Statlig program for forurensningsovervåking

Levels and trends of metals and nutrients

Riverine inputs and direct discharges to Norwegian coastal waters – 2007

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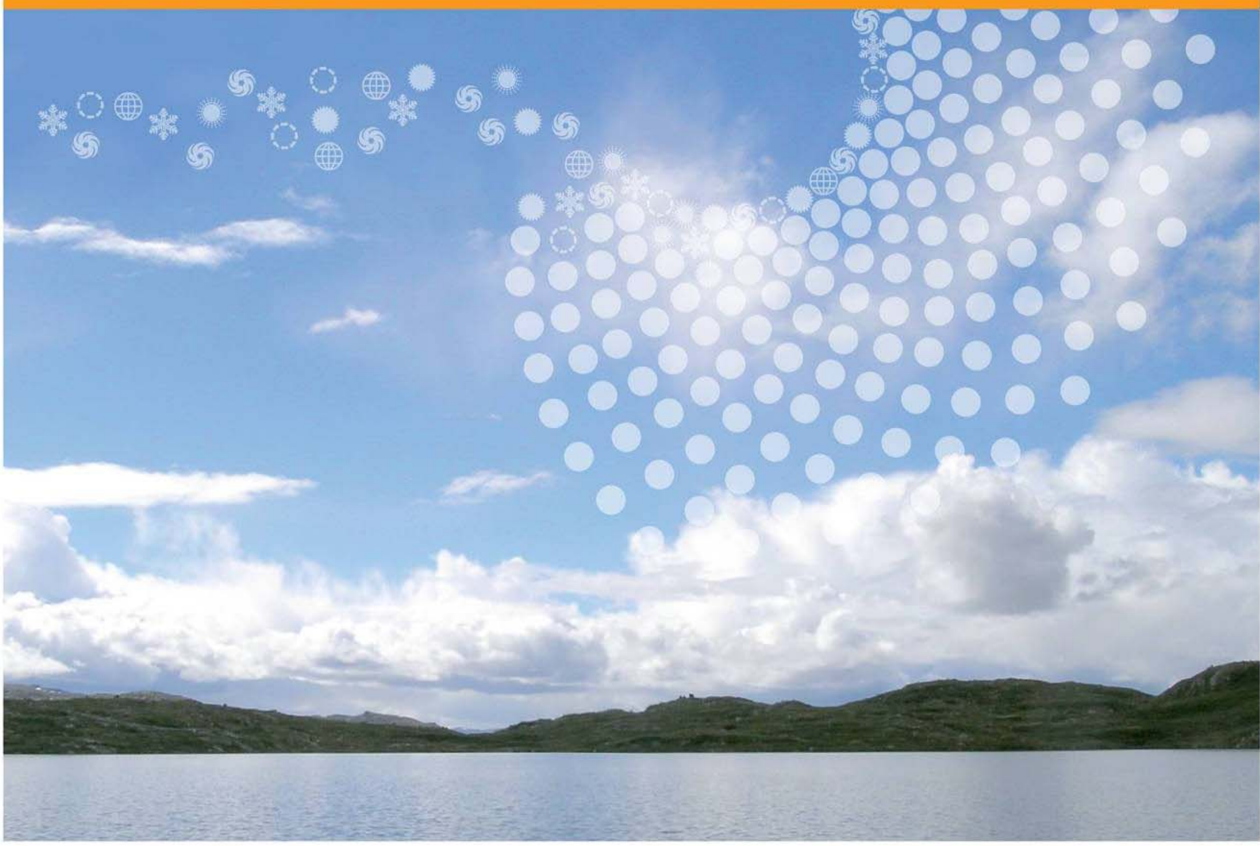

Riverine inputs and direct discharges to Norwegian coastal waters – 2007

OSPAR Commission

Norwegian Institute for Water Research
– an institute in the Environmental Research Alliance of Norway

REPORT

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Abstract

The report presents results from the 2007 monitoring of 46 Norwegian rivers in accordance with the requirements of the OSPAR Commission. Riverborne inputs of nutrients, suspended particulate matter, total organic carbon, silicate, metals (Cd, Hg, Pb, Cu, Zn, As), PCB7 and the pesticide lindane to Norwegian coastal waters are calculated based on concentration and flow data. In addition, the inputs from rivers not monitored, as well as direct discharges to marine waters along the coast from Sweden in the south to Russia in the north have been estimated. In general, there was an overall increase of inputs from 2006 to 2007 of most substances monitored in the RID Programme. The increases are within normal variations from year-to-year, and mainly caused by increased riverine water discharges and increased reporting of industrial discharges.

4 keywords, Norwegian	4 keywords, English
1. Elvetilførsler	1. Riverine inputs
2. Direkte tilførsler	2. Direct discharges
3. Norske kystområder	3. Norwegian coastal waters
4. Overvåking	4. Monitoring

Øyvind Kaste	*Øyvind Kaste*	*Jarle Nygard*
Project manager	Research manager	Strategy director

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Preface

This report presents the results of the 2007 monitoring of riverine and direct discharges to Norwegian coastal waters (RID). The monitoring is part of a joint monitoring programme under the "OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic".

The Norwegian contribution for 2007 has been administered by Jon L. Fuglestad and Christine Daae Olseng at the Norwegian Pollution Control Authority (SFT). SFT has commissioned the Norwegian Institute for Water Research (NIVA), the Norwegian Institute for Agricultural and Environmental Research (Bioforsk) and the Norwegian Water Resources and Energy Directorate (NVE) to organise and carry out the monitoring, undertake the analyses and report the results.

At NIVA, Øyvind Kaste has co-ordinated the RID programme in 2007. Other co-workers at NIVA include John Rune Selvik and Torulv Tjomsland (direct discharges and modelling with TEOTIL), Tore Høgåsen (databases, calculation of riverine loads), Eirik Fjeld (sub-chapter on emerging pollutants), Stein W. Johansen (quality assurance of chemical sampling; until July 2007), Bente Lauritzen (contact person at NIVAlab), Tor S. Traaen (quality assurance of chemical analyses; until October 2007), and Liv Bente Skancke (quality assurance of chemical sampling/analyses; from September 2007).

At Bioforsk, Eva Skarbøvik has been the main responsible for the 2007 reporting, Per G. Stålnacke has been main responsible for the overall data handling and the statistical parts of the report, Annelene Pengerud and Paul Andreas Aakerøy have assisted in data analyses and the editing of the final report. Stig A. Borgvang has represented the link to OSPAR's RID Assessment Panel and the RID Data Centre.

At NVE, Jarle Thorvaldsen has been responsible for the local sampling programmes, Stein Beldring has carried out the hydrological modelling, and Erlend Moe has been the administrative contact.

Overall quality assurance of the annual report has been carried out by Richard F. Wright, NIVA.

The sampling has been performed by several fieldworkers; their names are given in Annex II.

Below is an overview of sub-contractors and data sources involved:

- *The Norwegian Water Resources and Energy Directorate (NVE):*
  Water sampling, provision of water discharge data, water discharge modelling.
- *The Norwegian Institute for Agricultural and Environmental Research (Bioforsk)*
  Data analysis, reporting.
- *The TEOTIL-programme:*
  Calculations with the input-model TEOTIL2 of input of nutrients to Norwegian coastal areas in non-monitored water courses
- *The Norwegian Meteorological Institute (met.no):*
  Precipitation and temperature data
- *Statistics Norway (SSB):*

Data on discharges in outlets from wastewater treatment plants with a connection of > 50 p.e. (person equivalents).

- *The Norwegian Pollution Control Authority (SFT):*
  Data on discharges in outlets from industrial plants.
- *Directorate of Fisheries (FD):*
  Fish farming effluents.

Oslo, November 2008

Øyvind Kaste

Project co-ordinator

Content

Part A: Principles, Results and Discussions

Annexes:

Part B: Data Report

Part A

Principles, Results and Discussions

Summary

The main objective of the monitoring programme on Riverine Inputs and Direct Discharges (RID Programme) is to monitor and assess the riverine and direct inputs of selected pollutants to the Norwegian part of OSPAR's Maritime Area. The entire study area (i.e. main Norwegian land area) is divided into the following four coastal areas/sub-regions: Skagerak, North Sea, Norwegian Sea, and Barents Sea.

The monitoring in rivers is carried out in 10 so-called 'main rivers' with monthly sampling; and 36 so-called 'tributary rivers' with sampling 4 times a year. The catchment areas of these 46 rivers constitute about 50% of the Norwegian area draining to the Convention waters. The inputs from the remaining areas are estimated. The model Teotil is used to estimate loads of nutrients from unmonitored areas. Direct discharges are estimated for wastewater treatment plants, industry and fish farming (the industrial discharges reported here are from 2006).

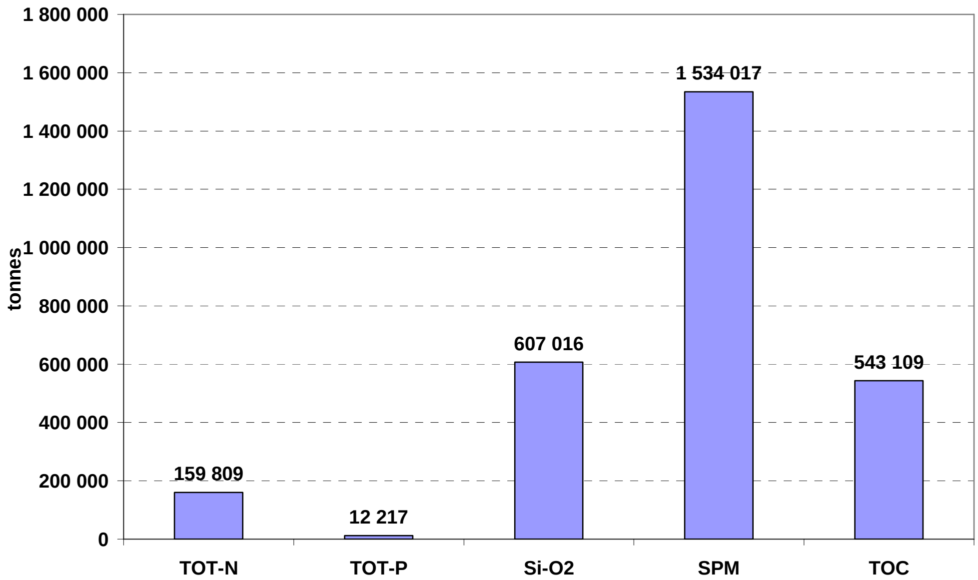
In 2007, additional monitoring was done in rivers in the southern parts of the country during summer floods, as well as in a set of rivers at the west coast during autumn. In addition, water samples from the rivers Glomma and Alna were analysed for different emerging polar pollutants, such as pesticides (and their degradation products), pharmaceuticals, hormones, antibiotics, and industrial chemicals (alkylphenolics and perfluorinated compounds). The results of this additional monitoring is given at the end of the RID report.

Climate conditions
2007 was a year with relatively high precipitation, which also gave high runoff in the rivers. Snowmelt came relatively early with floods in spring, whereas the southern part of the country had unusual high floods during summer. A relatively mild winter period resulted in recurring snowmelt episodes. In mid-Norway discharges were highly influenced by summer droughts, whereas discharges in the western parts were about 30 % higher than the long-term normal due to high precipitation in summer and autumn. Water discharges in the northern parts of the country did not differ considerably from the long-term normal, apart from extensive flooding in December due to high temperatures and precipitation.

Nutrient and particle inputs
The total nutrient input to coastal waters from land based sources in Norway in 2007 was estimated to about 12 000 tonnes of phosphorus and 160 000 tonnes of nitrogen (Figure 15). Total silicate inputs was estimated to about 600 000 tonnes and total organic carbon (TOC) to about 540 000 tonnes. The input of suspended particulate matter amounted to about 1.5 million tonnes.

There was an overall increase of suspended particulate matter from 2006 to 2007, mainly linked to high floods during sampling in the Skagerak region in the main rivers. Long-term trend analyses show a decrease in SPM *concentrations* in Otra, Orkla and Vefsna, but for sediment *loads* no clear trends have been found.

There was a reduction of loads of nitrogen from 2006 to 2007, but an increase in phosphorus loads. The latter can to a large extent be explained by increased water discharge during sampling dates. Nutrient inputs from direct discharges have also increased, but whether this is due to an actual increase or to improved reporting from the pollution sources is uncertain. The increase from aquaculture, however, is mainly believed to be due to an increase of this activity.



Total inputs of nutrients and particles in 2007

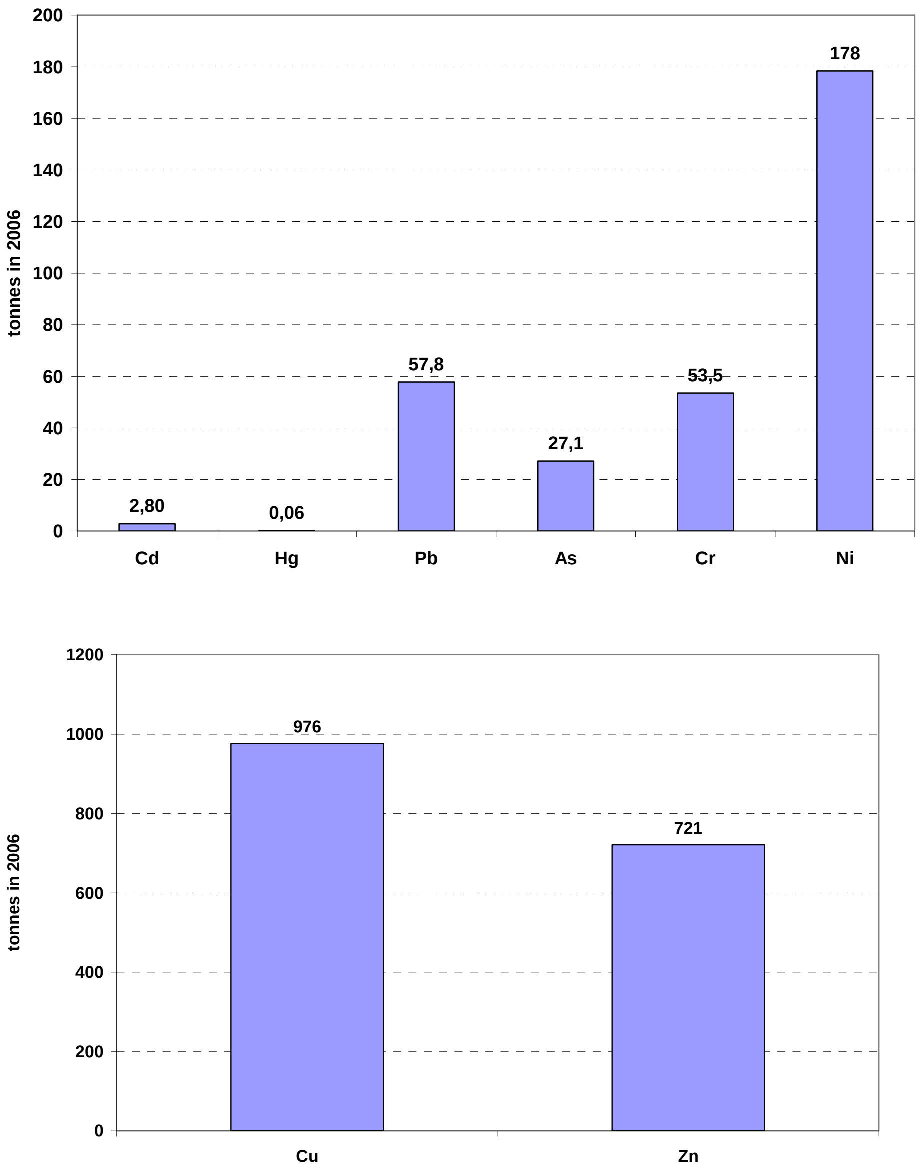
Long-term trend analyses show that nitrogen *concentrations* have been reduced in Rivers Skien, Vefsna and Alta, whereas in River Drammen the concentrations have increased over time. Nitrogen *loads* have been reduced in Rivers Skien and Vefsna, whereas there has been an increase in River Orreelva of both nitrogen and phosphorus loads during the period 2004-2007. There havce been a long-term downward trends for phosphorus *concentrations* in River Alta, whereas a downward trend for phosphorus *loads* has been found in River Vefsna.

Metal inputs

The total inputs of metals (lower estimates) in 2007 were estimated to 0.06 tonnes of mercury, 2.8 tonnes of cadmium, 27 tonnes of arsenic, 58 tonnes of lead, 54 tonnes of chromium, 178 tonnes of nickel, 721 tonnes of zinc and 976 tonnes of copper.

Direct discharges of metals have increased from 2006 to 2007, except for decreases in mercury, chromium and nickel inputs. It is not clear whether this is due to actual increases or to improved reporting by the pollution sources. An exception is the increase of copper losses from aquaculture, as compared to what was reported in former RID Reports. This is due to changed calculation methods for the losses of this metal when fish cages are cleansed in the fish farming units along the coast.

Riverine inputs of metals mainly increased from 2006 to 2007, due to a combination of high water discharges and relatively high concentrations in some rivers. In the long term perspective, however, both metal concentrations and loads have been reduced in most of the main rivers, but this may also be a result of changed detection limits over time. However, a clear trend in reduction of copper in River Vefsna has been detected.



Total inputs of metals in 2007

Lindane and PCB7 inputs

Total riverine loads of lindane in the main rivers were estimated to 0-13.6 kg depending on whether lower or upper estimates are used (Figure 29). The total PCB7 loads to the sea were calculated to 23-105 kg (depending on lower or upper estimates). Sewage effluents account for about 23 kg in 2007, due to reported discharges from sewage treatment plants in the Skagerak region. The concentrations of these two substances are so low that variations from year-to-year do not really reflect inputs but only the detection limits. It does therefore not make sense to discuss variations in these two substances.

Total inputs to Norwegian coastal areas

There was an overall increase of inputs from 2006 to 2007 of most substances monitored in the RID Programme. The increases are within normal variations from year-to-year, and mainly caused by increased riverine water discharges and increased reporting of industrial discharges (which in fact are from 2006).

1. Introduction

1.1 The RID Programme

The Riverine Inputs and Direct Discharges to Norwegian coastal waters (RID) is part of the OSPAR Programme for which the general principles, background and reporting requirements are shown in Annex I.

This report presents the 2007 results of the monitoring of 46 rivers in Norway, as well as estimated loads from the remaining land area draining into the Atlantic sea, including 201 unmonitored rivers and areas downstream sampling points (see Figure 1 for the different RID areas). The report also gives direct discharges from industry, sewage treatment plants and fish farming. The parameters monitored and the loads estimated are as agreed within OSPAR, i.e. nutrient fractions, metals and organic pollutants. The four coastal areas included in Norway's reporting include:

I. Skagerak:	From the Swedish border to Lindesnes (the southernmost point of Norway), at about 57°44'N
II. North Sea:	From Lindesnes northwards to Stadt (62° N)
III. Norwegian Sea:	From Stadt to the county border of Troms and Finnmark (70°30'N)
IV. Barents Sea:	From 70°30'N to the Russian border.

The total length of the coastline, including fjords and bays, is 21 347 km.

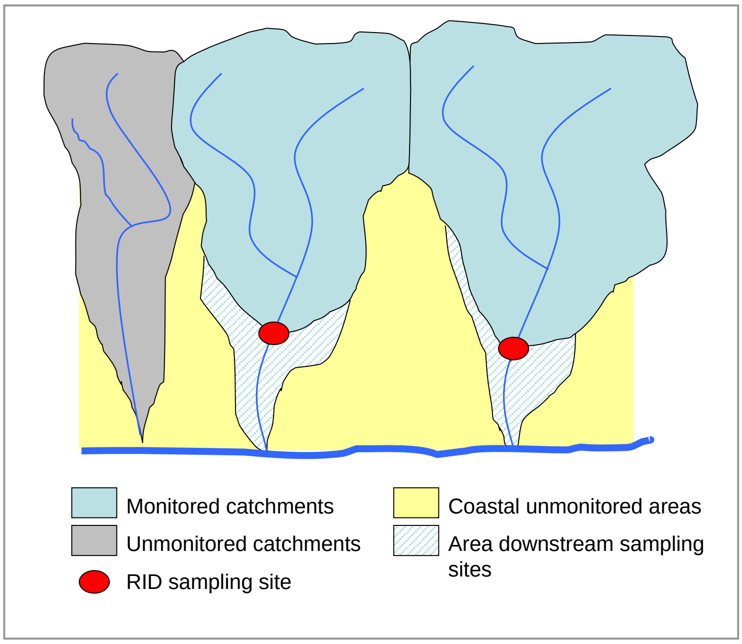


Figure 1. Illustration of how some areas are covered by RID monitoring stations (blue areas); whereas others are downstream of the sampling sites (blue shaded); others again are coastal areas between catchment (yellow); and finally there are unmonitored catchments (grey). Of the latter, 109 have been monitored earlier whereas 92 have never been monitored.

1.2 The RID Rivers

The Norwegian river basin register system "REGINE" (NVE; www.nve.no) classifies the Norwegian river basins into 262 main catchment areas, of which 247 drain into coastal areas. These rivers range from *Haldenvassdraget* in the south east (river no. 001) to *Grense Jakobselv* in the north east (river no. 247). A selection of these rivers has been done in order to fulfill the RID requirements, and in 2007, 10 'main' rivers were monitored monthly or more often; and 36 'tributary' rivers were monitored quarterly. It is important to note that the name 'tributary' is only used to signify that these rivers are monitored more seldom than the main rivers, as they all drain directly into the sea. The programme in 2007 is the same as that followed since 2004. See Annex IV for further details on the changes of the RID monitoring programme in former years.

Figure 2 shows the four coastal areas, and also illustrates how some of the 10 main rivers typically were chosen to represent larger land areas within these four regions.

The land use in the catchments of the 10 main rivers is shown in
Figure *3*. Large parts of Norway are covered by forests and mountainous areas, and the amount of agricultural land is much lower than in most other countries in Europe.
Figure *4* shows how Norway is divided into areas covered by forest, agriculture and artificial surfaces, mountains and mountain plateaus, as well as lakes and wetlands. The map clearly shows that mountains and forests are the main land cover categories, as reflected by the land use distribution in the main rivers.

More information on the catchments of the 46 monitored rivers is given in Annex III.

1.3 Unmonitored areas and direct discharges

Unmonitored areas include areas downstream the sampling points of the 46 RID rivers, as well as inputs from unmonitored rivers and coastal areas (cf. Figure 1). In the unmonitored areas, inputs are calculated, partly based on data from former years, partly on the TEOTIL model, and partly by using reported discharges from point sources such as industry, sewage treatment plants and fish farming. Direct discharges have been estimated based on data from the Norwegian Pollution Control Authority's FORURENSNING database (for industry); Statistics Norway's database KOSTRA (for municipal wastewater and wastewater from scattered dwellings); and the Directorate of Fisheries' ALTINN database (for information of discharges from aquaculture and fisheries).

1.4 The 2007 RID Report

The 2007 RID Report is organised as follows:

- The methodology of the RID Programme is outlined in Chapter 2, but with details presented in Annex IV;
- Climatic conditions in 2007 are described in Chapter 3, since these conditions in many ways explain the variability in the riverine loads;
- Main results of the 2007 RID Programme are given in Chapter 4;
- A comparison between the results of 2007 and 2006 are given in Chapter 5;
- Trends of concentrations since 1990 are given for water discharge normalised data for the 10 main rivers in Chapter 6;

- Trends of loads since 1990 is given in Chapter 7 for the 10 main rivers;
- In 2007, some additional sampling was done in several rivers, some samples were analysed for typical RID parameters whereas others were analysed for emerging pollutants. The results are given in Chapter 8.
- The main conclusions of the 2007 RID Programme are summarised in Chapter 9.

In order to improve the readability of the 2007 RID Report, more text, tables and figures have been placed in annexes to part A.

Part B gives, as in former years, the three most important data tables of the programme, namely an overview of all concentrations and water discharge values in all rivers during sampling in 2007; the calculated annual loads of each river in 2007; as well as overview tables of all loads to the four coastal areas and total for Norway in 2007.

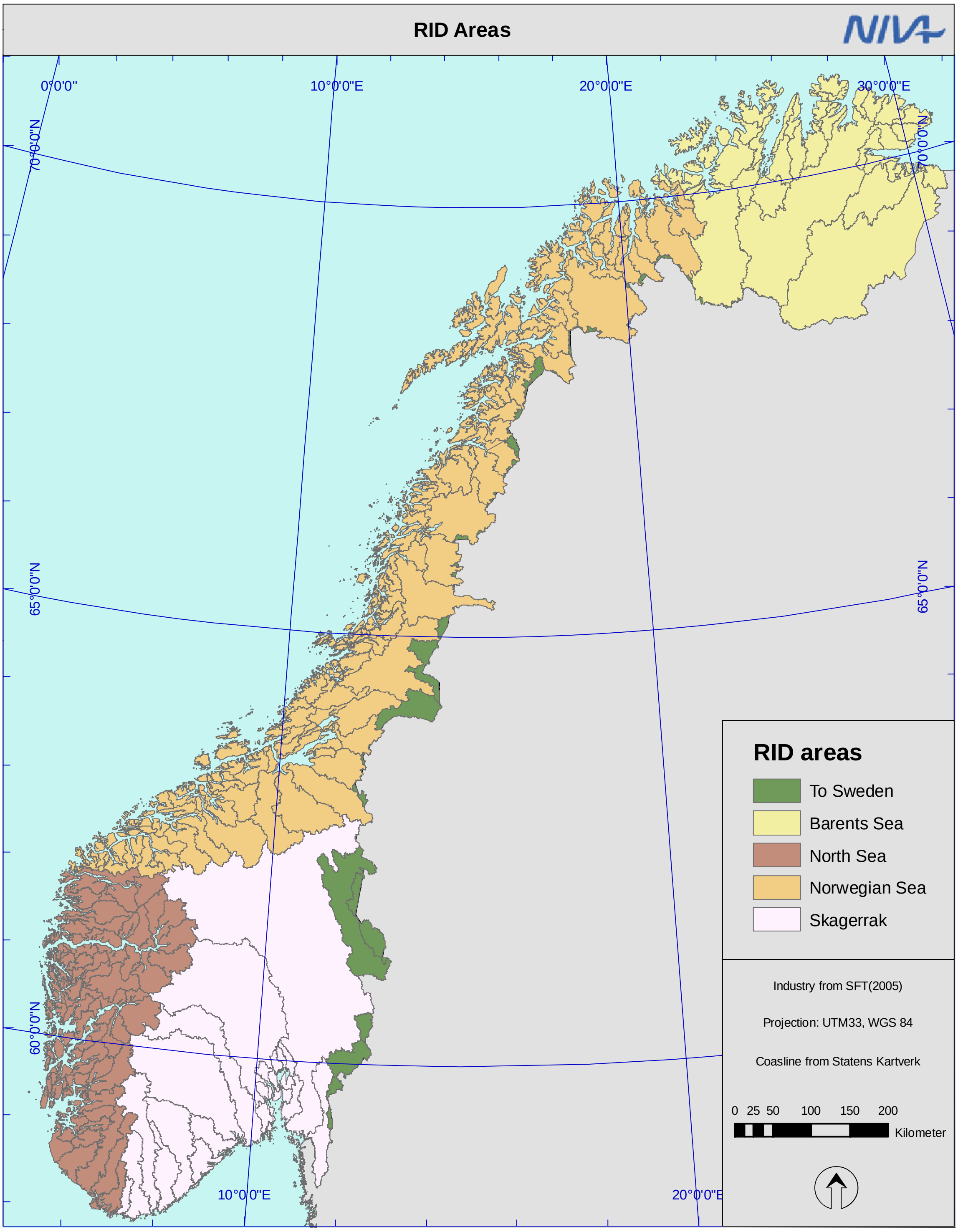


Figure 2. Norway has been divided into four Discharge Areas, i.e. Skagerak, North Sea, Norwegian Sea and the Barents Sea. Minor parts of Norway drain to Sweden.

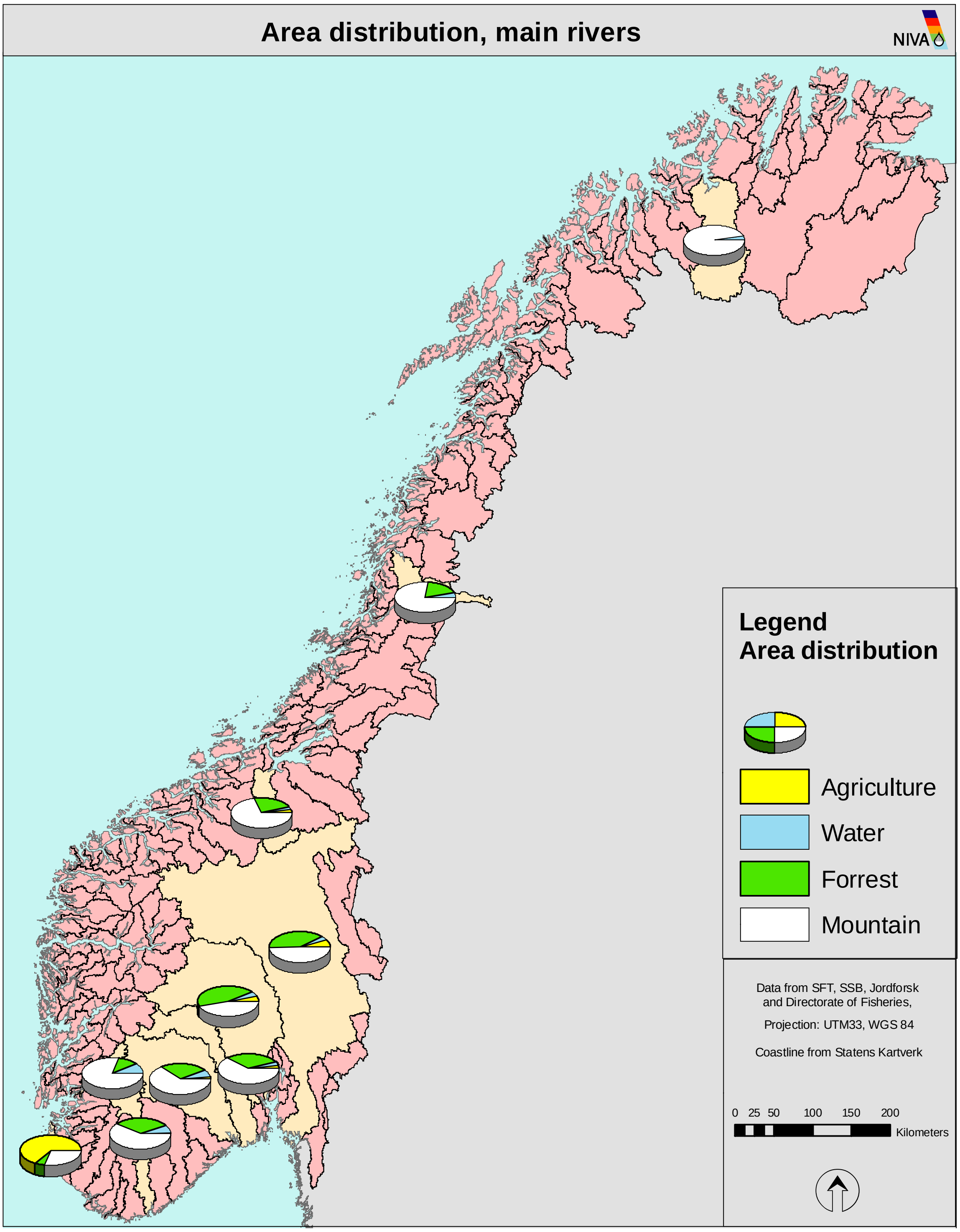


Figure 3. Land use in the catchment areas of the 10 main rivers. "Water" signifies proportion of lakes in the catchment; "Mountains" include moors and mountain plateaus not covered by forest. Based on data from The Norwegian Forest and Landscape Institute.

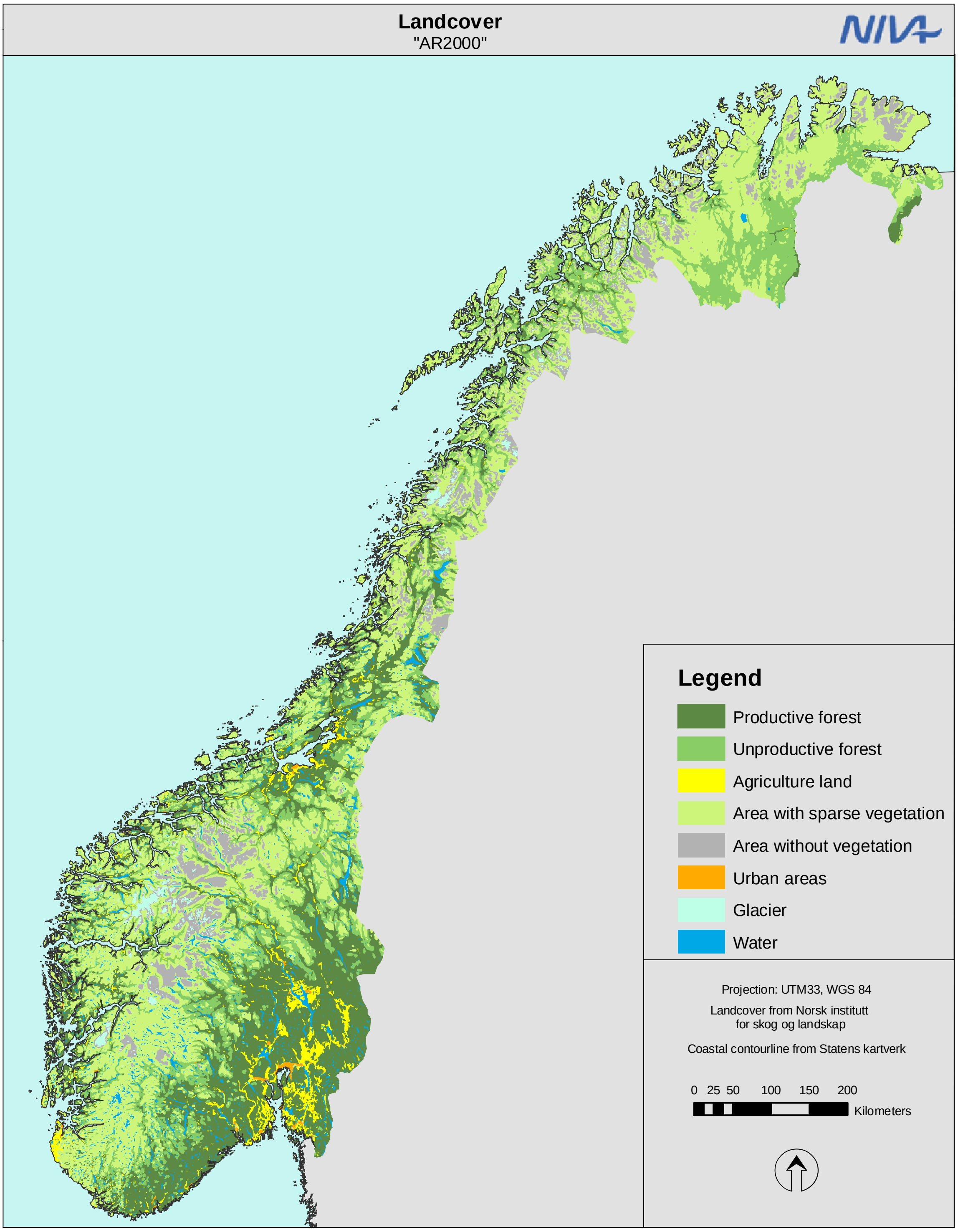


Figure 4. Land cover map of Norway. See also Figure 3 where the land use in the catchments of the 10 main RID rivers is shown.

2. Methodology

This chapter gives a relatively brief overview of the methodology used in the RID Programme, including both methodology used to estimate the riverine loads and the direct discharges. More detailed methodological information is given in Annex IV.

2.1 Selection of RID Rivers

Table 1 gives an overview of the major “types” of Norwegian rivers draining into coastal areas as related to the RID Programme. The selection of the 10 + 36 RID rivers is more thoroughly described in Annex IV, but a short overview is given here:

- Of the 10 main rivers, 8 have been selected because they are believed to be the most important load-bearing rivers; whereas two relatively unpolluted rivers (*Suldalslågen* and *Alta*) were included for comparison purposes.
- The 36 rivers sampled 4 times a year were selected due to their size and loads, as well as available water discharge measurements.
- The total drainage area of the 46 monitored rivers is about 180 000 km^2, which constitutes about 50% of the total Norwegian land area draining into the convention seas.

Prior to 2004, the RID Programme sampled the 36 rivers once a year, in addition to 109 other rivers. After 2004, the 109 rivers have not been sampled by the programme. Of the total of 247 rivers draining into the sea, 92 have never been sampled by the RID Programme (c. Table 1). However, the RID Programme estimates inputs from the entire Norwegian area draining into convention waters, except from Spitsbergen.

Table 1. Norwegian rivers draining into coastal areas and the methods used to estimate loads from these rivers.

Type of river	Number
Total number of rivers draining into Norwegian coastal areas	247
Main rivers, monitored monthly or more often	10
Tributary rivers, monitored quarterly since 2004	36
Tributary rivers, monitored once a year in 1990-2003; modelled from 2004 onwards	109
Rivers that have never been monitored by the RID Programme (loads are modelled)	92

2.2 Water Sampling Methodology

The methodology described in the Commissions Document “Principles of the Comprehensive Study on Riverine Inputs” (PARCOM, 1988; 1993) has been followed. Sampling has been carried out in the same manner as the previous year (Skarbøvik et al., 2007).

The quarterly sampling has been designed to cover four main meteorological and hydrological conditions in the Norwegian climate, viz. winter season with low temperatures, snowmelt during spring, summer low flow season, and autumn floods/high discharges. In 2007, additional samples were collected in several rivers, as reflected in Table 2 and Table 3, which show the sampling frequency and dates of sampling for respectively the 10 rivers monitored monthly or more often, and the 36 rivers monitored quarterly.

Table 2. Sampling frequency and dates in 2007 in the 10 main rivers, for all substances (above) and PCB7 and lindane (below).

River	Glomma	Drammen	Numedals-lågen	Skiens-elva	Otra	Orre	Suldals-lågen	Orkla	Vefsna	Altaelva
Dates of sampling (dd.mm.)	08.01.	03.01.	09.01.	10.01.	15.01.	08.01.	17.01.	04.01.	05.01.	08.01.
	05.02.	07.02.	13.02.	15.02.	15.02.	06.02.	16.02.	12.02.	05.02.	06.02.
	05.03.	07.03.	26.03.	05.03.	05.03.	06.03.	15.03.	08.03.	05.03.	12.03.
	10.04.	04.04.	11.04.	10.04.	24.04.	10.04.	13.04.	11.04.	02.04.	09.04.
	07.05.	05.05.	07.05.	03.05.	08.05.	07.05.	11.05.	07.05.	04.05.	07.05.
	16.05.	16.05.								
	25.05.	29.05.								
	04.06.	06.06.	12.06.	13.06.	21.06.	12.06.	18.06.	07.06.	08.06.	18.06.
	15.06.	18.06.								
	25.06.	25.06.								
		04.07.	06.07.	06.07.	06.07.	09.07.	26.07.	05.07.	06.07.	10.07.
		06.07.	06.07.	11.07.						
	09.07.	11.07.	11.07.							
	06.08.	08.08.	07.08.	08.08.	14.08.	06.08.	16.08.	08.08.	13.08.	06.08.
	10.09.	05.09.	11.09.	11.09.	12.09.	11.09.	17.09.	24.09.	11.09.	10.09.
	08.10.	02.10.	09.10.	01.10.	04.10.	02.10.	05.10.	08.10.	01.10.	01.10.
	05.11.	08.11.	06.11.	06.11.	07.11.	06.11.	07.11.	06.11.	05.11.	05.11.
	09.12.	04.12.	11.12.	10.12.	12.12.	11.12.	10.12.	05.12.	07.12.	10.12.
No.	16	18	14	13	12	12	12	12	12	12

River	Glomma	Drammen	Numedals-lågen	Skiens-elva	Otra	Orre	Suldals-lågen	Orkla	Vefsna	Altaelva
PCB7 and	05.02	07.02	13.02	15.02.	15.02.	06.02	16.02	12.02	05.02	06.02
	07.05	05.05.	07.05	03.05.	08.05	07.05	11.05	07.05	04.05	07.05
	06.08	08.08	07.08	08.08.	14.08	06.08	16.08	08.08	13.08	06.08
	08.10	02.10	09.10	01.10.	04.10	02.10	05.10	08.10	01.10	01.10
No.	4	4	4	4	4	4	4	4	4	4

Table 3. Sampling frequency and dates in 2007 in the 36 tributary rivers.

River	Tista	Tokkeelva	Nidelv (south)	Tovdalselva	Mandalselva	Lyngdalselva
Date ddmmyyy	05.02	06.02	06.02	04.02	20.02	20.02
	11.05.	15.05	15.05	08.05.	19.05.	19.05
		06.07				
		11.07				
	06.08	13.08	13.08	14.08	16.08	16.08
	08.10	22.10	22.10	04.10	30.09	30.09.
River	Kvina	Sira	Bjerkreimselva	Figgjoelva	Lyseelva	Årdalselva
Date ddmmyy	20.02.2007	20.02.2007	25.02.2007	06.02.2007	12.02.2007	19.02.2007
	19.05.2007	19.05.2007	09.05.2007	08.05.2007	07.05.2007	15.05.2007
	16.08.2007	16.08.2007	25.08.2007	08.08.2007	20.08.2007	09.08.2007
	30.09.2007	30.09.2007	29.10.2007	02.10.2007	10.10.2007	10.10.2007
River	Ulla	Sauda	Vikedalselva	Vosso	Jostedøla	Gaular
Date ddmmyy	19.02.2007	19.02.2007	19.02.2007	12.02.2007	12.02.2007	12.02.2007
	15.05.2007	15.05.2007	15.05.2007	22.05.2007	14.06.2007	25.05.2007
					16.08.2007	30.08.2007
					03.10.2007	05.10.2007
					15.10.2007	22.11.2007
					08.11.2007	29.11.2007
	09.08.2007	09.08.2007	09.08.2007	27.08.2007	28.11.2007	11.12.2007
	10.10.2007	10.10.2007	10.10.2007	04.10.2007	10.12.2007	18.12.2007
River	Jølstra	Nausta	Breimselva	Driva	Surna	Gaula
Date ddmmyy	12.02.2007	12.02.2007	27.02.2007	25.02.2007	26.02.2007	20.02.2007
	25.05.2007	25.05.2007	10.06.2007	22.05.2007	09.05.2007	24.05.2007
	31.08.2007	30.08.2007	26.08.2007	29.08.2007	15.08.2007	29.08.2007
	05.10.2007	05.10.2007	19.10.2007	05.10.2007	09.10.2007	06.11.2007
River	Nidelva	Stjørdalselva.	Verdalselva.	Snåsa	Namsen	Røssåga
Date ddmmyy	20.02.2007	20.02.2007	24.02.2007	24.02.2007	24.02.2007	09.02.2007
	24.05.2007	24.05.2007	25.05.2007	25.05.2007	25.05.2007	04.05.2007
	29.08.2007	29.08.2007	29.08.2007	29.08.2007	29.08.2007	13.08.2007
	06.11.2007	06.11.2007	07.11.2007	07.11.2007	07.11.2007	01.10.2007
River	Ranaelva	Beiarelva	Målselv	Barduelva	Tanaelva	Pasvikelva
Date ddmmyy	14.02.2007	08.03.2007	04.02.2007	04.02.2007	05.02.2007	06.02.2007
	04.05.2007	06.06.2007	07.05.2007	07.05.2007	07.05.2007	07.05.2007
	13.08.2007	15.08.2007	12.08.2007	12.08.2007	06.08.2007	10.08.2007
	01.10.2007	22.10.2007	01.10.2007	01.10.2007	02.10.2007	01.10.2007

The sampling sites are indicated on the map in Figure 5.

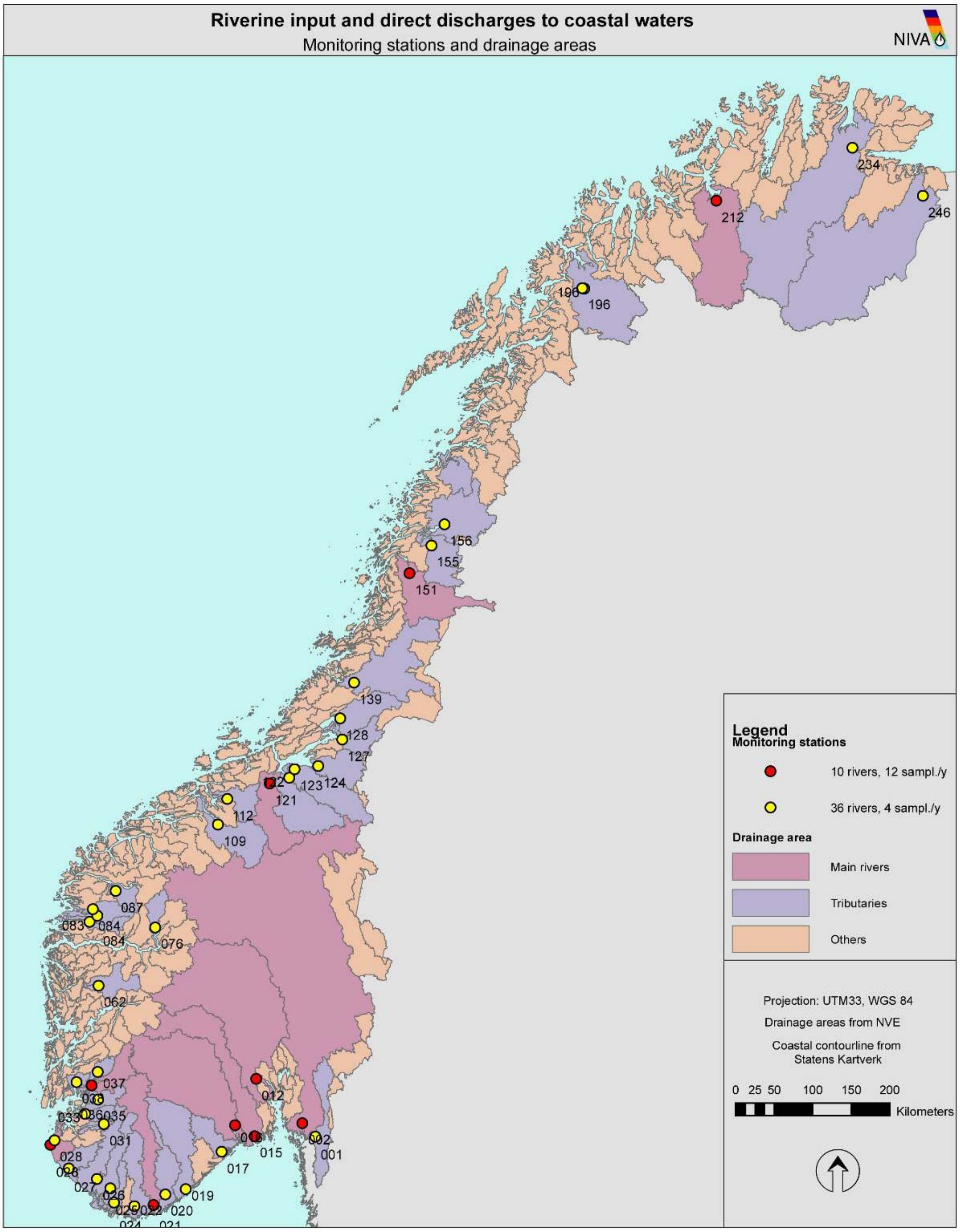


Figure 5. River sampling sites in the Norwegian RID programme. Red dots represent the 10 main rivers. Yellow dots represent the 36 'tributary' rivers. Numbers next to the dots refer to the national river register (REGINE; www.nve.no).

2.3 Chemical parameters – detection limits and analytical methods

In 2007, the following parameters were monitored:

- Six fractions of nutrients (total phosphorus, orthophosphates, total nitrogen, ammonium, nitrate + nitrite and silicate)
- Eight heavy metals (copper, zinc, cadmium, lead, chromium, nickel, mercury and arsenic)
- One pesticide (lindane)
- Seven PCB compounds (CB28, CB52, CB101, CB118, CB138, CB153, CB180)
- Four general parameters; suspended particulate matter (S.P.M.), pH, conductivity and total organic carbon (TOC).

Information on methodology and obtainable limits of detection for all parameters included in the sampling programme, are shown in Annex IV. There have been no changes in the analytical methods or in detection limits since the RID 2006-programme (Skarbøvik et al., 2007).

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

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

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

According to the RID Principles, and in particular 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. no more than 30% of the samples below the detection limit). As shown in Table 4, four metals and two nutrient species did not achieve this requirement in 2007. This includes cadmium, arsenic, mercury and chromium, as well as orthophosphate and ammonium. As previously, PCB7 compounds and Lindane were 100% below the detection limit. As the analytical methods used have acceptably low detection limits, the data thus indicate that the concentrations of these parameters were relatively low in Norwegian river waters in 2007.

Table 4. Proportion of analyses below detection limit for all parameters included in the sampling programme in 2007. Detection limits are shown in Annex IV.

Parameter	Unit	% below detection limit	Total no of samples	No of samples below det limit
pH		0	379	0
Conductivity	mS/m	0	379	0
SPM	mg/l	3	379	10
TOC	mg/l C	0	377	0
TOT-P	µg/l P	3	379	13
PO_4-P	µg/l P	33	379	125
TOT-N	µg/l N	0	379	0
NO_3-N	µg/l N	2	379	6
NH_4-N	µg/l N	38	379	144
SiO_2	mg/l SiO_2	0	379	0
Pb	µg/l	3	379	12
Cd	µg/l	32	378	122
Cu	µg/l	0	379	0
Zn	µg/l	1	379	2
As	µg/l	39	378	149
Hg	ng/l	88	379	335
Cr	µg/l	44	378	168
Ni	µg/l	8	379	31
Lindane (HCHG)	ng/l	100	40	40
PCB (CB101-V)	ng/l	100	40	40
PCB (CB118-V)	ng/l	100	40	40
PCB (CB138-V)	ng/l	100	40	40
PCB (CB153-V)	ng/l	100	40	40
PCB (CB180-V)	ng/l	100	40	40
PCB (CB28-V)	ng/l	100	40	40
PCB (CB52-V)	ng/l	100	40	40

2.4 Quality assurance and direct on-line access to data

Data from the laboratory analyses were transferred to a database and quality checked against historical data by researchers with long experience in assessing water quality data. Whenever any anomalies were found, the samples were re-analysed. When this quality assurance was done, the data were transferred to NIVA's web pages, where an on-line system was established early in 2004. The system allows the authorised users to view values and graphs of each of the 46 monitored rivers. Data were uploaded continuously after each sampling.

2.5 Water discharge and hydrological modelling

For the 10 main rivers, daily water discharge measurements were, as in former years, used for the calculation of loads. Since the stations for water discharge are not located at the same site as the water quality stations, the water discharge at the water quality sampling sites have been calculated by up- or downscaling, according to drainage area.

For the 36 rivers monitored quarterly, as well as the remaining 109 rivers from the former RID studies, water discharge has been simulated with a spatially distributed version of the HBV-model (Beldring et al., 2003). The use of this model was introduced in 2004. Annex IV gives more information on the methodology.

Since 2006, the model algorithms have been improved and the model has been re-calibrated against observed streamflow from 121 catchments located in different hydrological regimes and landscape types in Norway, in order to determine a globally applicable set of model parameters. This has resulted in better correlation between observed and simulated water discharge.

2.6 Calculating Riverine Loads

The formula given by the Paris Commission was used for calculating loads for all of the 46 rivers:

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

C_i = measured concentration in sample *i*
Q_i = corresponding flow for sample *i*
Q_r = mean flow rate for each sampling period (i.e., annual flow)
N = number of samples taken in the sampling period

Essentially the formula expresses the annual load (L) as the product of a flow-weighted estimate of annual mean concentration and annual flow (Qa).

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

- For nutrients, S.P.M, Silica and TOC, the modelled average water discharge in 2007 was multiplied with average concentration for the period 1990-2003.
- For metals, the modelled average water discharge in 2006 was multiplied with average concentration for the period 2000-2003 (earlier data were not used due to high detection limits).

For the remaining area (includes those 92 remaining rivers that drain to the sea, but not included in either this or former RID studies as well as areas downstream of the sampling points), the nutrient loads were calculated by means of the TEOTIL model. The model was used to assemble pollution load compilations of nitrogen and phosphorus in catchments or groups of catchments. The model estimates annual loads of phosphorus and nitrogen based on national statistical information on population, effluent treatment, industrial and agricultural point sources. Losses from agricultural fields and natural run-off from forest and mountain areas are based on an export coefficient approach.

For metals, all direct discharges of metals in these unmonitored areas were considered to be direct discharges to the sea.

2.7 Direct discharges to the sea

Data sources for direct discharges include:

- Municipal wastewater and scattered dwellings (Statistics Norway- SSB / KOSTRA);
- Agriculture (BIOFORSK)- *nutrients only*
- Aquaculture (The Directorate of Fisheries / ALTINN (altinn.no))- *nutrients only*
- Industry (The Norwegian Pollution Control Authority - SFT/Forurensning)

The details on how these data are extracted are given in Annex IV.

The reporting of industrial wastewater in 2007 was delayed due to changes in the database, and the data for 2007 are therefore based on the 2006-reporting.

Inputs from fish farming are done as in former years. The sale statistics of SSB with regard to trout and salmon show an increase in fish farming activities of 17 % from 2006 to 2007 (see Figure 6), which has a bearing on the discharges from fish farming although there has been improvements in treatment and production procedures.

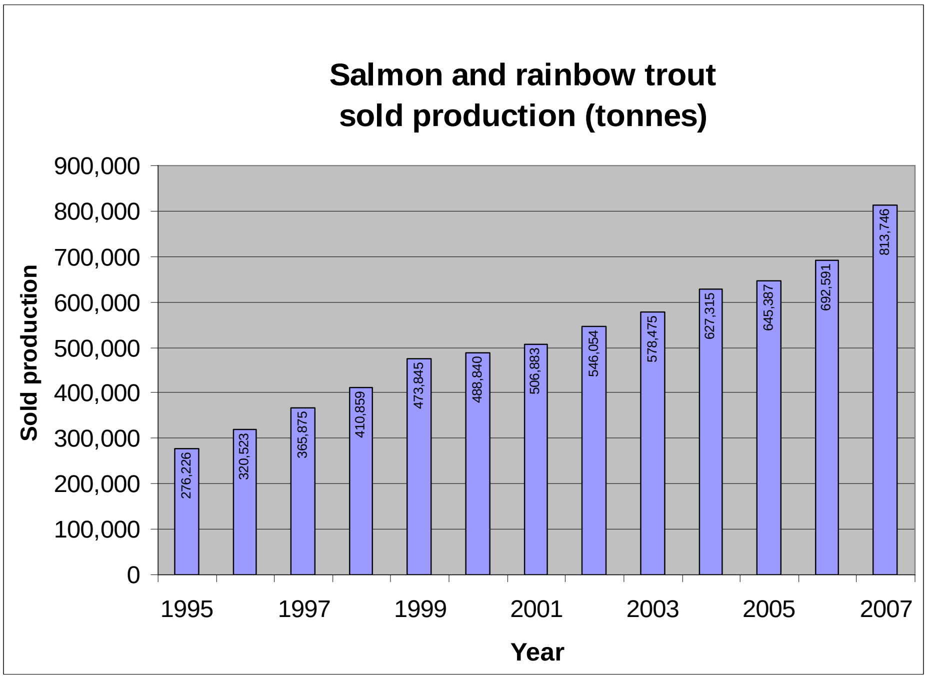


Figure 6. Quantities of sold trout and salmon for the period 1995-2007 (based on SSB data).

3. Climatic conditions in 2007

The riverine inputs reported in the 2007 RID Programme are directly dependent on the meteorological and hydrological conditions of the year. An overview of these conditions (i.e. air temperature, precipitation and water discharge) is therefore given in this chapter.

3.1 Air temperature

Mean annual temperature in Norway in 2007 was 1.3 °C above the long-term normal (1961-1990), which makes 2007 the 10th warmest year registered in Norway since 1900. This is 0.5 °C lower than the mean annual temperature in the three years of maximum temperature; 1934, 1990 and 2006. The largest deviations from the long-term normal were registered in northern and parts of eastern Norway, where mean annual temperatures were up to 2 °C above normal (Figure 7).

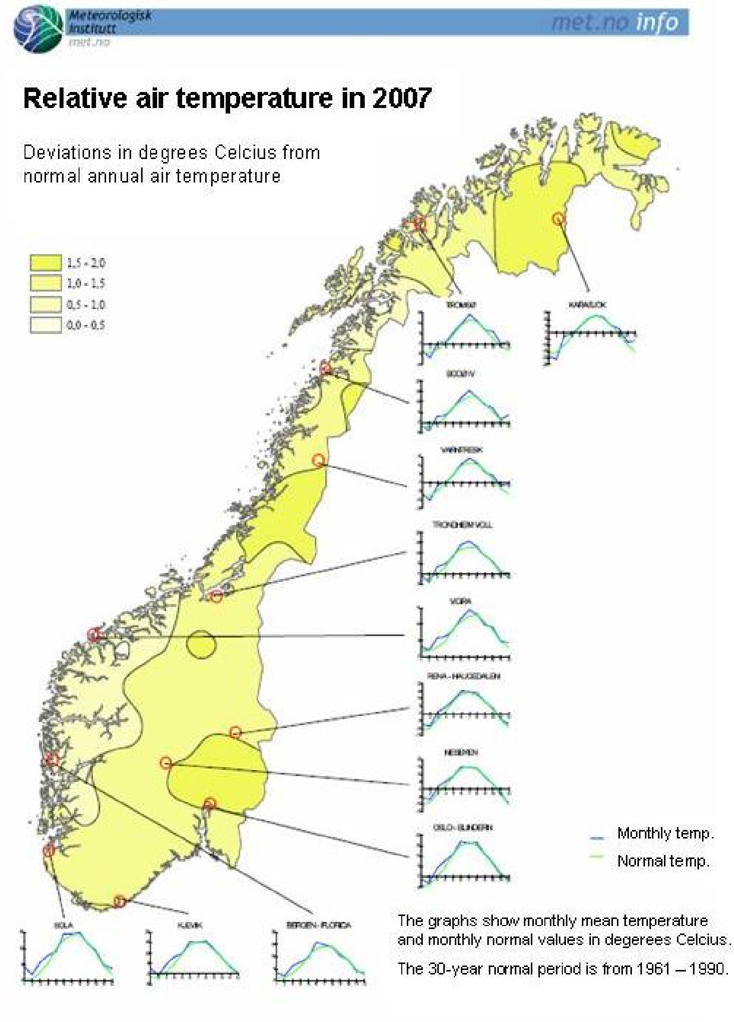


Figure 7. Air temperature in Norway in 2007 relative to the long-term normal of 1961-1990. Source: Norwegian Meteorological Institute (met.no).

The highest mean annual temperatures (up to 9 °C) were registered along the coast of southern Norway, with temperatures ranging between 1.2 and 1.6 °C above normal. The lowest mean annual temperatures were registered in the mountain areas of southern Norway (-1.8 °C) and at *Finnmarksvidda* in northern Norway (-1.3 °C), with mean annual temperatures ranging between 1.1 and 1.8 °C above normal (met.no, 2008).

High air temperatures largely influence runoff conditions in Norway, as temperatures determine the extent of snowmelt and glacial melting. Even though a mild, snow-rich winter led to a positive mass-balance for most glaciers in 2007, the high air temperatures still caused most glacial ice fronts to withdraw during the year. Water temperatures during summer in southern Norway were 1-3 °C lower than mean water temperatures during the period 1997-2006, due to mild weather and high precipitation. Temperatures in glacial rivers generally show less variation between years as these are largely influenced by glacial melting and snowmelt. Mean annual temperatures in 2007 in some glacial rivers in southern Norway were less than 0.5 °C below the 1997-2006 mean temperatures (NVE, 2008).

3.2 Precipitation

Annual precipitation in Norway in 2007 was 15 % higher than the long-term normal (1961-1990). This makes 2007 the 5th "wettest" year registered in Norway since 1900. The largest deviations from the long-term normal were registered along the coast of western Norway, parts of the coast along northern Norway and at *Finnmarksvidda* in northern Norway (125-150 % of the long-term normal; Figure 8).

The mountain areas in southern Norway and large parts of northern Norway received significantly more snow than normal during the winter period. Monthly precipitation in January 2007 is the 3rd highest ever registered for that month in Norway, up to 250-300 % of the long-term normal in parts of the country. Precipitation in summer was 110 % of the long-term normal for the whole country, but parts of eastern Norway received as much as 175-200 % of the long-term normal, which caused severe flooding in certain areas. For this reason, additional sampling was carried out in the RID programme in selected rivers in eastern and southern Norway (cf. Chapter 8).

The autumn period (September-November) was significantly drier than normal in most of southern and eastern Norway, whereas *Møre og Romsdal* in western Norway received 150 % of the long-term normal precipitation. The RID Programme carried out additional sampling in some rivers in western Norway during autumn, although not specifically during floods. Monthly precipitation in December was 115 % of the long-term normal for the country as a whole, and up to 150 % of the long-term normal in parts of eastern, southern and northern Norway (met.no, 2008).

Parts of mid-Norway experienced in 2007 (as in 2006) little precipitation and to some extent droughts during the summer period. Summer drought may in this area have caused higher *concentrations* but lower *loads* of many of the substances measured in the RID Programme.

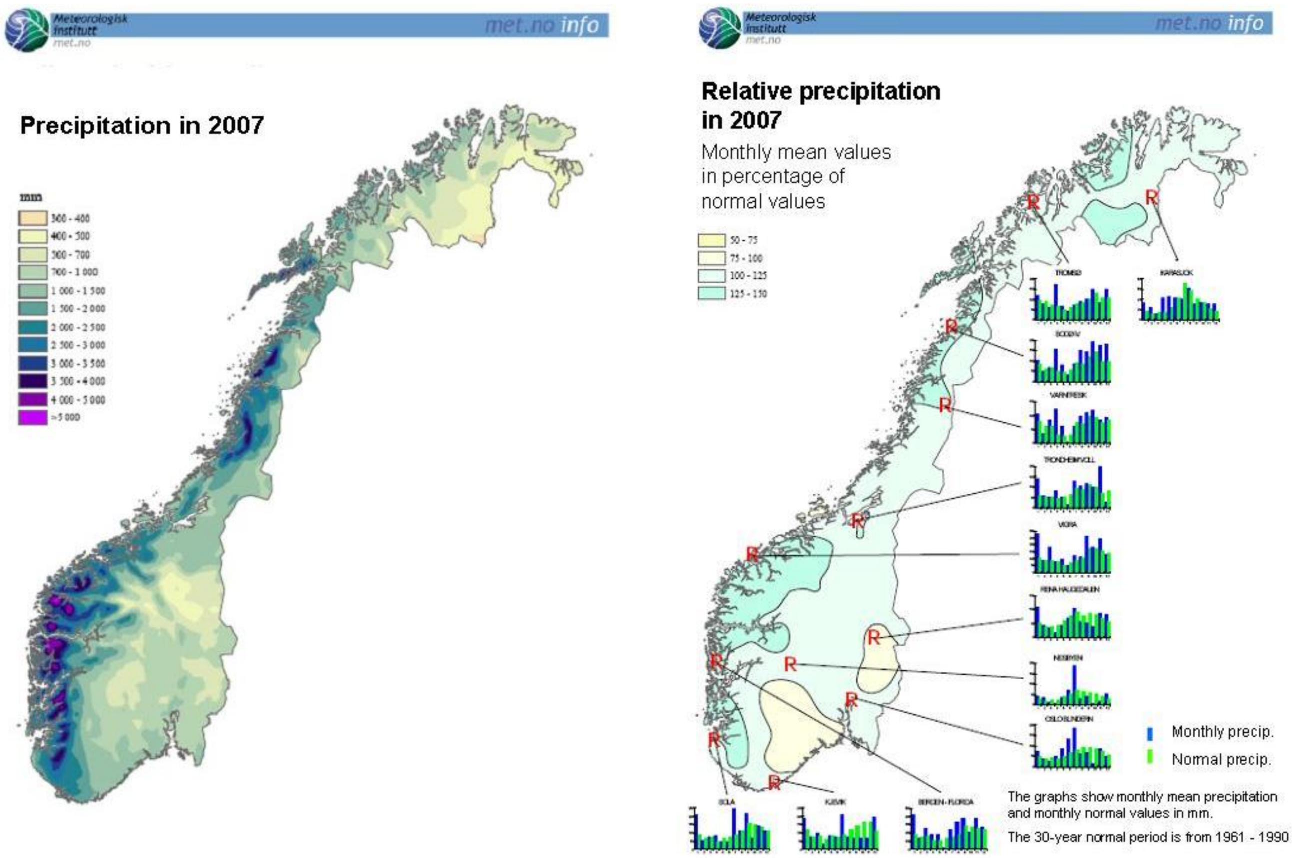


Figure 8. Precipitation in 2007 (left panel) and precipitation in 2007 relative to the long-term normal of 1961-1990 (right panel). Source: Norwegian Meteorological Institute (met.no).

3.3 Water discharge

Runoff in Norway in 2007 was characterised by early snowmelt and floods in spring, alternating floods and droughts during summer, and high water discharges in large parts of the country in late autumn/early winter. A relatively mild winter period resulted in recurring snowmelt, runoff and ”wet” conditions, as compared to winters with more stable, cold temperatures. Water discharges in the northern parts of the country did not differ considerably from the long-term normal, apart from extensive flooding in December due to high temperatures and precipitation. After a relatively warm and dry spring, high precipitation led to severe flooding in large parts of eastern and southern Norway in late June and July. Discharges in mid-Norway were highly influenced by summer droughts, whereas discharges in the western parts were about 30 % higher than the long-term normal due to high precipitation in summer and autumn. Annual water discharges in southern Norway were below normal due to a relatively dry spring and autumn (NVE, 2008).

Figure 9 shows the monthly mean water discharge in 2007 compared to mean water discharge during the 30-year period of 1977-2006 (“long-term mean”) for 8 of the 10 main rivers (Rivers *Suldalslågen* and *Orre* are excluded due to discrepancies in the long-term datasets). The discharges reflect the conditions for precipitation and temperature described above, as follows:

In Rivers *Glomma*, *Drammen*, *Numedalslågen*, *Skien* and *Otra* the discharge patterns in 2007 were characterised by high discharges in winter and early spring, and in summer. Discharges in Rivers Drammen and Numedalslågen in July were about 360 % of the 30-year mean, clearly reflecting the flooding that occurred in large parts of eastern and southern Norway. Discharges were below the long-term mean in all five rivers in autumn/early winter, except in River Numedalslågen in December where discharges were about 160 % of the long-term mean. As shown in Table 2, additional sampling was carried out during the summer floods, and in Chapter 8 the results of this additional sampling is given.

Discharges in River *Orkla* in Trøndelag (mid-Norway) were above the 30-year mean in winter and early spring, and in autumn. The monthly mean discharge in February was about twice the long-term mean. Discharges in spring and summer were below the long-term mean, due to little precipitation and summer droughts.

In the two northernmost rivers, Rivers *Vefsna* and *Alta*, discharges were high in April (255 and 184 % of the 30-year mean, respectively), reflecting high temperatures and early snowmelt. Mean monthly water discharges in River Alta in autumn and early winter ranged between 126 and 153 % of the long-term mean. Both rivers experienced high discharges in December due to high temperatures and precipitation.

The total annual runoff in all 8 rivers ranged between 101 % of the 30-year mean in River *Otra*, and 123 % in Rivers *Drammen* and *Alta*.

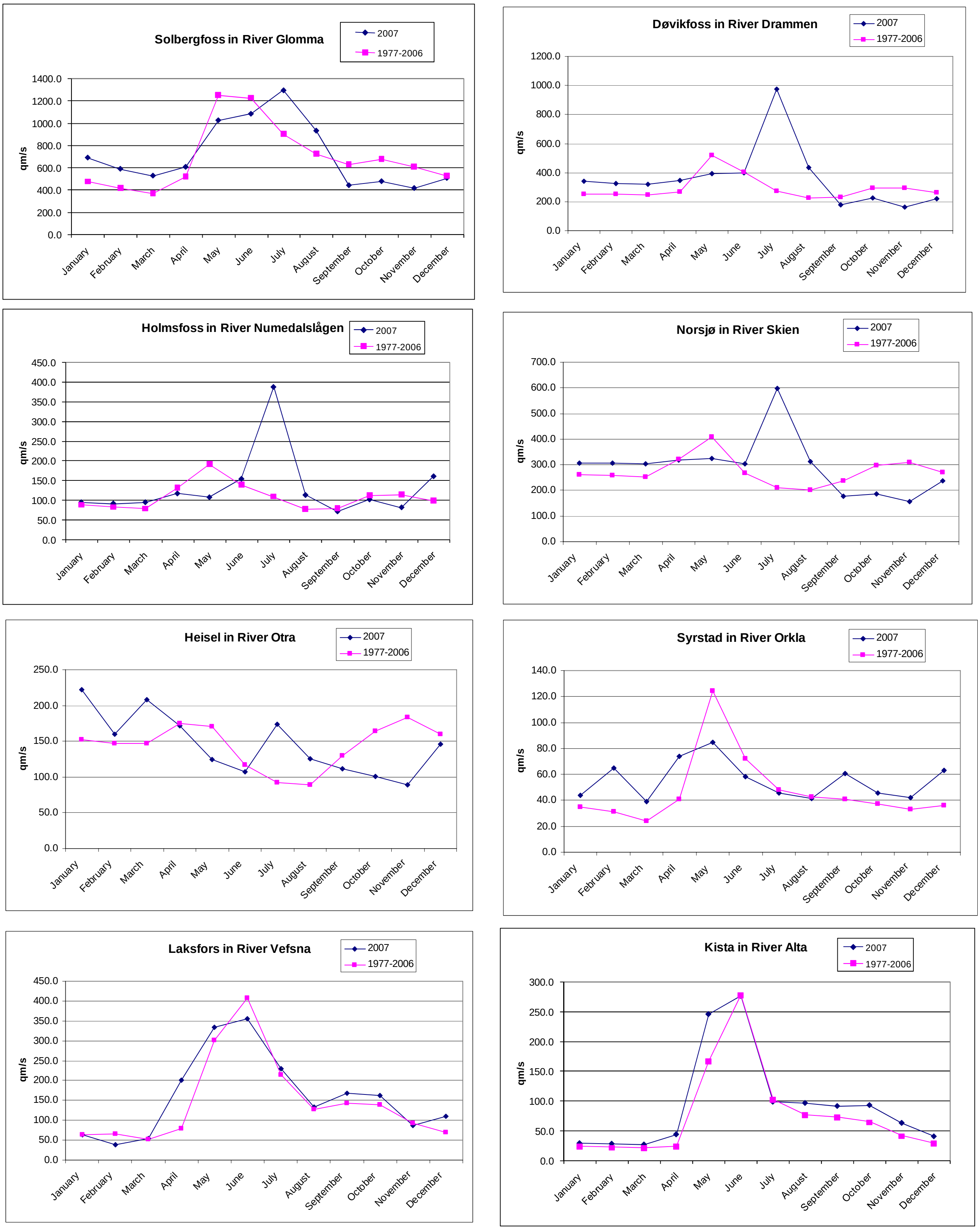


Figure 9. Monthly mean water discharge in 2007 and as a mean of 30 years (1977-2006), derived from hydrological stations (named) in 8 of the rivers monitored monthly (data from the Norwegian Water Resources and Energy Directorate, NVE).

4. Results of the 2007 RID Program

The statistics for direct discharges and the results of the TEOTIL model are presented first in the chapter, before the total inputs to marine waters of nutrients, metals and pesticides are given. The underlying data are given in detail in Part B, the Data Report. The next chapter (Chapter 5) gives a comparison of inputs in 2006 and 2007. For long-term trends that are also adjusted for water discharge variations, see Chapters 6 and 7.

4.1 Direct Discharges Statistics and TEOTIL Modelling Results

Direct discharges forindustrial units (data from 2006), waste water treatment plants, and fish farming units and shown in
Figure 10, Figure 11, and Figure 12, respectively.
Figure 13 and Figure14 show the total inputs of nitrogen and phosphorus from direct discharges (not adjusted for retention) and the relative importance of the different direct sources to the four coastal areas.

Some of the above reported discharges are monitored in the RID rivers, as the pollution sources are located upstream of the sampling sites. The TEOTIL model has therefore been used for estimating the direct discharges of nitrogen and phosphorus to Norwegian coastal waters that are not covered by the RID monitoring stations (i.e. areas not covered by the sampling sites in rivers):

- Downstream sampling sites in the 10+36 rivers monitored in 2007.
- Downstream former sampling sites in the 109 rivers monitored earlier.
- For the total catchment areas of the 92 rivers which have never been monitored.

Table 5 shows the direct discharges as calculated by the TEOTIL model.

Table 5. Overview of direct discharges (tonnes) of all four coastal areas in 2007 (2006 for industrial units). Data have been adjusted for retention by the TEOTIL model, and direct discharges upstream of RID monitoring stations are not included.

	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	TN	TP	SPM	TOC
Sewage Effluents	0.029	0.02	4	1.2	0.29	0.17	0.31	1.4	11 444	918	3 782	850
Industrial Effluents	0.319	0.01	8.5	39.6	3.31	1.00	1.69	7.5	2 361	211	527 596	211
Fish Farming	0	0.00	688	0.0	0.00	0.00	0.00	0.0	39 527	8 352	0	0
Total	**0.35**	**0.03**	**700**	**40.8**	**3.60**	**1.18**	**1.99**	**8.8**	**53 333**	**9 481**	**531 378**	**1 061**

Of the three sources for direct discharges, fish farming is the most important nutrient source, especially along the coasts of the North and Norwegian Seas. Fish farming is also the most important direct source for copper, due to losses when the net cages are cleansed. Apart from copper, industrial effluent is the most important source for metal inputs, and is also the most important source for suspended particulate matter. It must be noted that the latter is due to a few large and therefore very local discharges of particulate matter to the Norwegian Sea.

Figure 10. Industrial units reporting discharges of nitrogen and phosphorus to freshwater systems. Co-ordinates on industry from SFT (INKOSYS) 2005; coast line from Statens Kartverk; Projection UTM33; WGS 84.

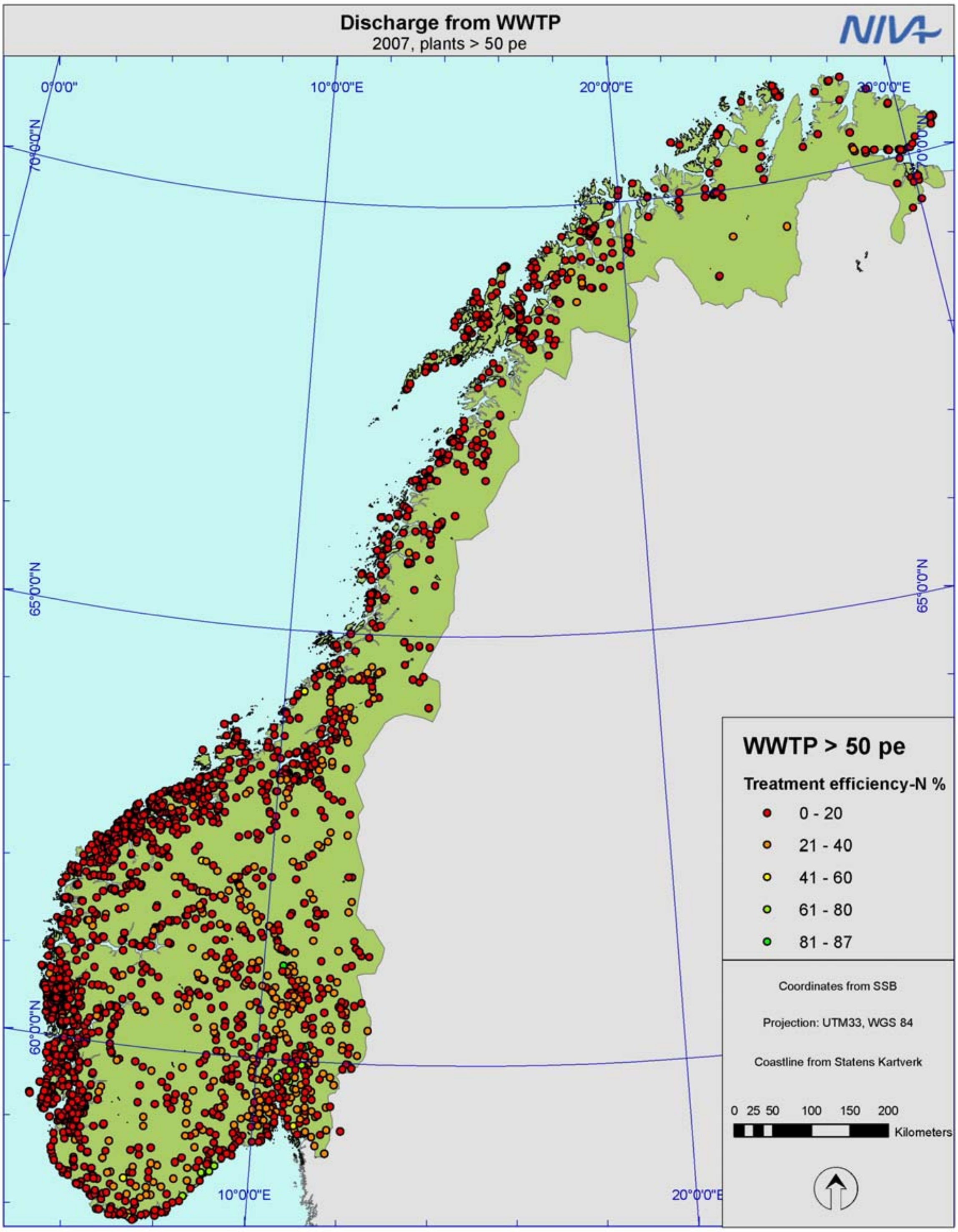


Figure 11. Sewage treatment plants in Norway 2006 and nitrogen treatment efficiency. Co-ordinates from KOSTRA/SSB.

Figure 12. Fish farms in Norway. Based on data from the Directorate of Fisheries/ALTINN.

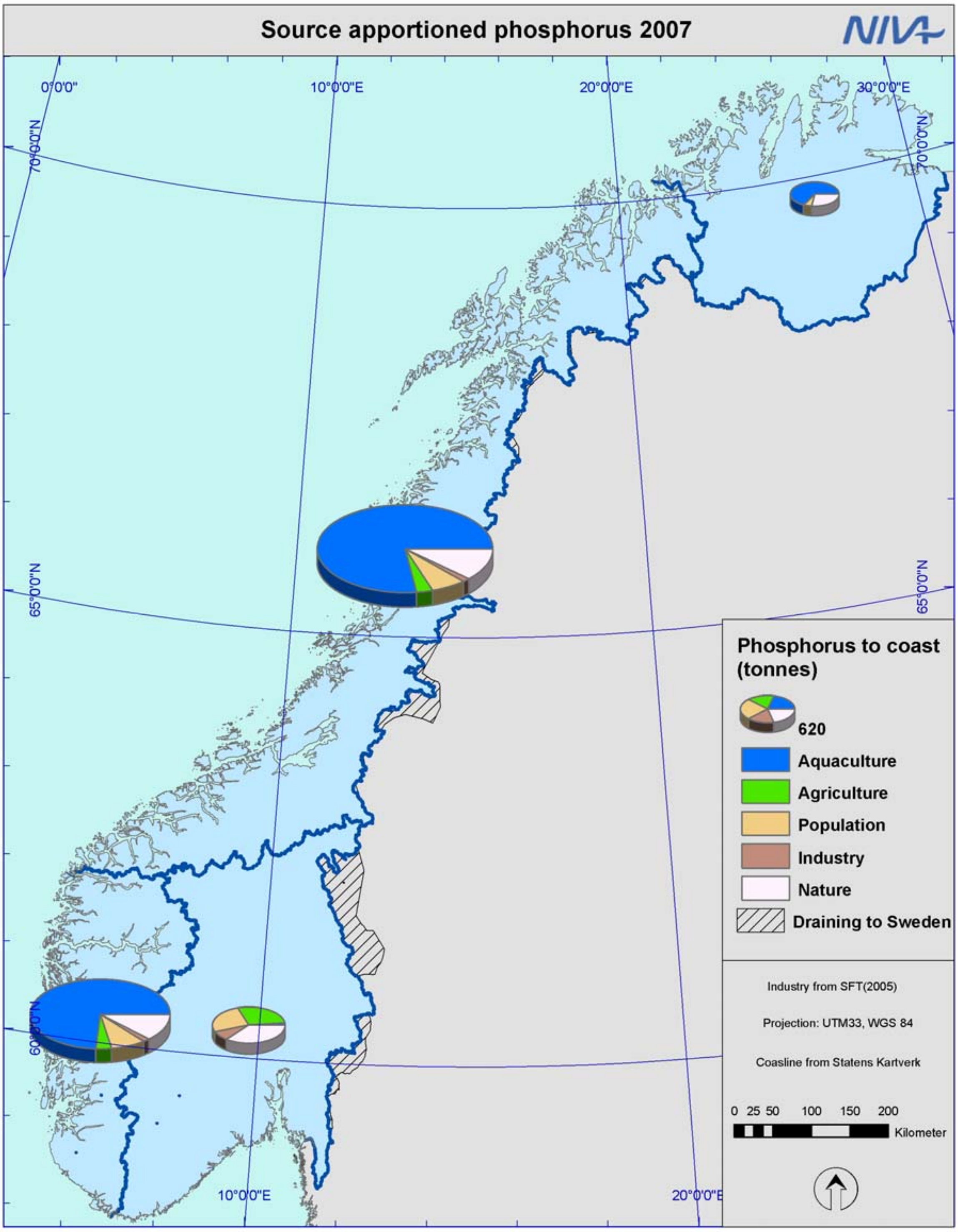


Figure 13. The relative importance of the five phosphorus sources to total inputs to the four coastal areas - (Source Oriented Approach, incl. marine salmon/trout farming). The size of the circles indicates the total amount (tonnes). Data from 2007, industrial data from 2006.

