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OSPAR Commission

Riverine inputs and direct discharges to Norwegian coastal waters – 2006

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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 2006 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, the Norwegian inputs to coastal waters of all RID substances in 2006 may be characterised as being within normal fluctuations as compared to former years. A relatively small increase in nutrient inputs are partly explained by high water discharges in the Skagerrak area in 2006, partly by increased inputs from direct discharges. In terms of metals, an increase in riverine inputs of nickel and a decrease in zinc since 2005 were explained by fluctuations in concentrations and water discharges in the rivers Pasvik and Orkla. Long-term trends (1990-2006) show declines in riverine loads and concentrations of many metals, but this is mainly the result of subsequently lower detection limits. For nutrients and particulate matter, no overall conclusive long-term trends were detected.

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Preface

This report presents the results of the 2006 monitoring of riverine and direct discharges to Norwegian coastal waters. The monitoring is part of a joint monitoring programme under the “OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic”.

The Norwegian contribution is administered by Jon L. Fuglestad, senior adviser 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 Administration (NVE) to organise and carry out the monitoring, undertake the analyses and report the results.

At NIVA, Stig A. Borgvang co-ordinated the RID programme in 2006, whereas in 2007 the follow-up and administration of RID data analyses and reporting has been co-ordinated by Øyvind Kaste. 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), Stein W. Johansen (quality assurance of chemical sampling), Bente Lauritzen (contact person at NIVAlab), and Tor S. Traaen (quality assurance of chemical analyses).

At Bioforsk, Eva Skarbøvik has been the main responsible for the 2006 reporting, Per G. Stålnacke has been main responsible for the overall data handling and the statistical parts of the report, and Stig A. Borgvang has undertaken quality assurance and 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.

Oslo, 19 November 2007

Øyvind Kaste

Project co-ordinator

Content

Part A: Principles, Results and Discussions

Part B: Data Report

Part A

Principles, Results and Discussions

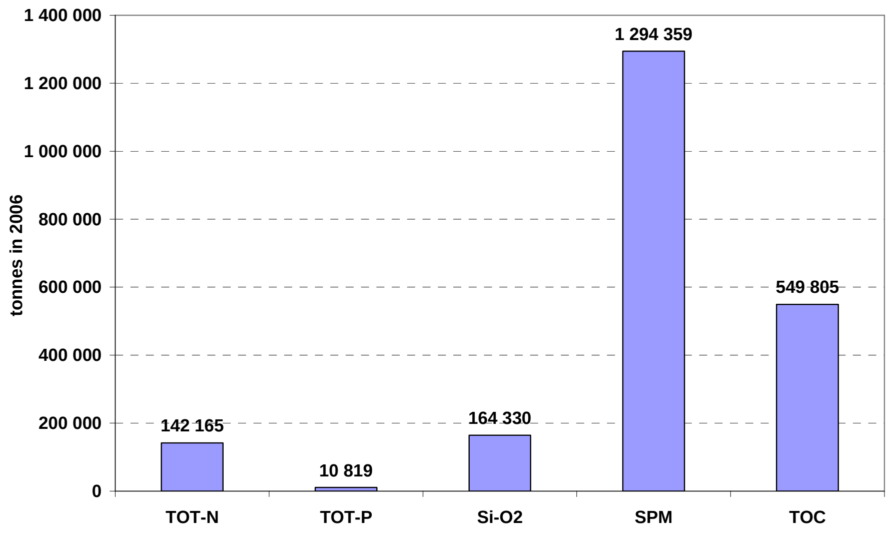
Summary

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: Skagerrak, North Sea, Norwegian Sea, and Barents Sea.

The monitoring in rivers is based on 10 so-called 'main rivers' with monthly sampling; and 36 so-called 'tributary rivers' with sampling 4 times a year. For discharges entering directly into marine recipients or below the sampling sites for river water quality, i.e. municipal wastewater and industrial discharges, estimates are based on data from effluent control programmes.

Climate conditions in 2006
2006 was one of the warmest years ever registered in Norway. The runoff in the south and east part of the country was characterised by low water flows during summer, and higher than normal water discharges during autumn floods, resulting in an annual runoff equal to or higher than the 30-year normal from 1976-2005. The northern and north-western parts of the country experienced, in general, lower annual discharges than normal.

Nutrient and particle inputs in 2006
The total nutrient input to coastal waters from land based sources in Norway in 2006 was estimated to about 10 800 tonnes of phosphorus and about 142 000 tonnes of nitrogen. The total inputs of nitrogen, phosphorus, silicate, suspended particulate matter and total organic carbon in 2006 are shown below:

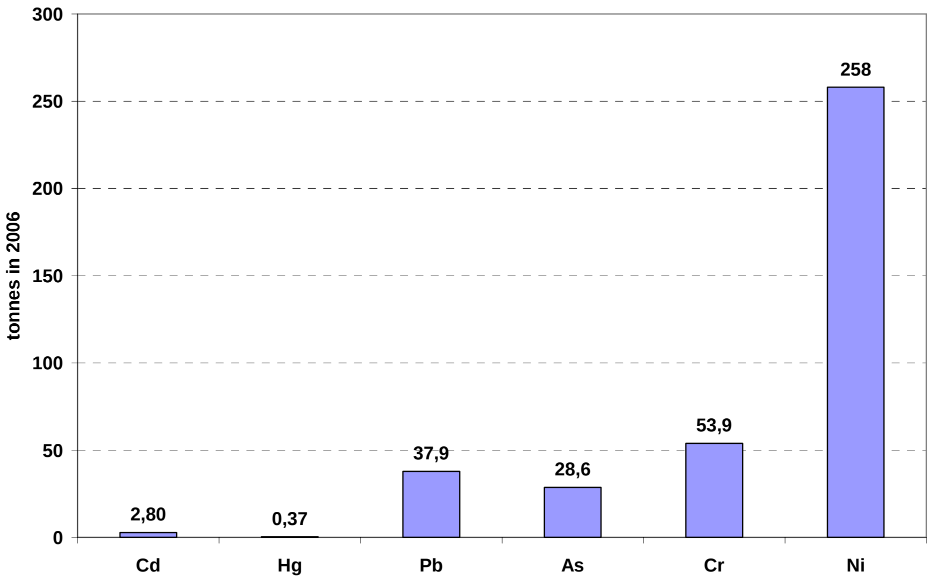


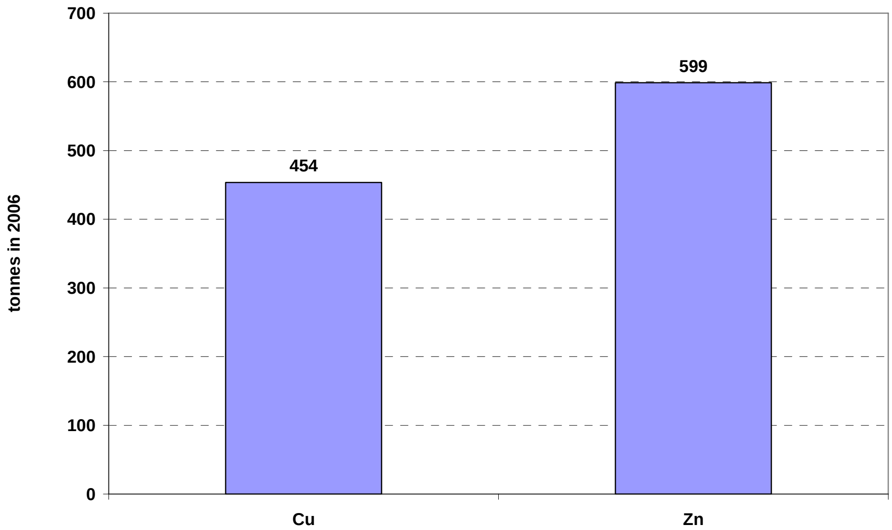
As for 2005, the distribution of nutrient fractions reflects that fish farming is the main source for orthophosphate, total phosphorus and ammonium in the three northernmost marine areas. Totally in Norway, the nutrient loading from fish farming contributes to almost 70 % of the total phosphorus loading and over 20 % of the total nitrogen loading.

In terms of changes since 2005, the total load of suspended particulate matter was equal for riverine loads, and only slightly increased for direct inputs. Total inputs of nutrients did, however, increase. For riverine inputs this was mainly caused by high autumn water discharges in the Skagerrak region, where the density of agricultural land and population is the highest in the country. The direct discharges increased slightly in all four regions, reflecting increases in inputs from fish farming and sewage treatment plants.

Metal inputs in 2006

In 2006, the total inputs (upper estimates) of cadmium to coastal areas were estimated to 2.8 tonnes, arsenic to about 29 tonnes, lead to about 38 tonnes, chromium to about 54 tonnes and nickel to about 258 tonnes. Copper and zinc comprised the largest inputs of heavy metals, which in 2006 amounted to about 454 tonnes and 599 tonnes, respectively:





For riverine loads of metals, there were in general small changes in total loads from 2005 to 2006. The main exceptions are a decrease in zinc, and an increase in nickel, explained by an actual decrease in zinc concentrations in the *River Orkla* from 2005 to 2006, and a concentration peak of nickel during snowmelt and very high water discharge in the *Pasvik*

River, respectively. For direct discharges, no major changes in metal loads were observed from 2005 to 2006.

Lindane and PCB7 inputs in 2006

Total loads of lindane were estimated to between 3 (lower estimate) and 13 (higher estimate) kg in 2006, whereas PCB7 loads were estimated to between 0 and 146 kg. No estimates were made for the tributary rivers and the direct sources.

Common for lindane and PCB7s are very low riverine concentrations, and, thus, few samples above the detection limit. The resulting loads therefore become very dependent on the detection limits and the water discharge at the dates of sampling, and comparisons with former years will therefore be a more or less meaningless exercise

Total inputs to Norwegian coastal areas in 2006

In summary, the inputs of RID substances in 2006 may be characterised as within normal values, and there was, thus, no alarming changes in any particular substances from former years. This conclusion is drawn both from direct comparisons with 2005, and comparisons based on flow normalised concentrations and loads in the period 1990-2006. Some variations can naturally be seen for the many substances in this study, including

- Increases in nutrient inputs since 2005, both from riverine and direct sources, explained partly by high water discharges in the Skagerrak area in 2006, partly by increased inputs from direct discharges;
- An increase in riverine inputs of nickel and a decrease in zinc as compared to 2005, explained by fluctuations in concentrations and water discharges in two particular rivers; namely *Pasvik* and *Orkla*.
- Long-term trends (1990-2006) show declines in riverine loads and concentrations of many metals. This is mainly the result of subsequently lower detection limits.
- For nutrients and particulate matter, no overall conclusive long-term trends were detected.

1. Introduction

The 2006 Study on Riverine Inputs and Direct Discharges to Norwegian coastal waters (RID) was successfully implemented by means of:

1. regular field work and sampling according to agreed sampling frequency, and according to NIVA's and NVE's (Norwegian Water Resources and Energy Directorate) QA system for Field and Sampling Procedures;
2. continuing the sampling strategy for tributaries that was introduced in 2004;
3. continuing to improve estimates of water flow in tributaries by applying the gridded HBV-model to simulate the water discharge for the 36 rivers monitored quarterly, the 109 rivers previously sampled once a year, and for the 92 rivers never monitored;
4. supplying land use information for the most important catchments as a mean to explain variations in concentrations and loads amongst rivers.

The general principles, background and reporting requirements as agreed by OSPAR are shown in **Annex I**.

This report contains the 2006 results of the monitoring of ten main rivers and 36 additional water courses in Norway, as well as the estimated loads from a total of 201 (92+109) unmonitored or previously monitored water courses and areas downstream of the sampling points. 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 work in 2006 has involved personnel of NIVA and NVE, the data analysis and reporting carried out in 2007 has also involved personnel from Bioforsk. Below, an overview is given of sub-contractors, data sources and personnel involved.

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

Project co-ordinators: Stig A. Borgvang (2006) and Øyvind Kaste (2007), NIVA

Project participants from NIVA:
Stein W. Johansen (fieldwork co-ordination, status reporting, reporting)
John Rune Selvik (TEOTIL Modelling, GIS)
Bente Lauritzen (laboratory analyses)
Line Barkved (water flow issues, liaison with NVE modellers)
Tore Høgåsen (database, on-line data accessibility)
Torulv Tjomsland (TEOTIL Modelling)
Tor Traaen (quality assurance of laboratory data)
Erik Bjerknes (practical field work material liaison with NVE)

Project participants from Bioforsk (from 2007 onwards):
Per G. Stålnacke (statistical analyses, trend analyses, reporting, assistant project leader for NIVA in 2006)
Eva Skarbøvik (reporting)
Stig A. Borgvang (reporting)

Project participants from NVE
Erlend Moe (administrative contact)
Jarle Thorvaldsen (logistics, fieldwork co-ordination)
Stein Beldring (hydrological modelling)

Personnel for water sampling in the 10 main rivers:
Nils Haakensen
Vibeke Svenne
Vebjørn Opdahl
Agnar Johnsen
Joar Skauge
Eskil Nerheim (etter 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

2. Norwegian Rivers and the Selection of Monitored Rivers

2.1 Rivers Draining into Coastal Areas.

The coastline of Norway has been divided into the following four coastal areas/sub-regions (Figure 1):

I. Skagerrak:	From the Swedish border to Lindesnes (the southernmost point of Norway), at about 57°44’N
II. North Sea:	From Lindesnes northwards to Stadt (62° N)
III. Norwegian Sea:	From Stadt 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 this coastline, including fjords and bays, is 21 347 km.

The Norwegian Water Resources and Energy Directorate (NVE; www.nve.no) has developed a river basin register system “REGINE”. This system classifies the Norwegian river basins into about 20 000 sub-units, or 262 main catchment areas. Of these 262 rivers, 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).

Consequently, there are no less than 247 Norwegian rivers entering into the marine waters along a 21 347 km long coastline. Since, for obvious reasons, all of these rivers could not be monitored, the selection of a set of representative rivers became necessary. Thus, for the last sixteen years, the RID Programme has monitored ten ‘main’ rivers that drain into the four main coastal areas. Figure 1 illustrates how each river typically is meant to represent a larger land area. The rationale for selecting these particular rivers is further described in Section 2.3. In addition to these 10 main rivers, a set of 36 so-called ‘tributary’ rivers, or rivers monitored four times a year, have been selected. All these rivers discharge directly to the sea. This monitoring strategy was first introduced in 2004 (cf. Borgvang et al., 2006A).

2.2 Land use in Norwegian Catchments

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. In Figure 2, 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 will be shown in Sections 2.4 and 2.5, this land cover distribution is also reflected in the monitored rivers (Figure 3).

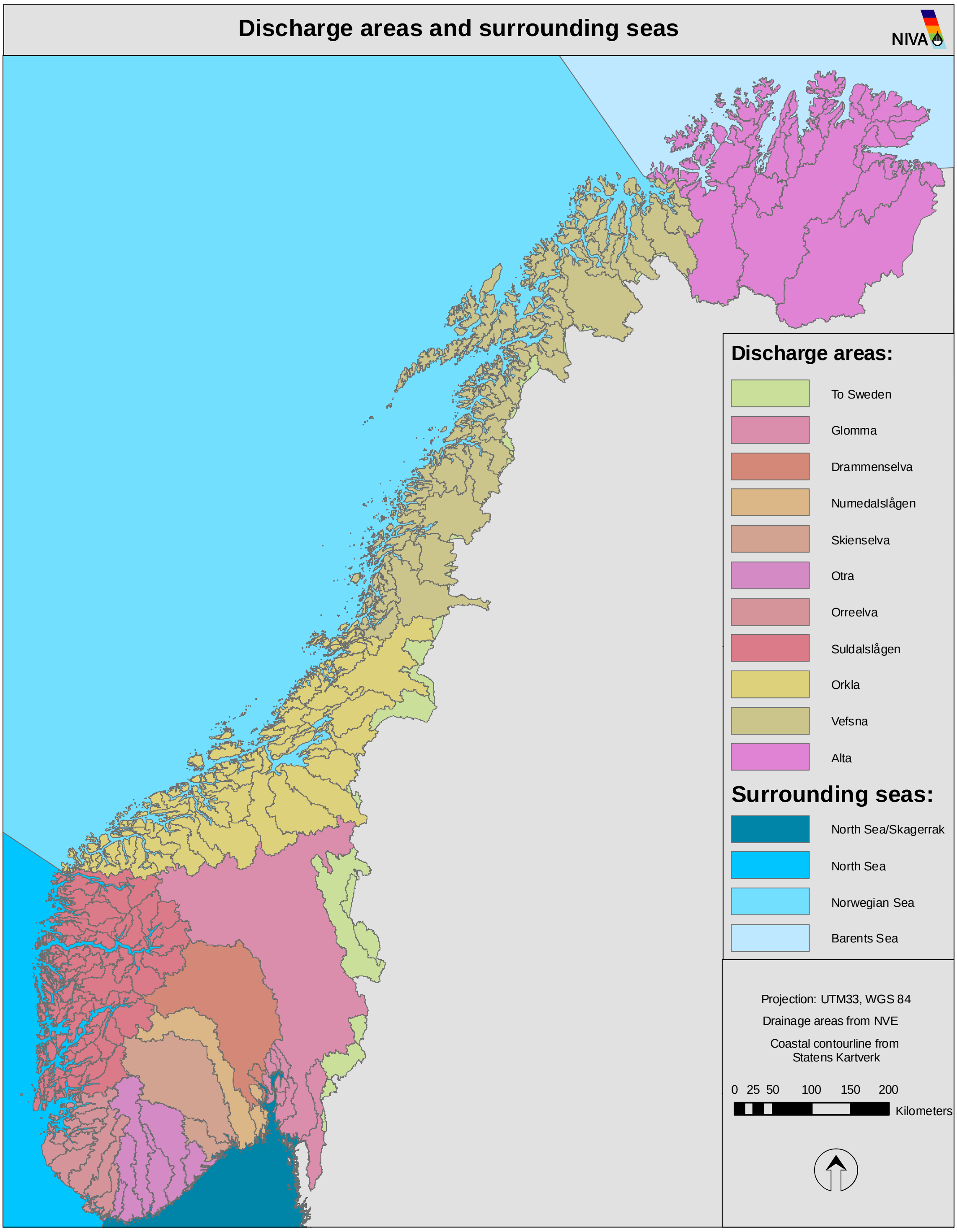


Figure 1. Norway divided into four Discharge Areas, i.e. Skagerrak, North Sea, Norwegian Sea and the Barents Sea.

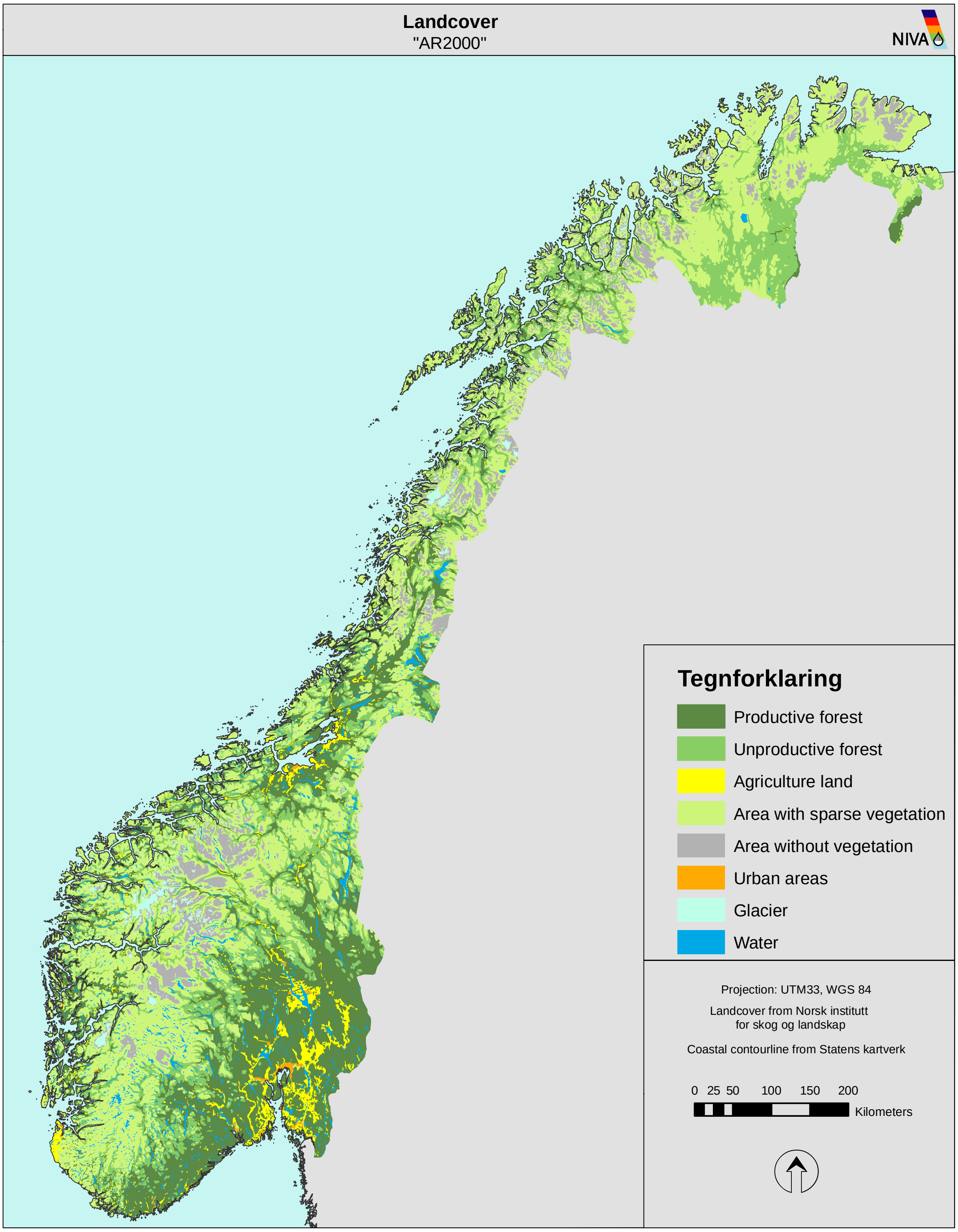


Figure 2. Land cover map of Norway. See also Figure 3 where the land use in the 10 main RID rivers is shown.

2.3 Selection of Rivers for Monitoring

As described in Section 2.1, a total of 247 rivers are entering 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 therefore have been necessary to monitor a huge 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 (cf. Figure 1 and Table 2) 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 11-16 times in 2006.

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 Skagerrak, a proportionally higher number of rivers has been chosen for this part of the country.

The load from the remaining rivers has been calculated through modelling (see Chapter 4 on Methodology). Table 1 gives an overview of the major “types” of Norwegian rivers draining into coastal areas as related to the RID Programme.

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 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

2.4 Catchment Information for Rivers Monitored Monthly – Main Rivers

The rivers chosen for the comprehensive study (monthly or more frequent sampling) are the same as in 1990-2005 and are presented in Table 2 and Figure 1. Figure 2 shows the distribution of mountains; forests; agricultural areas; and lakes in these ten catchments.

The rivers *Glomma*, *Drammenselva*, *Numedalslågen*, *Skienselva*, and *Otra* drain into the Skagerrak 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. Mean water discharge at the outlet is about 300 m^3/s.

Orreelva and *Suldalslågen* are draining 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 is draining 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 are causing 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 (cf. Figure 3 and Table 3) has been included in the study to represent a relatively non-polluted water-course. The river is, however, heavily impacted by hydropower development.

Table 2. 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. Skagerrak	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 (Cf. Table 3).

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 are representing typical river systems in 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.

