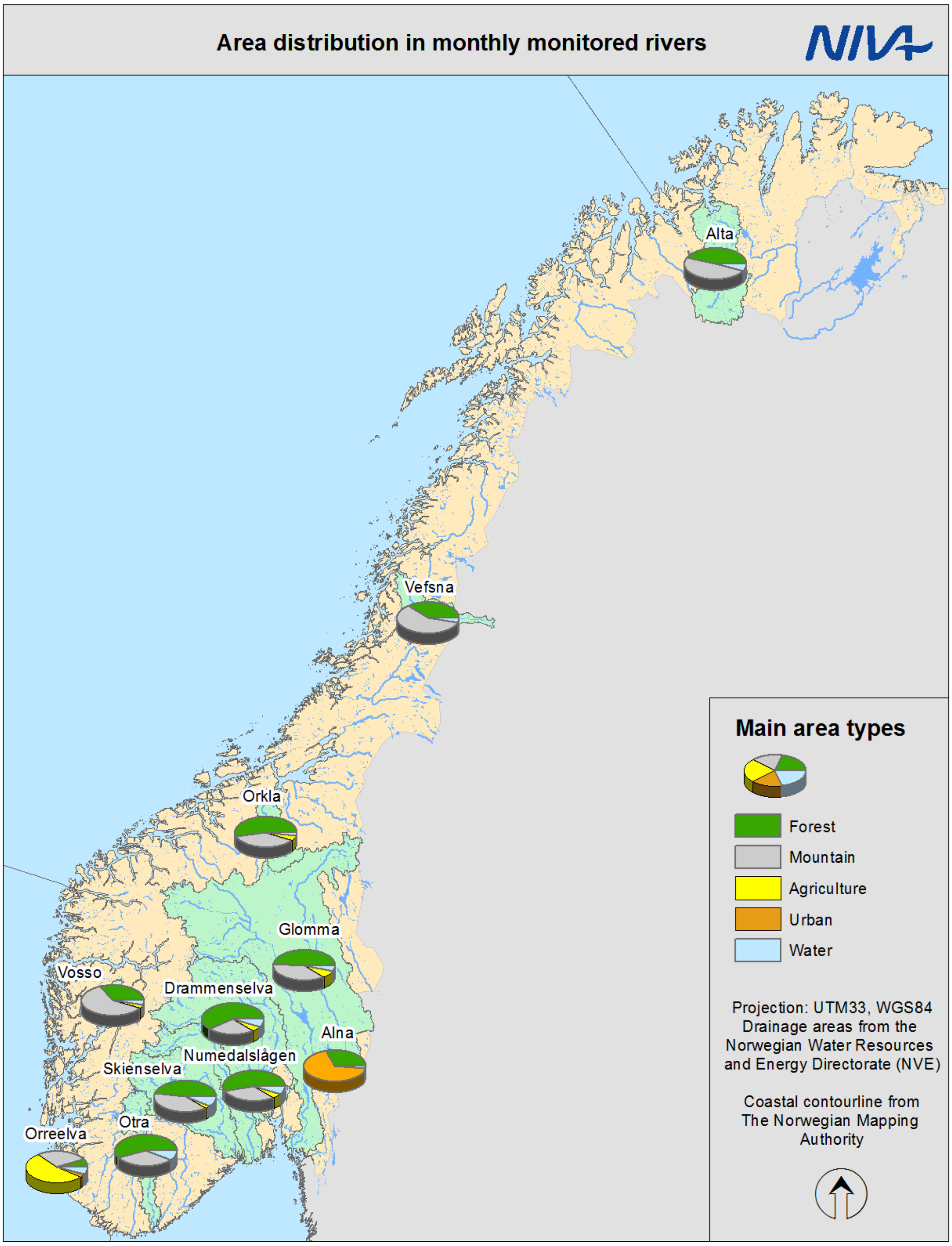

Figure A.III-2. Land use in the catchment areas of the 11 rivers monitored monthly. 'Water' refers to lakes in the catchment; 'Mountain' includes moors and mountain plateaus not covered by forest. Based on data from NIBIO.

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.

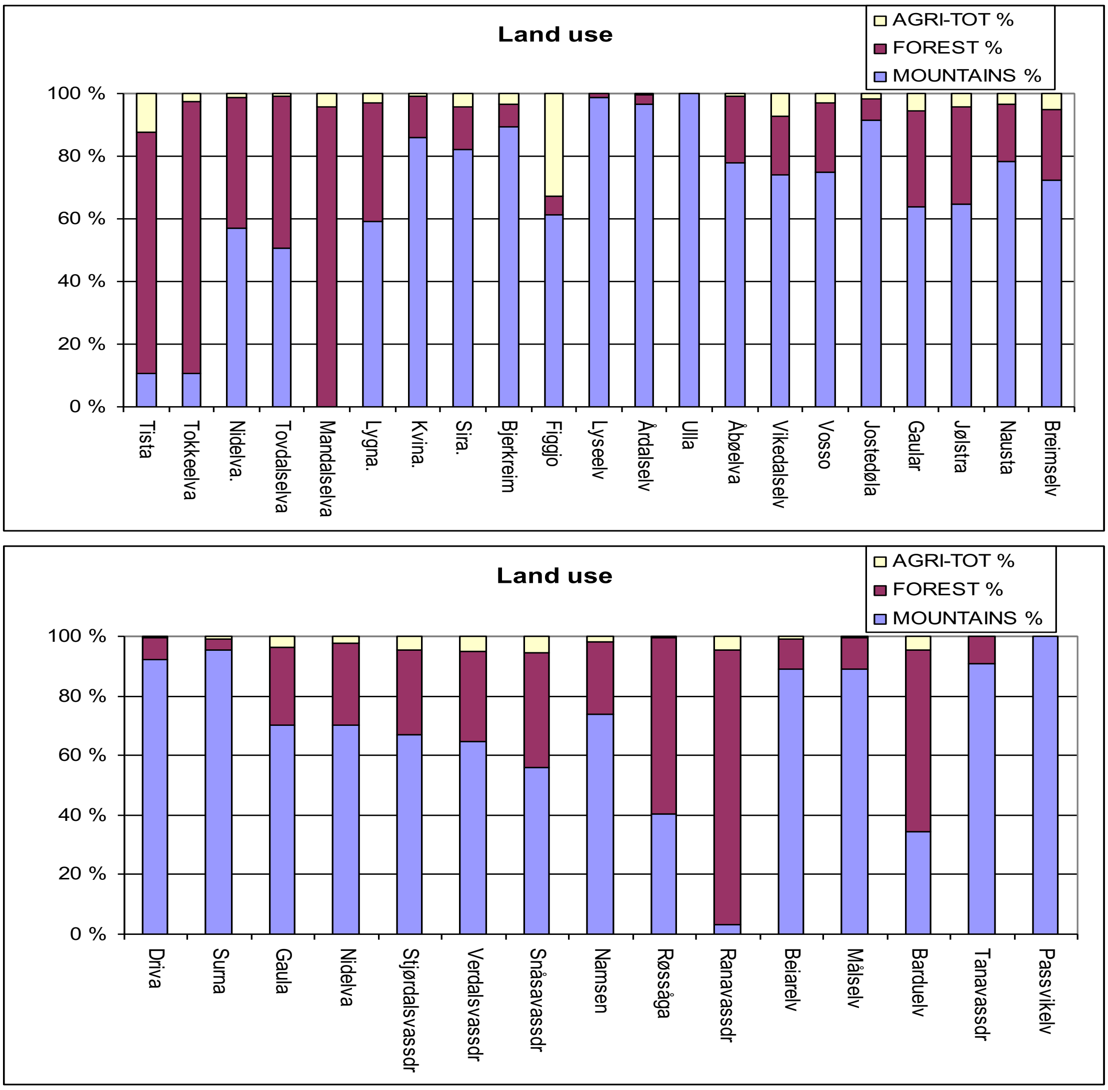

Figure A-III-1. Land use distribution in the catchment areas of the 36 rivers monitored quarterly. "Agri-tot" means total agricultural land. "Mountains" include moors and mountain plateaus not covered by forest.

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 in grab water samples.

Table A-IV-3. Analytical methods and limits of quantification for parameters included in the grab water sampling programme in 2015.

Parameter	Limit of quantification	Analytical Methods (NS: Norwegian Standard)
pH		NS 4720 and NS-EN ISO 10523
Conductivity (mS/m)	1	NS-ISO 7888
Turbidity (FNU)	0.2/0.3	NS-EN ISO 7027
Suspended particulate matter (SPM) (mg/L)		NS 4733 modified
Total Organic Carbon (TOC) (mg C/L)	0.1	NS-ISO 8245 modified
Total phosphorus (µg P/L)	1	NS 4725 - Peroxodisulphate oxidation method modified (automated)
Orthophosphate (PO4-P) (µg P/L)	1	NS 4724 - Automated molybdate method modified (automated)
Total nitrogen (µg N/L)	10	NS 4743 - Peroxodisulphate oxidation method
Nitrate (NO_3-N) (µg N/L)	2	NS-EN ISO 10304-1
Ammonium (NH_4-N) (µg N/L)	2	NS-EN ISO 14911
Silicone (Si) (Si/ICP; mg Si/L)	0.005	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Silver (Ag) (µg Ag/L)	0.002	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Arsenic (As) (µg As/L)	0.025	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Cadmium (Cd) (µg Cd/L)	0.003	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Chromium (Cr) (µg Cr/L)	0.025	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Copper (Cu) (µg Cu/L)	0.04	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Mercury (Hg) (µg Hg/L)	0.001	NS-EN ISO 12846 modified
Nickel (Ni) (µg Ni/L)	0.04	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Lead (Pb) (µg Pb/L)	0.005	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified
Zinc (Zn) (µg Zn/L)	0.15	NS-EN ISO 17294-1 and NS EN ISO 17294-2 modified

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.

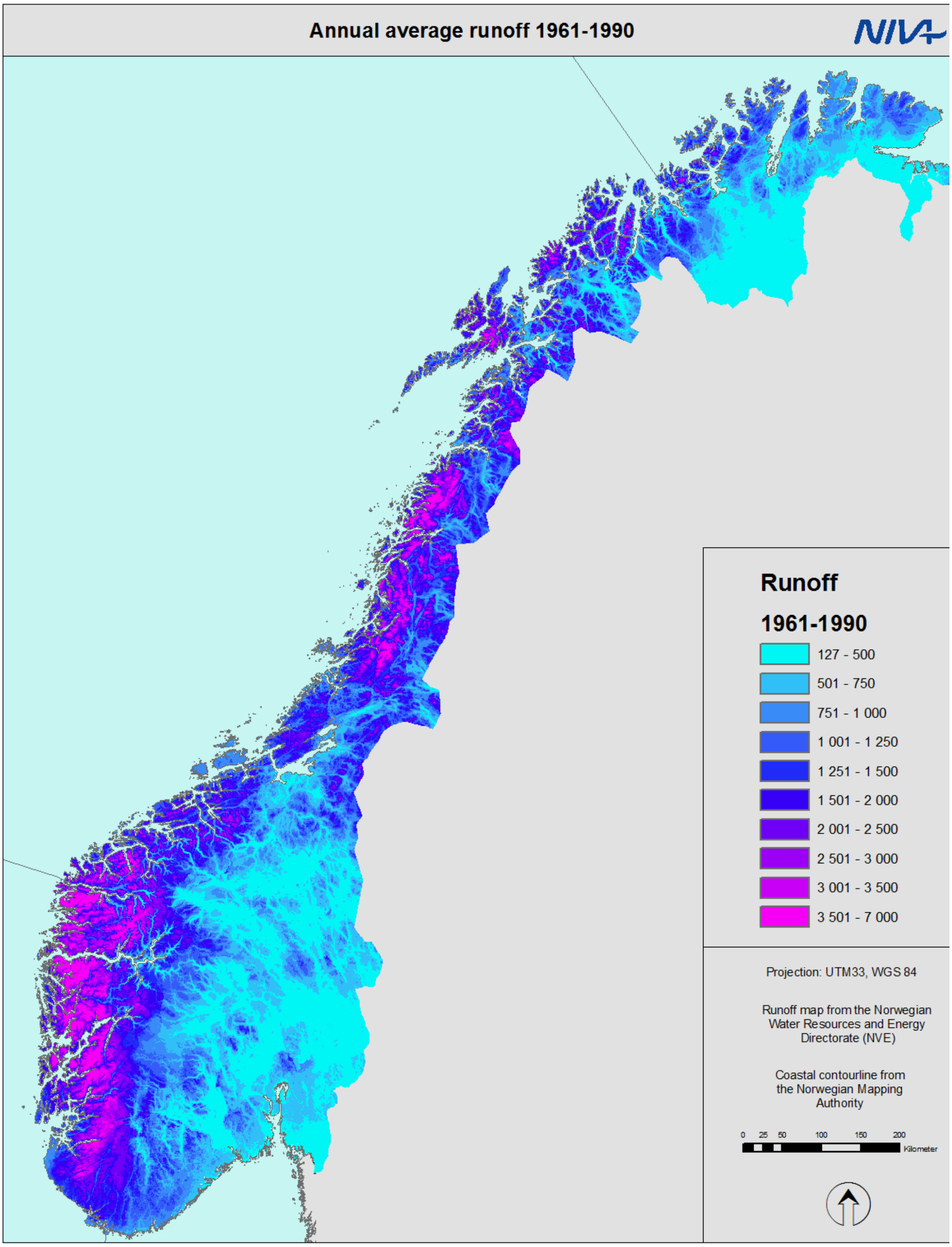

Figure A-IV-1. Average annual runoff (mm/year) for Norway for the period 1961-1990.

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 rivers Glomma, Drammenselva, and Alna, for the period 2013-2016 (July):
<u>All rivers (2013-summer 2015):</u>

- <u>2013</u>: 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.
- <u>2014</u>: 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 –summer 2016: Routine maintenance was performed at all three stations in May/June.

- River Alna: The equipment that was vandalised in November 2014 was replaced in January 2015. The pH-sensor was exchanged in June 2015, and calibrated. The sensor was also manually cleaned. Check on sensor in November 2015; the sensor was reported to be running well. Early December 2015: Discovered errors in values from sensors since 30.11.2015, on 8 December service was therefore carried out. March 2016: pH sensor looks normal, but very high values had been registered. The pH sensor was exchanged in May 2016 and the sonde was manually cleaned. Observations from 13 June showed that the pH values had not been improved, and newservice is needed.
- River Drammenselva: May 2015; the sensor was cleaned and tested, turbidity returned to normal values. Early June, the station visited again and the pH-sensor was exchanged and calibrated. 15. September: Data transfer had stopped on the 9. September, so the battery was exchanged, after that the sensor worked again. 9. November: Data have stopped 3 November so the station was again visited, and the logger was changed. 16. November: The station was checked and found to function well. 5.January 2016: pH-sensor calibrated. 8 March: Ice damage at the site. 11. May 2016: pH sensor exchanged. The sonde was cleansed, and the tube with the sonde was moved a bit upwards in the water.
- River Glomma: The water pump in River Glomma stopped in May, but was fixed soon after. The pH sensor was exchanged and calibrated. 7. January 2016: pH calibrated. The sonde and CDOM was cleaned. Firmware logger upgraded. 5. May 2016: pH-sensor exchanged, sonde and CDOM cleaned.

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 Trends in riverine loads and concentrations.

Pollutant Concentrations - 10 year trends

Analyses done for concentrations in the water samples, not volume-weighted.

Legend:

🟩 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 V13. Trends in nutrient and particle concentrations in nine Norwegian main rivers in the last 10 years (2006- 2015). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

CONCENTRATIONS. 2006-2015

River	NH$_4$-N	NO$_3$-N	Tot-N	PO$_4$-P	Tot-P	SPM
Glomma	0.9502	0.2409	0.4913	0.1460	0.3958	0.2249
Drammenselva	0.8310	0.0115	0.1813	0.6221	0.9331	0.5128
Numedalslågen	0.3215	0.9662	0.5338	0.2727	0.2975	0.7426
Skienselva	0.6595	0.0036	0.2553	0.6013	0.2195	0.3838
Otra	0.1517	0.5473	0.3535	0.3623	0.2268	0.1000
Orreelva	0.5182	0.2079	0.1246	0.7492	0.2563	0.5241
Orkla	0.3040	0.3920	0.0168	0.6303	0.5890	0.1492
Vefsna	0.2851	0.5518	0.6801	0.7702	0.4961	0.5264
Altaelva	0.9469	0.0210	0.0052	0.1491	0.0125	0.1296

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. 2006-2015

River	Cd	Cu	Ni	Pb	Zn
Glomma	0.9035	0.0406	0.0879	0.6534	0.0171
Drammenselva	0.4071	0.0173	0.4903	0.4975	0.0114
Numedalslågen	0.3245	0.0335	0.4823	0.4013	0.0634
Skienselva	0.0794	0.1929	0.0444	0.4050	0.0763
Otra	0.8407	0.0306	0.1526	0.9470	0.2541
Orreelva	0.3359	0.3834	0.3082	0.3104	0.7577
Orkla	0.6801	0.0432	0.3648	0.0091	0.2738
Vefsna	0.3081	0.7453	0.0477	0.4974	0.0900
Altaelva	0.6949	0.1311	0.1277	0.8623	0.3362

Trend Analyses - Pollutant Loads, 10 year trends

Not volume weighted.
Legend:

🟩	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 in nine Norwegian main rivers in the last 10 years (2006-2015). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS. 2006-2015

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

Table V6. Trends for metal loads in nine Norwegian main rivers in the last 10 years (2006-2015). The table shows the p-values. The colours indicate the degree of statistical significance (see legend).

LOADS metals. 2006-2015

River	Q	Cd	Cu	Ni	Pb	Zn
Glomma	0.0892	0.5312	0.4208	0.5312	0.5312	0.0397
Drammenselva	0.3252	0.6547	0.5312	0.7884	0.0603	0.4208
Numedalslågen	0.7884	0.4208	0.1284	0.9287	0.6547	0.5312
Skienselva	0.3252	0.3252	0.6547	0.5312	0.0892	0.4208
Otra	0.2449	0.4725	0.0892	0.4208	0.7884	0.2449
Orreelva	0.4208	0.8505	0.5312	0.4208	0.4725	0.5312
Orkla	0.1797	0.1797	0.0603	0.6547	0.0892	0.1797
Vefsna	0.4208	0.1797	0.2449	0.0603	0.9287	0.2449
Altaelva	0.9287	0.2812	0.7884	0.1797	0.6547	0.7884

Pollutant Loads - complimentary charts

Loads are not flow-normalised.

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.

For data on concentrations in each river since 1990, it is referred to http://vannmiljo.miljodirektoratet.no/.

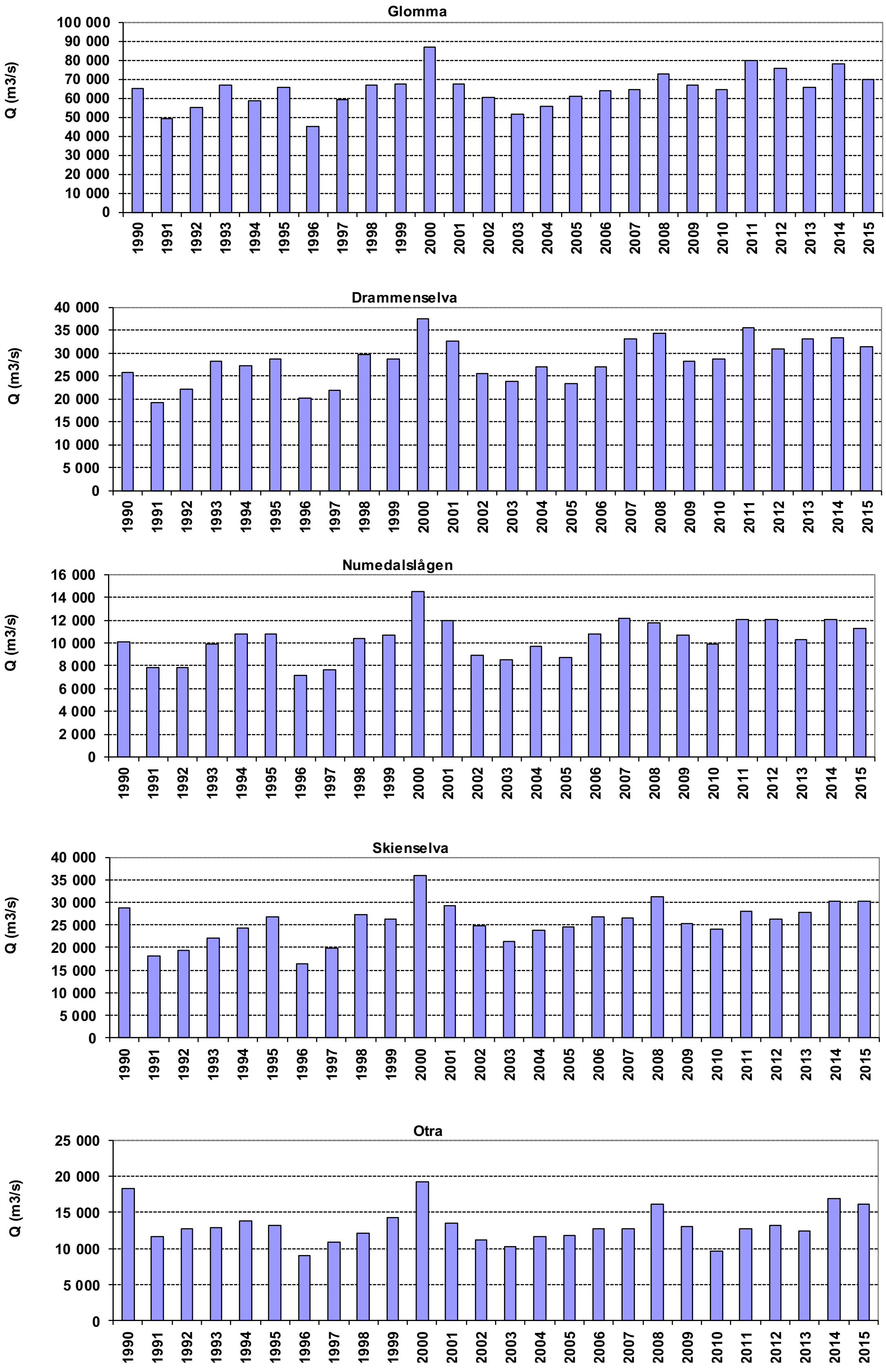


Figure A-V-1a. Annual water discharge (Q) in the five main rivers draining to Skagerrak, Norway, 1990-2015.

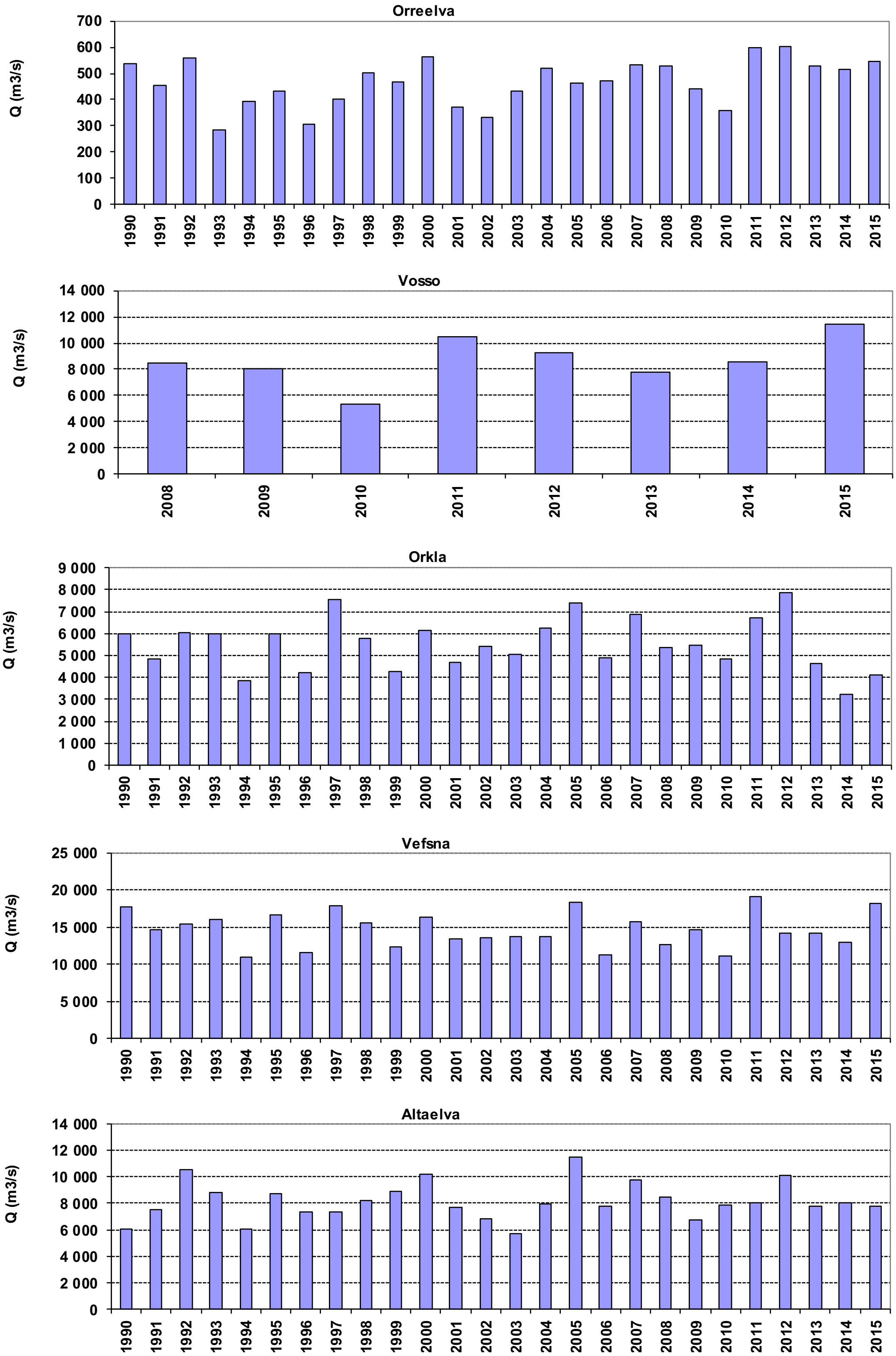
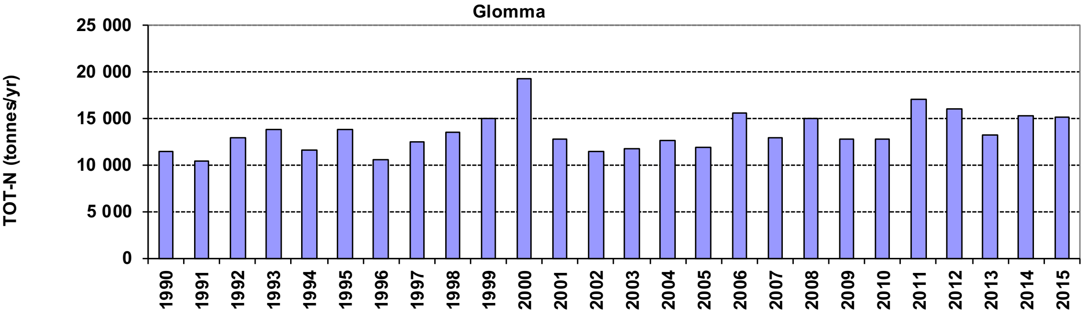
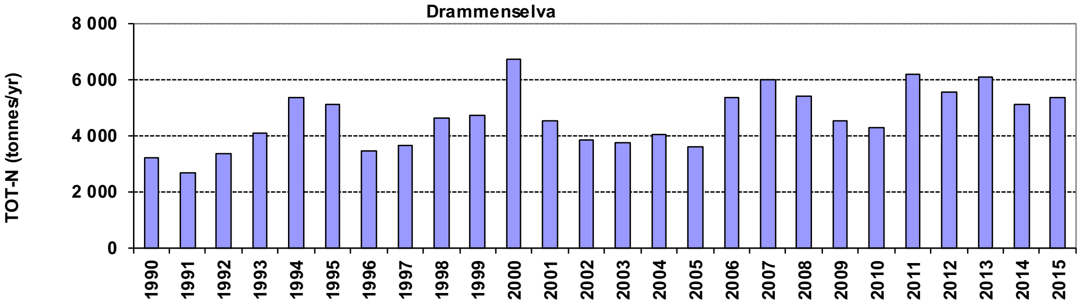
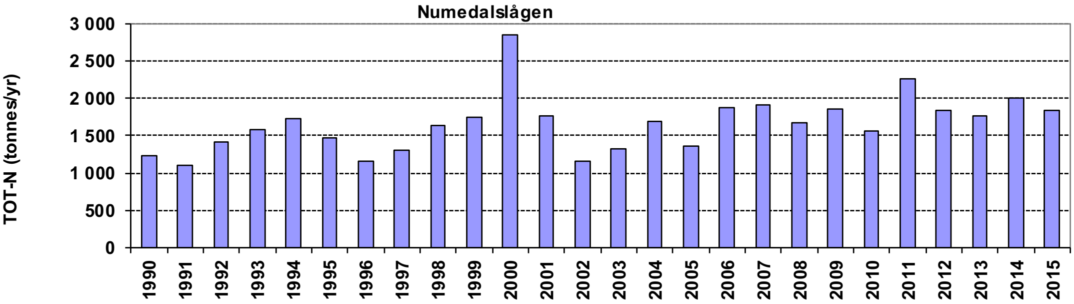
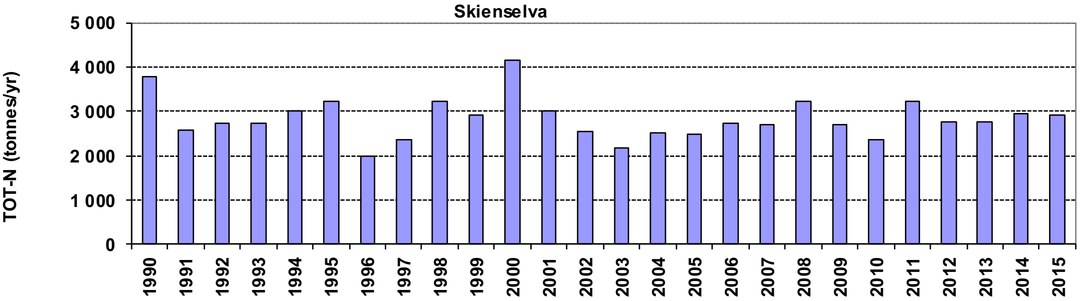


Figure A-V-1b. Annual water discharge (Q) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).









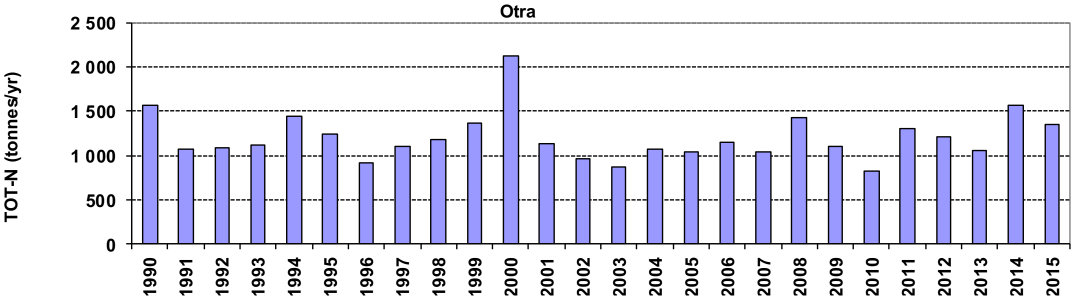
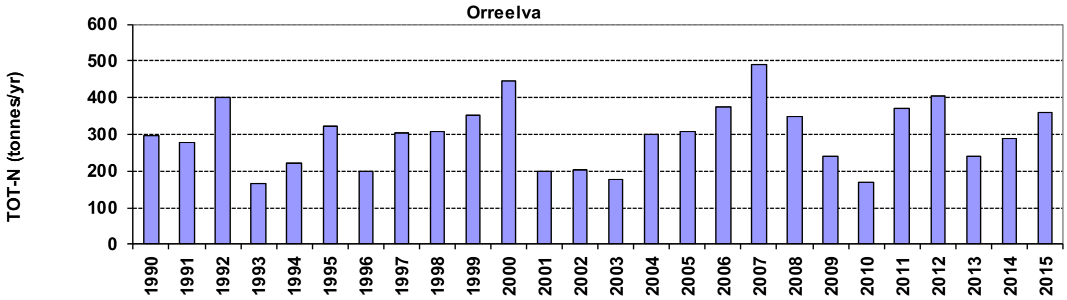
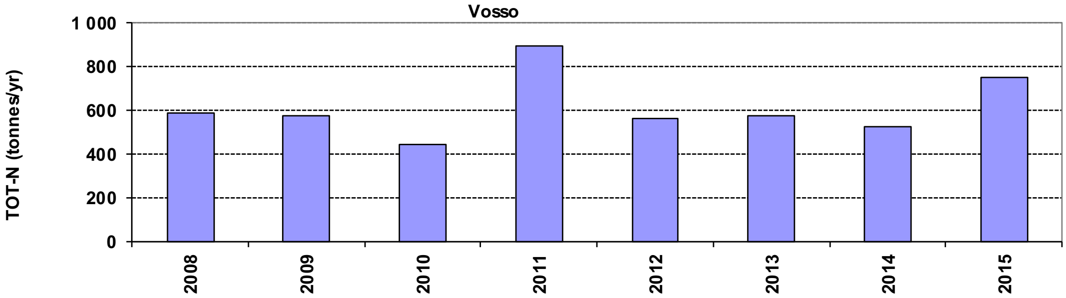
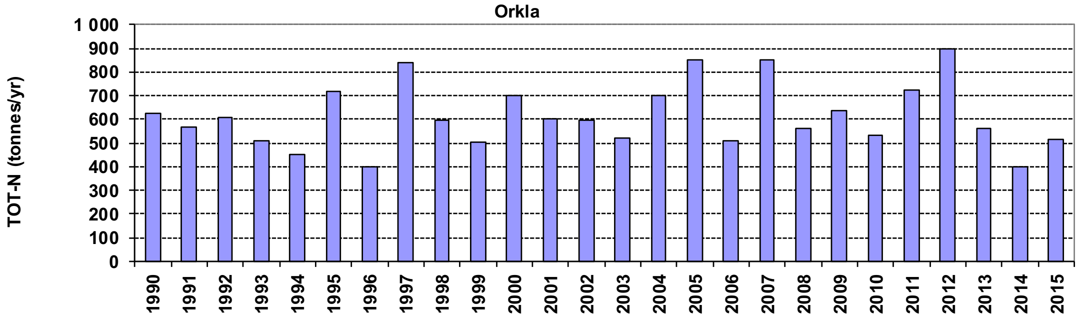
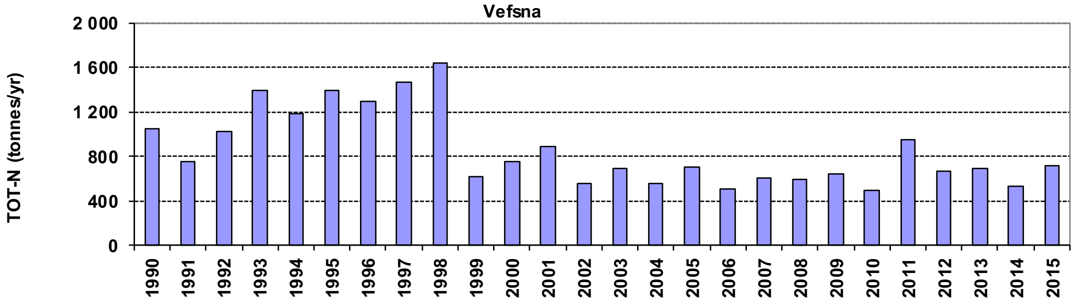


Figure A-V-2a. Annual riverine loads of total nitrogen (Tot-N) in the five main rivers draining to Skagerrak, Norway, 1990-2015.