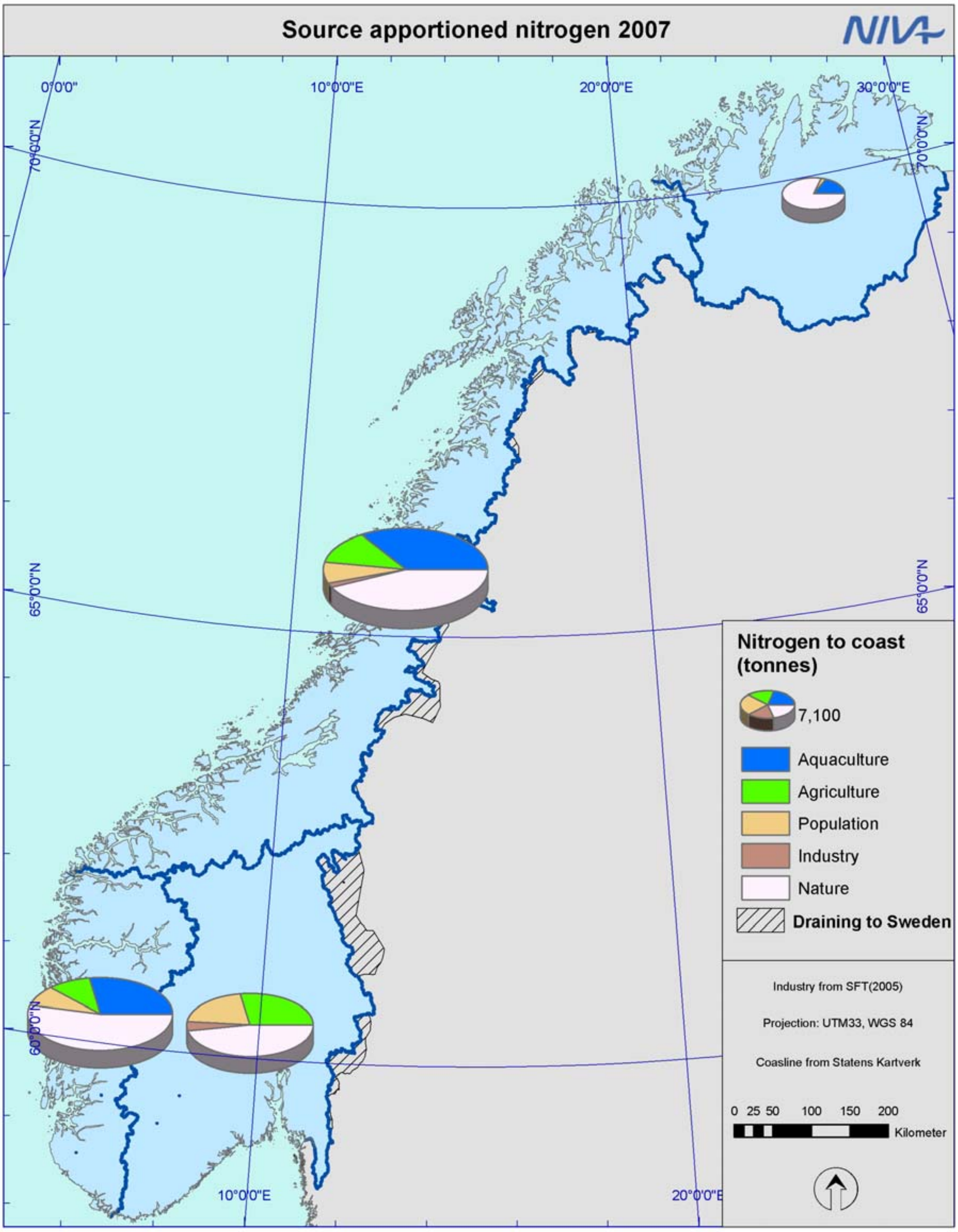


Figure 14. The relative importance of the five nitrogen sources to total inputs to the four coastal areas (Source Orientated Approach, incl. marine salmon/trout farming). The size of the circles indicates the total amount (tonnes). Data from 2007; industrial data from 2006 .

4.2 Total nutrient and particle input in 2007

The total nutrient input to coastal waters from land based sources in Norway in 2007 was estimated to about 12 000 tonnes of phosphorus and 160 000 tonnes of nitrogen (Figure 15). Total silicate inputs was estimated to about 600 000 tonnes and total organic carbon (TOC) to about 540 000 tonnes[1]. The input of suspended particulate matter amounted to about 1.5 million tonnes.

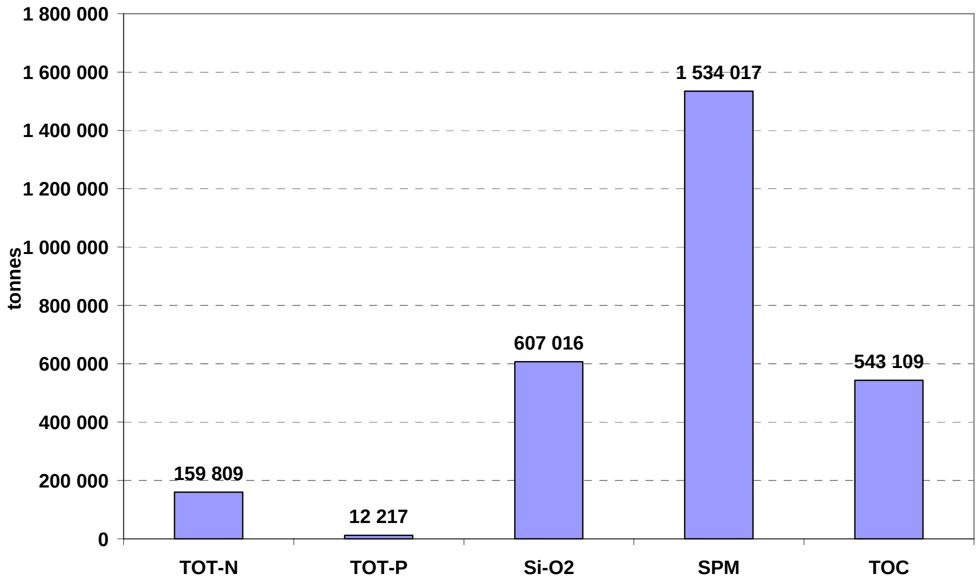


Figure 15. Total input of nitrogen, phosphorus, silicate, suspended particulate matter and total organic carbon to Norwegian coastal waters in 2007.

An overview of the inputs of the different nitrogen and phosphorus fractions per coastal area is given in Figure 16. The relatively high ammonium and orthophosphate inputs in the North Sea and Norwegian Sea derive from fish farming. In Skagerak and the Barents Sea there is less aquaculture. In Skagerak, sewage treatment plants are the most important nutrient sources of the direct discharges. Nutrient inputs are highest to the Norwegian Sea, and lowest to the Barents Sea.

[1] TOC was not reported from sewage effluents in 2007, and data from 2006 were therefore used for this source.

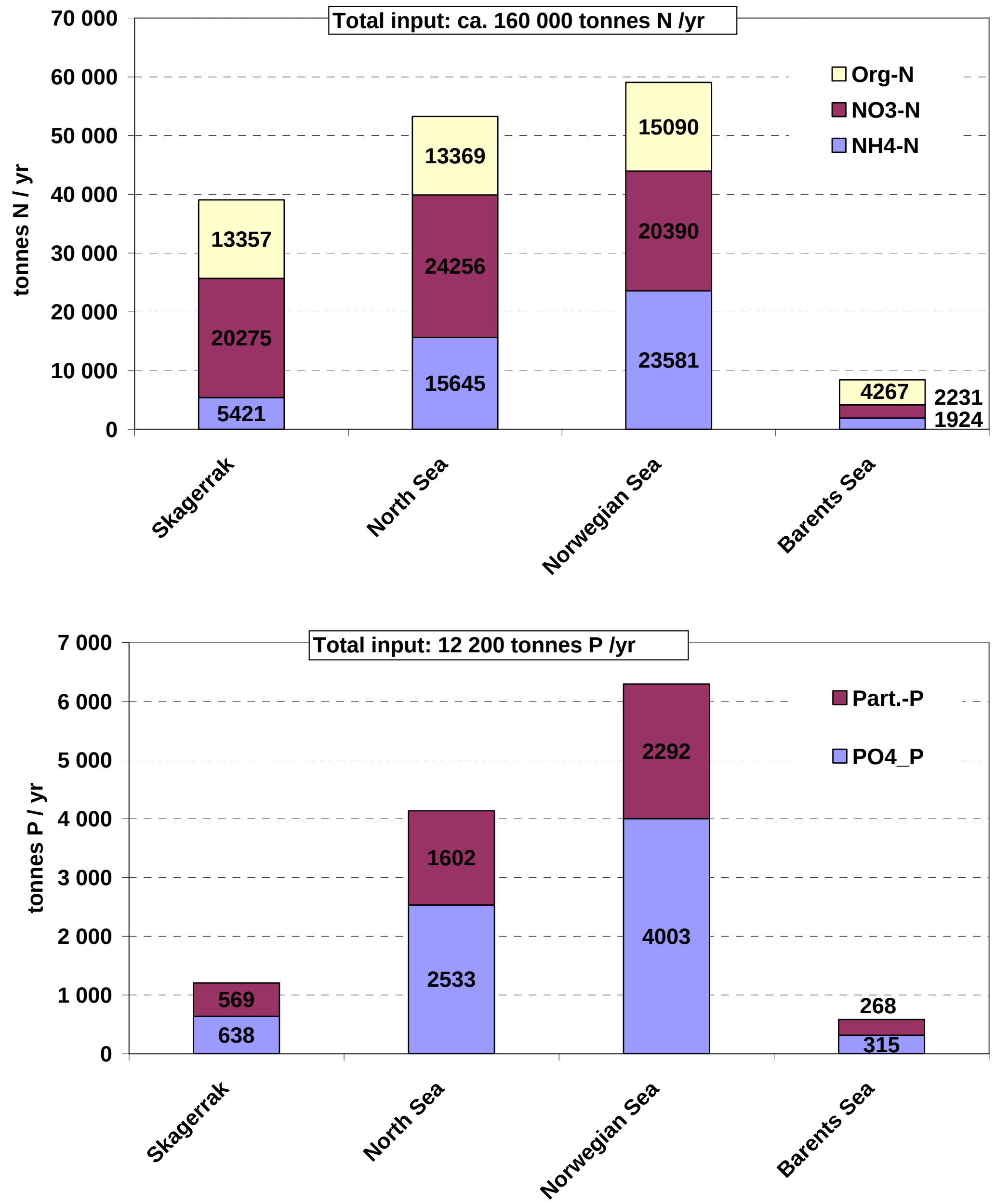


Figure 16. 2007-loads of total-N (upper panel) and total-P (lower panel) divided into different fractions for the four Norwegian sub-regions.

The sources of suspended particulate matter are shown in Figure 17. Riverine inputs constitute the major source, with an estimated one million tonnes. The *direct* industrial discharges (downstream sampling areas and in unmonitored areas) also account for a relatively high share, especially to the Norwegian Sea (based on 2006-data). As noted above, this is due to relatively few industrial units discharging high quantities on a local scale. There are no estimates for unmonitored areas or fish farms.

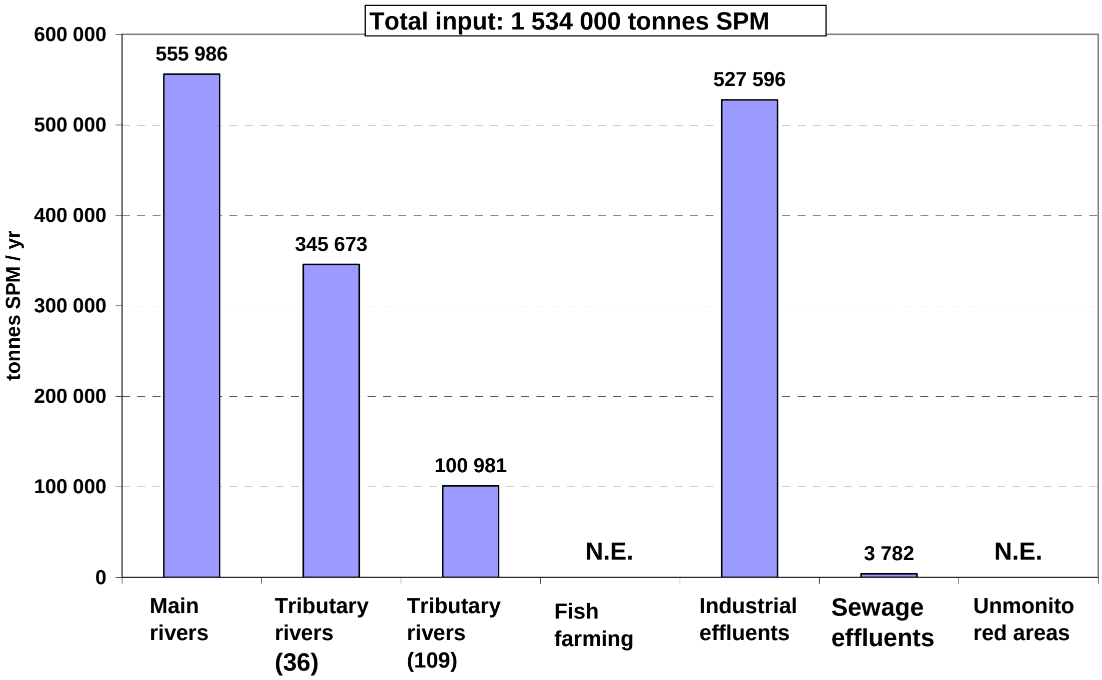


Figure 17. Inputs of particulate matter (SPM) from rivers and direct discharges in 2007.

The proportion of sources of particulate matter and nutrients is further illustrated in Figure 18
Figure 18. In general, the 46 monitored rivers account for between 70-90% of the total riverine inputs of nutrients. This reflects that the monitored rivers cover about 50% of the land draining to the coastal areas, and include most of the known large land-based sources of nutrients.

Comparing riverine inputs with direct discharges (Figure 18, lower panel) shows that direct discharges are most important for orthophosphate and total phosphorus and ammonium, whereas the riverine sources are most important for loads of silicate, nitrate and particulate matter, although the latter is, as discussed above, not reported for fish farms and unmonitored areas.

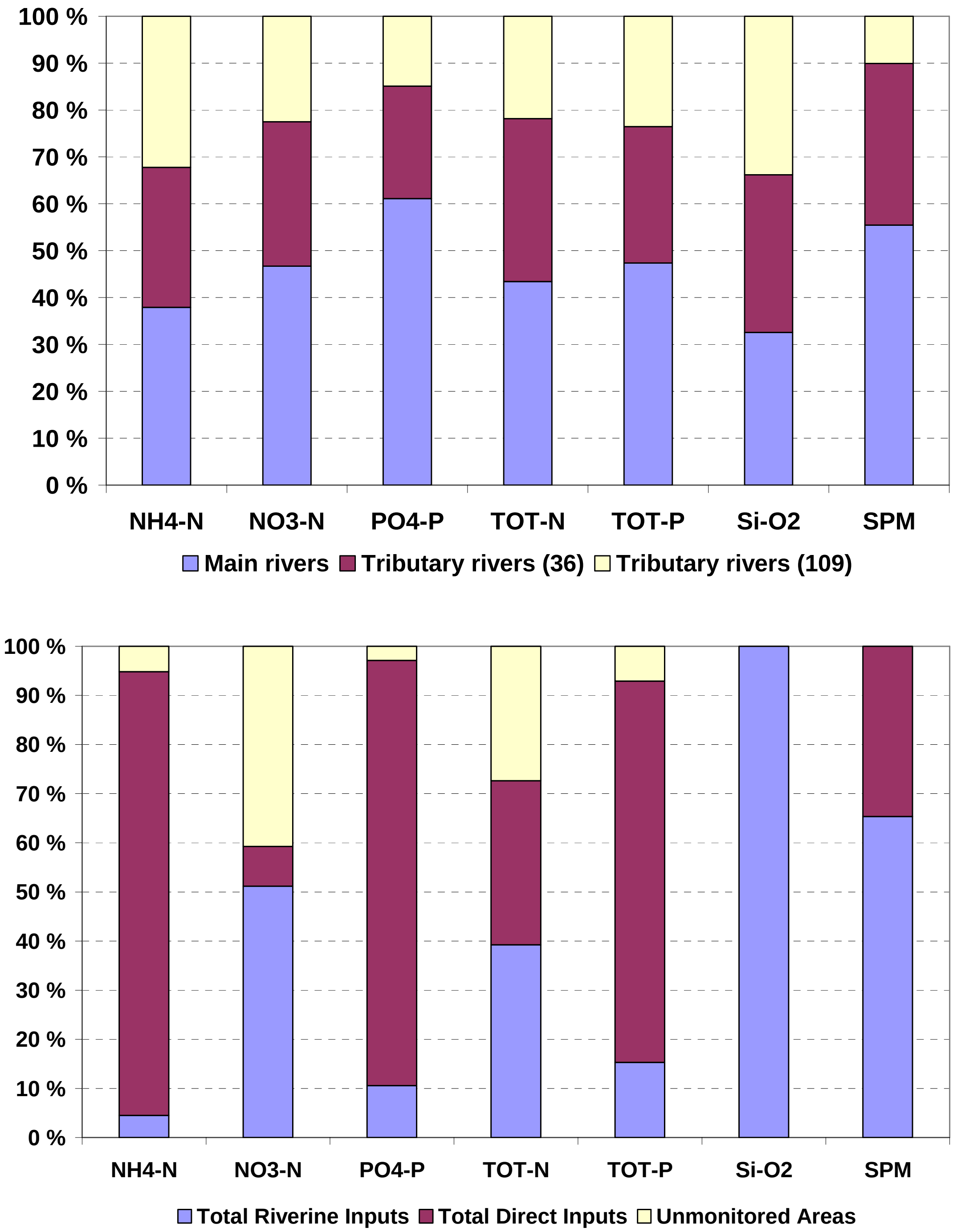


Figure 18 Main sources for nutrients, silicate and suspended particulate matter (SPM) divided into riverine contribution only (top panel) and the proportion between riverine, direct inputs and unmonitored areas (lower panel). Note that for SPM there are no estimates of inputs from fish farming and unmonitored areas.

The relative share of inputs from fish farms to the total inputs of nutrients is shown in Figure 19 for the four coastal areas. Due to few fish farms in the Skagerak area, this area has significantly lower inputs from this source than the three other coastal areas, where aquaculture is responsible for a very high proportion of the total nutrient inputs. In Skagerak, on the other hand, discharges from sewage treatment plants have a proportionally larger impact than in the other areas; e.g. about 60% of total ammonium discharges in this area derive from sewage treatment plants.

Totally in Norway, the nutrient loading from fish farming contributes to almost 70 % of the total phosphorus inputs and 25 % of the total nitrogen inputs. In terms of nutrient fractions, 68 % of the ammonium and 77 % of orthophosphate derives from fish farming.

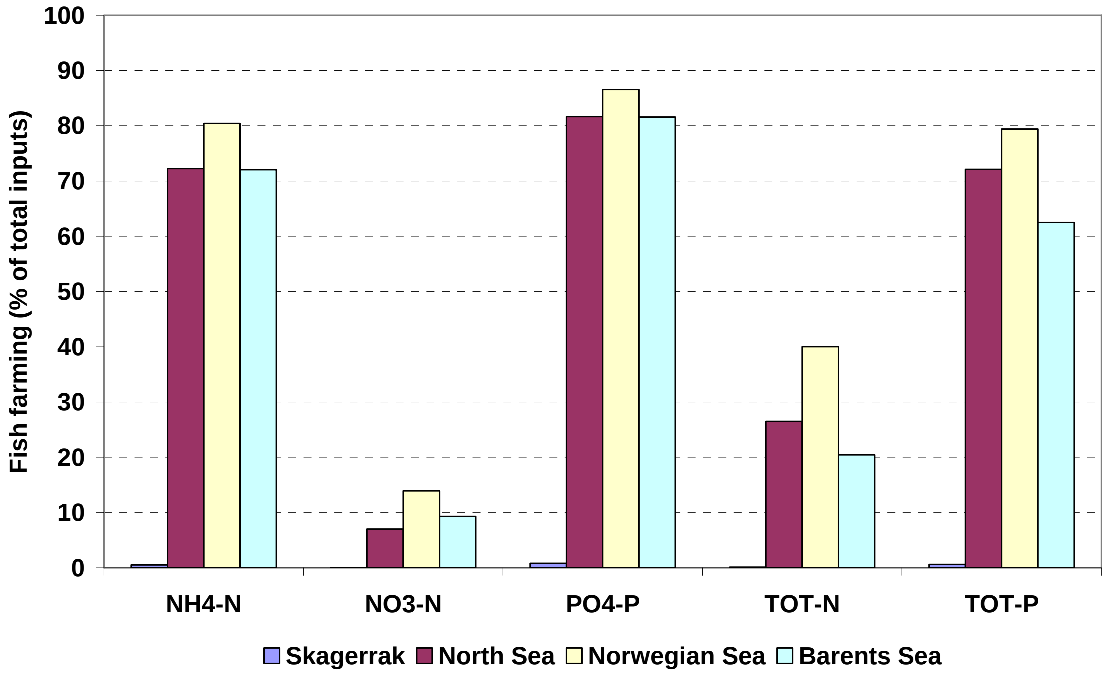


Figure 19. The relative share of nutrient inputs from fish-farming to the total inputs in 2007 for the 4 coastal areas.

4.3 Total metal inputs in 2007

In 2007, the total inputs of metals to coastal areas ranged from 0.06 tonnes of mercury to 976 tonnes of copper (lower estimates; Figure 20 and Figure 21).

Inputs (lower estimates) of cadmium were estimated to 2.8 tonnes, arsenic to about 27 tonnes, lead to about 58 tonnes, chromium to about 54 tonnes and nickel to about 178 tonnes. Copper and zinc comprised the largest inputs of heavy metals, which in 2007 amounted to about 976 and 721 tonnes, respectively.

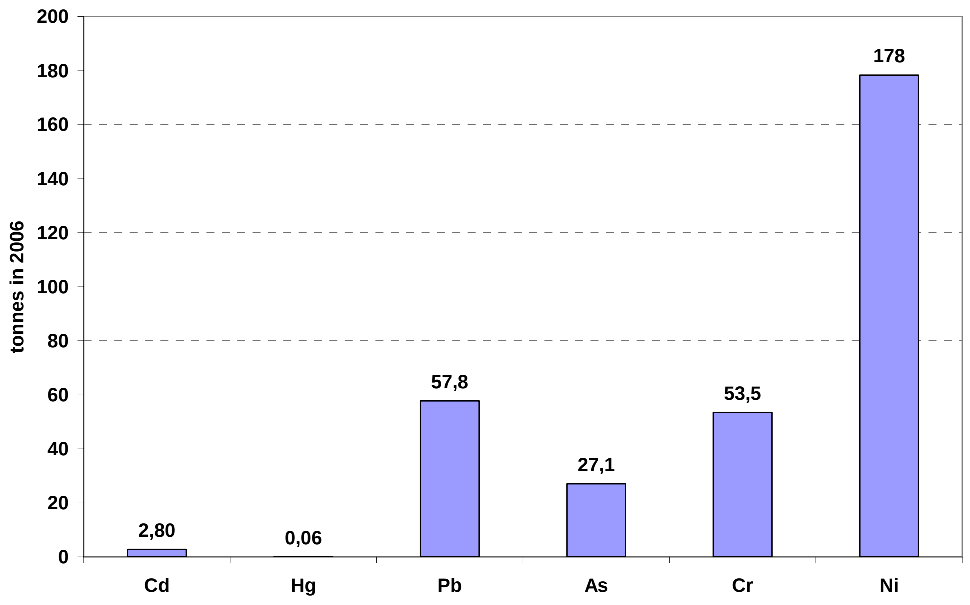


Figure 20 . Total input of Cadmium, Mercury, Lead, Arsenic, Chromium and Nickel in 2007 (lower estimates).

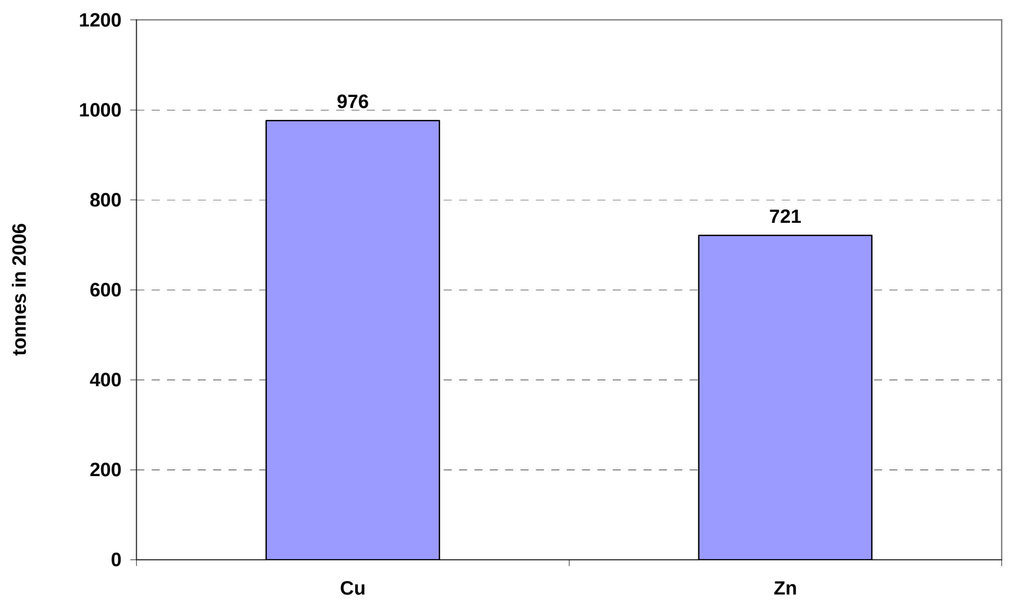


Figure 21. Total input of Copper and Zinc in 2007 (lower estimates).

For all metals except mercury (Hg) and copper (Cu), the riverine loads accounted for about 90% or more of the total input to Norwegian coastal waters (Figure 22). Estimates of copper discharges from fish farming were made for the first time in 2005, and explain the high copper inputs in 2005, -06 and -07 as compared to previous years. However, a calculation error in 2005 and -06 probably gave too low inputs, and the 2007-values are therefore higher than the two previous years. Updated values for former years will be calculated.

In addition to copper, the proportion of mercury in the direct discharges is also relatively high. In 2007 this probably explained by the relatively low riverine inputs of mercury, which in 2007 were only 15% of 2006 values (for lower estimates); whereas the direct inputs were only 30% of those in 2006. In earlier years, the high proportion of mercury from direct discharges was explained by high discharges from a few sewage treatments plants in the Skagerak region. It was also suggested that these high numbers could have been caused by error of units. In 2007, there are no such high values of mercury for these specific treatment plants, which reinforces the theory that these may have been erroneous. As noted in Skarbøvik et al. (2007), this is also confirmed by a study from 2003 (Berg et al., 2003), where the total Norwegian load of mercury from sewage treatment plants was estimated to 61 kg.

The metal inputs per sub-region and other details are given in Part B.

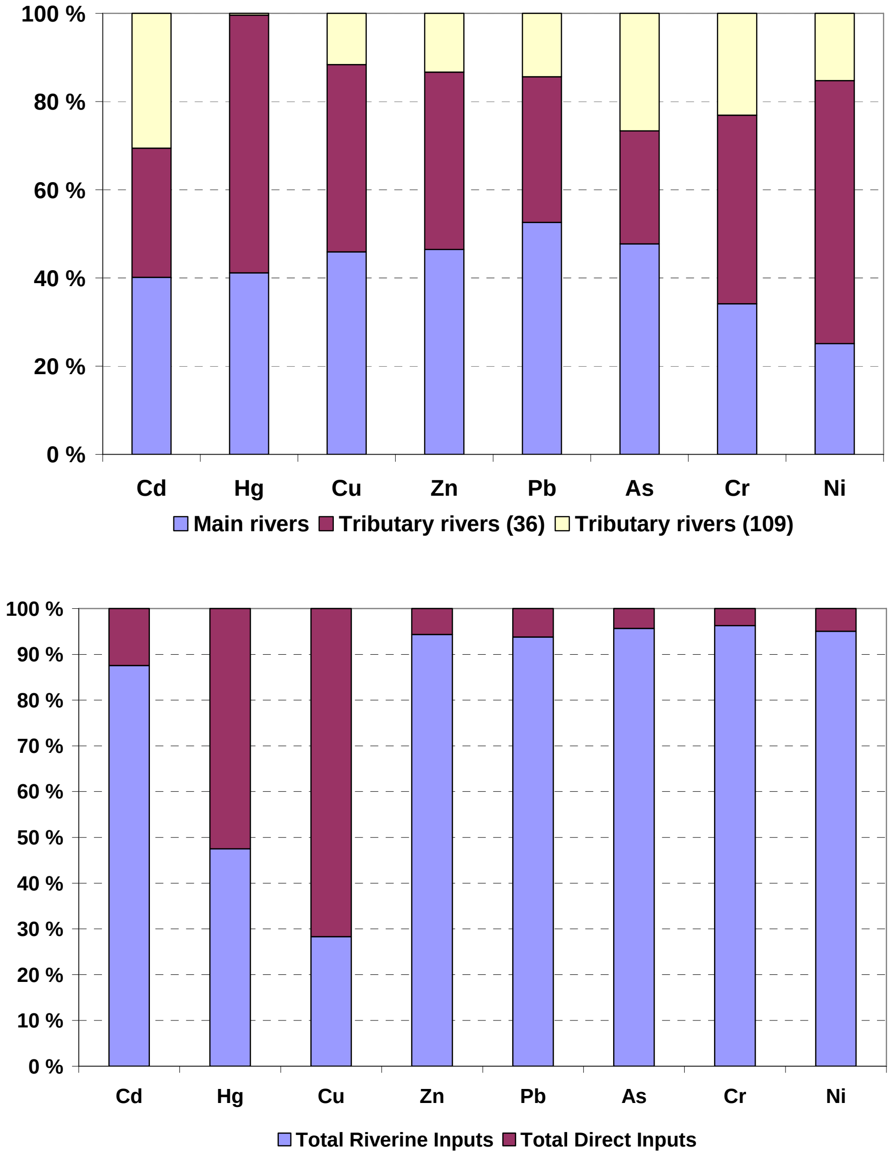


Figure 22. Relative share of riverine and direct discharges of the total inputs of metals to the Norwegian coastal waters in 2007.

4.4 Total lindane and PCB7 inputs in 2007

The pesticide lindane is usually detected at very low concentrations, often below the detection limit, which is 0.2 ng/L (see all detection limits in Annex IV). Total riverine loads of lindane in the main rivers were estimated to 0-13.6 kg depending on whether lower or upper estimates are used (Figure 29).

The total PCB7 loads to the sea were in 2007 calculated to 23-105 kg . If only riverine inputs are considered, the span is from 0-82 kg. Sewage effluents account for about 23 kg in 2007 (equal for lower and higher estimates), due to reported discharges from sewage treatment plants in the Skagerak region.

Estimates of both lindane and PCB7 inputs mainly reflect the detection limits, since all of the samples were below the detection limits. The lower estimate is therefore zero, whereas the upper estimate is based on all samples having concentration at the detection limit, in accordance with the RID principles.

No measurements and therefore no estimates were made for the inputs from tributary rivers for these two parameters.

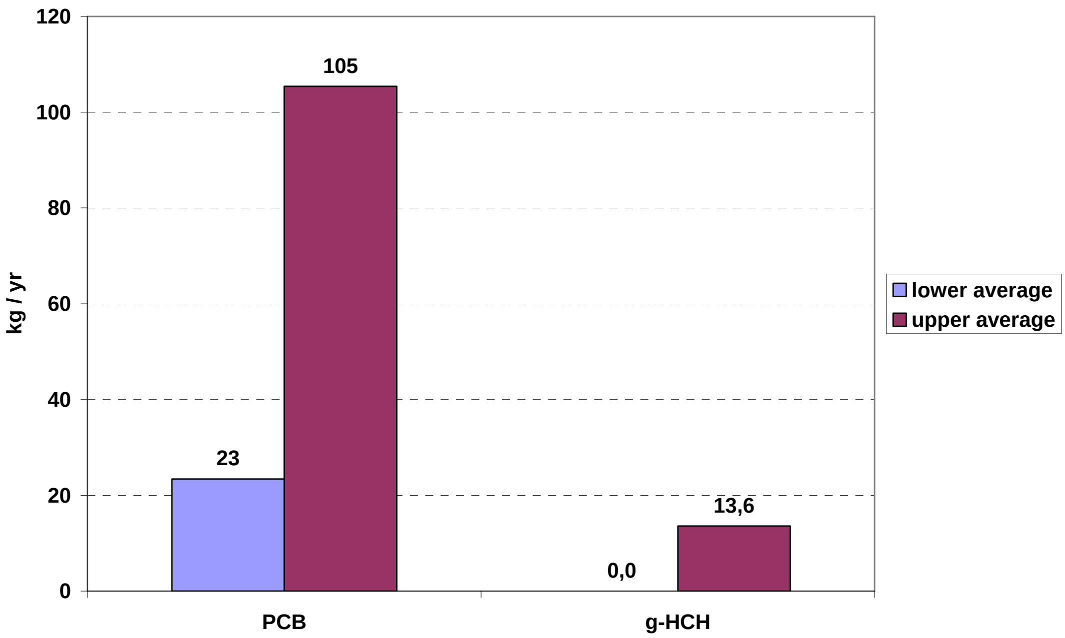


Figure 23. Inputs (lower and upper average) from the main rivers (10) and sewage treatment plants of PCB7 and lindane in 2007.

5. Comparisons of Inputs from 2006 to 2007

In this chapter, the RID 2007 results are compared with last year's results. Riverine loads are discussed first, both for nutrients, metals and pesticides; next the changes in the direct discharges are evaluated, and finally the total inputs.

5.1 Riverine loads in 2006 and 2007

The loads in rivers are discussed based on the data for the 10 main rivers, the 36 monitored rivers and the 109 previously monitored rivers (up to and including 2003). Loads and estimated water discharges for unmonitored areas (92 rivers and areas below sampling points) are not included in the analyses.

Whereas most substances showed a decline in riverine loads from 2004 to 2005 (Borgvang et al., 2007), and the trends in 2006 were more varied (Skarbøvik et al., 2007), the trends in 2007 seem to reflect the relatively high water discharges this year. This means that sediments, most metals, and phosphorus loads increased, whereas nitrogen loads and a few metals decreased since 2006.

The main difference between 2006 and 2007 in terms of water discharge was an overall increase of 7 % in total water flow. This increase varies between the regions, with almost no increase (0.1%) in the Skagerak region, to 17 % increase in the Barents Sea (cf. Table 6).

Table 6. River water discharges (1000 m^3/d) to the Norwegian coast in 2006 and 2007. The data is based on the main rivers (10) and tributary rivers (36+109). Increases in flow shown in orange.

	Total Norway	Skagerak	North Sea	Norwegian Sea	Barents Sea
2007	608 197	182 757	171 937	188 677	64 825
2006	566 962	182 518	157 940	171 143	55 360
% change from 06 to 07	7	0.1	9	10	17

In terms of the eight main rivers for which there exist good long-term water discharge measurements, three of the rivers in the Skagerak region increased their water discharge from 2006 to 2007 (cf. Figure 24). Otra was the only of the eight rivers that had a lower water discharge than the 30-year period from 1977-2006. High water discharges often lead to higher discharges of compounds to the sea, especially compounds that are transported associated with particulate matter.

However, the water discharge during sampling dates must also be included in the analysis, especially since the RID load calculation method is heavily dependent on this variable. In Figure 25 comparisons are given of mean water discharge during sampling dates in the four coastal areas in 2006 and 2007. Water discharge during sampling was in general higher than in 2006 in main rivers draining to Skagerak and the Barents Sea; whereas for tributary rivers, water discharge was higher in 2007 than in 2006 for the North Sea only.

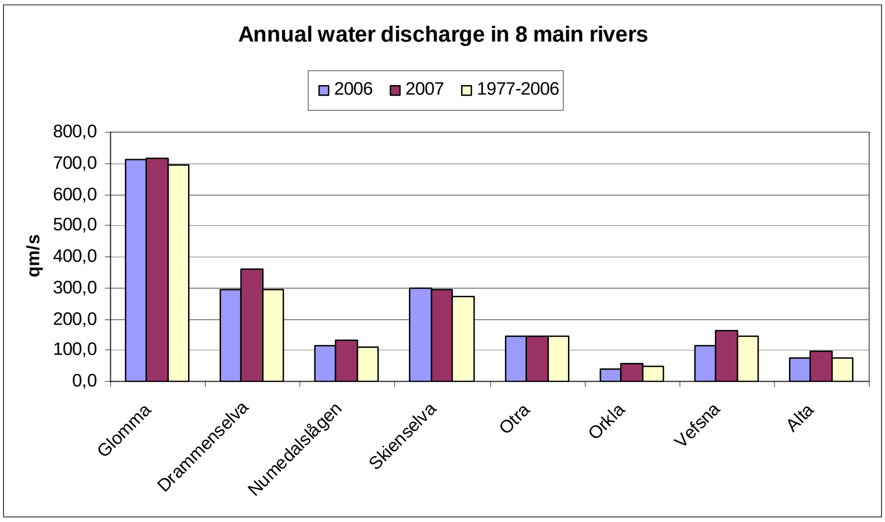


Figure 24. Annual water discharge in m^3/s in 8 of the 10 main rivers, in 2006, 2007 and as a 30-year normal. (The hydrological stations are the same as those given in Chapter 3.3; Figure 12.)

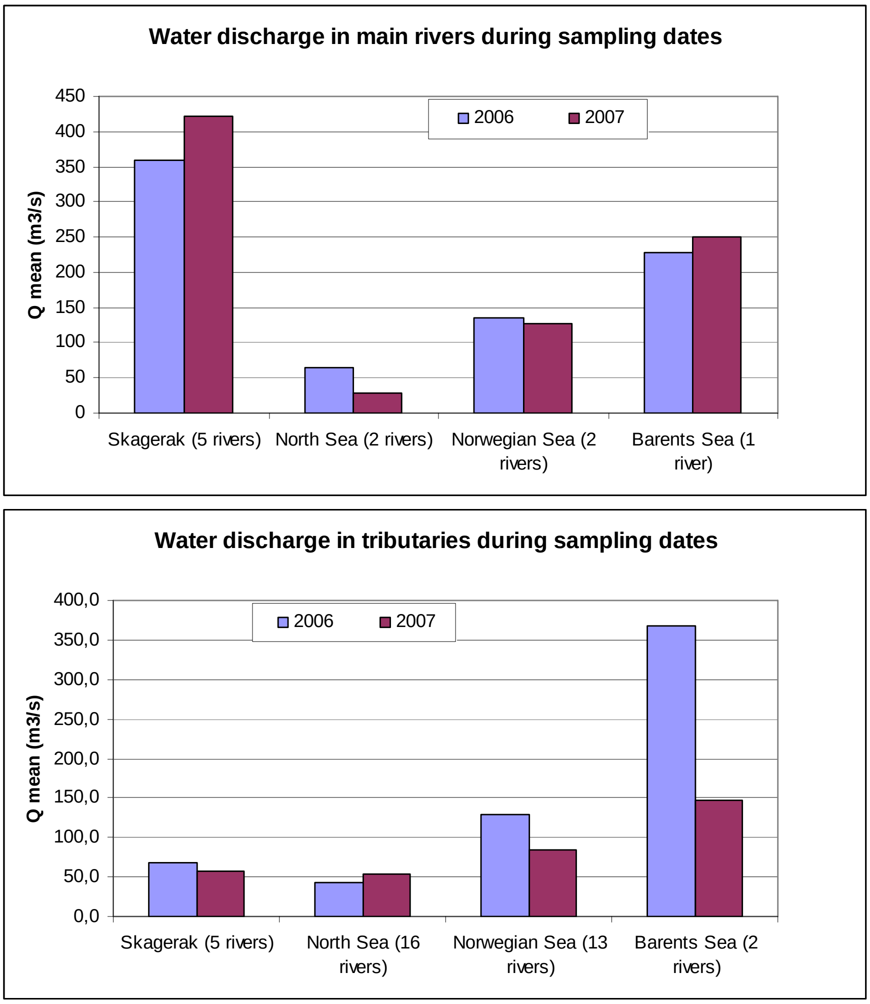


Figure 25. Mean water discharge in m^3/s during the dates of sampling in 2006 and 2007; for the main rivers (upper panel) and tributary rivers (lower panel); divided into the four coastal areas.

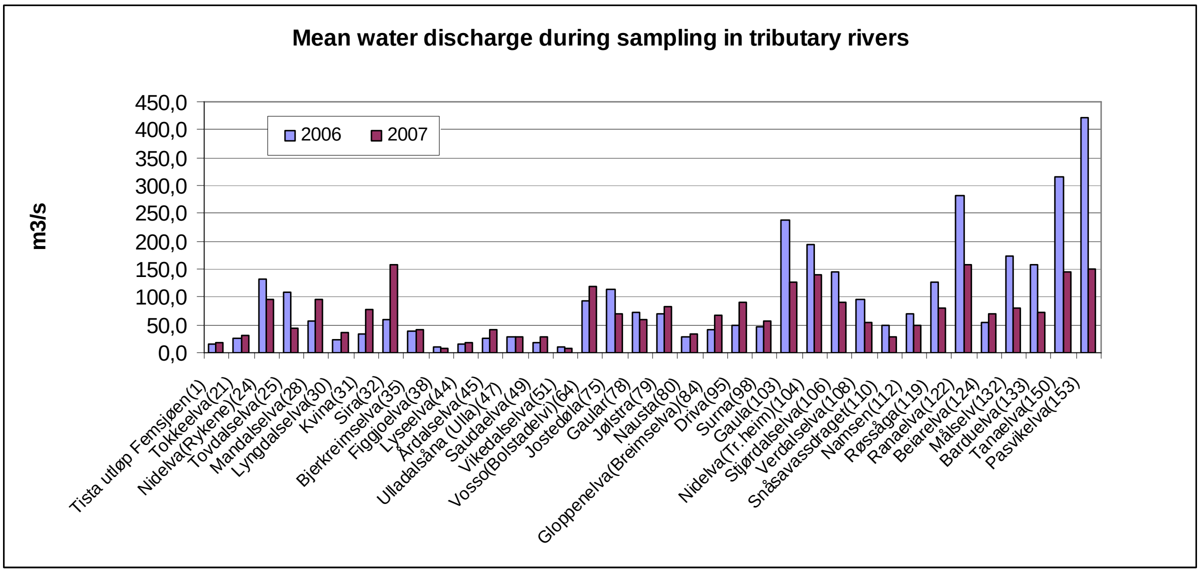


Figure 26. Variations in differences from 2006 to 2007 in mean water discharge during sampling dates in the 34 tributary rivers monitored quarterly.

Overall, the mean water discharge in the main rivers was 250 m^3/s in 2007, which was lower than in 2006 when the average was 228 m^3/s. However, in the tributary rivers, it was opposite, with a mean water discharge of 95 m^3/s in 2006 and 71 m^3/s in 2007. The variation from river to river is, however, huge for the tributary rivers, as shown in Figure 26.

As demonstrated by numerous studies (e.g. Walling and Webb, 1981), suspended particulate matter (SPM) and substances transported in the particulate form often reflect variations in the water discharge.
Table 7 shows that an increase in SPM can be seen for main rivers in the Skagerak region and tributary rivers in the North Sea region, which reflects the water discharge during sampling dates in rivers in these areas. The increase in Skagerak is to a large extent explained by the flood samples collected during summer 2007 (cf. Table 2 and Chapter 8), which resulted in the highest observed suspended particulate matter concentration ever observed in the RID-Programme for the Drammen River. Additional samples were also collected from tributaries draining into the North Sea during autumn (Table 3 and Chapter 8).

Changes in the 109 tributary rivers not monitored since 2003 will mainly reflect between-year variations in annual water discharge, as the calculated concentrations have remained the same since 2003. There is, thus only small variations from 2006 to 2007; in general a small increase except for a small decrease in Skagerak (where also the modelled water discharge decreased for this group of rivers).

Table 7. Riverine load (in 1000 tonnes) of SPM in 2006 and 2007. Increases in loads shown in light orange, decreases in green, and small changes (less than 5 tons) shown in yellow.

	Total Norway		Skagerak		North Sea		Norwegian Sea		Barents Sea	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Main rivers	321	556	282	527	9.7	6	25	20	4	3
Tributary rivers (36)	397	346	31	16	137	175	209	138	21	17
Tributary rivers (109)	97	101	21	19	28	32	41	44	6.2	7
Total Norway	815	1003	333	562	175	212	275	201	31	27

Total riverine phosphorus loads continue to increase (since 2004), although the increase from 2006 to 2007 is only 1 % (Table 8). Total phosphorus often increases with increasing water discharge, and the increase is therefore believed to be linked to the water discharge during sampling dates. The increase in the main rivers is particularly pronounced in the Skagerak region, where water discharge during sampling dates was significantly higher in 2007 than in 2006. This is to a large extent due to the extra flood sampling during summer 2007 (Chapter 8). In the Norwegian Sea there was a decrease whereas the two other coastal areas were more or less similar to the situation in 2006. Since water discharge is such an important explanation for the variability, flow normalised trend analyses are presented in Chapter 6 and 7. Skagerak is the region with the highest proportion of agriculture and settlements in Norway, and intensive rainfall and high water discharges in this part of the country will inevitably lead to high particle and phosphorus runoff and a subsequent increase in the overall Norwegian inputs.

Nitrogen concentrations and loads often do not respond to water discharge in the same way as particles and phosphorus. As also discussed in Chapter 8, the nitrogen species were little affected by the high summer floods, and the N:P ratios therefore decreased in many rivers during these floods. There was an overall *decrease* from 2006 to 2007 of about 9 % for total nitrogen loads (Table 8). The relatively high 2006 loads of nitrogen are therefore now reduced, almost to the level estimated in 2005. In 2004, the riverine loads were about 65,000 tonnes, and total nitrogen loads have therefore fluctuated between 60-70,000 tonnes the latter four years.

Table 8. Total riverine load of total nitrogen and total phosphorus in 2006 and 2007 (tonnes). Increases in loads shown in light orange, decreases in green.

	Nitrogen		Phosphorus	
	2006	2007	2006	2007
Major rivers (10)	29 231	27 233	666	887
Tributary rivers (36)	26763	21 794	742	545
Tributary rivers (109)	12918	13 709	412	440
Total Rivers	68 912	62 735	1 820	1 872

In terms of metal loads, there was a general increase from 2006 to 2007 in the main rivers except for mercury (Table 9). This increase is mainly explained by water discharge during sampling, and is therefore not necessarily an increase as such, but a result of the methodology, including sampling frequency and load calculation method. The decrease in mercury is negligible, and mainly seen in the lower estimates in the analyses from the Norwegian Sea, and, thus, therefore probably a result of laboratory methods and detection limits. The relatively large increases of total lead loads (Pb) of 126 % as compared to 2006 are to a large extent explained by the flood samples in Rivers Numedalslågen (1000%) and Drammen (400%).

It is important to note that the metal variations in total riverine loads from year-to-year are often caused by variations in a few rivers with high metal concentrations; these often have point sources such as mines in their catchment area. River Pasvikelva and River Orkla are typical examples of this. Variations in metal concentrations in these rivers are directly linked to the water discharge during sampling. The relatively large decrease of total nickel loads in 2007 as compared to 2006 from about 180 to about 100 tonnes is mainly explained by a decrease of nickel concentrations in the Pasvik River. The average annual concentration only decreased with 3 µg/l in this river, but a high concentration in May 2006 combined with high water discharges gave a huge difference in the load calculations. Two other metals that have decreased are cadmium and arsenic, this reduction is slight and there are variations between coastal areas since there is a slight increase in some areas (e.g. cadmium in the North Sea) and reduction in others (mainly Skagerak).

Table 9. Riverine loads of various metals in 2006 and 2007. All values in tonnes/yr. Increases from 2006 are marked with orange, decreases in green, and no change in yellow. (On the row for total rivers, changes of 2 % or less have been defined as no change.)

		Cd		Cu		Zn		Pb	
		2006	2007	2006	2007	2006	2007	2006	2007
Main rivers (10)	Lower avg	0.94	0.98	98.0	126.8	265.8	316.0	13.5	28.5
	Upper avg	0.97	1.03	98.0	126.8	265.8	316.0	13.5	28.5
Tributary rivers (36)	Lower avg	0.93	0.72	89.8	117.3	227.1	273.7	15.4	17.9
	Upper avg	1.06	0.95	89.8	117.3	227.1	273.7	15.4	17.9
Trib rivers (109)	Lower avg	0.69	0.75	30.2	32.1	84.0	90.6	7.2	7.8
	Upper avg	0.69	0.75	30.2	32.1	84.0	90.6	7.2	7.8
Total rivers	Lower avg	2.56	2.45	218.0	276.3	577	680	36.0	54.2
	Upper avg	2.71	2.73	218.0	276.3	577	680	36.0	54.2
		As		Cr		Ni		Hg	
		2006	2007	2006	2007	2006	2007	2006	2007
Main rivers (10)	Lower avg	10.4	12.4	16.9	17.6	41.8	42.6	0.05	0.01
	Upper avg	10.4	12.7	17.9	19.4	41.8	42.7	0.09	0.07
Tributary rivers (36)	Lower avg	10.4	6.6	19.7	22.0	181.3	101.1	0.05	0.02
	Upper avg	11.0	8.8	22.3	25.7	181.4	101.3	0.10	0.10
Trib rivers (109)	Lower avg	6.6	6.9	10.9	11.9	23.3	25.8	0.10	0.00
	Upper avg	6.6	6.9	10.9	11.9	23.3	25.8	0.09	0.00
Total rivers	Lower avg	27.4	25.9	47.4	51.5	246.4	170	0.20	0.03
	Upper avg	28.0	28.4	51.1	57.0	246.4	170	0.29	0.17

The increase in copper in the main rivers is mainly primarily linked to increases in the Skagerak region, especially due to high values in flood samples in River Numedalslågen. There are also increases in Orkla and slight increases in River Skien, Otra, and Orre. In the tributary rivers, the increased copper concentrations are mainly seen in the North Sea region, in particular samples collected during relatively high water discharges in Rivers Sira and Kvina.

In terms of changes in PCB7 inputs, these are, as last year, mainly a result of the detection limit of the analytical method used. A comparison between 2006 and 2007 suggests a decrease of PCB7 loads, but in reality this is caused by some samples in 2006 that had higher detection limits than normal due to contamination of the samples. In addition to detection limits, water discharge during sampling is important for the variations of loads in PCB7 and lindane. These substances are only analysed four times a year, and only in the main rivers. With concentrations always below the detection limits, the subsequent load calculations become highly dependent on fluctuations in water discharge on the sampling dates.

In summary, the changes in riverine inputs from 2006 to 2007 mainly reflect changes in water discharge during sampling, effects of sampling frequency and effects of using the RID calculation method which is highly dependent on the concentration and water discharge during sampling.

5.2 Direct discharges in 2007 compared to earlier years

The reporting of industrial discharges for 2007 has been delayed due to a change in the database system, and the figures from 2006 have therefore been used in the 2007-reporting of RID. The same problem occurred last year, and in the 2006-reporting, industrial data from 2005 were therefore used. The data on sewage treatment plants and fish farming are, however, for 2007. Due to the fact that the *reporting* of the different sources for direct discharges often varies considerably from year-to-year, it is deemed necessary to compare more than two years, and
Table 10 therefore also includes values from 2004 and 2005.

Table 10. The total direct inputs to the Norwegian coast in 2004, 2005, 2006 and 2007. The direct discharges comprise (i) sewage effluents, (ii) industrial effluents, and (iii) fish farming. All values are given in tonnes/yr. Data for industrial effluents in 2006 are identical to the 2005 data; and in 2007 the data for industrial effluents are derived from the 2006 reporting. Cells shaded orange indicate increase from 2006 to 2007; green indicates decrease.

	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	NH_4-N	NO_3-N	PO_4-P	Tot-N	Tot-P	SPM
2004	0.10	0.14	17.5	23.6	2.2	0.8	0.8	8.9	27232	3506	4266	36477	6300	365458
2005	0.09	0.03	246	19.8	2.1	0.6	3.4	11.9	30887	3961	4710	39280	6943	475932
2006	0.09	0.09	236	22.0	1.8	0.6	2.8	11.6	37255	4792	5677	47365	8342	479336
2007	0.35	0.03	700	40.8	3.6	1.2	2.0	8.8	41976	5434	6441	53333	9481	531378

The general increase in nutrients and suspended particles is due to an increase in these parameters for all four coastal areas, both for sewage effluents and fish farming, in 2007; as well as an increase of nutrients from industrial inputs from 2005 to 2006. Fish farming is, however, responsible for the largest inputs and also the largest increases. As the table shows, this increase of total nutrient inputs continues the trend from 2004. It is not clear whether this is due to an actual increase in inputs, or to improved reporting from the different pollutant sources. The changes in direct metal discharges between 2006 and 2007 can be summarised as follows:

- Large increase in cadmium discharge is mainly due to reported industrial discharges in the North Sea area;
- Large increase of copper compared to the former reports, is mainly due to a new method for calculation losses from fish farming;
- Doubling of zinc discharges; here the discharges from sewage effluents have been reduced significantly, whereas there has been a major increase in reported industrial discharges in the North Sea and Norwegian Sea regions;
- Increase of lead discharges is due to higher reported industrial discharges in the North Sea region;
- Increase in arsenic is mainly due to industrial discharges in the North Sea region;
- Decrease in mercury, which is mainly due to decreases in mercury from sewage treatment plants. There is a suspicion of errors in the units reported in earlier years, especially from some sewage treatment plants in the Skagerak region. The decrease is therefore not necessarily real, but may be a result of erroneously high reported discharges in earlier years;

- A small reduction of chromium in spite of increases in reported discharges from sewage treatment plants and industry in the Skagerak region, but due to relatively large reductions in reported discharges from industry in the Norwegian Sea;
- The reduction of nickel discharges is due to decreases in industrial effluents in the Norwegian Sea, whereas sewage effluents of nickel have increased slightly in other regions.

In terms of the huge increase in copper loads from fish farming, SFT reports that all discharge of copper from anti-fouling treatment of net cages was considered as lost to the aquatic environment until a regulation on the discharge from net washing facilities was put in force. The quantification of discharges is now based on sale statistics for a number of products in regular use and SFT assumes that 85% of the copper content is lost to the environment. The quantity used per fish farm is not included in official statistics, but for the RID Programme a theoretical distribution proportional to the fish production was used. Copper from anti-fouling paint from boats amounts to 250-300 tonnes per year, but is presently not included in the RID reporting.

The statistics show increasing discharges of copper from fish farming in the period 2004 to 2006, as shown in Figure 27.

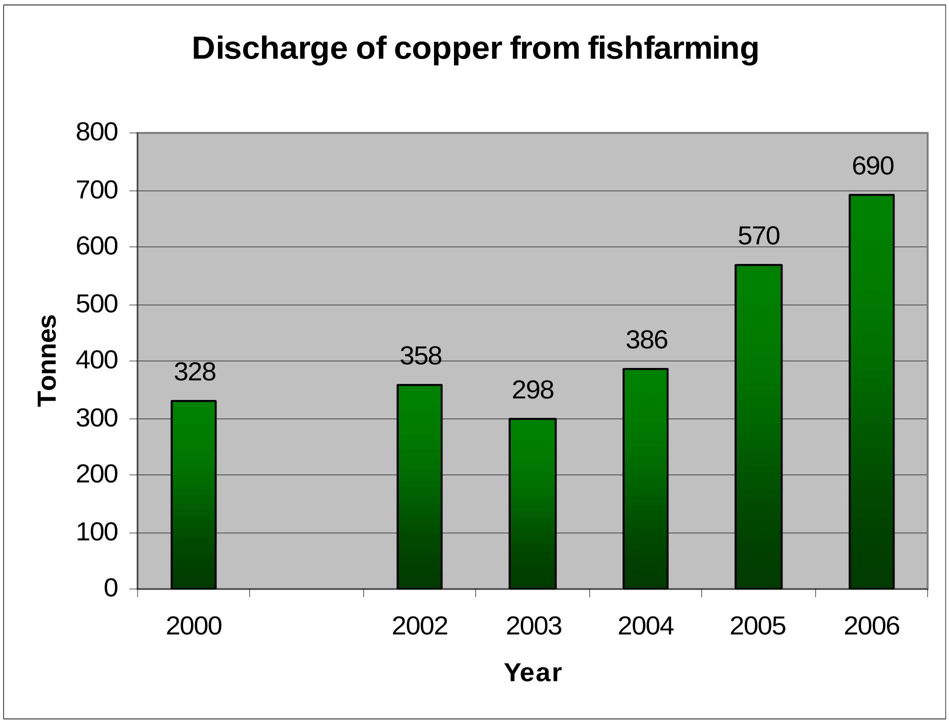


Figure 27. Discharge of copper from fish farming, caused by cleaning of net cages, in the period 1995-2006.

A general conclusion on the variations in the direct discharges from year-to-year is, thus, that it is difficult to ascertain whether the variations are due to actual reductions or increases in discharges, or whether they mainly can be explained by insufficient and varying reporting of discharges, including errors in units.

5.3 Total input variations from 2006 to 2007

The variations of total inputs discussed above has lead to an overall increase of inputs from 2006 to 2007 of most substances monitored in the RID Programme (Figure 28, Figure 29 and Figure 30) The increases are within normal variations from year-to-year, and mainly caused by increased riverine water discharges and increased reported industrial discharges (from 2006-data).

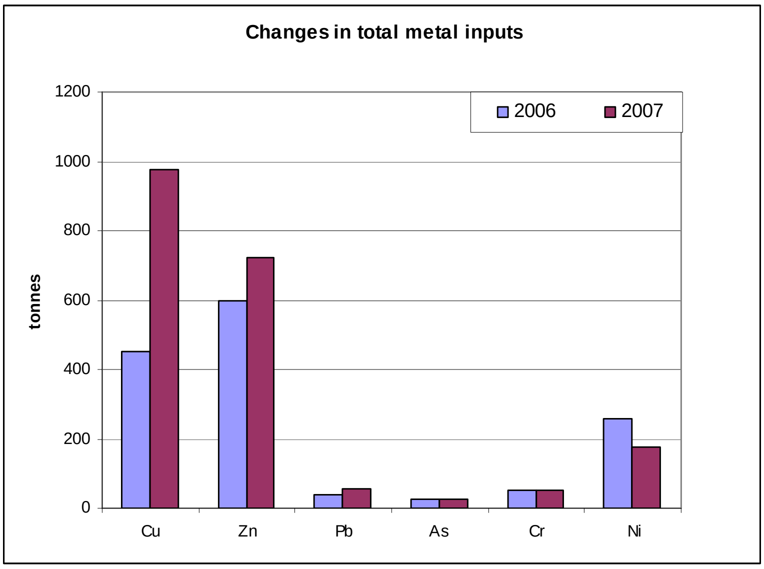


Figure 28. Changes from 2006 to 2007 of total inputs to Norwegian coastal waters of six metals.

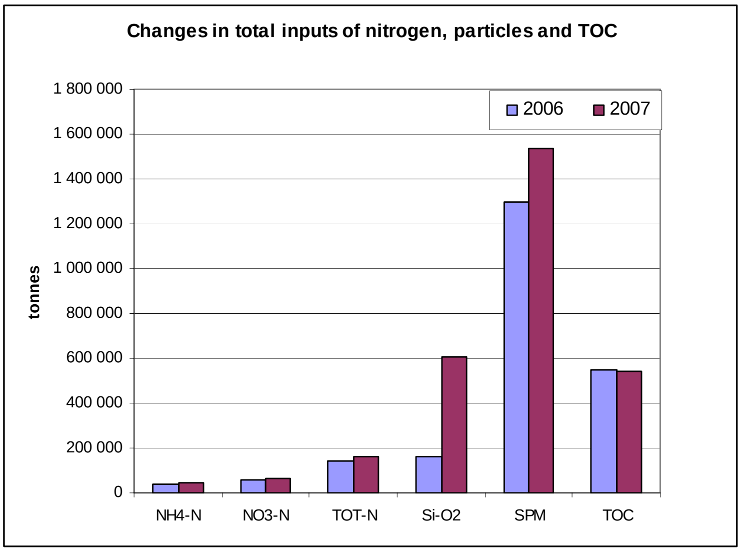


Figure 29. Changes from 2006 to 2007 of total inputs to Norwegian coastal waters of nitrogen, silica, particles and TOC.

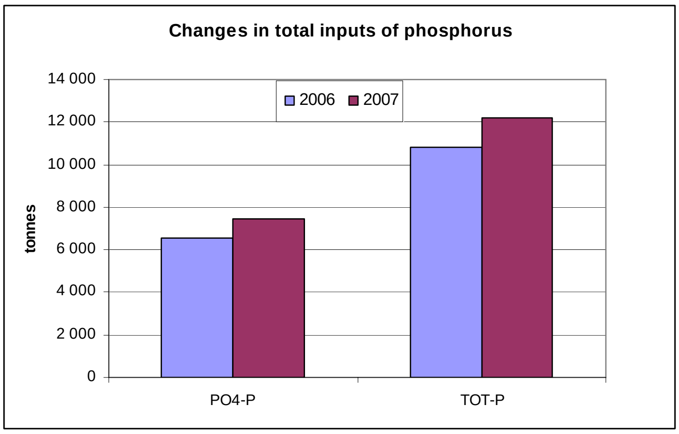


Figure 30. Changes from 2006 to 2007 of total inputs to Norwegian coastal waters of phosphorus.

6. Trend analyses - pollutant concentrations

In this chapter, the trends in the concentrations of the RID parameters are analysed for the 10 main rivers for the period 1990-2007. The trends are adjusted for year-to-year variations in water discharge.

6.1 Statistical methodology

In this report, the partial Mann-Kendall test (Libiseller and Grimvall, 2002) has been used to test for long-term changes in solute concentrations measured in the 10 main rivers. The method has its methodological basis in the seasonal Mann-Kendall-test (SMK; Hirsch and Slack, 1984) with the difference that water discharge is included as explanatory variable. The trend analyses were performed on the upper estimates of concentrations (i.e., if the concentration of the sample was below the detection limit, the concentration was set equal to the value of the detection limit).

In addition, a multivariate test based on Loftis et al. (1991) and further developed by Wahlin et al. (2008) has been applied for all rivers. This implies that the trends in individual rivers are statistically 'weighted' to determine the summary trend. Basically, it follows the same procedure as the seasonal Mann-Kendall test; each site is tested separately for trends before they are summed up to an overall test statistic.

All the methods use tests for monotonic[2] trends (including linear trends), and each month is tested separately for trends before it is summed up to an overall test statistic.

The trends were regarded statistically significant at the 5%-level (double-sided test)[3]. P-values between 5% and 20% were defined as 'significant' and should be interpreted as a tendency or indication of a trend over time.

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

6.2 Data selection and technical remarks

The analysis has been based on monthly observations in the ten main rivers for the period 1990-2007. In months with more than one sample, an arithmetic concentration average was

[2] Monotonic is here defined as a consistent increase or decrease over time. Monotonic trends may be linear (the same slope over time) or non-linear.

[3] In statistics, a result is called significant if it is unlikely to have occurred by chance. "A statistically significant trend" simply means there is statistical evidence that there is a difference; it does not mean the difference is necessarily large, important or significant in the usual sense of the word. Thus, the 5%-level in this case, does not mean a 5% or larger change in concentrations.

calculated. The rivers *Suldalslågen* and *Alta* were sampled less frequently than monthly during the period 1990-1998.

Chemical variables analysed for trends include conductivity (cond), cadmium (Cd), copper (Cu), nickel (Ni), lead (Pb), zinc (Zn), ammonium nitrogen (NH_4-N), nitrate nitrogen (NO_3-N), total nitrogen (TN), orthophosphate (PO_4-P), total phosphorus (TP) and suspended particulate matter (SPM). No trend analyses were performed for mercury (Hg) because of the general high analytical uncertainty of this parameter and the change in analytical methods during the period 1999-2003 (Weideborg et al., 2004). Other parameters not analysed for trends due to too short time series and/or gaps in the series include arsenic (As), cobolt (Co), chromium (Cr), total organic carbon (TOC), dissolved organic carbon (DOC), Silica (SiO_2), PCB7 and lindane (γ-HCH).

During one specific year, all Norwegian RID river samples are analysed by the same laboratory. Thus, all samples from 1990 up to 1998, and from 2004 to date, were analysed by the same laboratory, but samples in the period 1999-2003 were analysed by a different laboratory. Such changes in laboratory often mean changes in methods and detection limits.

Another challenge is the statistical handling of observations below the detection limit, the so-called LOD values (Limit of Detection). This represents a particular problem in the Norwegian RID data-sets, which contain several rivers with low contamination levels. Particularly noteworthy is the high number of LOD observations for many metals in Norwegian rivers (see Skarbøvik et al., 2007 for the details). There was a general increase in frequency of LOD values for some metals, SPM and total-P during the period 1999-2003 due to higher LOD (Skarbøvik et al., 2007). In the period 1990-1998 also values below LOD were reported. These examples illustrate the need for more efficient assessments of 'true' long-term trends, as well as the importance of recording changes in laboratories (see Skarbøvik and Borgvang, 2007.)

6.3 Results from trend analysis

6.3.1 Water discharge

Trends in water flow in the ten main rivers were here assessed for the *specific sampling dates* for chemical analyses, and not as trends in general hydrological conditions. No statistically significant trends since 1990 were detected except for an upward trend in *Skienselva* ($p<0.05$; Table 11; Figure 31) and a downward trend in *Suldalslågen* ($p<0.06$). Orreelva shows a tendency of elevated water discharge in 2004 and onwards (Figure 31; lower panel)

A visual inspection of the time series (Annex V) indicated elevated water flow during the autumn 2000 in all rivers discharging into the Skagerak, except from the *River Otra* which had unusually high water flow during sampling at the end of 2004.

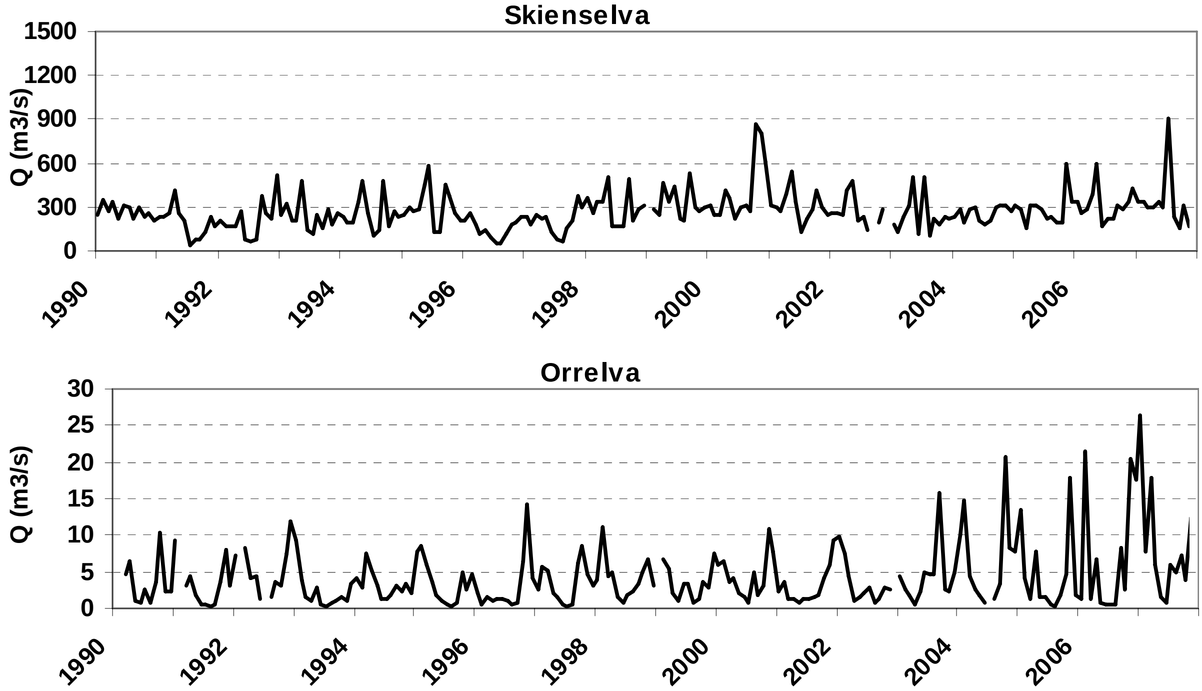


Figure 31. Monthly discharge (based only on data at the day of water quality sampling) in Skienselva (upper panel) and Orreelva (lower panel), 1990-2007.

6.3.2 Nitrogen

For total nitrogen, three statistically significant *downward* trends were detected (p<0,05; Table 11); in *Skienselva, Vefsna and Alta*. These trends were explained by downward trends in nitrate concentrations (Table 11; Figure 32). One more river, *Suldalslågen*, showed indications of reduced tot-N concentrations, but the trend was not statistically significant (p<0.07; Table 11). A statistically significant *upward* trend for tot-N was detected for *Drammenselva* (Table 11; Figure 33). This is primarily an effect of low concentrations in the beginning of the series combined with elevated concentrations since 2006. In Drammenselva nitrate-N showed the same temporal variability, though the trend was not statistically significant.

Tendencies of increased tot-N concentrations in *Numedalslågen and Glomma* are also mainly explained by low concentrations during the first three years of the monitoring period (1990-1992; Annex V). Given that nitrate concentrations in *Glomma* do not show the same upward tendency, the increased tot-N concentrations is most likely related to increased concentrations of organic-N.

Significant downward trends in nitrate were detected in four rivers: *Alta, Skienselva, Suldalslågen* and *Vefsna* (Table 11; Figure 32 for Skienselva and Vefsna, and Annex V for Alta and Suldalslågen). The seasonal Mann-Kendall test revealed that the downward trend for nitrate in *Suldalslågen* is mainly explained by significantly decreased concentrations during autumn (August-October). The upward tendency for nitrate in *Numedalslågen* is mainly explained by low concentrations in 1990 and 1991.

Ammonium showed three statistically downward trends (p<0.05; Table 11). The general low concentration e.g. in relation to nitrate mean that the ammonium load is low.

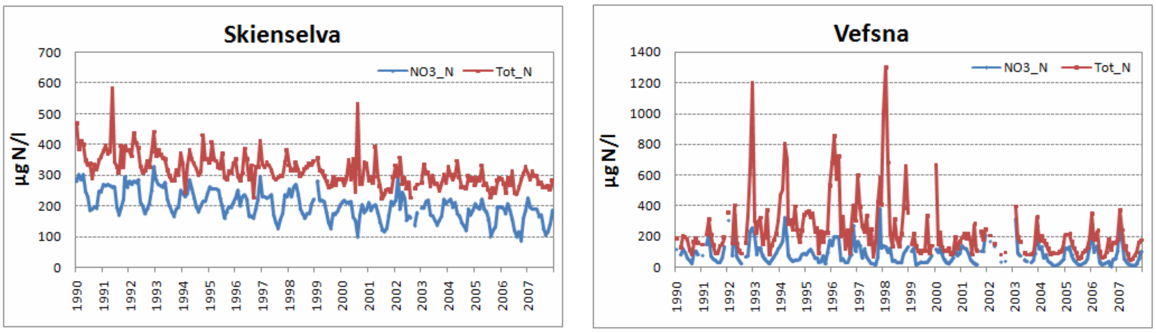


Figure 32. Monthly total-nitrogen and nitrate concentrations in Skienselva (left panel) and Vefsna (right panel), 1990-2007.

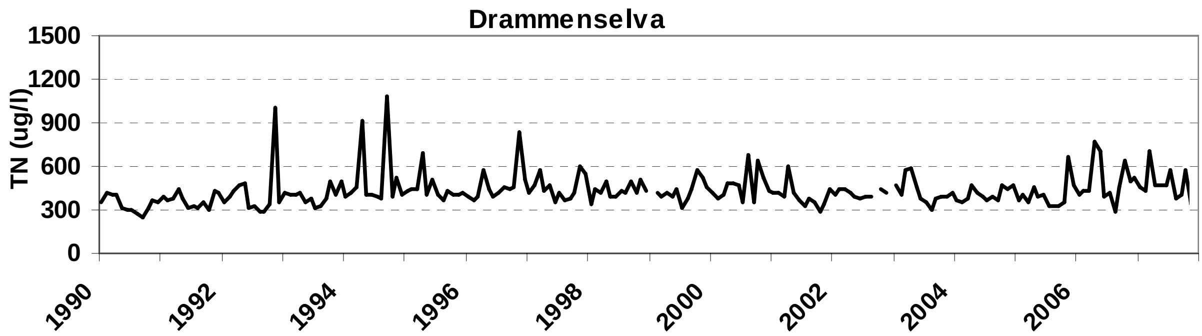


Figure 33. Monthly total-nitrogen and nitrate concentrations in Drammenselva, 1990-2007.

6.3.3 Phosphorus and particulate matter

The only statistically significant *downward* trend was detected in *Alta* (p<0.05), with low concentrations during 2003-2007 as specific feature (Figure 34). The general lack of significant trends in total phosphorus concentrations (Table 12) is somewhat surprising given the improvements of municipal sewage treatment achieved during the last 15 years.

A more detailed exploratory analysis of the time series showed surprisingly high concentration levels and peak values in all rivers except *Orreelva* and *Vefsna* during the period 1999-2002. In rivers where total phosphorus concentrations are normally regulated by erosion processes (e.g., *Numedalslågen*), the usually strong relationship between concentrations of total phosphorus and suspended particulate matter (1990-1998 and 2003-2006) was almost non-existent during the period 1999-2002 (Figure 35). Particularly noteworthy is the occurrence of high total phosphorus concentrations at low SPM levels during this period compared to earlier and later periods (1990-1998 and 2003-2006).

In this context it is worth mentioning that the year 2000 was extreme in terms of water flow in the five rivers discharging into the coastal area of Skagerak, i.e. *Glomma*, *Drammenselva*, *Numedalslågen*, *Skienselva*, and *Otra*. The annual water discharge in these five rivers was the highest ever reported during the study period (1990-2007). This was due to the intensive rainfall during the autumn 2000.

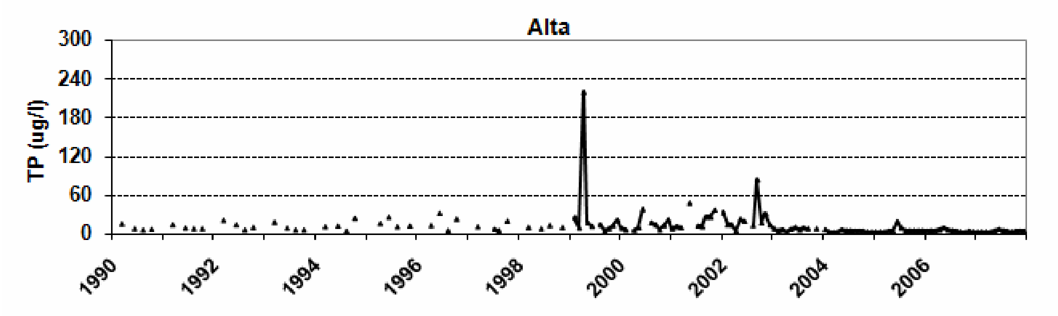


Figure 34. Monthly total-phosphorus concentrations in the Alta river, 1990-2007.

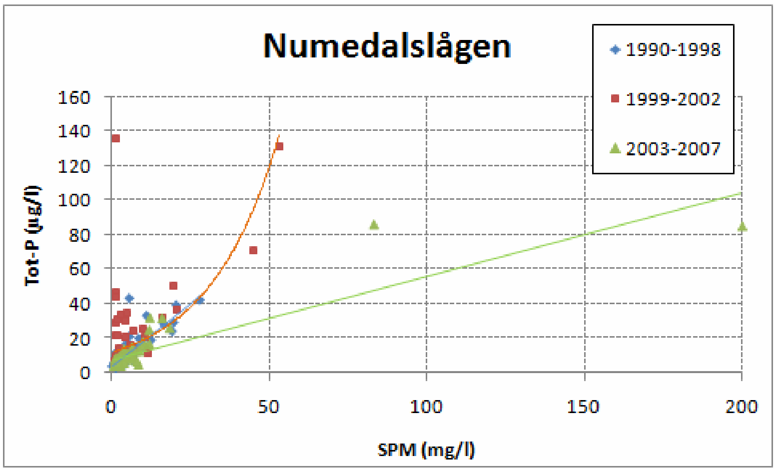


Figure 35. Scatter plot of the relationship between total phosphorus and suspended particulate matter concentrations in three time periods in Numedalslågen.

The unregular '1999-2002 pattern' in tot-P is far less obvious for orthophosphate, except for the rivers *Drammenselva, Suldalslågen* and *Alta,* and to some extent also the years 2000-2002 in the river *Orkla* (see figures in Annex V). The formal statistical trend test for phosphate only shows one single trend which was close to be statistically significant; namely in the river *Alta* (see Table 11).

For SPM, downward trends were detected in Rivers *Otra, Orkla* and *Vefsna* (Table 11). In addition, the more detailed exploratory analysis revealed that peak SPM values above 40 mg/l in *Glomma* have been rare after year 2000. The only exception observed was in early 2005. Particularly low SPM levels were observed in the rivers during 2002. In the year 2000, high autumn concentrations were detected in *Glomma, Drammenselva, Numedalslågen* and S*kienselva*, which corroborated well with the peaks in water flow during the same period. The peak values in 2007 in Drammenselva and Numedalslågen are explained by increased and additional monitoring during a summer flood situation (cf. Chapters 5, 7 and 8). In River *Suldalslågen*, no high peak values were observed during 1990-1998, probably due to a combination of lower sampling frequency and differences in hydrologic regime caused by extensive hydropower regulations in this river.

Table 11 summarises long-term trends of nutrient and particle concentrations in the ten main Norwegian RID rivers. The more detailed figures for all rivers and nutrient and SPM concentrations are given in Annex V.

Table 11. Long-term trends for water discharge (estimated at the day of water quality sampling), nutrient and particle concentrations in the 10 Norwegian main rivers 1990- 2007. The table shows the p-value which indicates significance, see legend.

River	Q	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Glomma	0,4714	0,0233	0,2423	0,0762	0,5615	0,6259	0,7156
Drammenselva	0,1248	0,6734	0,1528	0,0423	0,2862	0,9345	0,8306
Numedalslågen	0,3835	0,3626	0,0534	0,0700	0,3824	0,3295	0,7016
Skienselva	0,0409	0,4124	0,0001	0,0003	0,2596	0,7763	0,5943
Otra	0,7028	0,6598	0,0956	0,1491	0,0832	0,1097	0,0028
Orreelva	0,1716	0,3263	0,6451	0,9256	0,4160	0,5406	0,6160
Suldalslågen	0,0590	0,6340	0,0452	0,0504	0,1295	0,6294	0,2160
Orkla	0,8480	0,1910	0,7033	0,8327	0,2153	0,2207	0,0103
Vefsna	0,6908	0,0014	0,0002	0,0159	0,2412	0,0537	0,0382
Altaelva	0,3593	0,0097	0,0279	0,0062	0,0560	0,0244	0,0709
All rivers	0,2505	0,0499	0,0118	0,1149	0,5153	0,5548	0,1090

Significant downward (p<0,05)
Downward but not significant (0,05<p<0,2)
Significant UPWARD (p<0,05)
Upward but notsignificant (0,05<p<0,2)

6.3.4 Metals

A majority of the five analysed metals (Cd, Cu, Ni, Pb and Zn) showed statistically downward trends in most of the ten studied rivers. More precisely, 38 of 50 metal trend tests revealed a statistically significant downward trend (Table 12). Furthermore, six additional tests showed an indication of decreased concentrations ($0.05<p<0.2$).

It is important to remember that the detection limits have changed during the course of the monitoring programme. It is therefore difficult to determine if observed trends really reflect reductions in discharges of metals from e.g., industrial plants or sewage treatment plants.

Copper showed relatively few analyses below detection limits and downward trends in four out of ten rivers could be detected, as well as tendencies of decreased concentrations in three more rivers. Vefsna showed the highest significancy (Figure 36) of reduced copper concentrations.

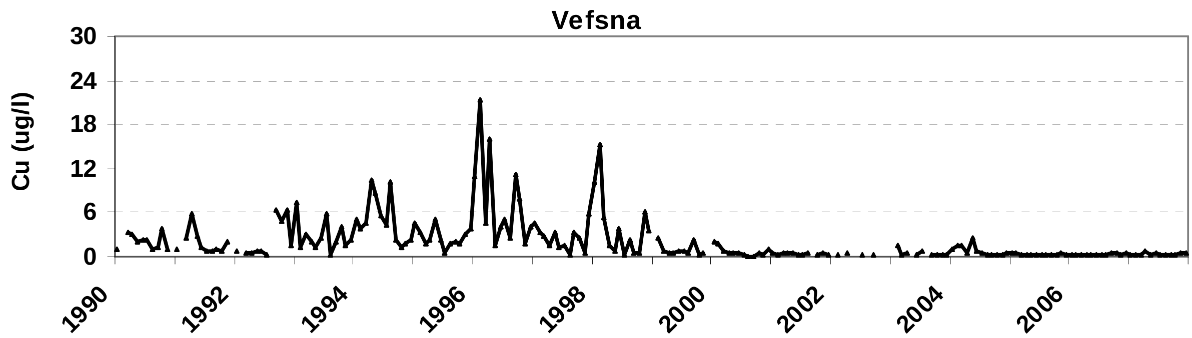


Figure 36. Monthly Copper concentrations in the Vefsna river, 1990-2007.

