



Riverine inputs and direct discharges to Norwegian coastal waters 2003. OSPAR Commission

A: Principles and discussion. B: Data report

TA-2069/2004
82-7655-2390

**Riverine Inputs and Direct Discharges
to Norwegian Coastal Waters - 2003
OSPAR Commission.
A: Principles, Results and
Discussions**

Aquateam – Norwegian Water Technology Centre A/S

Report no: 04-043A

Project no: O-02106

Project manager: Mona Weideborg, M.Sc.

Co-workers: Eilen Arctander Vik, Ph.D

Elisabeth Lyngstad, M.Sc.

aquateam

REPORT

P.O. Box 6875 Rodeløkka
0504 Oslo Norway
Telephone: +47 22 35 81 00
Telefax: +47 22 35 81 10

Report number: 04-043A
Availability: Open

Title Riverine inputs and direct discharges to Norwegian coastal waters – 2003.OSPAR Commission. A: Principles, results and discussions	Date 10 December 2004
	Number of pages 56
Author(s) sign. Mona Weideborg  Eilen Arctander Vik Elisabeth Lyngstad	Responsible sign.  Bjarne Paulsrud
	Project number O-02106

Client(s) Norwegian Pollution Control Authority (SFT)	Contact person(s) Jon L. Fuglestad
--	---------------------------------------

<p>Summary</p> <p>Riverine inputs to Norwegian coastal waters from 10 main and 126 tributary rivers were monitored during 2003 covering the nutrients (Tot-P, PO₄-P, Tot-N, NO₃-N, NH₄-N, SiO₂), 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 (full program), the programme has been reduced with 19 small tributary rivers draining to the Norwegian Sea and the Barents Sea subregions. 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.</p> <p>The total annual nutrient load to coastal waters from land based sources was found to be 8 500 tonnes of phosphorus and 116 100 tonnes of nitrogen. About 16 % 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 61 % 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 183 and 486-509 tonnes, respectively. Inputs of cadmium were estimated to be 1.4-2.8 tonnes, lead 34-35 tonnes, mercury 2.3-2.4 tonnes, arsenic 19-23 tonnes, total chromium 36-38 tonnes and nickel 93-107 tonnes. The pesticide lindane was detected in most samples in very low concentrations. Total load of lindane was estimated to be about 45 kg.</p> <p>Retention in the fjords, leaching from the marine sediments and discharges from landfills located near the coast are not included in these figures.</p>

Key words - English

Key words - Norwegian

Pollution inputs	Forurensningstilførsler
Norwegian coastal areas	Norske kystområder
Riverine inputs	Elvetilførsler
Direct inputs	Direkte tilførsler

Preface

This report presents the results of the 2003 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 2003-investigation lasted from January throughout December. This report is the Norwegian part of the 2003 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. Some of 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, 10 December 2004

Mona Weideborg

Table of Contents

PREFACE	2
SUMMARY AND CONCLUSIONS.....	5
1. INTRODUCTION.....	7
2. RIVER SYSTEMS INCLUDED IN THE STUDY	8
2.1. General Aspects	8
2.2. Main Rivers.....	9
2.3. Tributary Rivers.....	11
3. METHODOLOGY	12
3.1. Methodology for Assessment of Riverine Inputs.....	12
3.1.1. Objective	12
3.1.2. Site Selection	12
3.1.3. Sampling Strategy and Frequency	12
3.2. Monitoring Parameters and Analytical Methods.....	13
3.2.1. Chemical parameters – detection limits and analytical methods	13
3.2.2. Method used to estimate flow rate	15
3.2.3. Calculation of annual load	20
3.3. Methodology for assessment of direct discharges to marine waters	21
3.3.1. Wastewater treatment plant effluents.....	22
3.3.2. Industrial effluents	23
3.3.3. Fish farming effluents	24
3.3.4. Other inputs (nutrients in run-off from “down stream areas” of main and tributary rivers and rivers not monitored)	24
4. RESULTS AND DISCUSSION	25
4.1. Measured concentrations and calculated loads	25
4.2. Water flow.....	26
4.3. Nutrients, particulate matter and total organic carbon	27
4.4. Metals	32
4.5. Other parameters	37

4.6. Trend analysis.....	37
4.6.1. Nutrient trends	38
4.6.2. Metals trends	40
4.6.3. Lindane trends.....	46
4.7. Mean annual water flow (1931-60, 1961-90) and mean load.....	46
4.8. Retention in fjords.....	47
4.9. Leakage from sediments	48
5. REFERENCES.....	49
5.1. Project Personnel.....	49
5.2. Literature	50

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 2003 are given for riverine inputs of 10 main rivers and 126 tributaries. Random samples of 145 tributary rivers were monitored before 2002. The active monitoring programme in 2003 covered drainage from approximately 72 % of the main land area compared to 75% in the full program carried out in 2001. The sampling programme for 2003 was reduced with 9 tributary rivers to the Norwegian Sea and 10 tributary rivers to the Barents Sea. The loads of the 19 rivers were stipulated based on concentrations measured in 2002 and 2001. The flow of these 19 rivers was relatively low, and the use of old 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.

For most Norwegian rivers the input to the sea shows large annual variations due to large seasonal differences in water flow, erosion, runoff and loss of river sediments. To control the fulfilment of the Ministerial Declaration of the North Sea, a "normalised" set of chemical data has also been prepared for 2003. The 2003 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 coastline is classified as a problem area with regard to eutrophication according to OSPAR Comprehensive procedure, and part of the coastline is classified according to EUs Nitrate- and Urban waste water directives. The Skagerrak region received in 2003 approximately 10 % of the total phosphorus (Tot-P) and 30 % of the total nitrogen (Tot-N) loading to the Norwegian coastal waters. In this region about 68 % of the P- and about 77 % of the N-loads are found in the riverine inputs. During year 2003, all rivers with outlet in the Skagerrak area showed a decreased annual water flow (4-15 % decrease) compared to 2002.

Total annual loads to coastal waters from Norway include approximately 8 500 tonnes of total phosphorus and 116 100 tonnes of total nitrogen. The phosphorus load is lower than in 2002 and the nitrogen load is almost the same as in 2002. About 16 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 61 % of the total phosphorus loading and 21 % of the total nitrogen loading. Fish farming comprises the major sources of phosphorus pollution in the Remaining North Sea, Norwegian Sea and Barents Sea subregions. In the Skagerrak area, fish farming comprises only small units. Compared with the other regions, the phosphorus input from Skagerrak is small, in spite that this area comprises most of the agriculture and urban areas in Norway.

For the country as a whole, the phosphorus loading decreased by 20 % in 2003 compared with the 2002 loads, due to lower inputs from the rivers. The phosphorus loading from fish farming was at the same level in 2003 as in 2002.

The inputs of total phosphorus to the Skagerrak area were in 2003 found to be approximately one half of the 2002 inputs, due to decreased inputs from the main rivers and the tributaries. A decrease was expected due to the lower water flow of all rivers in the Skagerrak area in 2003. For the main rivers in the Skagerrak region, the calculated loads in 2003 decreased by 60 % for total phosphorus. The decrease in water flow in the rivers discharging to this region was only 11 %. The high flow in 2000 is likely to have washed out sediments with high concentrations of nutrients the the rivers. The four next years more normal and reduced water flows have reduced the water concentrations back to “normal” condition.

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 1.4-2.8 tonnes, lead (Pb) 34-35 tonnes, mercury (Hg) 3.3-2.4 tonnes, arsenic (As) 19-23 tonnes, total chromium (Cr) 36-38 tonnes and nickel (Ni) 93-107 tonnes. Copper (Cu) and zinc (Zn) comprised the largest inputs of trace metals, which in 2003 amounted to approximately 183 and 486-509 tonnes, of which 77 and 81 % respectively, were river monitored. The high uncertainty in the cadmium value is due to the many samples with concentrations below the detection limit (<50%).

A significant decrease was found in the total input from 1999 to 2003 for all metals with exception of mercury. For most of the metals, the 2003 reported total loads to the Norwegian coastal waters were lower than in 2002 or at the same level. The total loads of copper, chromium and arsenic were almost the same in 2003 as in 2002. Total inputs of the other metals, except mercury, decreased between 8 % for zinc to 25 % for nickel. A major reason for this significant decrease in metal loading was decrease in water flow of all rivers in the Skagerrak area also in year 2003. For some of the metals and rivers, also the concentration decreased.

For mercury the same decrease as for the other metals is not seen. The total loads of mercury seem to have increased from 2002 to 2003, due to increased concentration in the tributary rivers, and also in the rivers Drammenselva, Skienselva and Otra. This increase in Hg concentration could be caused by clean-up of contaminated sites in the catchment areas of these rivers. The uncertainty in the stipulated total loads especially from the tributaries is, however, high. The uncertainty of the measured concentrations is also high.

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 24-25 kg. Load of tributary rivers has been stipulated to approximately 20 kg. The total loads were stipulated to 45 kg. This is almost the same level as in 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 Drammenselva and Skienselva with use of the Trend-Y-Tector. A downward trend was found for nitrogen in Otra in 1980-2003 and for Suldalslågen in 1990-2003. Longer time series are needed to make sound conclusions about these trends. Significant reductions in the yearly inputs of metals were found in Orkla (Cu, Zn, Cr, Ni, Cd and As), Suldalslågen (As, Pb, Cd, Cr, Ni, Cu and Zn), Numedalslågen (Cd and Cr), Skienselva (Pb and Cr), Otra (Cd, Cr and Zn), Orreelva (Cr), 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 - 2003).

In addition to the ten rivers, random samples were taken from 126 rivers in 2003. The load estimation was based on the results from the random sampling supplemented with other data from 2003-monitoring programmes, and existing knowledge of the river systems concerned. The sampling programme for 2003 was reduced with 9 tributary rivers to the Norwegian Sea and 10 to the Barents Sea, compared to the full programme (2001). The loads of these rivers were stipulated based on concentrations measured in 2002 or 2001. The 19 rivers comprised a drainage area of 2081 km² to the Norwegian Sea and 5216 km² to the Barents Sea. The 19 tributary inputs are relatively low, and the use of 2002/2001 data is not expected to influence on the total calculated loading.

The total drainage area of the monitored rivers in 2003 is 221 855 km², while the total area of mainland Norway is 323 802 km² (Table 1). Totally 306 707 km² of the drainage area is included in the investigation, of which 72% is river monitored in 2003 (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 land 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 (SSB, 2004).

Population	4.58 million
Area:	
- Mainland Norway	323 802 km ²
- The whole country incl. Svalbard and Jan Mayen	385 199 km ²
Coastline:	
- Length of the continental coastline	25 148 km
- Not including fjords and bays	2 650 km
- Length of the islands' coastline	58 133 km
- Total	83 281 km

2.2. Main Rivers

The rivers chosen for the comprehensive study are the same as in 1990-2002 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.). Five of the main rivers in this monitoring programme (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.

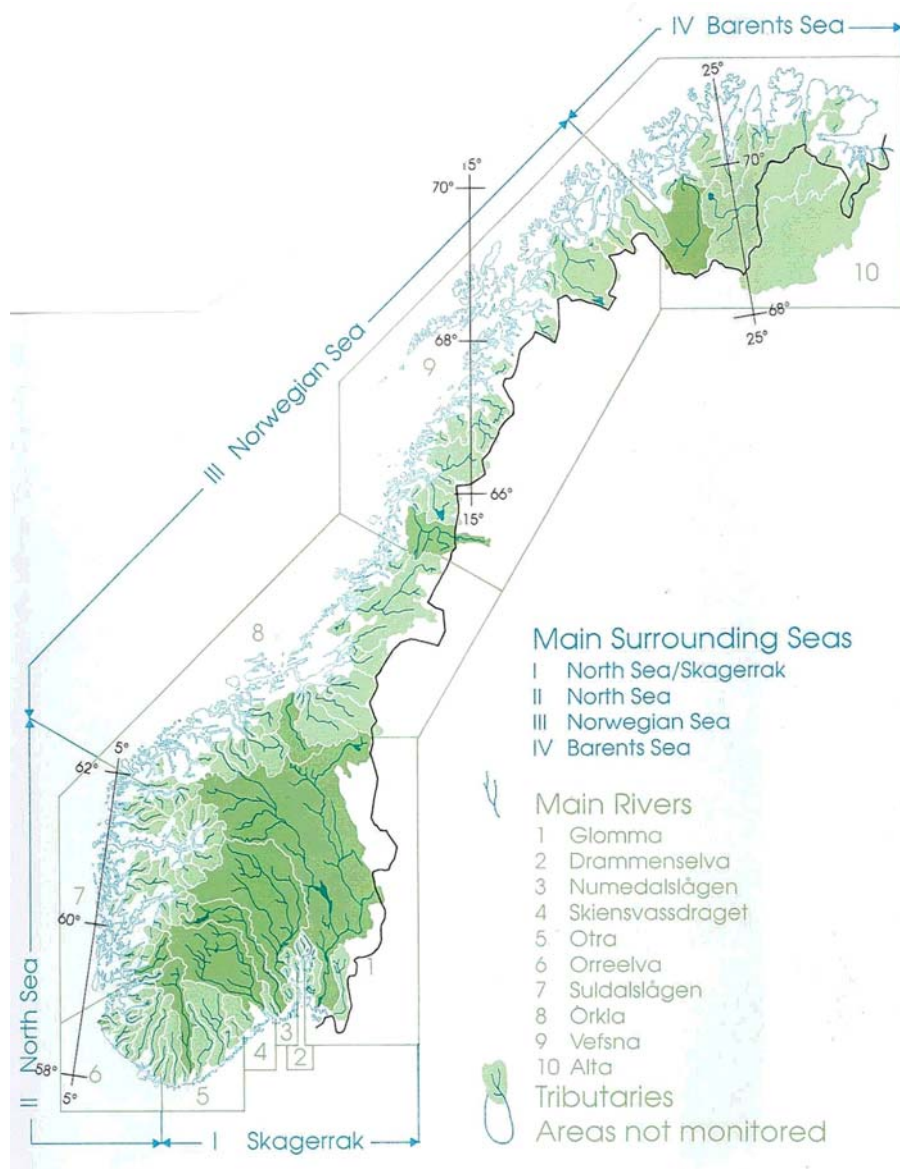


Figure 1. Norway divided into four Discharge Areas. Main Rivers and Tributaries with Drainage Basins. Source: Norwegian Water Resources and Energy Administration. Design: NIVA

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
7	Suldalslågen	1 457	7 420
8	Orkla	3 053	5 710
9	Vefsna	4 122	15 655
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 most of the Norwegian rivers with catchment areas larger than 500 km² and several of the minor rivers (streams) also are included in the 2003 study. Some information about these rivers is shown in Tables 8.1-8.2 (Appendix VIII, Report B). The 19 small tributary rivers draining Norwegian Sea and Barents Sea were not included in the monitoring in 2003. The loads of these rivers were, however, stipulated based on analytical results from 2002 and 2003.

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 - 2003.

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 2003, as described in PARCOM 10/3/2. Two of the main rivers (Glomma and Drammenselva) were sampled weekly in the period with the highest anticipated flow (May – June). Suldalslågen was sampled only 10 times in 2003. In most of the main rivers the parameter lindane have been sampled and analysed 4 times in 2003. Lindane was sampled 3 times in Suldalslågen. The sampling frequency for the main rivers is shown in Table 3.

Table 3. Sampling sites, sampling frequency and distance from the river outlet of the main rivers.

River/Location	Km to Outlet	J	F	M	A	M	J	J	A	S	O	N	D
Glomma at Sarpsfoss	17	x	x	x	x	xxx	xxxx	xx	x	x	x	x	x
Drammenselva upstream the town bridge	0,5	x	x	x	x	xxxx	xxxxx	x	x	x	x	x	x
Numedalslågen at Bommestad	~3	x	x	x	x	x	x	x	x	x	x	x	x
Skienselva at Klosterfoss	~3	x	x	x	x	x	x	x	x	x	x	x	x
Otra at Skråstad	~6	x	x	x	x	x	x	x	x	x	x	x	x ¹⁾
Orreelva near the outlet	0	x	x	x	x	x	x	x	x	x	x	x	x
Orkla at Vormstad	~13	x	x	x	x	x	x	x	x	x	x	x	x ¹⁾
Vefsna at Kvalfors	~12		xx	x	x	x	x	x		x	x	x	xx ¹⁾
Suldalslågen near the outlet	0	x	x	x	x		x	x		x	x	x	x
Alta just upstream Alta	~6	x	x	x	x	x	x	x		x	x	xx	x ¹⁾

¹ Sample collected in January 2004

The tributary rivers were sampled once in 2003. 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 2003 the water samples from the main rivers were collected 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 trained and 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 immediately initiated.

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 2002 to 2003 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 ($\mu\text{g P/L}$)	1.0	NS 4725
Orthophosphate ($\text{PO}_4\text{-P}$) ($\mu\text{g P/L}$)	1.0	NS 4724
Total Nitrogen ($\mu\text{g N/L}$)	10	NS 4743
Nitrate and nitrite ($\text{NO}_3 + \text{NO}_2$) ($\mu\text{g N/L}$)	4	NS 4743
Ammonia (NH_4) ($\mu\text{g N/L}$)	1	NS 4746
Silicate (SiO_2) (mg/L)	1.07	SS028150-2
Lead (Pb) ($\mu\text{g Pb/L}$)	0.02	SS028152-2
Cadmium (Cd) ($\mu\text{g Cd/L}$)	0.01	SS028152-2
Copper (Cu) ($\mu\text{g Cu/L}$)	0.1	SS028152-2
Zinc (Zn) ($\mu\text{g Zn/L}$)	0.5	SS028152-2
Chromium (Cr-tot) ($\mu\text{g Cr/L}$)	0.05	SS028152-2
Nickel (Ni) ($\mu\text{g Ni/L}$)	0.2	SS028152-2
Arsenic (As) ($\mu\text{g As/L}$)	0.05	SS028152-2
Mercury (Hg) (ng Hg/L)	2	NS 4768 (CETAC)
Lindane (ng/L)	0.1	EPA 508 mod. – GC/ECD

In 2003 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 2003, most nutrient measurements were above the detection limit, except for orthophosphate. Only Glomma and Alta had more than 70% of the PO_4 measurements above the detection limits.

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

The low concentration of heavy metals, especially cadmium, 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: Suldalslågen
- Cadmium: Glomma, Drammenselva, Numedalslågen, Orreelva, Suldalslågen, Vefsna, Alta
- Zinc: Vefsna

- Mercury: Glomma, Drammenselva, Numedalslågen, Skienselva, Otra, Orreelva, Orkla, Suldalslågen, Vefsna
- Nickel: Suldalslågen, Vefsna, Alta

However, this is not likely to affect the results and conclusions of the year 2003-study. In the cases where 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, 1990-2003 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 method for estimation of flow rate is based on regular registration of water level at the closest hydrometric station. The results are transformed to water flow via a flow rate calibration curve developed for the station. A parabolic relationship between water level and flow rate is anticipated.

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).

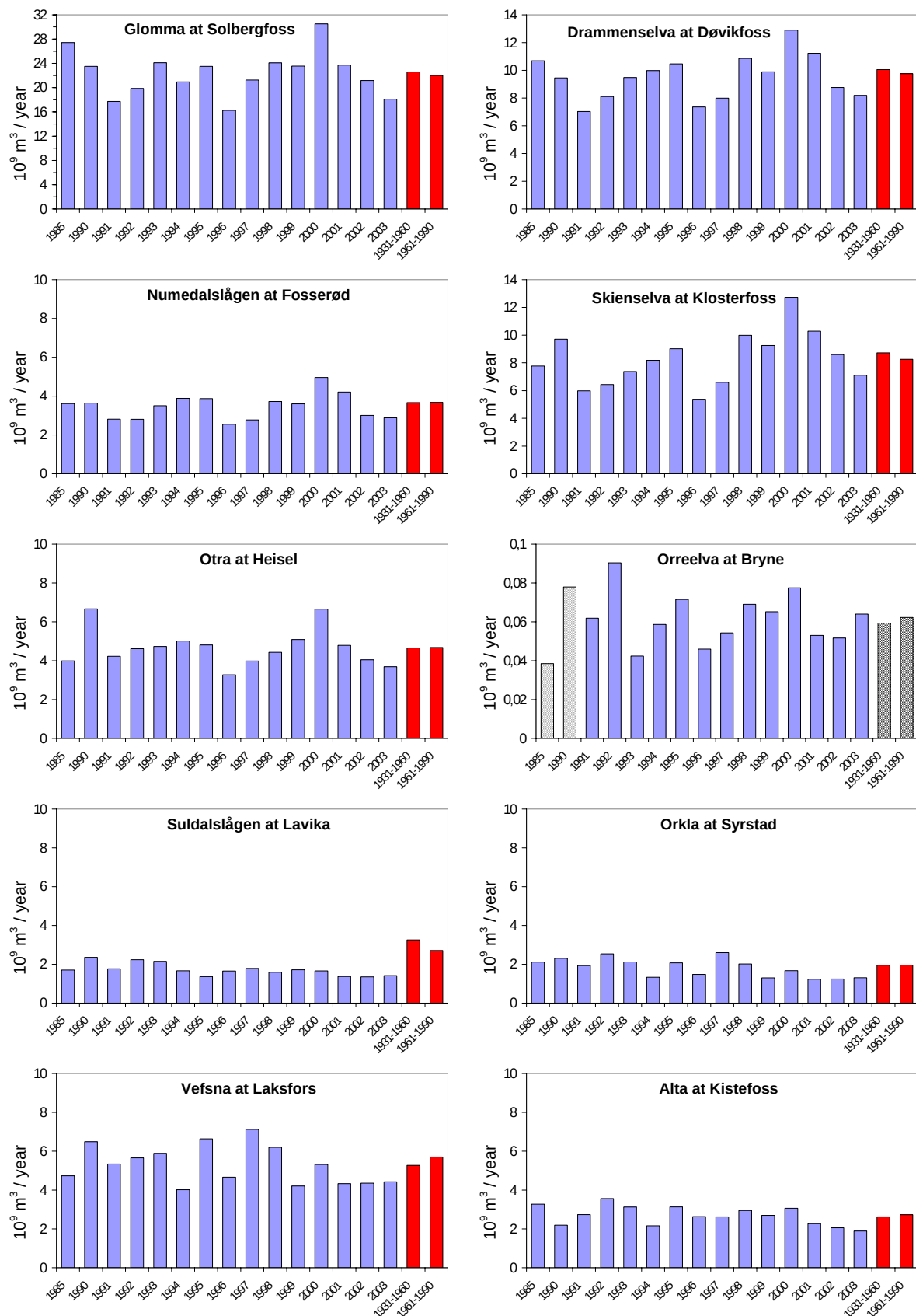


Figure 2. Main Rivers. Mean Annual Flow (1931-60 and 1961-90) and Annual Water Flow for 1985, 1990-2003 (10^9 m^3). Source: Norwegian Water Resources and Energy Administration.

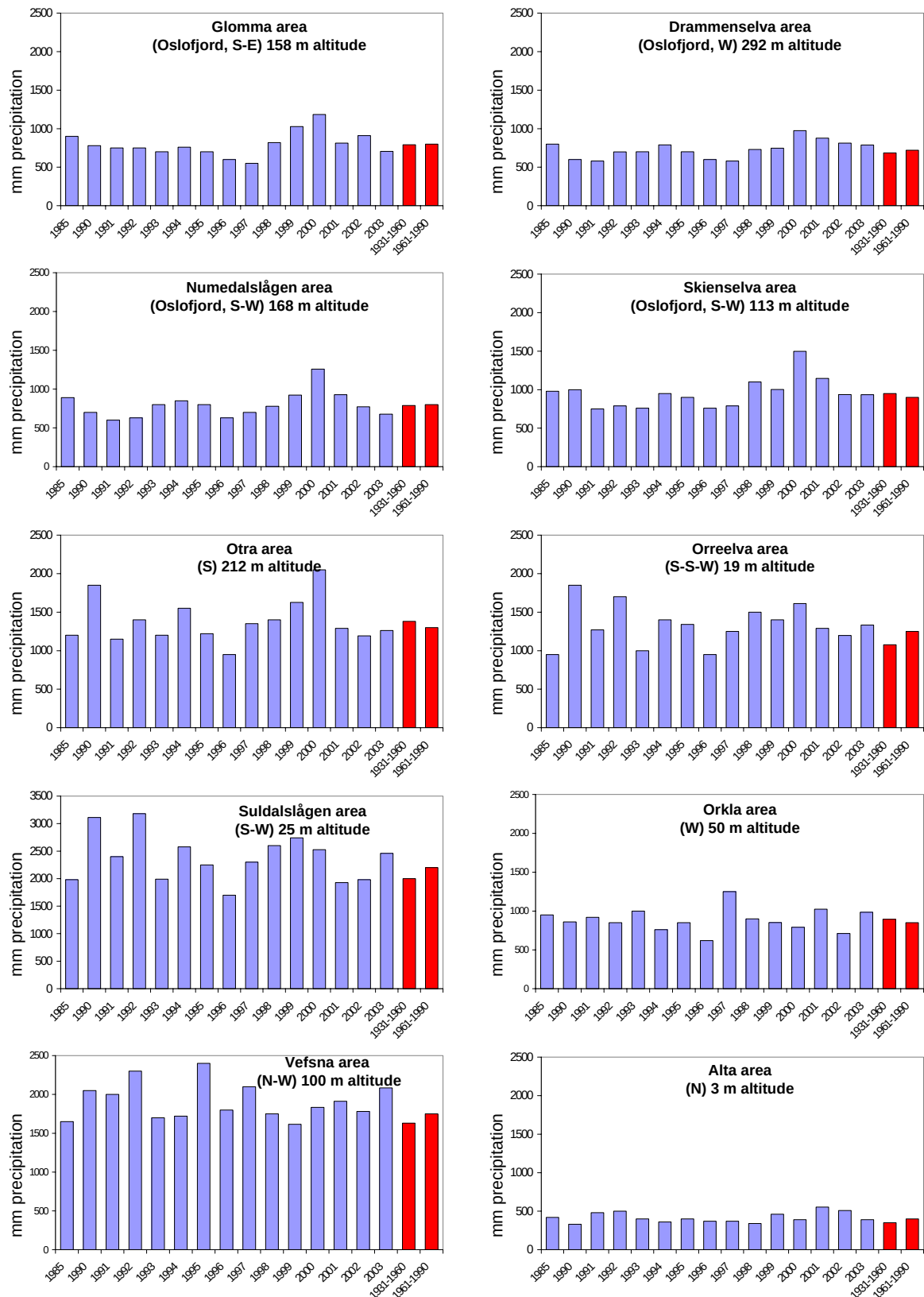


Figure 3. Main Rivers. Mean Annual Precipitation (1931-60 and 1961-90) at Stations near Outlet and Annual Precipitation in the Years 1985, 1990-2003 (mm/year). Source: The Norwegian Meteorological Institute. (S = South, E = East, W = West, N = North)

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 hydrometric stations as used in 2002 were also used in 2003. The water flow measurements at Klosterfoss station in Skienselva terminated in 2001. An upstream hydrometric station, Skotfoss was used for Skienselva in 2003 as in 2002. Figure 4 shows measured water flow at the new station. In Figure 2, the total annual water flow shown for Klosterfoss in 2003 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, 2004). The additional water supplied is estimated using measured rainfall data from the local catchment areas (DNMI, 2004a).

For all main rivers, seasonal changes in water flow in 2003 are shown in Figure 4.

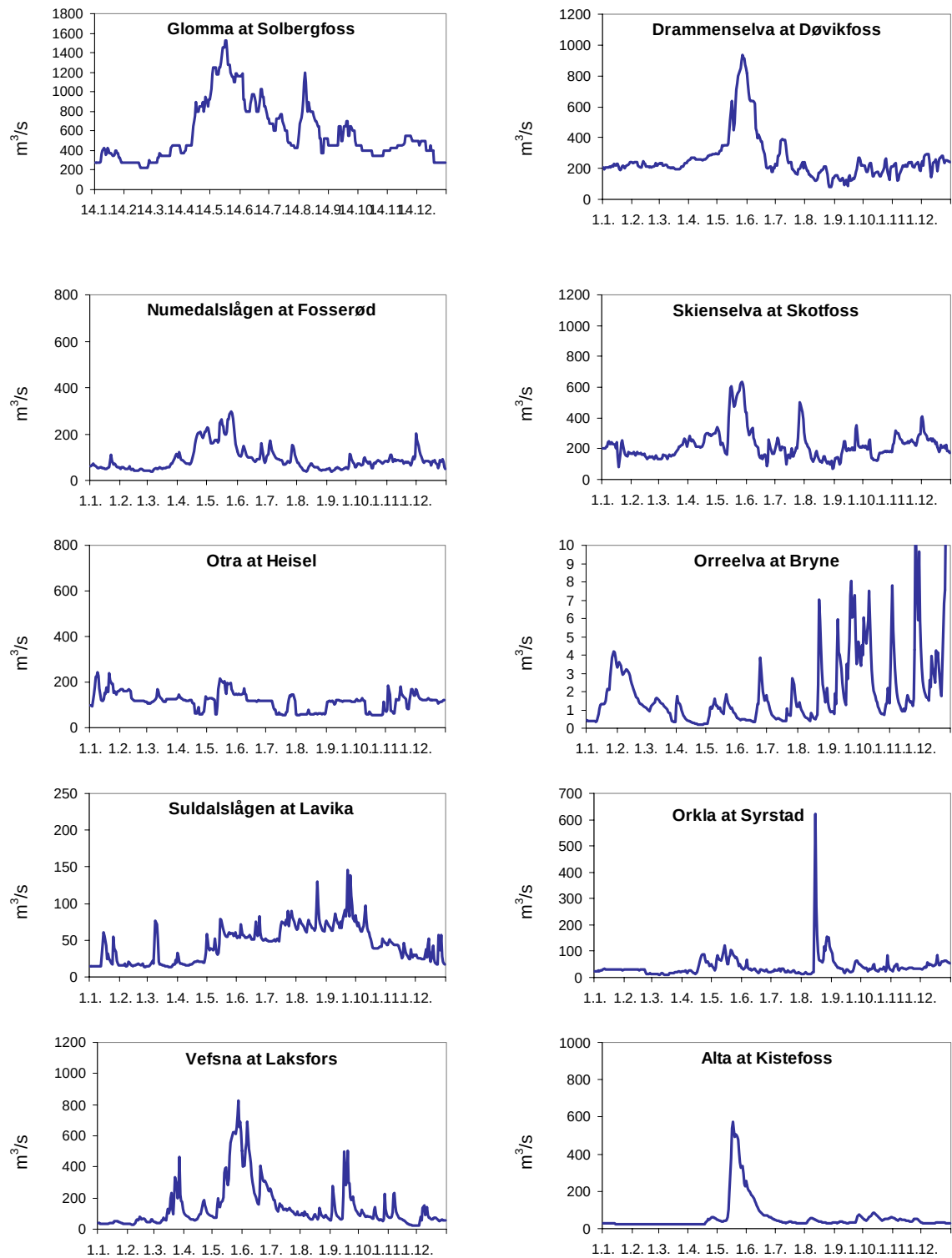


Figure 4. Main Rivers. Seasonal Changes in Daily Water Flow (m³/s). Source: Norwegian Water Resources and Energy Administration.

For the tributary rivers the mean water flow data (1931-60) and measured precipitation (2003) 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:

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

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:

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

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 2003:

- Precipitation data for 2003 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 (km² 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			
Skagerrak	1. Glomma	41 218	2 389	2 416	46 023	94.8
	1. Inner Oslofjord		959	342	1 301	73.7
	2. Drammenselva	17 028	226	320	17 574	98.0
	3. Numedalslågen	5 513	1 043	631	7 187	91.2
	4. Skienselva	10 348	1 200	1 283	12 831	90.0
	5. Otra	3 730	9 109	904	13 743	93.4
Subtotal	Skagerrak	77 837	14 926	5 896	98 659	94.0
The re-remaining North Sea	6. Orreelva	105	7 233	2 513	9 851	74.5
	7. Suldalslågen	1 466	16 205	12 681	30 352	58.2
Subtotal	Remaining North Sea	1 571	23 438	15 194	40 203	62.2
The Norwegian Sea	8. Orkla	2 680	28 118	17 036	47 834	64.4
	9. Vefsna	4 113	21 827 ¹⁾ (23 907) ²⁾	20 930 ¹⁾ (18 850) ²⁾	46 870	55.3 ¹⁾ (59.8) ²⁾
Subtotal	Norwegian Sea	6 793	49 945¹⁾ (52 025)²⁾	37 966¹⁾ (35 886)²⁾	94 704	59.9¹⁾ (62.1)²⁾
The Barents Sea	10. Alta	7 367	39 939 ¹⁾ (45 155) ²⁾	25 835 ¹⁾ (20 619) ²⁾	73 141	64.7 ¹⁾ (71.8) ²⁾
Subtotal	Barents Sea	7 367	39 939¹⁾ (45 155)²⁾	25 835¹⁾ (20 619)²⁾	73 141	64.7¹⁾ (71.8)²⁾
Total		93 568	128 247¹⁾ (135 544)²⁾	84 892¹⁾ (77 595)²⁾	306 707	72.3¹⁾ (74.7)²⁾

1) The 19 tributary rivers left out from the sampling programme in 2003

2) Full programme (145 tributary rivers)

3.3. Methodology for assessment of direct discharges to marine waters

The computer model TEOTIL (Tjomsland and Ibrenk, 1992) for estimation of the nutrient loadings to Norwegian coastal waters was used for calculation of direct discharges of nitrogen and phosphorous. 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, fish farming, 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, 2004).

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, 2004). The figures take into account retention in water courses.

In 2003, 2549 wastewater treatment plants with a hydraulic capacity of at least 50 p.e. were registered in Norway (SSB, 2004).

Data from 2003 showed that there were registered 558 sewerage systems (serving more than 50 p.e.) with direct discharges of untreated wastewater (SSB, 2004). The major part (52%) of the wastewater treatment plants have only primary treatment, 12.5 % chemical treatment, 6.5 % biological treatment, 15 % chemical and biological treatment and 14 % 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 6.1 million p.e., advanced treatment account for 66% (chemical 36 %, chemical/biological 28%, biological 2%), primary treatment for 23%, direct discharges for 9%, 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 treatment 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. Data from 2002 was chosen, since they were more complete than 2003 data. 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, 2004).

3.3.3. Fish farming effluents

Nutrient loading (Tot-N, NH₄, Tot-P and PO₄) is reported from each fish farmer through a reporting system to the Norwegian Fisheries Directorate and thereafter estimated by use of the computer model TEOTIL (Borgvang and Tjomsland, 2004). 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 computer model TEOTIL calculates the load from each pollution source by using specific load coefficients for the land disposal (Holtan and Åstebøl, 1990) multiplied by areas (in square kilometres) of different categories and activity numbers, e.g. population. The coefficients used have been developed to account for 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 monitoring points) are shown in Table I (Appendix I, Report B), for the different subareas (1-10) in Appendix VI, Report B. Direct discharge areas (km²) 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). The discharges of the following substances included in the RID programme should be considerably reduced within 2010:

- Lead
- Cadmium
- Copper
- Mercury
- Chromium

Sources of metal inputs are industrial effluents, 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 were summarised in the RID report 2002 (Weideborg et al., 2003).

Fish farming comprises the major sources of phosphorus pollution to the Remaining North Sea, Norwegian Sea and Barents Sea subregions. In the Skagerrak area, fish farming comprises only small units, and municipal wastewater and run-off from agricultural areas comprise the major sources of phosphorus pollution to the Skagerrak subregion. Municipal wastewater and run-off from agricultural areas comprise the major sources of nitrogen pollution to all subregions. In addition to these nutrients the water is polluted by dissolved organic matter, especially from fish farming (not in the Skagerrak subregion), from the pulp and paper industry and from municipal wastewater. These sources of contamination 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 (2003), 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 Riv-

erine 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 orthophosphate, 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 2003 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 2003-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 2003 approximately 10 % 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 68 % of the P- and about 77 % of the N-loads, are included in the riverine inputs.

4.2. Water flow

The monitored precipitations in 2003 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 - 2003 and the yearly water flow was back to a normal (Figures 2 and 3). The water flow in this area decreased approximately 11 % from 2002 to 2003. 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 2003. The water flow had decreased from 1999 to 2003 in all the main rivers in the Skagerrak area.

Table 9. Changes in water flow from 1999 to 2003 for the Skagerrak area.

Rivers	Flow 2003 (m ³ /d)	Change in water flow (%)				
		From 1999 to 2000	From 2000 to 2001	From 2001 to 2002	From 2002 to 2003	From 1999 to 2003
River Glomma	50 795 145	+29	-22	-11	-15	-15
River Drammenselva	23 831 547	+30	-13	-22	-7	-17
River Numedalslågen	8 379 879	+38	-15	-29	-4	-20
River Skienselva	20 192 026	+ 37	-19	-16	-14	-20
River Otra	10 272 640	+31	-28	-16	-9	-28

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 2003 values.

Total annual load of (year 2003) for the four subregions are shown in Tables 1.1-1.4 (Appendix I, Report B) and in Figure 6. The results of the 2003 investigation show that total annual nutrient loads to coastal waters from land-based sources in Norway include approximately 8500 tonnes of phosphorus and 116 100 tonnes of nitrogen. The phosphorus load is lower than in 2002, and the nitrogen load is almost the same as in 2002. About 20 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 61 % of the total phosphorus loading and 21 % of the total nitrogen loading.

Figure 6A shows the contribution of tot-P and tot-N 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.

As shown in Figure 6, the environmental loading of nutrients from fish farming contributes to a major part of the total loading (approximately 61 % for phosphorus and 21% for nitrogen). Fish farming comprises the major sources of phosphorus pollution to the North Sea, Norwegian Sea and Barents Sea subregions. In the Skagerrak area, fish farming comprises only small units. Compared with the other subregions, the phosphorus input from Skagerrak is small, in spite that this area comprises most of the agriculture and urban areas of Norway.

For the whole country, the phosphorus loading was decreased by approximately 20% in 2003, compared with the 2002 loads.

The inputs of total phosphorus to the Skagerrak area were in 2003 found to be approximately one half of the 2002 inputs, due to decreased inputs from the main rivers and the tributaries. A decrease from 2002 to 2003 was expected due to the reductions in water flow of all rivers in the Skagerrak area (approximately 11% decrease, see Table 9). For the main rivers in the Skagerrak region, the calculated loads in 2003 decreased by 60 % for total phosphorus. This decrease in phosphorus is partly due to the reduced flow and partly due to decrease in phosphorus concentration from 2002 to 2003 (e.g. Glomma: from 30 to 17 µg tot-P/l and from 4 to 2 µg PO₄-P/l). A correlation analysis between nutrient concentrations and water flow and suspended material performed by Vik et al. (2002) indicated a possible positive correlation between S.P.M. and tot-P in Glomma. The concentration of total phosphorus was expected to decrease with decreasing concentration of suspended matter. The concentration of suspended matter was, however, at the same level in 2003 as in 2002. The high flow in 2000 is likely to have washed out sediments with high concentrations of nutrients the the rivers. The four next years more normal and reduced water flows have reduced the water concentrations back to “normal” conditions. The direct discharges in the Skagerrak area were approximately the same in 2003 as in 2002. There is no fish farming in this area.

The calculated phosphorus loads to the remaining North Sea area showed a reduction of 15%, due to the reduction in inputs from the tributary rivers. The total phosphorus loads from direct discharges and the fish farming in this area were approximately the same in 2003 as in 2002.

The calculated phosphorus loads to the Norwegian Sea area showed a reduction of 12%, due to reduction in inputs from the main and tributary rivers. A minor increase (5%) in total phosphorus loads from fish farming was, however, found. The total phosphorus loads from the direct discharges to this area were therefore approximately the same in 2003 as in 2002.

The calculated phosphorus loads to the Barents Sea area were reduced with 10%, mainly due to reduction in input from the main river Alta. A minor increase (7%) in total phosphorus loads from the fish farming was, however, found.

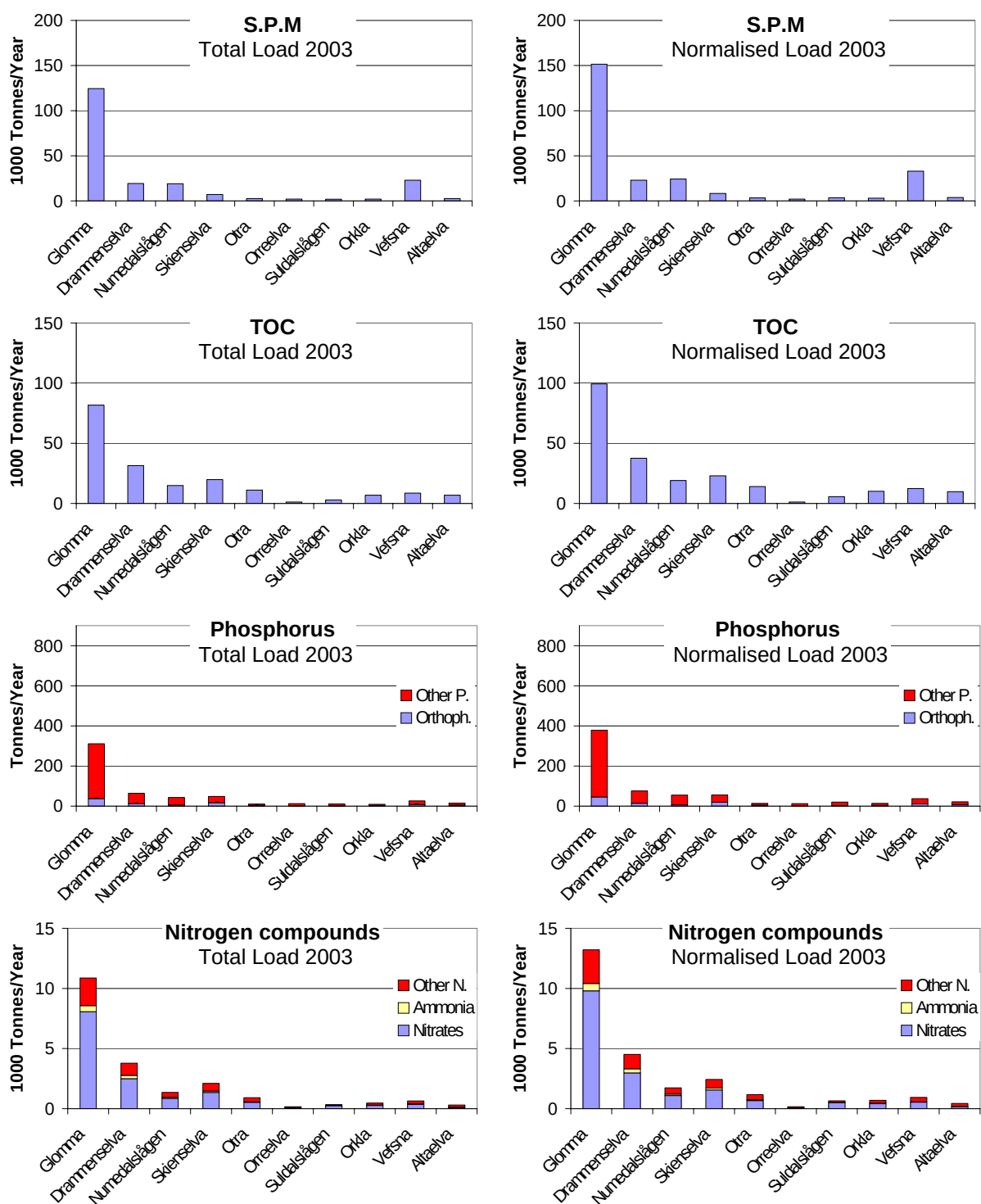
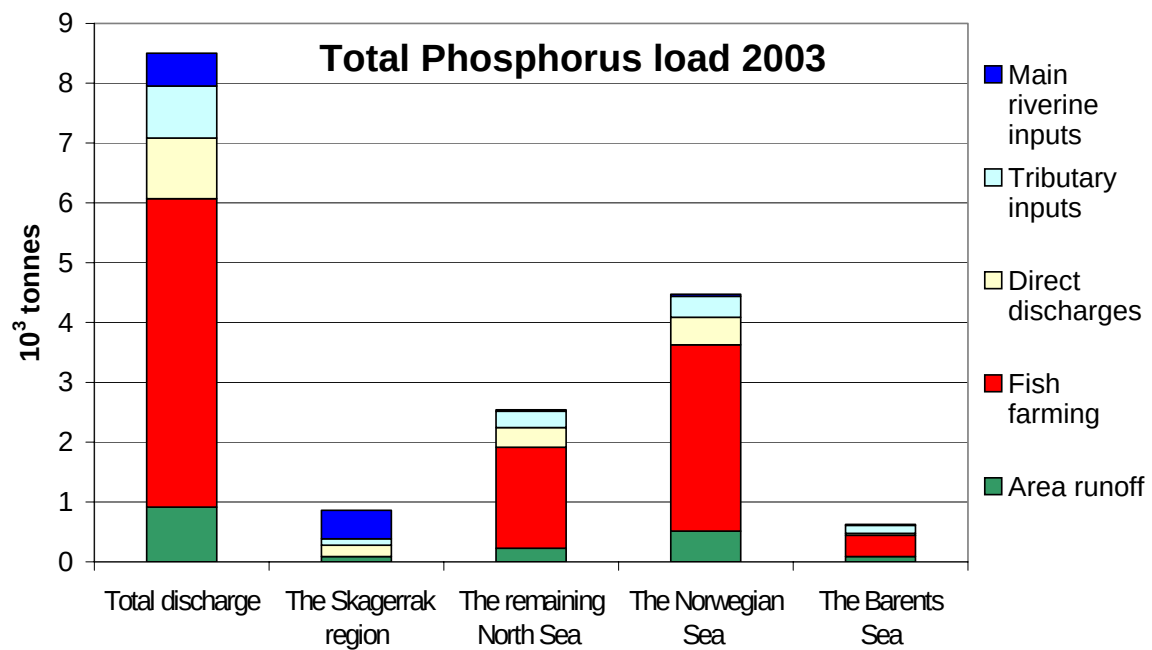
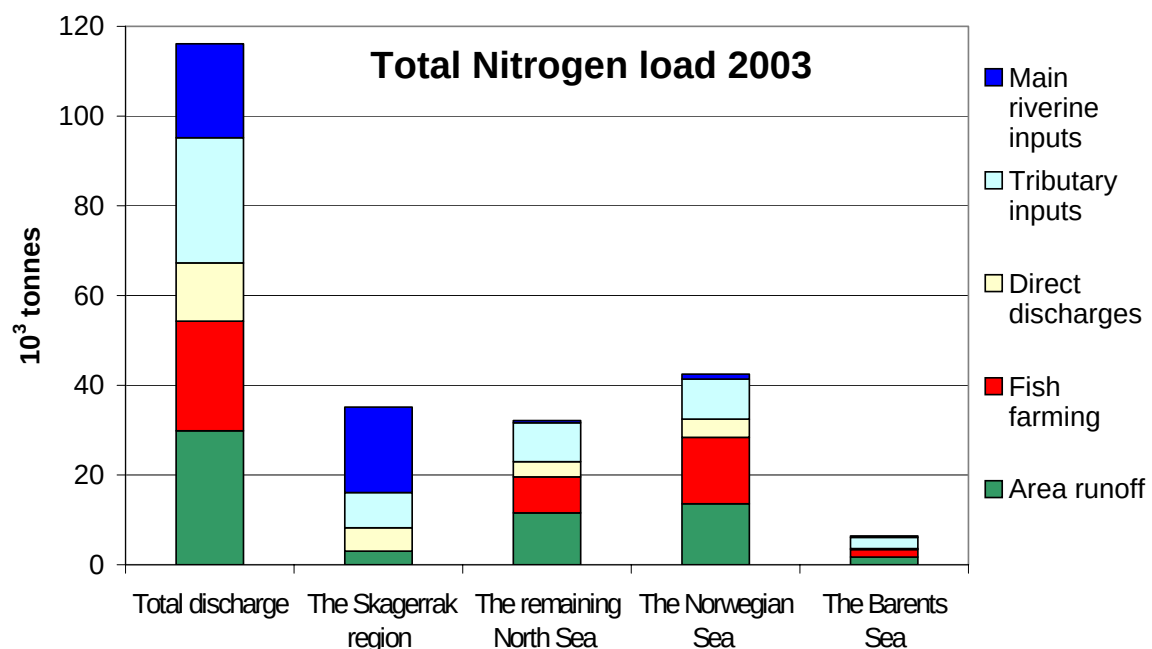


Figure 5. Main rivers. Suspended particulate matter (S.P.M.), total organic carbon (TOC) and nutrients (Tot-P, orthophosphate, Tot-N, nitrate, ammonia). Total loads 2003 and total normalised loads.



