Statlig program for forurensningsovervåking

Riverine inputs and direct discharges to Norwegian coastal waters - 2002

OSPAR Commission

A: Principles and discussions

B: Data report

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Riverine Inputs and Direct Discharges to Norwegian Coastal Waters - 2002

OSPAR Commission.

A: Principles, Results and Discussions

Aquateam – Norwegian Water Technology Centre A/S

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REPORT

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Summary

Riverine inputs to Norwegian coastal waters from 10 main and 129 tributary rivers were monitored during 2002 covering the nutrients (Tot-P, PO_4-P, Tot-N, NO_3-N, NH_4-N, SiO_2), suspended particulate matter (S.P.M.), total organic carbon (TOC), selected trace metals (Pb, Cd, Cu, Zn, Tot-Cr, Ni, As, Hg) and the persistent organic pollutant lindane. Compared to 2001, the programme has been reduced with 19 tributary rivers draining to the Barents Sea subregion. Additionally inputs from rivers not part of the monitoring programme, as well as direct discharges to marine waters along the coast from Sweden to Russia have been estimated.

The total annual nutrient load to coastal waters from land based sources was found to be 10 600 tonnes of phosphorus and 116 100 tonnes of nitrogen. About 34 % of the phosphorus and 42 % of the nitrogen were inputs from the monitored rivers and tributaries. The environmental loading from fish farming contributes to approximately 48 % of the total phosphorus loading and 21 % of the total nitrogen loading. Most inputs of trace metals were low, especially the riverine inputs of Cd, Pb and Hg. The largest discharges of trace metals comprise copper and zinc, with the input estimates of 179-180 and 520-537 tonnes, respectively. Inputs of cadmium were estimated to be 2.3-3.1 tonnes, lead 44 tonnes, mercury 1.6-1.7 tonnes, arsenic 22-24 tonnes, total chromium 35-38 tonnes and nickel 134-143 tonnes. The pesticide lindane was detected in most samples in very low concentrations. Total load of lindane was estimated to be about 47 kg.

Retention in the fjords, leaching from the marine sediments and discharge from landfills located near the coast are not taken into account in these figures.

Key words - English	Key words - Norwegian
Pollution inputs	Forurensningstilførsler
Norwegian coastal waters	Norske kystområder
Riverine inputs	Elvetilførsler
Direct inputs	Direkte tilførsler

Preface

This report presents the results of the 2002 monitoring of waterborne pollutants discharged to the Norwegian coastal waters, both riverine and direct discharges. The study is part of a joint monitoring programme under the "OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic". The Norwegian contribution is administered by the Norwegian Pollution Control Authority (SFT), which has contracted Aquateam – Norwegian Water Technology Centre to perform the actual investigations. Aquateam has since 1999 been responsible for the Riverine Input Project (RID). The 2002-investigation lasted from January throughout December. This report is the Norwegian part of the 2002 study, divided into two parts:

A: Principles, Results and Discussion
B: Data Report

The Programme Committee has consisted of Jon L. Fuglestad (SFT), Mona Weideborg and Eilen Arctander Vik (Aquateam). The practical investigations have been coordinated and the reporting has been performed by Mona Weideborg. Principal collaborator has been Eilen Arctander Vik. The data handling was performed by Elisabeth Lyngstad. The names and responsibilities of all participants are listed in Section 5.

We would like to express our gratitude to all participants of the investigation, especially to the local fieldworkers for the collection and transport of the samples. The contact persons at the Norwegian Water Resources and Energy Administration (NVE) and The Norwegian Meteorological Institute (DNMI), Eva Klausen and John Smits, are acknowledged for their kind cooperation.

Oslo, 18 December 2003

Mona Weideborg

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Summary and Conclusions

The objectives of the *Comprehensive study on riverine inputs and direct discharges (RID)* are to assess all riverborne and direct inputs of selected pollutants to OSPAR Convention waters on an annual basis. This contributes to the *Joint Assessment and Monitoring Programme (JAMP)* by providing data on inputs to Convention waters on a subregional and a regional level. In this report the results from 2002 are given for riverine inputs of 10 main rivers and 129 tributaries. Random samples of 145 tributary rivers were monitored before 2002. The active monitoring programme in 2002 covered drainage from approximately 60 % of the main land area compared to 75% in the full program carried out in 2001. The sampling programme for 2002 was reduced with 19 tributary rivers to the Barents Sea. The loads of these 19 rivers were stipulated based on concentrations measured in 2001. The tributary inputs to the Barents Sea are relatively low, and the use 2001 data is not expected to influence on the total calculated loading. For discharges entering directly into marine recipients, i.e. municipal wastewater and industrial discharges, estimates are based on data from existing effluent control programmes. Diffuse losses of total phosphorus, total nitrogen, phosphates, nitrates and ammonia from these coastal zones are estimated by using area specific run-off coefficients. Discharges from fish farming are estimated by using equations and factors described in OSPAR's HARP Guidelines. Results from an investigation of particle bound metals carried out in May – June 2003 are also included in this report.

For most Norwegian rivers the input to the sea shows large annual variations due to large seasonal differences in water flow and erosion. To control the fulfilment of the Ministerial Declaration of the North Sea, a "normalised" set of chemical data has also been prepared for 2001. The 2001 average monitored chemical concentrations in river water have been multiplied with long term average flow (LTA) for the period 1961-90 for the main rivers and for 1931-60 for the tributary rivers.

Greatest emphasis with regard to accuracy has been given to the input estimate to the Skagerrak region, as this is considered the most "sensitive" part of the Norwegian North Sea coast. The Skagerrak region received in 2002 approximately 17 % of the total phosphorus (Tot-P) and 30 % of the total nitrogen (Tot-N) loading to the Norwegian coastal waters. In this region about 85 % of the P- and about 76 % of the N-loads are found in the riverine inputs. During year 2002, all rivers with outlet in the Skagerrak area showed a decreased annual water flow (11-29 % decrease) compared to 2001.

Total annual loads to coastal waters from land-based sources in Norway include approximately 10 600 tonnes of total phosphorus and 116 100 tonnes of total nitrogen. The phosphorus load is higher and the nitrogen load is slightly lower than in 2001. About 34 and 42 % of the grand total inputs of phosphorus and nitrogen are monitored in the main and tributary rivers. The loading from fish farming contributes to approximately 48 % of the total phosphorus loading and 21 % of the total nitrogen loading.

It was found a decrease of 1.4 % for nitrogen and an increase of 14 % for phosphorus compared with the 2001 loads. A decrease should be expected due to the lower water flow of all rivers in the Skagerrak area in 2001. In the main rivers in the Skagerrak region, the calculated loads in 2002 decreased by 12 % for total nitrogen and by 22 % for total phosphorus. The decrease in water flow for the rivers discharging to this region was 16 %. The relatively large increase in the total phosphorus loading from 2001 to 2002 was mainly due to increase in loading from the fish farming industry (probably due to a new reporting system for fish farm-

ing). The phosphorus loading from tributary rivers in the Norwegian Sea subarea was also higher in 2002 than in 2001. The concentration of suspended matter in these tributary rivers had increased, indicating that a large part of the phosphorus was particle bound and not bioavailable.

Riverine inputs of metals and lindane were relatively low. For some of the rivers, the concentrations found for some metals and lindane, were lower than the detection limits given in the OSPAR Guidelines. Inputs of cadmium (Cd) were estimated to be 2.3-3.1 tonnes, lead (Pb) 44 tonnes, mercury (Hg) 1.6 – 1.7 tonnes, arsenic (As) 22-24 tonnes, total chromium (Cr) 35-38 tonnes and nickel (Ni) 134-143 tonnes. Copper (Cu) and zinc (Zn) comprised the largest inputs of trace metals, which in 2002 amounted to approximately 179-180 and 520-537 tonnes, of which 85 and 89 % respectively, were river monitored. The high uncertainty in the cadmium value is due to many analytical values below the detection limit (40%). The reported concentrations of Hg were in the same range as in the period 1999-2001.

For all the metals, except lead, the 2002 reported total loads to the Norwegian coastal waters were lower than in 2001. Total inputs of metals decreased between 5% for nickel to 34% for chromium. A major reason for this significant decrease in metal loading was probably decrease in water flow of all rivers in the Skagerrak area also in year 2002. High run-off with flooding periods can give higher loads of metals, due to increased water flow, increased leaching from the ground and increased particle loss from erosion. The total lead loading increased with 33 % from 2001 to 2002, mainly due to an increase in particulate matter in tributary rivers in the Norwegian Sea subregion. The uncertainty in the stipulated total loads from the tributaries is, however, high. The short-time investigation of particle bound metals indicated that most of the lead content in rivers was particle-bound (55-85%). It has therefore been concluded that a large part of the lead is particle-bound and is not bioavailable. The loading of cadmium from direct discharge decreased from 2001 to 2002, due to decreased discharges of Cd from industrial and sewage effluents.

The pesticide lindane was found in most samples, but in very low concentrations. The substance has been banned in Norway, and should not have been used for the last 10 years. The findings of this substance in Norwegian rivers are therefore most likely due to long-range transported air pollutants. Total load of main rivers was estimated to 27 kg. Load of tributary rivers has been stipulated to approximately 20 kg. The total loads were stipulated to 47 kg. This is 2% decrease from 2001 to 2002. Since lindane has not been analysed in the tributary rivers during the last years, the uncertainty of the stipulated total load is high.

On annual basis, statistical trend for total P, total N, the metals, and lindane have been carried out for all rivers. Significant upward trends for phosphorus were detected for Skienselva, Numedalslågen and Vefsna with use of the Trend-Y-Tector. For Otra, the downward trend seen for phosphorus for the period 1980-1998 did not continue from 1999. A significant upward trend in the yearly inputs of nitrogen was found for Drammenselva and Numedalslågen. A downward trend was found for nitrogen in Otra in 1980-2002 and for Suldalslågen in 1990-2002. In Vefsna a high increase of the yearly nitrogen input was found for the period 1990-1998. However, in 1999-2002 the load decreased to the same level as in 1990-1992. Longer time series are needed to make sound conclusions about these variations. Significant reductions in the yearly inputs of metals were found in Orkla (Cu, Zn, Cd and As), Suldalslågen (Pb, Cd,Cr, Ni, Cu and Zn), Numedalslågen (Cd and Cr), Skienselva (Pb), Otra (Cd, Cr and Zn), Vefsna (Cd, Cr, Ni) and Altaelva (Cd and Cu). Significant reductions in the yearly input of lindane were found in Drammenselva, Suldalslågen and Orreelva.

1. Introduction

At the Tenth Meeting of the Paris Commission (Lisbon, June 1988) the principles for the comprehensive study on riverine inputs were adopted. It was then decided to commence the study with measurements carried out in 1990, and to continue the work in the following years (PARCOM, 10/3/2).

The purpose is to provide the Commission with an assessment of the waterborne inputs to Convention waters. Besides riverine inputs, the information sought also relates to direct discharges. The objectives of the Comprehensive Study are:

1. To assess, as accurately as possible, all riverborne and direct inputs of selected pollutants to Convention waters on an annual basis. Inputs from lakes, polders and storm overflows are to be included where information is available.

2. To contribute to the implementation of the JAMP by providing data on inputs to Convention waters on a sub-regional and a regional level.

3. 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 the basis of the data for 1990 to 1995 whether the Principles of the Comprehensive Study on Riverine Inputs require revision.

4. Each Contracting Party bordering the maritime area and, excluding the EU, should:
    a. aim to monitor on a regular basis at least 90% of the inputs of each selected pollutant;
    b. provide, for a selection of their main rivers, information on the annual mean/-median concentrations of pollutants resulting from the monitoring according to paragraph 1.4a; and
    c. as far as is practicable, estimate inputs from diffuse sources, direct sources and minor rivers complementing the percentage monitored (cf. paragraph 1.4a) to 100%.

PARCOM Recommendation 88/2 stipulates that Contracting Parties should take effective national steps in order to reduce nutrient inputs into areas where these inputs are likely, directly or indirectly, to cause pollution, and to achieve a substantial reduction (of the order of 50%) in anthropogenic inputs of phosphorus and nitrogen to these areas between 1985 and 1995.

At the Third International Conference on the Protection of the North Sea States in 1990, Ministers agreed that discharges of selected persistent organic pollutants to the whole North Sea area are to be reduced by 50-70% depending on the pollutant in question.

2. River Systems Included in the Study

2.1. General Aspects

The length of the Norwegian mainland coastline, including fjords and bays is 21 347 km, and the length of the islands' coastline is 35 662 km (Table 1). Because of the length of the coast line, the great numbers of rivers, and retention processes in the fjords, in- and out-washing areas, monitoring of river-borne pollutants in Norway faces quite a few challenges with respect to assessing their impact on coastal waters. Further, to measure 90 % of the load from the Norwegian rivers, a great number of rivers would have to be included, which would be extremely expensive. It was therefore decided that 8 of the major load bearing rivers should be monitored in accordance with the objectives of the comprehensive study. Further it was decided that 2 "unpolluted" rivers should be monitored at a reduced, but appropriate frequency. In these 10 rivers a number of investigations have been carried out since 1990, and they have all been included in the National Monitoring Programme of Watercourses (SFT, 1980 - 2002).

In addition to the ten rivers it was decided to estimate the load of 145 other rivers (tributaries). Random samples were taken from 129 rivers in 2002. The load estimation was based on the results from the random sampling supplemented with other data from 2001-monitoring programmes, and existing knowledge of the river systems concerned. The sampling programme for 2002 was reduced with 19 tributary rivers to the Barents Sea. The loads of these rivers were stipulated based on concentrations measured in 2001. The 19 rivers comprised a drainage area of 45 155 km^2 to the Barents Sea. The tributary inputs to the Barents Sea are relatively low, and the use of 2001 data is not expected to influence on the total calculated loading.

The total drainage area of these monitored rivers is 229 152 km² for full programme and 183 997 km² for reduced programme, while the total area of mainland Norway is 323 878 km² (Table 1). Totally 306 707 km² of the drainage area is included in the investigation, of which 75% is river monitored in full programme and 60 % in reduced programme (Table 6). The programme focused on estimating the major loads to Skagerrak. In this region the monitored rivers and tributaries cover 94 % of the total area, whereof the main rivers alone cover 80 %.

The coastline is divided into subareas/regions, comprising the drainage basins of the ten main rivers with tributaries, as shown in Figure 1. Each subarea relates to one of the four discharge-/sub-regions (Figure 1 and Table I.I-I.IV (Report B, Appendix I,)) which are divided as follows (see also Table 5):

Barents Sea:	From the Russian border (about 70°30'N, 70°30'E), to about 70°30'N, 21°E
Norwegian Sea:	Southwards of 70°30'N, to about 62° N
North Sea:	Southwards of 62° N, to the Swedish border
Skagerrak:	From Lindesnes (the southernmost point of Norway), about 57°44'N to Sweden about 58°58'N, 11°E.

Some key information about Norway and the adjacent oceans is given in Table 1.

Table 1. Norway: Population, areas and length of coastline.

Population	4.5 million
Area:	
- Mainland Norway	323 878 km²
- The whole country incl. Svalbard and Jan Mayen	386 958 km²
Coastline:	
- Length of the continental coastline	21 347 km
- Not including fjords and bays	2 650 km
- Length of the islands' coastline	35 662 km

2.2. Main Rivers

The rivers chosen for the comprehensive study are the same as in 1990-2001 and presented in Table 2 and Figure 1. The rivers marked 1 to 5 represent the major load bearing rivers in Norway. As mentioned in Section 2.1, it was of special importance to estimate the major loads to Skagerrak (Figure I.I, Report B, Appendix I,) which is an important part of the North Sea, and considered to be most susceptible to pollution. Five monitored rivers (No 1 to 5) drain into the Skagerrak area.

Orreelva (No 6) is draining the most intensive agricultural area in Norway especially concerning domestic animals (milk and meat production). Discharges from manure stores and silos together with area run-off from heavily manured fields are causing great problems (eutrophication, including toxic algal blooms) both in Orreelva and in the other water bodies in this area.

Orkla (No 8) is also draining agricultural area, but farming in this part of the country is less extensive compared to the Orre area. More important in this area are abandoned mines in the upper part of the watercourse. Several other rivers in this area also receive discharge from abandoned mines (heavy metals).

Vefsna (No 9) is a watercourse where the water in periods carries large concentrations of suspended solids and as such is representative of many rivers in this part of the country.

River Suldalslågen (No 7) and river Alta (No 10) should be "unpolluted" river systems.

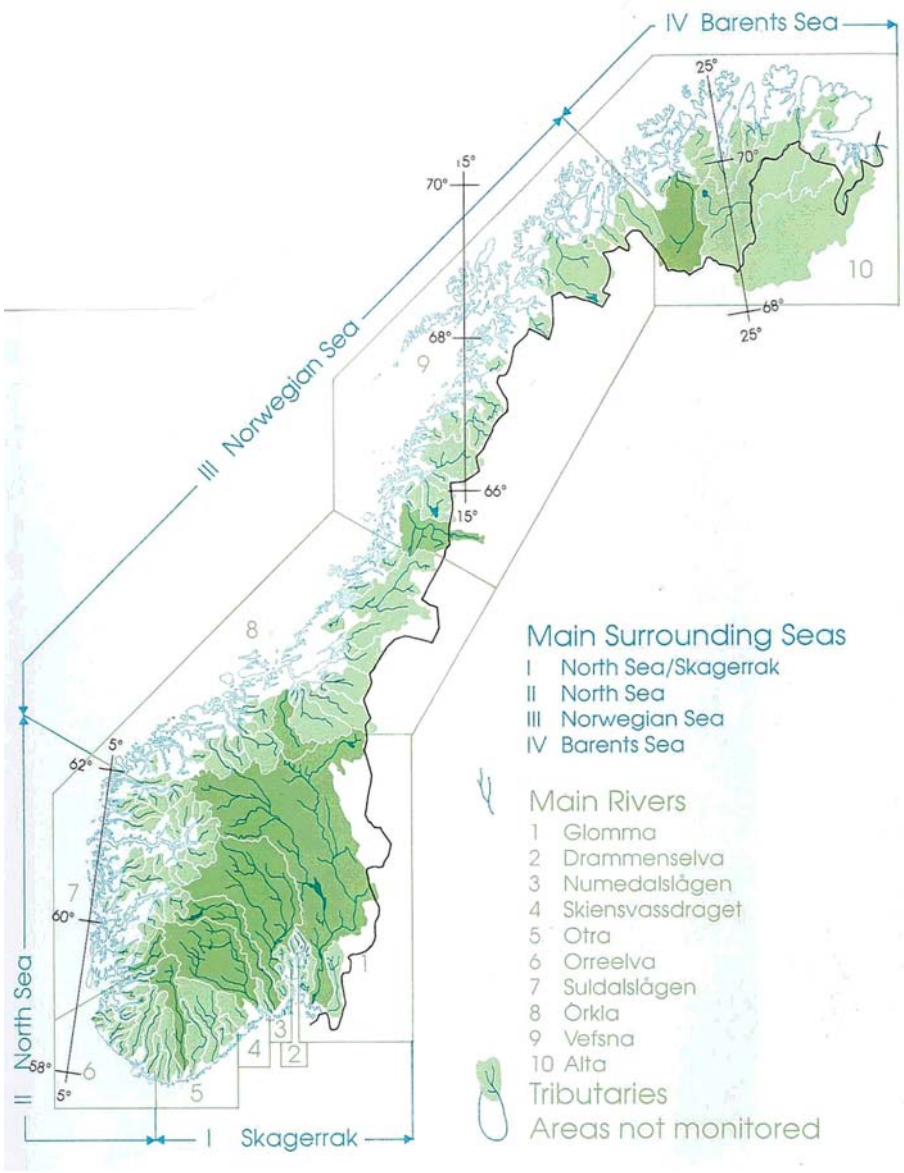


Figure 1. Norway divided into four Discharge Areas. Main Rivers and Tributaries with Drainage Basins. Source: Norwegian Water Resources and Energy Administration. Design: NIVA

Table 2. The main rivers with catchment areas and long term average flow (LTA) 1961-90.

No.	River	Catchment area, km^2	LTA, 1000 m^3/day (at outlet)
1	Glomma	41 918	61 350
2	Drammenselva	17 034	28 850
3	Numedalslågen	5 577	10 200
4	Skienselva	10 772	23 535
5	Otra	3 738	12 870
6	Orreelva	105	335
8	Orkla	3 053	5 710
9	Vefsna	4 122	15 655
7	Suldalslågen	1 457	7 420
10	Alta	7 373	7 495
Total		**95 149**	

The ten watercourses are all representing typical river systems in different parts of the country. As such they are very useful when estimating loads of comparable rivers, i.e. corrections and adjustments in the estimates of loads of tributaries, which are based on fewer data than the main rivers.

All these watercourses except Orreelva are regulated for hydroelectric power production.

2.3. Tributary Rivers

In addition to the ten main rivers, it was determined to assess inputs from the same 145 river systems as in 1990 - 2001 using "best estimates" of concentrations and flows. In total all Norwegian rivers with catchment areas larger than 500 km² and several of the minor rivers (streams) also are included in the 2002 study. Some information about these rivers is shown in Tables 8.1-8.2 (Appendix VIII, Report B). The 19 tributary rivers draining Barents Sea were not included in the monitoring in 2002. The loads of these rivers were, however, stipulated based on analytical results from 2001.

3. Methodology

3.1. Methodology for Assessment of Riverine Inputs

The methodology described in the Commissions Document "Principles of the Comprehensive Study on Riverine Inputs" (PARCOM, 1988, 1993) was followed.

3.1.1. Objective

A riverine input is a mass of a determinant carried to the maritime area by a watercourse (natural river or man-made watercourse) per unit of time. The objective is to obtain as accurate as possible an estimate of the input load to Norwegian coastal water, and to obtain information on the long-term trends in inputs where such information might provide an additional or a better basis for a trend assessment.

3.1.2. Site Selection

The sampling sites are located in regions of unidirectional freshwater flow. The sites chosen, have been areas where the water is well mixed (such as, at or immediately downstream a weir, in waterfalls, rapids or in channels in connection with hydroelectric power stations) and where uniform water quality is expected. When possible, samples are taken from the middle of bridges across the rivers. The water should be well mixed both horizontally and vertically.

Only one sampling site has been used in each of the rivers. The sampling sites were located as close to the freshwater limit as possible, but should not be influenced by seawater. Several of the most significant discharges from the industry and the municipal wastewater system are located downstream the sampling sites. These supplies will not be included in the riverine inputs, but are included in the direct discharge estimates (Table 1 (Appendix I) and Appendices II and III, Report B).

3.1.3. Sampling Strategy and Frequency

The sampling strategy has been designed on the basis of historical records. Although it should aim to cover the whole flow cycle, it has been concentrated on periods with expected high river-flow. Experience has shown that there is a positive correlation between periods of high river-flow and high input load, especially for suspended solids and trace metals.

Most monitoring effort has been directed towards the rivers with the highest input load (Glomma and Drammenselva). The original programme of 1990-1992 was reduced in 1993. Small changes in the programme were undertaken from 2000 to 2001. In the period 1990-2000, the river Vefsna has been anticipated variations due to differences in water drainages. Analytical results from the last year indicate that weekly sampling should not be necessary. The weekly sampling in river Vefsna in May – June was therefore left out in 2001 and 2002.

In the main rivers, with some exceptions, 12 spot samples or more have been taken at regular monthly intervals during the sampling period from January to December 2002, as described in PARCOM 10/3/2. Samples were not taken in December from Glomma, Drammenselva and Vefsna, due to ice problems at the sampling stations. Samples from some of these rivers could be collected in the first week of January 2003 instead of December. Two of the main rivers (Glomma and Drammenselva) were sampled weekly in the period with the highest anticipated flow (May – June). Vefsna was sampled only 5 times in 2002, due to ice problems and other

sampling problems. In most of the main rivers the parameter lindane have been sampled and analysed 4 times in 2002. Lindane was sampled 2 times in Vefsna and 3 times in Suldalslågen. The sampling frequency for the main rivers is shown in Table 3.

Table 3. Sampling sites and frequency of the main rivers.

River/Location	J	F	M	A	M	J	J	A	S	O	N	D
Glomma at Sarpsfoss	xx	x	x	x	xxxx	xxxx	x	x	x	x	x	[1]
Drammenselva upstream the town bridge	x	x	x	x	xxxx	xxxx	x	x	x	x	x	[1]
Numedalslågen at Bommestad	x	x	x	x	x	x	x	x	x	x	x	x [2]
Skienselva at Klosterfoss	x	x	x	x	x	x	x	x	x	x	x	x [2]
Otra at Skråstad	x	x	x	x	x	x	x	x	x	x	x	x [2]
Orreelva near the outlet	x	x	x	x	x	x	x	x	x	x	x	x [2]
Orkla at Vormstad	x	x	x	x	x	x	x	x	x	x	x	x [2]
Vefsna at Kvalfors		x	x	x			x		x			[1]
Suldalslågen near the outlet	x	x	x	x	x	x	x	x	x	x	x	x [2]
Alta just upstream Alta	x	x	x	x	x	x	x	x	x	x	x	x

[1] No sample due to ice problems

[2] Sample collected in January 2003

The tributary rivers were sampled once in 2002. Lindane was not analysed in the tributary rivers. The concentrations of lindane were estimated on the basis of knowledge about the activity in the different drainage areas, and the findings from the main rivers and samples/analyses from these areas in 1990-1997.

In 2002 the water samples from the main rivers were taken by local personnel and by the companies BUVA and AnalyCen (see Section 5). Aquateam personnel collected most of the samples from the tributary rivers. The persons were carefully instructed in advance. The samples were sent to the laboratory used by Aquateam (AnalyCen, Moss) immediately after sampling, usually arriving at the laboratory within 1 to 2 days. The samples were not conserved in the field. They were either conserved at the laboratory immediately after receiving or the analytical work was started immediately.

3.2. Monitoring Parameters and Analytical Methods

3.2.1. Chemical parameters – detection limits and analytical methods

In 2001 the following parameters were monitored: 6 nutrients (total phosphorus, orthophosphates, total nitrogen, ammonia, nitrate + nitrite and silicate), 8 metals (copper, zinc, cadmium, lead, total chromium, nickel, mercury and arsenic), 1 pesticide (lindane) and two general parameters (suspended particulate matter (S.P.M.) and total organic carbon (TOC)).

Information on methodology and obtainable limits of detection for all parameters included in the sampling programme, are shown in Table 4. According to the document "Principles of the Comprehensive Study of Riverine Inputs and Direct Discharges" (PARCOM, 1988), it is necessary to choose an analytical method, which gives at least 70 % of positive findings (i.e.

above the detection limit). The small changes in the detection limits from 2001 to 2002 have not influenced on the results.

Table 4. Analytical methods and detection limits.

Parameter	**Detection limit**	**Analytical Methods** (NS: Norwegian Standard)
Conductivity (mS/m)	-	NS-ISO 7888
Suspended particulate matter (S.P.M.) (mg/L)	0.6	NS 4733
Total Organic Carbon (TOC) (mg C/L)	0.1 – 0.4	NS-EN 1484-1
Total Phosphorus (µg P/L)	1.0	NS 4725
Orthophosphate (PO_4-P) (µg P/L)	1.0	NS 4724
Total Nitrogen (µg N/L)	10	NS 4743
Nitrate and nitrite ($NO_3 + NO_2$) (µg N/L)	4	NS 4743
Ammonia (NH_4) (µg N/L)	2	NS 4746
Silicate (SiO_2) (mg/L)	0.09	SS028150-2
Lead (Pb) (µg Pb/L)	0.02	SS028152-2
Cadmium (Cd) (µg Cd/L)	0.01	SS028152-2
Copper (Cu) (µg Cu/L)	0.05-0.1	SS028152-2
Zinc (Zn) (µg Zn/L)	0.1-0.5	SS028152-2
Chromium (Cr-tot) (µg Cr/L)	0.05-0.2	SS028152-2
Nickel (Ni) (µg Ni/L)	0.02-0.2	SS028152-2
Arsenic (As) (µg As/L)	0.05	SS028152-2
Mercury (Hg) (ng Hg/L)	2	NS 4768 (CETAC)
Lindane (ng/L)	0.1	EPA 508 mod. – GC/ECD

In 2002 the following laboratories have carried out the water analyses in the riverine input project:

- AnalyCen, Moss: Analyses of total phosphorus, orthophosphate, total nitrogen, ammonia, nitrate + nitrite and total organic carbon (TOC), mercury and lindane
- AnalyCen Nordic, Lidköping, Sweden: Analyses of metals and silicate.

For the main and tributary rivers, it was not possible to get >70% of the measurements above the detection limit for each parameter. An overview over parameters with less than 70% of the measurements above the detection limit is given in the Appendix IV and V (report B) for main and tributary rivers, respectively.

In 2002, most nutrient measurements were above the detection limit, with more than 70% above limit in all main and tributary rivers. For one of the two unpolluted main rivers, Suldalslågen, only 42% of the SPM measurement was above the detection limit.

All main rivers had more than 70% measurements above the detection limits for lead and copper.

The low concentration of heavy metals, especially cadmium, chromium and mercury, made it difficult to obtain 70% measurements above the detection limit. The following of the main rivers had less than 70% metal measurement above the detection limit:

- Chromium: Skienselva, Suldalslågen

- Cadmium: Drammenselva, Numedalslågen, Orreelva, Vefsna, Alta
- Zinc:Vefsna, Alta
- Mercury: Otra, Orreelva, Suldalslågen, Vefsna
- Nickel: Suldalslågen, Vefsna

However, this is not likely to affect the results and conclusions of the year 2002-study. In the cases were the results recorded were lower than the detection limits, two load quantities have been estimated, one assuming that the true concentration is zero and the other assuming that the true concentration is the detection limit. This provides maximum and minimum concentrations within which the true estimate will fall. When used to evaluate inputs, these data provide upper and lower boundaries for the estimate.

3.2.2. Method used to estimate flow rate

For the period 1931-60 the annual specific run-off from the total area of Norway is estimated at 42.9 l/s km². Expressed in volumetric units this amounts to 438 km³ water, which distributed over the whole country equal a mean run-off of 1350 mm. Mean annual run-off in Norway and from the sub-regions to the main surrounding seas for the period 1931-60 are shown in Table 5. For the main rivers mean annual water flow for the last LTA-period (1961-90) has been estimated. For the main rivers mean annual water flow (1931-60 and 1961-90) together with annual water flow for the years 1985, 1990-2002 are shown in Figure 2. Mean annual and annual precipitation for the same stations and periods are presented in Figure 3. As for precipitation, normals for Norway based on the LTA-period 1961-90 were published in 1993 (DNMI, 1993).

The difference between the total area given in Table 5 and the area given in Table 1 is due to rivers that drain into the neighbouring countries (Sweden, Russia and Finland).

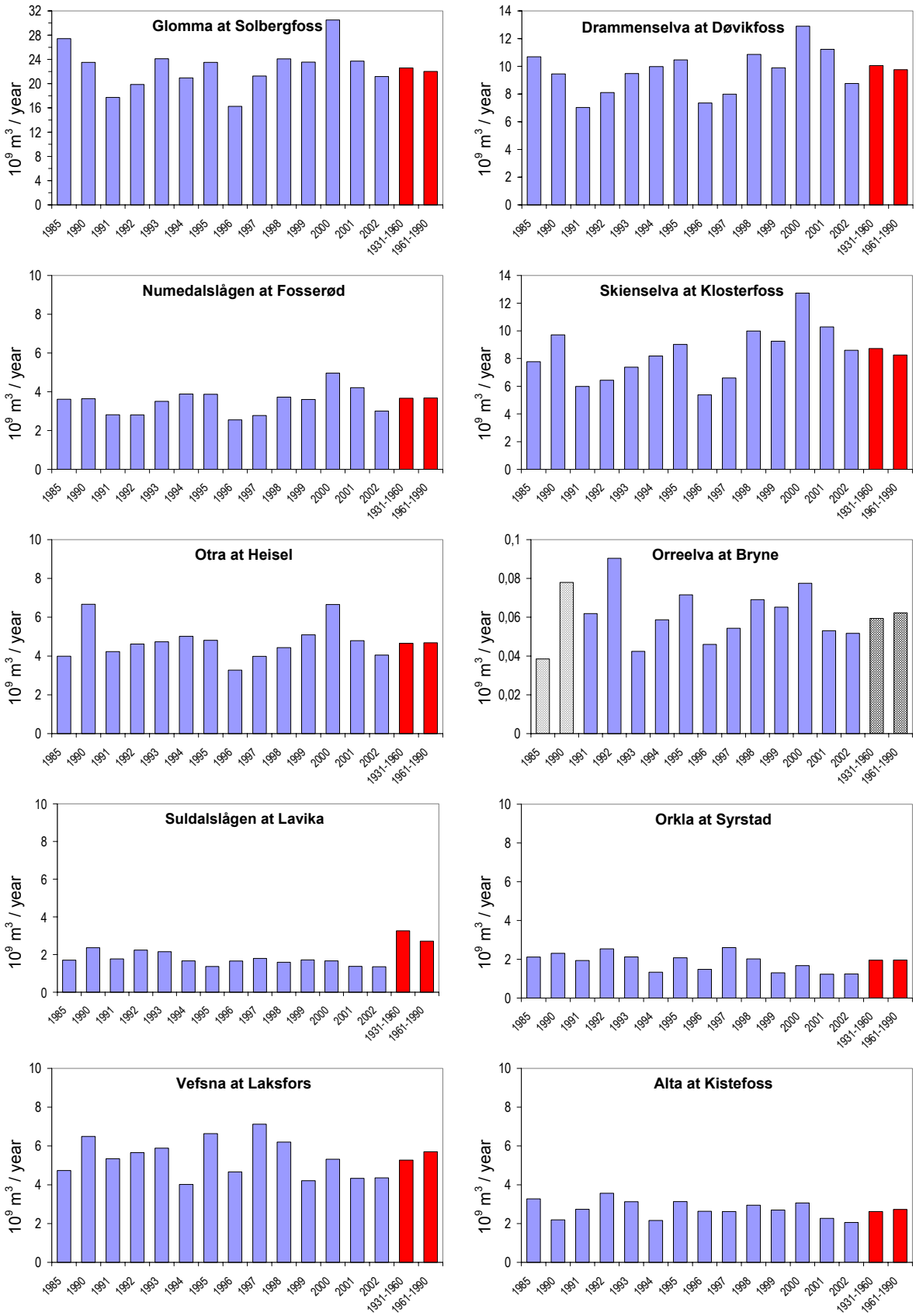


Figure 2. Main Rivers. Mean Annual Flow (1931-60 and 1961-90) and Annual Water Flow for 1985, 1990-2002 ($10^9 m^3$). Source: Norwegian Water Resources and Energy Administration.

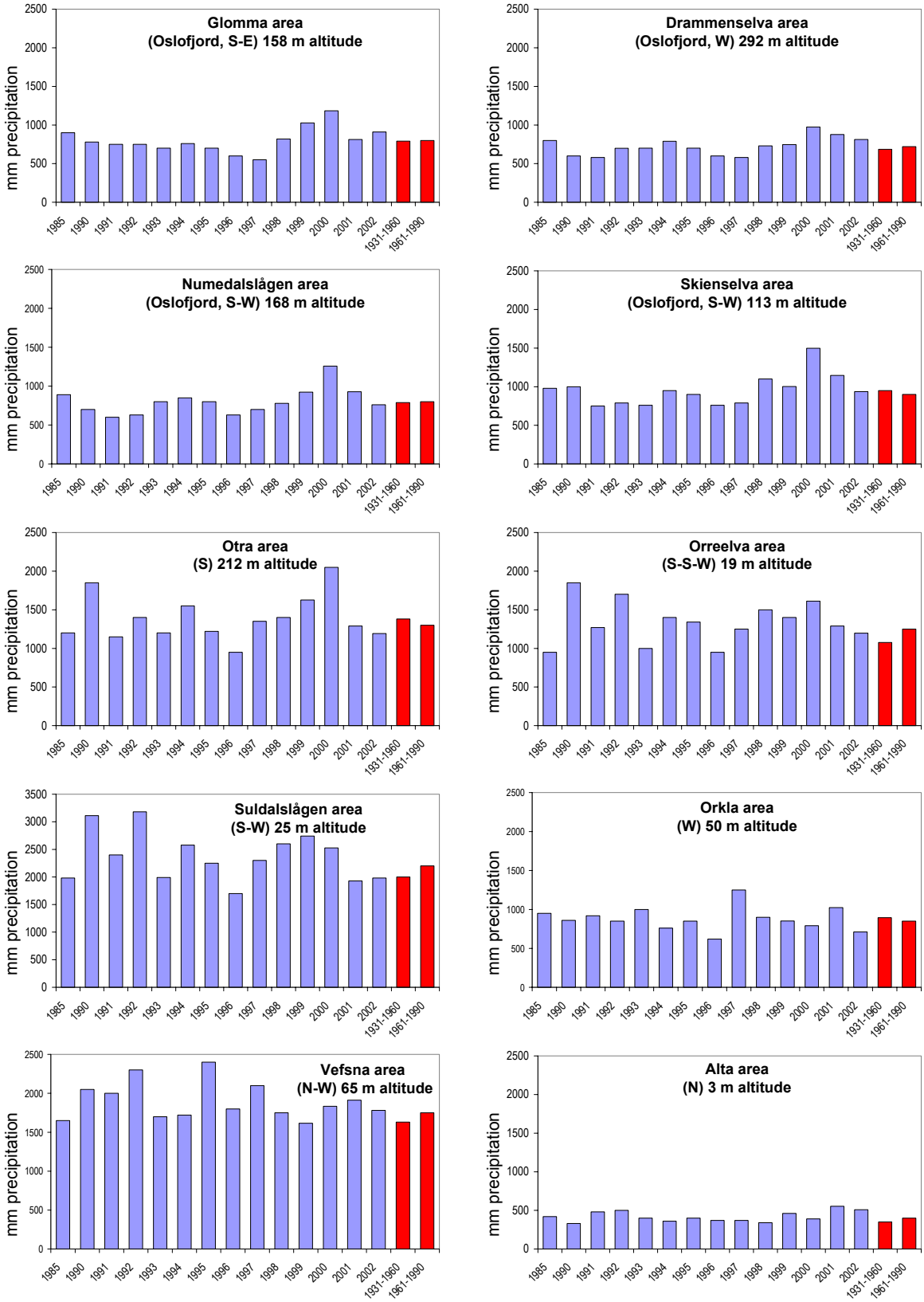


Figure 3. Main Rivers. Mean Annual Precipitation (1931-60 and 1961-90) at Stations near Outlet and Annual Precipitation in the Years 1985, 1990-2002 (mm/year). Source: The Norwegian Meteorological Institute. (S = South, E = East, W = West, N = North)

Table 5. Mean annual run-off (1931-60) from the subregions to the main surrounding seas.

Subregions	**Main Seas**	**Drainage area (km^2)**	**Run-off (mill. m^3)**
The Swedish border - Lindesnes	Skagerrak	98 699	57 934.47
Lindesnes – Stad	North Sea	138 902	164 875.88
Stad - the border of Finnmark	Norwegian Sea	94 704	231 928.67
Finnmark - the border of Russia	Barents Sea	73 141	41 462.90
Total		**405 446**	**496 201.92**

The same water flow stations as in 2001 were used. The water flow measurements at Klosterfoss station in Skienselva had been stopped in 2001. An upstream water flow station, Skotfoss was in 2002, as in 2001, used for Skienselva. Figure 4 shows measured water flow at the new station. In Figure 2, the total annual water flow shown for Klosterfoss in 2002 is estimated from the measured water flow at Skotfoss.

At a given location the water flow will change from one year to another and throughout the year. In natural river basins the seasonal variations will depend mostly on the distance from the coast, the altitude and the latitude, and on variations in precipitation. The mean input is determined both by the precipitation and the catchment area. Along the coast of Southern and Western Norway the summer low flows are usually dominant together with high run-off in autumn and winter. Thus although Western Norway has much more precipitation than Eastern Norway, its smaller catchment areas lead to much less absolute inputs to the sea from the western rivers. In the central part of Southern Norway and in the northern part of the country low water flows are typical both in summer and winter, whereas periods of higher run-off will appear during the snow-melting period (spring and early summer). In late summer and in autumn the flow depends on the precipitation and may therefore vary considerably.

In all main rivers continuous observations of the rate of flow are collected. For most rivers these stations are located upstream the sampling stations (NVE, 2003). The additional water supplied is estimated using measured rainfall data from the local catchment areas (DNMI, 2003a).

For all main rivers, seasonal changes in water flow in 2002 are shown in Figure 4.

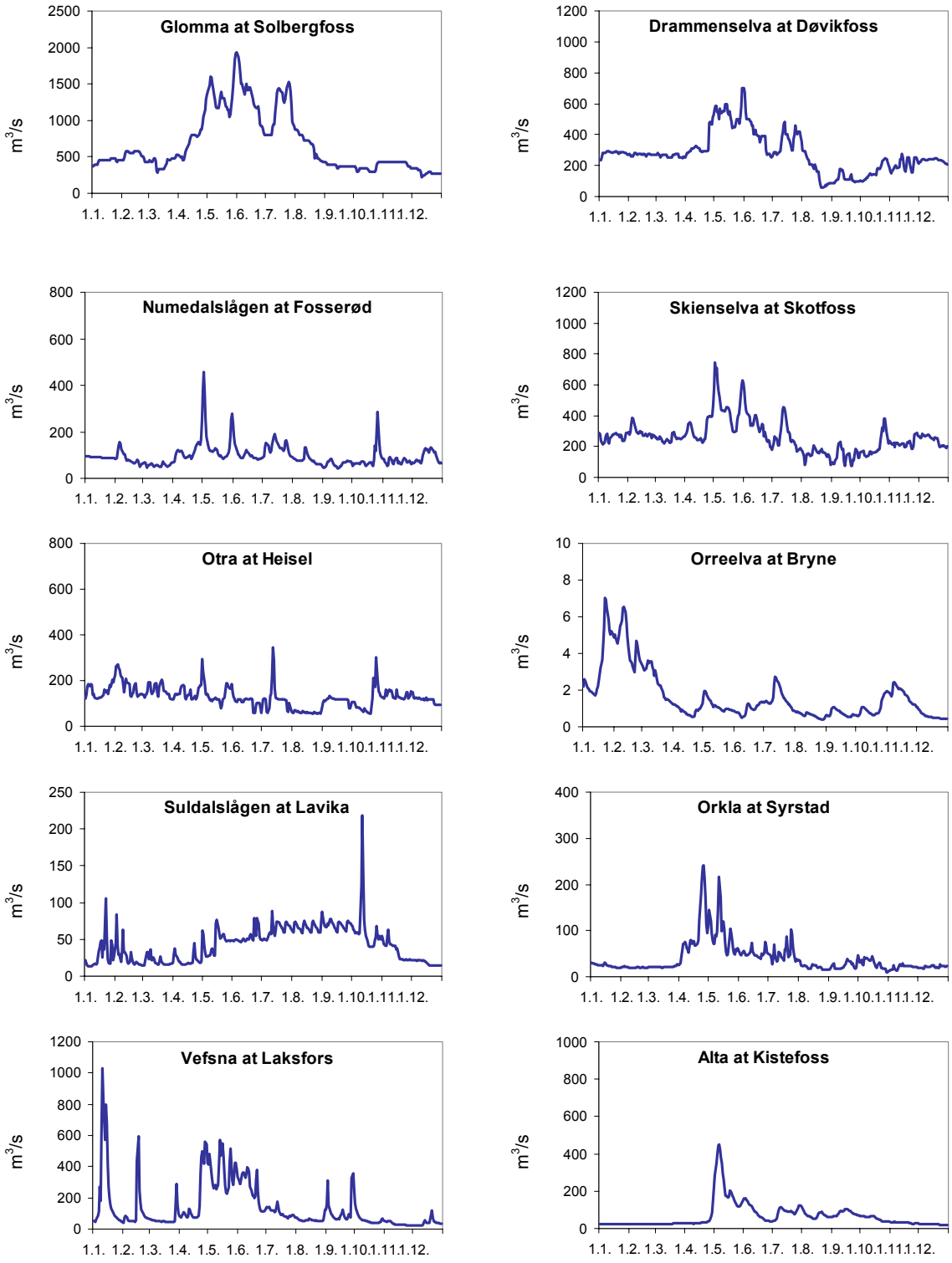


Figure 4. Main Rivers. Seasonal Changes in Daily Water Flow (m^3/s). Source: Norwegian Water Resources and Energy Administration.

For the tributary rivers the mean water flow data (1931-60) and measured precipitation (2002) are used for flow estimates.

3.2.3. Calculation of annual load

Paris Commission calculation methods were used for calculating loads for all main rivers. For the main rivers with 12 or less measurements the following formula has been used:

$$Load = Q_r \frac{\sum_{i=1}^{n}(C_i \bullet Q_i)}{\sum_{i=1}^{n} Q_i}$$

C_i = measured concentration in sample *i*
Q_i = corresponding flow for sample *i*
Q_r = mean flow rate for each sampling period
n = number of samples taken in the sampling period

This equation is a formula suited for estimating annual load when sampling dates are evenly spaced in time. Essentially it expresses the annual load (L) as the product of a flow-weighted estimate of annual mean concentration and annual flow (Qa). Then the annual load estimate can be strongly biased if the sampling frequency increases during periods of high flow. Incidents with high flow will have a great influence on the estimate, and high concentrations during such periods will eventually lead to an overestimated annual load. For the main rivers with more than 12 measurements (weekly measurements), the load for each month with more than one measurement were therefore calculated and summarised:

$$Load_{month} = Q_{month} \frac{\sum_{i=1}^{n}(C_i \bullet Q_i)}{\sum_{i=1}^{n} Q_i}$$

Q_{month} = total monthly flow

For the other rivers (tributaries), which have been monitored only once (or a few times per year), the best available estimates of flow (catchment area multiplied by specific run-off adjusted for deviations from normal precipitation) and flow-weighted concentrations have been used to estimate contaminant loads.

The following procedure was used for estimation of flow in 2002:

- Precipitation data for 2002 and normal precipitation 1931 – 1960 were collected.
- Mean precipitation for the catchment area in percent of the normal precipitation was calculated and multiplied with normal water flow.

Drainage basins to the different areas and regions (km² and %) are shown in Table 6.

Table 6. Drainage areas of monitored main and tributary rivers and down stream areas (km^2 and % monitored/estimated in each subarea and subregion). (Figure 1, Figures I.I-I.V, Report B).

Sub-regions	**Subareas**	**Drainage area of monitored rivers (km^2)**		**Down stream areas (km^2)**	**Total (km^2)**	**Monitored (%)**
		Main	**Tributary**			
Skagerak	No 1: Glomma	41 218	2 389	2 416	46 023	94.8
	No 1: Inner Oslofjord		959	342	1 301	73.7
	No 2: Drammenselva	17 028	226	320	17 574	98.0
	No 3: Numedalslågen	5 513	1 043	631	7 187	91.2
	No 4: Skienselva	10 348	1 200	1 283	12 831	90.0
	No 5: Otra	3 730	9 109	904	13 743	93.4
Subtotal		**77 837**	**14 926**	**5 896**	**98 659**	**94.0**
The remaining North Sea	No 6: Orreelva	105	7 233	2 513	9 851	74.5
	No 7: Suldalslågen	1 466	16 205	12 681	30 352	58.2
Subtotal		**1 571**	**23 438**	**15 194**	**40 203**	**62.2**
The Norwegian Sea	No 8: Orkla	2 680	28 118	17 036	47 834	64.4
	No 9: Vefsna	4 113	23 907	18 850	46 870	59.8
Subtotal		**6 793**	**52 025**	**35 886**	**94 704**	**62.1**
The Barents Sea	No 10: Alta	7 367	0 [1)] (45 155)[2)]	65744 [1)] (20 619)[2)]	73 141	10 [1)] (71.8)[2)]
Total		**93 568**	**90389 [1)] (135 544)[2)]**	**122 750 [1)] (77 595)[2)]**	**306 707**	**60 [1)] (74.7)[2)]**

1) The 19 tributary rivers left out from the sampling programme in 2002
2) Full programme (145 tributary rivers)

3.3. Methodology for assessment of direct discharges to marine waters

The computer model TEOTIL (Tjomsland and Ibrekk, 1992) for estimation of the nutrient loadings to Norwegian coastal waters was used for assessment of direct discharges. The model includes anthropogenic and natural sources. The model uses statistical data from censuses of Agriculture and Forestry, Population and Housing from the Statistics Norway (SSB). The census data are available on small geographic units. As a whole, Norway is divided into more than 1500 geographical units. Each census unit is further assigned to drainage basins (NVE, 1990). By combining census data and drainage basins a comprehensive database was developed. The database includes the following data: number of people, houses, farms, agricultural land, aquaculture, forest land, wetland, upland areas and so forth. Nutrient discharges from each sewage treatment plant and from industry are also included.

The metal loads from wastewater treatment plant effluents were estimated based on measured data from 2002 (SSB, 2003), supplementary information from Aquateam and measured or calculated flows. The effluent metal concentrations used after different forms of treatment,

based on Aquateam's investigation of metals in discharges from Norwegian municipal wastewater treatment plants in 1999 (Nedland, 2000) were used when analytical data were unavailable. The metal loads from industrial effluents were calculated based on data from SFT's database INKOSYS (SFT, 2003).

3.3.1. Wastewater treatment plant effluents

Statistics Norway (SSB) is responsible for the annual registration of data from all wastewater treatment plants in the country. SFT's computer programme SESAM was used until 2000. From 2001, the Internet based reporting system KOSTRA is used. Discharge figures from KOSTRA are used in the model "TEOTIL" to calculate the total discharges of total phosphorus ammonia, nitrates, orthophosphates and total nitrogen to Norwegian coastal waters. NIVA has performed this modelling (Borgvang and Tjomsland, 2003). The figures take into account retention in water courses.

In 2002, 2495 wastewater treatment plants with a hydraulic capacity of at least 50 p.e. were registered in Norway (SSB, 2003). In 2002, it was registered 144 fewer wastewater treatment plants than in 2001, due to fusion of treatment plants to larger units. There were registered 561 sewerage systems (serving more than 50 p.e.) with direct discharges of untreated wastewater (SSB, 2003). The major part (53%) of the wastewater treatment plants have only primary treatment, 12% chemical treatment, 6% biological treatment, 14 % chemical and biological treatment and 15% unconventional, unknown or other treatment. The major part of treatment plants with only primary treatment are serving smaller settlements, while the majority of advanced treatment plants (plants with chemical and/or biological treatment) are found near the larger cities, and therefore treat the main part of the produced wastewater. Of the total hydraulic capacity of 5.74 million p.e., advanced treatment account for 66% (chemical 37 %, chemical/biological 27%, biological 2%), primary treatment for 24%, direct discharges for 8%, and others for 2%. In the North Sea area of Norway, most of the wastewater are treated in chemical or combined biological-chemical treatment plants, whereas the most common treatment methods along the coast from Hordaland county and northwards are primary treatment or no treatment.

Preferably, the annual loads from municipal wastewater effluents have been estimated as the product of annual flow and flow-weighted effluent concentrations. For the municipal wastewater treatment plants with insufficient data, the loads were estimated by multiplying the number of people with Norwegian per capita loads. Standard removal efficiencies were used.

For raw (untreated) wastewater discharges, the document "Principles of the Comprehensive Study of Riverine Inputs and Direct Discharges" (Paris Commission, 1988), recommends the derived per capita loads listed in Table 7 to be used. The per capita loads for organic matter have been changed according to the EU Directive 91/271/EU, and Norwegian wastewater regulations (SFT, 2003).

The Norwegian per capita loads are based on studies of Norwegian sewerage districts (SFT, 1995). These data are also used to calculate pollution loads from the different treatment plants, reduced by the removal efficiency of the treatment plants. Municipal wastewater also includes a portion of industrial effluents. The fraction of the total person equivalents (p.e.) is proportioned between sewage and industrial wastewater according to the number of persons and the size of industrial effluents connected to each treatment plant.

Table 7. Per capita loads used for estimation of untreated sewage discharges.

Parameter	Parcom	Norway
BOD_5 (kg O/person/day)	0.063	0.060 [1)]
COD (kg O/person/day)		0.120
S.P.M. (kg S.P.M./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

1) Average value of max. 5 days

For metals in municipal wastewater discharges, calculated loads were based on measured concentrations in effluents from 14 treatment plants in Norway in 2002 (SSB, 2003) and measured or calculated flows from the wastewater effluents in 2002. For effluents without any measured flow, the 2002-flow was calculated to 600 litres per resident per day, (average for effluents with measured flows (Nedland, 2000)). The effluent metal concentrations used after different forms of treatment are given in Table 8.

Table 8. Concentrations of metals in discharges from Norwegian municipal wastewater treatment plants in 1999 (Nedland, 2000).

Metal	Direct discharges	Wastewater Treatment			
		Primary + Unconventional (except infiltration) Other, Unknown		Chemical, Biological, Biological/chemical Infiltration	
	µg/L	µg/L	% reduction	µg/L	% reduction
Cadmium (Cd)	0.25	0.20	20	0.15	40
Mercury (Hg)	0.10	0.08	20	0.05	50
Lead (Pb)	4	2.7	33	1.4	65
Nickel (Ni)	7	6.0	14	5.0	29
Chromium (Cr)	7	5.0	29	3.0	57
Zinc (Zn)	90	63	30	36	60
Copper (Cu)	60	38	37	15	75

3.3.2. Industrial effluents

Sampling frequency for industrial wastewater varies from weekly composite samples to random grab samples. Sampling is performed at least twice a year. Measured and estimated loads from industrial activities in the different areas are shown in Appendix III, Report B. NIVA has performed the TEOTIL modelling for total nitrogen and total phosphorus (Borgvang og Tjomsland, 2003). The calculations of the other discharges were performed by Aquateam. The metal data were collected from SFT's data base INKOSYS (SFT, 2003).

3.3.3. Fish farming effluents

Nutrient loading (Tot-N, NH_4, Tot-P and PO_4) from fish farming effluents in 2002 has been estimated by use of the computer model TEOTIL (Borgvang and Tjomsland, 2003). Equations and factors described in OSPAR's HARP Guidelines (Harmonised Quantifications and Reporting Procedures for Nutrients) (SFT, 2000b) are used. The results are presented in Table XII (Appendix XII, Report B).

From 2000 on, the loading from fish farming has been included in the grand total values. These loads have not been included in the previous input calculations from 1990-1999.

3.3.4. Other inputs (nutrients in run-off from "down stream areas" of main and tributary rivers and rivers not monitored)

The pollution load model calculates the load from each pollution source by using specific load coefficients (Holtan and Åstebøl, 1990) multiplied by areas (in square kilometres) of different categories and activity numbers, eg. population. The coefficients used are prepared according to precipitation, climate, vegetation and soil in the different areas. New coefficients have recently been calculated, giving higher differences between districts and higher background values (Ber, 2001).

Total direct nutrient discharges (Down stream areas) are shown in Table I (Appendix I, Report B), in the different subareas (1-10) in Appendix VI, Report B. Direct discharge areas (km^2) are shown in Table 6.

4. Results and Discussion

4.1. Measured concentrations and calculated loads

In this investigation riverine and direct inputs of nutrients (P- and N-compounds, silicate), suspended particulate matter (S.P.M.), total organic carbon (TOC), metals and lindane are measured or estimated.

The Norwegian Pollution Control Authority has prioritised elimination of the discharges of a number of organic pollutants and trace metals, presently in use in Norway (Miljøverndepartementet, 2001). Only a few of these substances are, however, included in the Norwegian part of the RID programme. PCB should be tried eliminated within 2005. The discharges of the following substances included in the RID programme should be considerably reduced within 2010:

- Lead
- Cadmium
- Copper
- Mercury
- Chromium

Most of this pollution is caused by industrial effluents, but other sources are municipal wastewater and landfill leachate.

Local pollution by heavy metals and arsenic is caused by discharges from industry, discharges from existing and abandoned mines, leaching from landfills or atmospheric precipitation. The municipal wastewater is, however, another source of pollution by several heavy metals. Long range transboundary air pollution is another source of pollution both with respect to heavy metals and persistent organic pollutants (e.g. the pesticide lindane). Metals naturally associated with suspended particulate material will also influence on the analytical results. A systematic investigation of particle bound metals and phosphorus, including analysis of several parallel samples from two rivers (Glomma and Drammenselva) with variable content of particulates, has been carried out in May – June 2003. The results from this investigation are summarised in Appendix XIV, Report B.

Municipal wastewater and run-off from agricultural areas comprise the major sources of phosphorus and nitrogen pollution. In addition to these nutrients the water is polluted by dissolved organic matter, especially from fish farming, from the pulp and paper industry and from municipal wastewater. These sources have been taken into account in this investigation.

The results given for riverine inputs (main rivers and tributaries) and discharges entering directly into marine recipients are mainly based on direct measurements. Measured concentrations of the chemical parameters of the ten main rivers (2002), mean values, standard deviation and range are listed in Appendix VII, Report B. Total annual loads of the main rivers in 2001 are shown in Appendix IV, Report B. Total annual loads of the tributaries are shown in Appendix V, Report B. For the whole country, total annual loads (Direct discharges and Riverine inputs) are shown in Table I (Appendix I, Report B). Some results are also presented graphically in Figures 5-9.

For some of the rivers, the measured concentrations of metals and lindane were lower than the detection limit given in the OSPAR Guidelines. In these cases a high and low discharge quantity has been estimated: the low assuming that the true concentration is zero and the high assuming that the true concentration is the limit of detection. This provides maximum and minimum concentrations between which the true estimate lies. When evaluating inputs these data provide a basis for upper and lower estimates.

To adjust the 2002 transport values to a "normal year", approximations have been made by multiplying weighted mean concentrations by mean water flow (LTA, 1961-90). "Mean-values" (normals) for the ten main rivers and tributaries are given in Appendix X, Report B, where also total discharges to the sub regions are shown. In Figure 5 the "normalised" nutrient transport values are compared with 2002-values.

Greatest emphasis with regard to accuracy has been given to the input estimate to the Skagerrak region, as this is considered the most sensitive part of the North Sea. The Skagerrak region received in 2002 approximately 17 % of the phosphorus and 30 % of the nitrogen discharges to the Norwegian coastline. In the Skagerrak region 94 % of the area is river-monitored, and about 85 % of the P- and about 77 % of the N-loads, are included in the riverine inputs.