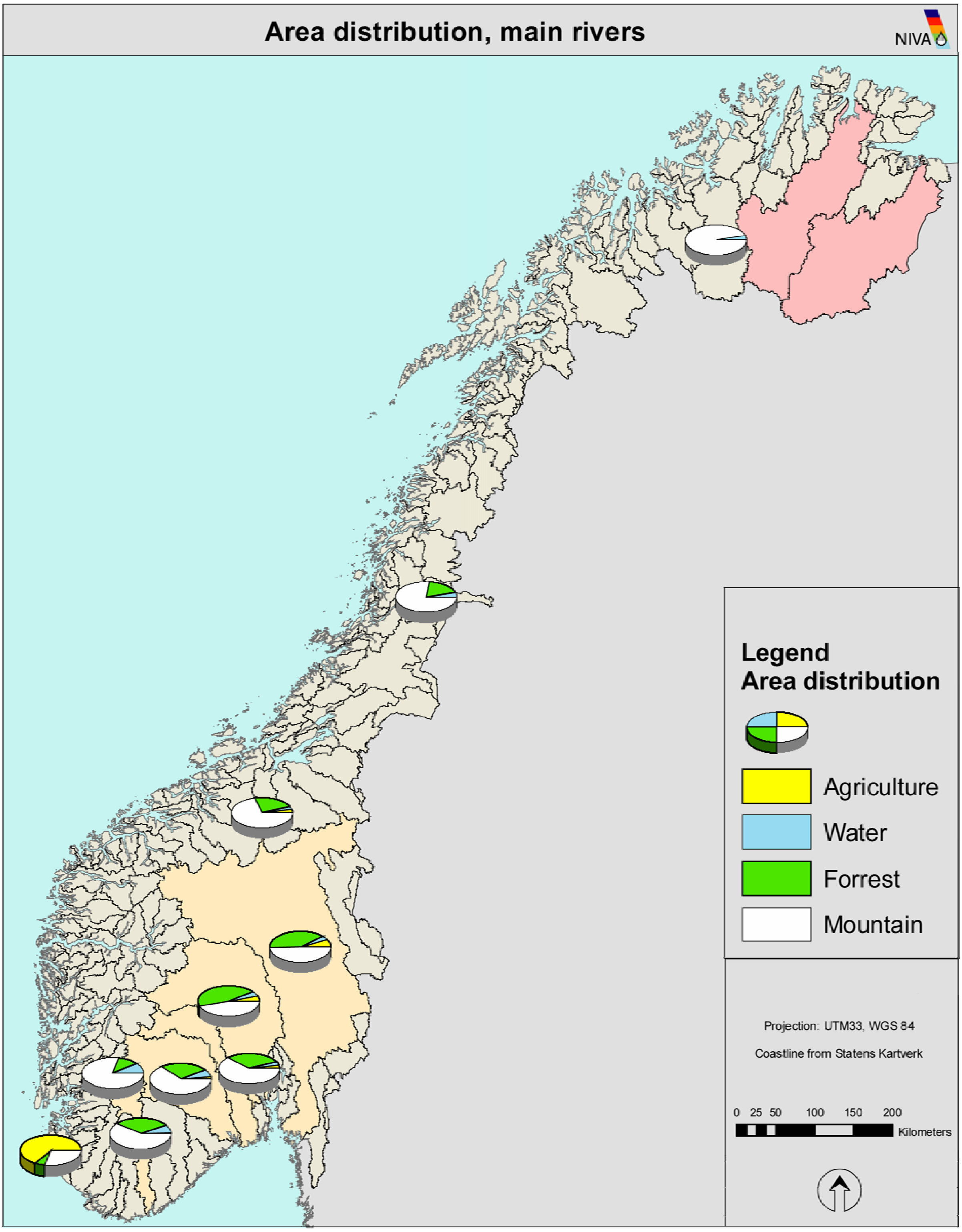
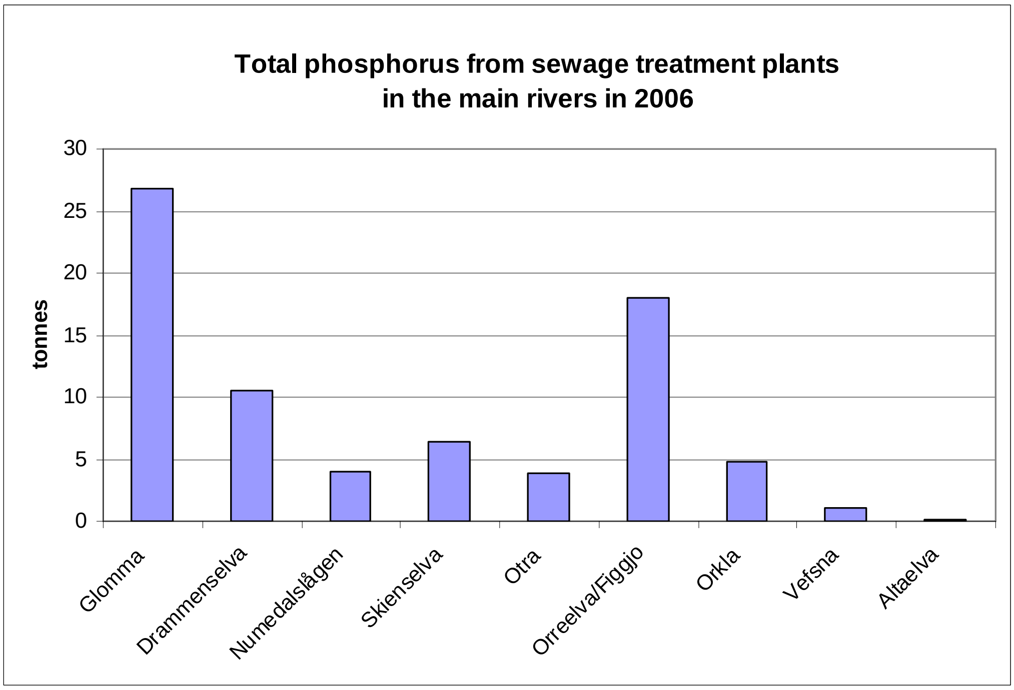


Figure 3. Land use in the catchment areas of the 10 main rivers. "Water" signifies proportion of lakes in the catchment; "Mountains" include moors and mountain plateaus not covered by forest. Based on data from The Norwegian Forest and Landscape Institute.

Figure 4. Sewage treatment plants in Norway 2006 and phosphorus treatment efficiency. Co-ordinates from KOSTRA/SSB. Derived from Selvik et al. 2007.

Figure 4 shows a map of sewage treatment plants in Norway. The discharge of phosphorus and nitrogen from sewage treatment plants in the 10 main rivers is shown in Figure 5. In general, these data tend to reflect the size of the catchment area, such as the rivers *Glomma* and *Drammen*, or rivers with sewage treatment plants serving larger cities and townships (e.g. *Orreelva*).



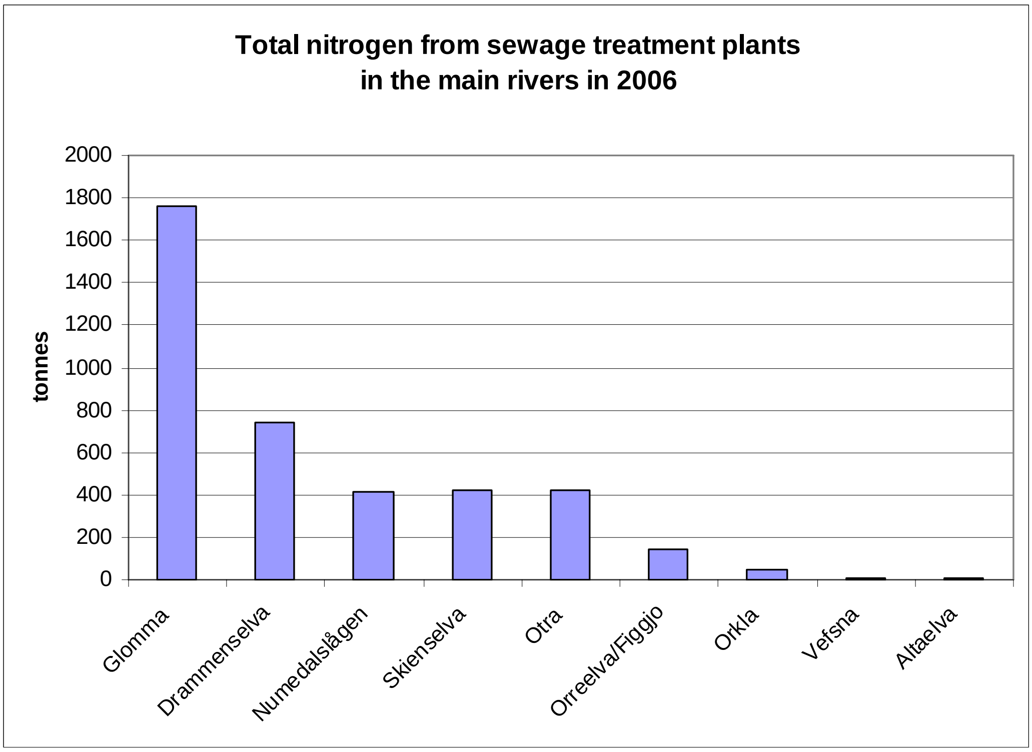


Figure 5. Discharge of phosphorus (top) and nitrogen (bottom) from sewage treatment plants in the catchment areas of rivers monitored monthly. Note that Orreelva also includes River Figgjo.

Figure 6 and Figure 7 give maps of fish farms and industrial units in Norway. Table 3 shows the industrial discharges of phosphorus and nitrogen from the ten main rivers. The data are from 2005; due to a data base problem data from 2006 were not ready for this report.

Figure 6. Fish farms in Norway. Based on data from the Directorate of Fisheries/ALTINN. Derived from Selvik et al. 2007.

Figure 7. 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. Derived from Selvik et al (2007).

Table 3. Number of industrial units, and reported phosphorus and nitrogen discharge from industry in the 10 main rivers in 2005. The four northernmost rivers have no reported industrial activity in these catchment areas and are therefore omitted from the table.*

Regine no.	River name (monthly sampling)	Number of industrial units	P discharge kg	N discharge kg
002	Glomma.	39	58919	223581
012	Drammen	7	6544	107800
015	Numedalslågen	7	8942	52280
016	Skiensvassdraget	6	10648	766740
021	Otra	2	2440	63880
028	Orreelva	1	0	309

* The data from 2006 were not available due to a database problem.

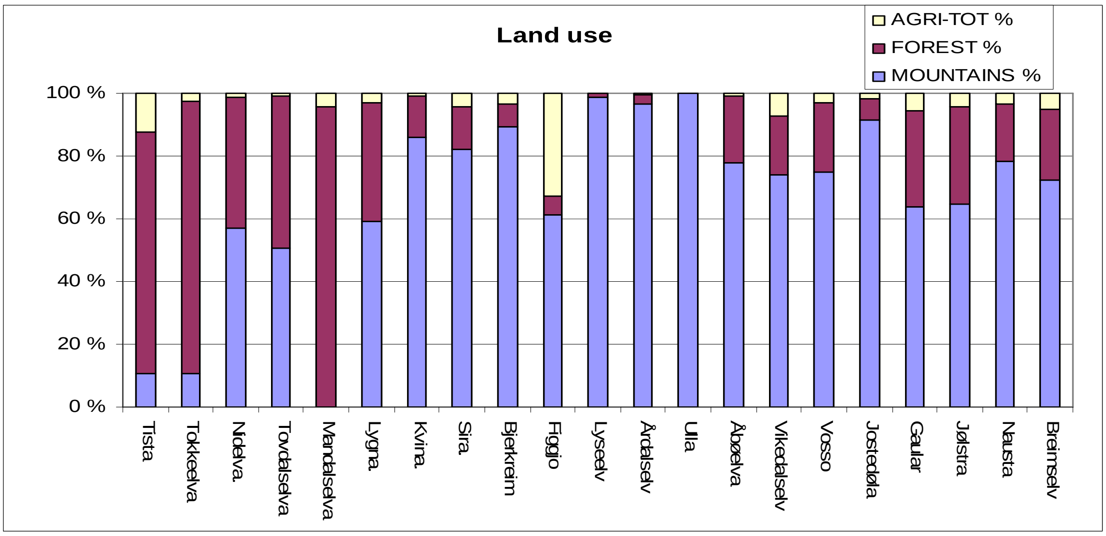
2.5 Catchment Information for Rivers Monitored Quarterly – Tributary Rivers

As stated above, 36 rivers covering an area of altogether 86 000 km^2 were monitored four times a year in 2006.

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. River basin characteristics (size and mean water discharge) are shown in Annex III.

Land use varies considerable, as shown in Figure 8. As an example, the *Figgjo* and *Tista* Rivers have the highest coverage of agricultural land (31[1] 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.

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



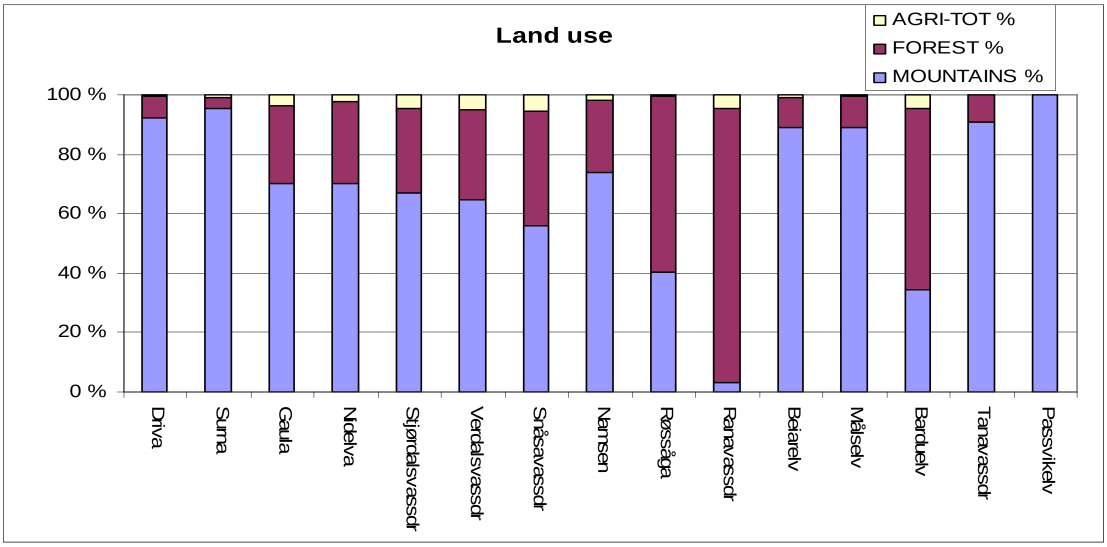


Figure 8. Land use distribution in the catchment areas of the 36 rivers monitored quarterly. “Agri-tot” means total agricultural land. “Mountains” include moors and mountain plateaus not covered by forest.

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.

The amount of nitrogen and phosphorus discharged from sewage treatment plants in the tributary rivers are shown in Figure 9. The variations depend partly on the population density, and partly on the size of the catchment areas. As an example, the high nutrient discharges in *Nidelva* are caused by the municipality of Trondheim.

The number of industrial plants discharging N and P are shown in Table 4 for 2005-data. The data should be treated with some care, as this only reflects the industrial units’ own reports.

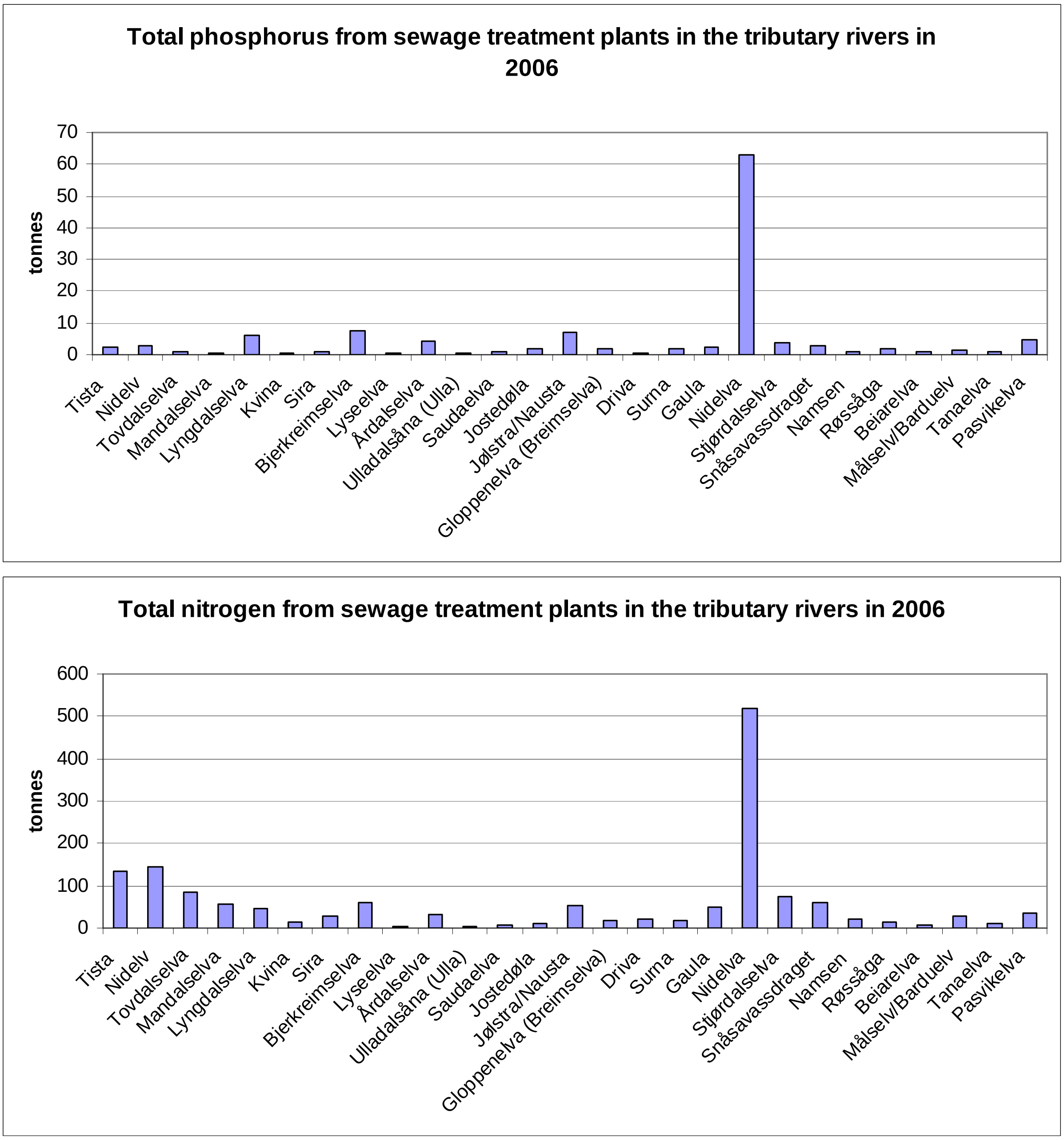


Figure 9. Discharge of phosphorus (top) and nitrogen (below) from sewage treatment plants in the catchment area of rivers monitored quarterly.

Table 4. Number of industrial units, and reported phosphorus and nitrogen discharge from industry in 2005, in rivers monitored quarterly. Rivers with no reported discharge of N or P from industry are omitted from the table.*

Regine no.	River name (quarterly sampling)	Number of industrial units	P discharge kg	N discharge kg
001	Tista	3	5303	30500
017	Tokkeelva	1	520	190
025	Kvina.	2	1035	90100
026	Sira.	1	6850	44800
027	Bjerkreim	1	0	0
028	Figgjo	0	0	309
062	Vosso	1	150	0
087	Breimselv	1	2540	0
123	Nidelva	2	1122	10040
124	Stjørdalsvassdr	1	3	0
127	Verdalsvassdr	1	0	0

* The data from 2006 were not available due to a database problem.

3. Climate conditions and water discharge in 2006

The year 2006 was, in addition to 1990 and 1934, the warmest year ever registered in Norway. Whereas large parts of Southern, Eastern and Northern Norway received precipitation above normal, the western parts received less precipitation than normal. The runoff in the south and east part of the country was characterised by low water flows during summer, and higher than normal water discharges during autumn floods, resulting in an annual runoff slightly higher than the 30-year period from 1976-2005. The northern and north-western parts of the country experiences, in general, lower annual discharges than normal.

3.1 Air temperature

Mean temperature for all of Norway was 1.8 °C above normal, which, together with the other two years of record, 1934 and 1990, is the highest temperature measured in Norway since 1900. For western Norway including Trøndelag, the year was the warmest ever recorded since 1900, with mean temperature 1.8-2 °C above normal. In eastern Norway, the temperature was also 2 °C above normal. The warmest mean temperature in Norway in 2006 was measured to 9.4 °C at the coast of Hordaland, i.e. in the North Sea region (Figure 10).

High air temperatures are important for runoff conditions in Norway, both due to snowmelt and glacial melting. The warm weather also resulted in warmer river waters in Norway, with the southern parts of the country having river water temperatures 1-3 °C higher than during the period 1997-2005 (NVE 2007). Due to increased glacial melting, the glacial rivers are exceptions from this trend.

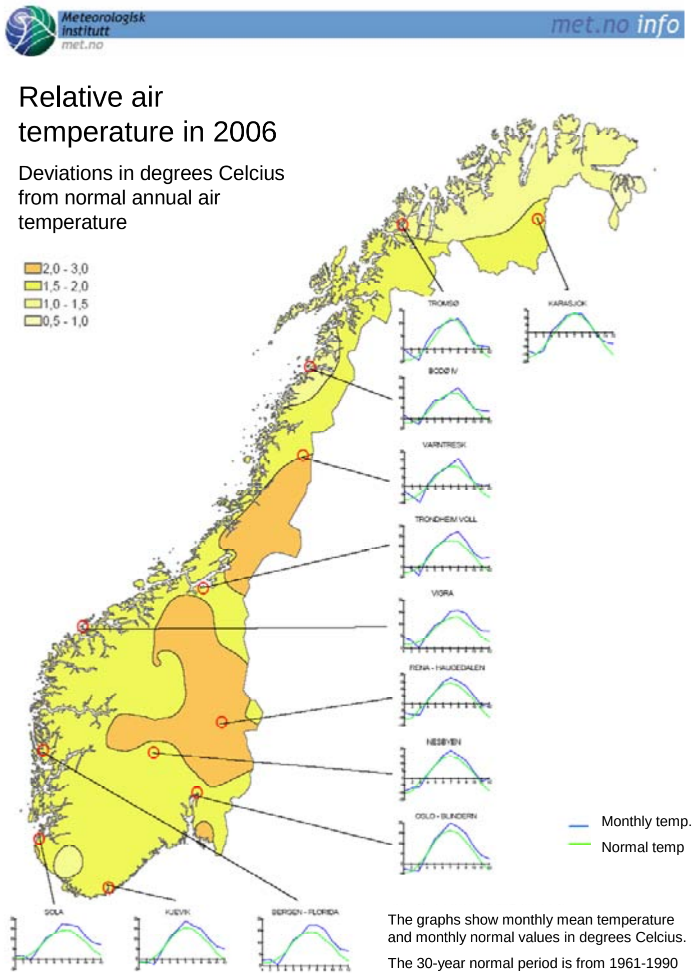


Figure 10. Relative air temperature in 2006 in Norway.

3.2 Precipitation

Precipitation in Norway in 2006 was 10% higher than the annual normal value. Since 1900, 17 years have been wetter than this. This makes 2006 a dryer year than 2005, which was the 4th wettest year in Norway since 1900. Due to higher temperatures, a lesser amount of the precipitation came as snow.

As usual in Norway, the year was wettest in the west (Figure 11, left panel), but the northernmost areas had the highest amount of precipitation as compared to normal values, with Finnmark (including the catchment area of River Alta) receiving 50-75% more than normal (Figure 11, right panel). In Møre and Romsdal and Trøndelag, however, the precipitation was less than normal. The variation through the year was significant, as the summer was relatively dry all over the country. This summer drought may have meant higher *concentrations* but lower *loads* during the summer of many of the substances measured in the RID Programme.

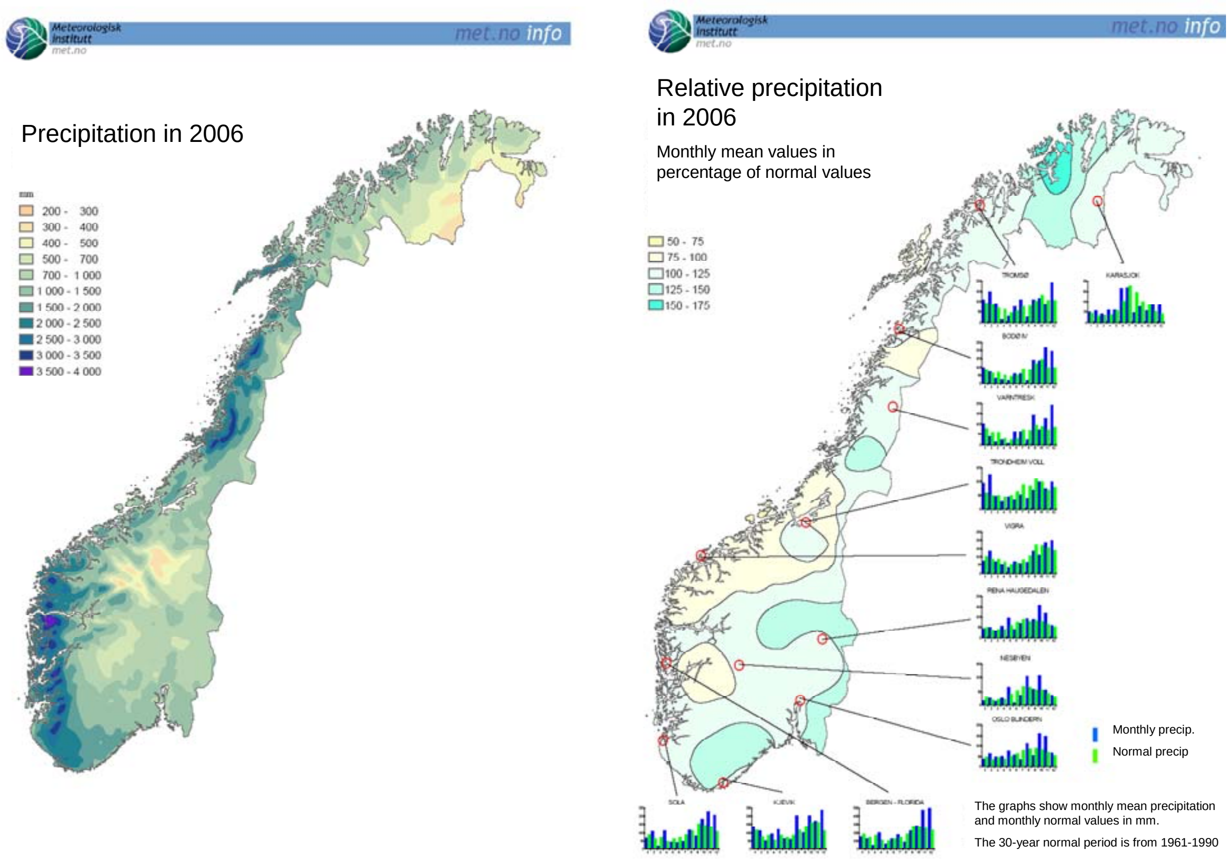


Figure 11. Precipitation in 2006 (left panel) and as compared with the period 1961-1990 (right panel). Source: Norwegian Meteorological Institute (met.no).

3.3 Water discharge

Runoff in Norway in 2006 was characterised by unusual events, starting with extreme floods in parts of Trøndelag in January/February, followed by a drought situation in large parts of the country during the summer, and ending with high water discharges again in November/December, especially in the south and south-east. Snowmelt came earlier than usual due to high air temperatures, and the glacial melting was high, resulting in a reduction of volume for all 12 glaciers measured by NVE (NVE 2007).

Figure 12 shows the monthly mean water discharge in 2006 as compared to that of the 30 year period of 1976-2005 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*, and *Skienselva*, the discharge patterns are characterised by relatively higher water discharges than normal during spring, with the highest monthly mean water discharge occurring in May for all rivers. During the summer months, the water discharge is significantly lower than the 30-year normal, followed again by higher than normal floods during autumn.

River *Otra* in southern Norway had lower springtime floods than normal, due to relatively low amounts of snow and low precipitation; whereas extensive autumn rain gave high monthly water discharges for this river – and this part of the country – in November and December.

In Trøndelag (mid-western Norway), the monthly mean discharge in River *Orkla* was lower than normal for most months, with an exception of the three first months of the year. This river’s total runoff was only 80% of the 30-year normal.