*

Figure 6A. Nutrients (Tot-P and Tot-N), total discharges in 2003 from mainland Norway to convention waters and the four subregions. Contribution from the 4 main sources and area runoff.

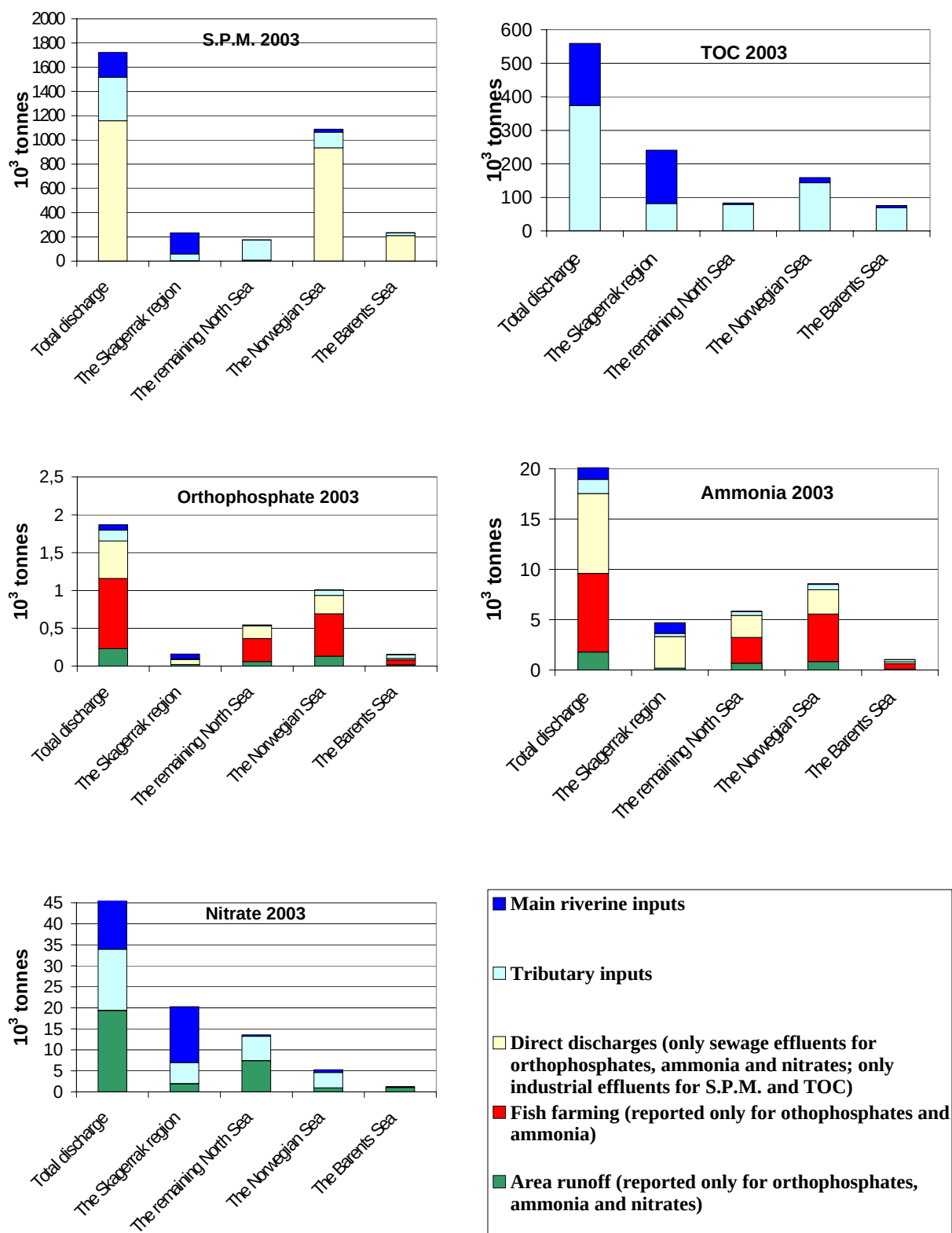


Figure 6B. S.P.M., TOC and nutrients (orthophosphate, ammonia and nitrate), total discharges in 2003 from mainland Norway to convention waters and the four subregions. Contribution from the 4 main sources and area runoff.

4.4. Metals

Total inputs of metals from 1999 to 2003 are shown in Table 10. A significant decrease was found in the total input from 1999 to 2003 for all metals with exception of mercury. A peak was observed in 2000 for the metals lead, cadmium, and zinc, possibly due to the flooding period in the Skagerrak area in autumn 2000. High runoff in flooding periods can significantly increase loads of metals, due to increased water flow, increased leaching from the ground and increased particle loss from erosion.

For mercury the same decrease as for the other metals is not seen. Due to the low concentrations of mercury compared to the other metals, the measurement uncertainty is >50%, while the other metals have measurement uncertainty ~10%.

*Table 10. Total input of metals (tonnes) and total suspended matter (tonnes *10³) from 1999 to 2003.*

Parameter	1999	2000	2001	2002	2003	Measurement Uncertainty (%)
Cadmium	4.1-4.7	5.0-5.1	2.3-3.6	2.3-3.1	1.4-2.8	20
Lead	53	68	31-33	44	34-35	10
Mercury	1.2-1.7	1.6-2.2	1.8-2.1	1.6-1.7	2.3-2.4	>50
Arsenic	33-34	30-31	24-29	22-24	19-23	12
Chromium	83-85	73-75	37-58	35-38	36-38	10
Nickel	236	175	144-150	134-143	93-107	10
Copper	291	243	193-195	179-180	183	10
Zinc	721	827-929	607-625	520-537	486-509	10
S.P.M.	4154-4172	2505-2532	1263-1287	1302-1323	1722-1741	-

Upper limit: limit= detection limit. Lower limit: limit=0

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 (> 50% 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 77 and 81 % 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 total loads of mercury seem to have increased with 40% from 2002 to 2003. The concentration in the tributary rivers in the Norwegian Sea subregion, and also in the main rivers Drammenselva, Skienselva and Otra seem to have increased, but the measurement uncertainty in the mercury measurements at nanogram level is higher than 50%. The uncertainty in the stipulated total loads from the tributaries (only one measurement per river) is therefore especially high.

The total loads of copper, chromium and arsenic were almost the same in 2003 as in 2002. For the other metals, except mercury, the 2003 reported total loads to the Norwegian coastal waters were lower than in 2002. Total inputs of the different metals decreased from 2002 to 2003 as follows:

- Lead: -20%
- Cadmium: -10%
- Zinc: -8%
- Nickel: -25% (high uncertainty due to high detection limit)

Total inputs of metals from 1999 to 2003 in the Skagerrak subarea are shown in Table 11. As seen for the whole country (Table 10), a significant decrease was found in the total input from 1999 to 2003 for all metals with exception of mercury. A peak was observed in 2000 for the all metals except for chromium and mercury, possibly due to the flooding period in the Skagerrak area in autumn 2000. High runoff in flooding periods can significantly increase loads of metals, due to increased water flow, increased leaching from the ground and increased particle loss from erosion. For mercury the same decrease as for the other metals is not seen. The Hg loading in the Skagerrak area seems to have been doubled from 1999 to 2002.

*Table 11. Input of metals (tonnes) and total suspended matter (tonnes *10³) from 1999 to 2003. Skagerrak subregion.*

Parameter	1999	2000	2001	2002	2003	Measurement Uncertainty (%)
Cadmium	1.4-1.7	2.4	1.3-1.6	1.3-1.4	1.0-1.2	20
Lead	23	42	17	20	20	10
Mercury	0.42-0.59	0.68-0.82	1.18-1.36	0.89-0.95	0.93-0.98	>50
Arsenic	15-16	18-19	14-17	12	10	12
Chromium	24-26	24-25	15-21	14	12	10
Nickel	54	70	37	41-43	32-35	10
Copper	101	131	84	82	68	10
Zinc	329	492	272	261	229	10
S.P.M.	428-431	555-558	314-316	199-200	232-233	-

Upper limit: limit= detection limit. Lower limit: limit=0

In the Skagerrak area the decrease in the loads from 2002 to 2003 were slightly higher than the decrease in total loads to the Norwegian coastal waters for most of the metals, with exception of lead, nickel and mercury. The total inputs of the different metals changed from 2002 to 2003 as follows:

- Lead: 0
- Cadmium: -14%
- Zinc: -12%
- Arsenic: -17%
- Copper: -17%
- Chromium: -14%
- Nickel: -19%
- Mercury: 0

A major reason for this significant decrease in loading of most of the metals was decreased water flow in all rivers in the Skagerrak area which continued in 2003. The water flow in the Skagerrak area decreased approximately 4-15 % from 2002 to 2003. An increase of suspended matter (17%) from 2002 to 2003 was expected to increase the metal concentrations, but such increase has not been seen this year.

A systematic investigation of particle bound metals and phosphorus, including analysis of several parallel samples from the rivers Glomma and Drammenselva in periods with variable content of particulates, has been carried out in May – June 2003 (Weideborg et al., 2003). The results from this investigation indicated that 55-85 % of the measured lead was bound to particles. The Pb loading in these rivers was probably depending on runoff, erosion and loss of river sediments. 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 was high. Only a minor part (approximately 0-20%) of the other metals was found to be particulate bound, they were probably mostly dissolved in the water or complexed with natural organic matter.

In the Skagerrak area, it was not found any significant increase or decrease in the mercury loads from 2002 to 2003. The flow rate in the rivers decreased, but a possible increase in Hg concentration was seen in the tributary rivers, and also in the rivers Drammenselva and Skienselva. This increase in Hg concentration could be caused by clean-up of contaminated sites in the catchment areas of these rivers.

The metal inputs from river Glomma have slightly decreased from 2002 to 2003, due to decrease in water flow and reduced input to the river. The measured concentration of lead in Glomma has, however, increased from 2002 to 2003. The concentration of lead was not expected to change from 2002 to 2003, since the concentration of particulate matter had not changed in Glomma. The total inputs of lead from the rivers in the Skagerrak region were the same as in 2002 in spite of lower water flow, due to increased concentration in Glomma.

Also the loading of cadmium from direct discharge decreased from 2002 to 2003, due to decreased discharges of Cd from industrial and sewage effluents, tributaries and main rivers.

Figures 13 – 16 show the annual load of the metals in 1990-2003.

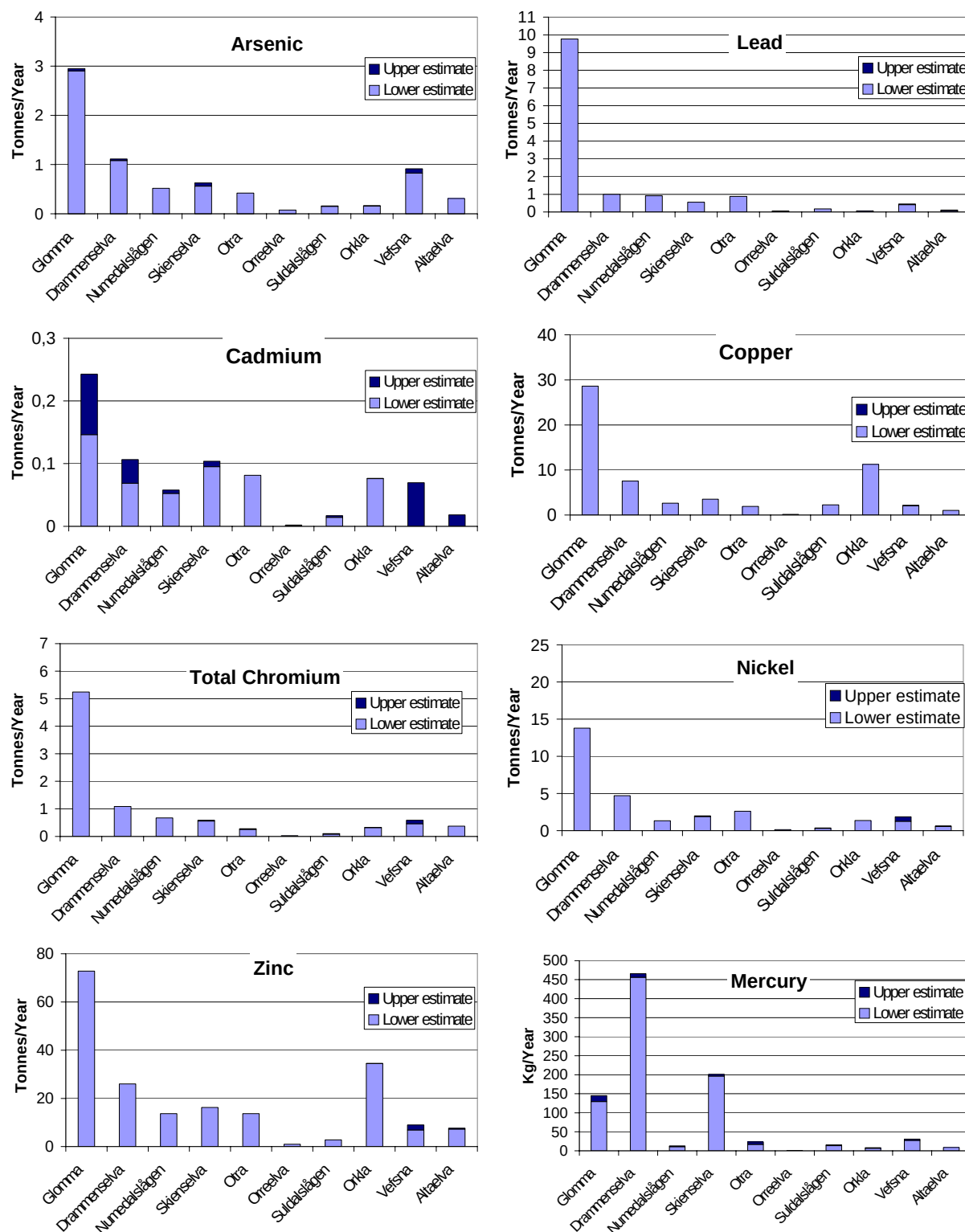


Figure 7. Main rivers. Metals (As, Pb, Cd, Cu, Total Cr, Ni, Zn and Hg). Total loads of the main rivers in 2003. Upper limit: limit= detection limit. Lower limit: limit=0.

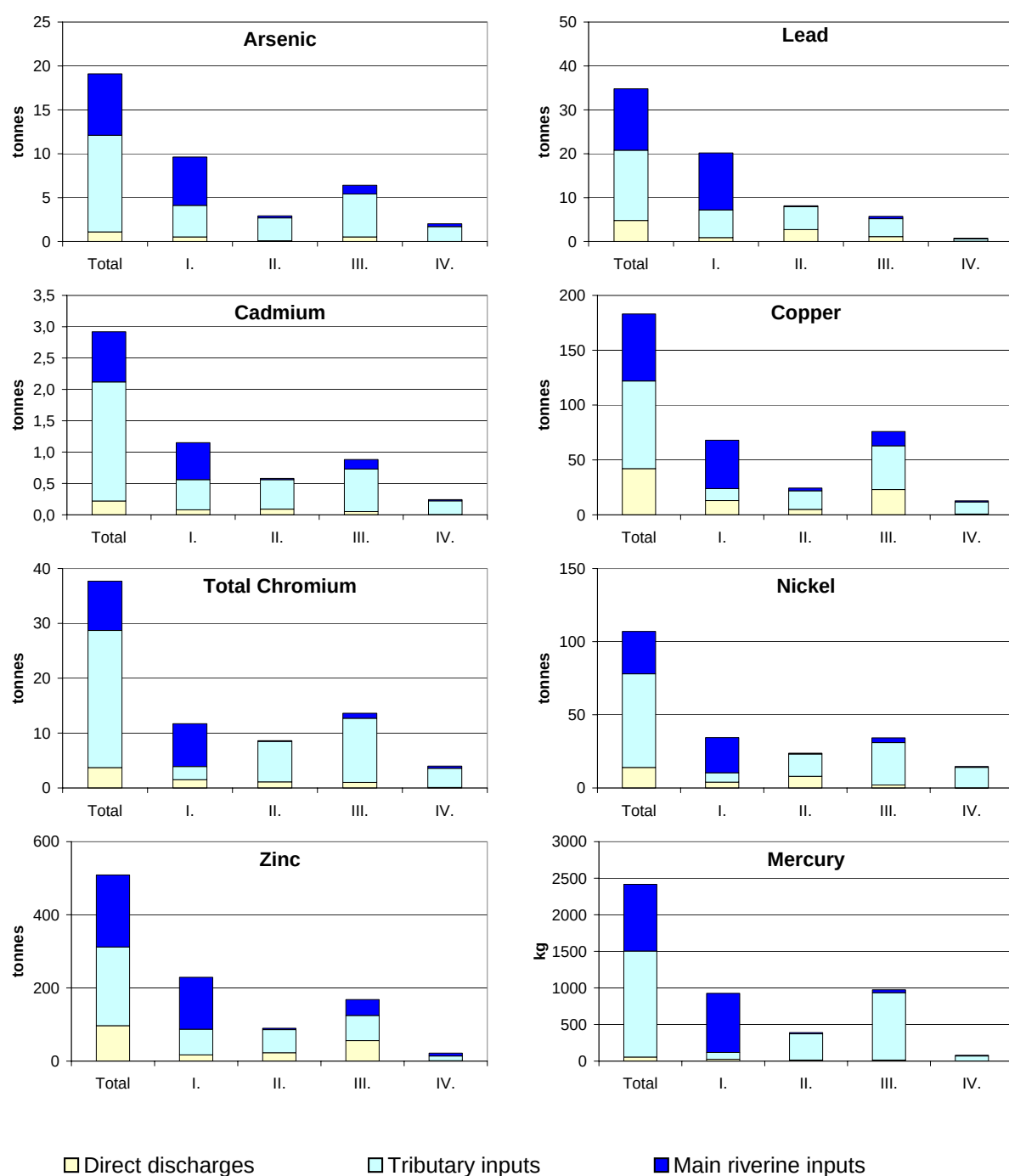


Figure 8. Metals, total discharges in 2003 from mainland Norway to convention waters and the four subregions (upper estimates). I: Skagerrak, II: The remaining North Sea, III: The Norwegian Sea, IV: The Barents Sea Contribution from the main rivers, tributary rivers and direct discharges.

4.5. Other parameters

Total annual load of silicate (SiO_2) is estimated to 388 000 – 389 000 tonnes (60 % from tributary rivers and 40 % from main rivers). This is a 7 % increase from 2002.

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 25 kg. Load of tributary rivers has been stipulated to approximately 20 kg. The total loads were stipulated to 45 kg (Figure 9). This is at the same level as in 2002 (only 4% decrease from 2002 to 2003). Since lindane has not been analysed in the tributary rivers during the last years, the uncertainty of the stipulated total load is, however, high.

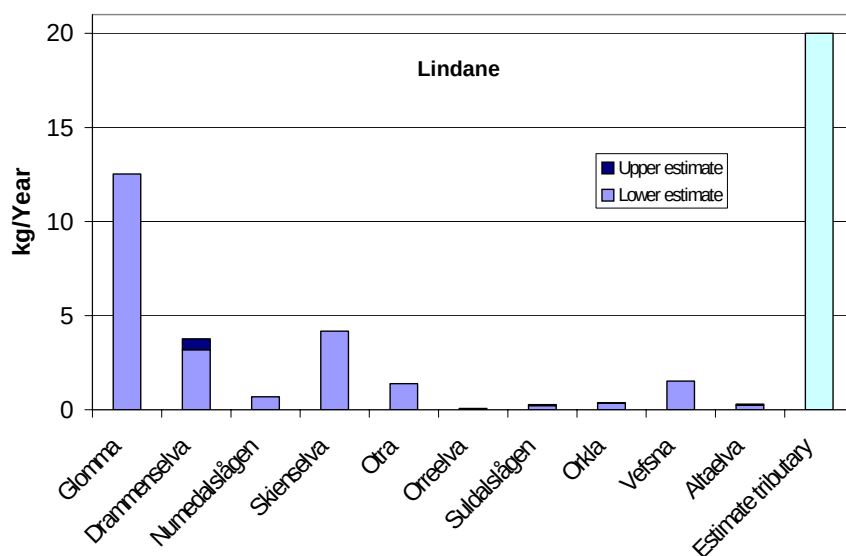


Figure 9. Lindane. Total loads of the main rivers in 2003 (lower and upper estimates) and estimate for the tributary rivers.

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 input levels from 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 2003 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 (1978-2003): Tot-P and Tot-N
- River Otra (1980-2003): Tot-P and Tot-N
- River Orkla (1974-2003): Cu and Zn

For the other parameters the 1990-2003 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 (1990-2003) 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 (1978-2003) 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 Drammenselva and Skienselva an upward trend for phosphorus was found for the period 1990-2003. 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 a downward trend was found for nitrogen for the period 1980 to 2003 and for Suldalslågen a downward trend was found for nitrogen for the period 1990 to 2003 (Figure 11).

A reduced phosphorus load was, however, noticed from 2002 to 2003 for all main rivers except Orreelva (Figure XIX, Appendix XIX).

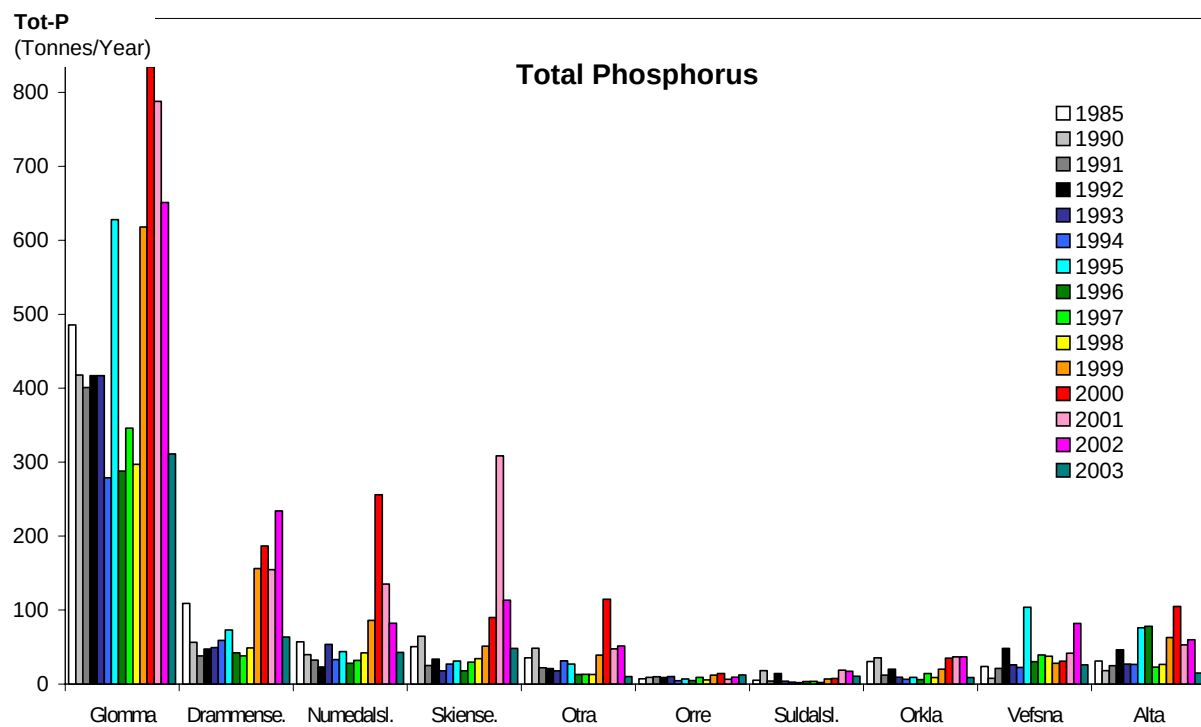
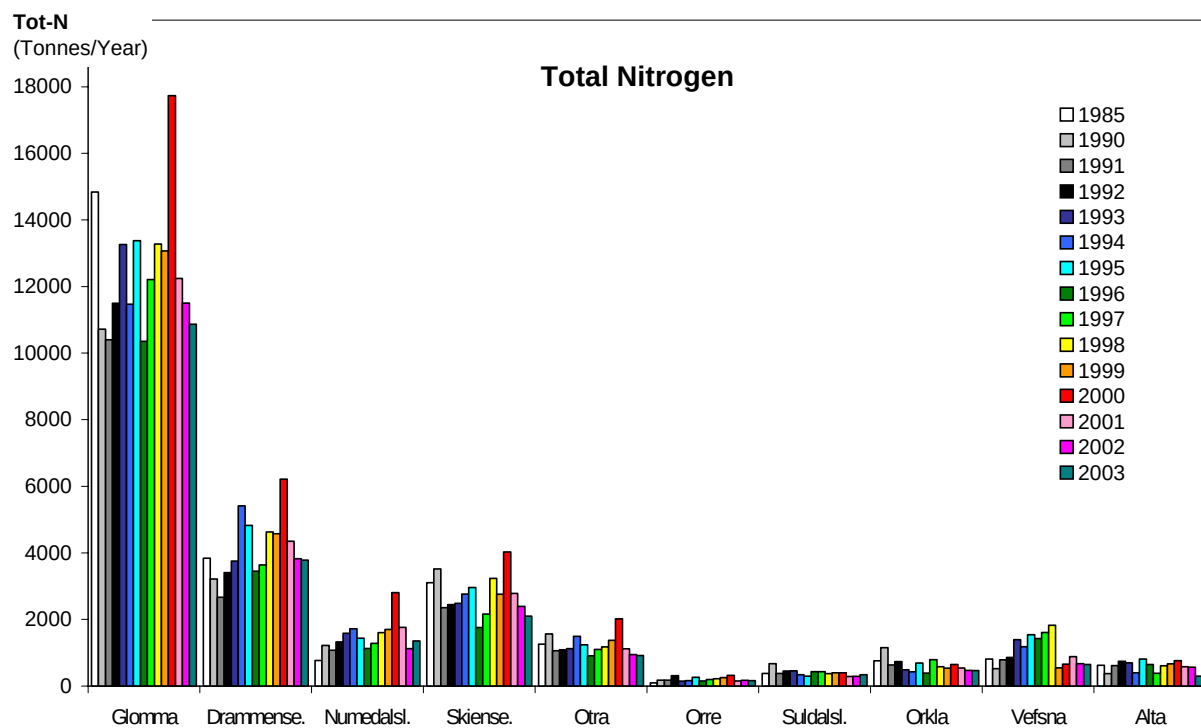


Figure 10. Main rivers. Annual total nitrogen and total phosphorus load in 1985, 1990- 2003.

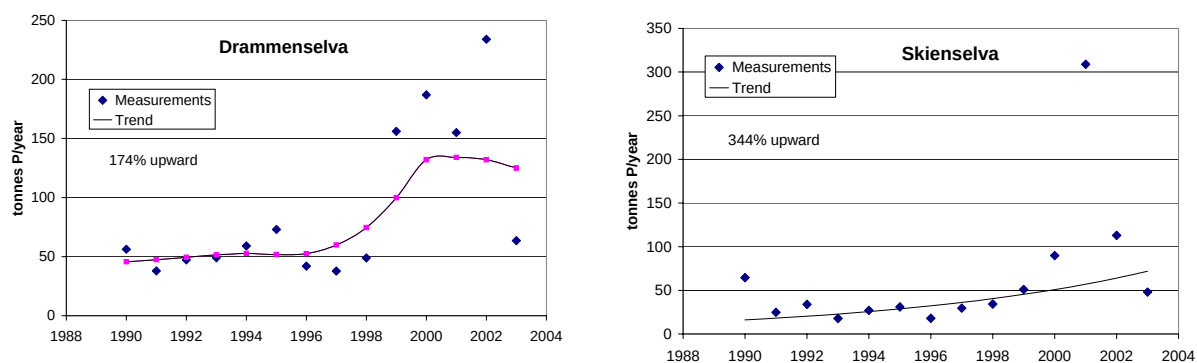


Figure 11. Measurements and trends in load of tot-P for Drammenselva and Skienselva

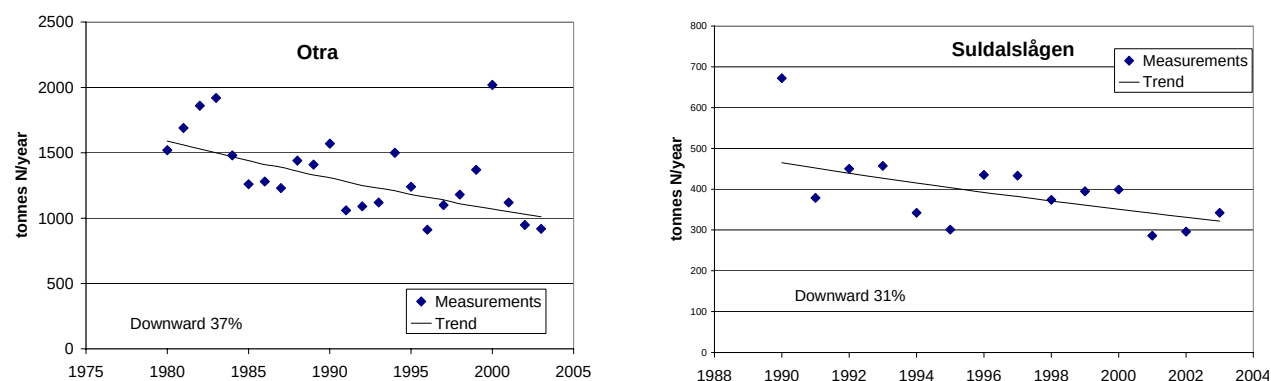


Figure 12. Measurements and trends in load of tot-N for Suldalslågen and Otra.

4.6.2. Metals trends

Annual load for metals in main rivers (1990-2003) are shown in figs. 13-16.

A reduction in the metal input from 2002 to 2003 was found for nearly all rivers. Trend analyses for the time period 1990-2003 for all 10 rivers were performed for all metals. Summary of trends found for all rivers with significant reduction in metal loading (especially for Cd) in 1990-2003 is shown in Table 12. The results show a decrease in metal loading over time for nearly all rivers.

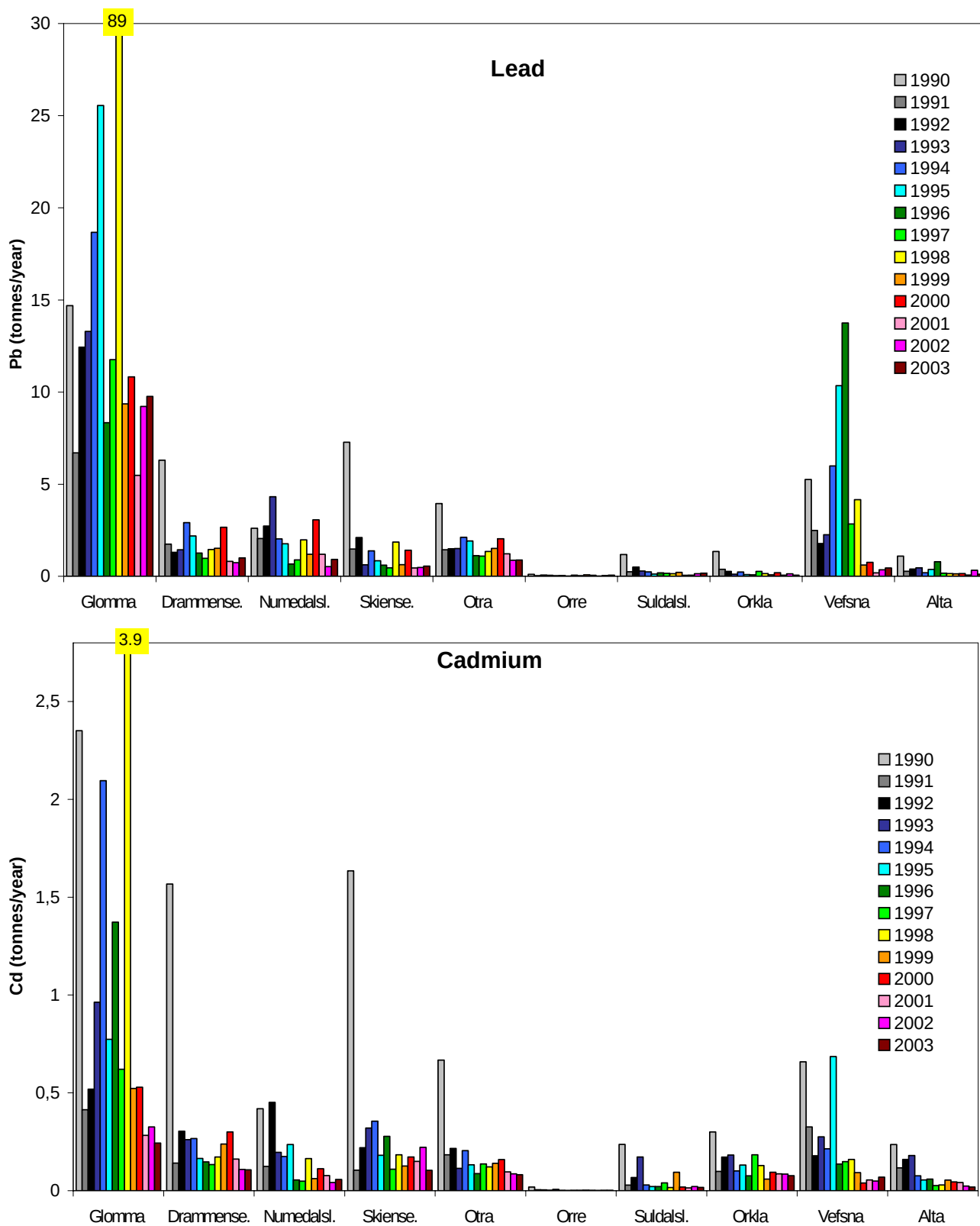


Figure 13. Main rivers. Annual total load of lead and cadmium in 1990-2003.

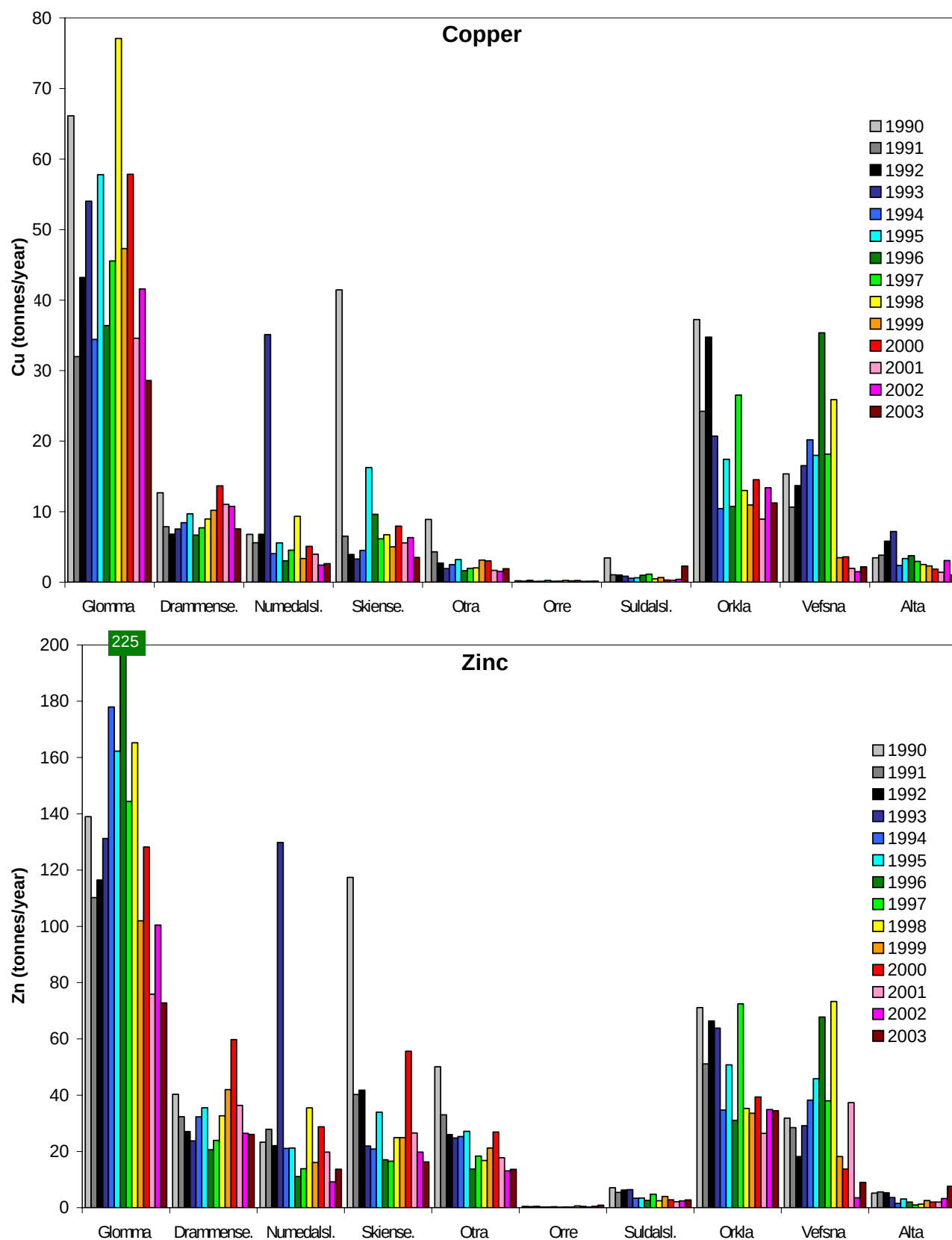


Figure 14. Main rivers. Annual total load of copper zinc and in 1990-2003.

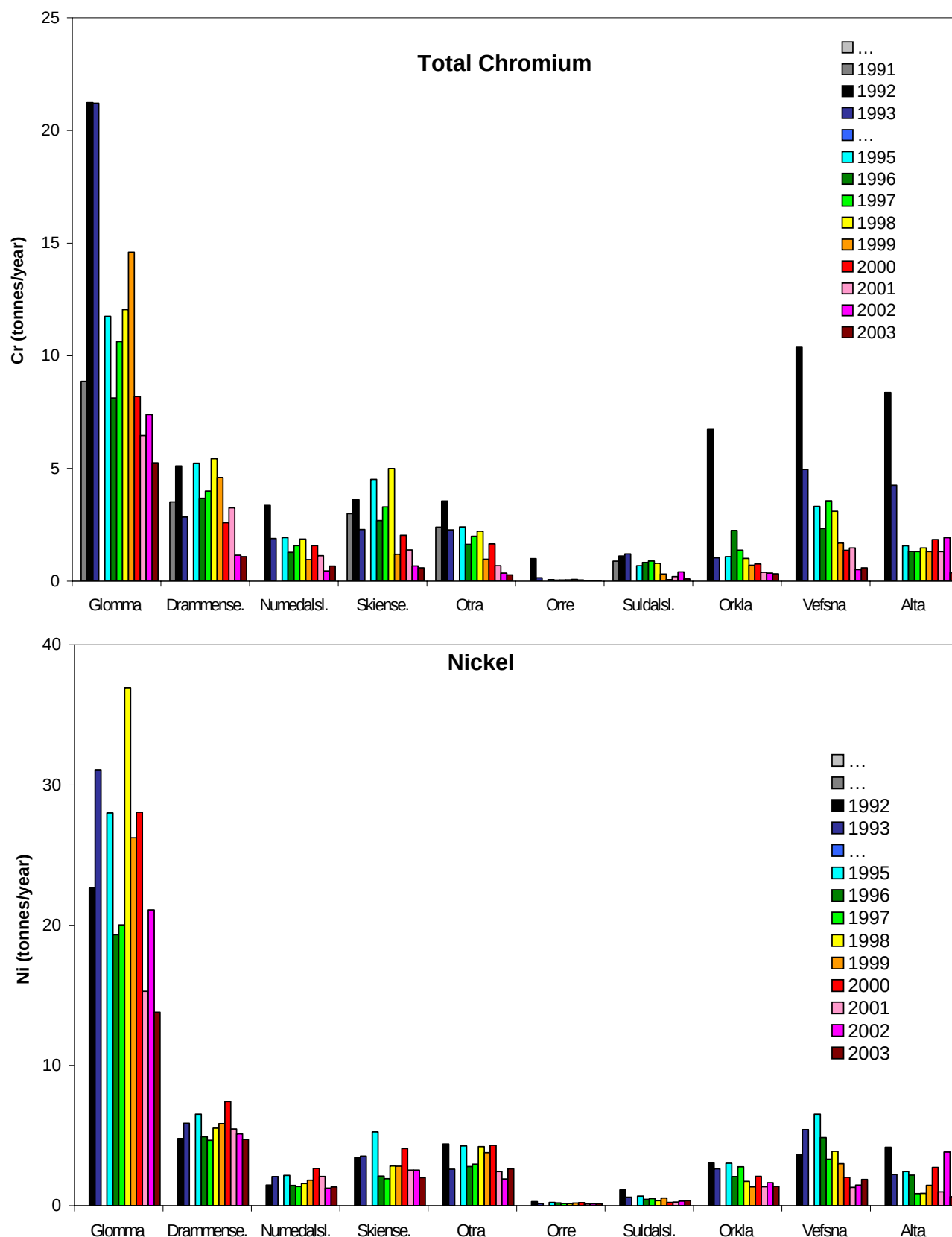


Figure 15. Main rivers. Annual total load of total chromium and nickel in 1990-2003. No measurement has been performed in 1990 and 1994 for those two parameters. In 1991 chromium has only been measured in Glomma, Drammenselva, Skienselva, Otra and Suldalslågen and no nickel measurement has been performed.

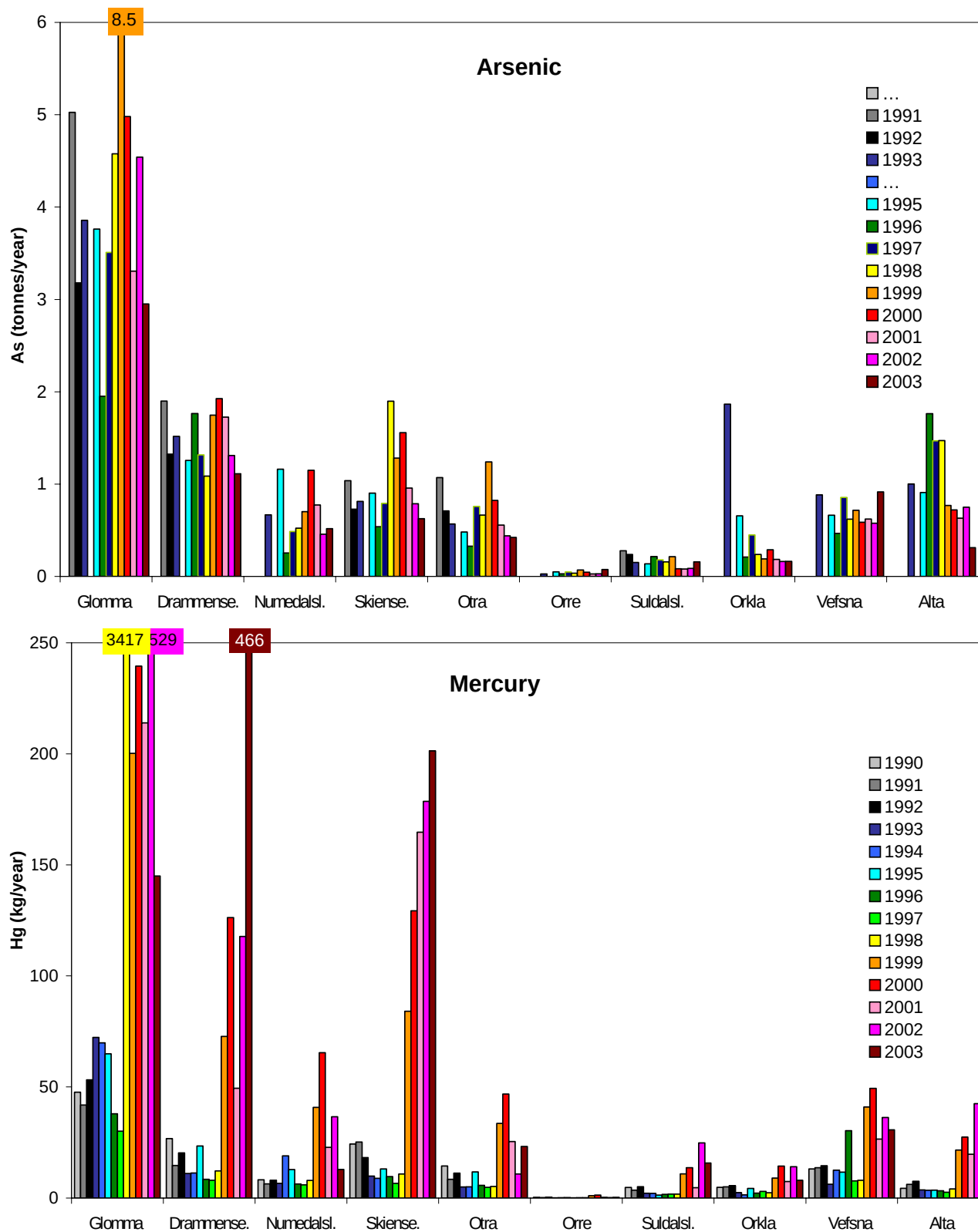


Figure 16. Main rivers. Annual total load of arsenic and mercury in 1990-2003. No arsenic measurement has been performed in 1990 and 1994 and in 1991 and 1992 arsenic has only been measured in Glomma, Drammenselva, Skienselva, Otra and Suldalslågen.