4.2. Water flow

The monitored precipitations in 2002 varied less than 25 % from normal precipitation in most of the country. The rivers in the Skagerrak region (Glomma, Drammenselva, Numedalslågen, Skienselva and Otra) showed extremely high flow in the autumn 2000 (Weideborg et al. 2001b). No such flood episodes were observed in 2001 or 2002 and the yearly water flow was almost back to a normal (Figures 2 and 3). The water flow in this area decreased approximately 16 % from 2001 to 2002. The high water flow gave in 2000 higher load for most pollutants to the Skagerrak region. Table 9 shows the changes in water flow from 1999 to 2002.

Table 9. Changes in water flow from 1999 to 2002 for the Skagerrak area.

Rivers	**Flow 2002 (m^3/d)**	**Change in water flow**		
		From 1999 to 2000	**From 2000 to 2001**	**From 2001 to 2002**
River Glomma	59 467 486	+29 %	-22 %	-11%
River Drammenselva	25 530 520	+30%	-13 %	-22%
River Numedalslågen	8 748 509	+38 %	-15 %	-29%
River Skienselva	23 545 303	+37 %	-19 %	-16%
River Otra	11 280 596	+31 %	-28 %	-16%

4.3. Nutrients, particulate matter and total organic carbon

Annual loads of nutrients (nitrogen and phosphorus compounds), suspended particulate matter (S.P.M.) and total organic carbon (TOC) in the main rivers are presented in Figure 5. The normalised load is compared with the 2002 values.

Total annual load of (year 2002) for the four subregions are shown in Tables 1.1-1.4 (Appendix I, Report B) and in Figure 6. The results of the 2002 investigation show that total annual nutrient loads to coastal waters from land-based sources in Norway include approximately 10600 tonnes of phosphorus and 116 100 tonnes of nitrogen. The phosphorus load is higher and the nitrogen load is slightly lower than in 2001. About 34 and 42 % of the grand total inputs of phosphorus and nitrogen are monitored in the main and tributary rivers. The environmental loading from fish farming contributes to approximately 48 % of the total phosphorus loading and 21 % of the total nitrogen loading.

Figure 6A shows the contribution from the 5 main sources of input: main rivers, tributary rivers, direct discharges, fish farming and area run-off. Figure 6B shows the contribution from the 5 main sources of input to the total load of TOC, S.P.M., orthophosphates, ammonia and nitrates. Since these parameters have not been reported in the same way for all sources, no conclusion should be made on the basis of this figure.

It was found a decrease in the loading of 1.4 % for nitrogen and an increase of 14 % for phosphorus in 2002, compared with the 2001 loads. A decrease was expected due to the reductions in water flow of all rivers in the Skagerrak area in 2002 (16% decrease, see Table 9). For the main rivers in the Skagerrak region, the calculated loads in 2002 decreased by 12 % for total nitrogen and by 22 % for total phosphorus. The decrease in water flow for the rivers discharging to this region was 16 %.

The relatively large increase in the total phosphorus loading from 2001 to 2002 was mainly due to increase in loading from fish farming, probably due to a new reporting system for fish farming. The phosphorus loading from tributary rivers in the Norwegian Sea subarea was also higher in 2002 than in 2001. The concentration of suspended matter in these tributary rivers had increased, indicating that a large part of the phosphorus was particle bound and not bioavailable.

A correlation analysis between nutrients and water flow and suspended particulate matter was performed by Vik et al. (2002), and it was concluded that the nutrient loading in some of the rivers may probably depend on run-off and erosion. The preliminary systematic short-time investigation of particle bound phosphorus in Glomma and Drammenselva in 2002 (Appendix XIV, Report B) also confirms that a large part of the phosphorus is particle-bound.

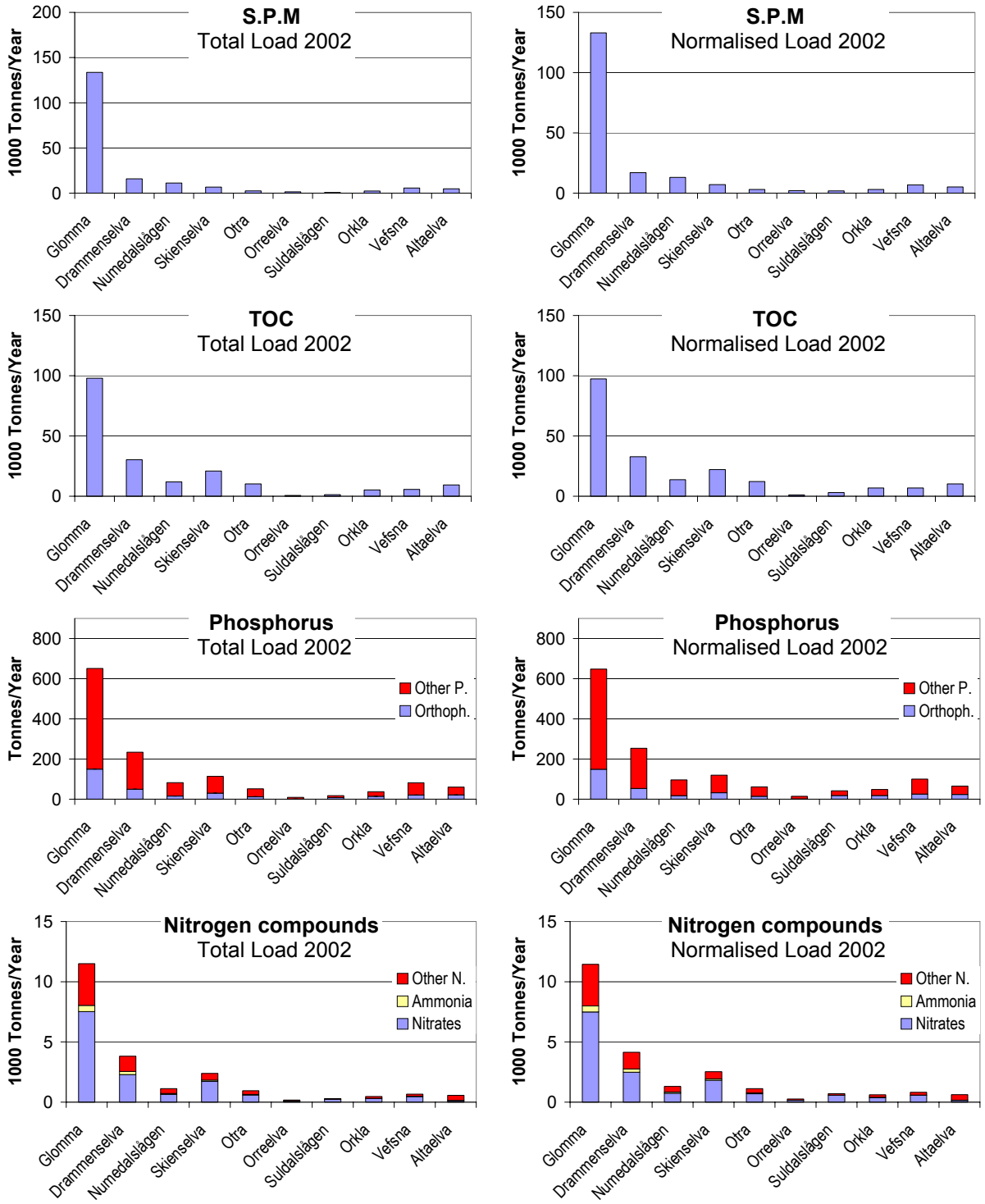
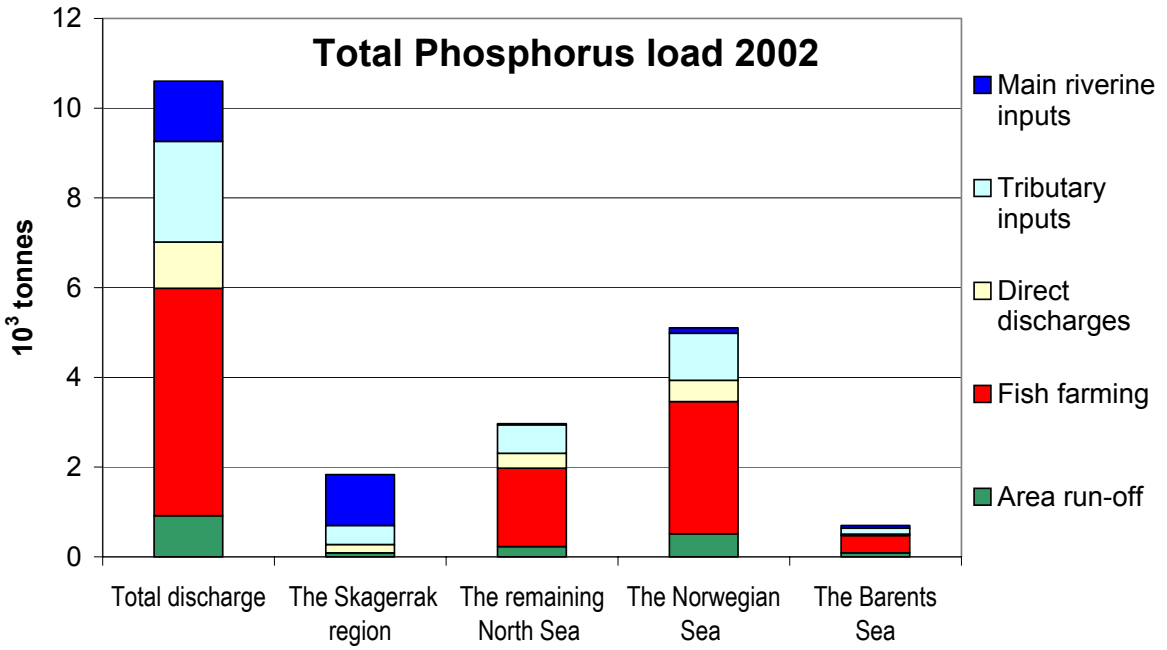


Figure 5. Main rivers. Suspended particulate matter (S.P.M.), total organic carbon (TOC) and nutrients (Tot-P, orthophosphate, Tot-N, nitrate, ammonia). Total loads 2002 and total normalised loads.



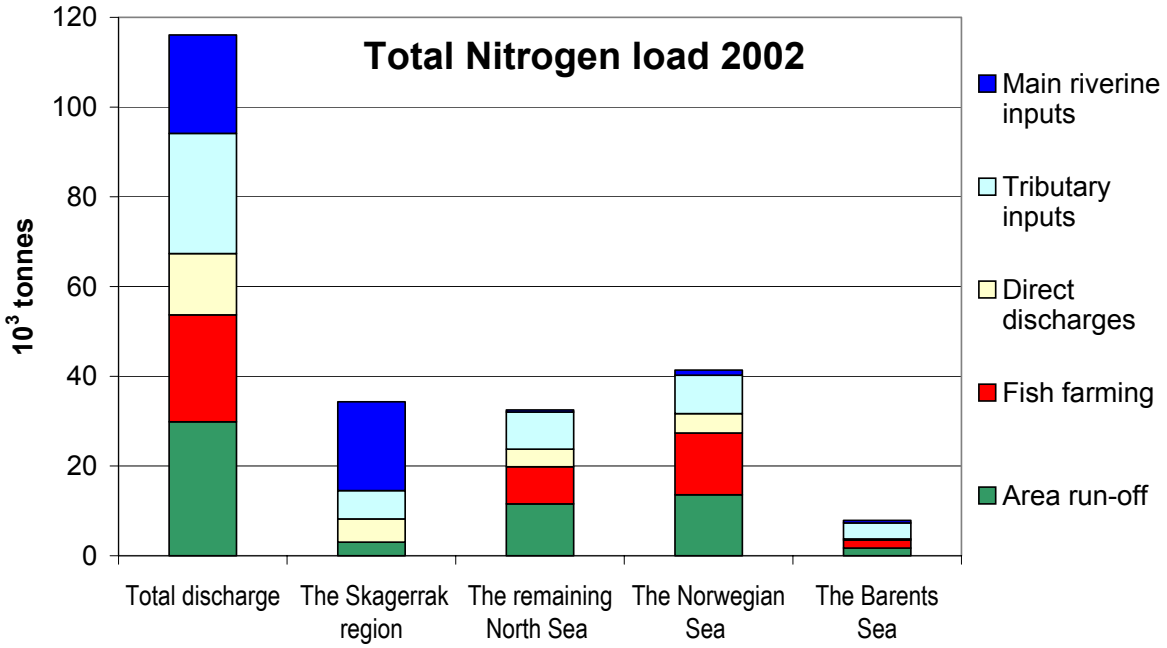


Figure 6A. Nutrients (Tot-P and Tot-N), total discharges in 2002 from mainland Norway to convention waters and the four subregions. Contribution from the 4 main sources and area run-off.

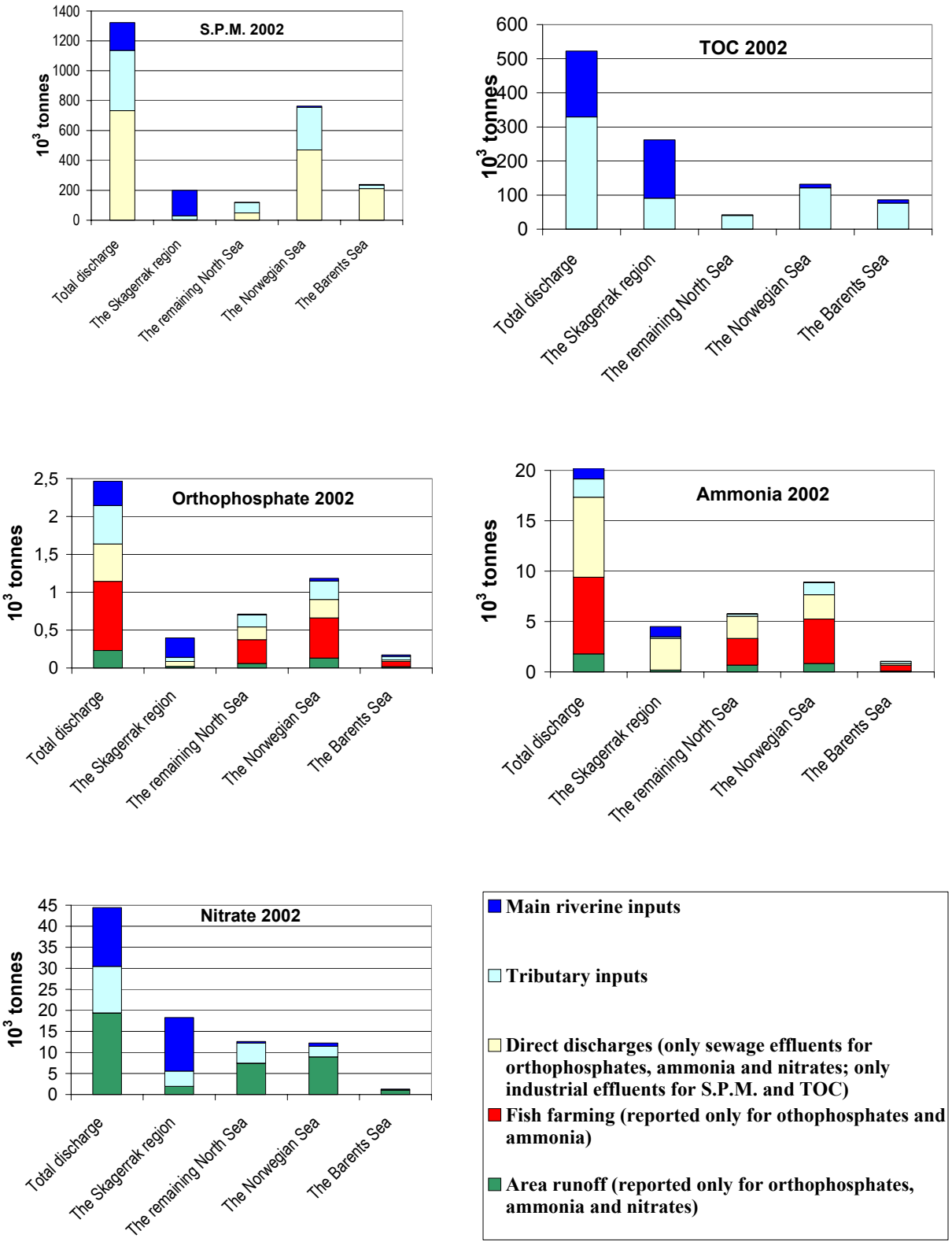


Figure 6B. S.P.M., TOC and nutrients (orthophosphate, ammonia and nitrate), total discharges in 2002 from mainland Norway to convention waters and the four subregions. Contribution from the 5 main sources.

4.4. Metals

Total inputs of metals in 2002 have been estimated to:

- Cadmium: 2.3-3.1 tonnes
- Lead: 44 tonnes
- Mercury: 1.6 – 1.7 tonnes
- Arsenic: 22-24 tonnes
- Chromium: 35-38 tonnes
- Nickel: 134-143 tonnes
- Copper: 179-180 tonnes
- Zinc: 520-537 tonnes

In Figure 7 the lower and upper loads of Cd, Pb, Hg, As and Cr from the ten main rivers are presented. The high uncertainty reported for cadmium inputs is due to the high number of samples measuring concentrations below the detection limit. Approximately 40% of the Cd measurements were below the detection limit.

Copper and zinc comprised the largest inputs of trace metals to the coastal waters, of which 85 and 89 % respectively, were river monitored. Figure 8 shows distribution of the contribution from the main rivers, tributary rivers and direct discharges of the metals to the four subregions (I: Skagerrak, II: The remaining North Sea, III: The Norwegian Sea, IV: The Barents Sea).

The reported concentrations of mercury were approximately in the same range as in 1999-2001. This was higher than the reported concentrations for the years 1990-1997 (Figure XVII, Appendix XIII, report B). This difference was most likely influenced by different analytical methods being used.

For all the metals, except lead, the 2002 reported total loads to the Norwegian coastal waters were lower than in 2001. Total inputs of the different metals decreased from 2001 to 2002 as follows:

- Mercury: 19%
- Cadmium: 14%
- Zinc: 14%
- Arsenic: 17%
- Copper: 8%
- Chromium: 34% (high uncertainty due to high detection limit in 2001)
- Nickel: 5%

The total lead loading has increased with 33% from 2001 to 2002 due to an increase in lead loading from tributary rivers especially in the Norwegian Sea subregions. In these areas the loading of particulate matter had increased with approximately 80 % from 2001 to 2002. (The uncertainty in the stipulated total loads from the tributaries is, however, high). The short-time investigation of particle bound metals indicated that most of the lead content in rivers was particle-bound (Appendix XIV, Report B). It is therefore suggested that the high loading of lead reported in 2002 was mostly particle-bound and not bioavailable.

In the Skagerrak area the decrease in the loads in 2002 were slightly lower than the decrease in total loads to the Norwegian coastal waters for most of the metals. The total inputs of the different metals decreased from 2001 to 2002 as follows:

- Cadmium: 13%
- Zinc: 4%
- Arsenic: 14%
- Copper: 2%
- Chromium: 33%

The metal inputs from Glomma have slightly increased from 2001 to 2002, probably due to increase in water flow.

In the Skagerrak area the decrease in the mercury loads in 2002 was higher than the decrease in total loads to the Norwegian coastal waters. Mercury inputs from this area decreased with 30% from 2001 to 2002. Lead has increased with 18 %. Nickel has increased with 17 % due to general increase in river loads and direct discharges.

A major reason for this significant decrease in metal loading was the decrease in water flow from all rivers in the Skagerrak area which also took place in 2002. The water flow in the Skagerrak area decreased approximately 11-29 % from 2001 to 2002. High run-off with flooding periods can give higher loads of metals, due to increased water flow, increased leaching from the ground and increased particle loss from erosion. The load of suspended particulate matter from the main rivers decreased with 37 % from 2001 to 2002. A similar decrease in lead loading should be expected, not an increase. The reason for the 18% increase in lead loading is not known, but there are obviously other sources to increased riverine inputs of lead than natural geology (particulates).

A correlation analysis between metals and water flow and suspended particulate matter performed by Vik et al. (2002) concluded that several of the metals are mainly particulate bound. The preliminary systematic investigation of particle bound metals in Glomma and Drammenselva carried out in May – June 2003 (Appendix XIV, Report B), also confirms that a considerable part of the metals is particle-bound.

Also the loading of cadmium from direct discharge decreased from 2001 to 2002, due to decreased discharges of Cd from industrial and sewage effluents.

Figures 13 – 16 show the annual load of the metals in 1990-2002.

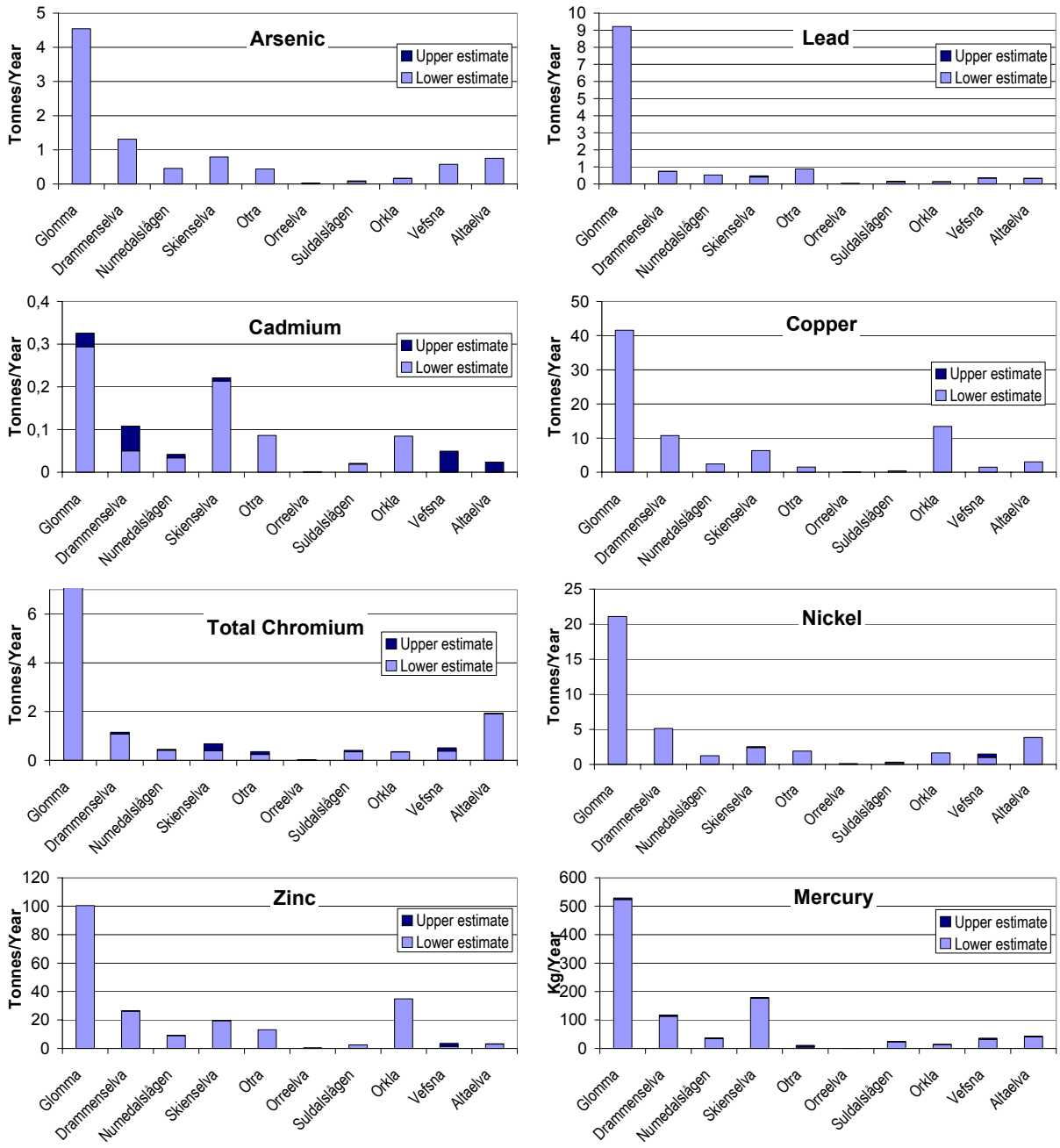


Figure 7. Main rivers. Metals (As, Pb, Cd, Cu, Total Cr, Ni, Zn and Hg). Total loads of the main rivers in 2002. Upper limit: limit= detection limit. Lower limit: limit=0.

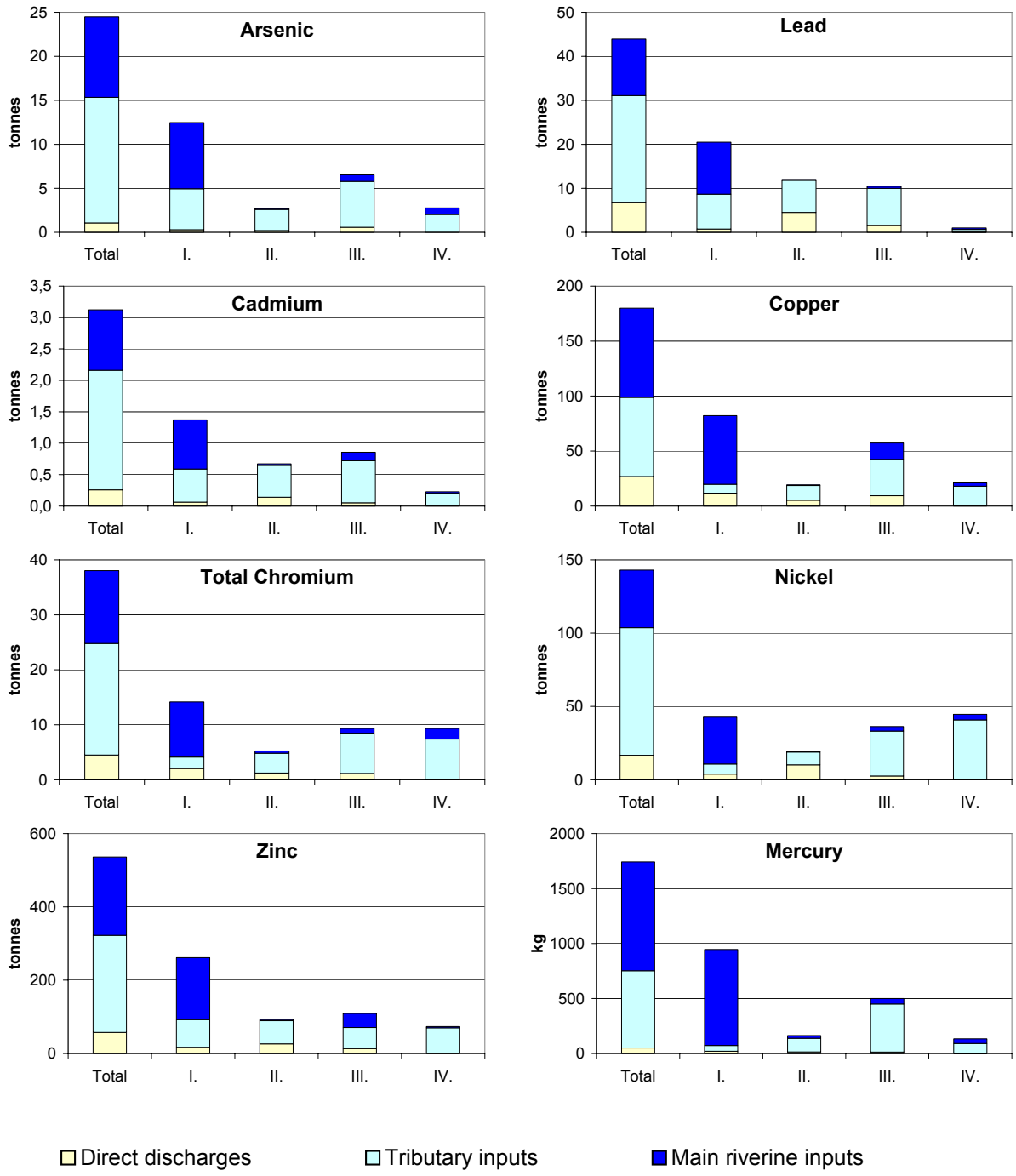


Figure 8. Metals, total discharges in 2002 from mainland Norway to convention waters and the four subregions (upper estimates). I: Skagerrak, II: The remaining North Sea, III: The Norwegian Sea, IV: The Barents Sea Contribution from the main rivers, tributary rivers and direct discharges.

4.5. Other parameters

Total annual load of silicate (SiO_2) is estimated to 360 000 – 361 000 tonnes (54 % from tributary rivers and 46 % from main rivers). This is a 15 % decrease from 2001.

The pesticide lindane was found in most samples, but in very low concentrations. Lindane has often been found in run-off water from areas where the compound has never been used. The substance has been banned in Norway, and should not have been used for the last 10 years. The findings of this substance in Norwegian rivers are therefore most likely due to long-range transported air pollutants. Total load of main rivers was estimated to 27 kg. Load of tributary rivers has been stipulated to approximately 20 kg. The total loads were stipulated to 47 kg (Figure 9). This is only 2% decrease from 2001 to 2002. Since lindane has not been analysed in the tributary rivers during the last years, the uncertainty of the stipulated total load is, however, high.

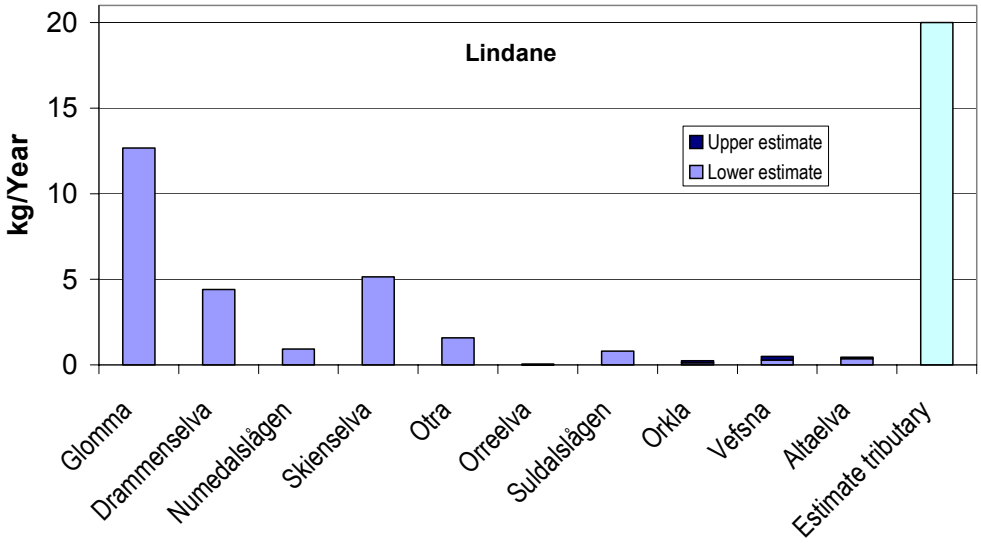


Figure 9. Lindane. Total loads of the main rivers in 2002 (lower and upper estimates) and estimate for the tributary rivers.

4.6. Trend analysis

The yearly inputs from the different rivers are highly dependent on the water flow. It is therefore difficult to conclude regarding altered pollution levels in the different rivers, even if there may be indications of an improved situation for most rivers and most parameters. Carrying out trend analyses, especially for the rivers with long time series, is an important tool. The period from 1990 to 2002 is too short to identify a real trend but it can give indications, which can lead to a closer study of the information.

On annual basis, statistical trend analysis (by the recommended tool "Trend-y-Tector" (ICES, 1999) for total P, total N, the metals, and lindane have been carried out for all rivers. The statistical method Mann-Kendall with significance level 5% was used. The measurement data (yearly loading), a smoother curve based on running averages (7 point Lowess smoother) and the trend curve are presented for all the rivers where "Trend-Y-Tector" found any trends.

Following rivers have the longest time series of continuous data:

- River Glomma (1978-2002): Tot-P and Tot-N
- River Otra (1980-2002): Tot-P and Tot-N

- River Orkla (1974-2002): Cu and Zn

For the other parameters the 1990-2002 series have been used, with exception of lindane where the lindane data for 1990 were ignored because of high analytical detection limit in 1990 (see Figure 24 for Drammenselva).

4.6.1. Nutrient trends

Phosphorus and nitrogen annual load for main rivers (1990-2002) are shown in Figure 10 and Appendix XIII, Report B.

No trends for phosphorus and nitrogen were detected in Glomma with use of the Trend-Y-Tector, even when long time series (1978-2001) were used. It seems, however, that the total phosphorus load for Glomma has decreased during the last three years after the large increase in 2000, caused by the increased water flow (Figure 10).

Trend analyses for phosphorus annual loads are shown in Figure 11 and for nitrogen in Figure 12 for all rivers where Trend-Y-Tector found any trends.

In Numedalslågen and Skienselva an upward trend for phosphorus and for Numedalslågen an upward trend for nitrogen was also found for the period 1990-2002. A similar upward trend for Drammenselva was observed for nitrogen. The reasons for these increases are not found. The total phosphorus load for these rivers has, however, decreased during the last three years after the large increase in 2000.

For Otra, the downward trend seen for phosphorus for the period 1980-1998 (74%) stopped from 1999 (see Figure 11). No trend was seen for Otra when data for the whole period 1980-2002 was analysed. However, a downward trend (34 %) was found for nitrogen for the same period (Figure 11).

For Suldalslågen a downward trend is seen for nitrogen for the period 1990-2002.

In Vefsna an upward trend was seen for phosphorus for the period 1990-2002. In Vefsna a high increase of the yearly nitrogen input (171 %) was found for the period 1990-1998. However, in 1999-2002 the load decreased to the same level as in 1990-1992, and no trend was seen for 1990-2002 or 1985-2002. Longer time series are needed to make conclusions about these variations (Figure 12).

A reduced phosphorus load was, however, noticed from 2001 to 2002 for all main rivers except Drammenselva, Orreelva, Vefsna and Alta (Figure XIX, Appendix XIX).

Significant trends for phosphorus and nitrogen were neither found for Orreelva nor Altaelva.

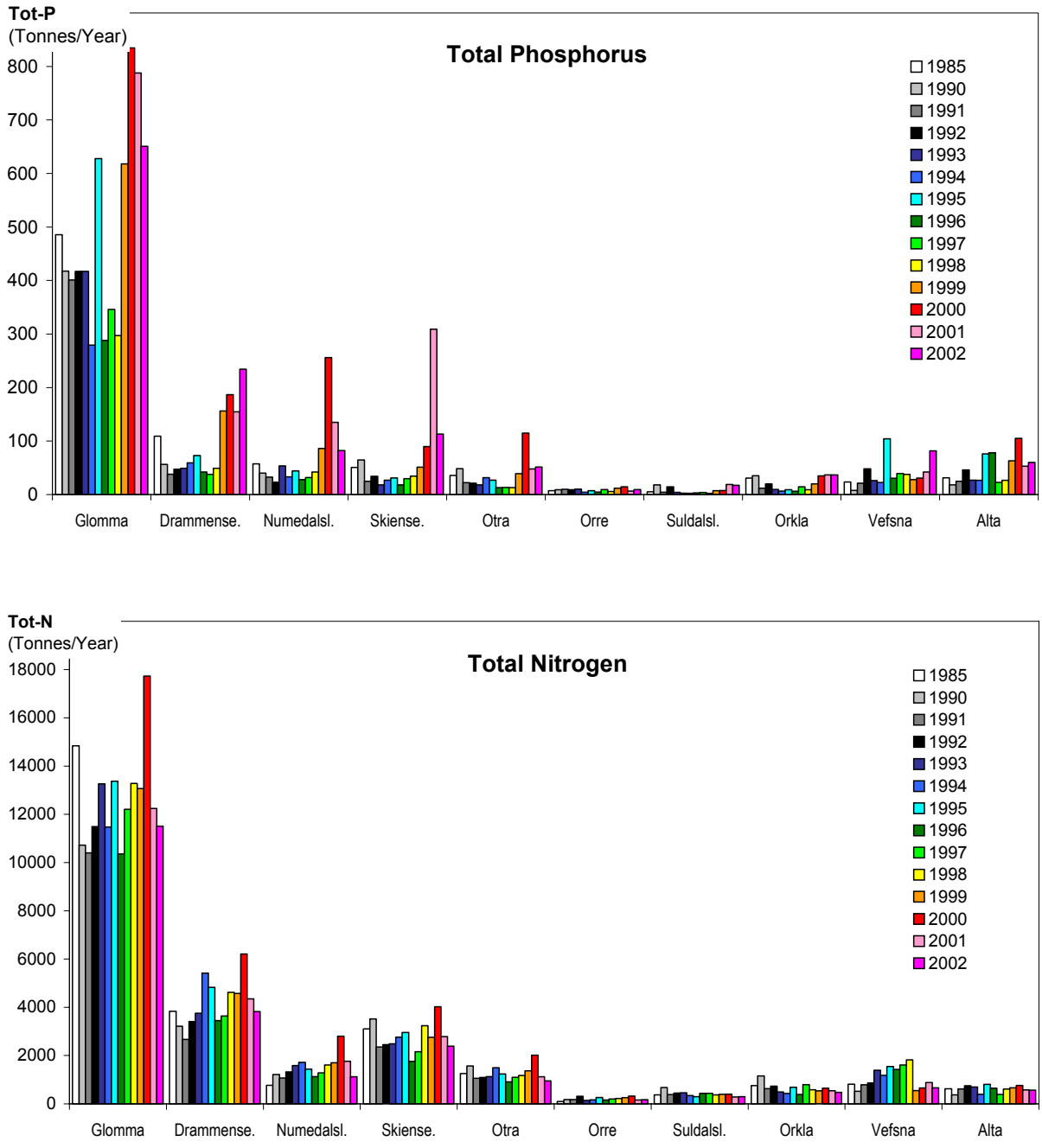


Figure 10. Main rivers. Annual total nitrogen and total phosphorus load in 1985, 1990- 2002.

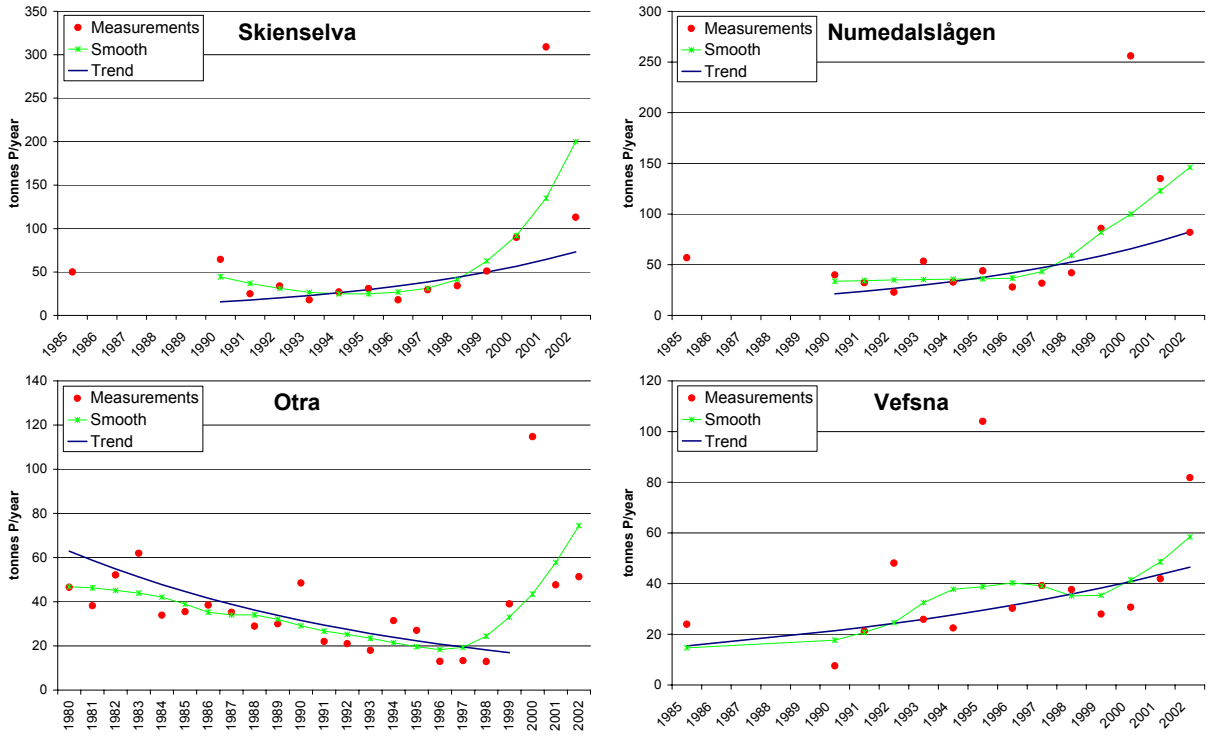


Figure 11. Measurements and trends in load of tot-P for Skienselva, Numedalslågen, Otra and Vefsna.

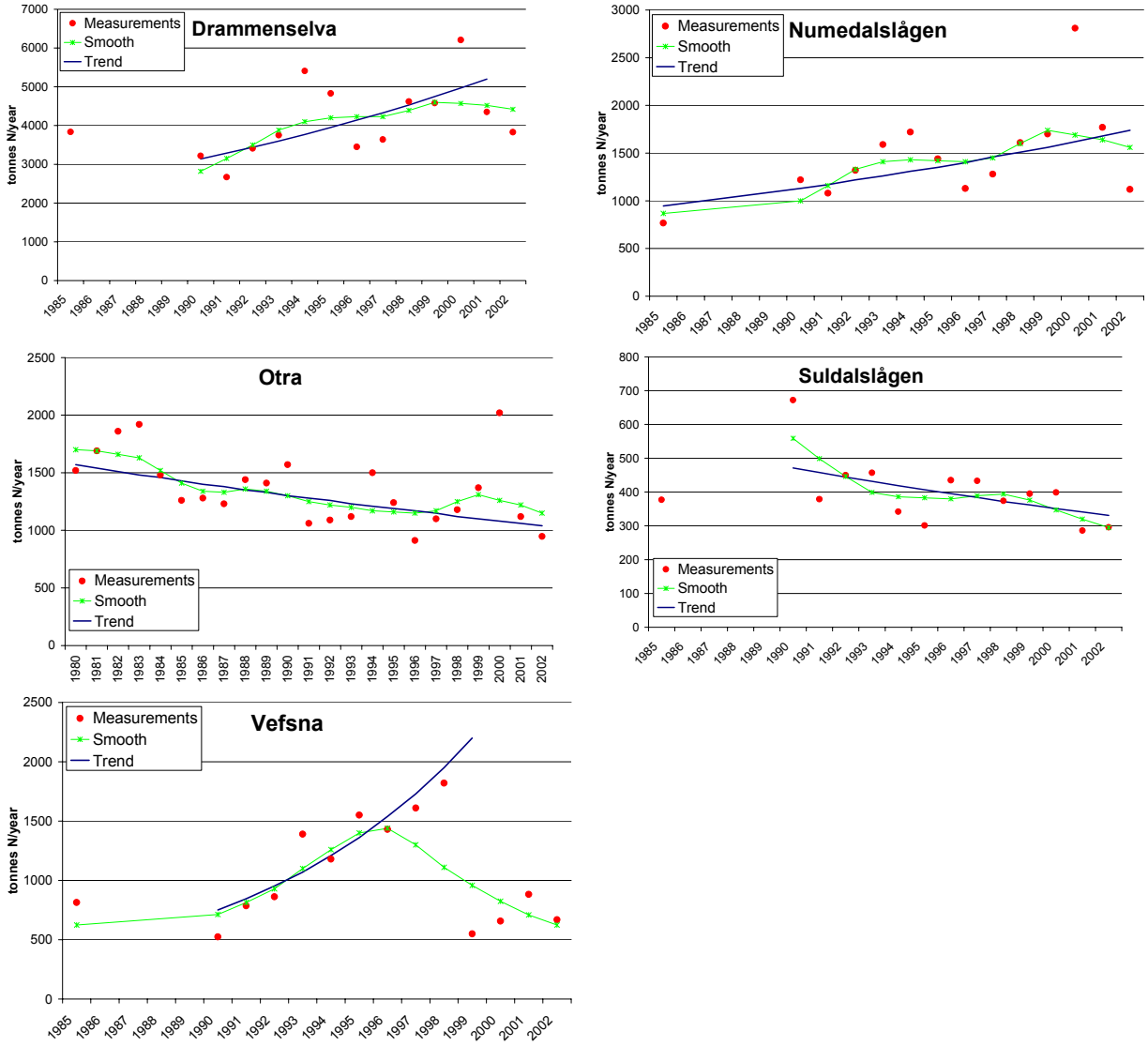


Figure 12. Measurements and trends in load of tot-N for Drammenselva, Numedalslågen Otra, Suldalslågen and Vefsna.

A significant increase was especially observed for phosphorus in Skienselva in 2001 (Figure 13). The reason for this increased discharge is unknown. The phosphorus concentration decreased in 2002 compared to 2001, but it seems not to be back to"normal" level.

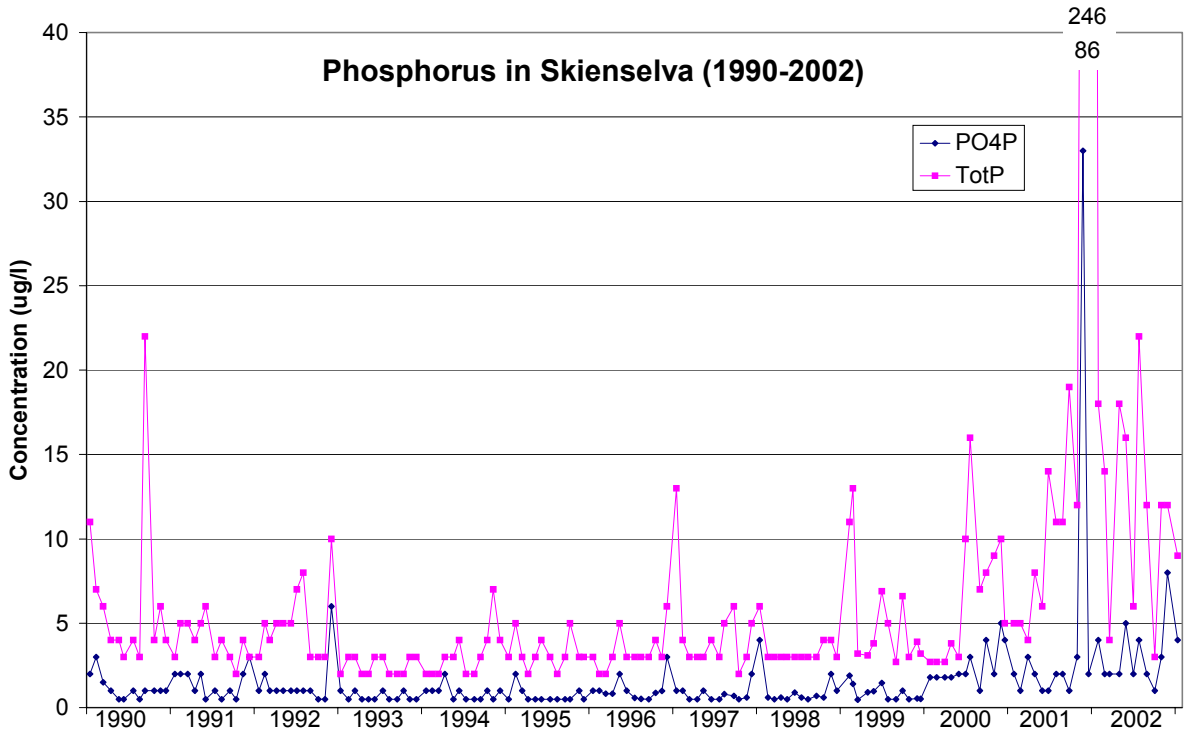


Figure 13. Concentration of tot-P and PO_4-P in Skienselva (1990-2002), all measurements included.

4.6.2. Metals trends

Annual load for metals in main rivers (1990-2002) are shown in figs. 14-17.

A reduction in the metal input from 2001 to 2002 was found for all rivers except Glomma and Alta. Trend analyses for the time period 1990-2002 for all 10 rivers were performed for all metals. All significant trends for metals are downward trends as shown in Figure 18-21. Summary of trends found for all rivers with significant reduction in metal concentrations in 1990-2002 is shown in Table 11. The results show a decrease in metal loading over time for nearly all rivers.

The long time series for copper and zinc in Orkla (1974-2002) show a significant reduction (84 % and 80 %) (Figure 20). However if only the period 1990-2001 is considered, no significant trend is found for Orkla by the Trend-Y-Tector. This means that the 10-year period is probably too short to give a significant trend even if such a trend exists. For the other metals in Orkla and for all metals in the other rivers no data before 1990 are available. Negative results in trend analysis for the time period 1990-2002 do not necessarily mean that there is no trend for the period, but could only indicate that the period can be too short for the trend to be statistically significant.

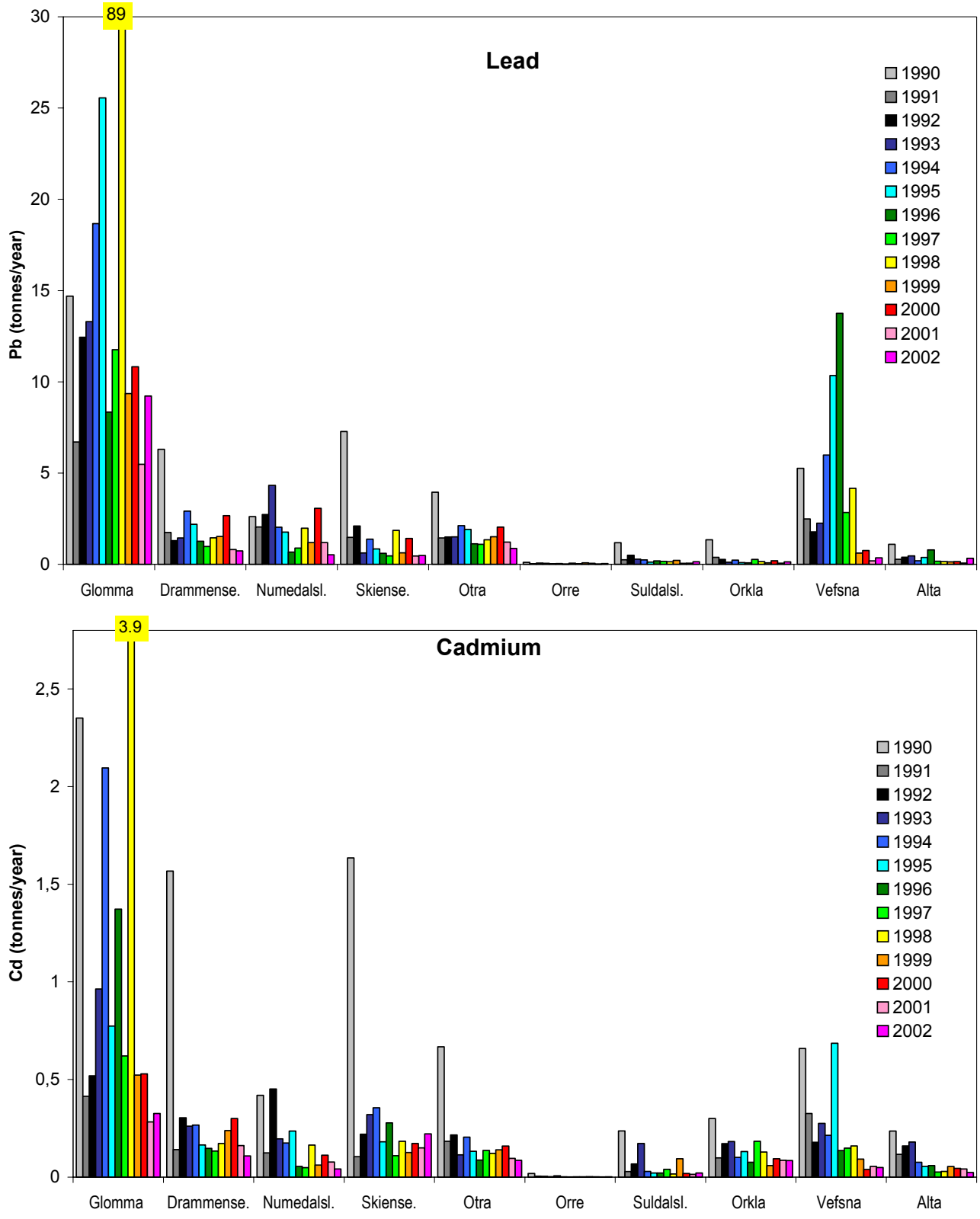


Figure 14. Main rivers. Annual total load of lead and cadmium in 1990-2002.

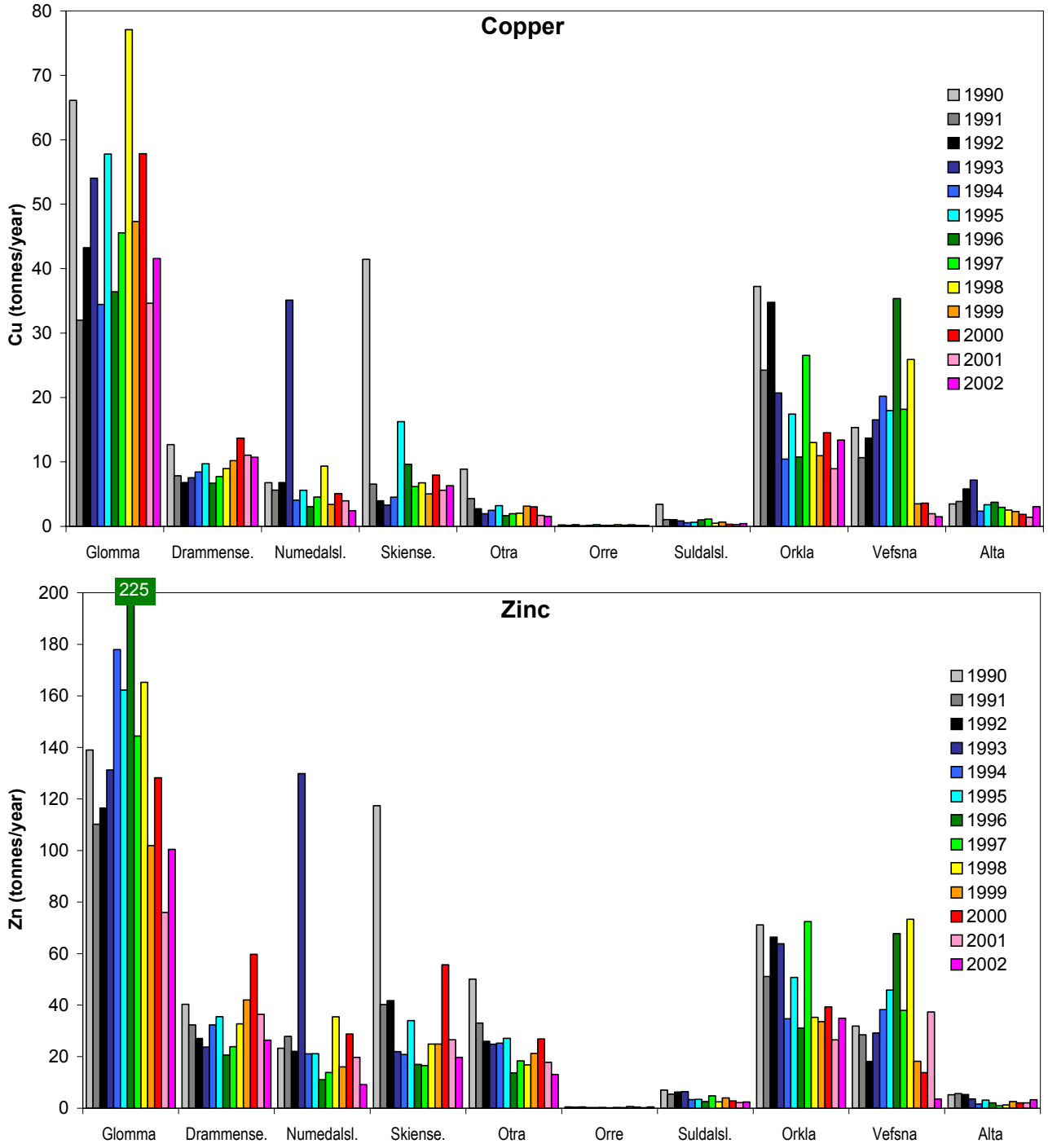


Figure 15. Main rivers. Annual total load of copper zinc and in 1990-2002.

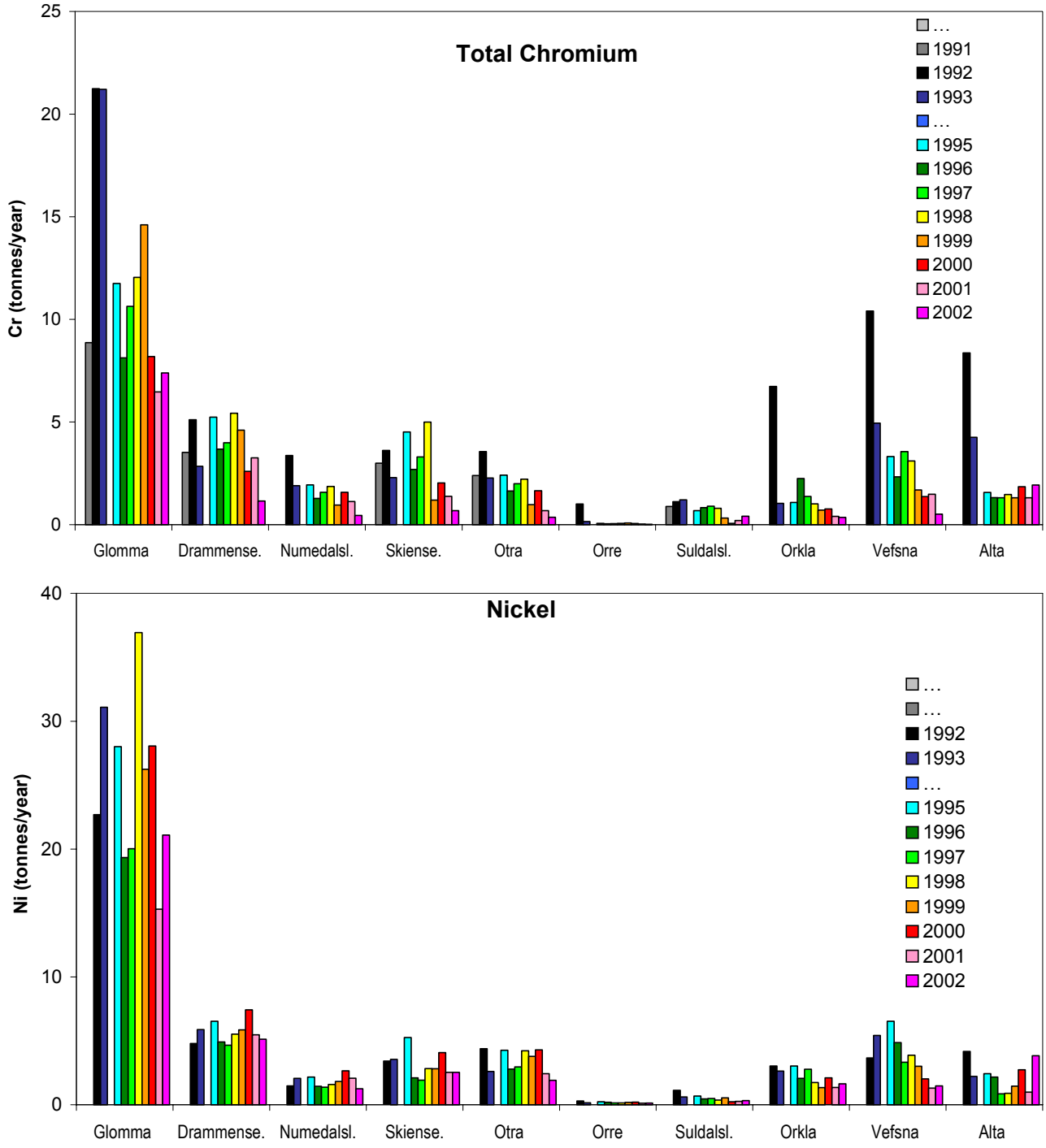


Figure 16. Main rivers. Annual total load of total chromium and nickel in 1990-2002. No measurement has been performed in 1990 and 1994 for those two parameters. In 1991 chromium has only been measured in Glomma, Drammenselva, Skienselva, Otra and Suldalslågen and no nickel measurement has been performed.