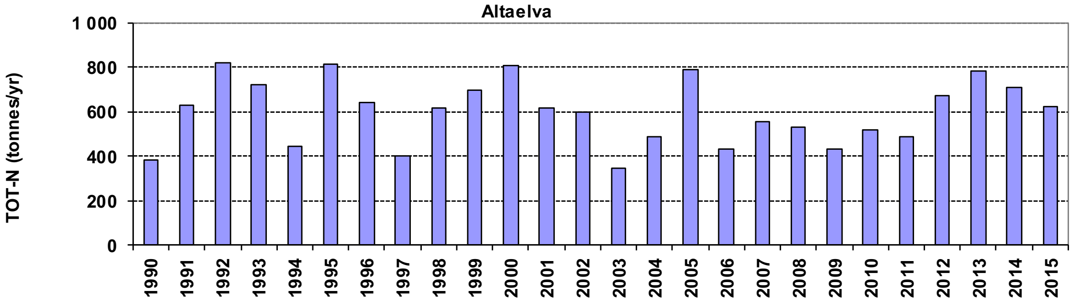


Figure A-V-2b. Annual riverine loads of total nitrogen (Tot-N) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).

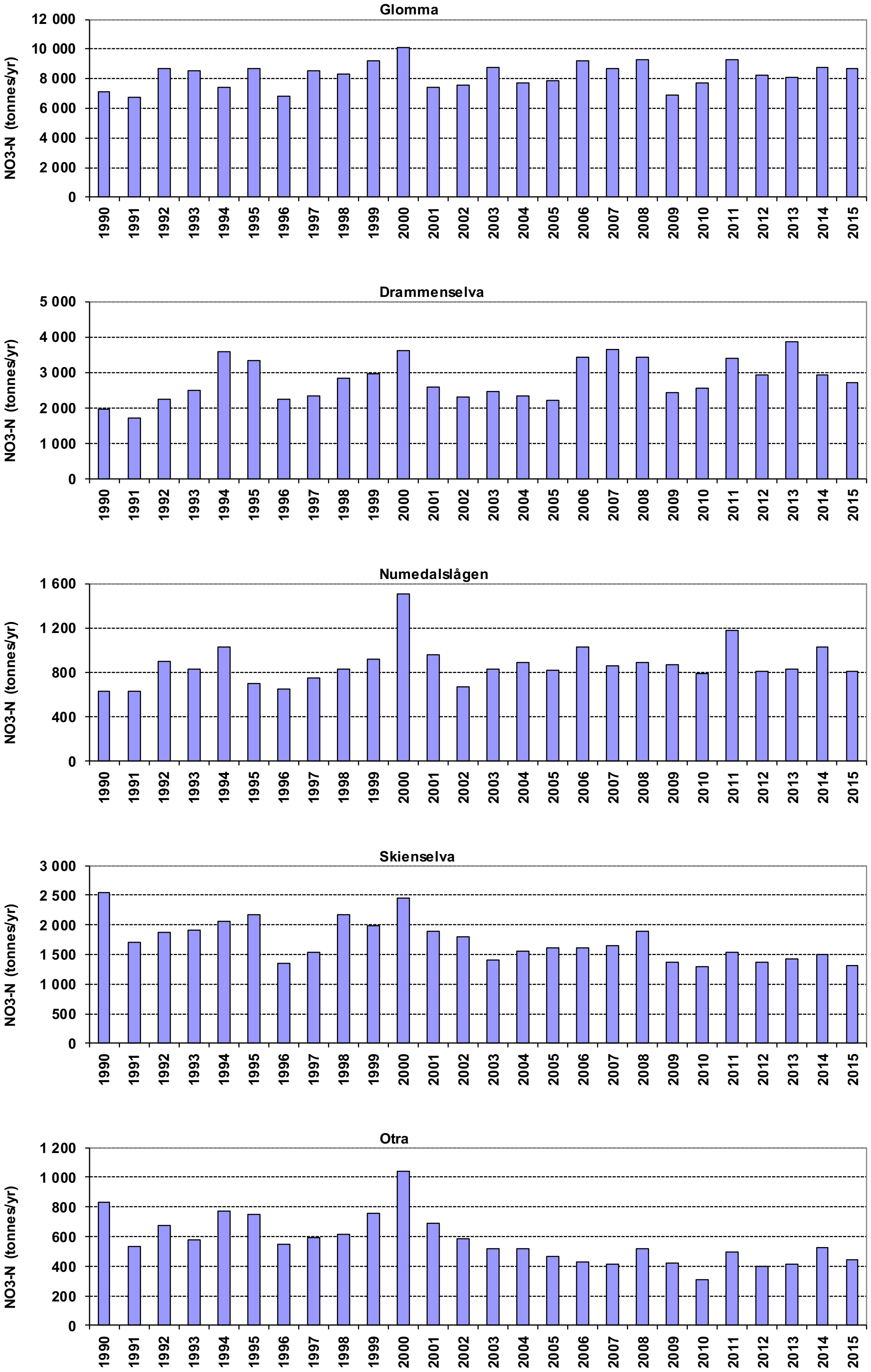


Figure A-V-3a. Annual riverine loads of nitrate-nitrogen (NO_3-N) in the five main rivers draining to Skagerrak, Norway, 1990-2015.

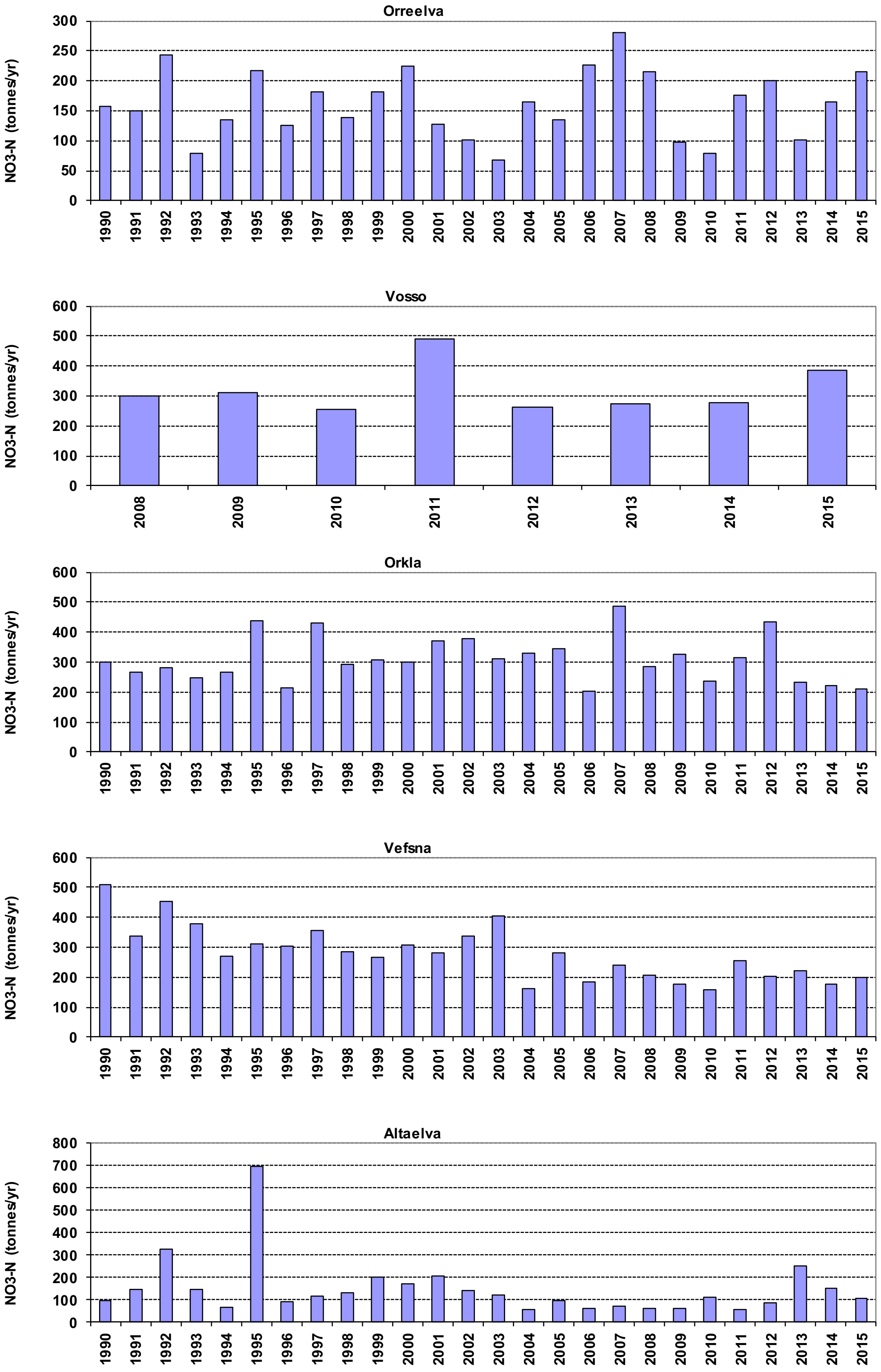


Figure A-V-3b. Annual riverine loads of nitrate-nitrogen (NO$_3$-N) from five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).

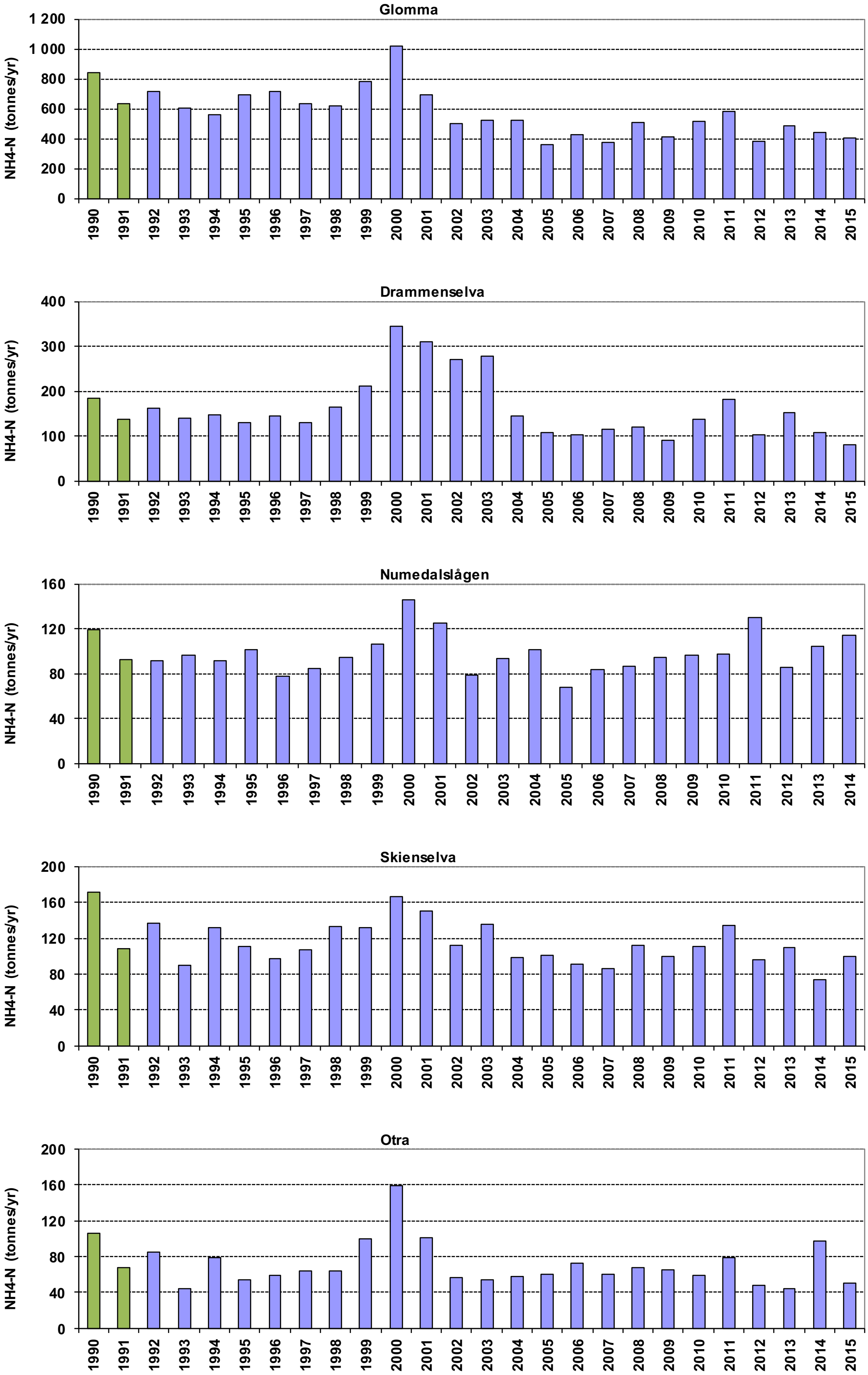


Figure A-V-4a. Annual riverine loads of ammonium-nitrogen (NH_4-N) in the five main rivers draining to Skagerrak, Norway, 1990-2015. Years with extra- or interpolated values are given in green.

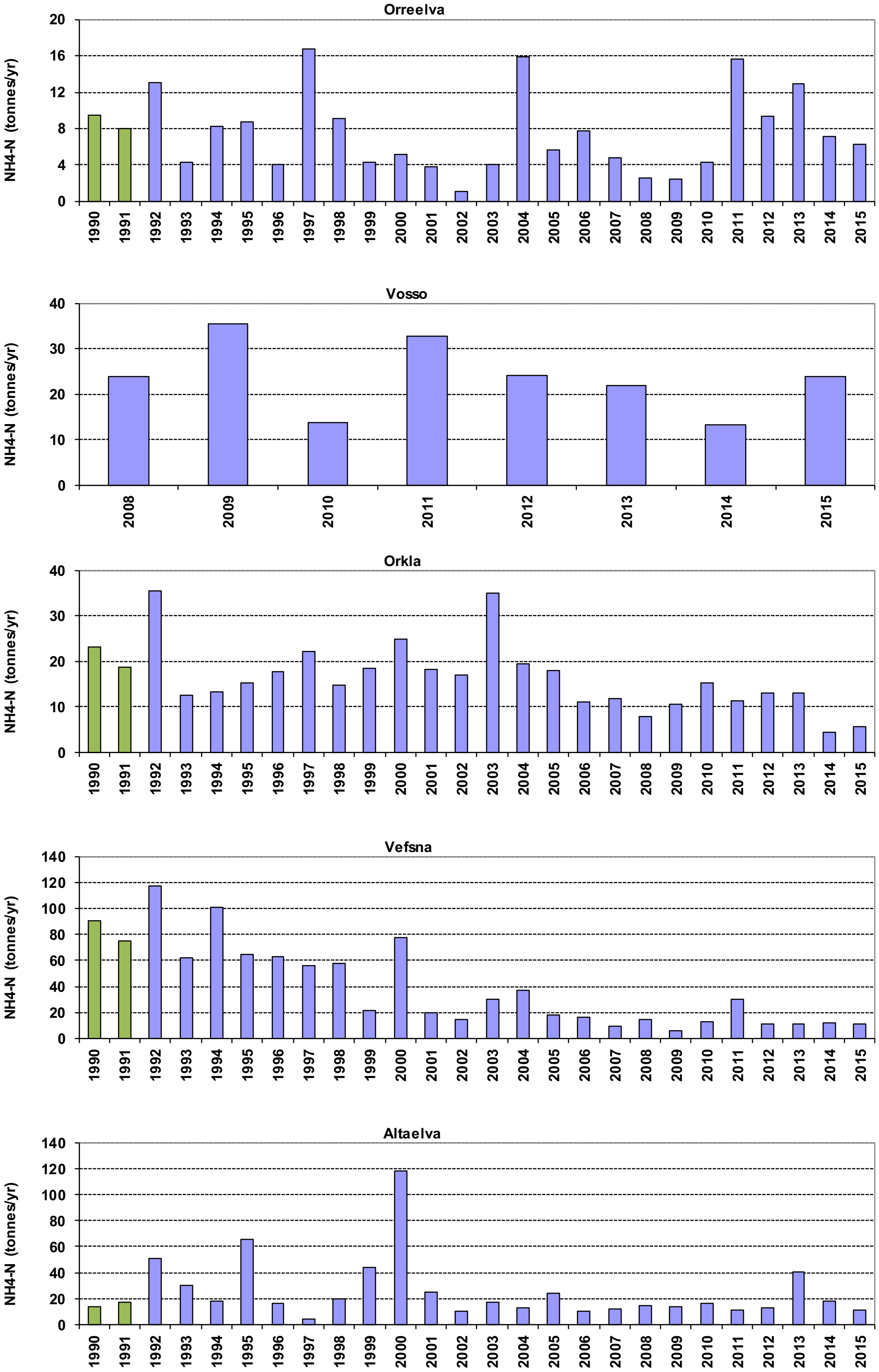


Figure A-V-4b. Annual riverine loads of ammonium-nitrogen (NH$_4$-N) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso). Years with extra- or interpolated values are given in green.

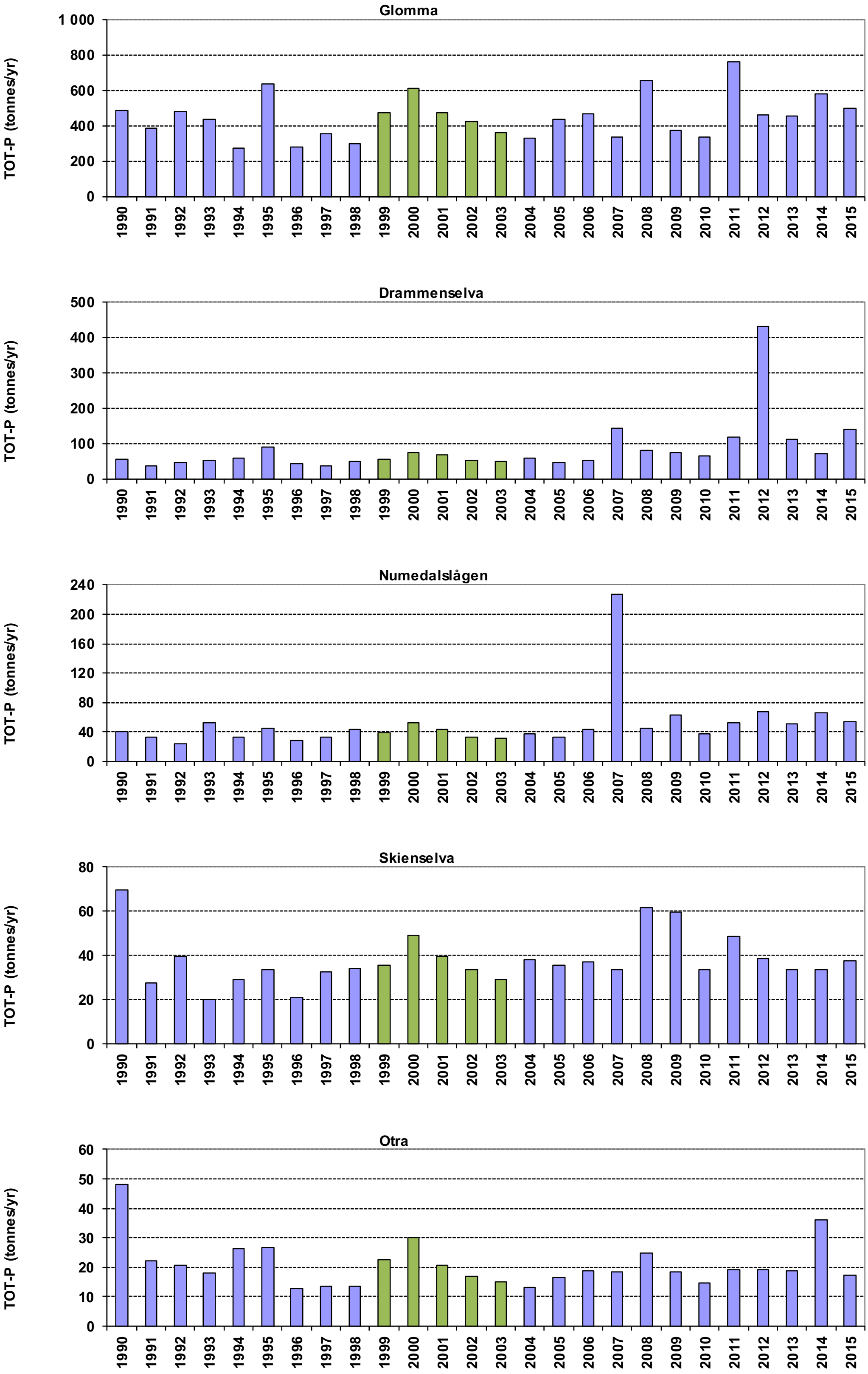


Figure A-V-5a. Annual riverine loads of total phosphorus (Tot-P) in the five main rivers draining to Skagerrak, Norway, 1990-2015. Years with extra- or interpolated values are given in green.

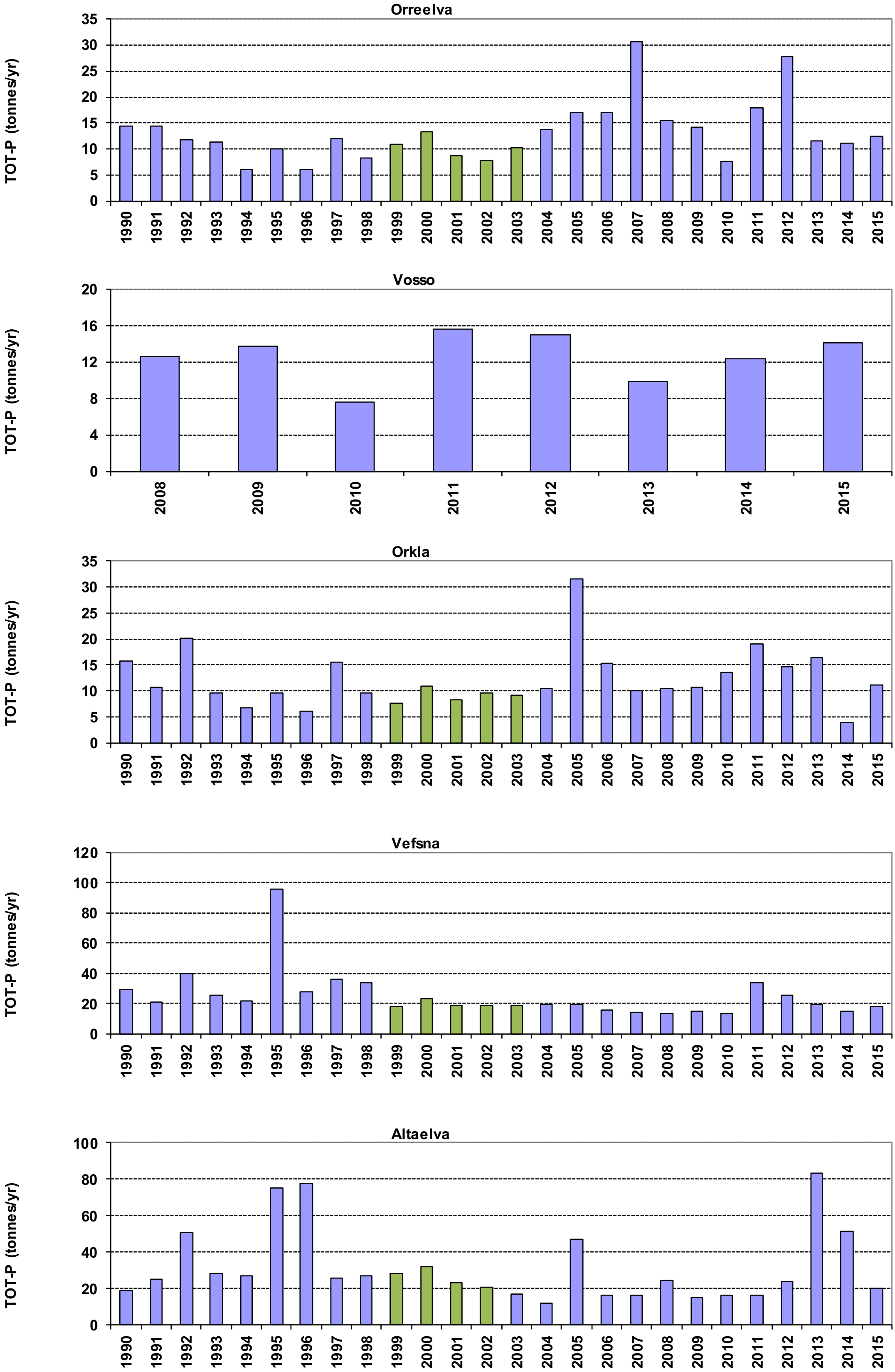


Figure A-V- 5b. Annual riverine loads of total phosphorus (Tot-P) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso). Years with extra- or interpolated values are given in green.

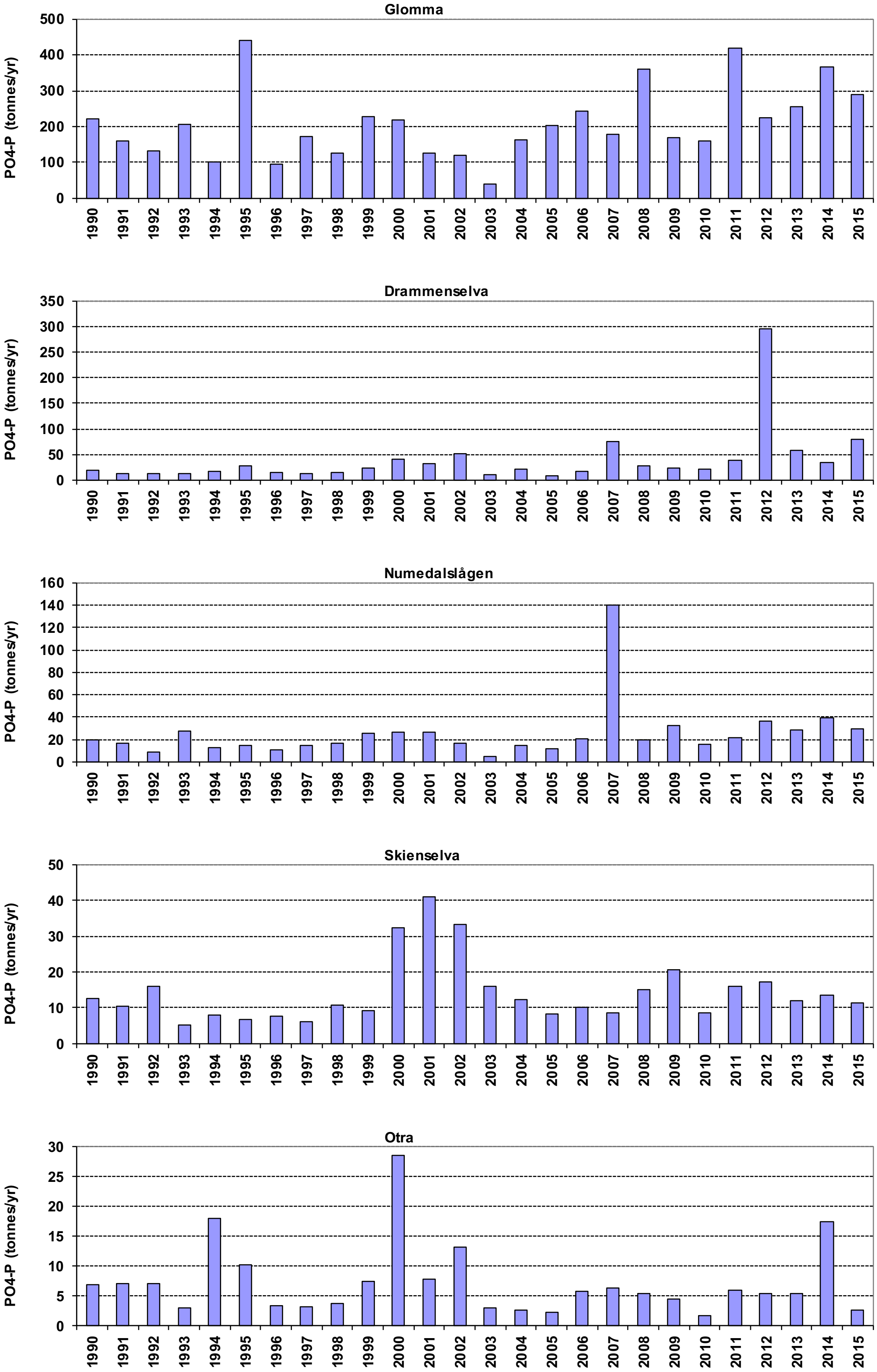


Figure A-V-6a. Annual riverine loads of orthophosphate-phosphorus (PO_4-P) in the five main rivers draining to Skagerrak, Norway, 1990-2015.

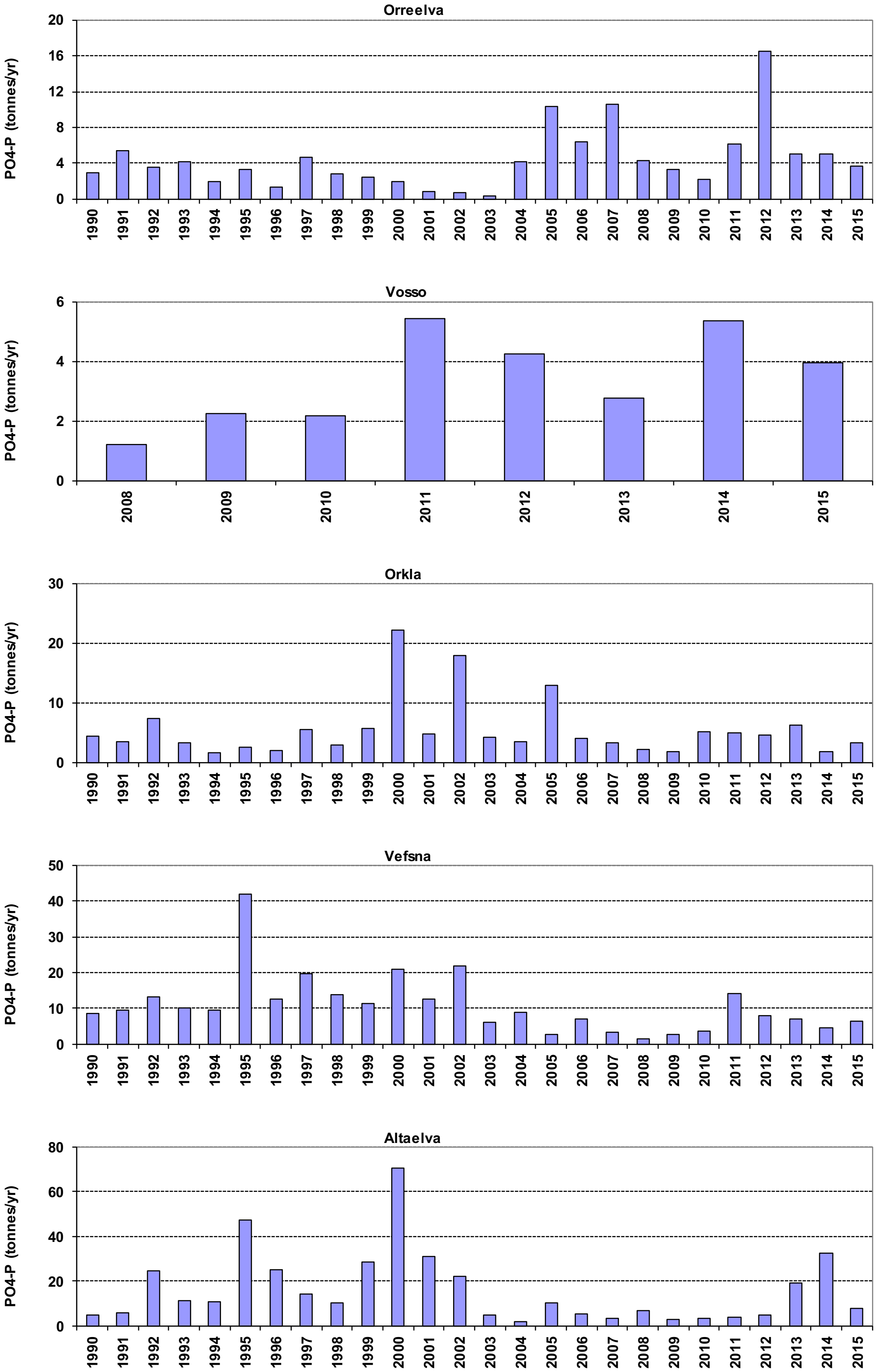


Figure A-V-6b. Annual riverine loads of orthophosphate-phosphorus (PO_4-P) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).

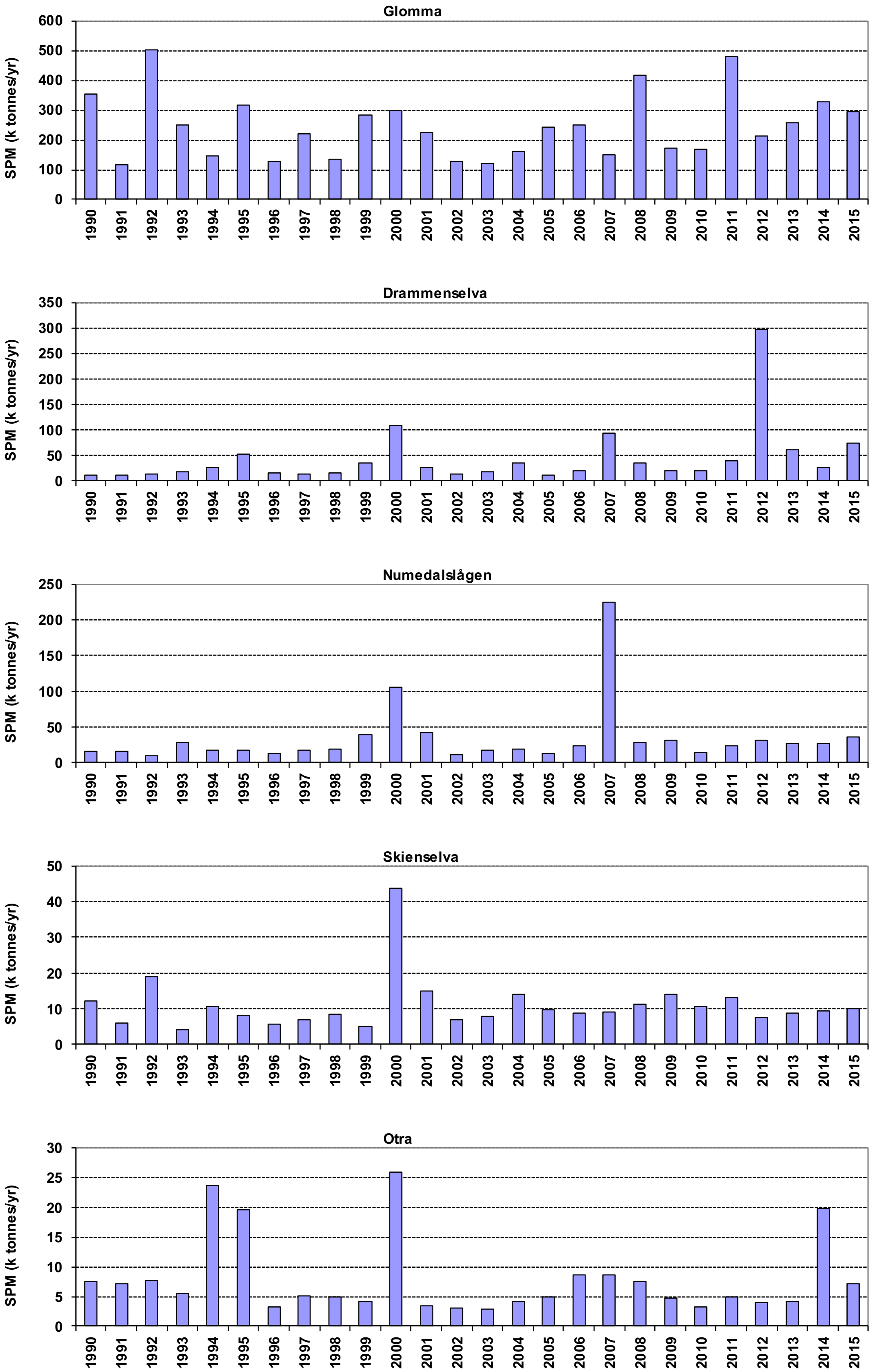


Figure A-V-7a. Annual riverine loads of suspended particulate matter (SPM) in the five main rivers draining to Skagerrak, Norway, 1990-2015.