6.3.5 Conductivity

The conductivity measurements showed significantly declining trends in the rivers *Skienselva, Otra, Suldalslågen* and *Altaelva* (Table 12). Reduced point source discharges from industrial plants and municipal sewage treatment plants, combined with reduction of long-range transported air pollution (especially sulphate) and lower natural inputs of cyclic seasalts, may explain these trends. An upward trend in conductivity was observed in *Drammenselva*; this is mainly due to low values in 1990 and 1991.

Table 12. Long-term trends for conductivity and metals in the 10 Norwegian main rivers 1990-2007. The table shows the p-value which indicates significance, see legend.

River	Q	Cond	Cd	Cu	Ni	Pb	Zn
Glomma	0,4714	0,2621	0,0022	0,1843	0,0012	0,0012	0,0007
Drammenselva	0,1248	0,0030	0,0004	0,9920	0,7513	0,0689	0,3765
Numedalslågen	0,3835	0,4246	0,0015	0,0437	0,0046	0,0104	0,0109
Skienselva	0,0409	0,0047	0,0012	0,0952	0,0041	0,0072	0,0022
Otra	0,7028	0,0000	0,0047	0,9613	0,0350	0,0024	0,0002
Orreelva	0,1716	0,3642	0,0004	0,2838	0,0010	0,0193	0,4072
Suldalslågen	0,0590	0,0044	0,0015	0,0598	0,1789	0,0740	0,0056
Orkla	0,8480	0,4652	0,0186	0,0154	0,0011	0,0029	0,0040
Vefsna	0,6908	0,7745	0,0001	0,0008	0,0006	0,0002	0,0003
Altaelva	0,3593	0,0022	0,0005	0,0037	0,0008	0,0001	0,0004
All rivers	0,2505	0,0222	0,0002	0,0178	0,0008	0,0006	0,0002

Significant downward (p<0,05)
Downward but not significant (0,05<p<0,2)
Significant UPWARD (p<0,05)
Upward but not significant (0,05<p<0,2)

The more detailed figures for all rivers and substances are given in Annex V.

6.4 Conclusions

In this chapter, a statistical assessment has been made on the long-term trends for the period 1990-2007 in monthly water discharge (only data at day of water quality sampling), concentrations of nutrients (NH_4-N, NO_3-N, Total-N; PO_4-P and Total-P), particulate matter (SPM), metals (Cd, Cu, Ni, Pb, and Zn), and conductivity in each of the ten main rivers. The main findings are:

- There is a substantial temporal variability (both between and within a year) in concentrations for all monitored substances
- Peaks are in most cases due to high water discharge
- High concentrations in Numedalslågen and Drammenselva in 2007 for many substances are explained by increased sampling frequency during a summer flood episode.
- For nitrogen we could detect the following upward and downward statistically-significant trends:

  - In Skienselva, Vefsna and Altaelva, downward trends in both total nitrogen and nitrate nitrogen;
  - In Glomma, Vefsna and Altaelva, downward trends in ammonium nitrogen;
  - In Drammenselva, upward trend in total nitrogen.
- For total phosphorus concentrations, only one statistically-significant downward trend could be detected, i.e. in Altaelva, but with some similar tendencies in Vefsna
- For suspended particle concentrations, statistically-significant downward long-term trends can be detected in Otra, Orkla and Vefsna.
- In Orreelva, elevated concentrations of both suspended particles and phosphorus and to some extent also nitrogen were observed in the period 2004-2007.
- For copper we could detect downward trends in four out of ten rivers and tendencies of decreased concentrations in three more rivers.
- For other metal concentrations, no firm conclusions can be drawn on long-term changes and the statistically significant downward trends in 34 out of 40 cases (i.e., 10 rivers and 4 parameters) are not necessarily explained by 'real' changes in concentrations. This is due to many values at LOD and that large changes in LOD values over the monitoring period have occurred. Thus, results and interpretations should in most rivers be used with great caution and should solely be used as an indication of the magnitude of loads and its uncertainty.

No statistically-significant upward or downward trends in monthly water discharge during sampling dates could be detected, except for an upward trend in Skienselva (particularly accentuated from 2004 and onwards).

7. Long-term trends in riverine loads

In this chapter, an assessment of the long-term trends for the period 1990-2007 in annual water discharge, riverine loads of nutrients (NH_4-N, NO_3-N, Total-N; PO_4-P and Total-P), particulate matter (SPM), metals (Cd, Cu, Ni, Pb, Zn, As and Hg), one pesticide (lindane) and PCB7, in each of the ten main rivers are presented.

7.1 Input-data, methodology and technical remarks

Daily water discharge data were downloaded from the HYDRA2-database (NVE). As pointed out in the methodology chapter, the water discharge data were spatially scaled to fit to the area of the site for water quality monitoring since the location of the water discharge measurement sites do not necessarily correspond to the location of the water quality sampling site.

Data on annual loads was derived from recalculation of all data (both water quality and water discharge) from the period 1990-2007. This was done because unrealistic reported load values in the Norwegian OSPAR reporting for single years were identified. In addition, other minor inconsistencies in water discharge data were identified in the OSPAR data files which were not possible to trace back despite attempts to recalculate the raw data.

The trend assessment of nutrients, SPM and copper was performed by comparing the estimated load with the flow-normalised loads. In some cases, flow normalisation was not possible due to bad model fit due to inconsistencies in the load and water discharge relationship. A trend line given as a smoother was also constructed according to the newly-developed method of Grimvall et al. (2008). More specifically, this smoother was obtained by statistical cross-validation that minimises the residuals in the statistical modelling. However, this ‘smoother’ should be interpreted with great caution and is only included to give a visual picture of the most likely long-term trend given the normalised loads.

It should be noted that flow normalisation and other statistical trend analyses were not conducted for metals (except for Cu) given the problem with changed LOD over time and/or a large number of samples reported at the LOD level. The lower and upper estimates are, however, given in graphs supplemented with a qualitative assessment based on a visual inspection of these graphs and underlying data.

All substances were covered for the period 1990-2007 except for the following:
Arsenic was not monitored in the period 1990-1993
PCB7 was not monitored in the period 1999-2003

Complementary figures to this chapter are given in Annex VI.

7.2 Water discharge

The riverine loads of nutrients and particles have considerable interannual variability as shown in previous reporting of the Norwegian RID-programme (e.g. Skarbøvik et al., 2007). This is mainly due to interannual variability in runoff.

The time series figures of actual[4] annual water discharges are presented in Annex VI. Below a summary of the most interesting observations made in the water discharge series is given:

- The water discharge can differ with a factor of two between years. This has been observed in all main rivers expect the heavily-regulated Suldalslågen and in the two most northern rivers (Vefsna and Altaelva; the latter also heavily regulated).
- In the five Skagerak rivers, the water discharge was particularly high in the year 2000, due to heavy and long-lasting rainfall in autumn 2000.
- For the two rivers in northern Norway, Vefsna and Altaelva, the highest annual water discharges were registered in 2005.
- 1996 was characterised by low water discharges in all Skagerak rivers.
- 2007 was a high discharge year in Glomma and Drammenselva.
- A serial correlation between years can be noted in all Skagerak rivers, particularly accentuated in Drammenselva, Numedalslågen and Skienselva
- No obvious upward or downward trends in annual water discharge could be detected in the visual inspection of the data.

7.3 Nitrogen

For all the five Skagerak rivers the observed total nitrogen loads were particularly high in 2000 and to some extent also in 1999. However, a substantial fraction of the interannual variation in nitrogen loads was removed when load data were flow normalised, especially in years with very high or low flows. In some rivers, flow normalisation also partly removed signs of upward or downward trends in the estimated/observed annual riverine loads of total nitrogen (e.g. in *Otra*).

The slight tendency of an upward trend in *Glomma* ("trend smoother") was mainly due to low concentrations and loads during the period 1990-1993.

Flow-normalised nitrogen loads were relatively low in 2001 in all five Skagerak rivers. This might be an effect of intensive leaching of nutrients and increased soil erosion during the precipitation-rich autumn of 2000, and thus, less available material for riverine transport in 2001.

After flow-normalisation, a clear downward trend can be seen in *Skienselva* and *Vefsna*. This was also seen on concentrations in the formal trend analysis (cf. Chapter 6). The rather abrupt change in loads in *Vefsna* before and after 1999 was rather remarkable. In fact the same pattern was also noted for NH_4-N, Pb and Cu (Figure 37), in addition to relative high concentration levels compared to the other rivers (cf. Chapter 6). This might indicate industrial discharges or sewage treatment effluents. One argument that supports this was the fact that high concentrations before 1999 were observed almost solely at low water discharge when dilution is at a minimum. However, no examples of industrial or sewage treatment plants with reduced effluents or units that have ceased to exist have been found. Similarly, the downward trend in *Skienselva* may be

[4] With 'actual' water discharge is meant the total water discharge as measured continuously, as opposed to the water discharge measured only during sampling dates.

caused by a number of different changes and measures in the watershed, but no concrete explanation has yet been found.

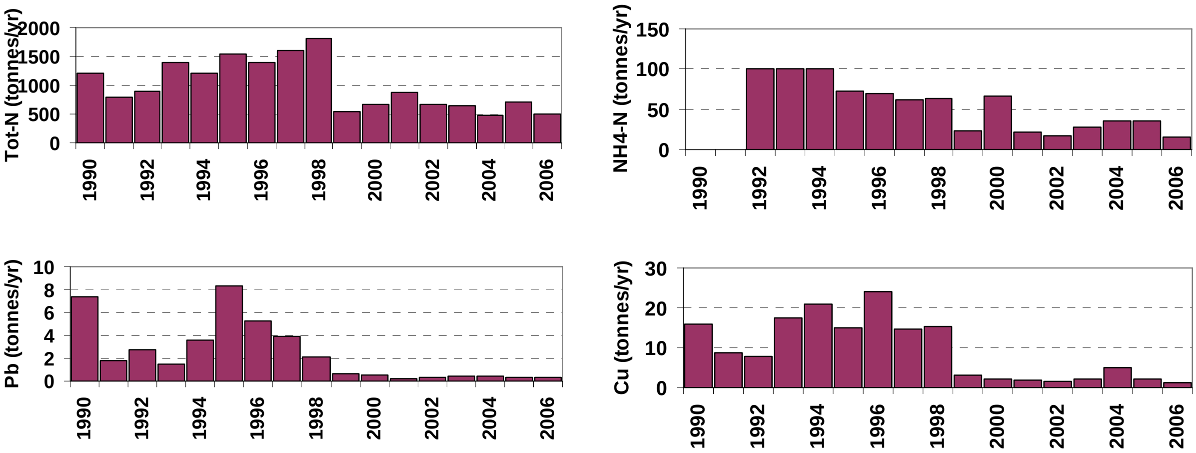


Figure 37. Annual riverine loads in Vefsna of total nitrogen, ammonium, lead and copper in 1990-2007. Shown are the upper estimates.

In *Orreelva,* elevated loads for both total nitrogen and nitrate-N in the period 2004-2007, with highest load ever observed in 2007 (Figure 38), have resulted in an upwards trend. The high loads in recent years were examined in more detail in Skarbøvik et al. (2007). They showed that there has been an increased occurrence of high water discharge events in the period 2004-2007 combined with high or relatively high nitrogen concentrations. In fact, of the 14 highest water discharge events (>17 m^3/s), as many as five occurred during the years 2004-2006. As mentioned above, the RID-method for load calculation gives high 'weight' on observations with high water discharge which implies that the annual load estimates could be significantly affected by simultaneous high water discharge and concentrations. In addition, *Orreelva* is a small river basin (100 km^2) and for Norwegian conditions a basin with a high share of agricultural land (30%). It is well-known from the scientific literature that the short-term variability increases dis-proportionally to the river basin/catchment size, especially where agricultural sources are dominant. It can therefore not be ruled out that the high loads in recent years are purely coincidental, i.e. that sampling by chance has been done during high flows. In addition, Skarbøvik et al (2007) indicated – by inspecting the daily records of water flow in *Orreelva* – that there was an increased number of high flows during the last 3-4 years. However, a more detailed flood frequency analysis has not been performed.

Phosphorus also showed elevated loads during the years 2004-2006, especially for the orthophosphate fraction (cf. next section). The similar pattern for nitrogen (nitrate-N) and orthophosphate in *Orreelva* (see Annex VI) indicates a purely hydrological phenomenon, or hydrology in combination with sudden changes in emissions from agricultural sources. However, a recent study on phosphorus by Molversmyr et al. (2008) in Orreelva based on various statistics on land use, agricultural management practices and waste water treatment indicate decreased P-emissions at the source between 1995 and 2007.

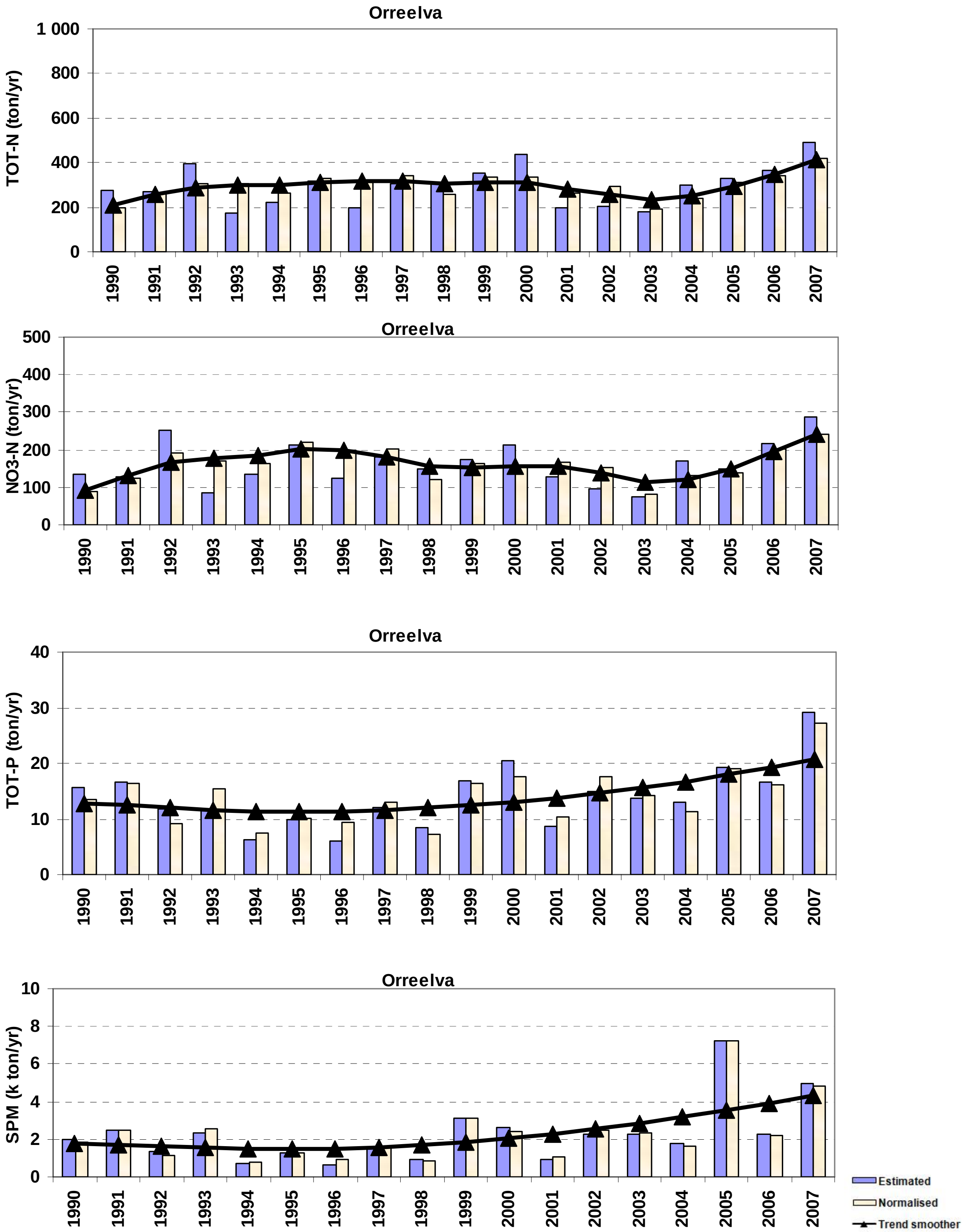


Figure 38. Annual riverine loads in Orreelva of total nitrogen, nitrate nitrogen, total phosphorus and suspended particulate matter, 1990-2007.

Changes in NH_4-N loads are shown in figures in Annex VI. Ammonium loads in most rivers only account for 1-5% of the total nitrogen loads. In addition, NH_4-N is normally quickly converted to nitrate-N in riverwater (via nitrification processes) and thus a less suitable parameter for long-term trend assessments.

7.4 Phosphorus

The total phosphorus loads show a general large interannual variability which in a majority of the ten rivers varied by a factor of six or more (e.g., *Numedalslågen, Skienselva, Otra, Suldalslågen, Vefsna* and *Altaelva*; blue bars in figures in Annex VI). Another common feature in almost all rivers was that the flow normalisation did not remove all the interannual variations (light yellow bars in figures in Annex VI). After flow normalisation, there were still high loads, in particular in the five Skagerak rivers in the period 1999-2002. As discussed in Chapter 6, there were indications that the normally existing correlation between total phosphorus and particulate matter became almost absent in the period 1999-2002. Apart from some wetter periods with increased water flow, the high observed and flow-normalised loads can not be explained. Given this and especially high interannual variability, it is difficult to detect long-term trends. The only exception is in Vefsna, where the phosphorus loads have declined, primarily during the years 2004-2007. Apparently this is the joint effect of low PO_4-P loads and SPM in the same years (Figure 39).

The tendency of upward trends in Orreelva was already discussed in the previous section as the same phenomena are also noted for nitrogen. The high loads in 2007 in Drammenselva and Numedalslågen are coupled to SPM and increased sampling frequency which is further discussed in the next section.

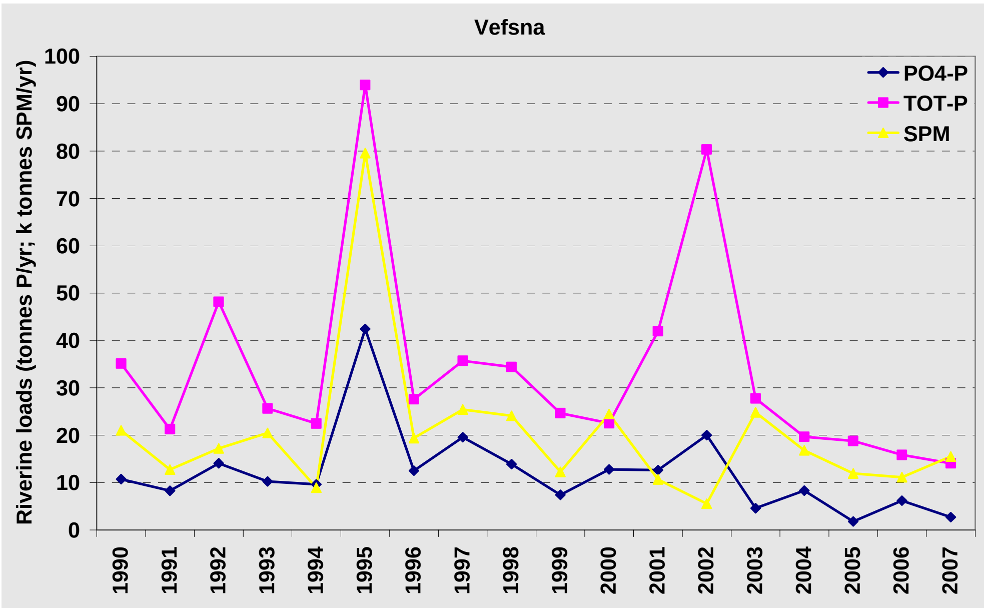


Figure 39. Observed riverine loads of total-P, PO4-P and SPM in Vefsna 1990-2007

Other high loads for single years are primarily connected to single observations such as the following examples:

- The high load in *Skienselva* in 2001 is explained by a very high value in December of almost 250 µg/l; normal values are in the range of 2-10 µg/l.
- The high load in *Numedalslågen* in 2000 is explained by a high October concentration of 131 µg/l in combination with high flow (600 m^3/s) and also relatively high SPM concentration of 53 mg/l.

- The high loads in *Otra* in 2000 is explained by a peak value of 42 µg/l on November 1, combined with high water flow (682 m^3/s) resulting in relatively high particle transport.

Orthophosphate (PO_4-P) did not show the same temporal pattern as for total phosphorus. A downward trend may be detected in loads after year 2000 in the three northernmost basins (the Vefsna case is already discussed above). However, PO_4-P concentrations are in most samples within one single year at very low levels (1-2 µg/l) or at LOD, which in turn have changed during the course of the monitoring period. This implies that interpretation of PO_4-P trends should be made with great caution.

7.5 Particulate matter

Similar as for total phosphorus, there has been a major interannual variability of suspended particulate matter (SPM). The fact that the flow-normalised method was not capable of removing the interannual variability in observed load to any particular degree is due to a rather poor relationship between loads and water discharge and/or single outliers in such relationships (Figure 40). This might indicate that the sampling method (regular monthly sampling) might underestimate the true loads as well as the unpredictability in the estimation of event-based substances like suspended particulate matter. The difference in load-discharge relationships in Figure 40 also illustrates another feature in SPM loads, namely that different rivers exhibit different relationships.

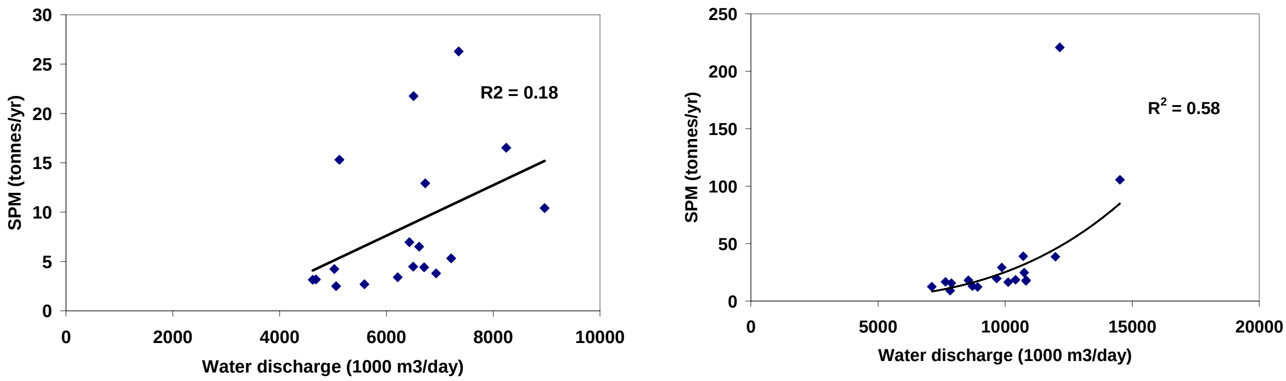


Figure 40. Scatterplot of the relationship between annual load of suspended particulate matter and annual water discharge in Otra (left panel) and Numedalslågen (right panel) in 2007.

Nevertheless, a common feature in the time series was the high particle loads in the year 2000 for all five Skagerak rivers. This is obviously explained by the high water discharge this year.

The high loads in 2007 in Drammenselva and Numedalslågen were due to increased sampling frequency due to campaign measurements during the summer flooding. It is evident that the additional samples taken in end of June and beginning of July during the flood captured high concentrations (Figure 41). A similar 'sampling-frequency' effect has also been noted during the extremely high flood in 1995 in Glomma. More specifically, during the last part of this flooding (in June 1995), daily water quality samples was collected. These data was published in Skarbøvik et al (2007) and showed high SPM concentrations but also variability in SPM concentrations (range from 20 to 65 mg/l) when water discharge was at the peak (3200-3700 m^3/s). These campaign measurements in Glomma in 1995 and in Drammenselva and Numedalslågen in 2007, imply that an ordinary sampling strategy (6 samples are normally collected during the May-June period) might miss or 'hit' concentration peaks randomly. This, in turn, may significantly affect the annual load estimate and thus the probability to detect long-term trends.

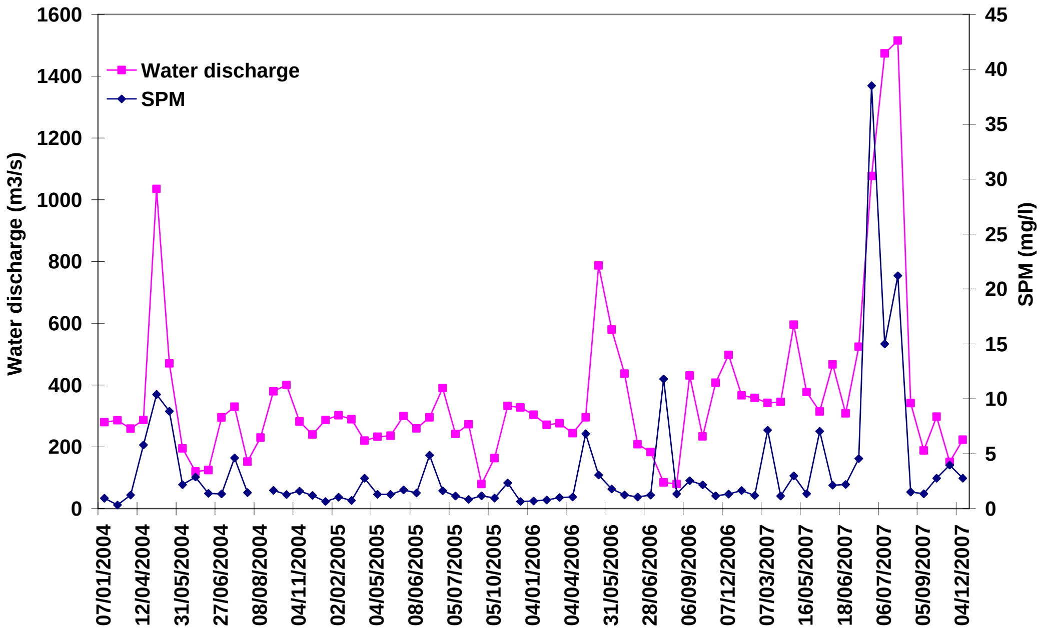


Figure 41. Concentrations of suspended particulate matter and water discharge at the day of water quality sampling in Drammenselva in 2004-2007.

Single observations can also explain the rather patchy picture and large inter-annual variation in loads. For example, high loads were also registred in Glomma in 1992 explained solely by only one high SPM concentration of 155 mg/l on December 3, 1992. This observation was not defined as an outlier as also other substances (both metals and nutrients) showed elevated concentrations the same day. Other examples of the influence of single observations for annual loads are given in Skarbøvik et al. (2007). This is a clear indication of the effect of insufficient sampling frequency especially for SPM, which in turn also affects other substances like particulate-P and metals attached to particles.

The discussion and examples above also explain that the evident downward trend in Glomma (Figure 42) might be due to single outliers in the beginning of the 1990s and the campaign measurements during the flooding in 1995.

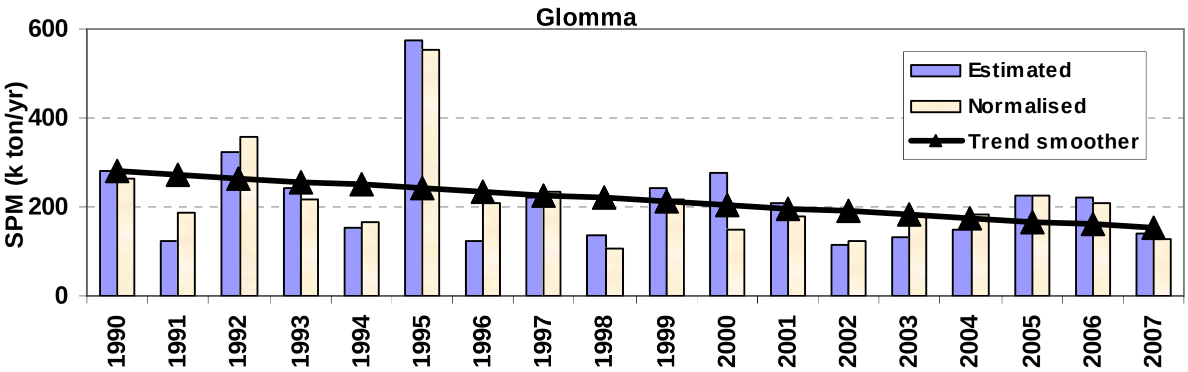


Figure 42. Estimated, flow-normalised and trend-line for the annual riverine load of suspended particulate matter in Glomma, 1990-2007.

Besides Drammenselva and Numedalslågen, the observed and flow-normalised particle loads in 2007 showed both somewhat higher and lower loads compared to loads in 2006. But overall, in a 17-year perspective, the loads of suspended particulate matter in 2007 were relatively normal in the other rivers.

7.6 Metals

In this section the annual riverine loads of six metals in the ten main rivers during the period 1990-2007 are assessed. All figures are given in Annex VI. The metals include:

- Copper (Cu)
- Lead (Pb)
- Zinc (Zn)
- Cadmium (Cd)
- Mercury (Hg)
- Arsenic (As)

Both lower and upper load estimates are given (see Annex VI). Lower load estimates have been calculated by setting all LoD values to zero concentration; whereas upper load estimates have been calculated by setting the concentration equal to the given LoD value.

Nickel, chromium, arsenic and PCB have not been included in this study, since these two substances have not been reported for all years of the monitoring period.

It should be stressed that no firm conclusions can be drawn about long-term changes in metal loads, except for copper. Possible visual trends in the data and figures shown in this section (including the complementary figures in Annex VI) are not necessarily explained by 'real' changes in loads. Thus, results and interpretations should in most rivers be used with great caution and should solely be used as an indication of the magnitude in loads and the uncertainty.

Copper (Cu)

Copper was the only metal with few LOD values and few changes in LOD over the monitoring period 1990-2007. Long-term trends have, in general, been difficult to identify in a majority of the rivers. However, the sharp break of tendency or trend in the River *Vefsna* is interesting. More precisely, the annual loads of copper during the years 1990-1998 amounted to around 12-17 tonnes, while it in the following period (1999-2007) dropped down to 2-5 tonnes. The same pattern is also noted in *Vefsna* for lead, nitrogen and phosphorus. The reason for this is not known; the sampling site in *Vefsna* is located *upstream* the major settlement (Mosjøen) and large industries in the catchment area, and no trend of declined water discharge can be observed.

A decline in loads in *Altaelva* can also be noted. In this river, the loads have declined from 4-7 tonnes in the early to mid 1990s to 1-3 tonnes in the 2000's.

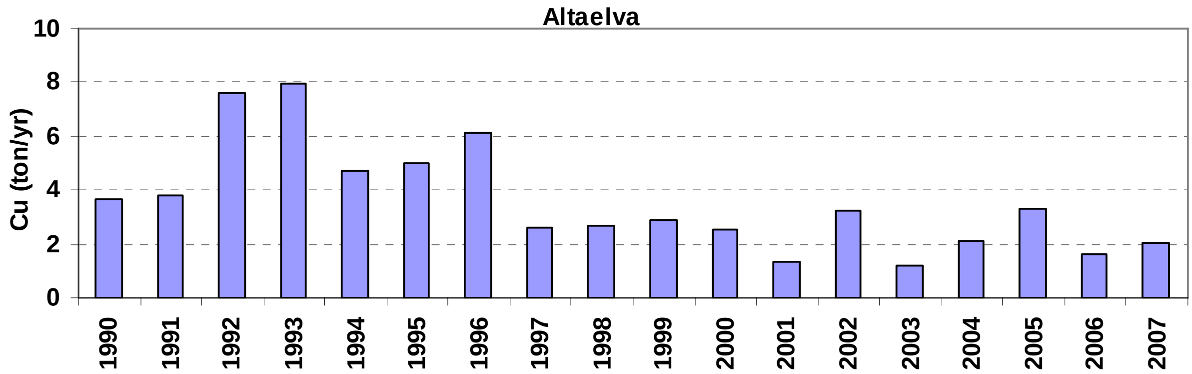


Figure 43. Annual riverine loads of Copper in Altaelva, 1990-2007.

Single years of anomalities also occur, such as 1993 in *Numedalslågen*, and 1990 in *Skienselva* and *Otra*. The high load in *Numedalslågen* in 1993 is explained by generally high values during the entire year, with e.g., 8 observations out of 13 with concentrations above 5 µg/l. In comparison, concentrations above 5 µg/l never occurred in the period 2000-2006. If 1993 is removed the downward trend also disappears (Figure 44).

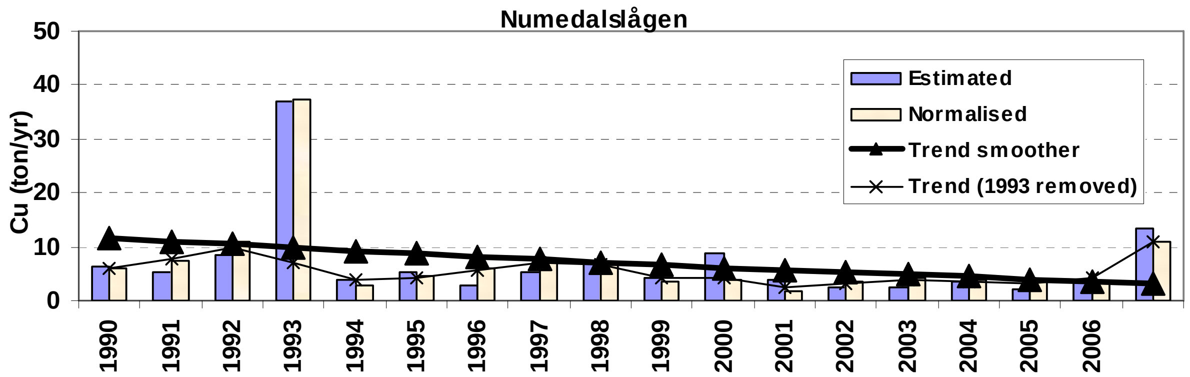


Figure 44. Annual riverine loads of Copper in Numedalslågen, 1990-2007.

The high load in *Skienselva* in 1990 is explained by 2 samples with high concentrations (17 µg/l and 20 µg/l), whereas normal values in this river are less than 1 ug/l. The high load in *Otra* in 1990 is explained by one single sample with high concentration (6µg/l) in combination with several observations around or above 1 µg/l.

Lead (Pb)
The interannual variability and trends of lead are mainly due to changes in LOD. Table 13 shows that the LOD for lead has changed by a factor of 100 during the monitoring period (1990-2007). This means that no reliable trend assessment of the annual loads of lead can be carried out.

Table 13. Changes in detection limits (LOD) for lead (µg/l).

Year	1990	1991	1992-1998	1999	2000	2001	2002-2003	2004-2007
LOD Pb	0.5	0.1	0.02	0.01 (0.1)[1]	0.01	0.01-0.02 (0.1)[1]	0.02-0.05 (0.2)[1]	0.005

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

Zinc (Zn)
The zinc loads showed a relative low interannual variability compared to many of the other metals. No clear visible signs of long-term trends could be detected, apart from a tendency in *Orkla* of decreasing loads. High loads in single years were almost solely explained by high single concentration values (e.g. 1993 in *Numedalsågen*, 1990 in *Skienselva*, and 2005 in *Orreelva*).

Cadmium (Cd)
More than 25% of the total number of observations of cadmium in the ten rivers was at LOD. In addition, the LODs have changed substantially during the course of the monitoring period; e.g., from 100 ng/l in 1990 to 10 ng/l in 1991 and down to 5 ng/l in 2004-2007. For this reason, no meaningful trend assessment of the annual loads is possible. The lower and upper load estimates given in Annex VI should therefore solely be used as an indication of the magnitude in loads. The high load in *Glomma* in 1998 was due to generally elevated concentrations at several sampling occasions throughout the year.

Mercury (Hg)
For mercury, 50% of the total number of observations in the ten rivers was at LOD. The LODs have not changed to any particular degree during the course of the monitoring period. In most rivers, the concentrations were just above LOD, and so no meaningful trend assessment of the annual loads was possible. Lower and upper load estimates should only be used as an indication of the magnitude in loads. The high loads in many rivers during the period 1999-2003 can only be explained by elevated concentrations, as discussed in Chapter 6.

Arsenic (As)
Lower and upper load estimates given in Annex VI should only be used as an indication of the magnitude in loads.

PCB7 and total lindane
PCB7 is here defined as the sum of seven compounds (CB28, CB52, CB101, CB118, C138, CB153, CB180). For both lindane and PCB7s, a general pattern has been low concentrations during the entire monitoring period. This obviously poses limitations to assess long-term trends with sufficient accuracy.

In the period 1990-1998, no values below LOD were observed for lindane. In this period, the actual values were reported, despite the fact that they were below LOD. In the period 1999-

2003, values below LOD for the upper estimates was set equal to a LOD of 0.1 ng/l; whereas in the period 2004-2006, the LOD increased to 0.2 ng/l, and upper estimates were therefore given as 0.2 ng/l. Apparent trends, therefore, mainly reflect the changes in LOD. The lower and upper load estimates can therefore only be used as an indication of the magnitude in loads.

Some more detailed examples of variations in loads of these substances are given below:

- The high lindane loads in 1990 for all rivers is regarded as peculiar, but raw-data show no signs of a single-outlier phenomenon. More precisely, concentrations are at high levels compared to 1991 and the following years.
- The high PCB7 load in year 1990 in all rivers is solely explained by a high LOD concentration in 1990, which was lowered in 1991 and the years onwards.
- The tendency of elevated loads in the period 2004-2007 could be explained by LOD values of 0.03-0.05 ng/l in the period 1991-1998 compared to 0.2 ng/l from 2004 and onwards. The higher LODs in recent years can be explained by the same reasons as given above for lindane.

7.7 Main findings of the trend analysis on loads

The main conclusions of the trend analysis on loads include:

- There is a substantial inter-annual variability in loads primarily coupled to a corresponding variability in water discharge.
- Peaks in annual loads were primarily due to single peak concentrations which in most cases are due to flooding peaks.
- High loads in Numedalslågen and Drammenselva in 2007 are explained by increased sampling frequency during a summer flood episode.
- For nutrients only very few trends could be detected:
  - In Skienselva and Vefsna, a downward trend in nitrogen;
  - In Orreelva, particulary high loads of both nitrogen, phosphorus and to some extent suspended particles were observed in the period 2004-2007.
  - In Vefsna, the phosphorus loads have declined primarily due to very low loads the last four years (2004-2007).
- For suspended particles, no long-term trends can be observed. This is most likely due to too low sampling frequency related to the fact that SPM concentrations normally show high peaks during elevated water discharge.
- For copper we could only note a downward trend in Vefsna and to some extent also in Altaelva.
- For other metal loads, no firm conclusions can be drawn about long-term changes and possible visual downward trends are not necessarily explained by ‘real’ changes in loads. This is due to many values at LOD and large changes in LOD values over the monitoring period. Thus, results and interpretations should in most rivers be used with great caution and should solely be used as an indication of the magnitude in loads and its uncertainty.
- For lindane and PCB, no conclusion about trends can be drawn due to the very low concentrations and in a majority of cases at LOD in combination with changed LOD over the monitoring period.

No obvious upward or downward trends in annual water discharge could be detected.

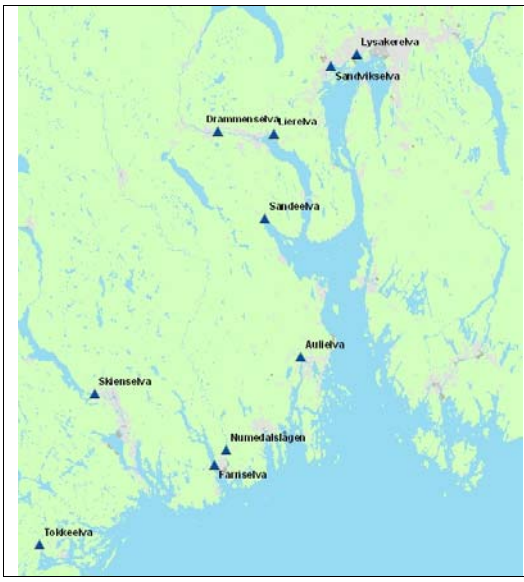
8. Additional sampling exercises in 2007

In addition to the regular RID monitoring programme, three additional sampling campaigns were carried out in 2007. The results from these are summarised in this chapter.

8.1 Additional samples collected during summer flood in South-eastern Norway

Following several days with heavy rainfall, many rivers in the Skagerak region experienced extraordinary floods during the first two weeks of July 2007 (Figure 45). The flows were highest in river basins located between Oslo and Kragerø, and to study possible effects on water quality, 10 rivers were sampled twice (6 and 11 July) during this two-week period. The sites are shown in Figure 46**.**

Figure 45. Flood in river Numedalslågen, July 2007 (photo: NRK)



RID ID	River	RID Category
11	Lysakerelva	III
12	Sandvikselva	III
14	Lierelva	III
15	Drammenselva	I
16	Sandeelva	III
17	Aulielva	III
19	Farriselva	III
21	Numedalslågen	I
18	Skienselva	I
20	Tokkeelva	II

Figure 46. Map showing the location of rivers sampled during the campaign in July 2007 (left panel); and the sampling sites and their RID river status represented by the three categories: I – main river, II – tributary river, monitored quarterly, III – tributary river, not monitored since 2004.

Figure 47 illustrates the magnitude of the flood event in Numedalslågen, one of the rivers that were most seriously affected. Several rivers experienced large peaks in SPM concentrations during the flood; especially Lierelva, Drammenselva, Sandeelva, Aulielva, and Numedalslågen (Table 14**)**. This had important implications for the water chemistry, most notably the total phosphorus and orthophosphate concentrations that show a strong positive correlation with SPM. Nitrogen species, on the other hand, were little affected by the high flows and elevated SPM concentrations. This implied that N:P ratos decreased dramatically in many rivers during the floods. Also TOC and several of the heavy metals (As, Cr, Cu, Ni, Pb and Zn) showed a general increase during the flood – especially in rivers with the largest increase in SPM concentrations (Table 14). Effects on Cd and Hg were less evident.

Table 14. Chemical results from the rivers sampled during the flood in July 2007, compared with the long-term mean 1990-2004.

Station name	Date	pH	KOND	SPM	TOTP	PO4-P	TOTN	NH4-N	NO3-N	TOC	As	Cd	Cr	Cu	Hg	Ni	Pb	SiO2	Zn
			mS/m	mg/l	µg/l P	µg/l P	µg/l N	µg/l N	µg/l N	mg/l C	µg/l	µg/l	µg/l	µg/l	ng/l	µg/l	µg/l	mg/l SiO2	µg/l
Lysakerelva	06/07/2007	7.01	3.3	4.3	15	4	490	27	150	8.6	2.07	0.06	0.49	2.26	<1	0.43	0.50	3.72	9.64
Lysakerelva	11/07/2007	7.08	3.4	2.4	12	4	425	14	135	8.6	0.27	0.03	0.20	0.75	<1	0.31	0.29	3.79	5.81
Lysakerelva	**Mean 1990-2004**		**7.5**	**5.6**	**21**	**5**	**566**	**24**	**306**	**4.8**	**0.20**	**0.04**	**2.68**	**3.97**	**2.75**	**1.10**	**0.68**	**3.66**	**7.23**
Sandvikselva	06/07/2007	7.51	8.3	5.5	21	7	785	25	440	9.2	2.70	0.03	0.58	1.67	12.5	0.49	0.40	4.84	5.99
Sandvikselva	11/07/2007	7.49	7.1	11.5	34	18	750	49	365	9.5	0.40	0.03	0.48	1.65	<1	0.64	0.65	5.20	9.04
Sandvikselva	**Mean 1990-2004**		**15.6**	**3.8**	**22**	**8**	**1161**	**38**	**796**	**5.0**	**0.28**	**0.19**	**0.54**	**1.97**	**3.39**	**0.76**	**0.82**	**3.58**	**5.53**
Lierelva	06/07/2007	7.45	8.6	106.0	94	74	920	22	665	6.2	0.94	0.08	2.60	4.09	<1	4.17	2.51	7.36	21.30
Lierelva	11/07/2007	7.51	8.6	80.6	82	69	835	19	590	6.2	0.78	0.06	2.10	3.18	<1	3.30	1.84	7.53	18.30
Lierelva	**Mean 1990-2004**		**15.6**	**36.5**	**64**	**22**	**1288**	**33**	**999**	**4.9**	**0.71**	**0.05**	**1.62**	**2.39**	**3.93**	**2.28**	**0.99**	**6.92**	**11.78**
Drammenselva	06/07/2007	6.87	2.7	15.0	21	13	405	10	195	5.4	0.47	0.03	0.45	2.01	<1	1.10	0.74	3.06	12.30
Drammenselva	11/07/2007	6.94	3.1	21.2	23	14	460	19	220	5.0	0.31	0.03	0.58	1.88	<1	1.00	0.80	3.64	11.50
Drammenselva	**Mean 1990-2004**	**7.01**	**3.6**	**2.4**	**8**	**2**	**430**	**19**	**263**	**3.4**	**0.16**	**0.02**	**0.25**	**0.97**	**6.54**	**0.61**	**0.20**	**2.62**	**3.52**
Sandeelva	06/07/2007	7.62	10.2	20.8	36	19	1100	19	800	7.5	0.50	0.21	0.79	3.59	<1	1.30	3.52	6.53	80.30
Sandeelva	11/07/2007	7.56	9.4	17.6	42	28	995	36	660	7.9	0.62	0.18	0.83	3.09	<1	1.30	2.13	7.25	64.30
Sandeelva	**Mean 1990-2004**		**137.0**	**9.7**	**33**	**9**	**1430**	**73**	**944**	**4.2**	**0.78**	**0.13**	**34.49**	**4.62**	**7.22**	**1.38**	**1.05**	**5.00**	**46.84**
Aulielva	06/07/2007	7.15	11.7	71.1	160	98	2630	59	2250	9.5	0.86	0.07	2.20	4.95	5	3.54	1.99	9.80	21.80
Aulielva	11/07/2007	7.16	10.5	82.9	158	144	2140	96	1600	9.5	1.30	0.07	2.60	4.90	<1	3.77	2.41	10.61	22.30
Aulielva	**Mean 1990-2004**		**45.0**	**19.8**	**66**	**27**	**2564**	**177**	**1682**	**5.7**	**2.99**	**0.04**	**10.00**	**3.56**	**8.68**	**3.20**	**0.56**	**5.98**	**6.52**
Farriselva	06/07/2007	6.76	3.4	2.4	6	2	555	6	395	4.8	0.15	0.04	0.10	0.63	<1	0.25	0.14	4.02	10.90
Farriselva	11/07/2007	6.69	3.3	0.9	4	1	535	3	380	4.5	0.10	0.03	<0.1	0.38	<1	0.10	0.05	4.00	6.99
Farriselva	**Mean 1990-2004**		**4.9**	**0.8**	**7**	**2**	**570**	**13**	**382**	**4.2**	**0.14**	**0.04**	**0.81**	**1.09**	**3.29**	**0.46**	**0.28**	**3.80**	**7.17**
Numedalslågen	06/07/2007	6.47	2.0	151.0	167	76	455	22	115	8.1	1.40	0.14	2.50	6.09	<1	2.99	8.77	4.58	30.70
Numedalslågen	11/07/2007	6.72	2.2	38.5	46	35	360	10	125	6.7	0.48	0.03	0.68	2.01	<1	1.10	1.79	4.17	9.00
Numedalslågen	**Mean 1990-2004**	**6.82**	**3.1**	**4.8**	**13**	**4**	**415**	**30**	**232**	**4.0**	**0.18**	**0.04**	**0.30**	**1.82**	**4.41**	**0.46**	**0.47**	**3.13**	**7.40**
Skienselva	06/07/2007	6.80	2.0	2.1	4	2	275	7	170	2.6	0.10	0.01	<0.1	0.42	<1	0.20	0.11	2.23	2.33
Skienselva	11/07/2007	6.74	2.0	1.3	4	2	280	5	165	2.7	0.20	0.02	0.10	0.52	<1	0.23	0.10	2.23	2.64
Skienselva	**Mean 1990-2004**	**6.72**	**2.2**	**1.1**	**7**	**2**	**315**	**14**	**204**	**2.4**	**0.11**	**0.03**	**0.19**	**0.99**	**5.5**	**0.33**	**0.17**	**2.00**	**3.79**
Tokkeelva	06/07/2007	6.52	2.9	0.9	4	1	340	5	155	5.3	0.26	0.03	0.10	1.66	<1	0.87	0.38	2.82	11.00
Tokkeelva	11/07/2007	6.47	3.8	1.1	5	2	340	<2	135	5.3	0.20	0.03	0.20	1.58	<1	0.65	0.48	2.74	8.28
Tokkeelva	**Mean 1990-2004**	**6.30**	**12.7**	**2.3**	**7**	**1**	**367**	**14**	**165**	**5.2**	**0.19**	**0.03**	**0.14**	**0.65**	**1.81**	**0.46**	**0.20**	**2.65**	**5.79**

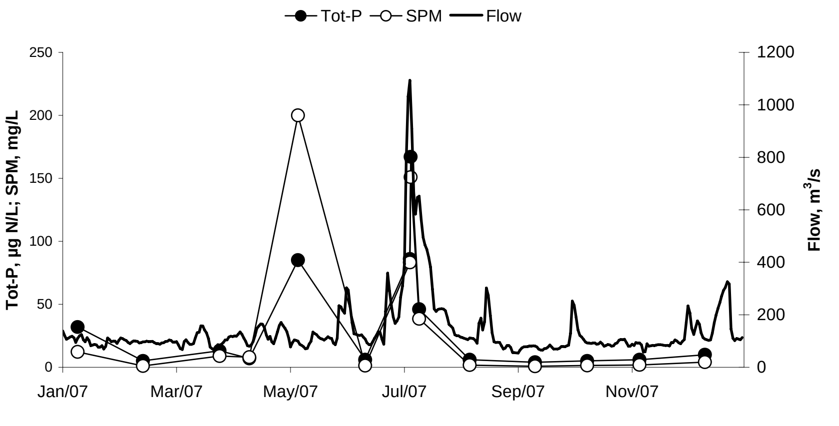


Figure 47. Tot-P and SPM concentrations vs. water flow in Numedalslågen, 2007.

8.2 Analysis of emerging pollutants in the rivers Glomma and Alna

As a part of an EU-wide screening program for emerging pollutants (Loos et al., 2008), water samples from the rivers Glomma and Alna were analyzed for different emerging polar pollutants, such as pesticides (and their degradation products), pharmaceuticals, hormones, antibiotics, and industrial chemicals (alkylphenolics and perfluorinated compounds).

The samples were shipped to the IES' RWER-Laboratory for analysis by means of SPE-LC-MS/MS (solid-phase extraction–liquid chromatography–tandem mass spectrometry). In total, analyses for 35 chemical compounds were performed (Table 15).

The number of substances with concentrations above the methods detection limits in the samples from the rivers Glomma and Alna were 11 and 13, respectively. However, the contaminant profiles showed profound differences (Figure 48).

Both rivers had elevated concentrations of industrial chemicals. The anti-corrosive complexing agents methylbenzotriazole and benzotriazole were the compounds with the highest concentrations in the river Glomma (136 and 68 ng/L, respectively), whereas the concentrations of these compounds were below the detection limits in the river Alna (< 1 ng/L). In this river the surfactant nonylphenol ethoxylate NPE1C and the monomer Bisphenol A were the compounds with the highest concentrations among the group of industrial chemicals (68 ng/L and 40 ng/L, respectively).

The river Alna had significantly higher concentrations of the pharmaceuticals Ibuprofen and Naproxen (140 and 40 ng/L, respectively) than the river Glomma (6 and <1 ng/L). These compounds are commonly used in pain-killers and anti-inflammatory drugs. Caffeine, a psychoactive stimulant in coffee, was also found in moderatly high concentrations in Alna (33 ng/L), whereas the concentration was below the detection limit in Glomma.

The concentrations of perfluorinated alkylated substances were also significantly elevated in the river Alna compared to the river Glomma. The compounds PFHxA and PFOS were dominating in Alna (38 and 21 ng/L, respectively), whereas they were beyond the detection limit in Glomma.

The higher concentrations of pharmaceuticals and caffeine in the river Alna compared to the river Glomma are as expected, as the moderately sized Alna river runs through a major city (Oslo) and receives untreated waste water from leakages in the sewer pipe systems. The River Glomma, which is the largest river in Norway, is far less influenced by sewage on a relative scale. However, it runs through a heavily industrialized area near the outlet and the high concentrations of certain industrial chemicals can be attributed to this. The sources for perfluorinated compounds in the Alna river could also probably be attributed to influence from household and industrial waste water, but other sources, such as fire foams must also be considered.

Table 15. Concentrations of emerging contaminants in the rivers Glomma and Alna (ng/L).

Compound	Description	Glomma	Alna
Caffeine	Coffee compound, alkaloide drug	0	33
2,4-D	Herbicide	0	0
Atrazin	Herbicide	0	0
Bentazone	Herbicide	5	0
Diuron	Herbicide	0	0
Mecoprop	Herbicide	0	0
Simazine	Herbicide	0	0
Isoproturon	Herbicide	0	0
Terbutylazin	Herbicide	0	0
Desethylter	Herbicide degradation product (desethylterbuthylazin) from terbuthylazin	0	0
Desethyl-Atrazine	Herbicide degradation product from atrazine	0	0
Estrone	Hormone, naturally occurring estrogen	0	0
2,4-Dinitrophenol	Industrial chemical	19	11
Nitrophenol	Industrial chemical	19	30
Benzotriazole	Industrial chemical, compexing agent, corrosion inhibitor	68	0
Methylbenzotriaz ole	Industrial chemical, compexing agent, corrosion inhibitor	136	0
Bisphenol A	Industrial chemical, monomer in polycarbonate	0	40
Nonylphenol	Industrial chemical, surfactant	0	0
tert-OP	Industrial chemical, surfactant (tert-octylphenol)	0	0
NPE1C	Industrial chemical, surfactant, a nonylphenol ethoxylate	12	68
PFDA	Perfluorinated alkylated substance, perfluorodecanic acid	0	1
PFHpA	Perfluorinated alkylated substance, perfluoroheptanoic acid	1	3
PFHxA	Perfluorinated alkylated substance, perfluorohexanoic acid	0	38
PFNA	Perfluorinated alkylated substance, perfluorononanoic acid	0	2
PFOS	Perfluorinated alkylated substance, perfluorooctanesulfonic acid	0	21
PFOA	Perfluorinated alkylated substance, perfluorooctanoic acid	1	6
PFUnA	Perfluorinated alkylated substance, perfluoroundecanoic acid	1	0
Carbama	Pharmaceutical, anticonvulsant and mood stabilizing drug (e.g. Carbamazepine)	27	0
Bezafibrate	Pharmaceutical, fibrate drug	0	0
Gemfibrozil	Pharmaceutical, fibrate drug	0	0
Diclofenac	Pharmaceutical, non-steroidal anti-inflammatory drug	0	0
Ibuprofen	Pharmaceutical, non-steroidal anti-inflammatory drug	6	140
Ketoprofen	Pharmaceutical, non-steroidal anti-inflammatory drug	0	0
Naproxen	Pharmaceutical, non-steroidal anti-inflammatory drug	0	42
Sulfamethoxa-zole	Pharmaceutical, sulfonamide bacteriostatic antibiotic	0	0

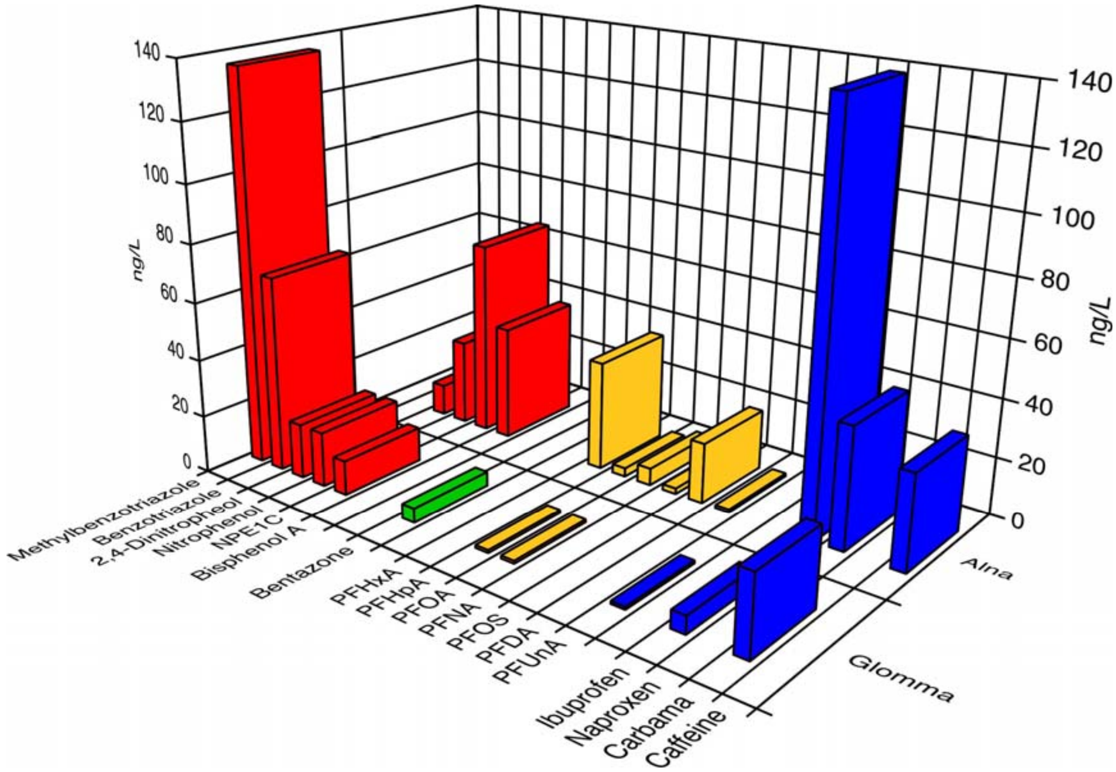


Figure 48. Concentrations of emerging contaminants in the rivers Glomma and Alna. Only substances with concentrations above the detection limit (< 1 ng/L) are depicted. The substances are divided in four groups: industrial chemicals (red), herbicides (green), perfluorinated alkylated substances (yellow) and pharmaceuticals/caffeine (blue).

A risk assessment of the findings reported here is beyond the scope of this brief report. In general, it is difficult to fully establish the risk posed by these compounds, due to lack of knowledge on the fate of these compounds and their possible adverse effects on the environment. Based on a literature review, Grung et al. (2008) estimate an environmental PNEC (Probably No Effect Concentration) for ibuprophen to be 20 000 ng/L. This is a concentration more than two orders of magnitude larger than found in the Alna river. The industrial chemicals methylbenzotriazole and benzotriazole, which were found in relatively high concentrations in the Alna river, have a moderately low acute toxicity. NOAEC (No Observed Adverse Effect Concentrations) values down to 0.58 and 0.45 mg/L for methylbenzotriazole and benzotriazole, respectively (Pillard et al., 2001) are far higher than the observed concentrations in the river Alna.

8.3 Additional samples from 18 rivers discharging into three fjords in western Norway

During the last decade, large areas along the southern coast of Norway have experienced a rapid decrease of the sugar kelp community (Moy et al., 2008). This may have dramatic effects on coastal marine ecosystems in the affected areas. Over the last few years, a similar trend has been detected in several fjords along the west coast; especially in Hardangerfjorden, Sognefjorden and Dalsfjorden (Moy et al., 2007).

To obtain more data on riverine inputs to these fjord areas, a sampling campaign was carried out in the period October - December 2007. Altogether 18 river were sampled 5 times during this period. These included 6, 11 and 1 rivers discharging into Hardangerfjorden, Sognefjorden and Dalsfjorden, respectively (Figure 49;
Table 16). All standard RID parameters, except Lindane, were analysed.

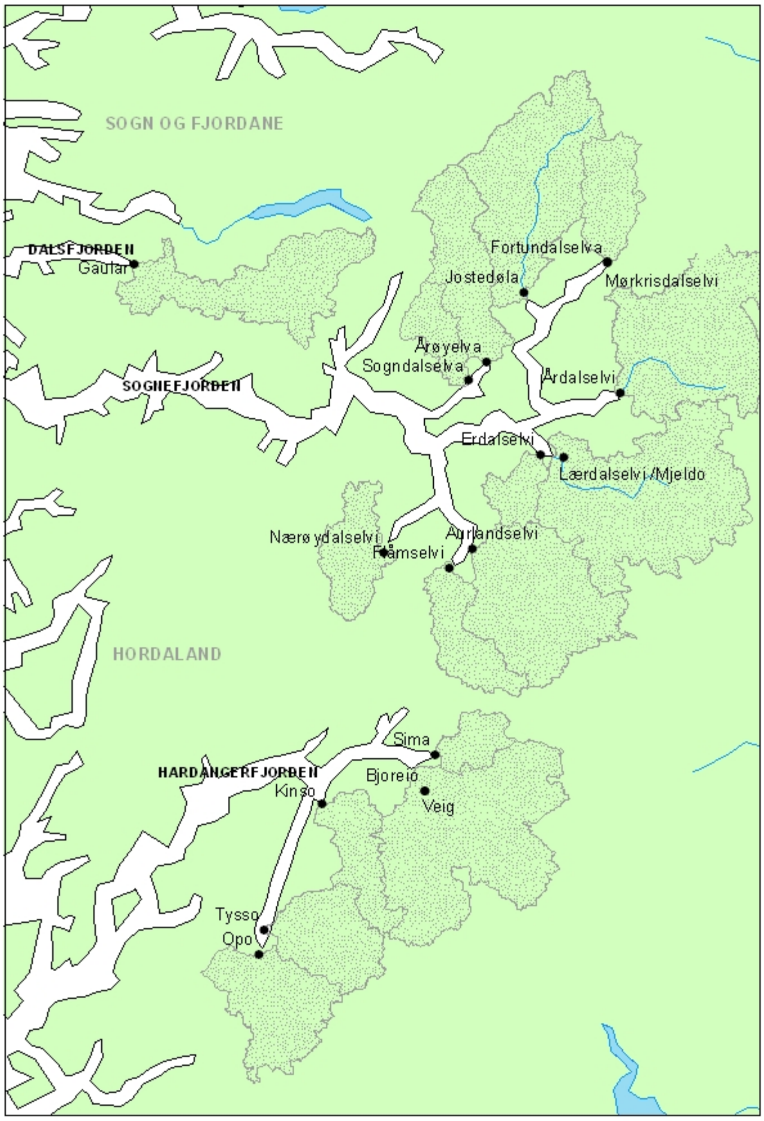


Figure 49. Map showing the location of the 18 west Norwegian rivers sampled in October-December 2007.

Table 16. Overview of the 18 rivers, including their catchment size and the adjoining coastal fjord. Total drainage areas for Hardangerfjorden, Sognefjorden and Dalsfjorden are 5786 km², 11090 km² and 1264 km², respectively.

No.	River	Catchment (km²)	Fjord/recipient
053	Opo	480	Hardangerfjorden
054	Tysso	385	Hardangerfjorden
055	Kinso	281	Hardangerfjorden
056	Veig	496	Hardangerfjorden
057	Bjoreia	592	Hardangerfjorden
058	Sima	145	Hardangerfjorden
067	Nærøyelva	290	Sognefjorden
068	Flåmselva	275	Sognefjorden
069	Aurlandselva	799	Sognefjorden
070	Erdalselva	138	Sognefjorden
071	Lærdalselva	1172	Sognefjorden
072	Årdalselva	989	Sognefjorden
073	Fortundalselva	508	Sognefjorden
074	Mørkrisdalselva	282	Sognefjorden
075	Jostedøla	864	Sognefjorden
076	Årøyelva	446	Sognefjorden
077	Sogndalselva	172	Sognefjorden
078	Gaular	625	Dalsfjorden

Although the flow patterns are be highly variable among rivers, even within the same region, the observed flow in River Gaular can give an indication of the flow regime in western Norway in 2007 (Figure 50). Here, the largest peaks in autumn occurred on 25 September, 1 November, and 7 December. Most rivers were sampled on fixed dates (±2 days): 5 October, 16 October, 7 November, 26 November, and 12 December, and hence no attempts were made to capture high flow events in any of the study rivers.

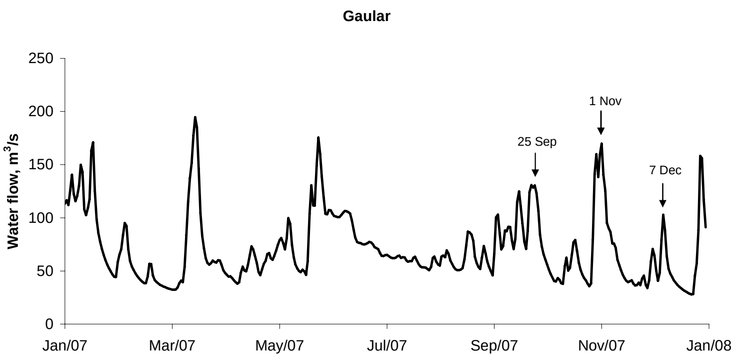


Figure 50. Daily mean water flow in the Gaular river, 2007. Autumn flow peaks are indicated by arrows.

The water chemistry data do in general reflect good water quality in the monitored rivers (Figure 51 and Annex VII). Concentrations of total phosphorus and total nitrogen are generally low; indicating little influence from local pollution sources. Exceptions are occasionally high nutrient concentrations in Sogndalselva and elevated heavy metal concentrations (As, Cu, Hg and Zn) in Tysso. Jostedøla is affected by glacier streams exporting relatively large amounts of suspended particulate matter (SPM). As the sampling campaign in 2007 tended to miss the highest flow peaks in Jostedøla, no high SPM values were captured in any of the samples. The highest SPM concentration measured was 11.8 mg/L (15 October 2007), whereas two months earlier (16 August 2007) the concentration was as high as 198 mg/L. TOC concentrations in the 18 rivers investigated were usually below 2 mg/L, whereas the concentrations of SiO_2 varied from 1 to 3 mg SiO_2/L (Figure 51).

The Tot-P, Tot-N, TOC, and SiO_2 concentrations measured in Jostedøla and Gaular during the autumn campaign in 2007 were within the range documented by previous monitoring (Figure 52). Both Jostedøla and Gaular have monitoring data covering the entire period from 1990 to 2007.

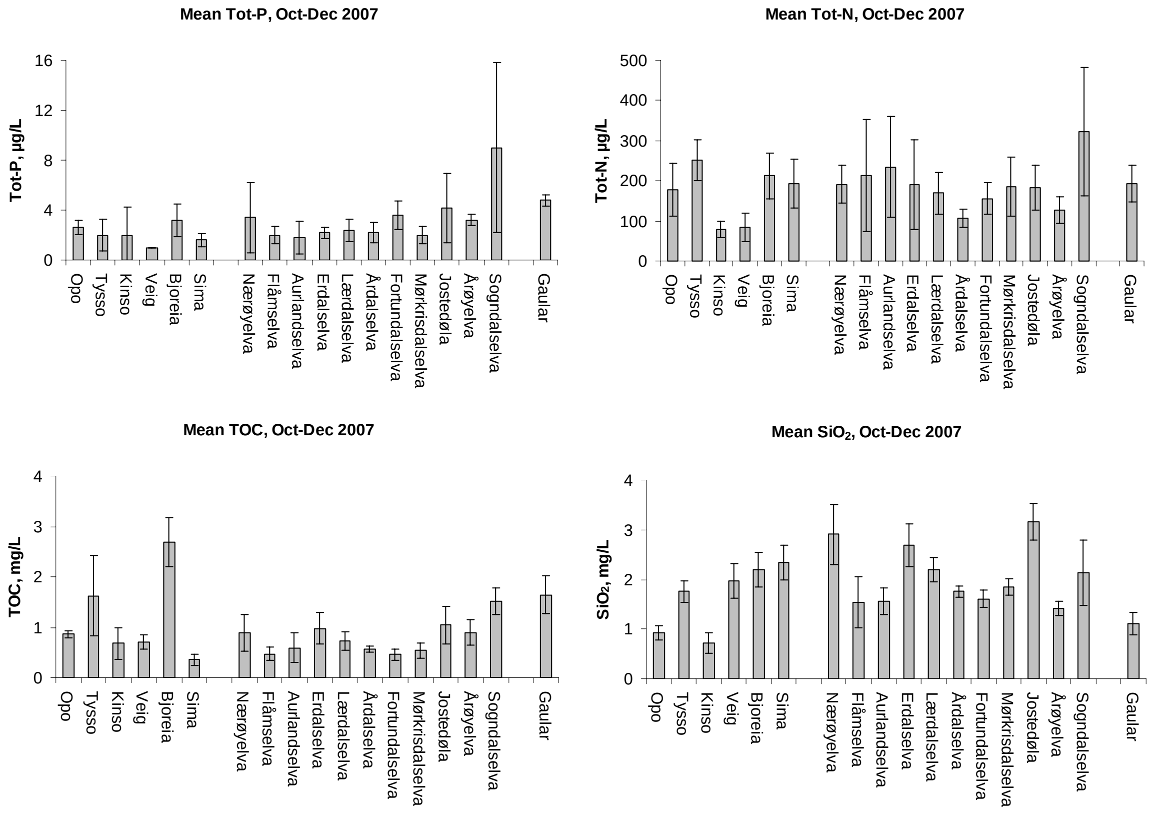


Figure 51. Mean and standard deviation of Tot-P, Tot-N, TOC, and SiO_2 concentrations, October – December 2007.

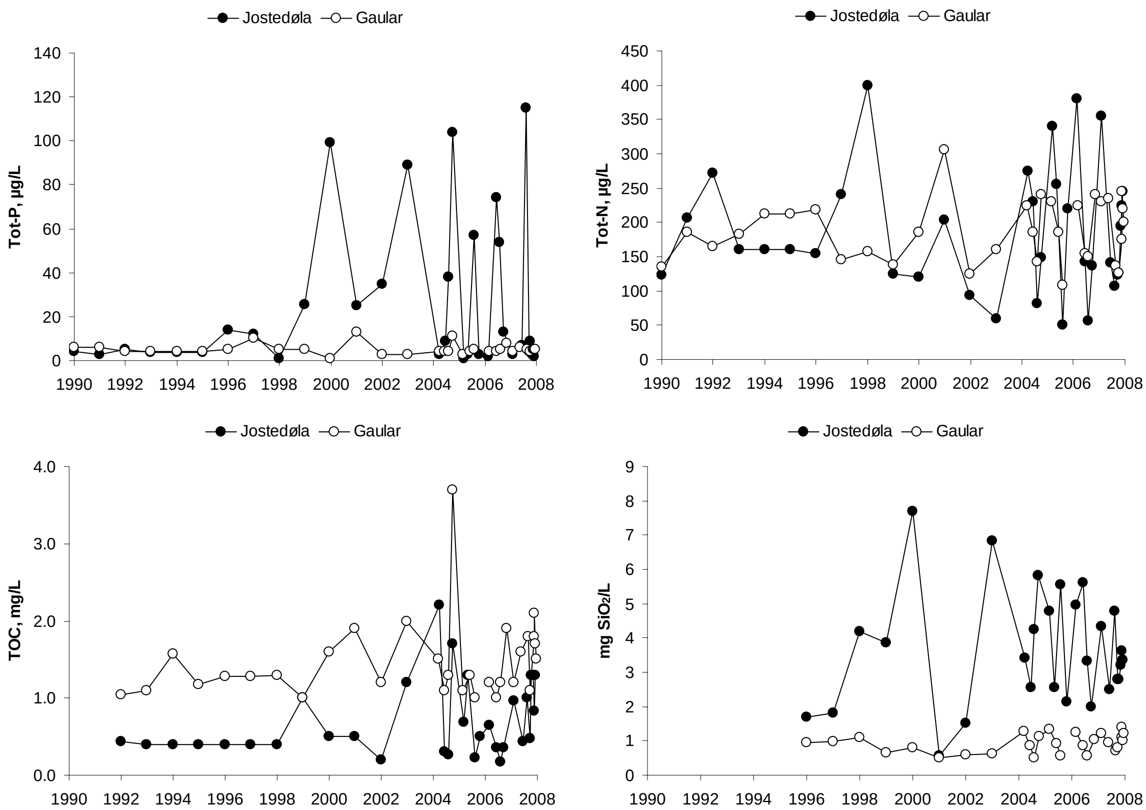


Figure 52. Concentrations of Tot-P, Tot-N, TOC, and SiO_2 in Jostedøla and Gaular 1990-2007.

9. Conclusions

In 2007, the total Norwegian inputs of nutrients, suspended solids, metals, one pesticide and PCB7s to coastal waters were calculated (Table 17). More detailed tables are given in the Data Report in Part B of this report.

Table 17. Overview of total inputs of RID parameters from mainland Norway in 2007; upper estimates[5]. In tonnes for all parameters, except PCB7 and Lindane which are given in kg.

Parameter	Skagerak	North Sea	Norwegian Sea	Barents Sea	Total Norwegian Coastal Waters
Cadmium	1.25	0.94	0.67	0.20	3.07
Mercury	0.09	0.04	0.05	0.02	0.20
Copper	128	281	482	84	976
Zinc	333	170	198	20	721
Lead	32.7	16.1	7.0	1.8	57.8
Arsenic	15.3	5.5	5.7	3.0	29.6
Chromium	20.8	14.3	18.4	5.4	58.9
Nickel	48	25	32	74	179
Ammonium	5 421	15 645	23 581	1 924	46 572
Nitrate	20 275	24 256	20 390	2 231	67 153
Orthophosphate	638	2 533	4 003	315	7 488
Total Nitrogen	39 053	53 271	59 062	8 423	159 809
Total Phosphorus	1 206	4 135	6 295	582	12 219
Silicate	207 243	119 219	160 107	120 447	607 016
SPM	562 395	219 672	725 599	26 662	1 534 328
TOC	253 541	92 802	125 071	71 695	543 109
PCB7[6]	89	2	10	5	105
Lindane[7]	11	0	2	1	14

The main findings of the 2007 RID Programme include;

For water discharge, the *actual* annual water discharge in all regions was higher than in 2006, but no long-term trends in water discharge has been detected. The average water discharge *during sampling* was higher in the main rivers and lower in the 36 tributary rivers than in 2006, but with large variations from river to river, depending on sampling dates. In River Skienselva, a downward trend in water discharge during sampling was detected.

For suspended particulate matter, there was an overall increase from 2006 to 2007, mainly linked to high floods during sampling in the Skagerak region in the main rivers. Long-term trend analyses show a decrease in SPM *concentrations* in Otra, Orkla and Vefsna, but for sediment *loads* no clear trends have been found. As in former years some few industrial discharges account locally for a large part of the total particulate inputs.

For nutrients, there is a general reduction of riverine loads of nitrogen from 2006 to 2007, but an increase in phosphorus loads. The latter can to a large extent be explained by increased water discharge during sampling dates. Nutrient inputs from *direct discharges* have also

[5] No estimates of metals, silicate, SPM, TOC, PCB and lindane are done for the unmonitored rivers
[6] Main rivers only

increased, but whether this is due to an actual increase or to improved reporting from the pollution sources is uncertain. Long-term trend analyses show that nitrogen *concentrations* have been reduced in Rivers Skien, Vefsna and Alta, mainly due to reductions of nitrate-N, whereas in River Drammen the concentrations have increased over time. The nitrogen *loads* have also been reduced in Rivers Skien and Vefsna, whereas River Orreelva has experienced an increase in both nitrogen and phosphorus loads during the period 2004-2007, despite mitigation efforts undertaken in its catchment area. Long-term downward trends for phosphorus *concentrations* can only be found in River Alta due to low concentrations since 2003, whereas a downward trend for phosphorus *loads* has only been found in River Vefsna.

For metals, all direct discharges have increased except for small decreases in mercury, chromium and nickel inputs. As with nutrients, it is not clear whether this is due to actual increases or to improved reporting by the pollution sources. An exception is the relatively high increase of copper, which is due to improved calculation methods for the losses of this metal when fish cages are cleansed in the fish farming units along the coast. Riverine inputs mainly increased from 2006 to 2007, due to a combination of high water discharges and relatively high concentrations in some specific rivers. In the long term perspective, however, metal *concentrations* have been reduced in most of the main rivers, but this may also be a result of changed detection limits over time. The most significant downward trend is in River Vefsna. No clear trends in metal *loads* in rivers have been found, with the exception of a reduction of copper in River Vefsna.

For PCBs and the pesticide residual lindane, the concentrations are so low that variations from year-to-year do not really reflect inputs but detection limits. It does therefore not make sense to discuss variations in these two substances.

On a more general basis, the variations from year-to-year in inputs from the Norwegian mainland may be explained by a number of factors, including

- Changes in water discharge patterns from year-to-year and between regions and seasons;
- High stochastic temporal variation in the concentration dynamics in rivers, which are not sufficiently covered by the present sampling frequency, especially in rivers only monitored 4 times a year;
- Uncertainties in load calculations for the rivers, as the load calculation method used puts a strong weight on the water discharge at the sampling date;
- The occurrence of substances where a large number of samples have concentrations below the detection limit, and where the difference between upper and lower estimates in reality is more a result of the value of the detection limit than of actual fluctuations;
- Changes and improvements in models used to estimate water discharge and loads in unmonitored areas;
- Insufficient reporting of direct discharges, including errors in units reported;
- Estimates of inputs from fish farms that are based on indirect data, as well as changed methodology for estimating copper loads from this activity.

In addition to these uncertainties, the total inputs to Norwegian coastal areas are also influenced by the fact that 201 rivers are not monitored at all; 109 of these were monitored once a year up to and including 2003, and 92 never have been monitored. There will, therefore, always be room for improvements in this programme. In autumn 2008 two projects have been initialised by the Norwegian Pollution Control Authority, with the aim of, *inter alia,* improving the sampling routines, the modelling, and the long-term trend analyses of the programme.

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Annexes to Part A

Annex I
The RID principles and objectives

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.

Annex II
Water sampling personnel

An overview of the personnel sampling water samples in 2007 is given below:

Personnel for water sampling in the 10 main rivers:

Nils Haakensen
Vibeke Svenne
Vebjørn Opdahl
Agnar Johnsen
Joar Skauge
Eskil Nerheim (after John Jastrey)
Eskild Henning Larsen
Anne Lise Ek
Einar Helland
Ellen Grethe Ruud Åtland

Personnel for water sampling in the 36 rivers with quarterly sampling:

Olav Smestad
Marianne Lien
Svein Gitle Tangen
Leif Johnny Bogetveit
Hallgeir Hansen
Nils Haakensen
Vebjørn Opdahl
Erik Kårvatn
Harald Viken
Egil Moen
Helge Utby
Einar Pettersen
Ellen Grethe Ruud Åtland
Einar Helland
Eskil Nerheim
Bjarne Stangvik

Annex III
Catchment information

Catchment information for rivers monitored monthly - Main Rivers

The rivers *Glomma, Drammenselva, Numedalslågen, Skienselva,* and *Otra* drain into the Skagerak area, the part of the North Sea which is considered to be most susceptible to pollution. These five rivers also represent the major load bearing rivers in Norway. Of these, the River *Glomma* is the largest river in Norway, with a catchment area of about 41 200 km^2, or about 13 % of the total land area in Norway. *Drammenselva* has the third largest catchment area of Norwegian rivers with its 17 034 km^2.

Orreelva and *Suldalslågen* drain into the coastal area of the North Sea (Coastal area II). *Orreelva* is a relatively small river with a catchment area of only 105 km^2, and an average flow of about 4 m^3/s, but it is included in the RID Programme since it drains one of the most intensive agricultural areas in Norway. More than 30% of its drainage area is covered by agricultural land, and discharges from manure stores and silos together with runoff from heavily manured fields cause eutrophication and problems with toxic algal blooms. River *Suldalslågen* with a drainage area of 1457 km^2 and population density of only 2.4 persons/km^2 and no industrial units reporting discharges of nitrogen or phosphorus has been included in the study to represent a relatively non-polluted water-course. The river is, however, heavily impacted by hydropower development.

Table A-III-1. The 10 main rivers, their coastal area, catchment size and long term average flow.

Discharge area	Name of river	Catchment area (km^2)	Long term average flow (1000 m^3/day) *
I. Skagerak	Glomma	41918	61347
	Drammenselva	17034	26752
	Numedalslågen	5577	10173
	Skienselva	10772	23540
	Otra	3738	12863
II. North Sea	Orreelva	105	430
	Suldalslågen	1457	6690
III. Norwegian Sea	Orkla	3053	3873
	Vefsna	4122	14255
IV. Barents Sea	Alta	7373	7573

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

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

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

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

Catchment information for rivers monitored quarterly – Tributary Rivers

As stated above, 36 rivers covering an area of altogether 86 000 km^2 were monitored four times a year in 2007.

The average size of their catchment areas is 2380 km^2, but the size varies from *Vikedalselva* with its 118 km^2, to the second largest drainage basin in Norway, *Pasvikelva* with a drainage basin of 18404 km^2.

Land use varies considerably, as shown in Figure A-III-1. As an example, the *Figgjo* and *Tista* Rivers have the highest coverage of agricultural land (31[7] and 12%, respectively), whereas some of the rivers have none or insignificant agricultural activities in their drainage basins (e.g. *Ulla*, *Røssåga*, *Målselv*, *Tana* and *Pasvik*). Some catchments, like *Lyseelv*, *Årdalselv* and *Ulla* in the west; and *Pasvik* in the north, are more or less entirely covered by mountains, moors, and mountain plateaus.

[7] Note that statistics for Figgjo also include values from Orre, as these rivers are adjacent.