In the two northernmost rivers, *Vefsna* and *Alta*, the spring flood was lower and earlier than usual with a culmination in May instead of June, reflecting higher temperatures and early snowmelt. The autumn was relatively normal in terms of water flow, except for high discharges in December in *Vefsna*.

Figure 12. Monthly mean water discharge in 2006 and as an average of 30 years, derived from hydrological stations (named) in 8 of the rivers monitored monthly (data from NVE).

4. Methodology

4.1 Water Sampling Methodology

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

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

Sampling Strategy
In 2006, water sampling for the RID Programme was carried out through a network of fieldworkers and professional staff administered by the Norwegian Water Resources and Energy Directorate (NVE). The sampling was done according to international scientific procedures. The personnel responsible for sampling had local knowledge of the rivers and watersheds. This ensured that abnormal variations in the rivers were detected; and that actions were taken if any unforeseen episodes happened.

After sampling the samples were immediately transferred to thermos bags and shipped to NIVA for analysis.

Sampling Frequency
In general, the main rivers were sampled 12 times a year, at regular monthly intervals during the sampling period from January to December 2006. Two of the main rivers (*Glomma* and *Drammenselva*) were sampled weekly or fortnightly in the period with the highest anticipated flow (May – June). Due to an error, the River *Suldalslågen* was not sampled in June, and there are therefore only 11 samples from this river in 2006. The sampling frequency for the main rivers thus varied between 11-16 times a year (Table 5). The exception is the parameters lindane and PCB7; these were sampled in designated bottles and analysed 4 times in 2006, except for the River *Glomma:* Here unfortunate circumstances resulted in only two samples being analysed for these two substances this year.

In the 36 rivers of quarterly sampling, the sampling was 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. With some exceptions due to weather conditions and seasonal differences from north to south in Norway, the samples have been taken in February, May, August and October (Table 6).

Table 5. Sampling frequency and dates in the 10 main rivers, for all substances (above) except for PCB7 and lindane which are given below.

River	Glomma	Drammen	Numedals-lågen	Skiens-elva	Otra	Orre	Suldals-lågen	Orkla	Vefsna	Altaelva
Dates of sampling (dd.mm.)	09.01.	04.01.	09.01.	10.01.	10.01.	04.01.	04.01.	10.01.	04.01.	03.01.
	07.02.	08.02.	08.03.	15.02.	13.02.	08.02.	08.02.	09.02.	08.02.	09.02.
	06.03.	09.03.	20.03.	17.03.	16.03.	13.03.	10.03.	13.03.	13.03.	13.03.
	11.04.	04.04.	18.04.	27.04.	18.04.	18.04.	07.04.	06.04.	10.04.	18.04.
	08.05.	03.05.	09.05.	10.05.	09.05.	15.05.	15.05.	08.05.	08.05.	09.05.
	22.05.	22.05.								
	29.05.	31.05.								
	06.06.	06.06.								
	16.06.	21.06.	12.06.	19.06.	12.06.	19.06.	-	12.06.	12.06.	12.06.
	26.06.	28.06.								
	03.07.	05.07.	20.07.	24.07.	11.07.	04.07.	11.07.	05.07.	07.07.	10.07.
	07.08.	09.08.	14.08.	15.08.	17.08.	07.08.	14.08.	09.08.	07.08.	07.08.
	04.09.	06.09.	11.09.	07.09.	12.09.	06.09.	11.09.	06.09.	06.09.	07.09.
	09.10.	03.10.	09.10.	04.10.	17.10.	02.10.	18.10.	04.10.	04.10.	02.10.
	06.11.	08.11.	07.11.	07.11.	08.11.	07.11.	10.11.	06.11.	06.11.	06.11.
	04.12.	07.12.	12.12.	04.12.	08.12.	05.12.	14.12.	11.12.	04.12.	04.12.
No.	16	16	12	12	12	12	11	12	12	12
River	Glomma	Drammen	Numedals-lågen	Skiens-elva	Otra	Orre	Suldals-lågen	Orkla	Vefsna	Altaelva
PCB7 and Lindane		08.02.	08.03.	15.02.	13.02.	08.02.	08.02.	09.02.	08.02.	09.02.
		03.05.	09.05.	10.05.	09.05.	15.05.	15.05.	08.05.	08.05.	09.05.
	07.08.	09.08.	14.08.	15.08.	17.08.	07.08.	14.08.	09.08.	07.08.	07.08.
	09.10.	03.10.	09.10.	04.10.	17.10.	02.10.	18.10.	04.10.	04.10.	02.10.
No.	2	4	4	4	4	4	4	4	4	4

Table 6. Sampling frequency and dates in the 36 tributary rivers.

River	Tista	Tokkeelva	Nidelv (south)	Tovdalselva	Mandalselva	Lyngdalselva
Date ddmmyyy	07.02.2006	13.02.2006	13.02.2006	13.02.2006	15.02.2006	15.02.2006
	08.05.2006	22.05.2006	22.05.2006	09.05.2006	14.05.2006	14.05.2006
	07.08.2006	08.08.2006	08.08.2006	17.08.2006	22.08.2006	22.08.2006
	09.10.2006	11.10.2006	11.10.2006		19.10.2006	19.10.2006
River	Kvina	Sira	Bjerkreimselva	Figgjoelva	Lyseelva	Årdalselva
Date ddmmyy	15.02.2006	15.02.2006	17.02.2006	08.02.2006	08.02.2006	10.02.2006
	14.05.2006	14.05.2006	13.05.2006	08.05.2006	07.05.2006	22.05.2006
	22.08.2006	22.08.2006	04.08.2006	07.08.2006	06.08.2006	21.08.2006
	19.10.2006	19.10.2006	13.10.2006	02.10.2006	01.10.2006	13.10.2006
River	Ulla	Sauda	Vikedalselva	Vosso	Jostedøla	Gaular
Date ddmmyy	10.02.2006	10.02.2006	10.02.2006	27.02.2006	02.03.2006	07.03.2006
	22.05.2006	23.05.2006	23.05.2006	20.05.2006	14.06.2006	15.06.2006
	21.08.2006	15.08.2006	15.08.2006	09.08.2006	09.08.2006	10.08.2006
	10.10.2006	13.10.2006	10.10.2006	10.10.2006	28.09.2006	09.11.2006
River	Jølstra	Nausta	Breimselva	Driva	Surna	Gaula
Date ddmmyy	02.03.2006	07.03.2006	23.02.2006	27.02.2006	14.02.2006	14.02.2006
	15.06.2006	12.06.2006	13.06.2006	18.05.2006	24.05.2006	09.05.2006
	11.08.2006	10.08.2006	01.09.2006	18.08.2006	16.08.2006	16.08.2006
	09.11.2006	09.11.2006	25.10.2006	17.10.2006	03.10.2006	08.11.2006
River	Nidelva	Stjørdalselva.	Verdalselva.	Snåsa	Namsen	Røssåga
Date ddmmyy	14.02.2006	14.02.2006	14.02.2006	14.02.2006	14.02.2006	08.02.2006
	09.05.2006	10.05.2006	10.05.2006	10.05.2006	10.05.2006	05.05.2006
	16.08.2006	16.08.2006	16.08.2006	16.08.2006	16.08.2006	07.08.2006
	08.11.2006	08.11.2006	08.11.2006	08.11.2006	08.11.2006	03.10.2006
River	Ranaelva	Beiarelva	Målselv	Barduelva	Tanaelva	Pasvikelva
Date ddmmyy	08.02.2006	15.03.2006	07.02.2006	07.02.2006	10.02.2006	11.02.2006
	05.05.2006	08.05.2006	08.05.2006	08.05.2006	09.05.2006	09.05.2006
	07.08.2006	23.08.2006	06.08.2006	06.08.2006	07.08.2006	07.08.2006
	03.10.2006	11.10.2006	01.10.2006	01.10.2006	28.09.2006	29.09.2006

Sampling Site Location

The sampling sites are indicated on the map of Figure 13. The sites are located in regions of unidirectional flow (no back eddies). In order to ensure as uniform water quality as possible, sites where the water is well mixed was chosen, such as at or immediately downstream a weir, in waterfalls, rapids or in channels in connection with hydroelectric power stations. Sampling sites were 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 will not be included in the riverine inputs, but are included in the direct discharge estimates.

Table 7 gives the co-ordinates of the sampling stations, whereas Figure 14 shows sampling sites in Rivers *Tokke*, *Nidelv* (southern Norway), *Verdalselva*, and *Barduelva*. 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 7. Co-ordinates of the 46 sampling points.

Regine No	RID-ID	Station name	Latitude	Longitude	RID-Region
002.Z-2	2	Glomma at Sarpsfoss	59,27800	11,13400	Skagerak
012.Z-2	15	Drammenselva	59,75399	10,00903	
015.Z-2	18	Numedalslågen	59,08627	10,06962	
016.Z-2	20	Skienselva	59,19900	9,61100	
021.Z-1	26	Otra	58,18742	7,95411	
028.0-4	37	Orreelva	58,73143	5,52936	North Sea
036.Z-1	48	Suldalslågen	59,48200	6,26000	
121.-3	100	Orkla	63,20100	9,77300	Norwegian Sea
151.Z-2	115	Vefsna	65,74900	13,23900	
212.Z-2	140	Altaelva	69,90100	23,28700	Barents Sea
Regine No	RID-ID	Station name	Latitude	Longitude	RID-Region
001.-2	1	Tista	59,12783	11,44436	Skagerak
017.Z-1	21	Tokkeelva	58,87600	9,35400	
019.Z-1	24	Nidelv (Rykene)	58,40100	8,64200	
020.Z-1	25	Tovdalselva	58,21559	8,11668	
022.-4	28	Mandalselva	58,14300	7,54604	
024.Z-1	30	Lyngdalselva	58,16300	7,08798	North Sea
025.Z-1	31	Kvina	58,32020	6,97023	
026.Z-1	32	Sira	58,41367	6,65669	
027.Z-1	35	Bjerkreimselva	58,47894	5,99530	
028.Z-0	38	Figgjoelva	58,79168	5,59780	
031.Z-0	44	Lyseelva	59,05696	6,65835	
33	45	Årdalselva	59,08100	6,12500	
035.-3	47	Ulladalsåna (Ulla)	59,33000	6,45000	
37	49	Saudaelva	59,38900	6,21800	
038.-2	51	Vikedalselva	59,49958	5,91030	
062.-1	64	Vosso (Bolstadelvi)	60,64800	6,00000	
076.-1	75	Jostedøla	61,41333	7,28025	
083.Z-0	78	Gaular	61,37000	5,68800	
084.-3	79	Jølstra	61,45170	5,85766	
084.7Z-0	80	Nausta	61,51681	5,72318	
087.-1	84	Gloppenelva (Breimselva)	61,76500	6,21300	
109.Z-1	95	Driva	62,66900	8,57100	Norwegian Sea
112.Z-1	98	Surna	62,98000	8,72600	
122.-4	103	Gaula	63,28600	10,27000	
123.-1	104	Nidelva(Tr.heim)	63,43300	10,40700	
124.Z-1	106	Stjørdalselva	63,44900	10,99300	
127.Z-1	108	Verdalselva	63,79200	11,47800	
128.-2	110	Snåsavassdraget	64,01900	11,50700	
139.Z-1	112	Namsen	64,44100	11,81900	
155.Z-1	119	Røssåga	66,10900	13,80700	
156.Z-1	122	Ranaelva	66,32300	14,17700	
161.Z-0	124	Beiarelva	66,99100	14,75000	
196.Z-2	132	Målselv	69,03600	18,66600	
196.AZ-1	133	Barduelva	69,04300	18,59500	
234.Z-1	150	Tanaelva	70,23000	28,17400	Barents Sea
246.-1	153	Pasvikelva	69,50100	30,11600	

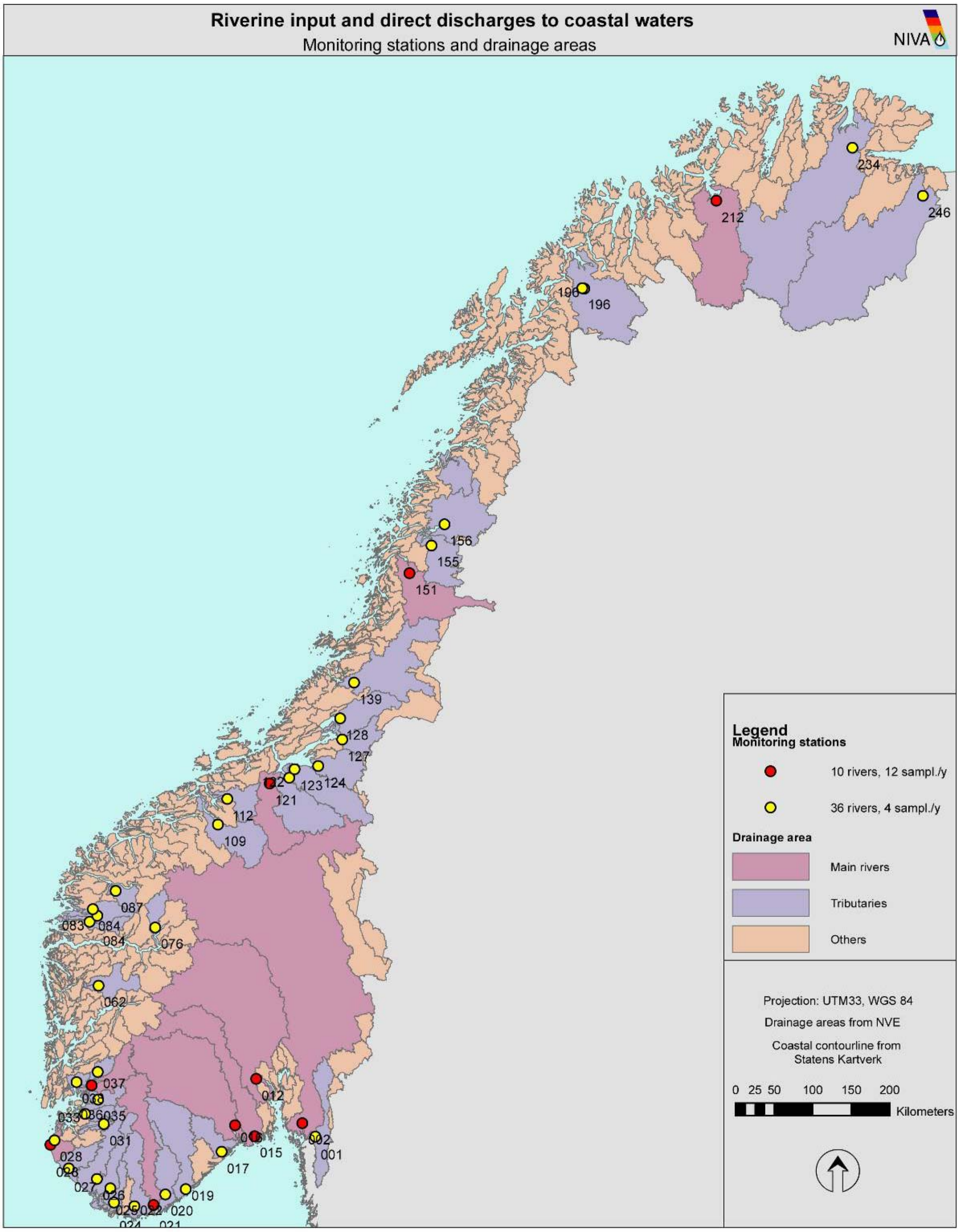


Figure 13. River sampling sites in the Norwegian RID programme. Red dots represent the 10 main rivers. Yellow dots represent the 36 'tributary' rivers. Numbers next to the dots refer to the national river register (REGINE; www.nve.no).

Figure 14. Water quality was monitored in 46 rivers in Norway in 2006. The pictures above show the monitoring sites in Tokkeelva (top left), Nidelv in southern Norway (top right), Verdalselva (lower left) and Barduelva (lower right) rivers. The sampling sites have been photographed for quality assurance reasons.

4.2 Chemical parameters – detection limits and analytical methods

In 2006, 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 Table 8. There have been no changes in the analytical methods since the RID 2005-programme (Borgvang *et al.* 2007).

Table 8. 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)

Parameter	**Detection limit**	**Analytical Methods (NS: Norwegian Standard)**
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)

According to the document "Principles of the Comprehensive Study of Riverine Inputs and Direct Discharges" (PARCOM, 1988), it is necessary to choose an analytical method, which gives at least 70 % of positive findings (i.e. no more than 30% of the samples below the detection limit). As shown in Table 9, only orthophosphate and mercury had more than 30% of the samples below the detection limit, apart from the PCB7 compounds and Lindane. Chromium had exactly 30% of the samples below detection limit, and cadmium 26 %. This reflects that the concentrations of these parameters were relatively low in Norwegian river waters in 2006.

Table 9. Proportion of analyses below detection limit for all parameters included in the sampling programme in 2007.

Parameter	Unit	% below detection limit	Total no of samples	No of samples below det limit
pH		0	271	0
Conductivity	mS/m	0	271	0
SPM	mg/l	0	271	1
TOC	mg/l C	0	271	0
TOT-P	µg/l P	0	271	0
PO_4-P	µg/l P	38	271	103
TOT-N	µg/l N	0	271	0
NO_3-N	µg/l N	4	271	10
NH_4-N	µg/l N	4	271	12
SiO_2	mg/l SiO_2	0	271	0
Pb	µg/l	1	271	4
Cd	µg/l	26	271	70
Cu	µg/l	0	271	0
Zn	µg/l	3	271	7
As	µg/l	10	271	27
Hg	ng/l	68	271	185
Cr	µg/l	30	271	82
Ni	µg/l	3	271	7
Lindane (HCHG)	ng/l	93	40	37
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

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 considerable if the detection limit is high.

4.3 Quality assurance and direct on-line access to data

Data from the laboratory analyses are transferred to a database and quality checked against historical data by researchers with long experience in assessing water quality data. Whenever any anomalies are found, the samples are re-analysed. When this quality assurance is done, the data are transferred to NIVA's web pages, where an on-line system was established early in 2004 (Figure 15). The system allows the authorised users to view values and graphs of each of the 46 monitored rivers. Data are uploaded continuously after each sampling.

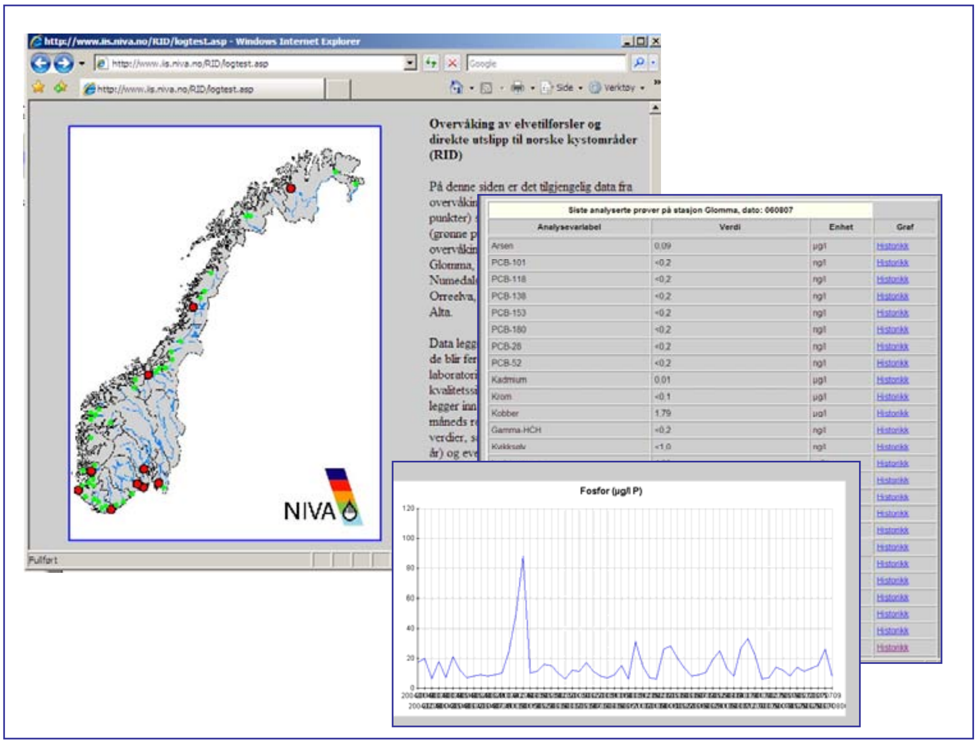


Figure 15. NIVA’s on-line web service for the RID Programme (AquaMonitor).The service is accessible for authorised viewers.

4.4 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 patially distributed HBV is 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 vegetations, 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 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 a relative 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 dwarfed 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 output 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 16 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.

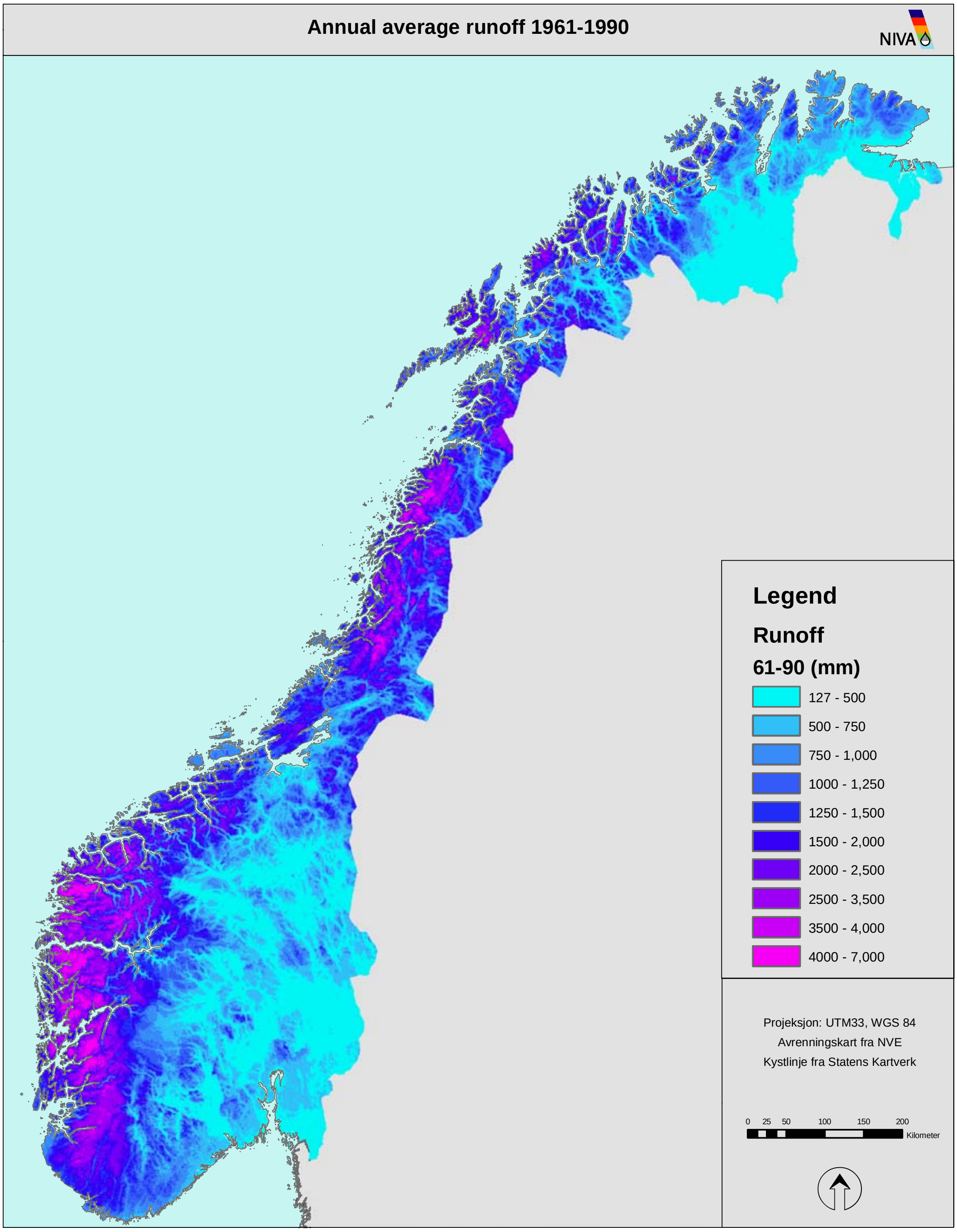


Figure 16. Annual average runoff (mm/year) for Norway for the period 1961-1990.

4.5 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 remaining 109 rivers (rivers monitored once a year in the period 1990-2003, but not after 2003), the calculation of loads was done as follows:

- For nutrients, S.P.M, Silica and TOC, the modelled average water discharge in 2006[2] 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 (see information below). For metals, all direct discharges of metals in these areas were considered to be direct discharges to the sea.

4.6 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)

4.6.1 Wastewater

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 statistics 2002). The major parts of treatment plants with only primary treatment are serving smaller settlements, while the majority of advanced treatment plants (plants with chemical and/or biological treatment) are found near the larger cities, and therefore treat the main part of the produced wastewater. Of

[2] As will be further outlined in Section 4.6.4, the method for calculating the average water discharge for the unmonitored rivers changed somewhat in 2006, due to a change in the area units of the TEOTIL model.

the total hydraulic capacity of 5.74 million p.e., 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 10 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 10. 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

Metals from wastewater

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.

Nutrients from wastewater

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.

4.6.2 Industrial effluents

In 2006, the reporting of industrial wastewater was delayed due to changes in the database, and the data for 2006 are therefore based on the 2005-reporting. 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 (Selvik *et al.*, 2007). The metal data were collected from SFT's data base INKOSYS.

4.6.3 Fish farming effluents

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 (see Figure 17), which has a bearing on the discharges from fish farming although there has been improvements in treatment yield and production procedures.