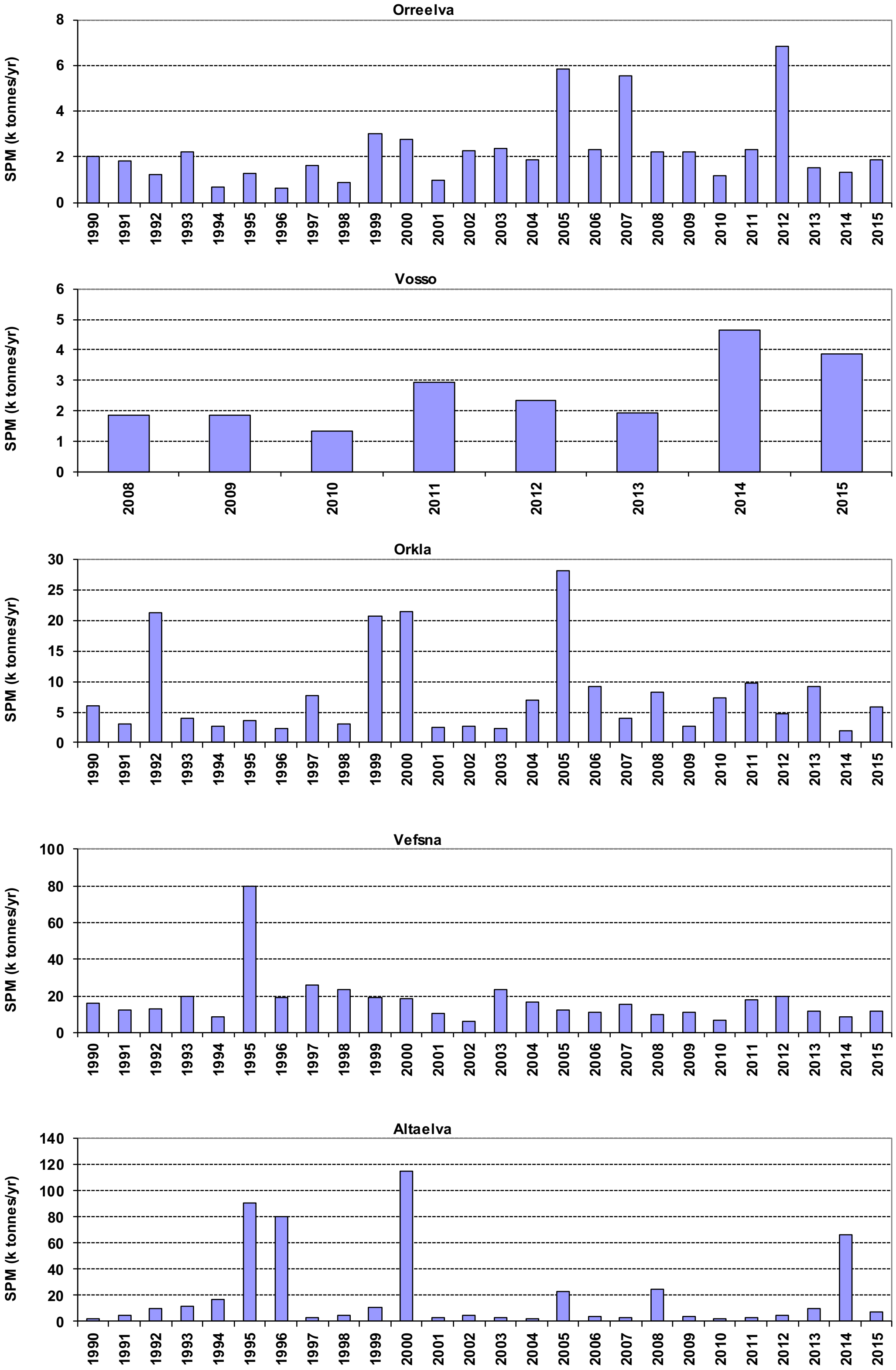


Figure A-V-7b. Annual riverine loads of suspended particulate matter (SPM) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).

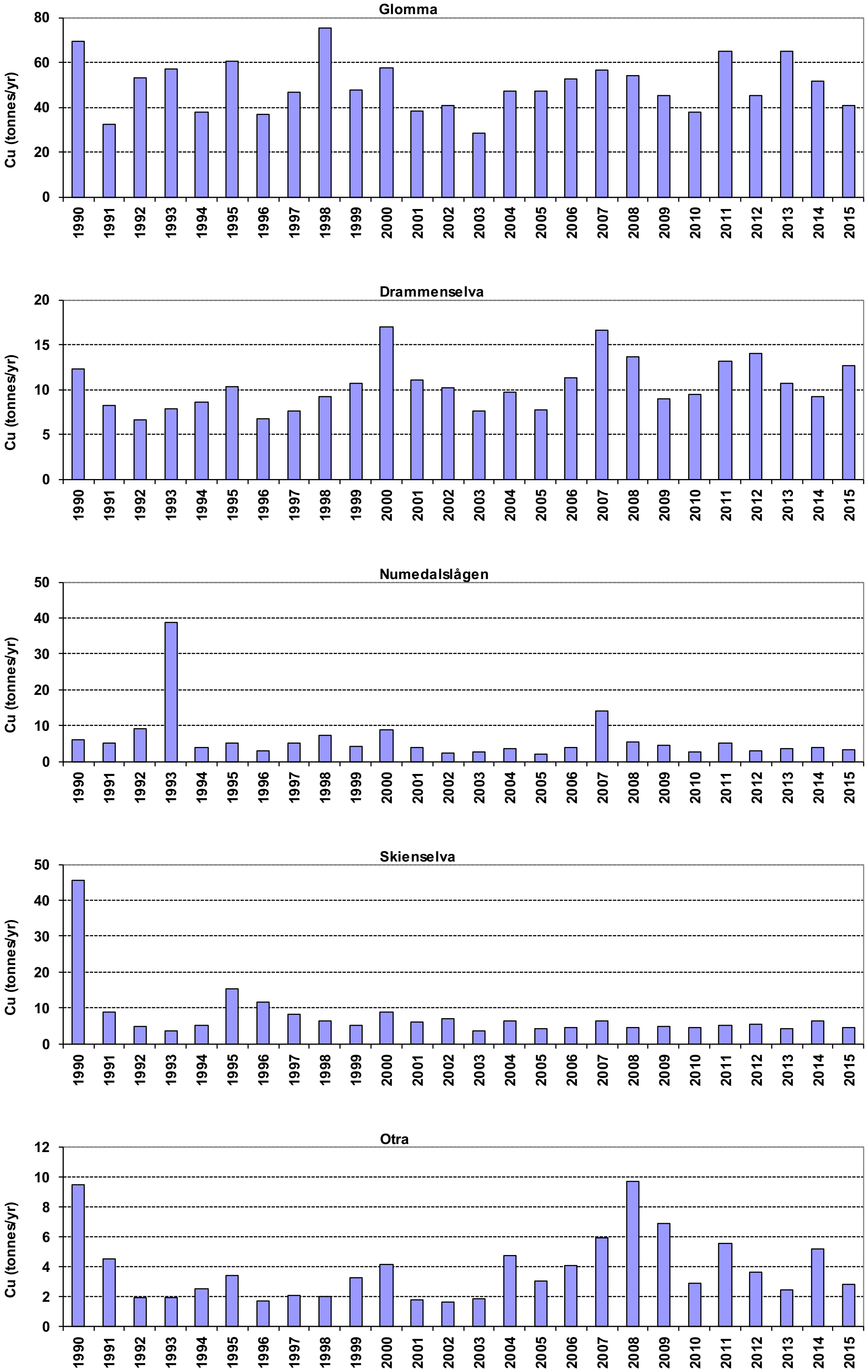


Figure A-V-8a. Annual riverine loads of copper (Cu) in the five main rivers draining to Skagerrak, Norway, 1990-2015.

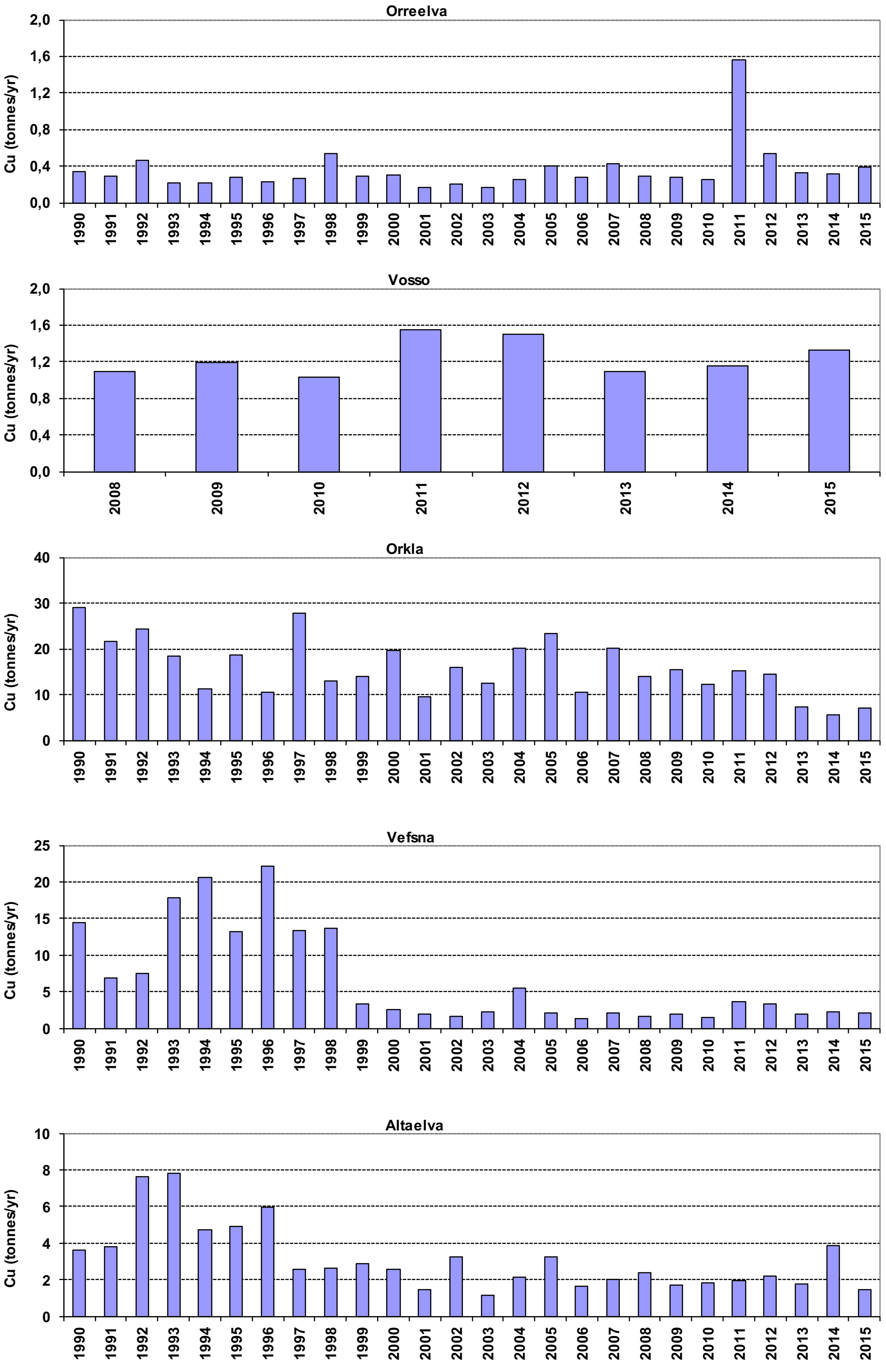


Figure A-V-8b. Annual riverine loads of copper (Cu) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).

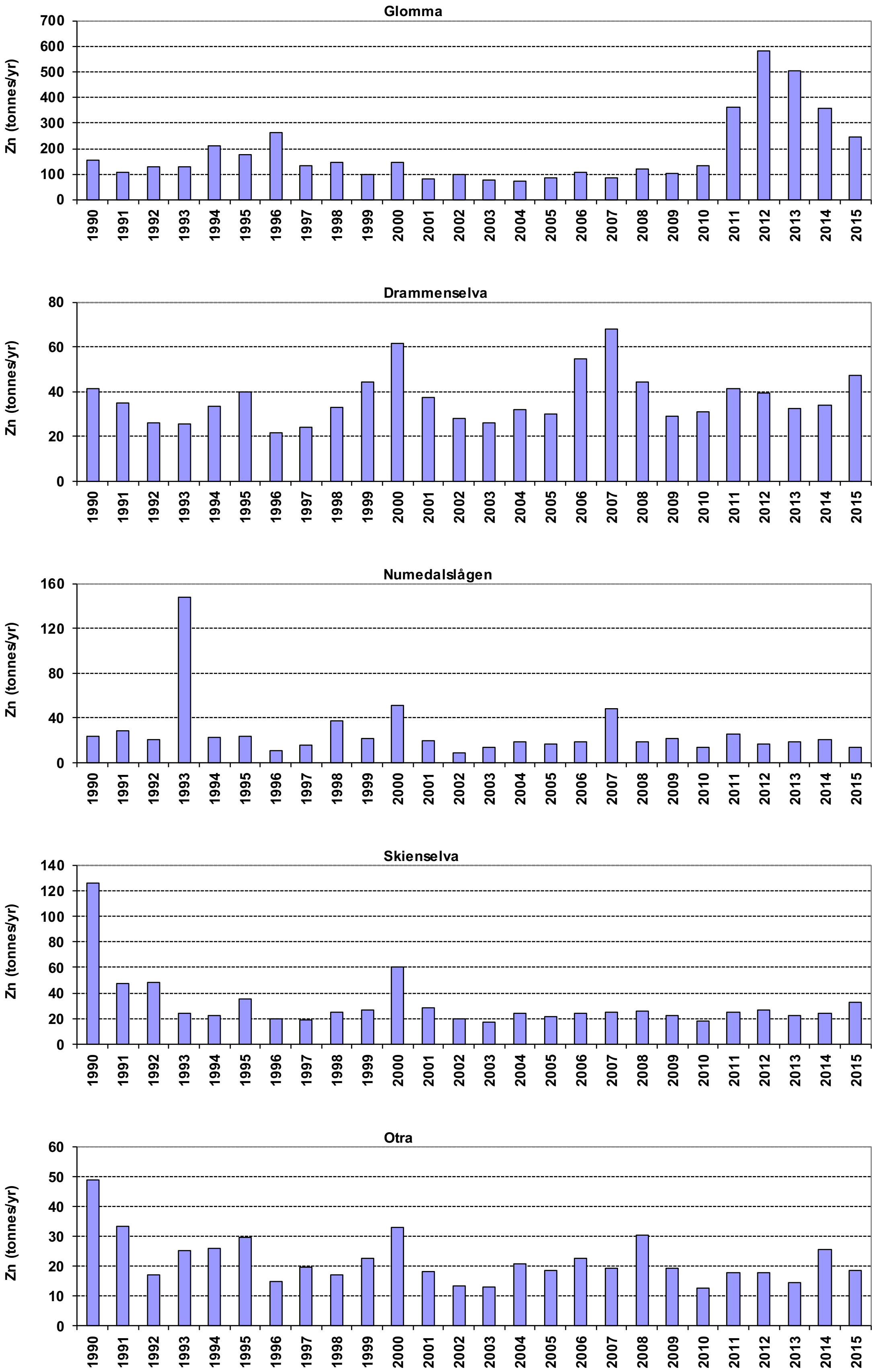


Figure A-V-9a. Annual riverine loads of zinc (Zn) in the five main rivers draining to Skagerrak, Norway, 1990-2015.

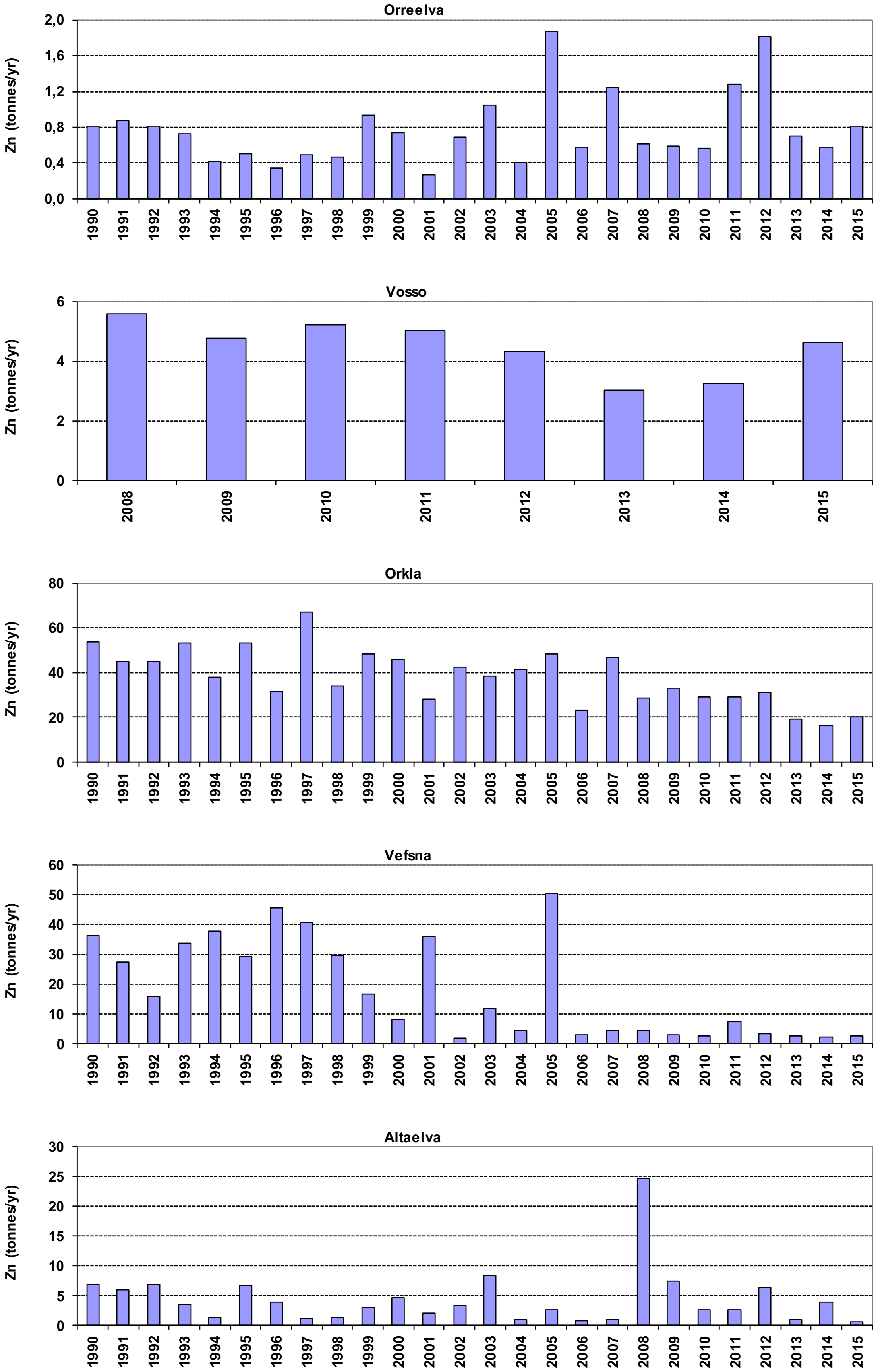


Figure A-V-9b. Annual riverine loads of zinc (Zn) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).

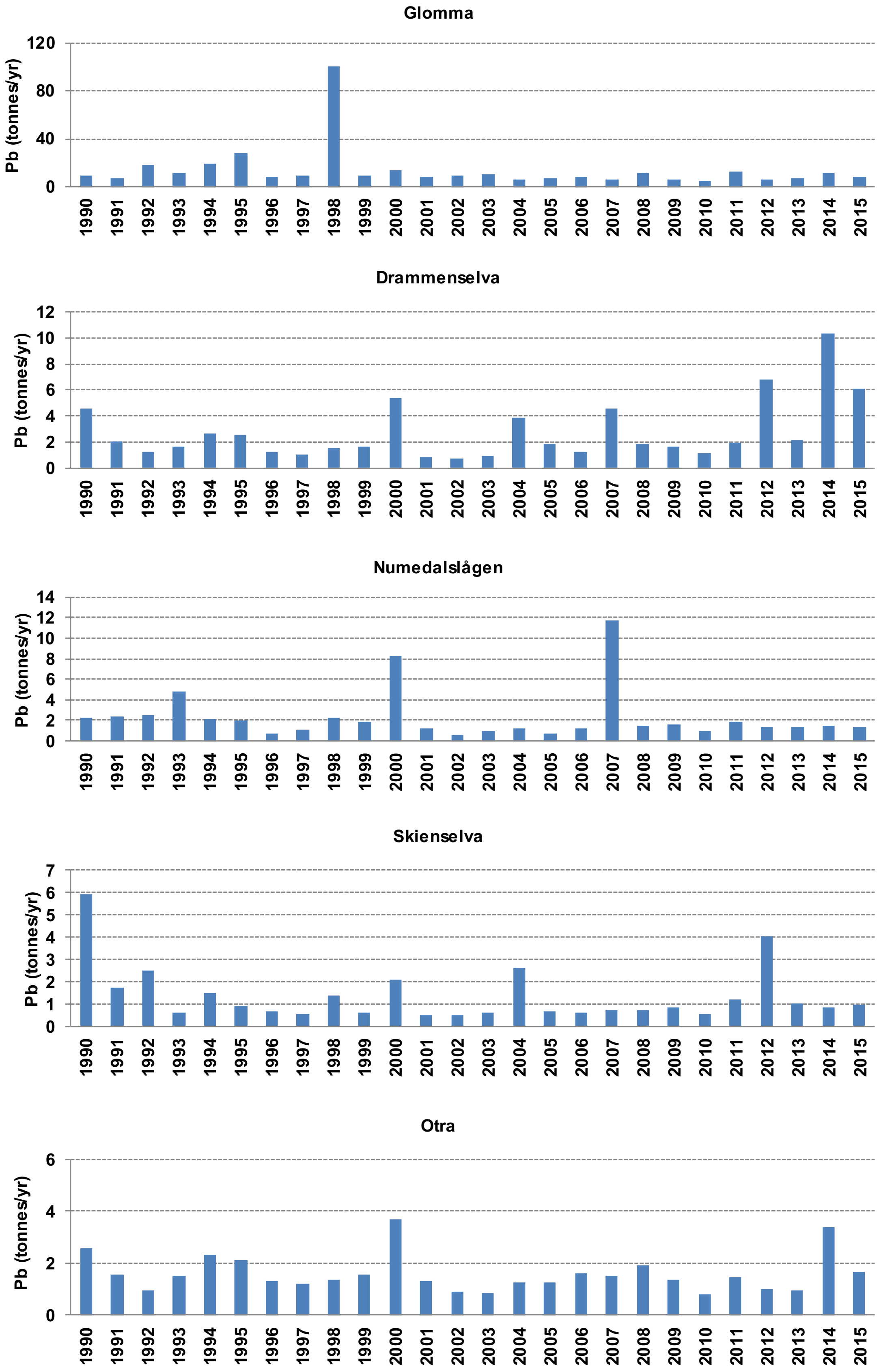


Figure A-V-10a. Annual riverine loads of lead (Pb) in the five main rivers draining to Skagerrak, Norway, 1990-2015.

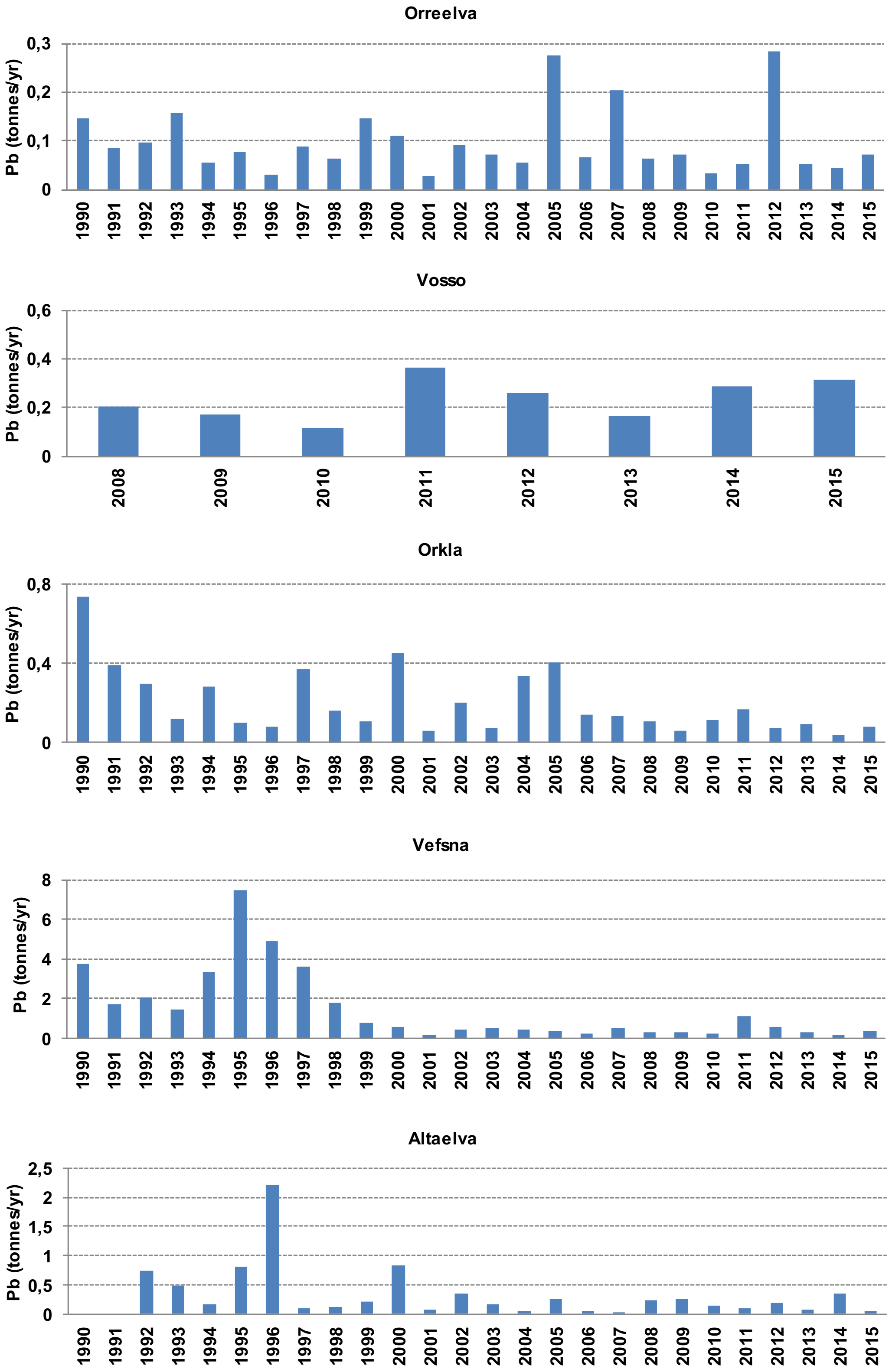


Figure A-V-10b. Annual riverine loads of lead (Pb) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).

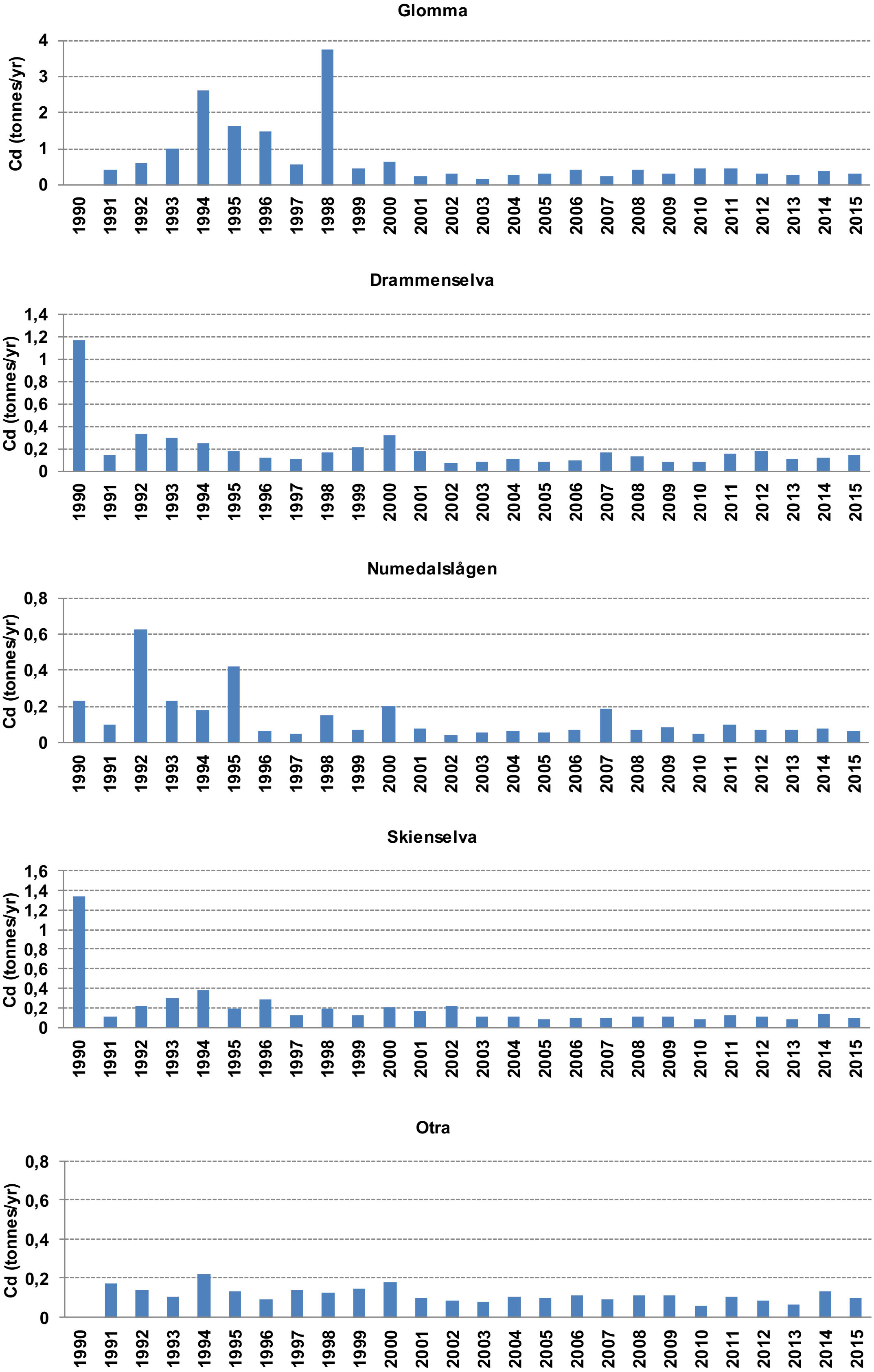


Figure A-V-11a. Annual riverine loads of cadmium (Cd) in the five main rivers draining to Skagerrak, Norway, 1990-2015

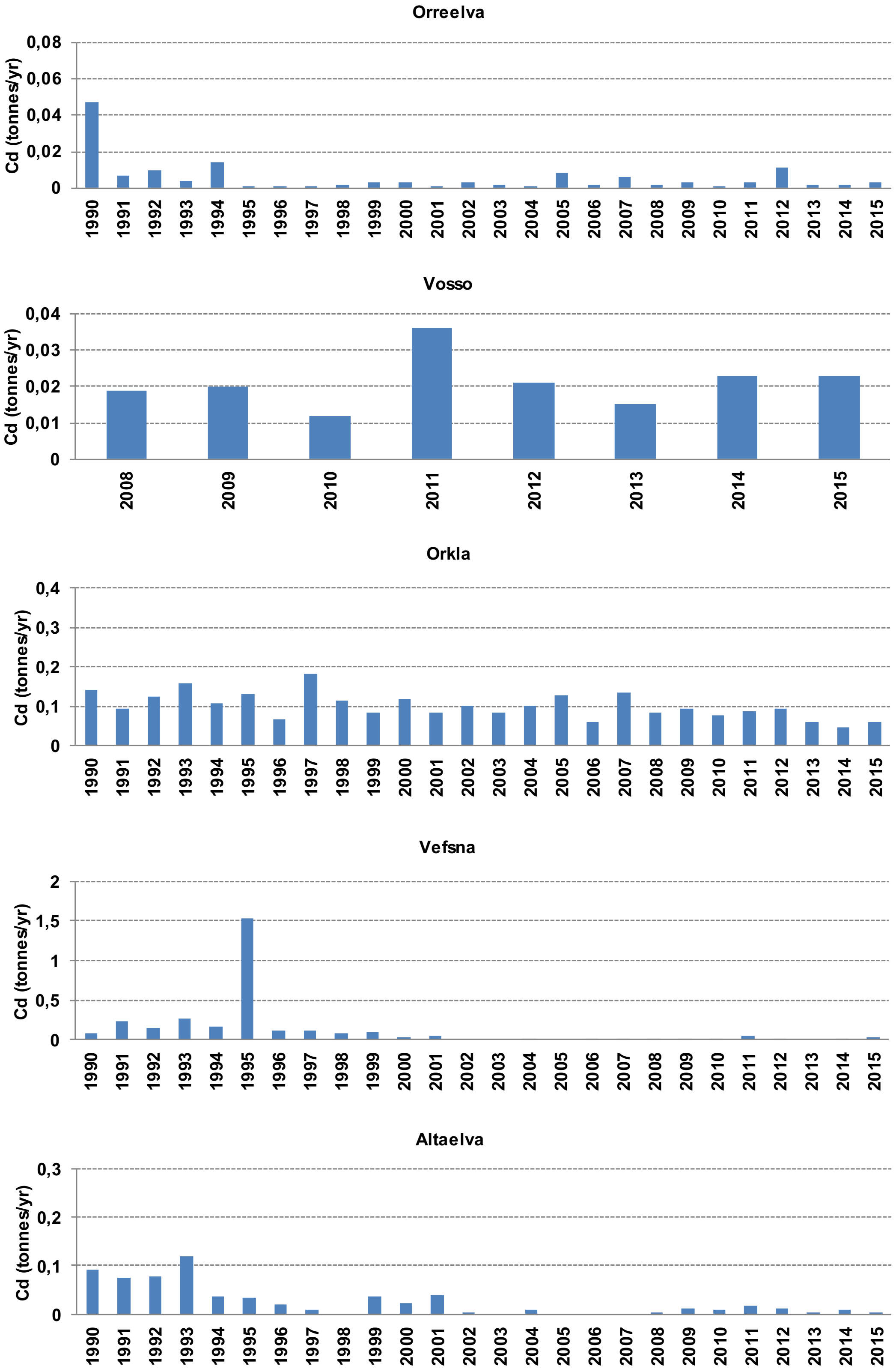


Figure A-V-11b. Annual riverine loads of cadmium (Cd) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso).