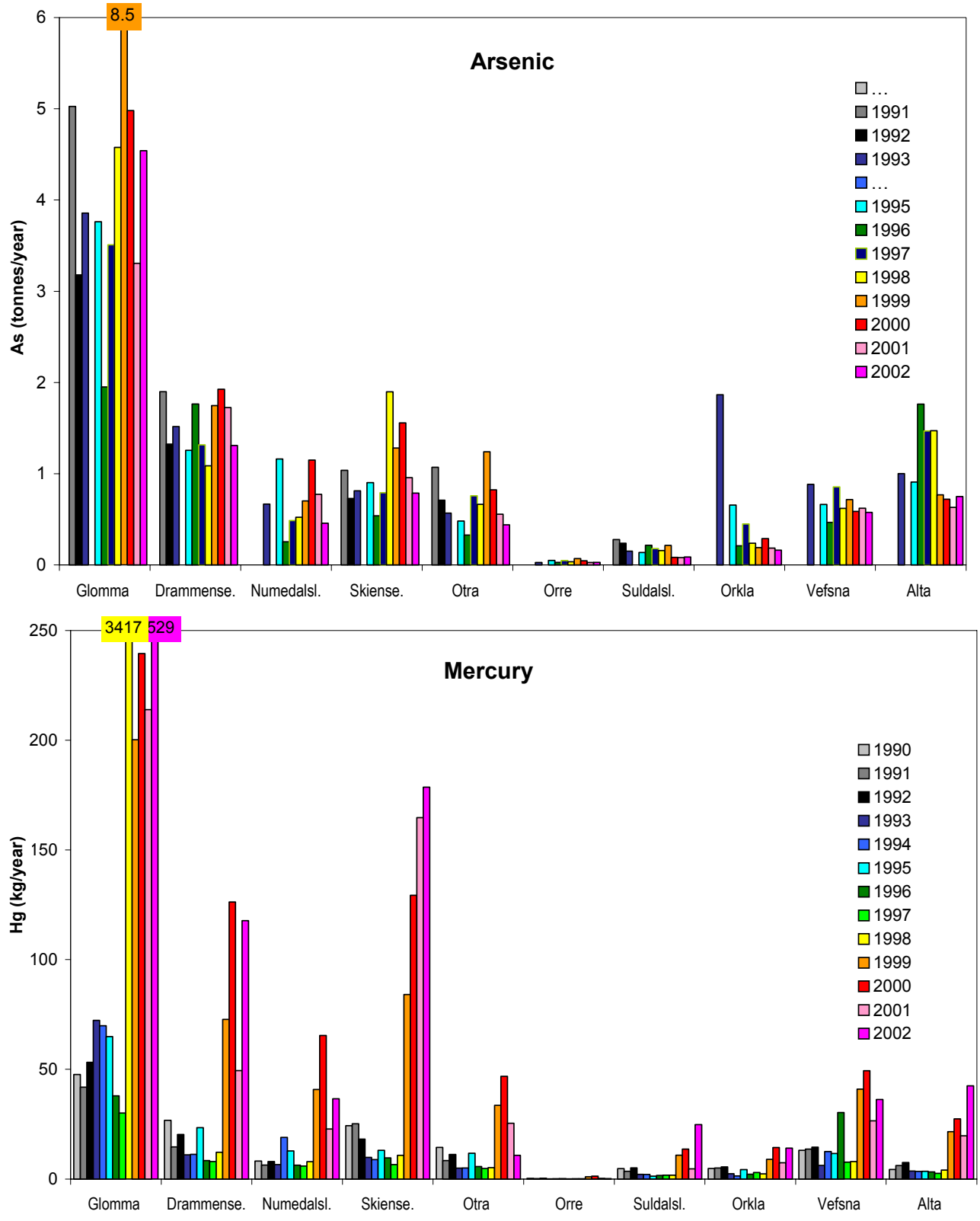


Figure 17. Main rivers. Annual total load of arsenic and mercury in 1990-2002. No arsenic measurement has been performed in 1990 and 1994 and in 1991 and 1992 arsenic has only been measured in Glomma, Drammenselva, Skienselva, Otra and Suldalslågen.

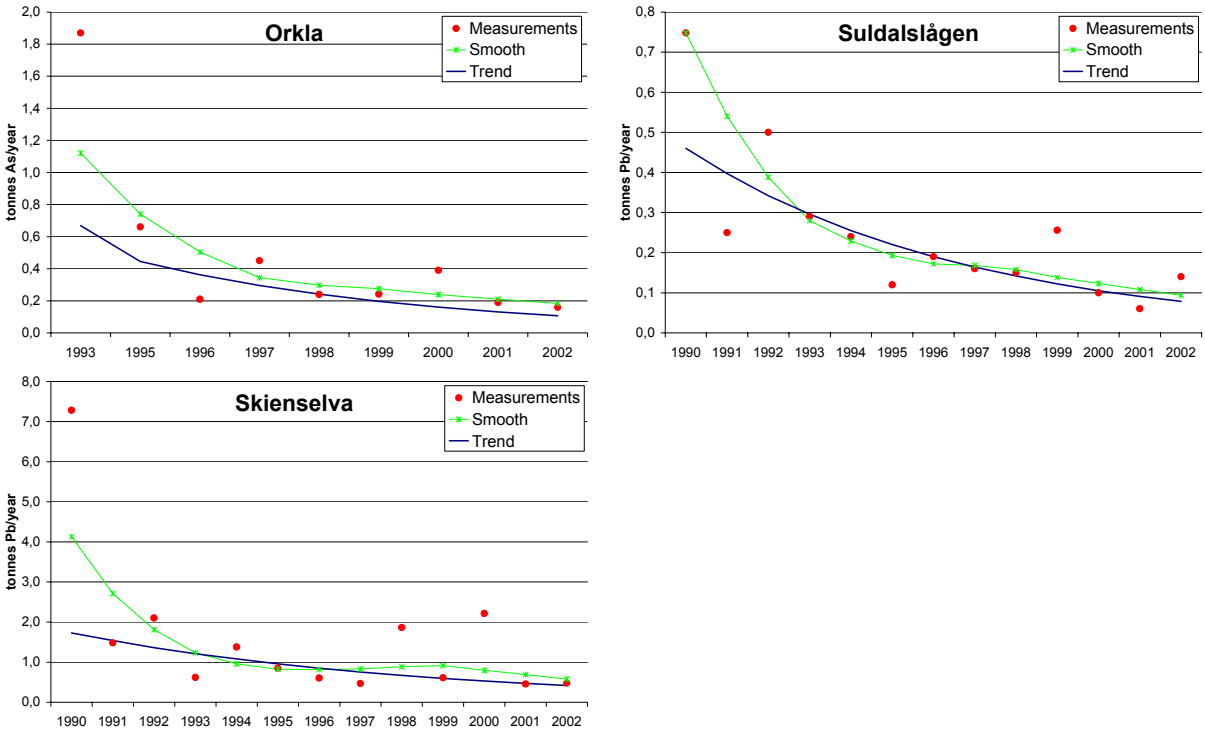


Figure 18. Measurements and trends in load of arsenic in Orkla and lead for Suldalslågen and Skienselva.

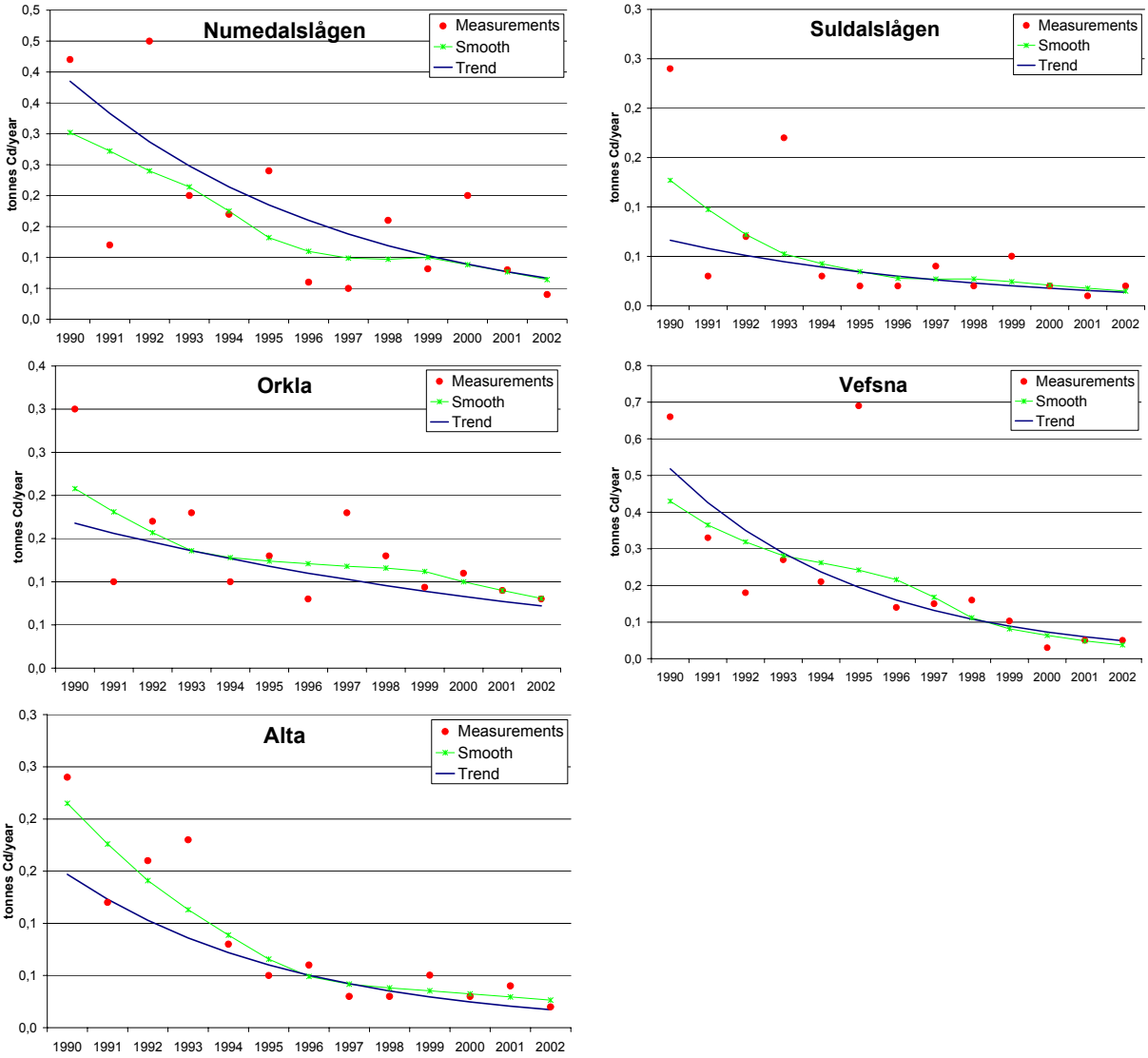


Figure 19. Measurements and trends in loads of cadmium in Numedalslågen, Suldalslågen, Orkla, Vefsna, and Alta.

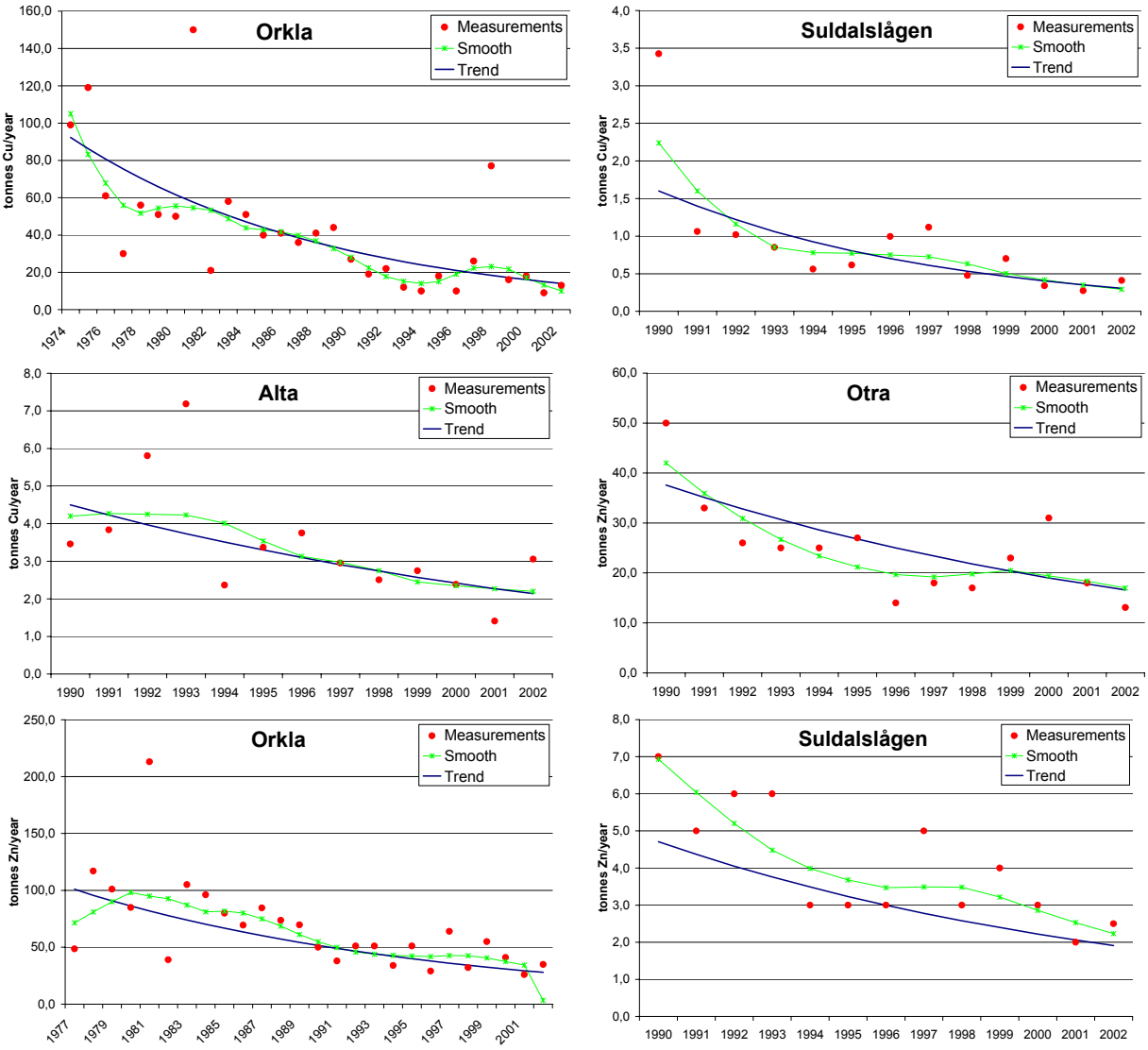


Figure 20. Measurements and trends in loads of copper in Orkla, Suldalslågen and Alta and zinc in Otra, Orkla and Suldalslågen.

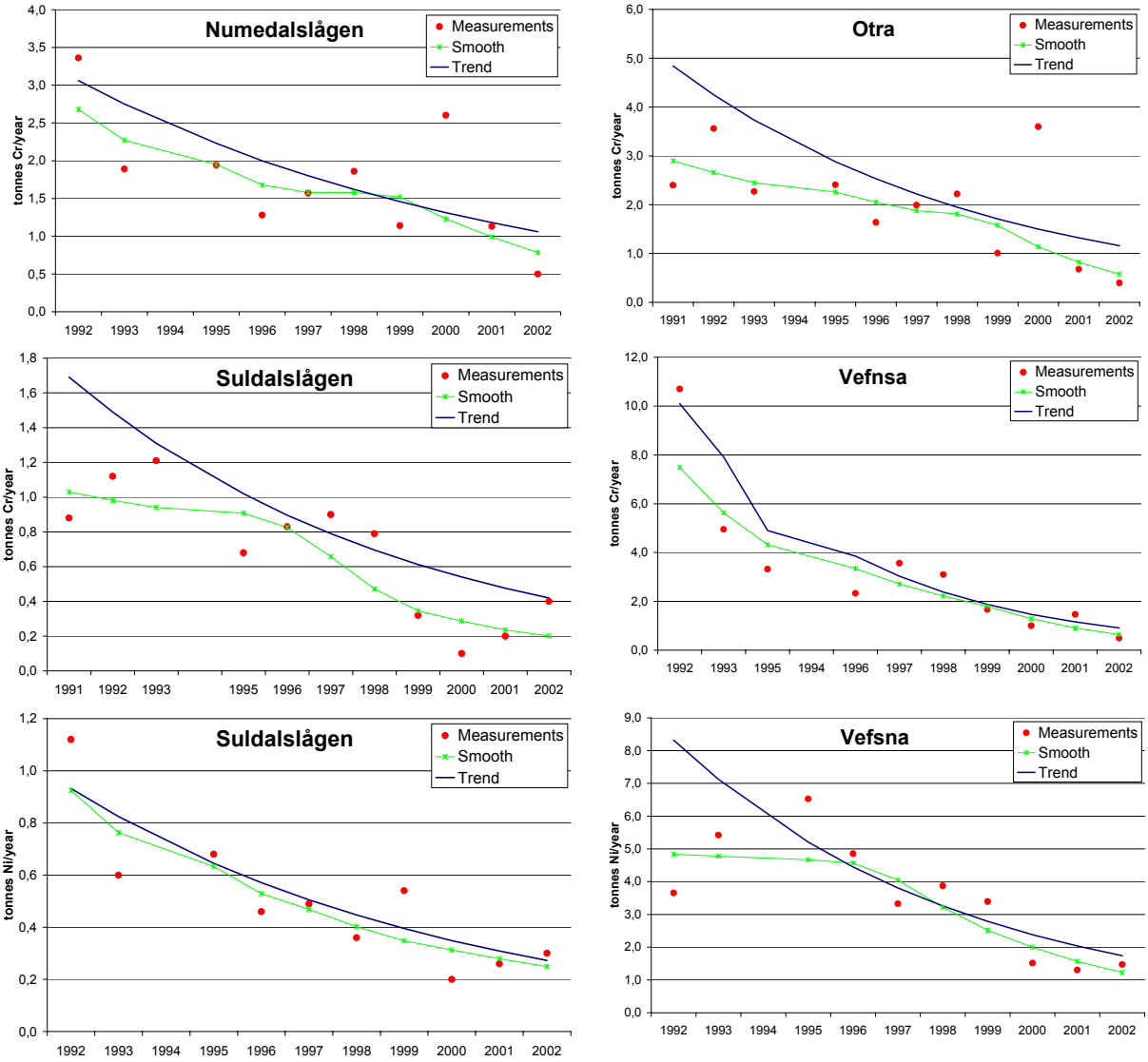


Figure 21. Measurements and trends in loads of chromium in Numedalslågen, Otra, Suldalslågen and Alta and nickel in Suldalslågen and Vefsna.

Table 11. Rivers where significant downward trend was detected for metals in the period 1990-2002.

River	Metals Downward trend size (%)						
	As	Pb	Cd	Cu	Zn	Cr	Ni
Glomma	-	-	-	-	-	-	-
Drammenselva	-	-	-	-	-	-	-
Numedalslågen	-	-	83%	-	-	65%	-
Skienselva	-	76%	-	-	-	-	-
Otra	-	-	54%	-	56%	76%	-
Orreelva	-	-	-	-	-	-	-
Suldalslågen	-	83%	79%	81%	59%	75%	71%
Orkla	84%	-	57%	85%	72%	-	-
Vefsna	-	-	89%	-	-	91%	79%
Alta	-	-	88%	53%	-	-	-

No trend analysis where performed for mercury because of the general high analytical uncertainty of this parameter and change in analytical methods in 1999. A trend analysis of mercury might only reflect an analytical artefact rather than a real change. For Glomma, however, a significant increase in measured mercury concentration, with more frequent cases of high concentration, can be noticed for 1998 and again from September 2001 (Figure 22). High concentrations are also repeated for 2002. An investigation is needed to find the source of increased mercury discharges to Glomma. For Glomma, the correlation analysis indicated no significant correlation between mercury and particulate suspended matter or water flow.

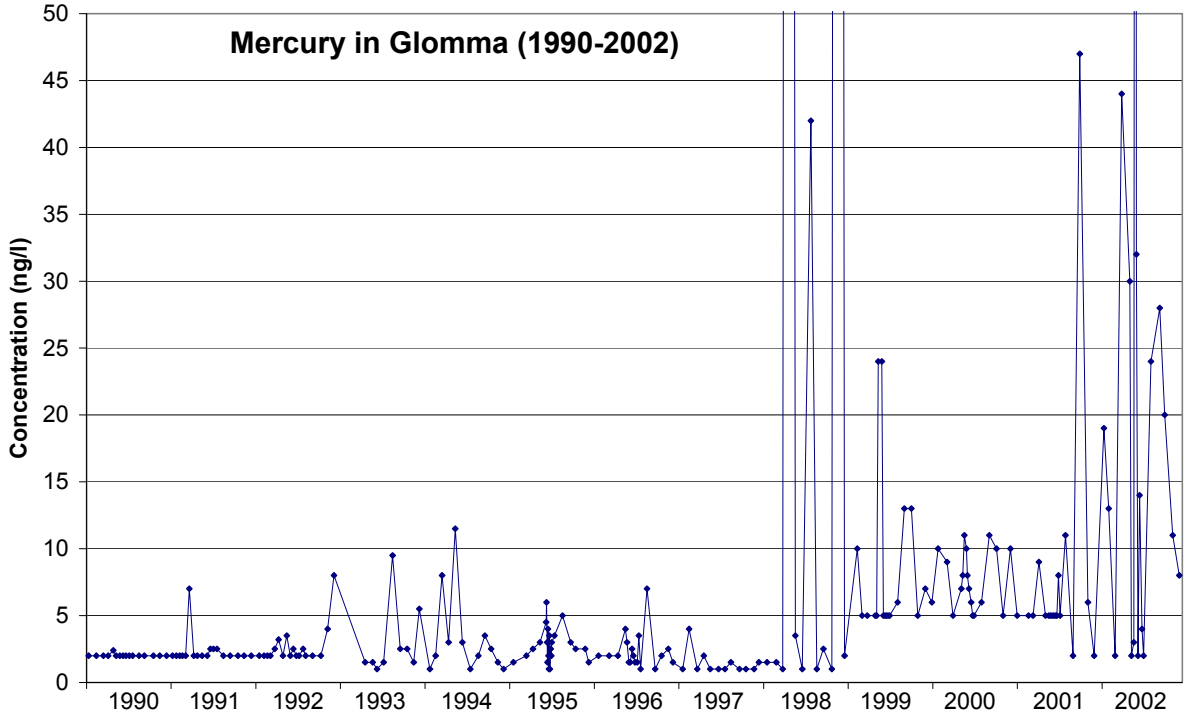


Figure 22. Concentration of mercury in Glomma (1990-2002), all measurements included.

4.6.3. Lindane trends

Annual load for lindane in main rivers (1990-2002) are shown in Figure 23.

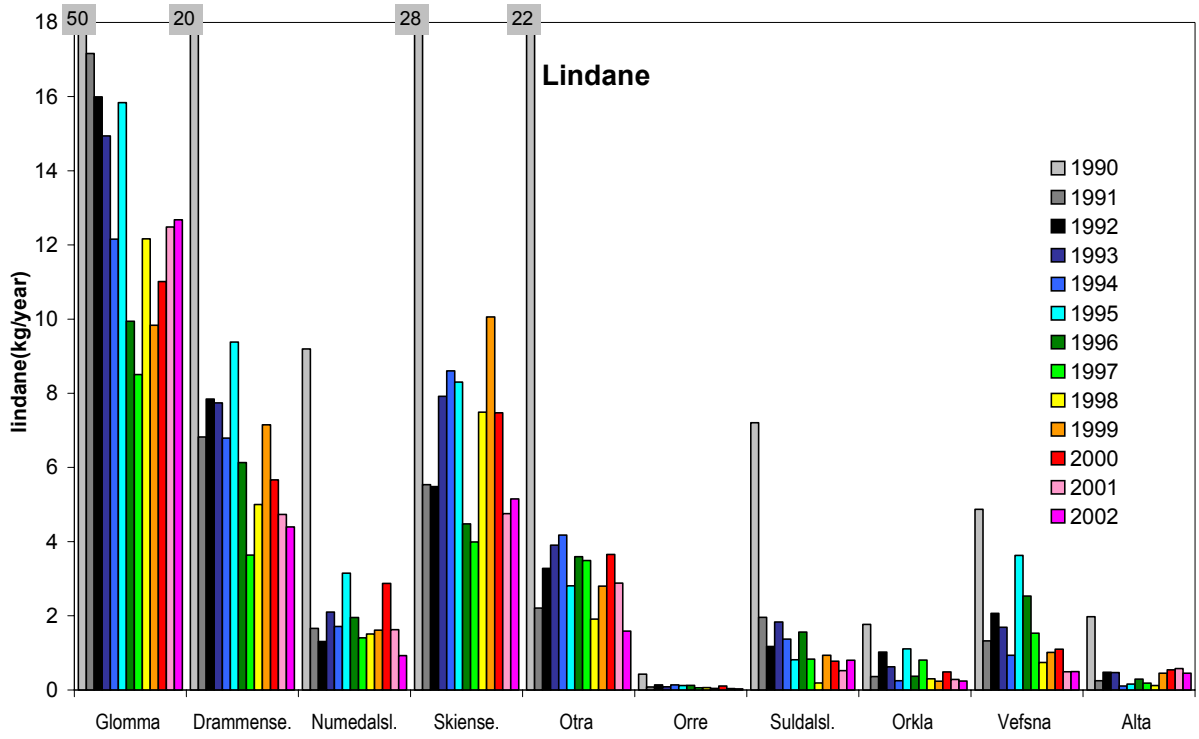
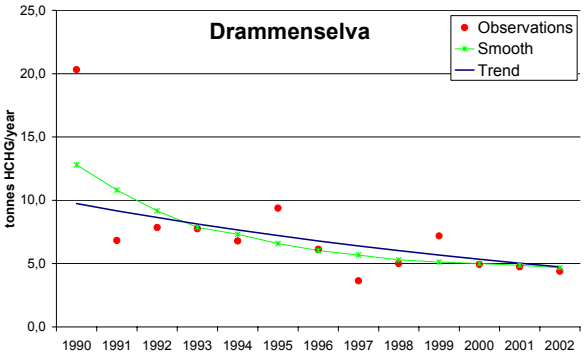
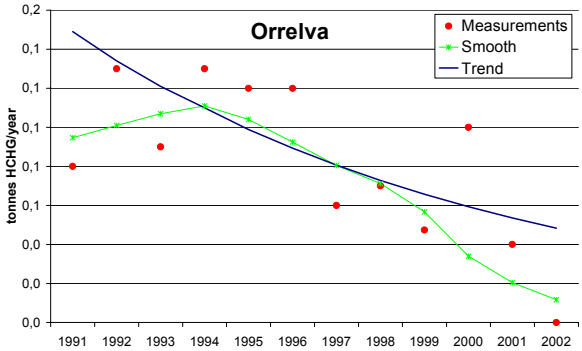


Figure 23. Main rivers. Annuals loads of lindane in 1990-2001.

The 1990 data for lindane were for all rivers significantly higher than later monitored data. It was therefore assumed that these high values were due to analytical problems. These data were ignored in the trend analysis of lindane. Trend analyses were performed for all main rivers (excluding the 1999 data), but a statistically significant trend was only seen for Drammenselva (downward trend 40%), (Suldalslågen (downward trend 68%) and Orreelva (downward trend 68%) (Figure 24). As described for metals, negative results in trend analyse for 1991-2001 do not necessarily mean that no trend exist, but rather that the period used could be too short for the trend to be statistically significant.





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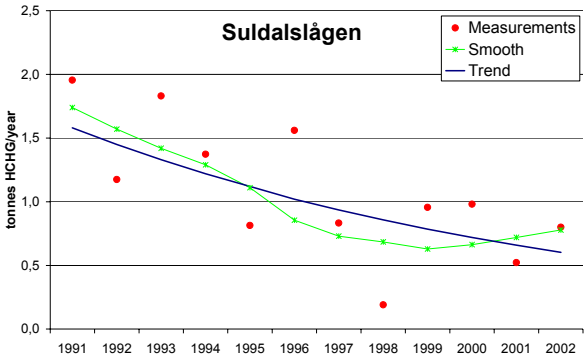


Figure 24. Measurements and trends in loads of lindane for Drammenselva, Orreelva and Suldalslågen.

4.7. Mean annual water flow (1931-60, 1961-90) and mean load

Mean annual river flow for the long term average (LTA) period 1961-90 has been estimated (Figure 2). For most of the main rivers the mean water flow 1961-90 is lower or at the same level as the 1931-60 period (DNMI, 1993).

Compared to Riverine Inputs to Marine Waters in 1990 - 2002, most calculated mean concentrations were approximately at the same level in 2002 with some exceptions. The concentration of total phosphorus has increased the last three years, and the concentrations of most of the heavy metals have slightly decreased. Mercury was at the same level as in 1999 (described in Section 4.4). The mean concentrations of silicate were slightly higher in all the main rivers in 2000. The mean concentrations from 1990 to 2002 are presented in Appendix XIII, Report B.

Total flow for all the rivers, and accordingly the calculated loads for most of the substances were slightly lower in 2002 than in 2001(Figure 2, Section 3.2).

The mass transport in the watercourses is strongly influenced by annual variations in precipitation/run-off, erosion and human activities in the drainage basins. The transport values may vary considerably from one year to another. These variations are complicating the estimation of "normal transport values" i.e. mass transport in a "normal" year.

During a normal winter, the upland area of Norway together with the eastern part of the country show very low run-off. The frozen soil and snowcover protect vegetation and surface soil from erosion. But with the mild winters (1990-1993, 1995 and 1999 - 2001), especially soil in plowed fields is exposed to more frequent and larger flood erosion also during the winter (i.e. Glomma).

From experience we have learned that the product of weighted concentrations and mean water flow gives a relatively good estimate of the mass-transport in rivers, especially for the large rivers, and those not considerably exposed to erosion material. The river Suldalslågen is regulated (partly diverted to another catchment area) and has now considerably less annual flow than before the regulation took place (the time period 1931-60).

4.8. Retention in fjords

Retention in watercourses is taken into account in the calculation of the Norwegian contribution to marine pollution, but using conservative figures. However, no corrections have been made for retention in fjords and other marine areas.

Considering the inputs to the open marine waters, one should also take into account retention in fjords, at least in well-defined threshold fjords. As a result of high salinity compared to freshwater, marine waters have better conditions for sedimentation of particles than lakes, e.g. clay settles very poorly in lakes, but more efficient in fjords. The water masses are usually stratified, with light brackish water on top of heavier, saline waters. Thus the overall stratification in fjords is in most cases stronger than in lakes. This implies that particulate pollutants lost to deep waters by sedimentation have less chance to be brought back to the euphotic zone in the sea than in lakes, but it implies also that fine particulate matters during stratification periods are not easily precipitated.

In addition, stronger stratification implies greater chance for oxygen depletion in deep waters, which in fact is seen in many sheltered Norwegian fjords. Theoretically this will improve the conditions for denitrification. However, this greater stability is often reduced by rougher physical conditions in fjords compared to lakes.

Retention in Norwegian fjords is very poorly studied by direct budget measurements. In the Drammensfjord, Magnusson and Næss (1986) found that about 60% of the incoming phosphorus was retained in the fjord, while for nitrogen the retention was only about 15%. In the silled Inner Oslofjord preliminary calculations indicate that nitrogen retention is in the order of 30-50% (Baalsrud and Bjerkeng, 1991).

Thus, nutrient retention in threshold fjords seems to be of a similar magnitude as we find in lakes, and it is likely to believe that retention in threshold fjords can be estimated from the same type of models that applies to lakes. The general lack of calibration data on retention models for threshold fjords implies that it is too early, at this stage of knowledge, to include this correction in the Norwegian discharge budget. It should be kept in mind, however, that a significant part of the particulate pollutants, and pollutants with particle affinity, end up in fjord sediments and thus are prevented from reaching the coastal waters.

4.9. Leakage from sediments

Leaching of metals, organic substances and nutrients from the marine sediments to the water is not taken into account in the calculations. The measurement of the river inputs includes the metals and lindane in particulate form in the rivers, but not leakage of these substances and other pollutants from previuosly accumulated suspended material in the fjords. Several studies have shown that large amounts of pollutants have been accumulated in some of the Norwegian harbour basins (Winther-Larsen, 1998). Resuspension of particles from the bottom, due to dredging, ship traffic etc. will increase the inputs of pollutants to the coastal water. Oxygen depletion in parts of the year may also cause changes in leaching depending on the actual substances present. More attention should be paid to these conditions.

5. References

5.1. Project Personnel

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Eilen Arctander Vik: Member of the Programme Committee (Aquateam)

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Contact with field workers/laboratory:	Mona Weideborg
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Other chemical analyses:	AnalyCen AS, Moss.
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Data Calculations:	Elisabeth Lyngstad, Aquateam
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(3) Numedalslågen:	Hanna Kolbjørnsen, BUVA, Drammen
(4) Skiensvassdraget:	Hanna Kolbjørnsen, BUVA, Drammen
(5) Otra:	Magne Aadnevik, Ingeniørvesenet. Kristiansand kommune
(6) Orreelva:	Geir Undheim, Landbrukskontoret, Time kommune.
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Summary - sammendrag The report contains results from the 2002 monitoring of 129 Norwegian rivers and tributaries in accordance with requirements of the Oslo and Paris Commission (OSPAR). Riverborne inputs of the nutrients, suspended particulate matter, total organic carbon, metals (Cd, Hg, Pb, Cu, Zn, Cr, Ni, As) and the pesticide lindane to Norwegian coastal waters are calculated based on concentration and flow data. Rapporten inneholder resultater fra overvåkning i år 2002 av 129 norske elver samt beregnede direkte tilførsler til norske kystområder. Elvetilførsler av næringssalter, suspendert stoff, total organisk karbon, tungmetaller (Cd, Hg, Pb, Cu, Zn, Cr, Ni, As) og lindan til norske kystområder er beregnet, basert på konsentrasjons- og vannføringsdata.

4 subject words	4 emneord
Pollution inputs, Norwegian coastal waters, riverine inputs, direct inputs	Forurensningstilførsler, norske kystområder, elvetilførsler, direkte tilførsler

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Summary

This report contains Appendices to the report " Riverine Inputs and Direct Discharges to Norwegian coastal waters - 2002. OSPAR Commission. A: Principles, results and discussions".

The report contains data from the 2002 monitoring of 139 Norwegian rivers and tributaries in accordance with requirements of the Oslo and Paris Commission (OSPAR). Riverborne inputs of the nutrients, suspended particulate matter, total organic carbon, metals (Cd, Hg, Pb, Cu, Zn, Cr, Ni, As) and the pesticide lindane to Norwegian coastal waters are calculated based on concentration and flow data. Run-off from approximately 60% of the mainland areas, and 94 % of the Skagerrak region, has been monitored. Discharges from areas not covered by the river monitoring stations, are estimated by use of specific activity and run-off coefficients. The sampling programme 2002 was reduced with 19 tributary rivers in the Barents Sea subregion. The load of these rivers were however, stipulated based on results from 2001.

Key words - English	Key words - Norwegian
Pollution discharges	Forurensningstilførsler
Norwegian coastal waters	Norske kystområder
Riverine inputs	Elvetilførsler
Direct discharges	Direkte tilførsler

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Appendix I. Total discharges 2002

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Table I. Total discharge from mainland Norway to convention waters 2002

		Area run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*	-	-	732 459	385 065	184 476	**1 302 000**	tonnes
	**	-	-	732 459	403 429	186 756	**1 322 644**	
TOC		-	-	263	328 918	193 213	**522 394**	tonnes
Orthoph.	*	232	912	494	472	317	**2 427**	tonnes
	**	232	912	494	507	320	**2 465**	
Total P	*	917	5 069	1 032	2 237	1 336	**10 592**	tonnes
	**	917	5 069	1 032	2 243	1 337	**10 598**	
Nitrates	*	19 365	-	51	11 020	14 004	**44 440**	tonnes
	**	19 365	-	51	11 022	14 004	**44 442**	
Ammonia	*	1 783	7 616	7 941	1 780	1 063	**20 181**	tonnes
	**	1 783	7 616	7 941	1 812	1 066	**20 217**	
Total N		29 861	23 799	13 696	26 738	21 966	**116 059**	tonnes
Silicate SiO2	*	-	-	-	195 436	164 842	**360 278**	tonnes
	**	-	-	-	195 436	165 932	**361 368**	
Arsenic	*	-	-	1.1	12	9.1	**22**	tonnes
	**	-	-	1.1	14	9.1	**24**	
Lead		-	-	6.8	24	13	**44**	tonnes
Cadmium	*	-	-	0.26	1.3	0.78	**2.3**	tonnes
	**	-	-	0.26	1.9	1.0	**3.1**	
Copper	*	-	-	27	72	81	**179**	tonnes
	**	-	-	27	72	81	**180**	
Total Cr-T	*	-	-	4.5	18	12	**35**	tonnes
	**	-	-	4.5	20	13	**38**	
Nickel	*	-	-	17	78	39	**134**	tonnes
	**	-	-	17	87	39	**143**	
Zinc	*	-	-	58	251	211	**520**	tonnes
	**	-	-	58	265	214	**537**	
Mercury	*	-	-	50	595	963	**1 608**	kg
	**	-	-	50	703	990	**1 743**	
Lindane	*	-	-	-	-	26	**26**	kg
	**	-	-	-	-	27	**27**	

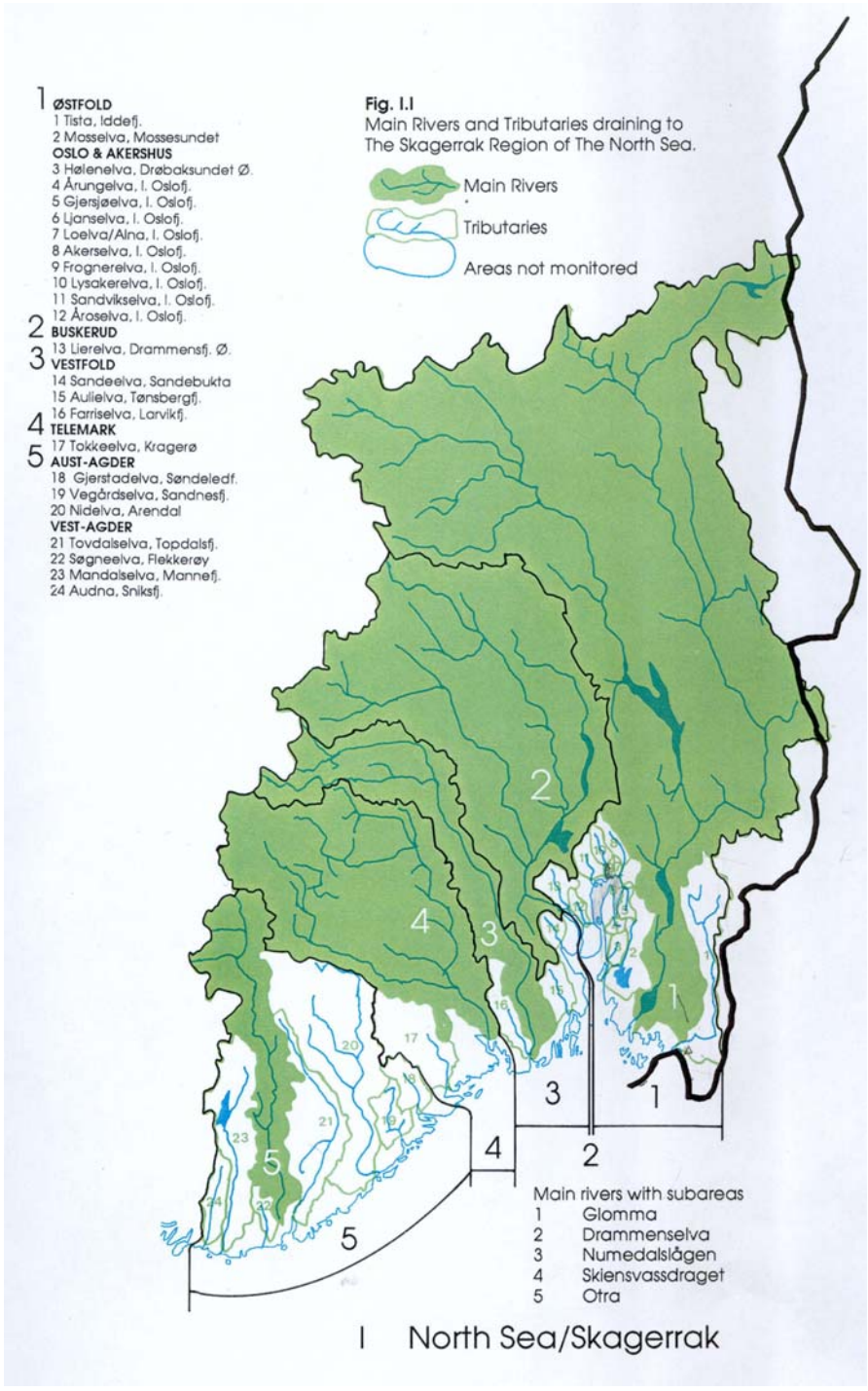
Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

Table I.I Total discharges to the Skagerrak Region 2002 (Figure I.I)

The Skagerrak region with sub-areas: (1) Glomma, (2) Drammenselva, (3) Numedalslågen, (4) Skienselva, (5) Otra.

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*			2 598	26 619	169 716	**198 933**	tonnes
	**			2 598	26 619	170 560	**199 777**	
TOC				84	91 031	171 114	**262 229**	tonnes
Orthoph.	*	22	0.00	65	54	253	**394**	tonnes
	**	22	0.00	65	54	256	**397**	
Total P		87	0.00	188	425	1 132	**1 832**	tonnes
Nitrates		1 944	-	20	3 591	12 760	**18 314**	tonnes
Ammonia	*	179	0.01	3 142	157	1 019	**4 498**	tonnes
	**	179	0.01	3 142	163	1 019	**4 503**	
Total N		2 992	0.02	5 199	6 321	19 790	**34 301**	tonnes
Silicate SiO2	*			-	27 136	142 610	**169 746**	tonnes
	**			-	27 136	143 315	**170 452**	
Arsenic				0.29	4.7	7.5	**12**	tonnes
Lead				0.72	7.9	12	**20**	tonnes
Cadmium	*			0.06	0.52	0.68	**1.3**	tonnes
	**			0.06	0.53	0.78	**1.4**	
Copper	*			12	7.6	63	**82**	tonnes
	**			12	8.0	63	**82**	
Total Cr-T	*			2.0	2.1	9.4	**14**	tonnes
	**			2.0	2.1	10	**14**	
Nickel	*			3.9	5.4	32	**41**	tonnes
	**			3.9	6.9	32	**43**	
Zinc				17	76	169	**261**	tonnes
Mercury	*			21	20	854	**894**	kg
	**			21	52	872	**945**	
Lindane				-	-	25	**25**	kg

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit


1 ØSTFOLD
1 Tista, Iddefj.
2 Mosselva, Mossesundet
OSLO & AKERSHUS
3 Hølenelva, Drøbaksundet Ø.
4 Årungelva, I. Oslofj.
5 Gjersjøelva, I. Oslofj.
6 Ljanselva, I. Oslofj.
7 Loelva/Alna, I. Oslofj.
8 Akerselva, I. Oslofj.
9 Frognerelva, I. Oslofj.
10 Lysakerelva, I. Oslofj.
11 Sandvikselva, I. Oslofj.
12 Åroselva, I. Oslofj.
2 BUSKERUD
3 VESTFOLD
13 Lierelva, Drammensfj. Ø.
14 Sandeelva, Sandebukta
15 Aulielva, Tønsbergfj.
16 Farriselva, Larvikfj.
4 TELEMARK
5 AUST-AGDER
17 Tokkeelva, Kragerø
18 Gjerstadelva, Søndeledf.
19 Vegårdselva, Sandnesfj.
20 Nidelva, Arendal
VEST-AGDER
21 Tovdalselva, Topdalsfj.
22 Søgneelva, Flekkerøy
23 Mandalselva, Mannefj.
24 Audna, Sniksfj.
Fig. I.I
Main Rivers and Tributaries draining to
The Skagerrak Region of The North Sea.
Main Rivers
Tributaries
Areas not monitored
Main rivers with subareas
1 Glomma
2 Drammenselva
3 Numedalslågen
4 Skiensvassdraget
5 Otra
I North Sea/Skagerrak

Source: NIVA

Table I.II Total discharges to the remaining North Sea 2002 (Figure I.II)

The remaining North Sea Region with sub-areas:
(6) Orreelva, (7) Suldalslågen

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*			48 793	60 829	2 082	**111 704**	tonnes
	**			48 793	68 620	2 428	**119 841**	
TOC				155	40 174	1 904	**42 234**	tonnes
Orthoph.	*	60	314	167	149	8.1	**699**	tonnes
	**	60	314	167	161	8.3	**711**	
Total P		228	1 745	332	637	26	**2 968**	tonnes
Nitrates		7 438	-	14	4 806	341	**12 599**	tonnes
Ammonia	*	678	2 643	2 200	217	6.9	**5 744**	tonnes
	**	678	2 643	2 200	230	7.6	**5 758**	
Total N		11 571	8 258	3 942	8 276	468	**32 515**	tonnes
Silicate SiO2	*			-	37 178	1 003	**38 181**	tonnes
	**			-	37 178	1 388	**38 566**	
Arsenic	*			0.20	1.3	0.10	**1.6**	tonnes
	**			0.20	2.4	0.12	**2.7**	
Lead				4.5	7.3	0.18	**12**	tonnes
Cadmium	*			0.14	0.35	0.02	**0.51**	tonnes
	**			0.14	0.51	0.02	**0.67**	
Copper	*			5.2	13	0.54	**19**	tonnes
	**			5.2	13	0.55	**19**	
Total Cr-T	*			1.2	2.9	0.37	**4.5**	tonnes
	**			1.2	3.6	0.43	**5.2**	
Nickel	*			10	3.2	0.36	**14**	tonnes
	**			10	8.8	0.45	**19**	
Zinc	*			26	60	2.9	**90**	tonnes
	**			26	63	2.9	**92**	
Mercury	*			15	98	23	**135**	kg
	**			15	124	25	**164**	
Lindane				-	-	0.83	**0.83**	kg

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

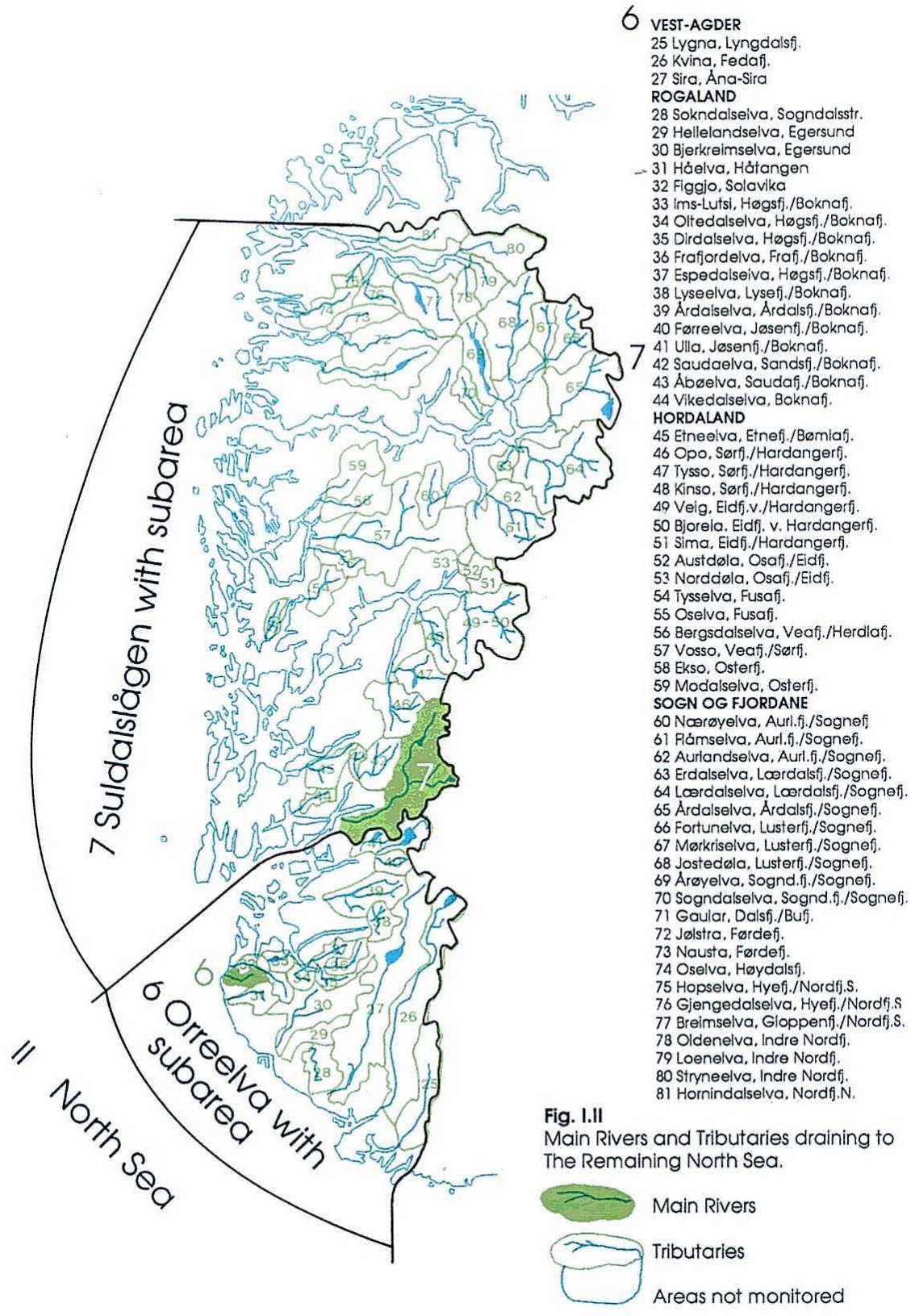


Fig. I.II
Main Rivers and Tributaries draining to The Remaining North Sea.

Source: NIVA

Table I.III Total discharges to the Norwegian Sea 2002 (Figure I.III)

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*			469 807	276 038	7 935	**753 781**	tonnes
	**			469 807	284 898	8 900	**763 605**	
TOC				23	121 001	10 837	**131 861**	tonnes
Orthoph.	*	132	530	243	228	34	**1 167**	tonnes
	**	132	530	243	244	34	**1 183**	
Total P	*	514	2 942	479	1 042	119	**5 096**	tonnes
	**	514	2 942	479	1 047	119	**5 101**	
Nitrates		8 954	-	16	2 512	767	**12 250**	tonnes
Ammonia	*	839	4 403	2 417	1 207	27	**8 892**	tonnes
	**	839	4 403	2 417	1 221	30	**8 909**	
Total N		13 597	13 758	4 311	8 573	1 141	**41 380**	tonnes
Silicate SiO2				-	69 876	10 748	**80 624**	tonnes
Arsenic	*			0.56	4.6	0.73	**5.9**	tonnes
	**			0 56	5.2	0.74	**6.5**	
Lead	*			1.5	8.4	0.47	**10**	tonnes
	**			1.5	8.4	0.49	**10**	
Cadmium	*			0.05	0.40	0.08	**0.54**	tonnes
	**			0.05	0.67	0.13	**0.86**	
Copper				9.3	33	15	**57**	tonnes
Total Cr-T	*			1.1	6.6	0.73	**8.5**	tonnes
	**			1.1	7.3	0.87	**9.3**	
Nickel	*			2.6	29	2.6	**34**	tonnes
	**			2.6	31	3.1	**36**	
Zinc	*			13	47	36	**97**	tonnes
	**			13	57	38	**109**	
Mercury	*			13	390	45	**449**	kg
	**			13	436	50	**500**	
Lindane	*			-	-	0.40	**0.40**	kg
	**			-	-	0.73	**0.73**	

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

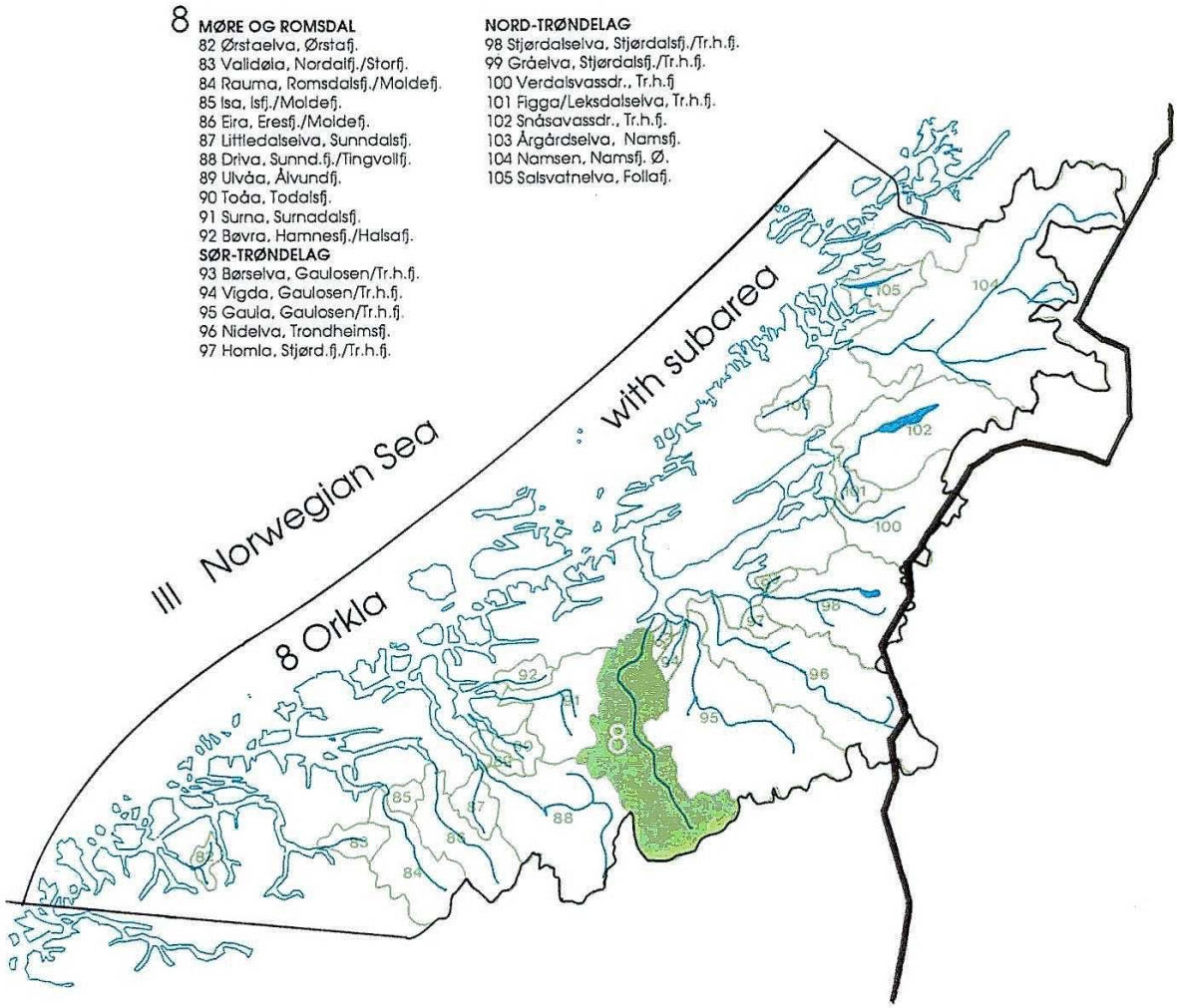


Fig. I.III A
Main Rivers and Tributaries draining to The Norwegian Sea (Southern Part).