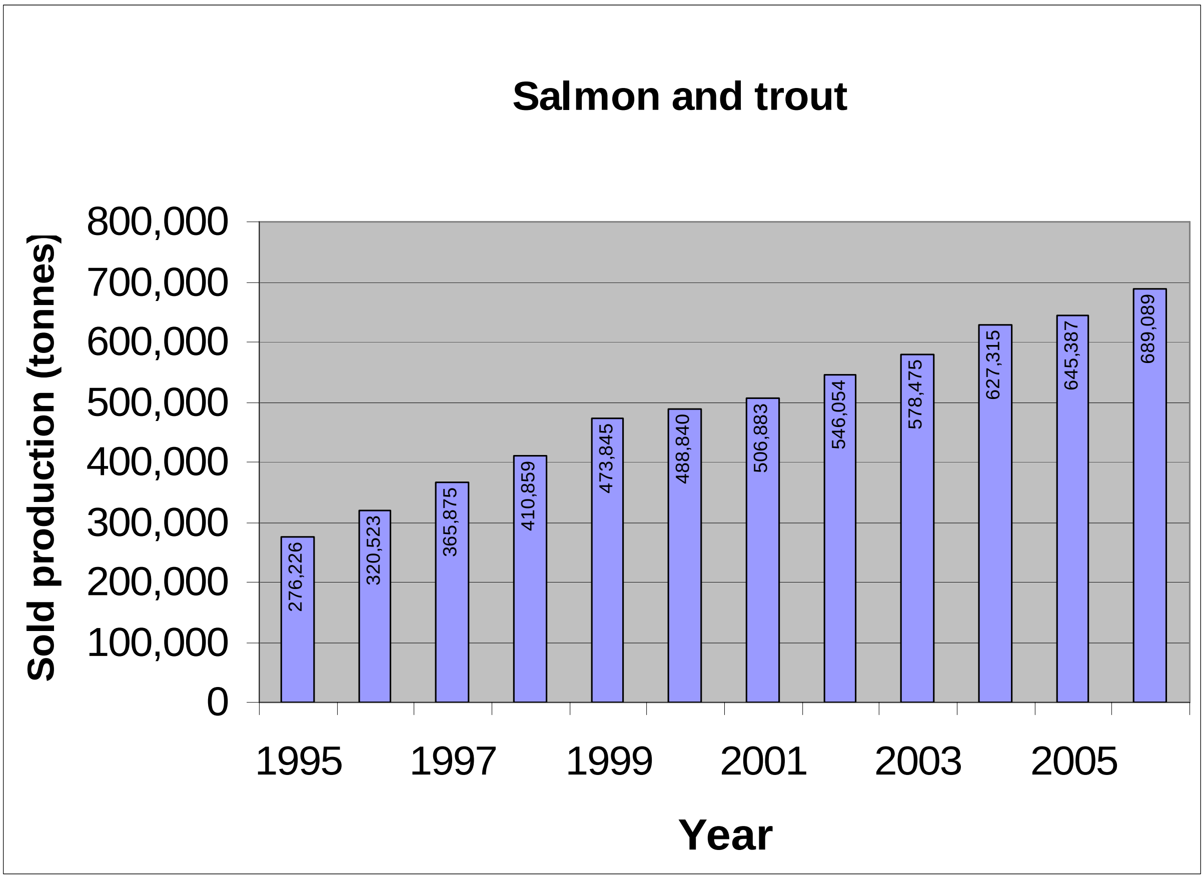


Figure 17. Quantities of sold trout and salmon for the period 1995-2006. The quantities for 2004 are preliminary (from Selvik et al., 2007, based on SSB data).

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 and 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.

4.6.4 All sources

With regard to nutrients, Norway uses the TEOTIL model as a tool 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 coefficients approach.

In 2006, the area response units used in the TEOTIL model was changed from statistical areas to Regine units, as described in more detail in Selvik et al 2007. This change has not only resulted in a finer resolution, but also a more watershed oriented resolution, since the Regine system is directly adapted to catchment and sub-catchment areas. This change may have resulted in more correctly estimated water discharges for the unmonitored areas, and the water discharge in these areas has therefore increased from 2005 to 2006. As already noted above (Section 4.4), this may call for a need to recalculate water discharges in former years.

TEOTIL was used for estimating the direct discharges of nitrogen and phosphorus to Norwegian coastal waters. With the Source Orientated Approach, Figure 18 and Figure 19 show the inputs of nitrogen and phosphorus from 247 rivers to Norwegian coastal areas and the importance of the various sources. With regard to direct discharges both figures show the considerable inputs of nutrients from fish farming. The 247 rivers represent:

- the ten main Norwegian RID rivers;
- the 36 rivers monitored four times a year;
- the 109 rivers monitored once a year up to 2003, the load from which is now based on modelled water flow and the average concentration for the period 1999-2003 for metals, 1990-2003 for nutrients;
- ninety-two rivers that never were part of the RID monitoring, but for which the inputs of nutrient have been estimated using TEOTIL.

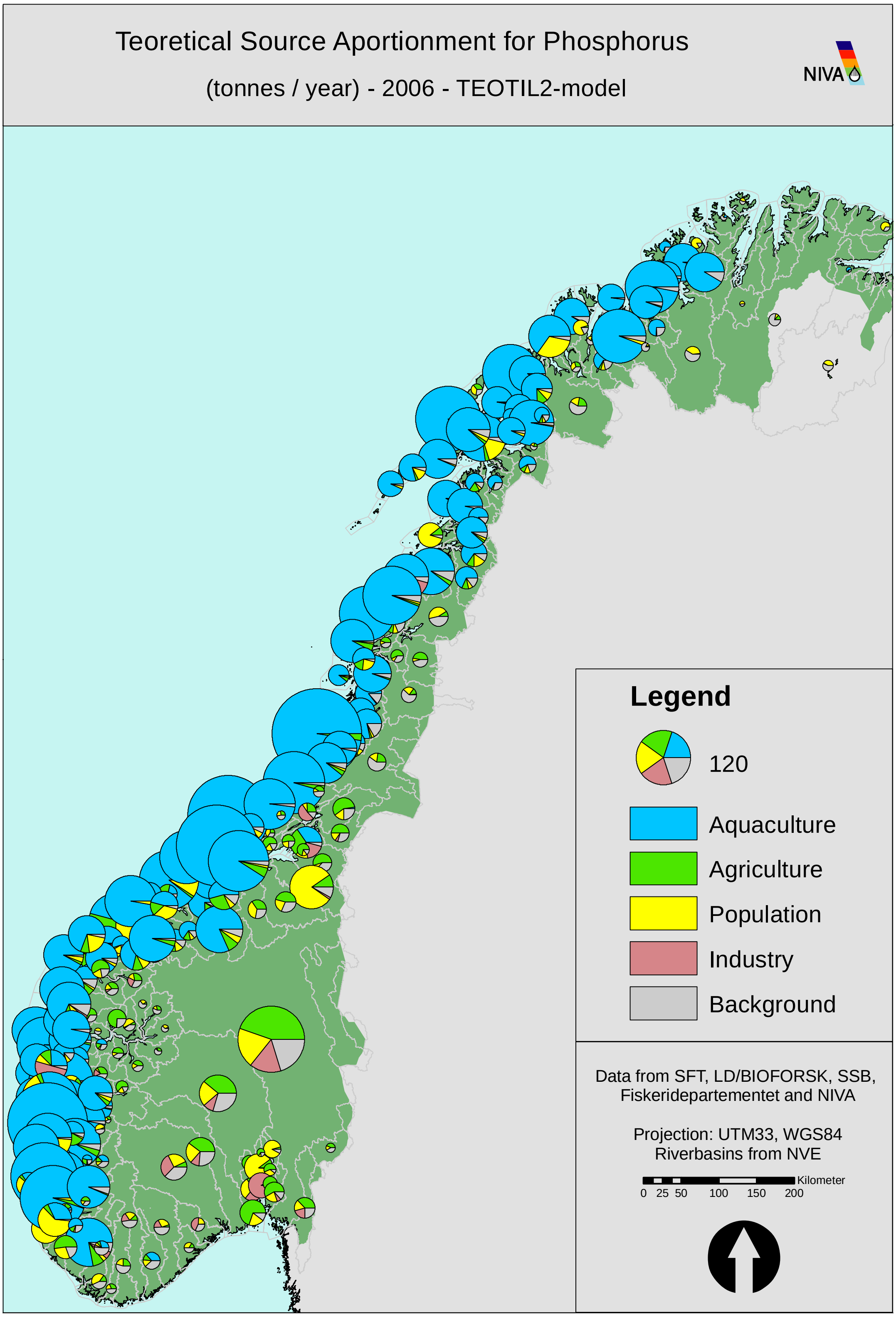


Figure 18. The relative importance of the five phosphorus sources taken account of when estimating the inputs to coastal areas from 247 rivers - (Source Orientated Approach, incl. marine salmon/trout farming). Data from 2006 (from Selvik et al. 2007).

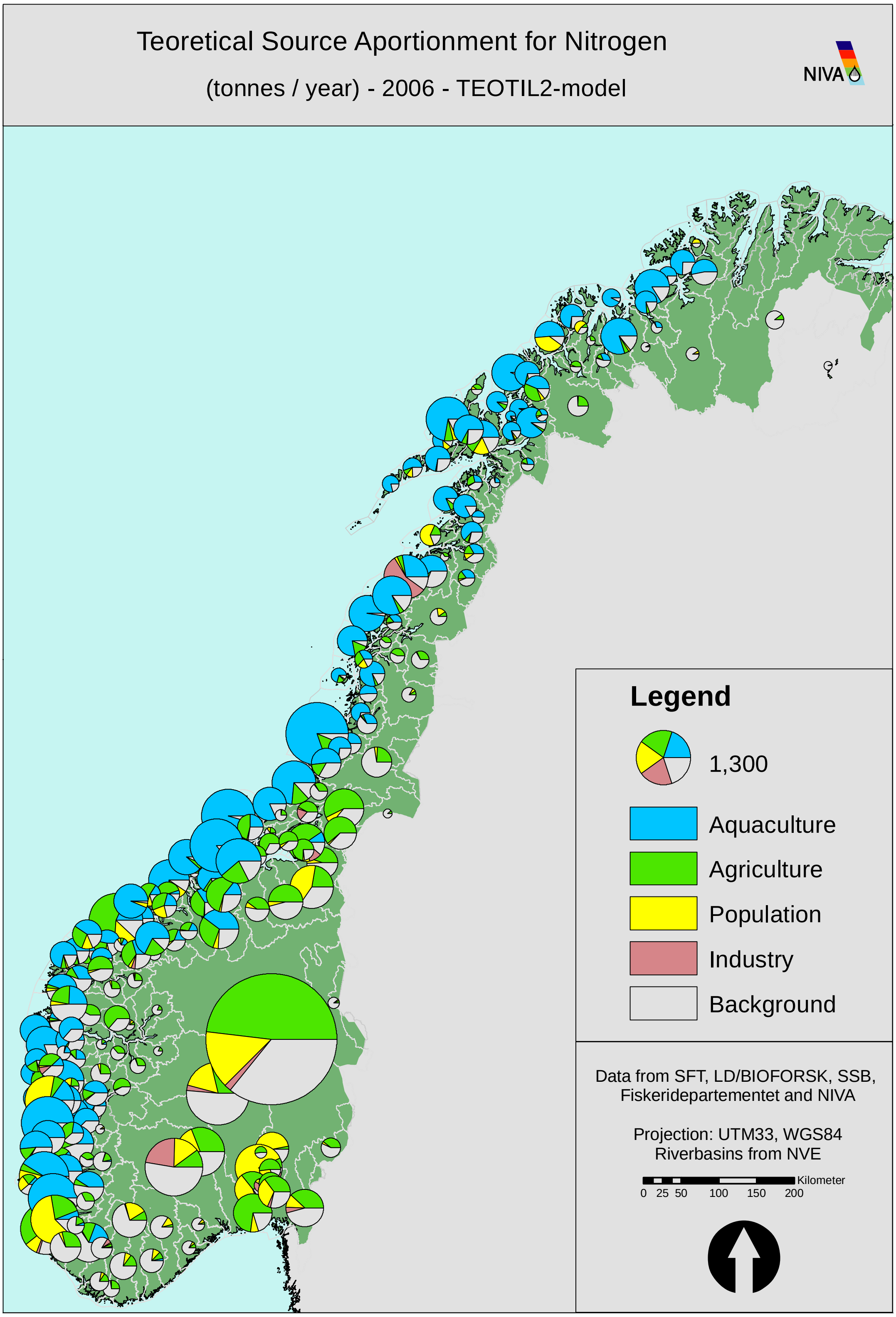


Figure 19. The relative importance of the five nitrogen sources taken account of when estimating the inputs to coastal areas from 247 rivers (Source Orientated Approach, incl. marine salmon/trout farming). Data from 2005 (from Selvik et al. 2007).

5. Total Inputs to Norwegian Coastal Waters 2006

Sections 5.1-5.3 give an overview of the total inputs in 2006 to the four major coastal areas in Norway: Skagerrak, North Sea, Norwegian Sea, and the Barents Sea of nutrients, metals and pesticides, respectively. The underlying data for the figures is given in detail in Part B, the Data Report. Section 5.4 gives a comparison of inputs in 2005 and 2006. For longer term trends that are also adjusted for water discharge variations, see Chapters 6 and 7.

5.1 Total nutrient and particle input in 2006

The total nutrient input to coastal waters from land based sources in Norway in 2006 was estimated to 10 800 tonnes of phosphorus and 142 000 tonnes of nitrogen (Figure 20). Total silicate inputs was estimated to 164 000 tonnes and total organic carbon (TOC) to just below 550 000 tonnes. The input of suspended particulate matter amounted to about 1.3 million tonnes.

An overview of the inputs of the different nitrogen and phosphorus fractions per coastal area is given in Figure 21. The total phosphorus loads are for all sub regions dominated by the dissolved inorganic fraction (PO_4-P) except for Skagerrak. This difference is due to the low number of fish-farms in Skagerrak; fish farming represents the major source of phosphorus input to the three other coastal areas. Low proportion of fish farming is also the reason why the input of ammonium to the Skagerrak area is lower than for the three other areas. The nutrient loads are highest to the sub-region of the Norwegian Sea and lowest to the Barents Sea (Figure 21).

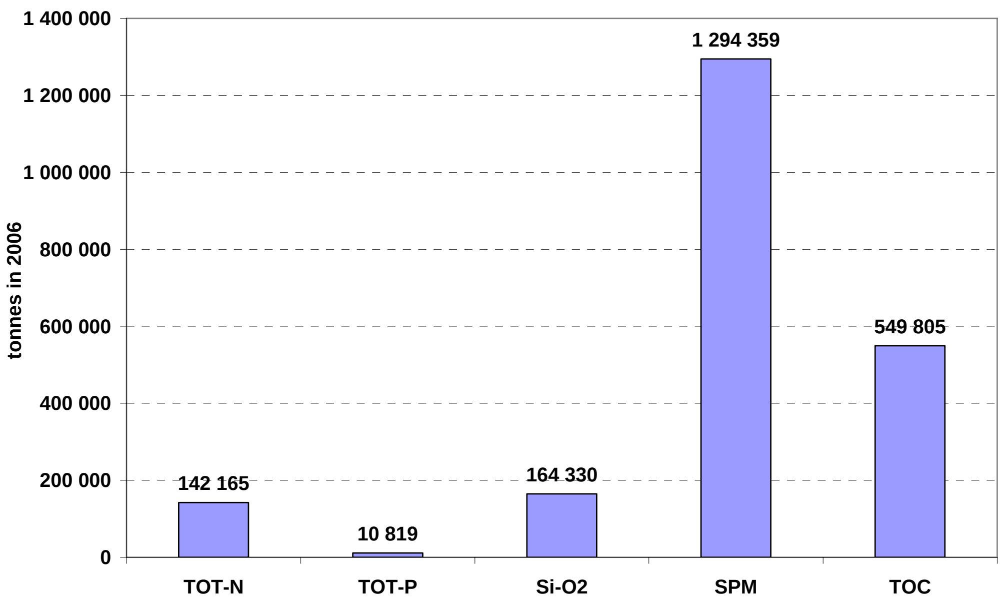


Figure 20. Total input of nitrogen, phosphorus, silicate, suspended particulate matter and total organic carbon in 2006.

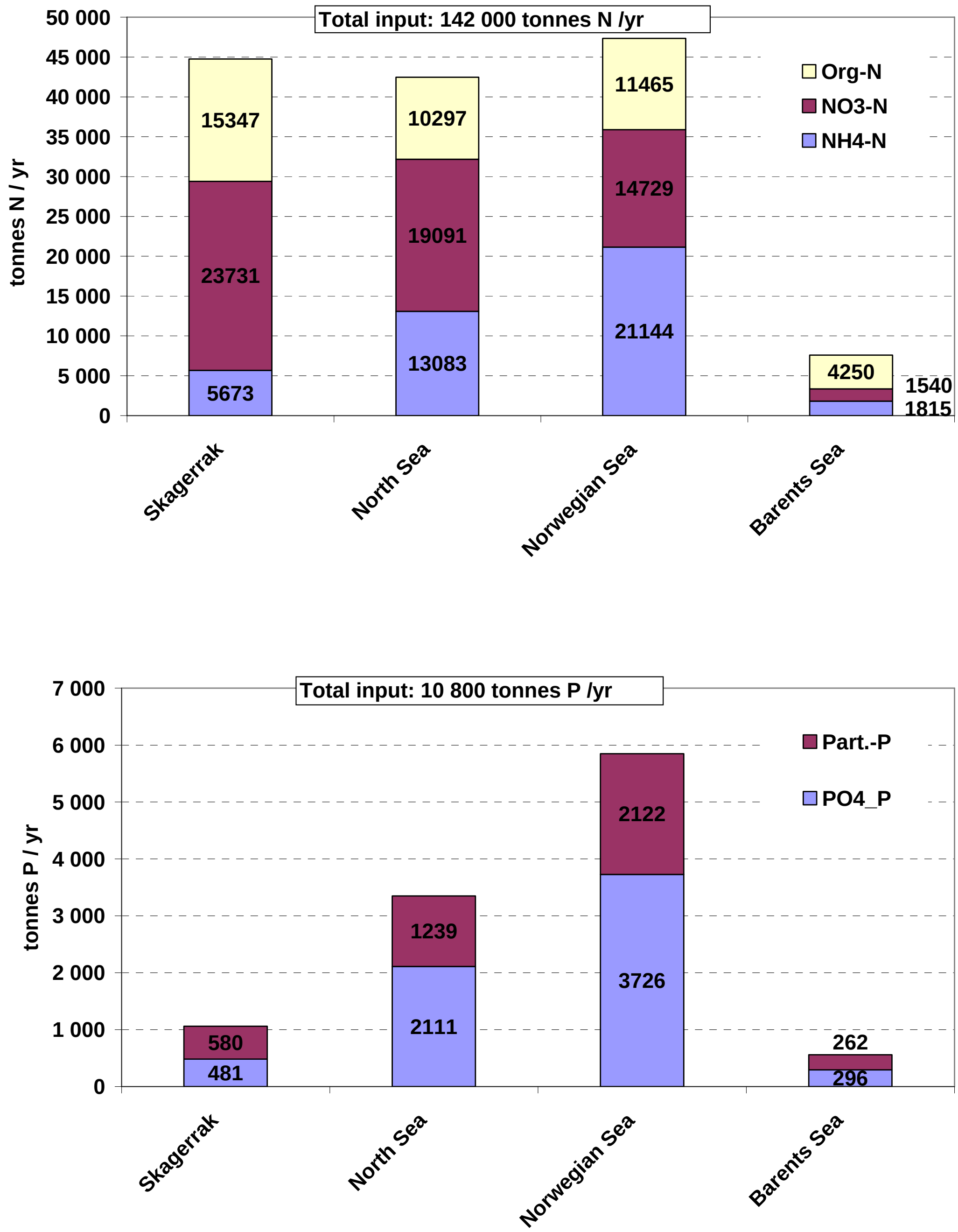


Figure 21. 2006-loads of total-N (upper panel) and total-P (lower panel) divided into different fractions for the four Norwegian sub-regions.

The sources of suspended particulate matter are shown in Figure 22. Riverine inputs constitute the major source, with an estimated 815 000 tonnes. The *direct* industrial discharges[3] also account for a relatively high share, especially to the Norwegian Sea (based on 2005-data). However, due to lack of monitoring data of discharges from sewage treatment plants and fish farming, as well as no estimates for unmonitored areas, the total input of about 1.3 million tonnes is underestimated.

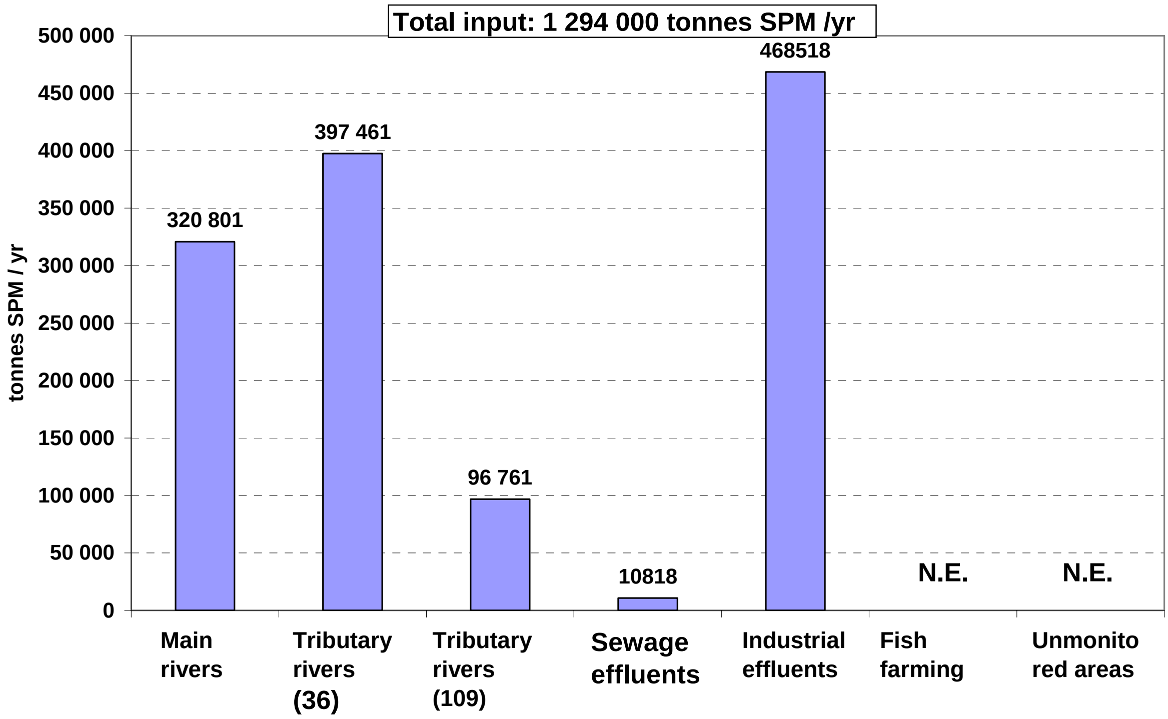


Figure 22. Inputs of particulate matter (SPM) from rivers and direct industrial discharges for in 2006.

The proportion of sources of particulate matter and nutrients is further illustrated in Figure 23. In general, the 46 monitored rivers account for about 80% of the total riverine inputs of nutrients. This may to some extent reflect the sampling frequency, as the inputs from the remaining 109 rivers are calculated based on an average of historical samples taken only once a year. Also, the sampling in the 36 rivers is designed as event sampling, implying that samples should be taken under typical conditions of the winter season, snowmelt, summer, and autumn rains. At least two of these samples will, therefore, probably carry more loads than the random samples collected from the 109 rivers.

Comparing riverine inputs with direct discharges (Figure 23, Lower panel) reveals 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.

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[3] In terms of the discussion on the relative weight of the different sources, it must be remembered that direct discharges only comprise the reported discharges downstream of sampling points or in unmonitored areas. This means that sources such as industry or sewage treatment plants may be much more important on a total scale, but this will be ‘masked’ within the riverine inputs.

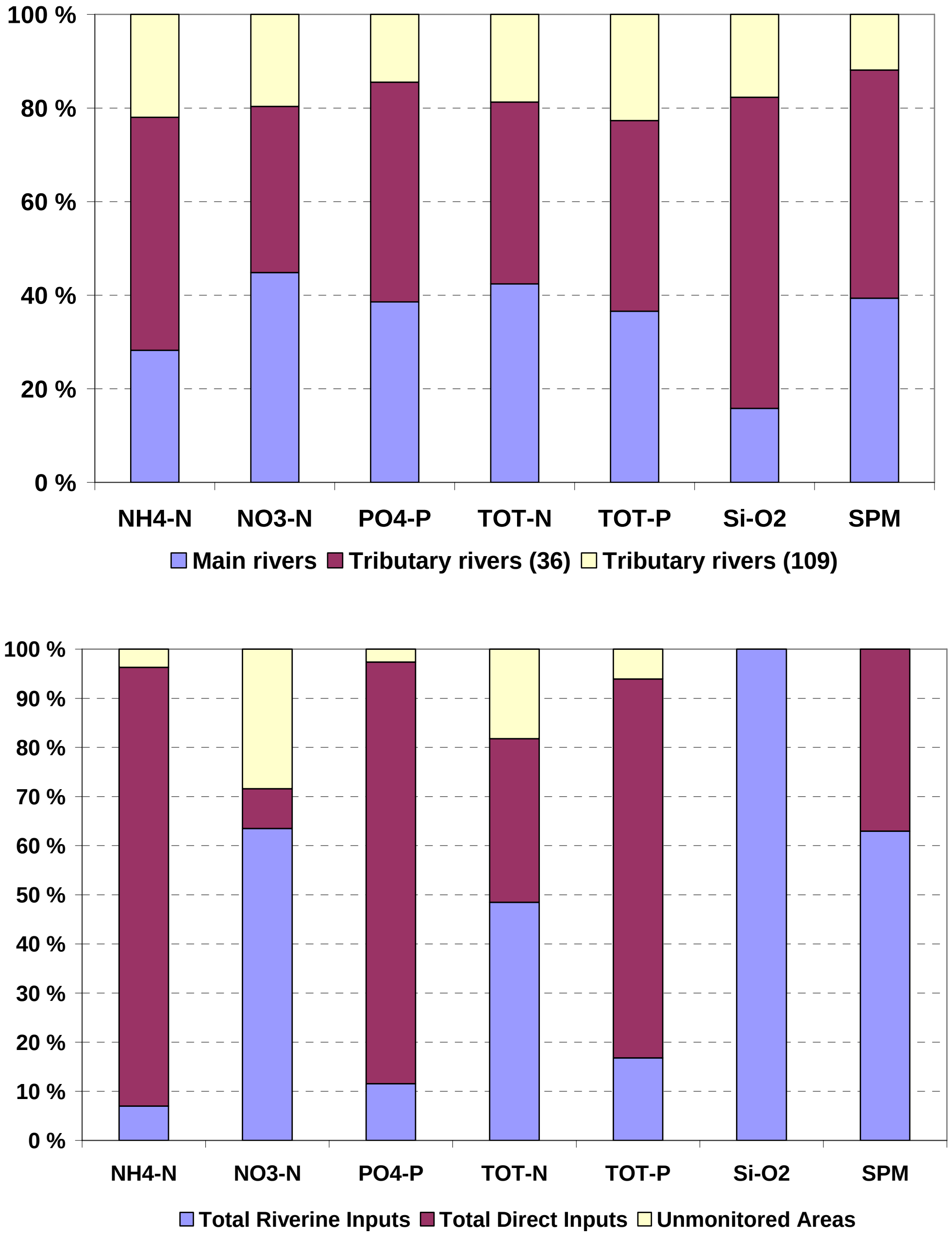

Figure 23 Main sources for nutrients, silicate and suspended particulate matter (SPM) divided into riverine contribution only (top panel) and the proportion between riverine, direct inputs and unmonitored areas (lower panel). Note that for SPM there are no estimates of inputs from fish farming and unmonitored areas.