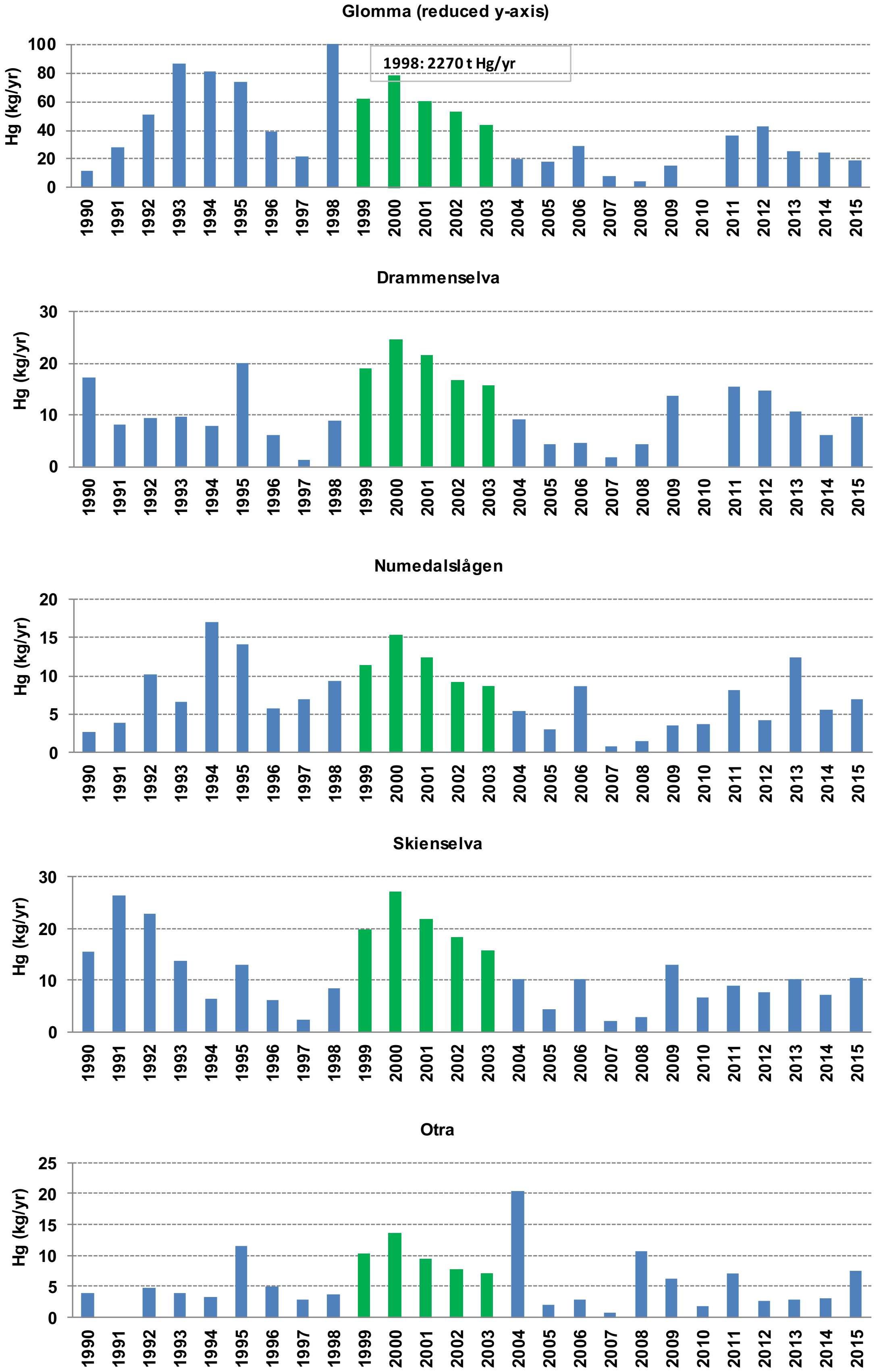


Figure A-V-12a. Annual riverine loads of mercury (Hg) in the five main rivers draining to Skagerrak, Norway, 1990-2015. Years with interpolated loads are given in green. Note Glomma with reduced y-axis.

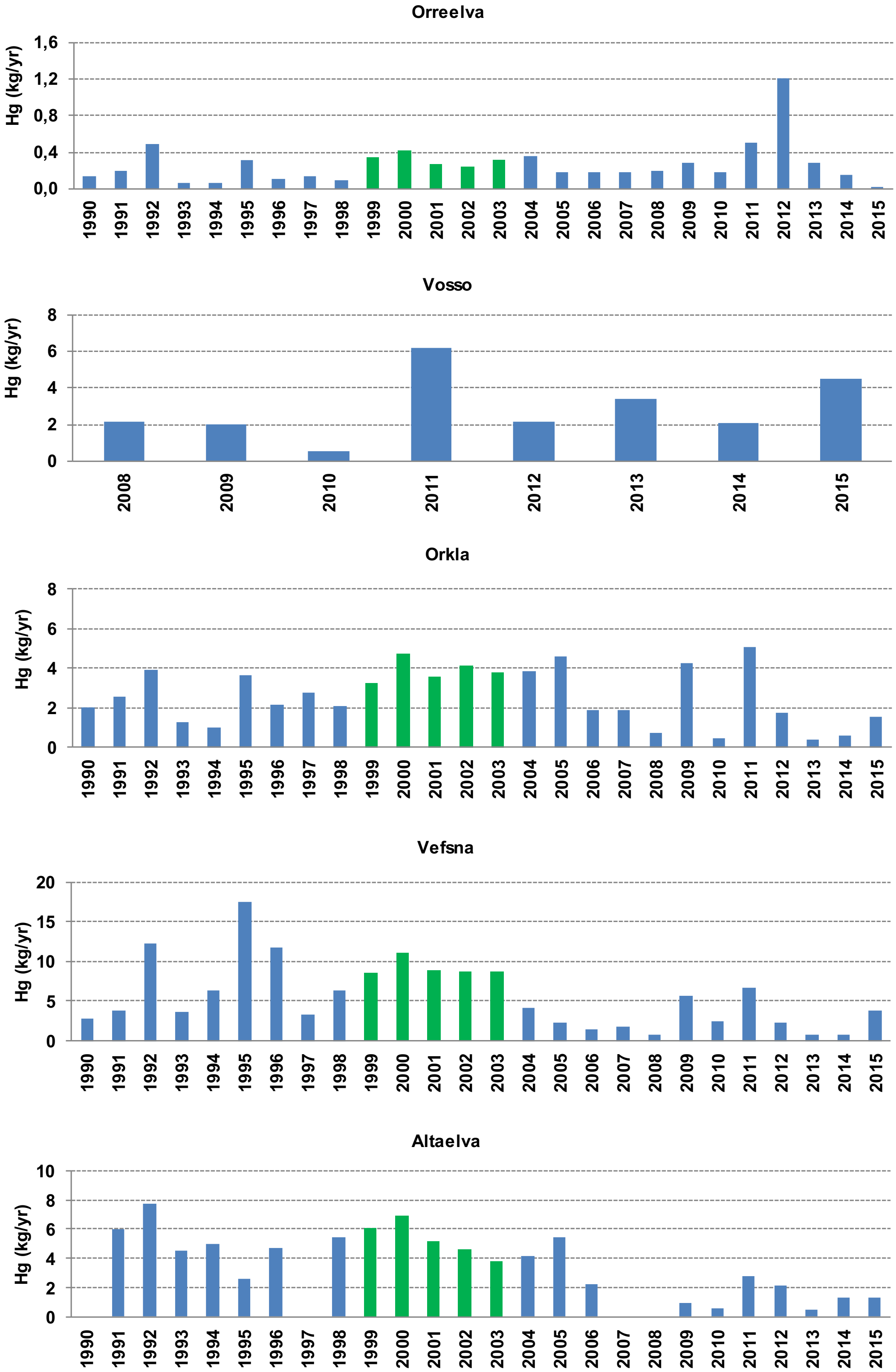


Figure A-V-12b. Annual riverine loads of mercury (Hg) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso). Years with interpolated loads are given in green.

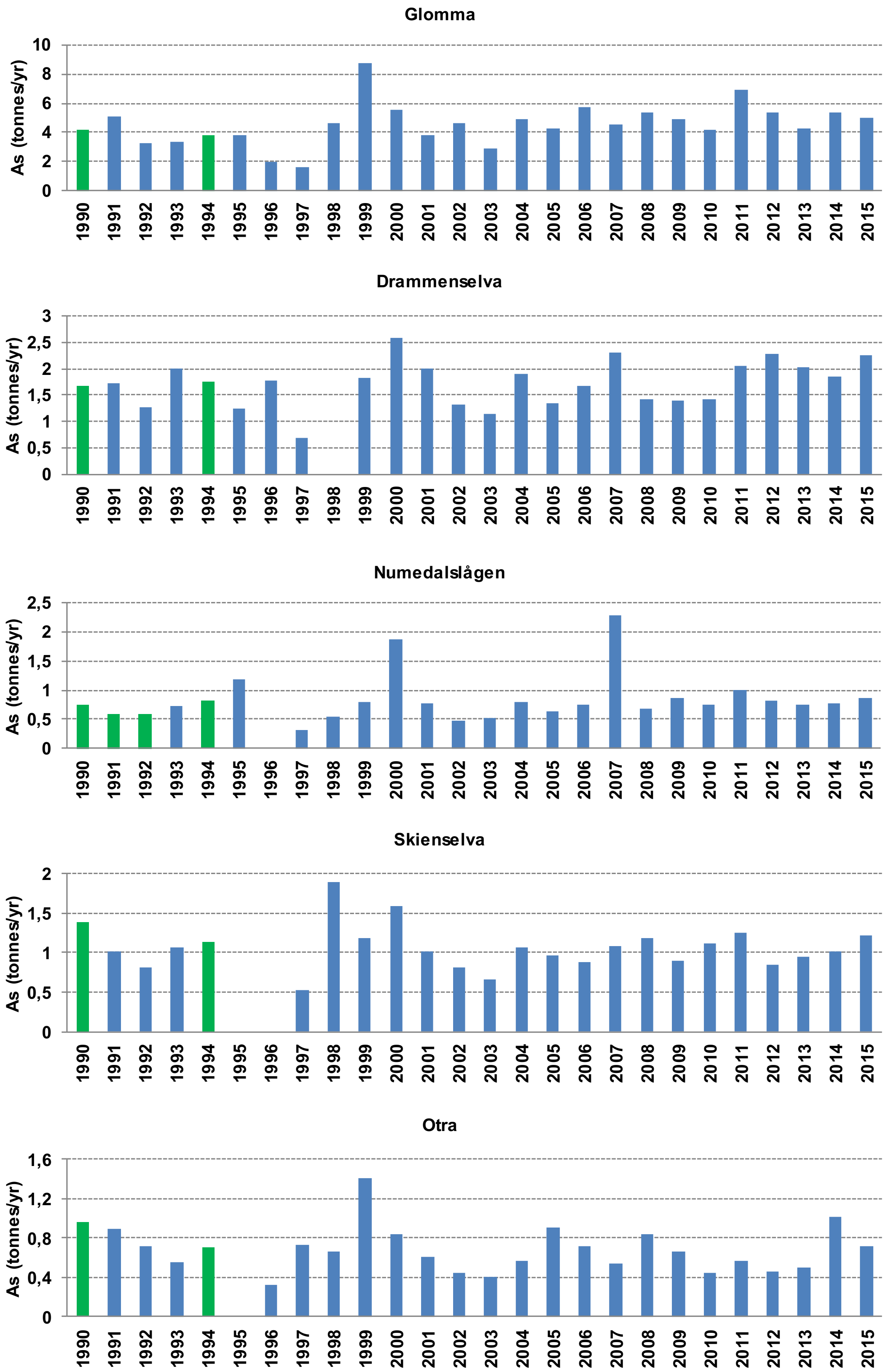


Figure A-V-13a. Annual riverine loads of arsenic (As) in the five main rivers draining to Skagerrak, Norway, 1990-2015. Years with extra- or interpolated loads are given in green.

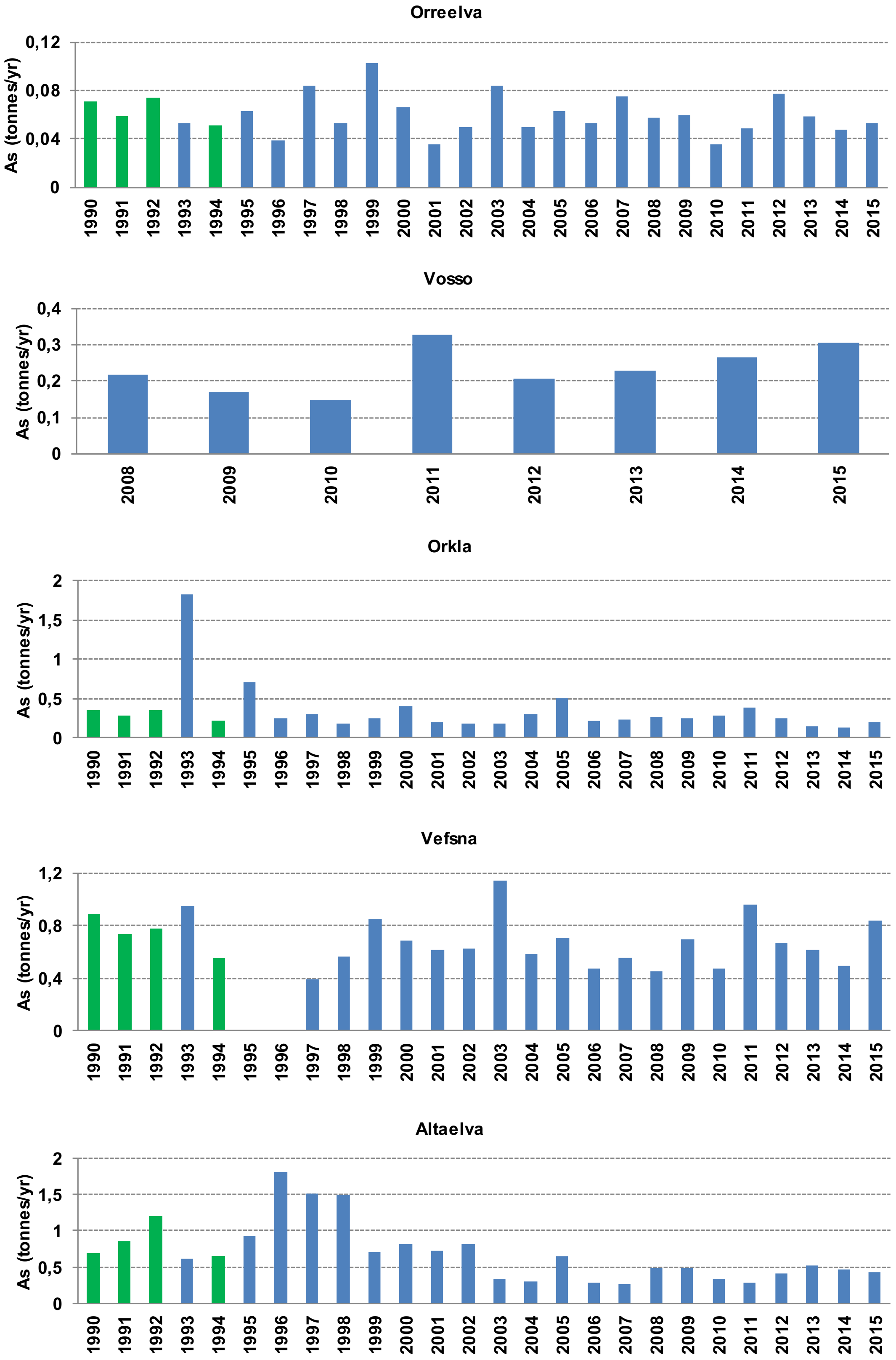


Figure A-V-13b. Annual riverine loads of arsenic (As) in the five main rivers draining to the North Sea, the Norwegian Sea and the Barents Sea, Norway, 1990-2015 (2008-2015 for River Vosso). Years with extra- or interpolated loads are given in green.

Addendum:

Data from the 2015 RID Programme

Table 1 Concentration data in 2015

Table 1a. Concentration data with statistics for the 47 monitored rivers in 2015

Legend:

🟥 Single values exceeding threshold levels

🟨 Single values almost at threshold level

24 Average concentrations exceeding threshold level

The threshold levels are shown in Table 17 in Chapter 3.3.3.

Glomma ved Sarpsfoss

Date DD.MM.YYYY	Qs [m3/s]	pH []	KOND [mS/m]	TURB860 [FNU]	SPM [mg/l]	TOC [mg C/l]	PO4-P [µg/l P]	TOTP [µg/l P]	NO3-N [µg/l N]	NH4-N [µg/l N]	TOTN [µg/l N]	SiO2 [mg SiO2/l]	Ag [µg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Ni [µg/l]	Cr [µg/l]	Hg [ng/l]
05.01.2015 15:00:00	537	7.15	4.79	2.90	2.49	3.90	5	7	372	19	585	4.20	<0.00	0.14	0.12	0.01	1.04	4.70	0.68	0.20	2.00
09.02.2015 15:00:00	597	7.41	5.27	4.90	4.10	3.80	6	9	380	30	620	4.46	0.03	0.14	0.17	0.01	1.22	10.20	0.68	0.22	2.00
09.03.2015	638	7.22	5.59	17.00	17.00	4.10	18	23	480	<2	715	5.53	<0.00	0.23	0.44	0.01	1.72	12.50	1.17	0.63	3.00
06.04.2015 15:45:00	522	7.26	5.48	9.40	7.57	4.30	7	13	430	23	665	5.08	<0.00	0.18	0.27	0.01	1.39	12.50	0.86	0.34	<1.00
04.05.2015 16:00:00	746	7.13	3.98	3.10	5.21	5.20	5	10	240	20	510	4.35	0.00	0.20	0.20	0.01	1.25	13.40	0.69	0.21	<1.00
13.05.2015 15:15:00	1062	7.18	4.93	5.60	7.12	4.70	7	12	490	9	730	4.69	<0.00	0.16	0.28	0.01	1.37	4.90	0.79	0.28	<1.00
30.05.2015 13:10:00	1249	7.17	3.96	4.90	6.31	4.80	6	13	340	12	615	3.79	<0.00	0.16	0.19	0.01	1.60	5.60	0.63	0.19	<1.00
08.06.2015 14:00:00	1459	7.16	3.91	6.90	8.97	5.00	8	15	390	8	605	2.98	0.00	0.19	0.27	0.02	1.85	8.50	0.79	0.25	<1.00
15.06.2015 14:00:00	1247	7.18	3.73	3.80	6.17	4.40	5	11	230	10	450	3.45	<0.00	0.14	0.19	0.01	1.70	17.10	0.67	0.20	<1.00
23.06.2015 14:00:00	1015	7.13	4.13	0.96	3.51	3.40	3	10	200	10	430	2.94	<0.00	0.12	0.10	0.01	1.44	6.70	0.60	0.09	<1.00
04.07.2015 09:45:00	1016	7.23	4.39	1.90	3.76	3.30	4	9	200	18	395	2.85	<0.00	0.11	0.09	0.01	1.32	6.20	0.55	0.10	<1.00
10.08.2015 14:00:00	1272	7.30	4.36	3.90	7.76	3.80	6	13	240	33	480	3.26	0.00	0.19	0.23	0.01	1.55	9.70	0.68	0.19	<1.00
07.09.2015 14:30:00	1336	7.23	4.97	16.00	20.70	5.20	23	31	340	18	640	3.90	0.00	0.25	0.50	0.01	2.03	7.10	1.06	0.41	<1.00
05.10.2015 14:20:00	836	7.15	3.92	2.70	3.61	5.90	2	12	220	6	525	3.69	0.00	0.17	0.19	0.01	1.39	11.60	0.69	0.24	2.00
09.11.2015 12:45:00	419	7.17	5.63	55.00	44.40	5.60	45	76	680	<2	975	6.06	0.00	0.36	0.93	0.02	2.46	13.40	1.41	0.97	<1.00
07.12.2015 13:40:00	523	7.29	5.33	37.00	30.80	5.10	27	45	480	4	755	5.46	0.00	0.32	0.68	0.02	1.97	13.70	1.24	0.73	<1.00
Avg.	905	7.21	4.65	11.00	11.22	4.53	11	19	357	14	606	4.17	0.00	0.19	0.30	0.01	1.58	9.86	0.82	0.33	0.56
Minimum	419	7.13	3.73	0.96	2.49	3.30	2	7	200	2	395	2.85	0.00	0.11	0.09	0.01	1.04	4.70	0.55	0.09	1.00
Maximum	1459	7.41	5.63	55.00	44.40	5.90	45	76	680	33	975	6.06	0.03	0.36	0.93	0.02	2.46	17.10	1.41	0.97	3.00
More than 70%LOQ	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	16	16	16
St.dev	344	0.08	0.68	14.78	11.66	0.78	12	18	135	9	147	0.99	0.01	0.07	0.23	0.00	0.36	3.76	0.26	0.24	0.60

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
05.01.2015 11:40:00	1	8.00	40.14	3.20	4.01	4.30	56	63	845	233	1610	8.40	0.01	0.27	0.35	0.03	2.56	8.30	0.80	0.24	1.00
05.02.2015 13:40:00	1	7.77	41.60	3.90	9.51	3.90	47	53	660	220	1310	7.97	<0.00	0.29	0.69	0.04	2.60	9.95	0.77	0.28	1.00
03.03.2015 12:35:00	4	7.82	52.10	9.40	14.90	4.80	46	50	810	84	1320	7.41	0.01	0.37	0.83	0.05	4.45	17.30	1.10	0.51	2.00
08.04.2015	1	8.12	38.60	3.10	5.19	4.20	23	31	770	70	1190	6.92	0.00	0.26	0.40	0.03	2.91	9.00	0.83	0.41	1.00
04.05.2015 10:00:00	0	7.96	42.60	3.00	5.38	4.00	42	58	880	150	1700	4.14	0.01	0.32	0.31	0.03	3.18	8.00	0.75	0.21	<1.00
04.06.2015 12:20:00	3	7.97	32.30	2.60	8.16	4.60	37	43	830	68	1470	6.86	0.01	0.35	0.52	0.03	3.41	9.30	0.82	0.37	<1.00
01.07.2015 12:15:00	0	8.08	42.30	5.10	7.84	4.10	35	90	1080	120	1720	7.26	0.01	0.46	0.22	0.03	3.20	9.80	1.03	0.34	<1.00
05.08.2015 09:25:00	1	7.78	19.60	99.00	202.00	7.40	390	470	640	<2	1500	7.16	0.01	1.52	23.50	0.73	26.20	129.00	4.98	5.57	2.00
07.09.2015 09:15:00	2	8.01	31.10	6.50	8.62	5.50	43	49	870	120	1500	8.38	0.00	0.45	0.91	0.05	3.95	21.50	1.12	0.54	<1.00
06.10.2015 10:40:00	1	8.01	38.90	2.00	1.93	4.10	79	90	1190	350	2200	8.38	0.00	0.38	0.25	0.04	2.94	9.40	0.86	0.19	1.00
03.11.2015 11:15:00	0	7.93	35.60	1.70	1.81	4.30	75	96	1150	240	1900	8.04	<0.00	0.35	0.19	0.03	2.62	8.60	0.82	0.13	<1.00
03.12.2015 10:40:00	2	7.96	37.90	3.90	6.11	4.90	44	55	740	180	1380	7.09	0.00	0.37	0.48	0.03	2.98	9.70	0.91	0.33	<1.00
Avg.	1	7.95	37.73	11.95	22.96	4.68	76	96	872	153	1567	7.33	0.00	0.45	2.39	0.09	5.08	20.82	1.23	0.76	0.67
Minimum	0	7.77	19.60	1.70	1.81	3.90	23	31	640	2	1190	4.14	0.00	0.26	0.19	0.03	2.56	8.00	0.75	0.13	1.00
Maximum	4	8.12	52.10	99.00	202.00	7.40	390	470	1190	350	2200	8.40	0.01	1.52	23.50	0.73	26.20	129.00	4.98	5.57	2.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	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	0.11	7.87	27.50	56.50	0.97	100	120	180	96	282	1.17	0.00	0.34	6.65	0.20	6.67	34.31	1.19	1.52	0.39

Drammenselva

Date DD.MM.YYYY	Qs [m3/s]	pH []	KOND [mS/m]	TURB860 [FNU]	SPM [mg/l]	TOC [mg C/l]	PO4-P [µg/l P]	TOTP [µg/l P]	NO3-N [µg/l N]	NH4-N [µg/l N]	TOTN [µg/l N]	SiO2 [mg SiO2/l]	Ag [µg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Ni [µg/l]	Cr [µg/l]	Hg [ng/l]
07.01.2015 12:25:00	324	7.19	3.31	1.20	1.51	3.20	<1	4	232	12	405	3.34	0.00	0.12	0.22	0.01	0.70	1.60	0.45	0.10	<1.00
18.02.2015 09:50:00	335	7.38	3.34	0.66	0.80	2.50	1	3	230	9	370	2.91	<0.00	0.11	1.20	0.01	0.58	2.04	0.42	0.09	<1.00
11.03.2015 08:25:00	336	7.46	4.21	2.60	3.07	2.90	4	7	330	4	520	3.49	<0.00	0.14	1.10	0.01	0.79	2.70	0.51	0.16	3.00
07.04.2015 11:00:00	319	7.23	4.57	1.40	1.72	3.10	2	1	310	11	480	3.30	<0.00	0.12	0.08	0.01	0.75	2.60	0.54	0.13	<1.00
05.05.2015 10:00:00	331	7.14	3.30	1.00	2.01	3.10	1	4	190	8	390	2.89	<0.00	0.12	0.09	0.01	0.63	1.90	0.57	0.31	<1.00
13.05.2015 10:00:00	402	7.11	3.70	1.00	1.35	3.30	1	2	250	5	445	2.94	<0.00	0.13	0.07	0.01	0.63	2.20	0.45	0.12	<1.00
26.05.2015 09:30:00	401	7.25	3.62	0.69	1.05	3.10	1	5	210	4	425	3.04	<0.00	0.11	0.06	0.01	0.57	1.70	0.40	0.10	<1.00
09.06.2015 09:30:00	475	7.22	3.71	0.88	1.25	3.50	1	3	230	2	395	2.36	<0.00	0.13	0.06	0.01	0.60	1.50	0.72	0.10	<1.00
15.06.2015 14:00:00	386	7.17	3.71	0.88	1.38	3.40	1	4	210	7	395	2.83	<0.00	0.13	0.07	0.01	0.65	1.80	0.42	0.09	<1.00
23.06.2015 09:30:00	302	7.16	3.89	1.90	1.55	3.40	1	6	190	6	390	2.76	<0.00	0.15	0.06	0.01	0.60	1.70	0.41	0.08	<1.00
07.07.2015 09:30:00	284	7.15	3.12	1.30	1.57	4.00	2	6	120	13	305	2.44	<0.00	0.14	0.08	0.01	0.62	1.80	0.39	0.08	<1.00
04.08.2015 10:00:00	302	7.07	3.16	0.90	1.12	3.30	<1	5	150	17	335	2.27	<0.00	0.13	0.05	0.01	0.58	1.00	0.39	0.08	1.00
03.09.2015 15:00:00	780	7.42	6.13	17.00	29.30	7.60	32	47	300	<2	735	5.27	<0.00	0.48	1.05	0.03	2.58	13.40	1.34	0.65	2.00
06.10.2015 08:30:00	465	7.17	3.38	1.10	1.83	4.20	2	6	170	11	410	2.91	<0.00	0.17	0.11	0.01	0.73	2.00	0.38	0.17	1.00
10.11.2015 13:00:00	331	7.10	3.47	3.00	2.10	4.10	2	7	230	4	410	3.15	<0.00	0.15	1.32	0.01	1.09	3.20	0.42	0.14	<1.00
08.12.2015 10:00:00	302	7.22	3.92	1.70	2.31	3.90	2	6	280	<2	460	3.79	0.01	0.16	0.53	0.02	1.52	2.90	0.53	0.16	<1.00
Avg.	380	7.22	3.78	2.33	3.37	3.66	3	7	227	7	429	3.11	0.00	0.16	0.38	0.01	0.85	2.75	0.52	0.16	1.19
Minimum	284	7.07	3.12	0.66	0.80	2.50	1	1	120	2	305	2.27	0.00	0.11	0.05	0.01	0.57	1.00	0.38	0.08	1.00
Maximum	780	7.46	6.13	17.00	29.30	7.60	32	47	330	17	735	5.27	0.01	0.48	1.32	0.03	2.58	13.40	1.34	0.65	3.00
More than 70%LOQ	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	16	16	16
St.dev	121	0.11	0.74	3.97	6.94	1.15	8	11	58	4	97	0.71	0.00	0.09	0.48	0.01	0.52	2.90	0.24	0.14	0.54

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.01.2015 10:30:00	116	7.04	4.14	6.30	12.60	2.80	19	30	452	50	840	4.93	0.01	0.21	0.50	0.02	0.82	3.80	0.52	0.31	<1.00
09.02.2015 10:00:00	77	7.10	4.04	2.60	6.28	3.20	2	6	218	34	415	3.96	<0.00	0.14	0.13	0.01	0.44	3.05	0.30	0.12	<1.00
09.03.2015 11:00:00	140	6.91	3.34	6.50	10.10	3.00	10	13	240	24	440	4.20	0.00	0.17	0.31	0.01	0.64	3.60	0.40	0.24	3.00
07.04.2015 10:00:00	65	7.00	4.62	2.20	2.61	3.20	3	7	290	31	500	4.89	0.00	0.15	0.17	0.01	0.65	3.60	0.42	0.16	1.00
05.05.2015 08:50:00	104	6.95	2.54	0.89	1.55	3.30	2	4	100	25	295	3.09	0.00	0.15	0.13	0.01	0.47	2.30	0.30	0.09	<1.00
08.06.2015 09:00:00	130	7.20	3.03	1.70	3.98	5.60	4	10	230	14	470	2.79	0.00	0.22	0.24	0.02	0.72	3.20	0.36	0.14	3.00
07.07.2015 09:30:00	95	6.94	2.30	0.96	1.31	2.60	2	5	58	29	210	2.44	0.00	0.15	0.10	0.01	0.53	1.40	0.25	0.06	<1.00
05.08.2015 10:00:00	153	6.90	2.63	2.40	2.78	4.70	3	8	95	24	320	2.76	0.01	0.20	0.23	0.01	0.70	2.50	0.38	0.16	1.00
07.09.2015 08:00:00	249	6.74	2.70	4.40	26.43	8.30	14	23	130	15	440	3.49	0.02	0.30	0.63	0.03	1.45	5.10	0.57	0.24	<1.00
05.10.2015 09:50:00	127	6.84	2.60	1.60	2.78	4.90	2	7	150	25	400	3.66	0.01	0.20	0.21	0.01	0.80	3.10	0.42	0.15	<1.00
09.11.2015 11:00:00	121	7.03	3.50	7.60	10.00	5.10	11	21	290	31	560	4.63	0.00	0.23	0.38	0.02	0.85	3.70	0.32	0.22	9.00
07.12.2015 10:00:00	120	6.87	3.57	5.10	5.20	4.60	7	12	260	33	525	4.89	0.00	0.21	0.29	0.02	0.71	3.60	0.43	0.21	<1.00
Avg.	125	6.96	3.25	3.52	7.13	4.28	7	12	209	28	451	3.81	0.01	0.19	0.27	0.01	0.73	3.25	0.39	0.18	2.00
Minimum	65	6.74	2.30	0.89	1.31	2.60	2	4	58	14	210	2.44	0.00	0.14	0.10	0.01	0.44	1.40	0.25	0.06	1.00
Maximum	249	7.20	4.62	7.60	26.43	8.30	19	30	452	50	840	4.93	0.02	0.30	0.63	0.03	1.45	5.10	0.57	0.31	9.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	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	47	0.12	0.74	2.35	7.12	1.63	6	8	110	9	158	0.91	0.00	0.05	0.16	0.01	0.26	0.92	0.09	0.07	2.34

Skienselva

Date DD.MM.YYYY	Qs [m3/s]	pH []	KOND [mS/m]	TURB860 [FNU]	SPM [mg/l]	TOC [mg C/l]	PO4-P [µg/l P]	TOTP [µg/l P]	NO3-N [µg/l N]	NH4-N [µg/l N]	TOTN [µg/l N]	SiO2 [mg SiO2/l]	Ag [µg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Ni [µg/l]	Cr [µg/l]	Hg [ng/l]
15.01.2015 10:10:00	344	6.78	1.87	0.52	0.51	2.80	2	2	146	7	280	2.36	<0.00	0.10	0.05	0.01	0.39	1.90	0.19	0.06	<1.00
18.02.2015 10:00:00	349	6.74	1.89	0.56	0.61	2.60	1	3	160	<2	275	2.42	0.00	0.10	0.07	0.01	0.40	2.60	0.23	0.08	<1.00
03.03.2015 15:20:00	314	6.76	2.07	0.58	0.94	2.70	2	5	170	2	300	2.38	<0.00	0.11	0.26	0.01	0.41	9.90	0.23	0.09	<1.00
08.04.2015 13:10:00	367	6.83	3.31	0.77	0.62	2.50	<1	2	150	8	265	2.42	<0.00	0.10	0.12	0.01	0.62	7.20	0.23	0.09	<1.00
05.05.2015 13:15:00	244	6.76	1.93	0.53	0.56	2.50	<1	3	140	7	285	2.16	<0.00	0.10	0.06	0.01	0.37	1.80	0.18	0.07	<1.00
09.06.2015 09:45:00	356	6.83	1.87	0.69	0.86	2.50	<1	3	120	2	240	2.21	<0.00	0.11	0.05	0.01	0.34	1.70	0.16	0.05	2.00
08.07.2015 09:00:00	206	6.79	1.77	0.43	0.58	3.30	<1	3	88	17	220	1.86	<0.00	0.10	0.03	0.01	0.35	1.50	0.18	0.05	<1.00
12.08.2015 09:30:00	191	6.86	1.73	0.52	0.46	2.10	<1	2	85	14	215	1.75	<0.00	0.11	0.05	0.01	0.34	2.60	0.15	0.06	<1.00
07.09.2015 10:15:00	776	6.82	1.78	0.90	1.45	2.80	1	3	97	11	255	1.87	<0.00	0.10	0.07	0.01	0.36	1.60	0.18	0.06	<1.00
06.10.2015 10:10:00	361	6.65	1.68	1.80	1.68	4.20	2	6	83	13	295	2.31	<0.00	0.16	0.12	0.01	0.56	2.30	0.17	0.13	6.00
18.11.2015 10:45:00	367	6.73	1.97	0.83	0.81	3.40	<1	4	110	14	255	2.31	<0.00	0.12	0.07	0.01	0.44	1.80	0.10	0.08	<1.00
02.12.2015 10:00:00	228	6.74	1.88	0.65	0.70	3.30	1	4	110	10	260	2.11	<0.00	0.12	0.07	0.01	0.45	2.10	0.21	0.08	<1.00
Avg..	342	6.77	1.98	0.73	0.82	2.89	1	3	122	9	262	2.18	0.00	0.11	0.08	0.01	0.42	3.08	0.18	0.08	1.50
Minimum	191	6.65	1.68	0.43	0.46	2.10	1	2	83	2	215	1.75	0.00	0.10	0.03	0.01	0.34	1.50	0.10	0.05	1.00
Maximum	776	6.86	3.31	1.80	1.68	4.20	2	6	170	17	300	2.42	0.00	0.16	0.26	0.01	0.62	9.90	0.23	0.13	6.00
More than 70%LOQ	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	152	0.06	0.43	0.37	0.38	0.57	0	1	31	5	27	0.24	0.00	0.02	0.06	0.00	0.09	2.64	0.04	0.02	1.45