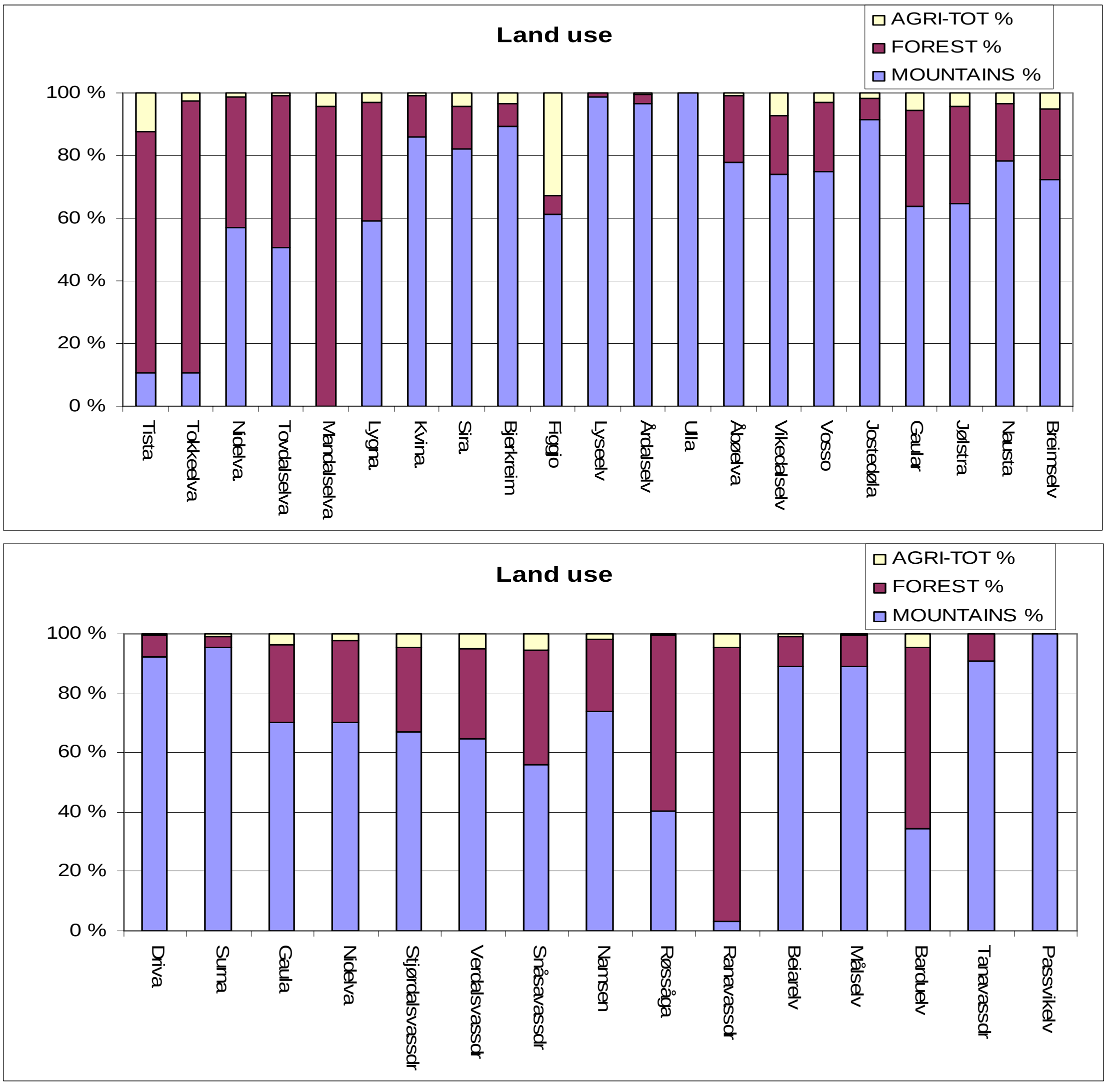

Figure A-III-1. Land use distribution in the catchment areas of the 36 rivers monitored quarterly. "Agri-tot" means total agricultural land. "Mountains" include moors and mountain plateaus not covered by forest.

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

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

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

Annex IV
Methodology

Method for the selection of rivers for monitoring

A total of 247 rivers discharge into the coastal waters of Norway. In order to comply with the PARCOM requirements to measure 90 % of the load from Norwegian rivers to coastal areas, it would have been necessary to monitor a large number of rivers. In order to reduce this challenge to a manageable and economically viable task, it was early on decided that 8 of the major load-bearing rivers should be monitored in accordance with the objectives of the comprehensive study. These comprise rivers *Glomma*, *Drammenselva*, *Numedalslågen*, *Skienselva*, *Otra*, *Orreelva*, *Orkla* and *Vefsna*. In addition, two relatively “unpolluted” rivers were included for comparison purposes; these comprise River *Suldalslågen* and River *Alta*, and are monitored at the same frequency. In these 10 rivers a number of studies have been carried out since 1990, and they have all been included in the National Monitoring Programme of Watercourses (www.sft.no). The ‘main’ rivers have been sampled 11-18 times in 2007.

In addition to these 10 main rivers, the RID Programme did, for 14 years (1990-2003), estimate the load of 126 - 145 so-called ‘tributary’ rivers, all discharging directly to the sea. These estimates were based on random sampling, which generally consisted of only one sample per year. Since the transport of dissolved and particle associated material in rivers can vary considerably over time, an important and necessary change in the programme was introduced in 2004: The number of “tributary rivers” was reduced to 36, and the sampling frequency was increased to 4 samples per year. The total drainage area for the original selection of 145 tributary rivers was 134 000 km^2, whereas the selected 36 rivers cover 86 000 km^2. This constitutes 64% of the former tributary area, illustrating that the 36 tributaries were selected for their relatively large drainage areas. The total drainage area of the monitored rivers is, then, about 180 000 km^2, which constitutes about 50% of the total land area draining into the convention seas.

The selection also focussed on finding rivers with representative water discharge data. Reliable data exist for 35 of the 36 selected rivers, although for four of the rivers water discharge is only monitored in tributaries and not in the main watercourse. Lyselva is the only river without a water discharge monitoring station.

Since it has been of special importance to estimate the major loads to Skagerak, a proportionally higher number of rivers have been chosen for this part of the country.

The load from the remaining rivers has been calculated through TEOTIL modelling. Table A-IV-1 gives an overview of the major “types” of Norwegian rivers draining into coastal areas as related to the RID Programme.

Table A-IV-1. Norwegian rivers draining into coastal areas and the methods used to estimate loads from these rivers

Type of river	**Number**
Total number of rivers draining into Norwegian coastal areas	247
Main rivers, monitored monthly or more often in 2004-2006	10
Tributary rivers, monitored quarterly in 2004-2006	36
Tributary rivers, monitored once a year in 1990-2003; modelled from 2004 onwards	109
Rivers that have never been monitored by the RID Programme (loads are modelled)	92

Sampling methodology and sampling sites

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

Several of the most significant discharges from the industry and the municipal wastewater system are located downstream the sampling sites. These supplies are not included in the riverine inputs, but are included in the direct discharge estimates.

Table A-IV-2 gives the co-ordinates of the sampling stations. For quality assurance reasons, the sampling sites have been documented by use of photographs. This, together with the co-ordinates, will ensure continuity if staff needs to be changed.

Table A-IV-2. Co-ordinates of the 46 sampling points.

Regine No	RID-ID	Station name	Latitude	Longitude	RID-Region
002.A51	2	Glomma at Sarpsfoss	59.27800	11.13400	Skagerak
012.A3	15	Drammenselva	59.75399	10.00903	
015.A1	18	Numedalslågen	59.08627	10.06962	
016.A221	20	Skienselva	59.19900	9.61100	
021.A11	26	Otra	58.18742	7.95411	
028.4A	37	Orreelva	58.73143	5.52936	North Sea
036.A21	48	Suldalslågen	59.48200	6.26000	
121.A41	100	Orkla	63.20100	9.77300	Norwegian Sea
151.A4	115	Vefsna	65.74900	13.23900	
212.A0	140	Altaelva	69.90100	23.28700	Barents Sea
Regine No	RID-ID	Station name	Latitude	Longitude	RID-Region
001.A6	1	Tista	59,12783	11.44436	Skagerak
017.A1	21	Tokkeelva	58.87600	9.35400	
019.A230	24	Nidelv (Rykene)	58.40100	8.64200	
020.A12	25	Tovdalselva	58.21559	8.11668	
022.A5	28	Mandalselva	58.14300	7.54604	
024.B120	30	Lyngdalselva	58.16300	7.08798	North Sea
025.AA	31	Kvina	58.32020	6.97023	
026.C	32	Sira	58.41367	6.65669	
027.A1	35	Bjerkreimselva	58.47894	5.99530	
028.A3	38	Figgjoelva	58.79168	5.59780	
031.AA0	44	Lyseelva	59.05696	6.65835	
032.4B1	45	Årdalselva	59.08100	6.12500	
035.A21	47	Ulladalsåna (Ulla)	59.33000	6.45000	
035.721	49	Saudaelva	59.38900	6.21800	
038.A0	51	Vikedalselva	59.49958	5.91030	
062.B0	64	Vosso (Bolstadelvi)	60.64800	6.00000	
076.A0	75	Jostedøla	61.41333	7.28025	
083.A0	78	Gaular	61.37000	5.68800	
084.A2	79	Jølstra	61.45170	5.85766	
084.7A0	80	Nausta	61.51681	5.72318	
087.A221	84	Gloppenelva (Breimselva)	61.76500	6.21300	
109.A0	95	Driva	62.66900	8.57100	Norwegian Sea
112.A0	98	Surna	62.98000	8.72600	
122.A24	103	Gaula	63.28600	10.27000	
123.A2	104	Nidelva(Tr.heim)	63.43300	10.40700	
124.A21	106	Stjørdalselva	63.44900	10.99300	
127.A0	108	Verdalselva	63.79200	11.47800	
128.A1	110	Snåsavassdraget	64.01900	11.50700	
139.A50	112	Namsen	64.44100	11.81900	
155.A0	119	Røssåga	66.10900	13.80700	
156.A0	122	Ranaelva	66.32300	14.17700	
161.B4	124	Beiarelva	66.99100	14.75000	
196.B2	132	Målselv	69.03600	18.66600	
196.AA3	133	Barduelva	69.04300	18.59500	
234.B41	150	Tanaelva	70.23000	28.17400	Barents Sea
246.A5	153	Pasvikelva	69.50100	30.11600	

Analytical methods and detection limits

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

Parameter	Detection limit	Analytical Methods (NS: Norwegian Standard)
pH	0.01	NS 4720
Conductivity (mS/m)	0.05	NS-ISO 7888
Suspended particulate matter (S.P.M.) (mg/L)	0.1	NS 4733 modified
Total Organic Carbon (TOC) (mg C/L)	0.1	EPA number 415.1 and 9060A STD.
Total phosphorus (µg P/L)	1.0	NS 4725 – Peroxidisulphate oxidation method
Orthophosphate (PO4-P) (µg P/L)	1.0	NS 4724 – Automated molybdate method
Total nitrogen (µg N/L)	10	NS 4743 – Peroxidisulphate oxidation method
Nitrate (µgN/L)	1	NS-EN ISO 10304-1
Ammonium (NH_4) (µg N/L)	5	NS-EN ISO 14911
Silicate (SiO_2) (Si/ICD; mg/L)	0.02	ICP-AES and ISO 11885 + NIVA's accredited method E9-5
Lead (Pb) (µg Pb/L)	0.005	ICP-MS; NIVA's accredited method E8-3
Cadmium (Cd) (µg Cd/L)	0.005	ICP-MS; NIVA's accredited method E8-3
Copper (Cu) (µg Cu/L)	0.01	ICP-MS; NIVA's accredited method E8-3
Zinc (Zn) (µg Zn/L)	0.05	ICP-MS; NIVA's accredited method E8-3
Arsenic (As) (µg As/L)	0.05	ICP-MS; NIVA's accredited method E8-3
Chromium (Cr) (µg Cr/L)	0.1	ICP-MS; NIVA's accredited method E8-3
Nickel (Ni) (µg Ni/L)	0.05	ICP-MS; NIVA's accredited method E8-3
Mercury (Hg) (ng Hg/L)	1.0	NS-EN 1483 and NIVA's accredited method E4-3
Lindane (ng/L)	0.2	NIVA's accredited method H3-2 (PCB)
2,4,4'-trichlorobiphenyl (CB28) (ng/L)	0.2	NIVA's accredited method H3-2 (PCB)
2,2',5,5'-tetrachlorobiphenyl (CB52) (ng/L)	0.2	NIVA's accredited method H3-2 (PCB)
2,2',4,5,5'-pentachlorobiphenyl (CB101) (ng/L)	0.2	NIVA's accredited method H3-2 (PCB)
2,3',4,4',5-pentachlorobiphenyl (CB118) (ng/L)	0.2	NIVA's accredited method H3-2 (PCB)
2,2',3,4,4',5'-hexachlorobiphenyl (CB138) (ng/L)	0.2	NIVA's accredited method H3-2 (PCB)
2,2',4,4',5,5'-hexachlorobiphenyl (CB153) (ng/L)	0.2	NIVA's accredited method H3-2 (PCB)
2,2',3,4,4',5,5'-heptachlorobiphenyl (CB180) (ng/L)	0.2	NIVA's accredited method H3-2 (PCB)

Water discharge and hydrological modelling

For the 10 main rivers, daily water discharge measurements were, as in former years, used for the calculation of loads. Since the stations for water discharge are not located at the same site as the water quality stations, the water discharge at the water quality sampling sites were calculated by up- or downscaling, according to drainage area.

For the 36 rivers monitored quarterly, as well as the remaining 109 rivers from the former RID studies, water discharge was simulated with a spatially distributed version of the HBV-model (Beldring et al., 2003). The use of this model was introduced in 2004. Earlier, the water discharge in the 145 rivers was calculated based on the 30-year average, and adjusted with precipitation data for the actual year. The results from the spatially-distributed HBV are transferred to TEOTIL for use in the load estimates. Smaller response units ('regine-units') was introduced in TEOTIL in order to improve load estimates for smaller basins (tributaries) (see Selvik et al., 2000 for more details). This update of the TEOTIL model in 2006 (see Section 4.6.4) resulted in an increased estimate of the water discharge in the unmonitored areas. It is believed that the present estimate is more correct than in former years, which implies that a recalculation of former years may be called for.

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

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

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

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

Whereas the model was re-calibrated against an extended set of streamflow observations in 2005, no alterations of the model have been done for the 2006 data. The 2006 modelled water flow data have, therefore, been done exactly the same way as in 2005.

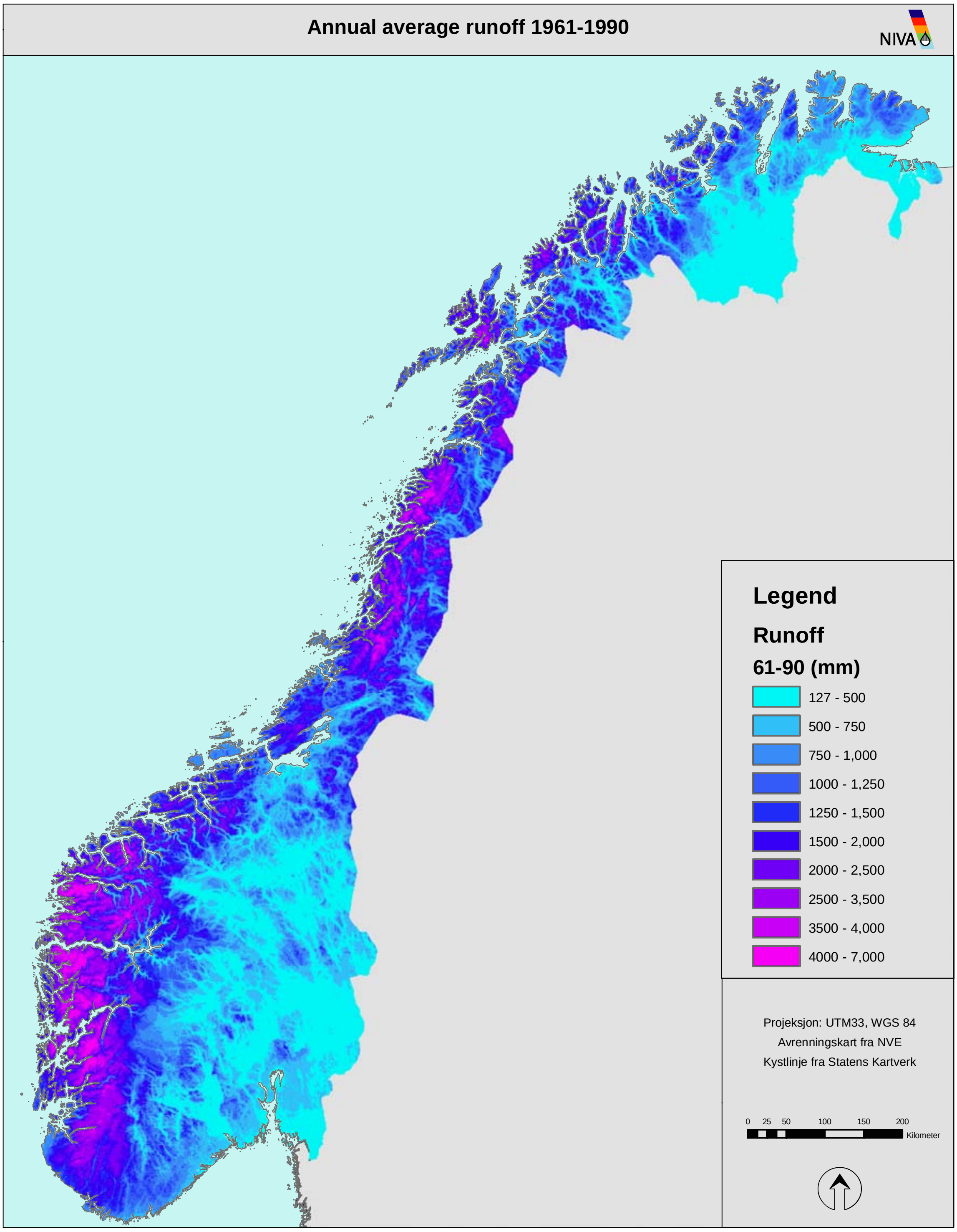

Figure A-IV-1. Annual average runoff (mm/year) for Norway for the period 1961-1990.

Direct discharges to the sea

Data sources:

- Municipal wastewater and scattered dwellings (Statistics Norway- SSB / KOSTRA);
- Agriculture (BIOFORSK)- *nutrients only*
- Aquaculture (The Directorate of Fisheries / ALTINN (altinn.no))- *nutrients only*
- Industry (The Norwegian Pollution Control Authority - SFT/INKOSYS)

<u>Wastewater</u>
Statistics Norway (SSB) is responsible for the annual registration of data from all wastewater treatment plants in the country. Approximately 50% of the Norwegian population is connected to advanced treatment plants with high efficiency on phosphorus treatment or both phosphorus and nitrogen. The rest of the population is connected to treatment plants with simpler primary treatment (42%) or no treatment (8%) (SSB, 2002). The major number of treatment plants with only primary treatment serves 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 most of the produced wastewater. Of the total hydraulic capacity of 5.74 million p.e. (person equivalent), chemical plants account for 37 %, primary treatment for 24%, chemical/biological for 27%, direct discharges for 8%, biological for 2% and others for 2% (2002 data). In the North Sea area of Norway, most of the wastewater (from 83% of the population in the area) is treated in chemical or combined biological-chemical treatment plants, whereas the most common treatment methods along the coast from Hordaland county and northwards are primary treatment or no treatment. The fifty percent reduction target for anthtropogenic phosporus is met for the Skagerak coast due to the efforts in treating the discharges from the population.

The annual discharges of nutrients from municipal wastewater effluents have mostly been estimated as the product of annual flow and flow-weighted concentrations. For the plants with no reporting requirements, the discharges were estimated by multiplying the number of people with standard Norwegian per capita load figures reduced by the removal efficiency of the treatment plants. “Principles of the Comprehensive Study of Riverine Inputs and Direct Discharges” (PARCOM, 1988), recommends the derived per capita loads listed in Table A-IV-4 to be used. The Norwegian per capita loads are based on studies of Norwegian sewerage districts (Farestveit et al., 1995).

Discharges from the population not connected to public treatment plants are estimated by the same approach as for unmonitored 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 A-IV-4. Per capita loads used for estimation of untreated sewage discharges.

Parameter	OSPAR	Norway
BOD (kg O/person/day)	0.063	0.046
COD (kg O/person/day)		0.094
TOC (kg TOC /person/day)		0.023
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

<u>Metals from wastewater</u>
The metal loads from wastewater treatment plants reflect the *reported* load from wastewater treatment plant. No assumptions on metal loads from other plants than those reporting have been considered. The metal loads from industrial effluents were calculated based on data from SFT's database INKOSYS.

<u>Nutrients from wastewater</u>
Statistics Norway (SSB) and the Norwegian Pollution Control Authority (SFT) jointly initiated annual registration of data of nutrients from all wastewater treatment plants in the country with a capacity of more than 50 person equivalents (p.e.). The data are reported each year by the municipalities. The electronic reporting system KOSTRA is used for the reporting of effluent data from the municipalities directly to SSB. Discharge figures from KOSTRA are used in the transport model "TEOTIL" to calculate the total discharges of total phosphorus and total nitrogen from population (wastewater treatment plants and scattered dwellings not connected to wastewater treatment plants), industry, agriculture and aquaculture sources to Norwegian coastal waters. The Norwegian Institute for Water Research (NIVA) performs this modelling. The figures take account of retention of nutrients in lakes.

<u>Industrial effluents</u>
In 2007, the reporting of industrial wastewater was delayed due to changes in the database, and the values for 2007 are therefore based on the 2006 data. 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 used TEOTIL for estimating the total nitrogen and total phosphorus loads from industry not connected to municipal treatment plants. The metal data were collected from SFT's data base INKOSYS.

<u>Fish farming effluents</u>
Fish farmers report monthly data about e.g. fish fodder, biomass, slaughtered fish and slaughter offal down to net cage level. The basis for the report from The Directorate of Fisheries is data available at altinn.no.

The sale statistics of SSB with regard to trout and salmon show the increase in fish farming activities since 1995, which has a bearing on the discharges from fish farming although there has been improvements in treatment yield and production procedures.

NIVA performs the estimates of discharges from fish farming of nitrogen and phosphorus according to HARP Guidelines (Guideline 2/method 1, see Borgvang and Selvik, 2000). The basis for the estimates are mass balance equations, i.e. feed used (based on P or N content in feed), and fish production (based on P or N content in produced fish). The estimates do not distinguish between particulate and dissolved fractions of the nitrogen and phosphorus discharge/loss. This simple approach will therefore overestimate the nitrogen and phosphorus discharges/losses, as it does not take into account the burial of particulate nitrogen and phosphorus (especially phosphorus) in the sediments.

The produced volume has increased compared to previous years and the corresponding discharges of nitrogen and phosphorus will normally increase correspondingly. Some factors may influence sold volume, biomass produced and discharges of nitrogen and phosphorus, a few is listed here:

- Farmers may adapt slaughtering according to the market situation and sold volume and biomass produced may not correspond.
- Underreporting on the use of feed is possible, but was more likely when feed quota was in operation (before 2005)
- Diseases may lead to delayed sale or reduced production

For more information about details in data reporting and availability see Selvik et al. (2007).

The loads from fish farming have been included in the grand total values as from 2000, i.e. these loads were not included in the input figures for the period 1990-1999.

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

After deducting N and P harvested with the fish and the proportion of feed not consumed by fish, the remaining N and P is excreted in particulate (faecal) and soluble form. Results from Enell (1987), Ackefors and Enell (1990) and Ackefors and Enell (1991) have shown that about 78% of the discharged N is in dissolved form and the rest (22%) in particulate form.

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Annex V
Trend Analyses – Pollutant Concentrations. Complimentary figures to Chapter 6.

The figures cover the following substances in consecutive order:

- Water discharge (Q)
- Total-N
- Nitrate-N (NO_3-N)
- Ammonium (NH_4-N)
- Total-P
- Phosphate-P (PO_4-P)
- Suspended particulate matter (SPM)
- Cadmium (Cd)
- Copper (Cu)
- Nickel (Ni)
- Lead (Pb)
- Zinc (Zn)

The figures in this Annex are complimentary to Chapter 6.

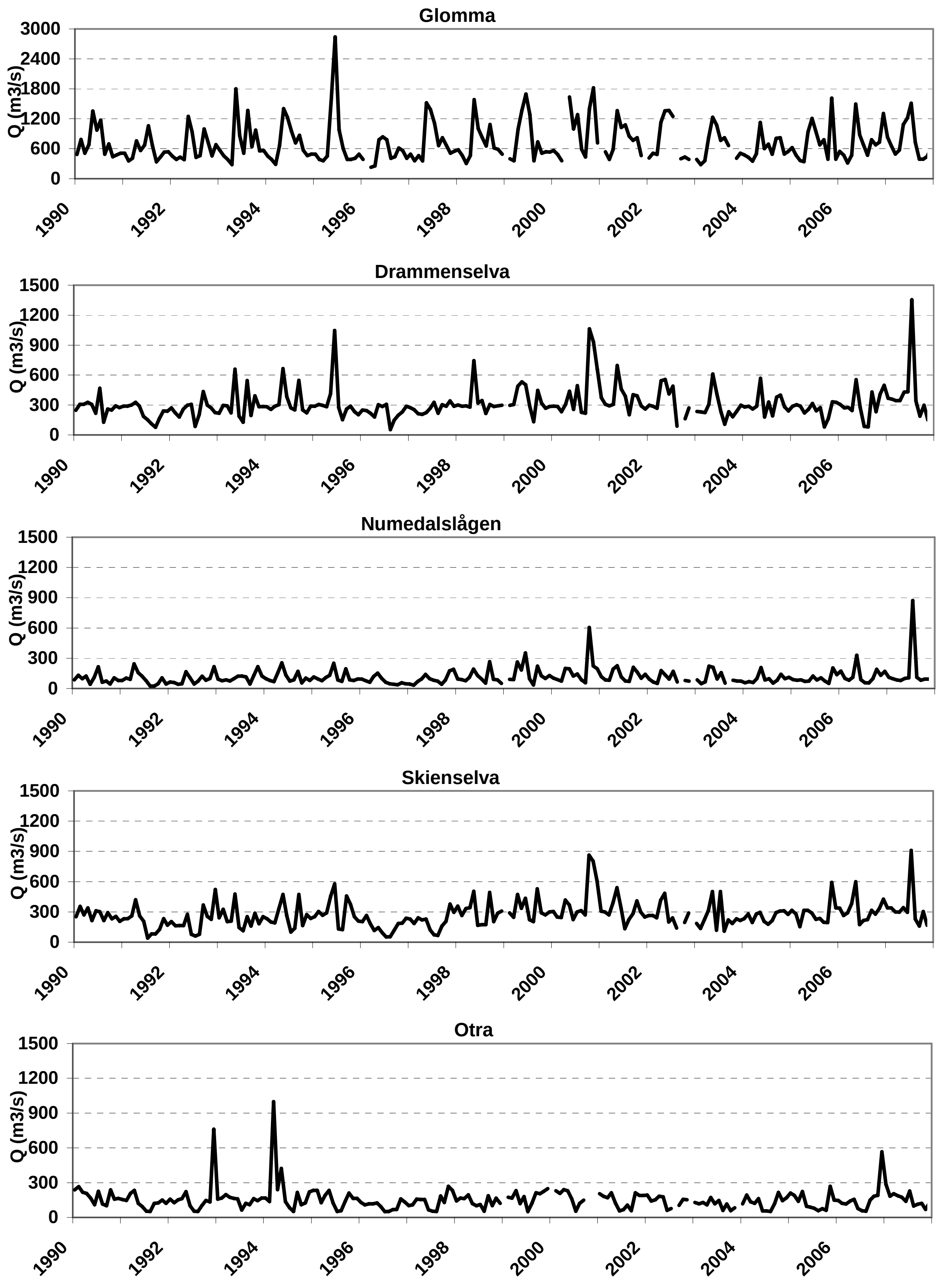


Figure A-V-1a. Monthly <u>*water discharge*</u> *(based only on data at the day of water quality sampling) in the five main Norwegian Skagerak rivers, 1990-2007.*

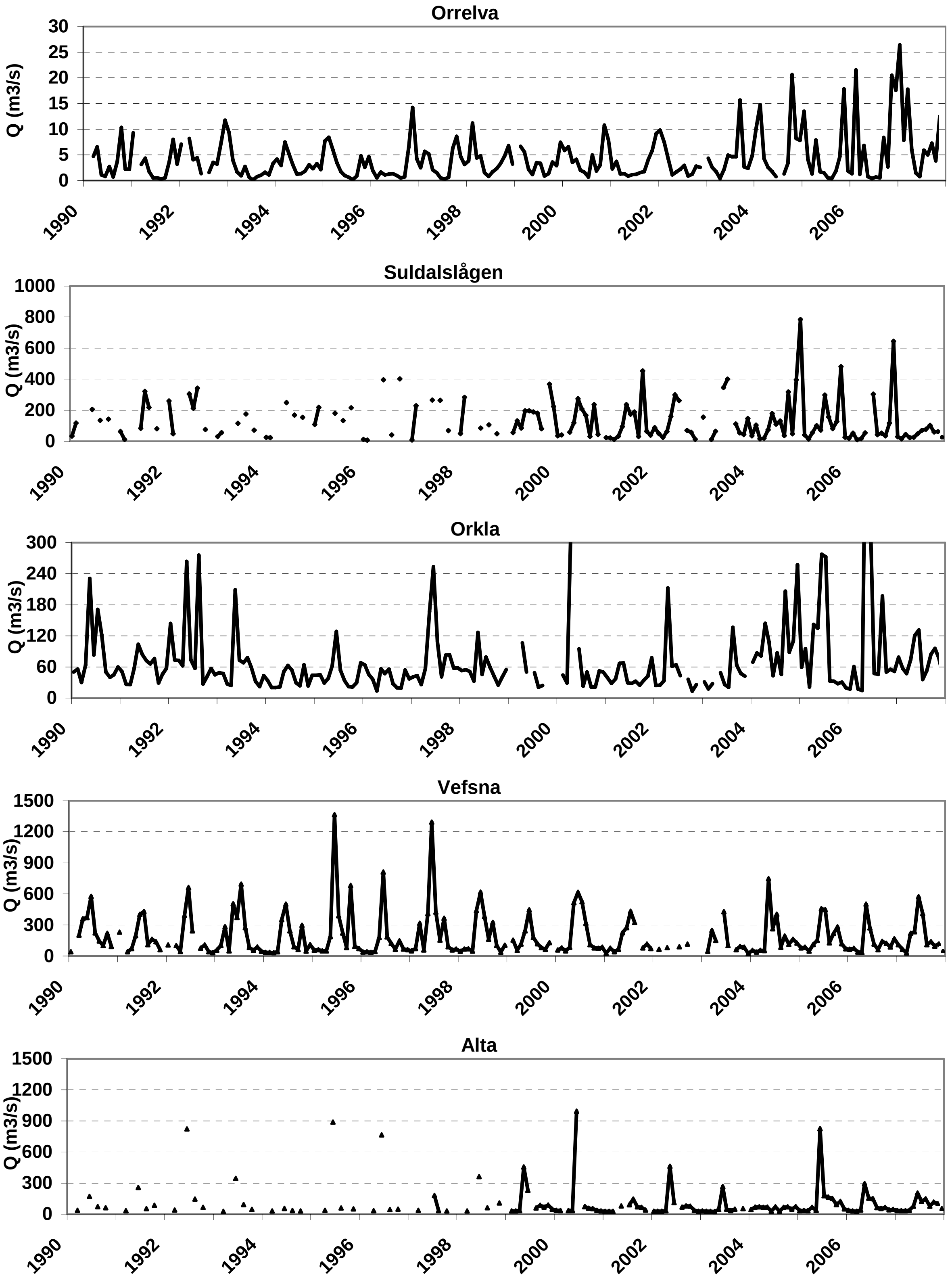


Figure A-V-1b. Monthly <u>*water discharge*</u> *(based only on data at the day of water quality sampling) in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.*

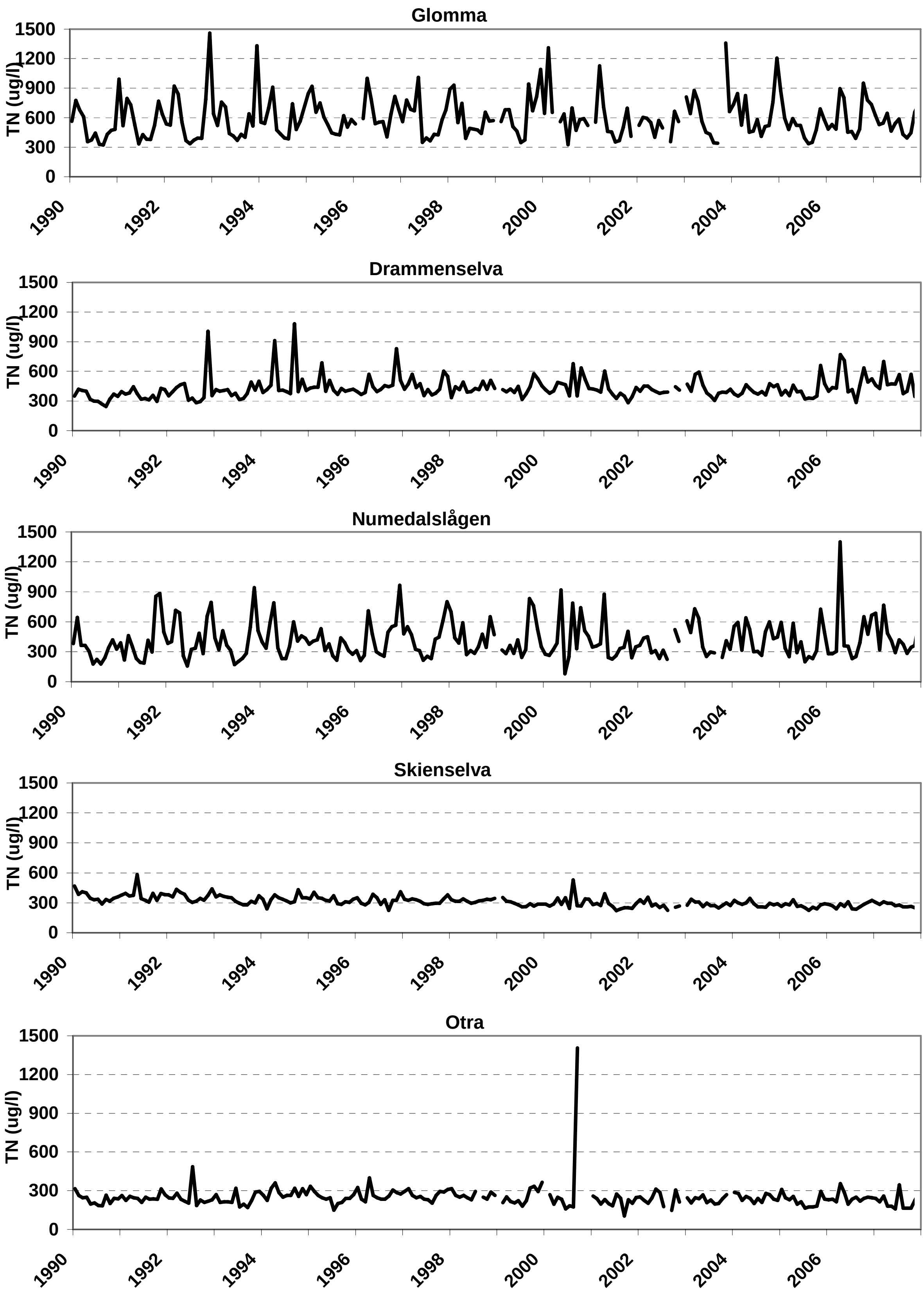


Figure A-V-2a. Monthly concentrations of *__total nitrogen__* *in the five main Norwegian Skagerak rivers, 1990-2007.*

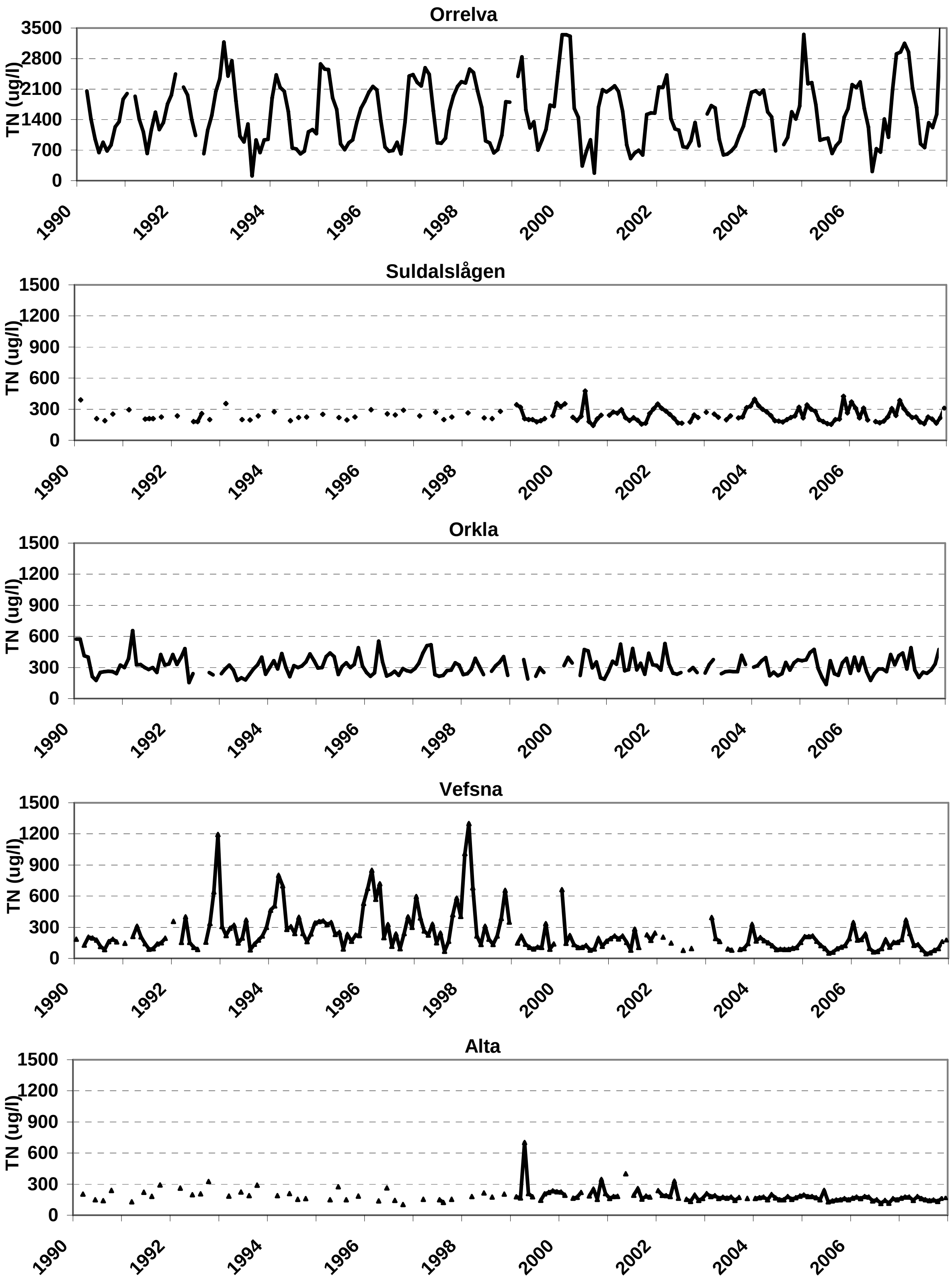


Figure A-V-2b. Monthly concentrations of total nitrogen in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

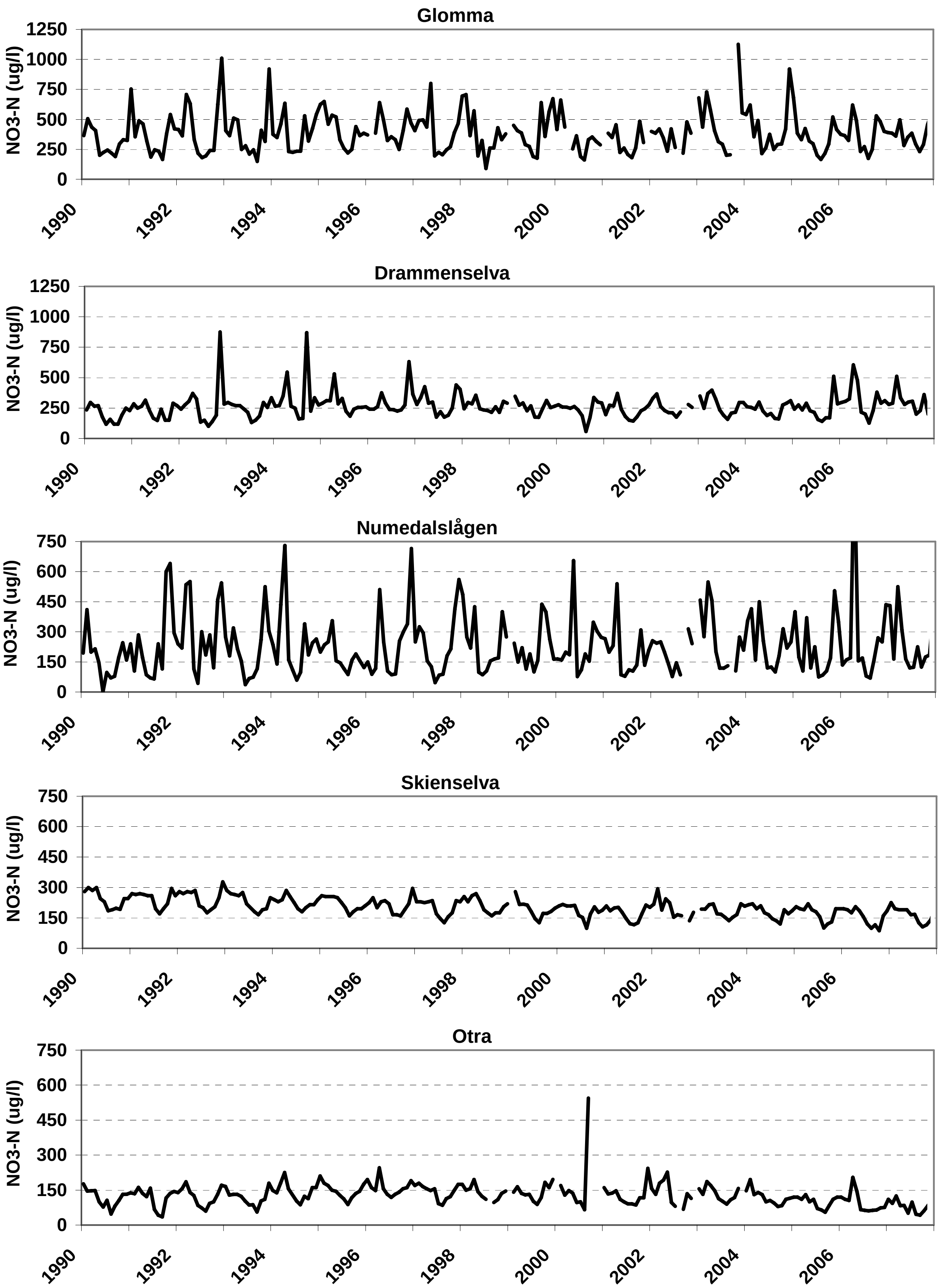


Figure A-V-3a. Monthly concentrations of <u>*nitrate nitrogen*</u> *in the five main Norwegian Skagerak rivers, 1990-2007.*

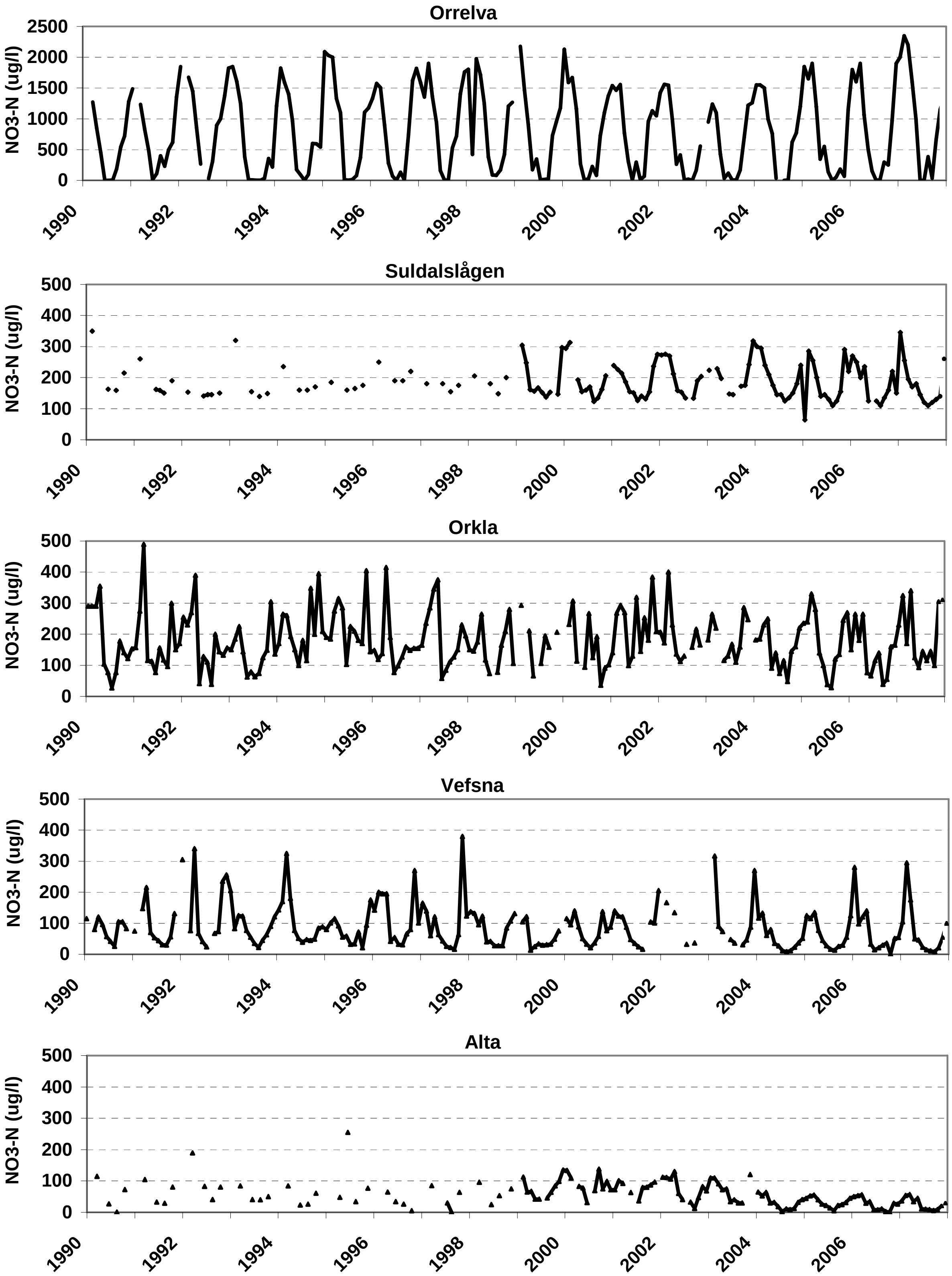


Figure A-V-3b. Monthly concentrations of nitrate nitrogen in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

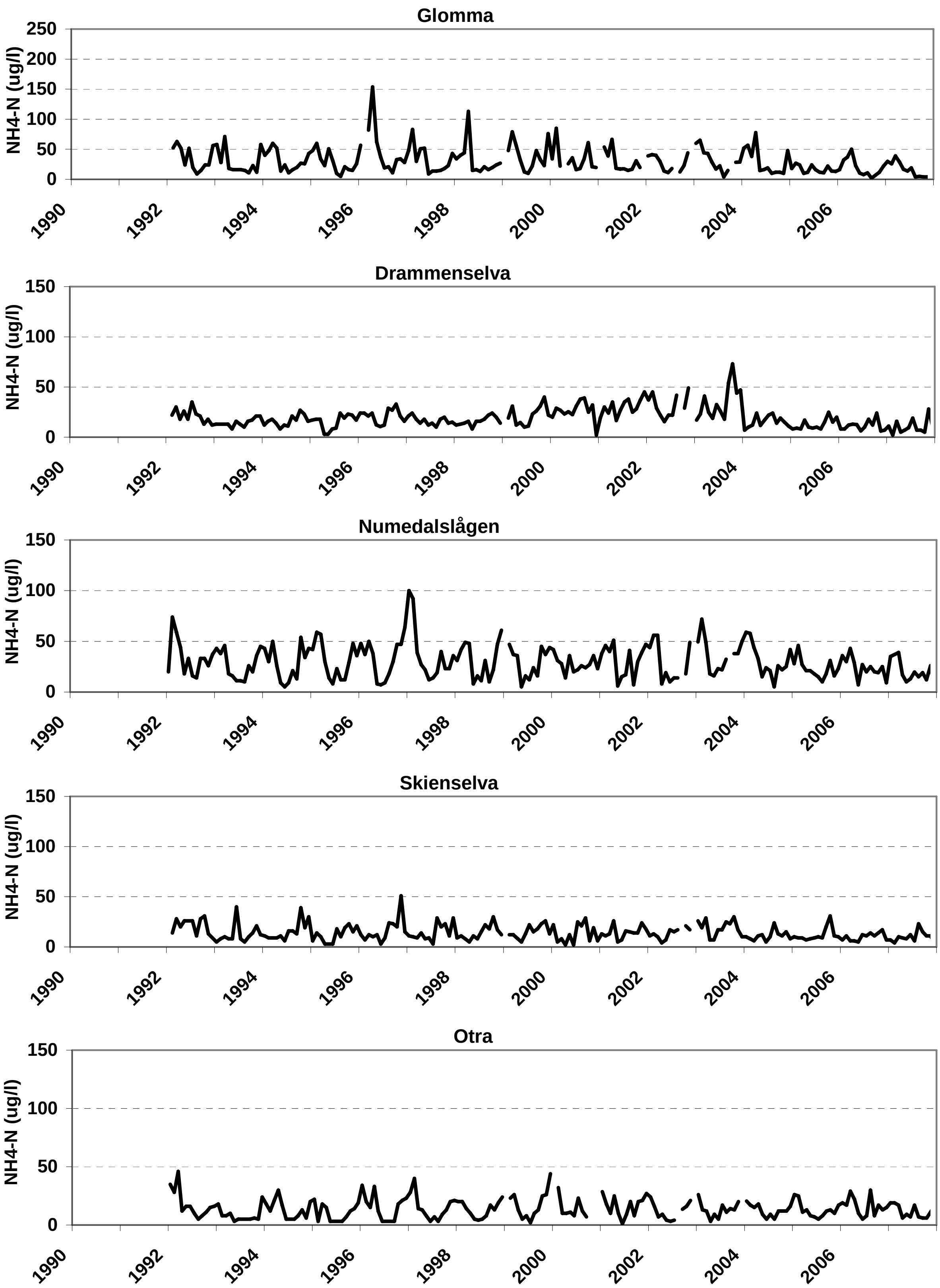


Figure A-V-4a. Monthly concentrations of NH_4-N in the five main Norwegian Skagerak rivers, 1990-2007.

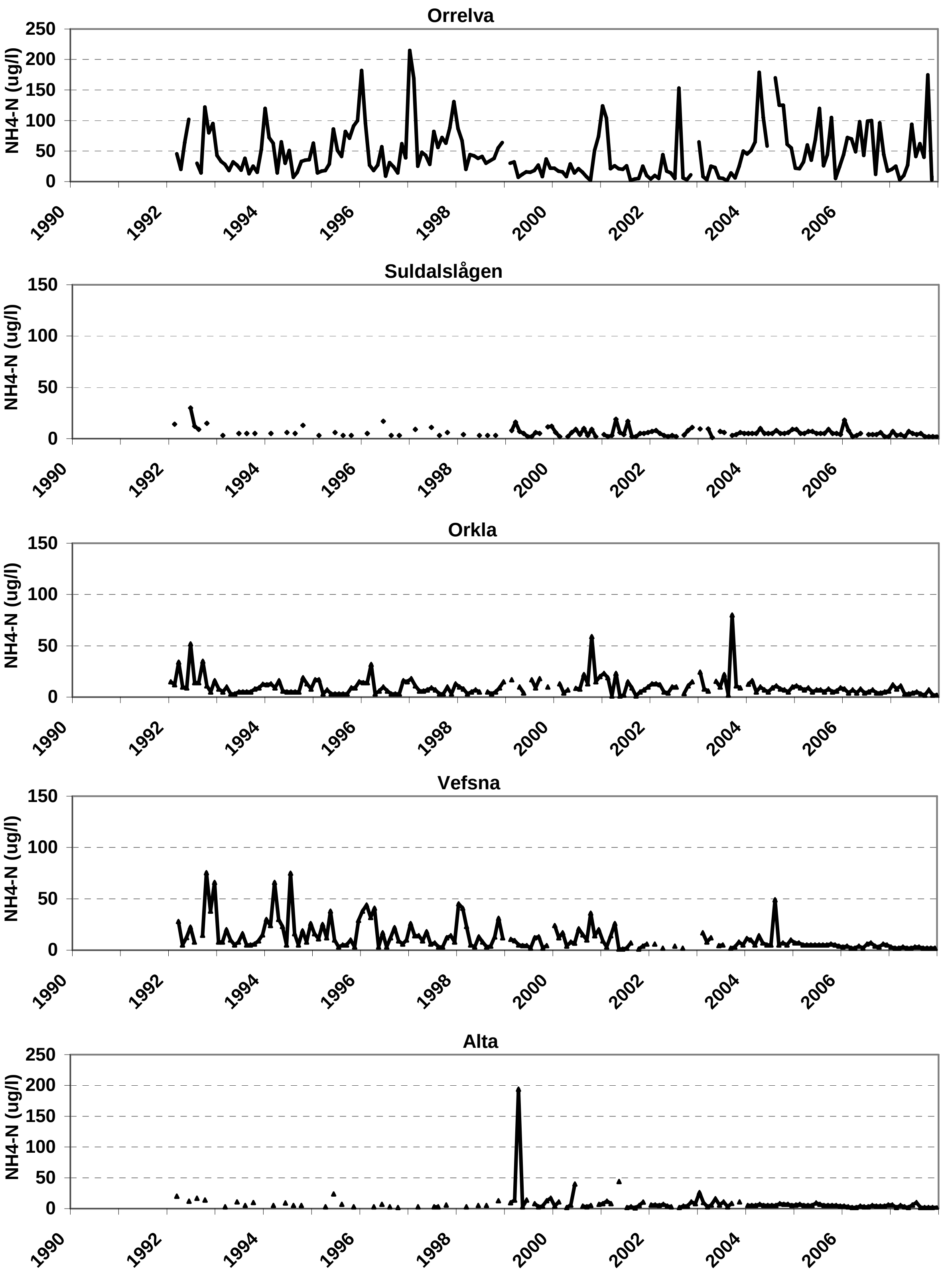


Figure A-V-4b. Monthly concentrations of <u>NH_4-N</u> in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

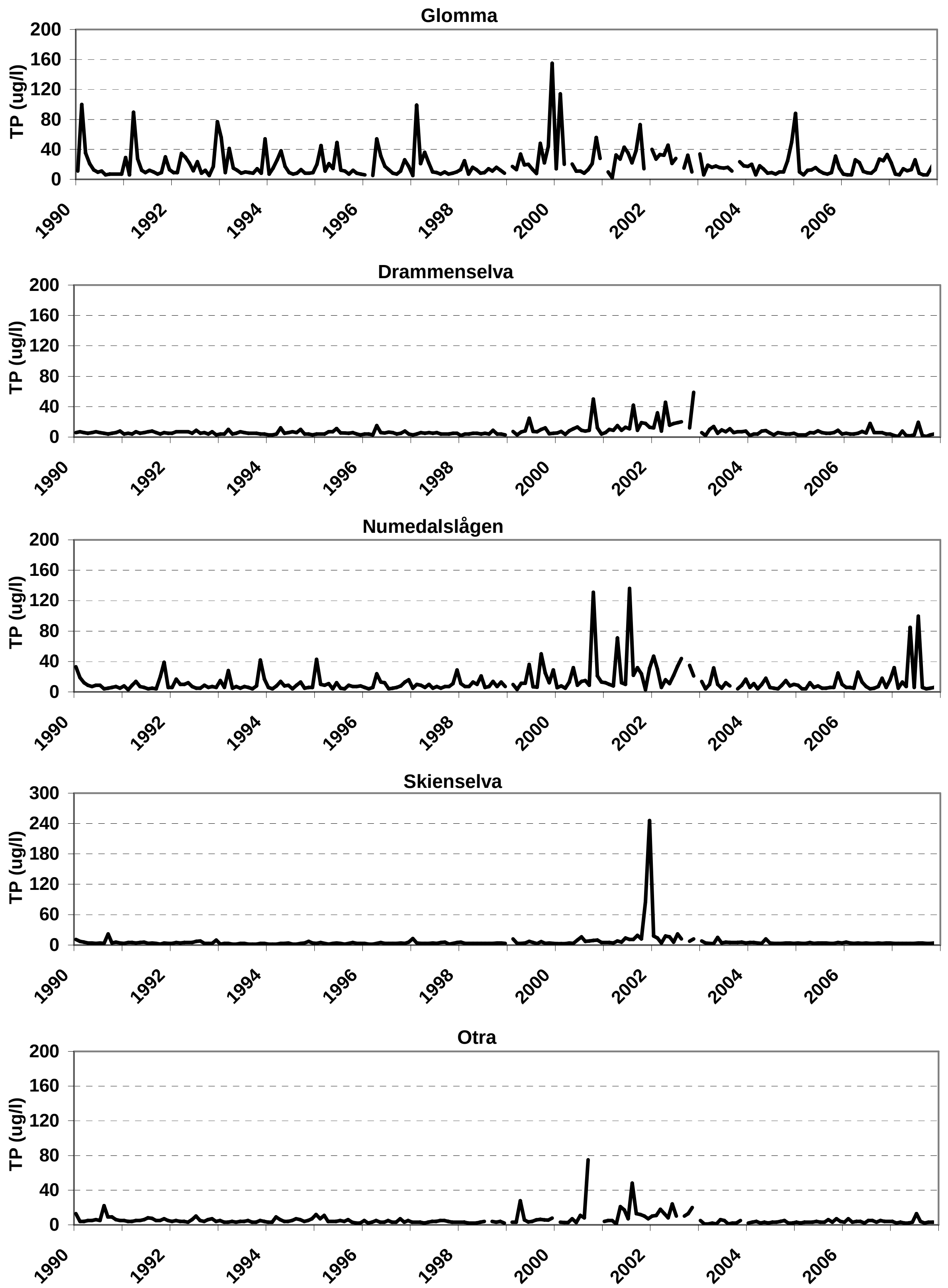


Figure A-V-5a. Monthly concentrations of *<u>total phosphorus</u>* *in the five main Norwegian Skagerak rivers, 1990-2007.*

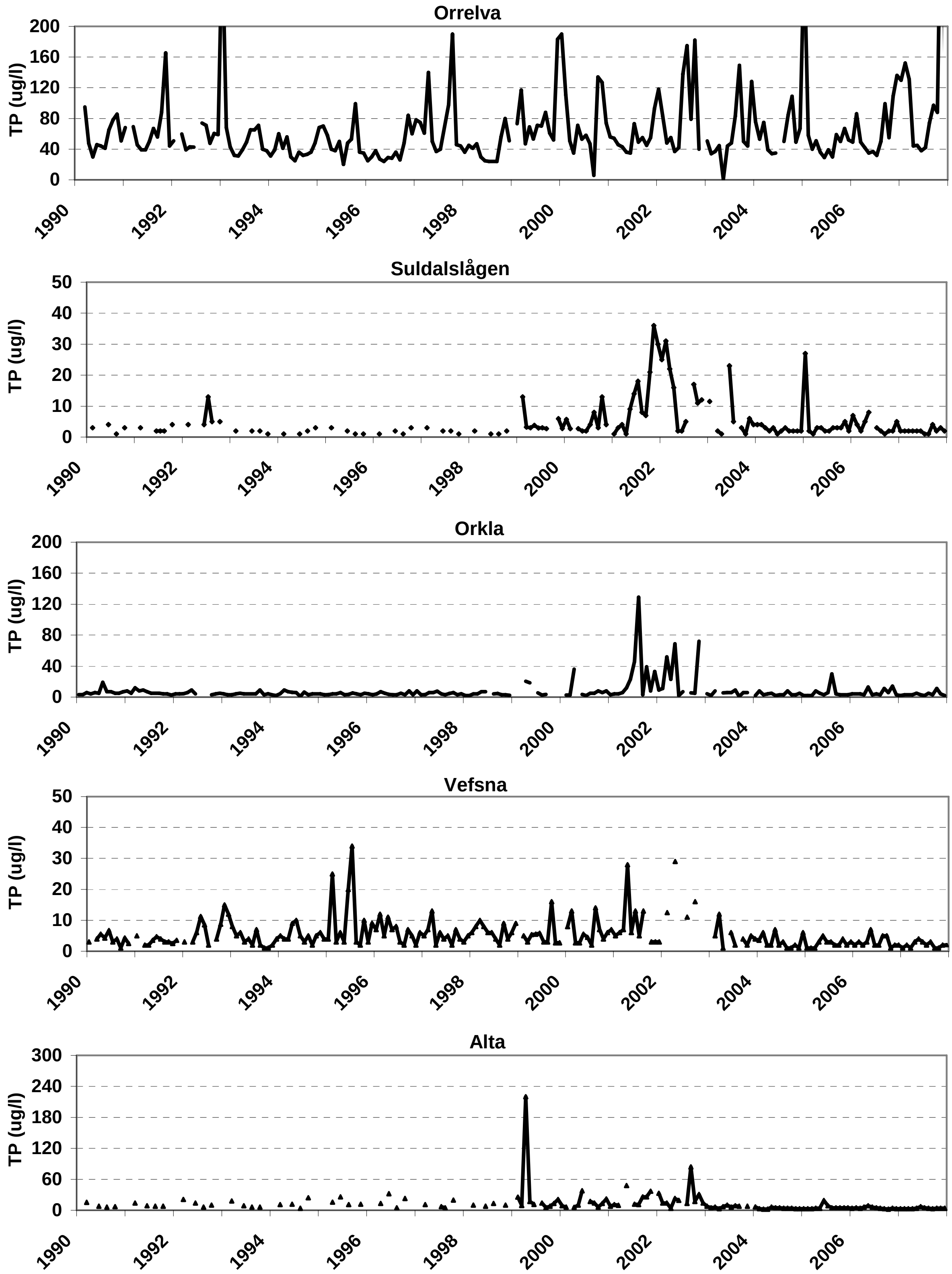


Figure A-V-5b. Monthly concentrations of total phosphorus in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

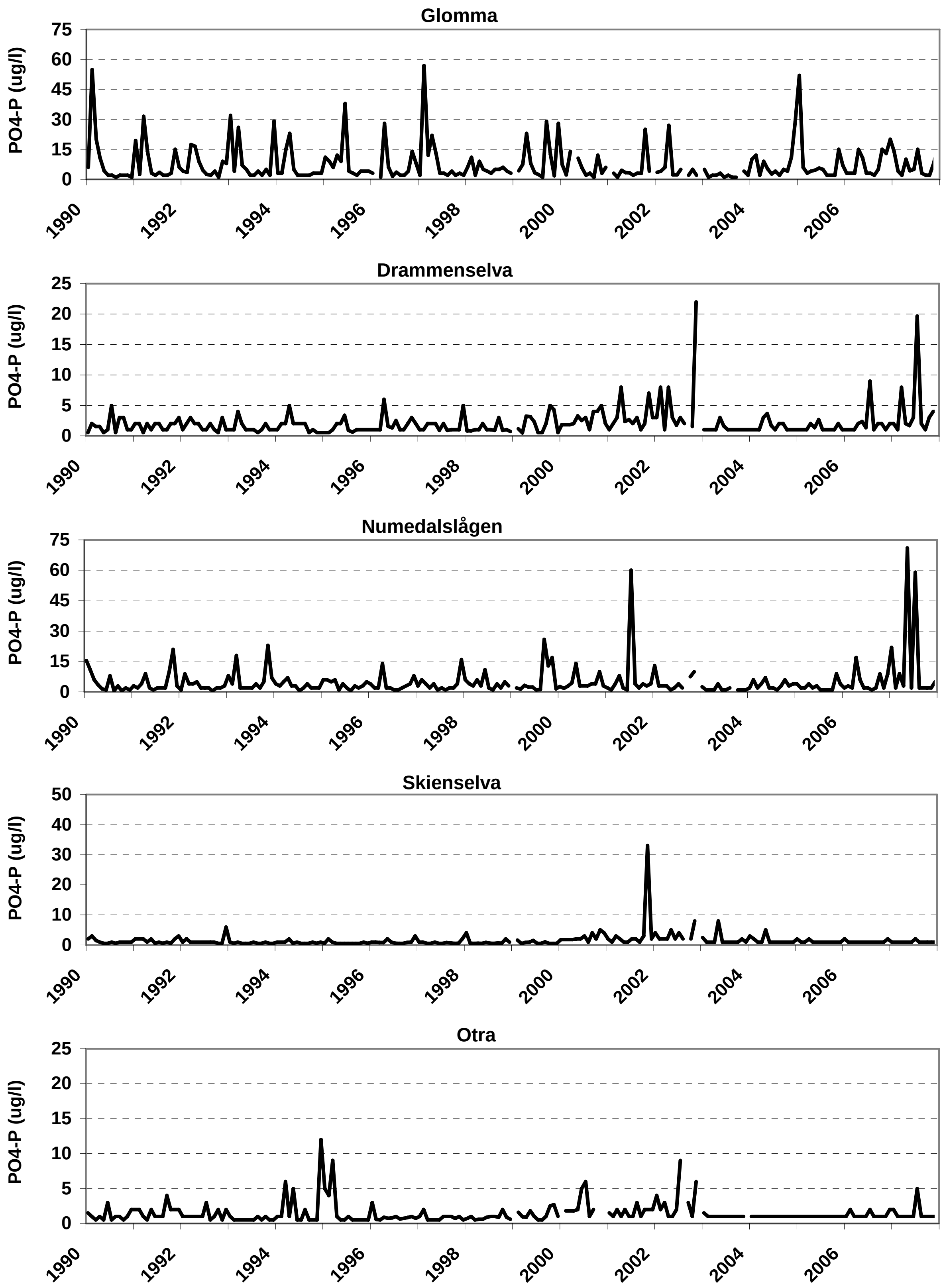


Figure A-V-6a. Monthly concentrations of PO4-P *in the five main Norwegian Skagerak rivers, 1990-2007.*

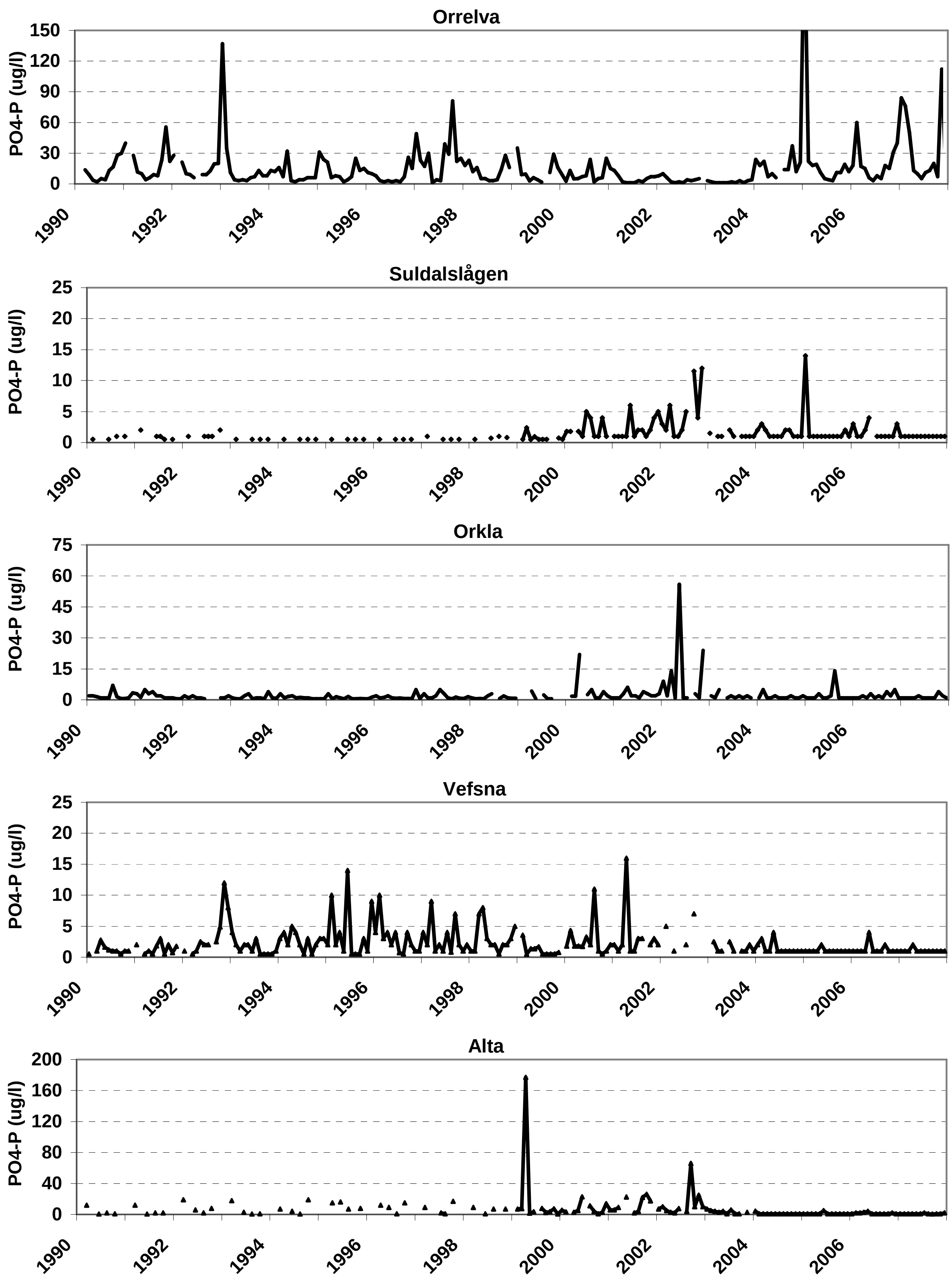


Figure A-V-6b. Monthly concentrations of PO4-P in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

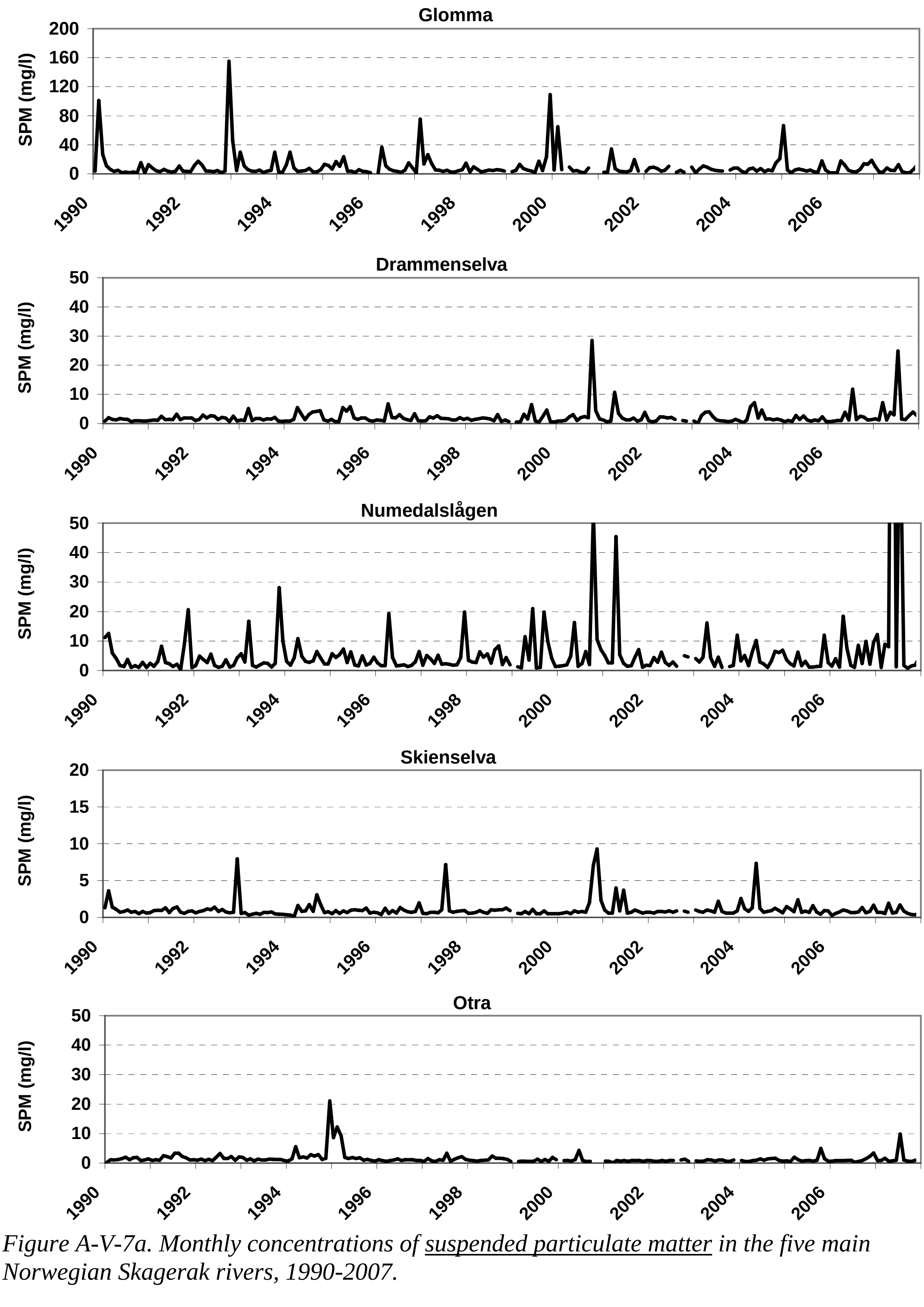


Figure A-V-7a. Monthly concentrations of *suspended particulate matter* *in the five main Norwegian Skagerak rivers, 1990-2007.*

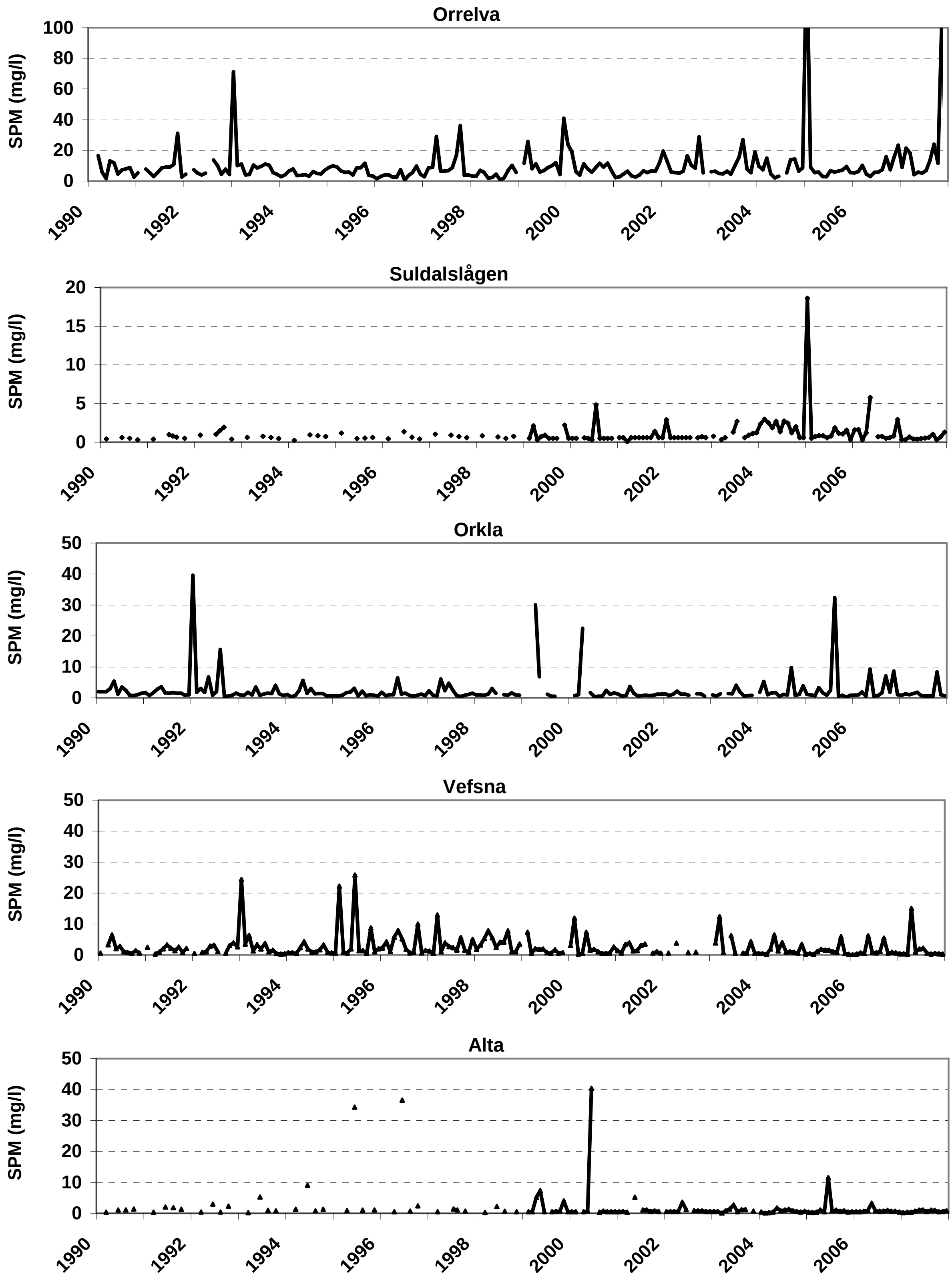


Figure A-V-7b. Monthly concentrations of suspended particulate matter in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

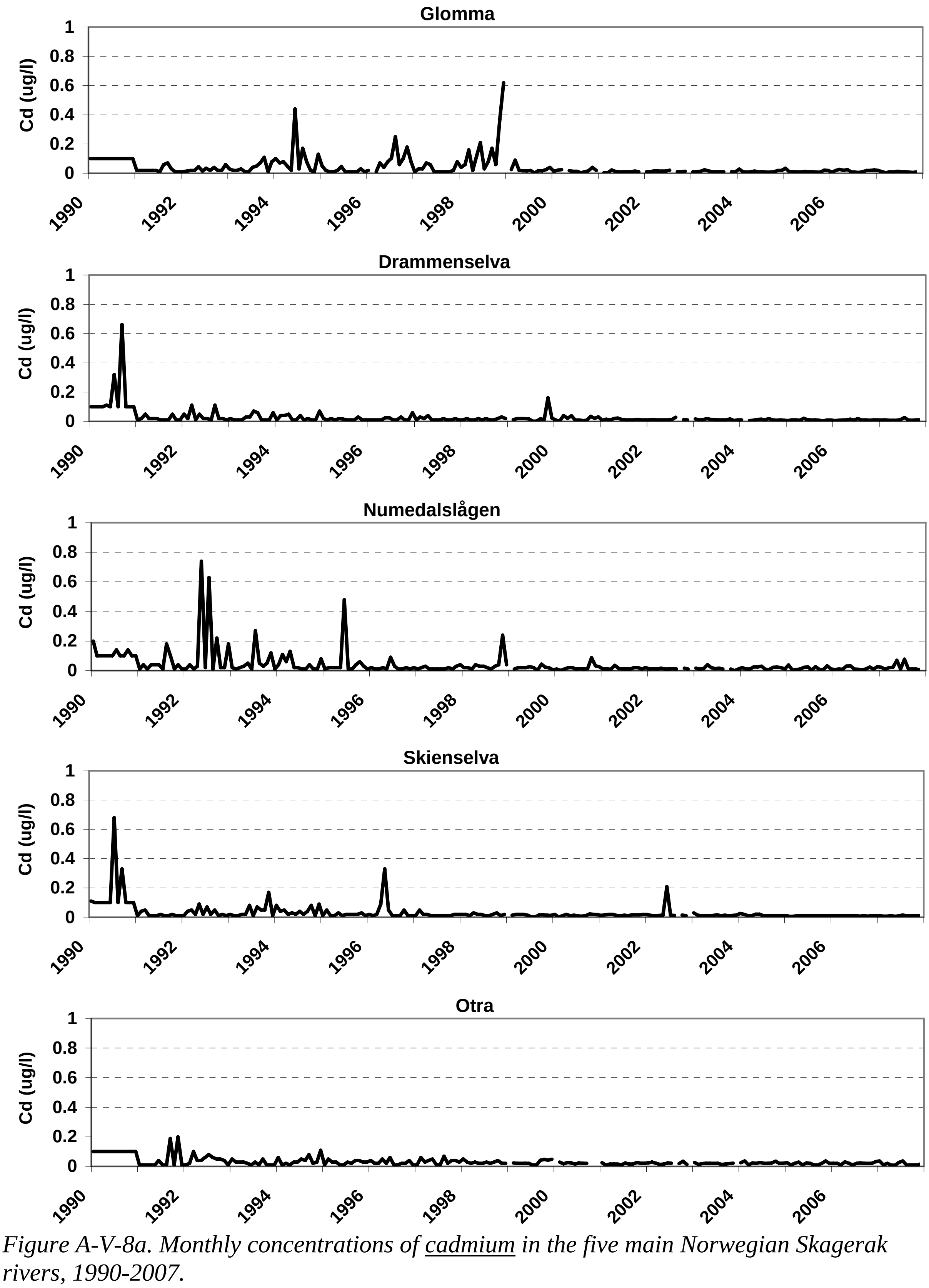


Figure A-V-8a. Monthly concentrations of <u>cadmium</u> in the five main Norwegian Skagerak rivers, 1990-2007.