Source: NIVA

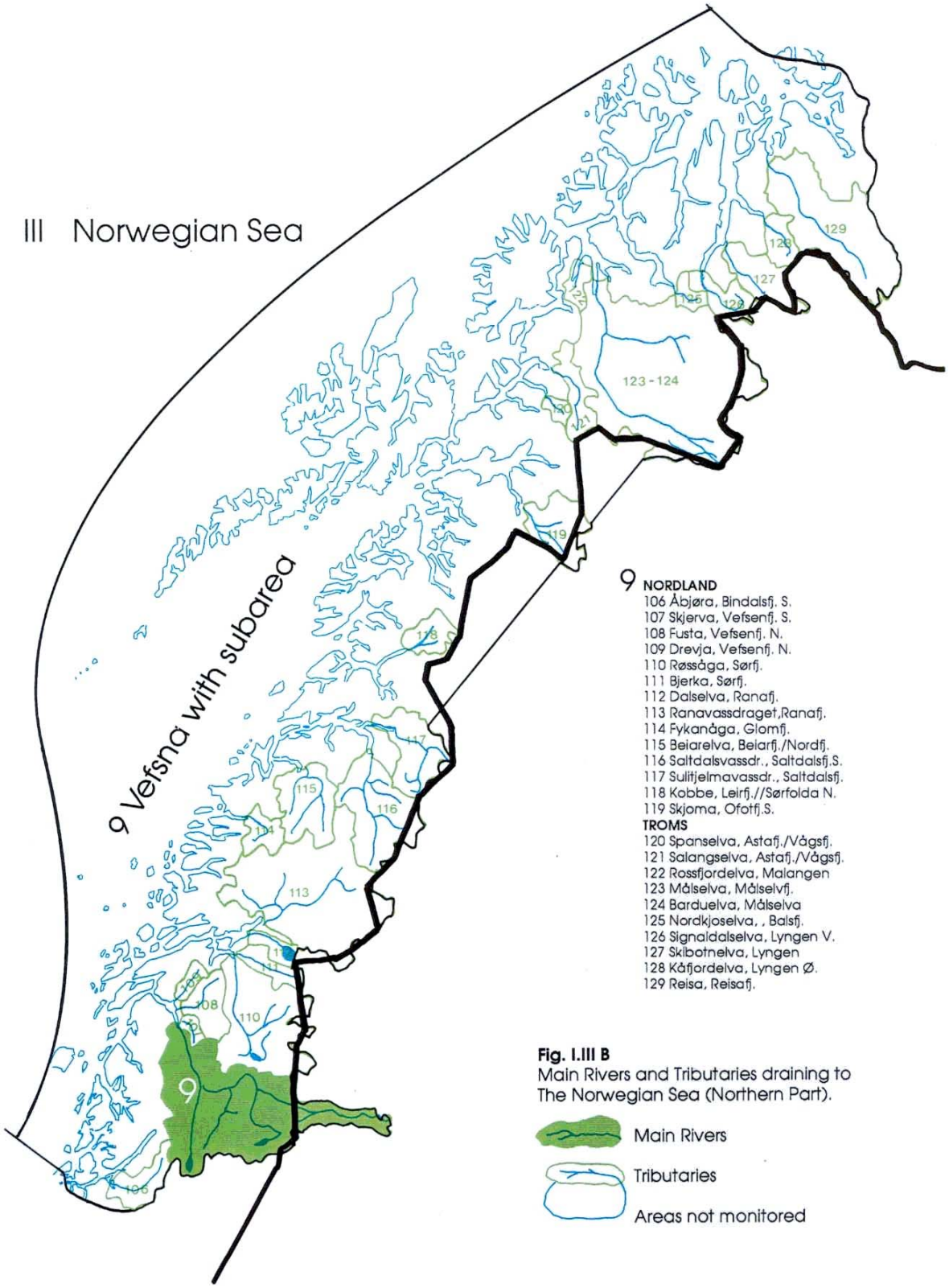


Fig. I.III B
Main Rivers and Tributaries draining to The Norwegian Sea (Northern Part).

Source: NIVA

Table I.IV Total discharges to the Barents Sea 2002 (Figure I.IV)

The Barents Sea with sub-area: (10) Alta

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*			211 261	21 578	4 744	**237 583**	tonnes
	**			211 261	23 291	4 868	**239 420**	
TOC				-	76 712	9 358	**86 070**	tonnes
Orthoph.	*	18	69	19	41	21	**168**	tonnes
	**	18	69	19	47	21	**174**	
Total P		88	382	32	134	60	**696**	tonnes
Nitrates	*	1 029	-	1.0	111	136	**1 277**	tonnes
	**	1 029	-	1.0	113	136	**1 279**	
Ammonia		87	570	182	198	10	**1 047**	tonnes
Total N		1 701	1782	244	3 568	567	**7 862**	tonnes
Silicate SiO2				-	61 246	10 481	**71 727**	tonnes
Arsenic	*			-	1.9	0.75	**2.6**	tonnes
	**			-	2.0	0.75	**2.8**	
Lead	*			0.05	0.33	0.32	**0.69**	tonnes
	**			0.05	0.60	0.33	**0.97**	
Cadmium	*			0.003	0.01	0.001	**0.01**	tonnes
	**			0.003	0.20	0.02	**0.23**	
Copper				0.67	17	3.1	**21**	tonnes
Total Cr-T	*			0.08	6.2	1.9	**8.1**	tonnes
	**			0.08	7.3	1.9	**9.3**	
Nickel				0.08	41	3.8	**45**	tonnes
Zinc	*			1.0	68	3.1	**72**	tonnes
	**			1.0	69	3.3	**73**	
Mercury	*			1.1	87	41	**130**	kg
	**			1.1	90	42	**134**	
Lindane	*			-	-	0.36	**0.36**	kg
	**			-	-	0.45	**0.45**	

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

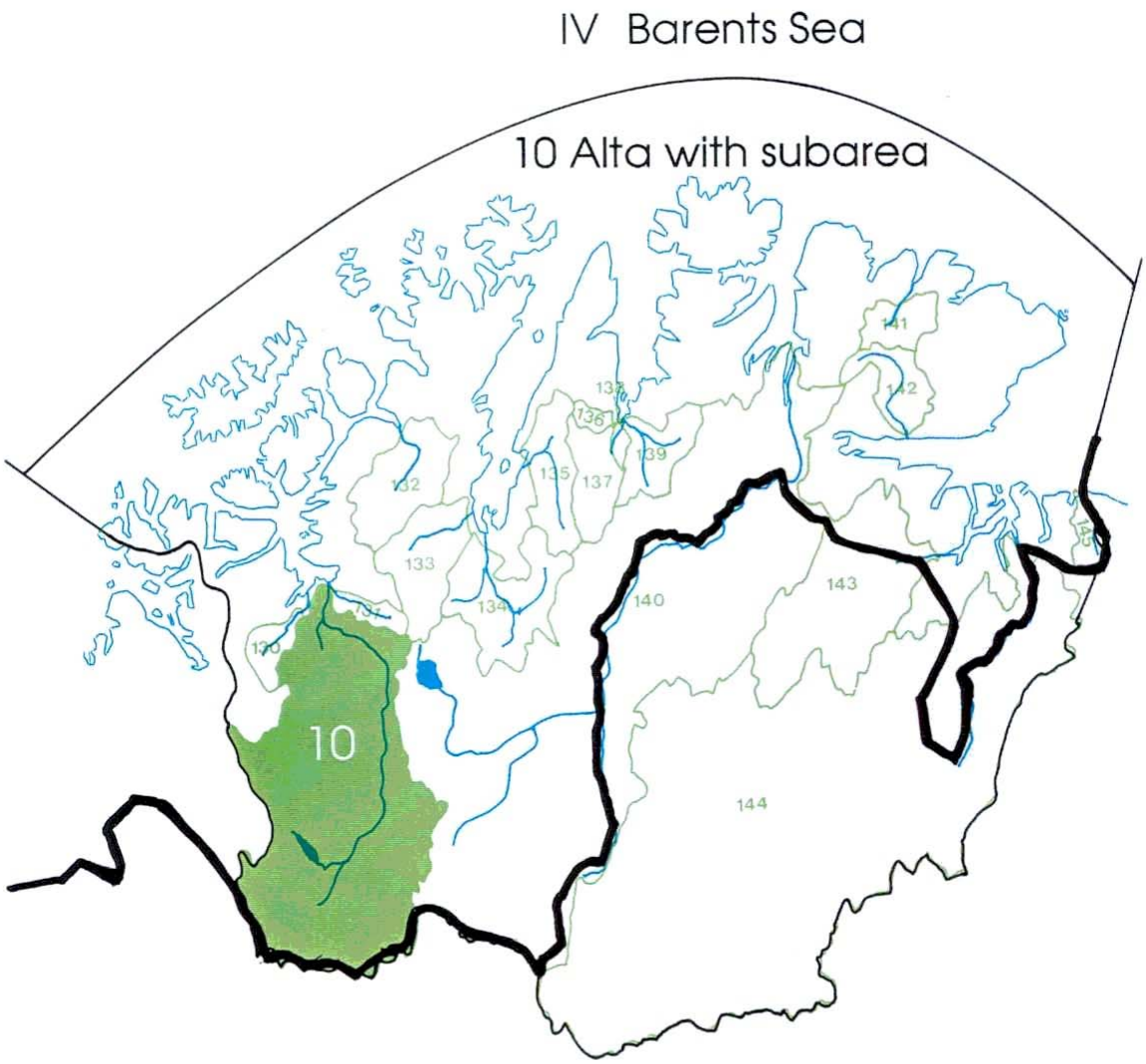


Fig. I.IV
Main Rivers and Tributaries draining to The Barents Sea.

Main Rivers

Tributaries

Areas not monitored

10 FINNMARK
130 Mattiselva, Kåfj./Altafj.
131 Tverrelva, Altafj.
132 Repparfjordelva, Repparfj.
133 Stabburselva, I. Porsangen V.
134 Lakselva, I. Porsangen S.
135 Børselva, I. Porsangen Ø.
136 Mattusjåkka, I. Laksefj. V.
137 Storelva, I. Laksefj. V.
138 Soussjåkka, I. Laksefj. V.
139 Adamselva, I. Laksefj. Ø.
140 Tanavassdr., Tanafj. S.
141 Vesterelva, Syltefj.
142 V. Jakobselv, Y. Varangerfj.
143 Neiden Munkfj./Varangerfj.
144 Passvikelva, Bøkfj./Varangerfj.
145 Grense Jakobselv, Varangerfj.

Source: NIVA

Appendix II. Sewage effluents from downstream areas of main and tributary rivers and rivers not monitored 2002

Table II	Sewage effluents from down stream areas of mainland Norway to convention waters 2002
Table II.I	Sewage effluents to the Skagerrak Region
Table II.II	Sewage effluents to the remaining North Sea
Table II.III	Sewage effluents to the Norwegian Sea
Table II.IV	Sewage effluents to the Barents Sea

Table II Sewage effluents from down stream areas of mainland Norway to convention waters 2002

Total quantity of substance discharge per year:

	I The Skagerrak Region	II The North Sea	III The Norwegian Sea	IV The Barents Sea	Sum	
S.P.M.						
TOC						
PO4-P	65	167	243	19	**494**	tonnes
Tot-P	108	278	405	32	**823**	tonnes
NO3-N	20	14	16	1.0	**51**	tonnes
NH4-N	3 142	2 200	2 417	182	**7 941**	tonnes
Tot-N	4 027	2 932	3 223	243	**10 425**	tonnes
SiO_2						
As						
Pb	605	335	452	45	**1 437**	kg
Cd	51	27	33	2.9	**114**	kg
Cu	5 691	4 198	6 416	666	**16 971**	kg
Cr	1 297	624	831	79	**2 831**	kg
Ni	2 136	933	971	81	**4 121**	kg
Zn	15 731	6 361	10 501	1 010	**33 603**	kg
Hg	19	9.8	13	1.1	**43**	kg
g-HCH						

Table II.I Sewage effluents to the Skagerrak Region 2002

Total quantity of substance discharge per year:

The Skagerrak region with sub-areas: (1) Glomma, (2) Drammenselva, (3) Numedalslågen, (4) Skienselva, (5) Otra.

	1	2	3	4	5	
S.P.M.						
TOC						
PO4-P	35	4.0	11	2.0	13	tonnes
Tot-P	58	7.0	18	4.0	21	tonnes
NO3-N	9.0	2.0	4.0	1.0	4.0	tonnes
NH4-N	1 546	270	580	214	532	tonnes
Tot-N	1 898	361	773	286	709	tonnes
SiO_2						
As						
Pb	293	28	166	28	90	kg
Cd	29	2.8	9.4	2.9	6.6	kg
Cu	2 979	317	827	307	1 261	kg
Cr	638	58	128	59	414	kg
Ni	1 264	91	327	95	359	kg
Zn	9 387	701	2 720	708	2 215	kg
Hg	10	1.0	4.4	1.0	2.7	kg
g-HCH						

Table II.II Sewage effluents to the remaining North Sea 2002

Total quantity of substance discharge per year:

The remaining North Sea Region with sub-areas:
(6) Orreelva, (7) Suldalslågen

	6	7	
S.P.M.			
TOC			
PO4-P	22	145	tonnes
Tot-P	36	242	tonnes
NO3-N	4.0	10	tonnes
NH4-N	633	1 567	tonnes
Tot-N	843	2 089	tonnes
SiO_2			
As			
Pb	104	231	kg
Cd	10	17	kg
Cu	926	3272	kg
Cr	200	424	kg
Ni	435	498	kg
Zn	1007	5354	kg
Hg	3.1	6.7	kg
g-HCH			

Table II.III Sewage effluents to the Norwegian Sea 2002

Total quantity of substance discharge per year:

The Norwegian Sea with sub-areas: (8) Orkla, (9) Vefsna

	8	9	
S.P.M.			
TOC			
PO4-P	146	97	tonnes
Tot-P	243	162	tonnes
NO3-N	9.0	7.0	tonnes
NH4-N	1 402	1 015	tonnes
Tot-N	1 870	1 353	tonnes
SiO_2			
As			
Pb	274	178	kg
Cd	21	12	kg
Cu	3825	2591	kg
Cr	510	321	kg
Ni	618	353	kg
Zn	6418	4083	kg
Hg	8.0	4.9	kg
g-HCH			

Table II.IV Sewage effluents to the Barents Sea 2002

Total quantity of substance discharge per year:

The Barents Sea with sub-area: (10) Alta

	10	
S.P.M.		
TOC		
PO4-P	19	tonnes
Tot-P	32	tonnes
NO3-N	1.0	tonnes
NH4-N	182	tonnes
Tot-N	243	tonnes
SiO_2		
As		
Pb	45	kg
Cd	2.9	kg
Cu	666	kg
Cr	79	kg
Ni	81	kg
Zn	1 010	kg
Hg	1.1	kg
g-HCH		

Appendix III. Industrial effluents from downstream areas of main and tributary rivers and rivers not monitored 2002

Table III	Industrial effluents from down stream areas of mainland Norway to convention waters 2002
Table III.I	Industrial effluents to the Skagerrak Region
Table III.II	Industrial effluents to the remaining North Sea
Table III.III	Industrial effluents to the Norwegian Sea
Table III.IV	Industrial effluents to the Barents Sea

Table III Industrial effluents from down stream areas of mainland Norway to convention waters 2002

Total quantity of substance discharged per year:

	I The Skagerrak Region	II The North Sea	III The Norwegian Sea	IV The Barents Sea	Sum	
SS	2 598	48 793	469 807	211 261	**732 459**	tonnes
TOC	84	155	23	-	**263**	tonnes
PO4-P	-	-	-	-	**-**	
Tot-P	80	54	74	0	**209**	tonnes
NO_3-N	-	-	-	-	**-**	
NH_4-N	-	-	-	-	**-**	
Tot-N	1 172	1 010	1 088	1.2	**3 271**	tonnes
SiO2	-	-	-	-	**-**	
As	292	198	564	-	**1 053**	kg
Pb	111	4 180	1 095	-	**5 386**	kg
Cd	11	113	19	-	**144**	kg
Cu	5 966	1 015	2 878	-	**9 858**	kg
Cr-tot	748	597	314	-	**1 659**	kg
Ni	1 719	9 230	1 630	-	**12 580**	kg
Zn	1 175	19 858	2 986	-	**24 019**	kg
Hg	1.5	4.8	0.42	-	**6.8**	kg

Table III.I Industrial effluents to the Skagerrak Region 2002

The Skagerrak Region with sub-areas: (1) Glomma, (2) Drammenselva, (3) Numedalslågen, (4) Skienselva, (5) Otra

Total quantity of substance discharged per year:

	1	2	3	4	5	
SS	898	144	976	446	133	tonnes
TOC	0.15	-	12	72	-	tonnes
PO_4-P						
Tot-P	27	21	21	10	1.6	tonnes
NO_3-N						
NH_4-N						
Tot-N	224	120	119	706	3.0	tonnes
SiO_2						
As	-	-	-	8.3	283	kg
Pb	43	-	30	0.44	38	kg
Cd	3.6	-	7.2	0.28	0.40	kg
Cu	5 217	0.70	2.9	63	682	kg
Cr-tot	514	0.12	4.0	75	155	kg
Ni	309	0.70	211	210	988	kg
Zn	809	0.26	78	44	243	kg
Hg	1.3	-	-	0.10	0.002	kg

Table III.II Industrial effluents to the remaining North Sea 2002

The remaining North Sea Region with sub-areas:
(6) Orreelva, (7) Suldalslågen

Total quantity of substance discharged per year:

	6	7	
SS	775	48018	tonnes
TOC	32	123	tonnes
PO_4-P			
Tot-P	3.4	51	tonnes
NO_3-N			
NH_4-N			
Tot-N	97	913	tonnes
SiO_2			
As	24	173	kg
Pb	15	4 165	kg
Cd	3.4	110	kg
Cu	66	948	kg
Cr-tot	29	568	kg
Ni	6 713	2 517	kg
Zn	425	19 433	kg
Hg	0.06	4.7	kg

Table III.III Industrial effluents to the Norwegian Sea 2002

The Norwegian Sea Region with sub-areas: (8) Orkla, (9) Vefsna

Total quantity of substance discharged per year:

	8	9	
SS	456 750	13 058	tonnes
TOC	23	0.45	tonnes
PO_4-P			
Tot-P	41	34	tonnes
NO_3-N			
NH_4-N			
Tot-N	406	683	tonnes
SiO_2			
As	0.10	564	kg
Pb	15	1 080	kg
Cd	1.2	18	kg
Cu	73	2 805	kg
Cr-tot	9.8	304	kg
Ni	9.4	1 621	kg
Zn	129	2 858	kg
Hg	0.29	0.13	kg

Table III.IV Industrial effluents to the Barents Sea 2002

The Barents Sea Region with sub-area: (10) Alta

Total quantity of substance discharged per year:

10

SS	21 1261	tonnes
TOC		
PO4-P		
Tot-P	0	tonnes
NO3-N		
NH4-N		
Tot-N	1.2	tonnes
SiO2		
As		
Pb		
Cd		
Cu		
Cr-tot		
Ni		
Zn		
Hg		

Appendix IV. Main riverine inputs 2002

Table IV.I	Main riverine inputs 2002	(1) Glomma
Table IV.II	Main riverine inputs 2002.	(2) Drammenselva
Table IV.III	Main riverine inputs 2002.	(3) Numedalslågen
Table IV.IV	Main riverine inputs 2002.	(4) Skienselva
Table IV.V	Main riverine inputs 2002.	(5) Otra
Table IV.VI	Main riverine inputs 2002.	(6) Orreelva
Table IV.VII	Main riverine inputs 2002.	(7) Suldalslågen
Table IV.VIII	Main riverine inputs 2002.	(8) Orkla
Table IV.IX	Main riverine inputs 2002.	(9) Vefsna
Table IV.X	Main riverine inputs 2002.	(10) Alta

Table IV.I Main riverine inputs 2002 (1) Glomma

Total volume: 59 467 486 m^3/d **Long term average flow (LTA): 61 350 000 m^3/d**
Minimum flow: 19 910 989 m^3/d **LTA period: 1961 to 1990**
Maximum flow: 171 234 503 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.		4.8	18	1.2	10.5 mg/l	133 653 tonnes	yes
TOC		4.2	18	2.8	6.1 mg/l	97 942 tonnes	yes
Orthoph.	*	4.28	18	<1	27 µg/l	149 tonnes	yes
	**	4.33	–	–	– µg/l	150 tonnes	–
Total P		30	18	10	83 µg/l	651 tonnes	yes
Nitrates		341	18	174	695 µg/l	7 525 tonnes	yes
Ammonia		22	18	4	44 µg/l	513 tonnes	yes
Total N		507	18	283	895 µg/l	11 507 tonnes	yes
Silicate SiO_2		3.82	18	1.84	6.43 mg/l	87 749 tonnes	yes
Arsenic		0.19	18	0.11	0.35 µg/l	4.5 tonnes	yes
Lead		0.38	18	0.057	0.88 µg/l	9.2 tonnes	yes
Cadmium	*	0.012	18	<0.01	0.022 µg/l	0.29 tonnes	yes
	**	0.014	–	–	– µg/l	0.33 tonnes	–
Copper		1.76	18	0.90	3.90 µg/l	42 tonnes	yes
Total Cr-T	*	0.27	18	0.076	0.80 µg/l	7.3 tonnes	yes
	**	0.28	–	–	– µg/l	7.4 tonnes	–
Nickel		0.82	18	0.40	1.60 µg/l	21 tonnes	yes
Zinc		4.23	18	1.20	8.10 µg/l	100 tonnes	yes
Mercury	*	24.9	18	<2	195 ng/l	523 kg	yes
	**	25.2	–	–	– ng/l	529 kg	–
Lindane		0.52	4	0.24	0.83 ng/l	13 kg	yes

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.II Main riverine inputs 2002 (2) Drammenselva

Total volume: 25 530 520 m^3/d **Long term average flow (LTA): 28 850 000 m^3/d**
Minimum flow: 5 234 675 m^3/d **LTA period: 1961 to 1990**
Maximum flow: 64 285 483 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.		1.7	17	0.6	4.2 mg/l	15 722 tonnes	yes
TOC		3.3	17	2.5	3.9 mg/l	30 304 tonnes	yes
Orthoph.	*	4.00	17	<1	22 µg/l	49 tonnes	yes
	**	4.06	–	–	– µg/l	50 tonnes	–
Total P		21	17	8	59 µg/l	234 tonnes	yes
Nitrates		240	17	135	397 µg/l	2 290 tonnes	yes
Ammonia		27	17	8	49 µg/l	257 tonnes	yes
Total N		405	17	315	571 µg/l	3 825 tonnes	yes
SiO_2		2.56	17	1.65	4.07 mg/l	24 240 tonnes	yes
Arsenic		0.14	17	0.097	0.24 µg/l	1.3 tonnes	yes
Lead	*	0.083	17	<0.02	0.34 µg/l	0.73 tonnes	yes
	**	0.084	–	–	– µg/l	0.74 tonnes	–
Cadmium	*	0.006	17	<0.010	0.029 µg/l	0.05 tonnes	no
	**	0.012	–	–	– µg/l	0.11 tonnes	–
Copper		1.02	17	0.50	3.00 µg/l	11 tonnes	yes
Total Cr-T	*	0.11	17	0.064	0.24 µg/l	1.1 tonnes	yes
	**	0.12	–	–	– µg/l	1.2 tonnes	–
Nickel		0.53	17	0.31	0.97 µg/l	5.1 tonnes	yes
Zinc	*	2.95	17	<0.50	13 µg/l	26.3 tonnes	yes
	**	2.98	–	–	– µg/l	26.5 tonnes	–
Mercury	*	13.5	17	<2	48 ng/l	113 kg	yes
	**	13.8	–	–	– ng/l	118 kg	–
Lindane		0.47	4	0.20	0.61 ng/l	4.4 kg	yes

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.III Main riverine inputs 2002 (3) Numedalslågen

Total volume: 8 748 509 m^3/d **Long term average flow (LTA): 10 200 000 m^3/d**
Minimum flow: 3 828 366 m^3/d **LTA period: 1961 to 1990**
Maximum flow: 41 792 159 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.		3.3	12	0.9	8.5 mg/l	11 225 tonnes	yes
TOC		3.4	12	2.4	6.6 mg/l	11 815 tonnes	yes
Orthoph.	*	4.83	12	<1.0	13 µg/l	14.9 tonnes	yes
	**	4.92	–	–	– µg/l	15.2 tonnes	–
Total P		26	12	6	56 µg/l	82 tonnes	yes
Nitrates		201	12	76	553 µg/l	639 tonnes	yes
Ammonia		30	12	8	58 µg/l	84 tonnes	yes
Total N		357	12	220	812 µg/l	1 121 tonnes	yes
SiO_2		2.81	12	1.33	4.29 mg/l	9 251 tonnes	yes
Arsenic		0.14	12	0.075	0.35 µg/l	0.46 tonnes	yes
Lead		0.16	12	0.067	0.49 µg/l	0.52 tonnes	yes
Cadmium	*	0.009	12	<0.01	0.023 µg/l	0.03 tonnes	no
	**	0.013	–	–	– µg/l	0.04 tonnes	–
Copper		0.72	12	0.37	1.20 µg/l	2.4 tonnes	yes
Total Cr-T	*	0.11	12	<0.05	0.32 µg/l	0.42 tonnes	yes
	**	0.13	–	–	– µg/l	0.45 tonnes	–
Nickel		0.37	12	0.24	0.67 µg/l	1.3 tonnes	yes
Zinc	*	2.77	12	<0.50	8.0 µg/l	9.1 tonnes	yes
	**	2.81	–	–	– µg/l	9.2 tonnes	–
Mercury	*	10.6	12	<2	38 ng/l	35 kg	yes
	**	11.1	–	–	– ng/l	37 kg	–
Lindane		0.29	4	0.14	0.44 ng/l	0.92 kg	yes

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.IV Main riverine inputs 2002 (4) Skienselva

Total volum: 23 545 303 m^3/d **Long term average flow (LTA): 23 535 000 m^3/d**
Minimum flow: 6 493 751 m^3/d **LTA period: 1961 to 1990**
Maximum flow: 66 954 205 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.		0.8	12	0.6	1.1 mg/l	6 609 tonnes	yes
TOC		2.4	12	2.2	2.6 mg/l	20 872 tonnes	yes
Orthoph.	*	3.17	12	<1.0	8 µg/l	29.5 tonnes	yes
	**	3.25	–	–	– µg/l	30.0 tonnes	–
Total P		12	12	3	22 µg/l	113 tonnes	yes
Nitrates		190	12	104	293 µg/l	1 719 tonnes	yes
Ammonia		14	12	4	26 µg/l	108 tonnes	yes
Total N		274	12	210	356 µg/l	2 389 tonnes	yes
SiO_2	*	1.69	12	<1.07	2.36 mg/l	15 299 tonnes	yes
	**	1.78	–	–	– mg/l	16 005 tonnes	–
Arsenic		0.09	12	0.065	0.11 µg/l	0.79 tonnes	yes
Lead	*	0.057	12	<0.02	0.23 µg/l	0.41 tonnes	yes
	**	0.065	–	–	– µg/l	0.48 tonnes	–
Cadmium	*	0.029	12	<0.01	0.21 µg/l	0.21 tonnes	yes
	**	0.030	–	–	– µg/l	0.22 tonnes	–
Copper		0.63	12	0.32	2.40 µg/l	6.3 tonnes	yes
Total Cr-T	*	0.05	12	<0.05	0.20 µg/l	0.39 tonnes	no
	**	0.08	–	–	– µg/l	0.68 tonnes	–
Nickel	*	0.27	12	0.17	0.57 µg/l	2.4 tonnes	yes
	**	0.29	–	–	– µg/l	2.5 tonnes	–
Zinc	*	2.13	12	<0.5	3.50 µg/l	19.6 tonnes	yes
	**	2.18	–	–	– µg/l	19.7 tonnes	–
Mercury	*	16.8	12	<2	75 ng/l	177 kg	yes
	**	16.9	–	–	– ng/l	179 kg	–
Lindane		0.64	4	0.37	0.96 ng/l	5.1 kg	yes

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.V Main riverine inputs 2002 (5) Otra

Total volume: 11 280 596 m^3/d **Long term average flow (LTA): 12 870 000 m^3/d**
Minimum flow: 4 772 578 m^3/d **LTA period: 1961 to 1990**
Maximum flow: 30 202 896 m^3/d

		Mean	Number of meas-urements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.	*	0.6	12	<0.6	1.3 mg/l	2 507 tonnes	no
	**	0.8	–	–	– mg/l	3 351 tonnes	–
TOC		2.4	12	1.7	4.7 mg/l	10 181 tonnes	yes
Orthoph.	*	2.92	12	<1	9 µg/l	11 tonnes	yes
	**	3.08	–	–	– µg/l	12 tonnes	–
Total P		13	12	5	24 µg/l	51 tonnes	yes
Nitrates		131	12	63	227 µg/l	586 tonnes	yes
Ammonia		13	12	3	25 µg/l	56 tonnes	yes
Total N		223	12	132	313 µg/l	948 tonnes	yes
SiO_2		1.39	12	0.77	1.99 mg/l	6 070 tonnes	yes
Arsenic		0.11	12	0.071	0.15 µg/l	0.44 tonnes	yes
Lead		0.21	12	0.11	0.41 µg/l	0.87 tonnes	yes
Cadmium		0.021	12	0.014	0.036 µg/l	0.09 tonnes	yes
Copper		0.38	12	0.16	0.92 µg/l	1.5 tonnes	yes
Total Cr-T	*	0.06	12	<0.05	0.20 µg/l	0.24 tonnes	yes
	**	0.08	–	–	– µg/l	0.36 tonnes	–
Nickel		0.45	12	0.25	0.70 µg/l	1.9 tonnes	yes
Zinc		3.08	12	1.90	5.50 µg/l	13 tonnes	yes
Mercury	*	1.1	12	<2	7 ng/l	4.9 kg	no
	**	2.6	–	–	– ng/l	10.8 kg	–
Lindane		0.42	4	0.25	0.54 ng/l	1.6 kg	yes

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.VI Main riverine inputs 2002 (6) Orreelva

Total volume: 275 520 m^3/d **Long term average flow (LTA):** 335 000 m^3/d
Minimum flow: 65 520 m^3/d **LTA period:** 1961 to 1990
Maximum flow: 1 179 360 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.		10.7	12	3.8	28.8 mg/l	1 340 tonnes	yes
TOC		7.3	12	4.9	13 mg/l	662 tonnes	yes
Orthoph.	*	4.08	12	<1	10 µg/l	0.59 tonnes	yes
	**	4.17	–	–	– µg/l	0.60 tonnes	–
Total P		86	12	36	182 µg/l	9.3 tonnes	yes
Nitrates		669	12	4	1560 µg/l	100 tonnes	yes
Ammonia		27	12	3	153 µg/l	1.3 tonnes	yes
Total N		1393	12	756	2420 µg/l	172 tonnes	yes
SiO_2	*	1.81	12	0.86	5.36 mg/l	136 tonnes	yes
	**	2.08	–	–	– mg/l	172 tonnes	–
Arsenic		0.30	12	0.11	0.65 µg/l	0.029 tonnes	yes
Lead	*	0.28	12	<0.02	1.20 µg/l	0.044 tonnes	yes
	**	0.28	–	–	– µg/l	0.044 tonnes	–
Cadmium	*	0.007	12	0.0052	0.049 µg/l	0.0011 tonnes	no
	**	0.014	–	–	– µg/l	0.0016 tonnes	–
Copper		1.11	12	0.68	2.10 µg/l	0.14 tonnes	yes
Total Cr-T	*	0.13	12	0.056	0.36 µg/l	0.017 tonnes	yes
	**	0.15	–	–	– µg/l	0.019 tonnes	–
Nickel		1.12	12	0.7	1.90 µg/l	0.13 tonnes	yes
Zinc	*	4.28	12	0.71	26 µg/l	0.49 tonnes	yes
	**	4.36	–	–	– µg/l	0.50 tonnes	–
Mercury	*	1.0	12	<2	7 ng/l	0.07 kg	no
	**	2.7	–	–	– ng/l	0.25 kg	–
Lindane	*	0.32	4	<0.10	0.83 ng/l	0.026 kg	yes
	**	0.34	–	–	– ng/l	0.029 kg	–

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.VII Main riverine inputs 2002 (7) Suldalslågen

Total volume: 3 700 512 m^3/d **Long term average flow (LTA): 7 420 000 m^3/d**
Minimum flow: 1 160 352 m^3/d **LTA period: 1961 to 1990**
Maximum flow: 18 863 712 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.	*	0.44	12	0.5	2.9 mg/l	742 tonnes	no
	**	0.79	–	–	– mg/l	1 088 tonnes	–
TOC		0.88	12	0.4	1.7 mg/l	1 242 tonnes	yes
Orthoph.	*	5.00	12	<1	14 µg/l	7.5 tonnes	yes
	**	5.08	–	–	– µg/l	7.7 tonnes	–
Total P	*	13.6	12	<2	31 µg/l	16.9 tonnes	yes
	**	13.8	–	–	– µg/l	17.2 tonnes	–
Nitrates		196	12	125	276 µg/l	241 tonnes	yes
Ammonia	*	5.2	12	<2	11 µg/l	5.6 tonnes	yes
	**	5.5	–	–	– µg/l	6.3 tonnes	–
Total N		232	12	164	350 µg/l	296 tonnes	yes
SiO_2	*	0.66	12	<0.21	1.33 mg/l	867 tonnes	no
	**	0.94	–	–	– mg/l	1 216 tonnes	–
Arsenic	*	0.06	12	<0.05	0.13 µg/l	0.070 tonnes	yes
	**	0.07	–	–	– µg/l	0.087 tonnes	–
Lead	*	0.083	12	<0.02	0.21 µg/l	0.137 tonnes	yes
	**	0.085	–	–	– µg/l	0.140 tonnes	–
Cadmium	*	0.0135	12	<0.010	0.028 µg/l	0.019 tonnes	yes
	**	0.0143	–	–	– µg/l	0.021 tonnes	–
Copper	*	0.28	12	<0.05	0.88 µg/l	0.40 tonnes	yes
	**	0.29	–	–	– µg/l	0.41 tonnes	–
Total Cr-T	*	0.17	12	0.041	1.90 µg/l	0.35 tonnes	no
	**	0.22	–	–	– µg/l	0.41 tonnes	–
Nickel	*	0.16	12	<0.20	0.48 µg/l	0.23 tonnes	no
	**	0.24	–	–	– µg/l	0.32 tonnes	–
Zinc		1.78	12	1.1	3.7 µg/l	2.5 tonnes	yes
Mercury	*	11.3	12	<2	126 ng/l	23 kg	no
	**	12.8	–	–	– ng/l	25 kg	–
Lindane		0.51	3	0.24	0.75 ng/l	0.80 kg	yes

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.VIII Main riverine inputs 2002 (8) Orkla

Total volume: 4 292 233 m^3/d **Long term average flow (LTA): 5 710 000 m^3/d**
Minimum flow: 1 099 592 m^3/d **LTA period: 1961 to 1990**
Maximum flow: 26 267 538 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.	*	1.14	12	<0.60	2.2 mg/l	2 295 tonnes	yes
	**	1.19	–	–	– mg/l	2 335 tonnes	–
TOC		2.76	12	1.7	4.4 mg/l	5 228 tonnes	yes
Orthoph.	*	9.50	12	<1	56 µg/l	13.6 tonnes	yes
	**	9.75	–	–	– µg/l	13.9 tonnes	–
Total P	*	21.8	12	2	72 µg/l	36.7 tonnes	yes
	**	22.3	–	–	– µg/l	36.9 tonnes	–
Nitrates		188	12	112	400 µg/l	300 tonnes	yes
Ammonia		10	12	2	23 µg/l	13 tonnes	yes
Total N		295	12	235	533 µg/l	473 tonnes	yes
SiO_2		2.43	12	1.48	4.29 mg/l	3 856 tonnes	yes
Arsenic	*	0.098	12	<0.05	0.16 µg/l	0.159 tonnes	yes
	**	0.103	–	–	– µg/l	0.163 tonnes	–
Lead	*	0.10	12	<0.02	0.43 µg/l	0.129 tonnes	yes
	**	0.11	–	–	– µg/l	0.133 tonnes	–
Cadmium		0.050	12	0.026	0.099 µg/l	0.08 tonnes	yes
Copper		7.38	12	2.8	14 µg/l	13 tonnes	yes
Total Cr-T	*	0.15	12	0.059	0.36 µg/l	0.34 tonnes	yes
	**	0.17	–	–	– µg/l	0.36 tonnes	–
Nickel		0.95	12	0.45	1.70 µg/l	1.6 tonnes	yes
Zinc		20	12	9.3	40 µg/l	35 tonnes	yes
Mercury	*	12.6	12	<2	72 ng/l	13 kg	yes
	**	12.9	–	–	– ng/l	14 kg	–
Lindane	*	0.09	4	<0.10	0.37 ng/l	0.12 kg	no
	**	0.17	–	–	– ng/l	0.24 kg	–

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.IX Main riverine inputs 2002 (9) Vefsna

Total volume: 13 504 404 m^3/d **Long term average flow (LTA):** 15 655 000 m^3/d
Minimum flow: 2 132 570 m^3/d **LTA period:** 1961 to 1990
Maximum flow: 100 484 907 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.	*	1.08	5	<0.6	3.80 mg/l	5 640 tonnes	no
	**	1.32	–	–	– mg/l	6 565 tonnes	–
TOC		1.14	5	0.60	1.70 mg/l	5 609 tonnes	yes
Orthoph.		4.0	5	1	7 µg/l	21 tonnes	yes
Total P		16	5	8	29 µg/l	82 tonnes	yes
Nitrates		107	5	32	182 µg/l	467 tonnes	yes
Ammonia	*	3.6	5	<2	10 µg/l	14 tonnes	yes
	**	4.0	–	–	– µg/l	17 tonnes	–
Total N		146	5	78	205 µg/l	668 tonnes	yes
SiO_2		1.50	5	0.88	1.99 mg/l	6 892 tonnes	yes
Arsenic		0.11	5	0.06	0.14 µg/l	0.58 tonnes	yes
Lead	*	0.060	5	<0.02	0.13 µg/l	0.35 tonnes	yes
	**	0.064	–	–	– µg/l	0.36 tonnes	–
Cadmium	*	0.000	5	<0.01	<0.01 µg/l	0.000 tonnes	no
	**	0.010	–	–	– µg/l	0.049 tonnes	–
Copper		0.29	5	0.14	0.51 µg/l	1.5 tonnes	yes
Total Cr-T	*	0.07	5	0.062	0.20 µg/l	0.38 tonnes	yes
	**	0.11	–	–	– µg/l	0.51 tonnes	–
Nickel	*	0.25	5	0.092	0.60 µg/l	0.99 tonnes	no
	**	0.33	–	–	– µg/l	1.47 tonnes	–
Zinc	*	0.32	5	<0.5	1.6 µg/l	1.5 tonnes	no
	**	0.72	–	–	– µg/l	3.5 tonnes	–
Mercury	*	5.3	4	<2	18 ng/l	32 kg	no
	**	6.3	–	–	– ng/l	36 kg	–
Lindane	*	0.05	2	<0.1	0.10 ng/l	0.29 kg	no
	**	0.10	–	–	– ng/l	0.49 kg	–

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Table IV.X Main riverine inputs 2002 (10) Alta

Total volume: 6 466 415 m^3/d **Long term average flow (LTA): 7 495 000 m^3/d**
Minimum flow: 1 814 921 m^3/d **LTA period: 1961 to 1990**
Maximum flow: 44 523 949 m^3/d

		Mean	Number of measurements	Minimum concentration during the year	Maximum concentration during the year	Total quantity of substance discharge each year	Where 70% of the measurement above limit of detection?
S.P.M.	*	0.87	12	<0.6	3.60 mg/l	4 744 tonnes	yes
	**	1.02	–	–	– mg/l	4 868 tonnes	–
TOC		3.2	12	2.5	5.0 mg/l	9 358 tonnes	yes
Orthoph.		13.1	12	1	66 µg/l	21 tonnes	yes
Total P		24	12	4	84 µg/l	60 tonnes	yes
Nitrates		70	12	12	130 µg/l	136 tonnes	yes
Ammonia		5	12	2	11 µg/l	10 tonnes	yes
Total N		188	12	135	331 µg/l	567 tonnes	yes
SiO_2		4.78	12	3.00	7.29 mg/l	10 481 tonnes	yes
Arsenic		0.27	12	0.13	0.79 µg/l	0.75 tonnes	yes
Lead	*	0.070	12	0.013	0.26 µg/l	0.32 tonnes	yes
	**	0.075	–	–	– µg/l	0.33 tonnes	–
Cadmium	*	0.001	12	<0.01	0.014 µg/l	0.001 tonnes	no
	**	0.010	–	–	– µg/l	0.024 tonnes	–
Copper		0.63	12	0.26	2.40 µg/l	3.1 tonnes	yes
Total Cr-T	*	0.27	12	0.079	1.70 µg/l	1.90 tonnes	yes
	**	0.30	–	–	– µg/l	1.93 tonnes	–
Nickel	*	0.59	12	<0.20	3.40 µg/l	3.81 tonnes	yes
	**	0.60	–	–	– µg/l	3.83 tonnes	–
Zinc	*	0.47	12	<0.10	2.60 µg/l	3.1 tonnes	no
	**	0.69	–	–	– µg/l	3.3 tonnes	–
Mercury	*	40.3	12	<2	270 ng/l	41 kg	yes
	**	40.8	–	–	– ng/l	42 kg	–
Lindane	*	0.14	4	<0.10	0.39 ng/l	0.36 kg	no
	**	0.19	–	–	– ng/l	0.45 kg	–

Measurements below detection limits are treated in two ways
* Detection limit = zero, ** Detection limit = limit

Appendix V. Input from the tributary rivers 2002

Table V.I	Tributary rivers in the sub-areas (1-5).	The Skagerrak region
Table V.II	Tributary rivers in the sub-areas (6-7).	Remaining North Sea
Table V.III	Tributary rivers in the sub-areas (8-9).	The Norwegian Sea
Table V.IV	Tributary rivers in the sub-area (10).	The Barents Sea

Table V.I. Inputs from tributary rivers in the Skagerrak Region 2002

The Skagerrak Region with sub-areas:
(1A) Glomma, (1B) Inner Oslofjord, (2) Drammenselva,
(3) Numedalslågen, (4) Skienselva, (5) Otra

Total quantity of substances discharged per year:

		1A	1B	2	3	4	5		Where 70% of the measurement above limit of detection?
S.P.M.		4 188	2 036	2 278	1 805	1 514	14 798	tonnes	yes
TOC		9 683	3 266	685	3 246	5 552	68 599	tonnes	yes
Orthoph.		4.3	8.1	2.4	1.4	2.0	36	tonnes	yes
Total P		43	28	8.0	14	17	315	tonnes	yes
Nitrates		329	410	91	281	156	2 323	tonnes	yes
Ammonia	*	9.7	35	4.8	9.3	0.0	98	tonnes	yes
	**	9.7	35	4.8	9.3	1.0	103		
Total N		724	612	117	454	343	4 071	tonnes	yes
Silicate SiO_2		2 985	2 615	913	1 984	2 379	16 260	tonnes	yes
Arsenic		0.41	0.26	0.07	0.45	0.20	3.3	tonnes	yes
Lead		0.34	0.26	0.048	0.13	0.31	6.9	tonnes	yes
Cadmium	*	0.023	0.014	0.003	0.024	0.036	0.42	tonnes	yes
	**	0.023	0.015	0.003	0.024	0.036	0.42		
Copper	*	1.3	1.1	0.18	0.82	0.26	3.8	tonnes	yes
	**	1.3	1.1	0.18	0.82	0.26	4.3		
Total Cr-T		0.27	0.17	0.06	0.09	0.12	1.4	tonnes	yes
Nickel	*	0.83	0.67	0.11	0.51	0.40	2.9	tonnes	yes
	**	0.83	0.67	0.11	0.51	0.40	4.4		
Zinc		2.5	1.7	0.65	5.4	5.2	60	tonnes	yes
Mercury	*	0.75	3.3	1.3	7.3	0.0	7.1	kg	yes
	**	2.3	3.4	1.3	7.3	2.0	36		
Lindane									

Measurements below detection limits are treated in two ways:
* Detection limit = zero, ** Detection limit = limit

Table V.II. Inputs from tributary rivers in the remaining North Sea 2002

The remaining North Sea Region with sub-areas: (6) Orreelva, (7) Suldalslågen

Total quantity of substances discharged per year:

		6	7		Where 70% of the measurement above limit of detection?
S.P.M.	*	2 881	57 949	tonnes	no
	**	6 511	62 109		
TOC		16 581	23 594	tonnes	yes
Orthoph.	*	83	66	tonnes	yes
	**	83	78		
Total P		231	405	tonnes	yes
Nitrates		2 162	2 643	tonnes	yes
Ammonia	*	96	121	tonnes	yes
	**	101	130		
Total N		3 286	4 990	tonnes	yes
Silicate SiO_2		10 215	26 963	tonnes	yes
Arsenic	*	0.74	0.53	tonnes	no
	**	0.76	1.6		
Lead		2.7	4.6	tonnes	yes
Cadmium	*	0.16	0.19	tonnes	no
	**	0.16	0.35		
Copper		2.5	11	tonnes	yes
Total Cr-T	*	0.65	2.3	tonnes	no
	**	0.69	2.9		
Nickel	*	0.75	2.4	tonnes	no
	**	2.2	6.5		
Zinc	*	28	33	tonnes	yes
	**	28	35		
Mercury	*	16	82	kg	no
	**	23	101		
Lindane					

Measurements below detection limits are treated in two ways:
* Detection limit = zero, ** Detection limit = limit

Table V.III. Inputs from tributary rivers in the Norwegian Sea 2002

The Norwegian Sea Region with sub-areas: (8) Orkla, (9) Vefsna

Total quantity of substances discharged per year:

		8	9		Where 70% of the measurement above limit of detection?
S.P.M.	*	233 909	42 130	tonnes	yes
	**	235 506	48 811		
TOC		90 542	30 071	tonnes	yes
Orthoph.	*	158	71	tonnes	yes
	**	167	77		
Total P	*	661	380	tonnes	yes
	**	665	380		
Nitrates		1 465	1 019	tonnes	yes
Ammonia	*	930	275	tonnes	yes
	**	932	287		
Total N		5 870	2 703	tonnes	yes
Silicate SiO_2		31 197	37 391	tonnes	yes
Arsenic	*	2.1	2.5	tonnes	yes
	**	2.5	2.7		
Lead		4.4	3.9	tonnes	yes
Cadmium	*	0.22	0.18	tonnes	no
	**	0.30	0.36		
Copper		21	12	tonnes	yes
Total Cr-T	*	4.4	2.2	tonnes	yes
	**	4.7	2.6		
Nickel	*	14	15	tonnes	yes
	**	15	16		
Zinc	*	30	17	tonnes	no
	**	33	24		
Mercury	*	75	315	kg	yes
	**	88	346		
Lindane					

Measurements below detection limits are treated in two ways:
* Detection limit = zero, ** Detection limit = limit

Table V.IV. Inputs from tributary rivers in the Barents Sea 2002

The Barents Sea Region with sub-area: (10) Alta

Total quantity of substances discharged per year:

		10		Where 70% of the measurement above limit of detection?
S.P.M.	*	21 578	tonnes	no
	**	23 291		
TOC		76 712	tonnes	yes
Orthoph.	*	41	tonnes	no
	**	47		
Total P		134	tonnes	yes
Nitrates	*	111	tonnes	yes
	**	113		
Ammonia		198	tonnes	yes
Total N		3 568	tonnes	yes
Silicate SiO_2		61 246	tonnes	yes
Arsenic	*	1.9	tonnes	no
	**	2.0		
Lead	*	0.33	tonnes	no
	**	0.60		
Cadmium	*	0.01	tonnes	no
	**	0.20		
Copper		17	tonnes	yes
Total Cr-T	*	6.2	tonnes	no
	**	7.3		
Nickel		41	tonnes	yes
Zinc	*	68	tonnes	yes
	**	69		
Mercury	*	87	kg	yes
	**	90		
Lindane				

Measurements below detection limits are treated in two ways:
* Detection limit = zero, ** Detection limit = limit

Appendix VI. Other inputs 2002

Table VI Nutrients from "Down Stream Areas of main and tributary rivers and rivers not monitored 2002. Direct run-off P and N.

Table VI Nutrients from "Down Stream Areas" of main and tributary rivers and rivers not monitored 2002. Direct run-off of P and N.

Sub-areas:		Background tonnes	Agriculture Area tonnes	Sum tonnes	
1 Glomma	P	18.4	15.0	33.4	
	N	463.1	485.3	948.3	
	PO_4-P	3.7	4.5	8.2	
	NO_3-N	277.8	339.7	617.5	
	NH_4-N	23.2	34.0	57.1	
1 Inner Oslofjord	P	3.4	3.3	6.7	
	N	72.8	107.3	180.1	
	PO_4-P	0.7	1.0	1.7	
	NO_3-N	43.7	75.1	118.8	
	NH_4-N	3.6	7.5	11.2	
2 Drammenselva	P	1.4	2.4	3.8	
	N	64.0	93.0	156.9	
	PO_4-P	0.3	0.7	1.0	
	NO_3-N	38.4	65.1	103.5	
	NH_4-N	3.2	6.5	9.7	
3 Numedalslågen	P	4.9	17.9	22.7	
	N	184.7	577.0	761.7	
	PO_4-P	1.0	5.4	6.3	
	NO_3-N	110.8	403.9	514.7	
	NH_4-N	9.2	40.4	49.6	
4 Skienselva	P	6.8	2.6	9.4	
	N	331.3	100.0	431.3	
	PO_4-P	1.4	0.8	2.1	
	NO_3-N	198.8	70.0	268.7	
	NH_4-N	16.6	7.0	23.6	
5 Otra	P	7.0	3.4	10.4	
	N	391.8	122.1	513.9	
	PO_4-P	1.4	1.0	2.4	
	NO_3-N	235.1	85.5	320.5	
	NH_4-N	19.6	8.5	28.1	
6 Orreelva	P	22.8	42.3	65.2	
	N	1 463.8	1 638.4	3 102.2	
	PO_4-P	4.6	12.7	17.3	
	NO_3-N	878.3	1 146.9	2 025.2	
	NH_4-N	73.2	114.7	187.9	
7 Suldalslågen	P	58.0	104.6	162.6	
	N	5 151.3	3 317.5	8 468.8	
	PO_4-P	11.6	31.4	43.0	
	NO_3-N	3 090.8	2 322.3	5 413.1	
	NH_4-N	257.6	232.2	489.8	
8 Orkla	P	142.1	210.4	352.4	
	N	3 714.3	6 508.4	10 222.7	
	PO_4-P	28.4	63.1	91.5	
	NO_3-N	2 228.6	4 555.9	6 784.5	
	NH_4-N	185.7	455.6	641.3	
9 Vefsna	P	83.6	78.4	162.0	
	N	1 920.5	1 453.4	3 373.8	
	PO_4-P	16.7	23.5	40.2	
	NO_3-N	1 152.3	1 017.4	2 169.6	
	NH_4-N	96.0	101.7	197.8	
10 Alta	P	86.1	2.2	88.4	
	N	1 618.3	82.4	1 700.7	
	PO_4-P	17.2	0.7	17.9	
	NO_3-N	9 71.0	57.7	1 028.7	
	NH_4-N	80.9	5.8	86.7	
SUM	**P**			**917**	**tonnes**
SUM	**N**			**29 861**	**tonnes**
SUM	**PO_4-P**			**232**	**tonnes**
SUM	**NO_3-N**			**19 365**	**tonnes**
SUM	**NH_4-N**			**1 783**	**tonnes**

Appendix VII. Main rivers 1-10. Measured concentrations 2002

Table VII.I	(1)	Glomma
Table VII.II	(2)	Drammenselva
Table VII.III	(3)	Numedalslågen
Table VII.IV	(4)	Skienselva
Table VII.V	(5)	Otra
Table VII.VI	(6)	Orreelva
Table VII.VII	(7)	Suldalslågen
Table VII.VIII	(8)	Orkla
Table VII.IX	(9)	Vefsna
Table VII.X	(10)	Alta

Table VII.I Measured concentrations 2002 – Watercourse: Glomma

Annual flow: **21 706 10^6 m^3** **Min:** **230 m^3/s**
Drainage area: **41 218 km^2** **Max:** **1 982 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-01-06	410	4.80	1.2	3.2	2	37	369	36	483	3.86	0.14	0.21	<0.01	0.93	<0.2	0.60	2.80	19	
2002-01-27	435	5.00	5.3	4.2	5	43	432	42	564	5.14	0.19	0.60	0.011	1.50	0.35	0.90	4.70	13	
2002-02-23	512	4.64	8.5	4.3	4	27	385	41	603	6.00	0.15	0.25	0.011	1.30	0.23	0.75	3.50	<2	
2002-03-24	483	5.02	9.1	4.2	6	33	420	40	594	5.57	0.28	0.67	0.016	3.90	0.80	1.30	6.00	44	0.33
2002-04-28	1 127	4.30	7.1	5.9	27	32	345	30	550	4.93	0.17	0.25	0.015	1.50	0.31	1.10	4.10	30	
2002-05-05	1 625	3.72	6.5	6.1	4	27	305	31	492	4.50	0.21	0.47	0.022	2.20	0.31	1.10	5.00	<2	
2002-05-15	1 370	3.70	2.3	5.6	1	83	228	7	409	3.64	0.11	0.22	0.012	1.90	0.13	0.56	4.20	3	
2002-05-21	1 212	3.60	3.7	4.0	<1	45	186	6	342	3.00	0.20	0.54	0.016	2.70	0.19	0.71	8.10	195	
2002-05-26	1 221	3.80	2.3	3.8	3	28	222	11	364	2.79	0.14	0.16	<0.01	2.00	0.09	0.54	5.50	32	
2002-06-02	1 912	4.60	8.5	4.4	4	22	695	23	895	3.64	0.23	0.48	0.015	2.20	0.23	0.80	4.30	2	
2002-06-09	1 391	4.00	3.8	3.9	1	15	331	4	496	6.43	0.20	0.88	0.017	1.70	0.47	0.96	4.70	14	
2002-06-19	1 229	4.20	4.1	2.9	2	26	323	13	457	2.57	0.12	0.06	0.015	1.20	0.08	0.62	3.10	4	
2002-06-26	947	4.20	2.9	3.3	2	22	330	5	442	2.57	0.14	0.21	0.011	1.10	0.11	0.42	2.70	2	0.83
2002-07-28	1 244	4.41	10.5	4.9	5	28	265	18	496	3.43	0.35	0.79	0.021	2.60	0.58	1.60	6.60	24	
2002-09-04	410	4.06	2.1	3.6	2	17	174	10	283	1.84	0.18	0.21	0.011	1.30	0.16	0.63	1.80	28	0.68
2002-09-25	384	4.53	2.1	2.8	2	13	260	15	427	1.91	0.14	0.38	<0.01	0.92	0.08	0.40	1.20	20	
2002-10-30	435	4.70	4.9	4.1	5	32	478	23	665	3.43	0.22	0.31	<0.01	1.80	0.32	1.00	3.70	11	0.24
2002-11-27	384	4.90	2.2	3.6	2	10	385	44	560	3.43	0.19	0.16	0.014	0.90	0.45	0.75	4.10	8	
Min.:	384	3.60	1.2	2.8	< 1	10	174	4	283	1.84	0.11	0.06	<0.01	0.90	0.08	0.40	1.20	<2	0.24
Max.:	1 912	5.02	10.5	6.1	27	83	695	44	895	6.43	0.35	0.88	0.022	3.90	0.80	1.60	8.10	195	0.83
Aver.:	930	4.34	4.8	4.2	4	30	341	22	507	3.82	0.19	0.38	0.014	1.76	0.28	0.82	4.23	25	0.52
St.dev.:	500	0.46	2.9	1.0	6	16	123	14	138	1.35	0.06	0.24	0.004	0.77	0.19	0.31	1.68	44	0.28
Numb.:	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	4

Table VII.II Measured concentrations 2002 – Watercourse: Drammenselva

Annual flow: 9 319 10^6 m^3 **Min:** 61 m^3/s
Drainage area: 17 028 km^2 **Max:** 744 m^3/s

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-01-28	298	3.45	1.0	2.7	3	12	331	37	400	2.57	0.11	0.038	<0.01	0.72	0.23	0.56	2.60	<2	
2002-02-25	287	3.72	0.6	2.6	8	32	367	45	450	2.57	0.12	0.038	0.012	0.95	0.11	0.53	2.40	7	
2002-03-18	266	3.66	0.9	2.5	1	8	262	29	450	4.07	0.11	0.030	<0.01	0.51	0.07	0.41	2.00	48	0.61
2002-04-29	542	3.00	2.3	3.2	8	46	229	22	415	2.57	0.11	0.085	<0.01	1.30	0.10	0.54	2.80	3	
2002-05-07	606	3.30	1.8	3.6	2	16	252	19	478	3.00	0.12	0.120	0.013	3.00	0.13	0.97	4.30	23	
2002-05-14	638	2.80	4.2	3.6	1	20	135	8	333	2.57	0.10	0.055	<0.01	0.74	0.07	0.31	2.00	17	
2002-05-22	478	3.40	1.4	3.1	8	10	244	13	382	2.57	0.12	0.020	<0.01	1.20	<0.2	0.48	4.00	12	
2002-05-27	500	3.00	1.7	3.6	<1	17	219	22	398	2.57	0.12	0.040	<0.01	0.65	0.12	0.37	1.70	11	
2002-06-04	531	3.08	2.6	3.8	2	12	226	10	366	2.79	0.12	0.099	<0.01	0.69	0.12	0.53	2.10	19	
2002-06-11	425	3.61	2.4	3.4	1	25	237	19	384	2.57	0.14	0.049	<0.01	0.50	0.24	0.62	1.80	25	
2002-06-20	415	3.40	1.6	3.5	2	13	203	32	397	2.36	0.14	<0.02	0.014	0.83	0.10	0.46	2.40	15	
2002-06-30	271	3.50	1.3	3.6	2	21	176	27	359	2.14	0.12	0.072	<0.01	0.62	0.08	0.54	1.70	<2	0.53
2002-07-25	489	3.27	2.1	3.9	3	19	176	22	388	2.01	0.24	0.130	0.014	2.00	0.15	0.75	3.00	<2	
2002-08-27	87	4.00	1.4	3.6	2	20	218	42	390	2.10	0.21	0.340	0.029	0.74	0.08	0.51	<0.5	11	0.54
2002-10-01	108	5.55	0.8	3.3	1	14	161	28	315	1.65	0.12	0.110	0.013	0.88	0.16	0.40	2.40	8	
2002-10-30	215	4.10	1.3	3.5	2	10	397	30	571	2.79	0.17	0.110	0.011	0.86	0.09	0.70	13.0	5	0.20
2002-11-26	271	3.57	0.8	3.0	22	59	255	49	411	2.57	0.15	0.073	<0.01	1.10	0.064	0.37	1.90	25	
Min.:	87	2.80	0.6	2.5	<1	8	135	8	315	1.65	0.10	<0.02	<0.01	0.50	0.064	0.31	<0.5	<2	0.20
Max.:	638	5.55	4.2	3.9	22	59	397	49	571	4.07	0.24	0.340	0.029	3.00	0.24	0.97	13.0	48	0.61
Aver.:	378	3.55	1.7	3.3	4	21	240	27	405	2.56	0.14	0.084	0.012	1.02	0.12	0.53	2.98	14	0.47
St.dev.:	167	0.62	0.9	0.4	5	14	70	12	59	0.51	0.04	0.075	0.005	0.63	0.05	0.16	2.73	12	0.18
Numb.:	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	4