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
05.01.2015 10:00:00	177	6.11	1.54	0.39	0.50	2.90	<1	2	84	19	240	1.97	0.01	0.11	0.24	0.02	0.56	3.40	0.47	0.09	<1.00
04.02.2015 12:05:00	165	6.07	1.70	0.38	0.41	2.60	<1	1	92	10	230	1.80	<0.00	0.11	0.22	0.02	0.36	2.98	0.44	0.10	<1.00
09.03.2015 11:45:00	201	5.90	1.83	0.61	0.61	2.50	<1	2	110	11	235	1.86	<0.00	0.09	0.22	0.02	0.42	3.90	0.76	0.09	1.00
08.04.2015 13:11:00	160	6.19	1.52	0.45	0.58	2.00	<1	2	83	4	195	1.70	<0.00	0.07	0.15	0.01	0.35	2.30	0.37	0.07	<1.00
05.05.2015 11:15:00	201	6.18	1.32	0.33	0.57	1.90	<1	<1	78	7	200	1.44	0.00	0.10	0.14	0.01	0.39	2.10	0.28	0.08	<1.00
08.06.2015 10:45:00	150	6.13	1.61	0.71	5.71	2.90	<1	2	68	<2	210	1.31	0.00	0.13	0.24	0.02	0.56	2.80	0.46	0.07	<1.00
07.07.2015 13:30:00	92	6.33	1.50	0.40	0.69	1.70	<1	3	43	6	137	1.00	0.00	0.09	0.10	0.01	0.30	1.90	0.24	0.05	<1.00
05.08.2015 11:28:00	98	6.39	1.71	0.89	0.68	2.20	<1	2	44	10	180	1.04	<0.00	0.10	0.15	0.01	0.36	2.30	0.26	0.05	1.00
07.09.2015 14:34:00	231	5.89	1.48	0.61	1.34	3.70	<1	4	44	11	225	1.22	<0.00	0.14	0.33	0.02	0.46	2.80	0.57	0.08	<1.00
05.10.2015 13:15:00	194	5.91	1.27	0.52	0.81	3.00	<1	3	51	6	205	1.29	<0.00	0.11	0.22	0.01	0.39	2.20	0.32	0.07	<1.00
09.11.2015 13:05:00	220	6.06	1.65	0.93	1.40	4.00	<1	4	82	12	255	1.82	0.01	0.16	0.42	0.02	0.65	3.80	0.23	0.11	4.00
07.12.2015 09:00:00	338	5.82	1.90	0.85	1.20	4.30	2	5	88	7	290	2.01	0.00	0.15	0.48	0.03	0.60	4.40	0.45	0.12	3.00
Avg..	186	6.08	1.59	0.59	1.21	2.81	1	3	72	9	217	1.54	0.00	0.11	0.24	0.02	0.45	2.91	0.40	0.08	1.42
Minimum	92	5.82	1.27	0.33	0.41	1.70	1	1	43	2	137	1.00	0.00	0.07	0.10	0.01	0.30	1.90	0.23	0.05	1.00
Maximum	338	6.39	1.90	0.93	5.71	4.30	2	5	110	19	290	2.01	0.01	0.16	0.48	0.03	0.65	4.40	0.76	0.12	4.00
More than 70%LOQ	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	65	0.18	0.19	0.21	1.46	0.84	0	1	22	4	39	0.36	0.00	0.03	0.12	0.00	0.11	0.81	0.16	0.02	1.00

Orreelva

Date DD.MM.YYYY	Qs [m3/s]	pH []	KOND [mS/m]	TURB860 [FNU]	SPM [mg/l]	TOC [mg C/l]	PO4-P [µg/l P]	TOTP [µg/l P]	NO3-N [µg/l N]	NH4-N [µg/l N]	TOTN [µg/l N]	SiO2 [mg SiO2/l]	Ag [µg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Ni [µg/l]	Cr [µg/l]	Hg [ng/l]
06.01.2015 10:10:00	13	7.62	17.54	5.70	8.35	5.80	25	68	1490	16	2110	3.62	0.00	0.27	0.29	0.01	1.66	3.20	1.15	0.22	<1.00
03.02.2015 13:15:00	4	7.58	17.30	3.10	7.89	5.50	32	57	1480	4	2160	2.08	<0.00	0.26	0.32	0.01	1.72	3.58	1.04	0.21	<1.00
03.03.2015 12:30:00	17	7.56	16.70	7.30	12.10	5.70	13	69	1550	<2	2090	1.29	<0.00	0.29	0.67	0.02	3.18	9.00	1.22	0.29	<1.00
07.04.2015	2	7.90	17.70	3.20	8.34	5.20	10	38	980	8	1700	0.20	<0.00	0.21	0.22	0.01	1.66	2.10	1.02	0.20	<1.00
11.05.2015 07:00:00	7	7.69	17.60	2.90	5.32	5.40	10	35	640	81	1380	0.16	0.00	0.25	0.12	0.01	1.53	1.70	0.94	0.14	<1.00
02.06.2015 11:20:00	11	7.77	18.00	4.20	7.48	6.20	16	43	330	17	1220	0.17	0.00	0.24	0.18	0.01	1.96	2.10	0.99	0.13	<1.00
07.07.2015 08:50:00	1	7.77	18.30	4.10	4.53	6.10	6	42	<2	54	620	1.10	<0.00	0.36	0.06	0.01	1.26	1.20	1.09	0.08	<1.00
05.08.2015 07:15:00	1	7.46	18.60	7.10	4.54	5.40	13	64	59	100	980	2.61	0.00	0.31	0.05	0.01	1.25	0.90	1.05	0.08	<1.00
07.09.2015 08:45:00	3	7.67	20.40	4.50	10.44	5.80	<1	41	<2	3	750	2.31	<0.00	0.31	0.25	0.01	1.07	1.50	1.07	0.07	<1.00
06.10.2015 10:00:00	2	7.78	18.60	2.30	13.18	5.70	24	96	64	14	1020	3.15	0.00	0.31	0.30	0.02	1.49	4.60	1.08	0.16	<1.00
02.11.2015 12:45:00	2	7.71	19.10	5.20	19.90	4.60	13	86	80	4	705	2.87	<0.00	0.24	0.16	0.01	1.18	1.50	0.90	0.08	2.00
01.12.2015 13:10:00	14	7.55	18.10	6.60	9.21	5.00	27	77	1400	63	2200	3.49	<0.00	0.26	0.38	0.02	1.68	3.30	1.14	0.15	<1.00
Avg..	6	7.67	18.16	4.68	9.27	5.53	16	60	673	31	1411	1.92	0.00	0.28	0.25	0.01	1.64	2.89	1.06	0.15	1.08
Minimum	1	7.46	16.70	2.30	4.53	4.60	1	35	2	2	620	0.16	0.00	0.21	0.05	0.01	1.07	0.90	0.90	0.07	1.00
Maximum	17	7.90	20.40	7.30	19.90	6.20	32	96	1550	100	2200	3.62	0.00	0.36	0.67	0.02	3.18	9.00	1.22	0.29	2.00
More than 70%LOQ	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	6	0.12	0.96	1.70	4.32	0.45	9	20	663	35	615	1.30	0.00	0.04	0.17	0.01	0.55	2.22	0.09	0.07	0.29

Vosso(Bolstadelvi)

Date DD.MM.YYYY	Qs [m3/s]	pH []	KOND [mS/m]	TURB860 [FNU]	SPM [mg/l]	TOC [mg C/l]	PO4-P [µg/l P]	TOTP [µg/l P]	NO3-N [µg/l N]	NH4-N [µg/l N]	TOTN [µg/l N]	SiO2 [mg SiO2/l]	Ag [µg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Ni [µg/l]	Cr [µg/l]	Hg [ng/l]
05.01.2015 12:50:00	61	6.49	1.59	0.57	0.62	1.20	2	4	146	9	245	1.12	<0.00	0.07	0.04	0.01	0.35	0.89	0.36	0.06	<1.00
02.02.2015 13:30:00	25	6.57	2.13	<0.30	0.21	1.10	1	4	142	4	240	1.16	0.01	0.06	0.04	0.01	0.29	1.31	0.37	0.05	<1.00
02.03.2015 10:15:00	46	6.43	2.34	0.43	0.39	1.20	1	3	200	<2	290	1.29	<0.00	0.06	0.04	0.00	0.37	1.38	0.40	0.07	<1.00
07.04.2015 11:30:00	20	6.74	2.16	0.54	0.56	1.10	1	4	210	<2	300	1.33	<0.00	0.08	0.05	0.01	0.42	1.10	0.39	0.06	1.00
04.05.2015 12:30:00	46	6.60	2.41	0.76	0.74	1.40	3	5	200	<2	345	1.43	<0.00	0.12	0.29	0.01	0.56	1.80	0.53	0.14	<1.00
02.06.2015 10:20:00	166	6.70	2.05	0.43	1.50	1.30	<1	3	130	4	275	1.19	<0.00	0.07	0.06	0.01	0.38	1.20	0.38	0.05	<1.00
07.07.2015 14:00:00	573	6.37	1.09	0.55	0.96	0.75	<1	3	51	7	111	0.84	<0.00	0.07	0.08	0.00	0.26	1.20	0.24	0.04	<1.00
03.08.2015 10:32:00	120	6.36	<1.00	0.80	0.34	0.57	<1	2	29	7	88	0.60	<0.00	0.08	0.05	0.01	0.24	0.83	0.18	<0.03	<1.00
07.09.2015 12:15:00	66	6.45	<1.00	0.43	0.58	0.83	<1	2	44	<2	124	0.62	<0.00	0.04	0.04	0.00	0.20	0.51	0.20	0.03	<1.00
05.10.2015 10:40:00	46	6.41	<1.00	0.39	0.41	0.83	<1	2	50	4	132	0.56	0.00	0.07	0.05	0.00	0.29	0.96	0.15	0.04	2.00
02.11.2015 10:50:00	125	6.32	1.04	0.43	0.43	1.10	<1	3	82	9	165	0.82	<0.00	0.08	0.04	0.00	0.27	0.89	0.24	0.05	2.00
07.12.2015 12:20:00	250	6.32	1.44	0.69	1.31	1.40	2	5	140	5	250	1.04	<0.00	0.08	0.09	0.01	0.41	1.10	0.54	0.09	3.00
Avg.	129	6.48	1.35	0.50	0.67	1.07	1	3	119	4	214	1.00	0.00	0.07	0.07	0.01	0.34	1.10	0.33	0.06	0.67
Minimum	20	6.32	1.00	0.30	0.21	0.57	1	2	29	2	88	0.56	0.00	0.04	0.04	0.00	0.20	0.51	0.15	0.03	1.00
Maximum	573	6.74	2.41	0.80	1.50	1.40	3	5	210	9	345	1.43	0.01	0.12	0.29	0.01	0.56	1.80	0.54	0.14	3.00
More than 70%LOQ	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	12	12	12
St.dev	155	0.14	0.58	0.16	0.40	0.27	1	1	66	3	86	0.30	0.00	0.02	0.07	0.00	0.10	0.33	0.13	0.03	0.65

Orkla

Date DD.MM.YYYY	Qs [m3/s]	pH []	KOND [mS/m]	TURB860 [FNU]	SPM [mg/l]	TOC [mg C/l]	PO4-P [µg/l P]	TOTP [µg/l P]	NO3-N [µg/l N]	NH4-N [µg/l N]	TOTN [µg/l N]	SiO2 [mg SiO2/l]	Ag [µg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Ni [µg/l]	Cr [µg/l]	Hg [ng/l]
06.01.2015 11:00:00	47	7.53	6.41	0.47	0.96	2.50	1	3	125	12	305	3.41	<0.00	0.09	0.02	0.06	4.76	21.80	0.85	0.19	<1.00
09.02.2015 11:00:00	49	7.76	7.91	3.70	9.27	2.50	8	15	225	5	410	3.96	<0.00	0.16	0.17	0.07	6.50	20.90	1.15	0.75	<1.00
04.03.2015 10:00:00	31	7.56	7.79	0.44	0.38	2.10	<1	4	200	2	345	3.47	<0.00	0.08	0.01	0.04	4.56	16.40	0.74	0.14	<1.00
07.04.2015 11:20:00	17	7.71	8.91	0.62	1.56	2.90	1	4	310	<2	495	3.73	<0.00	0.14	0.03	0.07	8.12	22.40	0.95	0.23	<1.00
04.05.2015 08:50:00	41	7.42	7.50	0.46	0.82	3.80	1	2	230	<2	435	3.30	<0.00	0.11	0.02	0.07	8.03	23.10	0.94	0.23	<1.00
04.06.2015 08:10:00	78	7.34	4.89	0.80	1.22	3.90	<1	3	82	<2	290	2.64	<0.00	0.10	0.02	0.03	4.49	11.10	0.96	0.22	<1.00
06.07.2015 07:40:00	63	7.47	5.21	0.45	0.69	2.50	<1	3	110	5	250	2.04	<0.00	0.09	0.01	0.03	3.51	8.50	0.58	0.13	<1.00
06.08.2015 08:30:00	138	7.22	4.67	3.30	11.47	5.60	5	18	78	6	365	2.49	<0.00	0.22	0.13	0.03	4.13	7.80	1.29	0.59	2.00
07.09.2015 07:00:00	55	7.40	5.04	0.38	0.73	4.10	<1	3	83	<2	260	2.27	<0.00	0.11	0.02	0.02	2.57	5.20	0.75	0.17	<1.00
06.10.2015 10:00:00	17	7.67	7.38	0.45	0.64	3.60	<1	3	150	<2	350	2.89	<0.00	0.13	0.02	0.05	5.09	16.70	0.60	0.18	<1.00
09.11.2015 11:20:00	33	7.65	7.76	0.34	0.50	2.40	<1	3	210	2	345	3.34	<0.00	0.10	0.01	0.05	4.96	20.50	0.67	0.11	8.00
08.12.2015 09:20:00	37	7.46	7.20	0.34	0.64	3.70	1	3	250	3	445	3.49	<0.00	0.12	0.02	0.06	5.17	18.20	0.75	0.20	<1.00
Avg.	50	7.52	6.72	0.98	2.41	3.30	1	5	171	3	358	3.09	0.00	0.12	0.04	0.05	5.16	16.05	0.85	0.26	0.83
Minimum	17	7.22	4.67	0.34	0.38	2.10	1	2	78	2	250	2.04	0.00	0.08	0.01	0.02	2.57	5.20	0.58	0.11	1.00
Maximum	138	7.76	8.91	3.70	11.47	5.60	8	18	310	12	495	3.96	0.00	0.22	0.17	0.07	8.12	23.10	1.29	0.75	8.00
More than 70%LOQ	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	12	12	12
St.dev	33	0.16	1.43	1.19	3.76	1.01	2	5	77	3	76	0.61	0.00	0.04	0.05	0.02	1.66	6.32	0.22	0.20	2.02

Vefsna

Date DD.MM.YYYY	Qs [m3/s]	pH []	KOND [mS/m]	TURB860 [FNU]	SPM [mg/l]	TOC [mg C/l]	PO4-P [µg/l P]	TOTP [µg/l P]	NO3-N [µg/l N]	NH4-N [µg/l N]	TOTN [µg/l N]	SiO2 [mg SiO2/l]	Ag [µg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Ni [µg/l]	Cr [µg/l]	Hg [ng/l]
05.01.2015 13:30:00	131	7.63	6.51	0.75	0.94	1.90	<1	2	46	3	147	1.69	<0.00	0.11	0.04	<0.00	0.32	0.25	0.31	0.08	<1.00
18.02.2015 08:30:00	134	7.56	7.16	0.57	0.64	1.60	<1	2	55	<2	138	1.73	<0.00	0.09	0.03	<0.00	0.26	0.34	0.27	0.08	<1.00
10.03.2015 12:30:00	78	7.52	8.36	0.75	0.89	2.10	<1	2	38	<2	138	1.77	<0.00	0.11	0.03	<0.00	0.38	0.40	0.27	0.14	2.00
07.04.2015 09:00:00	119	7.46	6.23	1.60	5.71	2.00	2	6	37	<2	137	1.62	<0.00	0.10	0.16	0.01	0.46	0.59	0.41	0.25	1.00
05.05.2015 10:00:00	95	7.65	8.94	0.59	0.64	2.00	<1	4	24	<2	160	1.40	<0.00	0.13	0.03	<0.00	0.33	0.33	0.30	0.09	<1.00
08.06.2015 08:30:00	445	7.48	4.96	0.50	1.43	1.40	<1	2	25	<2	93	1.29	0.00	0.16	0.04	0.00	0.30	0.16	0.32	0.08	<1.00
06.07.2015 09:00:00	537	7.29	3.40	1.20	3.13	0.90	3	4	27	4	83	0.96	<0.00	0.11	0.08	0.01	0.32	0.62	0.39	0.09	<1.00
18.08.2015 08:20:00	182	7.22	2.99	0.73	0.53	0.66	<1	2	14	3	63	0.78	0.00	0.15	0.03	0.00	0.19	0.23	0.16	0.05	<1.00
14.09.2015 12:25:00	82	7.51	4.24	<0.30	0.18	0.75	<1	1	17	<2	85	0.86	<0.00	0.11	0.02	<0.00	0.19	<0.15	0.14	0.03	<1.00
05.10.2015 11:30:00	369	7.51	4.91	0.82	1.66	2.10	<1	2	17	<2	119	1.28	<0.00	0.13	0.06	0.00	0.37	0.56	0.19	0.11	<1.00
09.11.2015 10:30:00	180	7.51	5.35	0.38	0.60	1.90	<1	2	51	<2	125	1.48	<0.00	0.12	0.04	<0.00	0.45	0.40	0.09	0.07	4.00
01.12.2015 09:00:00	82	7.58	6.85	<0.30	0.90	2.20	<1	2	50	<2	170	1.67	<0.00	0.11	0.02	<0.00	0.31	0.28	0.25	0.08	<1.00
Avg.	203	7.49	5.82	0.66	1.44	1.63	0	3	33	1	122	1.38	0.00	0.12	0.05	0.00	0.32	0.35	0.26	0.10	0.58
Minimum	78	7.22	2.99	0.30	0.18	0.66	1	1	14	2	63	0.78	0.00	0.09	0.02	0.00	0.19	0.15	0.09	0.03	1.00
Maximum	537	7.65	8.94	1.60	5.71	2.20	3	6	55	4	170	1.77	0.00	0.16	0.16	0.01	0.46	0.62	0.41	0.25	4.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	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	12	12	12
St.dev	157	0.13	1.86	0.38	1.55	0.56	1	1	15	1	33	0.35	0.00	0.02	0.04	0.00	0.09	0.16	0.10	0.06	0.89

Altaelva

Date DD.MM.YYYY	Qs [m3/s]	pH []	KOND [mS/m]	TURB860 [FNU]	SPM [mg/l]	TOC [mg C/l]	PO4-P [µg/l P]	TOTP [µg/l P]	NO3-N [µg/l N]	NH4-N [µg/l N]	TOTN [µg/l N]	SiO2 [mg SiO2/l]	Ag [µg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Ni [µg/l]	Cr [µg/l]	Hg [ng/l]
05.01.2015 13:00:00	26	7.54	9.18	0.30	0.42	2.90	3	6	93	<2	295	5.98	<0.00	0.13	0.01	<0.00	0.42	<0.15	0.24	0.15	<1.00
09.02.2015 08:00:00	26	7.58	8.16	0.43	0.44	2.70	4	4	63	<2	205	5.83	<0.00	0.11	<0.01	<0.00	0.41	<0.15	0.23	0.17	<1.00
09.03.2015 10:10:00	24	7.76	8.28	0.37	0.41	2.70	4	6	43	<2	230	6.43	<0.00	0.11	0.01	<0.00	0.38	<0.15	0.22	0.16	<1.00
07.04.2015 07:30:00	24	7.73	7.95	<0.30		2.60	1	3	38	<2	175	5.38	<0.00	0.11	0.01	<0.00	0.38	<0.15	0.21	0.14	1.00
07.05.2015 08:40:00	60	7.63	9.34	0.48	0.86	2.60	<1	4	62	<2	240	6.09	<0.00	0.11	0.02	<0.00	0.45	<0.15	0.23	0.18	<1.00
08.06.2015 08:50:00	351	7.36	5.31	1.70	6.52	4.50	5	11	25	<2	225	3.19	0.00	0.18	0.04	0.00	0.66	0.33	0.51	0.59	<1.00
06.07.2015 08:15:00	110	7.46	7.44	<0.30	0.46	3.10	2	5	43	18	190	3.75	<0.00	0.17	0.01	<0.00	0.49	0.17	0.22	0.11	1.00
04.08.2015 08:17:00	124	7.51	5.42	0.42	1.10	3.20	<1	5	20	2	175	3.36	<0.00	0.12	0.01	<0.00	0.50	0.17	0.24	0.15	1.00
07.09.2015 08:50:00	57	7.55	7.24	0.44	0.65	2.90	3	7		<2	275	3.17	<0.00	0.12	0.01	<0.00	0.44	<0.15	0.21	0.11	<1.00
12.10.2015 09:00:00	71	7.51	7.44	0.36	0.41	2.90	1	4	48	<2	210	3.84	<0.00	0.14	0.01	<0.00	0.40	0.17	0.25	0.13	<1.00
09.11.2015 08:50:00	48	7.71	8.52	<0.30	0.40	2.90	1	5	75	35	300	4.61	<0.00	0.14	0.01	<0.00	0.45	<0.15	<0.04	0.15	<1.00
02.12.2015 12:30:00	35	7.54	6.90	<0.30	0.33	2.90	1	4	53	<2	200	4.97	<0.00	0.12	0.01	<0.00	0.44	<0.15	0.24	0.15	<1.00
Avg.	80	7.57	7.60	0.38	1.09	2.99	2	5	51	5	227	4.72	0.00	0.13	0.01	0.00	0.45	0.07	0.23	0.18	0.25
Minimum	24	7.36	5.31	0.30	0.33	2.60	1	3	20	2	175	3.17	0.00	0.11	0.01	0.00	0.38	0.15	0.04	0.11	1.00
Maximum	351	7.76	9.34	1.70	6.52	4.50	5	11	93	35	300	6.43	0.00	0.18	0.04	0.00	0.66	0.33	0.51	0.59	1.00
More than 70%LOQ	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	no	yes	yes	no
n	12	12	12	12	11	12	12	12	11	12	12	12	12	12	12	12	12	12	12	12	12
St.dev	92	0.12	1.28	0.39	1.82	0.51	1	2	21	10	43	1.22	0.00	0.02	0.01	0.00	0.08	0.05	0.10	0.13	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2015 15:00:00	24	6.78	4.97	4.00	5.49	8.60	8	16	470	<2	785	4.48	0.04	0.36	0.33	0.02	1.32	11.40	0.75	0.44	2.00
22.05.2015 15:30:00	29	6.79	4.93	3.80	4.64	8.50	7	14	460	<2	830	4.93	0.00	0.34	0.35	0.02	1.40	10.10	0.80	0.45	2.00
10.08.2015 15:00:00	21	6.77	4.91	2.30	2.29	8.30	5	14	420	14	850	3.71	<0.00	0.38	0.34	0.01	1.73	20.40	0.73	0.35	1.00
05.10.2015 13:15:00	23	6.86	4.78	2.10	2.01	8.90	3	11	380	6	760	3.62	<0.00	0.35	0.21	0.02	1.31	6.10	0.66	0.33	<1.00
Avg.	24	6.80	4.90	3.05	3.61	8.58	6	14	433	5	806	4.18	0.01	0.36	0.31	0.02	1.44	12.00	0.74	0.39	1.25
Minimum	21	6.77	4.78	2.10	2.01	8.30	3	11	380	2	760	3.62	0.00	0.34	0.21	0.01	1.31	6.10	0.66	0.33	1.00
Maximum	29	6.86	4.97	4.00	5.49	8.90	8	16	470	14	850	4.93	0.04	0.38	0.35	0.02	1.73	20.40	0.80	0.45	2.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
St.dev	4	0.04	0.08	0.99	1.72	0.25	2	2	41	6	41	0.63	0.02	0.02	0.06	0.00	0.20	6.04	0.06	0.06	0.58

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
04.02.2015 09:40:00	23	6.02	2.00	0.35	0.39	4.90	<1	3	149	11	355	3.49	<0.00	0.22	0.28	0.03	0.46	5.13	0.43	0.15	2.00
12.05.2015 05:15:00	32	6.45	2.30	0.49	0.80	5.10	<1	4	150	4	370	3.11	<0.00	0.22	0.22	0.03	0.54	4.90	0.51	0.17	<1.00
11.08.2015 09:00:00	20	6.46	2.55	1.20	1.02	5.60	<1	4	85	6	350	2.51	<0.00	0.23	0.16	0.02	0.90	4.70	0.65	0.16	<1.00
05.10.2015 10:00:00	40	6.19	1.69	0.73	0.92	6.90	1	5	69	14	360	2.74	<0.00	0.25	0.40	0.03	0.60	5.00	0.49	0.18	<1.00
Avg.	29	6.28	2.13	0.69	0.78	5.62	0	4	113	9	359	2.96	0.00	0.23	0.27	0.03	0.62	4.93	0.52	0.16	0.50
Minimum	20	6.02	1.69	0.35	0.39	4.90	1	3	69	4	350	2.51	0.00	0.22	0.16	0.02	0.46	4.70	0.43	0.15	1.00
Maximum	40	6.46	2.55	1.20	1.02	6.90	1	5	150	14	370	3.49	0.00	0.25	0.40	0.03	0.90	5.13	0.65	0.18	2.00
More than 70%LOQ	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	9	0.21	0.37	0.37	0.28	0.90	0	1	42	5	9	0.43	0.00	0.01	0.11	0.00	0.19	0.18	0.09	0.01	0.50

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
04.02.2015 12:35:00	104	6.38	2.62	1.20	1.45	3.40	4	6	237	7	405	3.09	<0.00	0.15	0.31	0.03	0.74	4.60	0.26	0.22	<1.00
12.05.2015 12:13:00	166	6.50	2.43	0.96	1.71	3.40	2	4	190	7	390	2.13	<0.00	0.17	0.28	0.03	0.74	4.50	0.27	0.13	<1.00
11.08.2015 12:40:00	91	6.24	1.57	0.64	0.60	3.70	<1	3	90	14	285	1.50	<0.00	0.16	0.17	0.02	0.78	3.60	0.25	0.10	<1.00
05.10.2015 11:40:00	124	6.29	1.44	0.64	0.88	4.50	<1	3	84	10	300	2.10	<0.00	0.18	0.37	0.02	0.72	3.80	0.32	0.12	2.00
Avg.	121	6.35	2.02	0.86	1.16	3.75	2	4	150	10	345	2.20	0.00	0.16	0.28	0.02	0.74	4.12	0.28	0.14	0.50
Minimum	91	6.24	1.44	0.64	0.60	3.40	1	3	84	7	285	1.50	0.00	0.15	0.17	0.02	0.72	3.60	0.25	0.10	1.00
Maximum	166	6.50	2.62	1.20	1.71	4.50	4	6	237	14	405	3.09	0.00	0.18	0.37	0.03	0.78	4.60	0.32	0.22	2.00
More than 70%LOQ	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	33	0.11	0.60	0.27	0.51	0.52	1	1	76	3	61	0.65	0.00	0.01	0.08	0.00	0.03	0.50	0.03	0.05	0.50

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.02.2015 12:05:00	56	5.98	2.35	0.71	1.01	4.60	<1	3	119	20	310	2.59	0.01	0.20	0.59	0.04	0.43	6.79	0.41	0.14	<1.00
05.05.2015 13:50:00	60	6.51	2.05	1.30	8.46	3.70	4	9	91	7	320	1.75	0.01	0.20	0.97	0.03	2.02	6.50	0.50	0.19	<1.00
05.08.2015 11:21:00	57	6.22	2.09	0.67	1.62	5.10	<1	4	40	19	270	0.99	0.01	0.25	0.42	0.03	0.64	4.60	0.36	0.12	1.00
05.10.2015 14:09:00	62	6.20	1.71	0.85	1.61	6.90	<1	5	69	22	370	1.87	0.00	0.26	0.64	0.03	0.63	4.80	0.46	0.17	3.00
Avg.	59	6.23	2.05	0.88	3.18	5.08	1	5	80	17	318	1.80	0.01	0.23	0.65	0.03	0.93	5.67	0.43	0.16	1.00
Minimum	56	5.98	1.71	0.67	1.01	3.70	1	3	40	7	270	0.99	0.00	0.20	0.42	0.03	0.43	4.60	0.36	0.12	1.00
Maximum	62	6.51	2.35	1.30	8.46	6.90	4	9	119	22	370	2.59	0.01	0.26	0.97	0.04	2.02	6.79	0.50	0.19	3.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	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	3	0.22	0.26	0.29	3.54	1.35	2	3	33	7	41	0.66	0.00	0.03	0.23	0.01	0.73	1.13	0.06	0.03	1.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2015 10:40:00	65	5.90	2.01	0.56	0.75	3.20	1	4	108	12	265	1.50	0.04	0.14	0.57	0.03	0.39	4.27	0.21	0.11	<1.00
11.05.2015 08:25:00	110	6.54	2.57	1.10	1.64	3.60	2	5	100	7	305	1.41	0.00	0.17	0.48	0.03	0.41	4.40	0.23	0.11	1.00
03.08.2015 09:14:00	69	6.08	1.79	0.99	2.72	3.10	2	7	75	14	270	0.65	0.00	0.14	0.56	0.02	0.31	3.40	0.16	0.07	<1.00
06.10.2015 10:38:00	57	6.10	1.54	0.89	1.11	4.90	1	5	67	12	310	1.05	<0.00	0.21	0.56	0.02	0.35	3.00	0.24	0.11	1.00
Avg.	75	6.16	1.98	0.89	1.56	3.70	2	5	88	11	288	1.15	0.01	0.16	0.54	0.02	0.36	3.77	0.21	0.10	0.50
Minimum	57	5.90	1.54	0.56	0.75	3.10	1	4	67	7	265	0.65	0.00	0.14	0.48	0.02	0.31	3.00	0.16	0.07	1.00
Maximum	110	6.54	2.57	1.10	2.72	4.90	2	7	108	14	310	1.50	0.04	0.21	0.57	0.03	0.41	4.40	0.24	0.11	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	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	0.27	0.44	0.23	0.86	0.83	1	1	20	3	23	0.39	0.02	0.03	0.04	0.01	0.04	0.68	0.04	0.02	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2015 11:45:00	29	5.98	3.68	0.42	0.50	2.40	2	3	216	<2	335	2.40	0.03	0.14	0.30	0.05	0.18	6.40	0.16	0.06	<1.00
11.05.2015 09:29:00	37	6.50	2.92	0.55	1.04	3.20	<1	5	130	<2	315	1.33	0.00	0.16	0.43	0.03	0.42	5.50	0.13	0.06	1.00
03.08.2015 10:15:00	26	5.97	2.27	0.98	2.29	3.90	1	7	130	14	355	0.90	<0.00	0.21	0.56	0.03	0.25	5.10	0.12	0.05	2.00
06.10.2015 08:40:00	22	6.39	2.48	0.49	1.25	4.50	1	4	180	<2	410	1.71	0.00	0.23	0.41	0.03	0.46	4.70	0.27	0.07	<1.00
Avg.	29	6.21	2.84	0.61	1.27	3.50	1	5	164	4	354	1.59	0.01	0.18	0.42	0.03	0.33	5.42	0.17	0.06	0.75
Minimum	22	5.97	2.27	0.42	0.50	2.40	1	3	130	2	315	0.90	0.00	0.14	0.30	0.03	0.18	4.70	0.12	0.05	1.00
Maximum	37	6.50	3.68	0.98	2.29	4.50	2	7	216	14	410	2.40	0.03	0.23	0.56	0.05	0.46	6.40	0.27	0.07	2.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	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	6	0.28	0.62	0.25	0.75	0.91	1	2	42	6	41	0.64	0.01	0.04	0.11	0.01	0.13	0.73	0.07	0.01	0.50

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2015 13:30:00	52	5.89	4.72	0.66	4.09	2.50	3	9	195	2	370	2.12	0.02	0.14	0.45	0.05	0.40	7.80	0.18	0.07	<1.00
11.05.2015 11:14:00	66	6.44	2.66	0.60	1.14	3.50	<1	5	98	<2	310	0.68	0.01	0.18	0.51	0.02	1.03	5.80	0.21	0.08	<1.00
03.08.2015 11:15:00	86	6.08	2.37	1.20	3.75	4.60	2	10	74	6	335	0.60	<0.00	0.26	0.73	0.02	0.77	3.40	0.16	0.08	2.00
06.10.2015 07:18:00	38	6.11	2.60	0.72	1.31	6.50	1	6	150	<2	430	1.52	0.01	0.25	0.57	0.02	1.49	4.10	0.28	0.12	1.00
Avg.	61	6.13	3.09	0.80	2.57	4.28	2	8	129	2	361	1.23	0.01	0.21	0.56	0.03	0.92	5.28	0.21	0.09	0.75
Minimum	38	5.89	2.37	0.60	1.14	2.50	1	5	74	2	310	0.60	0.00	0.14	0.45	0.02	0.40	3.40	0.16	0.07	1.00
Maximum	86	6.44	4.72	1.20	4.09	6.50	3	10	195	6	430	2.12	0.02	0.26	0.73	0.05	1.49	7.80	0.28	0.12	2.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	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	20	0.23	1.10	0.27	1.56	1.71	1	2	54	2	52	0.72	0.01	0.06	0.12	0.01	0.46	1.96	0.05	0.02	0.50