Table 12. Rivers where significant downward trend for metal load was found in the period 1990-2003.

River	Metals Downward trend size (%)						
	As	Pb	Cd	Cu	Zn	Cr	Ni
Glomma	-	-	79%	-	-	68%	-
Drammenselva	-	-	62%	-	-	-	-
Numedalslågen	-	-	85%	-	-	70%	-
Skienelva	-	74%	-	-	-	80%	-
Otra	-	-	64%	-	58%	88%	-
Orreelva	-	-	-	-	-	89%	-
Suldalslågen	-	81%	80%	76%	58%	87%	68%
Orkla	83%	-	60%	85%	79%	92%	56%
Vefsna	-	-	89%	-	-	93%	78%
Alta	-	-	89%	69%	-	-	-

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 17). High concentrations are also repeated for 2002, but the concentration seems to be back to normal level in 2003. For Glomma, the correlation analysis indicated no significant correlation between mercury and particulate suspended matter or water flow.

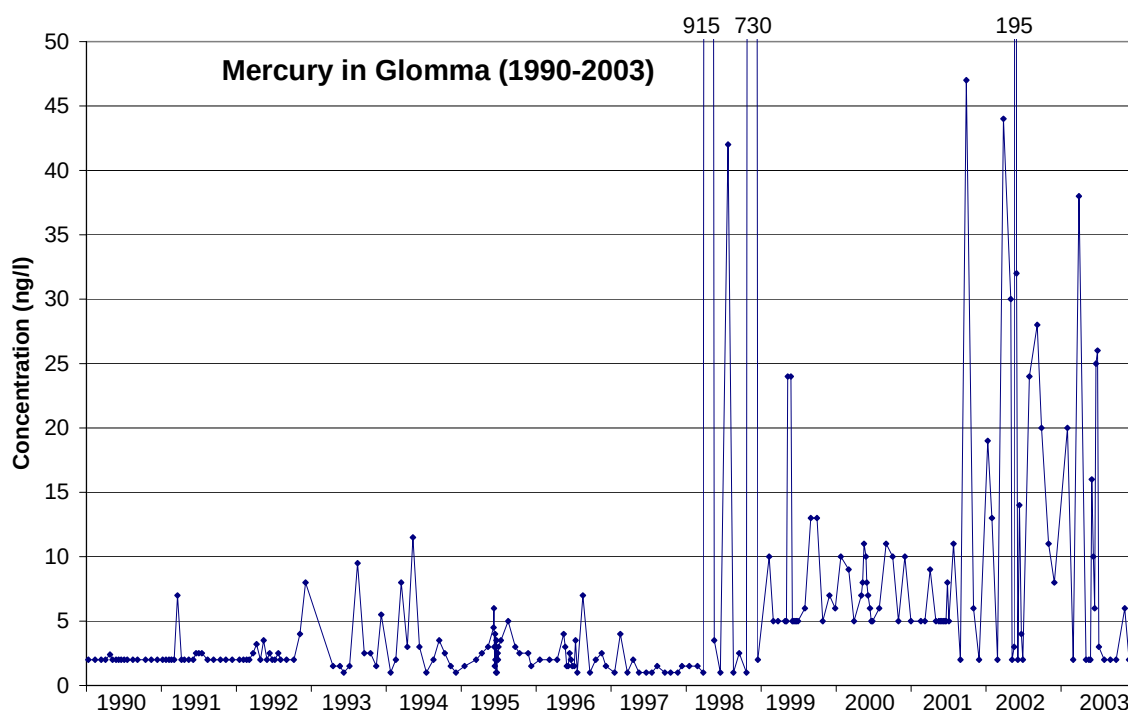


Figure 17. Concentration of mercury in Glomma (1990-2003), all measurements included.

4.6.3. Lindane trends

Annual load for lindane in main rivers (1990-2003) is shown in Figure 18.

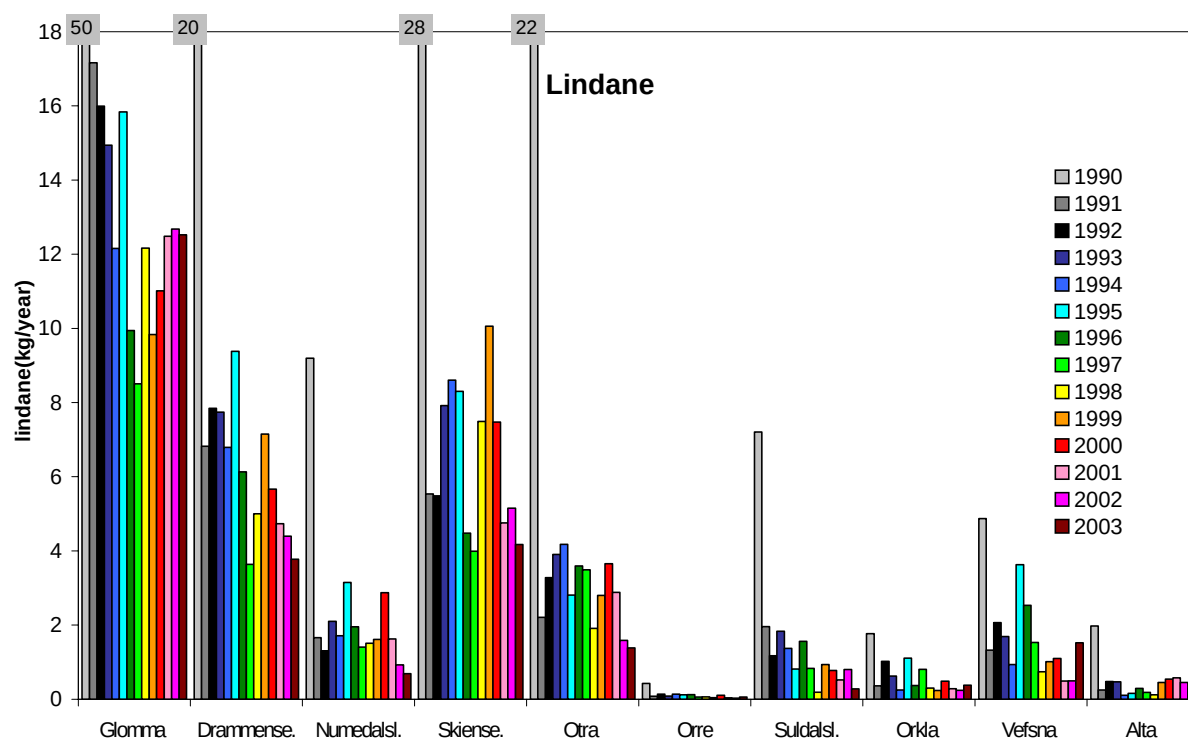


Figure 18. Main rivers. Annual loads of lindane in 1990-2003.

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 57%), (Suldalslågen (downward trend 74%) and Orreelva (downward trend 64%).

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 than in the 1931-60 period (DNMI, 1993).

Compared to Riverine Inputs to Marine Waters in 1990 - 2003, most calculated mean concentrations were approximately at the same level in 2003 with some exceptions. The concentration of total phosphorus has increased from 1998 to 2002, but has decreased from 2002 to 2003, and the concentrations of some of the heavy metals have slightly decreased. Mercury was approximately at the same level as in 1999, but a slight increase is found from 2002 to 2003. The mean concentrations of silicate were slightly higher in all the main rivers in 2000. The mean concentrations from 1990 to 2003 are presented in Appendix XIII, Report B.

Total flow for all the rivers in the Skagerrak region and the Barentshavet region, and accordingly the calculated loads for most of the substances were slightly lower in 2003 than in 2002 (Figure 2, Section 3.2). The flow in the rivers in the other regions was almost at the same level in 2003 as in 2002.

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 expected to be exposed to more frequent and larger flood erosion also during the winter

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 previously 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.

5. References

5.1. Project Personnel

Jon L. Fuglestad: Member of the Programme Committee/Project Manager (SFT-2001)
Mona Weideborg: Member of the Programme Committee/Project Manager (Aquateam)
Eilen Arctander Vik: Member of the Programme Committee (Aquateam)

Project Manager:	Mona Weideborg, Aquateam
Quality assurance:	Eilen Arctander Vik, Aquateam
Responsible for the logistic system:	Mona Weideborg
Contact with field workers/laboratory:	Mona Weideborg
Care of equipment, shipment of bottles etc.:	Cecilie Kildal, AnalyCen, Moss
Analyses of metals (Pb, Cu, Zn, As, Ni, Cr, Cd) and Silicate:	AnalyCen Nordic, Lidköping
Other chemical analyses:	AnalyCen AS, Moss.
Data Collection/evaluation:	Mona Weideborg,
Data Calculations:	Elisabeth Lyngstad, Mona WeideborgA
Reporting work:	Mona Weideborg, Elisabeth Lyngstad

Field workers main rivers:

(1) Glomma:	Mona Weideborg, Aquateam /Marianne Ørebekk AnalyCen
(2) Drammenselva:	Hanna Kolbjørnsen, BUVA, Drammen
(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.
(7) Suldalslågen:	Øyvind Vårvik, Suldal Elveeigarlag, Suldalsosen
(8) Orkla:	Thor-Ola Svinsås, Vormsund
(9) Vefsna:	Gunn Frilund, Fylkesmannens miljøvernavdeling.
(10) Alta:	Petter Nilsen, Finnmarksforskning, Alta

Field workers tributary rivers:

Erlend Tveekrem Lund, Oslo
Hanna Kolbjørnsen, BUVA, Drammen

5.2. Literature

Baalsrud, K. og B. Bjerkeng (1991): Tiltaksanalyse for Indre Oslofjord. Brukerkrav. Siktedyp og oksygen i dypvannet. En enkel lineær modell. NIVA-rapport O-90131 (l.nr. 2524). 79 s.

Ber, E. (2001): Avrenning av næringssaltene fosfor og nitrogen. Notat fra Landbrukspolitisk avdeling. Landbruksdepartementet. 27.08.2001.

Borgvang, S.A. og Tjomsland, T. (2004): Tilførsel av næringssalter til Norges kystområder 2001, beregnet med tilførselsmodellen TEOTIL. SFT rapport under utarbeidelse.

Bloom, N.S. and E.A. Crecelius (1983): Determination of Mercury in Seawater at sub-nanogram per liter levels. Marine Chem. 14, pp. 49- 59.

DNMI (1993): Nedbørnormaler 1961-90. DNMI. Oslo, 63 s.

DNMI (2004a): Nedbørdata fra 2003. DNMI. Oslo (unpublished).

DNMI (2004b): Klimatologisk hurtigoversikt, året 2003. DNMI, Oslo

EU (2000): Europaparlamentets og Rådets direktiv 2000/60/E oktober 2000 om fastsettelse av rammer for fellesskapstiltak for vannpolitikk.

Holtan, G., Berge, D., Holtan, H. and T. Hopen (1991): Paris Convention. Annual report on direct and riverine inputs to Norwegian coastal waters during the year 1990: A: Principles, results and discussions. SFT-report 452A/91. NIVA-report 0-90001/Serial No.:2582. 43 pages, B: Data report. SFT-report 452B/91. NIVA-report 0-90001/Serial No.: 2577.103 p.

Holtan, G., Berge, D., Holtan, H. and T. Hopen (1992): Paris Convention. Annual report on direct and riverine inputs to Norwegian coastal waters during the year 1991: A: Principles, results and discussions. SFT-report 488A/92. NIVA-report 0-90001/Serial No.:2809. 40 pages, B: Data report. SFT-report 488B/92. NIVA-report 0-90001/Serial No.: 2777. 104 p.

Holtan, G., Berge, D., Holtan, H. and T. Hopen (1993): Annual report on direct and riverine Inputs to Norwegian coastal waters during the year 1992. A. Principles, results and discussion. B Data report. SFT-report 542/93. NIVA-report O-90001/Serial No.: 2964. 137p.

Holtan, G., Berge, D., Holtan, H. and T. Hopen (1994): Annual report on direct and riverine inputs to Norwegian coastal waters during the year 1993. A. Principles, results and discussion. B. Data report. SFT-report 580/94. NIVA-report O-90001/Serial No.:3162. 138 p.

Holtan, G., Berge, D., Holtan, H. and T. Hopen (1995). Paris Convention. Annual report on direct and riverine inputs to Norwegian coastal waters during the year 1994. A. Principles, results and discussion. B. Data report. SFT-report 623/95. NIVA-report O-90001/Serial no.: 3361. 136 p.

Holtan, G., Berge, D. Holtan, H. and T. Hopen (1996): Paris Convention. Annual report on direct and riverine inputs to Norwegian coastal waters during the year 1995. A. Principles, results and discussion. B. Data report. SFT-report 674/96. NIVA-report O-90001/Serial no.:

3568-96. 137 p.

Holtan, G., Berge, D., Holtan, H. and T. Hopen (1997): Paris Convention. Annual report on direct and riverine inputs to Norwegian coastal waters during the year 1996. A. Principles, results and discussion. B. Data report. SFT-report 715/97 NIVA-report O-90001/Serial no.: 3740-97. 138 p.

Holtan, G., Berge, D., Holtan, H. and T. Hopen (1998): Oslo and Paris Commissions (OSPAR). Annual report on direct and riverine inputs to Norwegian coastal waters during the year 1997. A. Principles, results and discussion. B. Data report. SFT-report 750/98 NIVA-report O-90001/Serial no.: 3952-98. 139 p.

Holtan, G., Berge, D. and T. Hopen (1999): Oslo and Paris Commissions (OSPAR). Annual report on direct and riverine inputs to Norwegian coastal waters during the year 1998. A. Principles, results and discussion. B. Data report. SFT-report 780/99 NIVA-report O-90001/Serial no.: 4116-99. 140 p.

Holtan, G., Hovind, H., Hopen, T. og B. H. Lauritsen (1999): Kvikksølv i 155 norske elver (1993-1997). En analyseteknisk utfordring. Vann 3b/1999. pp. 656-672.

Holtan, H., Berge, D. and J. Molvær (1990): Retention of nutrients in lakes and rivers with comments on retention in fjords. Paper prepared for PARCOM. NIVA-document O-90145. 14 s. (unpublished).

Holtan, H. og S.O. Åstebøl (1990): Håndbok i innsamling av data om forurensningstilførsler til vassdrag og fjorder. Revidert utgave. NIVA-Jordforsk O-89043/O-892301 (l.nr.2501). 53 s.

Holtan, H. og G. Holtan (1996): Flommen på Østlandet mai/juni 1995. Effekter på vannkvaliteten i Glomma og Drammenselva. SFT-rapport 641/96. NIVA-rapport O-90001 (l.nr. 3437-96). 47 s.

Holtan, G. og Hopen, T. (2001): Beregnede P-N-tilførsler fra avløp og industri for 2000 (upublisert).

Ibrekk, H.O., Holtan, H. Berge, D., Gulbrandsen, R. og K. Øren (1991): Nordsjøplan. Vassdrag. NIVA-rapport O-902302 (l.nr. 2628). 92 s.

ICES (1999): Trend-Y-tector. Data program developed by "ICES working Group on Statistical Aspects of Environmental Monitoring" based on work in OSPAR working group INPUT. Available information on the Internet: <http://waterland.net/rikz/osparwg/trend-y-tector>.

Magnusson, J. og Næs, K. (1986): Basisundersøkelser i Drammensfjorden 1982-84: Delrapport 6: hydrografi, vannkvalitet og vannutskiftning. Overvåkingsrapport nr. 243/86. NIVA-rapport 8000315 (L.nr. 1892).

Miljøverndepartementet (2001): Stortingsmelding nr. 24 (2000-2001): Regjeringens miljøvernpolitikk og rikets miljøtilstand. 2. februar 2001.

Nedland, K.T. (2000): Utslipp av tungmetaller og organiske miljøgifter med avløpsvann i 1999. Aquateam-rapport 00-056. O-00203.

NVE (1987): Avrenningskart over Norge. NVE. Oslo. 8 kartblad.

NVE (1990): Vassdragsregisterets kartbok. V 24. NVE. Oslo.

NVE (2004): Vannføringsdata fra 2003. NVE. Oslo (unpublished).

Nøst, T. and R.H. Daverdin (1999): Kjemisk overvåking av norske vassdrag - Elveserien 1998. NINA. Oppdragsmelding 608. 34 s.

OSPAR (1994). Oslo and Paris Conventions for the Prevention of Marine Pollution. Sixteenth Joint Meeting of the Oslo and Paris Commissions. Karlskrona 13-17 June 1994. OSPAR 16/4/8. 7 p.

OSPAR (1998): Principles of the Comprehensive Study on Riverine Inputs and Direct Discharges. Reference Number: Agreement 1998-05. Date of adoption: 1998, Sintra.

OSPAR (1998): OSPAR Strategy with regard to Hazardous Substances. Reference number 1998-16.

OSPAR (2000): Presentation of New Methods for monitoring Hazardous substances in the Aquatic environment, in relation to possible future development of OSPAR Monitoring programme. Presented by Denmark on the INPUT meeting Lisbon 12-21 January 2000. INPUT 00/7/5-E. 5 p.

OSPAR (2002): Adoption of common EU/OSPAR approach on risk assessment methodology for the marine environment. Meeting of OSPAR, Amsterdam 24-28 June 2002. OSPAR 02/7/4-E.

Parcom (1986): Eighth Meeting of the Paris Commission. Annex 4-6. Madrid 2-4 June 1986.

Parcom (1988): Tenth Meeting of the Paris Commission. PARCOM 10/3/2. Lisbon 15-17 June 1988.

Parcom (1993): Convention for the Prevention of Marine Pollution from Land Based Sources. Fifth Meeting of the Ad hoc Working Group on Input Data. INPUT 5/6/1.

Rosland, D.S. (1998): Trender - transporter av nitrogen og fosfor i jord og vassdrag. Vann 3-98. pp. 334-344.

SFT (1980-1999): The National Monitoring Programme of Water Courses. Monitoring Results. Annual Reports; TA-1980, 1981: TA-580, 1982: TA-588, 1983: TA-597, 1984: TA-607, 1985: TA-622, 1986: TA-628, 1987: TA-639, 1988: TA-629/1989, 1989: TA-711/1990.

SFT (1995): Miljømål for vannforekomstene. Tilførselsberegninger. SFT-rapport 95:02, 70 s.

SFT (1999): Overvåking av langtransportert forurensset luft og nedbør. Årsrapport – Effekter 1998. Rapport nr. 781/99. TA 1680/1999. 249 s.

SFT (2000): Development of HARP Guidelines; Harmonised Quantification and Reporting Procedures for Nutrients. Norwegian Pollution Control Authority Publication No 1759/2000, 179 p.

SFT (2004): Industriutslippstall for 2003 hentet fra INKOSYS (upubliseret).

SFT (2003): Forslag til forskrift om utslipp av avløpsvann (avløpsforskriften) 24.06.2003.

SNV (1991): Kvicksilver i Sverige. Problem och åtgärder. ISBN 91-620-1101-4. 36 s.

SSB (1979, 1980, 1990-2004): Statistical Yearbooks. SSB. Oslo.

SSB (2004): Antall avløpsanlegg, etter fylke. 2003. <http://www.ssb.no/avlut/tab-2005-01-27-01>.

The County Environmental Agencies: Østfold, Oslo and Akershus, Buskerud, Vestfold, Telemark, Aust-Agder, Vest-Agder, Rogaland, Hordaland, Sogn og Fjordane, Møre og Romsdal, Sør-Trøndelag, Nord-Trøndelag, Nordland, Troms, Finnmark: Chemical data from monitored rivers in 2003.

Tjomsland, T. og H.O. Ibrenk (1992): TEOTIL. Modul for teoretisk beregning av fosfor- og nitrogentilførsler i Norge. NIVA-rapport 0-902301 (l.nr. 2786). 38 s.

Vik, E.A., Stang, P. M. and Weideborg, M. (2002): Estimation of uncertainty in calculated riverine input to Norwegian coastal water. Statistical evaluation on riverine input data from 1999-2001. Aquateam report 02-036.

Weideborg (1999): Erfaring med passive prøvetakere som hjelpemiddel i overvåkning av organiske miljøgifter og tungmetaller i vann. Presentasjon på Forum for offshore miljøovervåking, SFT, 23. Mars 1999. 3 s.

Weideborg, M. (2000): Should we improve the comprehensive study on riverine inputs and direct discharges? Notat til SFT/innspill til INPUT meeting Lisbon 17-21 January 2000. 5 s.

Weideborg, M., Vik, E.A., Thoresen, H., Kelley, A.E., Stang, P. and Nedland K.T. (2001a): OSPAR commission. Direct and riverine inputs to Norwegian coastal waters during the year 1999. A: Principles, results and discussions. B. Data report. Aquateam Report 00-052. Norwegian State Pollution Monitoring Programme. Report no. 817/01. SFT report TA 1793/2001.

Weideborg, M., Vik, E.A., Stang, P. and Storhaug, R. (2001b): Direct and riverine inputs to Norwegian coastal waters – 2000. OSPAR commission. A: Principles, results and discussions. B. Data report. Aquateam Report 01-031. Norwegian State Pollution Monitoring Programme. Report no. 841/01. SFT report TA 1852/2001.

Weideborg, M., Vik, E.A., Stang, P. and Lyngstad, E. (2002): Riverine inputs and direct discharges to Norwegian coastal waters - 2001. OSPAR Commission. A: principles, results and discussions. B: Data report. Aquateam report 02-016. Norwegian State Pollution Monitoring Programme, report no. 859/02. SFT report TA 1914/2002.

Weideborg, M., Vik, E.A and Lyngstad, E. (2003): Riverine inputs and direct discharges to Norwegian coastal waters - 2001. OSPAR Commission. A: principles, results and discussions. B: Data report. Aquateam report 03-043. Norwegian State Pollution Monitoring Programme, report no. 891/03. SFT report TA 1998/2003.

Weideborg, M. (2002): Comparison of sampling methods used for monitoring trace metals and organic pollutants in rivers. Aquateam report 01-072.

Weideborg, M., Kelley, A.E., and Vik, E.A. (2002): Experiences from use of passive samplers in monitoring of trace metals and organic pollutants in freshwater bodies. Verh. Internat. Veriein. Limnol. Vol 28, 1121-1127.

Welz, B., Melcher, M. Sinerius, H.W. og D. Maier (1984): Picotrace Determination of Mercury, using the Amalgamation Technique. At. Spectrosc. 1984, 5.

Winther-Larsen, T. (1998): Forurensede marine sedimenter. Oversikt over tilstand og prioriteringer. SFT-rapport 98:11.



Norwegian Pollution Control Authority (SFT)

P.O. Box: 8100 Dep, N-0032 Oslo, Norway

Office address: Strømsveien 96

Telephone: +47 22 57 34 00

Telefax: +47 22 67 67 06

E-mail: postmottak@sft.no

Internett: www.sft.no

Utførende institusjon Aquateam – Norwegian Water Technology Centre AS	SFT contact person Jon L. Fuglestad	ISBN-number 82-7655-2390
---	--	-----------------------------

	SFT department Section for environmental monitoring	TA-number 2069/2004
--	---	------------------------

Project responsible Mona Weideborg	Year 2004	No. of pages 56	Contract number - SFT 6004066
---------------------------------------	--------------	--------------------	----------------------------------

Publisher SFT	Project financed by SFT
------------------	----------------------------

Author(s) Mona Weideborg, Eilen A. Vik, and Elisabeth Lyngstad
Title – English and Norwegian Riverine inputs and direct discharges to Norwegian coastal waters – 2003. OSPAR Commission. A: Principles, results and discussions. Elvetilførsler og direkte tilførsler til norske kystområder – 2003. OSPAR Commission. A: Prinsipper, resultater og diskusjoner.
Summary - sammendrag The report contains results from the 2003 monitoring of 136 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 2003 av 136 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 Pollution inputs, Norwegian coastal waters, riverine inputs, direct inputs	4 emneord Forurensningstilførsler, norske kystområder, elvetilførsler, direkte tilførsler
--	--

Riverine Inputs and Direct Discharges to Norwegian Coastal Waters - 2003. OSPAR Commission.

B: Data Report

Aquateam - Norwegian Water Technology Centre A/S

Report no: 04-043B

Project no: O-02106

Project manager: Mona Weideborg, M.Sc.

Co-workers: Elisabeth Lyngstad, M.Sc.

Eilen Arctander Vik, Ph.D

Ragnar Storhaug, M.Sc.

aquateam REPORT

P.O. Box 6875 Rodeløkka
NO-0504 Oslo Norway
Telephone: + 47 22 35 81 00
Telefax: + 47 22 35 81 10

Report number: 04-043B
Availability: Open

<p>Title</p> <p>Riverine Inputs and Direct Discharges to Norwegian Coastal Waters - 2003. OSPAR Commission. B: Data report</p>	<p>Date</p> <p>10.12.2004</p> <p>Number of pages</p> <p>97</p>
<p>Author(s) sign.</p> <p>Mona Weideborg</p> <p>Elisabeth Lyngstad</p> <p>Eilen Arctander Vik</p> <p>Ragnar Storhaug</p>	<p>Responsible sign.</p> <p><i>Bjarne Paulsrud</i></p> <p>Bjarne Paulsrud</p> <p>Project number</p> <p>O-02106</p>
<p>Client(s)</p> <p>Norwegian Pollution Control Authority (SFT)</p>	<p>Contact person(s)</p> <p>Jon L. Fuglestad</p>

<p>Summary</p> <p>This report contains Appendices to the report “ Riverine Inputs and Direct Discharges to Norwegian coastal waters - 2003. OSPAR Commission. A: Principles, results and discussions”.</p> <p>The report contains data from the 2003 monitoring of 136 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 72 % 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 2003 was reduced with 19 of the smallest tributary rivers in the Norwegian Sea and the Barents Sea subregions. The load of these rivers were however, stipulated based on results from 2001 and 2002.</p>
--

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

Table of Content

Appendix I.	Total discharges 2002	5
Table I.	Total discharge from mainland Norway to convention waters 2003.....	6
Table I.I	Total discharges to the Skagerrak Region 2003 (Figure I.I)	7
Table I.II	Total discharges to the remaining North Sea 2003 (Figure I.II)	9
Table I.III	Total discharges to the Norwegian Sea 2003 (Figure I.III).....	11
Table I.IV	Total discharges to the Barents Sea 2003 (Figure I.IV)	14
Appendix II.	Sewage effluents from downstream areas of main and tributary rivers and rivers not monitored 2003	16
Table II	Sewage effluents from down stream areas of mainland Norway to convention waters 2003	17
Table II.I	Sewage effluents to the Skagerrak Region 2003	18
Table II.II	Sewage effluents to the remaining North Sea 2003.....	19
Table II.III	Sewage effluents to the Norwegian Sea 2003	20
Table II.IV	Sewage effluents to the Barents Sea 2003	21
Appendix III.	Industrial effluents from downstream areas of main and tributary rivers and rivers not monitored 2003	22
Table III	Industrial effluents from down stream areas of mainland Norway to convention waters 2003	23
Table III.I	Industrial effluents to the Skagerrak Region 2003	24
Table III.II	Industrial effluents to the remaining North Sea 2003.....	25
Table III.III	Industrial effluents to the Norwegian Sea 2003	26
Table III.IV	Industrial effluents to the Barents Sea 2003	27
Appendix IV.	Main riverine inputs 2003	28
Table IV.I	Main riverine inputs 2003 (1) Glomma	29
Table IV.II	Main riverine inputs 2003 (2) Drammenselva.....	30
Table IV.IV	Main riverine inputs 2003 (4) Skienselva.....	32
Table IV.V	Main riverine inputs 2003 (5) Otra	33
Table IV.VI	Main riverine inputs 2002 (6) Orreelva	34
Table IV.VII	Main riverine inputs 2003 (7) Suldalslågen	35
Table IV.VIII	Main riverine inputs 2003 (8) Orkla.....	36
Table IV.IX	Main riverine inputs 2003 (9) Vefsna.....	37
Table IV.X	Main riverine inputs 2003 (10) Alta	38
Appendix V.	Input from the tributary rivers 2003	39
Table V.I.	Inputs from tributary rivers in the Skagerrak Region 2003	40
Table V.II.	Inputs from tributary rivers in the remaining North Sea 2003	41
Table V.III.	Inputs from tributary rivers in the Norwegian Sea 2003	42
Table V.IV.	Inputs from tributary rivers in the Barents Sea 2003.....	43
Appendix VI.	Other inputs 2003	44
Table VI	Nutrients from “Down Stream Areas” of main and tributary rivers and rivers not monitored 2003. Direct run-off of P and N.	45

Appendix VII.	Main rivers 1-10. Measured concentrations 2003.....	46
Table VII.I	Measured concentrations 2003 – Watercourse: Glomma.....	47
Table VII.II	Measured concentrations 2003 – Watercourse: Drammenselva.....	48
Table VII.III	Measured concentrations 2003 – Watercourse: Numedalslågen.....	49
Table VII.IV	Measured concentrations 2003 – Watercourse: Skienselva.....	50
Table VII.V	Measured concentrations 2003 – Watercourse: Otra.....	51
Table VII.VI	Measured concentrations 2003 – Watercourse: Orreelva.....	52
Table VII.VII	Measured concentrations 2003 – Watercourse: Suldalslågen	53
Table VII.VIII	Measured concentrations 2003 – Watercourse: Orkla.....	54
Table VII.IX	Measured concentrations 2003 – Watercourse: Vefsna.....	55
Table VII.X	Measured concentrations 2003 – Watercourse: Alta.....	56
Appendix VIII.	Tributary rivers. Measured concentrations 2003.....	57
Table VIII.	Tributary rivers, measured concentrations 2003	58
Appendix IX.	Tributary rivers. Annual load 2003	66
Table IX.	Tributary rivers, annual load 2003.....	67
Appendix X.	Tributary rivers. "Mean" load 2003.....	72
Table X.	Tributary rivers, "mean" load 2003	73
Appendix XI.	"Mean" total discharges.....	78
Table XI	Mean total discharges from mainland Norway to convention waters	79
Table XI.I	Mean total discharges to the Skagerrak Region	80
Table XI.II	Mean total discharges to the Remaining North Sea	81
Table XI.III	Mean total discharges to the Norwegian Sea.....	82
Table XI.IV	Mean total discharges to the Barents Sea	83
Appendix XII.	Fish farming effluents to convention waters 2002	84
Table XII	Fish farming effluents from down stream areas of mainland Norway to convention waters (2002)	85
Appendix XIII.	Mean concentrations and loads from 1990 to 2003. Main rivers	86

Appendix I. Total discharges 2003

Table I	Total discharges from mainland Norway to convention waters 2003
Table I.I	Total discharges to the Skagerrak Region
Table I.II	Total discharges to the remaining North Sea
Table I.III	Total discharges to the Norwegian Sea
Table I.IV	Total discharges to the Barents Sea

Table I. Total discharge from mainland Norway to convention waters 2003

		Area run-off	Fish farming	Direct discharges	Tributary inputs	Main river- ine inputs	Grand total	
S.P.M.	*	-	-	1 158 301	359 774	203 692	1 721 767	tonnes
	**	-	-	1 158 301	377 421	205 432	1 741 154	
TOC		-	-	351	373 478	185 379	559 208	tonnes
Orthoph.	*	231	928	494	143	73	1 869	tonnes
	**	231	928	494	233	92	1 978	
Total P	*	915	5 155	1 014	846	546	8 476	tonnes
	**	915	5 155	1 014	870	548	8 502	
Nitrates	*	19 369	-	51	14 544	14 385	48 349	tonnes
	**	19 369	-	51	14 552	14 385	48 357	
Ammonia	*	1 783	7 814	7 941	1 424	1 143	20 105	tonnes
	**	1 783	7 814	7 941	1 427	1 143	20 108	
Total N		29 866	24 419	12 956	27 934	20 947	116 121	tonnes
Silicate SiO₂	*	-	-	0	235 414	152 799	388 213	tonnes
	**	-	-	0	235 626	153 815	389 441	
Arsenic	*	-	-	1.1	11	7.0	19	tonnes
	**	-	-	1.1	15	7.3	23	
Lead		-	-	4.8	16	14	34	tonnes
		-	-	4.8	16	14	35	
Cadmium	*	-	-	0.22	0.7	0.54	1.4	tonnes
	**	-	-	0.22	1.9	0.8	2.8	
Copper	*	-	-	42	80	61	183	tonnes
	**	-	-	42	80	61	183	
Total Cr-T	*	-	-	3.7	23	9	36	tonnes
	**	-	-	3.7	25	9	38	
Nickel	*	-	-	14	51	28	93	tonnes
	**	-	-	14	64	29	107	
Zinc	*	-	-	97	194	195	486	tonnes
	**	-	-	97	215	197	509	
Mercury	*	-	-	55	1 344	866	2 265	kg
	**	-	-	55	1 450	912	2 417	
Lindane	*	-	-	-	-	24	24	kg
	**	-	-	-	-	25	25	

Measurements below detection limits are treated in two ways

*Detection limit = zero, ** Detection limit = limit

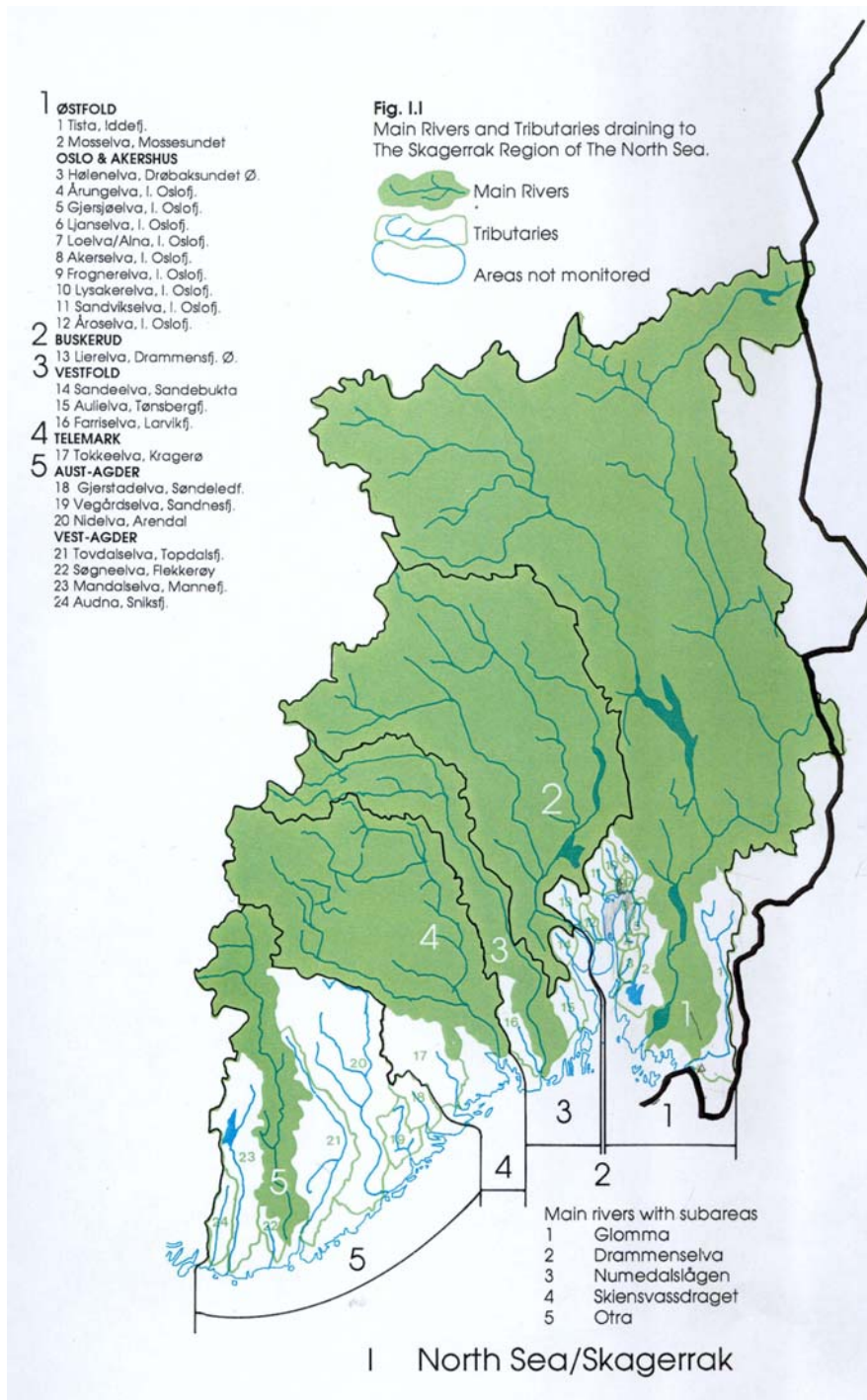
Table I.I Total discharges to the Skagerrak Region 2003 (Figure I.I)

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.	*			3 178	56 494	172 431	232 103	tonnes
	**			3 178	56 494	173 577	233 249	
TOC				105	81 900	159 039	241 044	tonnes
Orthoph.	*	22	0.00	65	11	61	159	tonnes
	**	22	0.00	65	30	75	192	
Total P		87	0.00	191	107	474	859	tonnes
		87	0	191	112	476	866	
Nitrates		1 948	-	20	5 023	13 293	20 284	tonnes
Ammonia	*	180	0.01	3 142	303	1 058	4 682	tonnes
	**							
Total N		2 998	0.02	5 210	7 875	19 027	35 109	tonnes
Silicate SiO₂	*			0	28 089	134 711	162 800	tonnes
	**			0	28 089	135 324	163 413	
Arsenic				0.52	3.6	5.5	10	tonnes
				0.5	3.6	5.6	10	
Lead				0.89	6.3	13	20	tonnes
Cadmium	*			0.08	0.47	0.44	1.0	tonnes
	**			0.08	0.48	0.59	1.2	
Copper	*			13	10.9	44	68	tonnes
	**							
Total Cr-T	*			1.5	2.4	7.8	12	tonnes
	**			1.5	2.4	8	12	
Nickel	*			4.0	3.5	24	32	tonnes
	**			4.0	6.4	24	35	
Zinc				17	70	142	229	tonnes
Mercury	*			26	91	810	927	kg
	**			26	101	848	975	
Lindane				-	-	22	22	kg
				-	-	23	23	

Measurements below detection limits are treated in two ways

*Detection limit = zero, ** Detection limit = limit



Source: NIVA

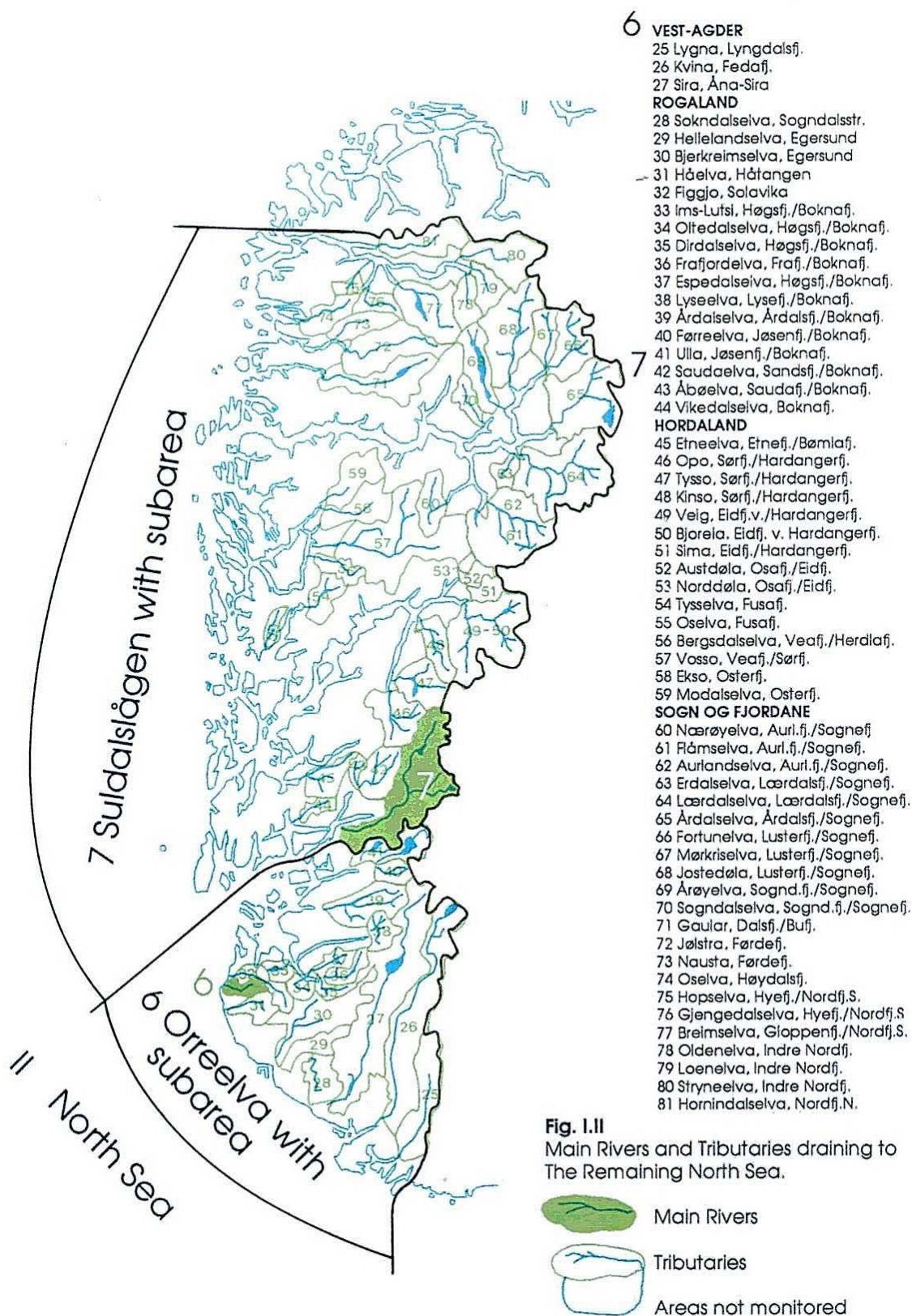
Table I.II **Total discharges to the remaining North Sea 2003**
(Figure I.II)

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.	*			9 022	153 919	3 852	166 793	tonnes
	**			9 022	164 388	3 884	177 294	
TOC				192	78 950	4 157	83 299	tonnes
Orthoph.	*	60	303	167	13	1.0	544	tonnes
	**	60	303	167	49	1.9	581	
Total P		227	1686	329	261	23	2 525	tonnes
		227	1686	329	275	23	2 539	
Nitrates		7 437	-	14	5 787	330	13 568	tonnes
Ammonia	*	678	2552	2 200	378	10.7	5 818	tonnes
	**	678	2552	2 200	379	11.2	5 819	
Total N		11 569	7973	3 414	8 655	508	32 119	tonnes
Silicate SiO2	*			-	52 200	1 403	53 603	tonnes
	**			-	52 412	1 806	54 218	
Arsenic	*			0.09	1.1	0.23	1.4	tonnes
	**			0.09	2.6	0.23	3.0	
Lead				2.7	5.2	0.24	8.2	tonnes
				2.7	5.2	0.24	8.2	
Cadmium	*			0.09	0.12	0.02	0.2	tonnes
	**			0.09	0.47	0.02	0.6	
Copper	*			4.9	17	2.42	25	tonnes
	**			4.9	17	2.44	25	
Total Cr-T	*			1.1	6.3	0.11	7.5	tonnes
	**			1.1	7.4	0.13	8.6	
Nickel	*			8	8.2	0.45	16	tonnes
	**			8	15.2	0.50	23	
Zinc	*			23	60	3.7	87	tonnes
	**			23	63	3.7	90	
Mercury	*			14	351	13.4	379	kg
	**			14	359	16.1	389	
Lindane				-	-	0.28	0.28	kg
				-	-	0.34	0.34	

Measurements below detection limits are treated in two ways

*Detection limit = zero, ** Detection limit = limit



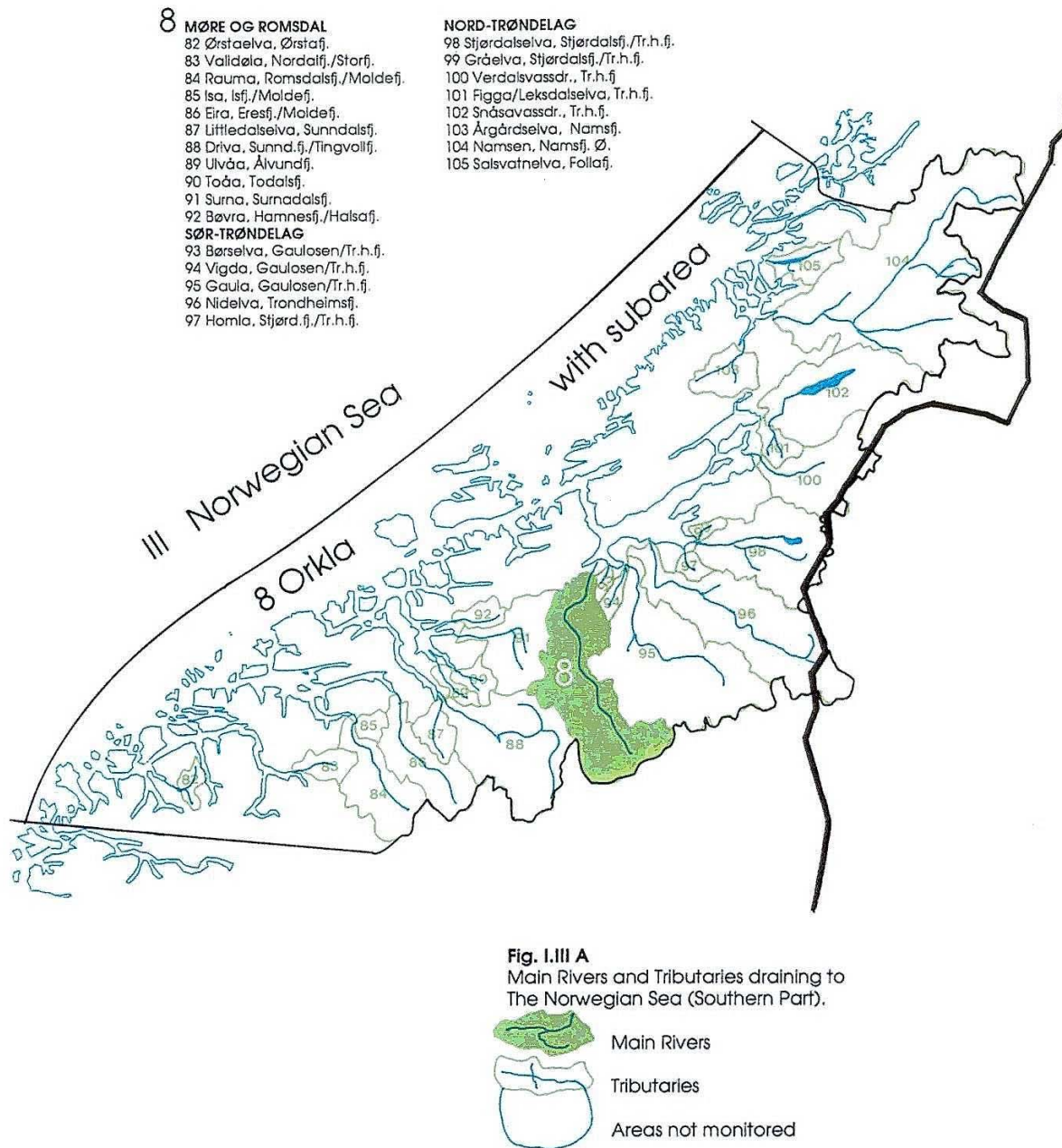
Source: NIVA

Table I.III **Total discharges to the Norwegian Sea 2003**
(Figure I.III)