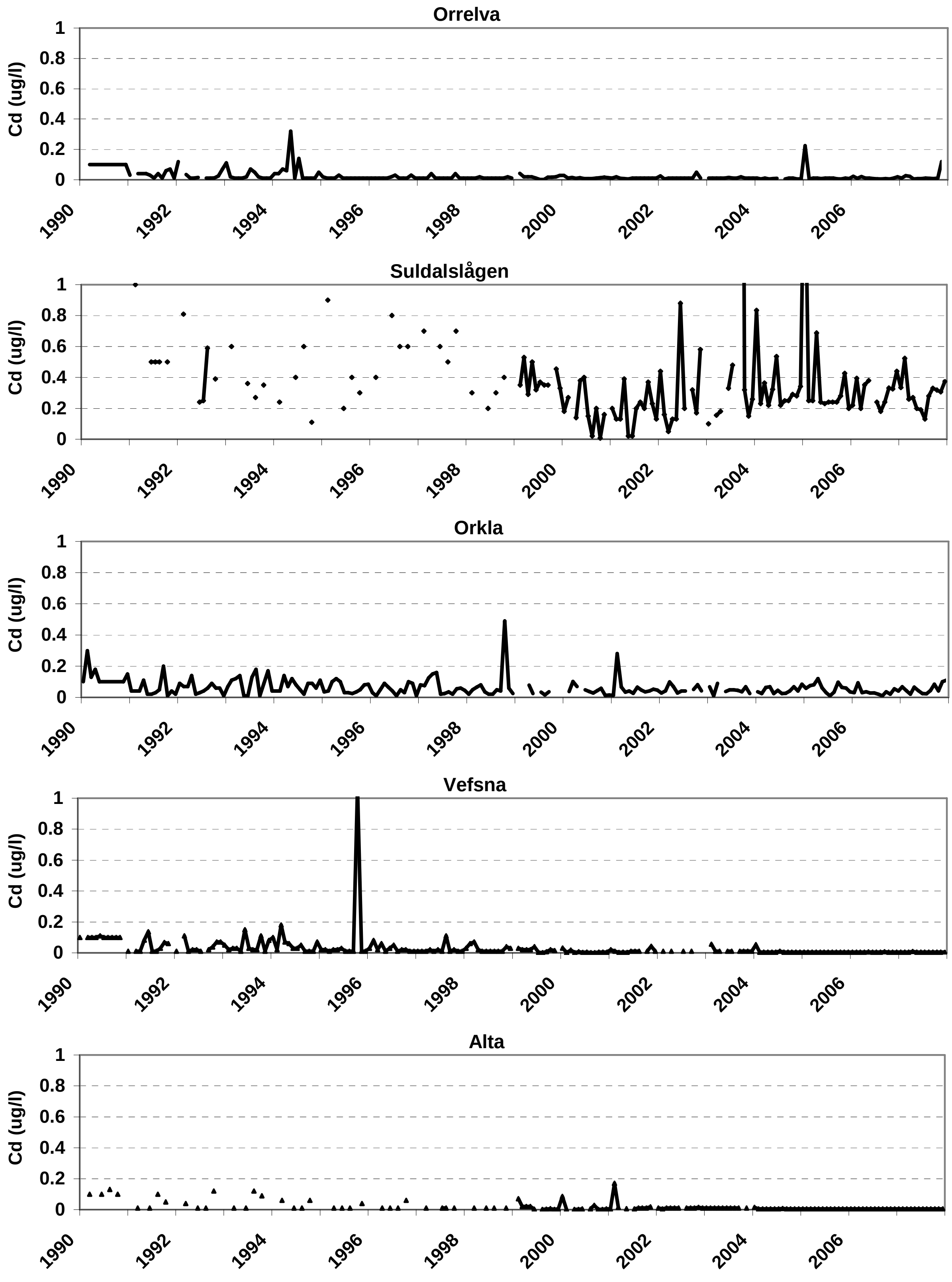


Figure A-V-8b. Monthly concentrations of <u>cadmium</u> in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

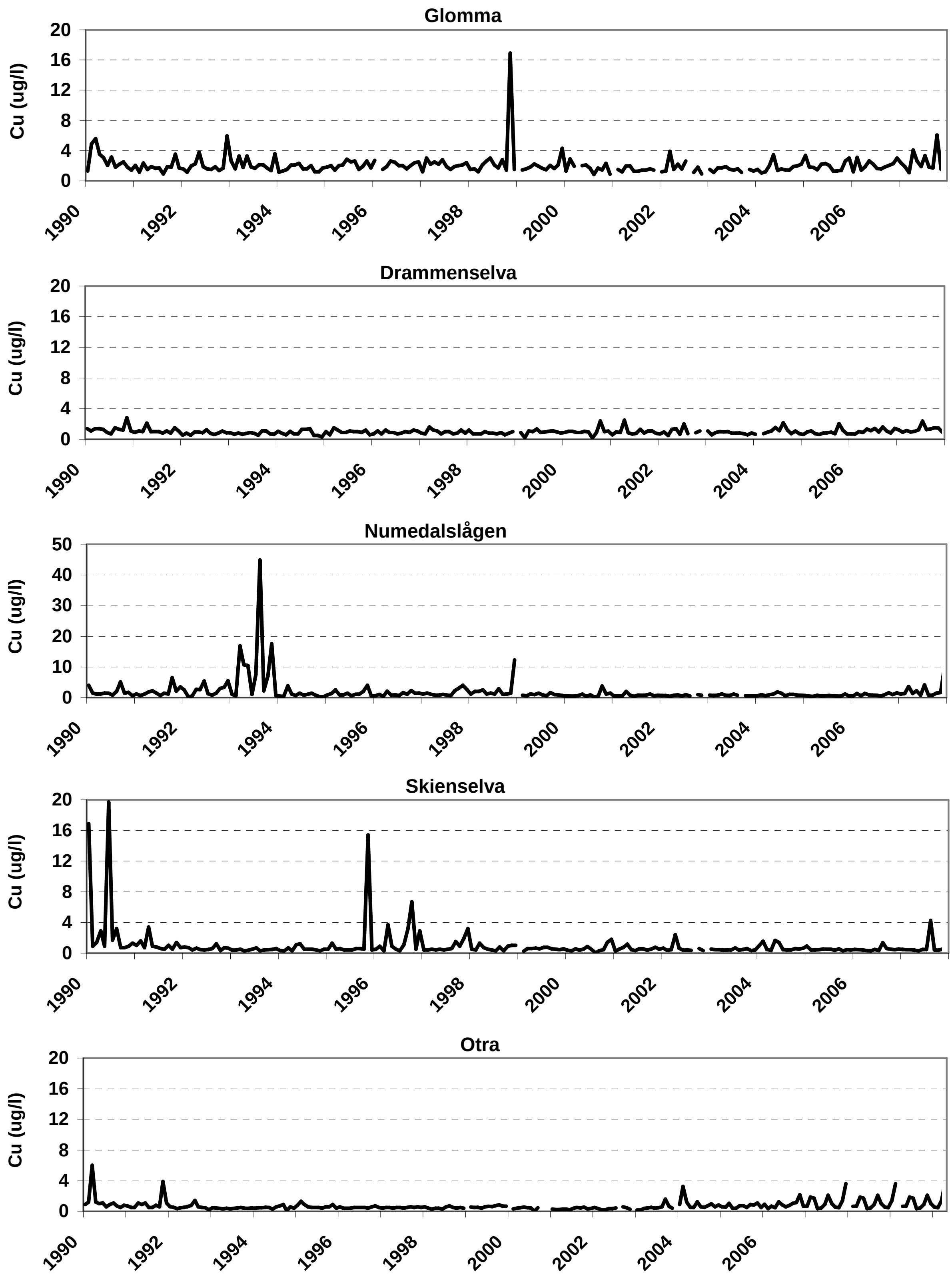


Figure A-V-9a. Monthly concentrations of <u>copper</u> in the five main Norwegian Skagerak rivers, 1990-2007.

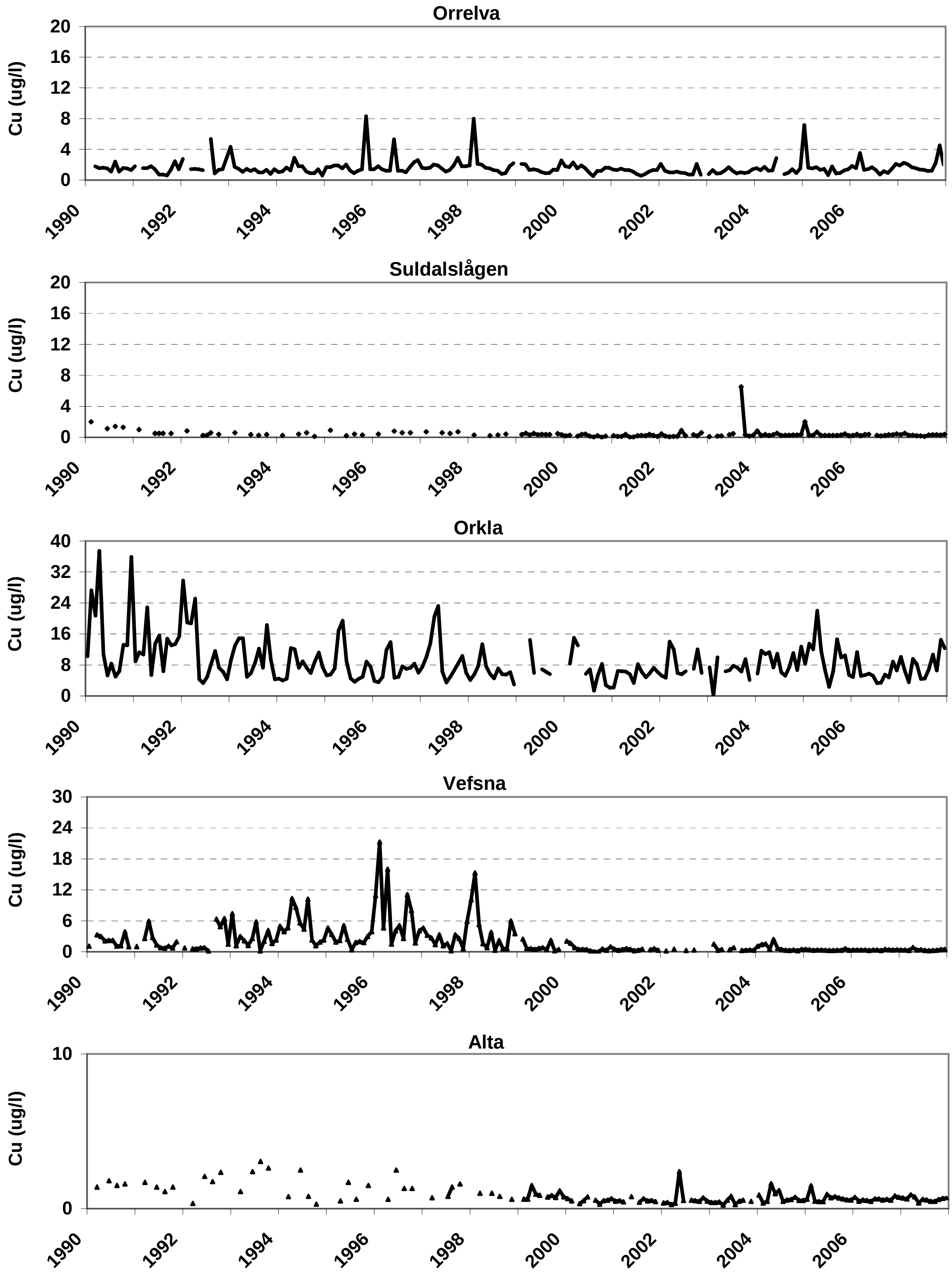


Figure A-V-9b. Monthly concentrations of <u>copper</u> in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

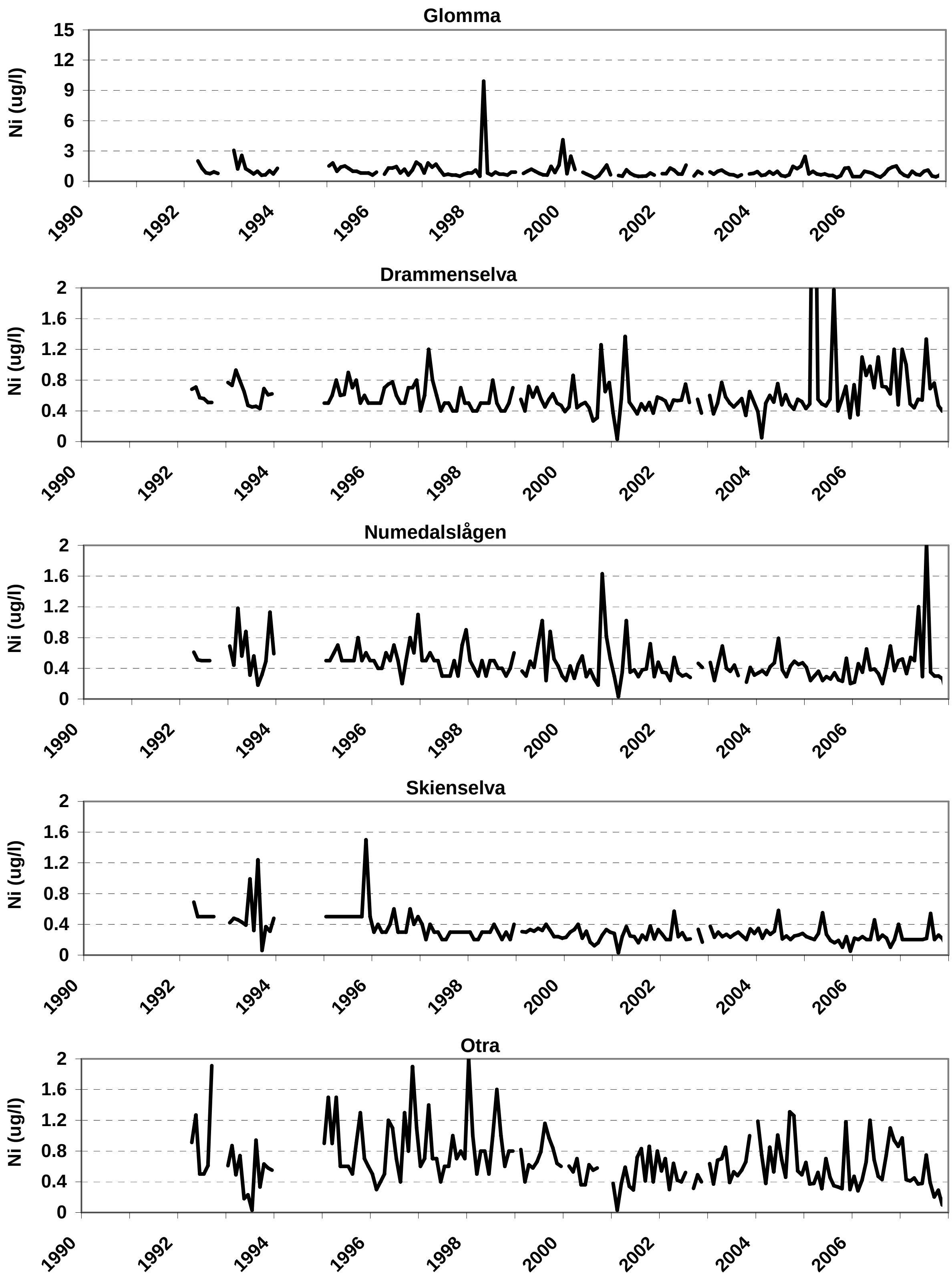


Figure A-V-10a. Monthly concentrations of nickel in the five main Norwegian Skagerak rivers, 1990-2007.

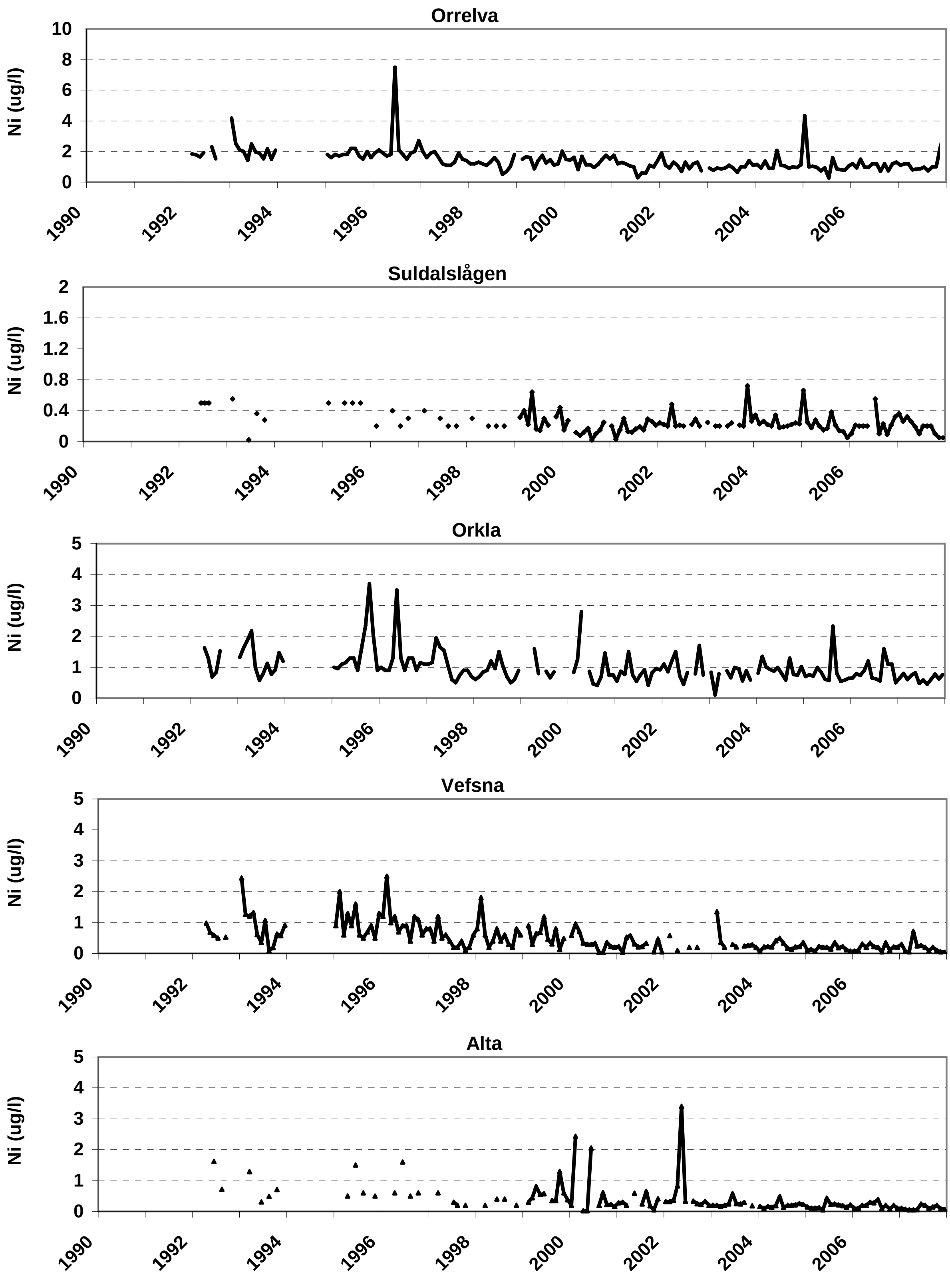


Figure A-V-10b. Monthly concentrations of <u>nickel</u> in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

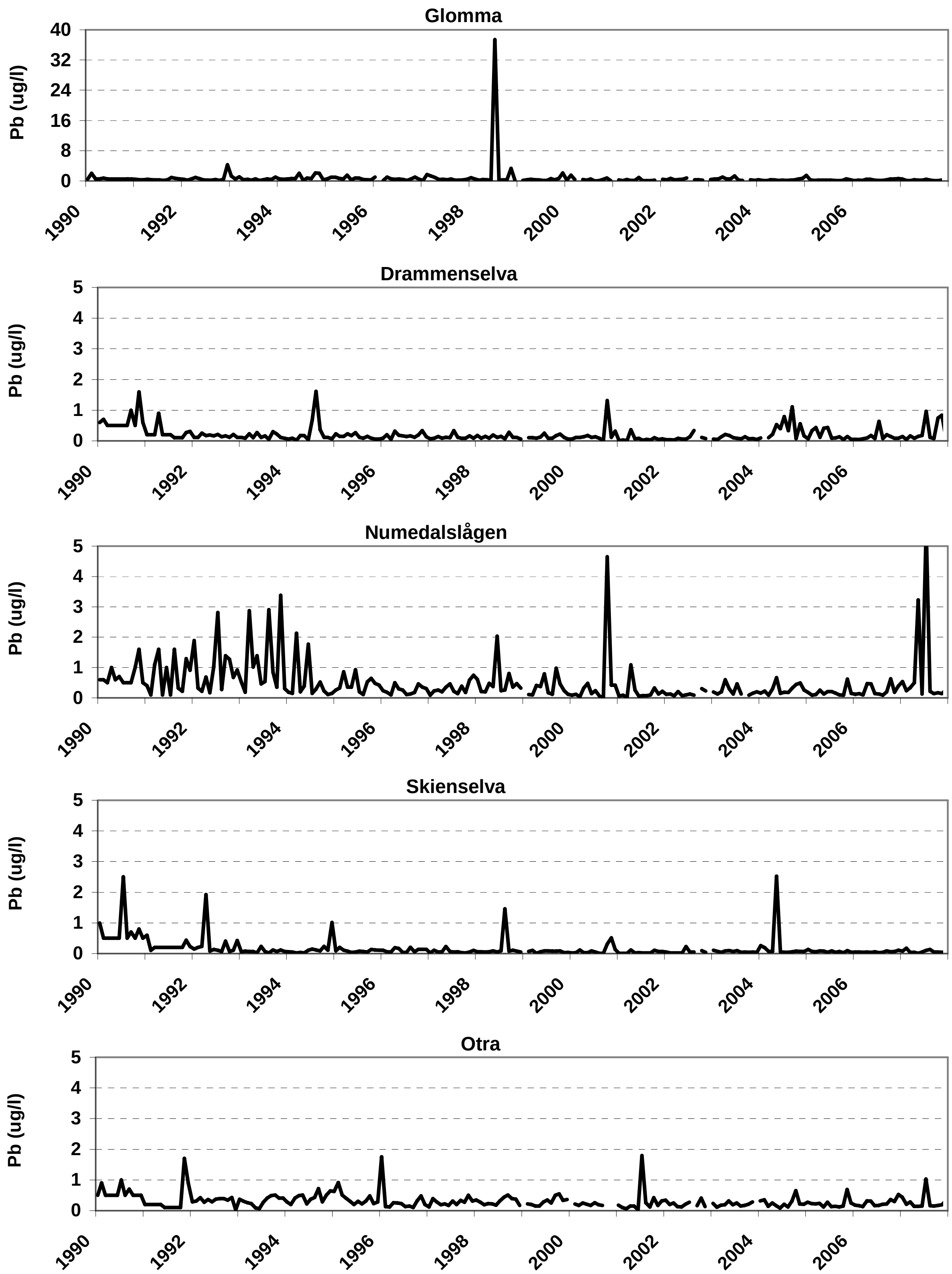


Figure A-V-11a. Monthly concentrations of lead in the five main Norwegian Skagerak rivers, 1990-2007.

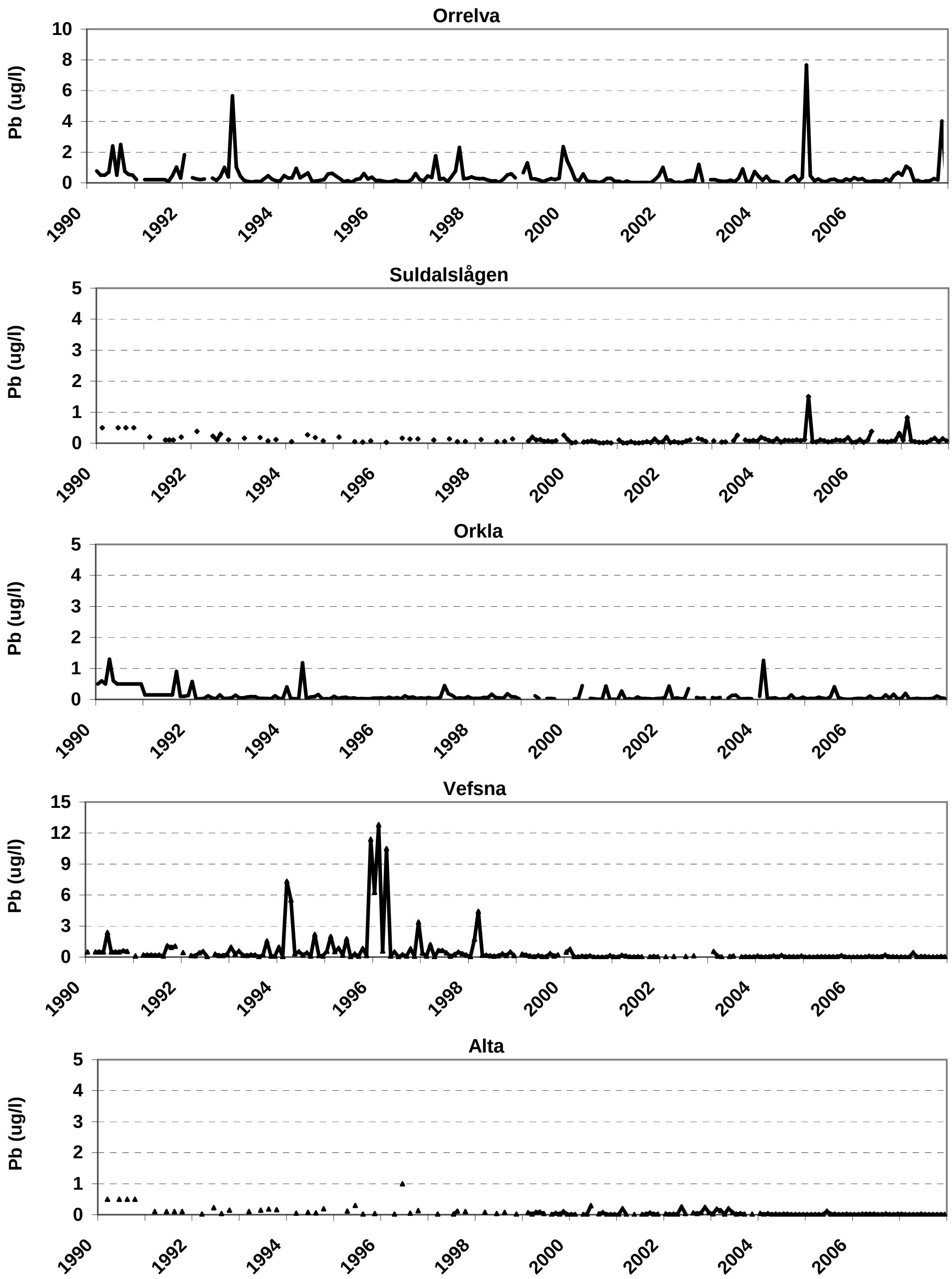


Figure A-V-11b. Monthly concentrations of <u>*lead*</u> *in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.*

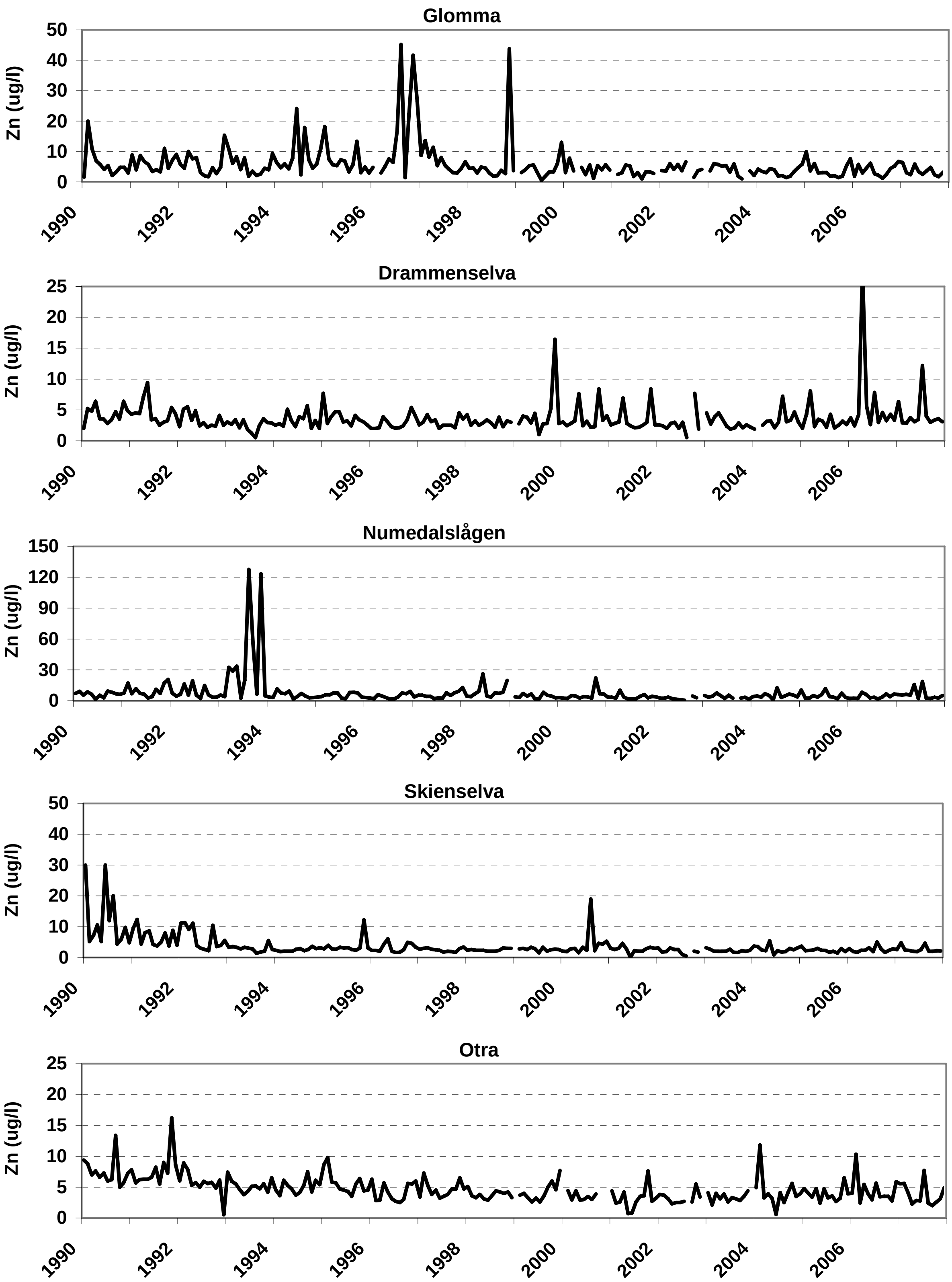


Figure A-V-12a. Monthly concentrations of zinc in the five main Norwegian Skagerak rivers, 1990-2007.

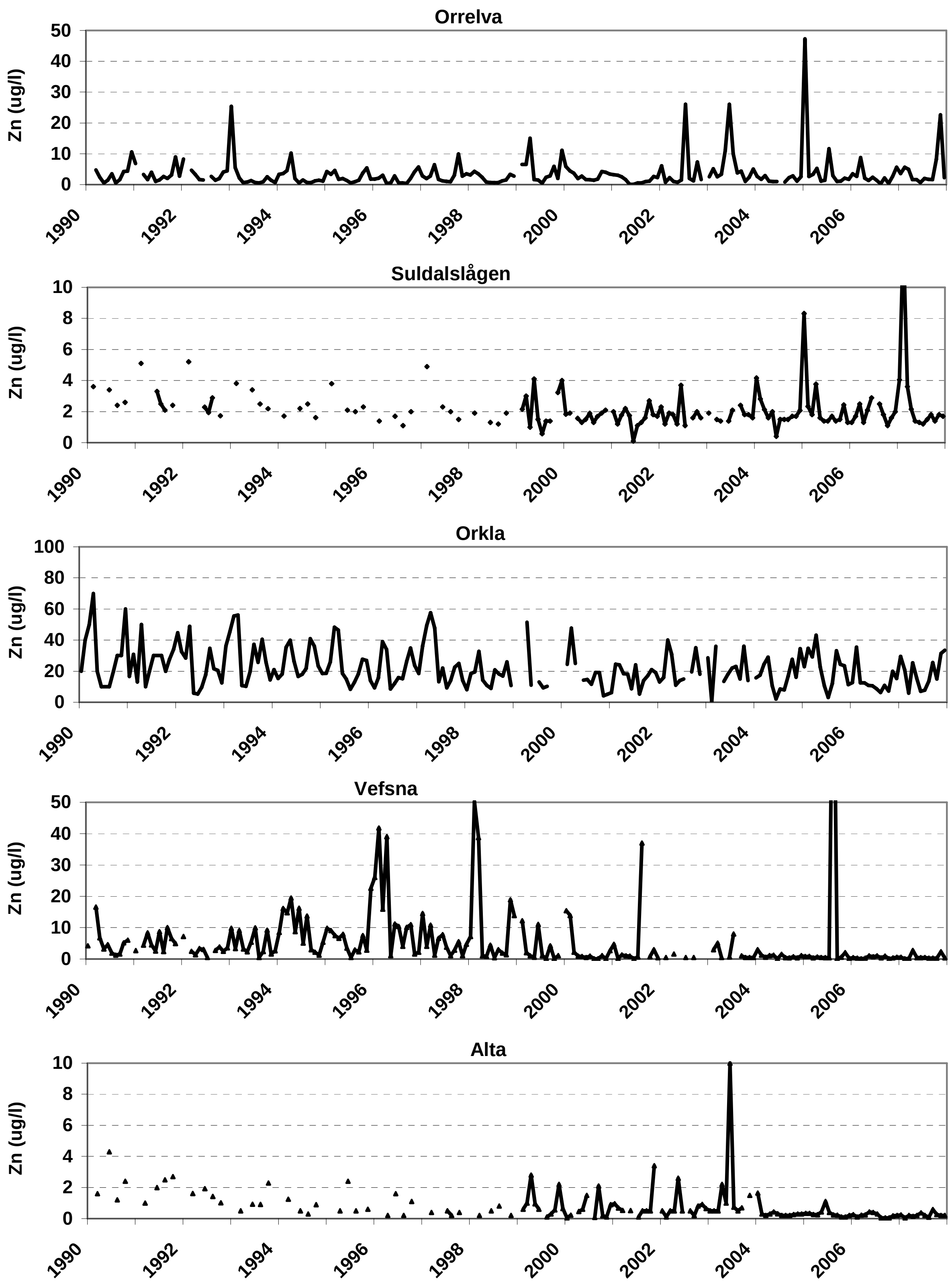


Figure A-V-12b. Monthly concentrations of <u>zinc</u> in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

Annex VI
Long-term trends in riverine loads. Complimentary figures to Chapter 7.

The figures cover the following substances in consecutive order:

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

The figures in this Annex are complimentary to Chapter 7.

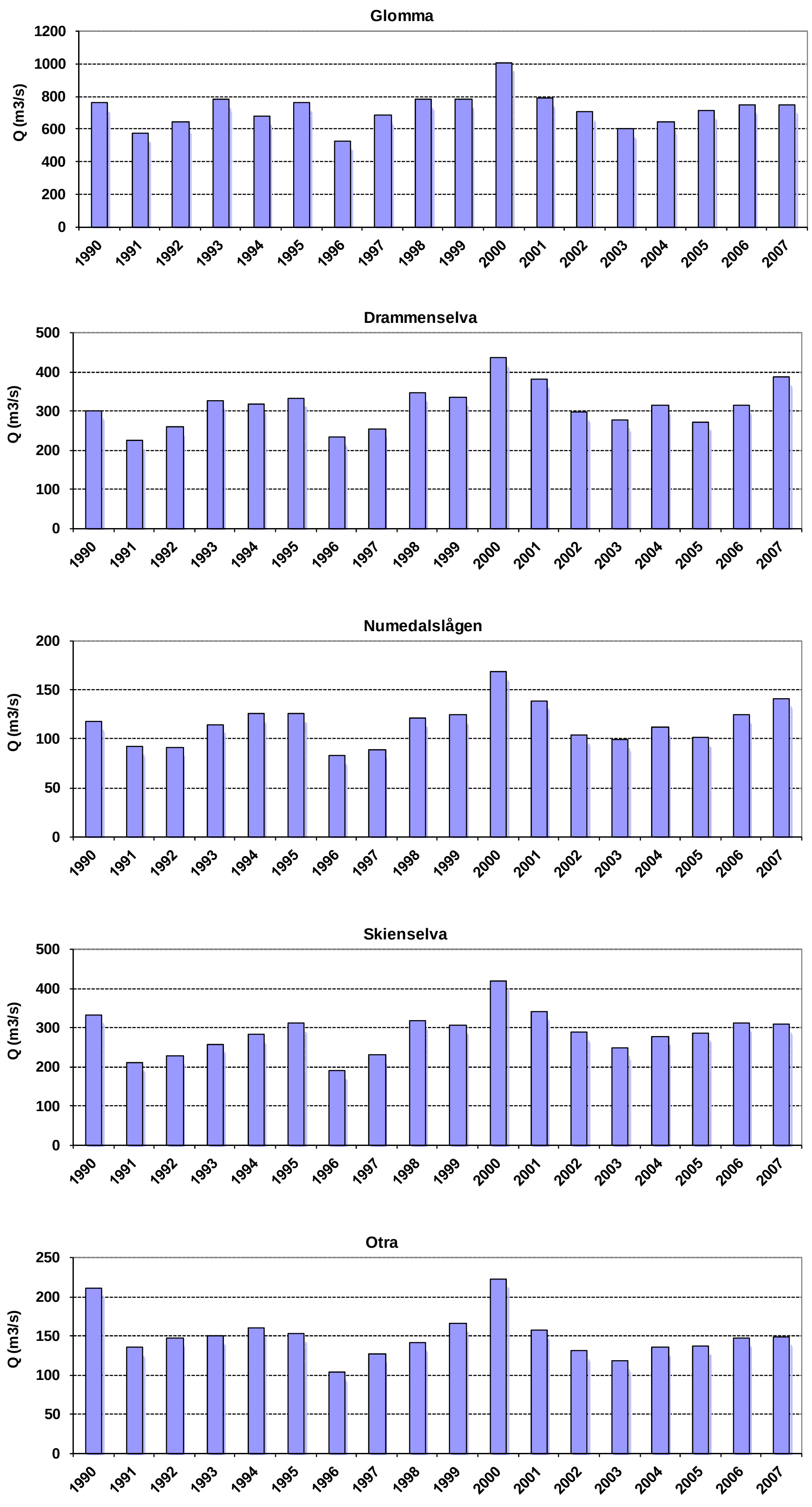


Figure A-VI-1a. Annual water discharge in 5 main rivers to Skagerak in Norway, 1990-2007.

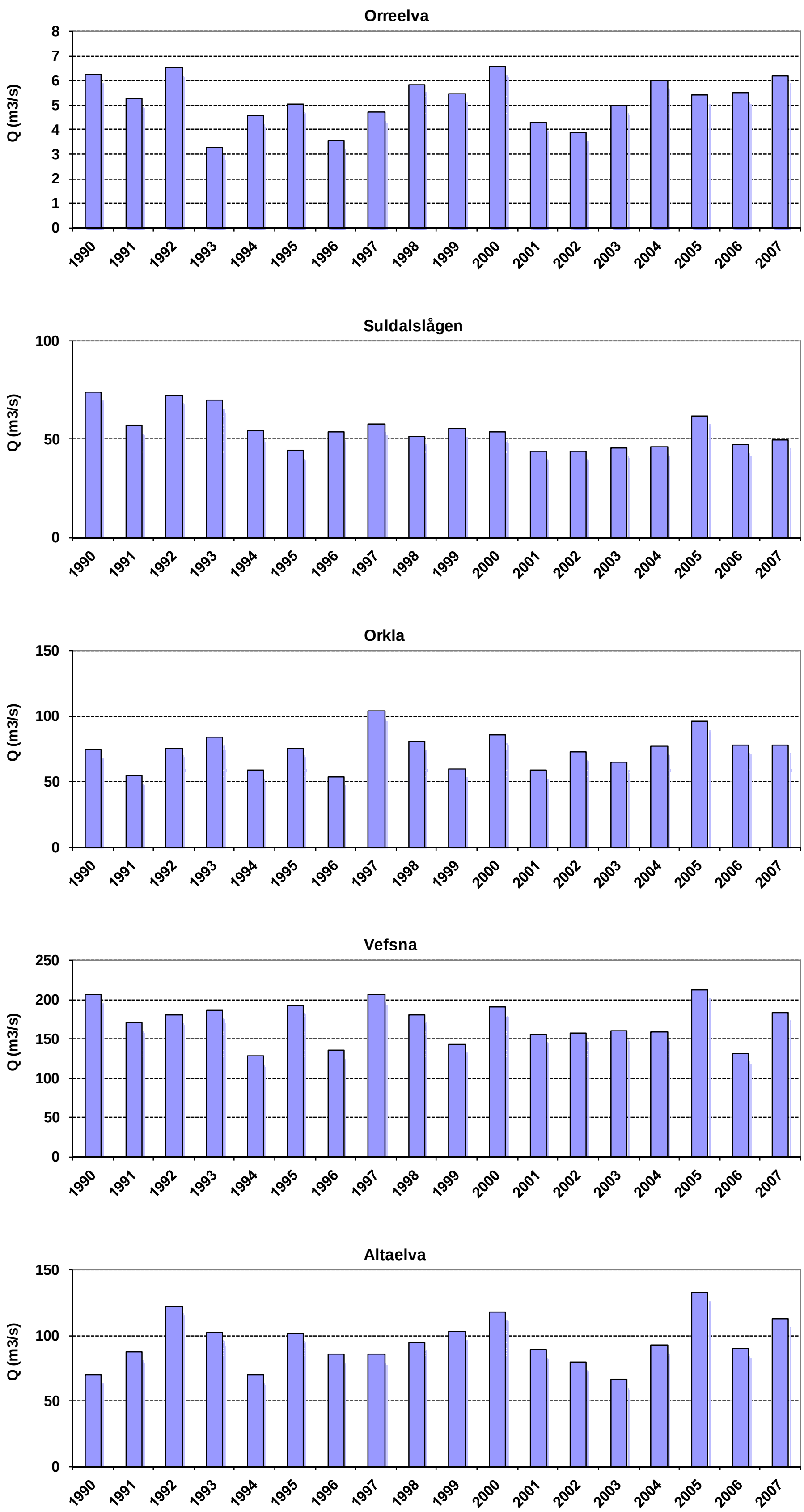
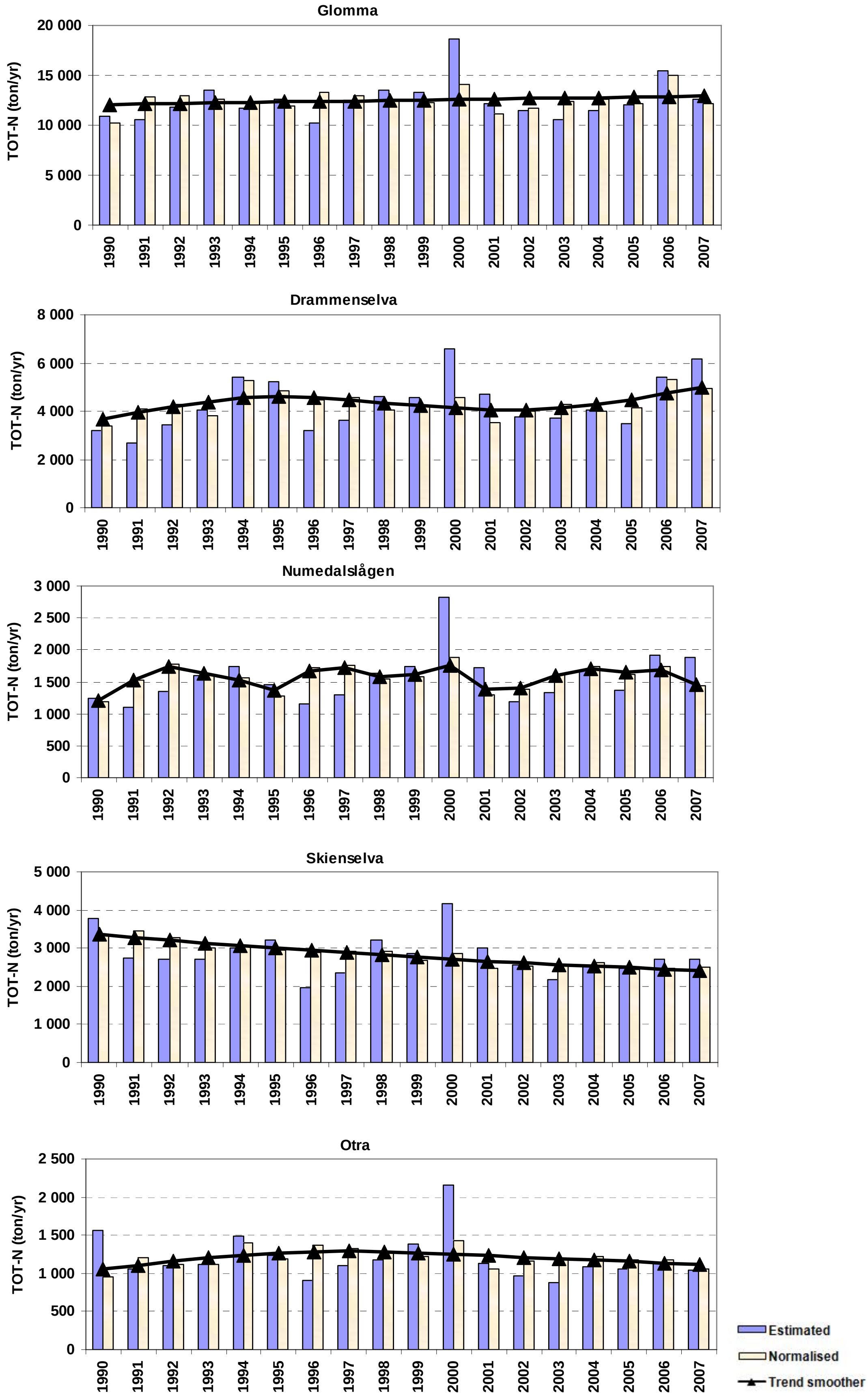


Figure A-VI-1b. Annual water discharge in 5 main rivers to the North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.



FigureA-VI-2a. Estimated, flow-normalised and trend line for annual riverine loads of total nitrogen in the five main Norwegian Skagerak rivers, 1990-2007.

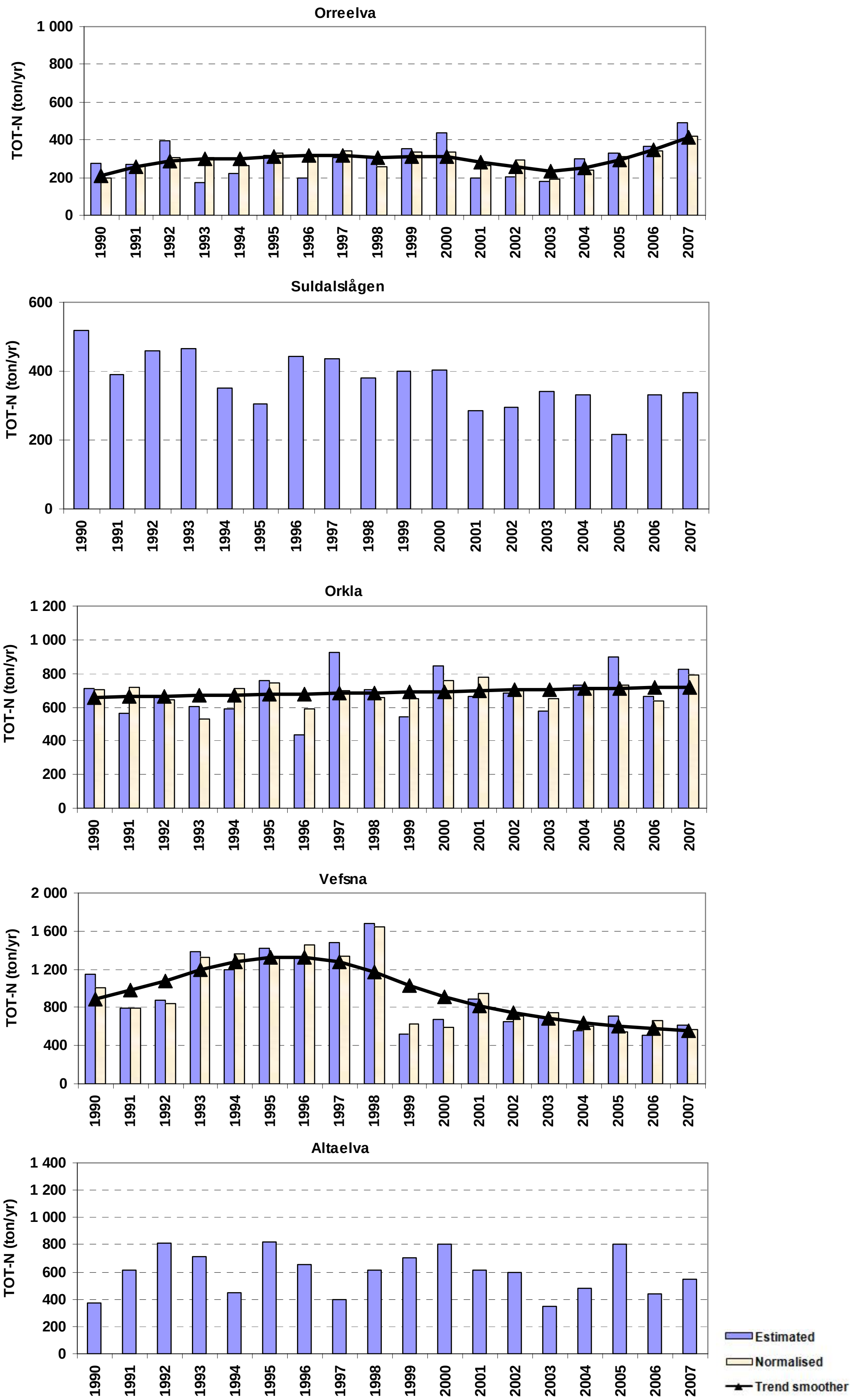


Figure A-VI-2b. Estimated, flow-normalised and trend line for annual riverine loads of total nitrogen in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

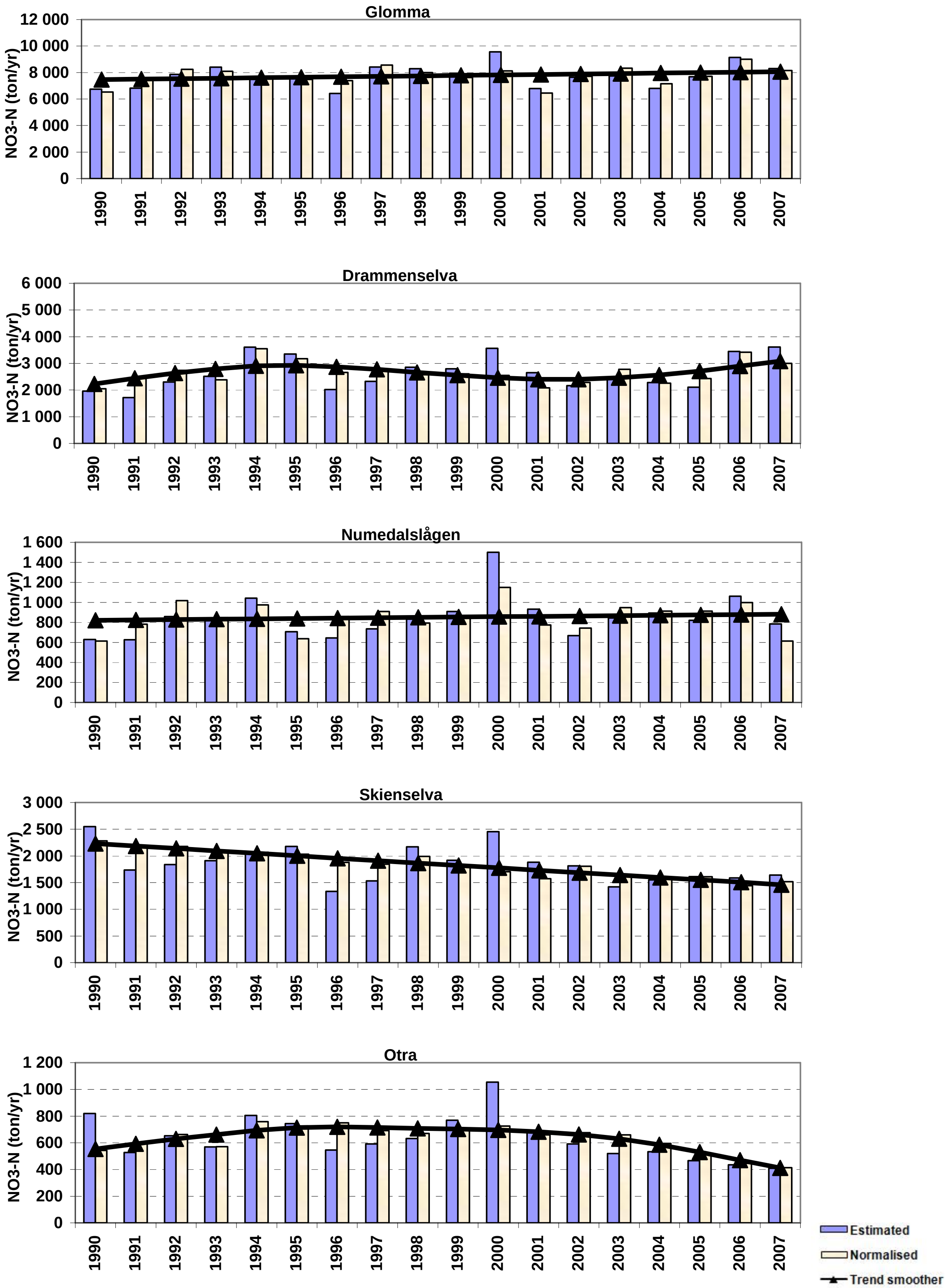


Figure A-VI-3a. Estimated, flow-normalised and trend line for annual riverine loads of *__nitrate nitrogen__* *in the five main Norwegian Skagerak rivers, 1990-2007.*

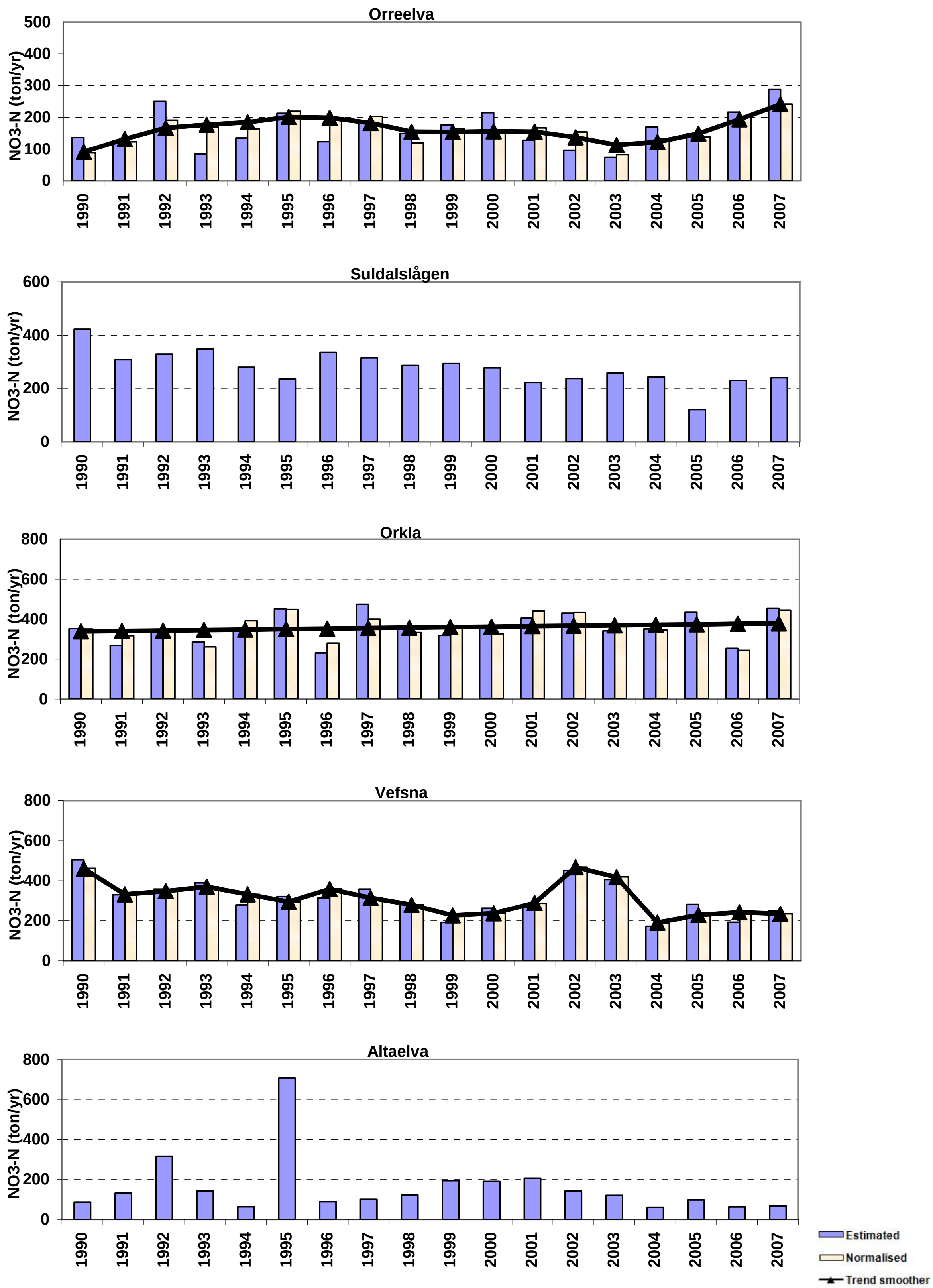


Figure A-VI-3b.Estimated, flow-normalised and trend line for annual riverine loads of nitrate nitrogen in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

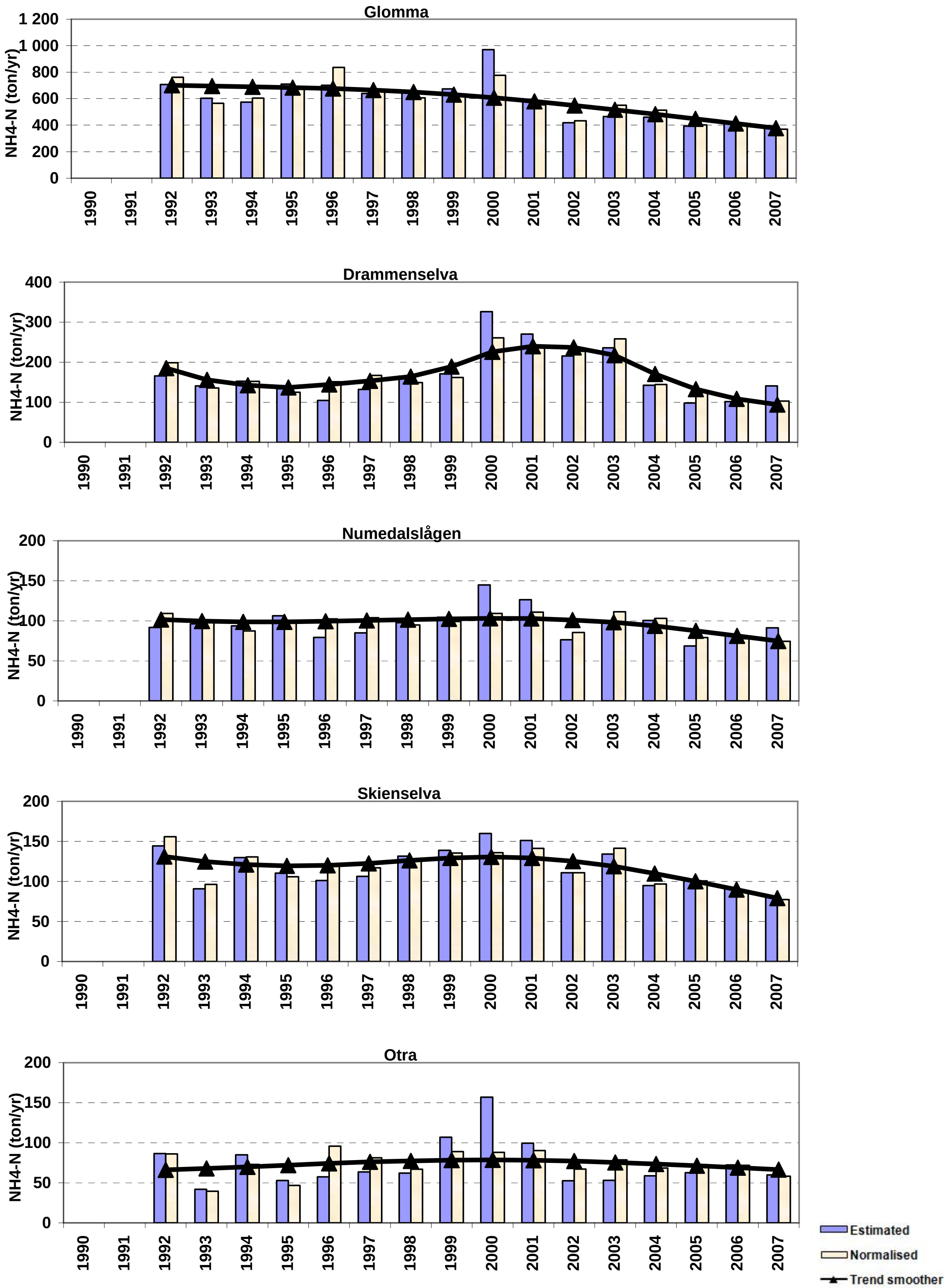


Figure A-VI-4a.Estimated, flow-normalised and trend line for annual riverine loads of NH_4-N in the five main Norwegian Skagerak rivers, 1990-2007.

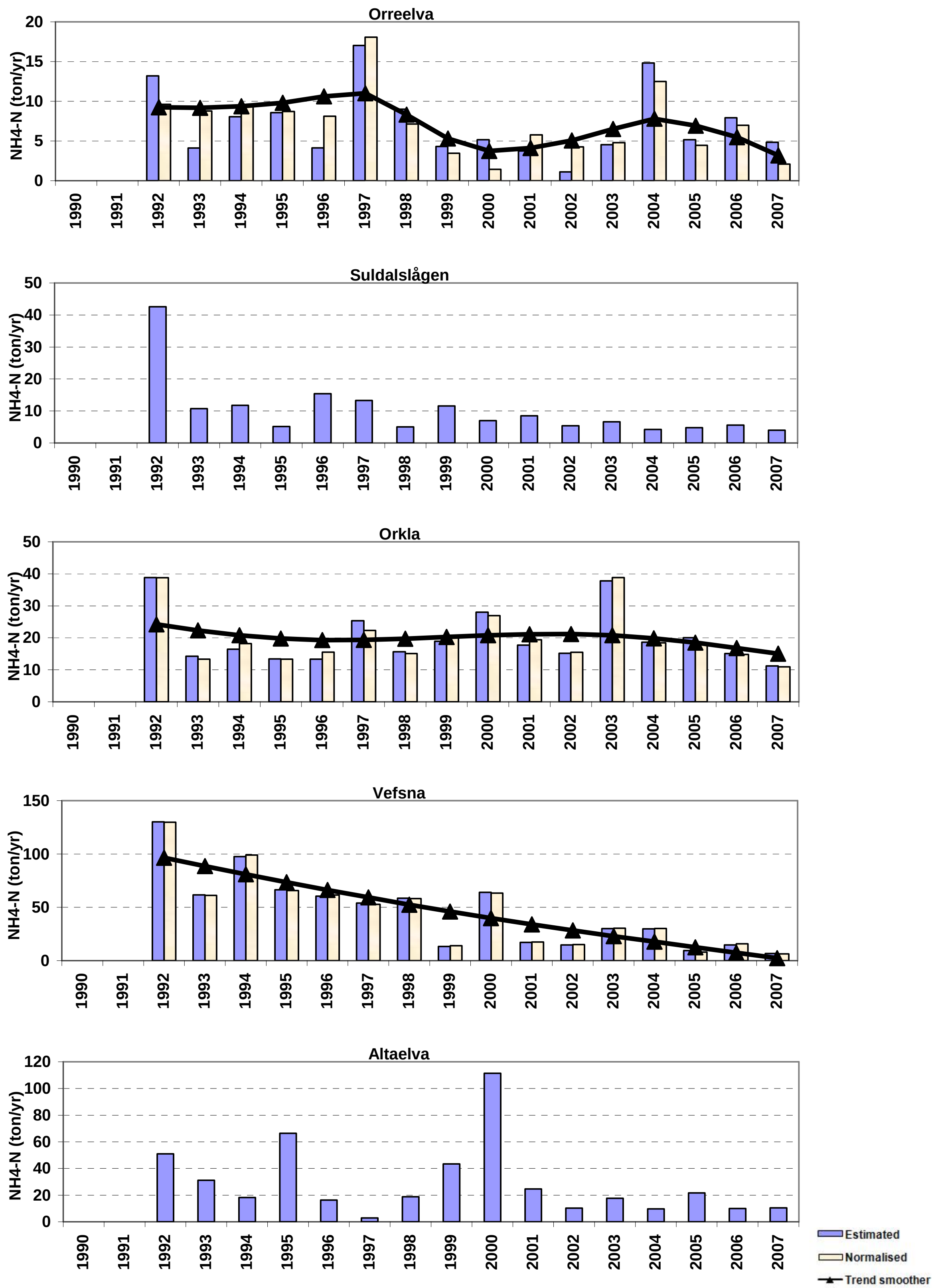


Figure A-VI-4b. Estimated, flow-normalised and trend line for annual riverine loads of NH_4-N in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

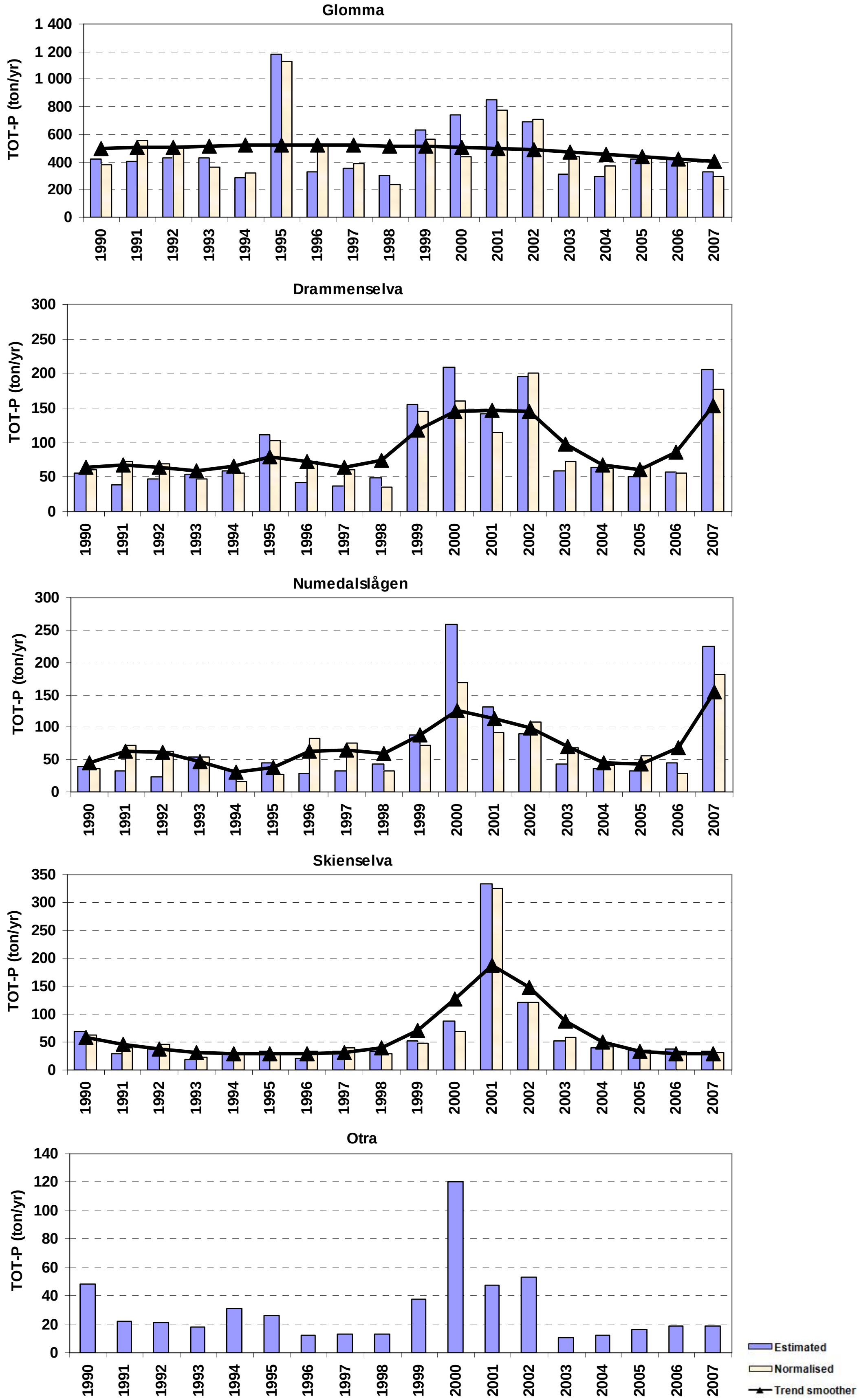


Figure A-VI-5a. Estimated, flow-normalised and trend line for annual riverine loads of total phosphorus in the five main Norwegian Skagerak rivers, 1990-2007.

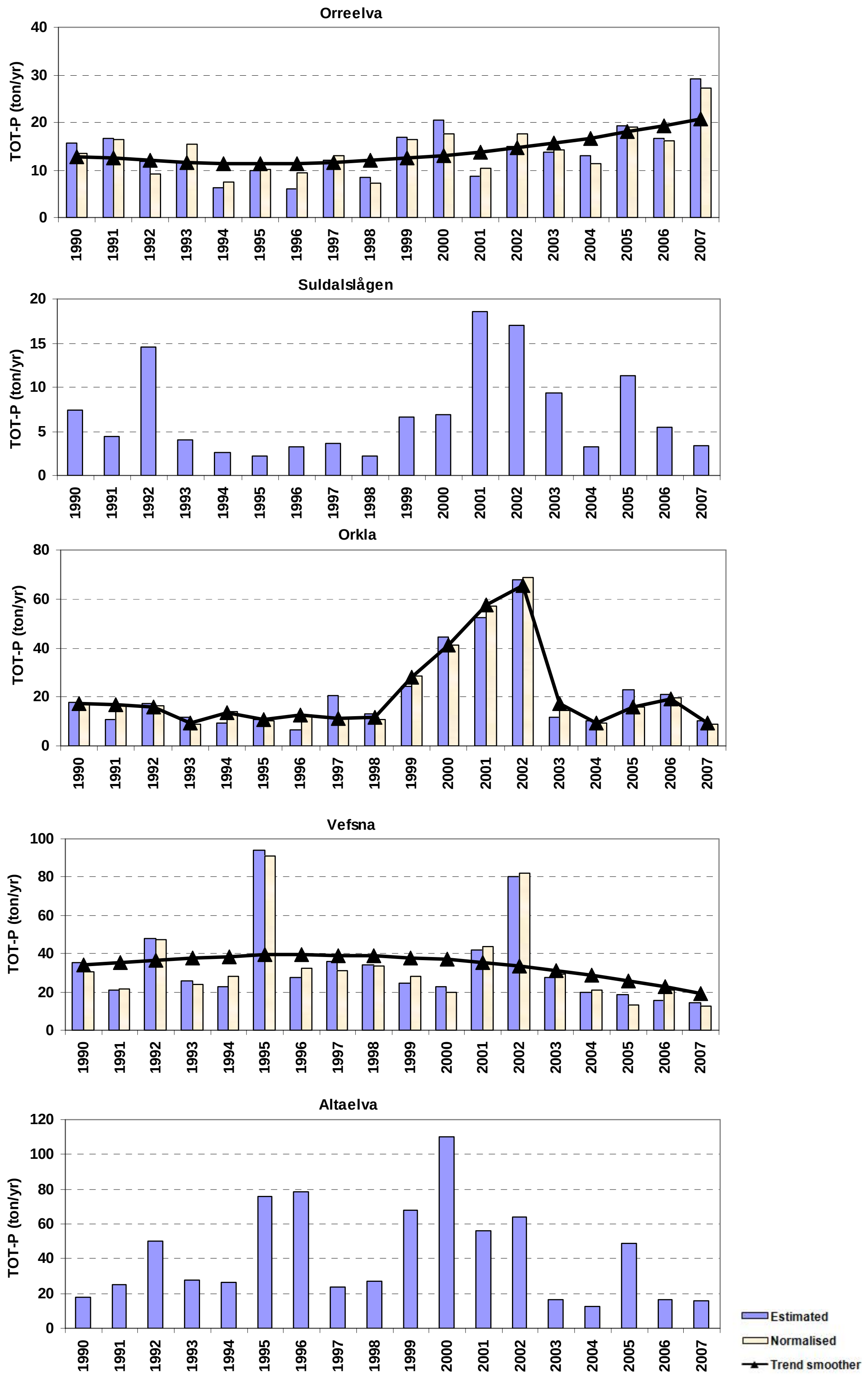


Figure A-VI- 5b. Estimated, flow-normalised and trend line for annual riverine loads of <u>total phosphorus</u> in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

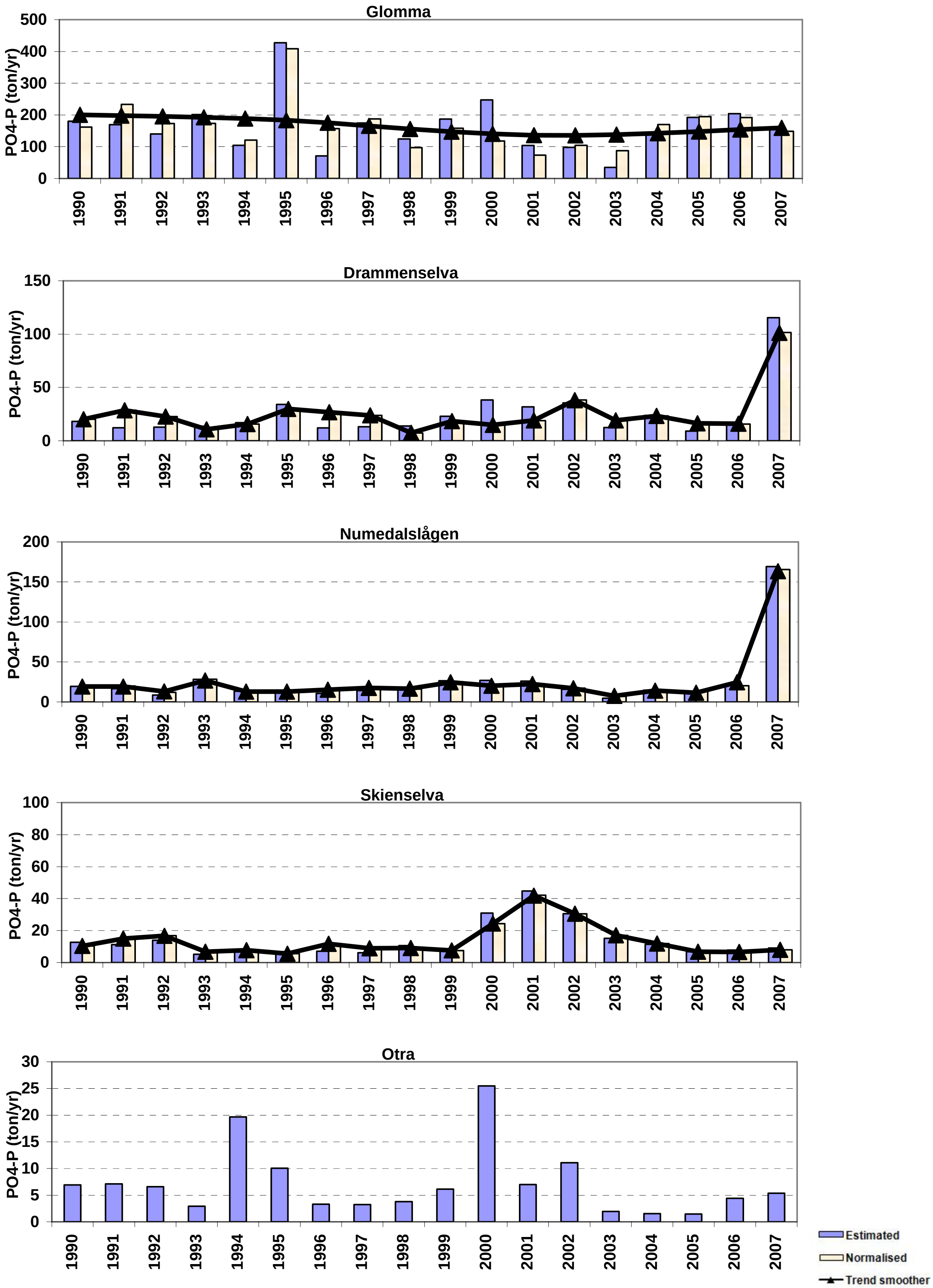


Figure A-VI-6a. Estimated, flow-normalised and trend line for annual riverine loads of PO4-P in the five main Norwegian Skagerak rivers, 1990-2007.