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2015 15:55:00	112	5.42	1.68	0.38	0.43	1.80	<1	3	88	15	205	0.65	0.01	0.11	1.28	0.01	0.35	6.30	0.12	0.08	1.00
11.05.2015 11:48:00	130	5.68	1.76	0.39	0.52	1.30	<1	2	90	18	220	0.89	<0.00	0.08	0.21	0.01	0.18	2.40	0.11	0.06	<1.00
03.08.2015 13:30:00	157	5.44	1.81	0.49	0.67	1.60	<1	3	79	20	210	0.66	<0.00	0.08	0.23	0.01	0.27	2.50	0.11	0.05	<1.00
06.10.2015 06:16:00	62	5.40	1.65	0.60	1.36	2.70	<1	4	69	18	245	0.70	0.00	0.11	0.36	0.01	0.39	2.20	0.27	0.07	<1.00
Avg.	115	5.48	1.72	0.46	0.75	1.85	0	3	82	18	220	0.72	0.00	0.10	0.52	0.01	0.30	3.35	0.15	0.07	0.25
Minimum	62	5.40	1.65	0.38	0.43	1.30	1	2	69	15	205	0.65	0.00	0.08	0.21	0.01	0.18	2.20	0.11	0.05	1.00
Maximum	157	5.68	1.81	0.60	1.36	2.70	1	4	90	20	245	0.89	0.01	0.11	1.28	0.01	0.39	6.30	0.27	0.08	1.00
More than 70%LOQ	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	40	0.13	0.07	0.10	0.42	0.60	0	1	10	2	18	0.11	0.00	0.02	0.51	0.00	0.09	1.97	0.08	0.01	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
04.02.2015 09:20:00	57	6.22	3.96	<0.30	0.35	1.20	1	4	415	<2	510	1.74	<0.00	0.08	0.17	0.02	0.19	3.08	0.15	0.05	<1.00
05.05.2015 09:00:00	45	6.60	3.89	0.32	0.56	1.20	<1	3	300	<2	435	1.54	<0.00	0.08	0.15	0.02	0.23	2.70	0.17	0.06	<1.00
03.08.2015 08:45:00	37	6.59	3.30	0.40	0.40	1.40	<1	5	290	10	420	1.29	<0.00	0.10	0.16	0.02	0.22	2.00	0.14	0.05	<1.00
06.10.2015 08:05:00	23	6.51	3.22	0.49	1.10	1.60	1	5	310	<2	485	1.23	<0.00	0.11	0.29	0.02	0.25	2.60	0.07	0.07	<1.00
Avg.	41	6.48	3.59	0.30	0.60	1.35	1	4	329	3	463	1.45	0.00	0.09	0.19	0.02	0.22	2.60	0.13	0.06	0.00
Minimum	23	6.22	3.22	0.30	0.35	1.20	1	3	290	2	420	1.23	0.00	0.08	0.15	0.02	0.19	2.00	0.07	0.05	1.00
Maximum	57	6.60	3.96	0.49	1.10	1.60	1	5	415	10	510	1.74	0.00	0.11	0.29	0.02	0.25	3.08	0.17	0.07	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	no	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	14	0.18	0.39	0.09	0.34	0.19	0	1	58	4	42	0.24	0.00	0.01	0.07	0.00	0.03	0.45	0.04	0.01	0.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
03.03.2015 12:15:00	19	6.81	18.80	1.80	2.76	3.00	16	23	1890	<2	2400	3.15	<0.00	0.16	0.35	0.04	2.40	22.30	0.79	0.18	<1.00
11.05.2015 06:30:00	7	7.38	10.60	1.20	3.65	2.70	8	17	960	8	1280	2.34	<0.00	0.17	0.66	0.02	0.98	4.90	0.51	0.20	1.00
05.08.2015 08:40:00	5	7.40	13.80	1.80	3.16	3.90	10	22	810	<2	1310	3.02	<0.00	0.19	0.23	0.01	1.07	2.70	0.60	0.17	<1.00
06.10.2015 09:30:00	4	7.44	10.90	2.30	8.40	3.20	17	34	820	<2	1230	3.06	<0.00	0.19	0.93	0.02	1.03	5.60	0.43	0.23	<1.00
Avg.	9	7.26	13.52	1.78	4.49	3.20	13	24	1120	2	1555	2.89	0.00	0.18	0.54	0.02	1.37	8.88	0.58	0.20	0.25
Minimum	4	6.81	10.60	1.20	2.76	2.70	8	17	810	2	1230	2.34	0.00	0.16	0.23	0.01	0.98	2.70	0.43	0.17	1.00
Maximum	19	7.44	18.80	2.30	8.40	3.90	17	34	1890	8	2400	3.15	0.00	0.19	0.93	0.04	2.40	22.30	0.79	0.23	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	7	0.30	3.80	0.45	2.63	0.51	4	7	518	3	564	0.38	0.00	0.02	0.31	0.01	0.69	9.04	0.16	0.03	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
15.02.2015 11:45:00	13	6.24	4.74	<0.30	<0.40	0.51	<1	1	150	11	235	2.29	0.01	0.03	0.10	0.02	0.27	5.00	0.19	0.04	<1.00
19.05.2015 10:45:00	18	5.94	2.40	<0.30	<0.20	1.20	<1	<1	65	<2	134	0.99	<0.00	0.06	0.16	0.01	0.37	1.70	0.12	0.04	1.00
09.08.2015	10	6.27	1.29	<0.30	0.29	0.73	<1	1	60	10	165	0.88	<0.00	0.05	0.11	0.01	0.33	1.90	0.07	0.04	<1.00
18.10.2015 13:00:00	4	6.49	2.28	<0.30	0.30	0.59	<1	1	190	11	280	2.31	<0.00	0.05	0.14	0.01	0.56	7.60	0.13	0.05	1.00
Avg.	11	6.24	2.68	0.00	0.15	0.76	0	1	116	8	204	1.62	0.00	0.05	0.13	0.01	0.38	4.05	0.13	0.04	0.50
Minimum	4	5.94	1.29	0.30	0.20	0.51	1	1	60	2	134	0.88	0.00	0.03	0.10	0.01	0.27	1.70	0.07	0.04	1.00
Maximum	18	6.49	4.74	0.30	0.40	1.20	1	1	190	11	280	2.31	0.01	0.06	0.16	0.02	0.56	7.60	0.19	0.05	1.00
More than 70%LOQ	yes	yes	yes	no	no	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	6	0.23	1.46	0.00	0.08	0.31	0	0	64	4	66	0.79	0.01	0.01	0.03	0.01	0.13	2.81	0.05	0.01	0.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
27.02.2015 11:00:00	78	6.36	3.57	<0.30	0.35	1.10	<1	1	240	<2	325	1.45	<0.00	0.04	0.10	0.01	0.20	2.00	0.14	0.07	<1.00
26.05.2015 09:28:00	70	6.06	2.05	0.58	0.44	1.80	<1	3	62	<2	175	0.85	<0.00	0.06	0.24	0.01	0.13	1.50	0.08	0.05	<1.00
17.08.2015 11:39:00	69	6.35	1.77	0.36	0.67	2.70	1	3	80	10	285	1.01	<0.00	0.10	0.26	0.01	0.21	1.10	0.11	0.07	<1.00
06.10.2015 13:00:00	17	6.36	1.85	<0.30	0.34	1.20	<1	2	110	<2	210	1.08	<0.00	0.06	0.31	0.01	4.06	6.90	0.07	0.07	2.00
Avg.	59	6.28	2.31	0.24	0.45	1.70	0	2	123	3	249	1.10	0.00	0.07	0.23	0.01	1.15	2.88	0.10	0.06	0.50
Minimum	17	6.06	1.77	0.30	0.34	1.10	1	1	62	2	175	0.85	0.00	0.04	0.10	0.01	0.13	1.10	0.07	0.05	1.00
Maximum	78	6.36	3.57	0.58	0.67	2.70	1	3	240	10	325	1.45	0.00	0.10	0.31	0.01	4.06	6.90	0.14	0.07	2.00
More than 70%LOQ	yes	yes	yes	no	yes	yes	no	yes	yes	no	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	28	0.15	0.85	0.13	0.15	0.74	0	1	80	4	68	0.26	0.00	0.02	0.09	0.00	1.94	2.71	0.03	0.01	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
16.02.2015 08:30:00	23	6.31	5.12	<0.30	0.56	1.00	3	8	110	16	255	2.08	0.02	0.04	0.04	0.02	0.22	4.10	0.58	0.04	<1.00
26.05.2015 13:00:00	51	6.21	1.79	0.53	0.35	2.00	<1	<1	26	4	185	0.86	<0.00	0.07	0.27	0.02	3.05	6.80	0.81	0.06	<1.00
18.08.2015 08:51:00	61	6.57	2.05	0.41	0.32	4.60	<1	3	79	5	290	1.68	<0.00	0.15	0.21	0.01	0.52	2.20	1.00	0.08	<1.00
06.10.2015 10:00:00	15	6.93	2.62	0.33	0.15	1.60	<1	2	110	<2	235	1.92	<0.00	0.08	0.08	0.01	1.17	3.40	0.44	0.05	<1.00
Avg.	37	6.50	2.90	0.32	0.34	2.30	1	3	81	6	241	1.64	0.00	0.08	0.15	0.01	1.24	4.12	0.71	0.06	0.00
Minimum	15	6.21	1.79	0.30	0.15	1.00	1	1	26	2	185	0.86	0.00	0.04	0.04	0.01	0.22	2.20	0.44	0.04	1.00
Maximum	61	6.93	5.12	0.53	0.56	4.60	3	8	110	16	290	2.08	0.02	0.15	0.27	0.02	3.05	6.80	1.00	0.08	1.00
More than 70%LOQ	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	22	0.32	1.52	0.10	0.17	1.59	1	3	40	6	44	0.54	0.01	0.05	0.11	0.00	1.27	1.95	0.25	0.02	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
04.02.2015 10:00:00	75	6.48	3.05	<0.30	0.29	0.83	1	<1	275	2	370	1.50	<0.00	0.06	0.05	0.01	0.22	2.12	0.25	0.05	<1.00
05.05.2015 09:00:00	74	6.50	1.88	1.30	2.64	0.91	2	3	130	<2	215	1.03	<0.00	0.07	0.11	0.01	0.29	1.40	0.23	0.09	<1.00
04.08.2015 08:30:00	254	6.38	1.44	1.00	1.63	0.91	2	4	89	4	155	0.78	<0.00	0.07	0.09	0.01	0.29	1.20	0.17	0.06	1.00
06.10.2015 08:30:00	49	6.55	1.46	0.35	0.51	0.65	<1	2	98	<2	180	0.71	<0.00	0.06	0.05	0.01	0.21	1.10	0.06	0.03	2.00
Avg.	113	6.48	1.96	0.66	1.27	0.82	1	2	148	2	230	1.00	0.00	0.07	0.07	0.01	0.25	1.46	0.18	0.06	0.75
Minimum	49	6.38	1.44	0.30	0.29	0.65	1	1	89	2	155	0.71	0.00	0.06	0.05	0.01	0.21	1.10	0.06	0.03	1.00
Maximum	254	6.55	3.05	1.30	2.64	0.91	2	4	275	4	370	1.50	0.00	0.07	0.11	0.01	0.29	2.12	0.25	0.09	2.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	95	0.07	0.76	0.49	1.09	0.12	1	1	86	1	97	0.36	0.00	0.01	0.03	0.00	0.04	0.46	0.08	0.03	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
16.02.2015 13:50:00	20	6.34	4.06	<0.30	<0.40	0.51	<1	2	610	<2	665	1.80	0.01	0.08	0.05	0.12	1.09	33.30	0.32	0.05	<1.00
26.05.2015 12:15:00	53	6.05	2.20	<0.30	0.25	1.40	<1	<1	230	<2	360	0.99	<0.00	0.09	0.11	0.05	0.88	13.80	0.15	0.07	<1.00
25.08.2015 09:30:00	53	6.35	1.56	<0.30	0.16	0.51	<1	3	220	3	300	0.79	<0.00	0.08	0.05	0.05	0.71	15.80	0.11	0.05	<1.00
20.10.2015 09:30:00	10	6.54	2.15	<0.30	0.10	0.48	<1	1	430	<2	485	1.17	<0.00	0.07	0.04	0.06	0.78	25.80	0.11	0.05	<1.00
Avg.	34	6.32	2.49	0.00	0.13	0.72	0	2	373	1	453	1.19	0.00	0.08	0.06	0.07	0.86	22.17	0.17	0.05	0.00
Minimum	10	6.05	1.56	0.30	0.10	0.48	1	1	220	2	300	0.79	0.00	0.07	0.04	0.05	0.71	13.80	0.11	0.05	1.00
Maximum	53	6.54	4.06	0.30	0.40	1.40	1	3	610	3	665	1.80	0.01	0.09	0.11	0.12	1.09	33.30	0.32	0.07	1.00
More than 70%LOQ	yes	yes	yes	no	yes	yes	no	yes	yes	no	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	22	0.20	1.09	0.00	0.13	0.45	0	1	186	1	161	0.44	0.01	0.01	0.03	0.03	0.17	9.09	0.10	0.01	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
03.02.2015 10:00:00	13	6.41	4.05	<0.30	0.51	0.78	1	2	242	12	345	1.18	<0.00	0.17	0.14	0.03	0.67	3.95	0.60	0.04	<1.00
12.05.2015 09:15:00	16	6.64	2.87	0.50	1.33	1.10	2	5	170	10	310	0.78	<0.00	0.16	0.25	0.02	0.44	2.60	0.33	0.07	<1.00
10.08.2015 10:00:00	6	6.41	2.26	0.45	0.52	1.20	<1	3	150	12	270	0.65	<0.00	0.23	0.11	0.01	0.37	1.50	0.29	0.04	<1.00
05.10.2015 09:10:00	5	6.65	2.95	0.75	1.64	1.50	1	3	230	32	425	0.97	<0.00	0.59	0.08	0.01	0.61	2.20	0.39	0.05	<1.00
Avg.	10	6.53	3.03	0.42	1.00	1.14	1	3	198	17	338	0.90	0.00	0.29	0.15	0.02	0.52	2.56	0.40	0.05	0.00
Minimum	5	6.41	2.26	0.30	0.51	0.78	1	2	150	10	270	0.65	0.00	0.16	0.08	0.01	0.37	1.50	0.29	0.04	1.00
Maximum	16	6.65	4.05	0.75	1.64	1.50	2	5	242	32	425	1.18	0.00	0.59	0.25	0.03	0.67	3.95	0.60	0.07	1.00
More than 70%LOQ	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	5	0.14	0.75	0.19	0.57	0.30	1	1	45	10	66	0.23	0.00	0.20	0.07	0.01	0.14	1.03	0.14	0.01	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2015 13:45:00	22	6.85	4.94	0.80	0.58	1.20	1	2	325	2	420	4.44	0.02	0.07	0.05	<0.00	0.57	0.61	0.18	0.06	<1.00
05.05.2015 11:30:00	24	6.85	2.51	0.48	0.50	1.60	<1	2	120	<2	230	3.09	<0.00	0.08	0.03	<0.00	0.63	0.67	0.16	0.07	<1.00
07.09.2015 12:30:00	93	6.65	1.41	3.00	4.41	0.24	3	4	50	<2	89	1.56	<0.00	0.05	0.13	<0.00	0.42	0.89	0.20	0.24	<1.00
06.10.2015 12:00:00	41	6.63	2.12	5.40	5.00	0.26	6	7	79	<2	143	2.91	<0.00	0.06	0.15	0.00	0.75	1.60	0.32	0.57	<1.00
Avg.	45	6.74	2.74	2.42	2.62	0.82	3	4	144	1	221	3.00	0.00	0.06	0.09	0.00	0.59	0.94	0.22	0.24	0.00
Minimum	22	6.63	1.41	0.48	0.50	0.24	1	2	50	2	89	1.56	0.00	0.05	0.03	0.00	0.42	0.61	0.16	0.06	1.00
Maximum	93	6.85	4.94	5.40	5.00	1.60	6	7	325	2	420	4.44	0.02	0.08	0.15	0.00	0.75	1.60	0.32	0.57	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	33	0.12	1.53	2.28	2.42	0.68	2	2	124	0	145	1.17	0.01	0.02	0.06	0.00	0.14	0.46	0.07	0.24	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
19.02.2015 14:00:00	155	5.67	2.90	0.82	2.36	2.10	7	11	120	<2	245	1.17	0.01	0.05	0.13	0.01	0.38	3.00	0.25	0.12	<1.00
18.05.2015 13:40:00	69	6.16	1.67	0.49	0.34	1.80	1	4	62	2	190	0.94	<0.00	0.04	0.06	0.00	0.28	1.10	0.13	0.07	<1.00
18.08.2015 11:50:00	71	6.13	1.02	0.44	0.36	0.96	1	3	39	6	130	0.67	<0.00	0.05	0.03	0.00	0.19	0.63	0.09	0.04	<1.00
12.10.2015 13:00:00	25	6.11	1.13	0.42	0.56	1.30	1	4	48	<2	148	0.68	<0.00	0.04	0.03	<0.00	0.23	0.67	<0.04	0.04	<1.00
Avg.	80	6.02	1.68	0.54	0.90	1.54	3	6	67	2	178	0.86	0.00	0.04	0.06	0.00	0.27	1.35	0.12	0.06	0.00
Minimum	25	5.67	1.02	0.42	0.34	0.96	1	3	39	2	130	0.67	0.00	0.04	0.03	0.00	0.19	0.63	0.04	0.04	1.00
Maximum	155	6.16	2.90	0.82	2.36	2.10	7	11	120	6	245	1.17	0.01	0.05	0.13	0.01	0.38	3.00	0.25	0.12	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	54	0.23	0.86	0.19	0.98	0.51	3	4	36	2	51	0.24	0.00	0.01	0.05	0.00	0.08	1.12	0.09	0.04	0.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
19.02.2015 12:30:00	186	6.02	2.29	0.76	1.94	1.40	5	9	160	<2	260	1.36	0.01	0.05	0.45	0.00	0.31	1.80	0.14	0.07	<1.00
18.05.2015 12:00:00	73	6.25	1.71	0.39	0.26	1.30	<1	2	100	<2	200	1.09	<0.00	<0.03	0.03	0.00	0.24	1.30	0.11	0.03	<1.00
18.08.2015 10:00:00	55	6.30	1.39	0.45	0.38	1.00	1	3	75	6	185	0.78	<0.00	0.03	0.02	0.00	0.18	0.90	0.08	<0.03	<1.00
12.10.2015 15:00:00	26	6.21	1.51	0.37	0.58	1.20	<1	4	97	<2	190	0.82	<0.00	0.03	0.03	0.00	0.20	0.95	<0.04	0.03	2.00
Avg.	85	6.20	1.72	0.49	0.79	1.23	2	5	108	2	209	1.01	0.00	0.03	0.13	0.00	0.23	1.24	0.08	0.03	0.50
Minimum	26	6.02	1.39	0.37	0.26	1.00	1	2	75	2	185	0.78	0.00	0.03	0.02	0.00	0.18	0.90	0.04	0.03	1.00
Maximum	186	6.30	2.29	0.76	1.94	1.40	5	9	160	6	260	1.36	0.01	0.05	0.45	0.00	0.31	1.80	0.14	0.07	2.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	no	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	70	0.12	0.40	0.18	0.78	0.17	2	3	36	2	35	0.27	0.00	0.01	0.21	0.00	0.06	0.42	0.04	0.02	0.50

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
19.02.2015 13:00:00	72	5.71	2.49	1.60	5.12	1.50	8	14	65	<2	190	1.10	0.01	0.05	0.22	0.01	0.27	2.50	0.18	0.09	<1.00
18.05.2015 13:00:00	28	6.11	1.49	0.32	0.46	1.60	<1	3	4	<2	88	0.86	<0.00	<0.03	0.05	0.01	0.15	0.83	0.09	0.05	<1.00
18.08.2015 11:00:00	21	6.16	<1.00	0.34	0.37	1.10	1	3	12	4	98	0.39	<0.00	0.05	0.04	<0.00	0.13	0.37	0.06	<0.03	<1.00
12.10.2015 14:00:00	10	6.33	1.20	0.33	0.93	1.70	2	4	81	<2	190	0.84	<0.00	0.03	0.04	<0.00	0.17	0.55	<0.04	0.04	<1.00
Avg.	33	6.08	1.30	0.65	1.72	1.48	3	6	41	1	142	0.80	0.00	0.03	0.09	0.00	0.18	1.06	0.08	0.04	0.00
Minimum	10	5.71	1.00	0.32	0.37	1.10	1	3	4	2	88	0.39	0.00	0.03	0.04	0.00	0.13	0.37	0.04	0.03	1.00
Maximum	72	6.33	2.49	1.60	5.12	1.70	8	14	81	4	190	1.10	0.01	0.05	0.22	0.01	0.27	2.50	0.18	0.09	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	27	0.26	0.66	0.64	2.28	0.26	3	5	38	1	56	0.30	0.00	0.01	0.09	0.00	0.06	0.98	0.06	0.03	0.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
19.02.2015 10:25:00	83	6.19	2.94	2.90	6.27	1.60	9	14	200	<2	310	2.01	0.00	0.05	0.12	<0.00	0.42	1.70	0.29	0.15	<1.00
18.05.2015 10:00:00	43	6.59	2.09	0.31	0.38	0.98	<1	4	210	<2	310	1.60	<0.00	<0.03	0.01	<0.00	0.31	0.66	0.14	0.04	1.00
17.08.2015 09:00:00	64	6.50	1.57	0.58	0.66	0.68	3	3	80	11	185	1.11	<0.00	0.03	0.02	<0.00	0.25	0.43	0.11	0.05	<1.00
12.10.2015 10:00:00	20	6.55	1.50	0.43	0.49	0.61	<1	2	88	4	165	0.99	<0.00	0.03	0.01	<0.00	0.22	0.49	0.05	0.03	<1.00
Avg.	53	6.46	2.02	1.06	1.95	0.97	3	6	145	4	243	1.43	0.00	0.03	0.04	0.00	0.30	0.82	0.15	0.07	0.25
Minimum	20	6.19	1.50	0.31	0.38	0.61	1	2	80	2	165	0.99	0.00	0.03	0.01	0.00	0.22	0.43	0.05	0.03	1.00
Maximum	83	6.59	2.94	2.90	6.27	1.60	9	14	210	11	310	2.01	0.00	0.05	0.12	0.00	0.42	1.70	0.29	0.15	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	no	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	27	0.18	0.66	1.24	2.88	0.45	4	6	70	4	78	0.47	0.00	0.01	0.05	0.00	0.09	0.60	0.10	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
17.02.2015 10:30:00	53	7.10	4.46	0.32	0.73	0.99	1	5	300	<2	380	3.56	0.00	0.04	0.01	<0.00	0.48	0.28	0.22	0.18	<1.00
11.05.2015 13:00:00	77	7.25	3.90	0.43	1.65	1.80	1	6	100	<2	240	2.94	<0.00	0.04	0.02	<0.00	0.78	0.56	0.24	0.18	<1.00
10.08.2015 12:00:00	68	7.12	2.57	0.42	0.74	0.87	<1	2	45	3	122	2.04	<0.00	0.03	0.01	<0.00	0.43	0.16	0.12	0.11	<1.00
26.10.2015 13:00:00	38	6.94	3.06	0.35	0.40	1.00	<1	1	74	<2	155	2.59	<0.00	0.03	0.01	<0.00	0.42	0.23	0.11	0.09	<1.00
Avg.	59	7.10	3.50	0.38	0.88	1.16	1	4	130	1	224	2.78	0.00	0.04	0.01	0.00	0.53	0.31	0.17	0.14	0.00
Minimum	38	6.94	2.57	0.32	0.40	0.87	1	1	45	2	122	2.04	0.00	0.03	0.01	0.00	0.42	0.16	0.11	0.09	1.00
Maximum	77	7.25	4.46	0.43	1.65	1.80	1	6	300	3	380	3.56	0.00	0.04	0.02	0.00	0.78	0.56	0.24	0.18	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	no	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	17	0.13	0.85	0.05	0.54	0.43	0	2	116	1	115	0.63	0.00	0.01	0.01	0.00	0.17	0.18	0.07	0.05	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
25.02.2015 13:00:00	26	6.85	2.93	0.49	0.83	1.80	<1	3	96	6	205	2.19	<0.00	<0.03	0.01	<0.00	0.45	0.35	0.21	0.10	<1.00
11.05.2015 15:46:00	70	7.12	3.49	0.45	0.57	2.80	<1	4	78	<2	225	1.70	<0.00	0.06	0.02	<0.00	0.68	0.51	0.48	0.18	<1.00
28.08.2015 18:00:00	44	6.85	2.65	1.40	2.61	4.50	2	7	73	8	300	1.62	<0.00	0.06	0.06	<0.00	0.88	0.56	0.58	0.24	1.00
29.10.2015 15:30:00	32	6.79	2.49	0.49	0.60	2.50	<1	3	100	<2	215	1.71	<0.00	0.04	0.01	<0.00	0.46	0.35	0.25	0.11	<1.00
Avg.	43	6.90	2.89	0.71	1.15	2.90	1	4	87	4	236	1.81	0.00	0.04	0.03	0.00	0.62	0.44	0.38	0.16	0.25
Minimum	26	6.79	2.49	0.45	0.57	1.80	1	3	73	2	205	1.62	0.00	0.03	0.01	0.00	0.45	0.35	0.21	0.10	1.00
Maximum	70	7.12	3.49	1.40	2.61	4.50	2	7	100	8	300	2.19	0.00	0.06	0.06	0.00	0.88	0.56	0.58	0.24	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	no	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	19	0.15	0.44	0.46	0.98	1.15	1	2	13	3	43	0.26	0.00	0.02	0.02	0.00	0.21	0.11	0.18	0.07	0.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
25.02.2015 15:45:00	46	7.77	41.10	2.20	3.11	3.00	4	7	390	76	630	5.49	<0.00	0.16	0.06	0.01	1.16	1.80	1.76	0.28	<1.00
05.05.2015 07:25:00	77	7.43	10.20	1.10	2.76	4.10	1	3	120	35	360	3.28	<0.00	0.11	0.07	0.01	1.40	1.90	1.44	0.32	<1.00
17.08.2015 07:30:00	60	7.65	17.80	8.60	16.20	2.30	13	13	210	21	425	4.67	<0.00	0.20	0.22	0.01	1.56	2.10	2.58	1.58	<1.00
13.10.2015 13:30:00	48	7.57	22.50	3.80	6.92	3.20	5	6	130	37	340	3.71	<0.00	0.14	0.10	0.01	1.08	1.80	1.59	0.64	2.00
Avg.	58	7.60	22.90	3.92	7.25	3.15	6	7	213	42	439	4.29	0.00	0.15	0.11	0.01	1.30	1.90	1.84	0.70	0.50
Minimum	46	7.43	10.20	1.10	2.76	2.30	1	3	120	21	340	3.28	0.00	0.11	0.06	0.01	1.08	1.80	1.44	0.28	1.00
Maximum	77	7.77	41.10	8.60	16.20	4.10	13	13	390	76	630	5.49	0.00	0.20	0.22	0.01	1.56	2.10	2.58	1.58	2.00
More than 70%LOQ	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	14	0.14	13.15	3.31	6.26	0.74	5	4	125	24	133	0.99	0.00	0.04	0.08	0.00	0.22	0.14	0.51	0.61	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
15.02.2015 14:45:00	67	7.26	3.61	1.40	1.71	2.40	2	4	110	<2	230	1.94	<0.00	0.08	0.02	<0.00	0.71	0.45	0.73	0.20	<1.00
05.05.2015 09:05:00	66	7.39	3.97	1.00	1.10	2.50	2	4	110	6	275	1.83	<0.00	0.10	0.03	<0.00	0.72	0.56	0.70	0.22	<1.00
17.08.2015 08:35:00	57	7.12	3.14	0.89	0.82	2.90	1	3	41	16	220	1.61	<0.00	0.10	0.02	0.00	0.70	0.47	0.75	0.17	<1.00
13.10.2015 12:50:00	53	7.21	3.42	0.66	1.40	2.80	<1	3	73	11	230	1.64	<0.00	0.09	0.31	0.00	1.12	1.20	0.68	0.15	<1.00
Avg.	61	7.24	3.54	0.99	1.26	2.65	1	4	84	8	239	1.75	0.00	0.09	0.09	0.00	0.81	0.67	0.72	0.19	0.00
Minimum	53	7.12	3.14	0.66	0.82	2.40	1	3	41	2	220	1.61	0.00	0.08	0.02	0.00	0.70	0.45	0.68	0.15	1.00
Maximum	67	7.39	3.97	1.40	1.71	2.90	2	4	110	16	275	1.94	0.00	0.10	0.31	0.01	1.12	1.20	0.75	0.22	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	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	7	0.11	0.35	0.31	0.38	0.24	1	1	33	6	25	0.16	0.00	0.01	0.14	0.00	0.21	0.36	0.03	0.03	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
25.02.2015 13:45:00	56	7.11	4.18	1.30	1.69	2.80	3	8	140	<2	260	1.62	0.00	0.08	0.04	<0.00	0.95	2.00	0.47	0.18	<1.00
05.05.2015 12:30:00	54	7.03	3.49	0.87	1.72	3.90	<1	1	77	5	245	1.54	<0.00	0.10	0.06	0.01	1.40	2.50	0.58	0.21	<1.00
17.08.2015 09:30:00	36	7.28	4.70	1.40	1.75	3.00	2	3	170	6	355	1.17	<0.00	0.09	0.06	0.01	1.63	2.80	0.53	0.20	<1.00
13.10.2015 14:15:00	40	7.21	4.03	2.70	5.81	2.90	4	5	200	<2	350	1.59	0.00	0.10	0.10	0.01	1.45	2.90	0.63	0.33	<1.00
Avg.	47	7.16	4.10	1.57	2.74	3.15	2	4	147	3	303	1.48	0.00	0.09	0.06	0.01	1.36	2.55	0.55	0.23	0.00
Minimum	36	7.03	3.49	0.87	1.69	2.80	1	1	77	2	245	1.17	0.00	0.08	0.04	0.00	0.95	2.00	0.47	0.18	1.00
Maximum	56	7.28	4.70	2.70	5.81	3.90	4	8	200	6	355	1.62	0.00	0.10	0.10	0.01	1.63	2.90	0.63	0.33	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	10	0.11	0.50	0.79	2.05	0.51	1	3	53	2	58	0.21	0.00	0.01	0.03	0.00	0.29	0.40	0.07	0.07	0.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
25.02.2015 11:55:00	35	7.27	5.74	1.20	1.03	2.70	1	4	120	<2	235	1.87	<0.00	0.10	0.04	<0.00	0.54	0.55	0.54	0.14	<1.00
05.05.2015 14:00:00	43	7.13	3.76	1.00	1.76	3.60	1	7	54	<2	205	1.63	<0.00	0.11	0.06	0.00	0.60	0.70	0.54	0.18	2.00
17.08.2015 11:15:00	25	7.53	6.96	3.70	5.58	3.40	5	6	120	7	315	1.75	<0.00	0.16	0.13	0.00	0.89	0.74	0.66	0.30	<1.00
13.10.2015 12:40:00	30	7.51	6.51	1.90	2.91	3.20	2	4	220	<2	380	2.01	<0.00	0.12	0.08	<0.00	0.74	0.62	0.56	0.23	3.00
Avg.	33	7.36	5.74	1.95	2.82	3.23	2	5	129	2	284	1.82	0.00	0.12	0.07	0.00	0.69	0.65	0.58	0.21	1.25
Minimum	25	7.13	3.76	1.00	1.03	2.70	1	4	54	2	205	1.63	0.00	0.10	0.04	0.00	0.54	0.55	0.54	0.14	1.00
Maximum	43	7.53	6.96	3.70	5.58	3.60	5	7	220	7	380	2.01	0.00	0.16	0.13	0.00	0.89	0.74	0.66	0.30	3.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	8	0.19	1.41	1.23	2.00	0.39	2	2	68	3	79	0.16	0.00	0.03	0.04	0.00	0.16	0.09	0.06	0.07	0.96

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
25.02.2015 10:30:00	36	7.18	4.81	2.10	2.68	4.00	2	5	190	<2	320	1.32	<0.00	0.11	0.05	<0.00	0.60	0.73	0.46	0.16	<1.00
05.05.2015 15:00:00	35	7.28	4.97	1.00	2.61	4.20	<1	3	170	<2	370	1.32	<0.00	0.12	0.05	0.00	0.64	0.78	0.47	0.20	1.00
17.08.2015 12:30:00	15	7.29	4.51	0.62	0.73	4.00	5	6	92	12	300	0.96	<0.00	0.12	0.02	0.00	0.56	0.38	0.41	0.11	<1.00
13.10.2015 11:15:00	20	7.26	4.59	0.85	2.76	4.20	1	5	140	<2	325	1.16	<0.00	0.12	0.04	0.00	0.61	0.68	0.33	0.14	<1.00
Avg.	26	7.25	4.72	1.14	2.19	4.10	2	5	148	3	329	1.19	0.00	0.12	0.04	0.00	0.60	0.64	0.42	0.15	0.25
Minimum	15	7.18	4.51	0.62	0.73	4.00	1	3	92	2	300	0.96	0.00	0.11	0.02	0.00	0.56	0.38	0.33	0.11	1.00
Maximum	36	7.29	4.97	2.10	2.76	4.20	5	6	190	12	370	1.32	0.00	0.12	0.05	0.00	0.64	0.78	0.47	0.20	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	11	0.05	0.21	0.66	0.98	0.12	2	1	43	5	30	0.17	0.00	0.01	0.01	0.00	0.03	0.18	0.06	0.04	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
15.02.2015 10:30:00	84	6.90	4.08	6.20	8.75	2.90	6	9	67	<2	185	2.04	0.00	0.11	0.15	<0.00	0.78	1.40	0.74	0.47	<1.00
11.05.2015 12:15:00	76	6.97	3.14	1.40	2.30	2.60	2	4	32	<2	155	1.34	<0.00	0.08	0.06	0.01	0.50	1.10	0.39	0.21	<1.00
10.08.2015 12:20:00	37	7.00	2.58	0.67	0.64	1.70	<1	2	43	6	132	0.87	<0.00	0.07	0.03	<0.00	0.46	0.66	0.26	0.10	1.00
13.10.2015 09:30:00	29	7.11	7.59	0.92	1.06	2.40	2	4	150	31	345	1.76	<0.00	0.10	0.04	0.00	0.88	1.30	0.60	0.14	2.00
Avg.	57	7.00	4.35	2.30	3.19	2.40	3	5	73	9	204	1.50	0.00	0.09	0.07	0.00	0.66	1.12	0.50	0.23	0.75
Minimum	29	6.90	2.58	0.67	0.64	1.70	1	2	32	2	132	0.87	0.00	0.07	0.03	0.00	0.46	0.66	0.26	0.10	1.00
Maximum	84	7.11	7.59	6.20	8.75	2.90	6	9	150	31	345	2.04	0.00	0.11	0.15	0.01	0.88	1.40	0.74	0.47	2.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	27	0.09	2.25	2.62	3.78	0.51	2	3	53	14	96	0.51	0.00	0.02	0.06	0.00	0.21	0.33	0.21	0.17	0.50

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
11.02.2015 10:00:00	364	7.38	6.82	0.75	1.51	1.50	1	2	53	9	148	1.05	0.00	0.08	0.16	0.00	0.36	4.70	0.38	0.10	<1.00
05.05.2015 11:00:00	63	7.32	4.23	0.30	0.19	0.99	<1	1	51	<2	125	0.87	<0.00	0.09	0.02	0.00	0.33	1.50	0.54	0.06	<1.00
18.08.2015 09:20:00	122	7.34	3.87	0.34	1.54	0.80	<1	2	32	3	124	0.84	<0.00	0.12	0.26	0.01	0.39	1.30	0.53	0.06	<1.00
05.10.2015 09:00:00	234	7.59	5.74	0.90	1.31	2.60	1	4	43	5	205	0.99	<0.00	0.11	0.31	0.01	0.59	9.60	0.54	0.12	3.00
Avg.	196	7.41	5.17	0.57	1.14	1.47	1	2	45	4	151	0.94	0.00	0.10	0.19	0.01	0.42	4.28	0.50	0.08	0.75
Minimum	63	7.32	3.87	0.30	0.19	0.80	1	1	32	2	124	0.84	0.00	0.08	0.02	0.00	0.33	1.30	0.38	0.06	1.00
Maximum	364	7.59	6.82	0.90	1.54	2.60	1	4	53	9	205	1.05	0.00	0.12	0.31	0.01	0.59	9.60	0.54	0.12	3.00
More than 70%LOQ	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	133	0.12	1.37	0.30	0.64	0.81	0	1	10	3	38	0.10	0.00	0.02	0.13	0.00	0.12	3.88	0.08	0.03	1.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
11.02.2015 11:00:00	398	7.58	8.88	2.10	4.60	2.00	6	10	60	<2	195	1.64	<0.00	0.11	0.23	0.01	0.60	2.60	0.49	0.22	<1.00
05.05.2015 13:00:00	108	7.44	5.79	0.65	1.10	1.10	<1	1	45	7	150	1.10	<0.00	0.09	0.03	<0.00	0.35	0.59	0.39	0.09	<1.00
18.08.2015 10:30:00	469	7.37	3.83	<0.30	0.28	0.56	<1	<1	24	4	90	1.02	<0.00	0.07	0.01	<0.00	0.25	0.43	0.27	0.05	<1.00
05.10.2015 10:30:00	469	7.50	5.12	0.36	0.41	1.50	<1	1	30	<2	129	1.20	<0.00	0.08	0.03	0.00	0.37	0.67	0.43	0.09	2.00
Avg.	361	7.47	5.90	0.78	1.60	1.29	2	3	40	3	141	1.24	0.00	0.09	0.08	0.00	0.39	1.07	0.39	0.11	0.50
Minimum	108	7.37	3.83	0.30	0.28	0.56	1	1	24	2	90	1.02	0.00	0.07	0.01	0.00	0.25	0.43	0.27	0.05	1.00
Maximum	469	7.58	8.88	2.10	4.60	2.00	6	10	60	7	195	1.64	0.00	0.11	0.23	0.01	0.60	2.60	0.49	0.22	2.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	no	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	172	0.09	2.14	0.85	2.03	0.61	3	5	16	2	44	0.27	0.00	0.02	0.10	0.00	0.15	1.02	0.09	0.08	0.50