The relative share of inputs from fish farms to the total inputs of nutrients is shown in Figure 24 for the four coastal areas. Due to few fish farms in the Skagerrak 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.

Totally in Norway, the nutrient loading from fish farming contributes to almost 70 % of the total phosphorus inputs and over 20 % of the total nitrogen inputs. In terms of nutrient fractions, almost 70 % of the ammonium and 77 % of orthophosphate derives from fish farming.

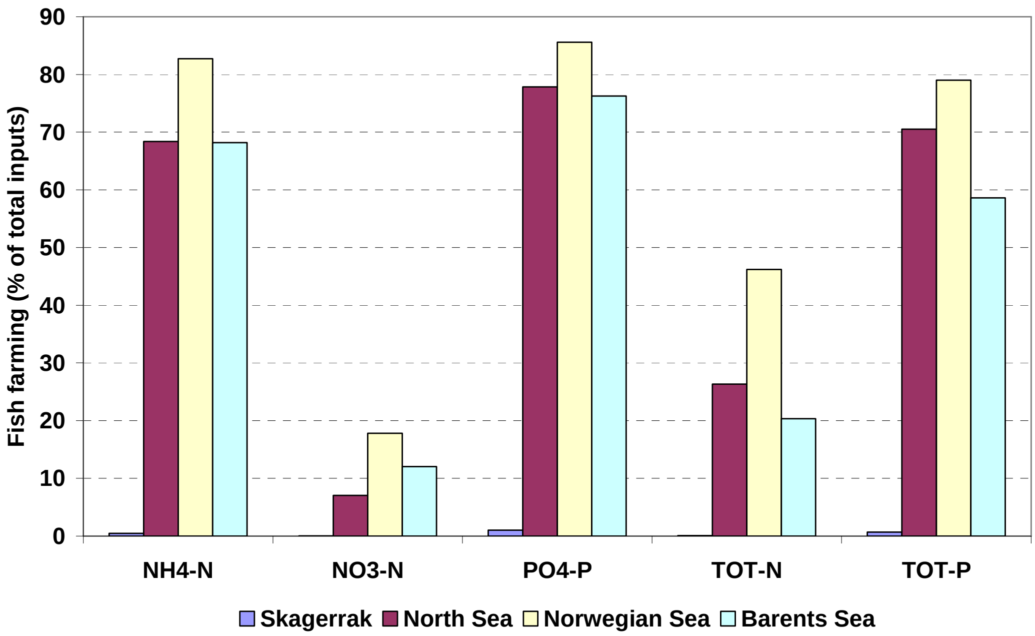

Figure 24. The relative share of nutrient inputs from fish-farming to the total inputs in 2006 for the 4 coastal areas.

5.2 Total metal inputs

In 2006, the total inputs of metals to coastal areas ranged from 0.37 tonnes of mercury to 599 tonnes of zinc (Figure 25 and Figure 26).

Inputs (upper estimates) of cadmium were estimated to 2.8 tonnes, arsenic to about 29 tonnes, lead to about 38 tonnes, chromium to about 54 tonnes and nickel to about 258 tonnes. Copper and zinc comprised the largest inputs of heavy metals, which in 2006 amounted to about 454 and 599 tonnes, respectively.

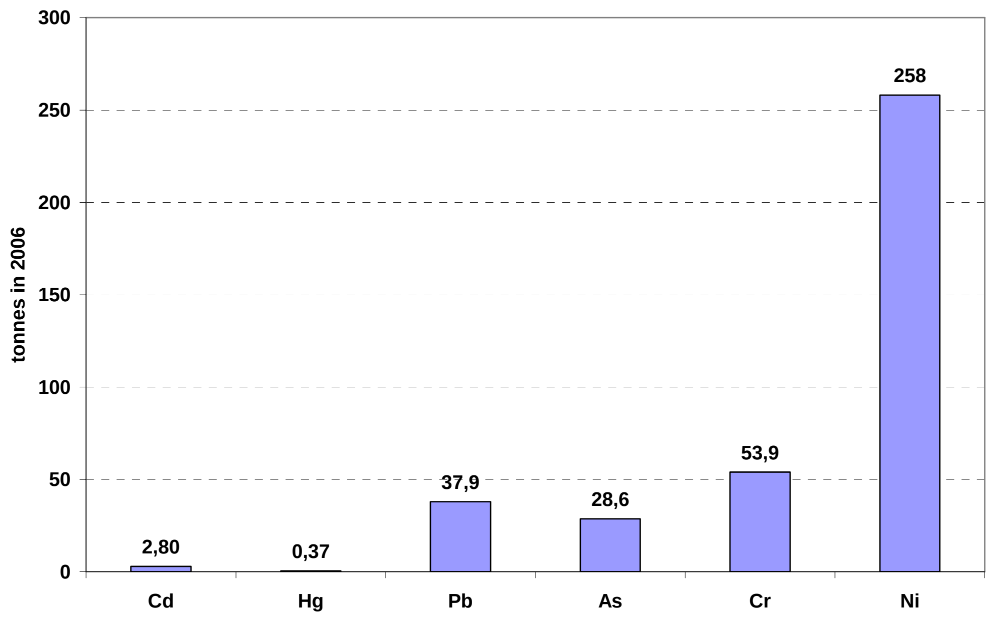

Figure 25 . Total input of Cadmium, Mercury, Lead, Arsenic, Chromium and Nickel in 2006.

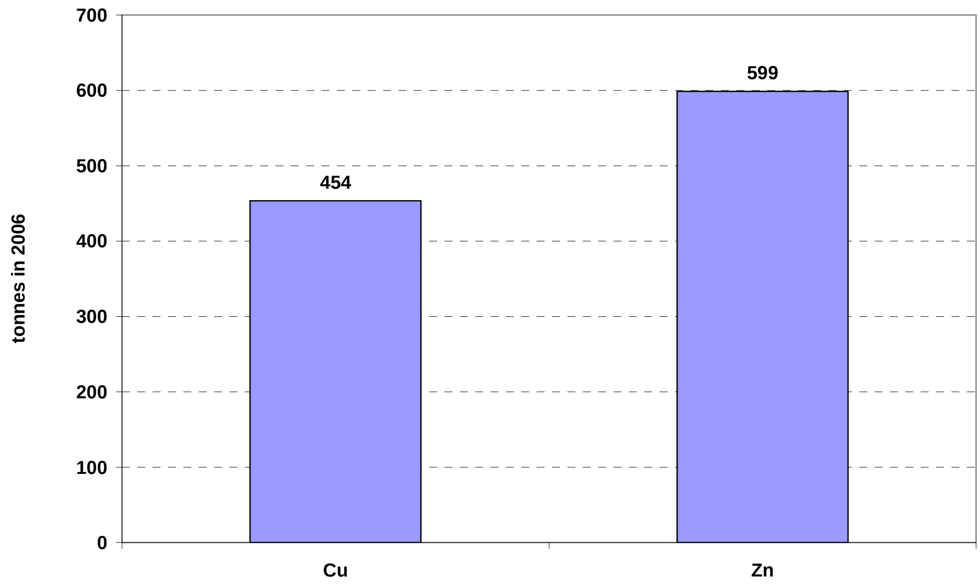

Figure 26. Total input of Copper and Zinc in 2006.

For all metals except mercury (Hg) and copper (Cu), the riverine loads accounted for at least 95% of the total input to Norwegian coastal waters (Figure 27). Estimates of copper discharges from fish farming were made for the first time in 2005, and explain the high copper inputs in 2005 and 2006 as compared to previous years. The high share of mercury from direct discharges is explained by reported high mercury discharges of 64 kg from one sewage treatment plant in the Skagerrak sub-region. A similar pattern was found last year, when three sewage treatment plants reported high inputs. There is a risk for errors in units in these reports, as 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. It is however, not within the means of the RID programme to quality check the data on effluents from sewage treatment plants.

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

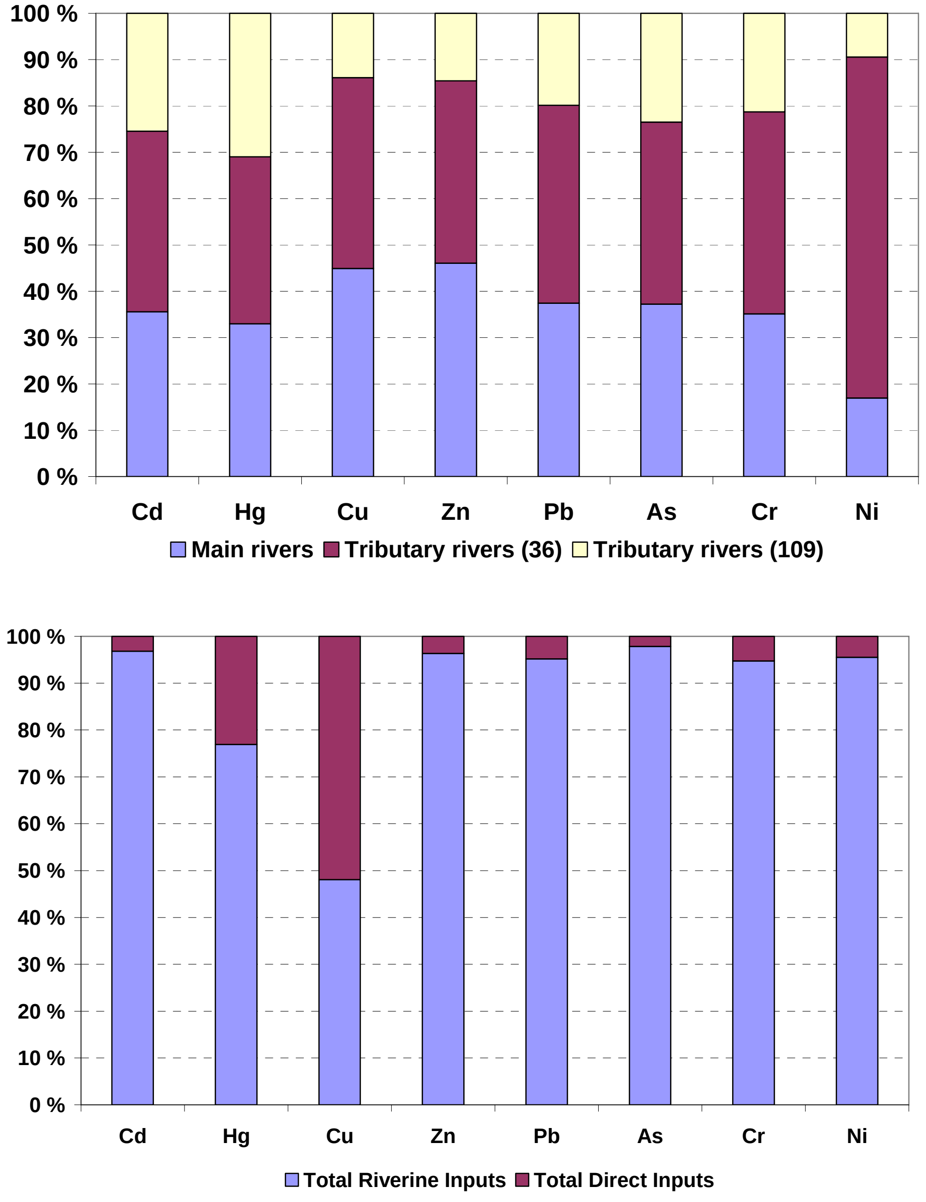

Figure 27. Relative share of riverine and direct discharges of the total inputs of metals to the Norwegian coastal waters in 2006.

5.3 Total lindane and PCB7 inputs

The pesticide lindane was usually detected in very low concentrations, often below the detection limit (see Part B). Total riverine loads of lindane in the main rivers were estimated to 3-13 kg depending on whether upper or lower levels (cf. Chapter 4.2) are used (Figure 29).

The PCB7 loads in the main rivers were in 2006 calculated to 0-146 kg. Again this span in estimates depend on whether the lower (0) or upper (146) estimates are used (Figure 29). Hence, the estimates of PCB7 inputs depend on the detection limit of the analytical method used.

No estimates were made for the inputs from tributary rivers or the direct source inputs for these two parameters.

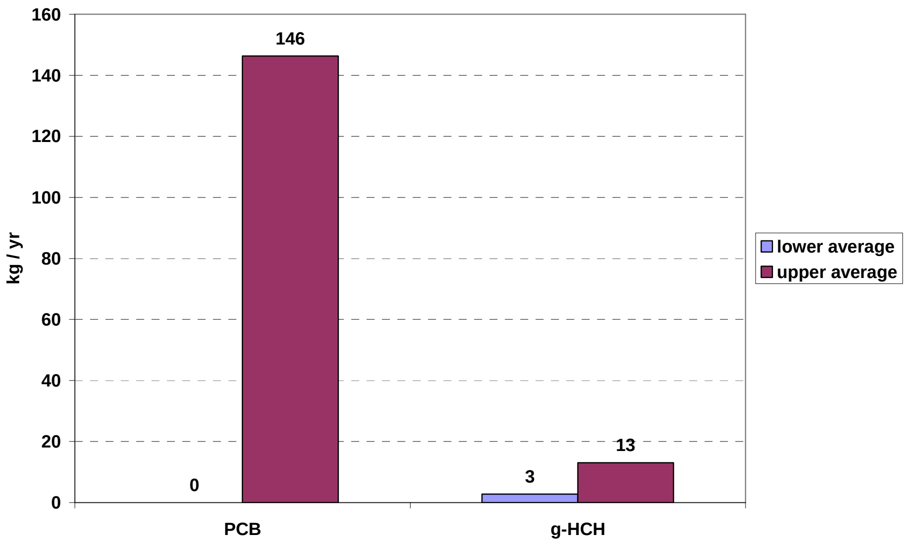

Figure 28. Riverine input (lower and upper average) in the main rivers (10) of PCB7 and lindane in 2006.

5.4 Comparisons of Inputs from 2005 to 2006

Riverine loads

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, since there were certain changes in the estimation method (TEOTIL) from 2005 to 2006 (cf. Selvik et al. 2007; Chapter 4.6.4).

Whereas most substances showed a decline in riverine loads from 2004 to 2005 (Borgvang et al 2007), the trend in 2006 was more varied. These variations may be explained by a combination of water discharge and methodology, the latter in particular in terms of sampling frequency.

The main difference between 2005 and 2006 in terms of water discharge, was an overall decrease of 10 % in total water flow from 2005 to 2006. However, this pattern has regional differences, as in 2006 the water discharge was higher than normal in the south and east of the country; and the main decrease from 2005 to 2006 was therefore in the mid- and northern parts of Norway.

These regional differences in water flow resulted in a decrease in water discharge of about 20 % in rivers draining to the North Sea, Norwegian Sea and Barents Sea; and an increase of about 15 % in rivers draining to Skagerrak (cf. Table 11).

Table 11. River water discharges (1000 m^3/d) to the Norwegian coast in 2005 and 2006. The data is based on the main rivers (10) and tributary rivers (36+109). Increases in flow shown in light orange, decreases in green.

	Total Norway	Skagerrak	North Sea	Norwegian Sea	Barents Sea
2006	566 962	182 518	157 940	171 143	55 360
2005	630 553	161 439	193 987	208 009	67 119
% change from 05 to 06	-10	+13	-19	-18	-18

This pattern is further illustrated in Figure 29, which shows the annual variations in water discharge at 8 hydrological stations in the main rivers from *Glomma* in the east to *Alta* in the north, for three different periods. Whereas the five first rivers (east and south) had annual water discharges higher than in 2005, and higher or equal to the 30-year normal, the three northernmost rivers had lower annual water discharges than both in 2005 and the 30-year normal. The seasonal differences within this pattern are, however, significant, as the high water discharge in the Skagerrak region derived from heavy rains during the autumn months, whereas the summer water discharge was less then normal, as discussed in Chapter 3.3.

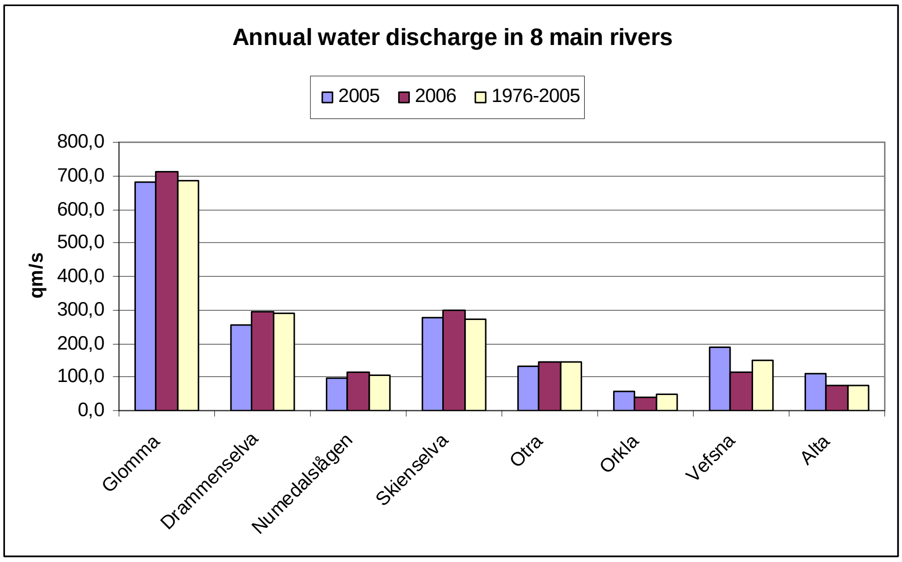

Figure 29. Annual water discharge in m^3/s in 8 of the 10 main rivers, in 2005, 2006 and as a 30-year normal. (The hydrological stations are the same as those given in Chapter 3.3; Figure 12.)

As demonstrated by numerous studies (e.g. Walling and Webb 1981; Asselmann 2000), suspended particulate matter (SPM) is a parameter that often reflects variations in the water discharge. Table 12 shows that there was an increase in SPM for all three categories of rivers in the Skagerrak region, which most likely is explained by the high water discharges here. On the other hand, a decrease is shown in all river categories in the North Sea region. This is probably explained by the high water discharge in this region in 2005, caused by heavy rains in the autumn (Borgvang et al. 2007). The decrease is especially noticeable for the two main rivers in this region, *Orre* and *Suldalslågen*, with average concentrations of SPM of 9.2 and 1.5 mg/L in 2006 compared to 18.3 and 2.4 mg/L in 2005, respectively.

In the Norwegian Sea area, the small increase in SPM the main rivers is probably explained by the choice of sampling dates in the River *Orkla*. Although this river had an overall decrease in water discharge in 2006 compared to 2005 (Figure 29), the average water discharge for the actual sampling dates was higher in 2006 (131 m^3/s) than in 2005 (96 m^3/s). This is again reflected in higher sediment loads. This example reflects that the load calculation method used in the RID programme does not account sufficiently for the general water discharge pattern, but instead puts too strong emphasis on the water discharge during the actual sampling dates.

Changes in the 109 tributary rivers not monitored in 2006 will mainly reflect between-year variations in annual water discharge, as the concentrations are unchanged compared to 2005. Thus, the pattern shown in Table 13 reflects that water discharge increased significantly in the Skagerrak region, and decreased in the three other regions. The most interesting pattern is, therefore, the patterns seen in the 36 tributaries monitored four times during 2006. The increase for all regions except the North Sea (which had an exceptional high water discharge in 2005), is partly linked to riverine variations in water discharge and partly to sampling frequency. With only four samples a year, the annual load estimates will be highly dependent on the water discharge measured on each sampling date, especially with the load calculation method used in the RID programme.

Table 12. Riverine load (in 1000 tonnes) of SPM in 2005 and 2006. Increases in loads shown in light orange, decreases in green, and no change shown in yellow.

	Total Norway		Skagerrak		North Sea		Norwegian Sea		Barents Sea	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Main rivers	348	321	265	282	40	9.7	19	25	24	4
Tributary rivers (36)	362	397	14	31	166	137	168	209	13	21
Tributary rivers (109)	105	97	14	21	35	28	49	41	7.6	6.2
Total riverine Norway	815	815	293	333	241	175	236	275	45	31

In terms of nutrient loads, there was an overall increase from 2005 to 2006 of 13 % for total nitrogen and 4.5 % for total phosphorus (Table 13). For nitrogen, the 2006 load is close to the

2004 value of about 65.000 tonnes, whereas for phosphorus, the 2006 was higher than both 2004 and 2005. The loads must, however, be seen in connection with the water discharge, and flow normalised analyses are therefore presented in Chapter 6 and 7. The increase from 2005 to 2006 for the riverine loads of nutrients is mainly due to the high water discharges in the Skagerrak region. This 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 inevitable lead to high nutrient runoff and a subsequent increase in the overall Norwegian nutrient inputs.

Table 13. Total riverine load of total nitrogen and total phosphorus in 2005 and 2006.

	Nitrogen		Phosphorus	
	2005	2006	2005	2006
Major rivers (10)	24 143	29 231	710	666
Tributary rivers (36)	22 264	26763	573	742
Tributary rivers (109)	14 165	12918	459	412
Total Rivers	60 572	68 912	1 741	1 820

The increase of total nitrogen and phosphorus inputs to the Skagerrak region also resulted in higher loads of individual N and P fractions in this area. There was an almost 40 % increase in NO_3-N inputs to the Skagerrak area from 15 571 to 21 751 tonnes/yr, whereas NH_4-N increased about 50 % from 948 to 1398 tonnes/yr. An example is River Nidelv in the Skagerrak region, where high nutrient concentrations (cf. Figure 30) combined with high floods gave an all-time high in ammonium and nitrate loads in spring 2006.

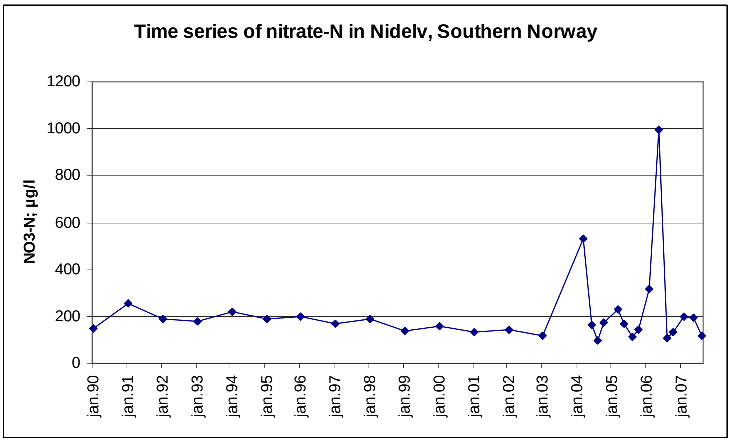

Figure 30. Time series of nitrate-N concentrations in Nidelv, southern Norway. The series illustrates the high concentration in 2006, as well as the likelihood for detecting higher concentrations with more frequent sampling.

For riverine loads of metals, there were in general small changes in total loads from 2005 to 2006 (Table 14). The main exceptions are a decrease in zinc, and an increase in nickel. The decrease in zinc is mainly due to a decrease in concentrations in the River *Orkla*, where concentrations during the first half of 2005 were much higher than in 2006. This river, which is heavily affected by mining activities, had water discharges of only 80% of the 30-year normal during 2006. As noted above, however, the average water discharge based on actual sampling dates was higher in 2006 than in 2005. The decrease in zinc may reflect a short-term decrease in loads from this region. The long-term trends in zinc and other constituents are displayed in Chapter 6 and 7 of this report.

Table 14. Riverine loads of various metals in 2005 and 2006. All values in tonnes/yr. Increases from 2005 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	
		2005	2006	2005	2006	2005	2006	2005	2006
Major rivers (10)	Lower avg	0.86	0.94	102.9	98.0	296.0	265.8	15.1	13.5
	Upper avg	0.92	0.97	102.9	98.0	296.0	265.8	15.1	13.5
Tributary rivers (36)	Lower avg	0.70	0.93	78.8	89.8	219.4	227.1	12.3	15.4
	Upper avg	0.94	1.06	78.8	89.8	219.4	227.1	12.3	15.4
Trib rivers (109)	Lower avg	0.78	0.69	33.6	30.2	93.8	84.0	8.1	7.2
	Upper avg	0.78	0.69	33.6	30.2	93.8	84.0	8.1	7.2
Total rivers	Lower avg	2.35	2.56	215.3	218.0	609	577	35.4	36.0
	Upper avg	2.65	2.71	215.3	218.0	609	577	35.4	36.0
		As		Cr		Ni		Hg	
		2005	2006	2005	2006	2005	2006	2005	2006
Major rivers (10)	Lower avg	10.0	10.4	13.6	16.9	38.7	41.8	0.04	0.05
	Upper avg	10.1	10.4	16.0	17.9	38.7	41.8	0.08	0.09
Tributary rivers (36)	Lower avg	8.7	10.4	17.6	19.7	86.1	181.3	0.03	0.05
	Upper avg	9.7	11.0	22.5	22.3	86.1	181.4	0.10	0.10
Trib rivers (109)	Lower avg	7.1	6.6	12.3	10.9	26.0	23.3	0.28	0.10
	Upper avg	7.1	6.6	12.3	10.9	26.0	23.3	0.28	0.09
Total rivers	Lower avg	25.7	27.4	43.6	47.4	150.8	246.4	0.34	0.20
	Upper avg	26.8	28.0	50.9	51.1	150.8	246.4	0.46	0.29

The increase in nickel is caused by a concentration peak that occurred during snowmelt and very high water discharge (9 May 2006) in the Pasvik River, draining to the Barents Sea. As illustrated in Figure 31, an even higher concentration was observed in 2004, and the increase in nickel from 2005 to 2006 may thus be more a result of natural variations than a real increase in loads from this river. Also other metals showed elevated concentrations at this particular date.