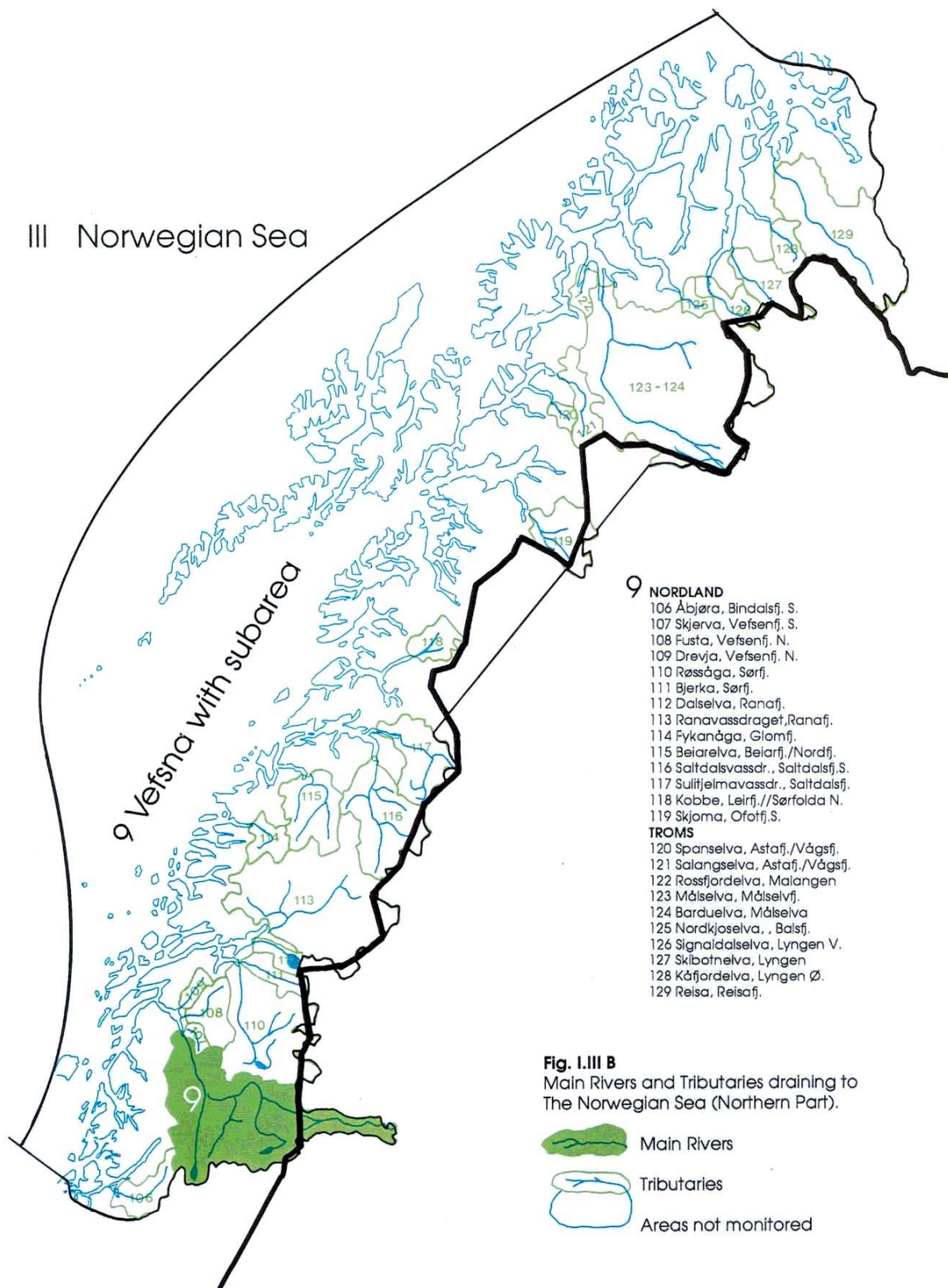
		Area Run-off	Fish farming	Direct discharges	Tributary inputs	Main river- ine inputs	Grand total	
S.P.M.	*			934 840	129 488	24 813	1 089 141	tonnes
	**			934 840	135 398	25 233	1 095 471	
TOC				53	143 681	15 382	159 117	tonnes
Orthoph.	*	131	561	243	68	6	1 008	tonnes
	**	131	561	243	96	10	1 041	
Total P	*	512	3114	462	344	34	4 467	tonnes
	**	512	3114	462	349	34	4 472	
Nitrates		8 956	-	16	3 649	650	13 271	tonnes
Ammonia	*	839	4724	2 417	531	59	8 570	tonnes
	**	839	4724	2 417	533	59	8 572	
Total N		13 599	14763	4 088	8 918	1 111	42 478	tonnes
Silicate SiO₂				0	89 197	9 387	98 584	tonnes
Arsenic	*			0.52	4.9	0.98	6.4	tonnes
	**			0.52	6.5	1.08	8.1	
Lead	*			1.1	4.0	0.48	5.7	tonnes
	**			1.1	4.1	0.52	5.8	
Cadmium	*			0.05	0.06	0.08	0.18	tonnes
	**			0.05	0.68	0.15	0.87	
Copper				22.9	40	13	77	tonnes
				23	40	13	77	
Total Cr-T	*			1.0	11.2	0.78	13.0	tonnes
	**			1.0	11.7	0.91	13.6	
Nickel	*			2.0	25	2.6	30	tonnes
	**			2.0	29	3.2	34	
Zinc	*			56	61	41	158	tonnes
	**			56	69	43	169	
Mercury	*			14	866	34	914	kg
	**			14	921	39	973	
Lindane	*			-	-	1.87	1.87	kg
	**			-	-	1.90	1.90	

Measurements below detection limits are treated in two ways

*Detection limit = zero, ** Detection limit = limit



Source: NIVA



Source: NIVA

Table I.IV Total discharges to the Barents Sea 2003 (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	19 873	2 596	233 730 tonnes
	**			211 261	21 141	2 737	235 139
TOC				-	68 947	6 801	75 748 tonnes
Orthoph.	*	18	64	19	51	5	157 tonnes
	**	18	64	19	58	5	164
Total P		88	355	32	134	15	625 tonnes
Nitrates	*	1 029	-	1.0	85	111	1 226 tonnes
	**	1 029	-	1.0	93	111	1 234
Ammonia		87	538	182	212	15	1 034 tonnes
Total N		1 701	1683	244	2 486	302	6 415 tonnes
Silicate SiO₂				-	65 928	7 297	73 225 tonnes
Arsenic	*			-	1.7	0.31	2.0 tonnes
	**			-	1.8	0.31	2.1
Lead	*			0.05	0.19	0.08	0.32 tonnes
	**			0.05	0.57	0.11	0.7
Cadmium	*			0.003	0	0	0.00 tonnes
	**			0.003	0.22	0.02	0.24
Copper				0.67	11	1.0	13 tonnes
Total Cr-T	*			0.08	2.8	0.4	3.3 tonnes
	**			0.08	3.5	0.4	3.9
Nickel				0.081	14	0.6	15 tonnes
				0.081	14	0.6	15
Zinc	*			1.0	4	7.3	12 tonnes
	**			1.0	13	7.6	21
Mercury	*			1.1	36	9	46 kg
	**			1.1	69	9	79
Lindane	*			-	-	0.24	0.24 kg
	**			-	-	0.30	0.30

Measurements below detection limits are treated in two ways

*Detection limit = zero, ** Detection limit = limit

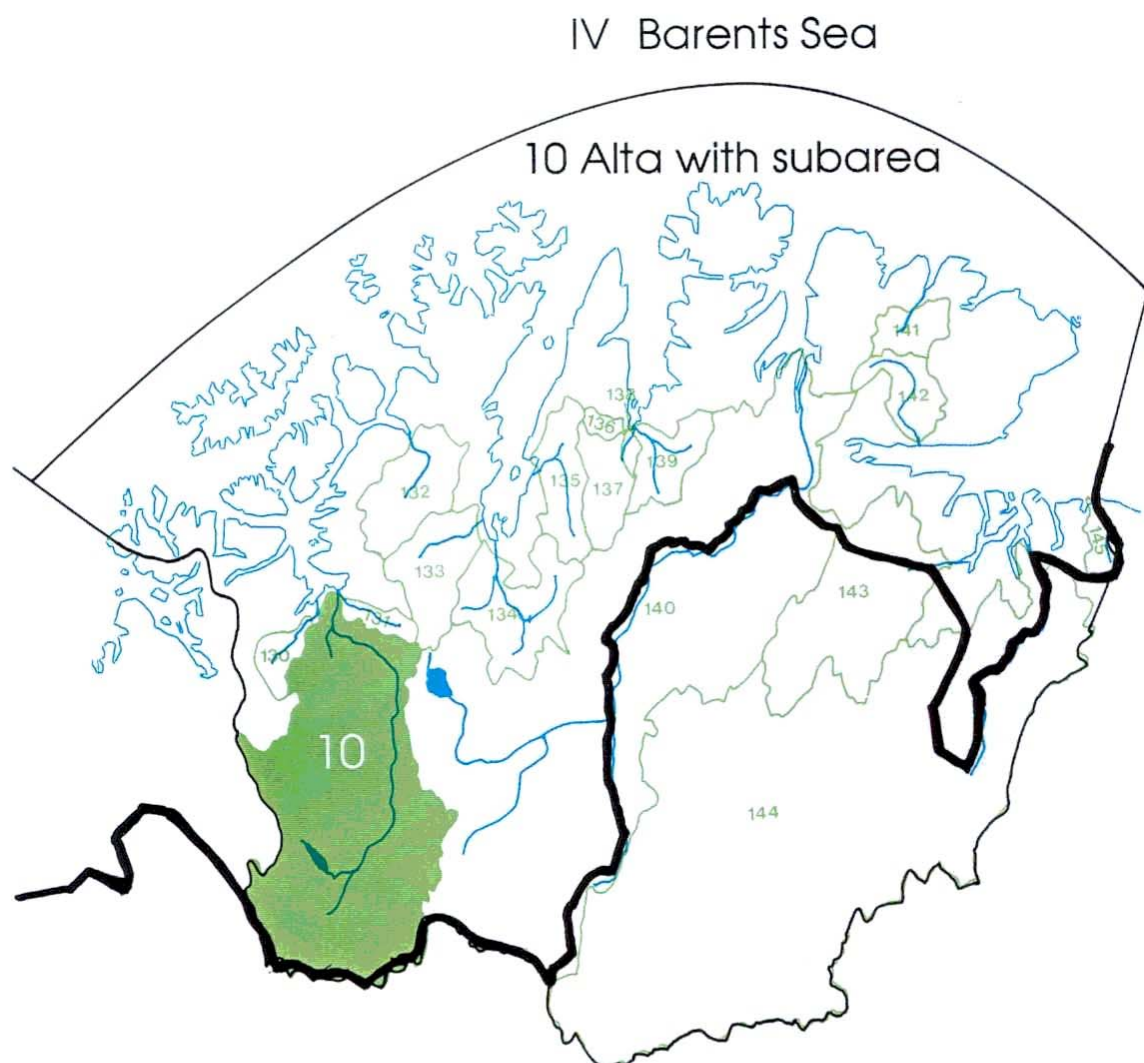


Fig. I.IV
Main Rivers and Tributaries draining to
The Barents Sea.



- 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 2003

Table II Sewage effluents from down stream areas of mainland Norway to
convention waters 2003

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 2003**

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	59	183	236	20	499	tonnes
Tot-P	99	305	394	33	831	tonnes
NO3-N	19	16	16	1.0	52	tonnes
NH4-N	2 920	2 335	2 411	190	7 855	tonnes
Tot-N	3 745	3 113	3 214	253	10 325	tonnes
SiO₂						
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

The results of the metals are from 2002.

Table II.I Sewage effluents to the Skagerrak Region 2003**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	30	5.0	9	4.0	11	tonnes
Tot-P	50	8.0	15	6.0	19	tonnes
NO3-N	9.0	1.0	3.0	2.0	3.0	tonnes
NH4-N	1 464	218	450	297	492	tonnes
Tot-N	1 804	290	599	396	656	tonnes
SiO₂						
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 2003**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	37	146	tonnes
Tot-P	62	243	tonnes
NO3-N	5.0	11	tonnes
NH4-N	756	1 578	tonnes
Tot-N	1008	2 105	tonnes
SiO₂			
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 2003

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	145	91	tonnes
Tot-P	242	152	tonnes
NO3-N	10	6.0	tonnes
NH4-N	1 473	937	tonnes
Tot-N	1 964	1 250	tonnes
SiO₂			
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 2003

Total quantity of substance discharge per year:

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

	10	
S.P.M.		
TOC		
PO4-P	20	tonnes
Tot-P	33	tonnes
NO3-N	1.0	tonnes
NH4-N	190	tonnes
Tot-N	253	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 2003

Table III	Industrial effluents from down stream areas of mainland Norway to convention waters 2003
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 2003**

Total quantity of substance discharged per year:

	I	II	III	IV	Sum	
	The	The	The	The		
	Skagerrak	North	Norwegian	Barents		
	Region	Sea	Sea	Sea		
SS	3 178	9 022	934 840	214 000	1161 040	tonnes
TOC	105	192	53	-	351	tonnes
PO4-P	-	-	-	-	-	
Tot-P	83	51	57	0	191	tonnes
NO₃-N	-	-	-	-	-	
NH₄-N	-	-	-	-	-	
Tot-N	1 183	482	865	1.2	2 531	tonnes
SiO₂	3	-	0	-	3	
As	515	90	523	-	1 128	kg
Pb	282	2 406	692	-	3 380	kg
Cd	28	63	14	-	105	kg
Cu	7 691	662	16 441	-	24 794	kg
Cr-tot	202	466	215.1	-	883	kg
Ni	1 853	6 571	1 075	-	9 498	kg
Zn	857	16 918	45 542	-	63 317	kg
Hg	6.5	4.5	0.71	-	11.6	kg

Table III.I Industrial effluents to the Skagerrak Region 2003

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	1511	105	61	1156	345	tonnes
TOC	0.00	0	50.5	54.8	0.00	tonnes
PO₄-P						
Tot-P	35	22.4	14	10.9	0.00	tonnes
NO₃-N						
NH₄-N						
Tot-N	233	105	73	769	2.7	tonnes
SiO₂	2.593					
As	0	0	0	0.2	515	kg
Pb	246	0	25	1.56	10	kg
Cd	24.9	0	3.2	0.08	0.31	kg
Cu	6928	0.19	1.0	38	724	kg
Cr-tot	53	0.54	0.7	1	147	kg
Ni	350	0.62	115	360	1027	kg
Zn	661	0.16	18	22	156	kg
Hg	5.5	0	1	0.01	0.070	kg

Table III.II Industrial effluents to the remaining North Sea 2003

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

Total quantity of substance discharged per year:

	6	7	
SS	1036	7986	tonnes
TOC	16	176	tonnes
PO₄-P			
Tot-P	6.9	44	tonnes
NO₃-N			
NH₄-N			
Tot-N	77	405	tonnes
SiO₂			
As	28	62	kg
Pb	22	2384	kg
Cd	3.1	60	kg
Cu	65	597	kg
Cr-tot	61	405	kg
Ni	6410	161	kg
Zn	206	16712	kg
Hg	1.51	2.9	kg

Table III.III Industrial effluents to the Norwegian Sea 2003**The Norwegian Sea Region with sub-areas: (8) Orkla, (9) Vefsna****Total quantity of substance discharged per year:**

	8	9	
SS	417606	517234	tonnes
TOC	53	0.45	tonnes
PO₄-P			
Tot-P	23	34	tonnes
NO₃-N			
NH₄-N			
Tot-N	143	722	tonnes
SiO₂		0.022	
As	0.92	522	kg
Pb	20	672	kg
Cd	1.8	12	kg
Cu	12095	4346	kg
Cr-tot	12.1	203	kg
Ni	7.5	1067	kg
Zn	40125	5417	kg
Hg	0.35	0.36	kg

Table III.IV Industrial effluents to the Barents Sea 2003

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

Total quantity of substance discharged per year:

10

SS 214000 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 2003

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 2003 (1) Glomma

Total volume: 50 795 145 m³/d **Long term average flow (LTA):** 61 350 000 m³/d
Minimum flow: 19 910 989 m³/d **LTA period:** 1961 to 1990
Maximum flow: 134 952 257 m³/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.		6.5	18	1.2	12 mg/l	124525	tonnes	yes
TOC		4.4	18	2.8	7.2 mg/l	81698	tonnes	yes
Orthoph.	*	2.0	18	1.0	6.0 µg/l	34	tonnes	yes
	**	2.2	–	–	– µg/l	37	tonnes	–
Total P		17	18	6.0	39 µg/l	311	tonnes	yes
Nitrates		483	18	201	1710 µg/l	8063	tonnes	yes
Ammonia		29	18	4.0	65 µg/l	507	tonnes	yes
Total N		639	18	341	2060 µg/l	10870	tonnes	yes
SiO₂		5.3	18	1.9	32 mg/l	84079	tonnes	yes
Arsenic	*	0.16	18	<0.05	0.23 µg/l	2.9	tonnes	yes
	**	0.16	–	–	– µg/l	3.0	tonnes	–
Lead		0.54	18	0.11	2.4 µg/l	9.8	tonnes	yes
Cadmium	*	0.007	18	<0.01	0.024 µg/l	0.15	tonnes	no
	**	0.012	–	–	– µg/l	0.24	tonnes	–
Copper		1.53	18	1.1	2.1 µg/l	29	tonnes	yes
Total Cr-T		0.29	18	0.084	0.61 µg/l	5.2	tonnes	yes
Nickel		0.74	18	0.44	1.1 µg/l	14	tonnes	yes
Zinc		4.1	18	0.98	8.7 µg/l	73	tonnes	yes
Mercury	*	8.6	18	2.0	38 ng/l	129	kg	no
	**	9.3	–	–	– ng/l	145	kg	–
Lindane		0.74	4	0.18	1.6 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 2003 (2) Drammenselva

Total volume: 23 831 547 m³/d **Long term average flow (LTA):** 61 350 000 m³/d
Minimum flow: 7 438 749 m³/d **LTA period:** 1961 to 1990
Maximum flow: 85 867 038 m³/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.	*	2.2	19	<0.1	7.7 mg/l	19196	tonnes	Yes
	**	2.2	–	–	– mg/l	19233	tonnes	–
TOC		3.7	19	2.4	4.6 mg/l	31473	tonnes	yes
Orthoph.	*	1.2	19	1.0	4.0 µg/l	8.3	tonnes	no
	**	1.6	–	–	– µg/l	12	tonnes	–
Total P	*	7.6	19	<1	14 µg/l	63	tonnes	yes
	**	7.7	–	–	– µg/l	63	tonnes	–
Nitrates		274	19	158	398 µg/l	2498	tonnes	yes
Ammonia		32	19	11	73 µg/l	279	tonnes	yes
Total N		421	19	304	593 µg/l	3783	tonnes	yes
Silicate SiO₂		2.5	19	2.1	3.0 mg/l	21921	tonnes	yes
Arsenic	*	0.13	19	<0.05	0.21 µg/l	1.1	tonnes	yes
	**	0.13	–	–	– µg/l	1.1	tonnes	–
Lead		0.11	19	0.041	0.28 µg/l	0.99	tonnes	yes
Cadmium	*	0.008	19	0.0065	0.02 µg/l	0.069	tonnes	no
	**	0.012	–	–	– µg/l	0.11	tonnes	–
Copper		0.89	19	0.58	1.5 µg/l	7.6	tonnes	yes
Total Cr-T		0.12	19	0.075	0.19 µg/l	1.1	tonnes	yes
Nickel		0.53	19	0.34	0.77 µg/l	4.7	tonnes	yes
Zinc		2.9	19	1.9	4.5 µg/l	26	tonnes	yes
Mercury	*	43	18	2.0	568 ng/l	456	kg	no
	**	46	–	–	– ng/l	466	kg	–
Lindane	*	0.40	4	<0.10	1.0 ng/l	3.2	kg	yes
	**	0.42	–	–	– ng/l	3.8	kg	–

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Table IV.III Main riverine inputs 2003 (3) Numedalslågen

Total volume: 8 379 879 m³/d **Long term average flow (LTA):** 10 200 000 m³/d
Minimum flow: 3 433 340 m³/d **LTA period:** 1961 to 1990
Maximum flow: 27 318 240 m³/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.		4.8	12	0.8	16 mg/l	18960	tonnes	yes
TOC		4.4	12	2.8	6.3 mg/l	14969	tonnes	yes
Orthoph.	*	1.0	12	1.0	4.0 µg/l	4.1	tonnes	no
	**	1.5	–	–	– µg/l	5.1	tonnes	–
Total P		12	12	4.0	32 µg/l	43	tonnes	yes
Nitrates		278	12	105	770 µg/l	858	tonnes	yes
Ammonia		36	12	16	72 µg/l	91	tonnes	yes
Total N		443	12	242	1000 µg/l	1357	tonnes	yes
SiO₂		3.2	12	1.9	5.4 mg/l	10292	tonnes	yes
Arsenic		0.17	12	0.089	0.32 µg/l	0.52	tonnes	yes
Lead		0.23	12	0.077	0.60 µg/l	0.92	tonnes	yes
Cadmium	*	0.013	12	<0.0	0.04 µg/l	0.05	tonnes	no
	**	0.015	–	–	– µg/l	0.06	tonnes	–
Copper		0.80	12	0.49	1.2 µg/l	2.6	tonnes	yes
Total Cr-T		0.22	12	0.061	0.74 µg/l	0.67	tonnes	yes
Nickel		0.39	12	0.22	0.69 µg/l	1.3	tonnes	yes
Zinc		3.8	12	1.5	7.5 µg/l	14	tonnes	yes
Mercury	*	3.7	12	2.0	8.0 ng/l	11	kg	no
	**	4.3	–	–	– ng/l	13	kg	–
Lindane		0.22	4	0.10	0.35 ng/l	0.69	kg	yes

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Table IV.IV Main riverine inputs 2003 (4) Skienselva

Total volum: 20 192 026 m³/d **Long term average flow (LTA):** 23 535 000 m³/d
Minimum flow: 6 353 031 m³/d **LTA period:** 1961 to 1990
Maximum flow: 56 646 664 m³/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.	*	0.82	12	0.60	2.2 mg/l	7137	tonnes	yes
	**	0.92	–	–	– mg/l	7768	tonnes	–
TOC		2.7	12	2.3	3.5 mg/l	19820	tonnes	yes
Orthoph.	*	1.1	12	1.0	8.0 µg/l	13	tonnes	no
	**	1.7	–	–	– µg/l	17	tonnes	–
Total P		5.6	12	2.7	15 µg/l	48	tonnes	yes
Nitrates		183	12	137	220 µg/l	1344	tonnes	yes
Ammonia		20	12	7.0	35 µg/l	127	tonnes	yes
Total N		290	12	248	340 µg/l	2098	tonnes	yes
Silicate SiO₂	*	1.7	12	<1.07	2.1 mg/l	12843	tonnes	yes
	**	1.8	–	–	– mg/l	13456	tonnes	–
Arsenic	*	0.087	12	<0.05	0.15 µg/l	0.56	tonnes	yes
	**	0.092	–	–	– µg/l	0.63	tonnes	–
Lead		0.069	12	0.039	0.14 µg/l	0.56	tonnes	yes
Cadmium	*	0.013	12	0.010	0.043 µg/l	0.10	tonnes	yes
	**	0.015	–	–	– µg/l	0.10	tonnes	–
Copper		0.46	12	0.34	0.69 µg/l	3.5	tonnes	yes
Total Cr-T	*	0.08	12	<0.05	0.14 µg/l	0.56	tonnes	yes
	**	0.08	–	–	– µg/l	0.59	tonnes	–
Nickel	*	0.26	12	<0.20	0.35 µg/l	1.9	tonnes	yes
	**	0.27	–	–	– µg/l	2.0	tonnes	–
Zinc		2.2	12	1.6	2.9 µg/l	16	tonnes	yes
Mercury	*	19	12	2.0	121 ng/l	197	kg	no
	**	20	–	–	– ng/l	201	kg	–
Lindane		0.49	4	0.19	1.1 ng/l	4.2	kg	yes

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Table IV.V Main riverine inputs 2003 (5) Otra

Total volume: 10 272 640 m³/d **Long term average flow (LTA):** 12 870 000 m³/d
Minimum flow: 4 754 127 m³/d **LTA period:** 1961 to 1990
Maximum flow: 21 292 093 m³/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.	*	0.67	12	0.6	1.1 mg/l	2614	tonnes	yes
	**	0.82	–	–	– mg/l	3092	tonnes	–
TOC		2.8	12	1.4	4.3 mg/l	11077	tonnes	yes
Orthoph.	*	0.33	12	1.0	1.0 µg/l	1.3	tonnes	no
	**	1.0	–	–	– µg/l	3.7	tonnes	–
Total P	*	2.3	12	1.0	6.0 µg/l	9.2	tonnes	no
	**	2.7	–	–	– µg/l	10	tonnes	–
Nitrates		138	12	90	190 µg/l	530	tonnes	yes
Ammonia		14	12	3.0	27 µg/l	52	tonnes	yes
Total N		240	12	198	330 µg/l	918	tonnes	yes
SiO₂		1.5	12	0.99	2.1 mg/l	5576	tonnes	yes
Arsenic		0.11	12	0.053	0.20 µg/l	0.42	tonnes	yes
Lead		0.23	12	0.11	0.36 µg/l	0.88	tonnes	yes
Cadmium		0.021	12	0.014	0.039 µg/l	0.081	tonnes	yes
Copper		0.53	12	0.18	1.6 µg/l	1.9	tonnes	yes
Total Cr-T	*	0.062	12	<0.05	0.10 µg/l	0.25	tonnes	yes
	**	0.071	–	–	– µg/l	0.28	tonnes	–
Nickel		0.69	12	0.37	1.1 µg/l	2.6	tonnes	yes
Zinc		3.6	12	2.1	6.0 µg/l	14	tonnes	yes
Mercury	*	4.4	12	<2	44 ng/l	17	kg	no
	**	6.1	–	–	– ng/l	23	kg	–
Lindane		0.34	4	0.19	0.54 ng/l	1.4	kg	yes

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Table IV.VI Main riverine inputs 2003 (6) Orreelva

Total volume: 392 168 m³/d **Long term average flow (LTA):** 333 000 m³/d
Minimum flow: 34 776 m³/d **LTA period:** 1961 to 1990
Maximum flow: 1 353 744 m³/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.		10,0	12	4,5	26,9 mg/l	2085 tonnes	yes
TOC		7,4	12	5,3	11,00 mg/l	1197 tonnes	yes
Orthoph.	*	1,50	12	1	4 µg/l	0,30 tonnes	no
	**	1,83	—	—	— µg/l	0,32 tonnes	—
Total P		61	12	<1	149 µg/l	12,3 tonnes	yes
		61	—	—	— µg/l	12 tonnes	—
Nitrates		592	12	7	1260 µg/l	68 tonnes	yes
Ammonia		20	12	1	78 µg/l	3,4 tonnes	yes
Total N		1197	12	589	2025 µg/l	165 tonnes	yes
SiO₂	*	1,61	12	<0,21	3,21 mg/l	310 tonnes	yes
	**	1,80	—	—	— mg/l	319 tonnes	—
Arsenic		0,46	12	0,21	0,97 µg/l	0,075 tonnes	yes
Lead	*	0,27	12	0,089	0,90 µg/l	0,063 tonnes	yes
	**						
Cadmium	*	0,004	12	<0,01	0,02 µg/l	0,0012 tonnes	no
	**	0,011	—	—	— µg/l	0,0019 tonnes	—
Copper		1,09	12	0,74	1,70 µg/l	0,15 tonnes	yes
Total Cr-T	*	0,18	12	0,071	0,39 µg/l	0,027 tonnes	yes
	**						
Nickel		0,95	12	0,63	1,40 µg/l	0,14 tonnes	yes
Zinc	*	6,46	12	1	26,00 µg/l	0,95 tonnes	yes
	**						
Mercury	*	0,0	12	<2	2 ng/l	0,00 kg	no
	**	2,0	—	—	— ng/l	0,29 kg	—
Lindane	*	0,36	4	0,19	0,62 ng/l	0,060 kg	yes
	**						

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Table IV.VII Main riverine inputs 2003 (7) Suldalslågen

Total volume: 3 880 224 m³/d **Long term average flow (LTA):** 7 420 000 m³/d
Minimum flow: 1 148 256 m³/d **LTA period:** 1961 to 1990
Maximum flow: 12 547 008 m³/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.	*	0.93	10	<0.06	2.7 mg/l	1766	tonnes	yes
	**	1.0	–	–	– mg/l	1799	tonnes	–
TOC		1.6	10	0.70	4.1 mg/l	2960	tonnes	yes
Orthoph.	*	0.60	10	1.0	2.0 µg/l	0.69	tonnes	no
	**	1.1	–	–	– µg/l	1.6	tonnes	–
Total P	*	6.4	10	1.0	23 µg/l	10.3	tonnes	yes
	**	6.5	–	–	– µg/l	10.4	tonnes	–
Nitrates		208	10	145	318 µg/l	262	tonnes	yes
Ammonia	*	5.3	10	<1	18 µg/l	7.3	tonnes	no
	**	6.0	–	–	– µg/l	7.8	tonnes	–
Total N		255	10	198	329 µg/l	342	tonnes	yes
SiO₂	*	0.81	10	0.54	1.4 mg/l	1093	tonnes	yes
	**	1.0	–	–	– mg/l	1487	tonnes	–
Arsenic	*	0.075	10	<0.05	0.25 µg/l	0.15	tonnes	yes
	**	0.085	–	–	– µg/l	0.16	tonnes	–
Lead		0.090	10	0.030	0.26 µg/l	0.17	tonnes	yes
Cadmium	*	0.0095	10	<0.010	0.022 µg/l	0.014	tonnes	no
	**	0.013	–	–	– µg/l	0.017	tonnes	–
Copper	*	0.85	10	<0.10	6.5 µg/l	2.3	tonnes	yes
	**	0.86	–	–	– µg/l	2.3	tonnes	–
Total Cr-T	*	0.045	10	<0.05	0.10 µg/l	0.084	tonnes	no
	**	0.065	–	–	– µg/l	0.10	tonnes	–
Nickel	*	0.21	10	0.20	0.72 µg/l	0.31	tonnes	no
	**	0.27	–	–	– µg/l	0.36	tonnes	–
Zinc		1.8	10	1.1	2.50 µg/l	2.8	tonnes	yes
Mercury	*	7.4	10	<2	71 ng/l	13	kg	no
	**	9.0	–	–	– ng/l	16	kg	–
Lindane	*	0.14	3	0.10	0.33 ng/l	0.22	kg	no
	**	0.18	–	–	– ng/l	0.28	kg	–

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Table IV.VIII Main riverine inputs 2003 (8) Orkla

Total volume: 4 497 145 m³/d **Long term average flow (LTA):** 5 710 000 m³/d
Minimum flow: 943 282 m³/d **LTA period:** 1961 to 1990
Maximum flow: 67 561 380 m³/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.	*	1.2	12	<0.60	4.0 mg/l	1936	tonnes	yes
	**	1.3	–	–	– mg/l	2073	tonnes	–
TOC		3.6	12	1.7	6.2 mg/l	6771	tonnes	yes
Orthoph.	*	0.83	12	1.0	5.0 µg/l	1.5	tonnes	no
	**	1.7	–	–	– µg/l	2.6	tonnes	–
Total P	*	4.8	12	1.0	9.0 µg/l	8.5	tonnes	yes
	**	4.9	–	–	– µg/l	8.7	tonnes	–
Nitrates		185	12	102	286 µg/l	277	tonnes	yes
Ammonia		18	12	2.0	80 µg/l	31	tonnes	yes
Total N		292	12	203	417 µg/l	464	tonnes	yes
SiO₂		2.4	12	1.6	3.0 mg/l	4080	tonnes	yes
Arsenic	*	0.090	12	<0.05	0.15 µg/l	0.16	tonnes	yes
	**	0.098	–	–	– µg/l	0.16	tonnes	–
Lead		0.05	12	0.021	0.14 µg/l	0.065	tonnes	yes
Cadmium	*	0.048	12	<0.01	0.11 µg/l	0.08	tonnes	yes
	**	0.049	–	–	– µg/l	0.08	tonnes	–
Copper	*	6.8	12	<0.05	12 µg/l	11	tonnes	yes
	**	6.8	–	–	– µg/l	11	tonnes	–
Total Cr-T	*	0.18	12	<0.05	0.28 µg/l	0.32	tonnes	yes
	**	0.18	–	–	– µg/l	0.32	tonnes	–
Nickel	*	0.78	12	<0.10	1.1 µg/l	1.4	tonnes	yes
	**	0.78	–	–	– µg/l	1.4	tonnes	–
Zinc	*	21	12	<0.50	48 µg/l	34	tonnes	yes
	**	21	–	–	– µg/l	34	tonnes	–
Mercury	*	3.8	12	2.0	20 ng/l	6.9	kg	no
	**	4.7	–	–	– ng/l	8.0	kg	–
Lindane	*	0.17	4	<0.10	0.30 ng/l	0.35	kg	yes
	**	0.19	–	–	– ng/l	0.38	kg	–

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Table IV.IX Main riverine inputs 2003 (9) Vefsna

Total volume:	12 826 044 m³/d	Long term average flow (LTA):	15 620 000 m³/d
Minimum flow:	2 179 483 m³/d	LTA period:	1961 to 1990
Maximum flow:	49 052 045 m³/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.	*	3,24	12	0,6	12 mg/l	22877 tonnes	yes
	**	3,39	—	—	— mg/l	23160 tonnes	—
TOC		1,75	12	0,9	2,7 mg/l	8611 tonnes	yes
Orthoph.		1,08	12	1	4 µg/l	4 tonnes	no
		1,58	—	—	— µg/l	7 tonnes	—
Total P		5	12	1	12 µg/l	26 tonnes	yes
Nitrates		123	12	31	498 µg/l	374 tonnes	yes
Ammonia	*	7,6	12	2	25 µg/l	28 tonnes	yes
	**						
Total N		183	12	80	610 µg/l	646 tonnes	yes
SiO₂		1,39	12	0,58	3,21 mg/l	5307 tonnes	yes
Arsenic		0,46	12	<0,05	4,60 µg/l	0,83 tonnes	yes
		0,51	—	—	— µg/l	0,92 tonnes	—
Lead	*	0,131	12	<0,02	0,94 µg/l	0,42 tonnes	yes
	**						
		0,151	—	—	— µg/l	0,45 tonnes	—
Cadmium	*	0,000	12	<0,01	0,1 µg/l	0,000 tonnes	no
	**						
		0,025	—	—	— µg/l	0,070 tonnes	—
Copper		0,54	12	0,27	2,50 µg/l	2,0 tonnes	yes
		0,63	—	—	— µg/l	2,18 tonnes	—
Total Cr-T	*	0,08	12	0,059	0,50 µg/l	0,46 tonnes	yes
	**						
		0,17	—	—	— µg/l	0,59 tonnes	—
Nickel	*	0,35	12	<0,20	2,50 µg/l	1,27 tonnes	no
	**						
		0,59	—	—	— µg/l	1,87 tonnes	—
Zinc	*	1,32	12	<0,5	8 µg/l	6,9 tonnes	no
	**						
		2,36	—	—	— µg/l	9,0 tonnes	—
Mercury	*	4,8	12	2	15 ng/l	27 kg	no
	**						
		6,2	—	—	— ng/l	31 kg	—
Lindane	*	0,32	4	0,15	0,71 ng/l	1,52 kg	yes
	**						

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Table IV.X Main riverine inputs 2003 (10) Alta

Total volume: 4 950 954 m³/d **Long term average flow (LTA):** 7 487 000 m³/d
Minimum flow: 2 177 113 m³/d **LTA period:** 1961 to 1990
Maximum flow: 23 082 350 m³/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.	*	0,82	13	<0,1	2,7 mg/l	2596 tonnes	no
	**	0,96	–	–	– mg/l	2737 tonnes	–
TOC		3,1	13	2,4	5 mg/l	6801 tonnes	yes
Orthoph.		4	13	1	8 µg/l	5 tonnes	yes
		3,62	–	–	– µg/l	5 tonnes	–
Total P		7	13	3	11 µg/l	15 tonnes	yes
Nitrates		73	13	10	155 µg/l	111 tonnes	yes
Ammonia		10	13	3	26 µg/l	15 tonnes	yes
Total N		170	13	136	210 µg/l	302 tonnes	yes
SiO₂		4,52	13	2,79	6,00 mg/l	7297 tonnes	yes
Arsenic		0,20	13	0,1	0,33 µg/l	0,31 tonnes	yes
Lead	*	0,041	13	<0,02	0,20 µg/l	0,08 tonnes	no
	**	0,063	–	–	– µg/l	0,11 tonnes	–
Cadmium	*	0,000	13	<0,010	0,01 µg/l	0,000 tonnes	no
	**	0,010	–	–	– µg/l	0,018 tonnes	–
Copper		0,46	13	0,24	0,81 µg/l	1,0 tonnes	yes
Total Cr-T	*	0,17	13	0,096	0,29 µg/l	0,37 tonnes	yes
	**						
Nickel	*	0,19	13	0,15	0,58 µg/l	0,57 tonnes	no
	**	0,25	–	–	– µg/l	0,63 tonnes	–
Zinc	*	1,31	13	<0,50	10,00 µg/l	7,2 tonnes	no
	**	1,61	–	–	– µg/l	7,6 tonnes	–
Mercury	*	4	13	2	14 ng/l	9 kg	yes
	**	4	–	–	– ng/l	9 kg	–
Lindane	*	0,15	4	0,06	0,3 ng/l	0,24 kg	yes
	**	0,17	–	–	– ng/l	0,30 kg	–

Measurements below detection limits are treated in two ways

* Detection limit = zero, ** Detection limit = limit

Appendix V. Input from the tributary rivers 2003

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 2003

**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.		3714	6970	32081	1979	1876	15877	tonnes	yes
TOC		7784	4004	1595	3214	5837	65553	tonnes	yes
Orthoph.	*	1.4	6.1	2.5	2.0	0.000	0.000	tonnes	no
	**	2.7	7.0	2.5	2.3	1.0	17	tonnes	no
Total P	*	20	24	27	18	10	19	tonnes	yes
	**	20	24	27	18	10	24	tonnes	yes
Nitrates		570	637	415	327	177	3260	tonnes	yes
Ammonia		15	31	3.1	21	3.1	250	tonnes	yes
Total N		878	831	482	480	331	5464	tonnes	yes
Silicate SiO₂		2393	2846	2058	2058	2457	18302	tonnes	yes
Arsenic	*	0.31	0.20	0.22	0.15	0.16	2.8	tonnes	yes
	**	0.31	0.20	0.22	0.20	0.16	2.8	tonnes	yes
Lead		0.23	0.44	0.56	0.12	0.21	5.1	tonnes	yes
Cadmium	*	0.014	0.018	0.015	0.022	0.034	0.41	tonnes	no
	**	0.017	0.018	0.015	0.024	0.034	0.41	tonnes	no
Copper		1.3	1.3	1.1	0.69	0.46	7.0	tonnes	yes
Total Cr-T	*	0.29	0.23	0.42	0.13	0.13	1.4	tonnes	yes
	**	0.29	0.23	0.42	0.18	0.13	1.4	tonnes	yes
Nickel	*	0.91	0.63	0.67	0.23	0.39	1.0	tonnes	no
	**	0.91	0.63	0.67	0.44	0.39	3.8	tonnes	no
Zinc		2.2	3.4	4.2	4.3	5.9	55	tonnes	yes
Mercury	*	1.3	4.3	3.1	16	3.1	68	kg	no
	**	2.7	4.3	3.1	16	3.1	77	kg	no
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 2003

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.	*	4470	142750	tonnes	no
	**	6975	150477		
TOC		17606	58144	tonnes	yes
Orthoph.	*	11	2	tonnes	no
	**	16	32		
Total P	*	29	220	tonnes	no
	**	34	229		
Nitrates		2238	3510	tonnes	yes
Ammonia	*	123	241	tonnes	yes
	**	123	241		
Total N		2859	5654	tonnes	yes
Silicate SiO₂	*	10890	39432	tonnes	yes
	**	10890	39627		
Arsenic	*	0.58	0.45	tonnes	no
	**	0.74	1.8		
Lead	*	1.2	3.8	tonnes	yes
	**	1.2	3.9		
Cadmium	*	0.065	0.059	tonnes	no
	**	0.11	0.34		
Copper		2.4	14	tonnes	yes
Total Cr-T	*	0.36	5.7	tonnes	no
	**	0.51	6.6		
Nickel	*	3.4	4.4	tonnes	no
	**	4.7	9.9		
Zinc	*	11	48	tonnes	yes
	**	11	51		
Mercury	*	39	297	kg	yes
	**	42	302		

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 2003**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.	*	88608	30776	tonnes	yes
	**	90447	33969		
TOC		97663	32340	tonnes	yes
Orthoph.	*	17	41	tonnes	no
	**	33	50		
Total P	*	147	164	tonnes	yes
	**	151	164		
Nitrates		2519	772	tonnes	yes
Ammonia	*	216	241	tonnes	yes
	**	216	243		
Total N		5626	2423	tonnes	yes
Silicate SiO₂		44637	34498	tonnes	yes
Arsenic	*	3.9	0.53	tonnes	no
	**	4.1	1.7		
Lead	*	1.8	1.7	tonnes	yes
	**	1.8	1.8		
Cadmium	*	0.000	0.057	tonnes	no
	**	0.28	0.33		
Copper		22	13	tonnes	yes
Total Cr-T	*	6.0	4.0	tonnes	yes
	**	6.1	4.3		
Nickel	*	13	9.9	tonnes	no
	**	15	11		
Zinc	*	21	29	tonnes	no
	**	24	35		
Mercury	*	359	624	kg	no
	**	375	652		

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 2003**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.	*	15613	tonnes	no
	**	16678		
TOC		55113	tonnes	yes
Orthoph.	*	42	tonnes	no
	**	48		
Total P	*	111	tonnes	yes
	**	111		
Nitrates	*	72	tonnes	yes
	**	79		
Ammonia		178	tonnes	yes
Total N		1982	tonnes	yes
Silicate SiO₂		55250	tonnes	yes
Arsenic	*	1.4	tonnes	no
	**	1.4		
Lead	*	0.15	tonnes	no
	**	0.46		
Cadmium	*	0.003	tonnes	no
	**	0.18		
Copper		9.0	tonnes	yes
Total Cr-T	*	2.4	tonnes	no
	**	2.9		
Nickel	*	10.6	tonnes	yes
	**	10.6		
Zinc	*	3.3	tonnes	yes
	**	10		
Mercury	*	31	kg	yes
	**	57		

Lindane

Measurements below detection limits are treated in two ways:

* Detection limit = zero, ** Detection limit = limit

Appendix VI. Other inputs 2003

Table VI Nutrients from “Down Stream Areas of main and tributary rivers and rivers not monitored 2003. Direct run-off P and N.