Table VII.III Measured concentrations 2002 – Watercourse: Numedalslågen

Annual flow: **3 193 10^6 m^3** **Min:** **44 m^3/s**
Drainage area: **5 513 km^2** **Max:** **484 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-01-28	93	2.85	1.6	2.8	13	47	256	44	364	3.21	0.12	0.120	0.012	0.68	0.24	0.35	3.70	<2	
2002-02-25	63	3.28	4.4	3.0	3	30	243	56	437	3.64	0.11	0.130	0.013	0.64	<0.1	0.34	2.50	19	
2002-03-18	51	3.49	2.8	2.4	3	6	250	56	450	2.36	0.08	0.067	<0.01	0.37	<0.05	0.24	2.50	<2	0.14
2002-04-29	177	2.00	6.2	5.4	3	16	200	8	289	3.21	0.14	0.210	0.016	0.72	0.13	0.54	3.60	21	
2002-05-28	136	2.40	2.7	4.1	<1	11	139	19	311	2.79	0.12	0.076	0.011	0.91	0.20	0.34	2.00	<2	
2002-06-30	92	2.30	1.7	2.6	2	22	77	10	234	2.08	0.10	0.098	<0.01	0.50	0.06	0.30	1.40	6	0.33
2002-07-24	171	2.52	2.9	3.4	4	34	146	14	314	2.79	0.13	0.130	0.014	0.95	0.11	0.32	1.00	3	
2002-08-27	64	2.60	1.4	2.6	2	44	85	14	224	1.78	0.14	0.092	<0.01	0.49	0.06	0.28	<0.5	4	0.44
2002-10-01	59	2.33	1.5	2.5	3	14	76	13	229	1.33	0.10	0.120	0.010	0.78	<0.05	0.26	1.20	12	
2002-10-30	100	3.91	8.5	6.6	12	56	553	23	812	4.29	0.35	0.490	0.023	1.20	0.32	0.67	8.00	38	0.23
2002-11-26	74	3.07	4.6	3.3	10	21	241	49	403	3.43	0.19	0.230	0.011	0.73	0.11	0.41	2.90	8	
2003-01-09	100	2.62	0.9	2.4	3	8	147	58	220	2.79	0.11	0.120	<0.01	0.62	0.14	0.41	4.40	16	
Min.:	51	2.00	0.9	2.4	<1	6	76	8	220	1.33	0.08	0.067	<0.01	0.37	<0.05	0.24	<0.5	<2	0.14
Max.:	177	3.91	8.5	6.6	13	56	553	58	812	4.29	0.35	0.490	0.023	1.20	0.32	0.67	8.00	38	0.44
Aver.:	98	2.78	3.3	3.4	5	26	201	30	357	2.81	0.14	0.157	0.013	0.72	0.13	0.37	2.81	11	0.29
St.dev.:	42	0.56	2.3	1.3	4	16	130	20	165	0.83	0.07	0.116	0.004	0.23	0.08	0.12	2.02	11	0.13
Numb.:	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4

Table VII.IV Measured concentrations 2002 – Watercourse: Skienselva

Annual flow: **8 594 10^6 m^3** **Min:** **75 m^3/s**
Drainage area: **10 348 km^2** **Max:** **775 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-01-28	264	1.98	0.7	2.6	4	18	217	11	330	2.14	0.100	<0.05	0.018	0.65	<0.2	0.27	3.10	<2	
2002-02-25	265	1.97	0.6	2.3	2	14	293	13	295	2.14	0.078	0.023	0.012	0.35	<0.1	0.20	1.80	4	
2002-03-18	241	1.94	0.8	2.3	2	4	189	10	356	<1.07	0.065	<0.02	0.010	0.43	0.06	<0.2	1.90	18	0.37
2002-04-29	415	1.90	0.8	2.6	2	18	244	4	269	2.36	0.084	<0.02	0.012	2.40	0.06	0.57	3.10	12	
2002-05-28	483	2.00	0.7	2.6	5	16	224	7	288	2.01	0.086	0.025	0.013	0.63	0.07	0.24	2.60	75	
2002-06-30	201	1.80	0.9	2.3	2	6	153	17	254	1.65	0.095	0.230	0.210	0.38	0.06	0.29	2.60	8	0.69
2002-07-24	239	1.77	0.7	2.5	4	22	165	15	276	1.69	0.093	0.050	0.014	0.41	0.07	0.20	1.00	13	
2002-08-27	140	1.80	0.9	2.4	2	12	161	17	224	1.48	0.096	0.053	0.012	0.36	0.07	0.21	<0.5	28	0.96
2002-10-01	167	1.75	0.6	2.4	<1	3	104	26	245	1.22	0.110	0.100	0.019	0.81	0.08	0.36	2.10	6	
2002-10-30	226	1.88	1.1	2.2	3	12	167	16	267	1.56	0.110	0.096	0.010	0.35	<0.05	0.31	2.10	9	0.54
2002-11-26	288	1.88	0.7	2.3	8	12	177	17	269	1.93	0.095	0.036	<0.01	0.32	<0.05	0.17	1.80	7	
2003-01-09	215	1.89	0.8	2.3	4	9	186	17	210	2.12	0.110	0.076	0.018	0.51	0.10	0.40	3.50	21	
Min.:	140	1.75	0.6	2.2	<1	3	104	4	210	<1.07	0.065	<0.02	<0.01	0.32	<0.05	0.17	<0.5	<2	0.37
Max.:	483	2.00	1.1	2.6	8	22	293	26	356	2.36	0.110	0.230	0.210	2.40	0.20	0.57	3.50	75	0.96
Aver.:	262	1.88	0.78	2.4	3	12	190	14	274	1.78	0.094	0.065	0.030	0.63	0.08	0.29	2.18	17	0.64
St.dev.:	98	0.08	0.14	0.1	2	6	49	6	41	0.40	0.014	0.059	0.057	0.58	0.04	0.11	0.87	20	0.25
Numb.:	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4

Table VII.V Measured concentrations 2002 – Watercourse: Otra

Annual flow: **4 117 10^6 m^3** **Min:** **55 m^3/s**
Drainage area: **3 730 km^2** **Max:** **350 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-01-28	193	1.56	0.8	3.0	4	10	156	24	253	1.78	0.140	0.34	0.024	0.49	<0.2	0.54	3.80	<2	
2002-02-25	140	1.57	<0.6	2.1	2	11	131	16	224	1.59	0.130	0.20	0.029	0.35	0.100	0.70	3.70	7	
2002-03-25	153	1.39	<0.6	2.0	3	18	180	7	203	1.69	0.090	0.25	0.020	0.22	0.059	0.30	3.10	<2	0.25
2002-04-29	184	1.30	0.9	1.9	1	13	193	9	244	1.52	0.071	0.13	0.014	0.21	0.053	0.64	2.30	<2	
2002-05-27	178	1.40	0.6	2.4	<1	8	227	4	313	1.33	0.082	0.12	0.016	0.35	0.056	0.42	2.50	<2	
2002-06-24	62	1.40	0.9	2.3	2	24	97	3	287	1.11	0.100	0.21	0.024	0.35	0.051	0.40	2.50	<2	0.54
2002-07-30	77	1.18	0.9	2.4	9	10	80	4	176	0.88	0.130	0.27	0.022	0.43	0.065	0.52	2.70	<2	
2002-09-04	116	1.18	1.3	2.4	3	13	63	14	132	0.99	0.120	0.21	0.024	0.92	0.100	0.38	3.30	<2	0.54
2002-09-30	93	1.16	0.8	2.0	3	7	73	13	162	0.77	0.088	0.11	0.014	0.29	0.051	0.25	1.90	<2	
2002-10-28	156	1.92	1.3	4.7	<1	13	134	16	306	1.99	0.150	0.41	0.036	0.47	0.130	0.49	5.50	4	0.34
2002-11-26	152	1.42	<0.6	2.1	6	20	114	21	212	1.56	0.100	0.13	0.014	0.27	<0.05	0.40	3.40	2	
2003-01-08	105	1.34	<0.6	1.7	2	5	121	25	160	1.52	0.083	0.12	0.014	0.16	0.062	0.33	2.20	<2	
Min.:	62	1.16	<0.6	1.7	<1	5	63	3	132	0.77	0.071	0.11	0.014	0.16	<0.05	0.25	1.90	<2	0.25
Max.:	193	1.92	1.3	4.7	9	24	227	25	313	1.99	0.150	0.41	0.036	0.92	0.200	0.70	5.50	7	0.54
Aver.:	134	1.40	0.8	2.4	3	13	131	13	223	1.39	0.107	0.21	0.021	0.38	0.081	0.45	3.08	3	0.42
St.dev.:	43	0.21	0.3	0.8	2	6	51	8	60	0.38	0.026	0.10	0.007	0.20	0.045	0.14	0.98	2	0.15
Numb.:	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4

Table VII.VI Measured concentrations 2002 – Watercourse: Orreelva

Annual flow: **101 10^6 m^3** **Min:** **0.8 m^3/s**
Drainage area: **105 km^2** **Max:** **13.7 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-01-28	9.8	17.3	19.5	5.4	8	118	1425	4	2149	<1.07	0.39	1.00	0.025	2.10	0.36	1.90	6.10	<2	
2002-02-26	7.5	16.2	12.6	5.6	10	83	1560	10	2140	0.86	0.16	0.18	0.005	1.20	<0.1	1.10	0.75	<2	
2002-03-19	4.3	16.3	5.9	4.9	6	48	1547	5	2420	2.79	0.11	0.18	<0.01	1.00	0.11	0.91	2.20	<2	0.13
2002-04-22	1.1	18.0	5.4	5.5	2	55	995	44	1421	<1.07	0.15	0.03	<0.01	0.99	<0.2	1.30	<1	<2	
2002-05-21	1.7	17.6	5.2	6.3	1	37	261	17	1188	<1.07	0.13	0.04	<0.01	1.10	0.07	1.10	0.71	<2	
2002-06-17	2.2	17.2	6.4	5.9	2	42	416	14	1155	1.86	0.17	<0.02	<0.01	0.95	0.06	0.70	1.50	<2	0.83
2002-07-22	2.9	18.0	16.4	8.9	<1	138	6	5	782	2.04	0.29	0.12	<0.01	0.93	0.33	1.30	26.00	<2	
2002-08-30	0.9	19.1	10.3	9.9	4	175	18	153	756	5.36	0.62	0.17	<0.01	0.71	0.13	0.88	2.00	<2	0.31
2002-09-30	1.2	18.9	8.4	11.0	3	79	4	6	916	2.57	0.41	0.13	<0.01	0.71	0.07	1.20	1.20	5	
2002-10-26	2.8	18.8	28.8	13.0	4	182	162	3	1335	3.00	0.65	1.20	0.049	2.10	0.22	1.30	7.30	7	<0.10
2002-11-25	2.6	18.6	5.3	5.5	5	40	558	11	796	2.14	0.27	0.14	<0.01	0.68	0.07	0.74	1.60	<2	
2003-01-06	0.9	20.0	3.8	5.8	4	36	1072	52	1655	1.11	0.27	0.16	<0.01	0.81	0.11	1.00	2.00	<2	
Min.:	0.9	16.2	3.8	4.9	<1	36	4	3	756	0.86	0.11	<0.02	0.005	0.68	0.06	0.70	0.71	<2	<0.10
Max.:	9.8	20.0	28.8	13.0	10	182	1560	153	2420	5.36	0.65	1.20	0.049	2.10	0.36	1.90	26.00	7	0.83
Aver.:	3.2	18.0	10.7	7.3	4	86	669	27	1393	2.08	0.30	0.28	0.014	1.11	0.15	1.12	4.36	3	0.34
St.dev.:	2.8	1.1	7.5	2.7	3	54	619	43	581	1.27	0.18	0.39	0.012	0.49	0.10	0.32	7.13	2	0.34
Numb.:	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4

Table VII.VII Measured concentrations 2002 – Watercourse: Suldalslågen

Annual flow: **1 351 10^6 m^3** **Min:** **13 m^3/s**
Drainage area: **1 457 km^2** **Max:** **218 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
28.01.2002	48	2.10	2.9	1.6	3	25	273	7	350	1.33	0.08	0.19	0.012	0.44	<0.2	0.24	2.30	<2	
25.02.2002	15	2.37	<0.6	1.0	2	31	276	8	307	1.29	<0.05	0.024	0.011	0.16	<0.1	0.22	1.20	5	
25.03.2002	27	2.32	<0.6	0.8	6	22	270	5	282	1.31	0.053	0.054	0.014	<0.05	<0.05	<0.2	1.90	<2	0.24
29.04.2002	33	2.20	<0.6	1.0	1	16	212	3	250	1.22	0.066	0.024	0.013	0.13	<0.05	0.48	1.80	<2	
27.05.2002	55	1.50	<0.6	0.7	<1	<2	158	2	213	<1.07	<0.05	<0.02	<0.01	0.13	<0.05	<0.2	1.20	<2	
25.06.2002	49	1.60	0.6	0.9	2	2	153	3	168	<1.07	0.056	0.076	0.012	0.88	<0.05	0.21	3.70	<2	0.55
30.07.2002	63	1.25	<0.6	0.7	5	5	134	<2	164	0.54	0.071	0.110	0.013	0.20	0.04	<0.2	1.10	<2	
03.09.2002	74	1.36	0.6	0.7	14	21	125	<2	180	0.69	0.068	0.210	0.028	0.17	0.08	0.22	1.60	<2	0.75
30.09.2002	69	1.33	0.5	0.5	9	13	142	5	170	0.47	0.056	0.099	0.014	0.47	1.90	0.22	1.60	126	
29.10.2002	68	1.92	0.7	1.7	4	11	190	8	245	1.03	<0.05	0.120	0.017	0.17	<0.05	0.29	2.00	5	
25.11.2002	23	2.29	<0.6	0.6	12	12	204	11	220	<1.07	0.130	0.061	0.012	0.58	<0.05	<0.2	1.60	<2	
06.01.2003	15	1.59	<0.6	0.4	2	5	217	10	239	<0.21	0.110	0.030	0.016	<0.1	<0.05	<0.2	1.30	<2	
Min.:	15	1.25	0.5	0.4	<1	<2	125	<2	164	<0.21	<0.05	<0.02	<0.01	<0.05	0.04	<0.2	1.10	<2	0.24
Max.:	74	2.37	2.9	1.7	14	31	276	11	350	1.33	0.130	0.210	0.028	0.88	1.90	0.48	3.70	126	0.75
Aver.:	45	1.82	0.8	0.9	5	14	196	6	232	0.94	0.070	0.085	0.014	0.29	0.22	0.24	1.78	13	0.51
St.dev.:	22	0.42	0.7	0.4	4	10	55	3	59	0.37	0.025	0.064	0.005	0.25	0.53	0.08	0.71	36	0.26
Numb.:	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	3

Table VII.VIII Measured concentrations 2002 – Watercourse: Orkla

Annual flow: **1 567 10^6 m^3** **Min:** **12.7 m^3/s**
Drainage area: **2 872 km^2** **Max:** **304 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-01-31	24	6.34	1.3	2.2	9	9	207	13	321	2.57	0.071	0.067	0.028	5.20	<0.2	1.10	13.0	<2	
2002-02-26	25	6.68	0.7	2.2	2	11	172	13	275	3.00	<0.05	0.430	0.042	4.70	0.06	0.86	16.0	72	
2002-03-31	33	8.60	1.2	3.9	14	52	400	12	533	4.29	0.120	0.021	0.099	14.00	0.20	1.20	40.0	9	<0.10
2002-04-28	212	4.90	2.2	4.4	1	23	230	5	339	2.79	0.110	0.053	0.070	12.00	0.36	1.50	31.0	<2	
2002-05-28	61	4.60	1.2	2.3	56	69	136	4	246	1.91	0.071	<0.02	0.028	5.90	0.13	0.72	11.0	5	
2002-06-27	64	4.70	1.2	3.1	<1	2	112	10	235	1.93	0.081	0.034	0.041	5.60	0.15	0.45	14.0	15	<0.10
2002-07-31	43	5.66	0.9	3.1	<1	7	130	10	251	1.99	0.160	0.350	0.041	6.40	0.27	0.83	15.0	15	
2002-09-03	28	7.40	1.6	2.1	5	9	175	2	292	2.36	0.130	0.087	0.054	6.90	0.15	0.81	21.0	6	0.37
2002-09-30	44	6.71	1.0	4.1	1	2	142	5	244	1.89	0.120	0.044	0.048	7.10	0.12	0.76	18.0	5	
2002-10-30	13	7.62	1.3	2.1	<1	<5	216	11	300	2.57	0.130	0.037	0.081	12.00	0.16	1.70	35.0	7	<0.10
2002-11-30	26	6.32	<0.6	1.9	24	72	166	15	251	2.36	0.067	0.048	0.042	5.90	0.13	0.75	18.0	7	
2003-01-05	28	5.65	1.1	1.7	2	6	164	23	256	1.48	0.120	0.079	0.026	2.80	0.13	0.67	9.3	10	
Min.:	13	4.60	<0.6	1.7	<1	2	112	2	235	1.48	<0.05	<0.02	0.026	2.80	0.06	0.45	9.3	<2	<0.10
Max.:	212	8.60	2.2	4.4	56	72	400	23	533	4.29	0.160	0.430	0.099	14.00	0.36	1.70	40.0	72	0.37
Aver.:	50	6.27	1.2	2.8	10	22	188	10	295	2.43	0.103	0.106	0.050	7.38	0.17	0.95	20.1	13	0.17
St.dev.:	53	1.24	0.4	0.9	16	26	76	6	82	0.73	0.033	0.135	0.023	3.41	0.08	0.36	9.9	19	0.14
Numb.:	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4

Table VII.IX Measured concentrations 2002 – Watercourse: Vefsna

Annual flow: **4 929 10^6 m^3** **Min:** **25 m^3/s**
Drainage area: **4 113 km^2** **Max:** **1 163 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-02-12	56	9.02	<0.6	1.1	4	8	182	10	203	1.99	0.110	<0.02	<0.01	0.20	<0.2	0.56	<0.5	1300*	
2002-02-28	75	8.05	<0.6	1.1	6	17	151	2	205	1.80	0.060	0.030	<0.01	0.14	0.10	0.60	<0.5	<2	
2002-04-03	82	8.00	3.8	1.7	1	29	134	2	148	1.93	0.140	0.072	<0.01	0.51	0.08	0.09	1.60	<2	<0.10
2002-07-15	90	3.83	0.7	0.6	2	11	32	4	78	0.88	0.130	0.068	<0.01	0.25	0.06	<0.2	<0.5	3	
2002-09-17	116	4.11	0.9	1.2	7	16	37	<2	94	0.88	0.130	0.130	<0.01	0.35	0.11	<0.2	<0.5	18	0.10
Min.:	56	3.83	<0.6	0.6	1	8	32	<2	78	0.88	0.060	<0.02	<0.01	0.14	0.06	0.09	<0.5	<2	<0.10
Max.:	116	9.02	3.8	1.7	7	29	182	10	205	1.99	0.140	0.130	<0.01	0.51	0.20	0.60	1.6	18	0.10
Aver.:	84	6.60	1.3	1.1	4	16	107	4.0	146	1.50	0.114	0.064	0.010	0.29	0.11	0.33	0.72	6	0.10
St.dev.:	22	2.44	1.4	0.4	3	8	69	3.5	59	0.57	0.032	0.043	0.000	0.15	0.05	0.23	0.49	8	0.00
Numb.:	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	2

* Not included in the calculations.

Table VII.X Measured concentrations 2002 – Watercourse: Alta

Annual flow: **2 360 10^6 m^3** **Min:** **21 m^3/s**
Drainage area: **7 367 km^2** **Max:** **515 m^3/s**

Date 2002	Qi m^3/s	Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l	Lindane (γ-HCH) ng/l
2002-01-07	29	9.10	0.6	3.3	7	33	112	6	238	5.57	0.140	0.029	<0.01	0.36	<0.2	0.32	<0.5	<2	
2002-02-04	29	12.00	<0.6	2.7	10	14	111	6	191	5.57	0.180	0.013	<0.005	0.40	<0.2	0.32	<0.1	<2	
2002-03-05	29	11.80	<0.6	2.9	5	14	106	5	190	6.43	0.130	<0.02	<0.01	0.26	0.08	0.36	<0.5	130	
2002-04-01	32	11.40	0.6	2.8	3	4	130	7	181	7.29	0.190	<0.02	<0.01	0.35	0.22	0.83	<0.50	270	<0.10
2002-05-04	461	5.70	3.6	5.0	2	23	60	4	331	4.93	0.440	0.260	<0.01	2.40	1.70	3.40	2.60	6	
2002-06-02	184	7.20	1.4	3.9	1	24	47	2	189	3.00	0.160	<0.02	<0.01	0.51	0.19	0.33	0.51	<2	
2002-06-30	42	14.90	1.1	2.6	14	15	34	4	140	3.43	0.250	0.058	<0.01	0.55	0.13	0.35	<0.5	39	<0.10
2002-08-09	69	12.40	0.9	2.8	4	13	33	2	154	3.43	0.250	0.059	<0.01	0.55	0.15	0.34	<0.5	11	
2002-09-03	78	9.79	0.8	3.0	66	84	12	4	135	3.43	0.170	0.040	<0.01	0.51	0.17	0.25	0.19	9	0.18
2002-10-03	77	15.50	0.8	3.3	10	17	47	4	195	4.07	0.250	0.063	<0.01	0.47	0.18	0.22	0.80	9	
2002-11-04	38	20.30	<0.6	2.5	25	31	82	11	144	5.36	0.790	0.240	0.014	0.70	0.22	0.33	0.91	3	0.39
2002-12-01	29	11.80	0.6	3.2	10	14	68	8	162	4.82	0.240	0.075	<0.01	0.49	0.16	<0.2	0.65	7	
Min.:	29	5.70	<0.6	2.5	1	4	12	2	135	3.00	0.130	0.013	<0.005	0.26	0.08	<0.2	<0.1	<2	<0.10
Max.:	461	20.30	3.6	5.0	66	84	130	11	331	7.29	0.790	0.260	0.014	2.40	1.70	3.40	2.60	270	0.39
Aver.:	91	11.82	1.0	3.2	13	24	70	5	188	4.78	0.266	0.075	0.010	0.63	0.30	0.60	0.69	41	0.19
St.dev.:	125	3.88	0.9	0.7	18	21	38	3	54	1.34	0.184	0.084	0.002	0.57	0.44	0.89	0.64	81	0.14
Numb.:	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4

Appendix VIII. Tributary rivers. Measured concentrations 2002

Table VIII. Tributary rivers, measured concentrations 2002

County		Watercourse	Drainage area Outlet km^2	Precip. 2002 (% of normal)	Flow (outlet) Normal 1930-60 10^6m^3/år	Flow (outlet) 2002 10^6m^3/år	Parameter Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l
Østfold (1.)	001	Tista. Iddefjord	1 588	109 %	721	787	4.70	2.1	8.7	4	25	373	10	639	3.00	0.27	0.31	0.023	0.98	0.25	0.58	2.6	<2
	003	Mosselva. Mossesundet	690	118 %	316	373	7.90	6.8	7.6	3	63	94	5	592	1.67	0.54	0.27	0.013	1.5	0.20	1.0	1.2	2
Oslo og Akers-hus (1.)	004	Hølenelva. Drøbaksundet Ø	137	102 %	60	62	24.9	3.8	10.0	35	71	1 700	33	2 270	9.64	0.83	0.51	0.025	2.3	0.52	2.5	2.5	3
	005	Årungelva. Indre Oslofjord	52	102 %	21	22	23.3	2.6	8.1	5	54	1 280	3	1 960	3.00	0.61	0.14	0.018	1.8	0.13	1.8	1.2	<2
	006	Gjersjøelva. Indre Oslofjord	86	113 %	38	43	16.8	1.9	6.9	2	45	732	22	1 150	3.86	0.38	0.10	<0.01	1.6	0.12	1.9	0.74	<2
	007	Ljanselva. Indre Oslofjord	42	104 %	17	18	28.0	2.0	5.9	62	114	840	615	1 840	6.21	0.45	0.39	0.037	2.6	0.22	2.1	4.1	<2
	008	Loelva/Alna. Indre Oslofjord	75	104 %	31	32	28.6	3.0	5.7	74	130	1 340	485	2 130	6.43	0.54	0.46	0.030	4.0	0.26	1.6	7.8	2
	009	Akerselva. Indre Oslofjord	227	104 %	125	130	4.90	2.7	3.8	3	29	183	24	364	3.00	0.32	0.81	0.041	2.0	0.19	0.66	4.3	8
	010	Frognerelva. Indre Oslofjord	23	104 %	11	11	25.9	3.4	4.1	55	108	1 450	26	1 850	6.00	0.62	0.48	0.021	5.5	0.31	1.8	7.7	8
	011	Lysakerelva. Indre Oslofjord	178	104 %	94	98	5.80	1.3	4.7	2	27	114	4	355	2.79	0.22	0.15	<0.01	0.63	0.087	0.28	1.4	2
	012	Sandvikselva. Indre Oslofjord	223	98 %	129	127	25.6	1.2	2.9	4	22	392	14	581	2.36	0.38	0.22	0.017	1.4	0.29	0.75	1.1	8
	013	Åroselva. Indre Oslofjord	113	102 %	61	62	14.9	13.9	8.3	9	58	1 400	4	1 633	7.07	0.60	0.71	0.042	2.6	0.72	1.2	3.7	11
Buske-rud (2.)	014	Lierelva. Drammensfjord Ø	309	102 %	181	185	13.2	12.3	3.7	13	43	491	26	630	4.93	0.40	0.26	0.017	0.98	0.30	0.62	3.5	7
Vestfold (3.)	016	Sandeelva. Sandebukta	193	96 %	103	100	474	6.7	4.5	2	44	416	6	715	1.89	0.75	0.46	0.083	3.4	0.13	1.1	14	19
	017	Aulielva. Tønsbergfjord	363	96 %	171	164	379	4.5	5.8	3	45	840	42	1 315	3.86	1.9	0.36	0.031	2.0	0.28	1.8	3.6	24
	019	Farriselva. Larvikfjord	491	108 %	334	362	3.00	1.1	5.1	2	7	282	5	462	3.21	0.18	0.055	0.029	0.43	0.093	0.29	9.3	4

County		Watercourse	Drainage area Outlet km²	Precip. 2002 (% of normal)	Flow (outlet) Normal 1930-60 $10^6 m^3$/år	Flow (outlet) 2002	Parameter Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l
Telemark (4.)	021	Tokkeelva. Kragerø	1 238	97 %	1 042	1 009	2.00	1.5	5.5	2	17	155	<1	340	2.36	0.2	0.31	0.036	0.26	0.12	0.40	5.2	<2
Aust-Agder (5.)	022	Gjerstadelva. Søndeledfjord	419	94 %	357	337	2.30	1.0	6.2	2	28	158	27	325	1.91	0.25	0.44	0.043	0.80	0.15	0.65	6.0	<2
	023	Vegårdselva. Sandnesfjord	457	129 %	422	545	2.70	1.2	5.1	2	16	136	4	272	1.24	0.26	0.30	0.029	0.39	0.14	0.52	5.7	<2
	024	Nidelva. Arendal	4 025	96 %	3 783	3 650	1.50	0.8	3.1	2	11	141	2	200	1.35	0.14	0.24	0.024	0.55	0.066	0.24	3.7	<2
Vest-Agder (5.)	025	Tovdalselva. Topdalsfjord	1 856	109 %	1 984	2 156	1.90	0.9	4.3	2	39	90	2	214	1.07	0.19	0.26	0.021	0.16	0.095	0.28	3.0	<2
	027	Søgneelva. Flekkerøy	204	109 %	244	266	4.80	0.8	4.8	2	45	369	3	443	1.46	0.24	0.35	0.054	0.41	0.11	0.67	6.0	<2
	028	Mandalselva. Mannefjord	1 809	105 %	2 624	2 756	1.70	0.7	3.8	2	16	134	9	215	0.81	0.16	0.48	0.023	0.12	0.084	0.20	2.6	<2
	029	Audna. Sniksfjord	450	105 %	639	671	3.30	0.7	4.0	2	16	240	<1	333	0.99	0.25	0.44	0.055	0.16	0.078	0.25	6.0	<2
	030	Lygna. Lyngdalsfjord	664	106 %	1 005	1 067	2.20	1.0	5.0	2	10	100	<1	230	0.24	0.23	0.42	0.029	<0.1	0.063	<0.2	3.7	<2
	031	Kvina. Fedafjord	1 445	106 %	2 625	2 786	2.40	1.0	6.1	2	15	84	<1	225	0.43	0.31	0.56	0.020	0.16	0.072	<0.2	3.5	<2
	032	Sira. Åna-Sira	1 916	99 %	3 589	3 547	1.60	0.7	1.8	2	15	146	14	230	0.84	0.09	0.39	0.017	<0.1	0.063	<0.2	2.4	2
Rogaland (6.)	033	Sokndalselva. Sogndalsstrand	294	99 %	474	467	3.72	1.5	2.6	2	17	227	9	355	1.03	0.14	0.35	0.038	294	99 %	474	467	3.72
	034	Hellelandselva. Egersund	241	99 %	437	431	2.79	0.9	2.7	6	32	218	21	373	1.03	0.12	0.53	0.032	241	99 %	437	431	2.79
	035	Bjerkreimselva. Egersund	705	99 %	1 727	1 703	3.12	<0.6	1.8	7	30	294	10	402	1.24	0.1	0.36	0.030	705	99 %	1727	1703	3.12
	036	Håelva. Håtangen	165	105 %	244	257	7.61	1.9	4.0	21	44	829	44	1 827	2.57	0.31	0.47	0.023	165	105 %	244	257	7.61
	038	Figgjo. Solavika	229	105 %	361	381	9.73	2.4	4.0	18	34	962	83	1 397	2.57	0.19	0.32	0.025	229	105 %	361	381	9.73
	039	Ims-Lutsivasdraget Høgsfjord Boknafj.	127	105 %	140	147	14.5	1.2	3.8	2	32	537	23	752	0.47	0.11	0.17	0.016	127	105 %	140	147	14.5
	040	Oltedalselva. Høgsfjord Boknafj.	102	105 %	225	237	3.57	0.9	1.9	2	15	233	9	373	1.80	0.08	0.87	0.027	102	105 %	225	237	3.57

County		Watercourse	Drainage area Outlet km^2	Precip. 2002 (% of normal)	Flow (outlet) Normal 1930-60 10^6m^3/år	Flow (outlet) 2002 10^6m^3/år	Parameter Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l
	041	Dirdalselva. Høgs-fjord Boknafjord	158	105 %	414	436	2.21	<0.6	1.9	36	74	260	6	373	1.01	0.08	0.25	0.012	0.22	0.061	<0.2	1.3	<2
	042	Frafjordelva. Frafjord Boknafjord	178	105 %	530	559	2.93	<0.6	2.0	7	21	531	12	617	1.14	0.06	0.32	0.015	0.39	0.074	<0.2	2.1	3
	043	Espedalselva. Høgsfjord Boknafj.	138	105 %	392	413	2.12	<0.6	1.8	4	15	143	10	213	1.35	<0.05	0.20	0.012	0.13	<0.05	<0.2	0.57	<2
	044	Lyseelva. Lysefjord Boknafjord	182	97 %	425	413	1.45	<0.6	2.2	8	34	16	8	110	1.18	0.07	0.36	0.012	0.24	0.084	<0.2	1.1	4
	045	Årdalselva. Årdals-fjord Boknafjord	519	95 %	1 332	1 269	2.12	<0.6	1.3	8	20	138	<2	191	0.92	0.05	0.18	0.011	0.15	0.072	<0.2	1.0	5
	046	Førreelva. Jøsen-fjord Boknafjord	163	85 %	441	376	1.94	<0.6	0.8	28	57	54	2	95	1.69	0.05	0.17	<0.01	0.19	0.072	<0.2	0.98	6
	047	Ulla. Jøsenfjord Boknafjord	393	85 %	1 034	882	1.94	<0.6	2.3	11	17	87	<2	176	1.26	0.09	0.46	0.013	0.32	0.16	<0.2	1.2	2
(7.)	049	Saudaelva. Sauda-fjord Boknafjord	353	85 %	946	808	2.84	<0.6	0.9	4	12	798	3	838	1.76	0.09	0.15	0.033	0.72	0.09	<0.2	6.9	2
	050	Åbøelva. Saudafjord Boknafjord	82	85 %	220	188	1.04	<0.6	0.6	3	10	126	<2	163	0.60	0.05	0.20	0.011	0.27	<0.05	<0.2	1.0	<2
	051	Vikedalselva. Vindafjord Boknafj.	118	85 %	298	254	2.45	0.7	1.4	6	32	228	<2	329	0.64	0.27	0.22	0.016	0.38	0.052	<0.2	1.7	2
Horda-land	052	Etneelva. Etnefjord Bømlafjord	252	85 %	388	331	2.38	0.7	0.9	7	21	349	11	418	0.86	0.17	0.24	0.016	0.47	<0.05	<0.2	2.1	<2
(7.)	053	Opo. Sørfjord Hardangerfjord	482	85 %	1 205	1 029	0.97	1.9	0.7	4	13	91	12	139	0.88	<0.05	0.38	0.019	0.33	0.10	<0.2	2.7	7
	054	Tysso. Sørfjord Hardangerfjord	388	85 %	970	828	2.42	<0.6	1.2	6	22	145	3	244	1.26	0.09	0.13	0.024	0.78	<0.05	<0.2	3.4	<2
	055	Kinso. Sørfjord Hardangerfjord	281	95 %	408	386	1.95	0.6	0.5	11	19	46	<2	221	0.28	<0.05	0.28	0.010	0.30	0.064	<0.2	0.54	<2
	056	Veig. Eidfjord Hardangerfjord	496	95 %	654	619	2.32	<0.6	0.7	4	15	39	<2	150	1.09	<0.05	0.14	0.014	0.23	<0.05	<0.2	0.72	<2
	057	Bjoreia. Eidfjord Hardangerfjord	592	95 %	485	459	1.90	0.7	1.4	12	18	50	2	136	1.03	<0.05	0.12	0.013	0.25	<0.05	<0.2	0.71	2
	058	Sima. Eidfjord Hardangerfjord	145	95 %	316	299	1.98	<0.6	0.4	2	5	95	<2	180	1.82	<0.05	0.14	<0.01	0.26	0.07	<0.2	<0.5	<2
	059	Austdøla. Osafjord Eidfjord	131	95 %	308	292	0.84	<0.6	0.3	4	161	45	<2	78	0.54	<0.05	0.12	0.010	0.12	0.067	<0.02	0.64	4
	060	Norddøla. Osafjord Eidfjord	40	95 %	94	89	4.88	0.6	0.1	2	51	95	3	103	1.29	0.13	0.059	<0.01	<0.1	0.091	<0.2	<0.5	7
	061	Tysseelva. Fusafjord	240	88 %	643	567	1.21	0.6	1.6	4	10	71	5	173	0.41	0.09	0.29	0.015	0.39	0.074	<0.2	1.6	3

County		Watercourse	Drainage area Outlet km^2	Precip. 2002 (% of normal)	Flow (outlet) Normal 1930-60 $10^6 m^3$/år	Flow (outlet) 2002 $10^6 m^3$/år	Parameter Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l
	062	Oselva. Fusafjord	109	97 %	315	305	3.15	1.2	2.9	4	10	120	7	322	0.99	0.16	0.22	0.020	0.92	0.21	0.21	2.9	6
	063	Bergsdalse. Veafjord Herdlafj.	198	90 %	500	447	1.43	0.6	1.2	2	7	75	2	157	0.51	0.07	0.19	0.012	0.28	0.054	<0.2	1.4	5
	064	Vosso. Veafjord Sørfjord	1 492	90 %	2 738	2 451	0.90	0.7	1.0	4	10	55	5	356	0.66	<0.05	0.19	0.016	0.25	<0.05	<0.2	1.6	3
	065	Ekso. Osterfjord	414	95 %	1 125	1 073	1.07	0.6	1.5	4	7	22	2	124	0.32	0.06	0.16	<0.01	0.22	<0.05	<0.2	0.7	5
	066	Modalselva. Osterfjord	385	95 %	1 159	1 105	0.84	<0.6	0.8	7	16	66	2	124	0.56	<0.05	0.16	<0.01	0.12	<0.05	<0.2	0.66	<2
Sogn og Fjordane (7.)	067	Nærøyelva. Aurlandsfjord Sognefj.	290	90 %	544	489	4.25	<0.6	0.4	4	7	125	<2	153	2.36	<0.05	0.089	<0.01	0.22	<0.05	<0.2	<0.5	7
	068	Flåmselva. Aurlandsfjord Sognefj.	280	83 %	463	385	1.30	0.7	0.4	2	6	69	<2	98	0.66	<0.05	0.064	<0.01	0.17	<0.05	0.23	<0.5	4
	069	Aurlandv. Aurlandsfjord Sognefjord	800	83 %	1 226	1 019	1.17	0.7	0.5	<1	9	78	2	112	0.94	<0.05	0.13	<0.01	0.31	<0.05	0.23	0.77	4
	070	Erdalselva. Lærdalsfjord Sognefj.	138	83 %	131	109	0.83	0.6	0.4	5	10	17	<2	54	1.11	<0.05	0.12	<0.01	0.13	<0.05	<0.2	<0.5	<2
	071	Lærdalsv. Lærdalsfjord Sognefjord	1 184	115 %	1 120	1 290	1.68	0.7	0.7	3	5	56	2	115	1.52	<0.05	0.15	0.011	0.42	0.05	<0.2	<0.5	4
	072	Årdalselva. Årdalsfjord Sognefjord	989	90 %	1 400	1 266	0.90	2.4	0.5	<1	13	66	<2	130	1.61	<0.05	0.14	0.010	1.6	0.12	0.31	0.71	2
	073	Fortunelva. Lusterfjord Sognefjord	508	90 %	817	738	0.76	3.3	0.4	<1	10	71	3	82	1.26	<0.05	0.22	<0.01	1.1	0.11	0.30	1.3	27
	074	Mørkriselva. Lusterfjord Sognefjord	282	90 %	486	440	0.60	5.2	0.2	<1	6	58	3	84	1.31	<0.05	0.22	<0.01	0.47	0.39	0.46	1.4	2
	075	Jostedøla. Lusterfjord Sognefjord	865	90 %	1 855	1 676	0.70	20.6	0.2	1	35	62	10	93	1.52	<0.05	0.37	<0.01	0.66	0.61	0.51	1.7	<2
	076	Årøyelva. Sognefjord	449	93 %	1 093	1 020	1.28	1.7	0.5	<1	21	57	3	100	1.22	<0.05	0.075	<0.01	0.16	0.054	<0.2	<0.5	2
	077	Sogndalselva Sogndalsfjord. Sognefj.	175	93 %	365	340	0.84	0.6	0.7	<1	3	13	2	66	0.69	<0.05	0.096	<0.01	0.16	<0.05	<0.2	<0.5	3
	078	Gaular. Dalsfjord Bufjord	627	80 %	1 568	1 262	1.08	<0.6	1.2	<1	3	55	4	125	0.60	<0.05	0.065	<0.01	0.14	<0.05	<0.2	0.74	3
	079	Jølstra. Førdefjord	714	77 %	1 673	1 283	1.80	0.9	1.1	<1	15	90	7	188	0.73	<0.05	0.10	<0.01	0.19	<0.05	<0.2	1.1	4
	080	Nausta. Førdefjord	277	77 %	714	547	1.11	0.6	1.6	<1	6	12	7	98	0.28	<0.05	0.11	<0.01	0.17	<0.05	<0.2	0.6	<2

County		Watercourse	Drainage area Outlet km^2	Precip. 2002 (% of normal)	Flow (outlet) Normal 1930-60 10^6m^3/år	Flow (outlet) 2002 10^6m^3/år	Parameter Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l
	081	Oselva. Høydalsfjord	287	77 %	712	546	1.83	1.0	2.9	<1	63	32	12	147	0.21	<0.05	0.14	<0.01	0.26	0.074	0.29	1.2	3
	082	Hopselva. Hyefjord Nordfjord S	73	77 %	173	132	0.96	<0.6	0.6	<1	4	77	5	106	0.34	<0.05	0.17	<0.01	<0.1	<0.05	<0.2	<0.5	2
	083	Gjengedalselva. Hyefjord Nordfjord S	170	77 %	402	310	1.00	<0.6	1.4	<1	12	47	5	110	0.54	<0.05	0.21	<0.01	0.15	0.061	<0.2	<0.5	<2
	084	Breimselva. Gloppen-fjord Nordfjord S	636	77 %	1 364	1 050	1.46	1.2	0.6	<1	4	120	7	164	0.96	<0.05	0.066	<0.01	0.20	0.058	<0.2	0.61	<2
	085	Oldenelva. Indre Nordfjord	226	77 %	500	385	1.34	1.4	0.3	<1	4	140	10	188	1.14	<0.05	0.088	<0.01	0.24	0.086	<0.2	0.54	<2
	086	Loenelva. Indre Nordfjord	261	77 %	535	412	1.31	1.9	0.4	<1	9	66	3	110	1.33	<0.05	0.13	<0.01	0.28	0.19	<0.2	<0.5	<2
	087	Stryneelva. Indre Nordfjord	531	77 %	1 008	776	1.63	1.1	0.4	<1	1	90	5	119	1.09	<0.05	0.078	<0.01	0.31	0.081	<0.2	<0.5	<2
	088	Hornindalselva. Nordfjord N	428	77 %	784	604	1.94	<0.6	1.0	<1	4	86	8	155	0.94	0.07	0.20	0.014	0.27	0.058	0.36	1.3	<2
Møre og Roms-dal (8.)	089	Ørstaelva. Ørstafjord	160	79 %	353	281	2.40	0.7	1.2	<1	23	50	16	160	1.39	<0.05	0.11	<0.01	0.21	0.096	0.32	<0.5	3
	090	Valldøla. Nordalfjord Storfjord	359	82 %	679	557	0.99	<0.6	0.3	<1	<1	12	15	73	0.90	<0.05	0.14	<0.01	0.26	0.097	<0.2	<0.5	<2
	091	Rauma. Romsdals-fjord Moldefjord	1202	78 %	1 243	970	1.19	<0.6	0.4	<1	<1	29	2	65	1.33	<0.05	0.11	<0.01	0.22	<0.05	<0.2	<0.5	<2
	092	Isa. Isfjord Moldefjord	175	98 %	315	308	1.16	2.0	0.3	<1	<1	20	<2	59	1.67	<0.05	0.17	<0.01	0.57	0.72	0.55	0.68	<2
	093	Eira. Eresfjord Moldefjord	1 119	85 %	1 228	1 049	2.12	<0.6	0.6	<1	<1	106	13	147	1.65	<0.05	0.14	<0.01	0.39	0.07	<0.2	<0.5	3
	094	Littledalselva. Sunndalsfjord	359	85 %	464	394	2.80	<0.6	0.5	2	10	113	2	127	3.21	<0.05	0.12	<0.01	0.24	0.12	<0.2	<0.5	<2
	095	Driva.Sunndalsfjord Tingvollfjord	2487	81 %	2 188	1 775	2.60	1.3	0.9	1	14	69	3	111	2.08	<0.05	0.11	<0.01	0.47	0.21	<0.2	<0.5	6
	096	Ulvåa. Ålvundfjord	199	81 %	358	291	2.00	1.7	1.8	1	13	123	9	231	2.36	<0.05	0.11	<0.01	0.81	0.14	<0.2	0.79	6
	097	Toåa. Todalsfjord	251	81 %	463	377	1.62	<0.6	1.1	<1	<1	20	<2	70	1.01	<0.05	0.11	<0.01	0.34	0.056	<0.2	<0.5	7
	098	Surna. Surnadalsfjord	1 200	76 %	1 816	1 388	2.52	0.8	1.5	<1	<1	50	9	137	0.92	<0.05	0.091	<0.01	0.47	<0.2	0.37	0.61	4
	099	Bøvra. Hamnesfjord Halsafjord	243	67 %	421	284	2.95	<0.6	2.5	<1	<1	213	24	317	1.26	<0.05	0.045	<0.01	0.24	0.055	0.12	<0.5	<2

County		Watercourse	Drainage area Outlet km^2	Precip. 2002 (% of normal)	Flow (outlet) Normal 1930-60 $10^6 m^3$/år	Flow (outlet) 2002	Parameter Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l
Sør-Trøndelag (8.)	101	Børselva.Gaulosen Trondheimsfjord.	110	93 %	104	97	11.6	1.8	5.0	14	24	200	<2	423	0.49	0.17	0.11	0.010	0.94	0.16	1.1	<0.5	22
	102	Vigda. Gaulosen Trondheimsfjord.	150	93 %	142	132	11.3	2.5	3.7	<1	12	158	5	375	1.31	0.14	0.059	<0.01	0.57	0.24	0.49	0.61	2
	103	Gaula. Gaulosen Trondheimsfjord.	3 659	79 %	3 046	2 415	4.79	71.1	10	<1	118	73	4	484	2.57	0.15	0.53	0.023	1.9	0.50	1.7	2.3	<2
	104	Nidelva. Trondheimsfjord	3 110	89 %	3 482	3 091	5.20	2.8	2.9	44	67	58	250	606	1.31	0.1	0.14	0.010	1.3	0.14	0.72	1.5	3
	105	Homla. Stjørdalsfjord Trondheimsfjord	157	73 %	149	109	7.71	0.8	5.7	<1	7	27	32	255	1.24	0.49	0.07	<0.01	0.55	0.10	0.48	0.56	<2
Nord Trøndelag (8.)	106	Stjørdalselva. Stjørdalsfj.Trondheimsfj.	2 117	86 %	2 570	2 212	2.88	7.4	7.4	<1	9	53	3	312	1.24	0.13	0.16	0.016	1.9	0.32	0.93	4.0	<2
	107	Gråelva. Stjørdalsfjord Trondheimsfj.	93	85 %	73	62	22.0	6.2	5.0	30	41	105	38	402	1.20	0.33	0.083	<0.01	0.86	0.16	0.50	<0.5	<2
	108	Verdalsvassdraget. Trondheimsfjord.	1472	84 %	1 857	1 563	12.6	15.2	8.2	2	21	82	8	115	1.71	0.18	0.36	0.019	1.5	0.29	0.80	2.5	7
	109	Figga/Leksdalselva. Trondheimsfjord	1 080	80 %	1 376	1 099	8.71	2.3	6.5	5	19	94	9	144	0.69	0.31	0.29	0.017	1.1	0.24	0.89	1.3	5
	110	Snåsavassdraget. Trondheimsfjord	1 095	80 %	1 376	1 100	4.77	1.4	4.1	2	20	80	8	216	0.79	0.09	0.12	0.012	0.053	0.057	1.1	0.81	4
	111	Årgårdselva. Namsfjord	1 110	79 %	1 376	1 090	6.46	1.4	3.3	1	8	25	26	166	0.64	0.09	0.14	<0.01	0.37	0.077	<0.2	0.52	8
	112	Namsen. Namsfjord Ø	1 124	95 %	1 376	1 301	5.82	1.1	1.5	2	10	43	13	127	0.69	0.12	0.17	0.014	0.88	0.11	0.32	1.2	3
	113	Salsvatnelva. Follafjord	1 154	83 %	1 374	1 136	4.92	0.6	2.1	1	5	54	3	115	0.94	0.07	0.15	0.014	0.22	0.094	0.21	1.2	5
Nordland (9.)	114	Åbjøra. Bindalsfjord S	526	96 %	1 330	1 274	78.9	0.8	1.0	2	6	93	13	93	0.49	0.12	0.27	0.012	0.35	<0.05	0.79	0.88	8
	116	Skjerva. Vefsenfjord S	104	109 %	135	148	48.6	1.7	3.4	88	112	73	175	583	1.35	0.47	0.49	0.032	1.5	0.20	5.5	7.4	4
	117	Fusta. Vefsenfjord N	544	109 %	1 088	1 189	3.03	0.9	1.1	<1	7	4	19	87	0.45	0.06	0.087	<0.01	0.21	<0.05	<0.2	<0.5	<2
	118	Drevja. Vefsenfjord N	177	109 %	363	397	4.66	1.0	0.9	12	12	4	<2	80	0.39	0.07	0.07	<0.01	0.21	0.078	0.22	<0.5	<2
	119	Røssåga. Sørfjord	2 092	97 %	2 995	2 918	4.00	9.3	0.9	<1	25	32	16	121	0.60	0.09	0.05	<0.01	0.37	0.057	0.38	2.2	<2
	120	Bjerka. Sørfjord	385	97 %	673	652	5.27	<0.6	1.4	<1	12	30	7	112	0.96	0.08	0.18	0.015	0.42	0.084	0.52	<0.5	<2

County		Watercourse	Drainage area Outlet km^2	Precip. 2002 (% of normal)	Flow (outlet) Normal 1930-60 10^6m^3/år	Flow (outlet) 2002 10^6m^3/år	Parameter Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l
	121	Dalselva. Ranafjord N	211	97 %	263	255	3.36	0.6	1.7	<1	7	5	7	86	0.92	<0.05	0.11	<0.01	0.38	0.071	0.52	<0.5	<2
	122	Ranavassdraget. Ranafjord N	3 847	107 %	5 447	5 852	3.44	<0.6	0.7	2	9	38	9	82	0.92	0.07	0.11	<0.01	0.29	0.15	0.40	0.58	<2
	123	Fykanåga. Glomfjord	297	102 %	971	990	3.15	<0.6	0.4	<1	5	25	2	77	0.45	<0.05	0.098	<0.01	0.15	<0.05	<0.2	<0.5	250
	124	Beiarelva. Beiarfjord Nordfjord	1 064	104 %	1 513	1 578	3.90	1.2	0.4	3	6	22	24	58	1.48	0.10	0.083	<0.01	0.27	0.084	0.37	<0.5	4
	125	Saltdalsvassdraget. Saltdalsfjord S	1 544	87 %	1 563	1 364	4.00	1.1	0.6	6	9	26	17	65	2.08	0.08	0.075	<0.01	0.17	<0.05	0.39	<0.5	2
	126	Sulitjelmavassdraget. Saltdalsfjord S	1 028	96 %	1 426	1 363	3.10	<0.6	0.7	2	6	28	<2	107	0.81	0.1	0.10	0.012	0.91	0.058	0.28	<0.5	<2
	127	Kobbelva. Leirfjord Sørfolda N	405	111 %	854	953	1.70	<0.6	0.4	1	5	28	2	71	0.99	<0.05	0.051	<0.01	0.10	0.063	0.16	<0.5	6
	128	Skjoma. Ofotfjord S	845	111 %	967	1 079	2.42	<0.6	1.2	1	7	10	2	73	2.14	0.14	0.11	0.013	0.42	<0.05	1.1	0.71	3
Troms (9.)	129	Spanselva. Astafjord Vågsfjord	142	107 %	224	239	9.65	0.8	0.9	1	9	78	2	98	1.33	0.07	0.15	0.015	0.64	0.086	1.5	0.80	4
	130	Salangselva. Astafjord Vågsfjord	539	107 %	695	742	8.20	0.7	0.5	3	10	9	<2	83	0.73	0.05	0.083	<0.01	0.24	<0.05	0.63	<0.5	3
	131	Rossfjordelva. Malangen	196	96 %	244	235	7.62	1.1	1.8	5	10	7	<2	93	0.58	0.06	0.11	0.010	0.048	0.071	0.45	0.58	10
	132	Målselva. Måls-elvfjord Malangen	3 239	102 %	2 932	2 996	7.18	0.8	0.9	1	17	38	<2	88	1.82	<0.05	0.19	0.012	0.40	0.078	0.52	<0.5	<2
	133	Barduelva. Målselv-fjorden Malangen	2 906	102 %	2 594	2 651	8.93	0.9	0.7	1	25	44	9	86	1.41	0.12	0.16	0.021	0.53	0.09	0.79	0.84	4
	134	Nordkjoselva. Balsfjord	191	110 %	167	183	4.85	0.7	1.2	5	6	27	5	74	1.97	0.12	0.055	<0.01	0.28	<0.05	<0.2	<0.5	6
	135	Signaldalselva. Lyngen V	473	110 %	413	453	5.17	1.5	13	5	7	38	8	113	2.08	0.08	0.10	<0.01	0.42	0.071	0.46	<0.5	9
	136	Skibotnelva. Lyngen	770	110 %	437	479	3.05	0.8	1.0	5	17	28	<2	71	1.61	0.06	0.058	<0.01	0.39	<0.05	0.69	<0.5	4
	137	Kåfjordelva. Lyngen Ø	358	110 %	226	247	3.58	<0.6	0.7	3	27	38	2	102	1.31	0.06	0.11	<0.01	0.92	0.11	0.67	<0.5	6
	138	Reisa. Reisafjord	2 702	130 %	1 363	1 766	37.7	1.0	1.0	3	7	42	5	93	3.00	0.21	0.32	0.015	0.74	0.11	0.77	0.96	8

County		Watercourse	Drainage area Outlet km^2	Precip. 2002 (% of normal)	Flow (outlet) Normal 1930-60 $10^6 m^3$/år	Flow (outlet) 2002 $10^6 m^3$/år	Parameter Cond mS/m	S.P.M. mg/l	TOC mg/l	PO_4-P µg/l	Tot-P µg/l	NO_3-N µg/l	NH_4-N µg/l	Tot-N µg/l	SiO_2 mg/l	As µg/l	Pb µg/l	Cd µg/l	Cu µg/l	Cr µg/l	Ni µg/l	Zn µg/l	Hg ng/l
Finn-mark (10.)*	139	Mattiselva. Kåfjord Altafjord	325	145 %	272	395	3.71	<0.6	2.7	2	2	14	4	160	1.37	0.12	0.024	<0.01	0.79	<0.2	0.30	0.74	5
	141	Tverrelva. Altafjord	234	145 %	111	162	4.27	1.0	4.5	3	6	40	7	244	2.14	0.11	0.023	<0.01	0.78	0.28	0.37	0.72	<2
	142	Repparfjordvass-draget. Repparfjord	1 090	110 %	859	944	3.35	0.6	3.7	<2	3	7	14	156	1.16	0.07	<0.02	<0.01	2.3	0.27	0.30	0.53	3
	143	Stabburselva. Indre Porsangen V	1 108	110 %	639	703	3.11	<0.6	2.7	2	3	10	15	123	2.01	0.05	<0.02	<0.01	0.53	<0.2	0.17	1.1	5
	144	Lakselva. Indre Porsangen S	1 533	110 %	769	845	5.25	5.9	2.8	2	11	13	8	149	1.99	<0.05	<0.02	<0.01	0.62	<0.2	0.37	<0.5	3
	145	Børselva.Indre Porsangen Ø	883	110 %	830	916	4.65	1.0	1.0	<2	3	5	11	90	3.00	<0.05	<0.02	<0.01	0.20	<0.2	0.24	0.96	8
	146	Mattusjåkka. Indre Laksefjord V	101	115 %	73	84	6.04	0.6	1.3	<2	<2	97	10	107	1.20	0.06	0.41	0.037	0.45	4.8	0.87	4.7	6
	147	Storelva. Indre Laksefjord V	690	115 %	477	549	3.60	<0.6	0.7	<2	4	21	4	101	2.57	<0.05	<0.02	<0.01	0.095	<0.2	0.26	1.1	5
	148	Soussjåkka. Indre Laksefjord V	92	115 %	73	84	5.70	<0.6	1.3	<2	<2	26	5	96	3.00	<0.05	<0.02	<0.01	0.17	<0.2	0.15	0.95	14
	149	Adamselva. Indre Laksefjord Ø	705	115 %	442	509	5.51	<0.6	1.6	<2	6	2	4	103	2.36	<0.05	<0.02	<0.01	0.26	<0.2	0.10	0.92	20
	150	Tanavassdraget. Tanafjord S	16 389	114 %	5 944	6 764	3.48	1.4	5.3	3	9	3	10	225	4.50	0.06	<0.02	<0.01	0.65	0.31	0.42	8.5	6
	151	Vesterelva. Syltefjord	469	120 %	512	616	5.66	<0.6	0.8	3	21	7	9	99	2.14	0.21	<0.02	<0.01	0.11	<0.2	<0.05	<0.5	2
	152	Vestre Jakobselva. Ytre.Varangerfjord	627	99 %	358	354	10.5	0.6	2.8	3	9	2	7	129	3.86	0.07	<0.02	<0.01	0.21	0.20	0.13	<0.5	6
	153	Passvikelva. Bøkfjord Varangerfjord	18 404	99 %	5 398	5 334	3.62	0.7	4.2	2	5	4	10	190	2.79	0.19	0.045	<0.01	1.5	0.52	6.6	1.0	2
	154	Neiden. Munkfjord Varangerfjord	2 960	126 %	915	1 154	2.63	1.2	4.1	2	5	<2	17	205	1.84	0.06	<0.02	<0.01	0.49	<0.2	0.22	0.62	<2
	155	Grense Jakobselv. Varangerfjord	234	93 %	133	123	4.13	0.8	2.9	2	3	3	6	162	2.79	0.18	0.34	0.032	2.3	4.2	8.1	4.5	<2

* Analytical results from tributary rivers in Finnmark are from 2001.