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
25.02.2015 13:20:00	30	7.65	10.80	0.33	<0.40	1.20	<1	<1	71	<2	146	4.24	<0.00	0.08	0.01	<0.00	0.41	0.53	0.66	0.08	<1.00
20.05.2015 12:30:00	56	7.42	7.79	0.49	0.96	1.80	2	2	7	<2	96	2.19	<0.00	0.08	0.02	0.00	0.35	0.50	0.70	0.11	<1.00
02.09.2015 14:10:00	74	7.16	3.59	2.70	4.32	0.34	2	3	12	11	94	1.94	<0.00	0.15	0.10	<0.00	0.51	4.20	0.57	0.16	<1.00
17.11.2015 11:15:00	40	7.36	7.34	<0.30	0.23	1.20	<1	2	80	<2	147	4.18	<0.00	0.10	0.01	<0.00	0.46	2.30	0.53	0.09	<1.00
Avg.	50	7.40	7.38	0.88	1.38	1.14	1	2	43	3	121	3.14	0.00	0.10	0.03	0.00	0.43	1.88	0.62	0.11	0.00
Minimum	30	7.16	3.59	0.30	0.23	0.34	1	1	7	2	94	1.94	0.00	0.08	0.01	0.00	0.35	0.50	0.53	0.08	1.00
Maximum	74	7.65	10.80	2.70	4.32	1.80	2	3	80	11	147	4.24	0.00	0.15	0.10	0.00	0.51	4.20	0.70	0.16	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	no	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	19	0.20	2.96	1.17	1.92	0.60	1	1	38	5	30	1.24	0.00	0.03	0.04	0.00	0.07	1.76	0.08	0.04	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
16.02.2015 12:00:00	23	7.61	9.60	0.31	<0.40	0.72	<1	1	92	4	170	3.06	0.00	0.03	<0.01	<0.00	0.32	<0.15	0.27	0.06	<1.00
11.05.2015 18:40:00	103	7.60	7.84	1.40	6.72	3.30	5	7	71	<2	245	3.11	<0.00	0.05	0.09	0.00	0.88	0.87	0.65	0.28	<1.00
16.08.2015 20:00:00	96	7.57	7.14	0.37	0.92	0.76	3	2	24	2	101	2.16	<0.00	0.04	0.02	<0.00	0.36	0.16	0.30	0.08	<1.00
06.10.2015 11:30:00	73	7.68	8.07	<0.30	0.52	1.20	<1	1	33	<2	110	2.51	<0.00	0.04	0.02	<0.00	0.41	2.40	0.30	0.22	<1.00
Avg.	74	7.62	8.16	0.52	2.04	1.50	2	3	55	2	157	2.71	0.00	0.04	0.03	0.00	0.49	0.86	0.38	0.16	0.00
Minimum	23	7.57	7.14	0.30	0.40	0.72	1	1	24	2	101	2.16	0.00	0.03	0.01	0.00	0.32	0.15	0.27	0.06	1.00
Maximum	103	7.68	9.60	1.40	6.72	3.30	5	7	92	4	245	3.11	0.00	0.05	0.09	0.00	0.88	2.40	0.65	0.28	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	no	yes	yes	no	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	36	0.05	1.04	0.54	3.06	1.22	2	3	32	1	66	0.46	0.00	0.01	0.04	0.00	0.26	1.06	0.18	0.11	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
16.02.2015 13:30:00	21	7.47	6.42	0.67	1.35	0.96	1	3	74	<2	144	2.38	0.00	0.05	0.02	<0.00	0.36	<0.15	0.31	0.10	<1.00
11.05.2015 19:30:00	94	7.74	9.19	2.90	6.98	2.40	5	9	99	<2	255	2.98	<0.00	0.06	0.11	0.00	0.80	1.10	0.71	0.37	<1.00
16.08.2015 21:00:00	88	7.67	7.33	0.49	1.20	0.52	2	2	20	2	83	1.58	<0.00	0.05	0.02	0.00	0.38	0.22	0.35	0.07	<1.00
06.10.2015 12:00:00	66	7.78	10.20	0.50	1.04	1.30	<1	2	63	<2	155	2.36	<0.00	0.04	0.02	<0.00	0.44	0.35	0.49	0.09	<1.00
Avg.	67	7.67	8.28	1.14	2.64	1.30	2	4	64	1	159	2.32	0.00	0.05	0.04	0.00	0.50	0.42	0.46	0.16	0.00
Minimum	21	7.47	6.42	0.49	1.04	0.52	1	2	20	2	83	1.58	0.00	0.04	0.02	0.00	0.36	0.15	0.31	0.07	1.00
Maximum	94	7.78	10.20	2.90	6.98	2.40	5	9	99	2	255	2.98	0.00	0.06	0.11	0.01	0.80	1.10	0.71	0.37	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	33	0.14	1.72	1.18	2.89	0.80	2	3	33	0	71	0.57	0.00	0.01	0.04	0.00	0.21	0.44	0.18	0.14	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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
09.02.2015 10:00:00	40	7.38	7.56	0.35	0.66	1.60	1	7	96	45	305	10.61	0.00	0.06	0.01	<0.00	0.29	0.96	0.25	0.27	<1.00
06.05.2015 14:00:00	111	7.60	6.08	0.54	0.91	2.30	2	7	5	<2	155	7.03	<0.00	0.07	0.02	<0.00	0.49	0.52	0.70	0.25	<1.00
10.08.2015 08:30:00	304	7.30	4.34	0.46	0.84	3.80	3	5	<2	3	185	5.85	<0.00	0.07	0.02	<0.00	0.43	0.31	0.37	0.29	<1.00
05.10.2015 12:30:00	167	7.25	4.32	1.30	3.46	4.50	3	15	9	40	320	6.43	<0.00	0.08	0.05	<0.00	0.56	0.85	0.41	0.43	<1.00
Avg.	155	7.38	5.58	0.66	1.47	3.05	2	9	28	22	241	7.48	0.00	0.07	0.02	0.00	0.44	0.66	0.43	0.31	0.00
Minimum	40	7.25	4.32	0.35	0.66	1.60	1	5	2	2	155	5.85	0.00	0.06	0.01	0.00	0.29	0.31	0.25	0.25	1.00
Maximum	304	7.60	7.56	1.30	3.46	4.50	3	15	96	45	320	10.61	0.00	0.08	0.05	0.00	0.56	0.96	0.70	0.43	1.00
More than 70%LOQ	yes	yes	yes	yes	yes	yes	yes	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	112	0.16	1.56	0.43	1.33	1.33	1	4	45	23	83	2.14	0.00	0.01	0.02	0.00	0.12	0.30	0.19	0.08	0.00

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 C/l]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg SiO2/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
08.02.2015 14:30:00	46	7.16	3.31	0.36	0.32	2.60	<1	3	36	12	190	5.55	0.00	0.07	0.09	0.03	1.07	6.40	0.76	0.13	<1.00
07.05.2015 05:15:00	561	6.59	3.42	3.20	4.14	8.60	21	38	3	<2	435	4.16	0.01	1.23	1.14	0.03	17.40	5.90	30.80	0.63	2.00
09.08.2015 16:30:00	293	7.23	3.53	0.48	0.60	3.00	5	7	<2	4	245	4.29	<0.00	0.19	0.13	0.02	1.75	1.90	6.12	0.11	<1.00
06.10.2015 08:30:00	73	7.28	3.54	0.45	0.47	3.20	<1	4	6	2	165	4.71	<0.00	0.11	0.01	<0.00	1.06	0.61	5.34	0.13	<1.00
Avg.	243	7.06	3.45	1.12	1.38	4.35	7	13	11	5	259	4.68	0.00	0.40	0.34	0.02	5.32	3.70	10.76	0.25	0.50
Minimum	46	6.59	3.31	0.36	0.32	2.60	1	3	2	2	165	4.16	0.00	0.07	0.01	0.00	1.06	0.61	0.76	0.11	1.00
Maximum	561	7.28	3.54	3.20	4.14	8.60	21	38	36	12	435	5.55	0.01	1.23	1.14	0.03	17.40	6.40	30.80	0.63	2.00
More than 70%LOQ	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	239	0.32	0.11	1.39	1.84	2.84	10	17	16	5	122	0.63	0.01	0.56	0.53	0.01	8.06	2.88	13.57	0.25	0.50

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 associated with SPM for the first three samples of the year. The final sample is a bottle sample with concentrations reported in ng/L

ALNA RIVER								
Freely dissolved concentrations (mean of replicate measurements, relative percent difference)								
Sample ID	Alna P9		Alna P10		Alna P11		Alna P12	
Deployed	16.01.2015		17.04.2015		15.07.2015		15.10.2015	
Retrieved	17.04.2015		15.07.2015		15.10.2015		05.02.2016	
Exposure time(d)	91		89		92		113	
	MEAN	% RPD	MEAN	% RPD	MEAN	% RPD	MEAN	% RPD
Cw,free (ng/L)								
NAP	2.2468077	10.3	3.4300086	8.2	1.2949205	12.5	2.4675414	26.1
ACY	0.2743323	0.1	0.5429143	3.6	0.4883851	14.9	0.3821359	6.1
ACE	0.4557049	15.8	3.0374804	6.9	0.4405594	3.0	0.3369776	2.0
FLUE	0.4228524	17.7	2.1778196	7.2	0.3729096	1.9	0.2315346	2.4
DBTHIO	0.6239414	3.8	1.7001856	4.0	0.8333507	6.4	0.5369105	4.0
PHE	0.691026	12.3	2.6365267	0.6	0.4038379	9.8	0.3166164	4.8
ANT	0.1675523	11.2	0.5140547	0.6	0.2635472	2.4	0.1438958	1.6
FLUOR	0.3994277	5.3	1.4707683	2.9	0.9165035	8.9	0.3141328	5.8
PYR	3.6942866	1.7	4.4626538	1.4	3.8940683	3.2	6.9920677	1.0
BaA	0.0493842	4.0	0.0921258	2.8	0.1474362	3.8	0.0933279	2.7
CHRY	0.071593	1.7	0.1224696	10.4	0.2658629	4.8	0.1590696	1.3
BbjF	0.0713448	9.7	0.1306317	5.9	0.1502006	4.4	0.1484179	6.4
BkF	0.0150805	5.3	0.0281695	0.7	0.0328816	6.4	0.0326793	8.0
BeP	0.1103321	7.7	0.1603121	6.0	0.1657914	0.3	0.1600759	8.0
BaP	0.0262158	9.6	0.0348029	5.6	0.0451679	0.9	0.0576914	5.4
PER	0.0150865	5.3	0.0191113	8.6	0.0274391	3.0	0.0288888	8.6
In123cdPYR	0.0095956	5.4	0.0157696	5.0	0.0186896	1.0	0.0202332	10.0
BDahANT	0.005253	10.0	0.0067018	5.8	0.0074803	3.3	0.008641	15.8
BghiPER	0.0308011	8.5	0.0393595	5.0	0.0438787	2.6	0.0470198	9.9
PCB31+28	0.0213447	12.4	0.0293647	0.7	0.0467032	6.2	0.0499698	8.8
CB52	0.008329	12.3	0.0152789	3.8	0.0222746	1.7	0.0125682	2.8
CB101	0.0031026	12.9	0.0062128	11.5	0.0113567	2.3	0.0056628	21.1
CB118	0.0012555	10.1	0.0027493	7.6	0.0044244	1.6	0.0021864	8.8
CB153	0.0020088	10.1	0.0046006	11.0	0.0071349	2.6	0.0040265	2.0
CB105								
CB138	0.0018133	4.8	0.0040152	5.3	0.0063255	2.8	0.0034158	10.3
CB156								
CB180	0.0006933	20.6	0.0015363	2.0	0.0018443	2.8	0.0011406	7.4
CB209								
BDE47	0.0008191	4.5	0.0011029	38.0	0.0015631	6.9	Background	
BDE99	0.0007962	13.2	0.0011598	5.9	0.0012784	4.4	interferences on	
BDE100	0.0001163		0.0001415		0.0002588	6.0	chromatograms	
BDE153	0.0001273		0.0001546		0.0001011			
BDE154	0.0001273		9.278E-05		6.737E-05			
BDE183	0.0001397		0.0001018		0.0001109		0.0007482	10.4
BDE196	0.0002556		0.0001862		0.0001217		0.0002576	
BDE209	0.0011337	0.4	0.0010329	11.2	0.0006134	19.6	0.0023988	8.2
BDE126	0.0001163		8.489E-05		9.239E-05			
aHBCD	0.002997	1.7	0.0041547	21.5	0.006011	2.6	0.0140277	15.8
bHBCD	0.0004096	11.0	0.0004045	83.2	0.0005489	2.7	0.0017207	20.0
gHBCD	0.0005593	1.0	0.000764	19.2	0.0010228	3.9	0.0007532	0.9

DRAMMEN RIVER								
Freely dissolved concentrations (mean of replicate measurements, relative percent difference)								
Sample ID	Drammen P9		Drammen P10		Drammen P11		Drammen P12	
Deployed	16.01.2015		20.04.2015		29.06.2015		13.10.2015	
Retrieved	20.04.2015		29.06.2015		13.10.2015		12.02.2016	
Exposure time(d)	94		70		106		122	
Cw,free (ng/L)								
NAP	5.8882826	1.3	3.8418456	1.4	3.1780686	26.5	8.5268821	15.9
ACY	1.8486227	1.3	0.4984293	2.0	0.4558259	10.5	1.9850877	18.0
ACE	1.813128	2.2	1.1456918	10.2	0.9223705	5.7	1.8619871	26.9
FLUE	1.879594	1.3	0.992793	12.1	0.5429507	1.2	1.7769556	29.7
DBTHIO	0.1732217	1.5	0.207954	4.6	0.2851735	0.3	0.1685856	19.3
PHE	6.0055278	1.4	2.7351864	6.4	1.8547804	0.5	6.2200197	30.3
ANT	0.1660116	1.3	0.0809436	8.8	0.0875026	10.0	0.2651543	16.5
FLUOR	4.5132672	2.8	1.9984431	7.4	0.9679154	0.6	4.1959677	34.2
PYR	3.310947	5.1	1.0960457	10.0	0.5197191	0.3	3.1295595	32.6
BaA	0.4497444	7.8	0.1191541	10.4	0.0386406	4.7	0.3409347	36.8
CHRY	1.0046187	1.7	0.3806692	9.0	0.1263063	3.7	0.7275176	34.6
BbjF	0.7709102	5.2	0.3623475	8.9	0.0925226	10.3	0.5303485	32.2
BkF	0.1798005	3.8	0.075489	9.7	0.0177475	0.5	0.1358903	33.6
BeP	0.3842213	1.9	0.1912683	7.4	0.0491597	7.4	0.2593711	29.8
BaP	0.1273305	5.2	0.0422939		0.1019902		0.1287997	29.8
PER	0.0986188		0.0425767		0.0346051	6.6	0.1080713	29.8
In123cdPYR	0.1047559		0.0518539	6.9	0.0131786	9.9	0.1148059	
BDahANT	0.1082631		0.0466806		0.0067781		0.1186523	
BghiPER	0.1123132	5.2	0.052861	8.2	0.0162332	8.9	0.1139698	29.9
PCB31+28	0.034263	5.2	0.0250617	8.2	0.0086217	1.9	0.0304188	10.5
CB52	0.0290147	9.6	0.0155244	10.5	0.00531	1.6	0.0218986	
CB101	0.0436238		0.0188087		0.003473	3.1	0.0239051	
CB118	0.0223794		0.0096477		0.002377	4.8	0.0245273	
CB153	0.0223794		0.0096477		0.0029363	4.8	0.0245273	
CB105								
CB138	0.0238662		0.0102868		0.0026783	4.8	0.0261572	
CB156								
CB180	0.0248521		0.0107112		0.0015484		0.0272379	
CB209								
BDE47	0.0149301	7.2	0.0089806	1.8	0.0017305		0.003864	
BDE99	0.0116511	14.5	0.0084977	13.2	0.0015476		0.0080414	
BDE100	0.0061629		0.0021082		0.0004422		0.0053609	
BDE153	0.0053724		0.0023153		0.0005018		0.0088322	
BDE154	0.0053724		0.0023153		0.0003345		0.0058881	
BDE183	0.0074348		0.0025431		0.000551		0.0097011	
BDE196	0.0162036		0.0069831		0.0006052		0.0106555	
BDE209	0.0319971	18.3	0.0053272		0.0008827		0.0128555	
BDE126	0.0048914		0.0021082		0.0004572		0.0080414	
aHBCD	0.0088841		0.0035662		0.0022326	1.1	0.0147979	39.6
bHBCD	0.008946		0.0038825		0.0006031		0.0097994	29.7
gHBCD	0.0094049		0.0045072		0.0007264	18.4	0.010305	29.8

GLOMMA RIVER								
Freely dissolved concentrations (mean of replicate measurements, relative percent difference)								
Sample ID	Glomma P9		Glomma P10		Glomma P11		Glomma P12	
Deployed	16.12.2014		17.04.2016		02.07.2015		16.10.2015	
Retrieved	17.04.2015		02.07.2016		16.10.2015		lost	
Exposure time(d)	122		76		106			
Cw,free (ng/L)								
NAP	5.6955549	1.6	2.6327049	1.5	1.1904505	11.2	lost	
ACY	0.7843048	0.4	0.2736603	0.8	0.5014358	5.2	lost	
ACE	2.03839	7.8	0.8927746	1.5	2.3028139	1.5	lost	
FLUE	2.3271542	8.4	0.8078786	10.4	0.7994244	4.9	lost	
DBTHIO	0.6026701	3.0	0.3023666	2.0	0.4992422	7.3	lost	
PHE	6.848843	4.2	2.3280802	9.6	2.7467642	8.9	lost	
ANT	0.2484969	7.8	0.0680995	9.1	0.0955389	12.5	lost	
FLUOR	4.4862625	5.1	1.7131707	19.4	1.4068145	12.0	lost	
PYR	3.0840051	7.4	0.8561756	20.9	0.8263913	12.1	lost	
BaA	0.3093124	9.1	0.0622494	25.8	0.0367429	11.6	lost	
CHRY	0.745875	3.6	0.1417046	28.8	0.0907564	19.5	lost	
BbjF	0.3540807	9.7	0.1347793	22.8	0.0724656	18.7	lost	
BkF	0.0851546	8.6	0.0275388	22.7	0.0135087	12.8	lost	
BeP	0.1790391	7.9	0.0759867	22.1	0.0443095	12.0	lost	
BaP	0.0740398	7.7	0.0144589		0.0127861		lost	
PER	0.0616275	11.7	0.1138067	20.2	0.0708177	13.2	lost	
In123cdPYR	0.0361068	14.4	0.0179381	13.0	0.009354	14.0	lost	
BDahANT	0.0143307		0.0158729		0.0064945		lost	
BghiPER	0.0413765	14.4	0.0191461	20.1	0.013062	13.5	lost	
PCB31+28	0.0194534	10.2	0.0113904	27.3	0.0073643	12.8	lost	
CB52	0.0090995	5.2	0.0075232	19.4	0.0039518	13.5	lost	
CB101	0.005773		0.0063945		0.002309	40.7	lost	
CB118	0.0029595		0.0032784		0.0013778		lost	
CB153	0.0039787	9.9	0.0036062	16.7	0.0030235	17.7	lost	
CB105							lost	
CB138	0.003153		0.0034931		0.0022886	19.4	lost	
CB156							lost	
CB180	0.0032823		0.0036365		0.0014831		lost	
CB209							lost	
BDE47	0.0049741	7.1	0.0037718	23.0	0.0013566	14.4	lost	
BDE99	0.0025768	4.3	0.0029535	32.0	0.0008701	11.3	lost	
BDE100	0.0009691		0.0009163		0.0004338	34.2	lost	
BDE153	0.001064		0.0007859		0.0004806		lost	
BDE154	0.001064		0.0007859		0.0003204		lost	
BDE183	0.0011686		0.0008632		0.0005278		lost	
BDE196	0.0021392		0.0023701		0.0005797		lost	
BDE209	0.0075135	18.6	0.0078929	44.3	0.000722		lost	
BDE126	0.0009691		0.0007158		0.000438		lost	
aHBCD	0.0072539	1.0	0.0023867		0.0024466	9.4	lost	
bHBCD	0.0010936		0.0013522		0.0005807		lost	
gHBCD	0.0017424	4.5	0.0012333		0.0005848		lost	

Concentration of contaminants associated with suspended particulate matter (SPM)													
Sample code		Alna SPM 1	Alna SPM 2	Alna SPM 3	Alna SPM 4	Drammen SPM 1	Drammen SPM 2	Drammen SPM 3	Drammen SPM 4	Glomma SPM 1	Glomma SPM 2	Glomma SPM 3	Glomma SPM 4
Deployed		09.01.2015	10.04.2015	10.07.2015	08.10.2015	07.01.2015	20.04.2015	29.06.2015	06.10.2015	09.12.2014	08.04.2015	02.07.2015	08.10.2015
Retrieved		16.01.2015	17.04.2015	15.07.2015	15.10.2015	16.01.2015	27.04.2015	06.07.2015	13.10.2015	16.12.2014	16.04.2015	10.07.2015	16.10.2015
Exposure time(d)		7	7	5	7	9	7	7	7	7	8	8	8
TOC ug/g		80.5	91.4	81.3	160	66.4	89.2	116	103	18.6	22.4	26.3	57.6
%OC		8.05	9.14	8.13	16	6.64	8.92	11.6	10.3	1.86	2.24	2.63	5.76
NAP	ng/g dw	40	83.2	46.7	44.8	30	16.6	14.2	10	11	10	10	10
ACY	ng/g dw	18	24	24	38	11	9.6	7.3	3.6	2	2	2	2
ACE	ng/g dw	11	13	12	25	4.6	4	2.9	4	14	2	2.1	3.3
FLUE	ng/g dw	25	32	23	55	9.7	6.6	6	3	13	2.1	2.1	3.1
DBTHIO	ng/g dw	16	29	20	31	7.7	5.2	4.73	2	10	1.03	2	2
PHE	ng/g dw	248	370	270	470	143	78	75	27	160	11	20	14
ANT	ng/g dw	55	99	81	110	15	13	8.7	4	26	2	3.7	2
FLUOR	ng/g dw	496	670	560	1100	307	240	220	84	237	16	41	17
PYR	ng/g dw	740	1000	640	1000	280	200	190	73	200	14	35	14
BaA	ng/g dw	215	220	210	480	132	92	92	35	110	5.9	21	6.4
CHRY	ng/g dw	229	290	240	470	150	100	110	43	103	12	25	11
BbjF	ng/g dw	439	500	440	720	244	180	200	75	129	17	35	17
BkF	ng/g dw	120	130	130	230	84	62	67	24	48	5	12	4.8
BeP	ng/g dw	391	540	390	410	138	100	110	40	66	8.9	19	8.7
BaP	ng/g dw	229	260	250	480	134	110	120	41	59	5.6	20	6.1
PER	ng/g dw	100	110	86	130	68	50	59	46	32	21	32	40
In123cdPYR	ng/g dw	170	240	220	370	110	92	98	39	46	6.6	14	7.2
BDahANT	ng/g dw	60	67	61	90	23	19	19	6.7	12	2	3.3	2
BghiPER	ng/g dw	409	600	420	490	133	99	100	42	58	7.8	15	8.7
PCB31+28	ng/g dw	2	2.6	2.1	1.5	0.6	Not analysed	Not analysed	0.5	0.5	Not analysed	Not analysed	0.5
CB52	ng/g dw	2	4.1	4	3.3	0.6			0.5	0.5			0.5
CB101	ng/g dw	3	3.2	3.5	3	0.5			0.5	0.5			0.5
CB118	ng/g dw	2.4	2.4	2.4	2.2	0.5			0.5	0.5			0.5
CB153	ng/g dw	5.2	1.02	1.2		0.55				0.5			0.5
CB105	ng/g dw		4.6	6.2	6.2				0.5				0.5
CB138	ng/g dw	4.9	4.9	5.3	5.9	0.52			0.5	0.5			0.5
CB156	ng/g dw		1	0.86									0.5
CB180	ng/g dw	3.4	3.3	4.2	3.9	0.5			0.5	0.5			0.5

Concentration of contaminants associated with suspended particulate matter (SPM)													
Sample code		Alna SPM 1	Alna SPM 2	Alna SPM 3	Alna SPM 4	Drammen SPM 1	Drammen SPM 2	Drammen SPM 3	Drammen SPM 4	Glomma SPM 1	Glomma SPM 2	Glomma SPM 3	Glomma SPM 4
BDE47	ng/g dw	1.63	2.6	1.6	0.93	0.15	0.29	0.16	0.2	0.52	0.1	0.1	0.2
BDE99	ng/g dw	0.83	2.8	2.1	1.6	0.23	0.48	0.46	0.3	0.4	0.1	0.1	0.3
BDE100	ng/g dw	0.15	0.6	11	0.25	0.1	0.1	0.1	0.2	0.1	6	0.1	0.2
BDE153	ng/g dw	0.17	0.49	0.26	0.3	0.1	0.28	0.22	0.3	0.1	0.28	0.13	0.3
BDE154	ng/g dw	0.13	0.33	0.26	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
BDE183	ng/g dw	0.5	0.91	0.43	0.51	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3
BDE196	ng/g dw	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
BDE209	ng/g dw	46.34	54	61	42	14.68	11	11	2.6	9.64	2	1.6	1
BDE126	ng/g dw				0.3				0.3				0.3
aHBCD	ng/g dw	8.8	23.3	18.9	11	2.2	0.7	0.5	0.5	2	0.5	0.5	0.5
bHBCD	ng/g dw	2	3.7	0.5	2.6	2	0.5	0.5	0.5	2	0.5	0.5	0.5
gHBCD	ng/g dw	2	6.6	6.8	5.8	2	0.6	0.5	0.5	2	0.5	0.5	0.5
SCCP	ng/g dw	436	1930	766	640	112	309	978	1340	40	123	253	320
MCCP	ng/g dw	1496	1700	350	171	123	24	557	290.0	8	0.5	43	96
BPA	ng/g dw	7.75	651.53	416.4415375	127.00	0.48	7.00	7	21.15	0.97	7.00	8.226550522	6.331
TBBPA	ng/g dw	9.50	0.77	1	3.70	155.92	1.00	0.97947442	2.27	38.02	1.00	1	1.793
PFBA	ng/g dw				water sample				water sample				water sample
PFPA	ng/g dw		1	1	(ng/L)		1	1	(ng/L)		1	1	(ng/L)
PFHxA	ng/g dw	0.5	0.5	0.5	1.61	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
PFHpA	ng/g dw	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
PFOA	ng/g dw	0.5	0.5	0.5	2.46	0.5	0.5	0.5	0.66	0.5	0.5	0.5	0.5
PFNA	ng/g dw	0.5	0.5	0.5	0.62	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
PFDA	ng/g dw	0.5	0.5	1.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
PFUdA	ng/g dw	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4
PFDoA	ng/g dw	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4
PFTrA	ng/g dw	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4
PFTeA	ng/g dw	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4
PFBS	ng/g dw	0.1	0.1	0.1	0.69	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
PFHxS	ng/g dw	0.1	0.1	0.1	0.77	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PFOS	ng/g dw	0.15	0.37	1.96	3.08	0.06	0.35	0.1	0.15	0.05	0.19	0.1	0.11
ip-PFNS	ng/g dw												
PFDS	ng/g dw	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1
PFDoS	ng/g dw	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1
PFOSA	ng/g dw	0.1	0.1	0.1	0.1	0.1	0.14	0.13	0.4	0.1	0.1	0.1	0.27
me-PFOSA	ng/g dw	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.5
et-PFOSA	ng/g dw	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.5
me-PFOSE	ng/g dw	5	5	5	5	5	5	5	5	5	5	5	5
et-PFOSE	ng/g dw	5	5	5	5	5	5	5	5	5	5	5	5
6:2 FTS	ng/g dw	0.3	0.3	0.3	1.09	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
4:2 F53B	ng/g dw												
6:2 F53B	ng/g dw												

Table 2 Riverine inputs

Table 2a. Riverine inputs from 155 Norwegian rivers in 2015

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	avg.	69849	295151	115805	291	499	8706	405	15182	103992	0.092	4.993	7.918	0.308	40.799	245.827	21.145	8.282	19.002
Alna	avg.	158	1228	280	4	5	47	7	83	424	0.000	0.025	0.120	0.005	0.288	1.186	0.070	0.042	0.060
Drammenselva	avg.	31414	75313	48045	80	140	2724	80	5378	39256	0.012	2.266	6.101	0.139	12.633	47.217	7.046	2.564	9.739
Numedalslågen	avg.	11286	36586	19767	30	54	809	107	1836	15401	0.027	0.858	1.286	0.061	3.332	14.104	1.678	0.757	6.887
Skienselva	avg.	30346	10151	32483	12	37	1322	99	2919	24128	0.004	1.223	0.933	0.098	4.699	32.443	2.024	0.848	10.562
Otra	avg.	16138	7186	18142	3	17	445	50	1354	9511	0.017	0.712	1.661	0.100	2.803	18.500	2.481	0.518	7.613
Orreelva	avg.	548	1864	1104	4	12	215	6	359	403	0.000	0.053	0.071	0.003	0.397	0.816	0.220	0.037	0.025
Vosso(Bolstadelvi)	avg.	11470	3883	4250	4	14	387	24	754	3884	0.002	0.306	0.313	0.023	1.330	4.631	1.375	0.227	4.520
Orkla	avg.	4089	5924	5604	3	11	210	6	515	4289	0.000	0.201	0.080	0.060	7.050	20.050	1.390	0.477	1.543
Vefsna	avg.	18250	11842	9734	6	18	197	11	716	8353	0.006	0.834	0.372	0.024	2.144	2.681	1.879	0.607	3.862
Altaelva	avg.	7772	7763	9943	8	20	105	11	622	11102	0.002	0.421	0.061	0.004	1.495	0.538	0.918	0.860	1.278
TRIBUTARY RIVERS (36)																			
Tista utløp Femsjøen	avg.	2406	3253	7560	5	12	380	4	704	3721	0.010	0.311	0.267	0.015	1.236	9.591	0.646	0.348	1.294
Tokkeelva	avg.	3025	891	6490	1	5	119	11	398	3250	0.000	0.258	0.329	0.031	0.661	5.471	0.559	0.187	0.617
Nidelva(Rykene)	avg.	12809	5772	17724	8	18	705	42	1632	10330	0.000	0.785	1.380	0.109	3.458	19.474	1.313	0.651	3.748
Tovdalselva	avg.	6571	7626	12596	3	13	190	41	778	4359	0.015	0.552	1.598	0.074	2.239	13.445	1.053	0.380	3.459
Mandalselva	avg.	9036	5039	12369	5	17	292	35	961	3936	0.031	0.555	1.760	0.077	1.226	12.638	0.710	0.338	2.647
Lyngdalselva	avg.	3368	1472	4264	1	6	201	4	432	1976	0.010	0.224	0.511	0.040	0.418	6.688	0.210	0.074	1.155
Kvina	avg.	7511	7088	11688	5	21	335	7	976	3124	0.025	0.578	1.573	0.073	2.515	14.074	0.558	0.237	2.904
Sira	avg.	14374	3661	9269	0	15	432	94	1144	3822	0.017	0.488	2.614	0.069	1.500	17.454	0.745	0.345	2.255
Bjerkreimselva	avg.	5044	1039	2424	1	8	620	4	857	2749	0.000	0.167	0.334	0.037	0.403	4.902	0.255	0.103	0.000
Figgjoelva	avg.	652	889	732	3	6	348	0	459	711	0.000	0.040	0.112	0.007	0.434	3.536	0.160	0.045	0.090

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]
Lyseelva	avg.	1807	151	552	0	1	69	5	123	999	0.003	0.030	0.088	0.009	0.234	2.253	0.088	0.028	0.501
Årdalselva	avg.	5681	929	3477	1	4	289	5	542	2361	0.000	0.130	0.405	0.015	1.112	4.354	0.225	0.132	0.852
Ulladalsåna (Ulla)	avg.	4193	536	3994	1	4	106	9	364	2265	0.005	0.139	0.284	0.022	2.280	6.721	1.196	0.097	0.000
Suldalslågen	avg.	14730	7670	4611	9	16	681	15	1091	4962	0.000	0.355	0.429	0.045	1.434	7.331	0.949	0.314	5.308
Saudaelva	avg.	4543	358	1462	0	3	508	2	665	1781	0.004	0.134	0.123	0.101	1.410	31.009	0.268	0.093	0.000
Vikedalselva	avg.	1146	426	449	1	1	83	6	139	383	0.000	0.099	0.072	0.008	0.221	1.178	0.175	0.023	0.000
Jostedøla	avg.	5279	6752	1103	6	8	193	1	316	4807	0.005	0.113	0.215	0.003	1.076	1.949	0.430	0.540	0.000
Gaular	avg.	6912	3501	4418	10	19	217	5	512	2475	0.010	0.118	0.220	0.018	0.781	4.883	0.438	0.214	0.000
Jølstra	avg.	7381	3373	3524	8	17	351	3	622	3175	0.015	0.100	0.712	0.009	0.722	4.034	0.310	0.140	1.109
Nausta	avg.	2842	3234	1543	5	10	48	1	162	970	0.003	0.042	0.146	0.006	0.225	1.748	0.135	0.067	0.000
Gloppenelva(Breimselva)	avg.	4843	5189	1980	8	14	280	7	462	2782	0.003	0.061	0.103	0.000	0.584	1.799	0.327	0.157	0.718
Driva	avg.	5665	1987	2514	2	8	258	2	461	5724	0.002	0.075	0.028	0.000	1.137	0.676	0.369	0.297	0.000
Surna	avg.	3715	1504	4066	1	6	114	5	323	2386	0.000	0.065	0.035	0.000	0.882	0.632	0.567	0.229	0.585
Gaula	avg.	7163	18257	8473	14	18	515	106	1108	10841	0.000	0.388	0.286	0.017	3.426	4.973	4.721	1.789	1.787
Nidelva(Tr.heim)	avg.	6950	3237	6685	4	9	218	21	609	4471	0.000	0.231	0.247	0.007	2.072	1.722	1.809	0.473	0.000
Stjørdalselva	avg.	5043	5091	5823	5	8	263	5	543	2788	0.003	0.167	0.113	0.011	2.426	4.611	1.015	0.424	0.000
Verdalselva	avg.	3535	3245	4165	2	7	163	2	359	2340	0.000	0.153	0.086	0.003	0.865	0.834	0.729	0.262	2.106
Snåsavassdraget	avg.	2782	2468	4171	2	5	163	2	339	1255	0.000	0.118	0.046	0.003	0.619	0.701	0.435	0.164	0.492
Namsen	avg.	4823	7415	4485	6	10	115	12	340	2808	0.003	0.164	0.152	0.006	1.158	2.075	0.938	0.488	1.434
Røssåga	avg.	11019	5356	7109	4	11	187	25	659	3958	0.006	0.386	0.871	0.032	1.791	23.239	1.895	0.392	5.041
Ranaelva	avg.	24544	13286	11990	15	29	332	20	1224	11241	0.000	0.755	0.667	0.040	3.526	9.715	3.569	0.986	8.479
Beiarelva	avg.	5051	3604	1953	3	4	60	8	207	5142	0.000	0.203	0.082	0.003	0.808	4.030	1.134	0.222	0.000
Målselv	avg.	8200	8328	5331	8	10	145	4	478	7989	0.002	0.130	0.127	0.006	1.659	3.257	1.258	0.572	0.000
Barduelva	avg.	7447	8666	3943	7	12	177	2	462	6440	0.002	0.133	0.139	0.009	1.478	1.521	1.402	0.503	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]
Tanaelva	avg.	17741	11322	23573	17	58	67	117	1512	42392	0.004	0.450	0.181	0.000	3.092	3.714	2.825	2.137	0.000
Pasvikelva	avg.	12556	12322	29084	64	115	20	12	1596	19740	0.038	3.656	3.298	0.110	50.401	19.984	94.152	1.940	5.935
TRIBUTARY RIVERS(108)																			
Mosselva	avg.	1067	2620	3005	1	10	170	6	356	163	0.000	0.147	0.101	0.001	0.584	0.580	0.397	-0.067	0.584
Hølenelva	avg.	145	352	526	2	4	74	2	102	467	0.000	0.036	0.028	0.001	0.129	0.229	0.150	-0.004	0.132
Årungelva	avg.	51	53	109	0	1	52	0	64	46	0.000	0.003	0.002	0.000	0.036	0.018	0.022	-0.001	0.028
Gjersjøelva	avg.	87	27	228	0	0	36	1	48	158	0.000	0.009	0.002	-0.001	0.048	0.013	0.067	-0.002	0.072
Ljanselva	avg.	68	150	133	1	2	23	1	30	158	0.000	0.014	0.005	0.000	0.061	-0.011	0.062	0.012	0.075
Akerselva	avg.	374	159	558	1	3	29	4	57	485	0.000	0.035	0.086	0.002	0.188	0.682	0.044	0.009	0.581
Frognerelva	avg.	33	37	53	0	1	15	1	20	73	0.000	0.006	0.000	0.000	0.057	0.022	0.019	0.002	0.043
Lysakerelva	avg.	314	119	641	0	0	21	2	34	267	0.000	0.038	0.011	0.000	-0.122	0.054	0.005	0.013	0.230
Sandvikselva	avg.	317	136	601	1	2	20	2	37	539	0.000	0.041	-0.054	-0.003	0.068	-0.266	0.039	0.054	0.000
Åroselva	avg.	188	868	487	1	2	109	2	124	463	0.000	0.045	0.066	0.003	0.152	0.255	0.075	0.082	0.120
Lierelva	avg.	442	5965	1171	2	8	127	0	147	1148	0.000	0.132	0.225	0.007	0.398	2.172	0.198	0.305	0.574
Sandeelva	avg.	341	1038	556	0	2	52	2	81	458	0.000	0.095	0.171	0.015	0.411	4.514	0.156	0.088	0.187
Aulielva	avg.	589	3005	1357	10	36	313	24	372	1831	0.000	0.200	0.110	0.012	0.583	1.083	0.587	0.158	0.941
Farriselva-Siljanvassdraget	avg.	1375	347	2392	1	2	169	3	249	1900	0.000	0.075	-0.114	0.022	-0.028	5.115	0.043	0.010	0.000
Gjerstadelva	avg.	1208	531	2411	1	2	78	12	155	749	0.000	0.106	0.206	0.004	0.223	2.081	0.262	0.026	0.662
Vegårdselva	avg.	1252	591	2481	1	2	63	5	143	448	0.000	0.125	0.128	0.010	0.274	0.101	0.248	0.046	0.457
Søgneelva-Songdalselva	avg.	964	340	1548	1	4	138	8	207	224	0.000	0.091	0.138	0.018	0.191	1.881	0.184	-0.165	0.352
Audnedalselva	avg.	1549	537	2063	1	3	170	7	273	517	0.000	0.110	0.243	0.016	0.172	3.241	0.192	-0.275	0.707
Soknedalselva	avg.	2250	1035	1536	2	6	207	14	291	969	0.000	0.131	0.237	0.019	0.411	2.633	1.975	0.060	1.026
Hellelandselva	avg.	1719	676	1465	2	4	184	9	269	653	0.000	0.094	0.245	0.014	0.232	2.086	0.199	0.049	0.784
Håelva	avg.	479	467	827	2	6	172	12	299	449	0.000	0.078	0.029	0.002	0.153	0.703	0.094	-0.008	0.262