Table VI **Nutrients from “Down Stream Areas” of main and tributary rivers and rivers not monitored 2003. Direct run-off of P and N.**

Sub-areas:		Background tonnes	Agriculture Area tonnes	Sum tonnes	
1 Glomma	P	18.4	15.6	34.1	
	N	463.1	489.5	952.5	
	PO ₄ -P	3.7	4.7	8.4	
	NO ₃ -N	277.8	342.6	620.5	
	NH ₄ -N	23.2	34.3	57.4	
1 Inner Oslofjord	P	3.4	3.3	6.7	
	N	72.8	106.7	179.5	
	PO ₄ -P	0.7	1.0	1.7	
	NO ₃ -N	43.7	74.7	118.4	
	NH ₄ -N	3.6	7.5	11.1	
2 Drammenselva	P	1.4	2.4	3.8	
	N	64.0	93.5	157.4	
	PO ₄ -P	0.3	0.7	1.0	
	NO ₃ -N	38.4	65.4	103.8	
	NH ₄ -N	3.2	6.5	9.7	
3 Numedalslågen	P	4.9	18.0	22.9	
	N	184.7	578.4	763.2	
	PO ₄ -P	1.0	5.4	6.4	
	NO ₃ -N	110.8	404.9	515.7	
	NH ₄ -N	9.2	40.5	49.7	
4 Skienselva	P	6.8	2.6	9.4	
	N	331.3	100.2	431.5	
	PO ₄ -P	1.4	0.8	2.1	
	NO ₃ -N	198.8	70.1	268.9	
	NH ₄ -N	16.6	7.0	23.6	
5 Otra	P	7.0	3.4	10.4	
	N	391.8	121.8	513.5	
	PO ₄ -P	1.4	1.0	2.4	
	NO ₃ -N	235.1	85.2	320.3	
	NH ₄ -N	19.6	8.5	28.1	
6 Orreelva	P	22.8	42.3	65.2	
	N	1463.8	1637.0	3100.9	
	PO ₄ -P	4.6	12.7	17.3	
	NO ₃ -N	878.3	1145.9	2024.2	
	NH ₄ -N	73.2	114.6	187.8	
7 Suldalslågen	P	58.0	104.1	162.1	
	N	5151.3	3316.6	8467.9	
	PO ₄ -P	11.6	31.2	42.8	
	NO ₃ -N	3090.8	2321.6	5412.4	
	NH ₄ -N	257.6	232.2	489.7	
8 Orkla	P	142.1	208.5	350.5	
	N	3714.3	6509.3	10223.5	
	PO ₄ -P	28.4	62.5	90.9	
	NO ₃ -N	2228.6	4556.5	6785.0	
	NH ₄ -N	185.7	455.6	641.4	
9 Vefsna	P	83.6	78.1	161.7	
	N	1920.5	1454.7	3375.1	
	PO ₄ -P	16.7	23.4	40.2	
	NO ₃ -N	1152.3	1018.3	2170.5	
	NH ₄ -N	96.0	101.8	197.8	
10 Alta	P	86.1	2.2	88.4	
	N	1618.3	82.6	1700.9	
	PO ₄ -P	17.2	0.7	17.9	
	NO ₃ -N	971.0	57.8	1028.8	
	NH ₄ -N	80.9	5.8	86.7	
SUM	P			915	tonnes
SUM	N			29866	tonnes
SUM	PO₄-P			231	tonnes
SUM	NO₃-N			19369	tonnes
SUM	NH₄-N			1783	tonnes

Appendix VII. Main rivers 1-10. Measured concentrations 2003

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 2003 – Watercourse: Glomma

Annual flow: 18540 10⁶ m³ **Min:** 230 m³/s
Drainage area: 41218 km² **Max:** 1562 m³/s

Date 2003	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
2003-01-29	384	5.49	9.4	4.1	5	34	680	60	811	6.43	0.20	0.36	0.011	1.5	0.61	0.93	3.6	20	1.63
2003-02-26	282	5.37	1.2	3.6	<1	6	436	65	641	4.29	0.19	0.47	<0.01	1.1	0.25	0.69	6.0	<2	
2003-03-26	358	6.14	6.5	3.6	2	19	729	44	876	6.21	0.23	0.54	0.013	1.7	0.57	1.0	5.7	38	
2003-04-30	819	4.81	10.7	5.7	2	16	577	43	766	4.71	0.23	1.00	0.024	1.7	0.44	1.1	5.2	<2	
2003-05-14	999	4.50	7.4	6.6	3	16	476	42	618	4.50	0.18	0.26	0.014	1.6	0.25	0.78	4.2	<2	
2003-05-21	1203	3.88	8.4	7.2	5	19	321	27	535	4.07	0.21	0.54	0.015	2.0	0.34	0.89	6.2	<2	
2003-05-28	1485	3.86	12.1	6.0	1	18	422	17	531	3.64	0.18	0.59	0.021	2.1	0.33	0.82	5.8	16	
2003-06-04	1229	3.55	5.9	4.9	1	12	261	12	376	2.79	0.16	1.10	0.011	1.8	0.17	0.71	4.1	10	
2003-06-11	1188	4.08	5.0	4.1	1	13	277	17	383	2.36	0.11	0.18	<0.01	1.4	0.084	0.49	2.3	6	
2003-06-18	947	4.08	3.8	3.6	<1	10	269	10	372	2.36	0.14	0.22	<0.01	1.3	0.11	0.56	1.9	25	
2003-06-25	947	4.56	10.0	4.6	1	27	448	30	674	32.14	0.16	0.78	0.012	1.6	0.23	0.82	4.5	26	0.84
2003-07-02	819	4.36	4.6	3.2	3	16	294	19	444	2.57	0.11	0.24	<0.01	1.4	0.19	0.64	3.2	3	
2003-07-28	717	4.27	4.9	3.2	1	14	290	26	419	3.00	<0.05	2.40	<0.01	1.4	0.43	0.61	8.7	<2	
2003-08-27	819	4.10	4.3	3.4	1	16	201	4	345	2.12	0.12	0.16	<0.01	1.6	0.12	0.44	1.9	2	0.31
2003-09-24	666	4.26	3.9	2.8	<1	11	204	15	341	1.89	0.13	0.11	<0.01	1.1	0.12	0.62	0.98	<2	0.18
2003-11-05	358	7.05	8.5	5.1	6	39	1710	32	2060	6.00	0.19	0.43	0.011	1.8	0.57	0.87	4.2	6	
2003-11-25	461	5.00	1.9	4.3	2	8	542	25	654	3.64	0.13	0.22	<0.01	1.2	0.18	0.55	3.0	<2	
2003-12-18	512	5.09	7.9	3.9	2	18	553	29	663	3.43	0.13	0.12	<0.01	1.3	0.21	0.76	2.1	2	
Min.:	282	3.55	1.2	2.8	< 1	6	201	4	341	1.89	<0.05	0.11	<0.01	1.10	0.08	0.44	0.98	<2	0.18
Max.:	1485	7.05	12.1	7.2	6	39	1710	65	2060	32.14	0.23	2.40	0.024	2.10	0.61	1.10	8.70	<38	1.63
Aver.:	789	4.69	6.5	4.4	2	17	483	29	639	5.34	0.16	0.54	0.012	1.53	0.29	0.74	4.09	<9	0.74
St.dev.:	352	0.88	3.0	1.2	1.6	8	345	17	392	6.83	0.05	0.55	0.004	0.29	0.17	0.18	1.95	<11	0.66
Numb.:	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	4

Direct and riverine inputs to Norwegian coastal waters – 2003 OSPAR Commission

Table VII.II Measured concentrations 2003 – Watercourse: Drammenselva

Annual flow: 8699 10⁶ m³ Min: 86 m³/s
 Drainage area: 17028 km² Max: 994 m³/s

Date 2003	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
2003-01-27	236	3.73	0.9	3.1	<1	6	350	17	470	2.57	0.21	0.057	0.016	1.1	0.11	0.6	4.5	<2	<0.1
2003-02-24	232	3.43	<0.06	2.4	<1	2	247	23	399	2.14	0.087	0.048	<0.01	0.59	0.13	0.36	2.7	568	
2003-03-24	223	4.49	2.8	3.2	<1	10	370	41	570	3.00	0.13	0.13	0.012	0.89	0.17	0.5	3.9	9	
2003-04-24	306	3.88	3.9	4.3	1	14	398	25	593	3.00	0.16	0.21	0.02	1.0	0.17	0.77	4.5	<2	
2003-05-06	370	4.00	2.4	4.3	4	5	385	25	523	2.79	0.15	0.14	0.012	0.95	0.13	0.73	3.9	<2	
2003-05-13	468	3.6	4.2	4.0	3	8	336	23	438	2.79	0.14	0.15	0.015	1.1	0.13	0.49	3.9	11	
2003-05-20	648	3.34	1.9	3.8	4	6	194	16	339	2.57	0.13	0.13	0.011	0.86	0.14	0.51	3.0	6	
2003-05-26	957	3.27	7.7	4.6	1	<1	389	11	543	2.79	0.12	0.28	0.013	0.96	0.19	0.6	2.9	10	
2003-06-03	733	3.23	2.9	3.4	<1	5	248	15	350	2.36	0.16	0.14	<0.01	0.76	0.11	0.56	2.5	5	
2003-06-10	486	3.62	3.6	3.7	1	14	238	31	369	2.57	0.12	0.093	<0.01	1.5	0.075	0.45	2.2	6	
2003-06-16	396	3.55	1.7	3.7	3	7	243	39	380	2.79	0.052	0.07	<0.01	0.9	0.11	0.52	2.3		1.02
2003-06-24	219	3.76	2.1	4.1	<1	9	235	26	417	2.36	0.16	0.13	0.015	0.85	0.089	0.49	2.5	20	
2003-06-30	213	3.69	1.7	4.1	2	13	212	52	389	2.36	0.19	0.095	0.013	0.99	0.10	0.49	2.2	37	
2003-07-28	234	3.58	1.2	3.9	1	7	191	26	349	2.36	<0.05	0.079	<0.01	0.8	0.09	0.45	1.9	131	0.41
2003-08-25	107	3.28	1.0	4.3	1	11	158	18	304	2.06	0.16	0.063	<0.01	0.79	0.089	0.5	2.1	3	
2003-09-29	234	3.63	0.9	3.9	1	6	209	54	380	2.10	0.11	0.13	<0.01	0.82	0.12	0.56	2.9	<2	0.15
2003-10-27	181	3.32	0.7	3.0	<1	7	217	73	390	2.12	0.12	0.067	0.017	0.73	0.12	0.34	2.1	<2	
2003-11-24	237	3.36	0.8	3.3	1	7	296	44	385	2.57	0.11	0.072	0.0065	0.58	0.099	0.65	2.6	2	
2003-12-22	298	3.84	1.4	3.2	<1	8	296	47	420	2.36	0.13	0.041	<0.01	0.82	0.093	0.52	2.2	<2	
Min.:	107	3.23	<0.1	2.4	<1	<1	158	11	304	2.06	<0.05	<0.04	0.007	0.58	0.075	0.34	1.90	<2	<0.10
Max.:	957	4.49	7.7	4.6	4	14	398	73	593	3.00	0.21	0.280	0.020	1.50	0.19	0.77	4.50	568	1.02
Aver.:	357	3.61	2.2	3.7	1.6	8	274	32	421	2.51	0.13	0.112	0.012	0.89	0.12	0.53	2.88	46	0.42
St.dev.:	217	0.31	1.8	0.6	1.1	4	76	16	82	0.30	0.04	0.060	0.003	0.20	0.03	0.11	0.84	134	0.42
Numb.:	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	18	4

Direct and riverine inputs to Norwegian coastal waters – 2003 OSPAR Commission

Table VII.III Measured concentrations 2003 – Watercourse: Numedalslågen

Annual flow: 3059 10⁶ m³ **Min:** 40 m³/s
Drainage area: 5513 km² **Max:** 316 m³/s

Date	Qi	Cond	S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg	Lindane (γ-HCH)
2003	m ³ /s	mS/m	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ng/l	ng/l
2003-01-27	74	4.80	7.2	5.3	2	20	770	41	1000	5.36	0.25	0.27	0.024	1.0	0.26	0.54	5.6	4	0.18
2003-02-24	48	3.48	2.9	2.9	<1	4	276	72	493	3.21	0.089	0.13	0.011	0.64	0.15	0.24	3.4	8	
2003-03-24	67	4.40	4.5	3.5	<1	10	548	49	731	4.71	0.15	0.20	0.013	0.85	0.17	0.46	4.5	<2	
2003-04-28	221	3.00	16.1	6.3	1	31.8	457	18	637	4.50	0.23	0.60	0.040	1.2	0.34	0.69	7.5	<2	0.35
2003-05-20	210	2.41	4.3	6.0	4	10	202	16	346	3.00	0.18	0.29	0.020	0.75	0.15	0.40	4.8	8	
2003-06-23	96	2.45	1.4	4.0	<1	5	119	23	252	2.36	0.12	0.13	0.014	0.7	0.088	0.36	2.2	7	
2003-07-28	157	2.50	4.5	5.9	1	12	119	22	298	3.00	0.11	0.46	0.017	1.1	0.15	0.44	5.3	2	0.25
2003-08-20	60	2.97	0.8	3.7	3	11	139	43	296	1.93	0.13	0.077	<0.01	0.49	0.061	0.25	1.6	5	
2003-08-29	45	2.65	1.3	5.3	<1	5	124	22	283	2.01	0.32	0.17	0.011	1.0	0.29	0.36	3.1	6	
2003-10-26	82	2.44	1.3	2.8	<1	4	105	38	242	2.36	0.11	0.091	<0.01	0.61	0.091	0.22	2.7	<2	0.10
2003-11-24	76	3.17	1.7	3.5	1	9	274	38	411	3.43	0.13	0.16	<0.001	0.62	0.74	0.41	3.4	4	
2003-12-22	73	3.63	12	3.2	<1	17	208	50	323	3.00	0.18	0.20	<0.01	0.61	0.10	0.31	1.5	<2	
Min.:	45	2.41	0.8	2.8	<1	4	105	16	242	1.93	0.09	0.077	<0.0	0.49	0.06	0.22	1.50	2	0.10
Max.:	221	4.80	16.1	6.3	4	32	770	72	1000	5.36	0.32	0.600	0.040	1.20	0.74	0.69	7.5	8	0.35
Aver.:	101	3.16	4.8	4.4	1.5	12	278	36	443	3.24	0.17	0.232	0.015	0.80	0.22	0.39	3.80	4	0.22
St.dev.:	61	0.79	4.8	1.3	1.0	8	209	17	234	1.10	0.07	0.156	0.010	0.23	0.19	0.13	1.79	2	0.11
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 2003 – Watercourse: Skienselva

Annual flow: 7370 10⁶ m³ **Min:** 74 m³/s
Drainage area: 10348 km² **Max:** 656 m³/s

Date	Qi	Cond	S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg	Lindane (γ-HCH)
2003	m ³ /s	mS/m	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ng/l	ng/l
2003-01-27	157	2.24	1.2	2.7	1	7	200	35	340	2.14	0.15	0.14	0.043	0.53	0.11	0.35	2.9	4	
2003-02-24	135	2.09	0.8	2.4	<1	4	193	19	334	2.10	0.071	0.076	0.013	0.45	0.14	0.23	2.7	3	
2003-03-24	226	2.10	0.71	2.4	<1	3	215	29	308	<1.07	0.086	0.043	<0.01	0.43	0.097	0.3	2.1	<2	1.05
2003-04-28	312	2.11	1.0	2.9	<1	2.7	219	7	308	1.95	0.077	0.09	0.011	0.38	0.062	0.24	2.0	11	
2003-05-20	501	1.97	0.9	2.4	8	15	170	7	262	2.12	0.082	0.098	0.011	0.41	0.07	0.27	2.0	2	
2003-06-23	118	1.93	0.7	3.1	<1	4	168	17	297	1.74	0.081	0.063	0.012	0.41	0.073	0.23	2.1	86	0.19
2003-07-28	501	1.86	2.2	3.0	1	6	153	17	271	2.06	<0.05	0.098	0.016	0.69	0.086	0.27	2.7	121	
2003-08-24	108	1.91	0.8	3.5	1	5	137	25	272	1.59	0.11	0.045	<0.01	0.38	0.068	0.3	1.7	<2	0.38
2003-09-29	221	1.84	0.6	3.0	<1	5	153	23	248	1.33	0.093	0.051	0.013	0.48	0.098	0.25	1.6	<2	
2003-10-26	184	1.89	<0.6	2.3	<1	5	166	30	272	1.44	0.11	0.041	0.01	0.60	0.076	<0.2	2.2	<2	0.32
2003-11-24	232	1.95	<0.6	2.5	2	6	220	17	299	1.89	0.094	0.049	0.012	0.34	<0.05	0.34	2.0	6	
2003-12-22	215	2.12	0.9	2.4	<1	4	207	10	272	1.76	0.095	0.039	0.015	0.42	0.063	0.28	2.3	<2	
Min.:	108	1.84	<0.6	2.3	<1	3	137	7	248	<1.07	<0.05	0.039	<0.01	0.34	<0.05	<0.20	1.60	2.00	0.19
Max.:	501	2.24	2.2	3.5	8	15	220	35	340	2.14	0.150	0.140	0.043	0.69	0.14	0.35	2.90	121	1.05
Aver.:	243	2.00	0.92	2.7	1.7	6	183	20	290	1.76	0.092	0.069	0.015	0.46	0.08	0.27	2.19	20	0.49
St.dev.:	134	0.13	0.44	0.4	2.0	3	29	9	29	0.35	0.025	0.031	0.009	0.10	0.03	0.05	0.40	40	0.38
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 2003 – Watercourse: Otra

Annual flow: 3750 10⁶ m³ **Min:** 55 m³/s
Drainage area: 3730 km² **Max:** 246 m³/s

Date	Qi	Cond	S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg	Lindane (γ-HCH)
2003	m ³ /s	mS/m	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ng/l	ng/l
2003-01-27	155	2.13	0.9	4.3	<1	5	190	27	330	2.06	0.20	0.36	0.039	0.22	0.099	0.94	6.0	<2	
2003-02-25	118	1.37	<0.6	1.4	<1	<1	131	13	206	1.46	0.10	0.11	0.014	0.18	<0.05	0.37	2.1	44	
2003-03-26	129	1.68	0.7	1.9	<1	<1	186	12	245	1.65	0.088	0.18	0.019	0.39	0.094	0.68	4.0	<2	
2003-04-29	109	1.70	1.1	2.5	<1	2	170	3	239	1.31	0.098	0.19	0.022	0.43	0.064	0.70	3.1	<2	0.28
2003-05-26	172	1.62	1.0	3.9	1	1	147	9	268	1.44	0.11	0.32	0.020	0.54	0.088	0.85	3.9	<2	
2003-06-25	118	1.52	0.7	2.8	<1	6	113	5	208	1.05	0.12	0.19	0.020	0.41	0.071	0.39	2.6	9	0.54
2003-07-28	148	1.41	1.0	3.1	1	5	101	17	229	1.29	0.053	0.25	0.021	0.46	0.077	0.53	3.3	<2	
2003-08-27	59	1.20	1.0	2.3	1	<1	90	11	198	0.99	0.13	0.15	0.014	0.58	<0.05	0.48	3.1	<2	0.36
2003-09-29	115	1.37	0.6	3.2	1	2	108	14	200	1.24	0.09	0.17	0.016	1.6	0.058	0.55	2.8	<2	
2003-10-28	58	1.68	<0.6	2.3	<1	2	118	13	238	1.41	0.14	0.21	0.019	0.65	0.06	0.66	3.5	<2	0.19
2003-11-24	84	1.79	1.0	3.4	<1	5	157	20	269	1.86	0.13	0.28	0.022	0.42	0.065	1.0	4.4	<2	
2004-01-05	118	1.57	<0.6	3	<1	<1	143	20	254	1.78	0.11	0.29	0.025	0.48	0.071	1.1	3.9	<2	
Min.:	58	1.20	<0.6	1.4	<1	1	90	3	198	0.99	0.053	0.11	0.014	0.18	<0.05	0.37	2.10	<2	0.19
Max.:	172	2.13	1.1	4.3	1	6	190	27	330	2.06	0.200	0.36	0.039	1.60	0.099	1.10	6.00	44	0.54
Aver.:	115	1.59	0.8	2.8	1.0	3	138	14	240	1.46	0.114	0.23	0.021	0.53	0.071	0.69	3.56	6	0.34
St.dev.:	35	0.24	0.2	0.8	0.0	2	33	7	38	0.32	0.036	0.07	0.007	0.36	0.016	0.24	1.01	12	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 2003 – Watercourse: Orreelva**Annual flow:** 143 10⁶ m³ **Min:** 0,4 m³/s**Drainage area:** 105 km² **Max:** 15,7 m³/s

Date 2003	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
2003-01-27	7.8	19.1	8.4	6.1	2	65	820	78	1400	1.56	0.39	0.24	<0.01	0.74	0.13	0.84	3	<2	
2003-02-24	2.6	18.3	6.4	5.3	2	34	1240	8	1720	<0.21	0.31	0.21	<0.01	1.3	0.23	0.77	5.1	<2	
2003-03-24	1.8	18.6	4.9	5.9	<1	37	1100	3	1670	0.21	0.28	0.13	<0.01	0.83	0.15	0.92	2.5	<2	
2003-04-28	0.4	20.1	4.8	6.8	<1	44.6	425	25	945	<1.07	0.21	0.11	<0.01	0.9	0.1	0.86	3.3	<2	0.27
2003-05-26	2.2	19.4	6.4	7.5	<1	<1	34	23	589	<1.07	0.48	0.11	<0.01	1.2	0.2	0.92	11	<2	
2003-06-23	4.9	19.3	4.5	7.6	1	44	119	6	606	2.10	0.97	0.18	0.015	1.7	0.38	1.1	26	<2	0.62
2003-07-28	4.6	18.9	10	6.6	2	48	7	5	679	3.21	0.87	0.092	<0.01	1.2	0.39	0.91	10	<2	
2003-08-26	4.6	19.7	15.5	11	1	83	8	1	790	2.08	0.65	0.3	<0.01	0.87	0.11	0.63	3.8	<2	0.35
2003-09-23	15.7	20	26.9	11	3	149	167	14	1030	3.00	0.53	0.9	0.02	1	0.15	1	4.4	<2	
2003-10-29	2.7	18.4	7.8	7.4	<1	50	707	6	1250	1.54	0.28	0.089	<0.01	0.92	0.07	1	1	<2	0.19
2003-11-24	2.4	18.2	5.4	5.4	3	44	1220	25	1660	3.00	0.25	0.11	<0.01	1	0.12	1.4	2.4	<2	
2003-12-16	4.8	18.2	19	8.4	4	128	1260	50	2025	2.57	0.31	0.74	0.011	1.4	0.17	1.1	5	<2	
Min.:	0.4	18.2	4.5	5.3	<1	<1	7	1	589	<0.21	0.21	0.09	<0.01	0.74	0.07	0.63	1.00	<2	0.19
Max.:	15.7	20.1	26.9	11.0	4	149	1260	78	2025	3.21	0.97	0.90	0.020	1.70	0.39	1.40	26.00	2	0.62
Aver.:	4.5	19.0	10.0	7.4	1.8	61	592	20	1197	1.80	0.46	0.27	0.011	1.09	0.18	0.95	6.46	2.0	0.36
St.dev.:	4.0	0.7	7.0	1.9	1.0	41	523	23	494	1.04	0.25	0.27	0.003	0.28	0.10	0.19	6.84	0.0	0.19
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 2003 – Watercourse: Suldalslågen

Annual flow: 1416 10⁶ m³ Min: 13 m³/s
 Drainage area: 1457 km² Max: 145 m³/s

Date	Qi	Cond	S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg	Lindane (γ-HCH)
2003	m ³ /s	mS/m	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ng/l	ng/l
2003-01-27	36	2.77	0.9	2.4	1	18	230	9	300	1.39	0.098	0.12	0.018	<0.1	0.079	0.29	2.5	<2	
2003-03-03	15	2.08	<0.06	0.7	1	3	222	<1	252	0.92	<0.05	0.03	<0.01	0.13	<0.05	<0.2	1.1	<2	
2003-03-25	14	2.00	<0.6	1.0	1	1	236	18	254	0.96	0.056	0.048	0.011	0.18	<0.05	<0.2	1.9	3	
2003-04-28	19	1.97	0.6	1.1	<1	<1	197	<1	222	<1.07	<0.05	0.047	0.022	0.18	<0.05	0.20	1.4	<2	
2003-06-30	52	1.47	1.3	1.2	2	23	147	7	198	0.75	0.074	0.078	0.011	0.33	<0.05	0.20	1.4	71	
2003-07-23	90	1.60	2.7	4.1	<1	5	145	6	236	1.29	0.25	0.26	0.011	0.48	0.099	0.24	2.1	<2	0.33
2003-09-30	84	1.50	0.6	2.1	<1	3	172	3	216	<1.07	0.067	0.10	0.011	6.5	0.071	0.21	2.4	<2	<0.10
2003-10-27	41	1.50	0.9	0.7	<1	1	175	4	225	0.54	0.081	0.066	<0.01	0.32	0.063	<0.2	1.8	<2	0.10
2003-11-24	24	1.89	1.1	1.1	1	6	242	6	315	1.16	0.066	0.086	0.011	0.15	0.072	0.72	1.8	<2	
2003-12-29	20	2.13	1.2	1.6	<1	4	318	<5	329	1.14	0.062	0.068	<0.01	0.26	0.065	0.26	1.6	<2	
Min.:	14	1.47	<0.06	0.7	<1	<1	145	<1	198	0.54	<0.05	0.030	<0.010	<0.10	<0.05	0.20	1.10	<2	0.10
Max.:	90	2.77	2.7	4.1	2	23	318	18	329	1.39	0.250	0.260	0.022	6.50	0.10	0.72	2.50	71	0.33
Aver.:	40	1.89	1.0	1.6	1.1	6.5	208	6	255	1.03	0.085	0.090	0.013	0.86	0.06	0.27	1.80	9	0.18
St.dev.:	28	0.40	0.7	1.04	0.3	7.7	53	5	45	0.25	0.060	0.065	0.004	1.98	0.02	0.16	0.45	22	0.13
Numb.:	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	3

Table VII.VIII Measured concentrations 2003 – Watercourse: Orkla

Annual flow: 1 641 10⁶ m³ Min: 11 m³/s
 Drainage area: 2 872 km² Max: 782 m³/s

Date	Qi	Cond	S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg	Lindane (γ-HCH)
2003	m ³ /s	mS/m	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ng/l	ng/l
2003-01-30	34	7.38	0.8	2.4	2	3	200	26	235	2.57	0.15	0.042	0.11	12	0.14	1	48	10	
2003-02-28	17	9.08	<0.6	1.7	1	2	265	8	328	2.79	<0.05	0.033	<0.01	<0.05	<0.05	<0.1	<0.5	<2	
2003-03-31	28	7.94	1.3	5	<5	8	220	6	376	2.57	0.14	0.066	0.09	10	0.19	0.79	36	<2	
2003-05-04	36	6.26	1.3	5.7	<1	5	129	3	276	2.14	<0.05	0.031	0.052	8.4	0.2	1.1	18	<2	0.15
2003-05-30	62	4.69	1.5	3.5	<1	6	102	28	203	1.71	0.091	0.054	0.023	4.3	0.14	0.68	8.7	20	
2003-06-30	26	6.16	1.3	2.6	2	6	130	10	259	1.61	0.11	0.13	0.048	6.6	0.14	0.66	18	6	0.21
2003-07-31	20	7.13	4	2.9	1	6	168	22	263	2.14	0.15	0.14	0.048	7.8	0.22	0.99	22	2	
2003-08-31	137	4.9	1.8	6.2	2	9	110	2	260	2.57	0.13	0.022	0.045	7.3	0.25	0.95	23	3	0.3
2003-09-30	63	5.64	<0.6	4.6	<1	1	159	80	259	2.79	0.082	0.021	0.036	6.3	0.23	0.56	15	2	
2003-10-30	47	7.27	0.7	4.4	2	6	286	11	417	3.00	0.074	0.03	0.069	9.5	0.28	0.89	36	<2	<0.10
2003-11-30	42	6.51	0.8	2.3	<1	6	247	9	328	2.57	0.076	0.023	0.024	4.1	0.17	0.59	14	3	
2004-01-04	69	6.55	0.8	2.3	<1	<1	198	15	295	2.79	0.074	0.028	0.036	5.6	0.15	1.1	16	<2	
Min.:	17	4.69	<0.60	1.7	<1	1	102	2	203	1.61	<0.05	0.021	<0.01	<0.05	<0.05	<0.10	<0.50	<2	<0.10
Max.:	137	9.08	4.0	6.2	5	9	286	80	417	3.00	0.150	0.140	0.110	12.00	0.28	1.10	48.0	20	0.30
Aver.:	48	6.63	1.3	3.6	1.7	5	185	18	292	2.44	0.098	0.052	0.049	6.83	0.18	0.78	21.3	5	0.19
St.dev.:	33	1.25	0.9	1.5	1.2	3	62	21	61	0.44	0.037	0.041	0.029	3.15	0.06	0.29	13.1	5	0.09
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 2003 – Watercourse: Vefsna

Annual flow: 4682 10⁶ m³ Min: 25 m³/s
 Drainage area: 4 113 km² Max: 568 m³/s

Date 2003	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
2003-02-05	35	1235*	1.6	1.7	4	7	135	25	176	1.44	4.6	0.94	<0.1	2.5	<0.5	2.5	<5	15	
2003-02-28	60	20.7	6.2	1.5	1	3	498	9	610	3.21	0.12	0.16	<0.01	0.5	0.12	<0.2	0.98	<2	
2003-03-28	248	6.35	12.4	2.7	<1	12	90	8	192	1.35	0.096	0.12	<0.01	0.32	0.2	0.37	5.1	<2	
2003-04-24	151	6.89	0.8	2.2	<1	1	73	12	162	1.31	0.11	0.032	<0.01	0.43	0.059	<0.2	<0.5	6	0.71
2003-06-01	568	4	3.6	2	<1	5	55	3	99	0.99	0.1	0.095	<0.01	0.47	0.1	0.39	0.76	7	
2003-06-30	292	2.62	8.8	0.9	4	7	41	6	81	0.58	0.071	0.031	<0.01	0.28	0.062	<0.2	<0.5	12	0.2
2003-07-31	100	3.23	0.6	1.6	<1	2	36	5	80	0.64	0.089	0.12	<0.01	0.78	0.1	0.21	8	7	
2003-09-02	63	4.97	0.6	1.3	1	4	31	2	85	0.99	0.11	<0.02	<0.01	0.27	0.11	0.24	1	<2	0.22
2003-10-06	93	6.16	<0.6	1.8	<1	2	46	3	94	1.39	0.11	0.04	<0.01	0.31	0.08	0.26	<0.5	2	
2003-11-02	85	6.83	4.3	1.8	2	5	88	8	144	1.41	<0.05	0.028	<0.01	0.33	0.11	0.28	<0.5	3	0.15
2003-12-01	25	9.17	<0.6	1.4	<1	4	270	5	327	1.95	0.11	<0.02	<0.01	0.32	0.07	<0.2	<0.5	3	
2004-01-07	61	455	<0.6	2.1	1	3	116	5	144	1.48	<0.5	<0.2	<0.1	<1	<0.5	<2	<5	13	
Min.:	25	2.62	0.6	0.9	1	1	31	<2	80	0.58	<0.05	<0.02	<0.01	0.27	0.06	<0.20	<0.5	<2	<0.15
Max.:	568	20.70	12.4	2.7	4	12	498	25	610	3.21	4.600	0.940	0.100	2.50	0.50	2.50	8.0	15	0.71
Aver.:	148	7.09	3.4	1.8	1.6	4.6	123	7.6	183	1.39	0.506	0.151	0.025	0.63	0.17	0.59	2.36	6	0.32
St.dev.:	156	5.16	3.9	0.5	1.2	3.0	135	6.2	151	0.69	1.295	0.256	0.035	0.63	0.16	0.79	2.64	5	0.26
Numb.:	12	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4

* Not included in the calculations, contaminated by seawater.

Table VII.X Measured concentrations 2003 – Watercourse: Alta

Annual flow: 1807 10⁶ m³ **Min:** 25 m³/s
Drainage area: 7 367 km² **Max:** 267 m³/s

Date	Qi	Cond	S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg	Lindane (γ-HCH)
2003	m ³ /s	mS/m	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ng/l	ng/l
2003-01-09	30	14.2	<0.6	2.4	7	8	110	26	210	5.57	0.24	0.032	<0.01	0.4	0.13	<0.20	<0.50	5	
2003-02-02	29	13.6	<0.6	2.6	5	5	110	10	180	5.57	0.33	0.18	<0.01	0.4	0.14	<0.2	<0.50	6	
2003-03-02	25	12.6	<0.06	2.5	4	6	91	3	190	5.79	0.24	0.13	<0.01	0.42	0.14	0.17	<0.5	4	
2003-04-08	25	12.1	0.8	2.7	3	3	72	6	163	6.00	0.13	<0.02	<0.01	0.24	0.18	<0.2	2.2	5	
2003-05-06	45	11.1	1.4	3	4	7	75	16	173	5.79	0.16	<0.2	<0.01	0.54	0.26	0.24	<1	14	0.06
2003-06-01	267	5.57	2.7	5.1	1	10	34	6	166	3.21	0.13	0.07	<0.01	0.81	0.29	0.58	10	6	
2003-07-03	49	7.76	0.5	3.4	6	6	40	11	176	3.21	0.19	0.025	<0.01	0.26	0.15	0.26	0.73	4	0.3
2003-08-02	34	8.88	1.2	3.6	1	9	30	3	143	3.00	0.22	0.04	<0.01	0.49	0.12	0.245	<0.5	2	0.22
2003-09-03	35	8.21	1.3	2.6	1	10	10	12	205	2.79	0.16	<0.02	<0.01	0.52	0.24	0.38	<0.5	2	
2003-09-30	63	8.12	1.2	3.6	<1	6	50	5	136	3.54	0.1	0.026	<0.01	0.58	0.14	0.2	0.88	3	
2003-11-03	59	9.65	0.61	2.8	3	6	155	8	155	4.71	0.14	<0.02	<0.01	0.39	0.16	0.21	2.5	3	<0.10
2003-11-28	48	11.7	0.9	3.2	3	10	87	14	169	4.93	0.26	0.03	<0.01	0.56	0.15	0.15	<0.5	2	
	35	12.8	<0.6	2.9	8	11	84	5	150	4.71	0.32	<0.02	<0.01	0.42	0.096	<0.2	0.68	<2	
Min.:	25	5.57	<0.1	2.40	1	3.0	10	3	136	2.79	0.100	<0.02	<0.010	0.24	<0.10	0.15	<0.50	<2	0.06
Max.:	267	14.20	2.7	5.1	8	11	155	26	210	6.00	0.330	0.200	0.010	0.81	0.29	0.58	10.00	14	0.30
Aver.:	57	10.48	1.0	3.1	4	7	73	10	170	4.52	0.202	0.063	0.010	0.46	0.17	0.25	1.61	4	0.17
St.dev.:	64	2.64	0.6	0.7	2	2	40	6	22	1.21	0.074	0.064	0.000	0.15	0.06	0.11	2.61	3	0.11
Numb.:	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	4

Appendix VIII. Tributary rivers. Measured concentrations 2003

Table VIII. Tributary rivers, measured concentrations 2003

County		Watercourse	Drainage area Outlet km ²	Precip. 2003 (% of normal)	Flow (outlet)		Parameter																
					Normal 1930-60 10 ⁶ m ³ /år	2003	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.	1588	101 %	721	725	5.05	2	7.6	2	16	566	13	805	3.00	0.27	0.19	0.019	1.2	0.28	0.82	2.4	<2
	003	Iddefjord Mosselva. Mossesundet	690	86 %	316	271	8.47	7.2	7.3	<4	28	513	17	942	0.73	0.36	0.29	<0.01	1.4	0.27	1.0	1.6	4
Oslo og Akers- hus (1.)	004	Hølenelva.	137	89 %	60	54	19.7	7.4	12.0	32	79	1508	94	2016	8.14	0.77	0.6	0.02	2.5	0.68	2.6	4.3	11
	005	Drøbaksundet Ø	52	89 %	21	19	27.2	1.1	5.8	22	35	3720	10	3860	1.03	0.34	0.05	<0.01	1.6	0.13	1.6	1.1	7
	006	Årungenelva. Indre Oslofjord	86	95 %	38	36	17.4	1.6	6.7	4	11	1041	32	1332	3.43	0.26	0.09	<0.01	1.5	0.14	1.8	1.3	8
	007	Gjersjøelva. Indre Oslofjord	42	89 %	17	15	32.3	2.7	5.7	30	54	965	62	1296	5.57	0.47	0.36	0.02	2.9	0.22	2.4	4.7	7
	008	Ljanselva. Indre Oslofjord	75	89 %	31	27	26.8	34.6	7	34	115	1010	120	1705	7.07	0.56	4.7	0.091	11.0	1.4	2.4	34	9
	009	Loelva/Alna. Indre Oslofjord	227	89 %	125	111	5.28	1.2	4.6	<4	10	244	35	416	3.43	0.18	0.59	0.032	1.3	0.13	0.44	5.4	6
	010	Akerselva. Indre Oslofjord	23	89 %	11	10	18.9	4.3	5.1	23	46	899	52	1170	5.79	0.32	0.54	0.018	3.8	0.27	1.1	6.3	6
	011	Frognerelva. Indre Oslofjord	178	89 %	94	84	6.69	1.8	5.2	<4	20	175	27	415	2.79	0.13	0.15	0.011	0.76	0.076	0.28	1.1	3
	012	Sandvikselva. Indre Oslofjord	223	89 %	129	115	10.9	9.5	7.2	5	36	518	27	785	5.14	0.22	0.46	0.018	1.4	0.27	0.54	2.6	4
	013	Åroselva. Indre Oslofjord	113	89 %	61	54	18.3	61.6	8.8	18	80	4220	137	4880	7.71	0.74	1.5	0.097	3.5	1.2	1.5	13	20
Buske- rud (2.)	014	Lierelva. Drammensfjord Ø	309	89 %	181	161	14.3	177	8.8	14	147	2290	17	2660	11.36	1.20	3.1	0.085	5.8	2.30	3.7	23	17
Vestfold (3.)	016	Sandeelva.	193	83 %	103	86	436	3.5	4.5	1	38	366	72	766	2.79	<0.5	0.35	0.12	2.3	<0.5	<2	11	41
	017	Sandebukta	363	83 %	171	142	3.1	8.3	6.7	11	70	940	64	1330	4.07	0.58	0.36	<0.01	1.4	0.23	1	2.6	44
	019	Tønsbergfjord Farriselva. Larvikfjord	491	86 %	334	288	20.40	0.6	4.8	<1	6	385	9	521	3.21	0.15	0.08	0.029	0.65	0.27	0.19	8.1	13

County		Watercourse	Drainage area Outlet km ²	Precip. 2003 (% of normal)	Flow (outlet)		Parameter																
					Normal 1930-60 10 ⁶ m ³ /år	2003	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
Tele- mark (4.)	021	Tokkeelva. Kragerø	1238	100 %	1042	1047	1.99	1.8	5.6	<1	10	170	3	318	2.36	0.15	0.2	0.033	0.44	0.12	0.37	5.7	3
Aust- Agder (5.)	022	Gjerstadelva. Søndeledfjord	419	102 %	357	364	1.90	1.7	6.8	<1	13	115	28	264	1.80	0.3	0.51	0.042	0.58	0.17	0.6	6.3	4
	023	Vegårdselva. Sandnesfjord	457	91 %	422	384	2.61	1.5	6	<1	3	114	27	307	1.29	0.3	0.37	0.042	0.68	0.19	0.55	6.8	<2
	024	Nidelva. Arendal	4025	88 %	3783	3329	1.49	0.7	3.6	<1	1	118	6	226	1.20	0.12	0.19	0.03	0.72	0.08	<0.2	4	<2
Vest- Agder (5.)	025	Tovdalselva. Topdalsfjord	1856	84 %	1984	1667	1.84	1.1	4.3	<1	<1	84	4	210	0.64	0.17	0.22	0.022	0.24	0.085	0.21	2.5	2
	027	Søgneelva. Flekkerøy	204	84 %	244	205	6.03	1.4	5.1	<1	8	602	22	817	1.89	0.29	0.44	0.054	0.7	0.13	0.49	4.7	2
	028	Mandalselva. Mannefjord	1809	94 %	2624	2467	1.64	1.2	3.7	<1	<1	165	17	298	0.71	0.12	0.33	0.019	0.22	0.07	<0.2	2.3	5
	029	Audna. Sniksfjord	450	94 %	639	600	3.67	1.1	4.4	<1	<1	324	10	483	1.26	0.22	0.3	0.037	0.27	0.066	<0.2	4.3	<2
	030	Lygna. Lyngdalsfjord	664	96 %	1005	965	2.95	0.9	3.9	<1	1	310	53	467	1.37	0.23	0.31	0.027	0.28	0.059	<0.2	3.8	4
	031	Kvina. Fedafjord	1445	96 %	2625	2520	3.27	0.7	4.9	<1	1	266	20	482	1.24	0.26	0.43	0.017	0.42	0.08	<0.2	2.8	2
	032	Sira. Åna-Sira	1916	101 %	3589	3625	1.60	0.8	2.2	<1	1	212	10	263	0.99	0.098	0.29	0.016	0.28	0.074	<0.2	2.5	11
Roga- land (6.)	033	Sokndalselva. Sogndalsstrand	294	105 %	474	497	4.38	2.2	2.2	<1	<1	282	19	347	1.03	0.17	0.23	0.027	0.75	0.073	6.2	3.7	2
	034	Hellelandselva. Egersund	241	105 %	437	459	3.15	1	3.3	1	9	315	22	430	0.90	0.17	0.38	0.019	0.39	0.06	0.28	2.9	3
	035	Bjerkreimselva. Egersund	705	105 %	1727	1814	3.34	0.8	2.1	2	2	332	19	380	1.26	0.069	0.2	0.019	0.19	<0.05	<0.2	1.4	3
	036	Håelva. Håtangen	165	100 %	244	244	11.2	1.6	4.7	17	47	936	76	1240	3.43	0.37	0.095	0.012	0.75	0.13	0.63	2.6	<2
	038	Figgjo. Solavika	229	100 %	361	361	10.1	2	3.6	7	27	596	76	854	1.91	0.2	0.23	<0.01	0.67	0.11	0.37	2.3	5
	039	Ims-Lutsivasdraget Høgsfjord Boknafj.	127	100 %	140	140	7.03	0.9	3.2	<1	<1	509	13	645	0.39	0.13	0.085	<0.01	0.53	0.12	0.2	1.2	<2
	040	Oltedalselva. Høgs- fjord Boknafj.	102	100 %	225	225	3.75	0.6	2.1	<1	<1	290	9	345	1.97	0.087	0.11	0.015	0.38	0.072	0.23	2.4	6

County		Watercourse	Drainage area Outlet km ²	Precip. 2003 (% of normal)	Flow (outlet)		Parameter																
					Normal 1930-60 10 ⁶ m ³ /år	2003	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
(7.)	041	Dirdalselva. Høgsfjord Boknafjord	158	100 %	414	414	2.22	<0.6	1.8	<1	<1	299	4	345	1.20	0.093	0.19	0.011	0.27	0.061	<0.2	0.88	3
	042	Frafjordelva. Frافjord Boknafjord	178	100 %	530	530	2	<0.6	1.8	<1	<1	234	15	252	0.94	0.08	0.19	<0.01	0.24	0.066	<0.2	1	4
	043	Espedalselva. Høgsfjord Boknafj.	138	100 %	392	392	2.29	0.6	1.6	<1	<1	194	5	237	1.74	0.052	0.08	<0.01	0.18	<0.05	<0.2	0.83	6
	044	Lyseelva. Lysefjord Boknafjord	182	100 %	425	423	1.7	<0.6	1.8	<1	<1	65	12	137	1.26	<0.05	0.11	<0.01	0.22	0.058	<0.2	0.64	2
	045	Årdalselva. Årdalsfjord Boknafjord	519	102 %	1332	1359	2.22	<0.6	1.6	<1	<1	180	3	245	1.03	<0.05	0.089	<0.01	0.16	0.062	<0.2	0.9	15
	046	Førreelva. Jøsen-fjord Boknafjord	163	102 %	441	450	2.22	<0.6	1.9	<1	1	97	<1	126	1.26	<0.05	0.041	<0.01	0.14	0.052	<0.2	<0.5	5
	047	Ulla. Jøsenfjord Boknafjord	393	102 %	1034	1054	2.31	<0.6	2	<1	<1	173	1	254	1.61	<0.05	0.066	<0.01	0.25	<0.05	<0.2	0.73	<2
	049	Saudaelva. Saudafjord Boknafjord	353	91 %	946	861	3.77	<0.6	2.1	<1	<1	1150	3	1340	1.59	0.057	0.035	0.032	1	0.092	<0.2	8.8	8
	050	Åbøelva. Saudafjord Boknafjord	82	91 %	220	200	0.91	<0.6	1.4	<1	<1	93	3	116	<0.21	<0.05	0.06	<0.01	0.2	<0.05	<0.2	0.7	8
	051	Vikedalselva. Vindafjord Boknafj.	118	91 %	298	271	2.59	0.9	2.2	<1	4	244	13	344	0.56	0.23	0.11	<0.01	0.35	<0.05	<0.2	0.94	3
Hordaland (7.)	052	Etneelva. Etnefjord Bømlafjord	252	91 %	388	353	2.3	0.6	1.7	<1	3	321	7	407	0.21	0.12	0.038	0.011	0.4	<0.05	<0.2	1.4	63
	053	Opo. Sørfjord Hardangerfjord	482	91 %	1205	1097	0.94	3.5	1.3	<1	2	97	7	125	1.29	<0.05	0.44	0.011	0.37	0.24	<0.2	3	4
	054	Tysso. Sørfjord Hardangerfjord	388	91 %	970	883	2.2	<0.6	1.4	<1	<1	150	5	181	1.05	<0.05	0.03	0.012	0.48	<0.05	<0.2	2.8	6
	055	Kinso. Sørfjord Hardangerfjord	281	102 %	408	416	1.82	<0.6	1.2	<1	<1	42	11	105	0.28	<0.05	0.029	<0.01	0.19	<0.05	<0.2	<0.5	4
	056	Veig. Eidfjord Hardangerfjord	496	102 %	654	667	2.45	<0.6	1.3	<1	<1	39	2	118	0.79	<0.05	<0.02	<0.01	0.18	<0.05	<0.2	<0.5	5
	057	Bjoreia. Eidfjord Hardangerfjord	592	95 %	485	463	1.85	0.7	2.2	<1	1	59	9	146	0.77	<0.05	0.087	<0.01	0.53	<0.05	0.27	0.82	2
	058	Sima. Eidfjord Hardangerfjord	145	102 %	316	323	2.09	<0.6	1.5	<1	<1	91	12	127	1.89	<0.05	0.027	<0.01	0.16	<0.05	<0.2	<0.5	18
	059	Austdøla. Osafjord Eidfjord	131	102 %	308	314	0.73	<0.6	1.3	<1	<1	49	9	93	0.47	<0.05	0.044	<0.01	0.17	0.078	<0.2	<0.5	<2
	060	Norddøla. Osafjord Eidfjord	40	102 %	94	96	3.06	<0.6	0.4	<1	1	62	12	106	0.88	0.097	0.044	<0.01	0.14	0.08	<0.2	<0.5	5
	061	Tysseelva. Fusafjord	240	101 %	643	650	1.23	<0.6	2.2	<1	1	99	8	154	0.36	0.066	0.17	<0.01	0.37	0.055	<0.2	1.3	10