Other significant variations or anomalies for specific rivers include:

- An increase in copper of 57% in *Drammenselva* is due to a 16 % increase in water discharge combined with increased copper concentrations in 2006;
- A decrease in lead inputs from *Suldalslågen* is mainly the result of a concentration peak in January 2005;
- Decreased loads of several nutrient fractions to the Barents Sea, e.g. NH_4 down 65%; PO_4 down 54%; total phosphorus down 66 %, as well as suspended particulate matter down 83%; are all mainly due to lower water discharge in this region. As reported in Borgvang et al (2006), the two northernmost counties had 10 and 30 years floods in 2005, whereas the water discharge in 2006 was lower than normal.
- An increase of PO_4 inputs from *Numedalslågen* is due to a concentration peak 18 April 2006, which also was accompanied by high concentrations of other nutrient fractions.

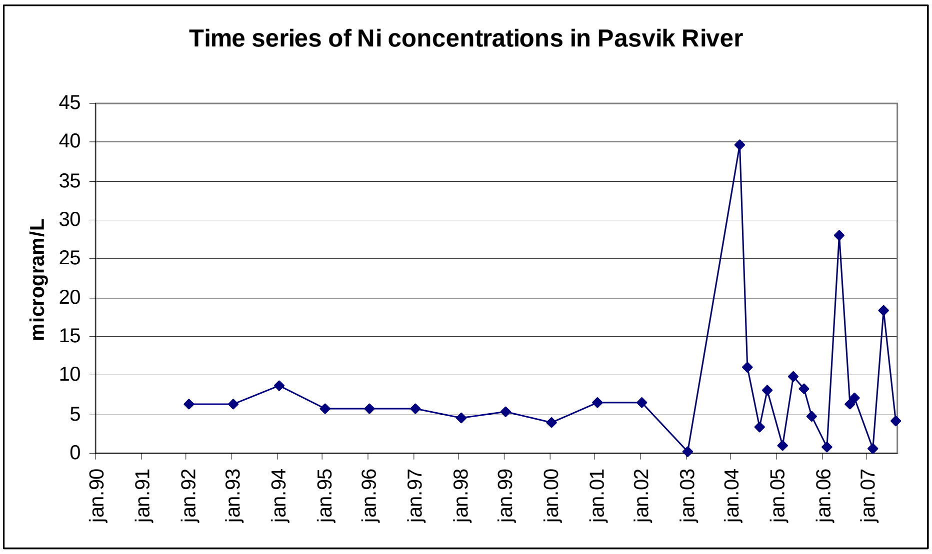

Figure 31. Time series of nickel concentrations in the Pasvik River.

In terms of changes in PCB7 inputs, these are, as noted in section 5.3, mainly a result of the detection limit of the analytical method used. A comparison between 2005 and 2006 suggests a 160 % increase of PCB7 loads to the Norwegian Sea and an almost 200% increase in the riverine PCB7 export from *Drammenselva*. This is a result of two circumstances:

- Higher detection limits for some samples, due to variations and/or anomalies in the laboratory equipment. In this case the LOD were higher than normal in the May samples, and this gave a significant impact on the upper estimates. In February 2005, on the other hand, the LOD was 50% lower than normal. Therefore, great caution must be taken when interpreting results with large differences between upper and lower estimates.
- PCB7 (and lindane) are only sampled four times a year. With concentrations usually 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 2005 to 2006 mainly reflect changes in water discharge and effects of varying sampling frequency. The general increase in loads from the 36 tributary rivers since 2005 is most probably a result of low sampling frequency. Sampling four times a year (although much better than the previous sampling strategy of once a year) renders the results more dependent on water discharge conditions during sampling. A study on water discharges in 2005 and 2006 revealed that the 2006 sampling dates included at least one flood event that exceeded the 2005 maximum levels. It is during such events that major loads are transported in the rivers.

Direct discharges

The reporting of industrial discharges for 2006 has been delayed due to a change in the database system, and the figures from 2005 have therefore been used in the 2006-reporting of RID. The data on sewage treatment plants and fish farming are, however, based on 2006 data. Due to the fact that the reporting of direct discharges often varies from year to year, Table 15 is also including values from 2004.

Table 15. The total direct inputs to the Norwegian coast in 2004, 2005 and 2006. The direct discharges comprise (i) sewage effluents. (ii) industrial effluents and (iii) fish farming. All values are given in tones/yr. Data for industrial effluents in 2006 are identical to the 2005 data.

	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	246.0	19.8	2.1	0.6	3.4	11.9	30887	3961	4710	39280	6943	475932
2006	0.09	0.09	235.5	22.0	1.8	0.6	2.8	11.6	37255	4792	5677	47365	8342	479336

The reason for the general increase in nutrients and suspended particles is simply due to a general increase in these parameters for all four coastal areas, both for sewage effluents and fish farming, in 2006. As the table shows, this increase is a continuation since 2004.

In terms of the total inputs from Norway, the changes in metal loads between 2005 and 2006 are relatively small. This is partly a result of the fact that the values for industrial effluents are the same as those in 2005.

Chromium, that showed a marked increase from 2004 to 2005, decreased between 2005 and 2006, although not back to 2004 levels. The reduction is mostly due to 2-4 sewage treatment plants in the North Sea area, reporting markedly lower effluent concentrations than in 2005. This explanation also holds true for reductions of nickel, arsenic, lead and copper to this area. The increase in zinc is mainly due to several sewage treatment plants in the Skagerrak region, where particularly one plant reported a more than 4 times increase in the effluents of this metal. Although nickel has been reduced on a national scale, an increase in nickel of about 130% can be seen in the Skagerrak area, due to a sewage treatment plant that has reported almost 20 times higher effluent concentrations in 2006 than in 2005.

Mercury inputs have, as Table 15 shows, varied markedly from 2004 through 2005 and to 2006. The main reason for the change from 2005 to 2006 is found in the reporting from sewage treatment plants. Some selected examples include plants that reported 1200 kg in 2005 vs. 40 kg in 2006; 0.05 kg in 2005 vs. 64 kg in 2006; and 0 kg in 2005 vs. 278 kg in 2006. In the North Sea area, such changes in reporting has lead to a decrease in mercury inputs of 90 % relative to last year, mainly due to a reduction from 20 to 2 kg from a few plants. As also noted above, these numbers may in fact reveal errors in units. Unfortunately, it was beyond the scope of this report to quality assure and change the raw data obtained from external databases.

The increase in copper from 2004 to 2005 was explained by Borgvang et al. (2007) as the result of copper inputs from fish farming being reported for the first time. This reporting has continued in 2006; the inputs are still high as compared to the 2004 reporting, but the slight decrease does probably only reflect that these inputs are based on estimates from indirect data (see Chapter 4 on the methodology).

In general, therefore, most variations in direct inputs seem to stem from insufficient reporting of discharges, and/or errors in units.

6. Trend analyses - pollutant concentrations

6.1 Statistical methods and uncertainty

The statistical properties of water quality data are usually not normally distributed and often exhibit a seasonal pattern due to the variation in water flow and influence of biological processes. 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 (Annex II; Figure II. 1). During one specific year, all Norwegian RID river samples are analysed by the same laboratory, i.e. all 46 rivers (up to and including 2003, all 146 rivers). For the Norwegian RID-programme all samples from 1990 up to 1998, and from 2004 to date, were analysed by the same laboratory, whereas samples in the period 1999-2003 were analysed by a different laboratory. 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 (Annex II; Figure II. 1). In the period 1990-1998 also values below LOD was 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.)

In this annual report a slightly modified statistical method to track long-term changes in solute concentrations measured in the 10 main rivers has been introduced. The new routine has its methodological basis in the seasonal Mann-Kendall-test (SMK; Hirsch and Slack, 1984) used in the 2004 and 2005 Norwegian RID-reports. The 1990-2004 and 1990-2005 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). The main feature with the new modified SMK-method is the inclusion of a routine by Helsel and Frans (2006) that better assesses data that contain LOD values. However, this modified method does not take account of annual changes in LODs. Thus, cautioness is recommended when applying the method since the statistical trends might be due to an effect of changed LOD rather than changes in water quality.

In addition, we have introduced a multivariate test for all rivers based on Loftis et al. (1991). 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-statistics.

All the methods use tests for monotonic[4] trends (including linear trends), and each month is tested separately for trends before it is summed up to an overall test-statistics.

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

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

In addition to the formal statistical test, a visual inspection of all the time series was performed (cf. Figures 35-38 and complimentary figures in Annex II).

6.2 Data selection

The analysis was based on monthly observations in the ten main rivers for the period 1990-2006. In months with more than one sample, an arithmetic concentration average was 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), zink (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 AOX, arsenic (As), cobolt (Co), chromium (Cr), total organic carbon (TOC), dissolved organic carbon (DOC), Silica (SiO_2), PCB7 and lindane (γ-HCH).

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 upwards or downwards trends since 1990 were detected. This indicates that sampling has occurred during relatively similar flow conditions throughout the years. The only exception is in *Skienselva* which show a downward tendency that was almost statistically significant ($p<0.06$; Table 16).

A desk study of the time series (Figure 38) showed elevated water flow during the autumn 2000 in all rivers discharging into the Skagerrak, except from the *River Otra* that had unusually high water flow during sampling at the end of 2004.

6.3.2 Nutrients and particulate matter

For total nitrogen, three statistically significant *downward* trends were detected ($p<0{,}05$; Table 16); in *Skienselva, Suldalslågen* and *Alta*. These trends were explained by downward trends in nitrate concentrations (Table 16; Figure 32; Figure II. 2). One more river, *Vefsna*,

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[5] 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 our case, does not mean a 5% or larger change in concentrations.

showed indications of reduced tot-N concentrations (Figure 32), but the trend was not regarded as statistically significant ($p<0.06$; Table 16). In addition to these rivers, nitrogen concentrations in some other rivers, such as *Orreelva*, have been reduced since 2000 (Figure 35. Such observations should not be over-interpreted, but they might indicate a parabolic (curved) trend that is not captured by the statistical test used, which detects monotonic trends only. No statistically significant *upward* trends for tot-N were detected (Table 16). Tendencies towards increased tot-N concentrations in *Drammenselva and Glomma* are mainly explained by low concentrations during the first three years of the monitoring period (1990-1992; Figure 35). Given that nitrate-N concentrations in *Drammenselva* and *Glomma* do not show the same upward tendency (Figure II. 2), 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 16; Figure 32). 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 two statistically downward trends ($p<0.05$; Table 16) and four additional tendencies of downward trends ($0.05<p<0.2\%$).

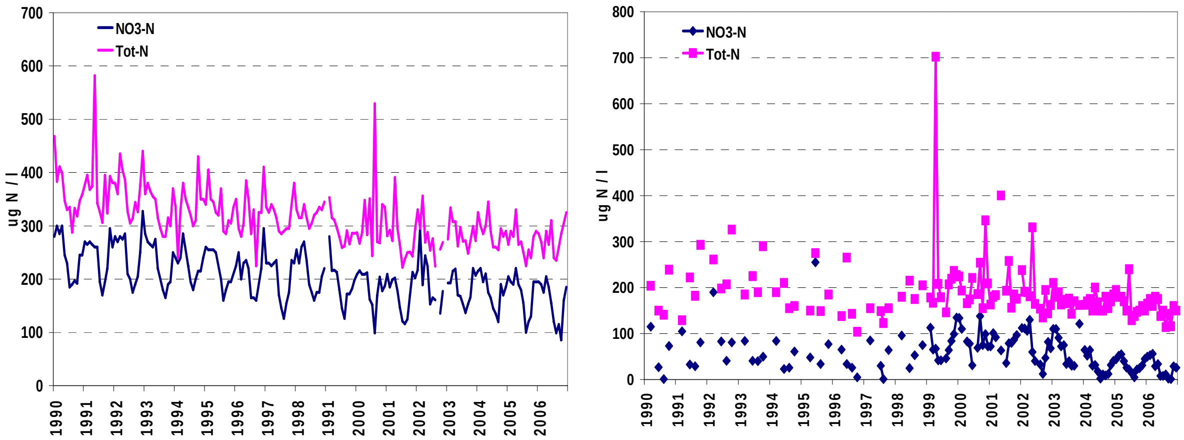

Figure 32. Monthly total-nitrogen and nitrate concentrations in Skienselva (left panel) and Vefsna (right panel).

For total phosphorus, tendencies of significant *increasing* trends were only detected in the rivers *Glomma* and *Numedalslågen* only ($p<0.17$ and $p<0.13$, respectively; Table 16). The only statistically significant *downward* trend was detected in *Alta* ($p<0.05$), with low concentrations during 2003-2006 as specific feature (Figure 33). The general lack of significant trends in total phosphorus concentrations (Figure 36) is somewhat surprising given the improvements of municipal sewage treatment achieved during the last 15-year period. 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 34). 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 Skagerrak, 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 (1990-2006).. This was due to the intensive rainfall during the autumn 2000.

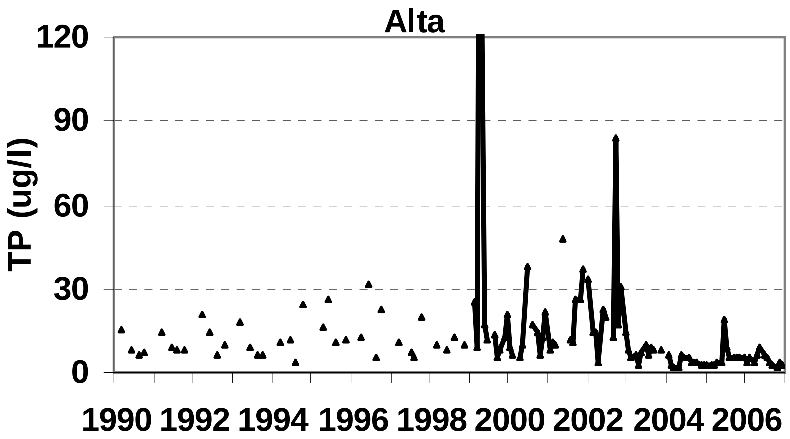

Figure 33. Monthly total-phosphorus concentrations in the Alta river, 1990-2006. NB! The peak-value of 220 ug/l in April 1999 is not visible in the graph due to cut axis.

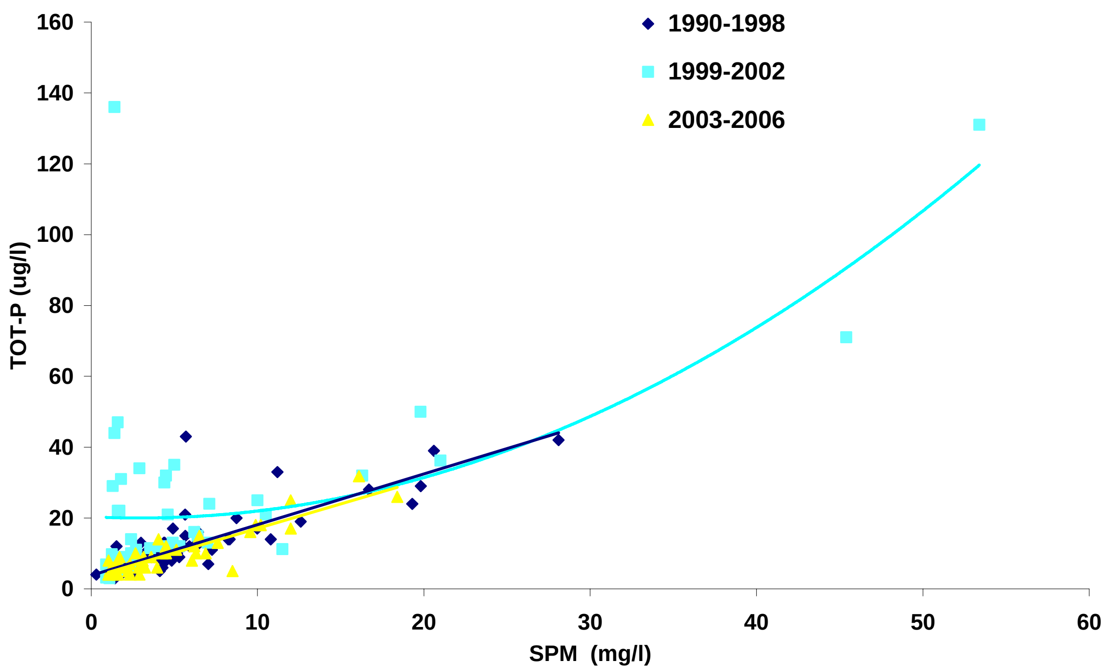

Figure 34. Scatter plot of the relationship between total phosphorus and suspended particulate matter concentrations in three time periods in Numedalslågen.

The peculiar '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 (*Annex II Figure II. 3*)*. The formal statistical trend test for phosphate only shows one single significant trend; namely in the river *Alta*.

For SPM, the only downward trend was detected in *Otra* (Table 16). However, the more detailed exploratory analysis revealed that peak SPM values above 40 mg/l in *Glomma* have hardly occurred after year 2000. The only exception was observed 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 *Skienselva*, which corroborated well with the peaks in water flow during the same period. In *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 16 summarises long-term trends of nutrient concentrations in the ten main Norwegian RID rivers.

Table 16. 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- 2006.

River	Q	NH_4-N	NO_3-N	Tot-N	PO_4-P	Tot-P	SPM
Drammenselva	0,2336	0,8650	0,3925	0,0891	0,6051	0,3421	0,3169
Skienselva	0,0595	0,1126	0,0000	0,0001	0,2367	0,2710	0,8464
Otra	0,4738	0,2470	0,4484	0,6766	0,6158	0,1692	0,0067
Numedalslågen	0,5619	0,9671	0,1518	0,2011	0,3639	0,1295	0,6287
Glomma	0,6444	0,0501	0,6374	0,0770	0,7444	0,1698	0,6528
Orkla	0,8397	0,4240	0,9770	0,7568	0,6703	0,3123	0,0749
Alta	0,8044	0,0000	0,0482	0,0008	0,0039	0,0024	TFD
Suldalslågen	0,0826	0,1148	0,0073	0,0002	0,2147	0,6951	0,1696
Vefsna	0,7273	0,0056	0,0004	0,0582	0,1544	0,1283	0,1500
Orreelva	0,9520	0,4744	0,7488	0,7237	0,3253	0,6569	0,8867
All rivers	0,5019	0,0513	0,0042	0,0781	0,8163	0,9843	0,0977

	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)
TFD	Too few data (number of missing values or LODs)

6.3.3 Metals

A majority of the five analysed metals (Cd, Cu, Ni, Pb, Zn) showed statistically downward trends in most of the ten studied rivers. More precisely, 37 of 46 metal trend tests[6] revealed a statistically significant downward trend (Table 17). Furthermore, five 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, i.e. between 1990 and 2006. Thus it is difficult to determine if observed trends really reflect reductions in discharges of metals from, in particular, industrial plants and sewage treatment plants.

[6] 4 tests were excluded due to too many missing values and/or LoD values.

6.3.4 Conductivity

The conductivity measurements showed significantly declining trends in the rivers *Skienselva*, *Otra*, and *Suldalslågen*. Reduced point source discharges from industrial plants and municipal sewage treatment plants, combined with reduction of long-range transported air pollution (especially sulphate), 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 17. Long-term trends for conductivity and metals in the 10 Norwegian main rivers 1990-2006.

River	Q	Cond	Cd	Cu	Ni	Pb	Zn
Drammenselva	0,2336	0,0230	0,0004	0,3910	0,4377	0,0208	0,1929
Skienselva	0,0595	0,0081	0,0014	0,0340	0,0020	0,0027	0,0012
Otra	0,4738	0,0012	0,0568	0,7215	0,0886	0,0223	0,0006
Numedalslågen	0,5619	0,9889	0,0044	0,0085	0,0026	0,0074	0,0129
Glomma	0,6444	0,9508	0,0460	0,0979	0,0030	0,0207	0,0027
Orkla	0,8397	0,2193	0,0401	0,0239	0,0030	0,0335	0,0051
Alta	0,8044	TFD	TFD	0,0000	TFD	TFD	0,0000
Suldalslågen	0,0826	0,0005	0,0000	0,0000	TFD	0,0518	0,0000
Vefsna	0,7273	0,6337	0,0007	0,0037	0,0021	0,0020	0,0025
Orreelva	0,9520	0,4761	0,0010	0,1442	0,0002	0,0263	0,6299
All rivers	0,5019	0,0444	0,0001	0,0036	0,0000	0,0003	0,0001

(light cyan)	Significant downward (p<0,05)
(green)	Downward but not significant (0,05<p<0,2)
(red)	Significant UPWARD (p<0,05)
(orange)	Upward but notsignificant (0,05<p<0,2)
TFD	Too few data (number of missing values or LODs)

Figures 35-37 show monthly concentrations of total nitrogen, total phosphorus and cadmium, respectively, for the ten main Norwegian rivers. Figure 38 shows monthly mean discharge. Similar charts for the other RID parameters are shown in Annex II.

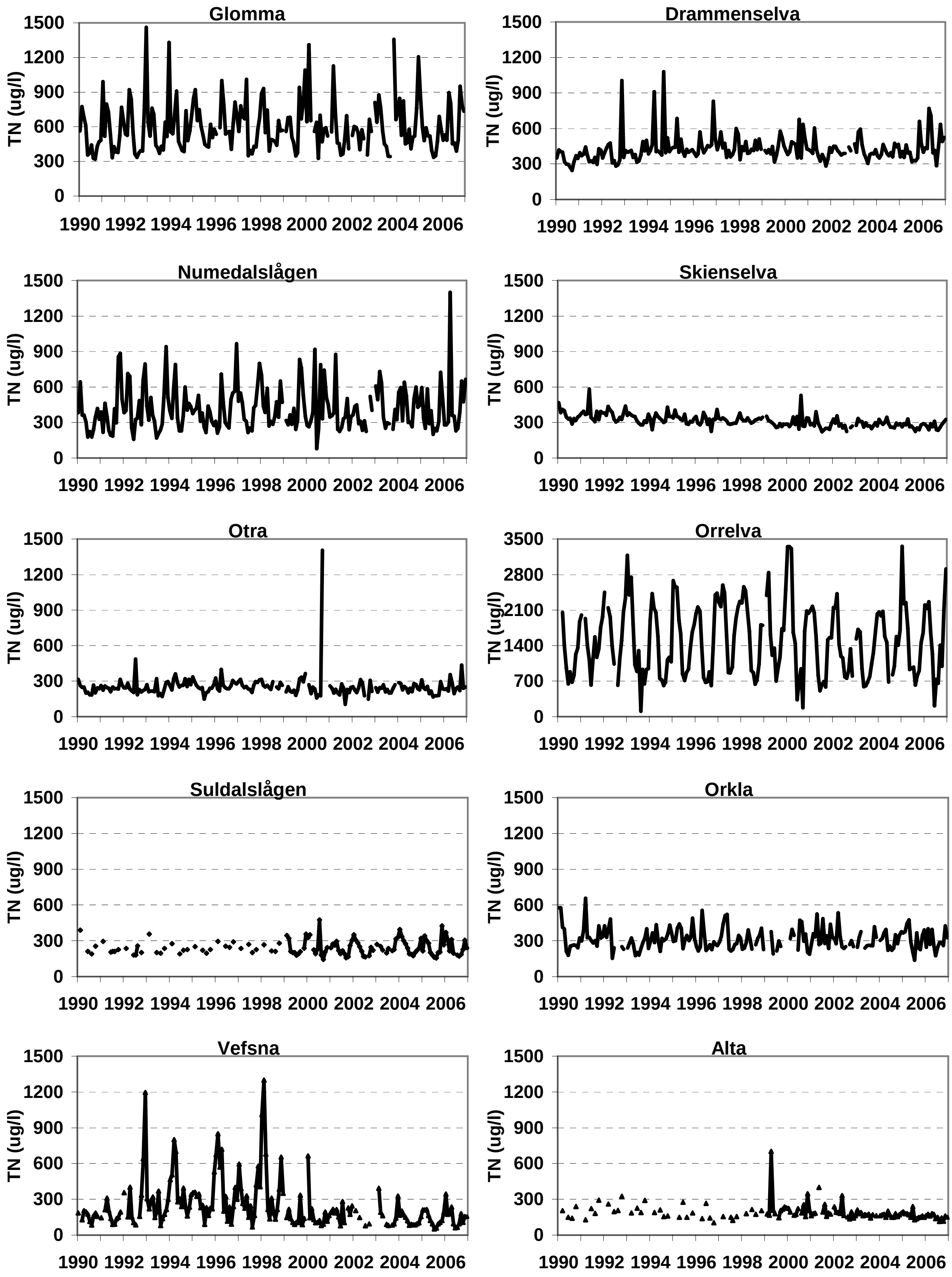

Figure 35. Monthly <u>total nitrogen</u> concentrations in the 10 Norwegian main rivers.