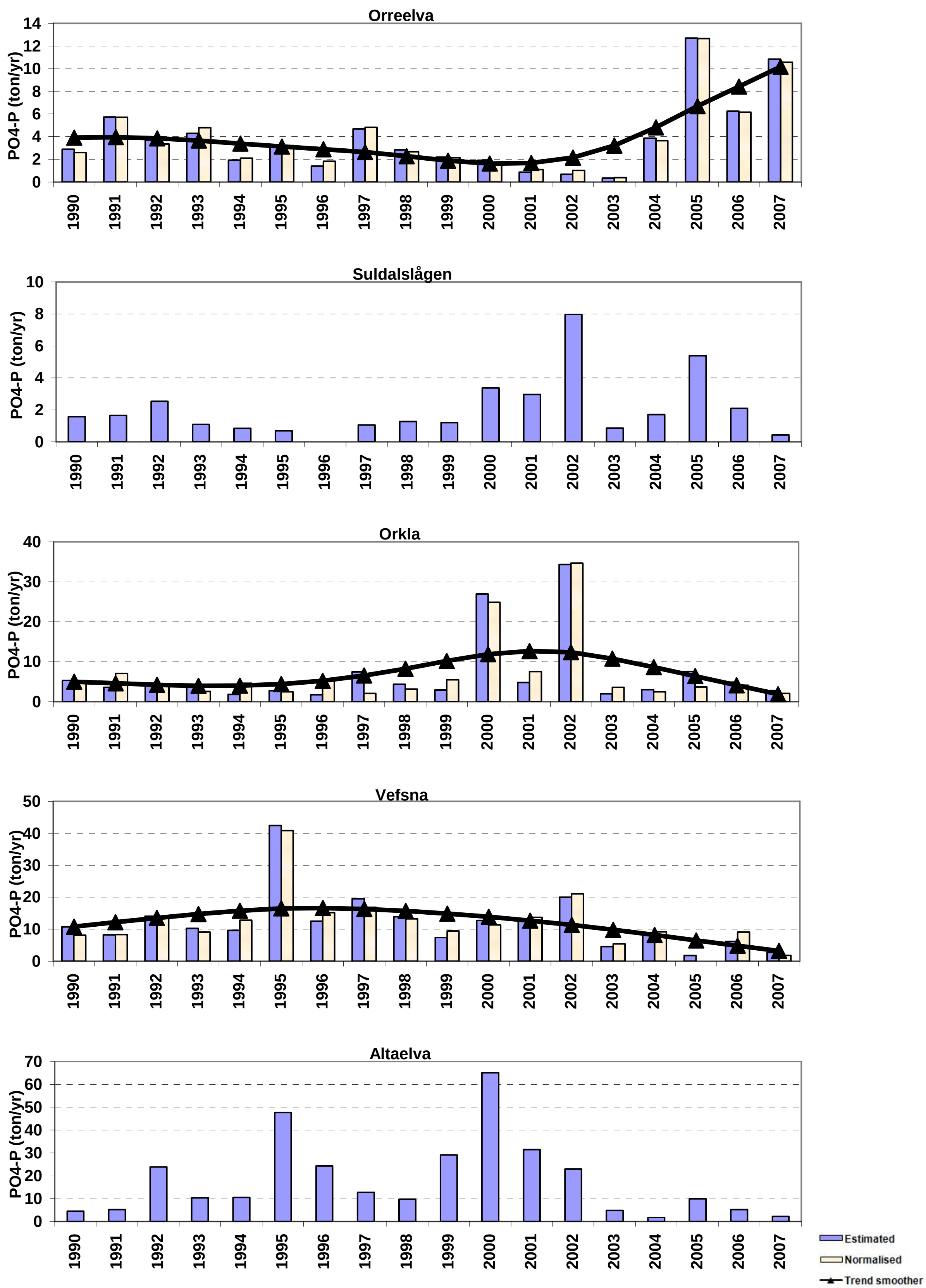


Figure A-VI-6b. Estimated, flow-normalised and trend line for annual riverine loads of $\underline{PO_4\text{-}P}$ *in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.*

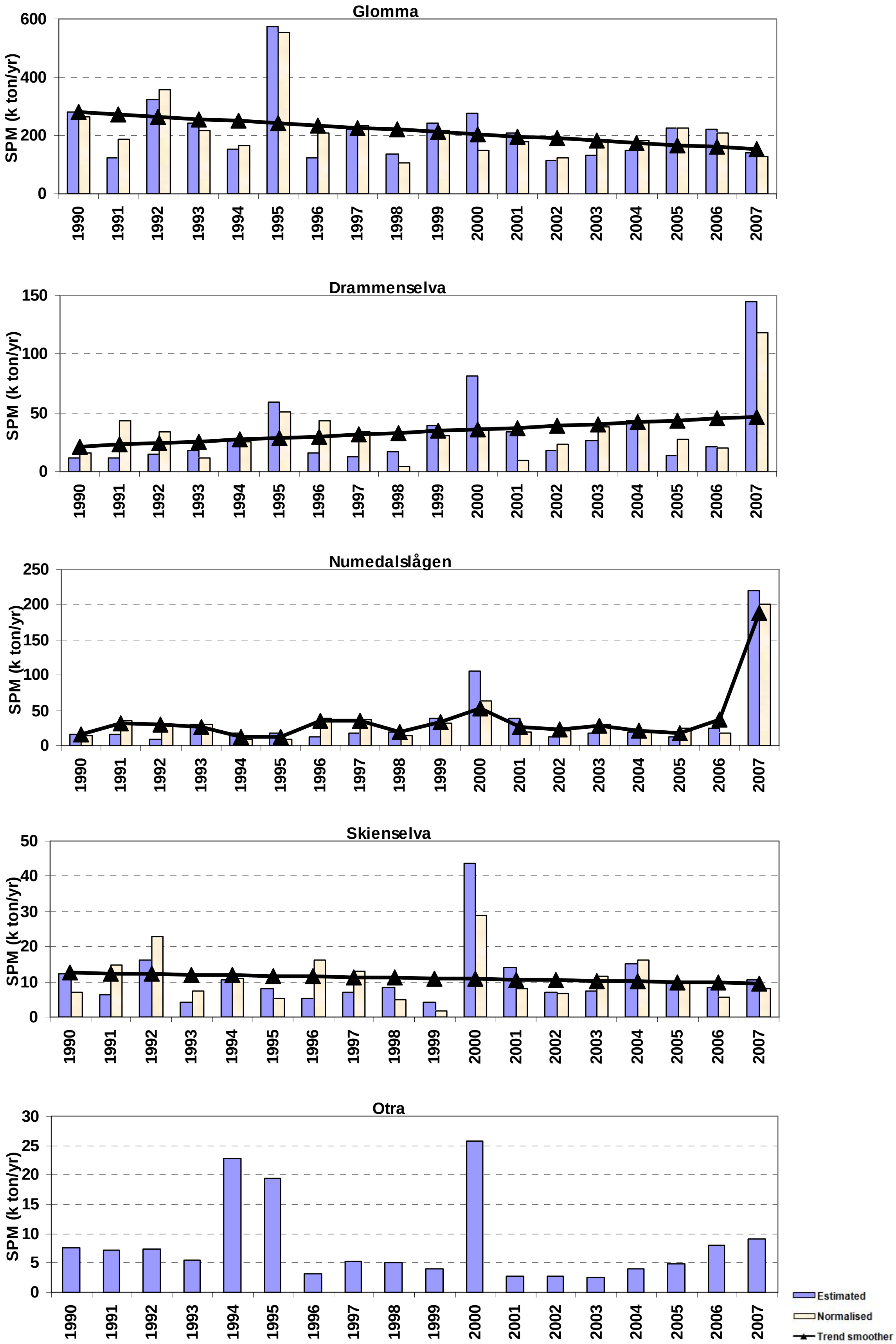


Figure A-VI-7a. Estimated, flow-normalised and trend line for annual riverine loads of *<u>suspended particulate matter</u>* *in in the five main Norwegian Skagerak rivers, 1990-2007.*

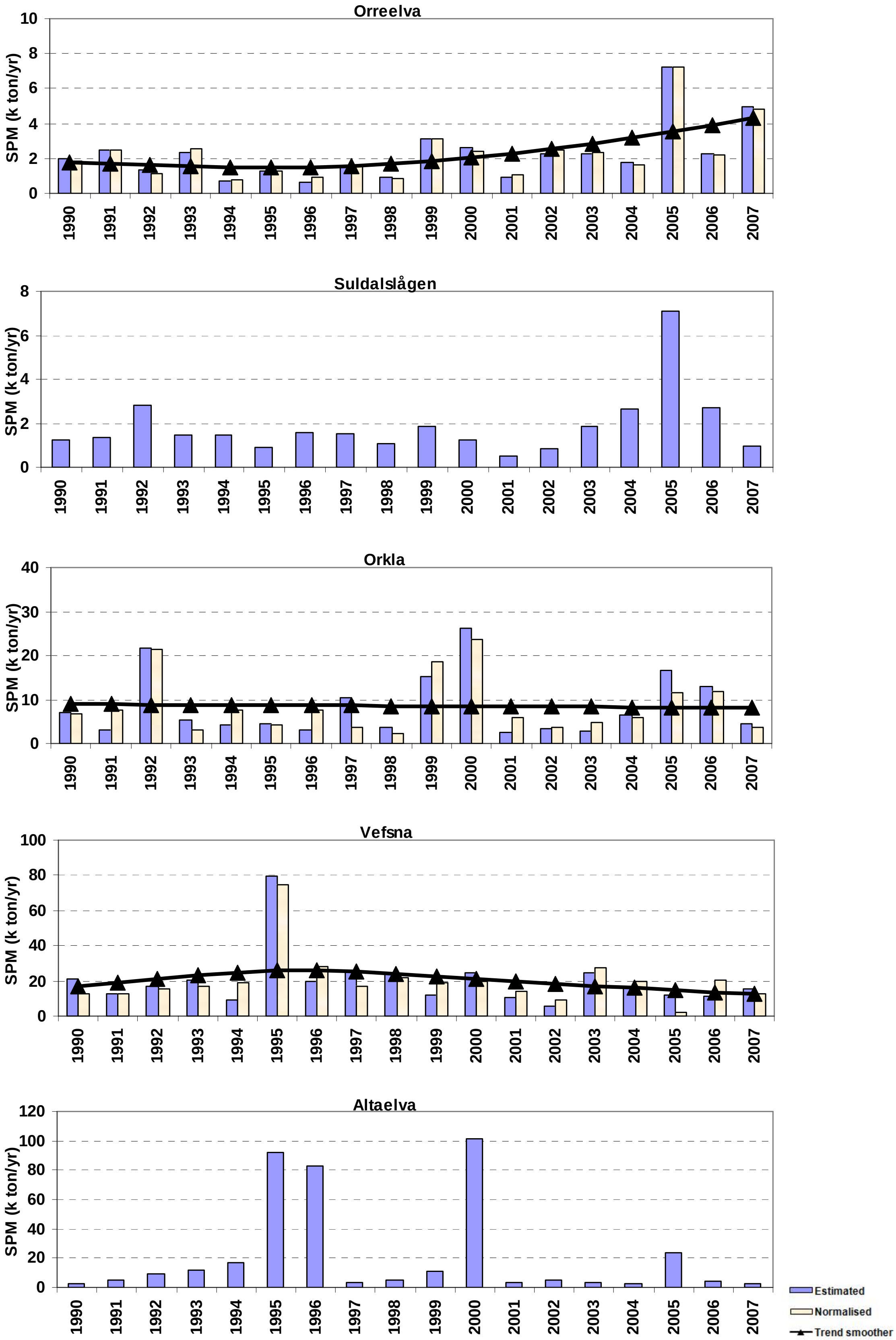


Figure A-VI-7b. Estimated, flow-normalised and trend line for annual riverine loads of suspended particulate matter in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

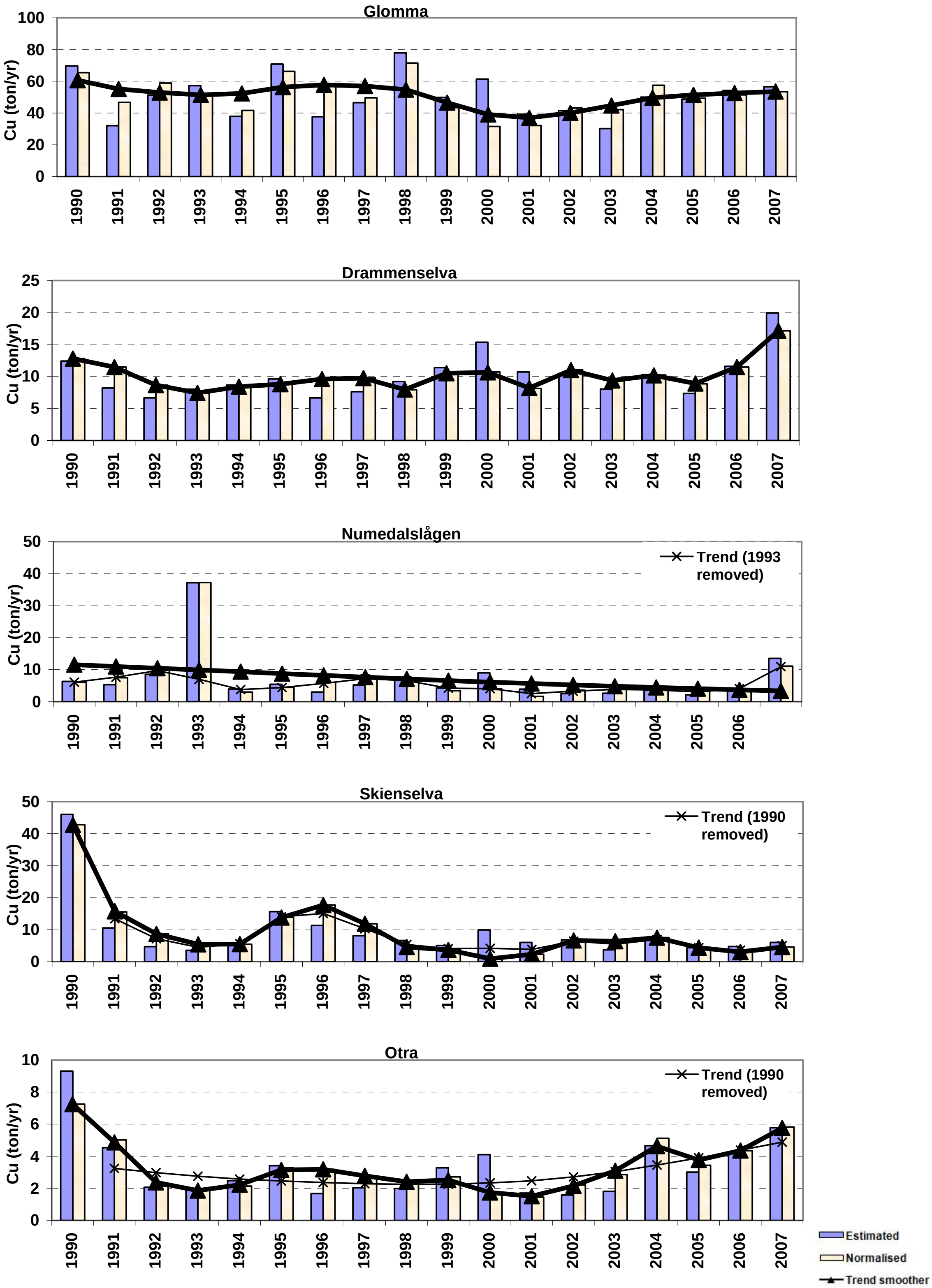


Figure A-VI-8a.Estimated, flow-normalised and trend line for annual riverine loads of <u>*Copper*</u> *in the five main Norwegian Skagerak rivers, 1990-2007.*

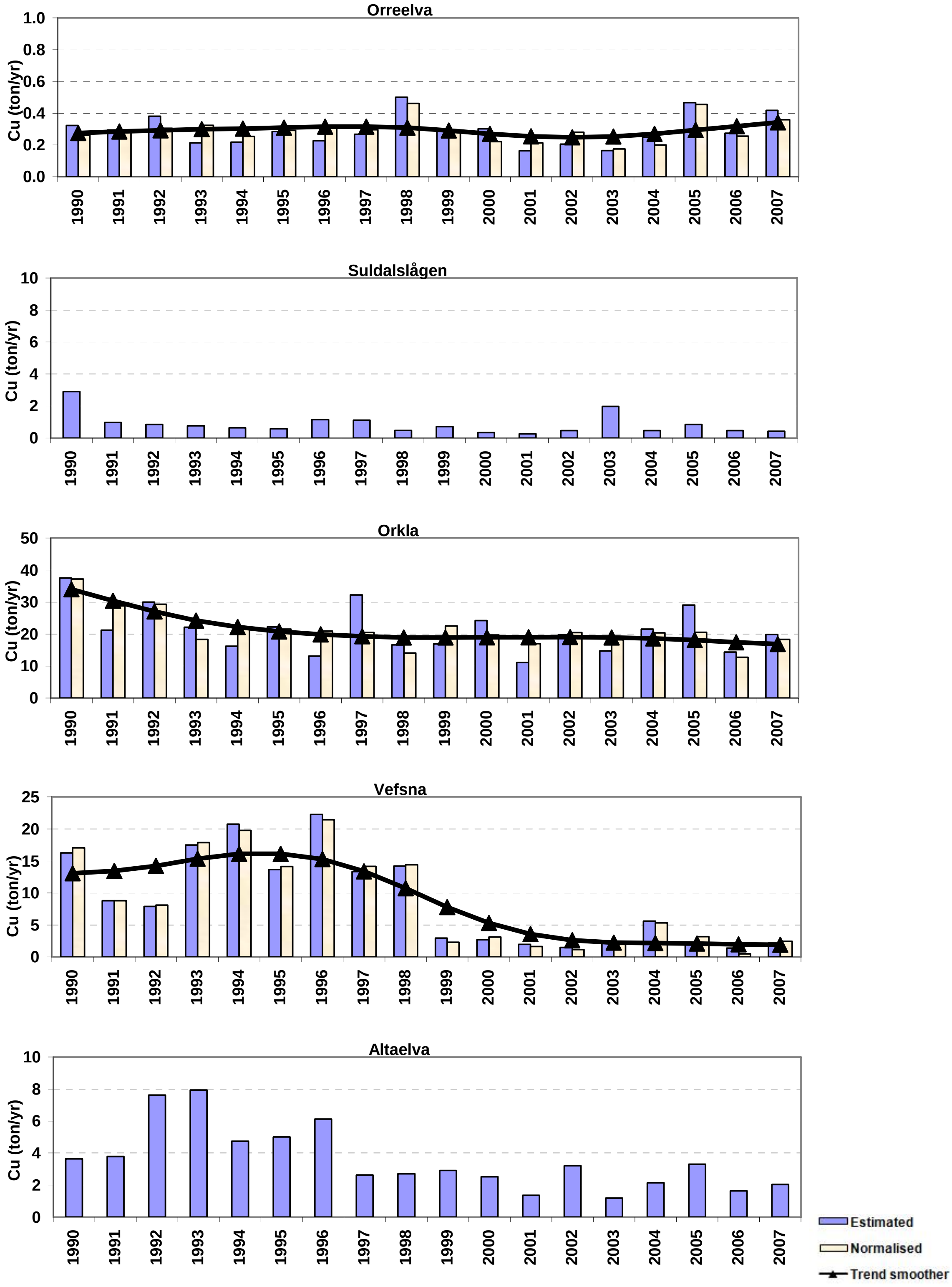


Figure A-VI-8b. Estimated, flow-normalised and trend line for annual riverine loads of *<u>Copper</u>* *in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.*

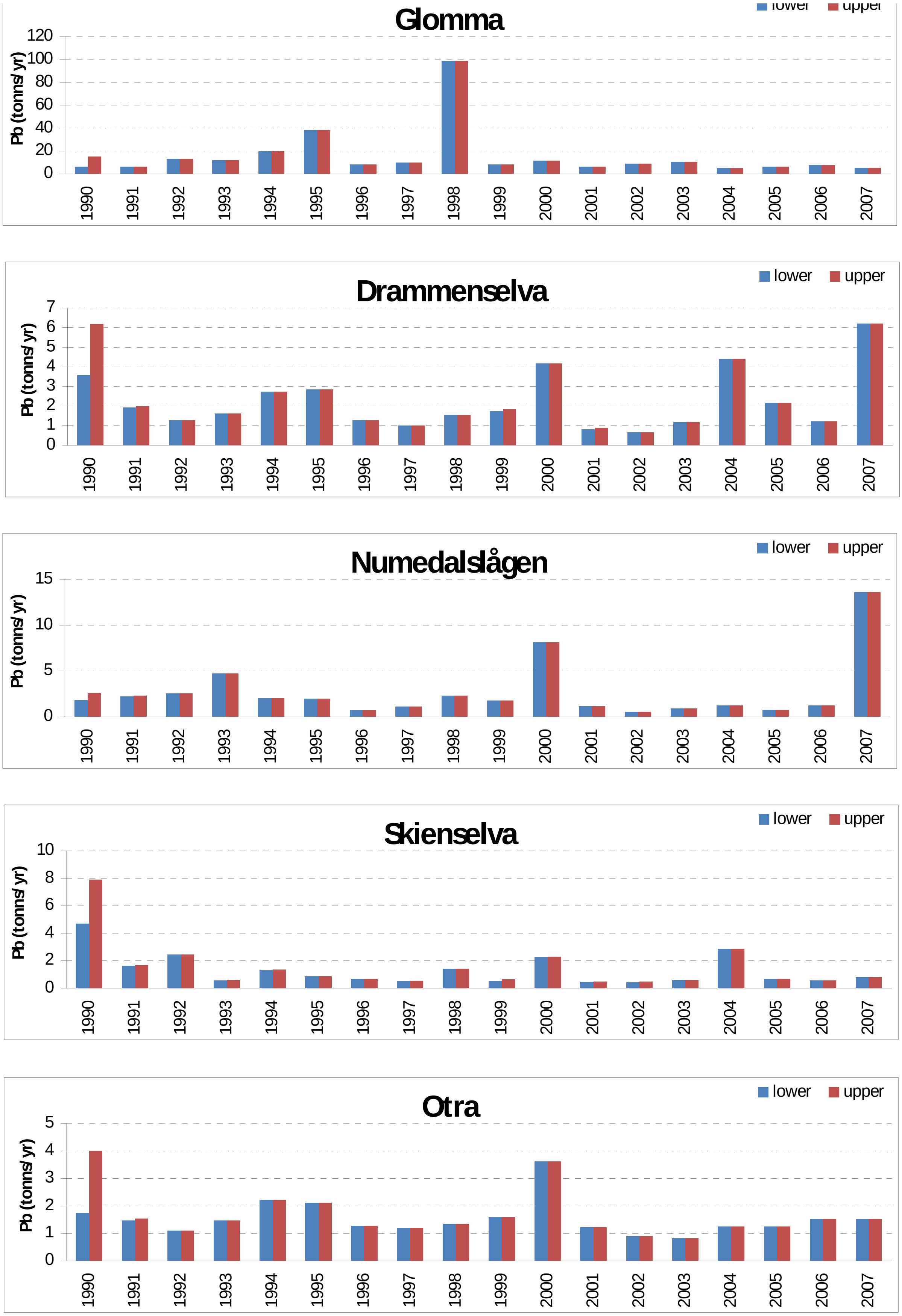


Figure A-VI-9a. Annual riverine loads (upper and lower estimates) of <u>Lead</u> in the five main Skagerak rivers in Norway, 1990-2007.

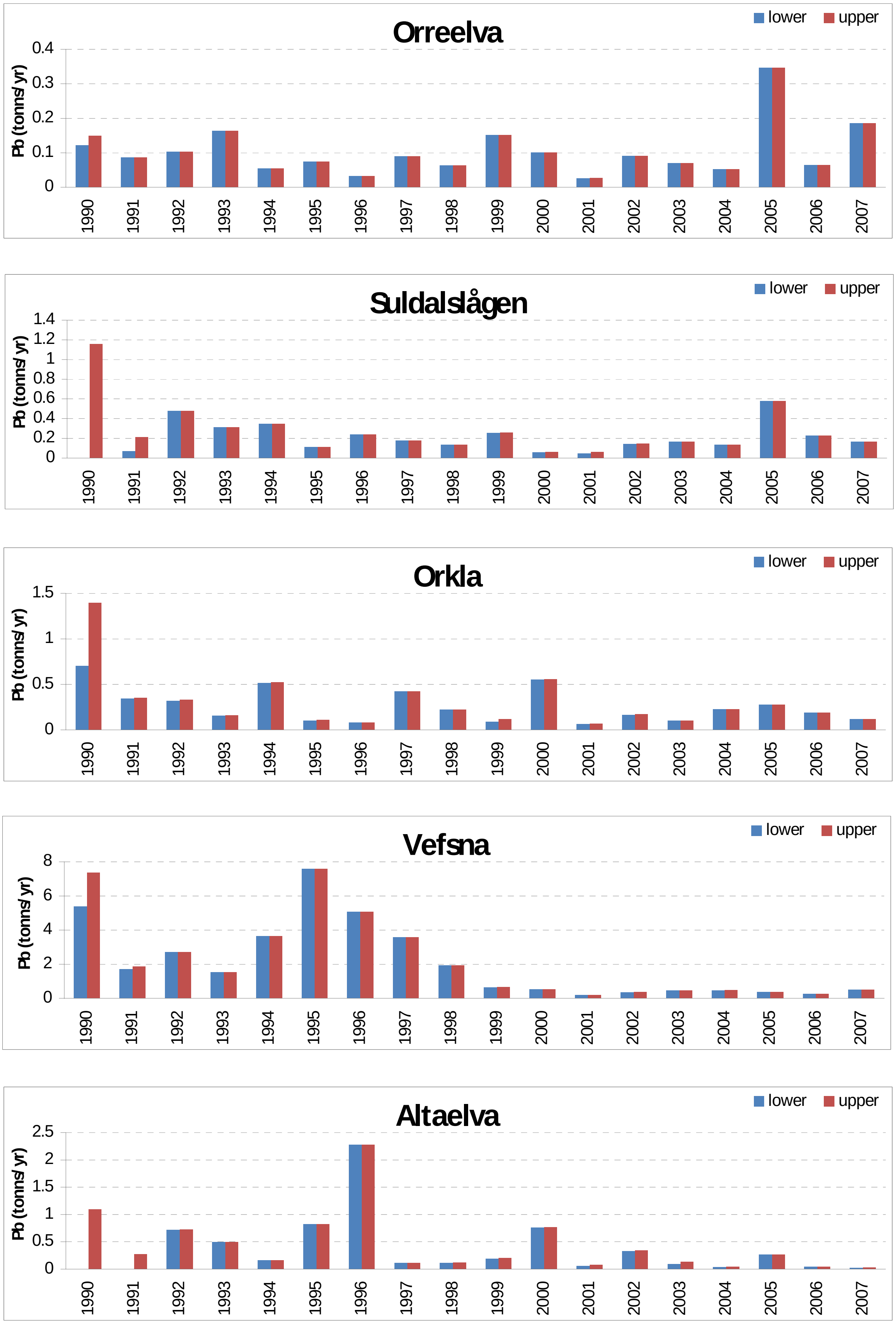


Figure A-VI-9b.Annual riverine loads (upper and lowe estimates) of Lead in the in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

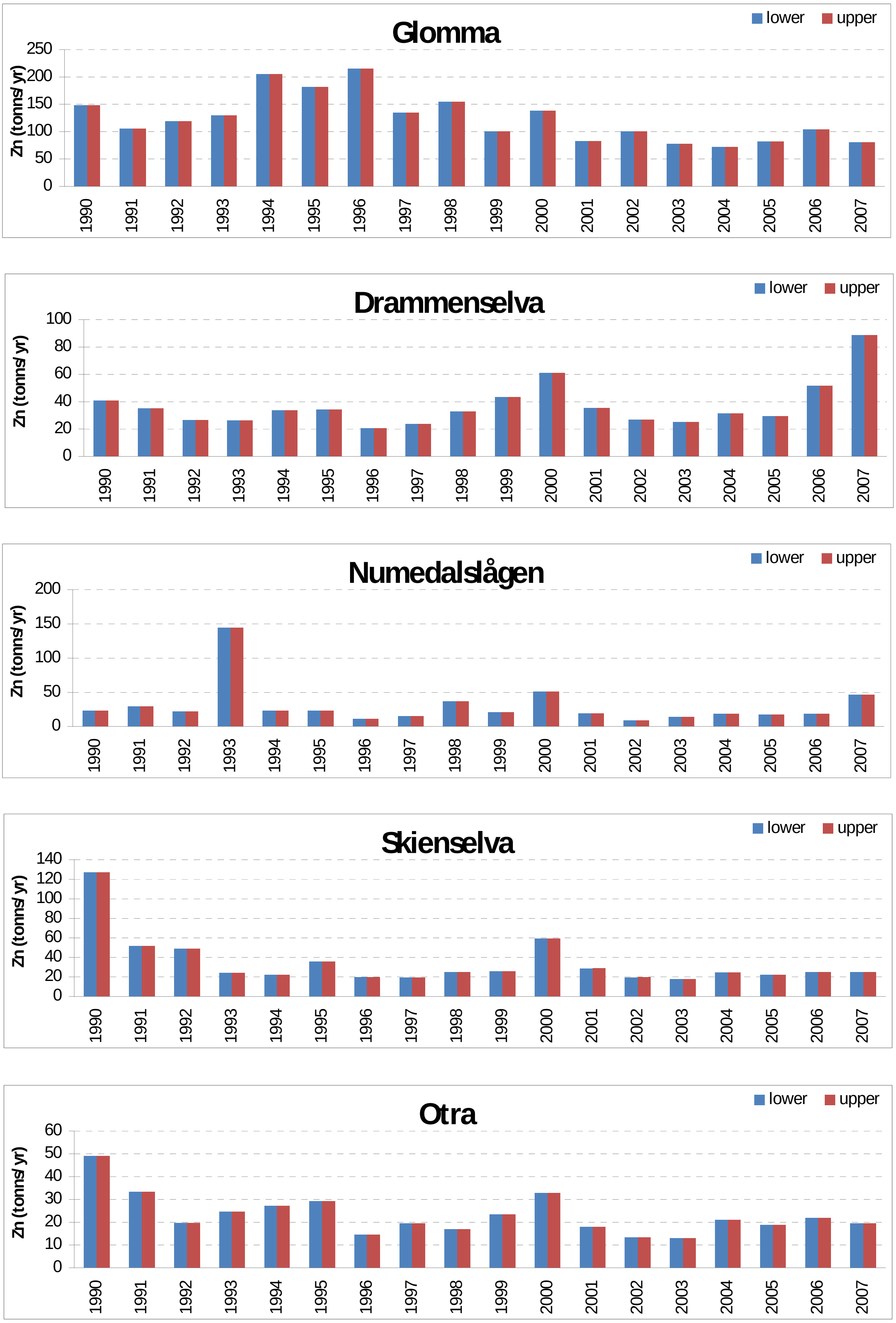


Figure A-VI-10a. Annual riverine loads (upper and lower estimates) of Zinc in the five main Skagerak rivers in Norway, 1990-2007.

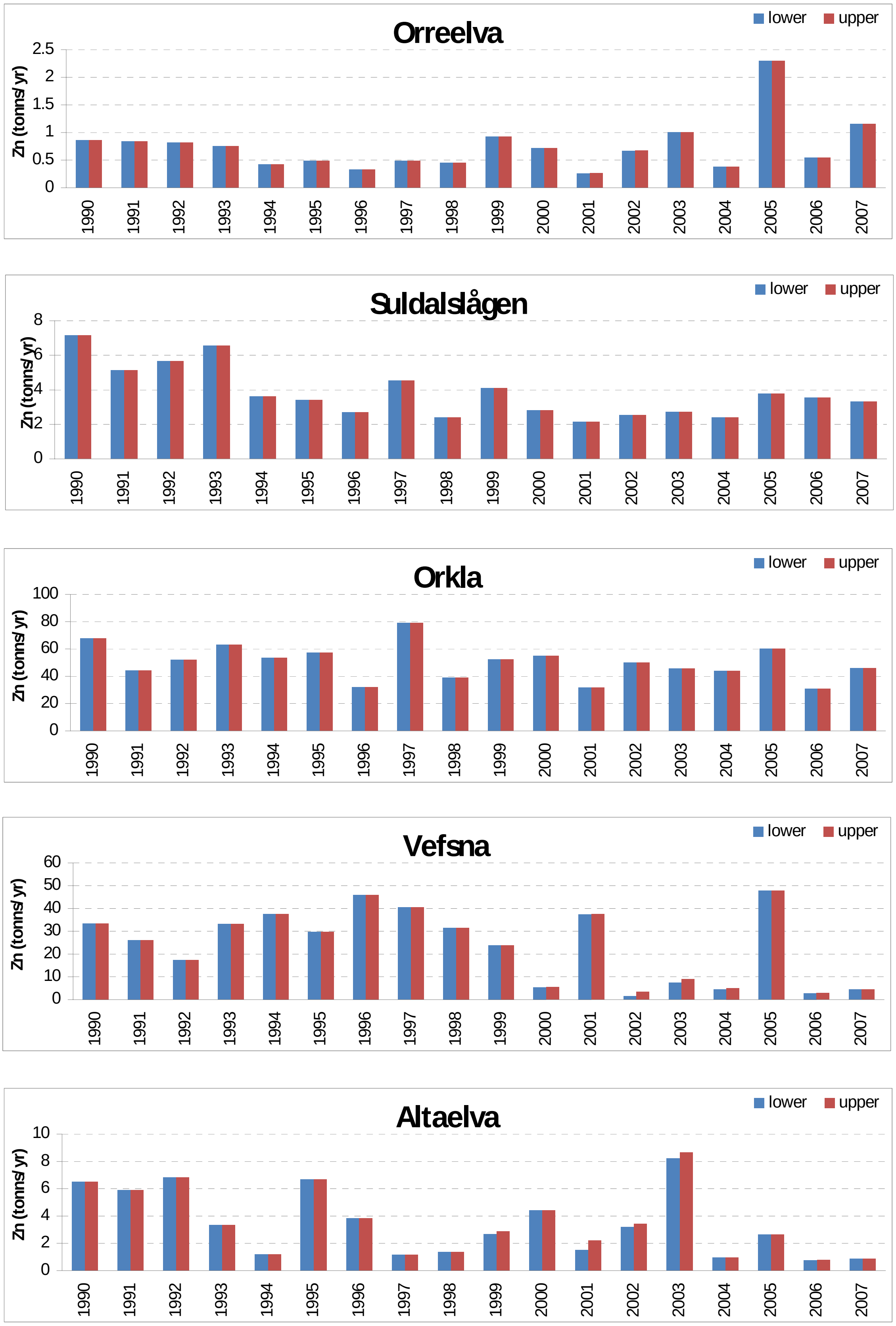


Figure A-VI-10b.Annual riverine loads (upper and lowe estimates) of <u>Zinc</u> in the in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

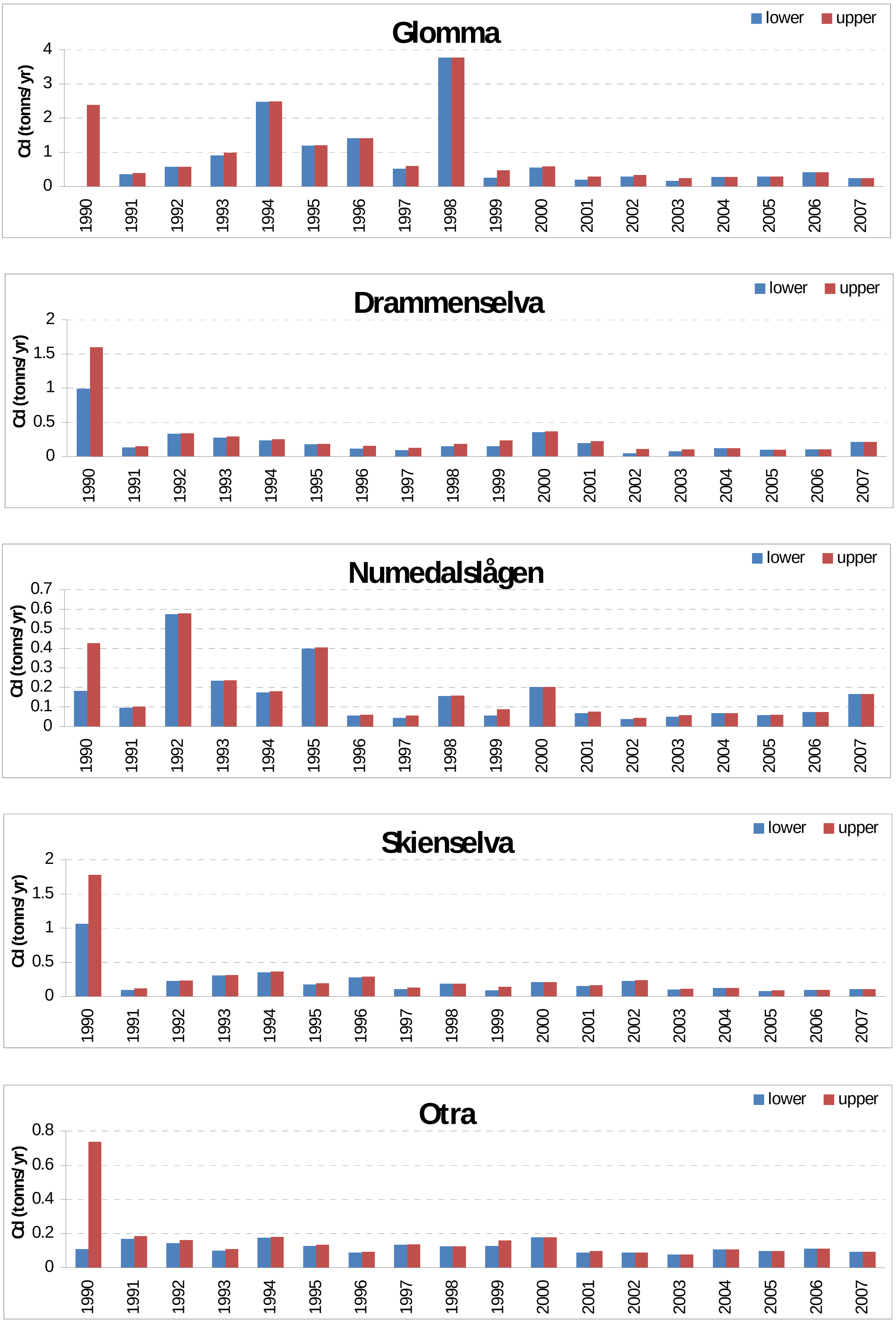
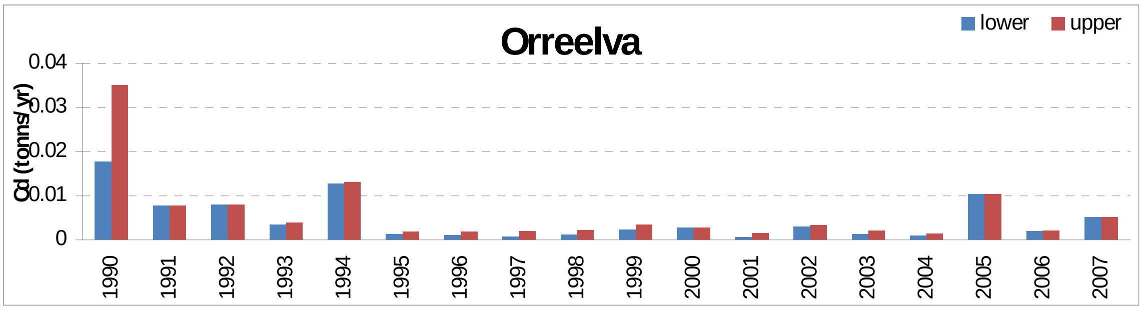
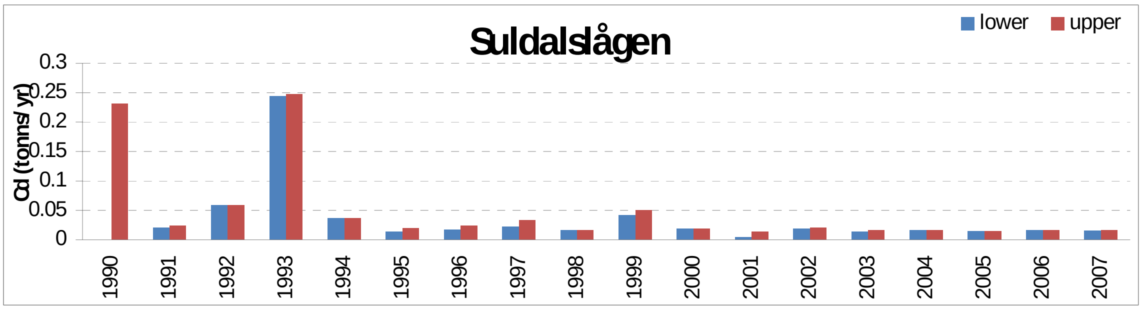
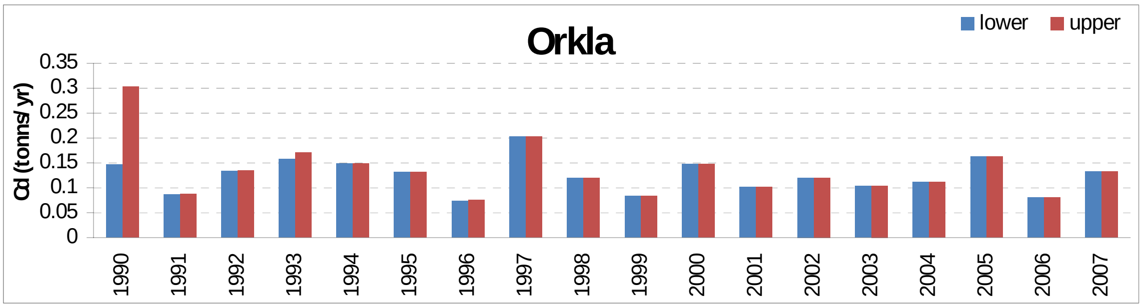
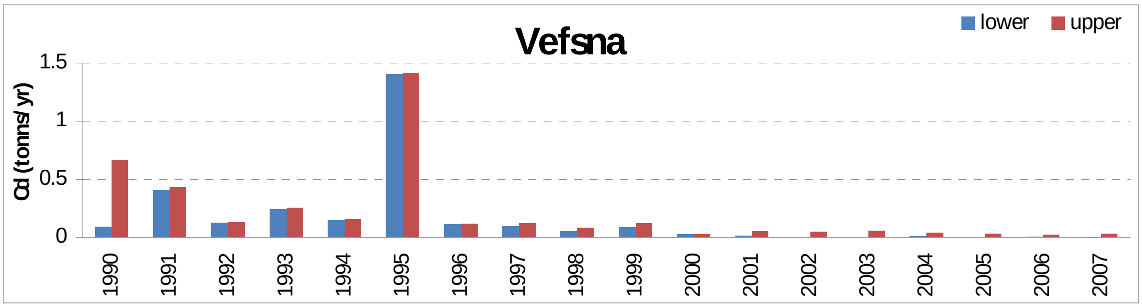


Figure A-VI-11a. Annual riverine loads (upper and lower estimates) of <u>Cadmium</u> in the five main Skagerak rivers in Norway, 1990-2007.









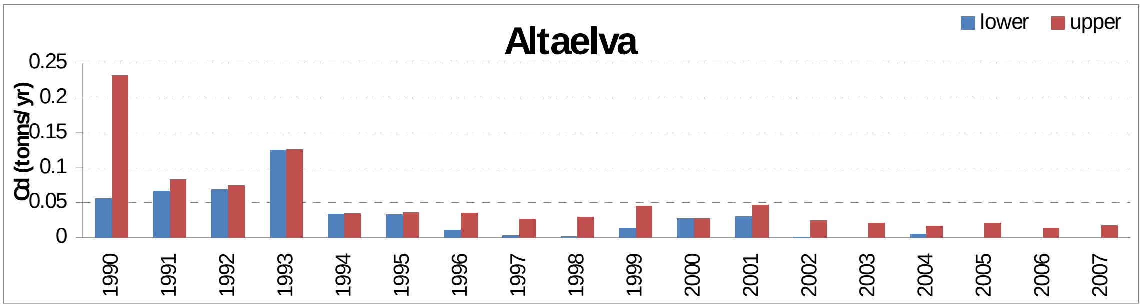


Figure A-VI-11b. Annual riverine loads (upper and lowe estimates) of Cadmium in the in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

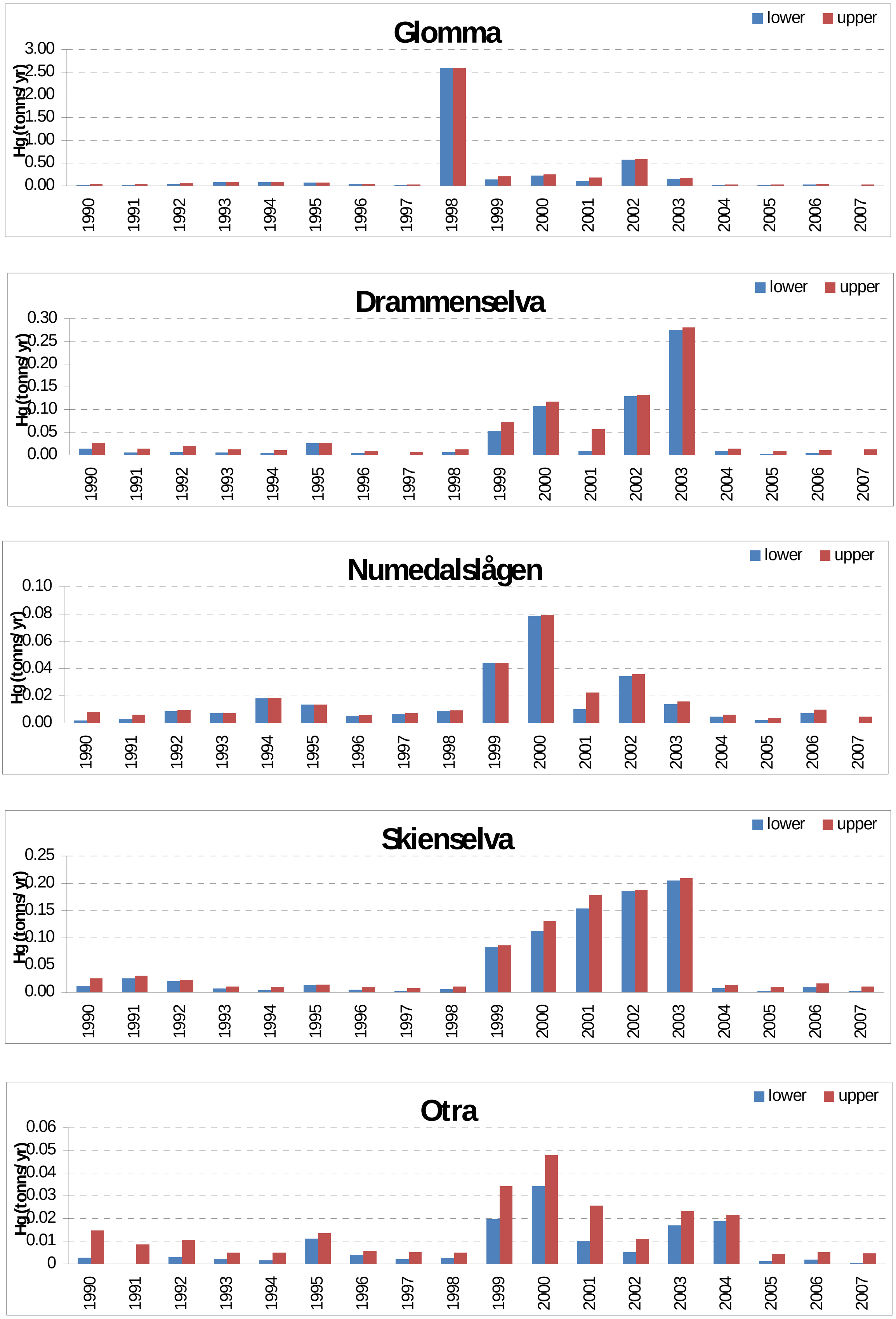


Figure A-VI-12a. Annual riverine loads (upper and lower estimates) of <u>Mercury</u> in the five main Skagerak rivers in Norway, 1990-2007.

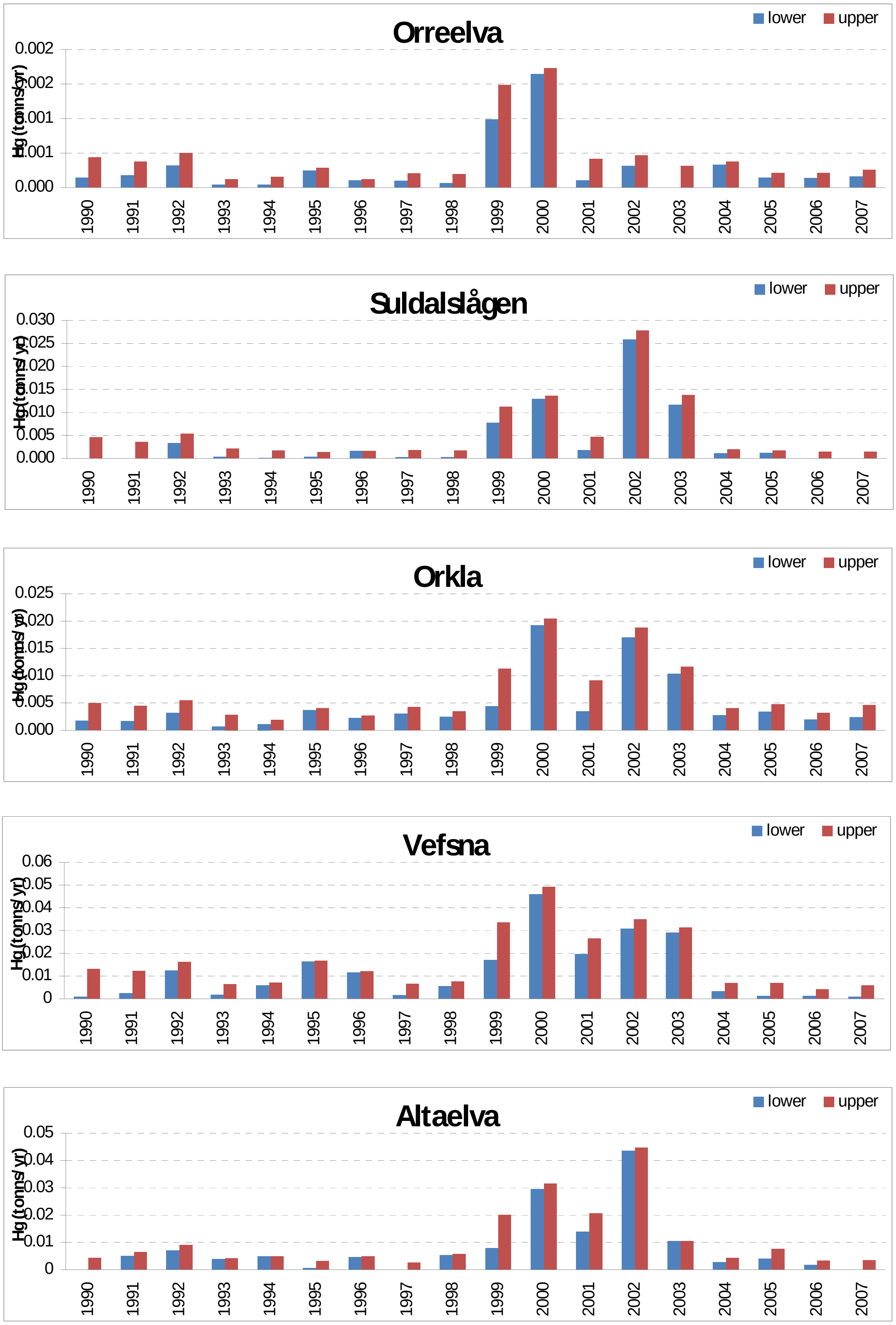


Figure A-VI-12b. Annual riverine loads (upper and lowe estimates) of Mercury in the in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

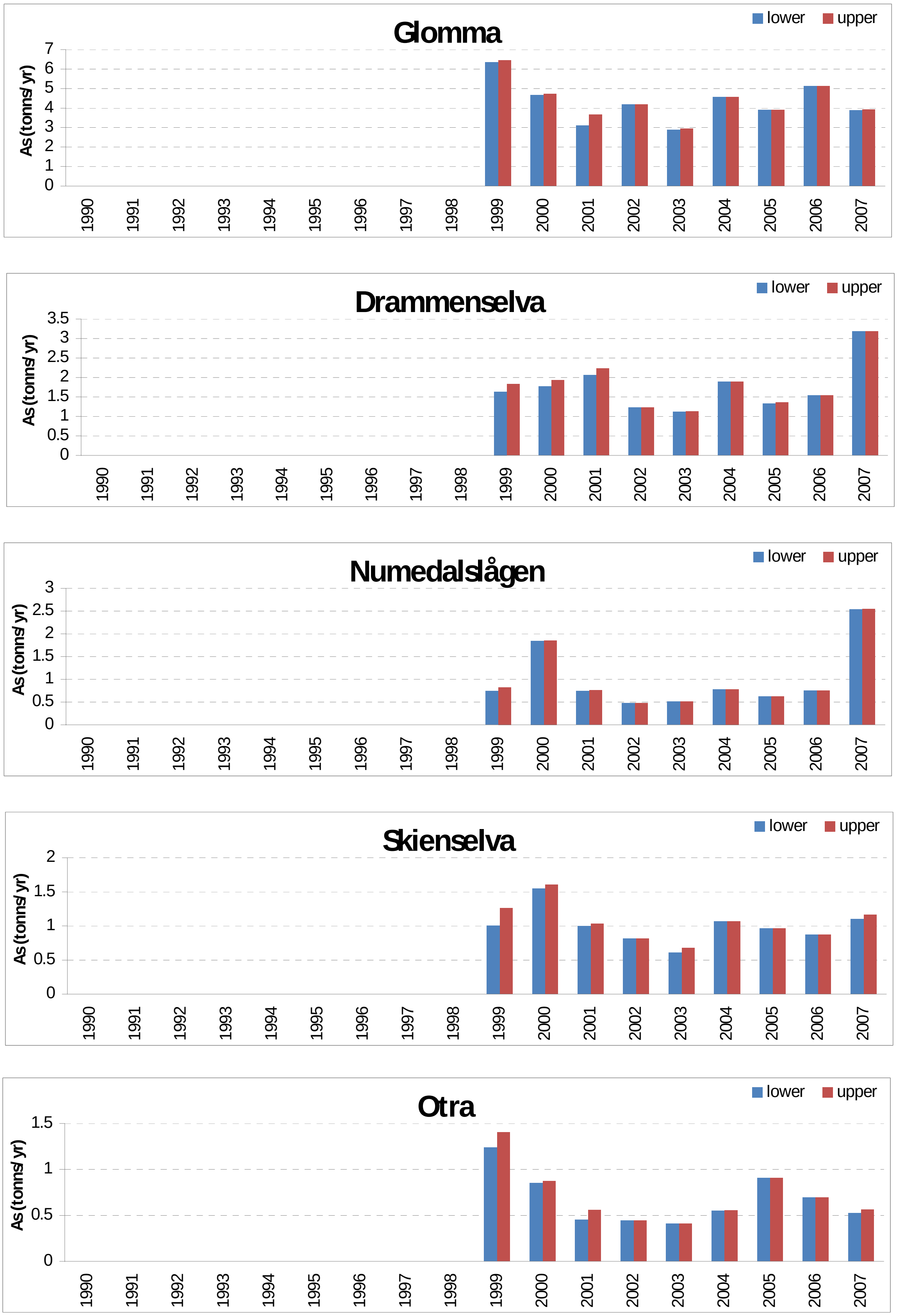


Figure A-VI-13a. Annual riverine loads (upper and lower estimates) of Arsenic in the five main Skagerak rivers in Norway, 1990-2007.

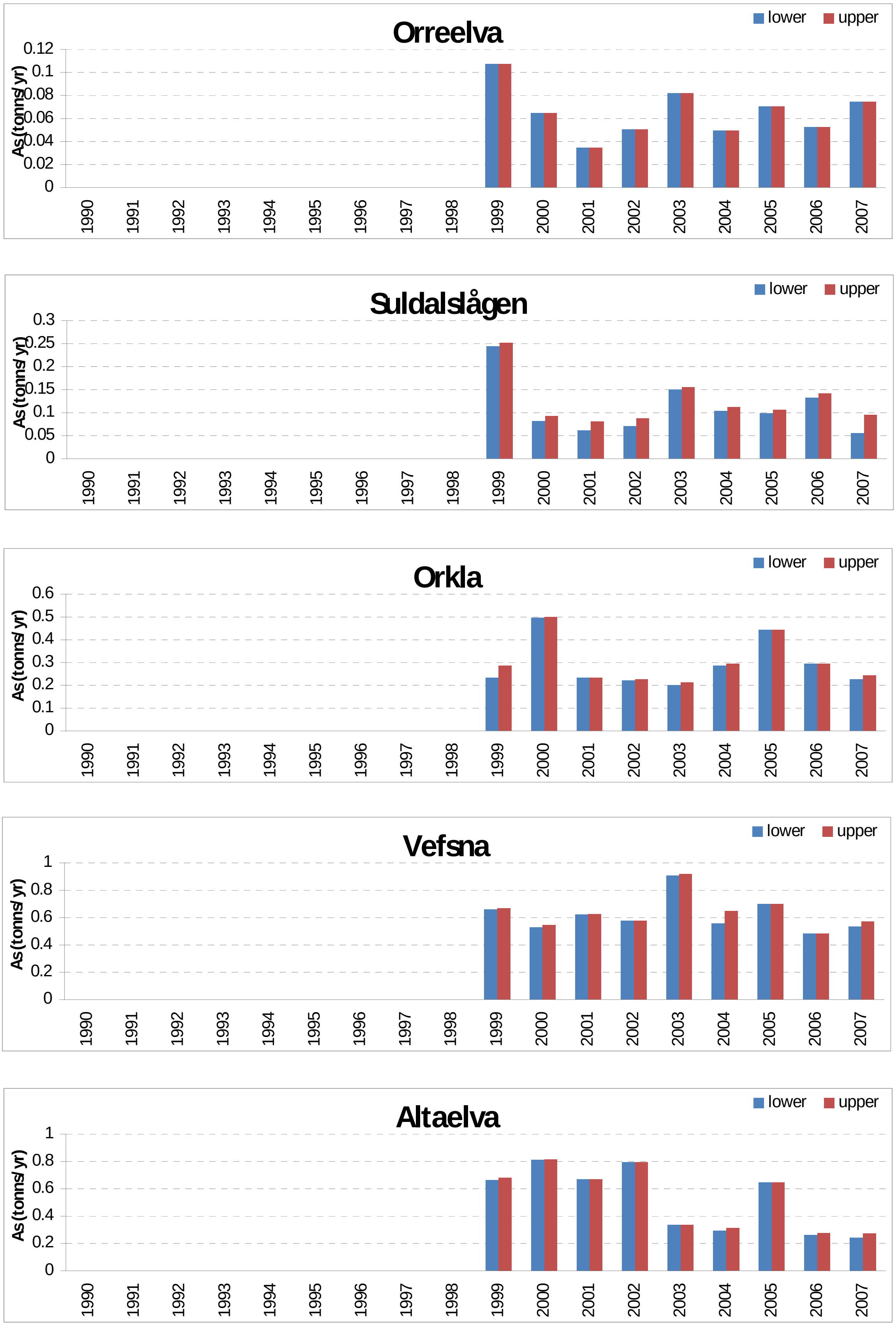


Figure A-VI-13b. Annual riverine loads (upper and lowe estimates) of Arsenic in the in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

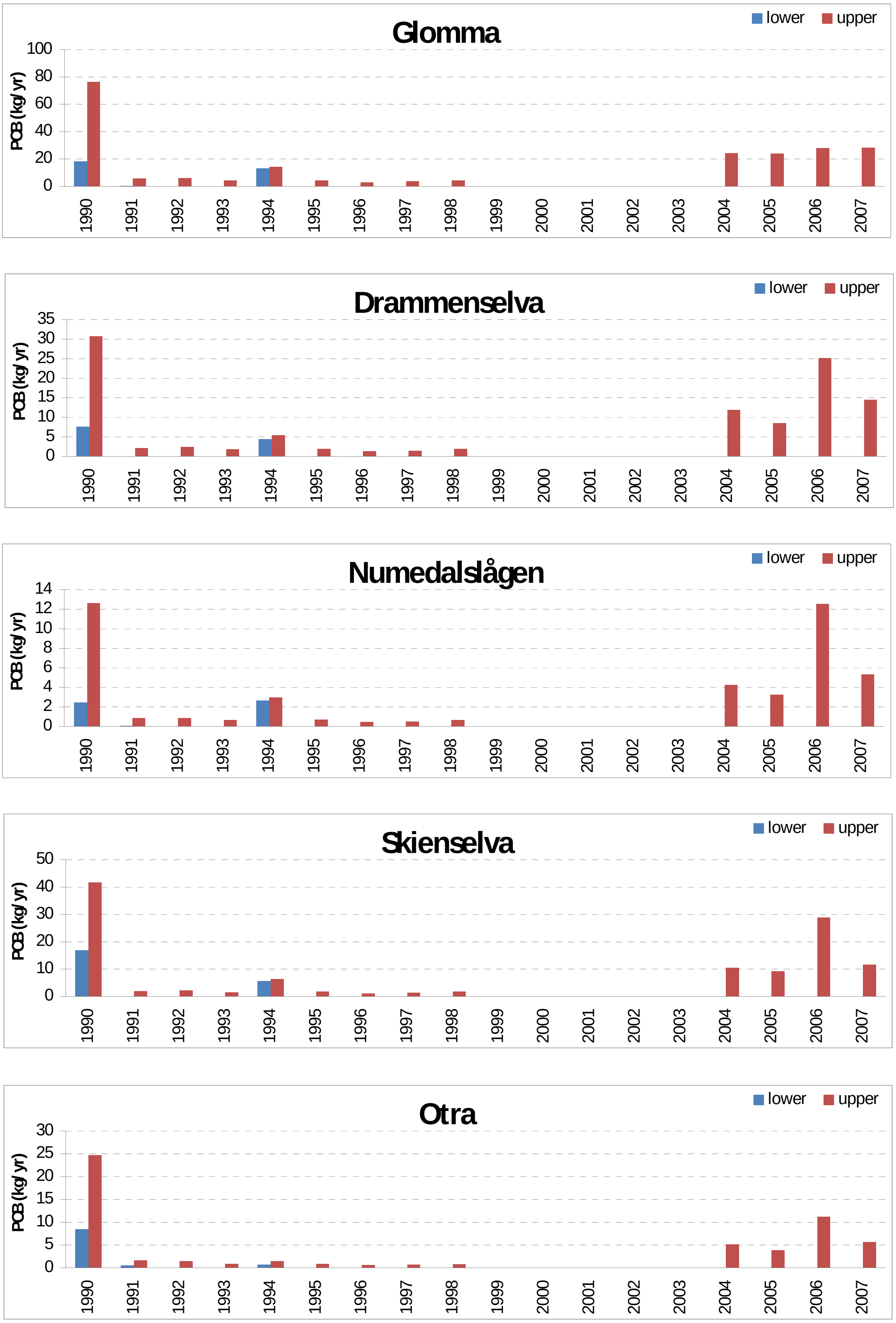


Figure A-VI-14a. Annual riverine loads (upper and lower estimates) of PCB in the five main Skagerak rivers in Norway, 1990-2007.

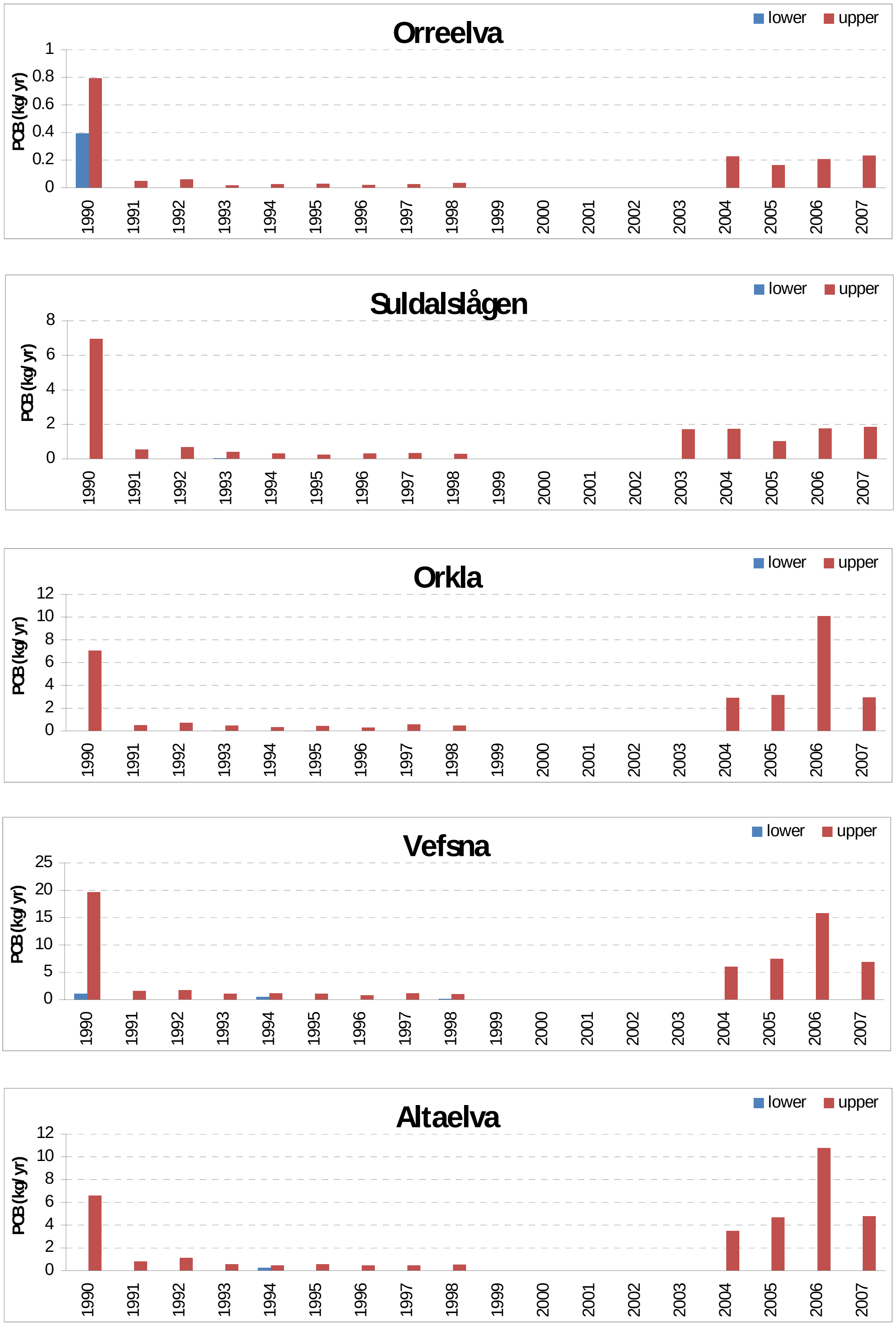


Figure A-VI-14b. Annual riverine loads (upper and lower estimates) of PCB in the in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

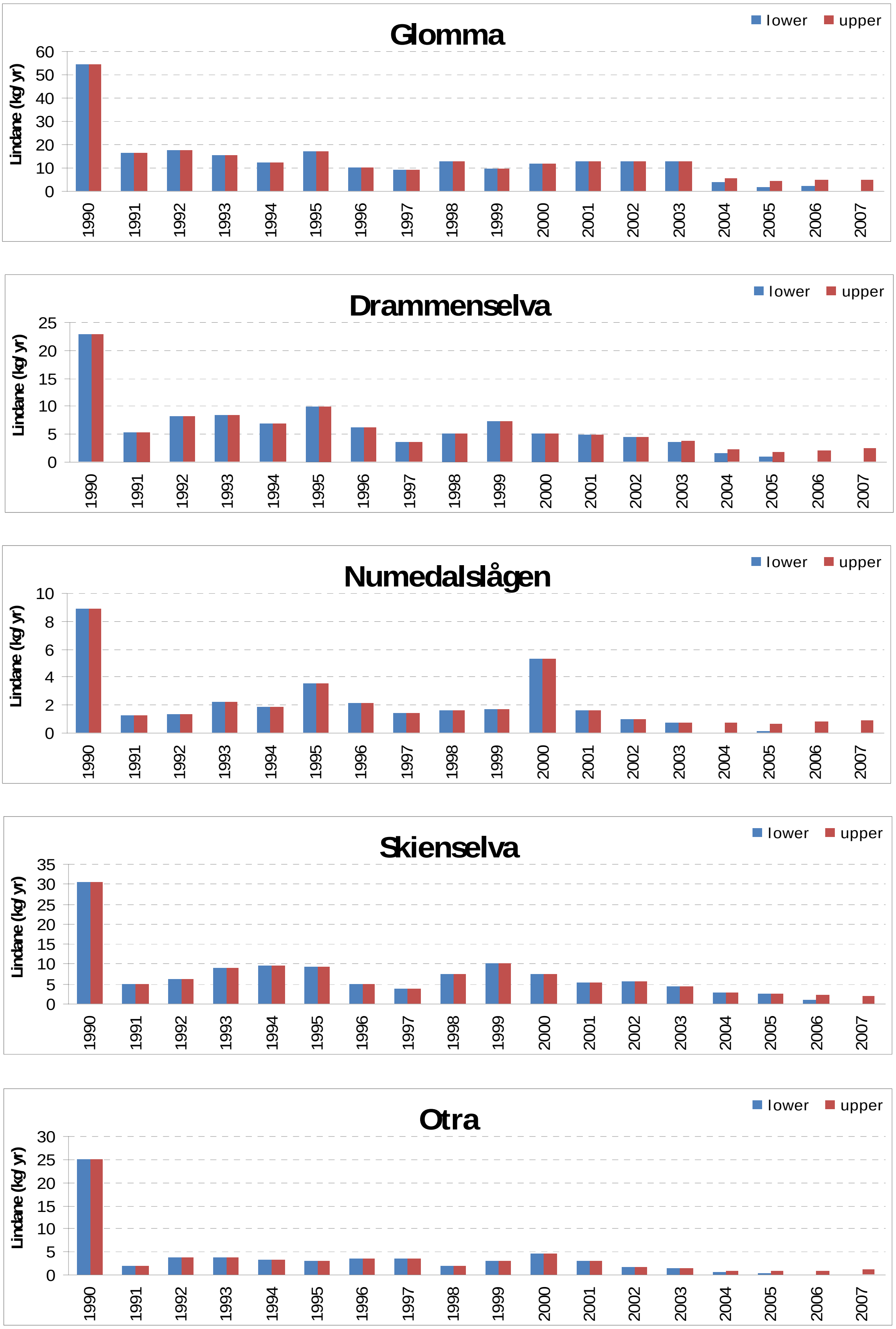


Figure A-VI-15a. Annual riverine loads (upper and lower estimates) of Lindane in the five main Skagerak rivers in Norway, 1990-2007.

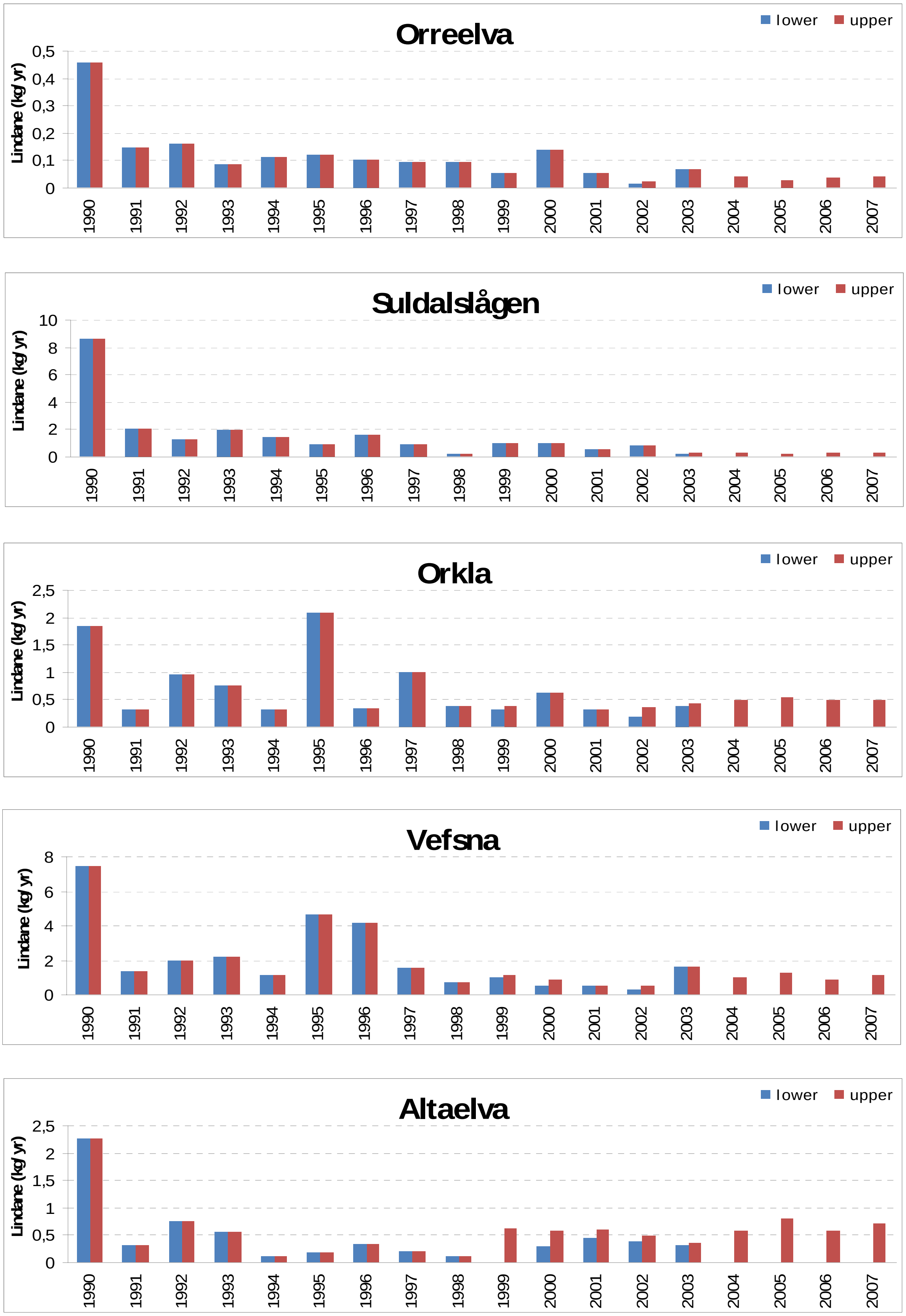


Figure A-VI-15b. Annual riverine loads (upper and lowe estimates) of Lindane in the in 5 main rivers to North Sea, Norwegian Sea and Barents Sea, Norway, 1990-2007.

Annex VII
Chemical results from 18 rivers in western Norway, October-December 2007, compared with the long-term mean 1990-2004.

Station name	Date	pH	KOND	SPM	TOTP	PO4-P	TOTN	NH4-N	NO3-N	TOC	As	Cd	Cr	Cu	Hg	Ni	Pb	SiO2	Zn
			mS/m	mg/l	µg/l P	µg/l P	µg/l N	µg/l N	µg/l N	mg/l C	µg/l	µg/l	µg/l	µg/l	ng/l	µg/l	µg/l	mg/l SiO2	µg/l
Opo	04/10/2007	6.57	1.2	2.4	3	1	150	14	69	0.8	<0.05	0.02	0.10	0.36	<1	0.22	0.34	0.81	2.51
Opo	16/10/2007	6.48	1.0	1.4	2	<1	100	2	64	0.8	<0.05	<0.005	<0.1	0.28	1.5	0.10	0.16	0.75	2.01
Opo	07/11/2007	6.63	1.3	1.7	3	2	145	3	80	0.9	<0.05	0.01	<0.1	0.30	<1	<0.05	0.21	0.98	2.45
Opo	26/11/2007	6.76	1.7	0.9	3	2	250	52	130	0.9	0.20	0.01	0.53	0.46	<1	0.40	0.17	1.05	2.70
Opo	12/12/2007	6.66	1.6	0.7	2	2	245	41	125	1.0	<0.05	0.01	<0.1	0.37	<1	0.20	0.14	1.05	3.07
Opo	**Mean 1990-2004**		**1.4**	**1.6**	**10**	**1**	**265**	**24**	**119**	**0.8**	**0.10**	**0.03**	**0.50**	**0.42**	**3.82**	**0.18**	**0.37**	**0.87**	**4.04**
Tysso	04/10/2007	6.85	2.4	<0.1	1	<1	190	<2	140	1.1	<0.05	0.02	<0.1	1.11	<1	1.80	0.09	1.69	8.06
Tysso	16/10/2007	7.08	2.6	1.8	2	<1	210	<2	145	1.6	0.09	0.03	<0.1	0.93	1	0.22	0.09	1.43	7.25
Tysso	07/11/2007	7.12	3.0	0.2	4	3	270	<2	125	3.0	<0.05	0.05	<0.1	1.40	3.5	<0.05	0.23	1.84	13.70
Tysso	26/11/2007	6.88	2.6	0.4	2	<1	270	<2	230	1.2	<0.05	0.03	0.10	0.91	1.5	0.20	0.05	1.81	5.58
Tysso	12/12/2007	6.82	2.7	<0.1	<1	<1	315	6	255	1.2	<0.05	0.02	<0.1	0.85	2	0.29	0.05	2.00	4.19
Tysso	**Mean 1990-2004**		**2.0**	**0.3**	**5**	**1**	**185**	**5**	**124**	**0.8**	**0.10**	**0.04**	**0.48**	**0.59**	**2.86**	**0.22**	**0.15**	**1.48**	**3.64**
Kinso	04/10/2007	7.15	2.1	0.2	<1	<1	51	<2	17	0.4	<0.05	<0.005	<0.1	0.22	<1	<0.05	0.02	0.45	0.91
Kinso	16/10/2007	7.06	1.8	5.9	6	4	90	<2	22	1.2	0.10	0.01	<0.1	0.33	<1	0.10	0.46	0.94	1.10
Kinso	07/11/2007	7.23	2.2	0.3	1	<1	63	<2	21	0.7	<0.05	0.01	<0.1	0.22	<1	<0.05	0.04	0.56	0.90
Kinso	26/11/2007	7.13	2.4	0.3	1	<1	86	<2	58	0.5	0.10	0.01	0.30	0.21	<1	<0.05	0.02	0.81	0.76
Kinso	12/12/2007	7.05	2.4	0.1	<1	<1	101	<2	58	0.6	<0.05	0.01	<0.1	0.13	1	0.06	0.03	0.83	0.70
Kinso	**Mean 1990-2004**		**1.9**	**0.7**	**7**	**2**	**116**	**5**	**67**	**0.6**	**0.07**	**0.04**	**0.35**	**0.46**	**2.39**	**0.14**	**0.17**	**0.70**	**1.74**
Veig	05/10/2007	7.23	2.9	0.2	<1	<1	50	<2	15	0.6	<0.05	0.01	<0.1	0.22	<1	0.25	0.01	1.73	1.10
Veig	16/10/2007	7.26	2.9	0.4	<1	<1	55	<2	14	0.7	0.07	<0.005	<0.1	0.17	<1	0.21	<0.005	1.58	0.22
Veig	07/11/2007	7.23	2.7	0.5	1	<1	77	<2	27	0.9	<0.05	0.01	<0.1	0.19	<1	<0.05	0.02	1.86	0.91
Veig	26/11/2007	7.20	3.3	0.2	1	<1	103	<2	69	0.5	0.05	0.01	0.30	0.21	<1	0.24	0.01	2.38	1.00
Veig	12/12/2007	7.06	3.2	0.1	<1	<1	137	3	85	0.8	0.10	0.01	<0.1	0.16	<1	0.27	0.01	2.29	0.81
Veig	**Mean 1990-2004**		**2.1**	**1.2**	**5**	**1**	**131**	**5**	**52**	**1.0**	**0.10**	**0.04**	**0.42**	**0.49**	**2.79**	**0.63**	**0.18**	**1.12**	**1.61**
Bjoreio	05/10/2007	7.00	2.8	0.2	3	<1	180	<2	74	2.3	<0.05	0.01	<0.1	0.53	<1	0.60	0.06	2.00	1.80
Bjoreio	16/10/2007	7.06	2.6	0.6	2	<1	136	<2	43	2.5	0.06	<0.005	<0.1	0.38	<1	0.50	0.04	1.81	0.68
Bjoreio	07/11/2007	6.99	2.7	0.3	4	1	220	<2	105	3.2	<0.05	0.01	<0.1	0.80	<1	0.21	0.09	2.08	1.60
Bjoreio	26/11/2007	6.99	3.4	0.2	5	1	235	<2	155	2.2	<0.05	0.01	<0.1	0.61	<1	0.54	0.05	2.61	1.50
Bjoreio	12/12/2007	6.85	3.1	0.2	2	1	290	<2	175	3.2	0.07	0.01	<0.1	0.55	<1	0.65	0.09	2.52	2.26
Bjoreio	**Mean 1990-2004**		**2.0**	**0.6**	**6**	**2**	**160**	**4**	**63**	**1.3**	**0.07**	**0.08**	**0.36**	**0.53**	**2.57**	**0.61**	**0.19**	**1.03**	**1.52**
Sima	05/10/2007	6.95	2.2	0.3	1	<1	143	<2	110	0.3	<0.05	<0.005	<0.1	0.26	<1	0.20	0.04	2.46	1.20
Sima	16/10/2007	7.02	2.0	0.5	<1	<1	118	<2	81	0.5	0.06	<0.005	<0.1	0.25	2	0.20	0.03	1.82	0.31
Sima	07/11/2007	7.03	2.3	0.4	2	1	215	<2	175	0.5	<0.05	<0.005	<0.1	0.27	<1	<0.05	0.04	2.25	0.48
Sima	26/11/2007	6.99	2.6	0.3	2	2	215	<2	175	0.2	0.10	0.01	0.39	0.29	<1	0.40	0.05	2.76	1.30
Sima	11/12/2007	6.89	2.5	0.3	2	2	270	2	240	0.4	0.05	0.02	<0.1	0.32	<1	0.10	0.05	2.42	1.60
Sima	**Mean 1990-2004**		**2.1**	**0.8**	**3**	**1**	**160**	**4**	**108**	**0.5**	**0.05**	**0.04**	**0.46**	**0.34**	**4.29**	**0.18**	**0.16**	**1.66**	**1.25**
Nærøydalselvi	04/10/2007	6.72	1.5	<0.1	2	<1	160	<2	110	0.6	<0.05	<0.005	<0.1	0.31	1	0.20	0.01	2.89	1.60
Nærøydalselvi	16/10/2007	6.50	1.0	1.4	8	4	136	<2	31	1.5	<0.05	<0.005	<0.1	0.33	<1	0.10	0.06	1.92	0.62
Nærøydalselvi	07/11/2007	6.76	1.5	0.2	2	<1	185	<2	140	0.8	<0.05	<0.005	<0.1	0.29	<1	<0.05	0.02	2.93	1.10
Nærøydalselvi	27/11/2007	6.97	230.0	0.2	4	1	225	<5	60	0.9	<0.05	0.01	<0.1	0.82	<1	0.20	0.02	3.51	1.10
Nærøydalselvi	11/12/2007	6.75	1.8	<0.1	1	1	250	<2	190	0.7	<0.05	<0.005	<0.1	0.28	<1	0.10	0.02	3.30	0.70
Nærøydalselvi	**Mean 1990-2004**		**2.0**	**0.6**	**6**	**1**	**168**	**5**	**123**	**0.6**	**0.05**	**0.02**	**0.56**	**0.38**	**3.43**	**0.24**	**0.15**	**2.22**	**2.06**
Flåmselvi	03/10/2007	6.91	1.8	0.3	1	<1	87	<2	52	0.4	<0.05	<0.005	<0.1	0.29	<1	0.21	0.04	1.03	1.20
Flåmselvi	16/10/2007	6.82	1.4	2.2	2	1	89	<2	51	0.6	0.10	<0.005	<0.1	0.31	<1	0.24	0.03	1.13	0.45
Flåmselvi	08/11/2007	7.08	2.5	1.1	2	2	185	<2	140	0.5	<0.05	<0.005	<0.1	0.34	<1	0.10	0.08	1.43	1.20
Flåmselvi	27/11/2007	7.27	55.8	0.3	2	1	285	<5	195	0.3	<0.05	0.01	<0.1	0.54	<1	0.10	0.01	1.88	1.20
Flåmselvi	11/12/2007	7.13	52.9	<0.1	3	1	415	<5	280	0.5	<0.05	0.01	<0.1	0.72	<1	0.10	0.02	2.23	0.81
Flåmselvi	**Mean 1990-2004**		**5.4**	**1.1**	**3**	**1**	**151**	**7**	**119**	**0.4**	**0.06**	**0.03**	**0.37**	**0.59**	**2.64**	**0.25**	**0.10**	**0.86**	**1.09**
Aurlandselvi	03/10/2007	6.80	1.8	0.1	1	<1	144	<2	100	0.4	<0.05	<0.005	0.23	0.31	<1	0.20	0.01	1.33	0.75
Aurlandselvi	15/10/2007	6.85	1.6	0.3	1	<1	116	<2	88	0.4	0.10	<0.005	<0.1	0.22	<1	0.06	<0.005	1.35	<0.05
Aurlandselvi	07/11/2007	6.92	2.4	0.6	4	4	420	<2	310	1.1	<0.05	0.01	<0.1	0.44	<1	0.10	0.07	1.95	0.94
Aurlandselvi	27/11/2007	6.76	1.9	0.3	2	1	190	<2	150	0.4	<0.05	<0.005	<0.1	0.29	<1	0.08	0.03	1.50	0.80
Aurlandselvi	11/12/2007	6.75	2.2	0.2	1	1	300	4	255	0.6	<0.05	0.01	<0.1	0.32	3	0.22	0.03	1.68	0.83
Aurlandselvi	**Mean 1990-2004**		**1.5**	**0.8**	**5**	**1**	**183**	**8**	**140**	**0.7**	**0.06**	**0.02**	**0.33**	**0.40**	**3**	**0.19**	**0.13**	**1.13**	**1.14**

Station name	Date	pH	KOND mS/m	SPM mg/l	TOTP µg/l P	PO4-P µg/l P	TOTN µg/l N	NH4-N µg/l N	NO3-N µg/l N	TOC mg/l C	As µg/l	Cd µg/l	Cr µg/l	Cu µg/l	Hg ng/l	Ni µg/l	Pb µg/l	SiO2 mg/l SiO2	Zn µg/l
Erdalselvi	03/10/2007	6.69	1.3	0.1	2	<1	66	2	26	0.7	<0.05	<0.005	<0.1	0.35	<1	0.10	0.02	2.27	1.20
Erdalselvi	15/10/2007	6.72	1.2	0.4	2	2	81	<2	25	0.7	<0.05	<0.005	<0.1	0.19	<1	0.05	0.01	2.18	0.31
Erdalselvi	09/11/2007	6.75	1.6	0.3	3	2	270	<2	175	1.4	<0.05	<0.005	<0.1	0.37	1.5	<0.05	0.03	2.93	0.60
Erdalselvi	28/11/2007	6.66	1.7	0.1	2	1	225	<2	140	0.8	<0.05	0.01	<0.1	0.30	<1	0.07	0.01	2.93	0.82
Erdalselvi	10/12/2007	6.66	1.5	<0.1	2	1	310	3	210	1.2	<0.05	0.01	<0.1	0.44	<1	0.26	0.10	3.12	0.85
Erdalselvi	**Mean 1990-2004**		**1.1**	**0.5**	**3**	**1**	**115**	**4**	**69**	**0.8**	**0.05**	**0.02**	**0.32**	**0.29**	**2.64**	**0.14**	**0.11**	**1.38**	**0.96**
Lærdalselva	02/10/2007	6.83	2.1	0.3	2	<1	113	2	72	0.8	<0.05	<0.005	0.36	1.00	<1	0.20	0.02	2.35	0.71
Lærdalselva	15/10/2007	6.88	2.3	1.4	2	<1	118	<2	72	0.7	0.06	<0.005	<0.1	0.37	<1	0.10	<0.005	2.18	0.23
Lærdalselva	08/11/2007	6.84	2.4	1.0	4	2	230	2	150	1.0	0.16	0.01	<0.1	0.60	<1	<0.05	0.03	2.50	0.99
Lærdalselva	27/11/2007	6.66	1.9	0.4	2	1	180	<2	125	0.5	<0.05	0.01	<0.1	0.44	<1	0.10	0.04	1.85	1.10
Lærdalselva	10/12/2007	6.70	2.3	0.6	2	1	205	4	155	0.6	<0.05	0.01	<0.1	0.40	<1	0.20	0.03	2.09	1.10
Lærdalselva	**Mean 1990-2004**		**1.7**	**0.9**	**6**	**1**	**163**	**5**	**109**	**0.9**	**0.05**	**0.03**	**0.22**	**0.62**	**2.57**	**0.19**	**0.11**	**1.70**	**1.21**
Årdalselvi	02/10/2007	6.45	0.9	0.6	2	<1	86	3	48	0.5	<0.05	<0.005	0.30	1.08	<1	0.20	0.02	1.64	1.20
Årdalselvi	15/10/2007	6.53	1.0	0.9	1	<1	81	3	55	0.5	<0.05	<0.005	<0.1	1.00	<1	0.20	<0.005	1.64	0.46
Årdalselvi	08/11/2007	6.55	1.1	1.0	3	1	111	<2	69	0.6	<0.05	0.01	<0.1	1.07	<1	<0.05	0.03	1.81	0.72
Årdalselvi	28/11/2007	6.29	1.2	0.7	3	2	119	2	85	0.6	<0.05	0.01	0.10	1.08	<1	0.10	0.02	1.89	0.71
Årdalselvi	11/12/2007	6.45	1.2	0.4	2	1	137	4	92	0.6	<0.05	0.01	<0.1	0.99	<1	0.48	0.02	1.80	0.63
Årdalselvi	**Mean 1990-2004**		**1.1**	**1.8**	**5**	**2**	**166**	**7**	**87**	**0.8**	**0.05**	**0.02**	**0.30**	**1.44**	**3.07**	**0.18**	**0.15**	**1.46**	**1.63**
Fortundalselva	03/10/2007	6.51	1.1	4.0	5	4	116	3	81	0.4	<0.05	0.01	0.10	1.79	<1	0.22	0.08	1.72	1.30
Fortundalselva	15/10/2007	6.65	1.1	2.6	3	2	114	<2	84	0.4	0.10	<0.005	<0.1	0.65	<1	0.09	0.02	1.53	0.31
Fortundalselva	08/11/2007	6.70	1.3	3.0	4	3	185	<2	150	0.7	<0.05	<0.005	<0.1	0.91	<1	<0.05	0.08	1.86	1.00
Fortundalselva	28/11/2007	6.48	1.3	1.8	4	2	165	3	140	0.3	<0.05	0.02	0.52	0.91	3	0.10	0.10	1.46	4.80
Fortundalselva	10/12/2007	6.58	1.4	1.1	2	1	200	4	170	0.4	<0.05	<0.005	<0.1	0.53	<1	0.24	0.04	1.48	0.83
Fortundalselva	**Mean 1990-2004**		**1.1**	**2.0**	**5**	**1**	**141**	**5**	**103**	**0.5**	**0.06**	**0.02**	**0.27**	**0.84**	**4.86**	**0.21**	**0.18**	**1.22**	**1.78**
Mørkrisdalselvi	03/10/2007	6.63	1.2	2.0	2	1	113	2	93	0.4	<0.05	0.01	0.30	0.70	<1	0.34	0.08	1.58	3.16
Mørkrisdalselvi	15/10/2007	6.62	1.1	5.3	3	2	100	<2	62	0.7	0.09	<0.005	0.20	0.64	<1	0.43	0.08	1.82	1.30
Mørkrisdalselvi	08/11/2007	6.84	1.7	1.4	2	1	220	<2	175	0.6	<0.05	0.01	<0.1	0.56	<1	0.20	0.05	1.86	1.10
Mørkrisdalselvi	28/11/2007	6.75	1.9	0.3	1	<1	230	<2	215	0.4	<0.05	<0.005	<0.1	0.36	<1	0.20	0.02	2.01	0.65
Mørkrisdalselvi	10/12/2007	6.76	1.9	0.3	2	1	265	4	230	0.6	<0.05	<0.005	<0.1	0.37	<1	0.37	0.01	1.94	0.54
Mørkrisdalselvi	**Mean 1990-2004**		**1.2**	**2.3**	**5**	**1**	**170**	**5**	**113**	**0.5**	**0.05**	**0.02**	**0.44**	**0.55**	**2.79**	**0.32**	**0.14**	**1.42**	**1.70**
Jostedøla	03/10/2007	6.73	1.6	4.7	4	3	123	<2	98	0.5	<0.05	0.01	0.37	0.76	<1	0.44	0.17	2.78	2.38
Jostedøla	15/10/2007	6.73	1.5	11.8	9	7	126	<2	62	1.3	<0.05	<0.005	0.32	0.56	<1	0.46	0.14	2.78	1.80
Jostedøla	08/11/2007	6.86	2.1	3.6	3	2	195	<2	155	1.3	<0.05	0.01	<0.1	2.02	<1	<0.05	0.14	3.21	1.90
Jostedøla	28/11/2007	6.78	2.5	1.9	3	2	225	<2	195	0.8	<0.05	<0.005	<0.1	0.58	<1	0.10	0.07	3.64	1.20
Jostedøla	10/12/2007	6.77	2.4	1.3	2	2	245	<2	195	1.3	0.06	<0.005	<0.1	0.53	<1	0.20	0.05	3.36	0.78
Jostedøla	**Mean 1990-2004**	**6.48**	**2.5**	**33.0**	**26**	**15**	**184**	**8**	**127**	**0.6**	**0.05**	**0.01**	**1.29**	**1.23**	**2.07**	**0.97**	**0.43**	**3.76**	**4.16**
Årøyelva	03/10/2007	6.53	1.2	1.3	3	<1	87	3	37	0.6	<0.05	<0.005	<0.1	0.32	<1	0.20	0.06	1.26	1.20
Årøyelva	15/10/2007	6.61	1.3	1.2	3	<1	100	<2	40	0.8	<0.05	<0.005	<0.1	0.25	<1	0.09	0.03	1.26	0.36
Årøyelva	08/11/2007	6.62	1.4	1.1	4	1	140	<2	90	0.9	<0.05	0.01	<0.1	0.28	<1	<0.05	0.05	1.49	0.87
Årøyelva	27/11/2007	6.49	1.4	0.9	3	1	146	2	105	0.9	<0.05	<0.005	<0.1	0.30	<1	0.05	0.04	1.51	0.85
Årøyelva	10/12/2007	6.46	1.4	0.6	3	1	165	3	105	1.3	<0.05	0.01	<0.1	0.45	<1	0.10	0.12	1.58	2.60
Årøyelva	**Mean 1990-2004**		**1.5**	**1.3**	**6**	**1**	**146**	**6**	**87**	**0.7**	**0.04**	**0.02**	**0.37**	**0.43**	**2.64**	**0.12**	**0.09**	**1.21**	**1.31**
Sogndalselva	03/10/2007	6.68	1.4	0.4	4	1	141	<2	74	1.1	<0.05	<0.005	<0.1	0.48	<1	0.10	0.03	1.39	1.90
Sogndalselva	15/10/2007	6.69	1.3	3.8	6	2	155	<2	50	1.6	<0.05	<0.005	<0.1	0.36	<1	0.10	0.86	1.46	0.80
Sogndalselva	08/11/2007	6.89	2.3	7.1	21	15	430	<2	300	1.8	<0.05	<0.005	<0.1	1.08	<1	0.26	0.24	2.82	3.65
Sogndalselva	27/11/2007	6.66	2.4	0.2	7	5	440	<2	175	1.5	<0.05	<0.005	<0.1	0.61	<1	0.20	0.07	2.50	1.30
Sogndalselva	10/12/2007	6.68	2.3	0.5	7	5	450	<2	250	1.6	<0.05	<0.005	<0.1	0.52	<1	0.28	0.03	2.46	1.40
Sogndalselva	**Mean 1990-2004**		**1.3**	**1.1**	**6**	**2**	**187**	**6**	**120**	**2.0**	**0.10**	**0.04**	**0.35**	**0.47**	**3.43**	**0.12**	**0.13**	**0.98**	**4.50**
Gaular	05/10/2007	6.16	1.0	0.4	4	1	126	<2	56	1.1	<0.05	0.01	<0.1	0.22	<1	0.08	0.05	0.81	1.10
Gaular	22/11/2007	6.09	1.5	0.7	5	3	175	<2	75	1.8	<0.05	0.01	0.31	0.29	<1	<0.05	0.08	1.11	1.30
Gaular	29/11/2007	6.32	1.8	0.7	5	3	245	<2	14	2.1	<0.05	0.01	0.20	0.38	<1	0.20	0.08	1.39	2.32
Gaular	11/12/2007	6.03	1.4	0.4	5	3	220	3	70	1.7	<0.05	0.01	<0.1	0.22	<1	0.10	0.15	1.01	1.20
Gaular	18/12/2007	6.19	1.5	1.1	5	3	200	5	120	1.5	<0.05	0.01	<0.1	0.27	<1	<0.05	0.07	1.22	1.30
Gaular	**Mean 1990-2004**	**6.18**	**1.4**	**0.9**	**5**	**1**	**185**	**6**	**99**	**1.4**	**0.08**	**0.01**	**0.13**	**0.26**	**2.4**	**0.12**	**0.06**	**0.87**	**1.18**

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Title – English and Norwegian
Riverine inputs and direct discharges to Norwegian coastal waters – 2007. OSPAR Commission.
Elvetilførsler og direkte tilførsler til norske kystområder – 2007. OSPAR Commission.