County		Watercourse	Drainage area Outlet km ²	Precip. 2003 (% of normal)	Flow (outlet)		Parameter																
					Normal 1930-60 10 ⁶ m ³ /år	2003	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
Sogn og Fjordane (7.)	062	Oselva. Fusafjord	109	117 %	315	369	2.96	0.6	3.6	<1	6	81	17	177	0.79	0.14	0.074	<0.01	0.91	0.17	0.38	1.6	15
	063	Bergsdalse. Veafjord Herdlafj.	198	105 %	500	523	1.68	<0.6	2.5	<1	1	106	8	224	0.58	<0.05	0.19	<0.01	0.33	0.061	<0.2	1.7	4
	064	Vosso. Veafjord Sørfjord	1492	105 %	2738	2867	0.98	<0.6	2.6	<1	<1	64	11	188	0.62	<0.05	0.03	<0.01	0.2	<0.05	<0.2	0.79	8
	065	Ekso. Osterfjord	414	110 %	1125	1238	1.36	<0.6	2.6	<1	2	53	16	166	0.49	<0.05	0.1	<0.01	0.22	<0.05	<0.2	1.6	3
	066	Modalselva. Osterfjord	385	110 %	1159	1275	0.86	<0.6	2.1	<1	<1	78	6	116	0.58	<0.05	0.11	<0.01	0.14	<0.05	<0.2	0.76	7
	067	Nærøyelva. Aur- landsfjord Sognefj.	290	102 %	544	554	1.01	<0.6	1.3	<1	<1	49	6	107	1.65	<0.05	0.023	<0.01	0.24	<0.05	<0.2	<0.5	14
	068	Flåmselva. Aurlands- fjord Sognefj.	280	102 %	463	472	1.05	<0.6	0.9	<1	<1	64	7	100	0.49	<0.05	0.032	<0.01	0.18	<0.05	<0.2	0.6	<2
	069	Aurlandv. Aurlands- fjord Sognefjord	800	102 %	1226	1251	1.41	2.3	2.1	<1	2	85	8	133	1.05	<0.05	0.2	<0.01	0.64	0.11	<0.2	1.1	2
	070	Erdalselva. Lærdals- fjord Sognefj.	138	102 %	131	133	0.73	<0.6	1.6	<1	<1	20	4	60	0.66	<0.05	0.029	<0.01	0.18	<0.05	<0.2	<0.5	7
	071	Lærdalsv. Lærdals- fjord Sognefjord	1184	105 %	1120	1176	1.75	<0.6	1.3	<1	1	54	9	110	1.22	<0.05	<0.02	<0.01	0.41	<0.05	0.2	<0.5	3
	072	Årdalselva. Årdals- fjord Sognefjord	989	105 %	1400	1467	0.93	1.4	2.1	<1	1	74	7	110	1.35	<0.05	0.03	<0.01	1	0.07	<0.2	0.64	4
	073	Fortunelva. Luster- fjord Sognefjord	508	105 %	817	856	0.67	2	1.5	<1	2	71	2	96	1.31	<0.05	0.11	<0.01	0.99	0.12	<0.2	0.94	9
	074	Mørkriselva. Luster- fjord Sognefjord	282	105 %	486	510	0.63	7	1.3	<1	6	47	8	65	1.93	<0.05	0.18	<0.01	0.65	0.62	0.49	2	<2
	075	Jostedøla. Lusterfjord Sognefjord	865	105 %	1855	1943	0.50	63.2	1.2	1	89	46	9	59	6.86	<0.05	0.83	<0.01	1.8	2.2	2	7.7	3
	076	Årøyelva. Sognefjord	449	108 %	1093	1185	1.24	2	1.2	<1	1	55	6	99	1.24	<0.05	0.062	<0.01	0.22	<0.05	<0.2	0.8	3
	077	Sogndalselva Sogn- dalsfjord. Sognefj.	175	108 %	365	395	0.79	<0.6	0.6	<1	2	13	11	42	0.60	0.15	0.025	<0.01	0.18	<0.05	<0.2	<0.5	6
	078	Gaular. Dalsfjord Bufjord	627	104 %	1568	1631	1.15	0.8	2	<1	3	68	3	160	0.62	<0.05	0.039	<0.01	0.17	<0.05	<0.2	0.68	9
	079	Jølstra. Førdefjord	714	106 %	1673	1773	1.52	0.6	1.9	<1	1	106	5	174	0.69	<0.05	0.03	<0.01	0.18	<0.05	<0.2	0.9	54
	080	Nausta. Førdefjord	277	106 %	714	757	1.09	0.7	2.3	<1	8	43	15	162	0.43	<0.05	0.057	<0.01	0.17	<0.05	<0.2	0.57	<2

County		Watercourse	Drainage area Outlet km ²	Precip. 2003 (% of normal)	Flow (outlet)		Parameter																
					Normal 1930-60 10 ⁶ m ³ /år	2003	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
Møre og Roms- dal (8.)	081	Oselva. Høydalsfjord	287	114 %	712	810	1.87	0.6	3.2	<1	3	31	10	166	<0.21	0.069	0.091	<0.01	0.63	0.077	<0.2	1.2	39
	082	Hopselva. Hyefjord Nordfjord S	73	102 %	173	176	0.92	<0.6	1.5	<1	<1	85	2	138	0.28	<0.05	0.067	<0.01	0.1	<0.05	<0.2	<0.5	9
	083	Gjengedalselva. Hyefjord Nordfjord S	170	112 %	402	450	1.10	0.8	2.1	<1	3	53	4	131	0.45	<0.05	0.041	<0.01	0.14	<0.05	<0.2	0.61	4
	084	Breimselva. Gloppen- fjord Nordfjord S	636	112 %	1364	1528	1.39	0.8	1.6	<1	4	108	7	175	0.99	<0.05	0.037	<0.01	0.22	0.055	<0.2	<0.5	8
	085	Oldenelva. Indre Nordfjord	226	112 %	500	560	1.16	1.9	1.7	<1	7	112	2	189	1.14	<0.05	0.08	<0.01	0.33	0.14	<0.2	0.59	<2
	086	Loenelva. Indre Nordfjord	261	112 %	535	599	1.19	1.6	1.3	<1	5	71	4	85	1.37	<0.05	0.083	<0.01	0.43	0.24	<0.2	0.65	4
	087	Stryneelva. Indre Nordfjord	531	112 %	1008	1129	1.55	1.3	1.6	<1	4	84	6	147	1.20	<0.05	0.037	<0.01	0.35	0.13	<0.2	<0.5	4
	088	Hornindalselva. Nordfjord N	428	112 %	784	878	2.25	0.7	1.8	<1	2	123	11	161	1.29	0.1	0.03	<0.01	0.24	<0.05	<0.2	0.84	3
	089	Ørstaelva. Ørstaffjord	160	107 %	353	378	2.50	0.9	1.8	<1	3	75	16	156	1.93	0.092	0.025	<0.01	0.29	<0.05	<0.2	<0.5	3
	090	Valldøla. Nordalfjord Storfjord	359	98 %	679	667	0.92	0.6	1	<1	<1	20	5	34	0.96	0.082	0.028	<0.01	0.3	0.068	<0.2	<0.5	3
	091	Rauma. Romsdals- fjord Moldefjord	1202	112 %	1243	1388	1.21	0.7	1	<1	<1	28	6	49	1.20	0.057	<0.02	<0.01	0.27	<0.05	<0.2	<0.5	7
	092	Isa. Isfjord Moldefjord	175	108 %	315	340	1.12	1.3	1	1	1	33	6	44	1.59	0.053	0.037	<0.01	0.38	0.27	<0.2	<0.5	<2
	093	Eira. Eresfjord Moldefjord	1119	116 %	1228	1425	2.19	<0.6	1.1	<1	<1	138	2	158	2.57	<0.05	0.075	<0.01	0.3	<0.05	<0.2	0.83	7
	094	Littlelalselva. Sunndalsfjord	359	118 %	464	548	2.72	<0.6	1.1	<1	<1	113	1	142	3.64	<0.05	0.03	<0.01	0.28	0.11	<0.2	<0.5	4
	095	Driva.Sunndalsfjord Tingvollfjord	2487	116 %	2188	2527	2.24	1.3	1.3	<1	3	56	3	94	2.14	0.086	0.045	<0.01	0.73	0.14	<0.2	0.6	3
	096	Ulvåa. Ålvundfjord	199	115 %	358	410	1.25	3.4	1.6	2	4	35	4	85	2.36	0.051	0.086	<0.01	0.89	0.2	<0.2	0.91	29
	097	Toåa. Todalsfjord	251	115 %	463	530	1.41	0.7	2.2	<1	1	36	3	89	1.29	0.069	0.03	<0.01	0.41	<0.05	<0.2	<0.5	9
	098	Surna. Surnadalsfjord	1200	115 %	1816	2089	2.34	1.7	2.3	<1	4	77	2	143	1.35	0.081	0.11	<0.01	0.75	0.1	0.21	0.64	<2
	099	Bøvra. Hamnesfjord Halsafjord	243	115 %	421	485	3.39	0.7	2.3	1	1	550	12	619	1.91	0.082	0.028	<0.01	0.43	0.082	0.24	0.72	5

County		Watercourse	Drainage area Outlet km ²	Precip. 2003 (% of normal)	Flow (outlet)		Parameter																
					Normal 1930-60 10 ⁶ m ³ /år	2003	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	123 %	104	128	14.1	5.3	5.1	16	33	436	66	753	1.80	0.46	0.16	<0.01	1.8	0.43	1.7	1.2	3
	102	Vigda. Gaulosen Trondheimsfjord.	150	123 %	142	175	12.2	8.9	2.9	1	12	243	6	378	2.14	0.26	0.097	<0.01	1.1	0.33	0.72	0.6	8
	103	Gaula. Gaulosen Trondheimsfjord.	3659	108 %	3046	3280	7.05	16.4	3.9	1	16	133	17	273	2.79	0.2	0.14	<0.01	1.4	0.54	1.4	1.3	<2
	104	Nidelva. Trondheimsfjord	3110	118 %	3482	4108	10.60	1.7	3.4	1	6	43	14	226	1.29	0.21	0.042	<0.01	0.81	0.22	0.64	0.64	70
	105	Homla. Stjørdalsfjord Trondheimsfjord	157	97 %	149	144	8.18	1.8	5.6	<1	6	64	7	225	1.82	0.67	0.045	<0.01	0.83	0.15	0.52	0.63	5
Nord-Trøndelag (8.)	106	Stjørdalselva. Stjørdalsfj. Trondheimsfj.	2117	106 %	2570	2725	4.4	1.9	4.5	<1	3	118	5	239	0.88	0.15	0.034	<0.01	1.4	0.17	0.61	1.8	9
	107	Gråelva. Stjørdalsfjord Trondheimsfj.	93	101 %	73	74	15.0	1.9	5.5	9	22	456	24	712	1.03	0.59	0.092	<0.01	1.1	0.18	0.71	<0.5	14
	108	Verdalsvassdraget. Trondheimsfjord.	1472	94 %	1857	1745	4.97	1.2	5	<1	1	55	7	197	1.03	0.16	0.041	<0.01	0.8	0.16	0.56	<0.5	5
	109	Figga/Leksdalselva. Trondheimsfjord	1080	98 %	1376	1348	5.53	4.1	12	1	12	125	2	368	2.14	0.33	0.22	<0.01	1.2	0.53	0.9	1.1	<2
	110	Snåsavassdraget. Trondheimsfjord	1095	98 %	1376	1349	4.77	1.6	4.2	<1	3	103	10	229	1.03	0.14	0.027	<0.01	0.61	0.16	0.53	0.82	6
	111	Årgårdselva. Namsfjord	1110	97 %	1376	1335	6.25	2.9	6.4	1	9	102	5	311	1.80	0.18	0.081	<0.01	0.7	0.29	0.4	0.52	10
Nordland (9.)	112	Namsen. Namsfjord Ø	1124	133 %	1376	1830	15.2	1.3	2.1	<1	2	43	4	117	0.62	0.12	0.024	<0.01	0.61	0.1	0.25	0.61	<2
	113	Salsvatnelva. Follafjord	1154	101 %	1374	1387	4.86	<0.6	1.9	3	5	67	8	137	1.03	<0.05	0.031	<0.01	0.26	0.32	<0.2	1.1	9
	114	Åbjøra. Bindalsfjord S	526	110 %	1330	1464	1.58	0.7	0.9	1	4	25	11	81	0.30	<0.05	0.025	<0.01	0.16	0.46	<0.2	<0.5	11
	116	Skjerva. Vefsenfjord S*	104	116 %	135	158	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	116 %	1088	1265	2.35	0.8	1.1	1	5	13	12	203	0.36	<0.05	0.025	<0.01	0.29	0.061	0.21	<0.5	8
	118	Drevja. Vefsenfjord N*	177	116 %	363	422	4.66	1.0	0.9	12	12	4	<2	80	0.39	0.068	0.07	<0.01	0.21	0.078	0.22	<0.5	<2
	119	Røssåga. Sørfjord	2092	134 %	2995	4014	3.87	1.9	0.9	1	6	43	10	108	0.73	<0.05	0.034	<0.01	0.38	0.065	0.45	3.9	<2
	120	Bjerka. Sørfjord	385	124 %	673	832	3.15	<0.6	1.9	<1	4	17	9	97	0.84	<0.05	0.055	<0.01	0.77	0.1	0.56	1.3	6

County		Watercourse	Drainage area Outlet km ²	Precip. 2003 (% of normal)	Flow (outlet)		Parameter																
					Normal 1930-60 10 ⁶ m ³ /år	2003	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
Troms (9.)	121	Dalselva. Ranafjord N*	211	124 %	263	325	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	3847	124 %	5447	6738	2.73	1.3	0.9	1	6	35	5	84	1.50	<0.05	0.13	<0.01	0.55	0.39	0.43	1.5	<2
	123	Fykanåga. Glomfjord*	297	105 %	971	1019	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	1064	37 %	1513	560	2.69	3.4	0.4	<1	10	23	7	61	1.35	<0.05	0.059	<0.01	0.36	0.14	0.34	<0.5	4
	125	Saltdalsvassdraget. Saltdalsfjord S	1544	37 %	1563	578	3.28	0.8	0.6	1	4	28	2	80	1.59	<0.05	<0.02	<0.01	0.29	<0.05	0.4	<0.5	194
	126	Sulitjelmavassdraget. Saltdalsfjord S	1028	109 %	1426	1548	2.18	<0.6	0.6	<1	5	9	4	67	0.39	<0.05	<0.02	0.033	0.71	<0.05	<0.2	<0.5	5
	127	Kobbelva. Leirfjord Sørfolda N*	405	118 %	854	1008	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	156 %	967	1508	2.05	<0.5	1.6	<1	2	12	8	38	1.52	0.11	0.036	<0.01	0.62	<0.05	<0.2	<0.5	<2
	129	Spanselva. Astafjord Vågsfjord *	142	125 %	224	280	9.65	0.8	0.9	1	9	78	2	98	1.33	0.065	0.15	0.015	0.64	0.086	1.5	0.80	4
	130	Salangselva. Astafjord Vågsfjord	539	143 %	695	996	7.43	0.7	1.4	<1	4	19	5	44	0.77	<0.05	<0.02	<0.01	0.25	<0.05	<0.2	<0.5	<2
	131	Rossfjordelva. Malangen*	196	141 %	244	345	7.62	1.1	1.8	5	10	7	<2	93	0.58	0.064	0.11	0.010	0.048	0.071	0.45	0.58	10
	132	Målselva. Måls- elvfjord Malangen	3239	134 %	2932	3928	6.3	0.7	1.8	1	2	26	5	55	1.54	<0.05	0.021	<0.01	0.35	0.069	0.25	0.6	5
	133	Barduelva. Målselv- fjorden Malangen	2906	134 %	2594	3475	6.55	1.8	1.4	<1	3	13	16	69	1.29	<0.05	0.077	<0.01	0.73	0.06	0.29	0.58	<2
	134	Nordkjøselva. Balsfjord*	191	140 %	167	234	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	140 %	413	578	3.76	0.8	2.3	3	6	30	16	69	1.78	0.15	0.03	<0.01	0.78	0.18	0.41	0.83	<2
	136	Skibotnelva. Lyngen	770	140 %	437	612	3.41	<0.5	2.0	<1	<1	24	10	69	1.61	0.073	0.025	<0.01	0.45	<0.05	1.2	0.5	<2
	137	Kåfjordelva. Lyngen Ø*	358	140 %	226	316	3.58	<0.6	0.7	3	27	38	2	102	1.31	0.059	0.11	<0.01	0.92	0.11	0.67	<0.5	6
	138	Reisa. Reisafjord	2702	122 %	1363	1667	3.92	0.7	1.8	3	6	38	17	90	2.57	0.13	0.044	<0.01	0.75	0.087	0.45	2.5	8

County		Watercourse	Drainage area Outlet km ²	Precip. 2003 (% of normal)	Flow (outlet)		Parameter																	
					Normal 1930-60 10 ⁶ m ³ /år	2003	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	98 %	272	266	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	98 %	111	109	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*	1090	112 %	859	962	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	1108	112 %	639	716	3.43	0.8	2.3	1	1	16	7	62	1.95	0.08	<0.02	<0.01	0.1	0.051	0.13	0.63	5	
	144	Lakselva. Indre Porsangen S	1533	112 %	769	861	5.44	1	2.6	1	3	10	6	85	2.14	0.05	0.054	<0.01	0.37	0.15	0.33	<0.5	<2	
	145	Børselva.Indre Porsangen Ø*	883	109 %	830	900	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	120 %	73	87	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	120 %	477	572	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	120 %	73	88	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	120 %	442	531	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	16389	110 %	5944	6538	5.17	0.7	3.1	4	9	<1	15	84	4.93	0.07	<0.02	<0.01	0.34	0.18	0.24	<0.5	<2	
	151	Vesterelva. Syltefjord*	469	128 %	512	655	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	141 %	358	505	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	18404	141 %	5398	7611	3.46	1.3	3.9	2	3	2	7	141	1.91	0.08	<0.02	<0.01	0.49	0.069	0.28	<0.5	<2	
	154	Neiden. Munkfjord Varangerfjord	2960	141 %	915	1290	3.74	1.4	4.2	3	14	<1	8	126	3.43	0.19	0.071	<0.01	1	0.1	5.9	<0.5	<2	
	155	Grense Jakobselv. Varangerfjord	234	139 %	133	184	4.88	1.2	3.3	1	3	6	1	126	3.64	0.2	0.028	<0.01	2.2	0.21	7.7	<0.5	7	

* Analytical results from these tributary rivers in Nordland and Troms are from 2002, those in Finnmark are from 2001.

Appendix IX. Tributary rivers. Annual load 2003

Table IX. Tributary rivers, annual load 2003

County	Watercourse	S.P.M. tonnes	TOC tonnes	PO ₄ -P tonnes	Tot-P tonnes	NO ₃ -N tonnes	NH ₄ -N tonnes	Tot-N tonnes	Parameter								
									SiO ₂ tonnes	As kg	Pb kg	Cd kg	Cu kg	Cr kg	Ni kg	Zn kg	Hg kg
Østfold (1.)	001 Tista. Iddefjord	1449	5508	1.45	11.60	410	9.4	583	2174	196	138	13.8	870	203	594	1739	< 1.4
	003 Mosselva. Mossesundet	1954	1981	< 1.1	7.60	139	4.6	256	198	98	79	< 2.7	380	73	271	434	1.09
Oslo og Akershus (1.)	004 Hølenelva. Drøbaksundet Ø	398	646	1.72	4.25	81	5.1	109	438	41	32	1.1	135	37	140	231	0.59
	005 Årungenelva. Indre Oslofjord	21	110	0.42	0.66	71	0.2	73	20	6	1	< 0.2	30	2	30	21	0.13
	006 Gjersjøelva. Indre Oslofjord	58	242	0.14	0.40	38	1.2	48	124	9	3	< 0.4	54	5	65	47	0.29
	007 Ljanselva. Indre Oslofjord	41	87	0.46	0.83	15	1.0	20	85	7	6	0.3	44	3	37	72	0.11
	008 Loelva/Alna. Indre Oslofjord	947	192	0.93	3.15	28	3.3	47	194	15	129	2.5	301	38	66	930	0.25
	009 Akerselva. Indre Oslofjord	134	513	< 0.4	1.11	27	3.9	46	382	20	66	3.6	145	14	49	602	0.67
	010 Frognerelva. Indre Oslofjord	42	49	0.22	0.45	9	0.5	11	56	3	5	0.2	37	3	11	61	0.06
	011 Lysakerelva. Indre Oslofjord	151	436	< 0.3	1.68	15	2.3	35	234	11	13	0.9	64	6	24	92	0.25
	012 Sandvikselva. I. Oslofjord	1094	829	0.58	4.15	60	3.1	90	592	25	53	2.1	161	31	62	299	0.46
	013 Åroselva. Indre Oslofjord	3321	474	0.97	4.31	228	7.4	263	416	40	81	5.2	189	65	81	701	1.08
	014 Lierelva. Drammensfjord Ø	28552	1420	2.26	23.71	369	2.7	429	1832	194	500	13.7	936	371	597	3710	2.74
Vestfold (3.)	016 Sandeelva. Sandebukta	301	386	0.09	3.26	31	6.2	66	239	< 43	30	10.3	198	< 43	< 172	945	3.52
	017 Aulielva. Tønsbergfjord	1175	949	1.56	9.91	133	9.1	188	576	82	51	< 1.4	198	33	142	368	6.23
	019 Farriselva. Larvikfjord	173	1384	< 0.3	1.73	111	2.6	150	927	43	23	8.4	187	78	55	2336	3.75
Tele- mark (4.)	021 Tokkeelva. Kragerø	1884	5863	< 1.0	10.47	178	3.1	333	2468	157	209	34.5	461	126	387	5967	3.14
Aust- Agder (5.)	022 Gjerstadelva. Søndeledfjord	619	2475	< 0.4	4.73	42	10.2	96	655	109	186	15.3	211	62	218	2293	1.46
	023 Vegårdselva. Sandnesfjord	576	2306	< 0.4	1.15	44	10.4	118	494	115	142	16.1	261	73	211	2613	< 0.8
	024 Nidelva. Arendal	2330	11983	< 3.3	3.33	393	20.0	752	3994	399	632	99.9	2397	266	< 666	13315	< 6.7
Vest- Agder (5.)	025 Tovdalselva. Topdalsfjord	1833	7167	< 1.7	< 1.7	140	6.7	350	1071	283	367	36.7	400	142	350	4167	3.33
	027 Søgneelva. Flekkerøy	287	1047	< 0.2	1.64	124	4.5	168	387	60	90	11.1	144	27	101	965	0.41
	028 Mandalselva. Mannefjord	2960	9127	< 2.5	< 2.5	407	41.9	735	1744	296	814	46.9	543	173	< 493	5674	12.33
	029 Audna. Sniksfjord	660	2641	< 0.6	< 0.6	194	6.0	290	759	132	180	22.2	162	40	< 120	2581	< 1.2
	030 Lygna. Lyngdalsfjord	868	3763	< 1.0	0.96	299	51.1	451	1323	222	299	26.1	270	57	< 193	3667	3.86
	031 Kvina. Fedafjord	1764	12347	< 2.5	2.52	670	50.4	1215	3132	655	1084	42.8	1058	202	< 504	7055	5.04
	032 Sira. Åna-Sira	2900	7975	< 3.6	3.63	769	36.3	953	3573	355	1051	58.0	1015	268	< 725	9063	39.88

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 (6.)	033 Sokndalselva. Sogndalsstrand	1094	1094	< 0.5	< 0.5	140	9.5	173	512	85	114	13.4	373	36	3084	1841	0.99
	034 Hellelandselva. Egersund	459	1514	0.46	4.13	145	10.1	197	413	78	174	8.7	179	28	128	1331	1.38
	035 Bjerkreimselva. Egersund	1451	3809	3.63	3.63	602	34.5	689	2293	125	363	34.5	345	< 91	< 363	2539	5.44
	036 Håelva. Håtangen	390	1147	4.15	11.47	228	18.5	303	837	90	23	2.9	183	32	154	635	< 0.5
	038 Figgjo. Solavika	722	1300	2.53	9.75	215	27.4	308	689	72	83	< 3.6	242	40	134	831	1.81
	039 Ims-Lutsi. Høgsfjord Boknafjord	126	447	< 0.1	< 0.1	71	1.8	90	54	18	12	< 1.4	74	17	28	168	< 0.3
	040 Oltedalselva Høgsfjord Boknafj.	135	473	< 0.2	< 0.2	65	2.0	78	444	20	25	3.4	86	16	52	540	1.35
	041 Dirdalselva Høgsfjord Boknafj.	< 248	744	< 0.4	< 0.4	124	1.7	143	496	38	79	4.5	112	25	< 83	364	1.24
	042 Frafjordelva. Frafjord Boknafj.	< 318	954	< 0.5	< 0.5	124	7.9	134	500	42	101	< 5.3	127	35	< 106	530	2.12
	043 Espedalselva. Høgsfj. Boknafj.	235	627	< 0.4	< 0.4	76	2.0	93	680	20	32	< 3.9	71	< 20	< 78	325	2.35
	044 Lyseelva. Lysefjord Boknafjord	< 254	761	< 0.4	< 0.4	27	5.1	58	534	< 21	46	< 4.2	93	25	< 85	270	0.85
	045 Årdalselva. Årdalsfjord Boknafj.	< 815	2174	< 1.4	< 1.4	245	4.1	333	1398	< 68	121	< 13.6	217	84	< 272	1169	20.38
	046 Førreelva. Jøsenfjord Boknafj.	< 270	855	< 0.4	0.45	44	< 0	57	569	< 22	18	< 4.5	63	23	< 90	< 225	2.25
	047 Ulla. Jøsenfjord Boknafjord	< 632	2108	< 1.1	< 1.1	182	1.1	268	1694	< 53	70	< 10.5	264	< 53	< 211	769	< 2.1
	049 Saudaelva. Saudafjord Boknafj.	< 517	1808	< 0.9	< 0.9	990	2.6	1154	1365	49	30	27.6	861	79	< 172	7577	6.89
(7.)	050 Åbøelva. Saudafjord Boknafj.	< 120	280	< 0.2	< 0.2	19	0.6	23	< 42	< 10	13	< 2.0	40	< 10	< 40	132	1.60
	051 Vikedalselva. Boknafjord	244	596	< 0.3	1.08	66	3.5	93	151	62	30	< 2.7	95	< 14	< 54	255	0.81
	052 Etneelva. Etnefjord Bømlafjord	212	600	< 0.4	1.06	113	2.5	144	76	42	13	3.9	141	< 18	< 71	494	22.23
	053 Opo. Sørfjord Hardangerfjord	3839	1426	< 1.1	2.19	106	7.7	137	1410	< 55	483	12.1	406	263	< 219	3291	4.39
	054 Tysso. Sørfjord Hardangerfjord	< 530	1236	< 0.9	< 0.9	132	4.4	160	927	< 44	26	10.6	424	< 44	< 177	2472	5.30
	055 Kinso. Sørfjord Hardangerfjord	< 249	499	< 0.4	< 0.4	17	4.6	44	116	< 21	12	< 4.2	79	< 21	< 83	< 208	1.66
	056 Veig. Eidfjord Hardangerfjord	< 400	867	< 0.7	< 0.7	26	1.3	79	529	< 33	< 13	< 6.7	120	< 33	< 133	< 333	3.33
	057 Bjoreia. Eidfjord Hardangerfjord	324	1018	< 0.5	0.46	27	4.2	68	357	< 23	40	< 4.6	245	< 23	125	380	0.93
	058 Sima. Eidfjord Hardangerfjord	< 194	484	< 0.3	< 0.3	29	3.9	41	609	< 16	9	< 3.2	52	< 16	< 65	< 161	5.81
	059 Austdøla. Osafjord Eidfjord	< 189	409	< 0.3	< 0.3	15	2.8	29	148	< 16	14	< 3.1	53	25	< 63	< 157	< 0.6
	060 Norddøla. Osafjord Eidfjord	< 58	38	< 0.1	0.10	6	1.2	10	84	9	4	< 1.0	13	8	< 19	< 48	0.48
	061 Tysseelva. Fusafjord	< 390	1429	< 0.6	0.65	64	5.2	100	237	43	110	< 6.5	240	36	< 130	845	6.50
	062 Oselva. Fusafjord	221	1328	< 0.4	2.21	30	6.3	65	292	52	27	< 3.7	336	63	140	590	5.53
	063 Bergsdalse. Veafjord Herdlafj.	< 314	1307	< 0.5	0.52	55	4.2	117	303	< 26	99	< 5.2	173	32	< 105	889	2.09
	064 Vosso. Veafjord Sørfjord	< 1720	7454	< 2.9	< 2.9	183	31.5	539	1781	< 143	86	< 28.7	573	< 143	< 573	2265	22.93
Hordaland (7.)	065 Ekso. Osterfjord	< 743	3219	< 1.2	2.48	66	19.8	206	610	< 62	124	< 12.4	272	< 62	< 248	1981	3.71
	066 Modalselva. Osterfjord	< 765	2678	< 1.3	< 1.3	99	7.7	148	738	< 64	140	< 12.8	179	< 64	< 255	969	8.93

County	Watercourse	Parameter															
		S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg
		tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	kg	kg	kg	kg	kg	kg	kg	kg
Sogn og Fjordane (7.)	067 Nærøyelva. Aurlandsfj. Sognefj	< 333	720	< 0.6	< 0.6	27	3.3	59	914	< 28	13	< 5.5	133	< 28	< 111	< 277	7.76
	068 Flåmselva. Aurlandsfj. Sognefj.	< 283	425	< 0.5	< 0.5	30	3.3	47	233	< 24	15	< 4.7	85	< 24	< 94	283	< 0.9
	069 Aurlandelva. Aurlandsfj. Sognefj	2876	2626	< 1.3	2.50	106	10.0	166	1313	< 63	250	< 12.5	800	138	< 250	1376	2.50
	070 Erdalselva. Lærdalsfj. Sognefj.	< 80	213	< 0.1	< 0.1	3	0.5	8	88	< 7	4	< 1.3	24	< 7	< 27	< 67	0.93
	071 Lærdalselva. Lærdalsfj. Sognefj	< 706	1529	< 1.2	1.18	64	10.6	129	1437	< 59	< 24	< 11.8	482	< 59	235	< 588	3.53
	072 Årdalselva. Årdalsfjord Sognefj.	2054	3081	< 1.5	1.47	109	10.3	161	1981	< 73	44	< 14.7	1467	103	< 293	939	5.87
	073 Fortunelva. Lusterfj. Sognefj.	1712	1284	< 0.9	1.71	61	1.7	82	1119	< 43	94	< 8.6	847	103	< 171	805	7.70
	074 Mørkriselva. Lusterfj. Sognefj.	3567	663	< 0.5	3.06	24	4.1	33	983	< 25	92	< 5.1	331	316	250	1019	< 1.0
	075 Jostedøla. Lusterfjord Sognefj.	122815	2332	1.94	172.95	89	17.5	115	13325	< 97	1613	< 19.4	3498	4275	3887	14963	5.83
	076 Årøyelva. Sogndalsfj. Sognefj.	2370	1422	< 1.2	1.18	65	7.1	117	1473	< 59	73	< 11.8	261	< 59	< 237	948	3.55
	077 Sogndalselva Sognd.fj. Sognefj	< 237	237	< 0.4	0.79	5	4.3	17	237	59	10	< 4.0	71	< 20	< 79	< 198	2.37
	078 Gaular. Dalsfjord Bufjord	1305	3261	< 1.6	4.89	111	4.9	261	1013	< 82	64	< 16.3	277	< 82	< 326	1109	14.68
	079 Jølstra. Førdefjord	1064	3369	< 1.8	1.77	188	8.9	309	1216	< 89	46	< 17.7	319	< 89	< 355	1596	95.76
	080 Nausta. Førdefjord	530	1740	< 0.8	6.05	33	11.3	123	324	< 38	43	< 7.6	129	< 38	< 151	431	< 1.5
	081 Oselva. Høydsalfjord	486	2592	< 0.8	2.43	25	8.1	134	< 170	56	74	< 8.1	510	62	< 162	972	31.59
	082 Hopselva. Hyefjord Nordfjord S	< 105	264	< 0.2	< 0.2	15	0.4	24	49	< 9	12	< 1.8	18	< 9	< 35	< 88	1.58
	083 Gjengedalselva. Hyefj. Nordfj.S	360	946	< 0.5	1.35	24	1.8	59	203	< 23	18	< 4.5	63	< 23	< 90	275	1.80
	084 Breimselva. Gloppenfj. Nordfj.S	1222	2444	< 1.5	6.11	165	10.7	267	1506	< 76	57	< 15.3	336	84	< 306	< 764	12.22
	085 Oldenelva. Indre Nordfjord	1063	951	< 0.6	3.92	63	1.1	106	636	< 28	45	< 5.6	185	78	< 112	330	< 1.1
	086 Loenelva. Indre Nordfjord	959	779	< 0.6	3.00	43	2.4	51	822	< 30	50	< 6.0	258	144	< 120	389	2.40
	087 Stryneelva. Indre Nordfjord	1468	1806	< 1.1	4.52	95	6.8	166	1355	< 56	42	< 11.3	395	147	< 226	< 565	4.52
	088 Hornindalselva. Nordfjord N	615	1581	< 0.9	1.76	108	9.7	141	1129	88	26	< 8.8	211	< 44	< 176	738	2.63
Møre og Romsdal (8.)	089 Ørstaelva. Ørsta fjord	340	680	< 0.4	1.13	28	6.0	59	729	35	9	< 3.8	110	< 19	< 76	< 189	1.13
	090 Valldøla. Nordalfjord Storfjord	400	667	< 0.7	< 0.7	13	3.3	23	643	55	19	< 6.7	200	45	< 133	< 334	2.00
	091 Rauma. Romsdalsfjord Moldefj.	971	1388	< 1.4	< 1.4	39	8.3	68	1665	79	< 28	< 13.9	375	< 69	< 278	< 694	9.71
	092 Isa. Isfjord Moldefjord	442	340	0.34	0.34	11	2.0	15	539	18	13	< 3.4	129	92	< 68	< 170	< 0.7
	093 Eira. Eresfjord Moldefjord	< 855	1567	< 1.4	< 1.4	197	2.8	225	3663	< 71	107	< 14.2	427	< 71	< 285	1182	9.97
	094 Littledalselva Sunndalsfjord	< 329	603	< 0.5	< 0.5	62	0.5	78	1995	< 27	16	< 5.5	153	60	< 110	< 274	2.19
	095 Driva. Sunndalsfjord Tingvollfj.	3286	3286	< 2.5	7.58	142	7.6	238	5416	217	114	< 25.3	1845	354	< 505	1516	7.58
	096 Ulvåa. Ålvundfjord	1393	655	0.82	1.64	14	1.6	35	965	21	35	< 4.1	365	82	< 82	373	11.88
	097 Toåa. Todalsfjord	371	1166	< 0.5	0.53	19	1.6	47	682	37	16	< 5.3	217	< 27	< 106	< 265	4.77
	098 Surna. Surnadalsfjord	3551	4805	< 2.1	8.36	161	4.2	299	2820	169	230	< 20.9	1567	209	439	1337	< 4.2
	099 Bøvra. Hamnesfjord Halsafjord	339	1115	0.48	0.48	267	5.8	300	924	40	14	< 4.8	208	40	116	349	2.42

County	Watercourse	Parameter															
		S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg
		tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	kg	kg	kg	kg	kg	kg	kg	kg
Sør-Trøndelag (8.)	101 Børselva. Gaulosen Trondheimsfj.	679	653	2.05	4.23	56	8.5	96	231	59	20	< 1.3	231	55	218	154	0.38
	102 Vigda. Gaulosen Trondheimsfj.	1555	507	0.17	2.10	42	1.0	66	374	45	17	< 1.7	192	58	126	105	1.40
	103 Gaula. Gaulosen Trondheimsfj.	53797	12793	3.28	52.48	436	55.8	896	9138	656	459	< 32.8	4592	1771	4592	4264	< 6.6
	104 Nidelva. Trondheimsfjord	6984	13969	4.11	24.65	177	57.5	929	5282	863	173	< 41.1	3328	904	2629	2629	287.59
	105 Homla. Stjørdalsfj. Trondheimsfj.	259	807	< 0.1	0.86	9	1.0	32	262	97	6	< 1.4	120	22	75	91	0.72
Nord-Trøndelag (8.)	106 Stjørdalselva. Stjørdalsfj.Tr.h.fj.	5177	12260	< 2.7	8.17	321	13.6	651	2394	409	93	< 27.2	3814	463	1662	4904	24.52
	107 Gråelva. Stjørdalsfj.Trondh.fj.	141	407	0.67	1.63	34	1.8	53	76	44	7	< 0.7	81	13	53	< 37	1.04
	108 Verdalsvassdrag. Trondheimsfj	2095	8727	< 1.7	1.75	96	12.2	344	1795	279	72	< 17.5	1396	279	977	< 873	8.73
	109 Figga/Leksdalselva. Trondh.fj	5528	16180	1.35	16.18	169	2.7	496	2889	445	297	< 13.5	1618	715	1214	1483	< 2.7
	110 Snåsavassdrag. Trondheimsfj	2158	5665	< 1.3	4.05	139	13.5	309	1387	189	36	< 13.5	823	216	715	1106	8.09
	111 Årgårdselva. Namsfjord	3872	8545	1.34	12.02	136	6.7	415	2403	240	108	< 13.4	935	387	534	694	13.35
	112 Namsen. Namsfjord Ø	2379	3843	< 1.8	3.66	79	7.3	214	1137	220	44	< 18.3	1116	183	458	1116	< 3.7
	113 Salsvatnelva. Follaifjord	< 832	2636	4.16	6.94	93	11.1	190	1427	< 69	43	< 13.9	361	444	< 277	1526	12.49
Nordland (9.)	114 Åbjøra. Bindalsfjord S	1025	1318	1.46	5.86	37	16.1	119	439	< 73	37	< 14.6	234	674	< 293	< 732	16.11
	116 Skjerva. Vefsenfjord S*	268	536	13.86	17.64	11	27.6	92	213	74	77	5.0	236	32	866	1166	0.63
	117 Fusta. Vefsenfjord N	1012	1391	1.26	6.32	16	15.2	257	461	< 63	32	< 12.6	367	77	266	< 632	10.12
	118 Drevja. Vefsenfjord N*	422	380	5.06	5.06	2	< 1	34	163	29	30	< 4.2	89	33	93	< 211	< 0.8
	119 Røssåga. Sørfjord	7626	3612	4.01	24.08	173	40.1	433	2924	< 201	136	< 40.1	1525	261	1806	15653	< 8.0
	120 Bjerka. Sørfjord	< 499	1581	< 0.8	3.33	14	7.5	81	695	< 42	46	< 8.3	641	83	466	1082	4.99
	121 Dalselva. Ranafjord N*	195	553	< 0.3	2.28	2	0.7	28	300	< 16	36	< 3.3	124	23	169	< 163	< 0.7
	122 Ranavassdraget. Ranafjord N	8759	6064	6.74	40.43	236	33.7	566	10106	< 337	876	< 67.4	3706	2628	2897	10106	< 13.5
	123 Fykanåga. Glomfjord*	< 611	407	< 1.0	5.09	25	2.0	78	458	< 51	100	< 10.2	153	< 51	< 204	< 509	254.67
	124 Beiarelva. Beiarfjord Nordfjord	1904	224	< 0.6	5.60	13	3.9	34	756	< 28	33	< 5.6	202	78	190	< 280	2.24
	125 Saltdalsvassdrag. Saltdalsfj. S	463	347	0.58	2.31	16	1.2	46	917	< 29	< 12	< 5.8	168	< 29	231	< 289	112.19
	126 Sulitjelmavassdrag. Saltdalsfj.	< 929	929	< 1.5	7.74	14	6.2	104	597	< 77	< 31	51.1	1099	< 77	< 310	< 774	7.74
	127 Kobbe. Leirfjord Sørfolda N*	< 605	403	1.01	5.04	28	2.0	72	994	< 50	51	< 10.1	101	64	161	< 504	6.05
	128 Skjoma. Ofotfjord S	< 754	2413	< 1.5	3.02	18	12.1	57	2295	166	54	< 15.1	935	< 75	< 302	< 754	< 3.0

County	Watercourse	Parameter															
		S.P.M.	TOC	PO ₄ -P	Tot-P	NO ₃ -N	NH ₄ -N	Tot-N	SiO ₂	As	Pb	Cd	Cu	Cr	Ni	Zn	Hg
		tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	kg	kg	kg	kg	kg	kg	kg	kg
Troms (9.)	129 Spanselva. Astafjord Vågsfjord*	224	252	0.28	2.52	22	0.6	27	372	18	42	4.2	179	24	420	224	1.12
	130 Salangselva. Astafjord Vågsfj.	697	1394	< 1.0	3.98	19	5.0	44	768	< 50	< 20	< 10.0	249	< 50	< 199	< 498	< 2.0
	131 Rossfjordelva. Malangen*	379	621	1.72	3.45	2	< 1	32	200	22	38	3.4	17	24	155	200	3.45
	132 Målselva. Målselv fj. Malangen	2750	7071	3.93	7.86	102	19.6	216	6061	< 196	82	< 39.3	1375	271	982	2357	19.64
	133 Barduelva. Målselva	6256	4865	< 3.5	10.43	45	55.6	240	4468	< 174	268	< 34.8	2537	209	1008	2016	< 7.0
	134 Nordkjoselva. Balsfjord*	164	280	1.17	1.40	6	1.2	17	460	28	13	< 2.3	65	< 12	< 47	< 117	1.40
	135 Signaldalselva. Lyngen V	463	1330	1.74	3.47	17	9.3	40	1029	87	15	< 5.8	451	104	237	480	< 1.2
	136 Skibotnelva. Lyngen	< 306	1224	< 0.6	< 0.6	15	6.1	42	983	45	15	< 6.1	275	< 31	734	306	< 1.2
	137 Kåfjordelva. Lyngen Ø*	< 190	221	0.95	8.54	12	0.6	32	413	19	35	< 3.2	291	35	212	< 158	1.90
	138 Reisa. Reisafjord	1167	3000	5.00	10.00	63	28.3	150	4286	217	73	< 16.7	1250	145	750	4167	13.33
Finn- mark (10.)	139 Mattiselva. Kåfjord Altafjord*	< 160	719	0.53	0.53	4	1.1	43	365	32	6	< 2.7	210	< 53	80	197	1.33
	141 Tverrelva. Altafjord*	109	491	0.33	0.66	4	0.8	27	234	12	3	< 1.1	85	31	40	79	< 0.2
	142 Repparfjordvasdraget. Repparfj*	577	3561	< 1.9	2.89	7	13.5	150	1114	64	< 19	< 9.6	2214	260	289	510	2.89
	143 Stabburselva. I. Porsangen V	573	1647	0.72	0.72	11	5.0	44	1397	54	< 14	< 7.2	72	37	93	451	3.58
	144 Lakselva. I. Porsangen S	861	2238	0.86	2.58	9	5.2	73	1845	43	46	< 8.6	319	129	284	< 430	< 1.7
	145 Børselva. I. Porsangen Ø*	900	900	< 1.8	2.70	5	9.9	81	2701	< 45	< 18	< 9.0	180	< 180	216	864	7.20
	146 Mattusjåkka. I. Laksefjord V*	52	113	< 0.2	< 0.2	8	0.9	9	105	5	36	3.2	39	418	76	410	0.52
	147 Storelva. I. Laksefjord V*	< 343	400	< 1.1	2.29	12	2.3	58	1470	< 29	< 11	< 5.7	54	< 114	149	629	2.86
	148 Soussjåkka. I.. Laksefjord V*	< 53	115	< 0.2	< 0.2	2	0.4	8	264	< 4	< 2	< 0.9	15	< 18	13	84	1.23
	149 Adamselva. I. Laksefjord Ø*	< 319	849	< 1.1	3.19	1	2.1	55	1251	< 27	< 11	< 5.3	138	< 106	53	488	10.62
	150 Tanavassdraget. Tanafjord S	4577	20268	26.15	58.84	< 7	98.1	549	32223	464	< 131	< 65.4	2223	1177	1569	< 3269	< 13.1
	151 Vesterelva. Syltefjord*	< 393	524	1.97	13.76	5	5.9	65	1404	138	< 13	< 6.6	72	< 131	< 33	< 328	1.31
	152 V. Jakobselva .Y.Varangerfjord*	303	1413	1.51	4.54	1	3.5	65	1946	33	< 10	< 5.0	106	101	66	< 252	3.03
	153 Passvikelva. Bøkfj. Varangerfj.	9894	29681	15.22	22.83	15	53.3	1073	14515	578	< 152	< 76.1	3729	525	2131	< 3805	< 15.2
	154 Neiden. Munkfjord Varangerfj.	1806	5417	3.87	18.06	< 1	10.3	163	4422	245	92	< 12.9	1290	129	7610	< 645	< 2.6
	155 Grense Jakobselva. Varangerfj.	221	608	0.18	0.55	1	0.2	23	671	37	5	< 1.8	405	39	1419	< 92	1.29

* The annual loads from these tributary rivers in Nordland and Troms are based on analytical results from 2002, those in Finnmark are based results from 2001.