Appendix IX. Tributary rivers. Annual load 2002

Table IX. Tributary rivers, annual load 2002

County	Watercourse	Parameter															
		S.P.M. tonnes	TOC tonnes	PO_4-P tonnes	Tot-P tonnes	NO_3-N tonnes	NH_4-N tonnes	Tot-N tonnes	SiO_2 tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Østfold (1.)	001 Tista. Iddefjord	1 654	6 851	3.15	19.69	294	7.9	503	2 362	213	244	18.1	772	197	457	2 047	< 1.6
	003 Mosselva. Mossesundet	2 534	2 832	1.12	23.48	35	1.9	221	623	201	101	4.8	559	75	373	447	0.7
Oslo og Akershus (1.)	004 Hølenelva. Drøbaksundet Ø	235	618	2.16	4.39	105	2.0	140	596	51	32	1.5	142	32	154	154	0.2
	005 Årungelva. Indre Oslofjord	57	176	0.11	1.18	28	0.1	43	65	13	3	0.4	39	3	39	26	< 0.0
	006 Gjersjøelva. Indre Oslofjord	82	296	0.09	1.93	31	0.9	49	166	16	4	< 0.4	69	5	82	32	< 0.1
	007 Ljanselva. Indre Oslofjord	36	106	1.11	2.04	15	11.0	33	111	8	7	0.7	47	4	38	74	< 0.0
	008 Loelva/Alna. Indre Oslofjord	96	183	2.37	4.16	43	15.5	68	206	17	15	1.0	128	8	51	250	0.1
	009 Akerselva. Indre Oslofjord	352	496	0.39	3.78	24	3.1	47	391	42	106	5.3	261	25	86	561	1.0
	010 Frognerelva. Indre Oslofjord	39	46	0.62	1.22	16	0.3	21	68	7	5	0.2	62	4	20	87	0.1
	011 Lysakerelva. Indre Oslofjord	128	462	0.20	2.65	11	0.4	35	274	22	15	< 1.0	62	9	28	138	0.2
	012 Sandvikselva. I. Oslofjord	153	369	0.51	2.80	50	1.8	74	300	48	28	2.2	178	37	95	140	1.0
	013 Åroselva. Indre Oslofjord	860	514	0.56	3.59	87	0.2	101	438	37	44	2.6	161	45	74	229	0.7
Buske-rud (2.)	014 Lierelva. Drammensfjord Ø	2 278	685	2.41	7.96	91	4.8	117	913	74	48	3.1	181	56	115	648	1.3
Vestfold (3.)	016 Sandeelva. Sandebukta	668	448	0.20	4.38	41	0.6	71	188	75	46	8.3	339	13	110	1 395	1.9
	017 Aulielva. Tønsbergfjord	739	953	0.49	7.39	138	6.9	216	634	312	59	5.1	329	46	296	591	3.9
	019 Farriselva. Larvikfjord	398	1 845	0.72	2.53	102	1.8	167	1 163	65	20	10.5	156	34	105	3 365	1.4
Tele-mark (4.)	021 Tokkeelva. Kragerø	1 514	5 552	2.02	17.16	156	< 1	343	2 379	202	313	36.3	262	121	404	5 249	< 2.0
Aust-Agder (5.)	022 Gjerstadelva. Søndeledfjord	337	2 089	0.67	9.43	53	9.1	109	642	84	148	14.5	270	51	219	2 021	< 0.7
	023 Vegårdselva. Sandnesfjord	655	2 782	1.09	8.73	74	2.2	148	678	142	164	15.8	213	76	284	3 109	< 1.1
	024 Nidelva. Arendal	2 920	11 314	7.30	40.15	515	7.3	730	4 927	511	876	87.6	2007	241	876	13 504	< 7.3
Vest-Agder (5.)	025 Tovdalselva. Topdalsfjord	1 940	9 271	4.31	84.08	194	4.3	461	2 310	410	561	45.3	345	205	604	6 468	< 4.3
	027 Søgneelva. Flekkerøy	213	1 275	0.53	11.95	98	0.8	118	387	64	93	14.3	109	29	178	1 594	< 0.5
	028 Mandalselva. Mannefjord	1 929	10 474	5.51	44.10	369	24.8	593	2 244	441	1 323	63.4	331	232	551	7 166	< 5.5
	029 Audna. Sniksfjord	470	2 683	1.34	10.73	161	< 1	223	661	168	295	36.9	107	52	168	4 024	< 1.3
	030 Lygna. Lyngdalsfjord	1 067	5 334	2.13	10.67	107	< 1	245	251	245	448	30.9	< 107	67	< 213	3 947	< 2.1
	031 Kvina. Fedafjord	2 786	16 993	5.57	41.79	234	< 3	627	1 194	864	1 560	55.7	446	201	< 557	9 750	< 5.6
	032 Sira. Åna-Sira	2 483	6 385	7.09	53.21	518	49.7	816	2 964	323	1 383	60.3	< 355	223	< 709	8 513	7.1

County	Watercourse	Parameter															
		S.P.M. tonnes	TOC tonnes	PO_4-P tonnes	Tot-P tonnes	NO_3-N tonnes	NH_4-N tonnes	Tot-N tonnes	SiO_2 tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Rogaland	033 Sokndalselva. Sogndalsstrand	700	1 214	0.93	7.94	106	4.2	166	480	65	163	17.7	140	< 23	747	2 148	< 0.9
(6.)	034 Hellelandselva. Egersund	388	1 163	2.58	13.78	94	9.0	161	443	52	228	13.8	151	41	< 86	1 551	< 0.9
	035 Bjerkreimselva. Egersund	< 1 022	3 065	11.92	51.08	501	17.0	684	2 116	165	613	51.1	392	111	< 341	5 108	< 3.4
	036 Håelva. Håtangen	489	1 029	5.40	11.32	213	11.3	470	662	80	121	5.9	247	41	< 51	3 087	< 0.5
	038 Figgjo. Solavika	914	1 523	6.85	12.94	366	31.6	532	979	72	122	9.5	419	57	< 76	9 897	1.1
	039 Ims-Lutsi. Høgsfjord Boknafjord	177	560	0.29	4.72	79	3.4	111	69	16	25	2.4	75	14	< 29	309	0.3
	040 Oltedalselva Høgsfjord Boknafj.	214	451	0.47	3.56	55	2.1	89	427	19	207	6.4	112	23	< 47	665	0.5
	041 Dirdalselva Høgsfjord Boknafj.	< 262	828	15.70	32.26	113	2.6	163	439	34	109	5.2	96	27	< 87	567	< 0.9
	042 Frafjordelva. Frafjord Boknafj.	< 335	1 117	3.91	11.73	297	6.7	345	634	35	179	8.4	218	41	< 112	1 173	1.7
	043 Espedalselva. Høgsfj. Boknafj.	< 248	743	1.65	6.19	59	4.1	88	557	< 21	83	5.0	54	< 21	< 83	235	< 0.8
	044 Lyseelva. Lysefjord Boknafjord	< 248	908	3.30	14.03	7	3.3	45	486	28	149	5.0	99	35	< 83	454	1.7
	045 Årdalselva. Årdalsfjord Boknafj.	< 761	1 649	10.15	25.38	175	< 3	242	1 169	69	228	14.0	190	91	< 254	1 269	6.3
	046 Førreelva. Jøsenfjord Boknafj.	< 226	301	10.54	21.46	20	0.8	36	637	20	64	< 3.8	72	27	< 75	369	2.3
	047 Ulla. Jøsenfjord Boknafjord	< 529	2 029	9.70	15.00	77	< 2	155	1 115	81	406	11.5	282	141	< 176	1 059	1.8
(7.)	049 Saudaelva. Saudafjord Boknafj.	< 485	727	3.23	9.69	644	2.4	677	1 419	75	121	26.6	581	73	< 162	5 572	1.6
	050 Åbøelva. Saudafjord Boknafj.	< 113	113	0.56	1.88	24	< 0	31	113	10	38	2.1	51	< 9	< 38	188	< 0.4
	051 Vikedalselva. Boknafjord	178	356	1.52	8.13	58	< 1	84	163	69	56	4.1	97	13	< 51	432	0.5
Horda-	052 Etneelva. Etnefjord Bømlafjord	232	298	2.32	6.95	116	3.6	138	284	56	79	5.3	156	< 17	< 66	695	< 0.7
land	053 Opo. Sørfjord Hardangerfjord	1 955	720	4.11	13.37	94	12.3	143	904	< 51	391	19.5	339	103	< 206	2 778	7.2
(7.)	054 Tysso. Sørfjord Hardangerfjord	< 497	994	4.97	18.22	120	2.5	202	1 047	78	108	19.9	646	< 41	< 166	2 816	< 1.7
	055 Kinso. Sørfjord Hardangerfjord	231	193	4.24	7.33	18	< 1	85	107	< 19	108	3.9	116	25	< 77	208	< 0.8
	056 Veig. Eidfjord Hardangerfjord	< 371	433	2.48	9.28	24	< 1	93	676	< 31	87	8.7	142	< 31	< 124	446	< 1.2
	057 Bjoreia. Eidfjord Hardangerfjord	322	643	5.51	8.27	23	0.9	62	472	< 23	55	6.0	115	< 23	< 92	326	0.9
	058 Sima. Eidfjord Hardangerfjord	< 180	120	0.60	1.50	28	< 1	54	545	< 15	42	< 3.0	78	21	< 60	< 150	< 0.6
	059 Austdøla. Osafjord Eidfjord	< 175	87	1.17	46.96	13	< 1	23	156	< 15	35	2.9	35	20	< 6	187	1.2
	060 Norddøla. Osafjord Eidfjord	53	9	0.18	4.54	8	0.3	9	115	12	5	< 0.9	< 9	8	< 18	< 45	0.6
	061 Tysseelva. Fusafjord	340	908	2.27	5.67	40	2.8	98	231	50	164	8.5	221	42	< 113	908	1.7
	062 Oselva. Fusafjord	366	885	1.22	3.05	37	2.1	98	301	49	67	6.1	281	64	64	885	1.8
	063 Bergsdalse. Veafjord Herdlafj.	268	536	0.89	3.13	34	0.9	70	230	30	85	5.4	125	24	< 89	626	2.2
	064 Vosso. Veafjord Sørfjord	1 716	2 451	9.80	24.51	135	12.3	873	1 628	< 123	466	39.2	613	< 123	< 490	3 921	7.4
	065 Ekso. Osterfjord	644	1 609	4.29	7.51	24	2.1	133	345	62	172	< 10.7	236	< 54	< 215	751	5.4
	066 Modalselva. Osterfjord	< 663	884	7.74	17.69	73	2.2	137	616	< 55	177	< 11.1	133	< 55	< 221	730	< 2.2

County	Watercourse	Parameter															
		S.P.M. tonnes	TOC tonnes	PO_4-P tonnes	Tot-P tonnes	NO_3-N tonnes	NH_4-N tonnes	Tot-N tonnes	SiO_2 tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Sogn og Fjordane (7.)	067 Nærøyelva. Aurlandsfj. Sognefj	< 293	196	1.96	3.42	61	< 1	75	1 153	< 24	44	< 4.9	108	< 24	< 98	< 245	3.4
	068 Flåmselva. Aurlandsfj. Sognefj.	269	154	0.77	2.31	27	< 1	38	255	< 19	25	< 3.8	65	< 19	88	< 192	1.5
	069 Aurlandelva..Aurlandsfj.Sognefj	713	510	< 1.0	9.17	79	2.0	114	961	< 51	132	< 10.2	316	< 51	234	785	4.1
	070 Erdalselva. Lærdalsfj. Sognefj.	65	43	0.54	1.09	2	< 0	6	121	< 5	13	< 1.1	14	< 5	< 22	< 54	< 0.2
	071 Lærdalselva. Lærdalsfj.Sognefj	903	903	3.87	6.45	72	2.6	148	1 963	< 65	194	14.2	542	65	< 258	< 645	5.2
	072 Årdalselva. Årdalsfjord Sognefj.	3 037	633	< 1.3	16.45	84	< 3	165	2 034	< 63	177	12.7	2 025	152	392	899	2.5
	073 Fortunelva. Lusterfj. Sognefj.	2 437	295	< 0.7	7.38	52	2.2	61	933	< 37	162	< 7.4	812	81	222	960	19.9
	074 Mørkriselva. Lusterfj. Sognefj.	2 286	88	< 0.4	2.64	25	1.3	37	575	< 22	97	< 4.4	207	171	202	615	0.9
	075 Jostedøla. Lusterfjord Sognefj.	34 531	335	1.68	58.67	104	16.8	156	2 550	< 84	620	< 16.8	1 106	1 023	855	2 850	< 3.4
	076 Årøyelva. Sogndalsfj. Sognefj.	1 734	510	< 1.0	21.42	58	3.1	102	1 246	< 51	76	< 10.2	163	55	< 204	< 510	2.0
	077 Sogndalselva Sognd.fj. Sognefj	204	238	< 0.3	1.02	4	0.7	22	233	< 17	33	< 3.4	54	< 17	< 68	< 170	1.0
	078 Gaular. Dalsfjord Bufjord	< 757	1 514	< 1.3	3.78	69	5.0	158	757	< 63	82	< 12.6	177	< 63	< 252	934	3.8
	079 Jølstra. Førdefjord	1 155	1 412	< 1.3	19.25	115	9.0	241	935	< 64	128	< 12.8	244	< 64	< 257	1 412	5.1
	080 Nausta. Førdefjord	328	876	< 0.5	3.28	7	3.8	54	153	< 27	60	< 5.5	93	< 27	< 109	328	< 1.1
	081 Oselva. Høydalsfjord	546	1 584	< 0.5	34.42	17	6.6	80	117	< 27	76	< 5.5	142	40	158	656	1.6
	082 Hopselva. Hyefjord Nordfjord S	< 79	79	< 0.1	0.53	10	0.7	14	45	< 7	23	< 1.3	< 13	< 7	< 26	< 66	0.3
	083 Gjengedalselva. Hyefj. Nordfj.S	< 186	433	< 0.3	3.71	15	1.5	34	166	< 15	65	< 3.1	46	19	< 62	< 155	< 0.6
	084 Breimselva. Gloppenfj. Nordfj.S	1 260	630	< 1.0	4.20	126	7.3	172	1 012	< 52	69	< 10.5	210	61	< 210	640	< 2.1
	085 Oldenelva. Indre Nordfjord	538	115	< 0.4	1.54	54	3.8	72	437	< 19	34	< 3.8	92	33	< 77	208	< 0.8
	086 Loenelva. Indre Nordfjord	783	165	< 0.4	3.71	27	1.2	45	547	< 21	54	< 4.1	115	78	< 82	< 206	< 0.8
	087 Stryneelva. Indre Nordfjord	854	310	< 0.8	0.78	70	3.9	92	848	< 39	61	< 7.8	241	63	< 155	< 388	< 1.6
	088 Hornindalselva. Nordfjord N	< 362	604	< 0.6	2.41	52	4.8	94	569	43	121	8.5	163	35	217	785	< 1.2
Møre og Romsdal (8.)	089 Ørstaelva. Ørstafjord	197	337	< 0.3	6.46	14	4.5	45	391	< 14	31	< 2.8	59	27	90	< 140	0.8
	090 Valldøla. Nordalfjord Storfjord	< 334	167	< 0.6	< 0.6	7	8.4	41	501	< 28	78	< 5.6	145	54	< 111	< 279	< 1.1
	091 Rauma. Romsdalsfjord Moldefj.	< 582	388	< 1.0	< 1.0	28	1.9	63	1 288	< 48	107	< 9.7	213	< 48	< 194	< 485	< 582
	092 Isa. Isfjord Moldefjord	617	92	< 0.3	< 0.3	6	< 1	18	515	< 15	52	< 3.1	176	222	170	210	< 0.6
	093 Eira. Eresfjord Moldefjord	< 630	630	< 1.0	< 1.0	111	13.6	154	1 732	< 52	147	< 10.5	409	73	< 210	< 525	3.1
	094 Littledalselva Sunndalsfjord	< 236	197	0.79	3.94	45	0.8	50	1 267	< 20	47	< 3.9	95	47	< 79	< 197	< 0.8
	095 Driva.Sunndalsfjord Tingvollfj.	2 307	1 597	1.77	24.84	122	5.3	197	3 689	< 89	195	< 17.7	834	373	< 355	< 887	10.6
	096 Ulvåa. Ålvundfjord	495	524	0.29	3.78	36	2.6	67	686	< 15	32	< 2.9	236	41	< 58	230	1.7
	097 Toåa. Todalsfjord	< 226	415	< 0.4	< 0.4	8	< 1	26	380	< 19	41	< 3.8	128	21	< 75	< 188	2.6
	098 Surna. Surnadalsfjord	1 110	2 082	< 1.4	< 1.4	69	12.5	190	1 279	< 69	126	< 13.9	652	< 278	514	847	5.6
	099 Bøvra. Hamnesfjord Halsafjord	< 170	709	< 0.3	< 0.3	60	6.8	90	359	< 14	13	< 2.8	68	16	34	< 142	< 0.6

County	Watercourse	Parameter															
		S.P.M. tonnes	TOC tonnes	PO_4-P tonnes	Tot-P tonnes	NO_3-N tonnes	NH_4-N tonnes	Tot-N tonnes	SiO_2 tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Sør-Trøndelag (8.)	101 Børselva. Gaulosen Trondheimsfj.	174	484	1.36	2.33	19	< 0	41	48	16	11	1.0	91	16	107	< 48	2.1
	102 Vigda. Gaulosen Trondheimsfj.	330	489	< 0.1	1.59	21	0.7	50	173	18	8	< 1.3	75	32	65	81	0.3
	103 Gaula. Gaulosen Trondheimsfj.	171 720	24 152	< 2.4	284.99	176	9.7	1 169	6 210	362	1 280	55.5	4 589	1 208	4 106	5 555	< 4.8
	104 Nidelva. Trondheimsfjord	8 656	8 965	136.02	207.12	179	772.8	1 873	4 041	297	433	30.9	4 019	433	2 226	4 637	9.3
	105 Homla. Stjørdalsfj. Trondheimsfj.	87	621	< 0.1	0.76	3	3.5	28	135	53	8	< 1.1	60	11	52	61	< 0.2
Nord-Trøndelag (8.)	106 Stjørdalselva. Stjørdalsfj.Tr.h.fj.	16 368	16 368	< 2.2	19.91	117	6.6	690	2 749	288	354	35.4	4 203	708	2 057	8 848	< 4.4
	107 Gråelva. Stjørdalsfj.Trondh.fj.	384	310	1.86	2.54	7	2.4	25	74	20	5	< 0.6	53	10	31	< 31	< 0.1
	108 Verdalsvassdrag. Trondheimsfj	23 758	12 817	3.13	32.82	128	12.5	180	2 679	281	563	29.7	2 345	453	1 250	3 908	10.9
	109 Figga/Leksdalselva. Trondh.fj	2 528	7 145	5.50	20.89	103	9.9	158	754	341	319	18.7	1 209	264	978	1 429	5.5
	110 Snåsavassdrag. Trondheimsfj	1 540	4 509	2.20	21.99	88	8.8	238	872	100	132	13.2	58	63	1 210	891	4.4
	111 Årgårdselva. Namsfjord	1 526	3 596	1.09	8.72	27	28.3	181	700	99	153	< 10.9	403	84	< 218	567	8.7
	112 Namsen. Namsfjord Ø	1 431	1 952	2.60	13.01	56	16.9	165	892	156	221	18.2	1 145	143	416	1 561	3.9
	113 Salsvatnelva. Follafjord	681	2 385	1.14	5.68	61	3.4	131	1 071	84	170	15.9	250	107	238	1 363	5.7
Nordland (9.)	114 Åbjøra. Bindalsfjord S	1 020	1 274	2.55	7.65	119	16.6	119	628	153	344	15.3	446	< 64	1 007	1 122	10.2
	116 Skjerva. Vefsenfjord S	252	503	13.03	16.58	11	25.9	86	200	70	73	4.7	222	30	814	1 095	0.6
	117 Fusta. Vefsenfjord N	1 070	1 307	< 1.2	8.32	5	22.6	103	535	67	103	< 11.9	250	< 59	< 238	< 594	< 2.4
	118 Drevja. Vefsenfjord N	397	357	4.76	4.76	2	< 1	32	153	27	28	< 4.0	83	31	87	< 198	< 0.8
	119 Røssåga. Sørfjord	27 136	2 626	< 2.9	72.95	93	46.7	353	1 751	274	146	< 29.2	1 080	166	1 109	6 419	< 5.8
	120 Bjerka. Sørfjord	< 391	913	< 0.7	7.83	20	4.6	73	629	50	117	9.8	274	55	339	< 326	< 1.3
	121 Dalselva. Ranafjord N	153	433	< 0.3	1.78	1	0.5	22	235	< 13	28	< 2.5	97	18	133	< 127	< 0.5
	122 Ranavassdraget. Ranafjord N	< 3 511	4 096	11.70	52.66	222	52.7	480	5 392	415	644	< 58.5	1 697	878	2 341	3 394	< 11.7
	123 Fykanåga. Glomfjord	< 594	396	< 1.0	4.95	25	2.0	76	445	< 49	97	< 9.9	148	< 49	< 198	< 495	247.5
	124 Beiarelva. Beiarfjord Nordfjord	1 894	631	4.73	9.47	35	37.9	92	2 334	158	131	< 15.8	426	133	584	< 789	6.3
	125 Saltdalsvassdrag. Saltdalsfj. S	1 500	818	8.18	12.27	35	23.2	89	2 835	109	102	< 13.6	232	< 68	532	< 682	2.7
	126 Sulitjelmavassdrag. Saltdalsfj.	< 818	954	2.73	8.18	38	< 3	146	1 110	131	136	16.4	1 240	79	382	< 681	< 2.7
	127 Kobbe. Leirfjord Sørfolda N	< 572	381	0.95	4.76	27	1.9	68	939	< 48	49	< 9.5	95	60	152	< 476	5.7
	128 Skjoma. Ofotfjord S	< 647	1 294	1.08	7.55	11	2.2	79	2 311	151	119	14.0	453	< 54	1 186	766	3.2

County	Watercourse	Parameter															
		S.P.M. tonnes	TOC tonnes	PO_4-P tonnes	Tot-P tonnes	NO_3-N tonnes	NH_4-N tonnes	Tot-N tonnes	SiO_2 tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Troms (9.)	129 Spanselva. Astafjord Vågsfjord	191	215	0.24	2.15	19	0.5	23	318	16	36	3.6	153	21	359	191	1.0
	130 Salangselva. Astafjord Vågsfj.	519	371	2.23	7.42	7	< 1	62	541	37	62	< 7.4	178	< 37	468	< 371	2.2
	131 Rossfjordelva. Malangen	258	423	1.17	2.35	2	< 0	22	136	15	26	2.3	11	17	106	136	2.3
	132 Målselva. Målselvfj. Malangen	2 397	2 697	3.00	50.94	114	< 6	264	5 458	< 150	569	36.0	1 199	234	1 558	< 1 498	< 6.0
	133 Barduelva. Målselva	2 386	1 856	2.65	66.27	117	23.9	228	3 749	318	424	55.7	1 405	239	2 094	2 227	10.6
	134 Nordkjoselva. Balsfjord	128	219	0.91	1.10	5	0.9	14	360	22	10	< 1.8	51	< 9	< 37	< 91	1.1
	135 Signaldalselva. Lyngen V	679	5 886	2.26	3.17	17	3.6	51	941	36	45	< 4.5	190	32	208	< 226	4.1
	136 Skibotnelva. Lyngen	383	479	2.39	8.14	13	< 1	34	770	29	28	< 4.8	187	< 24	331	< 239	1.9
	137 Kåfjordelva. Lyngen Ø	< 148	173	0.74	6.68	9	0.5	25	323	15	27	< 2.5	228	27	166	< 124	1.5
	138 Reisa. Reisafjord	1 766	1 766	5.30	12.37	74	8.8	164	5 299	371	565	26.5	1 307	194	1 360	1 696	14.1
Finn-mark (10.) *	139 Mattiselva. Kåfjord Altafjord	< 237	1 066	0.79	0.79	6	1.6	63	542	47	9	< 3.9	312	< 79	118	292	2.0
	141 Tverrelva. Altafjord	162	729	0.49	0.97	6	1.1	40	347	18	4	< 1.6	126	45	60	117	< 0.3
	142 Repparfjordvasdraget. Repparfj	567	3 494	< 1.9	2.83	7	13.2	147	1 093	63	< 19	< 9.4	2 172	255	283	500	2.8
	143 Stabburselva. I. Porsangen V	< 422	1 897	1.41	2.11	7	10.5	86	1 415	37	< 14	< 7.0	372	< 141	119	773	3.5
	144 Lakselva. I. Porsangen S	4 983	2 365	1.69	9.29	11	6.8	126	1 683	< 42	< 17	< 8.4	524	< 169	313	< 422	2.5
	145 Børselva. I. Porsangen Ø	916	916	< 1.8	2.75	5	10.1	82	2 748	< 46	< 18	< 9.2	183	< 183	220	879	7.3
	146 Mattusjåkka. I. Laksefjord V	50	109	< 0.2	< 0.2	8	0.8	9	100	5	34	3.1	38	401	73	393	0.5
	147 Storelva. I. Laksefjord V	< 329	384	< 1.1	2.19	12	2.2	55	1 410	< 27	< 11	< 5.5	52	< 110	143	603	2.7
	148 Soussjåkka. I.. Laksefjord V	< 51	110	< 0.2	< 0.2	2	0.4	8	253	< 4	< 2	< 0.8	14	< 17	13	80	1.2
	149 Adamselva. I. Laksefjord Ø	< 306	815	< 1.0	3.06	1	2.0	52	1 200	< 25	< 10	< 5.1	132	< 102	51	469	10.2
	150 Tanavassdraget. Tanafjord S	9 470	35 850	20.29	60.88	20	67.6	1 522	30 439	433	< 135	< 67.6	4 397	2 097	2 841	57 495	40.6
	151 Vesterelva. Syltefjord	< 369	493	1.85	12.93	4	5.5	61	1 320	129	< 12	< 6.2	68	< 123	< 31	< 308	1.2
	152 V. Jakobselva .Y.Varangerfjord	212	990	1.06	3.18	1	2.5	46	1 364	23	< 7	< 3.5	74	71	46	< 177	2.1
	153 Passvikelva. Bøkfj. Varangerfj.	3 734	22 404	10.67	26.67	21	53.3	1 013	14 860	1 013	240	< 53.3	8 001	2 774	35 206	5 334	10.7
	154 Neiden. Munkfjord Varangerfj.	1 385	4 733	2.31	5.77	< 2	19.6	237	2 127	73	< 23	< 11.5	566	< 231	254	716	< 2.3
	155 Grense Jakobselva. Varangerfj.	99	358	0.25	0.37	0	0.7	20	344	22	42	3.9	284	518	1 000	555	< 0.2

* The annual loads from tributary rivers in Finnmark are based on analytical results from 2001.

Appendix X. Tributary rivers. "Mean" load 2002

Table X. Tributary rivers, "mean" load 2002

County	Watercourse	Parameter															
		S.P.M. tonnes	TOC tonnes	PO_4-P tonnes	Tot-P tonnes	NO_3-N tonnes	NH_4-N tonnes	Tot-N tonnes	SiO_2 tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Østfold (1.)	001 Tista. Iddefjord	1 514	6 274	2.88	18.03	269	7.2	461	2 163	195	224	16.6	707	180	418	1 875	< 1.4
	003 Mosselva. Mossesundet	2 146	2 398	0.95	19.88	30	1.6	187	527	170	85	4.1	473	63	316	379	0.6
Oslo og Akershus (1.)	004 Hølenelva. Drøbaksundet Ø	230	605	2.12	4.29	103	2.0	137	583	50	31	1.5	139	31	151	151	0.2
	005 Årungelva. Indre Oslofjord	55	173	0.11	1.15	27	0.1	42	64	13	3	0.4	38	3	38	26	< 0.0
	006 Gjersjøelva. Indre Oslofjord	72	262	0.08	1.71	28	0.8	44	146	14	4	< 0.4	61	5	72	28	< 0.1
	007 Ljanselva. Indre Oslofjord	34	102	1.07	1.96	14	10.6	32	107	8	7	0.6	45	4	36	71	< 0.0
	008 Loelva/Alna. Indre Oslofjord	92	175	2.28	4.00	41	14.9	65	198	17	14	0.9	123	8	49	240	0.1
	009 Akerselva. Indre Oslofjord	338	476	0.38	3.63	23	3.0	46	376	40	101	5.1	251	24	83	539	1.0
	010 Frognerelva. Indre Oslofjord	37	45	0.60	1.18	16	0.3	20	65	7	5	0.2	60	3	20	84	0.1
	011 Lysakerelva. Indre Oslofjord	123	443	0.19	2.55	11	0.4	33	263	21	14	< 0.9	59	8	26	132	0.2
	012 Sandvikselva. I. Oslofjord	155	375	0.52	2.85	51	1.8	75	305	49	28	2.2	181	38	97	142	1.0
	013 Åroselva. Indre Oslofjord	842	503	0.55	3.51	85	0.2	99	428	36	43	2.5	158	44	73	224	0.7
Buskerud (2.)	014 Lierelva. Drammensfjord Ø	2 229	671	2.36	7.79	89	4.7	114	893	73	47	3.1	178	54	112	634	1.3
Vestfold (3.)	016 Sandeelva. Sandebukta	693	466	0.21	4.55	43	0.6	74	195	78	48	8.6	352	13	114	1 449	2.0
	017 Aulielva. Tønsbergfjord	768	989	0.51	7.68	143	7.2	224	658	324	61	5.3	341	48	307	614	4.1
	019 Farriselva. Larvikfjord	368	1 706	0.67	2.34	94	1.7	155	1 075	60	18	9.7	144	31	97	3 110	1.3
Telemark (4.)	021 Tokkeelva. Kragerø	1 564	5 733	2.08	17.72	162	< 1	354	2 457	208	323	37.5	271	125	417	5 421	< 2.1
Aust-Agder (5.)	022 Gjerstadelva. Søndeledfjord	357	2 212	0.71	9.99	56	9.6	116	680	89	157	15.3	285	54	232	2 141	< 0.7
	023 Vegårdselva. Sandnesfjord	507	2 154	0.84	6.76	57	1.7	115	525	110	127	12.2	165	59	220	2 407	< 0.8
	024 Nidelva. Arendal	3 026	11 726	7.57	41.61	533	7.6	757	5 106	530	908	90.8	2 080	250	908	13 996	< 7.6
Vest-Agder (5.)	025 Tovdalselva. Topdalsfjord	1 786	8 532	3.97	77.38	179	4.0	425	2 126	377	516	41.7	317	188	556	5 953	< 4.0
	027 Søgneelva. Flekkerøy	196	1 173	0.49	11.00	90	0.7	108	356	59	86	13.2	100	27	164	1 467	< 0.5
	028 Mandalselva. Mannefjord	1 837	9 972	5.25	41.99	352	23.6	564	2 137	420	1 260	60.4	315	220	525	6 823	< 5.2
	029 Audna. Sniksfjord	447	2 554	1.28	10.22	153	< 1	213	629	160	281	35.1	102	50	160	3 832	< 1.3
	030 Lygna. Lyngdalsfjord	1 005	5 026	2.01	10.05	101	< 1	231	237	231	422	29.1	< 100.5	63	< 201	3 719	< 2.0
	031 Kvina. Fedafjord	2 625	16 011	5.25	39.37	220	< 3	591	1 125	814	1 470	52.5	420	189	< 525	9 187	< 5.2
	032 Sira. Åna-Sira	2 512	6 460	7.18	53.84	524	50.2	825	2 999	327	1 400	61.0	< 358.9	226	< 718	8 614	7.2

County	Watercourse	Parameter															
		S.P.M. tonnes	TOC tonnes	PO_4-P tonnes	Tot-P tonnes	NO_3-N tonnes	NH_4-N tonnes	Tot-N tonnes	SiO_2 tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Rogaland	033 Sokndalselva. Sogndalsstrand	711	1 232	0.95	8.05	108	4.3	168	487	66	166	18.0	142	< 24	758	2 179	< 0.9
(6.)	034 Hellelandselva. Egersund	393	1 180	2.62	13.98	95	9.2	163	449	52	232	14.0	153	42	< 87	1 573	< 0.9
	035 Bjerkreimselva. Egersund	< 1 036	3 109	12.09	51.82	508	17.3	694	2 147	168	622	51.8	397	112	< 345	5 182	< 3.5
	036 Håelva. Håtangen	464	976	5.12	10.74	202	10.7	446	628	76	115	5.6	234	39	< 49	2 928	< 0.5
	038 Figgjo. Solavika	867	1 444	6.50	12.28	347	30.0	504	929	69	116	9.0	397	54	< 72	9 388	1.1
	039 Ims-Lutsi. Høgsfjord Boknafjord	168	531	0.28	4.47	75	3.2	105	66	15	24	2.2	71	13	< 28	294	0.3
	040 Oltedalselva Høgsfjord Boknafj.	203	428	0.45	3.38	52	2.0	84	405	18	196	6.1	106	22	< 45	630	0.5
	041 Dirdalselva Høgsfjord Boknafj.	< 248	786	14.89	30.60	108	2.5	154	417	32	103	5.0	91	25	< 83	538	< 0.8
	042 Frafjordelva. Frafjord Boknafj.	< 318	1 060	3.71	11.13	281	6.4	327	602	33	170	7.9	207	39	< 106	1 113	1.6
	043 Espedalselva. Høgsfj. Boknafj.	< 235	705	1.57	5.88	56	3.9	83	529	< 20	78	4.7	51	< 20	< 78	223	< 0.8
	044 Lyseelva. Lysefjord Boknafjord	< 255	934	3.40	14.44	7	3.4	47	501	29	153	5.1	102	36	< 85	467	1.7
	045 Årdalselva. Årdalsfjord Boknafj.	< 799	1 732	10.66	26.65	184	< 3	254	1 228	72	240	14.7	200	96	< 266	1 332	6.7
	046 Førreelva. Jøsenfjord Boknafj.	< 265	353	12.35	25.14	24	0.9	42	747	23	75	< 4.4	84	32	< 88	432	2.6
	047 Ulla. Jøsenfjord Boknafjord	< 620	2 377	11.37	17.57	90	< 2	182	1 307	95	475	13.4	331	165	< 207	1 240	2.1
(7.)	049 Saudaelva. Saudafjord Boknafj.	< 568	852	3.78	11.35	755	2.8	793	1 663	88	142	31.2	681	85	< 189	6 529	1.9
	050 Åbøelva. Saudafjord Boknafj.	< 132	132	0.66	2.20	28	< 0	36	132	12	44	2.4	59	< 11	< 44	220	< 0.4
	051 Vikedalselva. Boknafjord	208	417	1.79	9.53	68	< 1	98	191	80	65	4.8	113	15	< 60	506	0.6
Horda-	052 Etneelva. Etnefjord Bømlafjord	271	349	2.71	8.14	135	4.3	162	332	66	93	6.2	182	< 19	< 78	814	< 0.8
land	053 Opo. Sørfjord Hardangerfjord	2 290	844	4.82	15.67	110	14.5	168	1 059	< 60	458	22.9	398	121	< 241	3 255	8.4
(7.)	054 Tysso. Sørfjord Hardangerfjord	< 582	1 164	5.82	21.35	141	2.9	237	1 227	91	126	23.3	757	< 49	< 194	3 299	< 1.9
	055 Kinso. Sørfjord Hardangerfjord	245	204	4.48	7.75	19	< 1	90	114	< 20	114	4.1	122	26	< 82	220	< 0.8
	056 Veig. Eidfjord Hardangerfjord	< 392	458	2.62	9.81	25	< 1	98	715	< 33	92	9.2	150	< 33	< 131	471	< 1.3
	057 Bjoreia. Eidfjord Hardangerfjord	340	680	5.82	8.74	24	1.0	66	499	< 24	58	6.3	121	< 24	< 97	345	1.0
	058 Sima. Eidfjord Hardangerfjord	< 190	127	0.63	1.58	30	< 1	57	576	< 16	44	< 3.2	82	22	< 63	< 158	< 0.6
	059 Austdøla. Osafjord Eidfjord	< 185	92	1.23	49.62	14	< 1	24	165	< 15	37	3.1	37	21	< 6	197	1.2
	060 Norddøla. Osafjord Eidfjord	56	9	0.19	4.80	9	0.3	10	121	12	6	< 0.9	< 9.4	9	< 19	< 47	0.7
	061 Tysseelva. Fusafjord	386	1 029	2.57	6.43	46	3.2	111	262	57	187	9.7	251	48	< 129	1 029	1.9
	062 Oselva. Fusafjord	378	914	1.26	3.15	38	2.2	101	311	50	69	6.3	290	66	66	914	1.9
	063 Bergsdalse. Veafjord Herdlafj.	300	599	1.00	3.50	37	1.0	78	257	34	95	6.0	140	27	< 100	699	2.5
	064 Vosso. Veafjord Sørfjord	1 917	2 738	10.95	27.38	151	13.7	975	1 819	< 137	520	43.8	685	< 137	< 548	4 381	8.2
	065 Ekso. Osterfjord	675	1 688	4.50	7.88	25	2.3	140	362	65	180	< 11.3	248	< 56	< 225	788	5.6
	066 Modalselva. Osterfjord	< 696	928	8.12	18.55	77	2.3	144	646	< 58	186	< 11.6	139	< 58	< 232	765	< 2.3

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		S.P.M. tonnes	TOC tonnes	PO_4-P tonnes	Tot-P tonnes	NO_3-N tonnes	NH_4-N tonnes	Tot-N tonnes	SiO_2 tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Sogn og Fjordane (7.)	067 Nærøyelva. Aurlandsfj. Sognefj	< 326	218	2.18	3.81	68	< 1	83	1 283	< 27	48	< 5.4	120	< 27	< 109	< 272	3.8
	068 Flåmselva. Aurlandsfj. Sognefj.	324	185	0.93	2.78	32	< 1	45	307	< 23	30	< 4.6	79	< 23	106	< 231	1.9
	069 Aurlandelva..Aurlandsfj.Sognefj	858	613	< 1.2	11.04	96	2.5	137	1 156	< 61	159	< 12.3	380	< 61	282	944	4.9
	070 Erdalselva. Lærdalsfj. Sognefj.	78	52	0.65	1.31	2	< 0	7	145	< 7	16	< 1.3	17	< 7	< 26	< 65	< 0.3
	071 Lærdalselva. Lærdalsfj.Sognefj	784	784	3.36	5.60	63	2.2	129	1 704	< 56	168	12.3	470	56	< 224	< 560	4.5
	072 Årdalselva. Årdalsfjord Sognefj.	3 361	700	< 1.4	18.21	92	< 3	182	2 251	< 70	196	14.0	2 241	168	434	994	2.8
	073 Fortunelva. Lusterfj. Sognefj.	2 696	327	< 0.8	8.17	58	2.5	67	1 033	< 41	180	< 8.2	899	90	245	1 062	22.1
	074 Mørkriselva. Lusterfj. Sognefj.	2 530	97	< 0.5	2.92	28	1.5	41	636	< 24	107	< 4.9	229	190	224	681	1.0
	075 Jostedøla. Lusterfjord Sognefj.	38 212	371	1.85	64.92	115	18.5	173	2 822	< 93	686	< 18.5	1 224	1 132	946	3 153	< 3.7
	076 Årøyelva. Sogndalsfj. Sognefj.	1 858	547	< 1.1	22.96	62	3.3	109	1 335	< 55	82	< 10.9	175	59	< 219	< 547	2.2
	077 Sogndalselva Sognd.fj. Sognefj	219	255	< 0.4	1.09	5	0.7	24	250	< 18	35	< 3.6	58	< 18	< 73	< 182	1.1
	078 Gaular. Dalsfjord Bufjord	< 941	1 882	< 1.6	4.70	86	6.3	196	941	< 78	102	< 15.7	220	< 78	< 314	1 160	4.7
	079 Jølstra. Førdefjord	1 506	1 840	< 1.7	25.09	151	11.7	315	1 219	< 84	167	< 16.7	318	< 84	< 335	1 840	6.7
	080 Nausta. Førdefjord	428	1 142	< 0.7	4.28	9	5.0	70	199	< 36	79	< 7.1	121	< 36	< 143	428	< 1.4
	081 Oselva. Høydalsfjord	712	2 066	< 0.7	44.87	23	8.5	105	153	< 36	100	< 7.1	185	53	207	855	2.1
	082 Hopselva. Hyefjord Nordfjord S	< 104	104	< 0.2	0.69	13	0.9	18	59	< 9	29	< 1.7	< 17.3	< 9	< 35	< 86	0.3
	083 Gjengedalselva. Hyefj. Nordfj.S	< 241	563	< 0.4	4.83	19	2.0	44	215	< 20	84	< 4.0	60	25	< 80	< 201	< 0.8
	084 Breimselva. Gloppenfj. Nordfj.S	1 637	818	< 1.4	5.46	164	9.5	224	1 315	< 68	90	< 13.6	273	79	< 273	832	< 2.7
	085 Oldenelva. Indre Nordfjord	699	150	< 0.5	2.00	70	5.0	94	567	< 25	44	< 5.0	120	43	< 100	270	< 1.0
	086 Loenelva. Indre Nordfjord	1 017	214	< 0.5	4.82	35	1.6	59	711	< 27	70	< 5.4	150	102	< 107	< 268	< 1.1
	087 Stryneelva. Indre Nordfjord	1 109	403	< 1.0	1.01	91	5.0	120	1 102	< 50	79	< 10.1	313	82	< 202	< 504	< 2.0
	088 Hornindalselva. Nordfjord N	< 471	784	< 0.8	3.14	67	6.3	122	739	56	157	11.0	212	45	282	1 019	< 1.6
Møre og Romsdal (8.)	089 Ørstaelva. Ørstafjord	247	424	< 0.4	8.12	18	5.7	57	492	< 18	39	< 3.5	74	34	113	< 177	1.1
	090 Valldøla. Nordalfjord Storfjord	< 408	204	< 0.7	< 0.7	8	10.2	50	611	< 34	95	< 6.8	177	66	< 136	< 340	< 1.4
	091 Rauma. Romsdalsfjord Moldefj.	< 746	497	< 1.2	< 1.2	36	2.5	81	1 652	< 62	137	< 12.4	274	< 62	< 249	< 622	< 2.5
	092 Isa. Isfjord Moldefjord	629	94	< 0.3	< 0.3	6	< 1	19	526	< 16	53	< 3.1	179	226	173	214	< 0.6
	093 Eira. Eresfjord Moldefjord	< 737	737	< 1.2	< 1.2	130	16.0	181	2 026	< 61	172	< 12.3	479	86	< 246	< 614	3.7
	094 Littledalselva Sunndalsfjord	< 279	232	0.93	4.64	52	0.9	59	1 492	< 23	56	< 4.6	111	56	< 93	< 232	< 0.9
	095 Driva.Sunndalsfjord Tingvollfj.	2 845	1 969	2.19	30.63	151	6.6	243	4 548	< 109	241	< 21.9	1 028	460	< 438	< 1 094	13.1
	096 Ulvåa. Ålvundfjord	608	644	0.36	4.65	44	3.2	83	843	< 18	39	< 3.6	290	50	< 72	283	2.1
	097 Toåa. Todalsfjord	< 278	509	< 0.5	< 0.5	9	< 1	32	466	< 23	51	< 4.6	157	26	< 93	< 232	3.2
	098 Surna. Surnadalsfjord	1 453	2 725	< 1.8	< 1.8	91	16.3	249	1 674	< 91	165	< 18.2	854	< 363	672	1 108	7.3
	099 Bøvra. Hamnesfjord Halsafjord	< 253	1 054	< 0.4	< 0.4	90	10.1	134	533	< 21	19	< 4.2	101	23	51	< 211	< 0.8

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Sør-Trønde-lag (8.)	101	Børselva. Gaulosen Trondheimsfj.	187	520	1.46	2.50	21	< 0	44	51	18	11	1.0	98	17	114	< 52	2.3
	102	Vigda. Gaulosen Trondheimsfj.	355	525	< 0.1	1.70	22	0.7	53	185	20	8	< 1.4	81	34	70	87	0.3
	103	Gaula. Gaulosen Trondheimsfj.	21 6592	30 463	< 3.0	359.46	222	12.2	1 474	7 833	457	1615	70.1	5 788	1 523	5 179	7 006	< 6.1
	104	Nidelva. Trondheimsfjord	9 749	10 097	153	233.28	202	870.4	2 110	4 551	334	487	34.8	4 526	487	2 507	5 223	10.4
	105	Homla. Stjørdalsfj. Trondheimsfj.	119	847	< 0.1	1.04	4	4.8	38	185	73	10	< 1.5	82	15	71	83	< 0.3
Nord-Trønde-lag (8.)	106	Stjørdalselva. Stjørdalsfj.Tr.h.fj.	19 020	19 020	< 2.6	23.13	136	7.7	802	3 195	334	411	41.1	4 884	823	2 390	10 281	< 5.1
	107	Gråelva. Stjørdalsfj.Trondh.fj.	455	367	2.20	3.01	8	2.8	29	88	24	6	< 0.7	63	12	37	< 37	< 0.1
	108	Verdalsvassdrag. Trondheimsfj	28 224	15 226	3.71	38.99	152	14.9	214	3 183	334	668	35.3	2 785	538	1 485	4 642	13.0
	109	Figga/Leksdalselva. Trondh.fj	3 165	8 943	6.88	26.14	129	12.4	198	943	427	399	23.4	1 513	330	1 225	1 789	6.9
	110	Snåsavassdrag. Trondheimsfj	1 927	5 643	2.75	27.53	110	11.0	297	1 091	125	165	16.5	73	78	1 514	1 115	5.5
	111	Årgårdselva. Namsfjord	1 927	4 542	1.38	11.01	34	35.8	228	885	125	193	< 13.8	509	106	< 275	716	11.0
	112	Namsen. Namsfjord Ø	1 514	2 064	2.75	13.76	59	17.9	175	944	165	234	19.3	1 211	151	440	1 651	4.1
	113	Salsvatnelva. Follafjord	824	2 884	1.37	6.87	74	4.1	158	1 295	102	206	19.2	302	129	288	1 648	6.9
Nordland (9.)	114	Åbjøra. Bindalsfjord S	1 064	1 330	2.66	7.98	124	17.3	124	656	160	359	16.0	466	< 67	1 051	1 171	10.6
	116	Skjerva. Vefsenfjord S	230	461	11.92	15.17	10	23.7	79	183	64	66	4.3	203	27	745	1 002	0.5
	117	Fusta. Vefsenfjord N	979	1 196	< 1.1	7.61	4	20.7	95	489	61	95	< 10.9	228	< 54	< 218	< 544	< 2.2
	118	Drevja. Vefsenfjord N	363	327	4.35	4.35	1	< 1	29	140	25	25	< 3.6	76	28	80	< 181	< 0.7
	119	Røssåga. Sørfjord	27 855	2 696	< 3.0	74.88	96	47.9	362	1 797	282	150	< 30.0	1 108	171	1 138	6 589	< 6.0
	120	Bjerka. Sørfjord	< 404	942	< 0.7	8.07	20	4.7	75	649	51	121	10.1	283	57	350	< 336	< 1.3
	121	Dalselva. Ranafjord N	158	447	< 0.3	1.84	1	0.5	23	242	< 13	29	< 2.6	100	19	137	< 131	< 0.5
	122	Ranavassdraget. Ranafjord N	< 3 268	3 813	10.89	49.03	207	49.0	447	5 019	387	599	< 54.5	1 580	817	2 179	3 159	< 10.9
	123	Fykanåga. Glomfjord	< 583	389	< 1.0	4.86	24	1.9	75	437	< 49	95	< 9.7	146	< 49	< 194	< 486	242.8
	124	Beiarelva. Beiarfjord Nordfjord	1 816	605	4.54	9.08	33	36.3	88	2 238	151	126	< 15.1	409	127	560	< 757	6.1
	125	Saltdalsvassdrag. Saltdalsfj. S	1 719	938	9.38	14.07	41	26.6	102	3 249	125	117	< 15.6	266	< 78	610	< 781	3.1
	126	Sulitjelmavassdrag. Saltdalsfj.	< 856	999	2.85	8.56	40	< 3	153	1 162	137	143	17.1	1 298	83	399	< 713	< 2.9
	127	Kobbe. Leirfjord Sørfolda N	< 513	342	0.85	4.27	24	1.7	61	842	< 43	44	< 8.5	85	54	137	< 427	5.1
	128	Skjoma. Ofotfjord S	< 580	1 161	0.97	6.77	10	1.9	71	2 073	135	106	12.6	406	< 48	1 064	687	2.9

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Troms (9.)	129 Spanselva. Astafjord Vågsfjord	179	202	0.22	2.02	17	0.4	22	297	15	34	3.4	143	19	336	179	0.9
	130 Salangselva. Astafjord Vågsfj.	487	348	2.09	6.95	6	< 1	58	507	35	58	< 7.0	167	< 35	438	< 348	2.1
	131 Rossfjordelva. Malangen	269	439	1.22	2.44	2	< 0	23	141	16	27	2.4	12	17	110	142	2.4
	132 Målselva. Målselvfj. Malangen	2 345	2 638	2.93	49.84	111	< 6	258	5 340	< 147	557	35.2	1 173	229	1 524	< 1 466	< 5.9
	133 Barduelva. Målselva	2 334	1 815	2.59	64.84	114	23.3	223	3 668	311	415	54.5	1 375	233	2 049	2 179	10.4
	134 Nordkjoselva. Balsfjord	117	200	0.83	1.00	5	0.8	12	329	20	9	< 1.7	47	< 8	< 33	< 83	1.0
	135 Signaldalselva. Lyngen V	620	5 371	2.07	2.89	16	3.3	47	859	33	41	< 4.1	174	29	190	< 207	3.7
	136 Skibotnelva. Lyngen	350	437	2.19	7.43	12	< 1	31	702	26	25	< 4.4	170	< 22	302	< 219	1.7
	137 Kåfjordelva. Lyngen Ø	< 135	158	0.68	6.10	9	0.5	23	295	13	25	< 2.3	208	25	151	< 113	1.4
	138 Reisa. Reisafjord	1 363	1 363	4.09	9.54	57	6.8	127	4 090	286	436	20.5	1 009	150	1 050	1 309	10.9
Finn-mark (10.) *	139 Mattiselva. Kåfjord Altafjord	< 163	733	0.54	0.54	4	1.1	43	372	33	7	< 2.7	215	< 54	81	201	1.4
	141 Tverrelva. Altafjord	111	501	0.33	0.67	4	0.8	27	239	12	3	< 1.1	87	31	41	80	< 0.2
	142 Repparfjordvasdraget. Repparfj	516	3 180	< 1.7	2.58	6	12.0	134	994	58	< 17	< 8.6	1 977	232	258	455	2.6
	143 Stabburselva. I. Porsangen V	< 384	1 726	1.28	1.92	6	9.6	79	1 288	34	< 13	< 6.4	339	< 128	109	703	3.2
	144 Lakselva. I. Porsangen S	4 535	2 152	1.54	8.46	10	6.1	115	1 532	< 38	< 15	< 7.7	477	< 154	284	< 384	2.3
	145 Børselva. I. Porsangen Ø	830	830	< 1.7	2.49	4	9.1	75	2 489	< 41	< 17	< 8.3	166	< 166	199	797	6.6
	146 Mattusjåkka. I. Laksefjord V	44	94	< 0.1	< 0.1	7	0.7	8	87	5	30	2.7	33	349	63	341	0.4
	147 Storelva. I. Laksefjord V	< 286	334	< 1.0	1.91	10	1.9	48	1 225	< 24	< 10	< 4.8	45	< 95	124	524	2.4
	148 Soussjåkka. I.. Laksefjord V	< 44	95	< 0.1	< 0.1	2	0.4	7	220	< 4	< 1	< 0.7	12	< 15	11	70	1.0
	149 Adamselva. I. Laksefjord Ø	< 265	708	< 0.9	2.65	1	1.8	46	1 043	< 22	< 9	< 4.4	115	< 88	44	407	8.8
	150 Tanavassdraget. Tanafjord S	8 321	31 502	17.83	53.49	18	59.4	1 337	26 747	380	< 119	< 59.4	3 863	1843	2 496	50 521	35.7
	151 Vesterelva. Syltefjord	< 307	409	1.54	10.75	4	4.6	51	1 097	107	< 10	< 5.1	56	< 102	< 26	< 256	1.0
	152 V. Jakobselva .Y.Varangerfjord	215	1 002	1.07	3.22	1	2.5	46	1 380	24	< 7	< 3.6	75	72	47	< 179	2.1
	153 Passvikelva. Bøkfj. Varangerfj.	3 778	22 670	10.80	26.99	22	54.0	1 026	15 036	1 026	243	< 54.0	8 096	2807	35 624	5 398	10.8
	154 Neiden. Munkfjord Varangerfj.	1 098	3 751	1.83	4.57	< 2	15.6	188	1 686	58	< 18	< 9.1	448	< 183	201	567	< 1.8
	155 Grense Jakobselva. Varangerfj.	106	385	0.27	0.40	0	0.8	22	370	24	45	4.3	306	558	1076	598	< 0.3

* The mean loads from tributary rivers in Finnmark are based on analytical results from 2001.

Appendix XI. "Mean" total discharges.

(Mean concentrations of main and tributary rivers multiplied with mean water flow. 1961 – 90 main rivers and 1931 – 60 tributary rivers).

Table XI	Mean total discharges from mainland Norway to convention waters
Table XI.I	Mean total discharges to the Skagerak Region
Table XI.II	Mean total discharges to the Remaining North Sea
Table XI.III	Mean total discharges to the Norwegian Sea
Table XI.IV	Mean total discharges to the Barents Sea

Table XI Mean total discharges from mainland Norway to convention waters

(Mean water flow 1961-1990, main river, 1931-1960, tributary rivers)

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*	-	-	732 459	445 099	191 976	**1 369 534**	tonnes
	**	-	-	732 459	464 191	195 130	**1 391 779**	
TOC		-	-	263	340 323	206 134	**546 720**	tonnes
Orthoph.	*	232	912	494	493	348	**2 480**	tonnes
	**	232	912	494	532	352	**2 522**	
Total P	*	917	5 069	1 032	2 391	1 446	**10 855**	tonnes
	**	917	5 069	1 032	2 397	1 447	**10 862**	
Nitrates	*	19 365	-	51	11 605	15 076	**46 097**	tonnes
	**	19 365	-	51	11 607	15 076	**46 099**	
Ammonia	*	1 783	7 616	7 941	1 906	1 129	**20 374**	tonnes
	**	1 783	7 616	7 941	1 939	1 134	**20 413**	
Total N		29 861	23 799	13 696	27 973	23 586	**118 914**	tonnes
Silicate SiO2	*	-	-	-	197 963	174 922	**372 884**	tonnes
	**		-	-	197 963	176 565	**374 528**	
Arsenic	*	-	-	1.1	12	9.8	**23**	tonnes
	**	-	-	1.1	15	9.8	**25**	
Lead	*	-	-	6.8	25	13	**45**	tonnes
	**	-	-	6.8	25	14	**46**	
Cadmium	*	-	-	0.26	1.3	0.87	**2.5**	tonnes
	**	-	-	0.26	2.0	1.1	**3.3**	
Copper		-	-	27	75	88	**190**	tonnes
		-	-	27	76	88	**191**	
Total Cr-T	*	-	-	4.5	18	13	**36**	tonnes
	**	-	-	4.5	21	14	**40**	
Nickel	*	-	-	17	80	41	**138**	tonnes
	**	-	-	17	90	42	**149**	
Zinc	*	-	-	58	251	233	**542**	tonnes
	**	-	-	58	266	236	**559**	
Mercury	*	-	-	50	603	1 034	**1 687**	kg
	**	-	-	50	715	1 067	**1 832**	
Lindane	*	-	-	-	-	28.7	**28.7**	kg
	**	-	-	-	-	29.2	**29.2**	

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

Table XI.I Mean total discharges to the Skagerrak Region

(Mean water flow 1961-1990, main river, 1931-1960, tributary rivers)

The Skagerrak Region with sub-areas: (1) Glomma, (2) Drammenselva, (3) Numedalslågen, (4) Skienselva, (5) Otra.