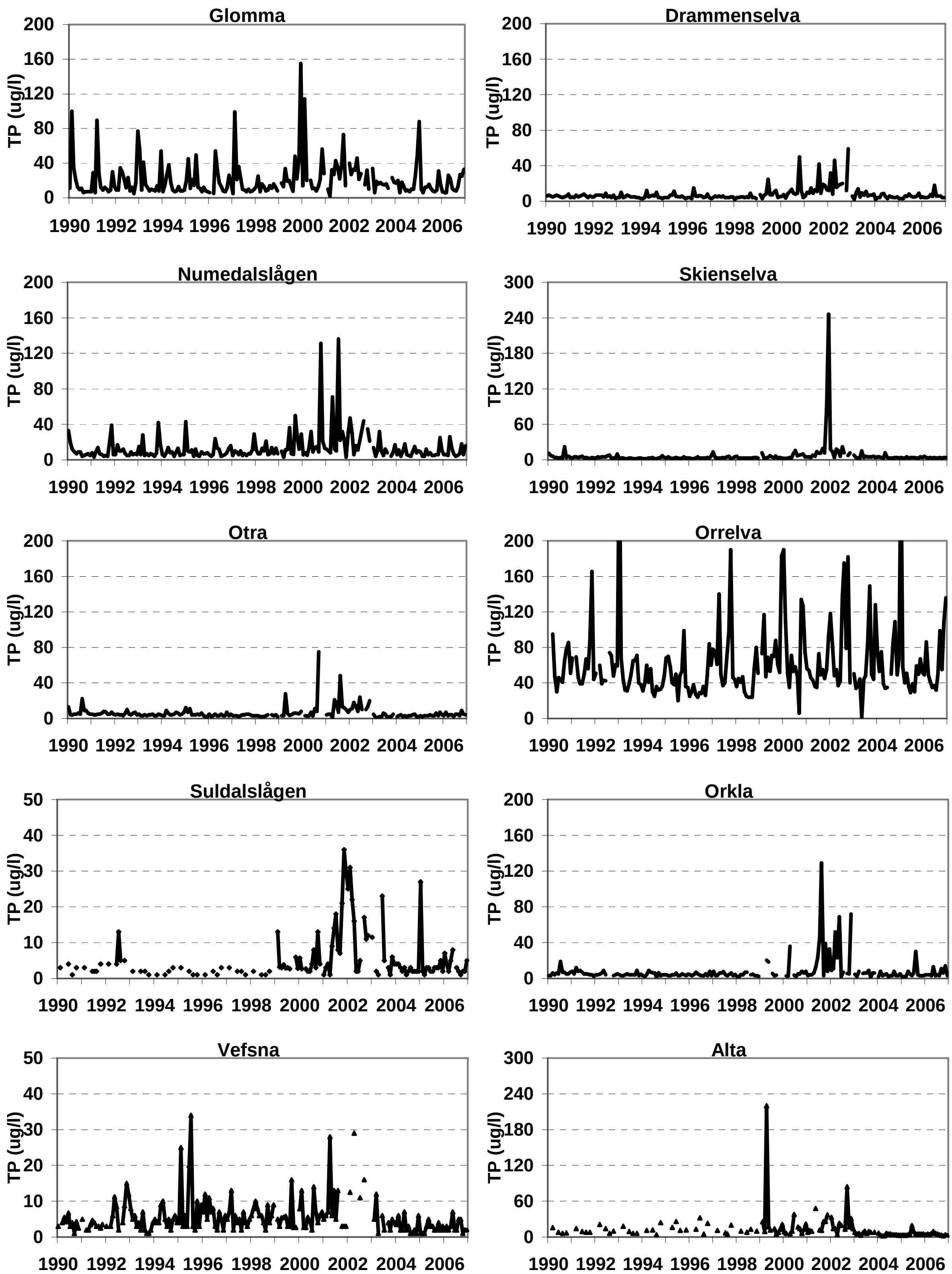

Figure 36. Monthly <u>total phosphorus</u> concentrations in the 10 Norwegian main rivers.

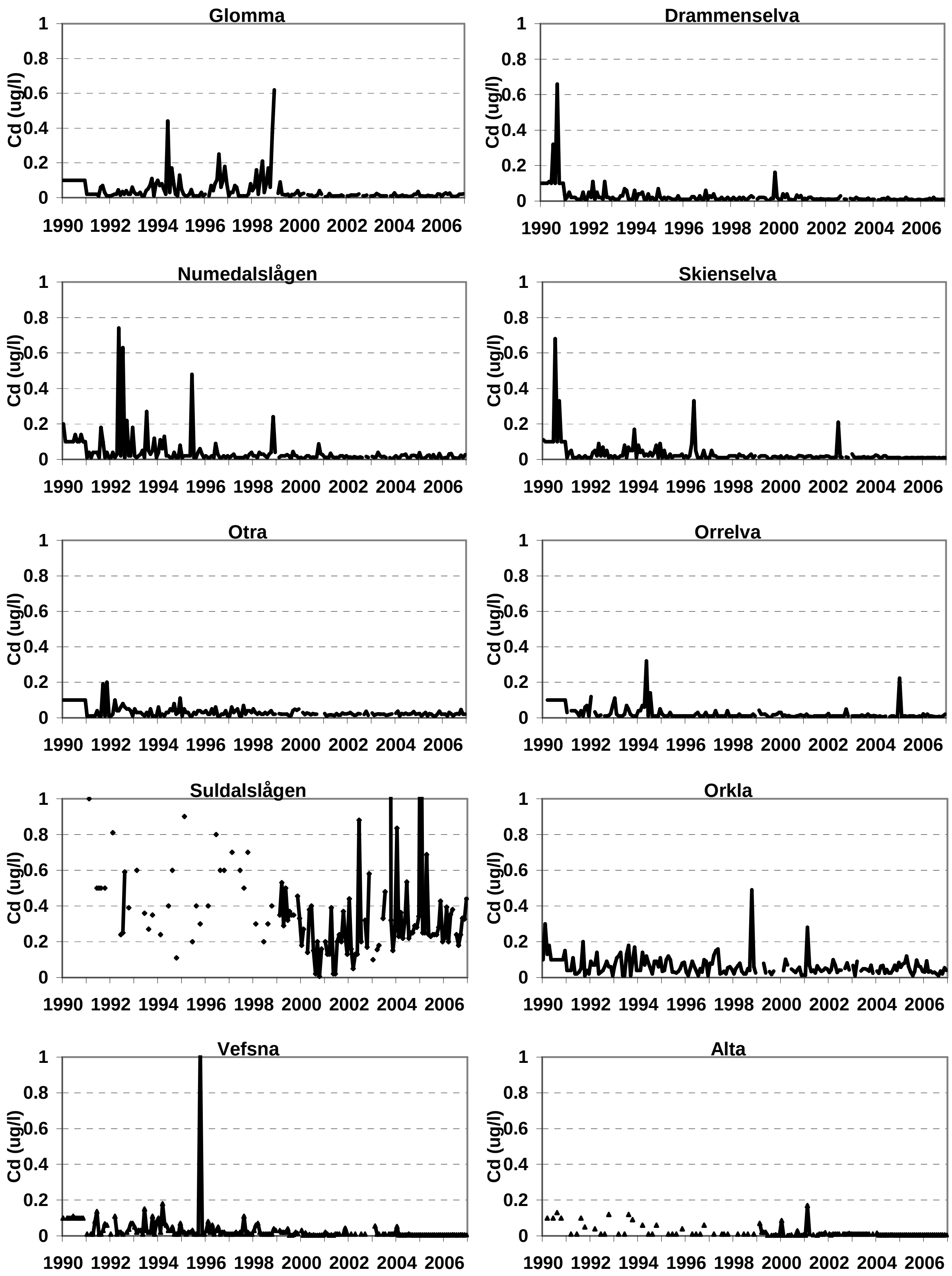

Figure 37. Monthly Cadmium *concentrations in the 10 Norwegian main rivers.*

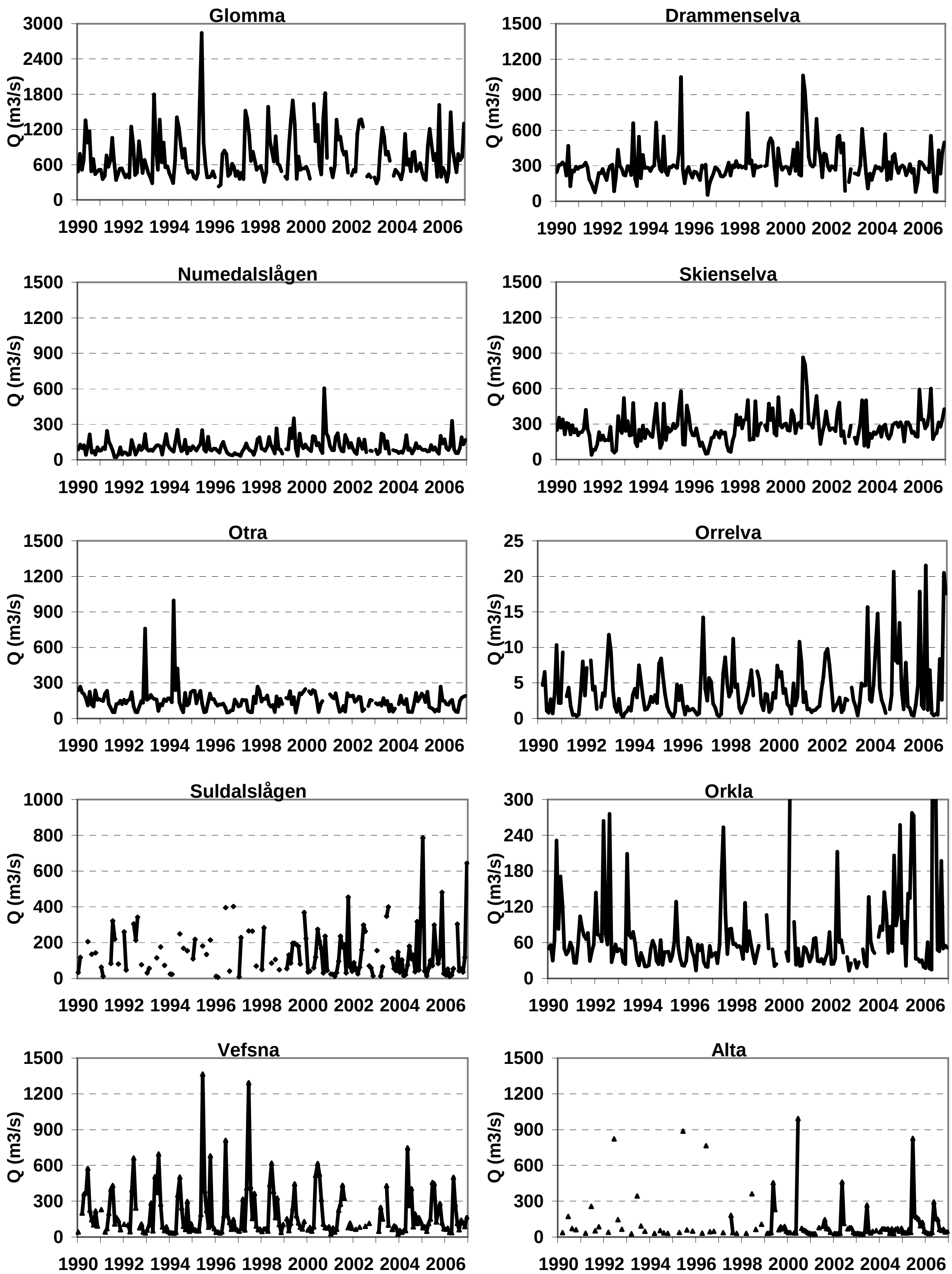

Figure 38. Waterflow at the day of water quality sampling in the ten Norwegian main rivers

7. Long-term trends in riverine loads

In this chapter, an assessment on the long-term trends in annual water discharge, riverine loads of nutrients (5 substances), particulate matter (SPM), metals (6 substances), one pesticide and PCB7, in each of the ten main rivers are presented.

All substances are covered for the period 1990-2006 except for the following:

- Arsenic was not monitored in the period 1990-1993
- PCB7 was not monitored in the period 1999-2003

Data on annual loads was taken from the Norwegian reporting to OSPAR and are thus regarded as the 'official' figures.

Daily water discharge was downloaded from the HYDRA2-database (NVE) and aggregated to annual water discharge at each sampling site. This was done because unrealistic reported 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 of re-calculations from the raw-data. It should also be noted that the water discharge data was spatially scaled to fit to the upstream area of the site for water quality monitoring since water discharge sites not necessarily correspond exactly to the location of the water quality site (cf. Section 4.4).

The assessment of nutrients, SPM and copper was performed by comparing the estimated load with the flow-normalised loads. A trend line given as a smoother is also given. Furthermore, this smoother was obtained by statistical cross-validation that minimise 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 <u>not</u> conducted for metals (besides Cu) given the problem with changed LOD over time and/or a large number of samples reported at the LOD level.

Complementary figures to this chapter are given in Annex III.

7.1 Water discharge

The riverine loads of nutrients and particles show a considerable interannual variability as shown in previous reporting of the Norwegian RID-programme (e.g. Borgvang et al. 2007). This is mainly due to interannual variability in runoff (Figure 39). Runoff is here derived from hydrological stations in the main rivers, adjusted to the size of the drainage area above the RID stations. As the figure shows, the water discharge can differ with a factor of two between years. In the five Skagerrak rivers, the water discharge was particularly high in the year 2000, due to heavy and long-term rainfall in autumn 2000. For the two rivers in Northern Norway, *Vefsna* and *Altaelva*, we note the highest annual water discharges in 2005. 1996 was characterised by low water discharges in all Skagerrak rivers. No obvious upward or downward trends in annual water discharge could be detected in the visual inspection of the data.

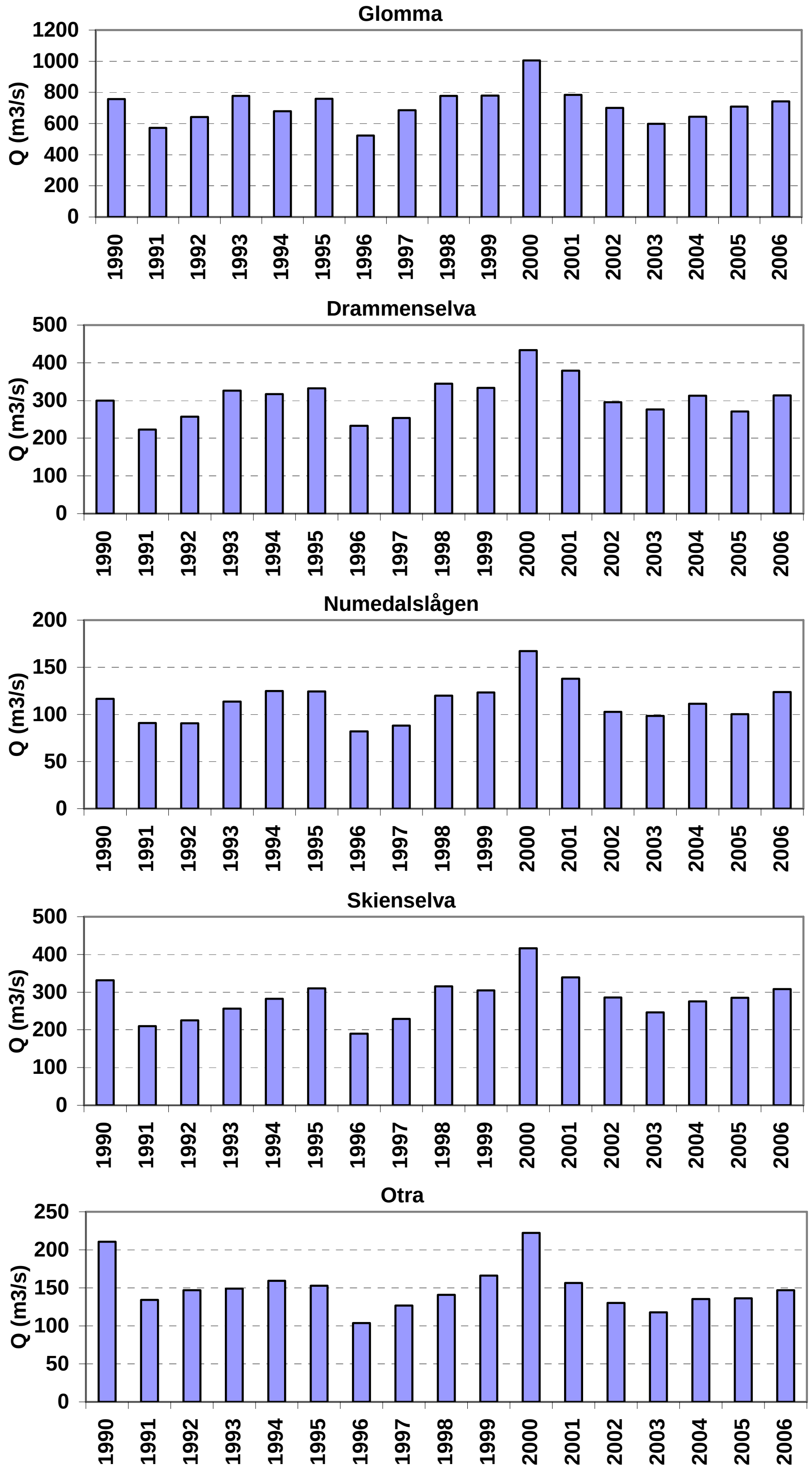

Figure 39A. Annual water discharge in 5 main rivers in Norway, 1990-2006.

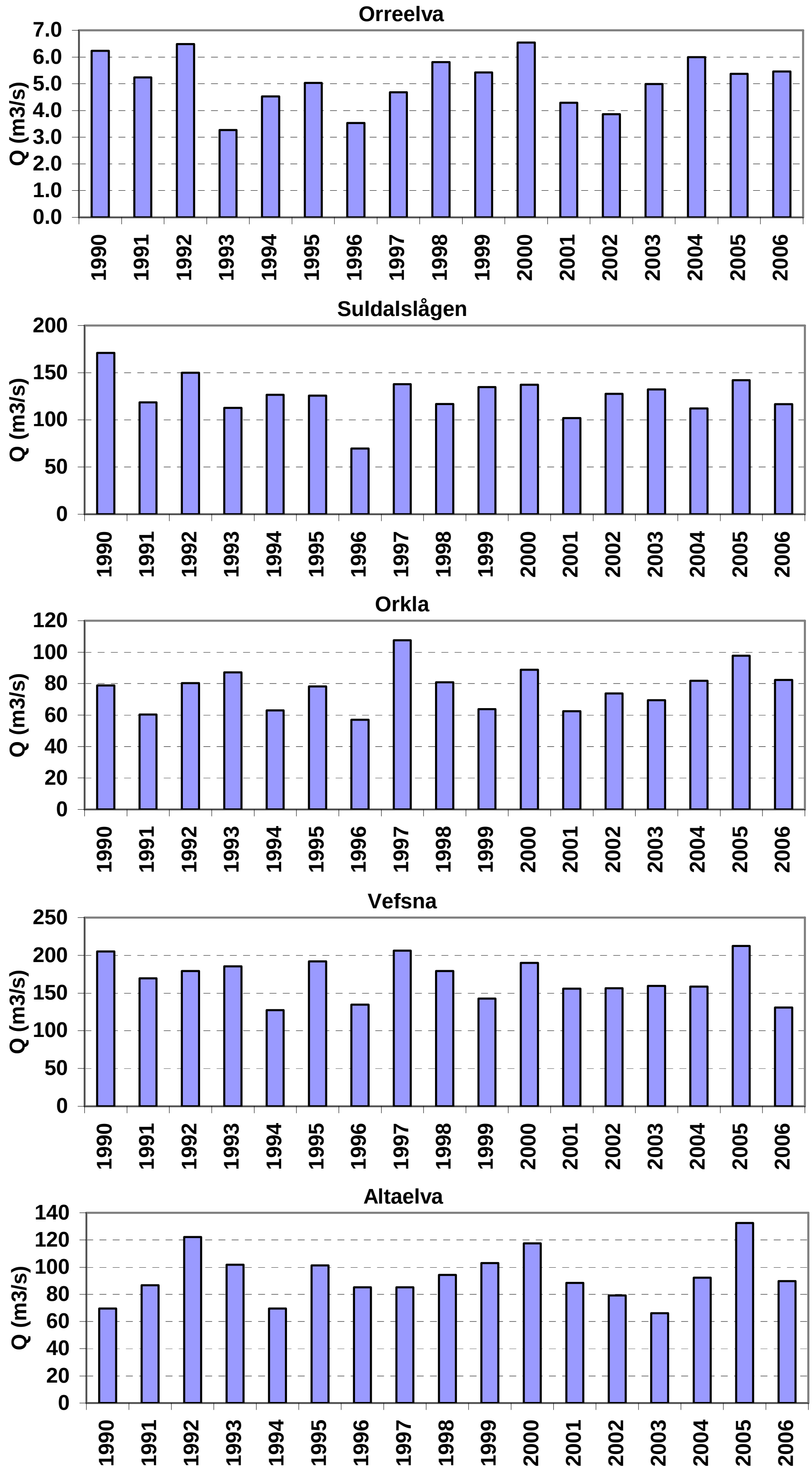

Figure 39B. Annual water discharge in 5 main rivers in Norway, 1990-2006.

7.2 Nitrogen

For all the five Skagerrak rivers the observed total nitrogen loads were particularly high in 2000 and to some extent also in 1999 (see blue bars in Figure 41). However, a substantial fraction of the interannual variation in nitrogen loads was removed when load data were flow normalised (light yellow bar in Figure 41). This could particularly be seen in years with very high or low flows. In some individual rivers, flow normalisation also partly removed signs of upward or downward trends in the estimated/observed annual riverine loads of total nitrogen (see e.g. *Otra*; Figure 41).

After flow-normalisation, a clear downward trend can be noted in *Skienselva* and *Vefsna*. This was also noted on concentrations in the formal trend analysis (cf. Chapter 6). The rather abrupt change in loads in *Vefsna* before and after 1999 was regarded as rather remarkable. In fact the same pattern was also noted for NH_4-N, Pb and Cu (Figure 40), 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 almost solely was observed at low water discharge when dilution is at a minimum. We have, however, not succeeded in finding examples of industrial or sewage treatment plants that have reduced their effluents or ceased to exist. Similarly, the downward trend in *Skienselva* may be caused by a number of different changes and measures in the watershed, but any concrete explanation has not yet been found.

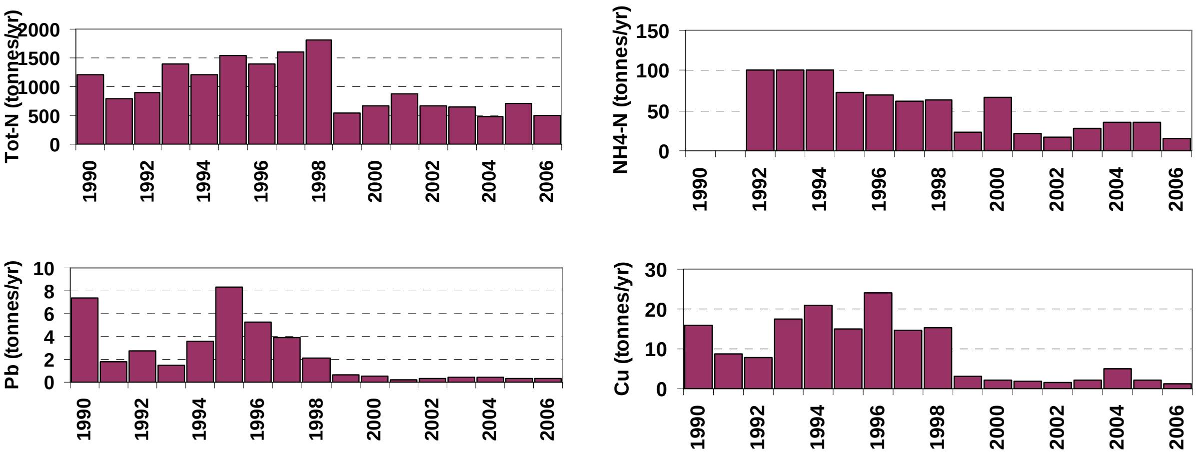

Figure 40. Annual riverine loads in Vefsna of total nitrogen, ammonium, lead and copper in 1990-2006. Bars show the upper estimates.

The upward trend in *Glomma* (trend smoother in Figure 41) was mainly due to low concentrations and hence loads during 1990-1993, (see discussion in Chapter 6), followed by high normalised loads in 2006. The high loads in *Glomma* in 2006 are illustrated in Figure 42. More precisely, we can note that the spring-flow concentrations in 2006 (observations on May 8, 22 and 29) were generally higher than the corresponding ones in 2005 (May 30 - June 27). In addition, there was a high flow-peak in autumn 2005 (November 7) with relatively low concentrations. Consequently, the flow-weighted concentrations in 2006 become much higher compared to 2005 which in turn influences the annual load estimates. This is a clear example of a situation where the RID-method for load calculation is unfortunate, as this method puts too much weight on the water discharge at the sampling date.

Noteworthy was also the relatively low flow-normalised nitrogen loads in 2001 in all five Skagerrak rivers (Figure 41). 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 river transportation in 2001.

The observed and flow-normalised nitrogen loads were slightly higher in 2006 than in 2005 in four of the five Skagerrak rivers and in *Orreelva* (North Sea) (Figure 41).

The somewhat peculiar 'trend' in *Orreelva,* with elevated loads for both total nitrogen and nitrate-N in the period 2004-2006, was examined in more detail. The scatter-plot of all observed total-N concentrations vs. the water discharge at the day of sampling showed that there has been an increased occurrence of high water discharge events in the period 2004-2006 combined with high or relatively high nitrogen concentrations. In fact, of the 14 highest water discharge event (>17 m^3/s), as many as five occurred during the years 2004-2006. Moreover, it can be observed that three of these observations occurred in 2006 alone. As already noted above, the RID-method for load calculation give high 'weight' on observations with high water discharge which imply 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 increase dis-proportionally to the river basin/catchment size, especially where agricultural sources are dominant. Therefore it cannot be ruled out that the high loads in recent years are pure coincidental, i.e. that sampling by chance has been done during high flows. The daily records of water flow in *Orreelva* might suggest that the number of high-flows shows an increased occurrence during the last 3-4 year period (Figure 44). However, a more detailed accounting of the number of floods over time was not performed in this analysis. It should be pointed out that also phosphorus showed elevated loads, especially orthophosphate, in the years 2004-2006 (Figure 45). The similar pattern for nitrogen (nitrate-N) and orthophosphate in *Orreelva* (see Annex III; Figure III.1 and Figure III.3) indicates either a pure hydrological phenomena, or hydrology in combination with sudden changes in emissions from agricultural sources (e.g., increased tillage, crop-failures etc). No detailed statistics on agricultural management practices were easily available for our study, but this issue is worth considering in next year's reporting.