Appendix X. Tributary rivers. "Mean" load 2003

Table X. Tributary rivers, "mean" load 2003

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	1442	5481	1.44	11.54	408	9.4	581	2163	195	137	13.7	865	202	591	1731	< 1.4
	003 Mosselva. Mossesundet	2272	2303	< 1.3	8.83	162	5.4	297	230	114	92	< 3.2	442	85	316	505	1.3
Oslo og Akershus (1.)	004 Hølenelva. Drøbaksundet Ø	448	726	1.94	4.78	91	5.7	122	493	47	36	1.2	151	41	157	260	0.7
	005 Årungenelva. Indre Oslofjord	23	124	0.47	0.75	79	0.2	82	22	7	1	< 0.2	34	3	34	23	0.1
	006 Gjersjøelva. Indre Oslofjord	61	254	0.15	0.42	40	1.2	51	130	10	3	< 0.4	57	5	68	49	0.3
	007 Ljanselva. Indre Oslofjord	46	98	0.52	0.93	17	1.1	22	96	8	6	0.3	50	4	41	81	0.1
	008 Loelva/Alna. Indre Oslofjord	1064	215	1.05	3.54	31	3.7	52	217	17	145	2.8	338	43	74	1045	0.3
	009 Akerselva. Indre Oslofjord	150	576	< 0.5	1.25	31	4.4	52	430	23	74	4.0	163	16	55	676	0.8
	010 Frognerelva. Indre Oslofjord	47	55	0.25	0.50	10	0.6	13	63	3	6	0.2	41	3	12	69	0.1
	011 Lysakerelva. Indre Oslofjord	170	490	< 0.4	1.89	17	2.5	39	263	12	14	1.0	72	7	26	104	0.3
	012 Sandvikselva. I. Oslofjord	1229	932	0.65	4.66	67	3.5	102	665	28	60	2.3	181	35	70	336	0.5
	013 Åroselva. Indre Oslofjord	3732	533	1.09	4.85	256	8.3	296	467	45	91	5.9	212	73	91	788	1.2
Buske- rud (2.)	014 Lierelva. Drammensfjord Ø	32081	1595	2.54	26.64	415	3.1	482	2058	218	562	15.4	1051	417	671	4169	3.1
Vestfold (3.)	016 Sandeelva. Sandebukta	362	466	0.10	3.93	38	7.4	79	288	< 52	36	12.4	238	< 52	< 207	1138	4.2
	017 Aulielva. Tønsbergfjord	1416	1143	1.88	11.94	160	10.9	227	694	99	61	< 1.7	239	39	171	443	7.5
	019 Farriselva. Larvikfjord	201	1605	< 0.3	2.01	129	3.0	174	1075	50	27	9.7	217	90	64	2709	4.3
Telemark (4.)	021 Tokkeelva. Kragerø	1876	5837	< 1.0	10.42	177	3.1	331	2457	156	208	34.4	459	125	386	5942	3.1
Aust- Agder (5.)	022 Gjerstadelva. Søndeledfjord	607	2426	< 0.4	4.64	41	10.0	94	642	107	182	15.0	207	61	214	2248	1.4
	023 Vegårdselva. Sandnesfjord	633	2534	< 0.4	1.27	48	11.4	130	543	127	156	17.7	287	80	232	2871	< 0.8
	024 Nidelva. Arendal	2648	13617	< 3.8	3.78	446	22.7	855	4539	454	719	113.5	2723	303	< 757	15130	< 7.6
Vest- Agder (5.)	025 Tovdalselva. Topdalsfjord	2183	8532	< 2.0	< 2.0	167	7.9	417	1276	337	437	43.7	476	169	417	4960	4.0
	027 Søgneelva. Flekkerøy	342	1247	< 0.2	1.96	147	5.4	200	461	71	108	13.2	171	32	120	1149	0.5
	028 Mandalselva. Mannefjord	3149	9710	< 2.6	< 2.6	433	44.6	782	1856	315	866	49.9	577	184	< 525	6036	13.1
	029 Audna. Sniksfjord	702	2810	< 0.6	< 0.6	207	6.4	308	807	140	192	23.6	172	42	< 128	2746	< 1.3
	030 Lygna. Lyngdalsfjord	905	3920	< 1.0	1.01	312	53.3	469	1378	231	312	27.1	281	59	< 201	3819	4.0
	031 Kvina. Fedafjord	1837	12862	< 2.6	2.62	698	52.5	1265	3262	682	1129	44.6	1102	210	< 525	7349	5.2
	032 Sira. Åna-Sira	2871	7896	< 3.6	3.59	761	35.9	944	3538	352	1041	57.4	1005	266	< 718	8973	39.5

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 (6.)	033 Sokndalselva. Sogndalsstrand	1042	1042	< 0.5	< 0.5	134	9.0	164	487	81	109	12.8	355	35	2937	1753	0.9
	034 Hellelandselva. Egersund	437	1442	0.44	3.93	138	9.6	188	393	74	166	8.3	170	26	122	1267	1.3
	035 Bjerkreimselva. Egersund	1382	3628	3.45	3.45	574	32.8	656	2184	119	345	32.8	328	< 86	< 345	2418	5.2
	036 Håelva. Håtangen	390	1147	4.15	11.47	228	18.5	303	837	90	23	2.9	183	32	154	635	< 0.5
	038 Figgjo. Solavika	722	1300	2.53	9.75	215	27.4	308	689	72	83	< 3.6	242	40	134	831	1.8
	039 Ims-Lutsi. Høgsfjord Boknafjord	126	447	< 0.1	< 0.1	71	1.8	90	54	18	12	< 1.4	74	17	28	168	< 0.3
	040 Oltedalselva Høgsfjord Boknafj.	135	473	< 0.2	< 0.2	65	2.0	78	444	20	25	3.4	86	16	52	540	1.4
	041 Dirdalselva Høgsfjord Boknafj.	< 248	744	< 0.4	< 0.4	124	1.7	143	496	38	79	4.5	112	25	< 83	364	1.2
	042 Frafjordelva. Frafjord Boknafj.	< 318	954	< 0.5	< 0.5	124	7.9	134	500	42	101	< 5.3	127	35	< 106	530	2.1
	043 Espedalselva. Høgsfj. Boknafj.	235	627	< 0.4	< 0.4	76	2.0	93	680	20	32	< 3.9	71	< 20	< 78	325	2.4
	044 Lyseelva. Lysefjord Boknafjord	< 255	765	< 0.4	< 0.4	28	5.1	58	537	< 21	47	< 4.2	93	25	< 85	272	0.8
	045 Årdalselva. Årdalsfjord Boknafj.	< 799	2132	< 1.3	< 1.3	240	4.0	326	1370	< 67	119	< 13.3	213	83	< 266	1146	20.0
	046 Førreelva. Jøsenfjord Boknafj.	< 265	838	< 0.4	0.44	43	< 0	56	558	< 22	18	< 4.4	62	23	< 88	< 221	2.2
	047 Ulla. Jøsenfjord Boknafjord	< 620	2067	< 1.0	< 1.0	179	1.0	263	1661	< 52	68	< 10.3	258	< 52	< 207	755	< 2.1
	049 Saudaelva. Saudafjord Boknafj.	< 568	1987	< 0.9	< 0.9	1088	2.8	1268	1500	54	33	30.3	946	87	< 189	8327	7.6
(7.)	050 Åbøelva. Saudafjord Boknafj.	< 132	308	< 0.2	< 0.2	20	0.7	25	< 46	< 11	14	< 2.2	44	< 11	< 44	145	1.8
	051 Vikedalselva. Boknafjord	268	655	< 0.3	1.19	73	3.9	102	166	68	33	< 3.0	104	< 15	< 60	280	0.9
Horda- land (7.)	052 Etneelva. Etnefjord Bømlafjord	233	659	< 0.4	1.16	124	2.7	158	83	47	15	4.3	155	< 19	< 78	543	24.4
	053 Opo. Sørfjord Hardangerfjord	4219	1567	< 1.2	2.41	117	8.4	151	1550	< 60	530	13.3	446	289	< 241	3616	4.8
	054 Tysso. Sørfjord Hardangerfjord	< 582	1358	< 1.0	< 1.0	146	4.9	176	1019	< 49	29	11.6	466	< 49	< 194	2717	5.8
	055 Kinso. Sørfjord Hardangerfjord	< 245	489	< 0.4	< 0.4	17	4.5	43	114	< 20	12	< 4.1	77	< 20	< 82	< 204	1.6
	056 Veig. Eidfjord Hardangerfjord	< 392	850	< 0.7	< 0.7	25	1.3	77	518	< 33	< 13	< 6.5	118	< 33	< 131	< 327	3.3
	057 Bjoreia. Eidfjord Hardangerfjord	340	1068	< 0.5	0.49	29	4.4	71	374	< 24	42	< 4.9	257	< 24	131	398	1.0
	058 Sima. Eidfjord Hardangerfjord	< 190	475	< 0.3	< 0.3	29	3.8	40	597	< 16	9	< 3.2	51	< 16	< 63	< 158	5.7
	059 Austdøla. Osafjord Eidfjord	< 185	401	< 0.3	< 0.3	15	2.8	29	145	< 15	14	< 3.1	52	24	< 62	< 154	< 0.6
	060 Norddøla. Osafjord Eidfjord	< 56	38	< 0.1	0.09	6	1.1	10	83	9	4	< 0.9	13	8	< 19	< 47	0.5
	061 Tysseelva. Fusafjord	< 386	1415	< 0.6	0.64	64	5.1	99	234	42	109	< 6.4	238	35	< 129	836	6.4
	062 Oselva. Fusafjord	189	1135	< 0.3	1.89	26	5.4	56	250	44	23	< 3.2	287	54	120	504	4.7
	063 Bergsdalse. Veafjord Herdlafj.	< 300	1249	< 0.5	0.50	53	4.0	112	289	< 25	95	< 5.0	165	30	< 100	849	2.0
	064 Vosso. Veafjord Sørfjord	< 1643	7120	< 2.7	< 2.7	175	30.1	515	1702	< 137	82	< 27.4	548	< 137	< 548	2163	21.9
	065 Ekso. Osterfjord	< 675	2926	< 1.1	2.25	60	18.0	187	555	< 56	113	< 11.3	248	< 56	< 225	1801	3.4
	066 Modalselva. Osterfjord	< 696	2435	< 1.2	< 1.2	90	7.0	135	671	< 58	128	< 11.6	162	< 58	< 232	881	8.1

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
Sogn og Fjordane (7.)	067 Nærøyelva. Aurlandsfj. Sognefj	< 326	707	< 0.5	< 0.5	27	3.3	58	898	< 27	13	< 5.4	131	< 27	< 109	< 272	7.6
	068 Flåmselva. Aurlandsfj. Sognefj.	< 278	416	< 0.5	< 0.5	30	3.2	46	228	< 23	15	< 4.6	83	< 23	< 93	278	< 0.9
	069 Aurlandelva..Aurlandsfj.Sognefj	2820	2575	< 1.2	2.45	104	9.8	163	1287	< 61	245	< 12.3	785	135	< 245	1349	2.5
	070 Erdalselva. Lærdalsfj. Sognefj.	< 78	209	< 0.1	< 0.1	3	0.5	8	87	< 7	4	< 1.3	24	< 7	< 26	< 65	0.9
	071 Lærdalselva. Lærdalsfj.Sognefj	< 672	1456	< 1.1	1.12	60	10.1	123	1368	< 56	< 22	< 11.2	459	< 56	224	< 560	3.4
	072 Årdalselva. Årdalsfjord Sognefj.	1961	2941	< 1.4	1.40	104	9.8	154	1891	< 70	42	< 14.0	1400	98	< 280	896	5.6
	073 Fortunelva. Lusterfj. Sognefj.	1634	1226	< 0.8	1.63	58	1.6	78	1068	< 41	90	< 8.2	809	98	< 163	768	7.4
	074 Mørkriselva. Lusterfj. Sognefj.	3405	632	< 0.5	2.92	23	3.9	32	938	< 24	88	< 4.9	316	302	238	973	< 1.0
	075 Jostedøla. Lusterfjord Sognefj.	117233	2226	1.85	165.09	85	16.7	109	12720	< 93	1540	< 18.5	3339	4081	3710	14283	5.6
	076 Årøyelva. Sogndalsfj. Sognefj.	2186	1312	< 1.1	1.09	60	6.6	108	1359	< 55	68	< 10.9	240	< 55	< 219	875	3.3
	077 Sogndalselva Sognd.fj. Sognefj	< 219	219	< 0.4	0.73	5	4.0	15	219	55	9	< 3.6	66	< 18	< 73	< 182	2.2
	078 Gaular. Dalsfjord Bufjord	1254	3136	< 1.6	4.70	107	4.7	251	974	< 78	61	< 15.7	267	< 78	< 314	1066	14.1
	079 Jølstra. Førdefjord	1004	3179	< 1.7	1.67	177	8.4	291	1147	< 84	43	< 16.7	301	< 84	< 335	1506	90.3
	080 Nausta. Førdefjord	500	1641	< 0.7	5.71	31	10.7	116	306	< 36	41	< 7.1	121	< 36	< 143	407	< 1.4
	081 Oselva. Høydsalfjord	427	2279	< 0.7	2.14	22	7.1	118	< 150	49	65	< 7.1	449	55	< 142	855	27.8
	082 Hopselva. Hyefjord Nordfjord S	< 104	259	< 0.2	< 0.2	15	0.3	24	48	< 9	12	< 1.7	17	< 9	< 35	< 86	1.6
	083 Gjengedalselva. Hyefj. Nordfj.S	322	844	< 0.4	1.21	21	1.6	53	181	< 20	16	< 4.0	56	< 20	< 80	245	1.6
	084 Breimselva. Gloppenfj. Nordfj.S	1091	2182	< 1.4	5.46	147	9.5	239	1344	< 68	50	< 13.6	300	75	< 273	< 682	10.9
	085 Oldenelva. Indre Nordfjord	949	849	< 0.5	3.50	56	1.0	94	567	< 25	40	< 5.0	165	70	< 100	295	< 1.0
	086 Loenelva. Indre Nordfjord	856	696	< 0.5	2.68	38	2.1	45	734	< 27	44	< 5.4	230	128	< 107	348	2.1
	087 Stryneelva. Indre Nordfjord	1311	1613	< 1.0	4.03	85	6.0	148	1210	< 50	37	< 10.1	353	131	< 202	< 504	4.0
	088 Hornindalselva. Nordfjord N	549	1412	< 0.8	1.57	96	8.6	126	1008	78	24	< 7.8	188	< 39	< 157	659	2.4
Møre og Romsdal (8.)	089 Ørstaelva. Ørsta fjord	318	636	< 0.4	1.06	26	5.7	55	681	32	9	< 3.5	102	< 18	< 71	< 177	1.1
	090 Valldøla. Nordalfjord Storfjord	408	679	< 0.7	< 0.7	14	3.4	23	655	56	19	< 6.8	204	46	< 136	< 340	2.0
	091 Rauma. Romsdalsfjord Moldefj.	870	1243	< 1.2	< 1.2	35	7.5	61	1492	71	< 25	< 12.4	336	< 62	< 249	< 622	8.7
	092 Isa. Isfjord Moldefjord	409	315	0.31	0.31	10	1.9	14	499	17	12	< 3.1	120	85	< 63	< 157	< 0.6
	093 Eira. Eresfjord Moldefjord	< 737	1351	< 1.2	< 1.2	169	2.5	194	3158	< 61	92	< 12.3	368	< 61	< 246	1019	8.6
	094 Littledalselva Sunndalsfjord	< 279	511	< 0.5	< 0.5	52	0.5	66	1691	< 23	14	< 4.6	130	51	< 93	< 232	1.9
	095 Driva.Sunndalsfjord Tingvollfj.	2845	2845	< 2.2	6.56	123	6.6	206	4689	188	98	< 21.9	1597	306	< 438	1313	6.6
	096 Ulvåa. Ålvundfjord	1216	572	0.72	1.43	13	1.4	30	843	18	31	< 3.6	318	72	< 72	326	10.4
	097 Toåa. Todalsfjord	324	1019	< 0.5	0.46	17	1.4	41	595	32	14	< 4.6	190	< 23	< 93	< 232	4.2
	098 Surna. Surnadalsfjord	3088	4178	< 1.8	7.27	140	3.6	260	2452	147	200	< 18.2	1362	182	381	1163	< 3.6
	099 Bøvra. Hamnesfjord Halsafjord	295	969	0.42	0.42	232	5.1	261	804	35	12	< 4.2	181	35	101	303	2.1

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
Sør-Trøndelag (8.)	101 Børselva. Gaulosen Trondheimsfj.	552	531	1.67	3.43	45	6.9	78	187	48	17	< 1.0	187	45	177	125	0.3
	102 Vigda. Gaulosen Trondheimsfj.	1263	412	0.14	1.70	34	0.9	54	304	37	14	< 1.4	156	47	102	85	1.1
	103 Gaula. Gaulosen Trondheimsfj.	49959	11881	3.05	48.74	405	51.8	832	8486	609	426	< 30.5	4265	1645	4265	3960	< 6.1
	104 Nidelva. Trondheimsfjord	5919	11838	3.48	20.89	150	48.7	787	4477	731	146	< 34.8	2820	766	2228	2228	243.7
	105 Homla. Stjørdalsfj. Trondheimsfj.	267	832	< 0.1	0.89	10	1.0	33	271	100	7	< 1.5	123	22	77	94	0.7
Nord-Trøndelag (8.)	106 Stjørdalselva. Stjørdalsfj.Tr.h.fj.	4884	11566	< 2.6	7.71	303	12.9	614	2258	386	87	< 25.7	3598	437	1568	4627	23.1
	107 Gråelva. Stjørdalsfj.Trondh.fj.	139	403	0.66	1.61	33	1.8	52	75	43	7	< 0.7	81	13	52	< 37	1.0
	108 Verdalsvassdrag. Trondheimsfj	2228	9284	< 1.9	1.86	102	13.0	366	1910	297	76	< 18.6	1485	297	1040	< 928	9.3
	109 Figga/Leksdalselva. Trondh.fj	5641	16510	1.38	16.51	172	2.8	506	2948	454	303	< 13.8	1651	729	1238	1513	< 2.8
	110 Snåsavassdrag. Trondheimsfj	2202	5781	< 1.4	4.13	142	13.8	315	1416	193	37	< 13.8	840	220	729	1129	8.3
	111 Årgårdselva. Namsfjord	3992	8809	1.38	12.39	140	6.9	428	2478	248	111	< 13.8	963	399	551	716	13.8
	112 Namsen. Namsfjord Ø	1789	2889	< 1.4	2.75	59	5.5	161	855	165	33	< 13.8	839	138	344	839	< 2.8
	113 Salsvatnelva. Folla fjord	< 824	2610	4.12	6.87	92	11.0	188	1413	< 69	43	< 13.7	357	440	< 275	1511	12.4
Nordland (9.)	114 Åbjøra. Bindalsfjord S	931	1197	1.33	5.32	33	14.6	108	399	< 67	33	< 13.3	213	612	< 266	< 665	14.6
	116 Skjerva. Vefsenfjord S	230	461	11.92	15.17	10	23.7	79	183	64	66	4.3	203	27	745	1002	0.5
	117 Fusta. Vefsenfjord N	870	1196	1.09	5.44	14	13.1	221	396	< 54	27	< 10.9	315	66	228	< 544	8.7
	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	5691	2696	3.00	17.97	129	30.0	323	2182	< 150	102	< 30.0	1138	195	1348	11681	< 6.0
	120 Bjerka. Sørfjord	< 404	1278	< 0.7	2.69	11	6.1	65	562	< 34	37	< 6.7	518	67	377	874	4.0
	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	7081	4903	5.45	32.68	191	27.2	458	8171	< 272	708	< 54.5	2996	2124	2342	8171	< 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	5145	605	< 1.5	15.13	35	10.6	92	2043	< 76	89	< 15.1	545	212	515	< 757	6.1
	125 Saltdalsvassdrag. Saltdalsfj. S	1250	938	1.56	6.25	44	3.1	125	2478	< 78	< 31	< 15.6	453	< 78	625	< 781	303.2
	126 Sulitjelmavassdrag. Saltdalsfj.	< 856	856	< 1.4	7.13	13	5.7	96	550	< 71	< 29	47.1	1013	< 71	< 285	< 713	7.1
	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	< 484	1548	< 1.0	1.93	12	7.7	37	1472	106	35	< 9.7	600	< 48	< 193	< 484	< 1.9

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	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	973	< 0.7	2.78	13	3.5	31	536	< 35	< 14	< 7.0	174	< 35	< 139	< 348	< 1.4
	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. Målselv fj. Malangen	2052	5277	2.93	5.86	76	14.7	161	4523	< 147	62	< 29.3	1026	202	733	1759	14.7
	133 Barduelva. Målselva	4668	3631	< 2.6	7.78	34	41.5	179	3335	< 130	200	< 25.9	1893	156	752	1504	< 5.2
	134 Nordkjøselva. 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	331	950	1.24	2.48	12	6.6	29	735	62	11	< 4.1	322	74	169	343	< 0.8
	136 Skibotnelva. Lyngen	< 219	874	< 0.4	< 0.4	10	4.4	30	702	32	11	< 4.4	197	< 22	525	219	< 0.9
	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	954	2454	4.09	8.18	52	23.2	123	3506	177	60	< 13.6	1023	119	614	3408	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	3180	< 1.7	2.58	6	12.0	134	994	58	< 17	< 8.6	1977	232	258	455	2.6
	143 Stabburselva. I. Porsangen V	512	1471	0.64	0.64	10	4.5	40	1247	49	< 13	< 6.4	64	33	83	403	3.2
	144 Lakselva. I. Porsangen S	769	1999	0.77	2.31	8	4.6	65	1647	38	42	< 7.7	284	115	254	< 384	< 1.5
	145 Børselva. I. Porsangen Ø	830	830	< 1.7	2.49	4	9.1	75	2489	< 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	1225	< 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	1043	< 22	< 9	< 4.4	115	< 88	44	407	8.8
	150 Tanavassdraget. Tanafjord S	4161	18425	23.77	53.49	< 6	89.2	499	29294	422	< 119	< 59.4	2021	1070	1426	< 2972	< 11.9
	151 Vesterelva. Syltefjord	< 307	409	1.54	10.75	4	4.6	51	1097	107	< 10	< 5.1	56	< 102	< 26	< 256	1.0
	152 V. Jakobselva .Y.Varangerfjord	215	1002	1.07	3.22	1	2.5	46	1380	24	< 7	< 3.6	75	72	47	< 179	2.1
	153 Passvikelva. Bøkfj. Varangerfj.	7017	21051	10.80	16.19	11	37.8	761	10294	410	< 108	< 54.0	2645	372	1511	< 2699	< 10.8
	154 Neiden. Munkfjord Varangerfj.	1281	3842	2.74	12.81	< 1	7.3	115	3136	174	65	< 9.1	915	91	5397	< 457	< 1.8
	155 Grense Jakobselva. Varangerfj.	159	438	0.13	0.40	1	0.1	17	484	27	4	< 1.3	292	28	1023	< 66	0.9

* The mean loads from these tributary rivers in Nordland and Troms are based on analytical results from 2002, those in Finnmark are based 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.	*	-	-	1 161 040	445 099	218 152	1 824 291	tonnes
	**	-	-	1 161 040	464 191	220 184	1 845 415	
TOC		-	-	351	340 323	202 716	543 390	tonnes
Orthoph.	*	231	928	494	493	78	2 225	tonnes
	**	231	928	494	532	101	2 286	
Total P	*	915	5 155	1 014	2 391	592	10 067	tonnes
	**	915	5 155	1 014	2 397	594	10 076	
Nitrates	*	19 369	-	51	11 605	15 460	46 484	tonnes
	**	19 369	-	51	11 607	15 460	46 486	
Ammonia	*	1 783	7 814	7 941	1 906	1 225	20 669	tonnes
	**	1 783	7 814	7 941	1 939	1 226	20 704	
Total N		29 866	24 419	12 956	27 973	22 614	117 827	tonnes
Silicate SiO₂	*	-	-	0	197 963	162 489	360 452	tonnes
	**	-	-	0	197 963	164 102	362 065	
Arsenic	*	-	-	1.1	12	8	21	tonnes
	**	-	-	1.1	15	8	24	
Lead	*	-	-	5	25	15	45	tonnes
	**	-	-	5	25	15	45	
Cadmium	*	-	-	0.2	1.3	0.6	2.2	tonnes
	**	-	-	0.2	2.0	0.9	3.1	
Copper		-	-	42	75	70	187	tonnes
		-	-	42	76	70	187	
Total Cr-T	*	-	-	4	18	10	32	tonnes
	**	-	-	4	21	10	35	
Nickel	*	-	-	14	80	30	124	tonnes
	**	-	-	14	90	31	135	
Zinc	*	-	-	97	251	219	568	tonnes
	**	-	-	97	266	222	585	
Mercury	*	-	-	55	603	948	1 606	kg
	**	-	-	55	715	1 001	1 771	
Lindane	*	-	-	-	-	26	26	kg
	**	-	-	-	-	27	27	

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.	*			3 178	25 558	177 480	206 216	tonnes
	**			3 178	25 558	178 757	207 493	
TOC				105	87 216	167 022	254 343	tonnes
Orthoph.	*	22	0.0	65	52	64	203	tonnes
	**	22	0.0	65	52	78	217	
Total P	*	87	0	191	407	489	1 174	tonnes
	**	87	0	191	407	491	1 176	
Nitrates	*	1 948	-	20	3 494	13 785	19 247	tonnes
	**							
Ammonia	*	180	0	3 142	155	1 111	4 587	tonnes
	**	180	0	3 142	160	1 111	4 593	
Total N		2 998	0	5 210	6 107	19 813	34 127	tonnes
Silicate SiO₂	*			0	26 426	139 654	166 080	tonnes
	**			0	26 426	140 303	166 729	
Arsenic				0.5	4	6	11	tonnes
				0.5	4	6	11	
Lead	*			0.9	8	14	22	tonnes
	**							
Cadmium	*			0.08	0.5	0.5	1.1	tonnes
	**			0.08	0.5	0.6	1.2	
Copper	*			13	7	46	66	tonnes
	**			13	8	46	67	
Total Cr-T	*			1.5	2	8	12	tonnes
	**			1.5	2	8	12	
Nickel	*			4.0	5	26	35	tonnes
	**			4.0	7	26	36	
Zinc	*			17	73	150	240	tonnes
	**							
Mercury	*			26	20	864	910	kg
	**			26	51	905	982	
Lindane				-	-	23	23	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.	*			9 022	67 900	7 477	84 399	tonnes
	**			9 022	76 504	7 555	93 081	
TOC				192	44 187	8 990	53 369	tonnes
Orthoph.	*	60	303	167	158	2	691	tonnes
	**	60	303	167	173	4	708	
Total P	*	227	1686	329	697	44	2 983	tonnes
	**	227	1686	329	697	44	2 983	
Nitrates		7 437	-	14	5 217	738	13 405	tonnes
Ammonia	*	678	2552	2 200	237	23	5 689	tonnes
	**	678	2552	2 200	251	24	5 704	
Total N		11 569	7973	3 414	9 005	1 081	33 042	tonnes
Silicate SiO₂	*			-	41 033	3 117	44 150	tonnes
	**			-	41 033	4 080	45 113	
Arsenic	*			0.1	1.4	0.5	1.9	tonnes
	**			0.1	2.7	0.5	3.2	
Lead	*			2.7	8	0.5	11	tonnes
	**							
Cadmium	*			0.09	0.37	0.04	0.5	tonnes
	**			0.09	0.56	0.04	0.7	
Copper	*			4.9	14.9	5.7	25	tonnes
	**			4.9	14.9	5.7	26	
Total Cr-T	*			1.1	3	0.2	5	tonnes
	**			1.1	4	0.3	5	
Nickel	*			8	4	1.0	12	tonnes
	**			8	10	1.1	18	
Zinc	*			23	65	8	97	tonnes
	**			23	68	8	100	
Mercury	*			14	108	32	155	kg
	**			14	139	38	191	
Lindane				-	-	0.6	0.6	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.	*			934 840	332 087	30 368	1 297 295	tonnes
	**			934 840	341 126	30 891	1 306 857	
TOC				53	138 848	19 299	158 200	tonnes
Orthoph.	*	131	561	243	247	7	1 188	tonnes
	**	131	561	243	265	13	1 212	
Total P	*	512	3114	462	1 166	42	5 297	tonnes
	**	512	3114	462	1 172	43	5 303	
Nitrates		8 956	-	16	2 795	815	12 582	tonnes
Ammonia	*	839	4724	2 417	1 334	75	9 388	tonnes
	**	839	4724	2 417	1 348	75	9 402	
Total N		13 599	14763	4 088	9 611	1 391	43 452	tonnes
Silicate SiO₂				0	74 697	11 773	86 470	tonnes
Arsenic	*			0.5	4.9	1.2	6.6	tonnes
	**			0.5	5.6	1.3	7.4	
Lead	*			1.1	9.2	0.6	11	tonnes
	**			1.1	9.2	0.6	11	
Cadmium	*			0.05	0.44	0.10	0.6	tonnes
	**			0.05	0.72	0.18	1.0	
Copper				23	37	17.1	77	tonnes
				23	37	17.3	77	
Total Cr-T	*			1.0	7	1	9	tonnes
	**			1.0	8	1	10	
Nickel	*			2.0	31	3	36	tonnes
	**			2.0	33	4	39	
Zinc	*			56	52	53	162	tonnes
	**			56	63	56	175	
Mercury	*			13.6	397	42	453	kg
	**			13.6	445	48	506	
Lindane	*			-	-	2.3	2.3	kg
	**			-	-	0.91	2.3	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.	*			214 000	19 554	2 827	236 381	tonnes
	**			214 000	21 003	2 980	237 983	
TOC				-	70 073	7 406	77 479	tonnes
Orthoph.	*	18	64	19	37	5	143	tonnes
	**	18	64	19	43	5	149	
Total P	*	88	355	32	121	16	613	tonnes
	**	88	355	32	121	16	613	
Nitrates	*	1 029	-	1	99	121	1 250	tonnes
	**	1 029	-	1	101	121	1 252	
Ammonia	*	87	538	182	180	17	1 004	tonnes
	**							
Total N		1 701	1683	244	3 250	329	7 206	tonnes
Silicate SiO₂				-	55 806	7 946	63 752	tonnes
Arsenic	*			-	1.8	0.3	2.1	tonnes
	**			-	1.9	0.3	2.2	
Lead	*			0.05	0.33	0.09	0.46	tonnes
	**			0.05	0.56	0.12	0.73	
Cadmium	*			0.00	0.01	-	0.01	tonnes
	**			0.00	0.18	0.02	0.21	
Copper				0.7	16.3	1.1	18.1	tonnes
Total Cr-T	*			0.08	5.9	0.4	6.4	tonnes
	**			0.08	6.9	0.4	7.4	
Nickel	*			0.1	40.7	0.6	41.4	tonnes
	**			0.1	40.7	0.7	41.5	
Zinc	*			1	60.7	7.9	69.6	tonnes
	**			1	61.5	8.3	70.8	
Mercury	*			1	78	9	89	kg
	**			1	81	10	91	
Lindane	*			-	-	0.3	0.3	kg
	**			-	-	0.3	0.3	kg

Measurements below detection limits are treated in two ways

*Detection limit = zero, ** Detection limit = limit

Appendix XII. Fish farming effluents to convention waters 2003

Table XII	Fish farming effluents from down stream areas of mainland Norway to convention waters (2003)
Table XII.I	Fish farming effluents to the Skagerrak region (2003)
Table XII.II	Fish farming effluents to the Remaining North Sea region(2003)
Table XII.III	Fish farming effluents to the Norwegian Sea region (2003)
Table XII.IV	Fish farming effluents to the Barents Sea region (2003)

Table XII Fish farming effluents from down stream areas of mainland Norway to convention waters (2003)

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	0.0
	N	0.0
	PO4-P	0.0
	NH4-N	0.0
7 Suldalslågen	P	0.0
	N	0.0
	PO4-P	158.5
	NH4-N	747.2
8 Orkla	P	28.5
	N	0.0
	PO4-P	239.1
	NH4-N	1527.4
9 Vefsna	P	7226.1
	N	274.9
	PO4-P	0.0
	NH4-N	2312.4
10 Alta	P	1795.5
	N	8525.7
	PO4-P	323.2
	NH4-N	0.0
SUM	P	5155
SUM	N	24419
SUM	PO4-P	928
SUM	NH4-N	7814

Appendix XIII. Mean concentrations and loads from 1990 to 2003. 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.

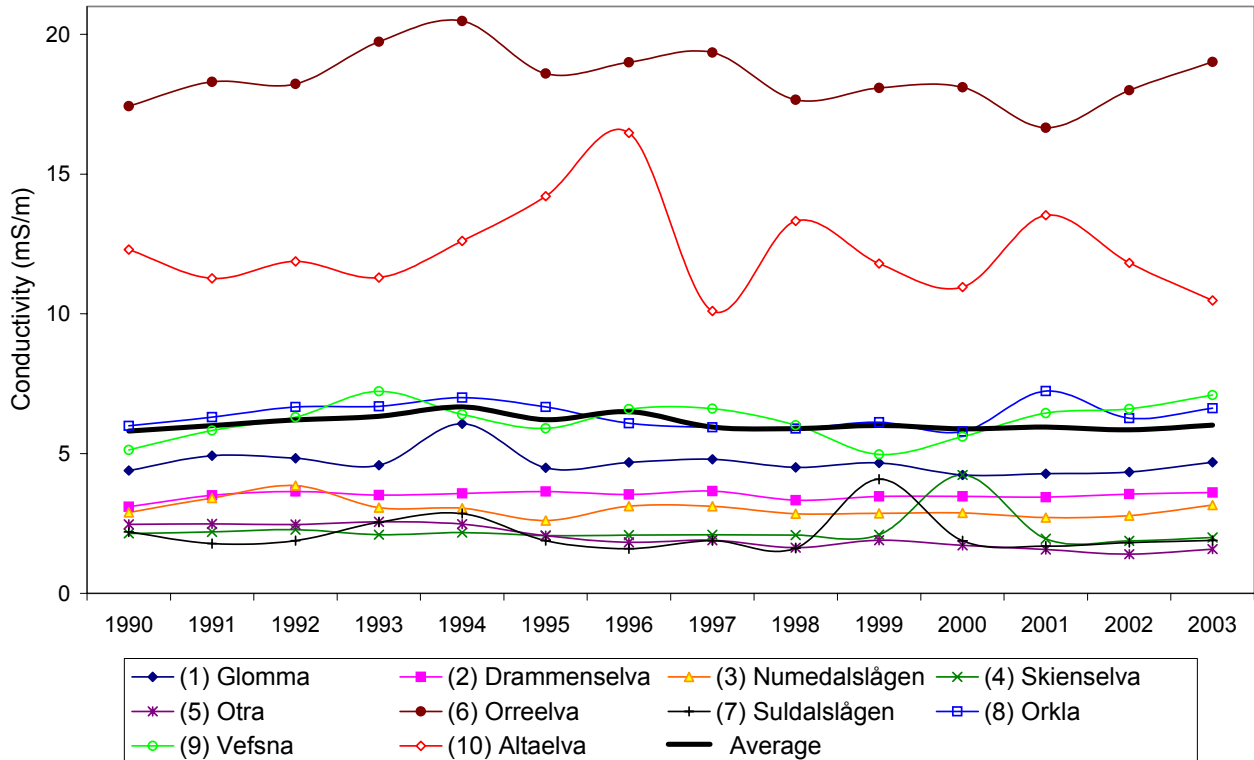


Figure XIII.I Specific conductivity in main rivers.
Mean value from 1990 to 2003 (mS/m).

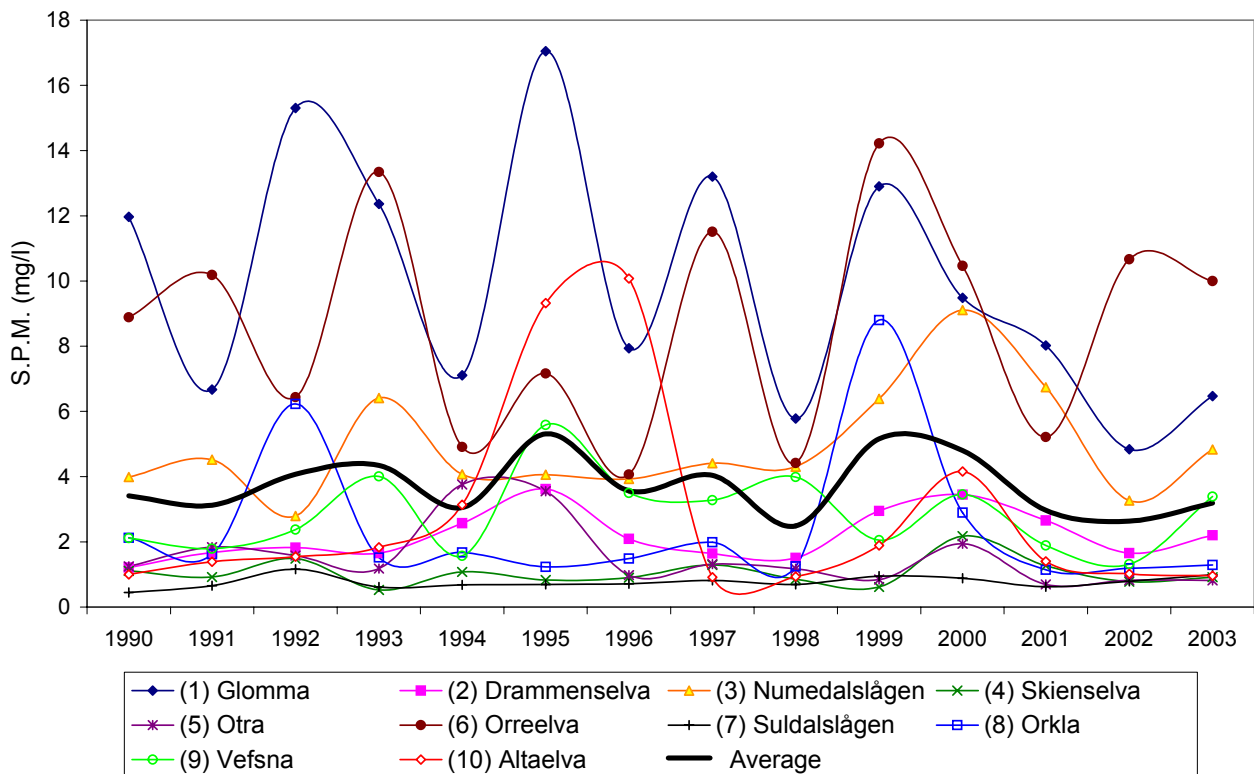


Figure XIII.II Suspended particulate matter (S.P.M.) concentration in main rivers.
Mean value from 1990 to 2003 (mg/l).

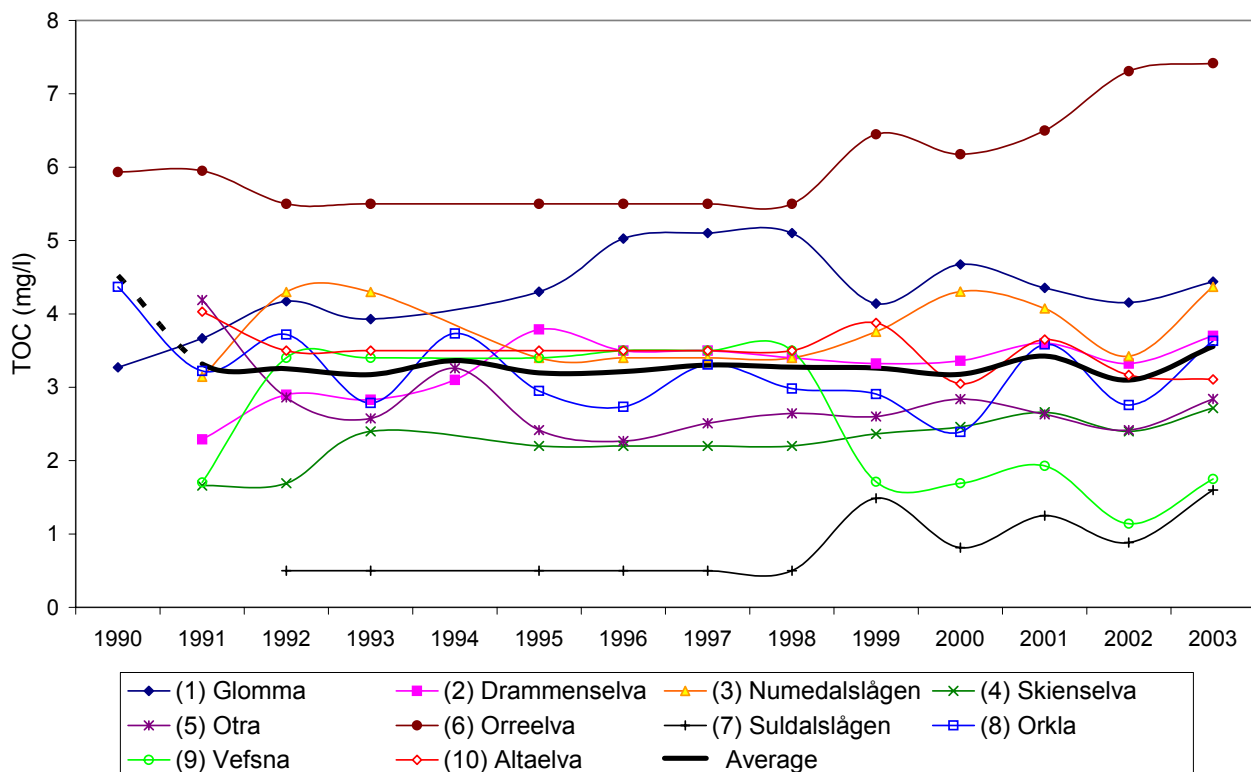


Figure XIII.III Total organic carbon (TOC) concentration in main rivers.
Mean value from 1990 to 2003 (mg/l).

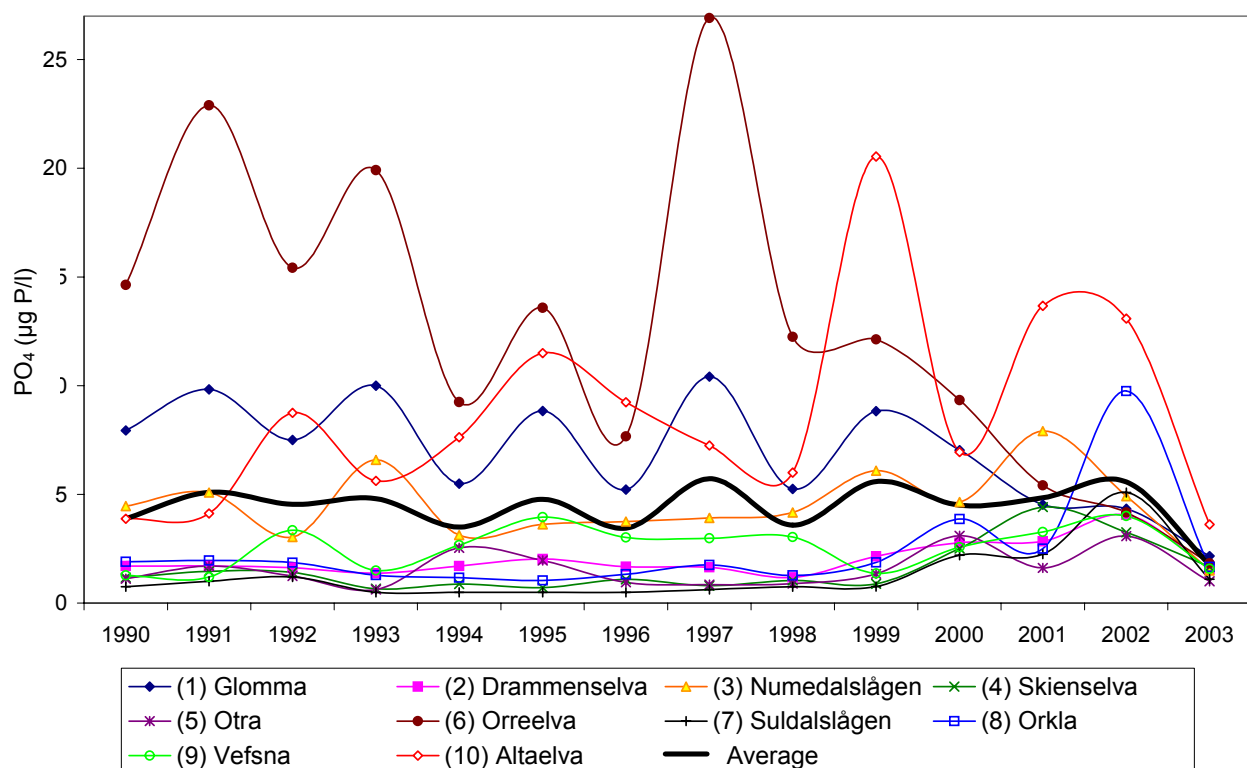


Figure XIII.IV Orthophosphate (PO₄) concentration in main rivers.
Mean value from 1990 to 2003 (µg/l).

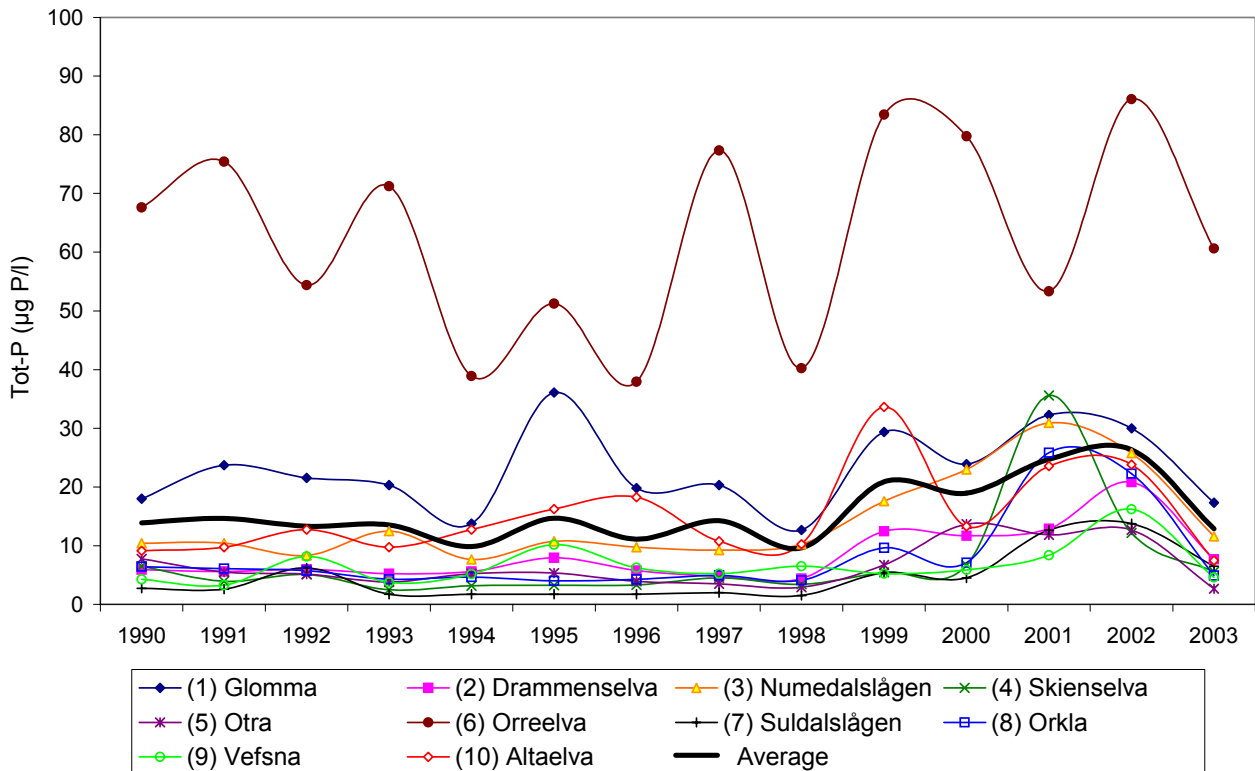


Figure XIII.V Total phosphorus (Tot-P) concentration in main rivers.
Mean value from 1990 to 2003 ($\mu\text{g/l}$).