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]
Imselva	avg.	430	147	533	0	1	84	2	114	5	0.000	0.016	0.014	0.002	0.081	0.299	0.075	-0.027	0.157
Oltedalselva,utløp Ragsvatnet	avg.	1005	249	607	0	0	104	4	125	751	0.000	0.025	0.055	0.007	0.147	1.088	0.151	0.040	0.000
Dirdalsåna	avg.	1572	222	946	0	2	143	2	192	569	0.000	0.061	0.105	0.004	0.152	0.734	0.422	-0.341	0.717
Frafjordelva	avg.	1771	319	1022	0	2	125	7	161	598	0.000	0.046	0.147	0.007	0.200	0.619	0.032	0.059	0.647
Espedalselva	avg.	1373	271	697	1	2	88	2	140	716	0.000	0.026	0.064	0.004	0.029	0.338	0.088	0.098	0.501
Førrelva	avg.	1739	317	1116	1	2	39	1	58	1024	0.000	0.038	0.091	0.003	0.069	0.271	0.146	0.055	0.000
Åbøelva	avg.	1055	164	347	1	1	35	-1	49	127	0.000	0.028	0.026	0.001	0.052	0.362	0.074	0.104	0.481
Etneelva	avg.	1920	531	818	1	2	218	3	278	483	0.000	0.121	0.054	0.010	0.272	0.768	0.576	0.806	1.227
Opo	avg.	5685	5880	1728	6	5	195	21	329	2466	0.000	0.418	0.830	-0.008	0.521	3.310	0.708	-0.036	-0.173
Tysso	avg.	3798	526	2259	3	-3	206	7	279	1017	0.000	0.155	0.071	0.008	1.173	4.775	0.914	0.177	2.079
Kinso	avg.	1822	658	378	2	0	17	7	59	130	0.000	0.067	0.033	-0.011	0.001	0.049	0.073	0.182	0.665
Veig	avg.	3216	704	1157	3	3	33	3	106	1572	0.000	0.054	0.055	0.003	0.096	-0.318	0.499	0.271	1.174
Bjoreio	avg.	3838	1002	2949	1	4	59	7	148	1441	0.000	0.128	0.102	-0.015	0.493	0.326	0.841	-0.288	1.401
Sima	avg.	940	262	145	1	1	29	1	45	773	0.000	0.025	0.009	-0.002	0.035	0.248	0.104	0.015	0.343
Austdøla	avg.	926	216	107	1	-1	26	3	38	103	0.000	0.020	0.020	0.002	0.041	0.153	0.037	0.015	0.422
Nordøla /Austdøla	avg.	278	100	20	0	0	11	0	14	123	0.000	0.010	0.006	0.000	0.012	0.001	0.050	0.006	0.000
Tysselvi Samnangervassdraget	avg.	2285	518	1411	1	3	70	6	147	199	0.000	0.077	0.136	0.011	0.242	1.168	0.200	-0.200	0.834
Oselva	avg.	1028	402	1229	2	4	53	3	121	355	0.000	0.058	0.097	0.007	0.375	-0.136	0.199	-0.049	0.000
DaleelviBergsdalsvassdraget	avg.	2156	544	885	1	1	65	6	138	404	0.000	0.065	0.149	0.009	0.267	1.307	0.193	-0.084	0.000
Ekso -Storelvi	avg.	5304	1355	2879	4	8	104	15	309	372	0.000	0.066	0.242	0.019	-0.266	-2.060	0.329	0.126	0.000
Modalselva -Moelvi	avg.	4671	852	1459	1	6	148	7	221	941	0.000	0.051	0.222	0.017	-0.259	0.402	0.355	0.311	0.000
Nærøydalselvi	avg.	2240	658	497	1	2	60	5	122	1960	0.000	0.041	-0.007	-0.002	0.187	0.706	0.072	0.176	0.818

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]
Flåmselvi	avg.	1247	562	194	1	1	26	3	46	281	0.000	0.045	0.012	-0.002	0.049	0.283	0.127	0.086	0.000
Aurlandselvi	avg.	3623	1276	793	2	1	116	5	173	1409	0.000	0.106	0.198	-0.022	0.439	1.122	0.319	0.065	0.000
Erdalselvi	avg.	420	80	146	0	0	1	0	12	89	0.000	0.008	0.006	-0.001	0.013	0.013	0.013	0.037	0.000
Lærdalselva /Mjeldo	avg.	3567	814	1029	2	3	110	5	217	1438	0.000	0.088	0.078	0.000	0.417	0.524	0.282	0.213	0.000
Årdalselvi	avg.	4033	1001	1030	2	4	99	8	167	2441	0.000	0.059	0.028	0.007	1.472	0.515	0.388	0.000	4.416
Fortundalselva	avg.	2453	2436	407	1	3	81	3	113	1283	0.000	0.137	0.054	0.011	0.773	1.025	0.237	0.125	1.791
Mørkrisdalselvi	avg.	1362	2156	213	1	1	29	2	53	919	0.000	0.035	0.064	0.000	0.272	0.864	0.251	0.176	0.000
Årøyelva	avg.	2888	1300	801	1	3	71	6	137	1519	0.000	0.059	0.080	0.000	0.070	0.750	0.140	0.179	0.000
Sogndalselva	avg.	1114	272	490	2	2	34	3	64	166	0.000	0.037	0.041	0.005	0.080	0.662	0.025	0.154	0.000
Oselva	avg.	2994	743	2732	1	5	58	16	169	645	0.000	0.180	0.106	-0.005	0.350	1.858	0.343	-0.349	1.639
Hopselva	avg.	852	235	218	0	1	28	1	41	75	0.000	0.017	0.027	0.003	0.009	0.322	0.022	0.128	0.311
Åaelva (Gjengedalselva)	avg.	1961	566	1067	1	3	43	4	87	218	0.000	0.059	0.044	-0.009	0.132	0.560	0.066	0.135	1.396
Oldenelva	avg.	1322	700	374	0	2	62	5	97	552	0.000	0.101	0.051	0.005	0.145	0.314	0.069	0.052	0.000
Loelvi	avg.	1527	864	279	0	2	48	2	77	767	0.000	0.122	0.040	0.005	0.160	0.081	0.045	0.136	0.000
Stryneelva	avg.	3113	1457	568	1	4	109	8	200	1336	0.000	0.125	0.067	0.007	0.687	1.023	0.221	0.198	1.136
Hornindalselva(Horndøla)	avg.	3107	851	1361	1	5	137	9	201	1317	0.000	0.129	0.033	0.006	0.325	0.912	0.348	-0.023	1.134
Ørstaelva	avg.	1138	345	650	4	9	41	6	86	696	0.000	0.038	0.008	-0.009	0.134	0.392	0.116	-0.037	0.415
Valldøla	avg.	1924	421	362	0	2	-13	4	-4	512	0.000	0.036	0.004	0.001	0.133	0.493	0.063	0.039	0.000
Rauma	avg.	5446	1133	1203	1	4	34	10	110	1519	0.000	0.113	0.066	-0.015	0.605	1.004	0.337	-1.430	0.000
Isa	avg.	801	233	159	0	1	4	1	5	457	0.000	0.015	-0.001	-0.006	0.091	0.011	0.065	0.071	0.292
Eira	avg.	4567	-804	979	1	3	175	8	247	3322	0.000	0.167	0.021	-0.036	0.476	0.442	0.200	0.417	2.501
Litledalselva	avg.	768	160	168	0	0	39	1	44	1004	0.000	0.015	-0.021	-0.001	0.010	0.014	0.185	0.078	0.000
Ålvunda	avg.	593	314	382	0	1	28	2	50	417	0.000	0.009	0.017	-0.005	0.181	0.162	0.043	0.012	0.270
Toåa	avg.	747	158	343	0	1	5	1	26	294	0.000	0.008	0.013	-0.001	0.122	0.060	0.012	-0.020	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]
Bøvra	avg.	752	205	700	0	0	34	2	71	371	0.000	0.022	0.007	0.002	0.065	0.063	0.048	0.012	0.000
Børselva	avg.	196	315	398	0	1	23	2	43	97	0.000	0.015	0.004	-0.001	0.100	-0.021	0.100	0.011	0.251
Vigda	avg.	294	1130	400	0	1	20	1	39	215	0.000	0.019	0.006	0.000	0.099	-0.116	-0.083	-0.090	0.242
Homla	avg.	352	87	861	0	1	5	2	28	205	0.000	0.062	0.002	0.001	0.084	-0.034	0.064	-0.008	0.257
Gråe	avg.	222	184	443	1	1	36	2	58	16	0.000	0.026	0.000	0.000	0.088	-0.045	0.031	0.021	0.000
Figgja	avg.	721	1669	2010	1	4	98	2	122	395	0.000	0.075	0.043	0.001	0.289	0.171	0.224	0.097	0.000
Årgårdselva	avg.	2202	2244	5359	1	14	79	14	298	1221	0.000	0.034	0.076	-0.001	0.546	0.253	0.359	-0.161	2.552
Moelva(Salsvatenelva)	avg.	2355	444	1709	1	0	50	5	105	860	0.000	0.087	0.017	0.005	-0.040	0.881	0.108	-0.765	0.000
Åelva(Åbjøra)	avg.	3267	890	1225	1	3	36	11	111	480	0.000	0.089	0.055	-0.003	0.191	0.775	0.289	0.121	0.000
Skjerva	avg.	580	392	709	2	4	20	15	92	278	0.000	0.052	0.066	0.004	0.223	0.425	0.316	0.012	0.423
Fusta	avg.	3369	1088	1091	1	5	17	25	140	558	0.000	0.158	0.022	0.025	0.168	0.849	0.277	-0.314	1.230
Drevja	avg.	1092	596	297	1	1	6	3	34	122	0.000	0.010	-0.002	0.006	0.092	0.149	0.023	-0.074	0.000
Bjerkaelva	avg.	2033	700	1413	1	0	18	6	76	609	0.000	0.032	0.062	0.002	0.373	0.506	0.470	0.026	1.855
Dalselva	avg.	1347	313	768	0	2	3	3	34	396	0.000	-0.004	0.017	-0.003	0.184	0.004	0.237	0.040	1.352
Fykanåga	avg.	1865	1263	340	1	2	24	5	55	237	0.000	0.129	-0.019	-0.005	0.077	0.350	0.078	-0.599	0.000
Saltelva	avg.	8158	12239	1452	5	-6	67	15	249	5583	0.000	0.290	-0.043	-0.011	0.695	3.458	0.834	6.819	0.000
SulitjelmavassdragetUtl Øvrevt	avg.	4396	-128	1685	3	1	18	13	96	1034	0.000	-0.592	-0.423	-0.015	-2.942	-15.115	0.250	10.182	3.611
Kobbelva	avg.	2354	640	344	1	0	24	3	59	930	0.000	0.077	0.005	0.013	0.043	0.010	0.133	-0.079	0.000
Elvegårdselva	avg.	3900	3157	1580	1	5	14	11	90	2558	0.000	0.103	0.179	0.020	0.605	1.294	0.890	0.961	2.491
Spanselva	avg.	536	122	110	0	0	6	1	17	286	0.000	0.010	0.013	0.003	0.092	0.096	0.195	-0.006	0.000
Salangselva	avg.	2059	393	797	1	1	12	6	46	589	0.000	-0.162	0.027	0.015	0.188	0.225	0.341	0.481	0.000
Lakselva(Rossfjordelva)	avg.	487	155	310	0	0	0	1	18	108	0.000	0.009	0.007	0.002	0.026	0.033	0.072	-0.022	0.355
Nordkjoselva	avg.	479	142	201	0	0	3	1	13	356	0.000	0.021	0.007	0.002	0.045	0.073	-0.003	0.131	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]
Signaldalselva	avg.	1251	440	845	1	1	8	4	28	945	0.000	0.040	-0.011	0.005	0.237	0.007	0.187	-0.041	0.000
Skibotnelva	avg.	1406	361	847	1	0	12	3	31	826	0.000	0.032	0.007	0.008	0.222	-0.089	0.532	0.359	1.283
Kåfjordelva	avg.	837	122	214	0	0	18	1	35	458	0.000	0.009	0.016	0.005	0.298	0.026	0.199	0.063	0.000
Reisaelva	avg.	4676	1414	2939	3	3	61	11	175	4130	0.000	0.130	0.131	0.019	1.234	1.301	1.182	-0.425	5.973
Mattiselva	avg.	383	89	500	0	0	2	1	14	205	0.000	0.017	-0.005	0.003	0.092	0.027	0.042	0.168	0.000
Tverrelva	avg.	275	100	577	0	0	4	1	21	215	0.000	0.009	0.002	0.001	0.077	0.049	0.035	0.014	0.000
Repparfjordelva	avg.	2510	541	4632	1	1	14	10	111	1060	0.000	0.061	-0.009	0.009	1.209	0.290	0.275	0.053	1.832
Stabburselva	avg.	1585	133	1389	1	1	10	3	37	1240	0.000	0.031	0.005	0.003	0.066	0.327	0.058	0.240	0.000
Lakseelv	avg.	1589	1629	1681	1	3	6	4	60	1196	0.000	0.032	0.022	0.006	0.319	-0.062	0.344	0.317	0.000
Børselva	avg.	1141	417	417	0	0	2	5	32	1183	0.000	0.002	0.046	0.002	0.083	0.220	0.090	0.262	0.000
Mattusjåkka	avg.	141	25	67	0	0	3	0	4	62	0.000	0.003	0.021	0.002	0.021	0.197	0.041	0.124	0.000
Stuorrajåkka	avg.	962	-139	246	0	0	9	1	31	828	0.000	0.032	0.077	0.009	-0.038	0.299	0.058	0.152	0.000
Soussjåkka	avg.	128	-19	61	0	0	1	0	4	128	0.000	0.001	0.004	0.001	0.004	0.019	0.002	0.034	0.000
Adamselva	avg.	1104	26	645	0	0	1	3	38	902	0.000	0.050	0.016	0.008	0.043	0.330	-0.011	-0.040	1.209
Syltefjordelva(Vesterelva)	avg.	1061	-3	310	1	1	2	3	23	850	0.000	0.063	-0.010	0.006	0.022	0.070	-0.116	0.681	0.774
Jakobselv	avg.	1020	135	1043	1	1	0	2	46	1321	0.000	0.028	-0.019	0.004	0.028	-0.490	0.004	0.012	0.000
Neidenelva	avg.	2760	1159	4832	2	2	18	12	191	2015	0.000	0.066	-0.080	0.020	0.524	-0.482	0.227	0.584	0.000
Grense Jakobselv	avg.	257	71	339	0	0	0	1	12	280	0.000	0.016	0.006	0.002	0.211	0.178	0.729	0.278	0.281
Mosselva	avg.	1067	2620	3005	1	10	170	6	356	163	0.000	0.147	0.101	0.001	0.584	0.580	0.397	-0.067	0.584
Hølenelva	avg.	145	352	526	2	4	74	2	102	467	0.000	0.036	0.028	0.001	0.129	0.229	0.150	-0.004	0.132
Årungelva	avg.	51	53	109	0	1	52	0	64	46	0.000	0.003	0.002	0.000	0.036	0.018	0.022	-0.001	0.028
Gjersjøelva	avg.	87	27	228	0	0	36	1	48	158	0.000	0.009	0.002	-0.001	0.048	0.013	0.067	-0.002	0.072
Ljanselva	avg.	68	150	133	1	2	23	1	30	158	0.000	0.014	0.005	0.000	0.061	-0.011	0.062	0.012	0.075
Akerselva	avg.	374	159	558	1	3	29	4	57	485	0.000	0.035	0.086	0.002	0.188	0.682	0.044	0.009	0.581

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]
Frognerelva	avg.	33	37	53	0	1	15	1	20	73	0.000	0.006	0.000	0.000	0.057	0.022	0.019	0.002	0.043
Lysakerelva	avg.	314	119	641	0	0	21	2	34	267	0.000	0.038	0.011	0.000	-0.122	0.054	0.005	0.013	0.230
Sandvikselva	avg.	317	136	601	1	2	20	2	37	539	0.000	0.041	-0.054	-0.003	0.068	-0.266	0.039	0.054	0.000
Åroselva	avg.	188	868	487	1	2	109	2	124	463	0.000	0.045	0.066	0.003	0.152	0.255	0.075	0.082	0.120
Lierelva	avg.	442	5965	1171	2	8	127	0	147	1148	0.000	0.132	0.225	0.007	0.398	2.172	0.198	0.305	0.574
Sandeelva	avg.	341	1038	556	0	2	52	2	81	458	0.000	0.095	0.171	0.015	0.411	4.514	0.156	0.088	0.187
Aulielva	avg.	589	3005	1357	10	36	313	24	372	1831	0.000	0.200	0.110	0.012	0.583	1.083	0.587	0.158	0.941
Farriselva-Siljanvassdraget	avg.	1375	347	2392	1	2	169	3	249	1900	0.000	0.075	-0.114	0.022	-0.028	5.115	0.043	0.010	0.000
Gjerstadelva	avg.	1208	531	2411	1	2	78	12	155	749	0.000	0.106	0.206	0.004	0.223	2.081	0.262	0.026	0.662
Vegårdselva	avg.	1252	591	2481	1	2	63	5	143	448	0.000	0.125	0.128	0.010	0.274	0.101	0.248	0.046	0.457
Søgneelva-Songdalselva	avg.	964	340	1548	1	4	138	8	207	224	0.000	0.091	0.138	0.018	0.191	1.881	0.184	-0.165	0.352
Audnedalselva	avg.	1549	537	2063	1	3	170	7	273	517	0.000	0.110	0.243	0.016	0.172	3.241	0.192	-0.275	0.707
Soknedalselva	avg.	2250	1035	1536	2	6	207	14	291	969	0.000	0.131	0.237	0.019	0.411	2.633	1.975	0.060	1.026
Hellelandselva	avg.	1719	676	1465	2	4	184	9	269	653	0.000	0.094	0.245	0.014	0.232	2.086	0.199	0.049	0.784
Håelva	avg.	479	467	827	2	6	172	12	299	449	0.000	0.078	0.029	0.002	0.153	0.703	0.094	-0.008	0.262
Imselva	avg.	430	147	533	0	1	84	2	114	5	0.000	0.016	0.014	0.002	0.081	0.299	0.075	-0.027	0.157
Oltedalselva,utløp Ragsvatnet	avg.	1005	249	607	0	0	104	4	125	751	0.000	0.025	0.055	0.007	0.147	1.088	0.151	0.040	0.000
Dirdalsåna	avg.	1572	222	946	0	2	143	2	192	569	0.000	0.061	0.105	0.004	0.152	0.734	0.422	-0.341	0.717
Frafjordelva	avg.	1771	319	1022	0	2	125	7	161	598	0.000	0.046	0.147	0.007	0.200	0.619	0.032	0.059	0.647
Espedalselva	avg.	1373	271	697	1	2	88	2	140	716	0.000	0.026	0.064	0.004	0.029	0.338	0.088	0.098	0.501
Førrelva	avg.	1739	317	1116	1	2	39	1	58	1024	0.000	0.038	0.091	0.003	0.069	0.271	0.146	0.055	0.000
Åbøelva	avg.	1055	164	347	1	1	35	-1	49	127	0.000	0.028	0.026	0.001	0.052	0.362	0.074	0.104	0.481
Etneelva	avg.	1920	531	818	1	2	218	3	278	483	0.000	0.121	0.054	0.010	0.272	0.768	0.576	0.806	1.227

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]
Opo	avg.	5685	5880	1728	6	5	195	21	329	2466	0.000	0.418	0.830	-0.008	0.521	3.310	0.708	-0.036	-0.173
Tysso	avg.	3798	526	2259	3	-3	206	7	279	1017	0.000	0.155	0.071	0.008	1.173	4.775	0.914	0.177	2.079
Kinso	avg.	1822	658	378	2	0	17	7	59	130	0.000	0.067	0.033	-0.011	0.001	0.049	0.073	0.182	0.665
Veig	avg.	3216	704	1157	3	3	33	3	106	1572	0.000	0.054	0.055	0.003	0.096	-0.318	0.499	0.271	1.174
Bjoreio	avg.	3838	1002	2949	1	4	59	7	148	1441	0.000	0.128	0.102	-0.015	0.493	0.326	0.841	-0.288	1.401
Sima	avg.	940	262	145	1	1	29	1	45	773	0.000	0.025	0.009	-0.002	0.035	0.248	0.104	0.015	0.343
Austdøla	avg.	926	216	107	1	-1	26	3	38	103	0.000	0.020	0.020	0.002	0.041	0.153	0.037	0.015	0.422
Nordøla /Austdøla	avg.	278	100	20	0	0	11	0	14	123	0.000	0.010	0.006	0.000	0.012	0.001	0.050	0.006	0.000
Tysselvi Samnangervassdraget	avg.	2285	518	1411	1	3	70	6	147	199	0.000	0.077	0.136	0.011	0.242	1.168	0.200	-0.200	0.834
Oselva	avg.	1028	402	1229	2	4	53	3	121	355	0.000	0.058	0.097	0.007	0.375	-0.136	0.199	-0.049	0.000
DaleelviBergsdalsvassdraget	avg.	2156	544	885	1	1	65	6	138	404	0.000	0.065	0.149	0.009	0.267	1.307	0.193	-0.084	0.000
Ekso -Storelvi	avg.	5304	1355	2879	4	8	104	15	309	372	0.000	0.066	0.242	0.019	-0.266	-2.060	0.329	0.126	0.000
Modalselva -Moelvi	avg.	4671	852	1459	1	6	148	7	221	941	0.000	0.051	0.222	0.017	-0.259	0.402	0.355	0.311	0.000
Nærøydalselvi	avg.	2240	658	497	1	2	60	5	122	1960	0.000	0.041	-0.007	-0.002	0.187	0.706	0.072	0.176	0.818
Flåmselvi	avg.	1247	562	194	1	1	26	3	46	281	0.000	0.045	0.012	-0.002	0.049	0.283	0.127	0.086	0.000
Aurlandselvi	avg.	3623	1276	793	2	1	116	5	173	1409	0.000	0.106	0.198	-0.022	0.439	1.122	0.319	0.065	0.000
Erdalselvi	avg.	420	80	146	0	0	1	0	12	89	0.000	0.008	0.006	-0.001	0.013	0.013	0.013	0.037	0.000
Lærdalselva /Mjeldo	avg.	3567	814	1029	2	3	110	5	217	1438	0.000	0.088	0.078	0.000	0.417	0.524	0.282	0.213	0.000
Årdalselvi	avg.	4033	1001	1030	2	4	99	8	167	2441	0.000	0.059	0.028	0.007	1.472	0.515	0.388	0.000	4.416
Fortundalselva	avg.	2453	2436	407	1	3	81	3	113	1283	0.000	0.137	0.054	0.011	0.773	1.025	0.237	0.125	1.791
Mørkrisdalselvi	avg.	1362	2156	213	1	1	29	2	53	919	0.000	0.035	0.064	0.000	0.272	0.864	0.251	0.176	0.000
Årøyelva	avg.	2888	1300	801	1	3	71	6	137	1519	0.000	0.059	0.080	0.000	0.070	0.750	0.140	0.179	0.000
Sogndalselva	avg.	1114	272	490	2	2	34	3	64	166	0.000	0.037	0.041	0.005	0.080	0.662	0.025	0.154	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]
Oselva	avg.	2994	743	2732	1	5	58	16	169	645	0.000	0.180	0.106	-0.005	0.350	1.858	0.343	-0.349	1.639
Hopselva	avg.	852	235	218	0	1	28	1	41	75	0.000	0.017	0.027	0.003	0.009	0.322	0.022	0.128	0.311

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 2015.

Compound	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (kg year^{-1})	Yearly load (kg year^{-1})
Naphthalene	177	56.7-57.2	74.3-77.3
Acenaphthylene	59	12.8	13.5-14.2
Acenaphthene	68	15.8	32.7
Fluorene	79	14.0	12.7-13.2
Phenanthrene	471	46.8	103.3
Anthracene	129	1.9	3.7-4.2
Fluoranthene	956	37.6	68.8
Pyrene	1237	27.0	44.0
Benz[a]anthracene	369	5.4	6.3
Chrysene	402	9.3	11.9
Benzo[bj]fluoranthene	676	10.6	11.1
Benzo[k]fluoranthene	202	3.0	3.1
Benzo[a]pyrene	402	4.6	0.8-3.7
Indeno[1,2,3-cd]pyrene	334	3.4-3.8	3.3
Dibenzo[a,h]anthracene	90	1.3	0.6-1.0
Benzo[ghi]perylene	588	4.1	3.8
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 2015.

	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (g year^{-1})	Yearly load (g year^{-1})
PCB31 (+28)	4.6-4.7	258-288	315-410
CB52	5.7	147-220	173-267
CB101	4.7	14-269	28-216
CB118	3.2	10-179	17-159
CB153	1.7	45-184	94-189
CB138	7.2	12-189	28-173
CB180	5.3	26-186	< 166

Table 2b iii. Estimated riverine load for polybrominated diphenyl ethers (PBDEs) in the rivers Alna, Drammen and Glomma for 2015.

	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (g year^{-1})	Yearly load (g year^{-1})
BDE47	2.0	2.5-94	85-133
BDE99	2.6	67-97	56-122
BDE100	8.9	13-47	329-386
BDE153	0.27-0.38	2.4-58	22-98
BDE154	< 0.26-0.32	< 46	18-66
BDE183	0.61-0.65	< 73	< 112
BDE196	< 0.38	< 107	< 132
BDE209	71	367-404	560-569
*Data for BDE28 not available			

Table 2b iv. Estimated riverine load for hexabromoycldododecane (HBCDD) in the rivers Alna, Drammen and Glomma for 2015.

	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (g year^{-1})	Yearly load (g year^{-1})
α-HBDD	22	54-108	< 257
β-HBCDD	1.3-1.8	65-92	7-167
γ-HBDD	8.1-8.2	13-96	22-189

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 2015.

	River		
	Alna	Drammen	Glomma
	Yearly load (g year^{-1})	Yearly load (g year^{-1})	Yearly load (kg year^{-1})
SCCPs	1054	71918	79700
MCCPs	610	17087	20073
BPA	442	1039-1106	1628-2005
TBBPA	0.7-2.7	332-449	243-682
PFOS	1.6	2.2-2.7	11-17
PFDS	0.12-0.13	< 2.2	< 17

Table 3. Total inputs to the sea from Norway in 2015

TOTAL NORWAY	Flow rate	SPM	TOC	PO4-P	TOTP	NO3N	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
Riverine inputs																		
Main Rivers	201 320	456 891	265 157	444	829	15 168	807	29 720	220 742	0	11.9	18.9	0.82	77	388	40	15.2	65
Tributary Rivers(36)	250 387	174 934	235 598	235	525	9 245	646	23 559	194 456	0	12.4	19.6	1.01	100	256	128	15.4	53
Tributary Rivers(109)	181 538	86 966	109 070	122	255	6 288	558	11 756	86 318	0	6.1	5.8	0.33	21	52	24	21.9	60
Total Riverine Inputs	633 245	718 792	609 826	801	1 609	30 701	2 011	65 035	501 515	0	30.3	44.3	2.17	198	696	192	52.5	178
Direct Discharges																		
Sewage Effluents		2 002		609	1 015	676	10 145	13 527			0.2	0.3	0.02	4	12	2	0.6	6
Industrial Effluents		137 867	751	114	191	116	1 743	2 324			4.8	1.1	0.11	5	17	6	1.3	15
Fish Farming				6 672	9 670	6 286	45 714	57 142						978				
Total Direct Inputs		139 869	751	7 395	10 875	7 078	57 601	72 992			5.0	1.4	0.13	987	29	8	1.9	21
Unmonitored																		
	478 573			204	830	28 540	2 512	45 664										
Region total																		
	1 111 818	858 660	610 577	8 401	13 314	66 319	62 124	183 692	501 515	0	35	46	2	1 185	725	200	54	199

SKAGERAK	Flow rate	SPM	TOC	PO4-P	TOTP	NO3N	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
Riverine Inputs																		
Main Rivers	159 191	425 615	234 523	419	753	14 053	748	26 753	192 712	0	10.1	18.0	0.7	65	359	34	13.0	54
Tributary Rivers (36)	33 846	22 581	56 740	21	65	1 686	133	4 473	25 598	0	2.5	5.3	0.3	9	61	4	1.9	12
Tributary Rivers (109)	10 366	16 875	20 321	23	84	1 661	81	2 499	10 094	0	1.3	1.4	0.1	3	22	3	0.3	6
Total Riverine Inputs	203 403	465 071	311 584	463	902	17 400	962	33 725	228 404	0	13.8	24.7	1.1	77	442	41	15.2	71
Direct Discharges																		
Sewage Effluents		1		80	134	280	4 204	5 606			0.1	0.2	0.0	3	9	1	0.2	4
Industrial Effluents		1 651	76	18	30	47	712	949			0.2	0.3	0.0	4	8	2	0.7	12
Fish Farming				5	7	5	34	43						1				
Total Direct Inputs		1 652	76	103	171	332	4 950	6 598			0.3	0.6	0.0	8	17	3	1.0	16
Unmonitored																		
	8 931			19	79	2 008	177	3 212										
Region total																		
	212 334	466 722	311 660	586	1 152	19 740	6 089	43 535	228 404	0	14	25	1	84	458	44	16	87

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	12 018	5 747	5 355	8	27	602	30	1 113	4 287	0	0.4	0.4	0.03	2	5	2	0.26	5
Tributary Rivers (36)	90 305	46 265	55 493	60	152	4 762	170	8 866	39 342	0	2.8	7.9	0.46	15	114	6	2.61	15
Tributary Rivers (109)	89 085	33 389	38 721	55	100	3 527	231	5 905	32 657	0	3.2	4.0	0.12	10	31	11	2.83	25
Total Riverine Inputs	191 409	85 401	99 568	123	279	8 891	431	15 884	76 285	0	6.4	12.3	0.61	27	150	19	5.70	45
Direct Discharges																		
Sewage Effluents		876		210	350	195	2 924	3 899			0.1	0.1	0.00	1	2	0	0.03	1
Industrial Effluents		130 199	389	48	79	20	295	394			4.6	0.7	0.08	1	8	4	0.52	3
Fish Farming				2 215	3 210	2 091	15 204	19 005						325				
Total Direct Inputs		131 075	389	2 472	3 639	2 305	18 423	23 298			4.7	0.8	0.09	326	10	5	0.54	4
Unmonitored																		
	179 818			71	288	12 112	1 066	19 379										
Region total																		
	371 227	216 476	99 957	2 666	4 205	23 308	19 920	58 561	76 285	0	11	13	1	353	160	24	6	49

NORWEGIAN SEA	Flow rate	SPM	TOC	PO4-P	TOTP	NO3N	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
Riverine inputs																		
Main Rivers	22 339	17 766	15 337	10	29	407	17	1 231	12 641	0	1.0	0.5	0.1	9	23	3	1.08	5
Tributary Rivers(36)	80 290	65 449	61 434	56	113	2 388	208	6 173	52 956	0	2.7	2.6	0.1	19	53	17	5.73	20
Tributary Rivers(109)	51 541	26 234	25 450	28	53	893	161	2 275	21 827	0	1.0	0.0	0.0	2	-5	5	14.38	15
Total Riverine Inputs	154 170	109 449	102 221	95	195	3 688	386	9 679	87 424	0	4.7	3.1	0.2	30	71	25	21.19	41
Direct Discharges																		
Sewage Effluents		864		221	368	141	2 114	2 818			0.03	0.04	0.00	0.8	1.5	0.2	0.31	0
Industrial Effluents		2 078	148	46	77	46	693	924			0.01	0.09	0.01	0.3	0.4	0.1	0.07	0
Fish Farming				2 820	4 087	2 648	19 259	24 074						413				
Total Direct Inputs		2 943	148	3 087	4 532	2 835	22 066	27 816			0.04	0.13	0.01	414	2	0	0.38	1
Unmonitored																		
	171 629			78	319	9 723	856	15 556										
Region total																		
	325 799	112 391	102 368	3 260	5 047	16 246	23 307	53 051	87 424	0	5	3	0	444	73	25	22	41

BARENTS SEA	Flow rate	SPM	TOC	PO4-P	TOTP	NO3N	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
Riverine inputs																		
Main Rivers	7 772	7 763	9 943	8	20	105	11	622	11 102	0	0.4	0.1	0.0	1	1	1	0.86	1
Tributary Rivers(36)	45 945	40 638	61 931	97	195	409	136	4 047	76 561	0	4.4	3.7	0.1	57	28	100	5.15	6
Tributary Rivers(109)	30 546	10 470	24 578	16	18	208	85	1 078	21 740	0	0.6	0.5	0.2	6	4	5	4.38	14
Total Riverine Inputs	84 263	58 871	96 453	120	233	722	233	5 747	109 402	0	5.4	4.3	0.3	64	33	106	10.40	21
Direct Discharges																		
Sewage Effluents		261		98	163	60	903	1 204			0.0	0.0	0.0	0.05	0.14	0.02	0.00	0
Industrial Effluents		3 939	138	2	4	3	43	57						0.00	0.00	0.00	0.00	
Fish Farming				1 633	2 366	1 542	11 216	14 020						240				
Total Direct Inputs		4 200	138	1 733	2 533	1 605	12 162	15 281			0.0	0.0	0.0	240	0	0	0.00	0
Unmonitored																		
	118 195			35	144	4 698	413	7 517										
Region Total																		
	202 458	63 071	96 590	1 889	2 910	7 025	12 808	28 544	109 402	0	5	4	0	304	33	106	10	21

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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.