Summary
The report presents results from the 2007 monitoring of 46 Norwegian rivers in accordance with the requirements of the OSPAR Commission. Riverborne inputs of nutrients, suspended particulate matter, total organic carbon, silicate, metals (Cd, Hg, Pb, Cu, Zn, As), PCB7 and the pesticide lindane to Norwegian coastal waters are calculated based on concentration and flow data. In addition, the inputs from rivers not monitored, as well as direct discharges to marine waters along the coast from Sweden in the south to Russia in the north have been estimated. In general, there was an overall increase of inputs from 2006 to 2007 of most substances monitored in the RID Programme. The increases are within normal variations from year-to-year, and mainly caused by increased riverine water discharges and increased reporting of industrial discharges.

4 subject words	4 emneord
Riverine inputs. Direct discharges. Norwegian coastal waters. Monitoring	Elvetilførsler. Direkte tilførsler. Norske kystområder. Overvåking

Part B

Data Report

Part B

Table 1. Raw data and summary statistics for the 10 main and 36 tributary rivers in Norway in 2007

Table 1. Raw data and summary statistics for the 10 main and 36 tributary rivers in Norway in 2007

Glomma ved Sarpsfoss

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
08.01.2007	834	7.08	4.61	9.94	4.70	14	22	390	30	625	4.75	0.29	0.49	0.02	2.34	6.40	0.91	0.39	<1.00		
05.02.2007	651	7.07	4.74	2.46	3.70	4	7	385	26	530	3.66	0.10	0.12	0.01	1.87	3.04	0.59	0.20	1.00	<0.20	1.40
05.03.2007	495	7.14	4.97	2.11	2.90	2	6	360	39	545	3.53	0.10	0.09	0.01	1.09	2.41	0.46	0.20	<1.00		
10.04.2007	573	7.19	5.16	8.06	4.00	10	14	495	29	645	4.71	0.20	0.28	0.01	4.07	5.87	1.00	1.00	<1.00		
07.05.2007	1146	7.09	3.99	5.63	4.60	6	14	260	16	465	3.70	0.20	0.19	0.01	2.34	4.20	0.81	0.20	<1.00	<0.20	1.40
16.05.2007	1094	7.15	4.15	4.34	3.80	3	12	315	24	480	3.47	0.10	0.14	0.01	2.31	3.40	0.64	0.20	<1.00		
25.05.2007	1016	7.15	4.11	4.69	3.30	4	8	270	11	445	3.17	0.10	0.15	0.01	3.20	2.46	0.60	<0.10	<1.00		
04.06.2007	1251	7.34	4.72	6.38	3.30	8	15	535	12	700	3.51	0.10	0.21	0.01	2.20	2.97	0.67	0.42	<1.00		
15.06.2007	1146	7.27	4.32	2.29	2.60	3	13	280	13	450	2.70	0.10	0.14	0.02	1.90	2.54	0.49	0.10	<1.00		
25.06.2007	1251	7.23	4.52	5.21	2.60	4	11	240	17	470	2.72	0.12	0.15	0.01	1.59	2.00	0.66	0.20	<1.00		
09.07.2007	1511	7.13	4.60	12.60	3.60	15	26	385	19	585	3.36	0.20	0.45	0.01	3.34	3.58	1.00	0.44	1.50		
06.08.2007	730	7.31	4.33	2.95	2.80	3	8	295	4	430	2.65	0.09	0.18	0.01	1.79	4.77	1.10	<0.10	<1.00	<0.20	1.40
10.09.2007	391	7.17	4.10	1.56	3.30	2	6	230	5	395	2.78	0.10	0.07	0.01	1.72	2.34	0.51	0.20	<1.00		
08.10.2007	391	7.32	4.74	1.37	2.90	2	6	290	4	445	2.89	<0.05	0.07	0.01	6.08	1.70	0.42	0.34	<1.00	<0.20	1.40
05.11.2007	443	7.30	5.13	6.43	3.70	8	15	455	4	655	3.98	0.78	0.24	0.01	1.54	2.97	0.60	0.20	<1.00		
09.12.2007	599	6.94	5.18	12.70	4.20	16	25	545	<2	740	4.51	0.32	0.46	0.01	1.70	4.19	1.40	<0.10	<1.00		
Lower avg.	845	7.18	4.59	5.55	3.50	7	13	358	16	538	3.50	0.18	0.21	0.01	2.44	3.43	0.74	0.26	0.16	0.62	1.40
Upper avg..	845	7.18	4.59	5.55	3.50	7	13	358	16	538	3.50	0.18	0.21	0.01	2.44	3.43	0.74	0.27	1.03	0.20	1.40
Minimum	391	6.94	3.99	1.37	2.60	2	6	230	2	395	2.65	0.05	0.07	0.01	1.09	1.70	0.42	0.10	1.00	0.20	1.40
Maximum	1511	7.34	5.18	12.70	4.70	16	26	545	39	740	4.75	0.78	0.49	0.02	6.08	6.40	1.40	1.00	1.50	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes
n	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	4	4
St.dev	359	0.11	0.40	3.67	0.66	5	7	104	11	107	0.70	0.18	0.14	0.00	1.23	1.35	0.27	0.22	0.13	0.00	0.00

Drammenselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
03.01.2007	367	6.94	3.92	1.64	3.40	2	4	280	11	460	3.19	0.10	0.14	0.01	1.25	6.37	1.20	0.20	<1.00		
07.02.2007	358	7.04	3.74	1.20	2.70	<1	3	290	<2	425	2.87	0.10	0.05	0.01	0.92	2.94	1.00	0.10	<1.00	<0.20	1.40
07.03.2007	342	7.13	7.16	7.14	2.60	8	13	510	16	700	3.10	0.10	0.16	0.01	1.15	2.84	0.49	0.20	<1.00		
04.04.2007	346	7.08	4.15	1.16	3.00	2	4	335	5	465	3.00	0.20	0.08	0.01	0.95	3.75	0.44	0.42	<1.00		
05.05.2007	595	6.98	3.16	2.99	3.00	1	4	220	6	370	2.76	0.10	0.12	0.01	0.86	3.70	0.71	<0.10	<1.00	<0.20	1.40
16.05.2007	377	7.05	3.66	1.36	3.10	1	5	255	11	395	2.74	0.10	0.05	0.01	0.80	2.14	0.41	0.10	<1.00		
29.05.2007	315	7.11	4.06	7.05	3.90	3	9	365	4	655	3.38	0.20	0.27	0.01	1.41	3.32	0.53	0.36	<1.00		
06.06.2007	467	6.96	3.91	2.14	3.70	3	7	340	<2	465	3.04	0.20	0.12	0.01	1.32	4.00	0.62	0.26	<1.00		
18.06.2007	308	7.01	3.33	2.19	3.30	2	6	200	7	365	2.70	0.10	0.16	0.01	0.82	1.90	0.42	0.20	<1.00		
25.06.2007	524	7.09	4.22	4.55	5.10	4	13	360	12	580	3.10	0.19	0.24	0.02	1.58	4.37	0.58	0.20	<1.00		
04.07.2007	1077	7.14	5.33	38.50	6.90	32	52	505	28	840	4.09	0.52	1.33	0.03	3.17	12.70	1.90	1.10	<1.00		
06.07.2007	1474	6.87	2.69	15.00	5.40	13	21	195	10	405	3.06	0.47	0.74	0.03	2.01	12.30	1.10	0.45	<1.00		
11.07.2007	1515	6.94	3.06	21.20	5.00	14	23	220	19	460	3.64	0.31	0.80	0.03	1.88	11.50	1.00	0.58	<1.00		
08.08.2007	341	7.21	3.61	1.52	3.80	2	6	200	7	375	2.67	0.09	0.11	0.01	1.28	4.00	0.69	<0.10	<1.00	<0.20	1.40
05.09.2007	188	7.00	3.80	1.36	3.70	1	5	230	7	400	2.74	0.20	0.07	0.01	1.35	3.01	0.76	<0.10	<1.00		
02.10.2007	298	7.02	3.99	2.77	4.20	3	9	360	5	570	3.23	0.06	0.75	0.01	1.50	3.32	0.47	0.20	<1.00	<0.20	1.40
08.11.2007	151	6.89	3.06	3.97	3.20	4	8	200	<2	345	2.76	0.15	0.84	0.01	1.44	3.60	0.40	<0.10	<1.00		
04.12.2007	223	7.21	5.38	2.77	3.30	4	7	450	<2	700	3.36	0.20	0.14	0.01	0.91	3.08	0.49	0.31	1.50		
Lower avg.	515	7.04	4.01	6.58	3.85	6	11	306	8	499	3.08	0.19	0.34	0.01	1.37	4.94	0.73	0.26	0.08	0.38	1.40
Upper avg..	515	7.04	4.01	6.58	3.85	6	11	306	9	499	3.08	0.19	0.34	0.01	1.37	4.94	0.73	0.28	1.03	0.20	1.40
Minimum	151	6.87	2.69	1.16	2.60	1	3	195	2	345	2.67	0.06	0.05	0.01	0.80	1.90	0.40	0.10	1.00	0.20	1.40
Maximum	1515	7.21	7.16	38.50	6.90	32	52	510	28	840	4.09	0.52	1.33	0.03	3.17	12.70	1.90	1.10	1.50	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes
n	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	4	4
St.dev	410	0.10	1.05	9.58	1.11	8	12	104	7	143	0.37	0.13	0.37	0.01	0.57	3.47	0.39	0.25	0.12	0.00	0.00

Numedalslågen

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
09.01.2007	110	6.78	4.03	12.20	4.10	22	32	430	35	685	5.20	0.26	0.54	0.02	1.08	5.99	0.52	0.40	<1.00		
13.02.2007	97	6.91	2.76	1.03	2.50	2	5	165	37	320	3.27	0.10	0.24	0.01	1.30	5.49	0.33	0.10	<1.00	<0.20	1.40
26.03.2007	85	6.88	4.43	8.87	3.70	9	13	525	39	765	4.77	0.20	0.33	0.02	3.63	6.14	0.54	0.42	<1.00		
11.04.2007	80	6.84	3.36	8.05	3.80	3	7	310	17	485	3.94	0.30	0.50	0.02	1.34	5.27	0.50	0.30	<1.00		
07.05.2007	100	6.79	2.73	200.00	3.60	71	85	165	10	410	4.36	0.77	3.23	0.07	2.22	15.80	1.20	1.00	<1.00	<0.20	1.40
12.06.2007	108	6.85	2.53	1.27	3.50	2	6	120	13	290	3.06	0.20	0.13	0.01	0.74	2.17	0.29	0.10	<1.00		
06.07.2007	1093	6.42	2.01	83.20	8.10	66	86	130	27	440	4.34	0.99	6.29	0.06	4.39	16.40	2.02	1.50	<1.00		
06.07.2007	1093	6.47	2.04	151.00	8.10	76	167	115	22	455	4.58	1.40	8.77	0.14	6.09	30.70	2.99	2.50	<1.00		
11.07.2007	651	6.72	2.18	38.50	6.70	35	46	125	10	360	4.17	0.48	1.79	0.03	2.01	9.00	1.10	0.68	<1.00		
07.08.2007	112	6.95	2.88	1.70	3.10	2	6	225	15	375	3.12	0.10	0.22	0.01	0.76	2.40	0.35	<0.10	<1.00	<0.20	1.40
11.09.2007	81	6.93	2.68	0.75	2.50	2	4	125	19	285	2.78	0.10	0.14	0.01	0.82	2.20	0.30	0.20	<1.00		
09.10.2007	93	6.92	2.85	1.53	4.00	2	5	175	12	345	2.97	0.10	0.17	0.01	1.45	3.43	0.30	<0.10	<1.00	<0.20	1.40
06.11.2007	93	6.98	3.06	1.86	2.80	2	6	185	26	365	3.14	0.05	0.14	0.01	1.60	2.56	0.26	<0.10	<1.00		
11.12.2007	108	6.81	3.68	4.08	4.30	5	10	390	5	620	4.30	<0.05	0.25	0.02	9.78	5.20	<0.05	0.20	1.50		
Lower avg.	216	6.80	2.94	36.72	4.34	21	34	228	21	443	3.86	0.36	1.62	0.03	2.66	8.05	0.76	0.53	0.11	0.38	1.40
Upper avg..	216	6.80	2.94	36.72	4.34	21	34	228	21	443	3.86	0.36	1.62	0.03	2.66	8.05	0.77	0.55	1.04	0.20	1.40
Minimum	80	6.42	2.01	0.75	2.50	2	4	115	5	285	2.78	0.05	0.13	0.01	0.74	2.17	0.05	0.10	1.00	0.20	1.40
Maximum	1093	6.98	4.43	200.00	8.10	76	167	525	39	765	5.20	1.40	8.77	0.14	9.78	30.70	2.99	2.50	1.50	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes
n	13	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	4	4
St.dev	305	0.17	0.72	63.64	1.89	29	48	133	11	149	0.78	0.41	2.69	0.04	2.58	7.97	0.82	0.70	0.13	0.00	0.00

Skienselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
10.01.2007	340	6.66	2.10	0.67	2.50	<1	3	225	7	305	2.35	0.10	0.08	0.01	0.48	2.61	0.20	0.10	2.00		
15.02.2007	340	6.58	2.04	0.68	2.50	<1	3	195	4	285	2.27	0.10	0.18	0.01	0.44	4.79	0.20	<0.10	<1.00	<0.20	1.40
05.03.2007	299	6.71	2.06	0.53	2.50	1	3	190	10	310	2.16	0.10	0.04	0.01	0.45	2.43	0.20	<0.10	<1.00		
10.04.2007	297	6.69	2.08	1.93	2.40	<1	3	190	9	295	2.27	0.24	0.04	0.01	0.39	2.27	0.20	0.10	<1.00		
03.05.2007	341	6.66	2.02	0.59	2.30	1	3	190	8	295	2.29	0.09	0.01	0.01	0.30	2.03	0.20	<0.10	<1.00	<0.20	1.40
13.06.2007	296	6.76	1.99	0.67	2.20	<1	3	165	12	270	2.16	0.07	0.05	0.01	0.48	1.90	0.20	<0.10	<1.00		
06.07.2007	978	6.80	2.00	2.08	2.60	2	4	170	7	275	2.22	0.10	0.11	0.01	0.42	2.33	0.20	<0.10	<1.00		
11.07.2007	843	6.74	1.97	1.30	2.70	2	4	165	5	280	2.22	0.20	0.10	0.02	0.52	2.64	0.23	0.10	<1.00		
08.08.2007	229	6.80	3.19	0.87	3.50	1	4	125	23	260	2.10	0.20	0.13	0.01	4.26	4.63	0.54	<0.10	<1.00	<0.20	1.40
11.09.2007	161	6.77	1.85	0.56	3.10	<1	3	105	15	260	2.05	0.10	0.05	0.01	0.43	2.00	0.20	0.20	<1.00		
01.10.2007	305	6.73	1.85	0.39	3.00	<1	3	115	11	265	2.07	<0.05	0.06	0.01	0.37	2.00	0.26	<0.10	<1.00	<0.20	1.40
06.11.2007	169	6.81	1.87	0.35	2.50	<1	4	140	11	250	2.00	<0.05	0.05	0.01	0.55	2.20	0.21	0.10	<1.00		
10.12.2007	219	6.64	2.05	0.55	2.40	<1	5	185	4	280	2.14	<0.05	0.04	0.01	0.51	2.16	0.10	<0.10	<1.00		
Lower avg.	371	6.72	2.08	0.86	2.63	1	3	166	10	279	2.18	0.10	0.07	0.01	0.74	2.61	0.23	0.05	0.15	0.50	1.40
Upper avg..	371	6.72	2.08	0.86	2.63	1	3	166	10	279	2.18	0.11	0.07	0.01	0.74	2.61	0.23	0.11	1.08	0.20	1.40
Minimum	161	6.58	1.85	0.35	2.20	1	3	105	4	250	2.00	0.05	0.01	0.01	0.30	1.90	0.10	0.10	1.00	0.20	1.40
Maximum	978	6.81	3.19	2.08	3.50	2	5	225	23	310	2.35	0.24	0.18	0.02	4.26	4.79	0.54	0.20	2.00	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	yes
n	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	4	4
St.dev	249	0.07	0.34	0.56	0.36	0	1	35	5	18	0.11	0.06	0.05	0.00	1.06	0.96	0.10	0.03	0.28	0.00	0.00

Otra

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
15.01.2007	286	5.79	2.00	0.81	3.10	2	4	110	19	240	1.91	0.24	0.44	0.04	0.67	5.54	0.97	0.10	<1.00		
15.02.2007	183	6.04	1.43	0.87	2.40	<1	2	93	19	215	1.79	0.10	0.21	0.01	1.85	5.58	0.43	0.10	<1.00	<0.20	1.40
05.03.2007	204	6.01	1.97	1.62	2.20	1	3	125	17	260	1.87	0.08	0.28	0.02	1.71	4.06	0.41	0.10	<1.00		
24.04.2007	186	6.16	1.30	0.58	2.00	<1	2	83	6	180	1.58	0.08	0.14	0.01	0.35	2.24	0.45	<0.10	1.00		
08.05.2007	174	6.17	1.27	0.77	1.90	<1	2	84	9	180	1.50	0.09	0.14	0.01	0.44	2.85	0.37	<0.10	<1.00	<0.20	1.40
21.06.2007	139	6.33	1.47	0.93	1.80	<1	3	51	7	160	1.07	0.09	0.15	0.03	0.88	2.76	0.38	<0.10	<1.00		
06.07.2007	229	6.23	1.96	9.85	4.20	5	13	98	17	345	1.71	0.25	1.03	0.04	2.09	7.71	0.75	0.30	<1.00		
14.08.2007	99	6.12	1.27	1.05	1.80	1	4	46	7	165	1.05	0.06	0.16	0.01	1.00	2.42	0.39	<0.10	<1.00	<0.20	1.40
12.09.2007	114	6.35	1.21	0.64	2.00	<1	2	42	6	165	1.09	<0.05	0.15	0.01	0.57	2.00	0.20	0.10	<1.00		
04.10.2007	122	6.11	1.37	0.54	2.20	<1	3	61	6	165	1.37	0.07	0.17	0.01	0.48	2.55	0.29	<0.10	<1.00	<0.20	1.40
07.11.2007	70	6.29	1.61	0.94	2.60	1	3	83	11	225	1.57	<0.05	0.19	0.01	1.39	3.10	0.10	<0.10	<1.00		
12.12.2007	127	6.03	1.74	0.87	3.40	1	3	105	16	280	2.01	<0.05	0.32	0.02	3.60	4.89	0.31	0.10	<1.00		
Lower avg.	161	6.14	1.55	1.62	2.47	1	4	82	12	215	1.54	0.09	0.28	0.02	1.25	3.81	0.42	0.07	0.08	0.25	1.40
Upper avg..	161	6.14	1.55	1.62	2.47	1	4	82	12	215	1.54	0.10	0.28	0.02	1.25	3.81	0.42	0.12	1.00	0.20	1.40
Minimum	70	5.79	1.21	0.54	1.80	1	2	42	6	160	1.05	0.05	0.14	0.01	0.35	2.00	0.10	0.10	1.00	0.20	1.40
Maximum	286	6.35	2.00	9.85	4.20	5	13	125	19	345	2.01	0.25	1.03	0.04	3.60	7.71	0.97	0.30	1.00	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	yes
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4	4
St.dev	61	0.16	0.30	2.61	0.74	1	3	27	5	58	0.34	0.07	0.25	0.01	0.95	1.77	0.23	0.06	0.00	0.00	0.00

Orreelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
08.01.2007	26	7.51	17.70	8.87	6.00	84	130	2000	20	2950	5.67	0.43	0.50	0.01	1.88	3.53	1.10	0.53	2.00		
06.02.2007	8	7.53	18.30	21.50	5.70	76	152	2350	25	3150	5.46	0.33	1.08	0.03	2.26	5.60	1.20	0.30	1.50	<0.20	1.40
06.03.2007	18	7.51	18.60	18.40	5.30	50	131	2200	3	2950	3.94	0.30	0.91	0.02	2.03	4.94	1.20	0.36	<1.00		
10.04.2007	6	7.68	19.10	4.14	4.80	13	44	1600	<10	2130	0.17	0.20	0.14	<0.01	1.65	1.60	0.80	0.34	1.50		
07.05.2007	1	7.63	19.20	5.72	4.80	10	45	990	27	1680	0.16	0.20	0.16	0.01	1.53	1.60	0.85	<0.10	<1.00	<0.20	1.40
12.06.2007	1	8.10	20.40	5.20	6.00	5	38	<1	94	850	0.94	0.24	0.06	0.01	1.37	0.70	0.88	0.30	<1.00		
09.07.2007	6	8.27	20.60	6.83	6.20	11	42	<1	41	760	0.98	0.33	0.12	0.01	1.34	2.00	0.98	<0.10	<1.00		
06.08.2007	5	7.88	18.40	13.50	5.70	13	74	385	62	1330	1.94	0.26	0.14	0.01	1.18	1.70	0.74	0.20	<1.00	<0.20	1.40
11.09.2007	7	7.98	19.90	24.00	6.40	20	97	36	40	1220	1.69	0.32	0.28	0.01	1.20	1.60	0.99	0.40	<1.00		
02.10.2007	4	7.33	17.80	11.60	6.00	7	88	665	175	1520	3.04	0.33	0.19	0.01	2.20	8.18	1.00	0.20	1.00	<0.20	1.40
06.11.2007	12	7.75	19.20	111.00	26.80	112	435	1150	3	3480	4.02	0.75	4.03	0.12	4.54	22.60	2.28	0.51	<1.00		
11.12.2007	5	7.70	18.70	14.50	5.60	12	112	1350	9	2240	4.04	0.22	0.40	0.01	2.00	2.21	3.24	0.25	1.00		
Lower avg.	8	7.74	18.99	20.44	7.44	34	116	1061	42	2022	2.67	0.33	0.67	0.02	1.93	4.69	1.27	0.28	0.58	1.75	1.40
Upper avg..	8	7.74	18.99	20.44	7.44	34	116	1061	42	2022	2.67	0.33	0.67	0.02	1.93	4.69	1.27	0.30	1.17	0.20	1.40
Minimum	1	7.33	17.70	4.14	4.80	5	38	1	3	760	0.17	0.20	0.06	0.01	1.18	0.70	0.74	0.10	1.00	0.20	1.40
Maximum	26	8.27	20.60	111.00	26.80	112	435	2350	175	3480	5.67	0.75	4.03	0.12	4.54	22.60	3.24	0.53	2.00	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4	4
St.dev	7	0.27	0.94	29.26	6.12	37	108	860	49	936	1.96	0.15	1.11	0.03	0.91	6.05	0.74	0.14	0.33	0.00	0.00

Suldalslågen

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
17.01.2007	29	6.40	3.71	0.31	0.98	<1	2	345	7	385	1.55	0.08	0.09	0.02	0.33	4.05	0.36	0.20	<1.00		
16.02.2007	16	6.39	2.35	0.33	0.69	<1	2	255	3	305	1.37	0.07	0.83	0.01	0.52	13.10	0.26	0.20	<1.00	<0.20	1.40
15.03.2007	44	6.36	3.00	0.68	1.30	<1	2	195	4	255	1.16	0.07	0.09	0.02	0.26	3.61	0.32	0.10	<1.00		
13.04.2007	24	6.50	2.48	0.41	0.90	<1	2	170	<2	220	1.13	0.08	0.05	0.01	0.27	2.15	0.26	<0.10	<1.00		
11.05.2007	26	6.58	1.99	0.38	0.80	<1	2	180	7	225	1.05	0.06	0.03	<0.01	0.20	1.40	0.19	<0.10	<1.00	<0.20	1.40
18.06.2007	49	6.57	1.49	0.48	0.47	<1	2	145	5	175	0.81	<0.05	0.03	0.01	0.19	1.30	0.10	<0.10	<1.00		
26.07.2007	70	6.46	1.32	0.54	0.58	<1	1	120	4	160	0.77	0.07	0.03	0.01	0.13	1.20	0.20	<0.10	<1.00		
16.08.2007	78	6.37	1.39	0.61	1.70	<1	1	110	5	225	0.88	0.08	0.10	0.01	0.28	1.50	0.20	<0.10	<1.00	<0.20	1.40
17.09.2007	102	6.33	1.58	1.02	2.00	1	4	120	<2	205	1.11	<0.05	0.16	0.01	0.33	1.80	0.20	0.20	<1.00		
05.10.2007	60	6.50	1.38	0.29	0.70	<1	2	130	<2	165	0.79	<0.05	0.05	0.01	0.32	1.40	0.10	0.30	<1.00	<0.20	1.40
07.11.2007	63	6.42	1.73	0.68	2.30	1	3	140	<2	215	1.20	<0.05	0.15	0.01	0.31	1.80	<0.05	<0.10	<1.00		
10.12.2007	26	6.55	1.96	1.30	1.10	<1	2	260	<2	310	1.30	<0.05	0.08	0.01	0.37	1.70	<0.05	<0.10	<1.00		
Lower avg.	49	6.45	2.03	0.59	1.13	0	2	181	3	237	1.09	0.04	0.14	0.01	0.29	2.92	0.18	0.08	0.08	0.25	1.40
Upper avg..	49	6.45	2.03	0.59	1.13	1	2	181	4	237	1.09	0.06	0.14	0.01	0.29	2.92	0.19	0.14	1.00	0.20	1.40
Minimum	16	6.33	1.32	0.29	0.47	1	1	110	2	160	0.77	0.05	0.03	0.01	0.13	1.20	0.05	0.10	1.00	0.20	1.40
Maximum	102	6.58	3.71	1.30	2.30	1	4	345	7	385	1.55	0.08	0.83	0.02	0.52	13.10	0.36	0.30	1.00	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	no	no	no	yes
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4	4
St.dev	26	0.09	0.74	0.31	0.59	0	1	72	2	67	0.25	0.01	0.22	0.01	0.10	3.33	0.10	0.07	0.00	0.00	0.00

Orkla

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
04.01.2007	79	7.36	6.75	0.83	2.60	1	2	230	12	415	3.10	0.10	0.03	0.07	10.10	29.50	0.65	0.30	<1.00		
12.02.2007	57	7.38	6.87	1.34	2.00	<1	3	325	8	440	3.27	0.10	0.20	0.04	6.31	20.80	0.80	0.30	<1.00	<0.20	1.40
08.03.2007	47	7.56	6.04	1.04	1.60	<1	3	170	11	285	2.87	0.05	0.01	0.02	3.53	5.84	0.60	0.20	<1.00		
11.04.2007	74	7.46	7.15	1.42	3.00	1	3	340	3	490	3.32	0.10	0.03	0.07	9.55	25.30	0.75	0.55	<1.00		
07.05.2007	121	7.16	4.17	1.82	3.60	2	5	125	3	275	2.55	0.09	0.03	0.04	8.20	15.30	0.82	0.20	<1.00	<0.20	1.40
07.06.2007	131	7.23	3.65	0.70	1.60	<1	3	93	4	205	1.85	0.08	0.02	0.02	4.42	6.98	0.48	0.20	<1.00		
05.07.2007	36	7.57	5.50	0.60	1.40	<1	2	145	5	255	2.06	0.10	0.02	0.02	4.43	7.83	0.59	0.10	<1.00		
08.08.2007	53	7.56	5.73	0.67	2.40	1	5	115	3	245	2.63	<0.05	0.02	0.04	6.84	13.60	0.45	<0.10	<1.00	<0.20	1.40
24.09.2007	85	7.50	6.00	0.57	2.60	<1	3	145	<2	275	2.74	0.13	0.03	0.08	10.70	25.50	0.60	0.20	<1.00		
08.10.2007	96	7.37	5.19	8.36	5.10	4	11	100	7	335	2.65	0.20	0.11	0.04	6.57	15.00	0.78	0.30	<1.00	<0.20	1.40
06.11.2007	77	7.50	7.27	1.03	4.10	2	4	305	<2	475	3.42	<0.05	0.05	0.10	14.50	31.40	0.62	<0.10	11.50		
05.12.2007	42	7.57	7.89	0.64	2.40	1	2	310	2	470	3.85	0.10	0.04	0.11	12.30	33.40	0.76	0.30	<1.00		
Lower avg.	75	7.44	6.02	1.59	2.70	1	4	200	5	347	2.86	0.09	0.05	0.06	8.12	19.20	0.66	0.22	0.96	2.88	1.40
Upper avg..	75	7.44	6.02	1.59	2.70	1	4	200	5	347	2.86	0.10	0.05	0.06	8.12	19.20	0.66	0.24	1.88	0.20	1.40
Minimum	36	7.16	3.65	0.57	1.40	1	2	93	2	205	1.86	0.05	0.01	0.02	3.53	5.84	0.45	0.10	1.00	0.20	1.40
Maximum	131	7.57	7.89	8.36	5.10	4	11	340	12	490	3.85	0.20	0.20	0.11	14.50	33.40	0.82	0.55	11.50	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4	4
St.dev	30	0.14	1.27	2.17	1.11	1	2	96	4	104	0.57	0.04	0.05	0.03	3.39	9.80	0.12	0.13	3.03	0.00	0.00

Vefsna

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
05.01.2007	110	7.42	7.10	0.37	1.70	<1	1	105	3	180	1.71	0.10	0.03	<0.01	0.37	0.61	0.30	0.20	<1.00		
05.02.2007	66	7.45	10.70	0.37	1.40	<1	2	295	<2	370	2.22	0.10	0.01	<0.01	0.35	0.10	0.07	0.20	<1.00	<0.20	1.40
05.03.2007	31	7.63	10.40	0.12	0.97	<1	<1	175	<2	240	2.01	0.10	0.01	<0.01	0.25	0.20	<0.05	0.20	<1.00		
02.04.2007	220	7.16	5.19	15.00	1.90	2	3	50	3	125	1.43	0.20	0.45	0.01	0.83	2.75	0.72	0.86	1.50		
04.05.2007	235	7.35	6.63	0.98	1.70	<1	4	46	<2	132	1.44	0.08	0.01	<0.01	0.36	0.47	0.24	0.20	<1.00	<0.20	1.40
08.06.2007	574	7.31	3.87	1.90	0.91	1	3	23	<2	83	1.13	0.10	0.07	<0.01	0.38	0.46	0.26	0.10	<1.00		
06.07.2007	410	7.23	3.15	2.21	0.50	<1	2	15	3	45	0.75	0.10	0.07	<0.01	0.25	0.51	0.20	<0.10	<1.00		
13.08.2007	111	7.36	3.44	0.59	0.56	<1	3	11	3	52	0.79	0.06	0.03	<0.01	0.21	0.32	0.09	<0.10	<1.00	<0.20	1.40
11.09.2007	139	7.50	4.83	0.30	1.40	<1	1	9	<2	77	1.13	0.09	0.03	<0.01	0.26	0.30	0.20	0.20	<1.00		
01.10.2007	97	7.56	6.04	0.51	1.30	<1	1	21	<2	95	1.33	<0.05	0.02	<0.01	0.30	0.27	0.10	<0.10	<1.00	<0.20	1.40
05.11.2007	120	7.64	7.10	0.38	1.90	<1	2	54	<2	160	1.98	<0.05	0.06	<0.01	0.43	2.34	<0.05	<0.10	<1.00		
07.12.2007	48	7.46	8.21	0.29	1.30	<1	2	100	<2	175	1.95	<0.05	0.03	<0.01	0.47	0.34	<0.05	<0.10	1.00		
Lower avg.	180	7.42	6.39	1.92	1.30	0	2	75	1	145	1.49	0.08	0.07	0.00	0.37	0.72	0.18	0.16	0.21	0.62	1.40
Upper avg..	180	7.42	6.39	1.92	1.30	1	2	75	2	145	1.49	0.09	0.07	0.01	0.37	0.72	0.19	0.21	1.04	0.20	1.40
Minimum	31	7.16	3.15	0.12	0.50	1	1	9	2	45	0.75	0.05	0.01	0.01	0.21	0.10	0.05	0.10	1.00	0.20	1.40
Maximum	574	7.64	10.70	15.00	1.90	2	4	295	3	370	2.23	0.20	0.45	0.01	0.83	2.75	0.72	0.86	1.50	0.20	1.40
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	no	yes	yes	yes	no	no	no	yes
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4	4
St.dev	162	0.15	2.50	4.17	0.48	0	1	85	0	92	0.49	0.04	0.12	0.00	0.17	0.87	0.19	0.21	0.14	0.00	0.00

Altaelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
08.01.2007	35	7.45	7.14	0.20	2.70	1	3	36	6	165	5.24	0.10	0.02	<0.01	0.69	0.24	0.10	0.20	<1.00		
06.02.2007	34	7.43	7.53	0.36	2.50	1	3	54	<2	175	5.54	0.08	0.01	<0.01	0.63	<0.05	0.07	0.20	<1.00	<0.20	1.40
12.03.2007	32	7.51	7.90	0.39	2.50	<1	3	57	5	175	6.10	0.10	<0.01	<0.01	0.89	0.20	<0.05	0.20	<1.00		
09.04.2007	37	7.64	8.43	0.70	2.50	<1	3	34	3	143	5.58	0.10	<0.01	<0.01	0.77	0.14	<0.05	0.46	<1.00		
07.05.2007	78	7.59	9.57	0.99	2.50	1	4	45	2	180	6.44	0.10	<0.01	<0.01	0.36	0.20	0.06	0.20	<1.00	<0.20	1.40
18.06.2007	205	7.31	3.85	1.07	3.40	<1	7	11	6	160	3.14	0.08	0.02	<0.01	0.61	0.36	0.24	0.20	<1.00		
10.07.2007	122	7.36	4.50	0.58	2.90	2	5	10	10	150	3.00	<0.05	0.01	<0.01	0.56	0.20	0.20	0.20	<1.00		
06.08.2007	147	7.61	4.98	1.04	2.90	<1	4	9	<2	140	3.34	0.08	<0.01	<0.01	0.47	0.09	0.10	0.20	<1.00	<0.20	1.80
10.09.2007	77	7.54	5.78	0.94	2.90	1	3	6	<2	147	3.38	0.10	<0.01	<0.01	0.46	0.59	0.15	0.20	<1.00		
01.10.2007	117	7.51	5.79	0.52	2.90	<1	4	9	<2	134	3.77	0.08	<0.01	<0.01	0.59	0.26	0.20	0.30	<1.00	<0.20	1.40
05.11.2007	101	7.56	6.01	0.55	3.00	1	4	20	<2	160	4.28	0.05	0.01	<0.01	0.66	0.21	0.09	<0.10	<1.00		
10.12.2007	53	7.35	5.54	0.89	3.00	2	4	29	<2	165	5.11	<0.05	0.01	<0.01	0.67	0.21	0.07	<0.10	<1.00		
Lower avg.	86	7.49	6.42	0.69	2.81	1	4	27	3	158	4.58	0.07	0.01	0.01	0.61	0.22	0.11	0.20	0.20	0.59	1.50
Upper avg..	86	7.49	6.42	0.69	2.81	1	4	27	4	158	4.58	0.08	0.01	0.00	0.61	0.23	0.12	0.21	1.00	0.20	1.50
Minimum	32	7.31	3.85	0.20	2.50	1	3	6	2	134	3.00	0.05	0.01	0.01	0.36	0.05	0.05	0.10	1.00	0.20	1.40
Maximum	205	7.64	9.57	1.07	3.40	2	7	57	10	180	6.44	0.10	0.02	0.01	0.89	0.59	0.24	0.46	1.00	0.20	1.80
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	no	no	yes	yes	yes	yes	no	no	yes
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4	4
St.dev	54	0.11	1.71	0.30	0.28	0	1	19	3	15	1.23	0.02	0.01	0.00	0.14	0.14	0.07	0.09	0.00	0.00	0.20

Tista utløp Femsjøen

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
05.02.2007	28	6.75	5.66	1.52	8.80	7	15	630	4	910	3.70	0.27	0.29	0.02	2.45	5.17	1.10	0.35	<1.00		
11.05.2007	13	6.95	5.84	4.61	8.30	5	14	670	10	985	4.09	0.27	0.26	0.02	1.33	5.80	6.29	0.28	<1.00		
06.08.2007	14	6.89	5.50	2.63	8.30	3	12	640	5	900	3.85	0.20	0.23	0.02	1.62	3.75	0.82	0.20	<1.00		
08.10.2007	13	6.80	5.59	1.88	8.00	2	10	625	2	910	3.51	0.13	0.20	0.02	1.16	3.24	0.78	0.20	<1.00		
Lower avg.	17	6.85	5.65	2.66	8.35	4	13	641	5	926	3.79	0.22	0.24	0.02	1.64	4.49	2.25	0.26	0.26	INF	INF
Upper avg..	17	6.85	5.65	2.66	8.35	4	13	641	5	926	3.79	0.22	0.24	0.02	1.64	4.49	2.25	0.26	1.00	INF	INF
Minimum	13	6.75	5.50	1.52	8.00	2	10	625	2	900	3.51	0.13	0.20	0.02	1.16	3.24	0.78	0.20	1.00	1.00	1.00
Maximum	28	6.95	5.84	4.61	8.80	7	15	670	10	985	4.09	0.27	0.29	0.02	2.45	5.80	6.29	0.35	1.00	1.00	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0	0
St.dev	7	0.09	0.14	1.38	0.33	2	2	20	3	39	0.24	0.07	0.04	0.00	0.57	1.20	2.70	0.07	0.00	0.00	0.00

Tokkeelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
06.02.2007	27	6.24	2.18	1.07	6.00	1	5	185	<2	395	3.17	0.20	0.23	0.03	0.44	5.80	0.39	0.20	<1.00		
15.05.2007	23	6.31	2.29	3.12	5.80	2	7	160	4	390	3.02	0.21	0.21	0.04	0.73	6.59	0.48	0.20	<1.00		
06.07.2007	50	6.52	2.85	0.91	5.30	1	4	155	5	340	2.82	0.26	0.38	0.03	1.66	11.00	0.87	0.10	<1.00		
11.07.2007	34	6.47	3.78	1.12	5.30	2	5	135	<2	340	2.74	0.20	0.48	0.03	1.58	8.28	0.65	0.20	<1.00		
13.08.2007	41	6.44	1.94	1.19	5.10	<1	5	110	<2	295	2.57	0.20	0.18	0.02	0.42	8.09	0.52	0.37	<1.00		
22.10.2007	8	6.50	2.06	2.64	6.30	1	7	120	<2	345	2.82	0.20	0.16	0.02	0.48	4.90	0.36	<0.10	<1.00		
Lower avg.	31	6.41	2.52	1.68	5.63	1	6	144	2	351	2.86	0.21	0.27	0.03	0.89	7.44	0.55	0.18	0.18		
Upper avg..	31	6.41	2.52	1.68	5.63	1	6	144	3	351	2.86	0.21	0.27	0.03	0.89	7.44	0.55	0.19	1.00		
Minimum	8	6.24	1.94	0.91	5.10	1	4	110	2	295	2.57	0.20	0.16	0.02	0.42	4.90	0.36	0.10	1.00		
Maximum	50	6.52	3.78	3.12	6.30	2	7	185	5	395	3.17	0.26	0.48	0.04	1.66	11.00	0.87	0.37	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	no		
n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
St.dev	15	0.11	0.70	0.95	0.47	1	1	28	1	37	0.21	0.02	0.13	0.01	0.58	2.18	0.19	0.10	0.00		

Nidelva(Rykene)

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
06.02.2007	122	6.44	2.32	2.55	2.90	2	5	200	14	355	2.70	0.10	0.27	0.03	0.81	4.36	0.23	0.10	1.00		
15.05.2007	131	6.68	2.02	0.84	2.40	1	3	195	13	310	2.07	0.10	0.17	0.02	0.83	3.60	0.22	0.20	<1.00		
13.08.2007	94	6.57	1.68	1.04	3.10	<1	6	115	<2	260	1.68	0.10	0.18	0.02	0.81	3.46	0.20	<0.10	<1.00		
22.10.2007	40	6.47	1.76	0.65	2.80	<1	2	135	4	270	1.98	0.10	0.17	0.01	0.84	4.08	0.22	<0.10	<1.00		
Lower avg.	97	6.54	1.94	1.27	2.80	1	4	161	8	299	2.11	0.10	0.20	0.02	0.82	3.88	0.22	0.08	0.25		
Upper avg..	97	6.54	1.94	1.27	2.80	1	4	161	8	299	2.11	0.10	0.20	0.02	0.82	3.88	0.22	0.12	1.00		
Minimum	40	6.44	1.68	0.65	2.40	1	2	115	2	260	1.68	0.10	0.17	0.01	0.81	3.46	0.20	0.10	1.00		
Maximum	131	6.68	2.32	2.55	3.10	2	6	200	14	355	2.70	0.10	0.27	0.03	0.84	4.36	0.23	0.20	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	41	0.11	0.29	0.87	0.29	1	2	43	6	43	0.43	0.00	0.05	0.01	0.02	0.42	0.01	0.05	0.00		

Tovdalselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
04.02.2007	62	6.22	2.20	0.97	4.10	1	4	120	15	305	2.33	0.29	0.46	0.04	2.14	11.00	0.42	0.20	<1.00		
08.05.2007	40	6.57	2.00	1.29	3.40	1	5	150	52	450	1.71	0.20	0.32	0.03	0.56	5.22	0.30	<0.10	<1.00		
14.08.2007	37	6.59	1.92	1.33	4.60	<1	6	56	15	320	1.18	0.20	0.33	0.02	0.59	4.32	0.30	<0.10	<1.00		
04.10.2007	35	6.36	1.98	0.94	5.10	<1	4	69	16	275	1.62	0.14	0.39	0.04	1.11	5.10	0.40	0.10	<1.00		
Lower avg.	43	6.44	2.02	1.13	4.30	1	5	99	25	338	1.71	0.21	0.37	0.03	1.10	6.41	0.36	0.08	0.08		
Upper avg..	43	6.44	2.02	1.13	4.30	1	5	99	25	338	1.71	0.21	0.37	0.03	1.10	6.41	0.36	0.12	1.00		
Minimum	35	6.22	1.92	0.94	3.40	1	4	56	15	275	1.18	0.14	0.32	0.02	0.56	4.32	0.30	0.10	1.00		
Maximum	62	6.59	2.20	1.33	5.10	1	6	150	52	450	2.33	0.29	0.46	0.04	2.14	11.00	0.42	0.20	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	13	0.18	0.12	0.21	0.73	0	1	44	18	77	0.48	0.06	0.07	0.01	0.74	3.09	0.06	0.05	0.00		

Mandalselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
20.02.2007	54	6.22	2.50	0.93	2.90	1	4	100	42	275	1.24	0.10	0.65	0.02	3.16	6.10	0.21	0.20	<1.00		
19.05.2007	105	6.29	2.41	1.41	2.80	<1	5	130	10	260	1.41	0.10	0.33	0.03	0.43	5.96	0.24	<0.10	<1.00		
16.08.2007	160	6.16	1.90	4.74	5.80	4	14	49	40	400	1.35	0.20	0.99	0.03	1.19	5.37	0.37	<0.10	<1.00		
30.09.2007	63	6.11	1.75	1.39	4.60	1	5	80	9	285	1.24	0.11	0.55	0.03	0.30	3.83	0.20	0.10	<1.00		
Lower avg.	96	6.20	2.14	2.12	4.03	2	7	90	25	305	1.31	0.13	0.63	0.03	1.27	5.32	0.26	0.08	0.08		
Upper avg..	96	6.20	2.14	2.12	4.03	2	7	90	25	305	1.31	0.13	0.63	0.03	1.27	5.32	0.26	0.12	1.00		
Minimum	54	6.11	1.75	0.93	2.80	1	4	49	9	260	1.24	0.10	0.33	0.02	0.30	3.83	0.20	0.10	1.00		
Maximum	160	6.29	2.50	4.74	5.80	4	14	130	42	400	1.41	0.20	0.99	0.03	3.16	6.10	0.37	0.20	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	48	0.08	0.37	1.76	1.44	2	5	34	18	64	0.08	0.05	0.28	0.01	1.32	1.04	0.08	0.05	0.00		

Lyngdalselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
20.02.2007	22	6.20	3.56	3.33	2.40	2	4	295	11	405	2.37	0.10	1.13	0.05	1.44	9.50	0.22	0.20	<1.00		
19.05.2007	30	6.31	3.20	1.67	3.40	1	5	185	4	325	1.03	0.20	0.43	0.04	0.29	4.88	0.12	0.10	<1.00		
16.08.2007	67	6.64	2.67	2.98	6.50	3	12	61	15	345	1.39	0.23	1.03	0.03	0.65	5.07	0.20	<0.10	<1.00		
30.09.2007	25	6.53	2.70	1.25	4.70	3	8	170	3	365	1.62	0.11	0.53	0.03	0.38	4.33	0.10	<0.10	<1.00		
Lower avg.	36	6.42	3.03	2.31	4.25	2	7	178	8	360	1.60	0.16	0.78	0.04	0.69	5.94	0.16	0.08	0.08		
Upper avg..	36	6.42	3.03	2.31	4.25	2	7	178	8	360	1.60	0.16	0.78	0.04	0.69	5.94	0.16	0.12	1.00		
Minimum	22	6.20	2.67	1.25	2.40	1	4	61	3	325	1.03	0.10	0.43	0.03	0.29	4.33	0.10	0.10	1.00		
Maximum	67	6.64	3.56	3.33	6.50	3	12	295	15	405	2.38	0.23	1.13	0.05	1.44	9.50	0.22	0.20	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	21	0.20	0.43	1.00	1.77	1	4	96	6	34	0.57	0.07	0.35	0.01	0.52	2.39	0.06	0.05	0.00		

Kvina

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
20.02.2007	44	6.14	5.42	1.34	2.20	6	10	250	33	395	2.02	0.10	0.67	0.04	2.50	13.60	0.28	0.39	<1.00		
19.05.2007	91	5.81	3.21	2.93	3.70	2	9	290	15	480	0.60	0.20	0.53	0.03	1.17	5.97	0.22	0.14	<1.00		
16.08.2007	121	6.01	2.35	3.35	7.80	3	13	47	30	390	1.22	0.29	1.12	0.02	0.96	4.82	0.20	<0.10	<1.00		
30.09.2007	52	6.32	2.73	1.29	6.70	2	8	135	9	400	1.75	0.14	0.81	0.03	1.57	5.62	0.21	<0.10	<1.00		
Lower avg.	77	6.07	3.43	2.23	5.10	3	10	181	22	416	1.40	0.18	0.78	0.03	1.55	7.50	0.23	0.13	0.13		
Upper avg..	77	6.07	3.43	2.23	5.10	3	10	181	22	416	1.40	0.18	0.78	0.03	1.55	7.50	0.23	0.18	1.00		
Minimum	44	5.81	2.35	1.29	2.20	2	8	47	9	390	0.60	0.10	0.53	0.02	0.96	4.82	0.20	0.10	1.00		
Maximum	121	6.32	5.42	3.35	7.80	6	13	290	33	480	2.02	0.29	1.12	0.04	2.50	13.60	0.28	0.39	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	36	0.22	1.37	1.07	2.60	2	2	111	12	43	0.63	0.08	0.25	0.01	0.68	4.09	0.04	0.14	0.00		

Sira

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
20.02.2007	96	5.20	1.82	1.32	1.80	<1	3	115	33	265	0.88	0.10	0.39	0.02	2.44	5.85	0.20	<0.10	1.50		
19.05.2007	161	5.32	1.69	0.90	1.60	1	4	95	25	235	0.90	0.09	0.36	0.02	2.48	3.36	0.22	<0.10	1.50		
16.08.2007	248	5.43	1.74	0.72	2.70	<1	5	48	10	205	0.92	0.07	0.42	0.01	0.60	2.52	0.10	<0.10	2.00		
30.09.2007	124	5.32	1.64	0.70	2.40	<1	4	68	9	190	0.90	<0.05	0.45	0.01	0.22	2.61	0.10	0.10	<1.00		
Lower avg.	157	5.32	1.72	0.91	2.12	0	4	82	19	224	0.90	0.06	0.41	0.02	1.44	3.58	0.16	0.02	1.25		
Upper avg..	157	5.32	1.72	0.91	2.12	1	4	82	19	224	0.90	0.08	0.41	0.02	1.44	3.58	0.16	0.10	1.50		
Minimum	96	5.20	1.64	0.70	1.60	1	3	48	9	190	0.88	0.05	0.36	0.01	0.22	2.52	0.10	0.10	1.00		
Maximum	248	5.43	1.82	1.32	2.70	1	5	115	33	265	0.92	0.10	0.45	0.02	2.48	5.85	0.22	0.10	2.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	66	0.09	0.08	0.29	0.51	0	1	29	12	33	0.02	0.02	0.04	0.01	1.19	1.56	0.06	0.00	0.41		

Bjerkreimselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
25.02.2007	31	6.46	3.86	2.44	1.10	3	9	460	3	575	1.86	0.10	0.71	0.02	0.24	3.41	0.20	0.20	<1.00		
09.05.2007	55	6.49	3.41	0.37	1.10	2	4	310	6	400	1.47	0.08	0.14	0.02	0.19	2.54	0.09	<0.10	<1.00		
25.08.2007	37	6.39	3.25	0.52	1.70	2	5	385	3	450	1.30	<0.05	0.20	0.02	0.23	2.26	0.10	0.10	<1.00		
29.10.2007	44	6.30	3.04	0.63	1.70	2	6	290	<2	390	1.46	<0.05	0.23	0.02	0.27	2.95	0.20	<0.10	<1.00		
Lower avg.	42	6.41	3.39	0.99	1.40	2	6	361	3	454	1.52	0.04	0.32	0.02	0.23	2.79	0.15	0.08	0.08		
Upper avg..	42	6.41	3.39	0.99	1.40	2	6	361	4	454	1.52	0.07	0.32	0.02	0.23	2.79	0.15	0.12	1.00		
Minimum	31	6.30	3.04	0.37	1.10	2	4	290	2	390	1.31	0.05	0.14	0.02	0.19	2.26	0.09	0.10	1.00		
Maximum	55	6.49	3.86	2.44	1.70	3	9	460	6	575	1.86	0.10	0.71	0.02	0.27	3.41	0.20	0.20	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	10	0.08	0.35	0.97	0.35	1	2	78	2	85	0.24	0.02	0.26	0.00	0.03	0.50	0.06	0.05	0.00		

Figgjoelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
06.02.2007	9	7.02	11.10	3.51	3.10	16	24	1400	15	1680	3.51	0.10	0.40	0.03	1.10	7.30	0.51	0.20	1.50		
08.05.2007	5	7.11	11.20	2.08	2.30	5	12	970	18	1290	2.35	0.10	0.22	0.01	0.83	3.53	0.34	0.20	<1.00		
08.08.2007	7	7.30	10.20	1.52	3.20	7	20	1250	24	1450	2.61	0.06	0.28	0.01	1.10	3.87	0.33	<0.10	<1.00		
02.10.2007	7	6.95	10.30	1.44	3.60	11	19	1250	7	1470	3.04	<0.05	0.76	0.02	1.04	5.94	0.54	0.10	1.00		
Lower avg.	7	7.10	10.70	2.14	3.05	10	19	1218	16	1473	2.88	0.06	0.42	0.02	1.02	5.16	0.43	0.12	0.62		
Upper avg..	7	7.10	10.70	2.14	3.05	10	19	1218	16	1473	2.88	0.08	0.42	0.02	1.02	5.16	0.43	0.15	1.12		
Minimum	5	6.95	10.20	1.44	2.30	5	12	970	7	1290	2.35	0.05	0.22	0.01	0.83	3.53	0.33	0.10	1.00		
Maximum	9	7.30	11.20	3.51	3.60	16	24	1400	24	1680	3.51	0.10	0.76	0.03	1.10	7.30	0.54	0.20	1.50		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	2	0.15	0.52	0.96	0.55	5	5	180	7	160	0.51	0.03	0.24	0.01	0.13	1.78	0.11	0.06	0.25		

Lyseelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
12.02.2007	19	6.38	3.69	<0.10	0.36	<1	1	140	<2	170	2.08	<0.05	0.05	0.02	0.17	1.90	0.10	0.20	<1.00		
07.05.2007	21	6.73	2.14	0.85	0.62	<1	1	58	4	95	0.83	<0.05	0.10	0.01	0.14	1.00	<0.05	<0.10	<1.00		
20.08.2007	22	6.53	1.47	0.16	1.90	<1	<1	44	<2	124	1.43	<0.05	0.20	<0.01	0.25	0.82	0.05	0.10	<1.00		
10.10.2007	8	6.68	2.29	0.17	0.69	<1	<1	120	<2	150	2.07	<0.05	0.08	0.01	0.21	1.30	<0.05	<0.10	<1.00		
Lower avg.	18	6.58	2.40	0.30	0.89	1	1	91	1	135	1.60	1.60	0.11	0.01	0.19	1.25	0.04	0.08	0.08		
Upper avg..	18	6.58	2.40	0.32	0.89	1	1	91	3	135	1.60	0.05	0.11	0.01	0.19	1.25	0.06	0.12	1.00		
Minimum	8	6.38	1.47	0.10	0.36	1	1	44	2	95	0.83	0.05	0.05	0.01	0.14	0.82	0.05	0.10	1.00		
Maximum	22	6.73	3.69	0.85	1.90	1	1	140	4	170	2.08	0.05	0.20	0.02	0.25	1.90	0.10	0.20	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	no	yes	yes	yes	yes	no	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	6	0.16	0.93	0.36	0.69	0	0	47	1	33	0.60	0.00	0.07	0.01	0.05	0.47	0.03	0.05	0.00		

Årdalselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
19.02.2007	37	6.69	8.61	0.67	1.10	1	2	2050	3	2190	4.90	0.06	0.50	0.01	0.85	3.90	0.20	0.30	1.00		
15.05.2007	66	6.75	4.64	0.37	1.30	<1	2	1300	6	1310	2.61	0.08	0.17	0.01	0.44	1.60	0.09	0.20	<1.00		
09.08.2007	35	6.61	3.90	0.41	1.30	<1	4	635	<2	635	2.74	<0.05	0.09	0.01	0.42	2.03	<0.05	0.34	<1.00		
10.10.2007	23	6.69	4.15	0.65	1.20	<1	2	900	<2	895	2.31	<0.05	0.08	0.01	0.28	1.40	0.08	<0.10	<1.00		
Lower avg.	40	6.68	5.32	0.52	1.23	0	3	1221	2	1258	3.14	0.04	0.21	0.01	0.50	2.23	0.09	0.21	0.25		
Upper avg..	40	6.68	5.32	0.52	1.23	1	3	1221	3	1258	3.14	0.06	0.21	0.01	0.50	2.23	0.11	0.24	1.00		
Minimum	23	6.61	3.90	0.37	1.10	1	2	635	2	635	2.31	0.05	0.08	0.01	0.28	1.40	0.05	0.10	1.00		
Maximum	66	6.75	8.61	0.67	1.30	1	4	2050	6	2190	4.90	0.08	0.50	0.01	0.85	3.90	0.20	0.34	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	18	0.06	2.21	0.16	0.10	0	1	616	2	681	1.19	0.01	0.20	0.00	0.25	1.14	0.07	0.11	0.00		

Ulladalsåna (Ulla)

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
19.02.2007	30	6.57	3.39	0.31	0.47	<1	<1	105	6	375	1.85	0.06	0.42	0.01	0.19	3.30	0.10	0.20	2.50		
15.05.2007	40	6.48	1.90	0.21	1.70	<1	1	33	4	97	1.13	0.05	0.12	0.01	0.19	1.30	0.09	0.10	<1.00		
09.08.2007	25	6.81	2.16	0.16	1.10	<1	3	66	<2	118	1.63	<0.05	0.03	0.01	0.37	3.29	<0.05	0.51	<1.00		
10.10.2007	19	6.89	2.54	<0.10	1.10	<1	<1	74	<2	122	2.20	<0.05	0.03	0.01	0.22	1.20	0.10	<0.10	<1.00		
Lower avg.	29	6.69	2.50	0.17	1.09	1	1	70	3	178	1.70	0.03	0.15	0.01	0.24	2.27	0.07	0.20	0.62		
Upper avg..	29	6.69	2.50	0.20	1.09	1	2	70	4	178	1.70	0.05	0.15	0.01	0.24	2.27	0.08	0.23	1.38		
Minimum	19	6.48	1.90	0.10	0.47	1	1	33	2	97	1.13	0.05	0.03	0.01	0.19	1.20	0.05	0.10	1.00		
Maximum	40	6.89	3.39	0.31	1.70	1	3	105	6	375	2.20	0.06	0.42	0.01	0.37	3.30	0.10	0.51	2.50		
More than 70%LOD	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	no	yes	yes	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	9	0.19	0.65	0.09	0.50	0	1	30	2	132	0.45	0.01	0.18	0.00	0.09	1.18	0.02	0.19	0.75		

Saudaelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
19.02.2007	31	6.06	3.07	0.26	0.55	1	2	360	6	430	1.28	0.05	0.42	0.03	0.38	6.20	0.27	0.20	<1.00		
15.05.2007	37	5.98	1.73	0.18	0.82	<1	<1	96	4	138	0.77	0.05	0.09	0.01	0.18	1.50	0.09	<0.10	<1.00		
09.08.2007	25	6.27	0.87	0.13	0.54	<1	3	65	<2	101	0.53	<0.05	0.05	<0.01	0.22	1.80	<0.05	0.44	<1.00		
10.10.2007	16	6.38	1.68	0.13	0.49	<1	1	170	<2	205	0.96	<0.05	0.05	0.01	0.23	1.00	0.06	<0.10	<1.00		
Lower avg.	27	6.17	1.84	0.18	0.60	0	2	173	3	219	0.89	0.02	0.15	0.01	0.25	2.62	0.10	0.16	0.16		
Upper avg..	27	6.17	1.84	0.18	0.60	1	2	173	4	219	0.89	0.05	0.15	0.01	0.25	2.62	0.12	0.21	1.00		
Minimum	16	5.98	0.87	0.13	0.49	1	1	65	2	101	0.54	0.05	0.05	0.01	0.18	1.00	0.05	0.10	1.00		
Maximum	37	6.38	3.07	0.26	0.82	1	3	360	6	430	1.28	0.05	0.42	0.03	0.38	6.20	0.27	0.44	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	9	0.19	0.91	0.06	0.15	0	1	132	2	147	0.32	0.00	0.18	0.01	0.09	2.41	0.10	0.16	0.00		

Vikedalselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
19.02.2007	13	6.38	4.08	2.74	0.76	1	3	400	15	465	1.33	0.20	0.63	0.04	0.64	7.20	0.68	0.30	<1.00		
15.05.2007	7	6.71	3.25	0.34	0.74	1	2	205	3	250	0.98	0.20	0.10	0.02	0.37	2.08	0.38	0.10	<1.00		
09.08.2007	7	6.53	2.59	0.62	1.30	<1	5	280	<2	335	0.81	0.20	0.10	0.02	0.42	2.73	0.22	0.37	<1.00		
10.10.2007	6	6.72	3.16	0.77	1.30	1	3	340	<2	400	1.13	0.27	0.09	0.01	0.42	1.70	0.33	<0.10	<1.00		
Lower avg.	8	6.58	3.27	1.12	1.02	1	3	306	5	363	1.06	0.22	0.23	0.02	0.46	3.43	0.40	0.19	0.19		
Upper avg..	8	6.58	3.27	1.12	1.02	1	3	306	6	363	1.06	0.22	0.23	0.02	0.46	3.43	0.40	0.22	1.00		
Minimum	6	6.38	2.59	0.34	0.74	1	2	205	2	250	0.81	0.20	0.09	0.01	0.37	1.70	0.22	0.10	1.00		
Maximum	13	6.72	4.08	2.74	1.30	1	5	400	15	465	1.33	0.27	0.63	0.04	0.64	7.20	0.68	0.37	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	3	0.16	0.61	1.10	0.32	0	1	83	6	92	0.22	0.04	0.27	0.01	0.12	2.55	0.20	0.14	0.00		

Vosso(Bolstadelvi)

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
12.02.2007	83	6.48	1.91	1.12	0.90	2	4	175	8	245	1.09	0.06	0.23	0.01	0.52	2.70	0.42	0.10	1.50		
22.05.2007	215	6.40	1.81	0.62	0.99	<1	3	160	10	235	1.20	0.07	0.06	<0.01	0.28	1.50	0.42	<0.10	<1.00		
27.08.2007	100	6.25	0.86	0.37	1.40	<1	2	24	4	127	0.68	<0.05	0.08	<0.01	0.26	0.88	0.20	<0.10	<1.00		
04.10.2007	75	6.42	1.10	0.33	1.00	<1	3	77	4	144	0.90	<0.05	0.06	0.01	0.47	2.00	0.28	<0.10	<1.00		
Lower avg.	118	6.39	1.42	0.61	1.07	1	3	109	7	188	0.97	0.03	0.11	0.00	0.38	1.77	0.33	0.02	0.38		
Upper avg..	118	6.39	1.42	0.61	1.07	1	3	109	7	188	0.97	0.06	0.11	0.01	0.38	1.77	0.33	0.10	1.12		
Minimum	75	6.25	0.86	0.33	0.90	1	2	24	4	127	0.69	0.05	0.06	0.01	0.26	0.88	0.20	0.10	1.00		
Maximum	215	6.48	1.91	1.12	1.40	2	4	175	10	245	1.20	0.07	0.23	0.01	0.52	2.70	0.42	0.10	1.50		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	no	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	65	0.10	0.52	0.36	0.22	1	1	71	3	61	0.23	0.01	0.08	0.00	0.13	0.77	0.11	0.00	0.25		

Jostedøla

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
12.02.2007	26	6.72	3.65	1.54	0.97	2	3	305	<2	355	4.34	<0.05	0.29	0.01	0.91	5.02	0.20	0.10	<1.00		
14.06.2007	161	6.32	1.64	5.09	0.43	6	7	105	<2	141	2.48	<0.05	0.26	0.01	0.73	2.24	0.44	0.64	<1.00		
16.08.2007	177	6.33	0.70	198.00	1.00	68	115	20	3	107	4.77	0.10	1.83	0.01	4.92	18.60	4.27	5.43	<1.00		
03.10.2007	50	6.73	1.57	4.65	0.48	3	4	98	<2	123	2.78	<0.05	0.17	0.01	0.76	2.38	0.44	0.37	<1.00		
15.10.2007	43	6.73	1.49	11.80	1.30	7	9	62	<2	126	2.78	<0.05	0.14	<0.01	0.56	1.80	0.46	0.32	<1.00		
08.11.2007	42	6.86	2.05	3.56	1.30	2	3	155	<2	195	3.21	<0.05	0.14	0.01	2.02	1.90	<0.05	<0.10	<1.00		
28.11.2007	26	6.78	2.48	1.94	0.83	2	3	195	<2	225	3.64	<0.05	0.07	<0.01	0.58	1.20	0.10	<0.10	<1.00		
10.12.2007	27	6.77	2.35	1.30	1.30	2	2	195	<2	245	3.36	0.06	0.05	<0.01	0.53	0.78	0.20	<0.10	<1.00		
Lower avg.	69	6.65	1.99	28.49	0.95	12	18	142	0	190	3.42	0.02	0.37	0.00	1.37	4.24	0.76	0.86	0.86		
Upper avg..	69	6.65	1.99	28.49	0.95	12	18	142	2	190	3.42	0.06	0.37	0.01	1.37	4.24	0.77	0.89	1.00		
Minimum	26	6.32	0.70	1.30	0.43	2	2	20	2	107	2.48	0.05	0.05	0.01	0.53	0.78	0.05	0.10	1.00		
Maximum	177	6.86	3.65	198.00	1.30	68	115	305	3	355	4.77	0.10	1.83	0.01	4.92	18.60	4.27	5.43	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	no	yes	yes	yes	no	no		
n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8		
St.dev	62	0.21	0.87	68.58	0.35	23	39	90	0	84	0.80	0.02	0.60	0.00	1.51	5.94	1.42	1.84	0.00		

Gaular

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
12.02.2007	43	6.11	1.95	0.38	1.20	2	4	170	<2	230	1.22	<0.05	0.02	0.01	0.31	1.75	0.10	0.10	<1.00		
25.05.2007	176	6.07	1.58	0.89	1.60	<1	6	73	4	235	0.94	<0.05	0.11	0.01	0.37	3.78	0.23	<0.10	<1.00		
30.08.2007	54	6.23	1.13	0.61	1.80	1	5	47	<2	137	0.73	<0.05	0.06	<0.01	0.27	0.88	0.10	<0.10	<1.00		
05.10.2007	44	6.16	1.01	0.44	1.10	1	4	56	<2	126	0.81	<0.05	0.05	0.01	0.22	1.10	0.08	<0.10	<1.00		
22.11.2007	37	6.09	1.45	0.68	1.80	3	5	75	<2	175	1.11	<0.05	0.08	0.01	0.29	1.30	<0.05	0.31	<1.00		
29.11.2007	41	6.32	1.78	0.72	2.10	3	5	14	<2	245	1.39	<0.05	0.08	0.01	0.38	2.32	0.20	0.20	<1.00		
11.12.2007	48	6.03	1.40	0.42	1.70	3	5	70	3	220	1.01	<0.05	0.15	0.01	0.22	1.20	0.10	<0.10	<1.00		
18.12.2007	33	6.19	1.49	1.11	1.50	3	5	120	5	200	1.22	<0.05	0.07	0.01	0.27	1.30	<0.05	<0.10	<1.00		
Lower avg.	59	6.15	1.47	0.66	1.60	2	5	78	2	196	1.05	1.05	0.08	0.01	0.29	1.70	0.10	0.08	0.08		
Upper avg..	59	6.15	1.47	0.66	1.60	2	5	78	3	196	1.05	0.05	0.08	0.01	0.29	1.70	0.11	0.14	1.00		
Minimum	33	6.03	1.01	0.38	1.10	1	4	14	2	126	0.73	0.05	0.02	0.01	0.22	0.88	0.05	0.10	1.00		
Maximum	176	6.32	1.95	1.11	2.10	3	6	170	5	245	1.39	0.05	0.15	0.01	0.38	3.78	0.23	0.31	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	no	no		
n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8		
St.dev	47	0.10	0.31	0.25	0.33	1	1	48	1	46	0.22	0.00	0.04	0.00	0.06	0.95	0.07	0.08	0.00		

Jølstra

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
12.02.2007	50	6.24	2.01	0.58	0.96	2	12	195	<2	260	1.24	<0.05	0.15	<0.01	0.30	3.56	0.10	0.10	<1.00		
25.05.2007	186	6.20	1.88	1.00	1.40	2	7	150	3	295	1.22	<0.05	0.08	<0.01	0.44	2.19	0.22	<0.10	1.50		
31.08.2007	54	6.26	1.44	0.51	1.40	1	4	130	<2	225	0.83	<0.05	0.04	<0.01	0.23	1.20	0.09	<0.10	<1.00		
05.10.2007	46	6.29	1.42	0.51	1.10	2	4	115	<2	180	0.94	<0.05	0.06	0.01	0.76	3.08	0.20	<0.10	<1.00		
Lower avg.	84	6.25	1.69	0.65	1.21	2	7	148	1	240	1.06	1.06	0.08	0.00	0.43	2.51	0.15	0.02	0.38		
Upper avg..	84	6.25	1.69	0.65	1.21	2	7	148	2	240	1.06	0.05	0.08	0.01	0.43	2.51	0.15	0.10	1.12		
Minimum	46	6.20	1.42	0.51	0.96	1	4	115	2	180	0.83	0.05	0.04	0.01	0.23	1.20	0.09	0.10	1.00		
Maximum	186	6.29	2.01	1.00	1.40	2	12	195	3	295	1.24	0.05	0.15	0.01	0.76	3.56	0.22	0.10	1.50		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	no	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	68	0.04	0.30	0.24	0.22	1	4	35	1	49	0.20	0.00	0.05	0.00	0.24	1.04	0.07	0.00	0.25		

Nausta

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
12.02.2007	19	6.16	3.06	0.33	0.88	2	4	160	<2	215	1.65	<0.05	0.02	0.01	0.25	1.68	0.20	0.10	<1.00		
25.05.2007	71	5.99	1.31	0.85	1.50	1	5	45	5	170	0.73	<0.05	0.13	0.01	0.29	2.82	0.12	<0.10	<1.00		
30.08.2007	23	6.33	1.07	0.51	2.30	2	5	36	<2	147	0.75	<0.05	0.07	<0.01	0.21	0.66	0.08	<0.10	<1.00		
05.10.2007	18	6.30	1.39	0.36	1.30	2	4	57	<2	155	1.01	<0.05	0.04	<0.01	0.24	1.10	0.08	<0.10	1.50		
Lower avg.	33	6.20	1.71	0.51	1.50	2	5	75	1	172	1.03	1.03	0.07	0.00	0.25	1.56	0.12	0.02	0.38		
Upper avg..	33	6.20	1.71	0.51	1.50	2	5	75	3	172	1.03	0.05	0.07	0.01	0.25	1.56	0.12	0.10	1.12		
Minimum	18	5.99	1.07	0.33	0.88	1	4	36	2	147	0.73	0.05	0.02	0.01	0.21	0.66	0.08	0.10	1.00		
Maximum	71	6.33	3.06	0.85	2.30	2	5	160	5	215	1.65	0.05	0.13	0.01	0.29	2.82	0.20	0.10	1.50		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	no	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	26	0.16	0.91	0.24	0.60	1	1	58	2	30	0.43	0.00	0.05	0.00	0.03	0.94	0.06	0.00	0.25		

Gloppenelva(Breimselva)

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
27.02.2007	24	6.62	1.94	0.39	0.87	2	3	220	2	315	1.58	<0.05	0.01	<0.01	0.34	0.98	0.10	<0.10	<1.00		
10.06.2007	116	6.65	1.74	1.24	0.77	1	4	190	7	255	1.30	<0.05	0.03	<0.01	0.37	0.66	0.10	<0.10	<1.00		
26.08.2007	60	6.62	1.26	1.48	0.79	<1	5	66	<2	146	0.75	<0.05	0.04	<0.01	0.29	0.64	0.10	<0.10	<1.00		
19.10.2007	72	6.53	1.61	0.50	0.96	<1	2	210	<2	250	1.35	<0.05	<0.01	<0.01	0.26	0.37	0.07	<0.10	<1.00		
Lower avg.	68	6.60	1.64	0.90	0.85	1	4	172	2	242	1.25	1.25	0.02	0.02	0.31	0.66	0.09	0.09	0.09		
Upper avg..	68	6.60	1.64	0.90	0.85	1	4	172	3	242	1.25	0.05	0.02	0.00	0.31	0.66	0.09	0.10	1.00		
Minimum	24	6.53	1.26	0.39	0.77	1	2	66	2	146	0.75	0.05	0.01	0.01	0.26	0.37	0.07	0.10	1.00		
Maximum	116	6.65	1.94	1.48	0.96	2	5	220	7	315	1.58	0.05	0.04	0.01	0.37	0.98	0.10	0.10	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	no	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	38	0.05	0.29	0.54	0.09	1	1	71	3	70	0.35	0.00	0.02	0.00	0.05	0.25	0.02	0.00	0.00		