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*			2 598	25 558	173 101	**201 257**	tonnes
	**			2 598	25 558	174 106	**202 262**	
TOC				84	87 216	178 291	**265 591**	tonnes
Orthoph.	*	22	0.00	65	52	263	**402**	tonnes
	**	22	0.00	65	52	266	**405**	
Total P	*	87	0.00	188	407	1 178	**1 860**	tonnes
	**							
Nitrates	*	1 944	-	20	3 494	13 233	**18 691**	tonnes
	**							
Ammonia	*	179	0.01	3 142	155	1 069	**4 545**	tonnes
	**	179	0.01	3 142	160	1 069	**4 550**	
Total N		2 992	0.02	5 199	6 107	20 560	**34 857**	tonnes
Silicate SiO2	*			-	26 426	147 796	**174 222**	tonnes
	**			-	26 426	148 543	**174 969**	
Arsenic				0.29	4.5	7.8	**13**	tonnes
Lead	*			0.72	7.68	12	**20**	tonnes
	**			0.72	7.68	12	**21**	
Cadmium	*			0.062	0.51	0.71	**1.3**	tonnes
	**			0.062	0.51	0.83	**1.4**	
Copper	*			12	7.4	64	**83**	tonnes
	**			12	7.8	64	**84**	
Total Cr-T	*			2.0	2.0	9.6	**13.7**	tonnes
	**			2.0	2.0	10.3	**14.3**	
Nickel	*			3.9	5.2	33	**42**	tonnes
	**			3.9	6.6	33	**43**	
Zinc	*			17	73	175	**266**	tonnes
	**			17	73	176	**266**	
Mercury	*			21	20	878	**918**	kg
	**			21	51	898	**970**	
Lindane				-	-	26	**26**	kg

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

Table XI.II Mean total discharges to the Remaining North Sea

(Mean water flow 1961-1990, main river, 1931-1960, tributary rivers)

The remaining North Sea Region with sub-areas: (6) Orreelva, (7) Suldalslågen

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*			48 793	67 900	3 856	**120 548**	tonnes
	**			48 793	76 504	4 691	**129 988**	
TOC				155	44 187	4 019	**48 361**	tonnes
Orthoph.	*	60	314	167	158	19	**718**	tonnes
	**	60	314	167	173	19	**733**	
Total P	*	228	1745	332	697	55	**3 057**	tonnes
	**	228	1745	332	697	56	**3 058**	
Nitrates		7 438	-	14	5 217	736	**13 404**	tonnes
Ammonia	*	678	2643	2 200	237	16	**5 773**	tonnes
	**	678	2643	2 200	251	17	**5 789**	
Total N		11 571	8258	3 942	9 005	979	**33 756**	tonnes
Silicate SiO2	*			-	41 033	2 303	**43 336**	tonnes
	**			-	41 033	3 200	**44 233**	
Arsenic	*			0.20	1.4	0.21	**1.8**	tonnes
	**			0.20	2.7	0.26	**3.1**	
Lead	*			4.5	8.0	0.40	**13**	tonnes
	**			4.5	8.0	0.41	**13**	
Cadmium	*			0.14	0.37	0.048	**0.56**	tonnes
	**			0.14	0.56	0.052	**0.75**	
Copper	*			5.2	14.9	1.2	**21**	tonnes
	**			5.2	14.9	1.2	**21**	
Total Cr-T	*			1.2	3.2	0.87	**5.3**	tonnes
	**			1.2	4.0	1.0	**6.3**	
Nickel	*			10	3.6	0.75	**14**	tonnes
	**			10	10	1.0	**21**	
Zinc	*			26	65	6.7	**98**	tonnes
	**			26	68	6.7	**101**	
Mercury	*			15	108	55	**178**	kg
	**			15	139	60	**214**	
Lindane				-	-	2.0	**2.0**	kg

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

Table XI.III Mean total discharges to the Norwegian Sea

(Mean water flow 1961-1990, main river, 1931-1960, tributary rivers)

The Norwegian Sea with sub-areas: (8) Orkla, (9) Vefsna

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*			469 807	332 087	9 854	**811 748**	tonnes
	**			469 807	341 126	11 032	**821 965**	
TOC				23	138 848	13 635	**152 505**	tonnes
Orthoph.	*	132	530	243	247	43	**1 194**	tonnes
	**	132	530	243	265	43	**1 212**	
Total P	*	514	2942	479	1 166	147	**5 250**	tonnes
	**	514	2942	479	1 172	148	**5 256**	
Nitrates		8 954	-	16	2 795	959	**12 725**	tonnes
Ammonia	*	839	4403	2 417	1 334	34	**9 026**	tonnes
	**	839	4403	2 417	1 348	37	**9 044**	
Total N		13 597	13758	4 311	9 611	1 429	**42 706**	tonnes
Silicate SiO2				-	74 697	13 410	**88 107**	tonnes
Arsenic	*			0.56	4.9	0.91	**6.3**	tonnes
	**			0.56	5.6	0.91	**7.1**	
Lead	*			1.5	9.2	0.59	**11**	tonnes
	**			1.5	9.2	0.61	**11**	
Cadmium	*			0.052	0.44	0.11	**0.60**	tonnes
	**			0.052	0.72	0.17	**0.94**	
Copper				9.294	37	19.3	**65**	tonnes
Total Cr-T	*			1.1	7.4	0.9	**9.4**	tonnes
	**			1.1	8.1	1.1	**10.4**	
Nickel	*			2.6	31	3	**37**	tonnes
	**			2.6	33	4	**40**	
Zinc	*			13	52	47	**113**	tonnes
	**			13	63	50	**126**	
Mercury	*			13	397	56	**466**	kg
	**			13	445	62	**521**	
Lindane	*			-	-	0.50	**0.50**	kg
	**			-	-	0.91	**0.91**	kg

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

Table XI.IV Mean total discharges to the Barents Sea

(Mean water flow 1961-1990, main river, 1931-1960, tributary rivers)

The Barents Sea with sub-area: (10) Alta

		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river-ine inputs	Grand total	
S.P.M.	*			211 261	19 554	5 166	**235 981**	tonnes
	**			211 261	21 003	5 301	**237 565**	
TOC				-	70 073	10 190	**80 263**	tonnes
Orthoph.	*	18	69	19	37	23	**166**	tonnes
	**	18	69	19	43	23	**171**	
Total P	*	88	382	32	121	65	**688**	tonnes
	**	88	382	32	121	65	**689**	
Nitrates	*	1 029	-	1.0	99	148	**1 277**	tonnes
	**	1 029	-	1.0	101	148	**1 279**	
Ammonia	*	87	570	182	180	11	**1 030**	tonnes
	**							
Total N		1 701	1782	244	3 250	617	**7 594**	tonnes
Silicate SiO2				-	55 806	11 412	**67 219**	tonnes
Arsenic	*			-	1.8	0.82	**2.6**	tonnes
	**			-	1.9	0.82	**2.7**	
Lead	*			0.045	0.33	0.34	**0.72**	tonnes
	**			0.045	0.56	0.36	**0.96**	
Cadmium	*			0.003	0.007	0.00	**0.011**	tonnes
	**			0.003	0.18	0.03	**0.21**	
Copper				0.67	16.3	3.3	**20**	tonnes
Total Cr-T	*			0.079	5.9	2.1	**8.0**	tonnes
	**			0.079	6.9	2.1	**9.1**	
Nickel	*			0.081	41	4.2	**45**	tonnes
	**			0.081	41	4.2	**45**	
Zinc	*			1.01	61	3.3	**65**	tonnes
	**			1.01	61	3.6	**66**	
Mercury	*			1.10	78	45	**125**	kg
	**			1.10	81	46	**128**	
Lindane	*			-	-	0.39	**0.39**	kg
	**			-	-	0.49	**0.49**	kg

Measurements below detection limits are treated in two ways
*Detection limit = zero, ** Detection limit = limit

Appendix XII. Fish farming effluents to convention waters 2002

Table XII	Fish farming effluents from down stream areas of mainland Norway to convention waters (2002)
Table XII.I	Fish farming effluents to the Skagerrak region (2002)
Table XII.II	Fish farming effluents to the Remaining North Sea region(2002)
Table XII.III	Fish farming effluents to the Norwegian Sea region (2002)
Table XII.IV	Fish farming effluents to the Barents Sea region (2002)

Table XII Fish farming effluents from down stream areas of mainland Norway to convention waters (2002)

Total quantity of substance discharged per year:

Sub-areas:		Tonnes	
1 Glomma	**P**	0.0	
	N	0.0	
	PO4-P	0.0	
	NH4-N	0.0	
1 Inner Oslofjord	**P**	0.0	
	N	0.0	
	PO4-P	0.0	
	NH4-N	0.0	
2 Drammenselva	**P**	0.0	
	N	0.0	
	PO4-P	0.0	
	NH4-N	0.0	
3 Numedalslågen	**P**	0.0	
	N	0.0	
	PO4-P	0.0	
	NH4-N	0.0	
4 Skienselva	**P**	0.0	
	N	0.0	
	PO4-P	0.0	
	NH4-N	0.0	
5 Otra	**P**	0.0	
	N	0.0	
	PO4-P	0.0	
	NH4-N	0.0	
6 Orreelva	**P**	187.3	
	N	886.7	
	PO4-P	33.7	
	NH4-N	283.8	
7 Suldalslågen	**P**	1 557.4	
	N	7 371.7	
	PO4-P	280.3	
	NH4-N	2 358.9	
8 Orkla	**P**	1 740.9	
	N	8 267.5	
	PO4-P	313.4	
	NH4-N	2 645.6	
9 Vefsna	**P**	1 201.6	
	N	5 490.3	
	PO4-P	216.3	
	NH4-N	1 756.9	
10 Alta	**P**	381.9	
	N	1 782.3	
	PO4-P	68.7	
	NH4-N	570.3	
SUM	**P**	**5 069**	**tonnes**
SUM	**N**	**23 799**	**tonnes**
SUM	**PO4-P**	**912**	**tonnes**
SUM	**NH4-N**	**7 616**	**tonnes**

Appendix XIII. Mean concentrations and loads from 1990 to 2002. Main rivers

Figure XIII.I	Conductivity, mean concentrations* in main rivers	(mS/m)
Figure XIII.II	Suspended particulate matter, mean concentrations* in main rivers	(mg/l)
Figure XIII.III	Total organic carbon, mean concentrations* in main rivers	(mg/l)
Figure XIII.IV	Orthophosphate, mean concentrations* in main rivers	(µg/l)
Figure XIII.V	Total phosphorus, mean concentrations* in main rivers	(µg/l)
Figure XIII.VI	Nitrate and nitrite, mean concentrations* in main rivers	(µg/l)
Figure XIII.VII	Ammonia, mean concentrations* in main rivers	(µg/l)
Figure XIII.VIII	Total nitrogen, mean concentrations* in main rivers	(µg/l)
Figure XIII.IX	Silicate, mean concentrations* in main rivers	(mg/l)
Figure XIII.X	Arsenic, mean concentrations* in main rivers	(µg/l)
Figure XIII.XI	Lead, mean concentrations* in main rivers	(µg/l)
Figure XIII.XII	Cadmium, mean concentrations* in main rivers	(µg/l)
Figure XIII.XIII	Copper, mean concentrations* in main rivers	(µg/l)
Figure XIII.XIV	Total, mean concentrations* in main rivers	(µg/l)
Figure XIII.XV	Nickel, mean concentrations* in main rivers	(µg/l)
Figure XIII.XVI	Zinc, mean concentrations* in main rivers	(µg/l)
Figure XIII.XVII	Mercury, mean concentrations* in main rivers	(ng/l)
Figure XIII.XVIII	Lindane, mean concentrations* in main rivers	(ng/l)
Figure XIII.XIX	Total nitrogen and total phosphorus, load in main rivers	(tonnes/year)

*Mean of reported values, for measurement below detection limits, detection limit is used as value for calculation.

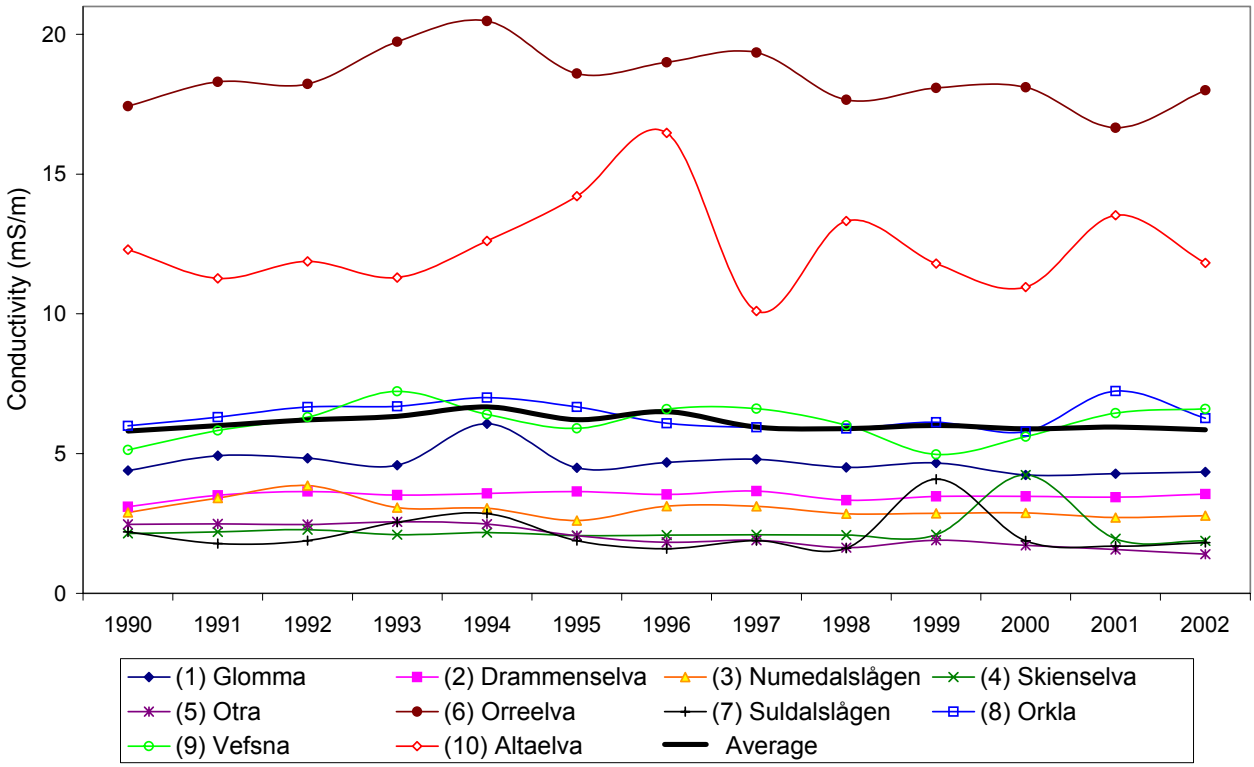


Figure XIII.I Specific conductivity in main rivers.
Mean value from 1990 to 2002 (mS/m).

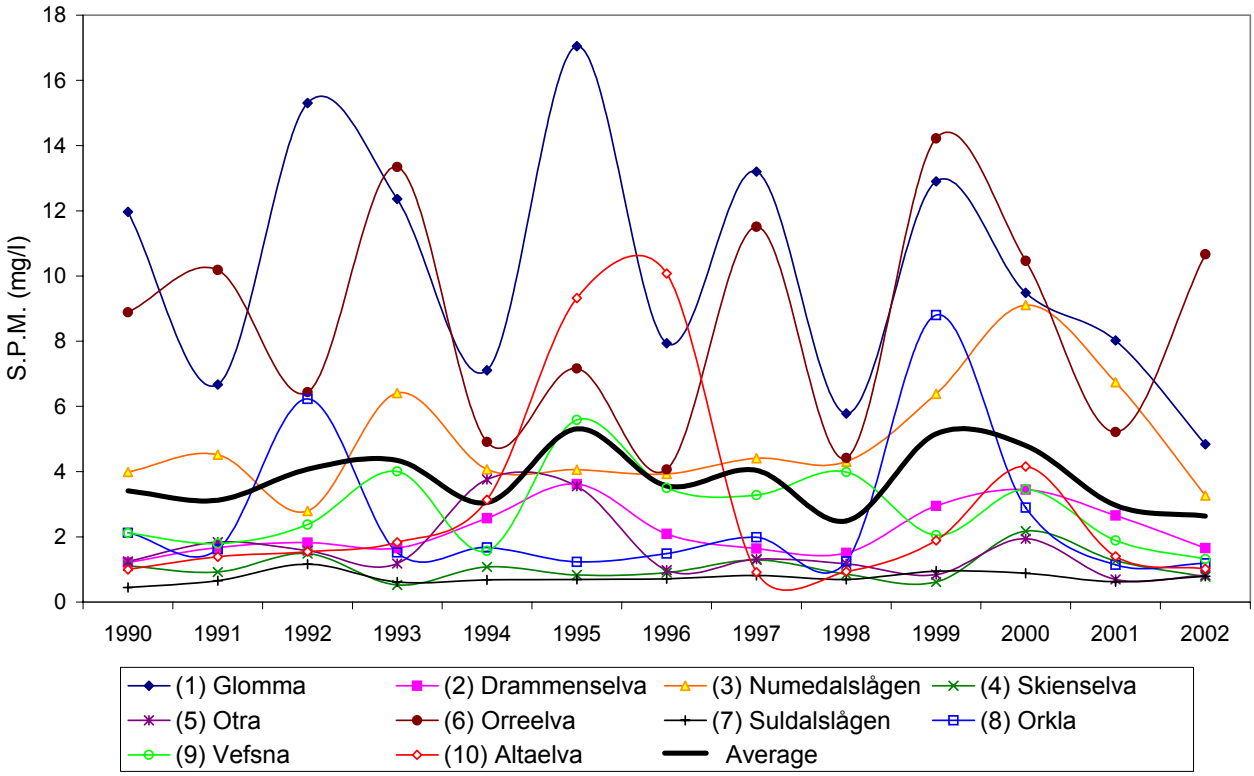


Figure XIII.II Suspended particulate matter (S.P.M.) concentration in main rivers.
Mean value from 1990 to 2002 (mg/l).

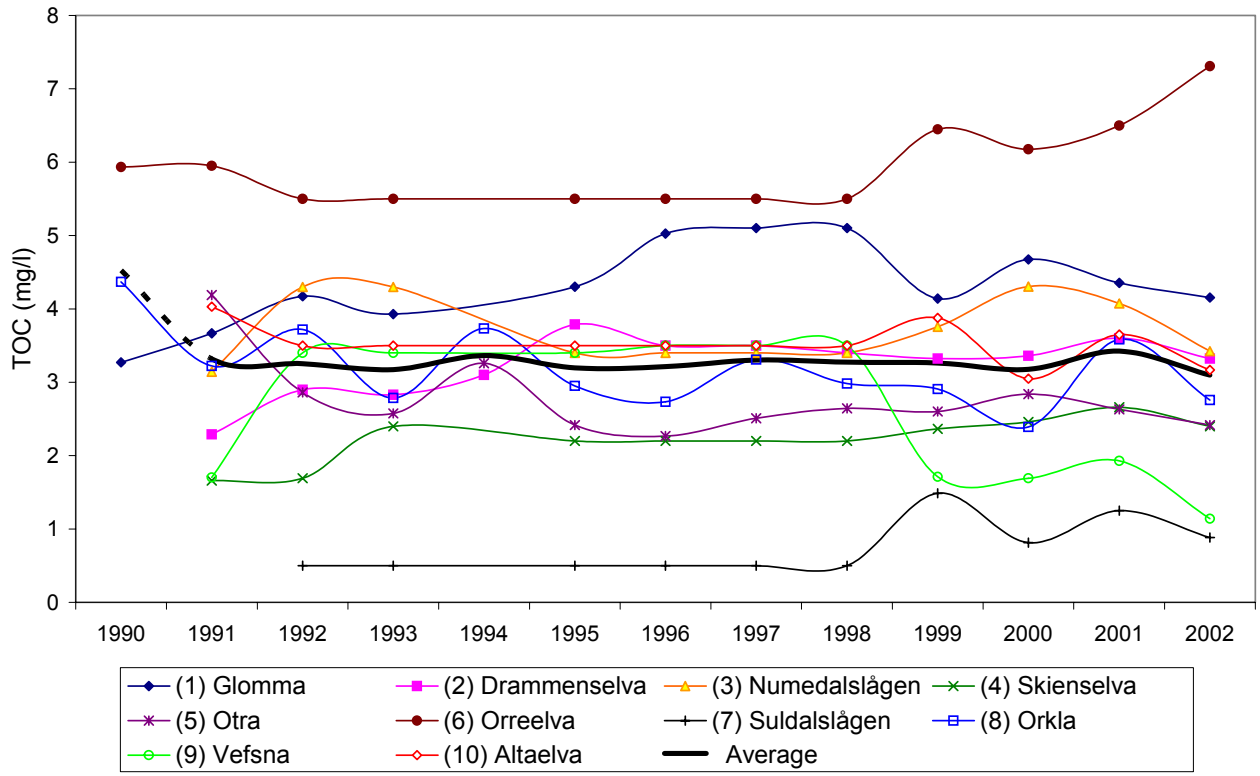


Figure XIII.III Total organic carbon (TOC) concentration in main rivers.
Mean value from 1990 to 2002 (mg/l).

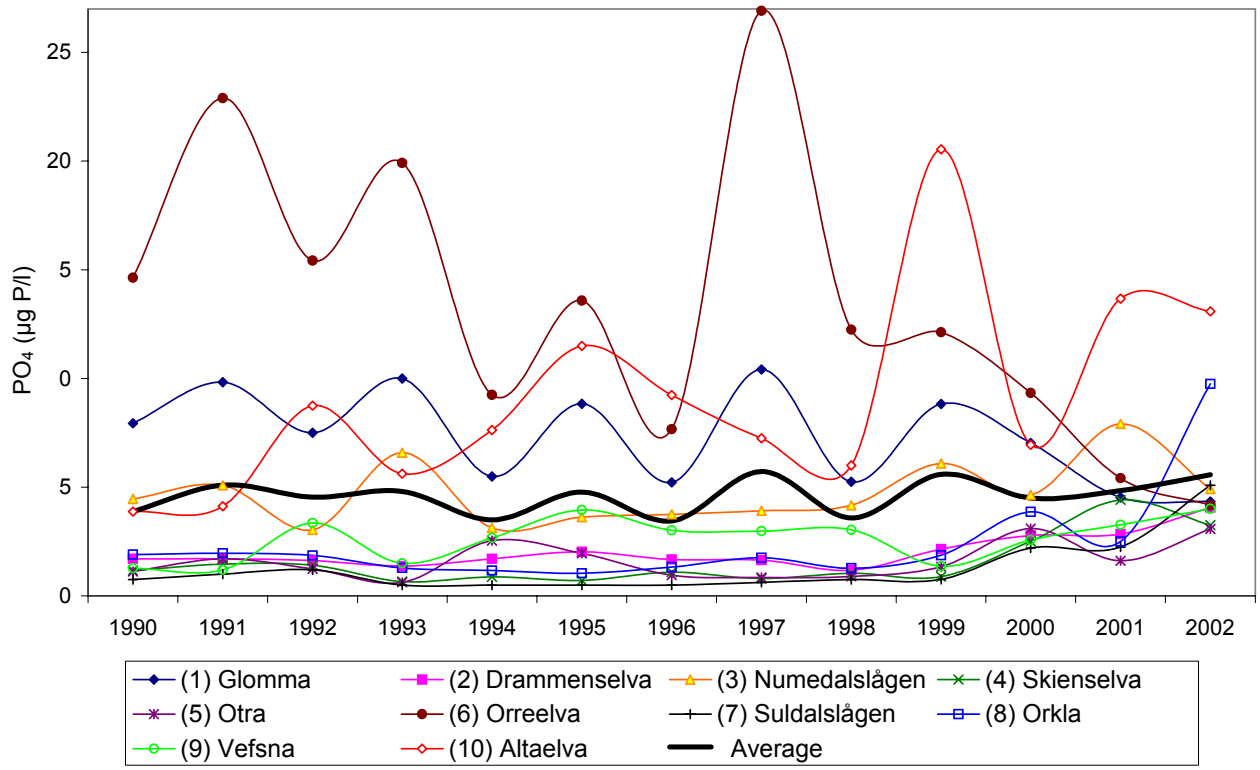


Figure XIII.IV Orthophosphate (PO_4) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

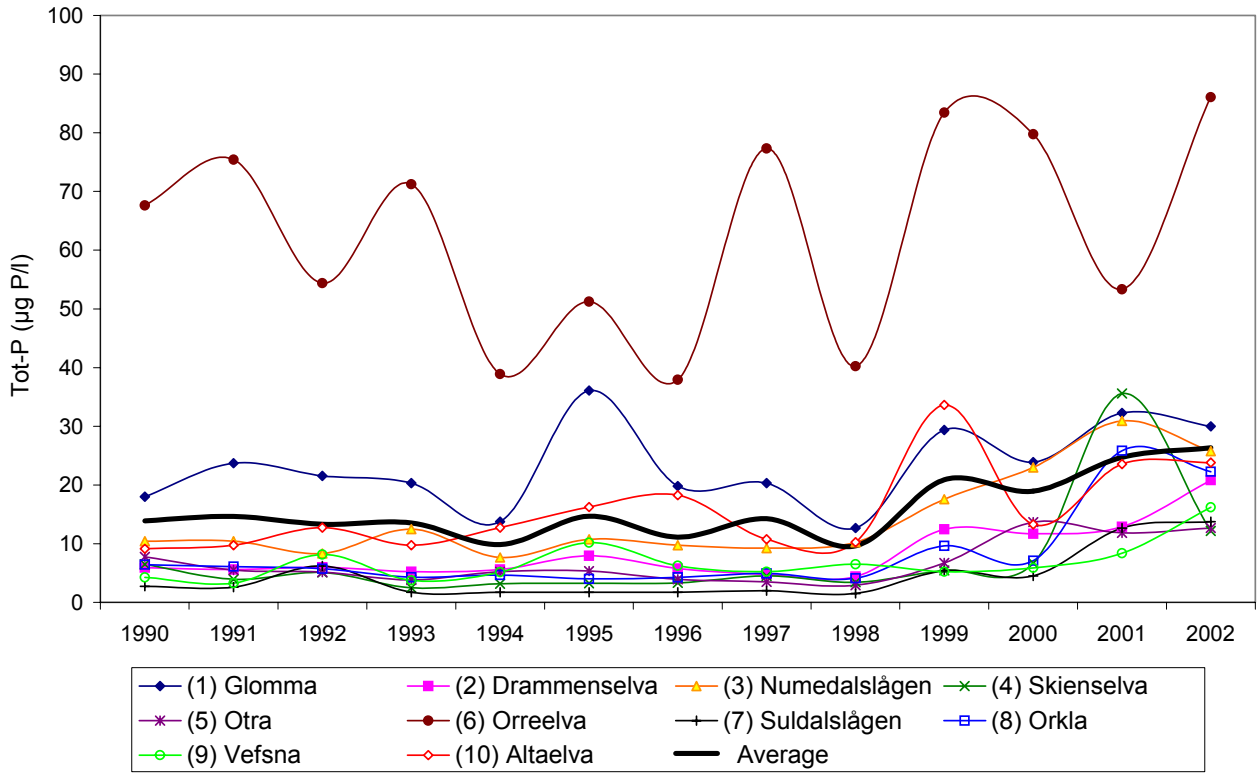


Figure XIII.V Total phosphorus (Tot-P) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

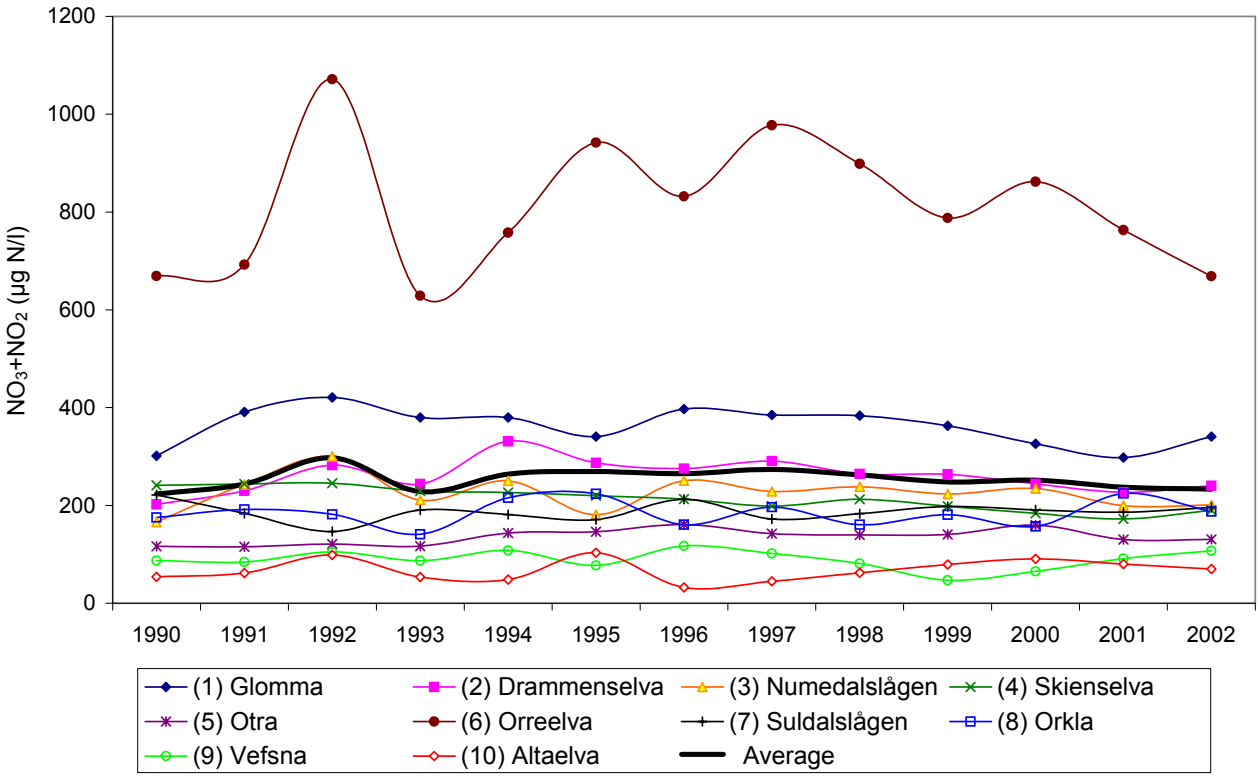


Figure XIII.VI Nitrate and nitrite (NO_2+NO_3) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

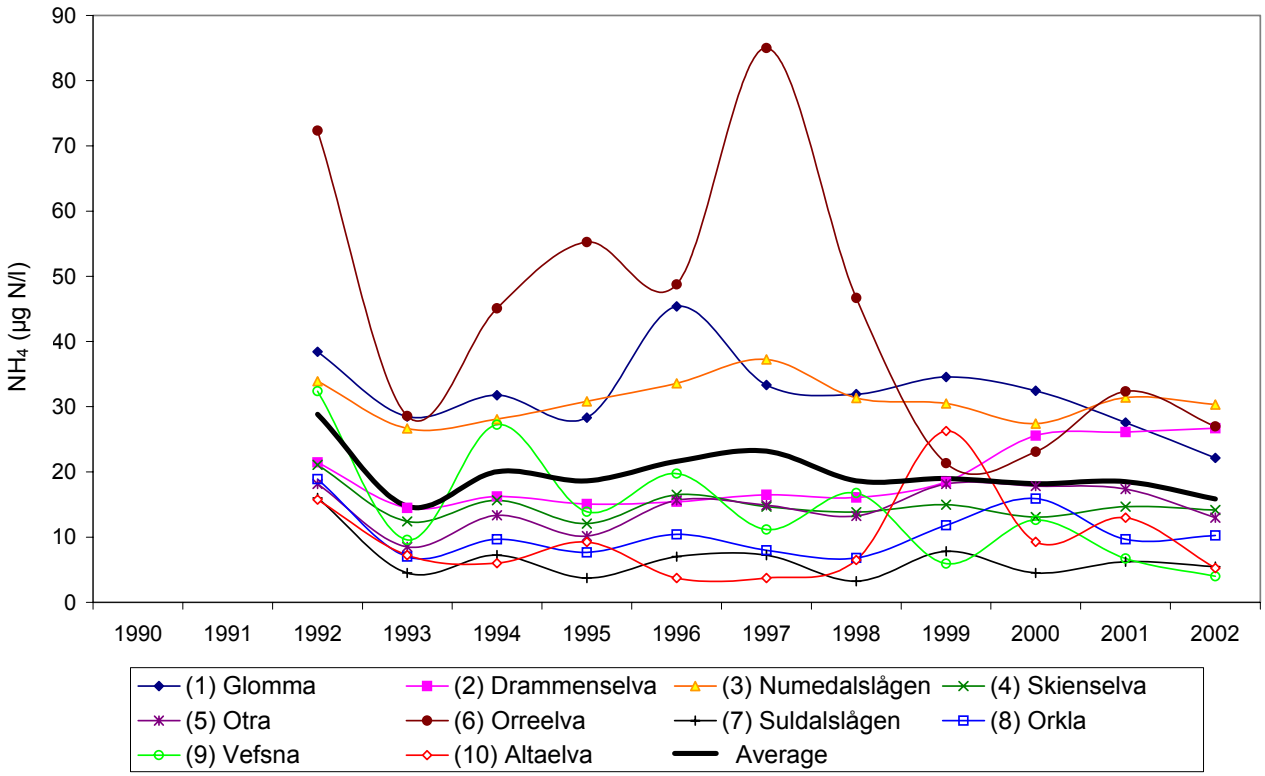


Figure XIII.VII Ammonia (NH_4) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

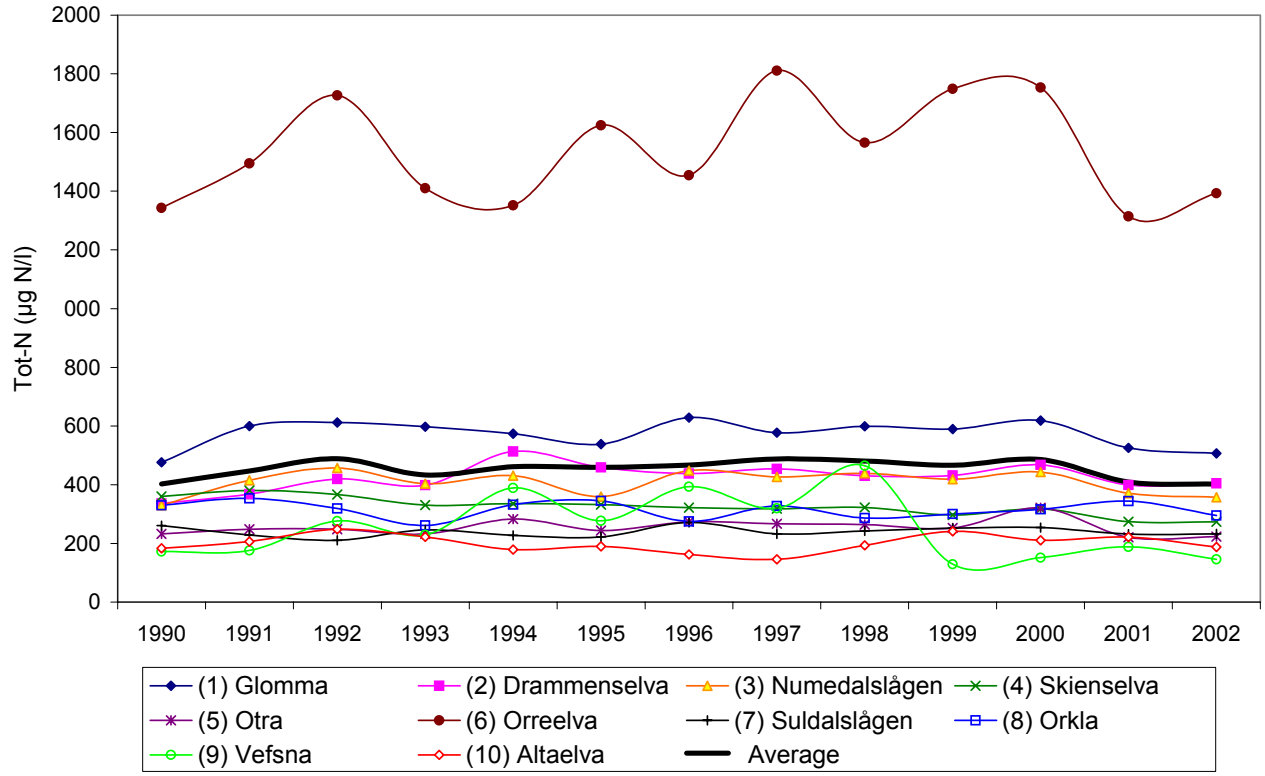


Figure XIII.VIII Total nitrogen (Tot-N) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

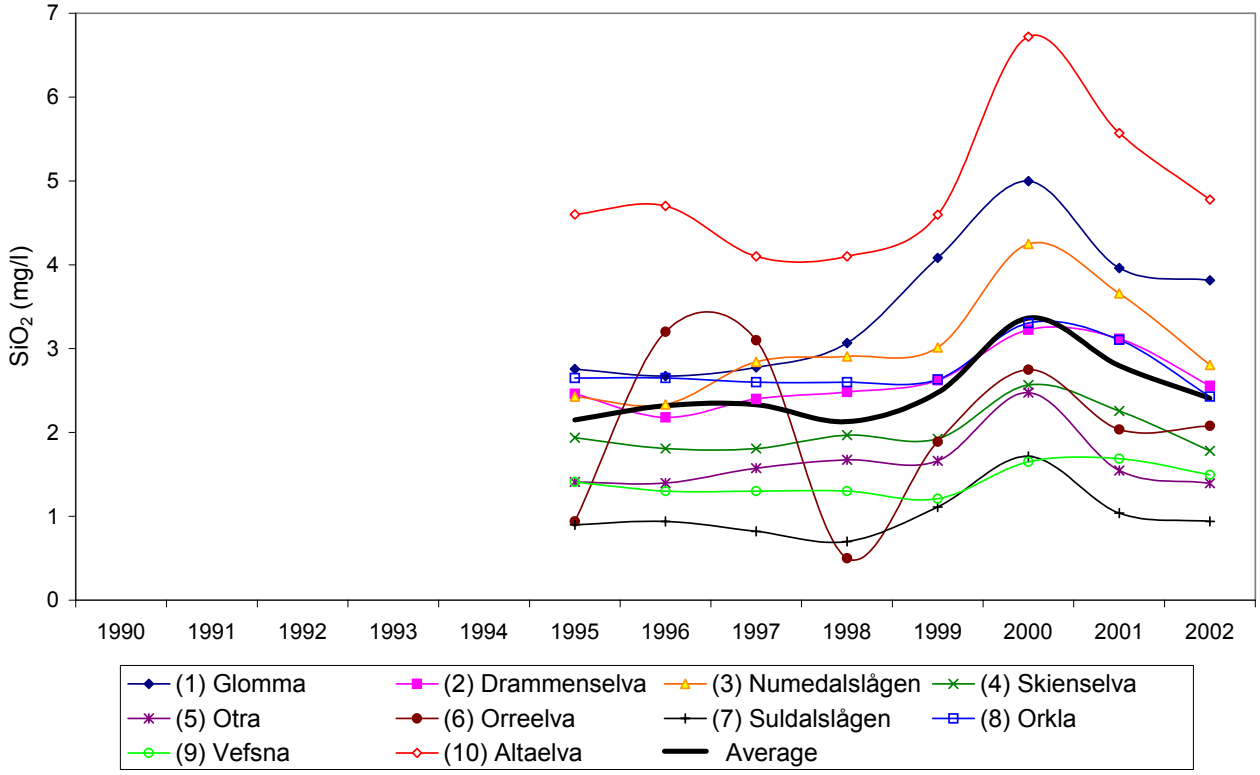


Figure XIII.IX Silicate (SiO_2) concentration in main rivers.
Mean value from 1990 to 2002 (mg/l).

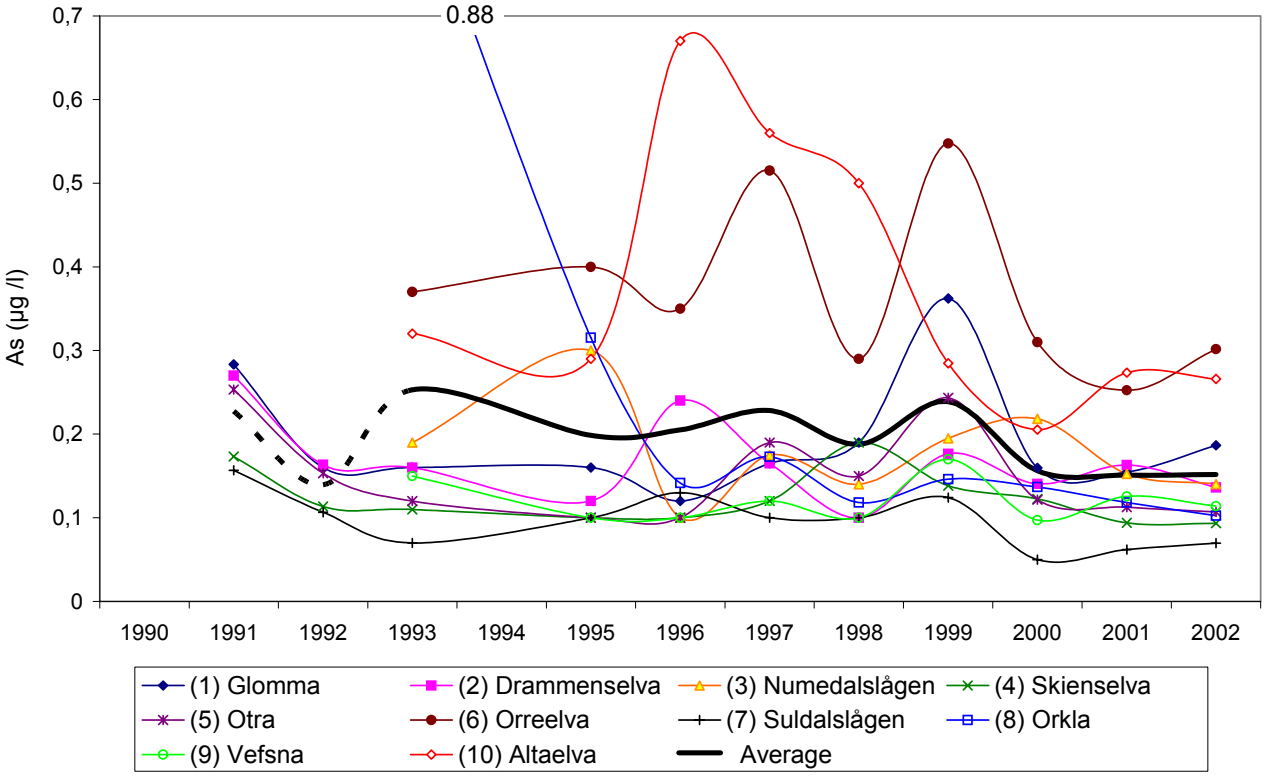


Figure XIII.X Arsenic (As) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

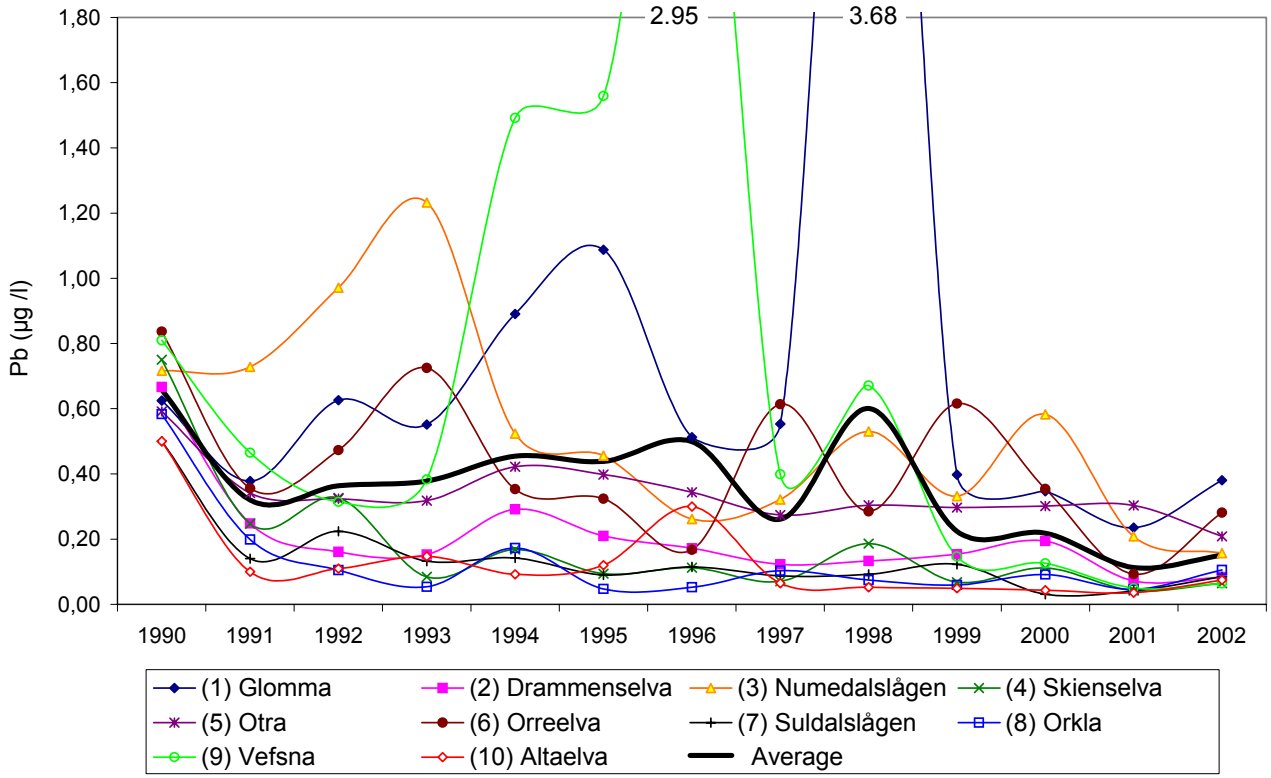


Figure XIII.XI Lead (Pb) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

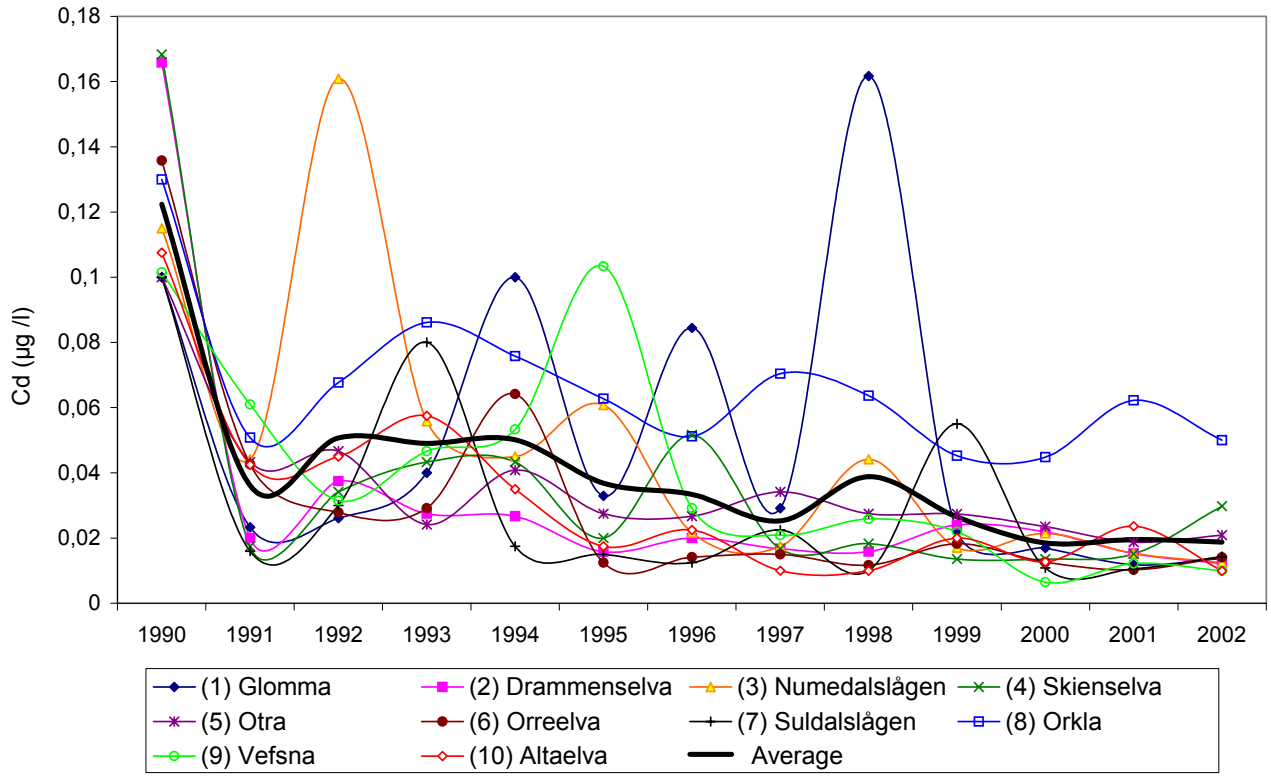


Figure XIII.XII Cadmium (Cd) concentration in main rivers.
Mean value from 1990 to 2002(µg/l).

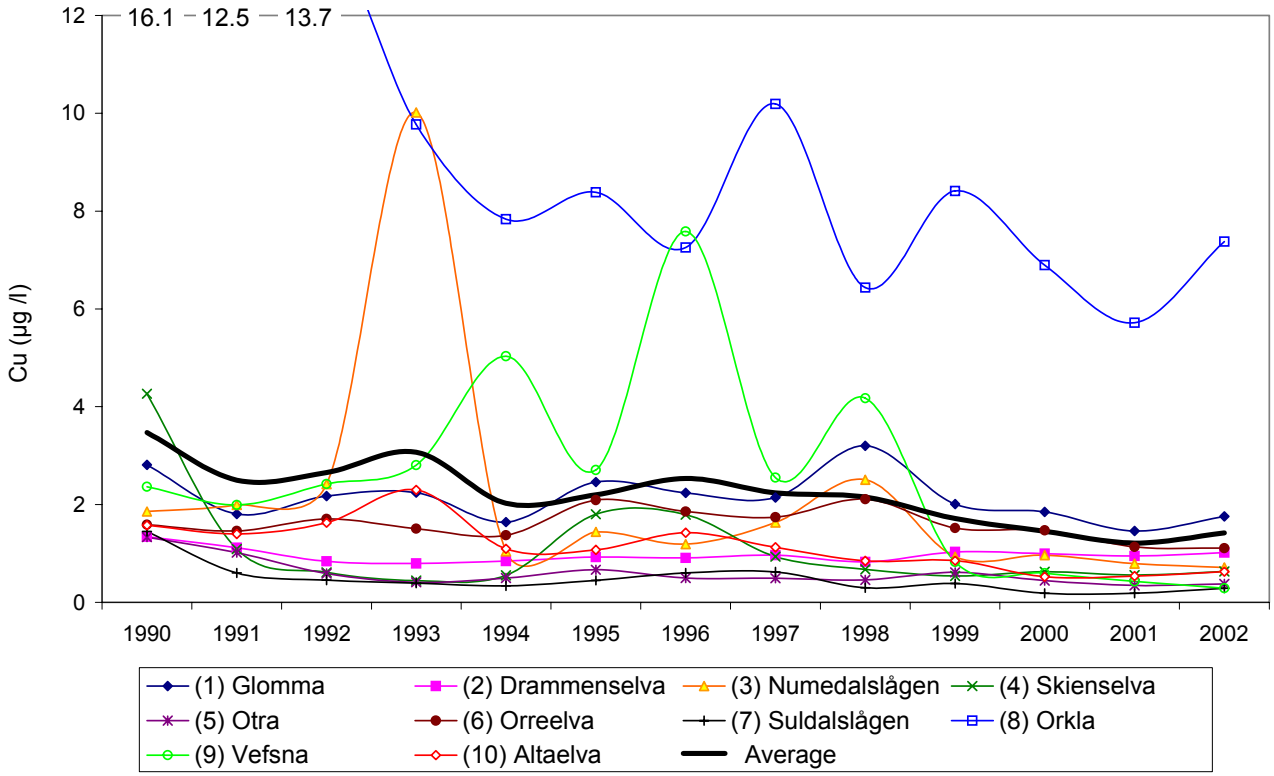


Figure XIII.XIII Copper (Cu) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

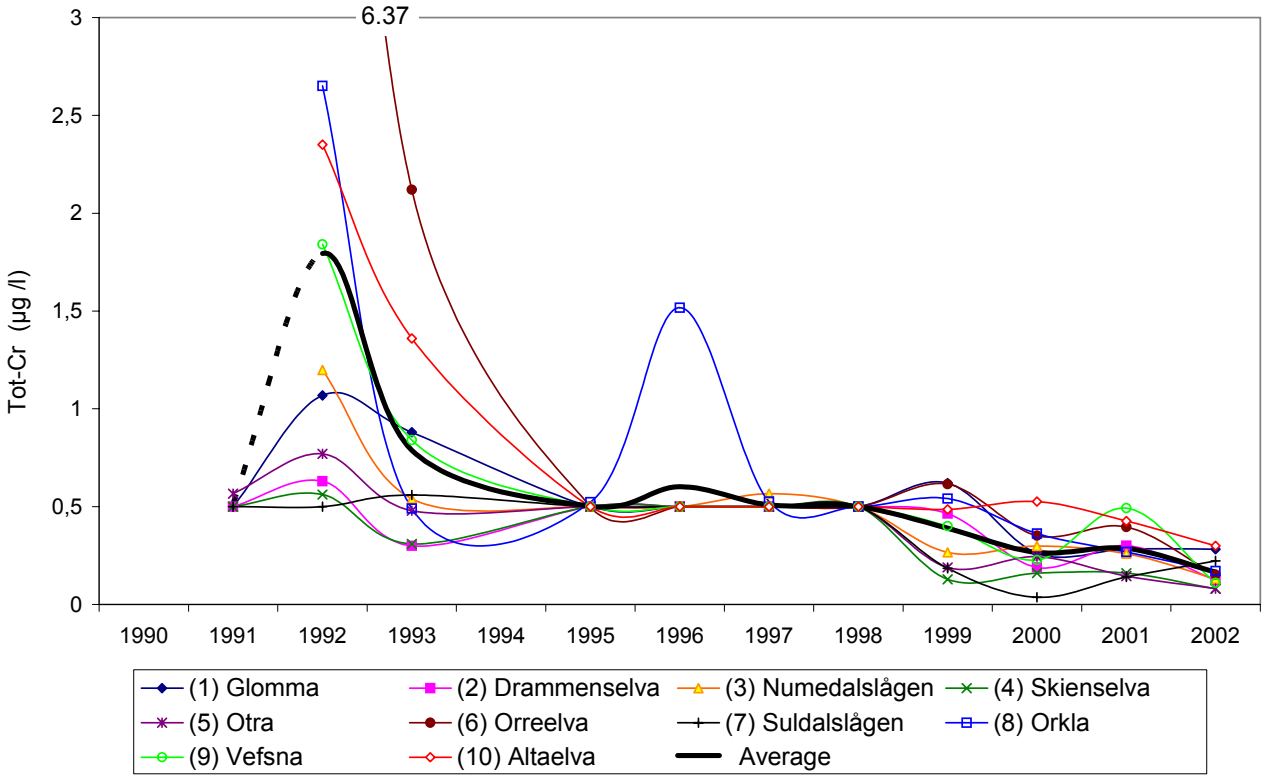


Figure XIII.XIV Total chromium (Tot-Cr) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l). Since 1999 a lower limit of detection has been reported.

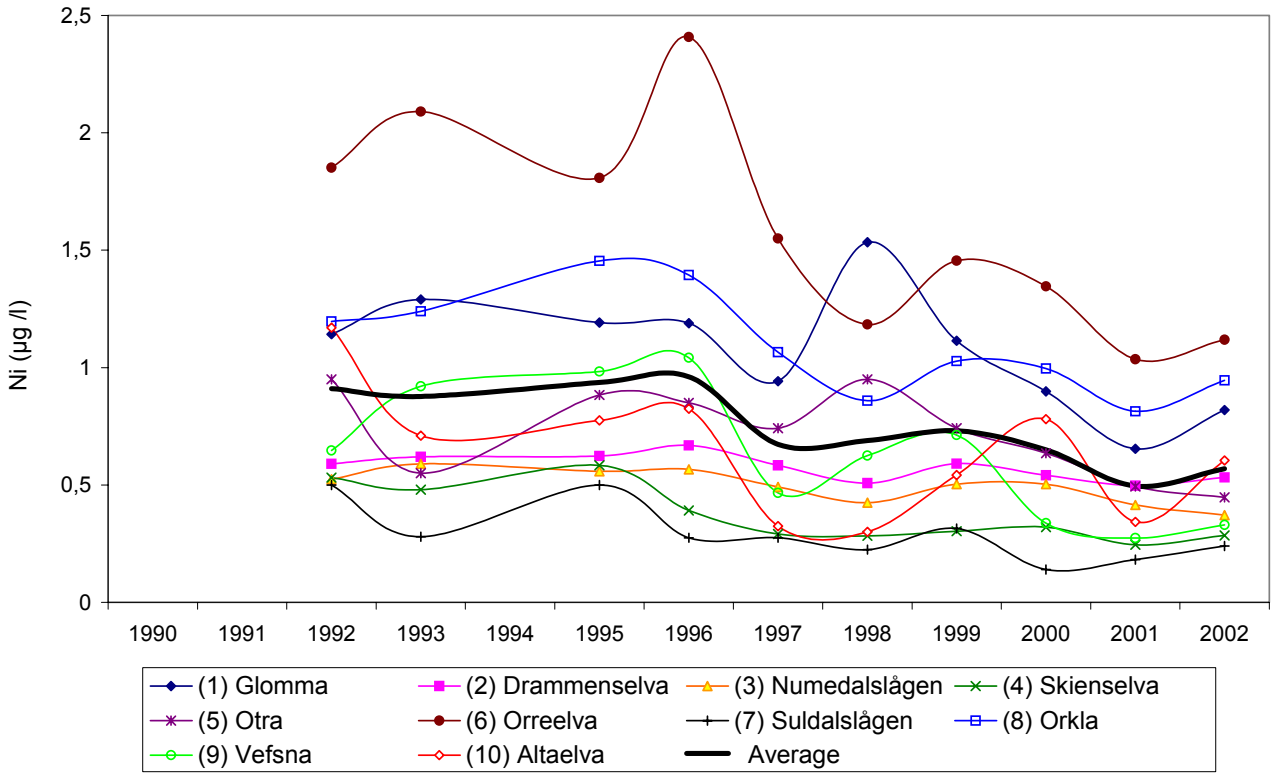


Figure XIII.XV Nickel (Ni) concentration in main rivers.
Mean value from 1990 to 2002 (µg/l).

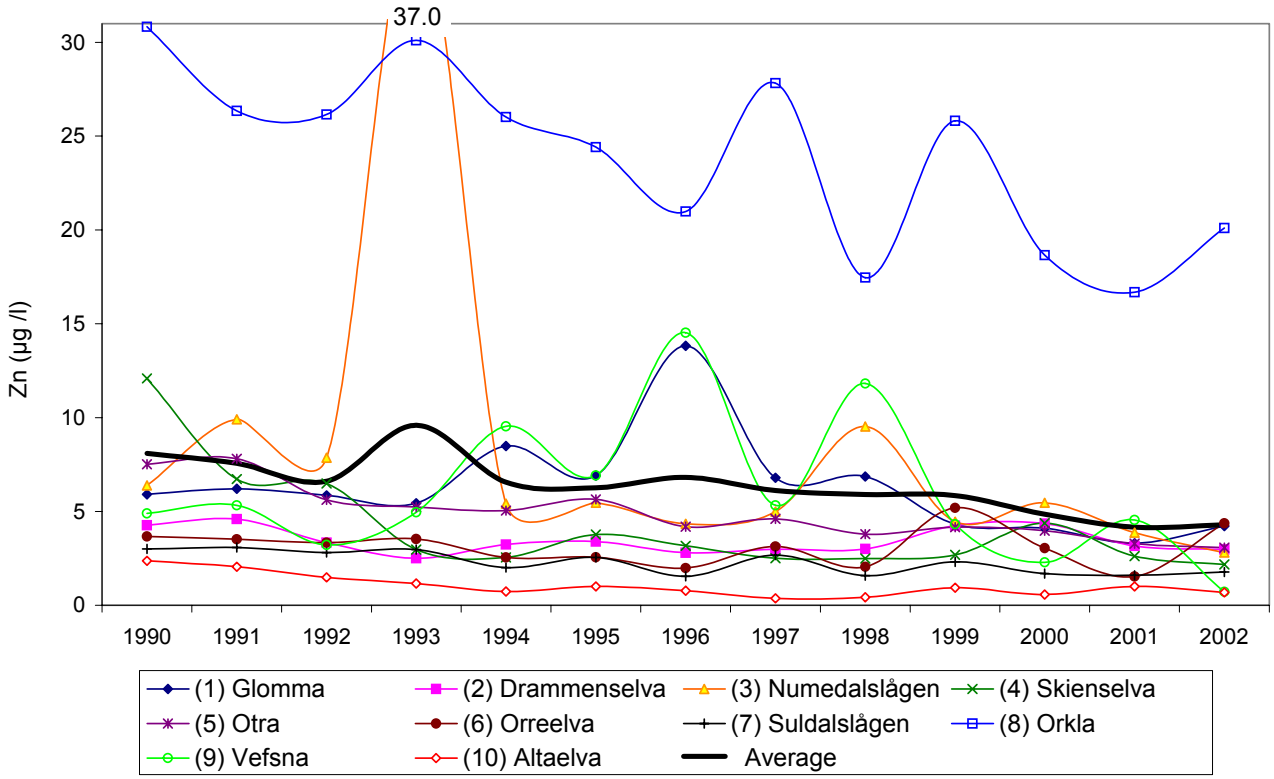


Figure XIII.XVI Zinc (Zn) concentration in main rivers .
Mean value from 1990 to 2002 (µg/l).