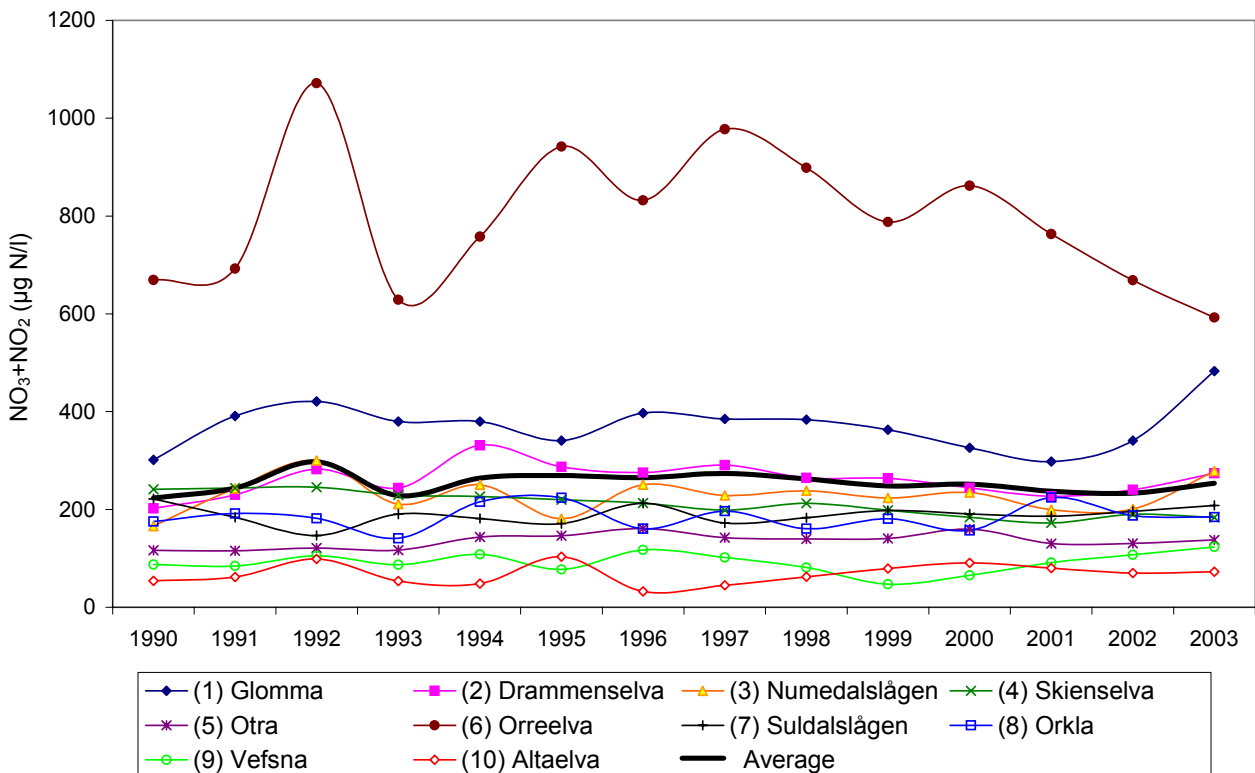


Figure XIII.VI Nitrate and nitrite ($\text{NO}_2 + \text{NO}_3$) concentration in main rivers.
Mean value from 1990 to 2003 ($\mu\text{g/l}$).

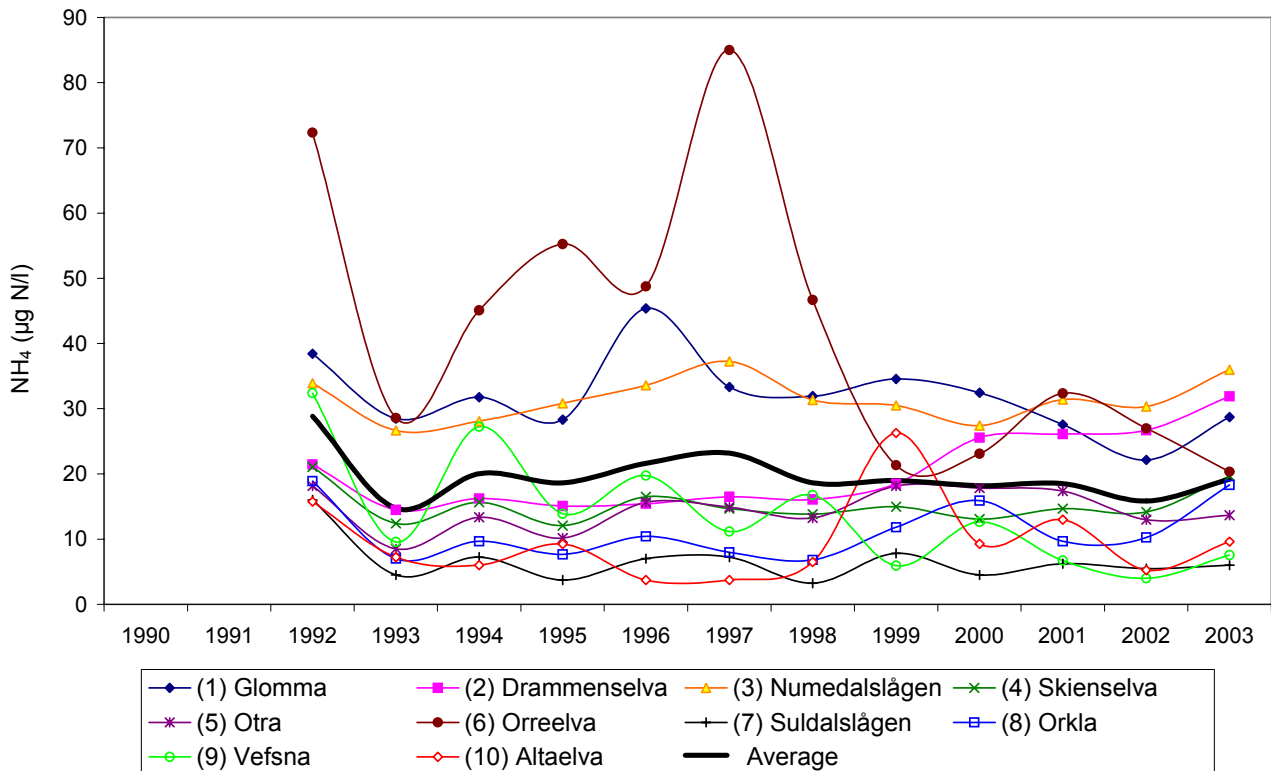


Figure XIII.VII Ammonia (NH_4) concentration in main rivers.
Mean value from 1992 to 2003 ($\mu\text{g/l}$).

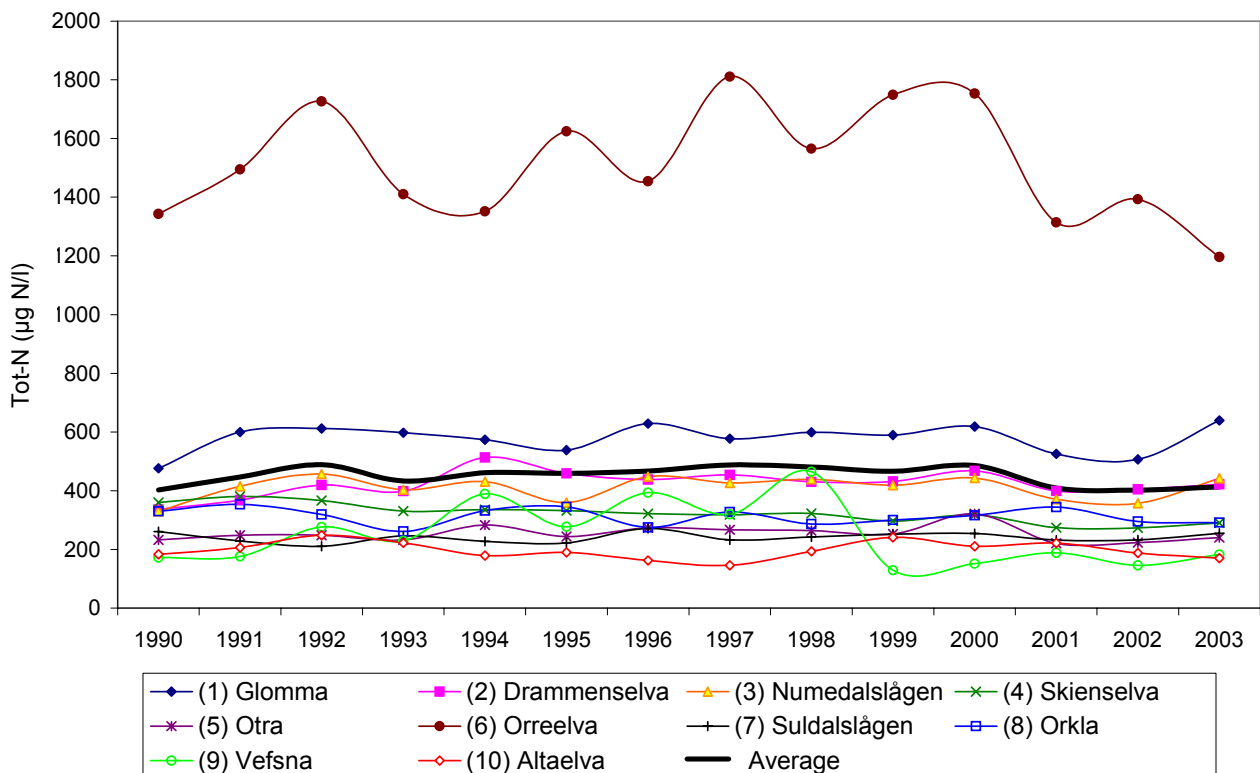


Figure XIII.VIII Total nitrogen (Tot-N) concentration in main rivers.
Mean value from 1990 to 2003 ($\mu\text{g/l}$).

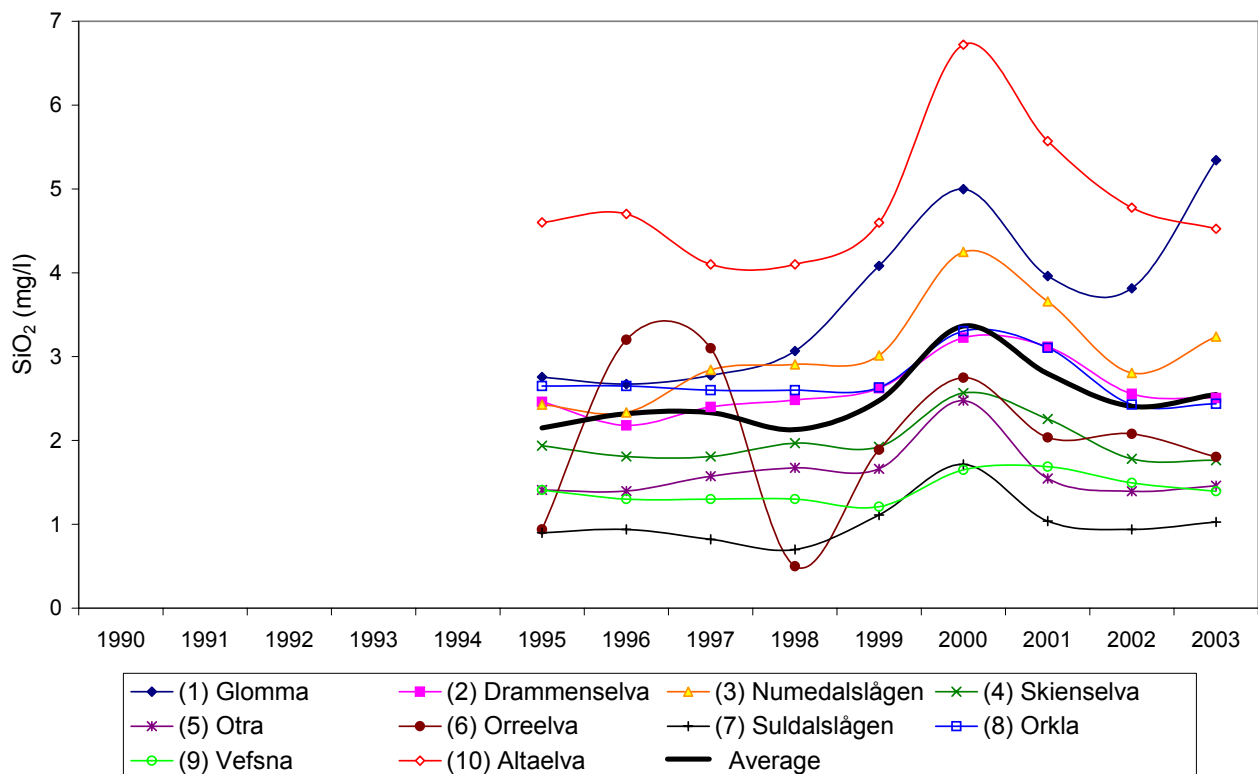


Figure XIII.IX Silicate (SiO_2) concentration in main rivers.
Mean value from 1995 to 2003 (mg/l).

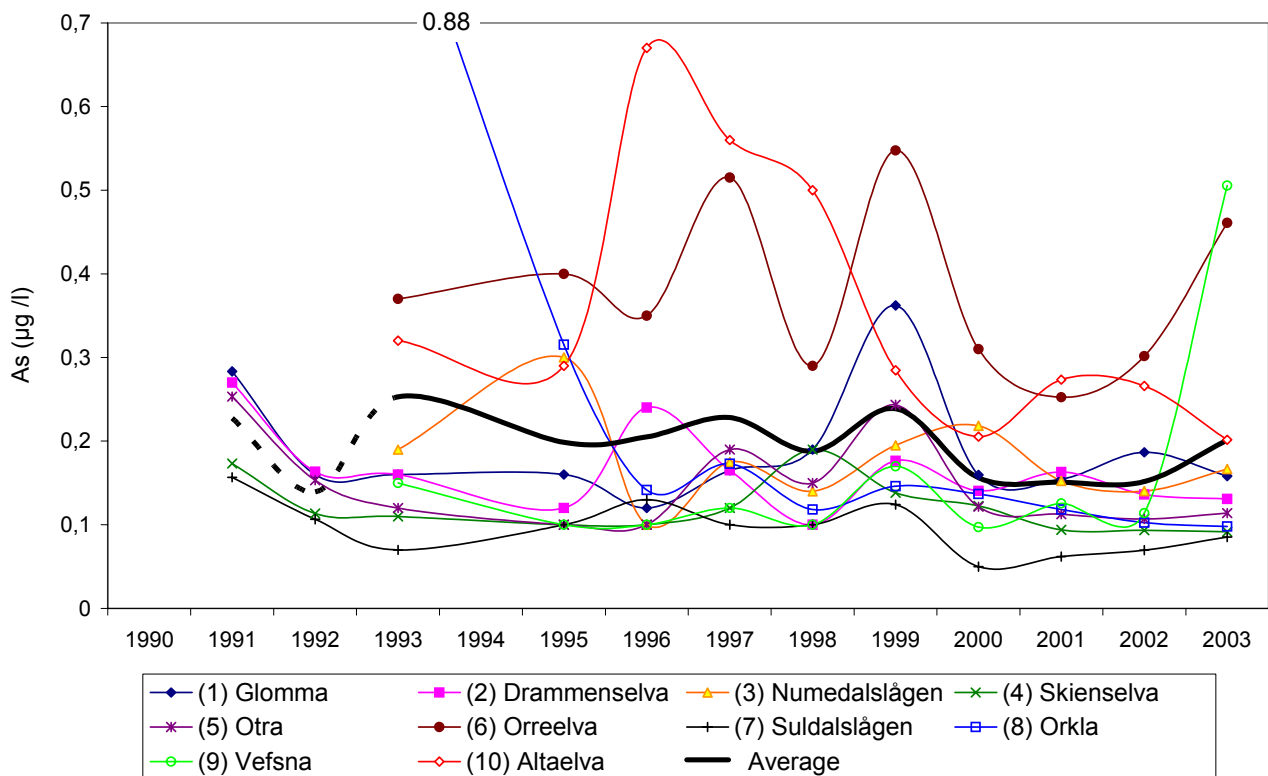


Figure XIII.X Arsenic (As) concentration in main rivers.
Mean value from 1991 to 2003 ($\mu\text{g/l}$).

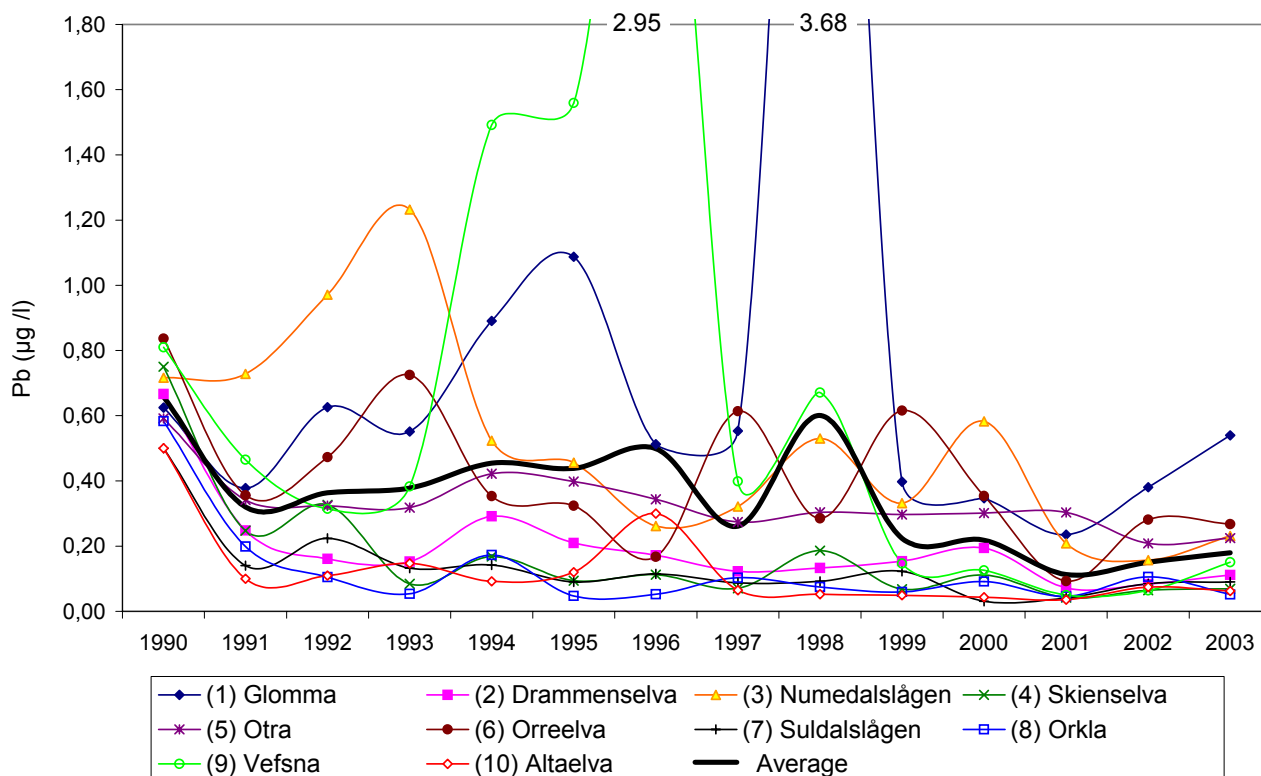


Figure XIII.XI Lead (Pb) concentration in main rivers.
Mean value from 1990 to 2003 (µg/l).

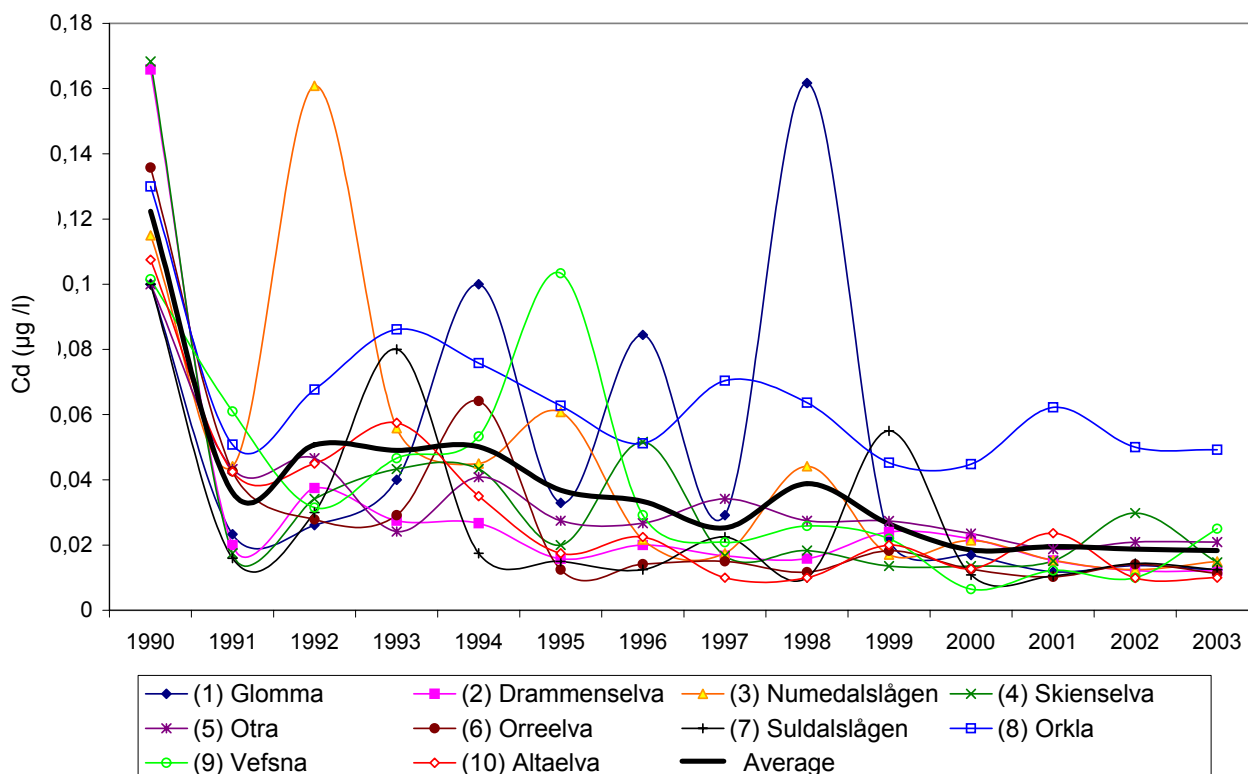


Figure XIII.XII Cadmium (Cd) concentration in main rivers.
Mean value from 1990 to 2003 (µg/l).

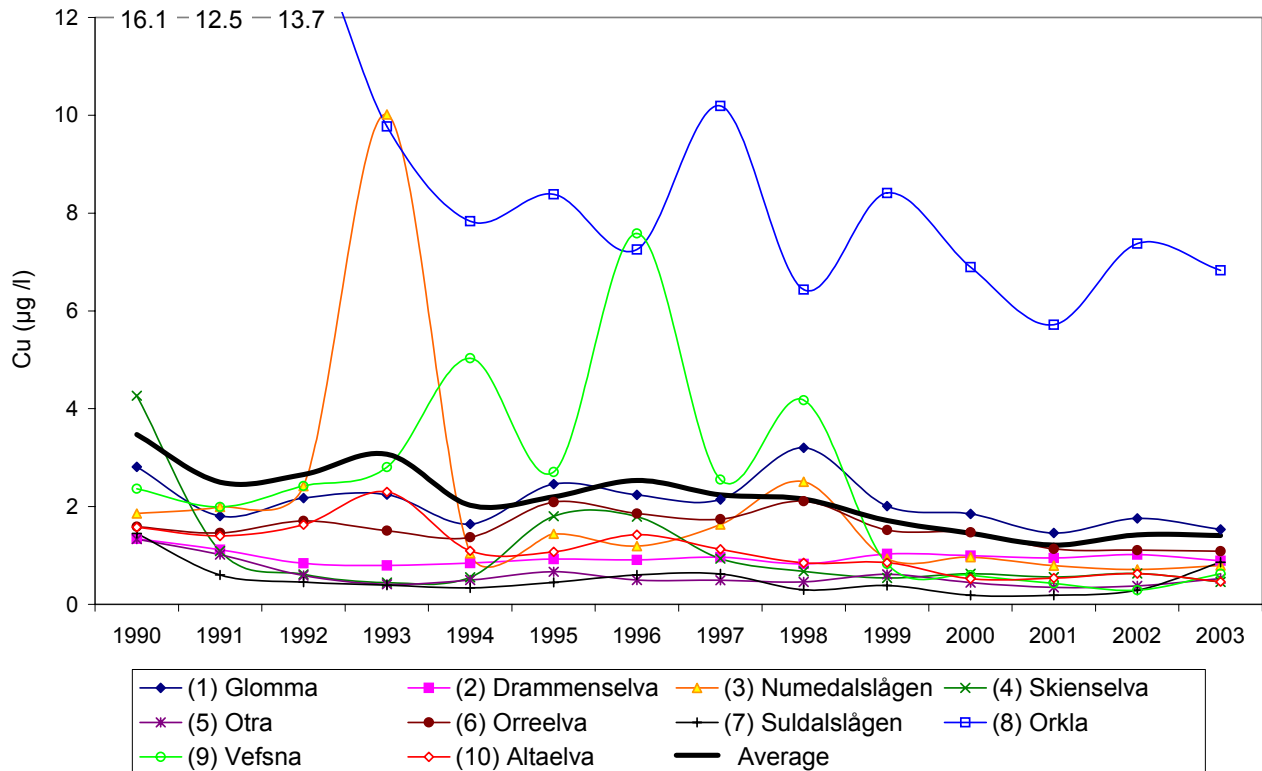


Figure XIII.XIII Copper (Cu) concentration in main rivers.
Mean value from 1990 to 2003 ($\mu\text{g/l}$).

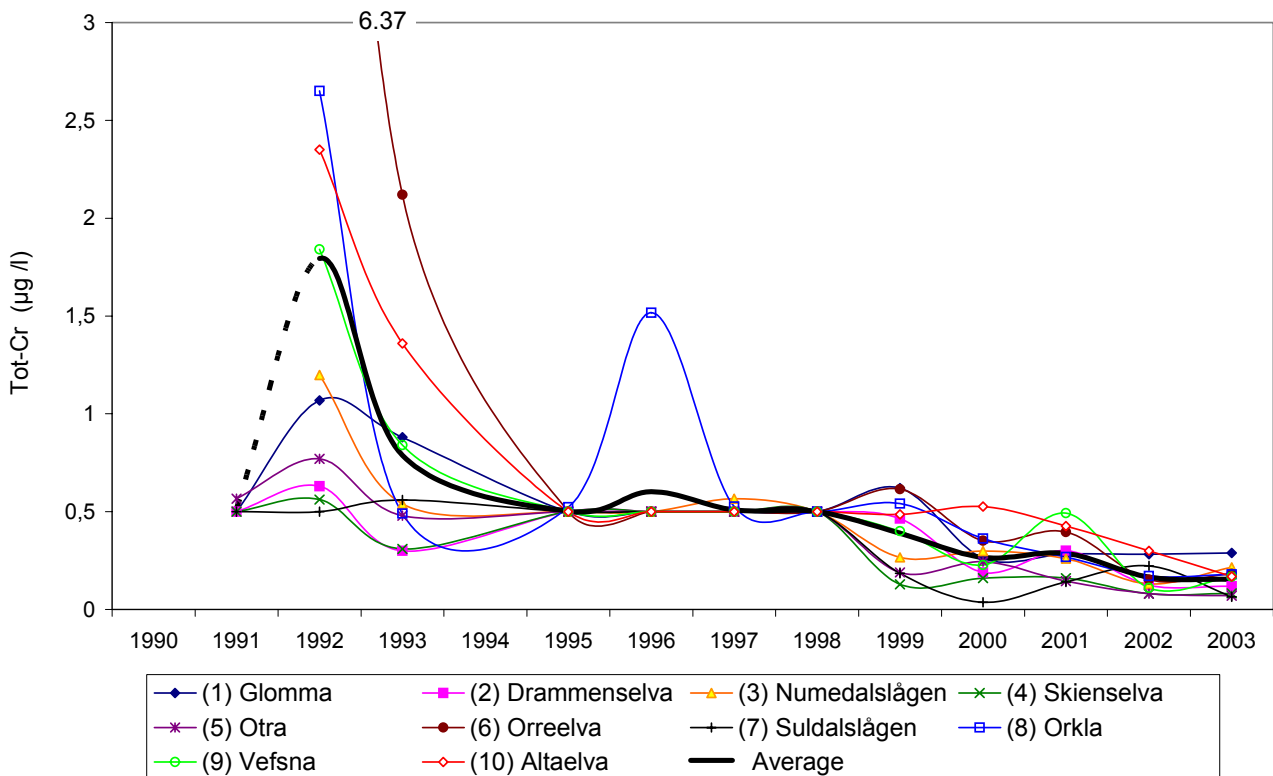


Figure XIII.XIV Total chromium (Tot-Cr) concentration in main rivers.
Mean value from 1991 to 2003 ($\mu\text{g/l}$). Since 1999 a lower limit of detection has been reported.

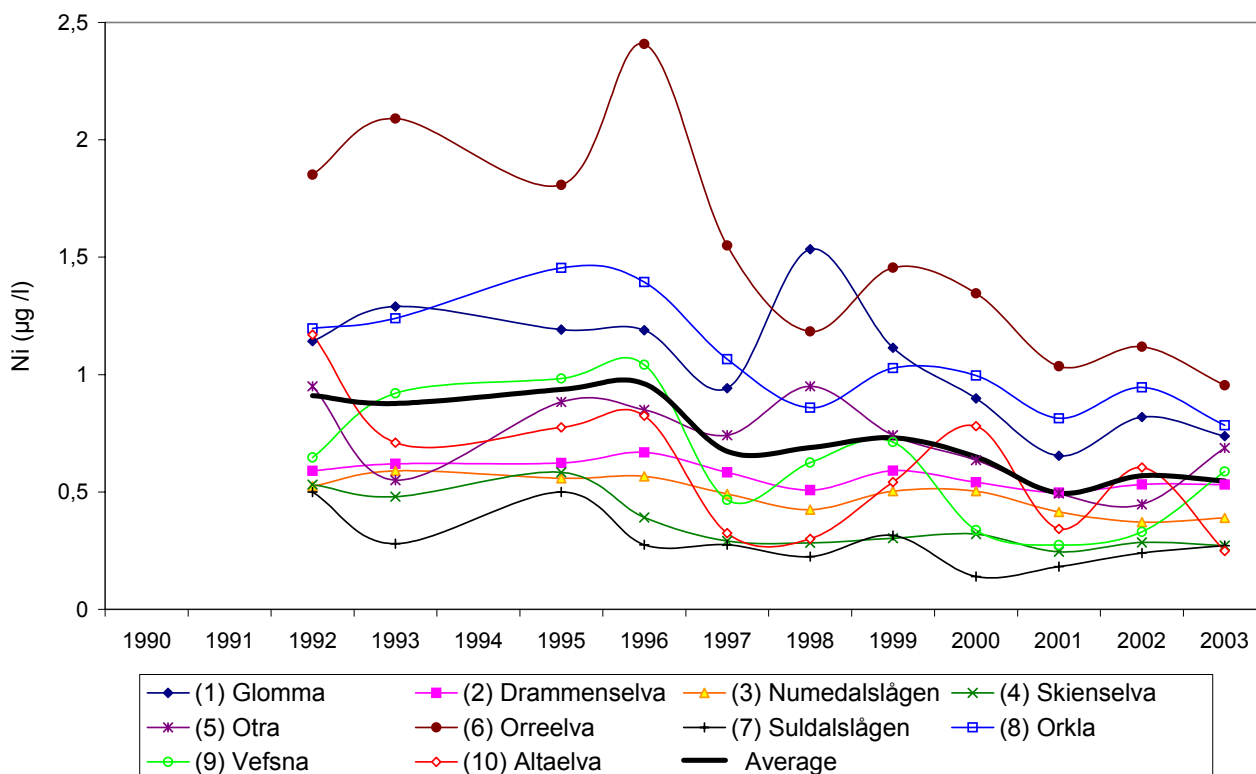


Figure XIII.XV Nickel (Ni) concentration in main rivers.
Mean value from 1992 to 2003 ($\mu\text{g/l}$).

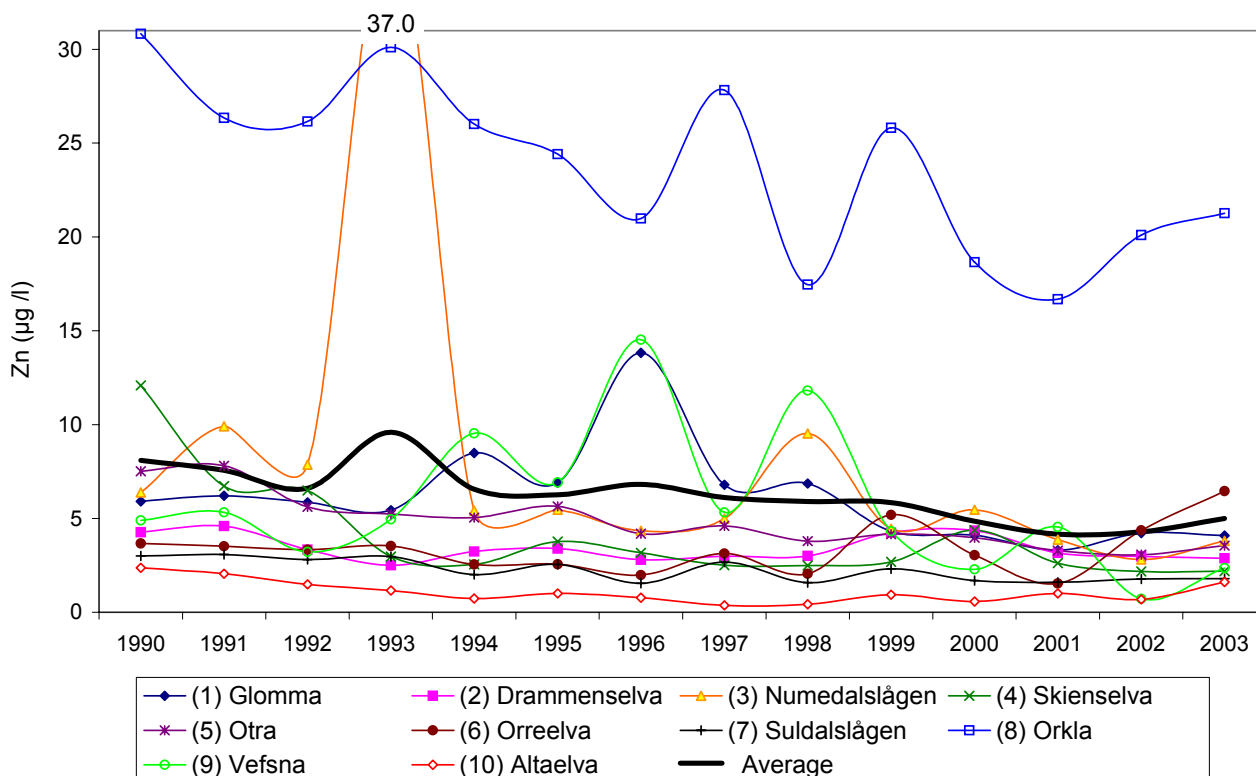


Figure XIII.XVI Zinc (Zn) concentration in main rivers.
Mean value from 1990 to 2003 ($\mu\text{g/l}$).

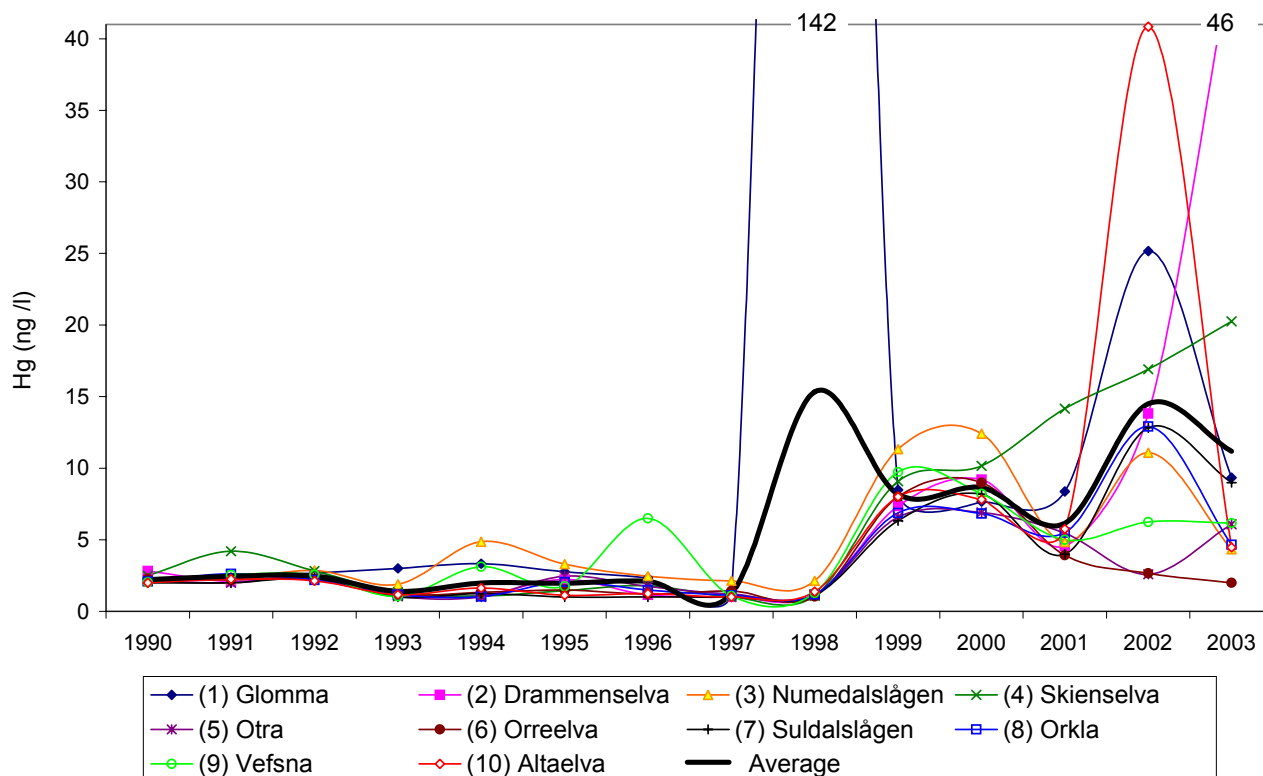


Figure XIII.XVII Mercury (Hg) concentration in main rivers.
Mean value from 1990 to 2003 (ng/l). Since 1999 a new analytical method is used.

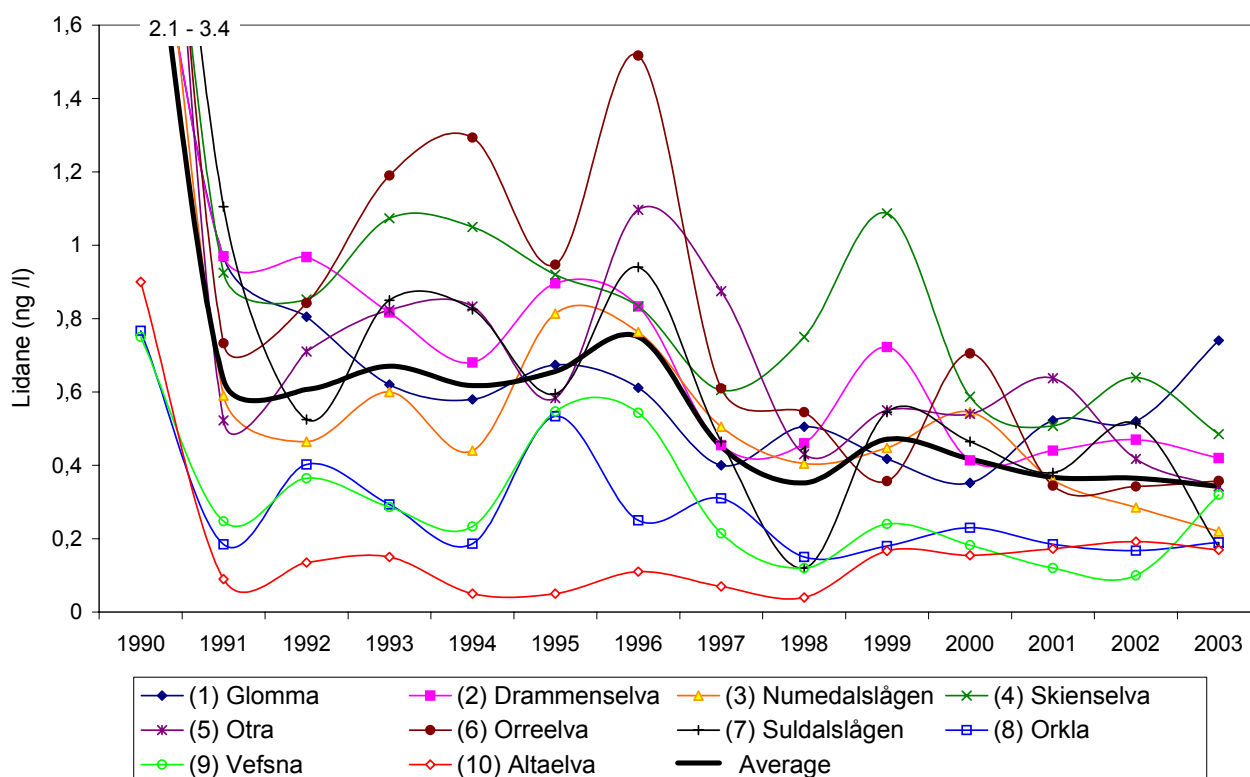


Figure XIII.XVIII Lindane concentration in main rivers
Mean value from 1990 to 2003 (ng/l).

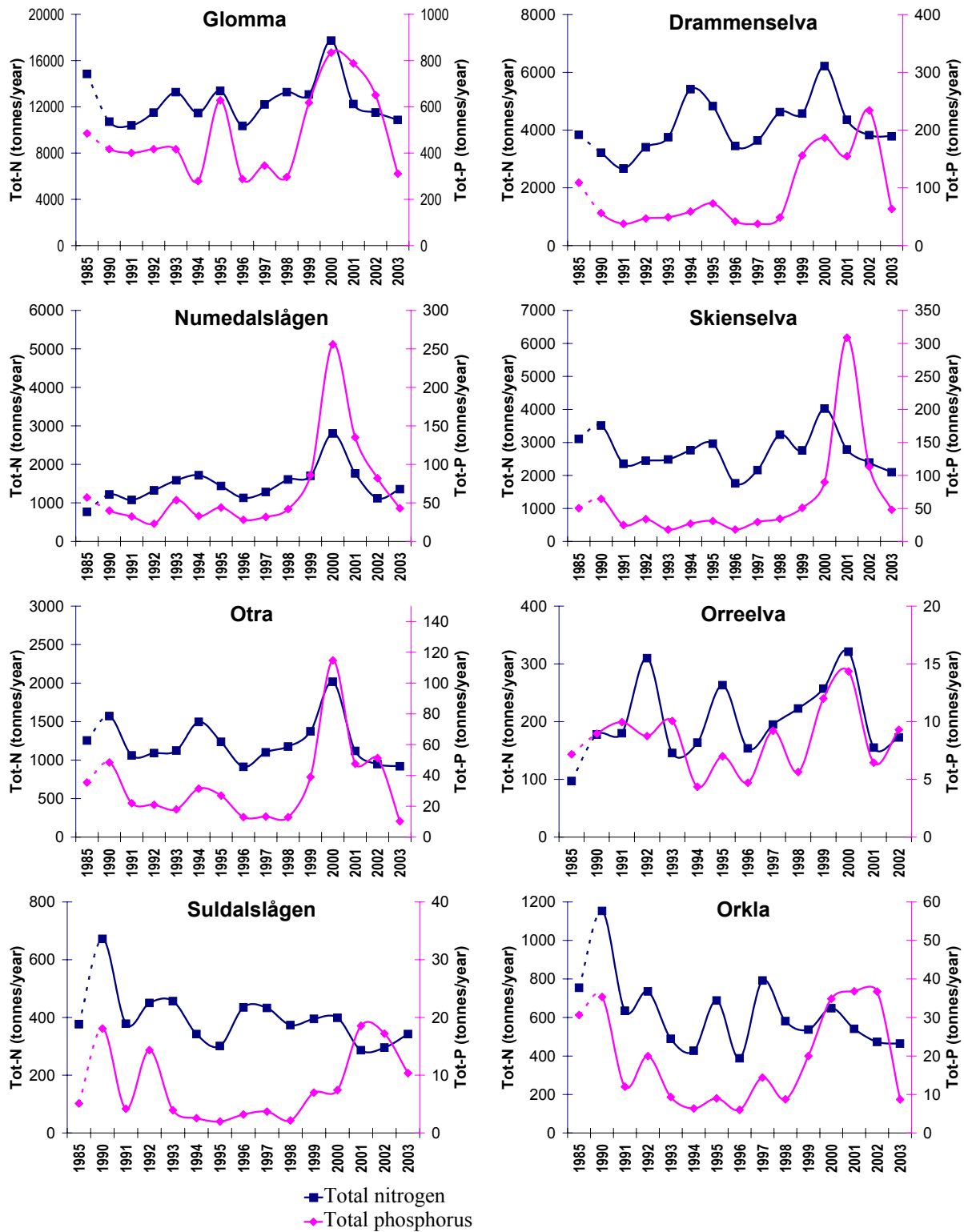


Figure XIX.XIX Total nitrogen (Tot-N) and total phosphorus (Tot-P) load in main rivers. Calculated load for 1985, 1990-2003 (tonnes/years). (Fig. continues on the next page.)

Direct and riverine inputs to Norwegian coastal waters – 2003. OSPAR Commission

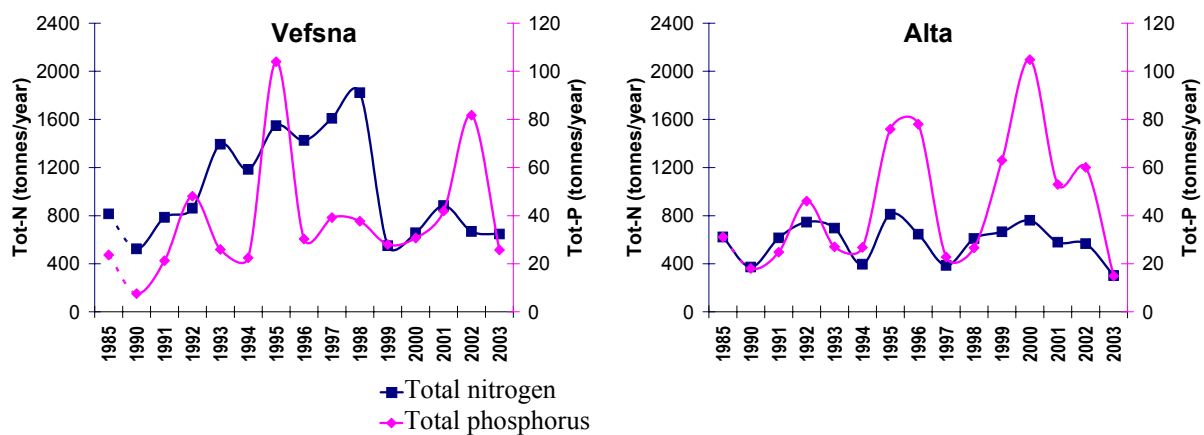


Fig. XIX.XIX (continue from previous page)