Driva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
25.02.2007	40	7.04	3.50	0.47	0.84	1	2	180	4	250	2.55	<0.05	0.02	<0.01	1.09	0.46	0.10	0.20	<1.00		
22.05.2007	147	7.10	2.91	1.81	1.60	1	3	69	5	180	2.93	<0.05	0.05	<0.01	0.70	0.59	0.23	0.36	1.00		
29.08.2007	118	7.08	2.88	0.84	1.50	<1	2	76	<2	175	2.50	<0.05	0.02	<0.01	1.12	0.51	0.10	0.20	<1.00		
05.10.2007	56	7.11	3.23	0.44	0.81	<1	2	105	<2	165	2.59	<0.05	0.01	<0.01	0.51	0.83	0.09	<0.10	<1.00		
Lower avg.	90	7.08	3.13	0.89	1.19	1	2	108	2	193	2.64	2.64	0.02	0.02	0.85	0.60	0.13	0.19	0.25	INF	INF
Upper avg..	90	7.08	3.13	0.89	1.19	1	2	108	3	193	2.64	0.05	0.02	0.00	0.85	0.60	0.13	0.22	1.00	INF	INF
Minimum	40	7.04	2.88	0.44	0.81	1	2	69	2	165	2.50	0.05	0.01	0.01	0.51	0.46	0.09	0.10	1.00	1.00	1.00
Maximum	147	7.11	3.50	1.81	1.60	1	3	180	5	250	2.93	0.05	0.05	0.01	1.12	0.83	0.23	0.36	1.00	1.00	1.00
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	no	yes	yes	yes	yes	no	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0	0
St.dev	51	0.03	0.29	0.64	0.42	0	1	51	2	39	0.20	0.00	0.02	0.00	0.30	0.16	0.07	0.11	0.00	0.00	0.00

Surna

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
26.02.2007	36	6.68	2.16	1.19	1.50	1	3	94	6	195	1.80	<0.05	0.02	<0.01	0.30	0.31	0.20	0.10	1.00		
09.05.2007	60	6.86	2.57	2.01	2.10	1	3	71	6	155	1.44	<0.05	0.01	<0.01	0.37	0.52	0.27	<0.10	<1.00		
15.08.2007	32	6.89	2.25	0.59	1.90	<1	4	39	<2	120	1.28	<0.05	0.02	<0.01	0.39	0.38	0.20	<0.10	1.50		
09.10.2007	99	6.94	2.92	1.76	4.20	3	6	120	2	295	1.75	<0.05	0.05	<0.01	0.70	0.77	0.43	0.20	<1.00		
Lower avg.	57	6.84	2.48	1.39	2.42	1	4	81	4	191	1.57	1.57	0.02	0.02	0.44	0.50	0.28	0.08	0.62		
Upper avg..	57	6.84	2.48	1.39	2.42	2	4	81	4	191	1.57	0.05	0.02	0.00	0.44	0.50	0.28	0.12	1.12		
Minimum	32	6.68	2.16	0.59	1.50	1	3	39	2	120	1.28	0.05	0.01	0.01	0.30	0.31	0.20	0.10	1.00		
Maximum	99	6.94	2.92	2.01	4.20	3	6	120	6	295	1.80	0.05	0.05	0.01	0.70	0.77	0.43	0.20	1.50		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	31	0.11	0.35	0.63	1.21	1	1	34	2	76	0.25	0.00	0.02	0.00	0.18	0.20	0.11	0.05	0.25		

Gaula

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
20.02.2007	60	7.42	15.90	2.55	2.70	5	5	360	16	520	4.02	0.10	0.37	0.01	0.94	3.90	1.40	0.56	<1.00		
24.05.2007	251	7.11	4.69	7.07	2.10	2	5	46	7	170	2.37	0.10	0.13	0.01	1.71	3.54	1.30	0.56	<1.00		
29.08.2007	96	7.14	9.62	8.47	9.80	3	8	120	<2	410	3.10	0.26	0.32	0.01	2.23	3.84	2.15	0.86	<1.00		
06.11.2007	96	7.60	12.00	5.31	4.70	5	9	255	<2	455	4.45	0.10	0.15	0.01	1.52	3.66	1.90	0.30	<1.00		
Lower avg.	126	7.32	10.55	5.85	4.82	4	7	195	6	389	3.49	0.14	0.24	0.01	1.60	3.74	1.69	0.57	0.57		
Upper avg..	126	7.32	10.55	5.85	4.82	4	7	195	7	389	3.49	0.14	0.24	0.01	1.60	3.74	1.69	0.57	1.00		
Minimum	60	7.11	4.69	2.55	2.10	2	5	46	2	170	2.38	0.10	0.13	0.01	0.94	3.54	1.30	0.30	1.00		
Maximum	251	7.60	15.90	8.47	9.80	5	9	360	16	520	4.45	0.26	0.37	0.01	2.23	3.90	2.15	0.86	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	85	0.23	4.69	2.55	3.50	2	2	140	7	153	0.93	0.08	0.12	0.00	0.53	0.17	0.41	0.23	0.00		

Nidelva(Tr.heim)

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
20.02.2007	49	7.08	3.31	1.15	2.30	1	4	105	7	220	1.91	0.10	0.37	<0.01	0.84	7.30	0.66	0.30	<1.00		
24.05.2007	267	7.11	3.22	1.08	2.40	1	3	99	2	200	1.82	0.07	0.03	<0.01	1.65	0.49	0.65	0.16	<1.00		
29.08.2007	123	7.11	3.81	6.36	4.20	4	9	150	6	330	2.31	0.20	0.19	<0.01	1.31	1.90	1.30	0.77	<1.00		
06.11.2007	117	7.32	3.67	2.05	3.00	2	4	115	2	235	2.14	<0.05	0.06	<0.01	0.80	0.99	0.75	<0.10	<1.00		
Lower avg.	139	7.16	3.50	2.66	2.97	2	5	117	4	246	2.05	0.09	0.16	0.16	1.15	2.67	0.84	0.31	0.31		
Upper avg..	139	7.16	3.50	2.66	2.97	2	5	117	4	246	2.05	0.10	0.16	0.00	1.15	2.67	0.84	0.33	1.00		
Minimum	49	7.08	3.22	1.08	2.30	1	3	99	2	200	1.82	0.05	0.03	0.01	0.80	0.49	0.65	0.10	1.00		
Maximum	267	7.32	3.81	6.36	4.20	4	9	150	7	330	2.31	0.20	0.37	0.01	1.65	7.30	1.30	0.77	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	92	0.11	0.28	2.51	0.87	1	3	23	3	58	0.22	0.07	0.16	0.00	0.41	3.14	0.31	0.30	0.00		

Stjørdalselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
21.02.2007	34	7.05	5.40	11.60	2.70	3	6	285	13	435	3.23	0.22	0.62	0.04	3.10	11.70	1.50	1.00	<1.00		
25.05.2007	164	6.80	2.30	1.90	2.40	1	3	52	<2	160	1.03	0.07	0.06	0.01	2.01	4.50	0.44	0.26	<1.00		
29.08.2007	77	6.99	3.17	16.40	8.40	6	12	96	2	370	2.05	0.20	0.56	0.02	2.56	8.28	1.40	0.79	<1.00		
07.11.2007	84	7.26	4.06	5.02	4.00	4	7	175	<2	325	1.97	<0.05	0.12	<0.01	1.39	3.95	0.59	<0.10	<1.00		
Lower avg.	90	7.02	3.73	8.73	4.38	4	7	152	4	323	2.07	0.12	0.34	0.02	2.26	7.11	0.98	0.51	0.51		
Upper avg..	90	7.02	3.73	8.73	4.38	4	7	152	5	323	2.07	0.14	0.34	0.02	2.26	7.11	0.98	0.54	1.00		
Minimum	34	6.80	2.30	1.90	2.40	1	3	52	2	160	1.03	0.05	0.06	0.01	1.39	3.95	0.44	0.10	1.00		
Maximum	164	7.26	5.40	16.40	8.40	6	12	285	13	435	3.23	0.22	0.62	0.04	3.10	11.70	1.50	1.00	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	54	0.19	1.32	6.52	2.77	2	4	102	6	117	0.90	0.09	0.29	0.01	0.73	3.62	0.55	0.43	0.00		

Verdalselva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
24.02.2007	21	7.43	9.84	2.29	2.80	1	3	285	6	425	2.89	0.10	0.12	0.01	0.91	1.90	0.52	0.46	<1.00		
25.05.2007	104	6.96	2.71	3.26	2.40	2	3	42	4	150	1.20	0.06	0.07	<0.01	0.49	0.96	0.44	0.16	<1.00		
29.08.2007	44	7.22	4.11	9.16	7.80	4	8	130	3	340	1.88	0.22	0.25	0.01	1.69	2.06	0.95	0.55	<1.00		
07.11.2007	49	7.51	5.21	2.04	4.20	2	4	195	<2	345	2.03	<0.05	0.07	<0.01	0.69	1.10	0.50	<0.10	<1.00		
Lower avg.	54	7.28	5.47	4.19	4.30	2	5	163	3	315	2.00	0.10	0.13	0.00	0.94	1.50	0.60	0.29	0.29	INF	INF
Upper avg..	54	7.28	5.47	4.19	4.30	2	5	163	4	315	2.00	0.11	0.13	0.01	0.94	1.50	0.60	0.32	1.00	INF	INF
Minimum	21	6.96	2.71	2.04	2.40	1	3	42	2	150	1.20	0.05	0.07	0.01	0.49	0.96	0.44	0.10	1.00	1.00	1.00
Maximum	104	7.51	9.84	9.16	7.80	4	8	285	6	425	2.89	0.22	0.25	0.01	1.69	2.06	0.95	0.55	1.00	1.00	1.00
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	no	no	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0	0
St.dev	35	0.25	3.09	3.36	2.46	1	2	103	2	117	0.70	0.08	0.08	0.00	0.53	0.56	0.23	0.22	0.00	0.00	0.00

Snåsavassdraget

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
24.02.2007	15	7.13	5.19	1.04	3.80	1	4	190	2	360	1.52	0.10	0.04	<0.01	0.55	0.81	0.39	0.20	<1.00		
25.05.2007	47	7.07	4.68	1.10	3.70	<1	4	180	5	335	1.39	0.09	0.04	<0.01	0.67	1.50	0.39	0.16	<1.00		
29.08.2007	22	7.14	4.34	1.19	6.30	1	5	120	<2	315	1.24	0.10	0.08	<0.01	0.78	0.90	0.51	0.20	<1.00		
07.11.2007	31	7.14	5.01	1.67	4.20	2	5	205	<2	365	1.51	<0.05	0.05	<0.01	0.58	1.10	0.36	<0.10	<1.00		
Lower avg.	29	7.12	4.80	1.25	4.50	1	5	174	2	344	1.41	0.07	0.05	0.05	0.64	1.08	0.41	0.14	0.14		
Upper avg..	29	7.12	4.80	1.25	4.50	1	5	174	3	344	1.41	0.08	0.05	0.00	0.64	1.08	0.41	0.16	1.00		
Minimum	15	7.07	4.34	1.04	3.70	1	4	120	2	315	1.24	0.05	0.04	0.01	0.55	0.81	0.36	0.10	1.00		
Maximum	47	7.14	5.19	1.67	6.30	2	5	205	5	365	1.52	0.10	0.08	0.01	0.78	1.50	0.51	0.20	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	no	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	14	0.03	0.38	0.29	1.22	1	1	37	2	23	0.13	0.02	0.02	0.00	0.10	0.31	0.07	0.05	0.00		

Namsen

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
22.02.2007	16	7.06	4.51	2.70	1.30	2	3	130	7	215	1.60	0.10	0.11	0.02	1.26	4.88	0.49	0.20	3.00		
25.05.2007	115	6.86	2.84	30.10	2.30	17	23	37	5	131	3.47	0.22	0.40	<0.01	1.54	4.96	1.90	1.60	<1.00		
29.08.2007	32	7.08	3.19	49.70	5.20	17	22	12	<2	205	2.20	0.31	0.79	0.01	2.38	7.12	3.20	3.00	<1.00		
07.11.2007	37	6.97	3.83	19.50	3.60	12	15	86	<2	200	3.17	0.05	0.26	<0.01	1.20	3.09	1.30	0.77	<1.00		
Lower avg.	50	6.99	3.59	25.50	3.10	12	16	66	3	188	2.61	0.17	0.39	0.01	1.60	5.01	1.72	1.39	0.75		
Upper avg..	50	6.99	3.59	25.50	3.10	12	16	66	4	188	2.61	0.17	0.39	0.01	1.60	5.01	1.72	1.39	1.50		
Minimum	16	6.86	2.84	2.70	1.30	2	3	12	2	131	1.60	0.05	0.11	0.01	1.20	3.09	0.49	0.20	1.00		
Maximum	115	7.08	4.51	49.70	5.20	17	23	130	7	215	3.47	0.31	0.79	0.02	2.38	7.12	3.20	3.00	3.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	no	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	44	0.10	0.74	19.69	1.69	7	9	52	2	38	0.86	0.12	0.29	0.01	0.54	1.65	1.14	1.22	1.00		

Røssåga

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
09.02.2007	51	7.27	3.77	0.20	0.65	<1	2	60	2	106	0.86	0.08	0.01	<0.01	0.27	7.32	0.40	<0.10	<1.00		
04.05.2007	89	7.40	4.84	0.43	0.88	<1	2	42	<2	105	0.88	0.06	0.10	0.01	0.35	5.91	0.33	<0.10	<1.00		
13.08.2007	106	7.52	3.99	0.56	0.74	<1	4	8	<2	76	0.49	<0.05	0.13	0.01	0.35	3.18	0.23	<0.10	<1.00		
01.10.2007	77	7.42	4.47	0.35	1.00	<1	2	28	2	95	0.77	<0.05	0.09	<0.01	0.29	4.10	0.31	<0.10	<1.00		
Lower avg.	81	7.40	4.27	0.38	0.82	1	3	35	1	96	0.75	0.04	0.08	0.00	0.32	5.13	0.32	0.32	0.32		
Upper avg..	81	7.40	4.27	0.38	0.82	1	3	35	2	96	0.75	0.06	0.08	0.01	0.32	5.13	0.32	0.10	1.00		
Minimum	51	7.27	3.77	0.20	0.65	1	2	8	2	76	0.49	0.05	0.01	0.01	0.27	3.18	0.23	0.10	1.00		
Maximum	106	7.52	4.84	0.56	1.00	1	4	60	2	106	0.88	0.08	0.13	0.01	0.35	7.32	0.40	0.10	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	no	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	23	0.10	0.48	0.15	0.15	0	1	22	0	14	0.18	0.01	0.05	0.00	0.04	1.85	0.07	0.00	0.00		

Ranaelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
14.02.2007	72	7.24	3.52	1.61	0.67	<1	3	45	7	102	1.09	0.10	0.57	<0.01	11.00	11.50	0.31	1.10	<1.00		
04.05.2007	172	7.75	8.92	1.14	1.50	1	3	42	<2	132	1.30	<0.05	0.10	<0.01	0.36	2.14	0.09	<0.10	<1.00		
13.08.2007	238	7.39	3.52	0.65	0.57	<1	3	17	<2	68	0.92	<0.05	0.01	<0.01	0.24	0.33	0.10	<0.10	<1.00		
01.10.2007	146	7.51	5.06	<0.10	0.78	<1	1	25	3	84	1.20	<0.05	0.01	<0.01	0.20	0.50	0.20	<0.10	<1.00		
Lower avg.	157	7.47	5.26	0.85	0.88	0	3	32	3	97	1.13	0.02	0.17	0.17	2.95	3.62	0.18	0.28	0.28		
Upper avg..	157	7.47	5.26	0.88	0.88	1	3	32	4	97	1.13	0.06	0.17	0.00	2.95	3.62	0.18	0.35	1.00		
Minimum	72	7.24	3.52	0.10	0.57	1	1	17	2	68	0.92	0.05	0.01	0.01	0.20	0.33	0.09	0.10	1.00		
Maximum	238	7.75	8.92	1.61	1.50	1	3	45	7	132	1.31	0.10	0.57	0.01	11.00	11.50	0.31	1.10	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	no	yes	yes	yes	no	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	69	0.22	2.55	0.65	0.42	0	1	13	2	27	0.16	0.03	0.27	0.00	5.37	5.32	0.10	0.50	0.00		

Beiarelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
08.03.2007	18	7.70	9.75	1.95	0.96	1	4	140	45	385	4.39	0.10	0.02	<0.01	0.48	1.10	0.36	0.30	2.00		
06.06.2007	134	7.17	4.21	3.56	0.82	1	3	19	4	62	1.57	0.06	0.06	0.01	0.51	0.89	0.55	0.30	<1.00		
15.08.2007	58	7.37	2.67	5.03	0.23	2	3	2	<2	23	1.63	0.08	0.07	<0.01	0.42	1.20	0.43	0.20	1.50		
22.10.2007	68	7.32	4.20	4.06	1.20	2	3	15	<2	80	2.12	0.07	0.03	<0.01	0.42	0.71	0.41	0.10	<1.00		
Lower avg.	69	7.39	5.21	3.65	0.80	2	3	44	12	138	2.43	0.08	0.05	0.00	0.46	0.98	0.44	0.22	0.88		
Upper avg..	69	7.39	5.21	3.65	0.80	2	3	44	13	138	2.43	0.08	0.05	0.00	0.46	0.98	0.44	0.22	1.38		
Minimum	18	7.17	2.67	1.95	0.23	1	3	2	2	23	1.57	0.06	0.02	0.01	0.42	0.71	0.36	0.10	1.00		
Maximum	134	7.70	9.75	5.03	1.20	2	4	140	45	385	4.39	0.10	0.07	0.01	0.51	1.20	0.55	0.30	2.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	no	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	48	0.22	3.11	1.29	0.41	1	1	64	21	167	1.33	0.02	0.02	0.00	0.04	0.22	0.08	0.10	0.48		

Målselv

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
04.02.2007	24	7.57	9.49	0.56	1.30	2	3	105	64	350	2.37	0.06	0.01	<0.01	0.48	3.05	0.07	0.10	<1.00		
07.05.2007	91	7.76	8.65	1.80	2.10	2	4	63	<2	180	2.70	<0.05	0.01	<0.01	0.60	2.08	0.21	0.44	<1.00		
12.08.2007	117	7.76	7.01	0.66	0.71	<1	3	10	<2	67	1.91	<0.05	0.01	<0.01	0.41	21.10	1.20	1.40	<1.00		
01.10.2007	86	7.61	8.03	<0.10	0.97	<1	1	18	<2	84	2.40	<0.05	0.01	<0.01	0.28	0.31	0.10	<0.10	<1.00		
Lower avg.	79	7.68	8.30	0.76	1.27	1	3	49	16	170	2.34	0.02	0.01	0.01	0.44	6.64	0.40	0.48	0.48		
Upper avg..	79	7.68	8.30	0.78	1.27	2	3	49	18	170	2.34	0.05	0.01	0.00	0.44	6.64	0.40	0.51	1.00		
Minimum	24	7.57	7.01	0.10	0.71	1	1	10	2	67	1.91	0.05	0.01	0.01	0.28	0.31	0.07	0.10	1.00		
Maximum	117	7.76	9.49	1.80	2.10	2	4	105	64	350	2.70	0.06	0.01	0.01	0.60	21.10	1.20	1.40	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	no	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	39	0.10	1.05	0.72	0.60	1	1	44	31	130	0.32	0.01	0.00	0.00	0.14	9.71	0.54	0.62	0.00		

Barduelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
04.02.2007	22	7.72	9.22	1.64	1.10	3	6	105	48	320	2.27	0.06	0.28	0.02	0.86	8.50	<0.05	0.10	<1.00		
07.05.2007	82	7.87	11.30	20.60	2.20	12	17	76	<2	215	3.55	0.08	0.19	<0.01	1.17	2.00	0.73	0.68	<1.00		
12.08.2007	106	7.95	9.10	1.99	0.51	<1	4	17	<2	58	1.71	<0.05	0.05	0.01	0.43	0.53	0.10	0.10	<1.00		
01.10.2007	78	7.89	11.35	0.58	1.30	<1	2	28	<2	108	2.31	<0.05	0.01	<0.01	0.32	0.29	<0.05	0.10	<1.00		
Lower avg.	72	7.86	10.24	6.20	1.28	4	7	57	12	175	2.46	0.04	0.13	0.01	0.69	2.83	0.21	0.24	0.24		
Upper avg..	72	7.86	10.24	6.20	1.28	4	7	57	14	175	2.46	0.06	0.13	0.01	0.69	2.83	0.23	0.24	1.00		
Minimum	22	7.72	9.10	0.58	0.51	1	2	17	2	58	1.71	0.05	0.01	0.01	0.32	0.29	0.05	0.10	1.00		
Maximum	106	7.95	11.35	20.60	2.20	12	17	105	48	320	3.55	0.08	0.28	0.02	1.17	8.50	0.73	0.68	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	no	yes	yes	no	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	36	0.10	1.25	9.62	0.70	5	7	41	23	117	0.78	0.01	0.12	0.01	0.40	3.86	0.33	0.29	0.00		

Tanaelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
05.02.2007	60	7.31	6.74	0.61	2.20	<1	5	125	9	285	7.96	0.05	<0.01	<0.01	0.52	1.65	0.22	0.30	<1.00		
07.05.2007	112	7.47	5.99	1.49	3.10	5	10	<1	24	160	7.72	0.07	0.01	<0.01	0.54	0.46	0.34	0.32	<1.00		
06.08.2007	245	7.39	6.29	1.46	4.80	2	9	<1	8	205	6.20	<0.05	0.03	<0.01	0.63	0.57	0.41	0.20	<1.00		
02.10.2007	158	7.22	4.34	0.65	3.30	2	6	3	<2	140	6.93	<0.05	0.01	<0.01	0.29	0.40	0.30	0.30	<1.00		
Lower avg.	144	7.35	5.84	1.05	3.35	2	8	32	10	198	7.20	0.03	0.01	0.01	0.50	0.77	0.32	0.28	0.28		
Upper avg..	144	7.35	5.84	1.05	3.35	3	8	33	11	198	7.20	0.06	0.01	0.00	0.50	0.77	0.32	0.28	1.00		
Minimum	60	7.22	4.34	0.61	2.20	1	5	1	2	140	6.20	0.05	0.01	0.01	0.29	0.40	0.22	0.20	1.00		
Maximum	245	7.47	6.74	1.49	4.80	5	10	125	24	285	7.96	0.07	0.03	0.01	0.63	1.65	0.41	0.32	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	no	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	79	0.11	1.05	0.49	1.08	2	2	62	9	64	0.80	0.01	0.01	0.00	0.15	0.59	0.08	0.05	0.00		

Pasvikelva

Date	Qs	pH	KOND	SPM	TOC	PO4-P	TOTP	NO3-N	NH4-N	TOTN	SiO2	As	Pb	Cd	Cu	Zn	Ni	Cr	Hg	HCHG	SUMPCB
DD.MM.YYYY	[m3/s]	[]	[mS/m]	[mg/l]	[mg/l C]	[µg/l P]	[µg/l P]	[µg/l N]	[µg/l N]	[µg/l N]	[mg/l SiO2]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
06.02.2007	64	7.08	3.76	0.58	3.70	<1	4	190	21	305	3.23	<0.05	0.12	<0.01	1.31	3.14	0.67	0.10	<1.00		
07.05.2007	149	6.74	2.63	2.41	2.00	<1	7	30	36	245	3.59	0.86	0.68	0.04	20.30	2.78	18.40	0.33	<1.00		
10.08.2007	160	7.23	3.33	0.81	3.00	<1	6	<1	4	133	4.06	0.08	0.03	<0.01	1.04	0.32	4.16	0.10	<1.00		
01.10.2007	224	7.14	3.78	1.07	3.50	1	6	<1	<2	160	4.21	<0.05	0.04	<0.01	1.62	0.98	8.62	0.20	<1.00		
Lower avg.	149	7.05	3.37	1.22	3.05	0	6	55	15	211	3.78	0.24	0.22	0.01	6.07	1.81	7.96	0.18	0.18		
Upper avg..	149	7.05	3.37	1.22	3.05	1	6	56	16	211	3.78	0.26	0.22	0.01	6.07	1.81	7.96	0.18	1.00		
Minimum	64	6.74	2.63	0.58	2.00	1	4	1	2	133	3.23	0.05	0.03	0.01	1.04	0.32	0.67	0.10	1.00		
Maximum	224	7.23	3.78	2.41	3.70	1	7	190	36	305	4.21	0.86	0.68	0.04	20.30	3.14	18.40	0.33	1.00		
More than 70%LOD	yes	yes	yes	yes	yes	no	yes	no	yes	yes	yes	no	yes	no	yes	yes	yes	yes	no		
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
St.dev	66	0.21	0.54	0.82	0.76	0	1	91	16	79	0.45	0.40	0.31	0.02	9.49	1.37	7.68	0.11	0.00		

Part B

Table 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2007.

Part B. Table 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2007.

River	Estimate	Flow rate	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	NH4N	NO3N	PO4P	TOTN	TOTP	SiO2	SPM	TOC	PCBs	gHCH
		1000 m3/d	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[1000 tonnes]	[1000 tonnes]	[1000 tonnes]	[kg]	[kg]
MAIN RIVERS (10)																				
Glomma ved Sarpsfoss	*lower avg.*	64 450	0.248	0.005	56.581	80.602	5.362	3.906	5.968	17.726	386	8304	162	12621	331	81.09	141.68	82.22	0.00	0.00
	upper avg.	64 450	0.248	0.025	56.581	80.602	5.362	3.940	6.376	17.726	388	8304	162	12621	331	81.09	141.68	82.22	28.23	4.70
Drammenselva	*lower avg.*	33 206	0.209	0.000	19.935	88.722	6.194	3.186	4.731	11.060	141	3613	115	6161	206	39.09	145.12	53.85	0.00	0.00
	upper avg.	33 206	0.209	0.012	19.935	88.722	6.194	3.186	4.898	11.060	144	3613	116	6161	206	39.09	145.12	53.85	14.54	2.42
Numedalslågen	*lower avg.*	12 152	0.166	0.000	13.505	46.238	13.604	2.534	3.700	5.313	91	784	169	1887	224	18.07	220.83	26.69	0.00	0.00
	upper avg.	12 152	0.166	0.005	13.505	46.238	13.604	2.543	3.747	5.321	91	784	169	1887	224	18.07	220.83	26.69	5.32	0.89
Skienselva	*lower avg.*	26 450	0.107	0.001	6.034	25.080	0.792	1.100	0.395	2.134	81	1643	9	2710	34	21.26	10.64	25.21	0.00	0.00
	upper avg.	26 450	0.107	0.010	6.034	25.080	0.792	1.170	0.998	2.134	81	1643	13	2710	34	21.26	10.64	25.21	11.59	1.93
Otra	*lower avg.*	12 779	0.093	0.000	5.786	19.570	1.528	0.526	0.386	2.305	60	409	5	1046	19	7.51	9.08	12.01	0.00	0.00
	upper avg.	12 779	0.093	0.005	5.786	19.570	1.528	0.563	0.577	2.305	60	409	8	1046	19	7.51	9.08	12.01	5.60	0.93
Orreelva	*lower avg.*	533	0.005	0.000	0.418	1.158	0.186	0.075	0.073	0.257	5	287	11	490	29	0.73	4.98	1.63	0.00	0.00
	upper avg.	533	0.005	0.000	0.418	1.158	0.186	0.075	0.074	0.257	5	287	11	490	29	0.73	4.98	1.63	0.23	0.04
Suldalslågen	*lower avg.*	4 232	0.016	0.000	0.429	3.315	0.168	0.056	0.136	0.265	4	240	0	337	3	1.59	0.98	1.99	0.00	0.00
	upper avg.	4 232	0.016	0.002	0.429	3.315	0.168	0.095	0.225	0.277	5	240	2	337	3	1.59	0.98	1.99	1.85	0.31
Orkla	*lower avg.*	6 704	0.133	0.002	19.884	45.950	0.119	0.225	0.554	1.617	11	455	3	822	10	6.78	4.42	6.99	0.00	0.00
	upper avg.	6 704	0.133	0.005	19.884	45.950	0.119	0.243	0.590	1.617	12	455	4	822	10	6.78	4.42	6.99	2.94	0.49
Vefsna	*lower avg.*	15 766	0.005	0.001	2.195	4.446	0.507	0.536	0.967	1.415	7	249	3	611	14	7.22	15.49	6.73	0.00	0.00
	upper avg.	15 766	0.031	0.006	2.195	4.446	0.507	0.571	1.176	1.442	14	249	6	611	14	7.22	15.49	6.73	6.91	1.15
Altaelva	*lower avg.*	9 698	0.000	0.000	2.042	0.871	0.026	0.243	0.676	0.500	11	67	2	546	16	14.25	2.78	10.40	0.00	0.00
	upper avg.	9 698	0.018	0.004	2.042	0.876	0.035	0.273	0.728	0.512	14	67	4	546	16	14.25	2.78	10.40	4.80	0.71
TRIBUTARY RIVERS (36)																				
Tista utløp Femsjøen	*lower avg.*	2 126	0.016	0.000	1.407	3.587	0.196	0.177	0.215	1.532	4	496	4	716	10	2.92	1.87	6.55		
	upper avg.	2 126	0.016	0.001	1.407	3.587	0.196	0.177	0.215	1.532	4	496	4	716	10	2.92	1.87	6.55		
Tokkeelva	*lower avg.*	2 048	0.023	0.000	0.764	6.176	0.225	0.163	0.151	0.456	1	108	1	258	4	2.11	1.04	4.08		
	upper avg.	2 048	0.023	0.001	0.764	6.176	0.225	0.163	0.154	0.456	2	108	1	258	4	2.11	1.04	4.08		

River	Estimate	Flow rate	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	NH4N	NO3N	PO4P	TOTN	TOTP	SiO2	SPM	TOC	PCBs	gHCH
		1000 m3/d	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[1000 tonnes]	[1000 tonnes]	[1000 tonnes]	[kg]	[kg]
Nidelva(Rykene)	*lower avg.*	9 195	0.074	0.001	2.755	12.941	0.683	0.336	0.333	0.733	31	574	3	1033	14	7.26	4.73	9.29		
	upper avg.	9 195	0.074	0.003	2.755	12.941	0.683	0.336	0.449	0.733	33	574	4	1033	14	7.26	4.73	9.29		
Tovdalselva	*lower avg.*	4 708	0.053	0.000	2.133	12.148	0.659	0.378	0.157	0.624	41	177	1	576	8	3.09	1.91	7.30		
	upper avg.	4 708	0.053	0.002	2.133	12.148	0.659	0.378	0.233	0.624	41	177	2	576	8	3.09	1.91	7.30		
Mandalselva	*lower avg.*	6 949	0.078	0.000	2.825	13.649	1.743	0.364	0.114	0.719	68	212	5	824	22	3.38	6.93	11.08		
	upper avg.	6 949	0.078	0.003	2.825	13.649	1.743	0.364	0.289	0.719	68	212	6	824	22	3.38	6.93	11.08		
Lyngdalselva	*lower avg.*	2 645	0.033	0.000	0.625	5.375	0.802	0.177	0.049	0.163	10	136	2	341	8	1.45	2.37	4.75		
	upper avg.	2 645	0.033	0.001	0.625	5.375	0.802	0.177	0.111	0.163	10	136	2	341	8	1.45	2.37	4.75		
Kvina	*lower avg.*	6 374	0.065	0.000	3.137	15.256	1.928	0.490	0.227	0.510	52	379	7	975	25	2.89	6.02	13.02		
	upper avg.	6 374	0.065	0.002	3.137	15.256	1.928	0.490	0.357	0.510	52	379	7	975	25	2.89	6.02	13.02		
Sira	*lower avg.*	13 619	0.070	0.007	6.402	16.215	2.026	0.328	0.098	0.725	85	369	1	1088	21	4.49	4.24	11.05		
	upper avg.	13 619	0.070	0.008	6.402	16.215	2.026	0.377	0.497	0.725	85	369	5	1088	21	4.49	4.24	11.05		
Bjerkreimselva	*lower avg.*	4 751	0.034	0.000	0.398	4.766	0.494	0.078	0.103	0.246	6	606	4	765	10	2.61	1.49	2.41		
	upper avg.	4 751	0.034	0.002	0.398	4.766	0.494	0.120	0.206	0.246	6	606	4	765	10	2.61	1.49	2.41		
Figgjoelva	*lower avg.*	590	0.004	0.000	0.223	1.172	0.093	0.014	0.027	0.095	3	269	2	323	4	0.64	0.48	0.67		
	upper avg.	590	0.004	0.000	0.223	1.172	0.093	0.017	0.032	0.095	3	269	2	323	4	0.64	0.48	0.67		
Lyseelva	*lower avg.*	1 807	0.005	0.000	0.126	0.808	0.075	0.000	0.057	0.028	1	55	0	86	0	0.99	0.21	0.63		
	upper avg.	1 807	0.006	0.001	0.126	0.808	0.075	0.033	0.084	0.042	2	55	1	86	1	0.99	0.23	0.63		
Årdalselva	*lower avg.*	5 048	0.015	0.000	0.933	4.043	0.398	0.086	0.414	0.174	6	2341	0	2406	4	5.75	0.90	2.28		
	upper avg.	5 048	0.015	0.002	0.933	4.043	0.398	0.119	0.440	0.194	7	2341	2	2406	4	5.75	0.90	2.28		
Ulladalsåna (Ulla)	*lower avg.*	3 676	0.011	0.001	0.315	3.011	0.220	0.045	0.267	0.100	4	89	0	240	1	2.16	0.26	1.54		
	upper avg.	3 676	0.011	0.002	0.315	3.011	0.220	0.071	0.290	0.115	5	89	1	240	2	2.16	0.28	1.54		
Saudaelva	*lower avg.*	3 712	0.017	0.000	0.342	3.821	0.224	0.042	0.215	0.156	4	236	0	300	2	1.20	0.25	0.85		
	upper avg.	3 712	0.019	0.001	0.342	3.821	0.224	0.068	0.280	0.172	5	236	1	300	2	1.20	0.25	0.85		
Vikedalselva	*lower avg.*	1 109	0.010	0.000	0.202	1.690	0.124	0.086	0.088	0.185	3	131	0	154	1	0.45	0.58	0.39		
	upper avg.	1 109	0.010	0.000	0.202	1.690	0.124	0.086	0.096	0.185	3	131	0	154	1	0.45	0.58	0.39		
Vosso(Bolstadelvi)	*lower avg.*	11 604	0.012	0.001	1.474	7.026	0.390	0.179	0.074	1.488	31	511	1	845	13	4.33	2.58	4.50		
	upper avg.	11 604	0.026	0.005	1.474	7.026	0.390	0.258	0.424	1.488	31	511	5	845	13	4.33	2.58	4.50		
Jostedøla	*lower avg.*	6 113	0.014	0.000	4.800	16.629	1.606	0.078	4.445	3.566	2	213	55	336	91	7.82	149.17	1.87		
	upper avg.	6 113	0.016	0.002	4.800	16.629	1.606	0.148	4.483	3.574	5	213	55	336	91	7.82	149.17	1.87		
Gaular	*lower avg.*	6 204	0.017	0.000	0.707	5.141	0.195	0.000	0.114	0.318	5	170	3	466	12	2.28	1.60	3.63		

River	Estimate	Flow rate	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	NH4N	NO3N	PO4P	TOTN	TOTP	SiO2	SPM	TOC	PCBs	gHCH
		1000 m3/d	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[1000 tonnes]	[1000 tonnes]	[1000 tonnes]	[kg]	[kg]
	upper avg.	6 204	0.018	0.002	0.707	5.141	0.195	0.113	0.283	0.334	7	170	4	466	12	2.28	1.60	3.63		
Jølstra	*lower avg.*	6 740	0.003	0.002	1.051	5.799	0.198	0.000	0.037	0.439	4	366	5	647	17	2.76	1.95	3.18		
	upper avg.	6 740	0.014	0.003	1.051	5.799	0.198	0.123	0.246	0.439	6	366	5	647	17	2.76	1.95	3.18		
Nausta	*lower avg.*	2 595	0.006	0.000	0.250	1.940	0.088	0.000	0.014	0.113	3	59	1	162	4	0.86	0.61	1.44		
	upper avg.	2 595	0.008	0.001	0.250	1.940	0.088	0.047	0.095	0.113	3	59	1	162	4	0.86	0.61	1.44		
Gloppenelva(Breimselva)	*lower avg.*	5 032	0.000	0.000	0.588	1.114	0.038	0.000	0.000	0.169	6	313	1	431	7	2.24	1.88	1.53		
	upper avg.	5 032	0.009	0.002	0.588	1.114	0.040	0.092	0.184	0.169	8	313	2	431	7	2.24	1.88	1.53		
Driva	*lower avg.*	7 370	0.000	0.001	2.283	1.579	0.077	0.000	0.630	0.408	7	240	1	494	6	7.25	3.05	3.66		
	upper avg.	7 370	0.013	0.003	2.283	1.579	0.077	0.135	0.672	0.408	9	240	3	494	6	7.25	3.05	3.66		
Surna	*lower avg.*	5 038	0.000	0.001	0.929	1.060	0.052	0.000	0.190	0.586	6	168	3	400	8	2.96	2.89	5.32		
	upper avg.	5 038	0.009	0.002	0.929	1.060	0.052	0.092	0.264	0.586	7	168	3	400	8	2.96	2.89	5.32		
Gaula	*lower avg.*	8 138	0.019	0.000	4.995	10.881	0.592	0.388	1.687	4.719	16	408	9	927	19	9.22	19.20	12.30		
	upper avg.	8 138	0.019	0.003	4.995	10.881	0.592	0.388	1.687	4.719	18	408	9	927	19	9.22	19.20	12.30		
Nidelva(Tr.heim)	*lower avg.*	8 640	0.000	0.000	4.181	4.747	0.326	0.273	0.863	2.572	10	360	6	750	15	6.32	7.75	9.19		
	upper avg.	8 640	0.016	0.003	4.181	4.747	0.326	0.306	0.929	2.572	10	360	6	750	15	6.32	7.75	9.19		
Stjørdalselva	*lower avg.*	6 191	0.024	0.000	4.713	13.247	0.529	0.216	0.865	1.765	4	254	7	609	14	3.79	15.04	9.24		
	upper avg.	6 191	0.027	0.002	4.713	13.247	0.529	0.243	0.918	1.765	7	254	7	609	14	3.79	15.04	9.24		
Verdalselva	*lower avg.*	3 924	0.003	0.000	1.172	1.869	0.163	0.119	0.332	0.809	4	168	3	371	6	2.41	5.86	5.64		
	upper avg.	3 924	0.008	0.001	1.172	1.869	0.163	0.135	0.365	0.809	5	168	3	371	6	2.41	5.86	5.64		
Snåsavassdraget	*lower avg.*	2 352	0.000	0.000	0.560	1.019	0.042	0.059	0.111	0.347	2	152	1	294	4	1.21	1.08	3.73		
	upper avg.	2 352	0.004	0.001	0.560	1.019	0.042	0.071	0.134	0.347	3	152	1	294	4	1.21	1.08	3.73		
Namsen	*lower avg.*	3 783	0.004	0.000	2.193	6.838	0.571	0.267	2.149	2.599	5	68	21	224	27	4.22	40.11	4.03		
	upper avg.	3 783	0.009	0.002	2.193	6.838	0.571	0.267	2.149	2.599	6	68	21	224	27	4.22	40.11	4.03		
Røssåga	*lower avg.*	10 557	0.015	0.000	1.246	18.517	0.356	0.112	0.000	1.169	3	117	0	359	10	2.78	1.61	3.19		
	upper avg.	10 557	0.022	0.004	1.246	18.517	0.356	0.222	0.385	1.169	8	117	4	359	10	2.78	1.61	3.19		
Ranaelva	*lower avg.*	19 164	0.000	0.000	10.499	15.041	0.682	0.080	0.885	1.011	10	202	2	652	18	7.76	5.20	6.19		
	upper avg.	19 164	0.035	0.007	10.499	15.041	0.682	0.390	1.504	1.011	20	202	7	652	18	7.76	5.37	6.19		
Beiarelva	*lower avg.*	5 528	0.005	0.001	0.947	1.864	0.106	0.140	0.464	0.966	10	45	3	159	6	3.83	7.84	1.61		
	upper avg.	5 528	0.010	0.002	0.947	1.864	0.106	0.140	0.464	0.966	12	45	3	159	6	3.83	7.84	1.61		
Målselv	*lower avg.*	10 915	0.000	0.000	1.728	34.496	0.042	0.018	2.579	2.124	19	137	3	499	11	9.17	3.18	4.87		
	upper avg.	10 915	0.020	0.004	1.728	34.496	0.042	0.202	2.687	2.124	27	137	5	499	11	9.17	3.29	4.87		

River	Estimate	Flow rate	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	NH4N	NO3N	PO4P	TOTN	TOTP	SiO2	SPM	TOC	PCBs	gHCH
		1000 m3/d	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[1000 tonnes]	[1000 tonnes]	[1000 tonnes]	[kg]	[kg]
Barduelva	*lower avg.*	9 912	0.013	0.000	2.320	5.387	0.352	0.099	0.961	0.887	13	157	13	493	26	8.83	24.94	4.53		
	upper avg.	9 912	0.024	0.004	2.320	5.387	0.352	0.215	0.961	0.950	20	157	16	493	26	8.83	24.94	4.53		
Tanaelva	*lower avg.*	17 528	0.000	0.000	3.254	3.929	0.105	0.121	1.671	2.216	58	88	15	1194	51	44.03	7.39	24.23		
	upper avg.	17 528	0.032	0.006	3.254	3.929	0.109	0.345	1.671	2.216	61	92	16	1194	51	44.03	7.39	24.23		
Pasvikelva	*lower avg.*	20 179	0.073	0.000	44.843	10.926	1.502	1.737	1.436	66.392	91	205	3	1396	44	28.83	9.44	22.20		
	upper avg.	20 179	0.101	0.007	44.843	10.926	1.502	1.915	1.436	66.392	96	210	7	1396	44	28.83	9.44	22.20		
TRIBUTARY RIVERS(109)																				
Mosselva	*upper avg.*	804	0.003	0.000	0.364	0.330	0.067	0.113	0.084	0.296	20	144	1	311	10	0.42	1.59	2.14		
Hølenelva	*upper avg.*	123	0.001	0.000	0.108	0.129	0.016	0.032	0.032	0.145	5	156	2	190	4	0.32	0.51	0.45		
Årungelva	*upper avg.*	51	0.000	0.000	0.033	0.018	0.001	0.008	0.007	0.030	1	35	0	53	1	0.04	0.13	0.08		
Gjersjøelva	*upper avg.*	86	0.000	0.000	0.048	0.027	0.002	0.009	0.011	0.066	1	35	0	48	1	0.10	0.08	0.18		
Ljanselva	*upper avg.*	57	0.001	0.000	0.051	0.070	0.005	0.008	0.009	0.038	3	18	1	33	1	0.12	0.25	0.12		
Loelva	*upper avg.*	96	0.003	0.000	0.274	0.792	0.092	0.020	0.036	0.064	7	44	2	75	6	0.26	1.03	0.20		
Akerselva	*upper avg.*	313	0.004	0.000	0.186	0.677	0.079	0.028	0.022	0.054	5	30	1	64	3	0.40	0.36	0.44		
Frognerelva	*upper avg.*	28	0.000	0.000	0.053	0.062	0.004	0.005	0.004	0.014	1	10	0	16	1	0.06	0.07	0.04		
Lysakerelva	*upper avg.*	286	0.001	0.000	0.081	0.165	0.013	0.019	0.018	0.026	3	32	1	59	2	0.38	0.58	0.50		
Sandvikselva	*upper avg.*	303	0.002	0.000	0.155	0.161	0.027	0.031	0.054	0.058	4	88	1	129	2	0.40	0.42	0.55		
Åroselva	*upper avg.*	162	0.003	0.000	0.138	0.269	0.035	0.033	0.069	0.056	4	74	1	107	3	0.35	0.80	0.37		
Lierelva	*upper avg.*	452	0.006	0.000	0.384	1.296	0.150	0.104	0.194	0.238	5	165	4	213	11	1.14	6.03	0.81		
Sandeelva	*upper avg.*	285	0.008	0.000	1.037	1.286	0.048	0.087	0.390	0.144	8	98	1	149	3	0.52	1.01	0.44		
Aulielva	*upper avg.*	461	0.005	0.000	1.253	0.349	0.043	0.587	0.416	0.740	30	283	5	431	11	1.01	3.33	0.96		
Farriselva	*upper avg.*	1 393	0.013	0.001	0.220	3.686	0.029	0.070	0.084	0.096	7	194	1	290	4	1.93	0.42	2.13		
Gjerstadelva	*upper avg.*	852	0.012	0.001	0.195	1.633	0.114	0.075	0.045	0.186	11	64	0	126	4	0.66	0.39	1.52		
Vegårdselva	*upper avg.*	883	0.010	0.000	0.176	1.627	0.079	0.079	0.049	0.144	10	56	1	121	2	0.57	0.47	1.42		
Søgneelva-Songdalselva	*upper avg.*	741	0.017	0.000	0.163	1.704	0.114	0.068	0.019	0.160	8	156	1	200	3	0.65	0.43	1.18		
Audnedalselva	*upper avg.*	1 317	0.025	0.001	0.155	3.041	0.221	0.117	0.044	0.123	12	145	1	229	4	0.86	0.66	1.72		
Soknedalselva	*upper avg.*	2 132	0.028	0.001	0.420	3.598	0.231	0.124	0.067	2.640	17	204	2	292	10	1.04	0.79	1.44		
Hellelandselva	*upper avg.*	1 620	0.016	0.001	0.246	2.335	0.256	0.090	0.055	0.183	8	189	1	270	7	0.64	0.55	1.25		
Håelva	*upper avg.*	433	0.003	0.000	0.140	0.937	0.039	0.067	0.020	0.065	10	177	3	271	8	0.49	0.43	0.76		
Imselva	*upper avg.*	409	0.002	0.000	0.092	0.321	0.016	0.029	0.038	0.060	3	83	0	116	1	0.13	0.19	0.50		
Oltedalselva	*upper avg.*	1 028	0.008	0.001	0.153	1.163	0.113	0.042	0.037	0.172	8	107	1	158	6	0.69	0.40	0.58		

River	Estimate	Flow rate	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	NH4N	NO3N	PO4P	TOTN	TOTP	SiO2	SPM	TOC	PCBs	gHCH
		1000 m3/d	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[1000 tonnes]	[1000 tonnes]	[1000 tonnes]	[kg]	[kg]
Dirdalsåna	*upper avg.*	1 608	0.008	0.001	0.172	0.907	0.144	0.065	0.050	0.116	5	139	2	189	5	1.01	0.37	0.81		
Frafjordelva	*upper avg.*	1 811	0.009	0.001	0.192	0.893	0.174	0.071	0.060	0.129	7	136	1	186	4	0.67	0.31	0.89		
Espedalselva	*upper avg.*	1 404	0.007	0.001	0.082	0.436	0.066	0.071	0.074	0.118	3	105	1	153	2	0.91	0.26	0.61		
Førrelva	*upper avg.*	1 525	0.006	0.001	0.092	0.442	0.049	0.064	0.094	0.102	3	104	1	119	4	0.86	0.21	0.94		
Åbøelva	*upper avg.*	862	0.004	0.000	0.066	0.398	0.039	0.034	0.045	0.068	2	48	0	66	1	0.28	0.14	0.29		
Etneelva	*upper avg.*	2 030	0.011	0.001	0.317	1.389	0.087	0.139	0.107	0.356	15	223	1	299	4	0.61	0.69	0.69		
Opo	*upper avg.*	4 654	0.029	0.004	0.565	5.394	0.718	0.187	0.386	0.420	40	202	3	450	16	1.47	2.67	1.41		
Tysso	*upper avg.*	3 432	0.024	0.002	0.792	4.102	0.132	0.139	0.344	0.388	6	156	2	231	6	1.85	0.43	1.03		
Kinso	*upper avg.*	1 718	0.005	0.001	0.125	0.398	0.084	0.052	0.190	0.097	3	42	1	73	4	0.44	0.41	0.38		
Veig	*upper avg.*	3 032	0.016	0.002	0.268	1.499	0.194	0.116	0.326	0.473	5	58	1	145	5	1.24	1.32	1.14		
Bjoreio	*upper avg.*	3 619	0.014	0.002	0.452	1.331	0.167	0.102	0.168	0.475	6	84	2	211	8	1.36	0.82	1.76		
SIMA	*upper avg.*	886	0.003	0.000	0.071	0.291	0.069	0.020	0.059	0.089	1	35	0	52	1	0.54	0.27	0.18		
Austdøla	*upper avg.*	703	0.002	0.000	0.044	0.253	0.024	0.015	0.032	0.023	1	32	0	42	4	0.23	0.11	0.11		
Nordøla /Austdøla	*upper avg.*	211	0.001	0.000	0.027	0.104	0.024	0.016	0.025	0.034	0	12	0	14	1	0.11	0.14	0.02		
Tysselvi	*upper avg.*	2 302	0.010	0.001	0.277	1.239	0.189	0.085	0.094	0.143	5	81	1	188	3	0.45	0.69	1.22		
Oselva	*upper avg.*	1 036	0.005	0.001	0.343	0.917	0.093	0.066	0.096	0.143	3	58	2	129	4	0.36	0.46	0.92		
Daleelvi	*upper avg.*	2 014	0.008	0.001	0.287	1.452	0.156	0.053	0.120	0.164	5	66	1	121	4	0.55	0.45	0.98		
Ekso -Storelvi	*upper avg.*	4 433	0.013	0.002	0.299	1.719	0.202	0.096	0.158	0.235	12	141	2	265	7	1.07	1.03	2.20		
Modalselva -Moelvi	*upper avg.*	4 222	0.012	0.002	0.170	1.626	0.212	0.085	0.208	0.358	7	178	2	258	7	1.12	0.83	1.33		
Nærøydalselvi	*upper avg.*	1 756	0.004	0.001	0.122	0.449	0.031	0.030	0.083	0.085	3	79	1	108	4	1.42	0.36	0.35		
Flåmselvi	*upper avg.*	1 275	0.004	0.001	0.090	0.384	0.037	0.028	0.050	0.118	3	55	0	70	1	0.40	0.49	0.20		
Aurlandselvi	*upper avg.*	3 705	0.009	0.002	0.629	1.241	0.213	0.085	0.186	0.267	11	189	1	248	7	1.53	1.05	0.91		
Erdalselvi	*upper avg.*	455	0.001	0.000	0.020	0.080	0.010	0.009	0.015	0.021	1	12	0	19	1	0.23	0.09	0.14		
Lærdalselva /Mjeldo	*upper avg.*	3 867	0.009	0.002	0.536	0.896	0.092	0.067	0.124	0.233	7	154	1	229	8	2.40	1.33	1.25		
Årdalselvi	*upper avg.*	3 635	0.013	0.003	1.439	1.443	0.080	0.066	0.192	0.272	10	321	2	437	6	1.94	2.00	1.26		
Fortundalselva	*upper avg.*	2 331	0.008	0.001	0.742	1.370	0.147	0.057	0.179	0.221	4	87	1	120	4	1.03	1.69	0.44		
Mørkrisdalselvi	*upper avg.*	1 294	0.004	0.001	0.264	0.968	0.087	0.024	0.248	0.210	2	53	1	80	2	0.67	1.08	0.25		
Årøyelva	*upper avg.*	2 753	0.009	0.001	0.178	0.824	0.055	0.048	0.137	0.138	6	88	1	147	6	1.22	1.30	0.67		
Sogndalselva	*upper avg.*	1 062	0.004	0.001	0.067	4.282	0.035	0.046	0.066	0.049	2	47	1	72	2	0.38	0.44	0.79		
Oselva	*upper avg.*	3 041	0.011	0.002	0.458	1.942	0.123	0.127	0.237	0.272	13	59	1	210	11	0.38	0.72	2.97		
Hopselva	*upper avg.*	851	0.003	0.000	0.030	0.245	0.036	0.025	0.055	0.040	2	30	0	42	1	0.14	0.18	0.25		

River	Estimate	Flow rate	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	NH4N	NO3N	PO4P	TOTN	TOTP	SiO2	SPM	TOC	PCBs	gHCH
		1000 m3/d	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[1000 tonnes]	[1000 tonnes]	[1000 tonnes]	[kg]	[kg]
Åelva	*upper avg.*	1 959	0.006	0.001	0.098	0.615	0.076	0.057	0.138	0.095	6	53	1	105	3	0.51	0.50	1.08		
Oldenelva	*upper avg.*	1 595	0.006	0.001	0.131	0.438	0.045	0.080	0.117	0.083	5	91	1	130	3	0.71	0.65	0.48		
Loelvi	*upper avg.*	1 843	0.006	0.001	0.224	0.457	0.056	0.061	0.177	0.092	5	80	1	111	4	0.97	0.84	0.42		
Stryneelva	*upper avg.*	3 757	0.012	0.002	1.052	0.823	0.081	0.093	0.288	0.199	13	148	1	246	6	1.59	3.96	0.89		
Hornindalselva(Horndøla)	*upper avg.*	3 253	0.012	0.002	0.338	1.140	0.090	0.104	0.219	0.291	10	140	1	231	5	1.46	1.03	1.44		
Ørstaelva	*upper avg.*	1 259	0.004	0.001	0.130	0.317	0.021	0.035	0.088	0.110	8	71	2	130	5	0.84	0.76	0.62		
Valldøla	*upper avg.*	2 507	0.007	0.001	0.263	0.595	0.048	0.069	0.173	0.112	5	63	1	102	3	1.03	0.64	0.52		
Rauma	*upper avg.*	5 718	0.018	0.003	0.569	1.357	0.120	0.165	0.318	0.303	13	136	1	212	6	3.96	1.54	1.36		
Isa	*upper avg.*	841	0.002	0.000	0.120	0.172	0.020	0.019	0.129	0.071	2	23	0	39	1	0.50	0.28	0.22		
Eira	*upper avg.*	4 962	0.015	0.003	0.634	1.019	0.111	0.113	0.331	0.235	10	217	1	311	5	3.24	1.03	1.12		
Litledalselva	*upper avg.*	999	0.003	0.000	0.111	0.178	0.018	0.022	0.089	0.053	1	23	0	38	2	0.77	0.21	0.25		
Ålvunda	*upper avg.*	963	0.003	0.001	0.307	0.369	0.024	0.015	0.063	0.068	3	67	1	103	3	1.05	0.39	0.64		
Toåa	*upper avg.*	1 214	0.004	0.001	0.173	0.263	0.026	0.021	0.053	0.054	2	17	1	54	2	0.57	0.30	0.59		
Bøvra	*upper avg.*	1 020	0.003	0.000	0.128	0.197	0.013	0.019	0.050	0.073	3	52	0	93	2	0.45	0.32	0.95		
Børselva	*upper avg.*	223	0.001	0.000	0.112	0.067	0.008	0.018	0.025	0.113	1	28	0	51	2	0.09	0.29	0.41		
Vigda	*upper avg.*	334	0.001	0.000	0.128	0.098	0.011	0.021	0.056	0.087	1	29	1	56	2	0.20	1.39	0.45		
Homla	*upper avg.*	438	0.001	0.000	0.123	0.111	0.007	0.073	0.036	0.075	3	8	0	43	2	0.24	0.19	0.94		
Gråe	*upper avg.*	272	0.001	0.000	0.109	0.067	0.007	0.033	0.035	0.058	1	54	1	82	1	0.32	0.30	0.52		
Figga	*upper avg.*	609	0.002	0.000	0.246	0.250	0.040	0.047	0.093	0.172	4	67	1	113	3	0.37	1.53	1.45		
Årgårdselva	*upper avg.*	1 606	0.005	0.002	0.378	0.551	0.059	0.063	0.161	0.189	14	81	4	231	11	0.85	2.05	4.50		
Moelva(Salsvatenelva)	*upper avg.*	1 687	0.006	0.002	0.142	0.776	0.036	0.030	0.110	0.095	3	37	1	82	2	0.61	0.32	1.26		
Åelva(Åbjøra)	*upper avg.*	2 529	0.008	0.002	0.245	0.642	0.093	0.060	0.182	0.282	6	27	1	91	9	0.54	1.13	1.73		
Skjerva	*upper avg.*	494	0.003	0.000	0.203	0.780	0.053	0.053	0.052	0.550	9	27	3	72	5	0.28	0.86	0.58		
Fusta	*upper avg.*	3 177	0.009	0.002	0.342	0.765	0.051	0.300	0.110	0.249	18	34	2	147	6	0.66	2.32	1.82		
Drevja	*upper avg.*	1 030	0.003	0.001	0.093	0.195	0.020	0.025	0.044	0.066	2	16	1	46	3	0.22	1.07	0.44		
Bjerkaelva	*upper avg.*	1 947	0.007	0.002	0.366	0.538	0.047	0.038	0.088	0.309	7	18	1	74	5	0.63	0.82	1.21		
Dalselva	*upper avg.*	1 051	0.003	0.001	0.148	0.201	0.025	0.016	0.035	0.170	5	8	1	45	2	0.34	0.51	0.70		
Fykanåga	*upper avg.*	2 186	0.007	0.001	0.132	0.379	0.047	0.034	0.064	0.128	6	36	1	71	4	0.53	1.04	0.51		
Saltelva	*upper avg.*	4 025	0.013	0.003	0.503	1.124	0.121	0.129	0.118	0.683	13	47	5	141	16	2.46	14.04	1.40		
SulitjelmavassdragetUtl Øvrevt	*upper avg.*	3 041	0.016	0.002	0.882	0.705	0.044	0.067	0.091	0.216	8	31	1	90	6	0.83	1.23	1.05		

River	Estimate	Flow rate	Cd	Hg	Cu	Zn	Pb	As	Cr	Ni	NH4N	NO3N	PO4P	TOTN	TOTP	SiO2	SPM	TOC	PCBs	gHCH
		1000 m3/d	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[tonnes]	[1000 tonnes]	[1000 tonnes]	[1000 tonnes]	[kg]	[kg]
Kobbelva	*upper avg.*	1 975	0.006	0.002	0.072	0.521	0.029	0.031	0.062	0.083	5	24	1	67	3	0.56	0.83	0.43		
Elvegårdselva	*upper avg.*	3 676	0.016	0.002	0.641	1.452	0.142	0.138	0.107	0.932	12	16	2	86	5	2.06	1.51	2.39		
Spanselva	*upper avg.*	506	0.002	0.000	0.095	0.102	0.016	0.009	0.032	0.153	1	5	0	13	1	0.19	0.19	0.19		
Salangselva	*upper avg.*	2 098	0.006	0.001	0.199	0.400	0.034	0.036	0.069	0.222	5	20	1	58	3	0.56	0.80	0.69		
Lakselva(Rossfjordelva)	*upper avg.*	648	0.002	0.001	0.044	0.104	0.015	0.012	0.023	0.075	2	2	0	29	1	0.13	0.17	0.43		
Nordkjoselva	*upper avg.*	583	0.002	0.000	0.071	0.096	0.008	0.021	0.017	0.041	1	4	0	15	1	0.40	0.25	0.21		
Signaldalselva	*upper avg.*	1 665	0.005	0.001	0.337	0.319	0.030	0.052	0.072	0.219	3	12	1	45	3	1.02	1.59	2.22		
Skibotnelva	*upper avg.*	2 284	0.007	0.002	0.400	0.456	0.026	0.042	0.067	0.802	4	21	1	68	3	1.34	0.65	1.17		
Kåfjordelva	*upper avg.*	1 068	0.003	0.001	0.469	0.515	0.027	0.024	0.043	0.240	1	25	0	49	2	0.68	0.33	0.30		
Reisaelva	*upper avg.*	6 061	0.022	0.005	1.825	2.721	0.273	0.249	0.242	1.560	14	86	3	231	11	7.71	2.81	3.69		
Mattiselva	*upper avg.*	467	0.001	0.000	0.122	0.098	0.003	0.019	0.026	0.045	1	3	0	18	1	0.20	0.10	0.36		
Tverrelva	*upper avg.*	335	0.001	0.000	0.089	0.072	0.003	0.012	0.026	0.043	1	7	0	24	1	0.28	0.11	0.44		
Repparfjordelva	*upper avg.*	2 727	0.008	0.002	1.817	0.433	0.017	0.055	0.207	0.291	7	32	1	123	4	1.19	0.64	2.75		
Stabburselva	*upper avg.*	1 843	0.005	0.001	0.224	0.537	0.012	0.034	0.079	0.098	5	18	1	65	2	1.77	0.43	1.52		
Lakseelv	*upper avg.*	1 544	0.005	0.001	0.396	0.382	0.033	0.024	0.166	0.295	4	5	1	58	4	1.36	2.12	1.39		
Børselva	*upper avg.*	1 244	0.004	0.001	0.070	0.338	0.008	0.022	0.084	0.085	5	4	1	31	1	1.52	0.31	0.41		
Mattusjåkka	*upper avg.*	145	0.001	0.000	0.018	0.187	0.016	0.003	0.192	0.035	0	1	0	4	0	0.07	0.03	0.06		
Stuorrajåkka	*upper avg.*	987	0.003	0.001	0.027	0.333	0.006	0.020	0.063	0.073	3	14	0	28	1	1.09	0.14	0.26		
Soussjåkka	*upper avg.*	132	0.000	0.000	0.006	0.040	0.001	0.002	0.008	0.006	0	1	0	4	0	0.17	0.03	0.05		
Adamselva	*upper avg.*	1 040	0.003	0.001	0.076	0.300	0.007	0.019	0.071	0.031	4	4	0	36	1	1.12	0.22	0.66		
Syltefjordelva(Vesterelva)	*upper avg.*	1 313	0.004	0.001	0.052	0.189	0.008	0.095	0.074	0.024	4	7	1	50	4	1.30	0.25	0.37		
Jakobselv	*upper avg.*	1 311	0.004	0.001	0.094	0.196	0.008	0.036	0.122	0.061	4	5	1	57	2	2.09	0.31	0.95		
Neidenelva	*upper avg.*	3 945	0.012	0.002	0.900	0.659	0.047	0.125	0.187	2.365	20	19	2	269	8	3.25	2.21	5.28		
Grense Jakobselv	*upper avg.*	388	0.003	0.000	0.312	0.359	0.026	0.024	0.306	1.106	2	2	0	20	0	0.42	0.16	0.36		

Part B

Table 3. Total inputs from Norway 2007

Table 3A Total Norway

TOTAL INPUTS																					
Discharge region	Estimate	Flow rate (km^3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	NH_4-N [tonnes]	NO_3-N [tonnes]	PO_4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	Si-O_2 [tonnes]	SPM [tonnes]	TOC [tonnes]	PCB [kg]	g-HCH [kg]
INPUTS TO OSPAR REGION: TOTAL NORWAY																				
RIVERINE INPUTS																				
	lower avg.		0,98	0,01	126,8	316,0	28,5	12,4	17,6	42,6	796	16 050	480	27 233	887	197 594	555 986	227 713	0	0,0
Main Rivers	upper avg.	185 971	1,03	0,07	126,8	316,0	28,5	12,7	19,4	42,7	815	16 050	495	27 233	887	197 594	555 986	227 713	82	13,6
	lower avg.		0,72	0,02	117,3	273,7	17,9	6,6	22,0	101,1	628	10 579	189	21 794	545	204 335	345 673	211 985	0	0,0
Tributary Rivers (36)	upper avg.	245 862	0,95	0,10	117,3	273,7	17,9	8,8	25,7	101,3	696	10 588	226	21 794	546	204 335	345 984	211 985	0	0,0
	lower avg.		0,75	0,00	32,1	90,6	7,8	6,9	11,9	25,8	677	7 726	117	13 709	440	205 088	100 981	102 350		
ributary Rivers (109)	upper avg.	176 363	0,75	0,00	32,1	90,6	7,8	6,9	11,9	25,8	677	7 726	117	13 709	440	205 088	100 981	102 350		
	lower avg.		**2,45**	**0,03**	**276,3**	**680**	**54,2**	**25,9**	**51,5**	**169,5**	**2 101**	**34 356**	**786**	**62 735**	**1 872**	**607 016**	**1 002 639**	**542 048**	**0**	**0,0**
Total Riverine Inpu	**upper avg.**	**608 197**	**2,73**	**0,17**	**276,3**	**680**	**54,2**	**28,4**	**57,0**	**169,7**	**2 187**	**34 364**	**837**	**62 735**	**1 873**	**607 016**	**1 002 950**	**542 048**	**82**	**13,6**
DIRECT DISCHARGES																				
	lower avg.		0,029	0,02	3,9	1,2	0,3	0,17	0,31	1,4	8 583	572	551	11 444	918		3 782	850	23	
Sewage Effluents	upper avg.		0,029	0,02	3,9	1,2	0,3	0,17	0,31	1,4	8 583	572	551	11 444	918		3 782	850	23	
	lower avg.		0,319	0,01	8,5	39,6	3,3	1,00	1,69	7,5	1 771	118	127	2 361	211		527 596	211	0	
Industrial Effluents	upper avg.		0,319	0,01	8,5	39,6	3,3	1,00	1,69	7,5	1 771	118	127	2 361	211		527 596	211	0	
	lower avg.				688,9						31 622	4 743	5 763	39 527	8 352					
Fish Farming	upper avg.				688,9						31 622	4 743	5 763	39 527	8 352					
	lower avg.		**0,35**	**0,03**	**701,3**	**40,8**	**3,6**	**1,2**	**1,99**	**8,81**	**41 976**	**5 434**	**6 441**	**53 333**	**9 481**		**531 378**	**1 061**	**23**	
Total Direct Inputs	**upper avg.**		**0,35**	**0,03**	**701,3**	**40,8**	**3,6**	**1,2**	**1,99**	**8,81**	**41 976**	**5 434**	**6 440**	**53 333**	**9 481**		**531 378**	**1 061**	**23**	
UNMONITORED AREAS																				
	lower avg.	455 653									2 409	27 355	213	43 741	865					
Unmonitored Areas	upper avg.	455 653									2 409	27 355	210	43 741	865					
	lower avg.		**2,80**	**0,06**	**978**	**721**	**57,8**	**27,1**	**53,5**	**178**	**46 486**	**67 144**	**7 440**	**159 809**	**12 217**	**607 016**	**1 534 017**	**543 109**	**23**	**0,0**
REGION TOTAL	**upper avg.**	**1 063 849**	**3,07**	**0,20**	**978**	**721**	**57,8**	**29,6**	**58,9**	**179**	**46 572**	**67 153**	**7 488**	**159 809**	**12 219**	**607 016**	**1 534 328**	**543 109**	**105**	**13,6**

3B Skagerak

Discharge region	Estimate	Flow rate (km^3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	NH_4-N [tonnes]	NO_3-N [tonnes]	PO_4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	Si-O_2 [tonnes]	SPM [tonnes]	TOC [tonnes]	PCB [kg]	g-HCH [kg]
TOTAL INPUTS																				
INPUTS TO OSPAR REGION: Skagerrak																				
RIVERINE INPUTS																				
	lower avg.		0,824	0,008	101,8	260,2	27,5	11,3	15,2	38,5	759	14 753	461	24 426	814	167 015	527 347	199 978	0,00	0,00
Main Rivers	upper avg.	149 038	0,824	0,057	101,8	260,2	27,5	11,4	16,6	38,5	764	14 753	468	24 426	814	167 015	527 347	199 978	65,28	10,88
	lower avg.		0,244	0,001	9,9	48,5	3,5	1,4	1,0	4,1	145	1 566	14	3 407	58	18 772	16 485	38 309	0,00	0,00
Tributary Rivers (36)	upper avg.	25 025	0,244	0,009	9,9	48,5	3,5	1,4	1,3	4,1	148	1 566	17	3 407	58	18 772	16 485	38 309	0,00	0,00
	lower avg.		0,112	0,000	5,1	17,3	1,1	1,5	1,6	2,7	143	1 827	22	2 843	74	21 456	18 561	15 252		
Tributary Rivers (109)	upper avg.	8 693	0,112	0,000	5,1	17,3	1,1	1,5	1,6	2,7	143	1 827	22	2 843	74	21 456	18 561	15 252		
	lower avg.		**1,18**	**0,01**	**116,8**	**326**	**32,1**	**14,2**	**18**	**45**	**1 047**	**18 146**	**497**	**30 675**	**946**	**207 243**	**562 392**	**253 538**	**0**	**0**
Total Riverine Inputs	**upper avg.**	**182 757**	**1,18**	**0,07**	**116,8**	**326**	**32,1**	**14,3**	**20**	**45**	**1 055**	**18 146**	**507**	**30 675**	**946**	**207 243**	**562 392**	**253 538**	**65**	**11**
DIRECT DISCHARGES																				
	lower avg.		0,025	0,02	3,93	0,7	0,3	0,1	0,3	1,4	3341	223	59	4454	98		0,972	2,52	23	
Sewage Effluents	upper avg.		0,025	0,02	3,93	0,7	0,3	0,1	0,3	1,4	3341	223	59	4454	98		0,972	2,52	23	
	lower avg.		0,05	0,008	7,07	6,4	0,3	0,9	1,0	1,5	823	55	44	1098	73		1,692	0,08	0	
Industrial Effluents	upper avg.		0,05	0,008	7,07	6,4	0,3	0,9	1,0	1,5	823	55	44	1098	73		1,692	0,08	0	
	lower avg.				0,61						28	4	5	35	7					
Fish Farming	upper avg.				0,61						28	4	5	35	7					
	lower avg.		**0,08**	**0,03**	**11,6**	**7**	**0,6**	**1,0**	**1,3**	**2,9**	**4 192**	**282**	**108**	**5 587**	**178**	**0**	**3**	**3**	**23**	
Total Direct Inputs	**upper avg.**		**0,08**	**0,03**	**11,6**	**7**	**0,6**	**1,0**	**1,3**	**2,9**	**4 192**	**282**	**108**	**5 587**	**178**	**0**	**3**	**3**	**23**	
UNMONITORED AREAS																				
	lower avg.	7 861									174	1 847	23	2 791	81					
Unmonitored Areas	upper avg.	7 861									174	1 847	23	2 791	81					
	lower avg.		**1,25**	**0,04**	**128**	**333**	**32,7**	**15,2**	**19,0**	**48,2**	**5 413**	**20 275**	**628**	**39 053**	**1 206**	**207 243**	**562 395**	**253 541**	**23**	**0**
REGION TOTAL	**upper avg.**	**190 618**	**1,25**	**0,09**	**128**	**333**	**32,7**	**15,3**	**20,8**	**48,2**	**5 421**	**20 275**	**638**	**39 053**	**1 206**	**207 243**	**562 395**	**253 541**	**89**	**11**

3C North Sea

TOTAL INPUTS																				
Discharge region	Estimate	Flow rate (km^3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	NH_4-N [tonnes]	NO_3-N [tonnes]	PO_4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	Si-O_2 [tonnes]	SPM [tonnes]	TOC [tonnes]	PCB [kg]	g-HCH [kg]
INPUTS TO OSPAR REGION: North Sea																				
RIVERINE INPUTS																				
	lower avg.		0,021	0,0002	0,8	4,5	0,4	0,1	0,2	0,5	9	527	11,3	828	33	2 322	5 955	3 615	0,0	0,00
Main Rivers	upper avg.	4 765	0,021	0,0018	0,8	4,5	0,4	0,2	0,3	0,5	10	527	12,4	828	33	2 322	5 955	3 615	2,1	0,35
	lower avg.		0,317	0,0118	21,6	93,8	8,9	1,6	6,2	8,5	224	6242	84,7	9 565	220	42 932	174 599	53 749	0,0	0,00
Tributary Rivers (36)	upper avg.	81 619	0,358	0,0344	21,6	93,8	8,9	2,3	8,1	8,6	240	6242	98,1	9 565	222	42 932	174 639	53 749	0,0	0,00
	lower avg.		0,366	0,0000	12,1	50,7	4,8	2,8	5,4	9,7	276	4344	46,9	6 903	197	73 965	31 678	35 229		
Tributary Rivers (109)	upper avg.	85 553	0,366	0,0000	12,1	50,7	4,8	2,8	5,4	9,7	276	4344	46,9	6 903	197	73 965	31 678	35 229		
	lower avg.		**0,70**	**0,01**	**34,5**	**149**	**14,0**	**4,6**	**11,8**	**18,7**	**509**	**11 113**	**143**	**17 296**	**449**	**119 219**	**212 231**	**92 593**	**0**	**0,0**
Total Riverine Inputs	**upper avg.**	**171 937**	**0,75**	**0,04**	**34,5**	**149**	**14,0**	**5,3**	**13,8**	**18,8**	**526**	**11 113**	**157**	**17 296**	**451**	**119 219**	**212 272**	**92 593**	**2**	**0,3**
DIRECT DISCHARGES																				
	lower avg.		0,004	0	0,0	0,4	0	0,04	0	0	2 533	169	213	3 378	355		200	0	0	0
Sewage Effluents	upper avg.		0,004	0	0,0	0,4	0	0,04	0	0	2 533	169	213	3 378	355		200	0	0	0
	lower avg.		0,192	0,002	1,3	20,095	2,1	0,07	0,5	5,8	306	20	35	408	58		7 200	209	0	0
Industrial Effluents	upper avg.		0,192	0,002	1,3	20,095	2,1	0,07	0,5	5,8	306	20	35	408	58		7 200	209	0	0
	lower avg.				245						11 293	1 694	2 057	14 116	2 981					
Fish Farming	upper avg.				245						11 293	1 694	2 057	14 116	2 981					
	lower avg.		**0,20**		**247**	**20,5**	**2,1**	**0,11**	**0,5**	**5,8**	**14 132**	**1 883**	**2 305**	**17 902**	**3 395**		**7 400**	**209**	**0**	**0**
Total Direct Inputs	**upper avg.**		**0,20**	**0,00**	**247**	**20,5**	**2,1**	**0,11**	**0,5**	**5,8**	**14 132**	**1 883**	**2 305**	**17 902**	**3 395**		**7 400**	**209**	**0**	**0**
	lower avg.	166 966									987	11 260	70	18 073	290					
Unmonitored Areas	upper avg.	166 966									987	11 260	70	18 073	290					
	lower avg.		**0,90**	**0,01**	**281**	**170**	**16,1**	**4,7**	**12,3**	**24,6**	**15 628**	**24 256**	**2 518**	**53 271**	**4 134**	**119 219**	**219 631**	**92 802**	**0,0**	**0,0**
REGION TOTAL	**upper avg.**	**338 903**	**0,94**	**0,04**	**281**	**170**	**16,1**	**5,5**	**14,3**	**24,7**	**15 645**	**24 256**	**2 533**	**53 271**	**4 135**	**119 219**	**219 672**	**92 802**	**2,1**	**0,3**

3D Norwegian Sea

Discharge region	Estimate	Flow rate (km^3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	NH_4-N [tonnes]	NO_3-N [tonnes]	PO_4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	$Si-O_2$ [tonnes]	SPM [tonnes]	TOC [tonnes]	PCB [kg]	g-HCH [kg]
TOTAL INPUTS																				
INPUTS TO OSPAR REGION: Norwegian Sea																				
RIVERINE INPUTS																				
Main Rivers	lower avg.		0,14	0,003	22	50,40	0,6	0,8	1,5	3,0	18	704	6	1 433	24	14 008	19 907	13 723	0	0,0
	upper avg.	22 470	0,16	0,011	22	50,40	0,6	0,8	1,8	3,1	26	704	10	1 433	24	14 008	19 907	13 723	10	1,6
Tributary Rivers (36)	lower avg.		0,08	0,003	38	116,55	3,9	1,8	11,7	20,0	110	2477	72	6 232	171	69 771	137 755	73 503	0	0,0
	upper avg.	101 511	0,22	0,038	38	116,55	3,9	2,8	13,1	20,0	151	2477	88	6 232	171	69 771	138 026	73 503	0	0,0
Tributary Rivers (109)	lower avg.		0,22	0,000	11	18,40	1,7	2,1	3,3	8,8	197	1433	40	3 177	141	76 328	43 691	36 996		
	upper avg.	64 696	0,22	0,000	11	18,40	1,7	2,1	3,3	8,8	197	1433	40	3 177	141	76 328	43 691	36 996		
Total Riverine Inputs	**lower avg.**		0,44	0,0065	71	185,34	6,2	4,6	16,6	31,8	326	4614	118	10 842	336	160 107	201 354	124 222	0	0,0
	upper avg.	188 677	0,60	0,0485	71	185,34	6,2	5,7	18,2	31,9	374	4614	138	10 842	336	160 107	201 624	124 222	10	1,6
DIRECT DISCHARGES																				
Sewage Effluents	lower avg.		0,00	0,00	0,00	0,1	0,0	0,0	0,0	0,0	2521	168	259	3362	432		3 581	847	0	
	upper avg.		0,00	0,00	0,00	0,1	0,0	0,0	0,0	0,0	2521	168	259	3362	432		3 581	847	0	
Industrial Effluents	lower avg.		0,08	0,00	0,15	13,03	0,9	0,0	0,2	0,1	642	43	48	856	81		520 394	2	0	
	upper avg.		0,08	0,00	0,15	13,03	0,9	0,0	0,2	0,1	642	43	48	856	81		520 394	2	0	
Fish Farming	lower avg.				412						18 923	2 838	3 450	23 654	4 999					
	upper avg.				412						18 923	2 838	3 450	23 654	4 999					
Total Direct Inputs	**lower avg.**		**0,08**	**0,00**	**412**	**13,1**	**0,9**	**0,0**	**0,2**	**0,1**	**22 086**	**3 049**	**3 757**	**27 872**	**5 512**		**523 975**	**849**	**0**	
	upper avg.		**0,08**	**0,00**	**412**	**13,0**	**0,9**	**0,0**	**0,2**	**0,1**	**22 086**	**3 049**	**3 757**	**27 872**	**5 512**		**523 975**	**849**	**0**	
UNMONITORED AREAS																				
Unmonitored Areas	lower avg.	238 917									1 121	12 726	110	20 348	447					
	upper avg.	238 917									1 121	12 726	108	20 348	447					
REGION TOTAL	**lower avg.**		**0,51**	**0,01**	**482**	**198**	**7,0**	**4,7**	**16,7**	**31,9**	**23 533**	**20 390**	**3 985**	**59 062**	**6 295**	**160 107**	**725 329**	**125 071**	**0**	**0**
	upper avg.	**238 917**	**0,67**	**0,05**	**482**	**198**	**7,0**	**5,7**	**18,4**	**32,0**	**23 581**	**20 390**	**4 003**	**59 062**	**6 295**	**160 107**	**725 599**	**125 071**	**10**	**2**

3E Barents Sea

TOTAL INPUTS																				
Discharge region	Estimate	Flow rate (km^3/s)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	NH_4-N [tonnes]	NO_3-N [tonnes]	PO_4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	Si-O_2 [tonnes]	SPM [tonnes]	TOC [tonnes]	PCB [kg]	g-HCH [kg]
INPUTS TO OSPAR REGION: Barents Sea																				
RIVERINE INPUTS																				
	lower avg.		0,00	0,00	2,0	1	0,0	0,2	0,7	1	11	67	2	546	16	14 248	2 776	10 398	0,0	0,0
Main Rivers	upper avg.	9 698	0,02	0,00	2,0	1	0,0	0,3	0,7	1	14	67	4	546	16	14 248	2 776	10 398	4,8	0,7
	lower avg.		0,07	0,00	48,1	15	1,6	1,9	3,1	69	148	293	18	2 590	95	72 860	16 834	46 424	0,0	0,0
Tributary Rivers (36)	upper avg.	37 707	0,13	0,01	48,1	15	1,6	2,3	3,1	69	157	302	23	2 590	95	72 860	16 834	46 424	0,0	0,0
	lower avg.		0,05	0,00	4,2	4	0,2	0,5	1,6	5	61	122	8	785	29	33 339	7 052	14 873		
Tributary Rivers (109)	upper avg.	17 421	0,05	0,00	4,2	4	0,2	0,5	1,6	5	61	122	8	785	29	33 339	7 052	14 873		
	lower avg.		**0,13**	**0,00**	**54,3**	**20**	**1,8**	**2,6**	**5,4**	**73,7**	**219**	**482**	**28**	**3 922**	**140**	**120 447**	**26 662**	**71 695**	**0,0**	**0,0**
Total Riverine Input	**upper avg.**	**64 825**	**0,20**	**0,02**	**54,3**	**20**	**1,8**	**3,0**	**5,4**	**73,7**	**232**	**491**	**35**	**3 922**	**140**	**120 447**	**26 662**	**71 695**	**4,8**	**0,7**
DIRECT DISCHARGES																				
	lower avg.		0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	188	13	19	250	32		0,0	0,0	0,0	
Sewage Effluents	upper avg.		0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	188	13	19	250	32		0,0	0,0	0,0	
	lower avg.		0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0	0	0	0		0,0	0,0	0,0	
Industrial Effluents	upper avg.		0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0	0	0	0		0,0	0,0	0,0	
	lower avg.				30,0						1 377	207	251	1 722	364					
Fish Farming	upper avg.				30,0						1 377	207	251	1 722	364					
	lower avg.		**0,0**	**0,0**	**30,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**1 565**	**219**	**270**	**1 972**	**396**		**0**	**0**	**0**	
Total Direct Inputs	**upper avg.**		**0,0**	**0,0**	**30,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**1 565**	**219**	**270**	**1 972**	**396**		**0**	**0**	**0**	
	lower avg.	41 909									127	1 521	9	2 530	46					
Unmonitored Areas	upper avg.	41 909									127	1 521	9	2 530	46					
	lower avg.		**0,13**	**0,00**	**84,3**	**20**	**1,8**	**2,6**	**5,4**	**73,7**	**1 912**	**2 222**	**308**	**8 423**	**582**	**120 447**	**26 662**	**71 695**	**0,0**	**0,0**
REGION TOTAL	**upper avg.**	**106 734**	**0,20**	**0,02**	**84,3**	**20**	**1,8**	**3,0**	**5,4**	**73,7**	**1 924**	**2 231**	**315**	**8 423**	**582**	**120 447**	**26 662**	**71 695**	**4,8**	**0,7**