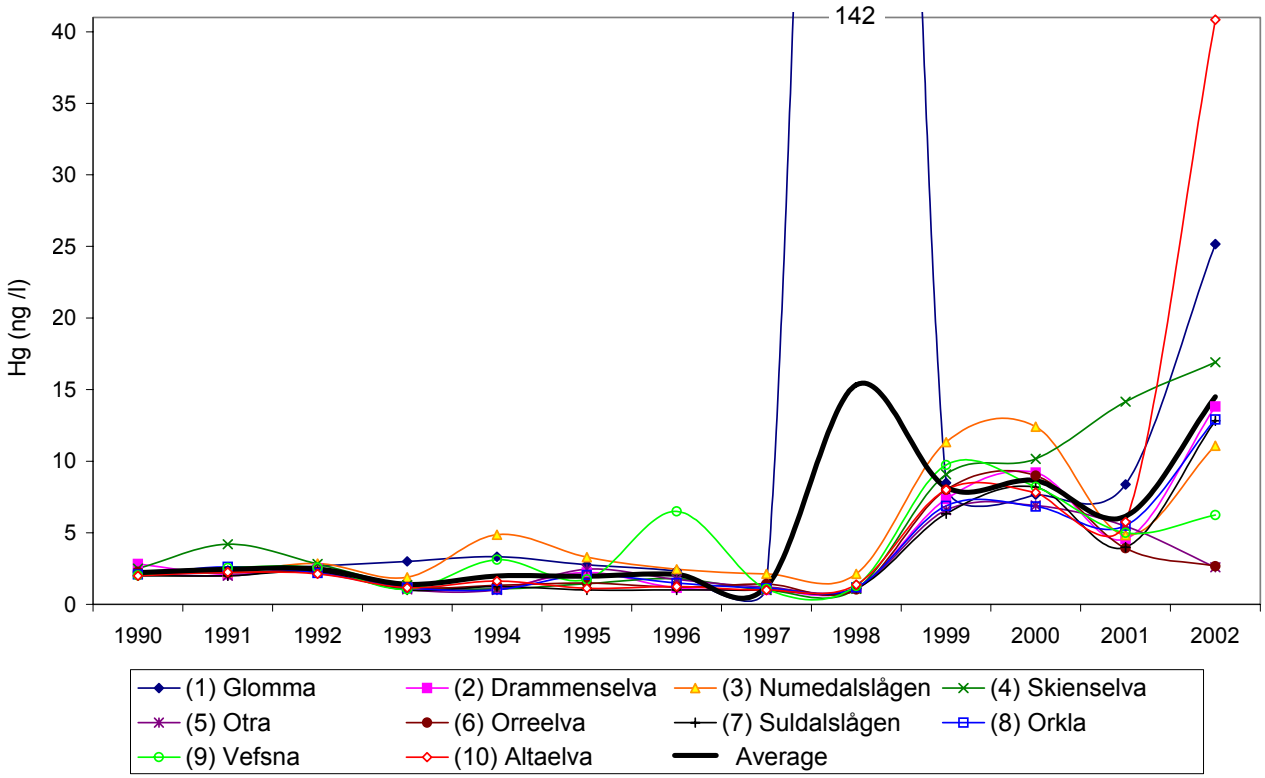


Figure XIII.XVII Mercury (Hg) concentration in main rivers.
Mean value from 1990 to 2002 (ng/l). Since 1999 a new analitical method is used.

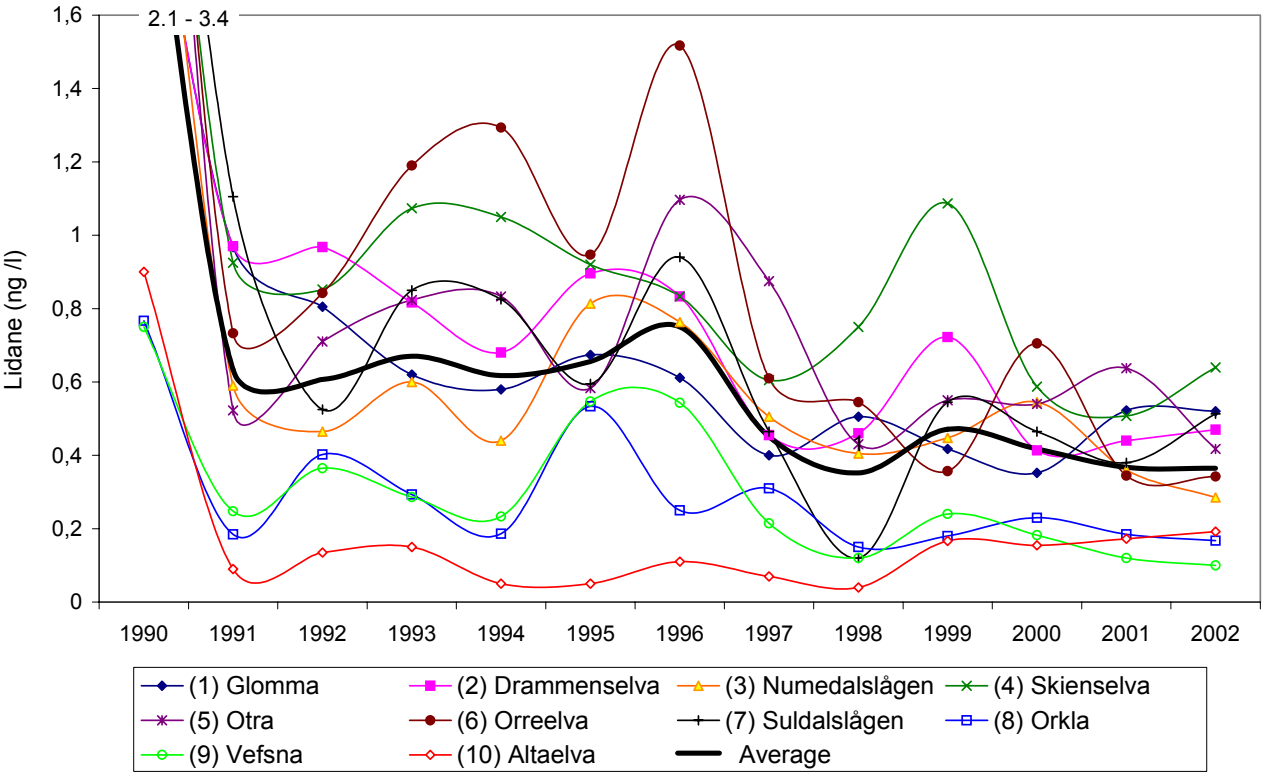


Figure XIII.XVIII Lindane concentration in main rivers
Mean value from 1990 to 2002 (ng/l).

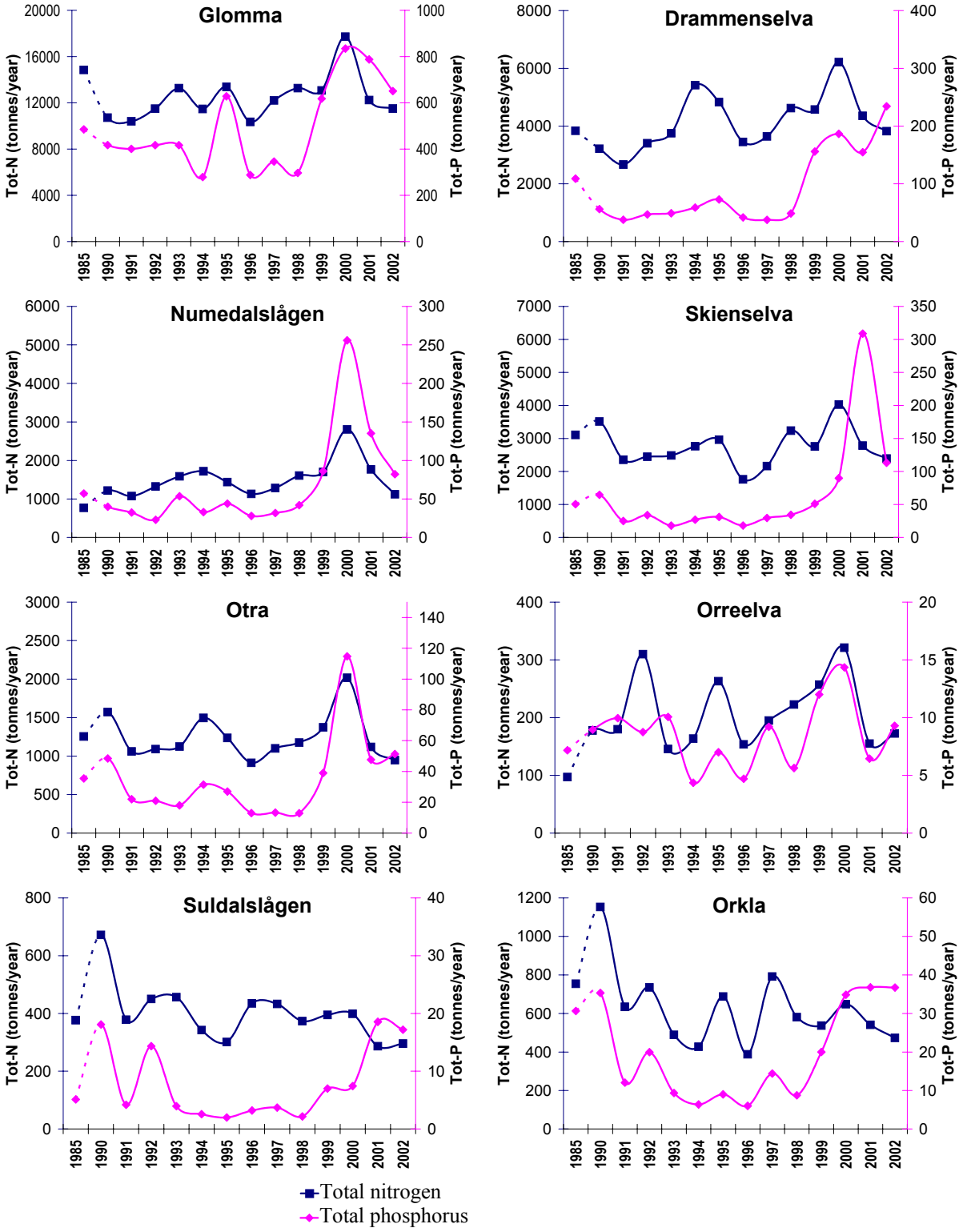


Figure XIX.XIX Total nitrogen (Tot-N) and total phosphorus (Tot-P) load in main rivers. *Calculated load for 1985, 1990-2002 (tonnes/years). (Fig. continues on the next page.)*

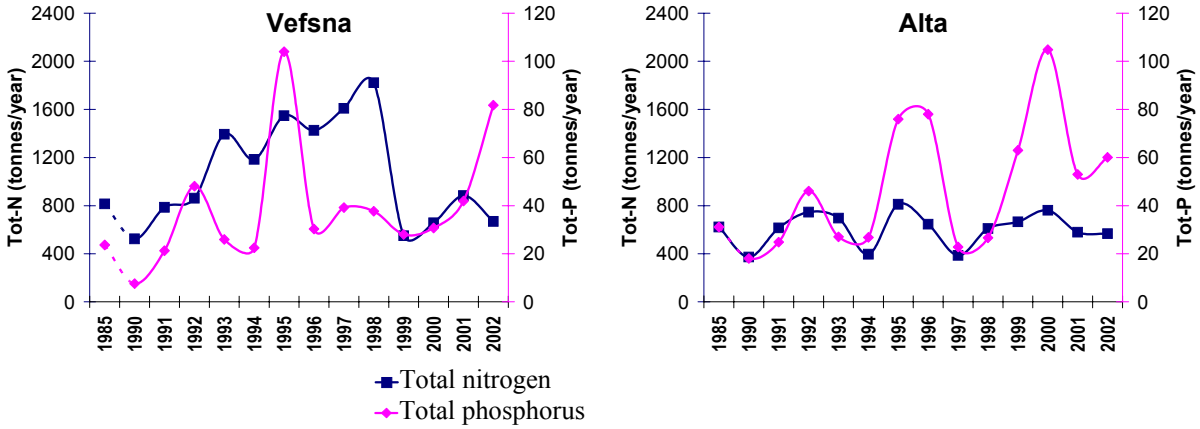


Fig. XIX.XIX (continue from previous page)

Appendix XIV. Investigation of particle bound metals and phosphorus

1. Introduction

In connection with RID 2003 a systematic short-time program including analysis of several parallel samples from rivers with variable content of particulates has been carried out. The analytical program included particulate bound metals and phosphorus.

The objectives of this program were:

- Quantifying the uncertainty in calculated river input depending on differences in samples, due to particulate matter.
- Quantifying variations in the soluble (possible anthropogenic) part of the metals and phosphorus. It is anticipated that mostly the soluble part of the metals is harmful to the organisms, since this part will be bioavailable for organisms and some heavy metals are expected to bioaccumulate in the organisms and biomagnify in the food chain. It is also expected that the soluble part of phosphorus is the active nutrient to eutrophication in the watercourse.

2. Method

Samples have been taken in the period 28 May – 30 July 2003 at the ordinary sampling localities in Glomma and Drammenselva parallel with the ordinary RID program. Three samples taken at the same time (but not real parallels) have been analysed for total and soluble concentration of phosphorus, arsenic, lead, copper, total chromium, nickel, zinc and cadmium.

The samples were filtered through 0.45 µm membrane filters. Precautions were taken to avoid contamination of the samples. The filters were rinsed with acid before use. Standard analytical methods were used (ICP-MS for the metals and NS-4724-2 for total phosphorus).

Total, particle bound and soluble parts of each of the metals and phosphorus were calculated. The results of the three samples taken at the same time were treated statistically (average, min., max., STD). Correlation analyses between the metal values and suspended matter (SPM), and total organic carbon (TOC) were carried out. Correlation analyses between the phosphorus values and orthophosphate (PO_4), suspended matter (SPM), and total organic carbon (TOC) were carried out. SPM, TOC and PO_4 values from the ordinary sampling program were used, only one sample (P1) in each series was analysed for SPM, TOC and PO_4. The results were also compared with precipitation data from sampling stations near Glomma and Drammenselva.

3. Results – Drammenselva

3.1. Phosphorus

The results from Drammenselva are shown in Figure XIV.I. Approximately 50-80 % of the phosphorus in the River Drammenselva seems to be particle bound. This indicates that the nutrient loading may depend on run-off and erosion. This corresponds with former correlation results (Weideborg et al, 2002) from 2000, where a significant positive correlation ($R^2 > 0.8$) between total phorphorus and suspended particulate matter in Drammenselva was found. No positive correlation was, however, found between total phorphorus and the content of suspended particulate matter in Drammenselva in 2001, or in the present study.

The dissolved P values were approximately at the same level as the PO_4-values.

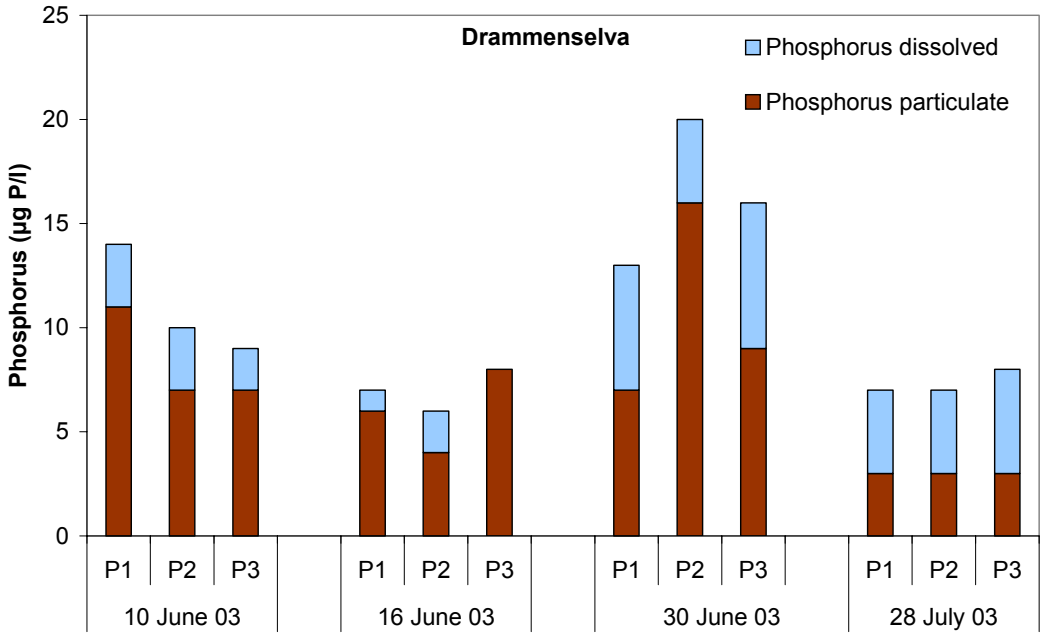


Figure XIV.I. Dissolved and particulate phosphorus in Drammenselva, 10 June – 28 July 2003. P1, P2, P3: Samples taken at the same time.

Correlation analyses between suspended particulate matter (SPM) and phosphorus were not performed since the variations in SPM were very low.

The uncertainty in calculated river input depending on differences in samples is shown in Appendix XIV.II. Table XIV.I shows the percentage standard deviation for phosphorus (total value samples) in Drammenselva.

Table XIV.I. Percentage standard deviation for phosphorus (total value samples) in Drammenselva, 10 June – 28 July 2003.

Sample (total)	% STD			
	10 Jun. 03	16 Jun. 03	30 Jun. 03	28 Jul. 03
Phosphorus	24.1	14.3	21.5	7.9

3.2. Metals

The results from Drammenselva are shown in Figures XIV.II-V.

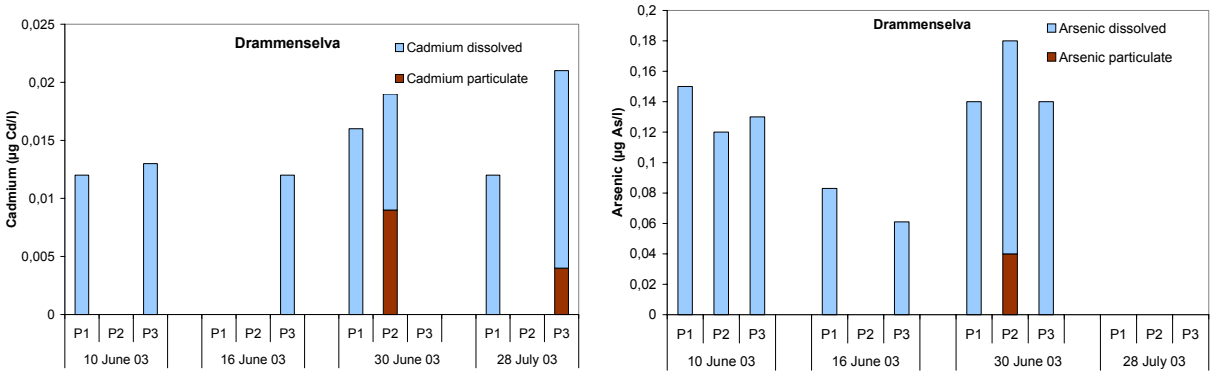


Figure XIV.II. Dissolved and particulate Cd and As in Drammenselva, 10 June – 28 July 2003. P1, P2, P3: Samples taken at the same time.

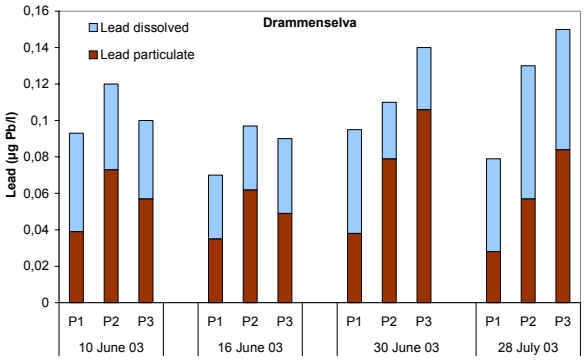


Figure XIV.III . Dissolved and particulate Pb in Drammenselva, 10 June – 28 July 2003. P1, P2, P3: Samples taken at the same time.

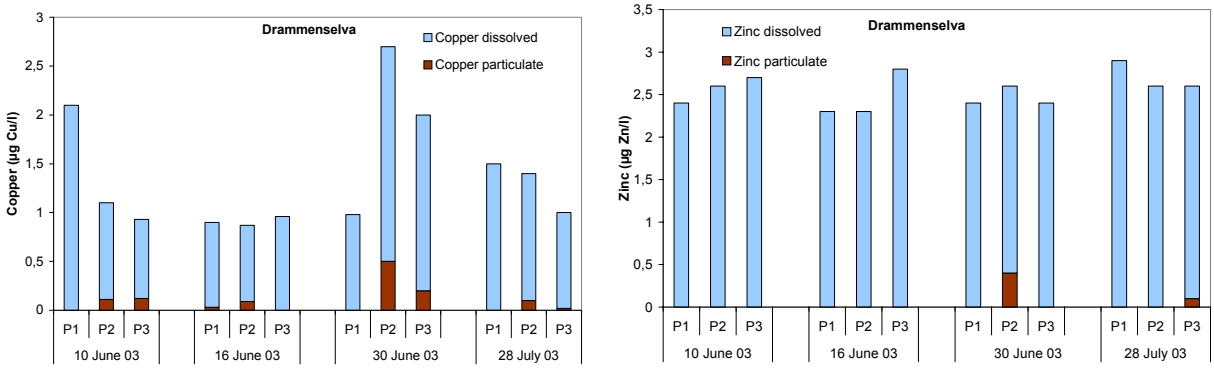


Figure XIV.IV . Dissolved and particulate Cu and Zn inDrammenselva, 10 June – 28 July 2003. P1, P2, P3: Samples taken at the same time.

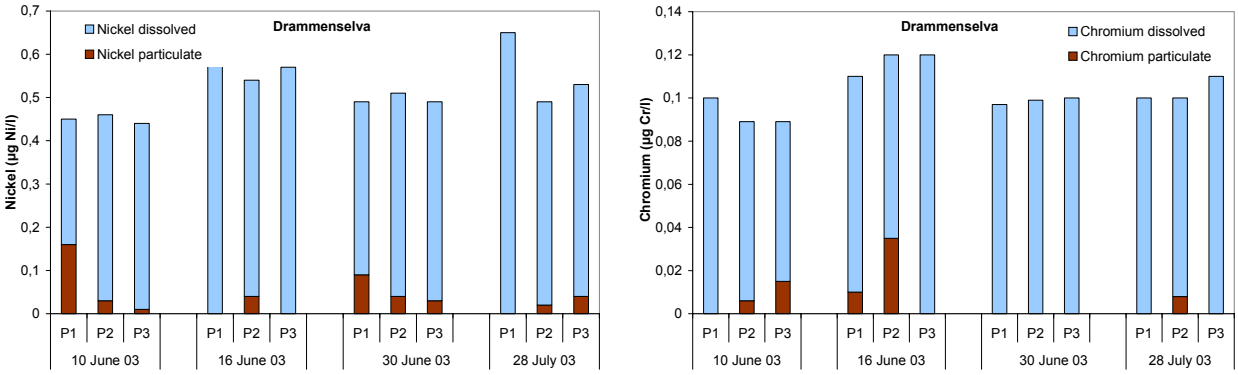


Figure XIV.V. Dissolved and particulate Ni and Cr in Drammenselva, 10 June – 28 July 2003. P1, P2, P3: Samples taken at the same time.

Most of the metal species were water soluble. Only lead was found to be particle bound (55%). Arsenic, cadmium, chromium, copper, nickel and zinc were mainly water soluble. This corresponds with former correlation results (Weideborg et al, 2002) from 2001. Lead was the only metal in Drammenselva positively correlated ($R^2 > 0.8$) to suspended particulate matter.

Correlation analyses between suspended particulate matter (SPM) and metals were not performed in the present study, since the variations in SPM were very low.

The soluble part of the metals shows limited variation within the sampling period.

The average, median, minimum and maximum values and standard deviation values are shown in Appendix XIV.I.

The uncertainty in calculated river input depending on differences in samples is shown in. Appendix XIV.II. Table 2 shows the percentage standard deviation for metals (total value samples) in Drammenselva.

Table XIV.II. Percentage standard deviation for metals (total value samples) in Drammenselva, 10 June – 28 July 2003.

Sample (total)	% STD			
	10 Jun. 03	16 Jun. 03	30 Jun. 03	28 Jul. 03
Arsenic	-	-	3.1	-
Lead	13.4	16.4	19.9	30.6
(Lead dissolved)	(11.6)	(9.4)	(35.0)	(17.7)
Cadmium	-	-	-	-
Copper	24.9	2.4	45.3	28.6
Chromium	9.6	5.1	3.1	10.0
Nickel	2.2	2.9	2.3	8.2
Zinc	11.5	2.6	8.3	17.1

4. Results – Glomma

4.1. Phosphorus

The results from Glomma are shown in Figure XIV.VI. There is a large variation in particle bound phosphorus in the different samples (0-90% particle fraction). This indicates that the nutrient loading may depend on run-off and erosion. This corresponds with former correlation results (Weideborg et al, 2002) from 2001. A positive correlation ($R^2 > 0.8$) between total phorphorus and suspended particulate matter in Glomma was found.

The dissolved P values were approximately at the same level as the PO_4-values.

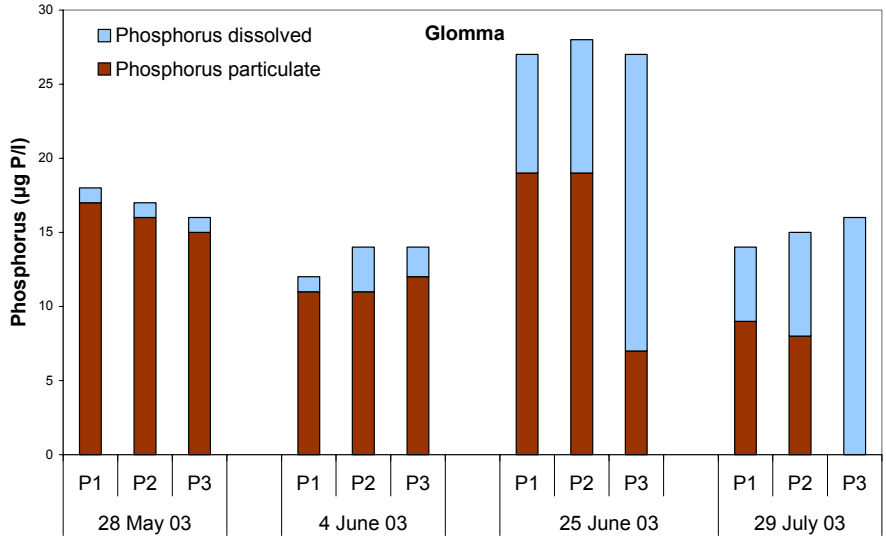


Figure XIV.VI . Dissolved and particulate phosphorus in Glomma, 28 May june – 29 July 2003. P1,P2, P3: Samples taken at the same time.

The uncertainty in calculated river input depending on differences in samples is shown in. Appendix XIV.II. Table XIV.I. shows the percentage standard deviation for phosphorus (total value samples) in Drammenselva.

Table XIV.III. Percentage standard deviation for phosphorus (total value samples) in Glomma 28 May – 29 July 2003.

Sample (total)	% STD			
	28 May 03	4 Jun. 03	25 Jun. 03	29 Jul. 03
Phosphorus	5.9	8.7	2.1	4.0

Metals

The results from Glomma are shown in Figures XIV.VII-X.

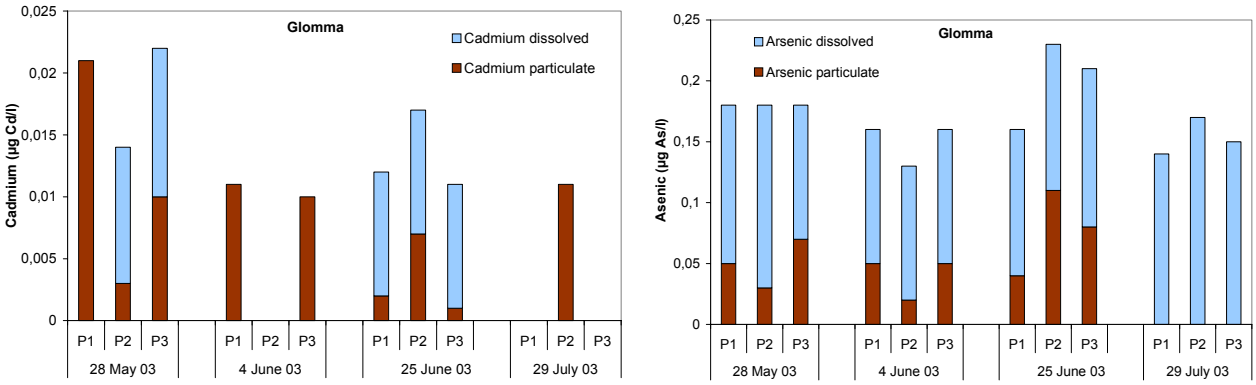


Figure XIV.VII. Dissolved and particulate Cd and As in Glomma, 28 May – 29 July 2003. P1, P2, P3: Samples taken at the same time.

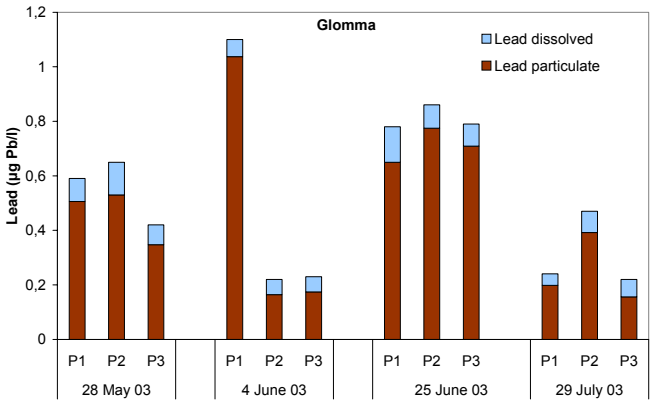


Figure XIV.VIII. Dissolved and particulate Pb in Glomma, 28 May – 29 July 2003. P1, P2, P3: Samples taken at the same time.

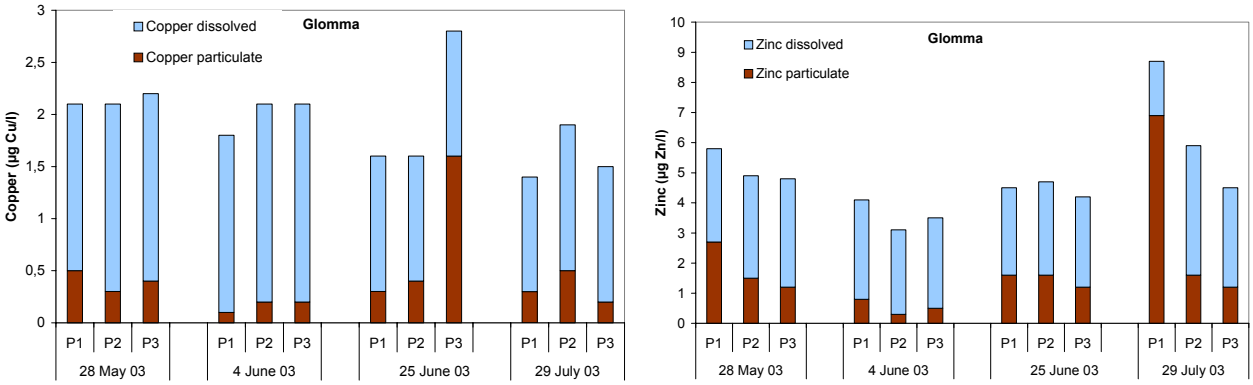


Figure XIV.VIIII. Dissolved and particulate Cu and Zn in Glomma, 28 May – 29 July 2003. P1, P2, P3: Samples taken at the same time.

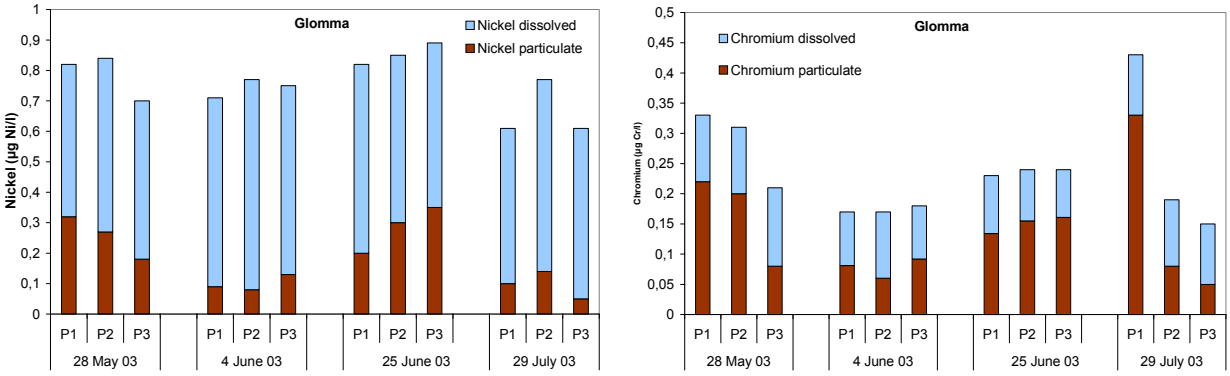


Figure XIV.X. Dissolved and particulate Ni and Cr in Glomma, 28 May – 28 July 2003. P1, P2, P3: Samples taken at the same time.

There is large variation in particle bound metals in the different samples. Lead was mainly found to be particulate bound (appr. 85%). Approximately 50% of chromium seems to be particle bound. The particle fraction of Cd varied between 10 and 100% in the different samples. The measured concentrations of cadmium were, however, very low and the uncertainty has to be high. Approximately 10-30% of the other metals (As, Cr, Cu, Zn) were particle bound.

A significant positive correlation between suspended matter (SPM) and cadmium (Cd) and between suspended matter (SPM) and nickel (Ni) are seen (Figure XIV.XI)

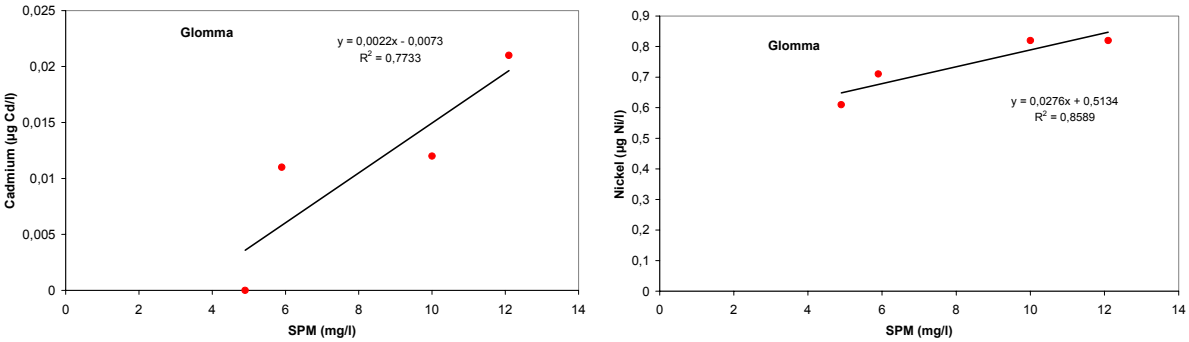


Figure XIV.XI. Correlation between suspended particulate matter (SPM) and cadmium (Cd) and between SPM and nickel (Ni) in Glomma, 28 May – 29 July 2003.

The samples are, however, few. Previous correlation results (Weideborg et al, 2002) from 2001 have shown a significant positive correlation (R^2> 0.8) between suspended particulate material and Ni and a possible significant correlation (R^2>0.6) was seen for Pb and Cr. No positive correlations between suspended particulate material and cadmium were seen.

A significant positive correlation between total organic carbon (TOC) and cadmium (Cd) and between TOC and copper (Cu) are seen (Figure XIV.XII.).

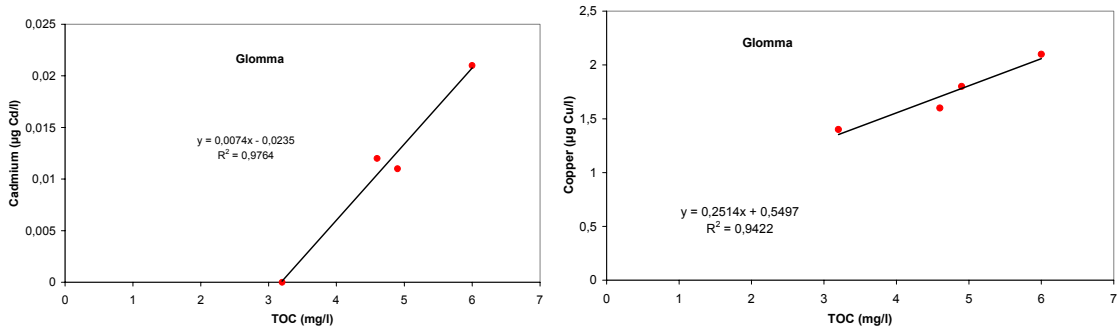


Figure XIV.XII. Correlation between total organic carbon (TOC) and cadmium (Cd) and between TOC and copper (Cu) in Glomma, 28 May – 29 July 2003.

These correlation results indicate that most of the Cd and Cu are complex bound to organic material (anthropogenic organic material or humus), but the samples are few.

With exception of cadmium, the soluble part of the metals seems to be nearly the same during the sampling period.

The average, median, minimum and maximum values and standard deviation values are shown in Appendix XIV.I.

The uncertainty in calculated river input depending on differences in samples is shown in. Appendix XIV.II. Table XIV.IV shows the percentage standard deviation for metals (total value samples) in Glomma.

Table XIV.IV. Percentage standard deviation for metals (total value samples) in Glomma, 28 May – 29 July 2003.

Sample (total)	% STD			
	28 May 03	04 Jun. 03	25 Jun. 03	29 Jul. 03
Arsenic	0.0	11.5	18.0	0.0
Lead	21.6	97.8	5.4	44.8
(Lead dissolved)	26.6	6.9	27.6	29.6
Cadmium	22.9	-	24.1	-
Copper	2.7	8.7	34.6	16.5
Chromium	22.7	3.3	2.4	59.0
Nickel	9.6	4.1	4.1	13.9
Zinc	10.7	14.1	5.6	33.6

5. Conclusions

The conclusions from this preliminary study of two rivers in the summer period are:

- A large part of measured total phosphorus in these two rivers was found to be particle-bound (approximately 70-90% in Glomma, and 50-80% in Drammenselva). A minor part of the phosphorus will be bioavailable. The phosphorus loading in these rivers in the summer period will probably depend on run-off and erosion. In 2002 approximately 80% of the total phosphorus load in Glomma was due to discharges from agricultural areas and background run-off. The dissolved P values were at the same level as the PO_4-values or slightly higher.
- 55-85 % of the measured lead was found to be particle bound, and only a small part of the total lead will be bioavailable and bioaccumulating. The Pb loading in these rivers probably depends on run-off and erosion.
- The particle fraction of Cd varied between 10 and 100% in the different samples. The measured concentrations of cadmium were, however, very low and the uncertainty has to be high. More studies have to be carried out.
- Only a minor part (approximately 0-20%) of the other metals was found to be particulate bound, they will be mostly dissolved in the water. A large part of these substances will be bioavailable and are expected to bioaccumulate in the organisms.
- Only small differences in the concentration of dissolved metals were found in the parallel samples and during the sampling period (except for Cd and As).
- The particle fraction of most of the metals seems to be larger in Glomma and in Drammenselva, probably due to a higher particle concentration (SPM) in Glomma than in Drammenselva in the sampling period..
- Cd and Cu seem to be complex bound to organic material (anthropogenic organic material or humus). A significant positive correlation between TOC and Cd and between TOC and Cu are seen.
- Total and dissolved metals should be analysed in samples from the main rivers in the RID program from 2004. A more detailed study of particle characteristics vs. metal concentrations should be carried out. Analyses of particle size distribution and particle volume, TOC and SPM should be included in selected samples
- It seems not to be necessary to analyse particulate phosphorus in all samples from the main rivers, since the dissolved P values are approximately at the same level as the PO_4-values.

Appendix XIV.I. Statistical data

River Glomma

Phosphorus	Total	Dissolved
Average	18.0	6.2
Min.	12.0	1.0
Max.	28.0	20.0
Median	15.5	4.0
STD	5.8	6.3

Copper	Total	Dissolved
Average	1.933	1.517
Min.	1.400	1.100
Max.	2.800	1.900
Median	2.000	1.500
STD	0.387	0.298

Arsenic	Total	Dissolved
Average	0.133	0.129
Min.	0.000	0.110
Max.	0.230	0.170
Median	0.160	0.125
STD	0.084	0.020

Chromium	Total	Dissolved
Average	0.238	0.101
Min.	0.150	0.079
Max.	0.430	0.130
Median	0.220	0.100
STD	0.082	0.014

Lead	Total	Dissolved
Average	0.548	0.078
Min.	0.220	0.042
Max.	1.100	0.130
Median	0.530	0.076
STD	0.295	0.026

Nickel	Total	Dissolved
Average	0.762	0.578
Min.	0.610	0.500
Max.	0.890	0.690
Median	0.770	0.565
STD	0.090	0.058

Cadmium	Total	Dissolved
Average	0.011	0.004
Min.	0.000	0.000
Max.	0.022	0.012
Median	0.011	0.000
STD	0.008	0.005

Zinc	Total	Dissolved
Average	4.89	3.13
Min.	3.10	1.80
Max.	8.70	4.30
Median	4.60	3.10
STD	1.44	0.58

River Drammenselva

Phosphorus	Total	Dissolved
Average	10.4	3.4
Min.	6.0	0
Max.	20	7.0
Median	8.5	3.5
STD	4.4	2.0

Copper	Total	Dissolved
Average	1.254	1.273
Min.	0.800	0.780
Max.	2.700	2.200
Median	0.995	0.985
STD	0.574	0.508

Arsenic	Total	Dissolved
Average	0.081	0.080
Min.	0.000	0.000
Max.	0.190	0.150
Median	0.086	0.102
STD	0.081	0.065

Chromium	Total	Dissolved
Average	0.099	0.097
Min.	0.075	0.074
Max.	0.120	0.120
Median	0.099	0.100
STD	0.012	0.012

Lead	Total	Dissolved
Average	0.106	0.047
Min.	0.070	0.031
Max.	0.150	0.073
Median	0.099	0.045
STD	0.024	0.013

Nickel	Total	Dissolved
Average	0.490	0.479
Min.	0.440	0.290
Max.	0.540	0.650
Median	0.490	0.470
STD	0.034	0.094

Cadmium	Total	Dissolved
Average	0.005	0.008
Min.	0.000	0.000
Max.	0.021	0.017
Median	0.000	0.011
STD	0.008	0.007

Zinc	Total	Dissolved
Average	2.33	2.51
Min.	1.90	2.20
Max.	2.60	2.90
Median	2.25	2.45
STD	0.23	0.22

Appendix XIV.II.Raw data

River Glomma

Sample	Fraction	28 May 2003					
		P1	P2	P3	Average	STD	% STD
Phosphorus	Total	18	17	16	17.000	1.000	5.9
	Dissolved	1	1	1	1.000	0.000	0.0
	Particulate	17	16	15	16.000	1.000	6.3
Arsenic	Total	0.18	0.18	0.18	0.180	0.000	0.0
	Dissolved	0.13	0.15	0.11	0.130	0.020	15.4
	Particulate	0.05	0.03	0.07	0.050	0.020	40.0
Lead	Total	0.59	0.65	0.42	0.553	0.119	21.6
	Dissolved	0.084	0.12	0.073	0.092	0.025	26.6
	Particulate	0.506	0.53	0.347	0.461	0.099	21.6
Cadmium	Total	0.021	0.014	0.022	0.019	0.004	22.9
	Dissolved	0	0.011	0.012	0.008	0.007	86.8
	Particulate	0.021	0.003	0.01	0.011	0.009	80.1
Copper	Total	2.1	2.1	2.2	2.133	0.058	2.7
	Dissolved	1.6	1.8	1.8	1.733	0.115	6.7
	Particulate	0.5	0.3	0.4	0.400	0.100	25.0
Chromium	Total	0.33	0.31	0.21	0.283	0.064	22.7
	Dissolved	0.11	0.11	0.13	0.117	0.012	9.9
	Particulate	0.22	0.2	0.08	0.167	0.076	45.4
Nickel	Total	0.82	0.84	0.7	0.787	0.076	9.6
	Dissolved	0.5	0.57	0.52	0.530	0.036	6.8
	Particulate	0.32	0.27	0.18	0.257	0.071	27.6
Zinc	Total	5.8	4.9	4.8	5.167	0.551	10.7
	Dissolved	3.1	3.4	3.6	3.367	0.252	7.5
	Particulate	2.7	1.5	1.2	1.800	0.794	44.1

Sample	Fraction	04 June 2003					
		P1	P2	P3	Average	STD	% STD
Phosphorus	Total	12	14	14	13.333	1.155	8.7
	Dissolved	1	3	2	2.000	1.000	50.0
	Particulate	11	11	12	11.333	0.577	5.1
Arsenic	Total	0.16	0.13	0.16	0.150	0.017	11.5
	Dissolved	0.11	0.11	0.11	0.110	0.000	0.0
	Particulate	0.05	0.02	0.05	0.040	0.017	43.3
Lead	Total	1.1	0.22	0.23	0.517	0.505	97.8
	Dissolved	0.063	0.056	0.056	0.058	0.004	6.9
	Particulate	1.037	0.164	0.174	0.458	0.501	109.3
Cadmium	Total	0.011	0	0.01	0.007	0.006	86.9
	Dissolved	0	0	0	0.000	0.000	0.0
	Particulate	0.011	0	0.01	0.007	0.006	86.9
Copper	Total	1.8	2.1	2.1	2.000	0.173	8.7
	Dissolved	1.7	1.9	1.9	1.833	0.115	6.3
	Particulate	0.1	0.2	0.2	0.167	0.058	34.6
Chromium	Total	0.17	0.17	0.18	0.173	0.006	3.3
	Dissolved	0.089	0.11	0.088	0.096	0.012	13.0
	Particulate	0.081	0.06	0.092	0.078	0.016	20.9
Nickel	Total	0.71	0.77	0.75	0.743	0.031	4.1
	Dissolved	0.62	0.69	0.62	0.643	0.040	6.3
	Particulate	0.09	0.08	0.13	0.100	0.026	26.5
Zinc	Total	4.1	3.1	3.5	3.567	0.503	14.1
	Dissolved	3.3	2.8	3	3.033	0.252	8.3
	Particulate	0.8	0.3	0.5	0.533	0.252	47.2

Sample	Fraction	25 June 2003					
		P1	P2	P3	Average	STD	% STD
Phosphorus	Total	27	28	27	27.333	0.577	2.1
	Dissolved	8	9	20	12.333	6.658	54.0
	Particulate	19	19	7	15.000	6.928	46.2
Arsenic	Total	0.16	0.23	0.21	0.200	0.036	18.0
	Dissolved	0.12	0.12	0.13	0.123	0.006	4.7
	Particulate	0.04	0.11	0.08	0.077	0.035	45.8
Lead	Total	0.78	0.86	0.79	0.810	0.044	5.4
	Dissolved	0.13	0.085	0.081	0.099	0.027	27.6
	Particulate	0.65	0.775	0.709	0.711	0.063	8.8
Cadmium	Total	0.012	0.017	0.011	0.013	0.003	24.1
	Dissolved	0.01	0.01	0.01	0.010	0.000	0.0
	Particulate	0.002	0.007	0.001	0.003	0.003	96.4
Copper	Total	1.6	1.6	2.8	2.000	0.693	34.6
	Dissolved	1.3	1.2	1.2	1.233	0.058	4.7
	Particulate	0.3	0.4	1.6	0.767	0.723	94.4
Chromium	Total	0.23	0.24	0.24	0.237	0.006	2.4
	Dissolved	0.096	0.085	0.079	0.087	0.009	9.9
	Particulate	0.134	0.155	0.161	0.150	0.014	9.5
Nickel	Total	0.82	0.85	0.89	0.853	0.035	4.1
	Dissolved	0.62	0.55	0.54	0.570	0.044	7.6
	Particulate	0.2	0.3	0.35	0.283	0.076	27.0
Zinc	Total	4.5	4.7	4.2	4.467	0.252	5.6
	Dissolved	2.9	3.1	3	3.000	0.100	3.3
	Particulate	1.6	1.6	1.2	1.467	0.231	15.7

Sample	Fraction	29 July 2003					
		P1	P2	P3	Average	STD	% STD
Phosphorus	Total	14	15	14	14.333	0.577	4.0
	Dissolved	5	7	16	9.333	5.859	62.8
	Particulate	9	8	0	5.000	6.083	121.7
Arsenic	Total	0	0	0	0.000	0.000	0.0
	Dissolved	0.14	0.17	0.15	0.153	0.015	10.0
	Particulate	0	0	0	0.000	0.000	0.0
Lead	Total	0.24	0.47	0.22	0.310	0.139	44.8
	Dissolved	0.042	0.078	0.064	0.061	0.018	29.6
	Particulate	0.198	0.392	0.156	0.249	0.126	50.6
Cadmium	Total	0	0.011	0	0.004	0.006	173.2
	Dissolved	0	0	0	0.000	0.000	0.0
	Particulate	0	0.011	0	0.004	0.006	173.2
Copper	Total	1.4	1.9	1.5	1.600	0.265	16.5
	Dissolved	1.1	1.4	1.3	1.267	0.153	12.1
	Particulate	0.3	0.5	0.2	0.333	0.153	45.8
Chromium	Total	0.43	0.19	0.15	0.257	0.151	59.0
	Dissolved	0.1	0.11	0.1	0.103	0.006	5.6
	Particulate	0.33	0.08	0.05	0.153	0.154	100.3
Nickel	Total	0.61	0.77	0.61	0.663	0.092	13.9
	Dissolved	0.51	0.63	0.56	0.567	0.060	10.6
	Particulate	0.1	0.14	0.05	0.097	0.045	46.6
Zinc	Total	8.7	5.9	4.5	6.367	2.139	33.6
	Dissolved	1.8	4.3	3.3	3.133	1.258	40.2
	Particulate	6.9	1.6	1.2	3.233	3.182	98.4

River Drammenselva

Sample	Fraction	10 June 2003					
		P1	P2	P3	Average	STD	% STD
Phosphorus	Total	14	10	9	11.000	2.646	24.1
	Dissolved	3	3	2	2.667	0.577	21.7
	Particulate	11	7	7	8.333	2.309	27.7
Arsenic	Total	0.12	0.12	0.12	0.120	0.000	0.0
	Dissolved	0.15	0.12	0.13	0.133	0.015	11.5
	Particulate	0	0	0	0.000	0.000	0.0
Lead	Total	0.093	0.12	0.1	0.104	0.014	13.4
	Dissolved	0.054	0.047	0.043	0.048	0.006	11.6
	Particulate	0.039	0.073	0.057	0.056	0.017	30.2
Cadmium	Total	0	0	0	0.000	0.000	0.0
	Dissolved	0.012	0	0.013	0.008	0.007	86.8
	Particulate	0	0	0	0.000	0.000	0.0
Copper	Total	1.5	1.1	0.93	1.177	0.293	24.9
	Dissolved	2.1	0.99	0.81	1.300	0.699	53.7
	Particulate	0	0.11	0.12	0.077	0.067	86.8
Chromium	Total	0.075	0.089	0.089	0.084	0.008	9.6
	Dissolved	0.1	0.083	0.074	0.086	0.013	15.4
	Particulate	0	0.006	0.015	0.007	0.008	107.9
Nickel	Total	0.45	0.46	0.44	0.450	0.010	2.2
	Dissolved	0.29	0.43	0.43	0.383	0.081	21.1
	Particulate	0.16	0.03	0.01	0.067	0.081	122.2
Zinc	Total	2.2	2.6	2.1	2.300	0.265	11.5
	Dissolved	2.4	2.6	2.7	2.567	0.153	6.0
	Particulate	0	0	0	0.000	0.000	0.0

Sample	Fraction	16 June 2003					
		P1	P2	P3	Average	STD	% STD
Phosphorus	Total	7	6	8	7.000	1.000	14.3
	Dissolved	1	2	0	1.000	1.000	100.0
	Particulate	6	4	8	6.000	2.000	33.3
Arsenic	Total	0.052	0	0	0.017	0.030	173.2
	Dissolved	0.083	0	0.061	0.048	0.043	89.6
	Particulate	0	0	0	0.000	0.000	0.0
Lead	Total	0.07	0.097	0.09	0.086	0.014	16.4
	Dissolved	0.035	0.035	0.041	0.037	0.003	9.4
	Particulate	0.035	0.062	0.049	0.049	0.014	27.7
Cadmium	Total	0	0	0	0.000	0.000	0.0
	Dissolved	0	0	0.012	0.004	0.007	173.2
	Particulate	0	0	0	0.000	0.000	0.0
Copper	Total	0.9	0.87	0.86	0.877	0.021	2.4
	Dissolved	0.87	0.78	0.96	0.870	0.090	10.3
	Particulate	0.03	0.09	0	0.040	0.046	114.6
Chromium	Total	0.11	0.12	0.11	0.113	0.006	5.1
	Dissolved	0.1	0.085	0.12	0.102	0.018	17.3
	Particulate	0.01	0.035	0	0.015	0.018	120.2
Nickel	Total	0.52	0.54	0.51	0.523	0.015	2.9
	Dissolved	0.59	0.5	0.57	0.553	0.047	8.5
	Particulate	0	0.04	0	0.013	0.023	173.2
Zinc	Total	2.3	2.2	2.2	2.233	0.058	2.6
	Dissolved	2.3	2.3	2.8	2.467	0.289	11.7
	Particulate	0	0	0	0.000	0.000	0.0

Sample	Fraction	30 June 2003					
		P1	P2	P3	Average	STD	% STD
Phosphorus	Total	13	20	16	16.333	3.512	21.5
	Dissolved	6	4	7	5.667	1.528	27.0
	Particulate	7	16	9	10.667	4.726	44.3
Arsenic	Total	0.19	0.18	0.19	0.187	0.006	3.1
	Dissolved	0.14	0.14	0.14	0.140	0.000	0.0
	Particulate	0	0.04	0	0.013	0.023	173.2
Lead	Total	0.095	0.11	0.14	0.115	0.023	19.9
	Dissolved	0.057	0.031	0.034	0.041	0.014	35.0
	Particulate	0.038	0.079	0.106	0.074	0.034	46.1
Cadmium	Total	0.013	0.019	0.01	0.014	0.005	32.7
	Dissolved	0.016	0.01	0	0.009	0.008	93.3
	Particulate	0	0.009	0	0.003	0.005	173.2
Copper	Total	0.99	2.7	2	1.897	0.860	45.3
	Dissolved	0.98	2.2	1.8	1.660	0.622	37.5
	Particulate	0	0.5	0.2	0.233	0.252	107.9
Chromium	Total	0.1	0.094	0.098	0.097	0.003	3.1
	Dissolved	0.097	0.099	0.1	0.099	0.002	1.5
	Particulate	0	0	0	0.000	0.000	0.0
Nickel	Total	0.49	0.51	0.49	0.497	0.012	2.3
	Dissolved	0.4	0.47	0.46	0.443	0.038	8.5
	Particulate	0.09	0.04	0.03	0.053	0.032	60.3
Zinc	Total	2.2	2.6	2.4	2.400	0.200	8.3
	Dissolved	2.4	2.2	2.4	2.333	0.115	4.9
	Particulate	0	0.4	0	0.133	0.231	173.2

Sample	Fraction	28 July 2003					
		P1	P2	P3	Average	STD	% STD
Phosphorus	Total	7	7	8	7.333	0.577	7.9
	Dissolved	4	4	5	4.333	0.577	13.3
	Particulate	3	3	3	3.000	0.000	0.0
Arsenic	Total	0	0	0	0.000	0.000	0.0
	Dissolved	0	0	0	0.000	0.000	0.0
	Particulate	0	0	0	0.000	0.000	0.0
Lead	Total	0.079	0.13	0.15	0.120	0.037	30.6
	Dissolved	0.051	0.073	0.066	0.063	0.011	17.7
	Particulate	0.028	0.057	0.084	0.056	0.028	49.7
Cadmium	Total	0	0	0.021	0.007	0.012	173.2
	Dissolved	0.012	0	0.017	0.010	0.009	90.4
	Particulate	0	0	0.004	0.001	0.002	173.2
Copper	Total	0.8	1.4	1	1.067	0.306	28.6
	Dissolved	1.5	1.3	0.98	1.260	0.262	20.8
	Particulate	0	0.1	0.02	0.040	0.053	132.3
Chromium	Total	0.09	0.1	0.11	0.100	0.010	10.0
	Dissolved	0.1	0.092	0.11	0.101	0.009	9.0
	Particulate	0	0.008	0	0.003	0.005	173.2
Nickel	Total	0.45	0.49	0.53	0.490	0.040	8.2
	Dissolved	0.65	0.47	0.49	0.537	0.099	18.4
	Particulate	0	0.02	0.04	0.020	0.020	100.0
Zinc	Total	1.9	2.6	2.6	2.367	0.404	17.1
	Dissolved	2.9	2.6	2.5	2.667	0.208	7.8
	Particulate	0	0	0.1	0.033	0.058	173.2