The similar phenomena as discussed above for *Orreelva* might also explain the high nitrogen loads in both 2005 and 2006 in *Suldalslågen* (Figure 41). *Suldalslågen* is, however, heavily regulated for hydropower purposes, with transfer of river water to adjacent river basins, and the water discharge has therefore been modelled in this river since 2004. Explaning trends in the River *Suldalslågen* is therefore not a straight-forward exercise.

Changes in NH_4-N loads is shown in Annex III Figure III.2. These results are not further commented given that the ammonium loads in most rivers only account for 1-5% of the total nitrogen loads. In addition, NH_4-N is normally quickly transferred to nitrate-N in river waters (via nitrification processes) and thus a less suitable parameter for long-term trend assessments.

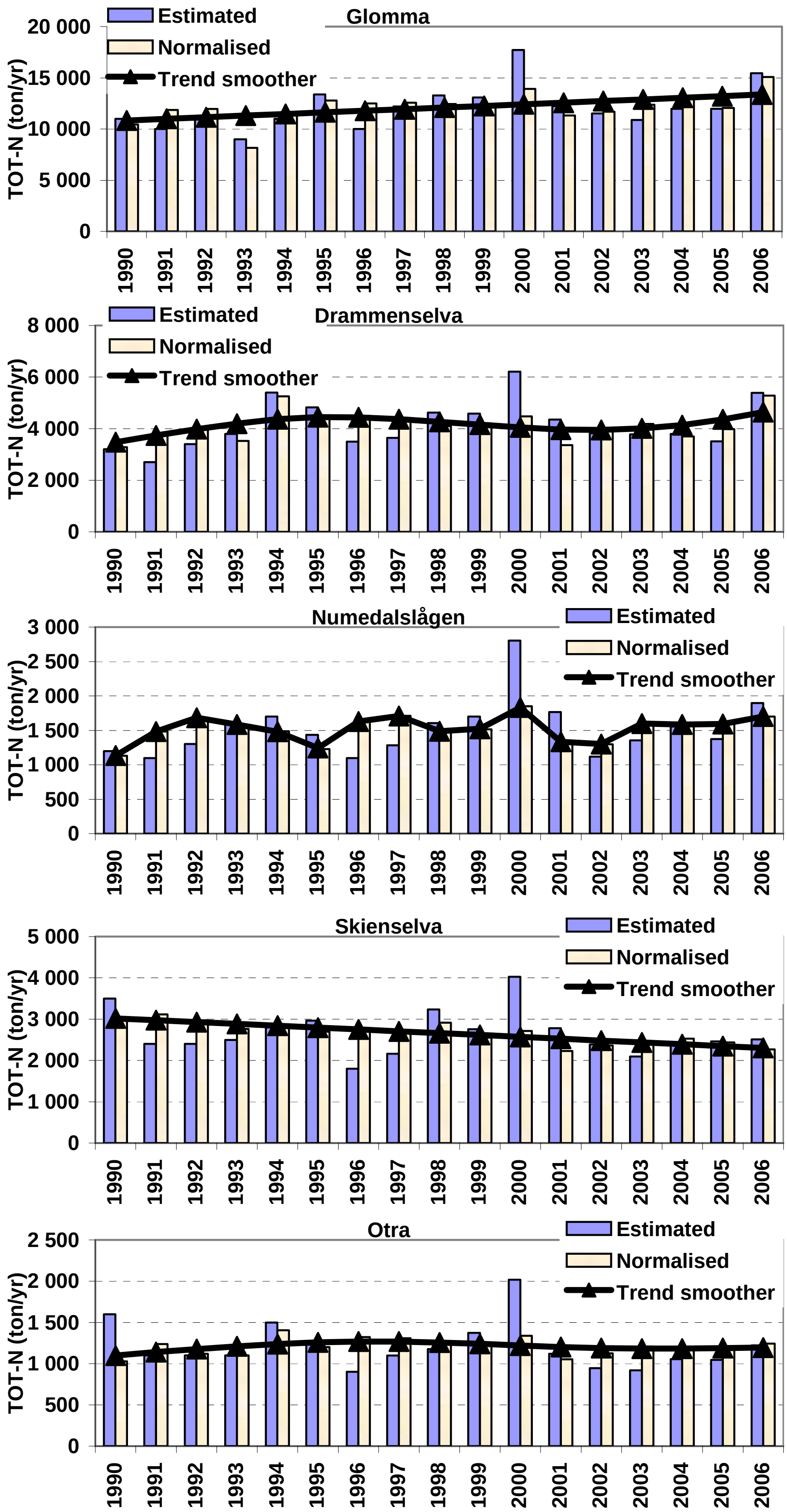

Figure 41A. Estimated, flow-normalised and trend line for annual riverine loads of <u>total nitrogen</u> in 5 main rivers in Norway, 1990-2006.

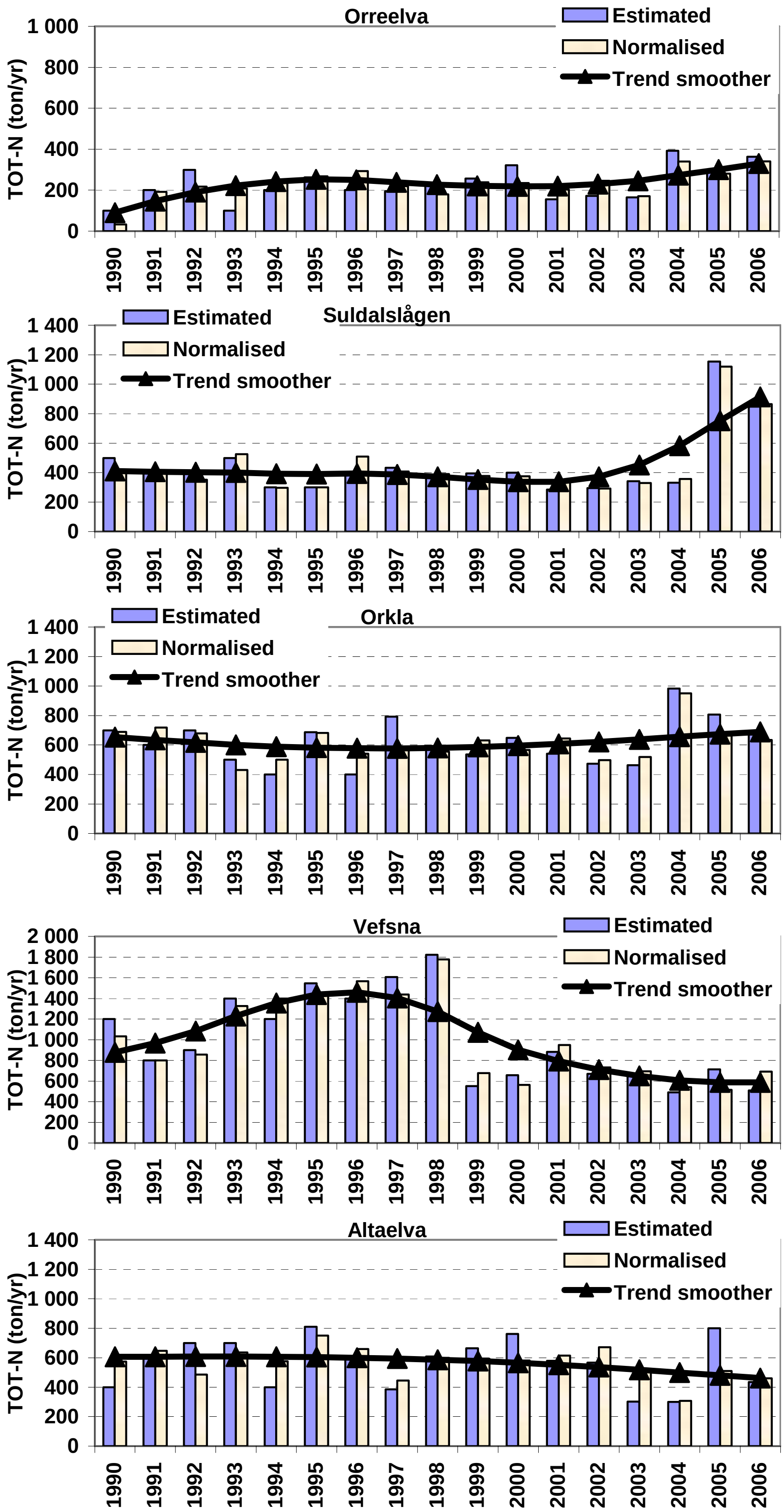

Figure 41B. Estimated, flow-normalised and trend line for annual riverine loads of <u>total nitrogen</u> in 5 main rivers in Norway, 1990-2006.

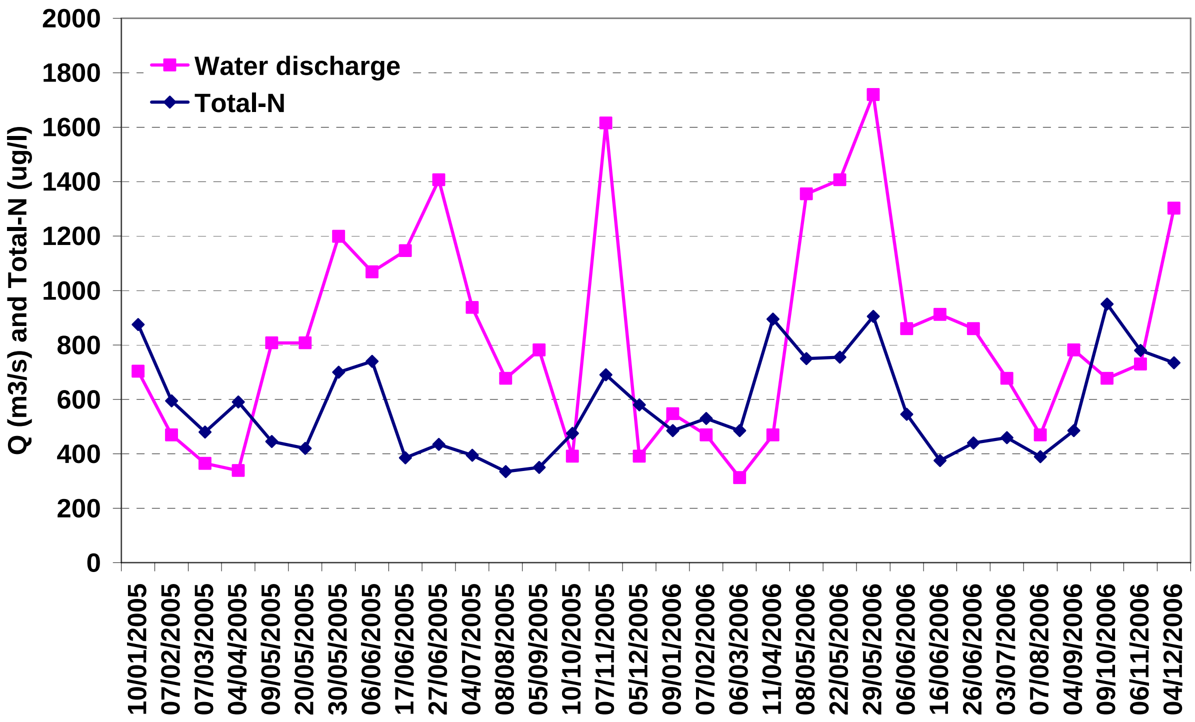

Figure 42. Total nitrogen concentrations and water discharge (at the day of water quality sampling) in Glomma in 2005-2006.

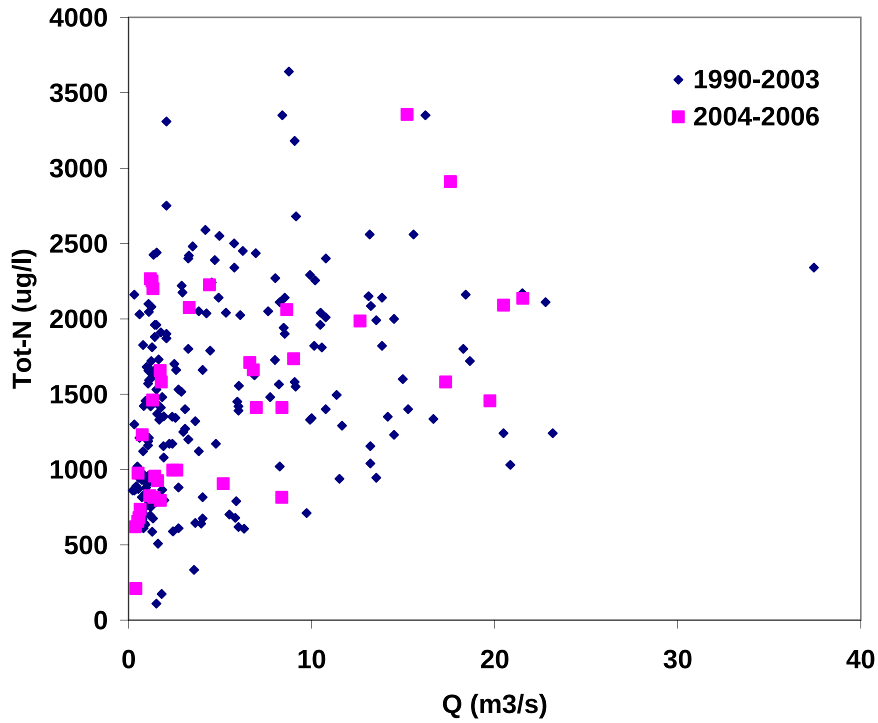

Figure 43. Scatterplot of the relationships between total nitrogen concentrations and water discharge (at the day of water quality sampling) in Orreelva.

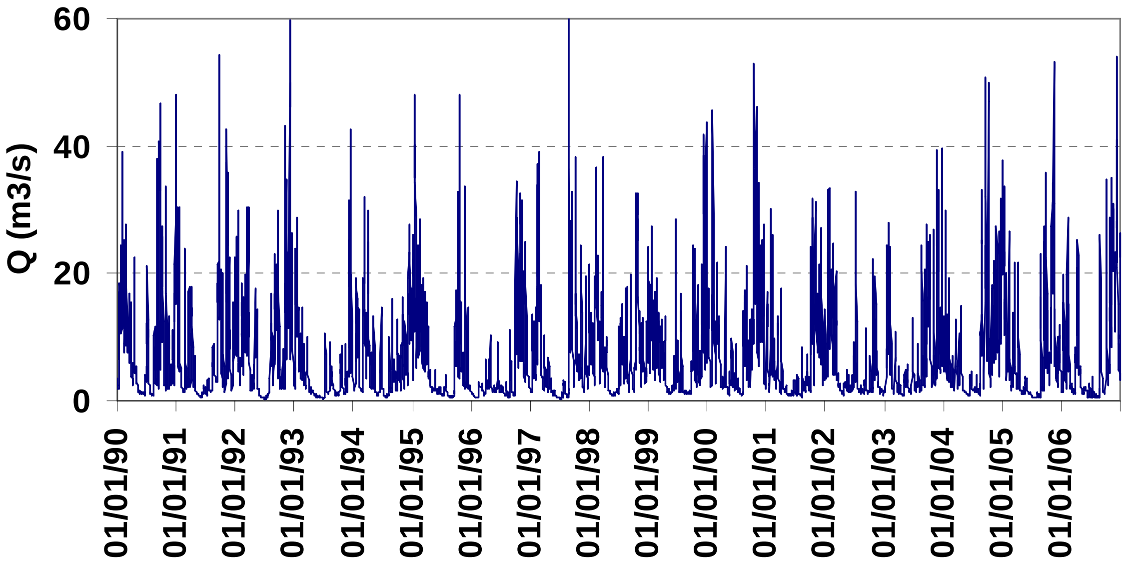

Figure 44. Daily water discharge in Orreelva (Haugland) 1990-2006. Data from NVE.

7.3 Phosphorus

The total phosphorus loads show a general large interannual variability which in a majority of the ten rivers varied with a factor six or more (e.g., *Numedalslågen*, *Skienselva*, *Otra*, *Suldalslågen*, *Vefsna* and *Altaelva*; blue bars in Figure 45). Another common feature in almost all rivers was that the flow-normalisation did not remove all the interannual variations (light yellow bars in Figure 45). After flow-normalisation, there were still high loads particularly accentuated in the five Skagerrak rivers in the period 1999-2002. As discussed in Chapter 6 on trends in concentrations, 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.

When comparing the phosphorus loads in 2006 with 2005 it should be noted that there were only marginal differences in loads (especially in relation to variations in years before 2005) after flow-normalisation in a majority of the rivers (Figure 45). The only exception is the huge phosphorus load in *Suldalslågen* in 2005. In a 15-year perspective the loads in 2006 have been fairly normal in all rivers, except for *Orreelva* which in fact show high annual loads all the three last years (2004-2006), the same phenomena as noted for nitrogen; see discussion in the previous section.

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 December–value 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 reported 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 and erosion.

Orthophosphate (PO_4-P) did not show the same temporal pattern as for total phosphorus (Annex III Figure III.3). A downward trend may be detected in loads after year 2000 in the three northernmost basins. However, PO_4-P concentrations are in most sampling occasions 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. His implies that interpretation of PO_4-P trends should be made with great caution.

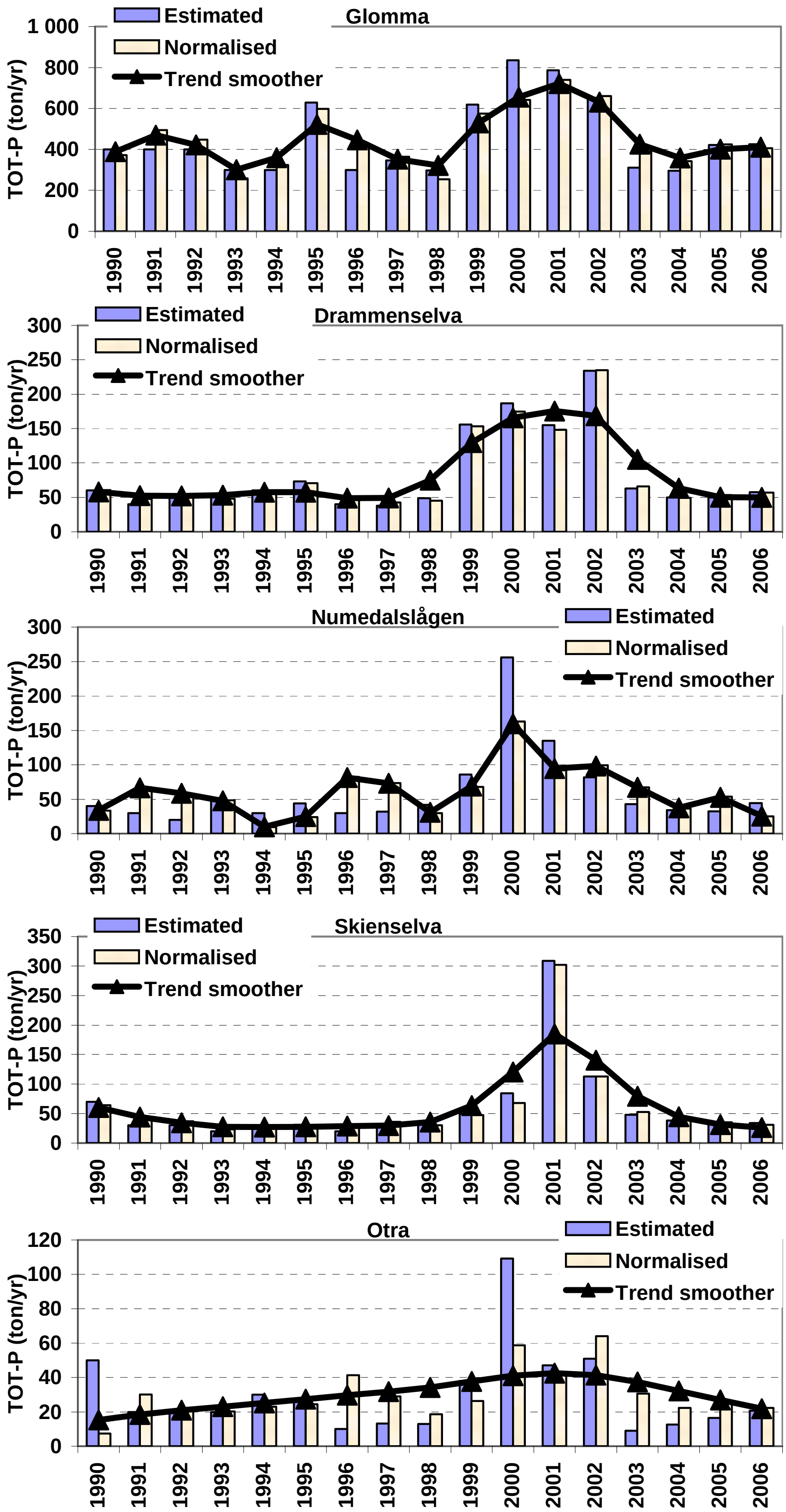

Figure 45A. Estimated, flow-normalised and trend line for annual riverine loads of <u>total phosphorus</u> in 5 main rivers in Norway, 1990-2006.

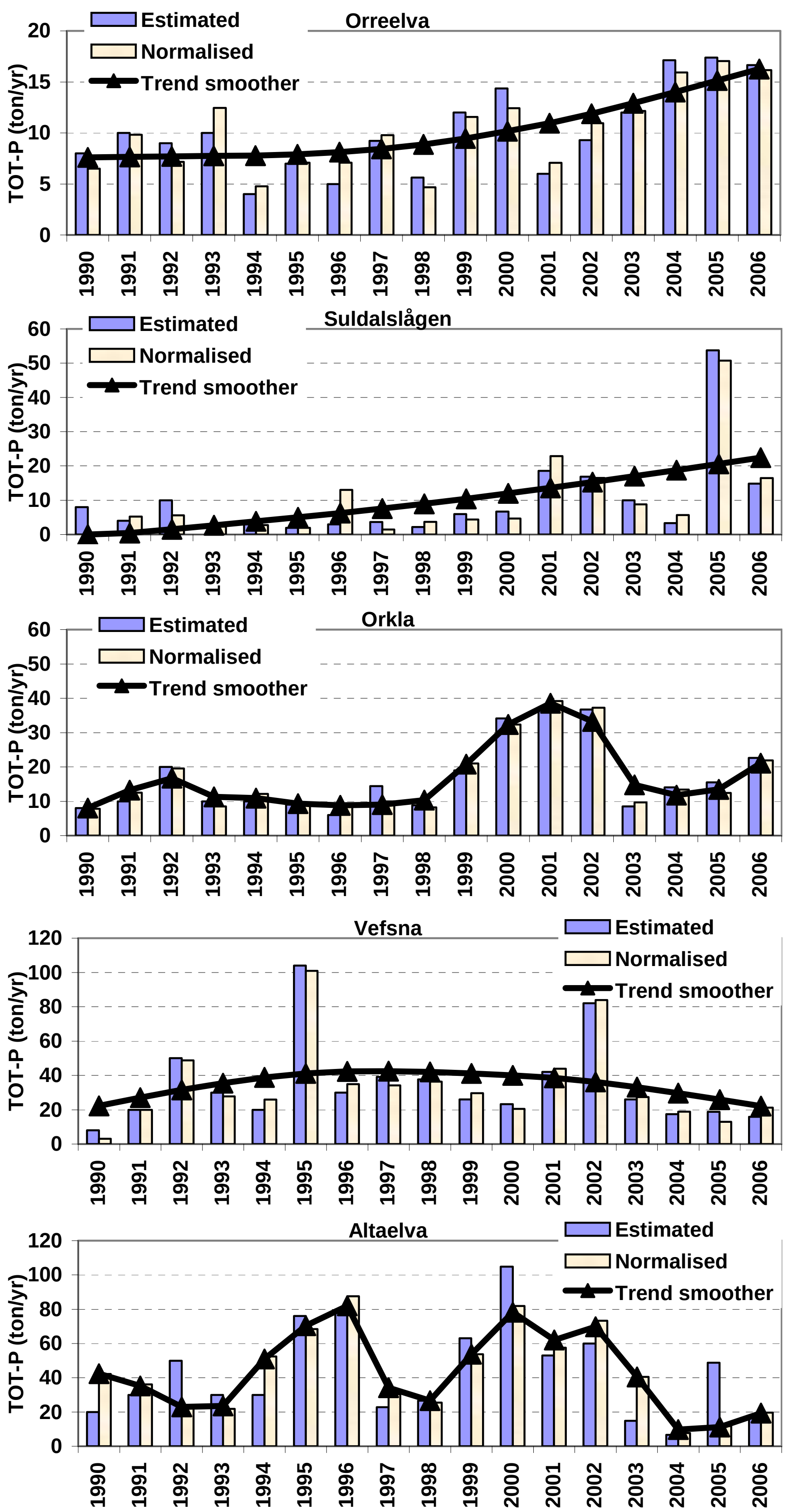

Figure 45B. Estimated, flow-normalised and trend line for annual riverine loads of <u>total phosphorus</u> in 5 main rivers in Norway, 1990-2006.

7.4 Particulate matter

Similar as for total phosphorus, there has been a major interannual variability of suspended particulate matter (SPM) (Figure 46). 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 (Figure 47). This might indicate that the sampling method (regular monthly sampling) might underestimate the true loads as well as the un-predictability in the estimation of event-based substances like suspended particulate matter. The difference in load-discharge relationships also illustrates another feature in SPM loads, namely that different rivers might exhibit different relationships.

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

In *Glomma*, the high loads in 1995 are explained by high water discharge during an extremely high flood in spring 1995. As a consequence, 135 km^2 of newly plowed soils were flooded. During the last part of this flooding (in June 1995), daily water quality samples was collected. As seen from Figure 48 (upper panel) there were high SPM-concentrations in this period. The large variability in SPM-concentrations (range from 20 to 65 mg/l) when water discharge was at the peak (3200-3700 m^3/s), implies that an ordinary sampling strategy (6 samples is normally taken during the May-June period) might miss concentration peaks. This, in turn, may significantly affect the annual load estimate.

Annual SPM loads as high as in 1995 were also registered in 1992 (Figure 46). As opposed to the 1995 case, this high load was explained by only one high SPM concentration of 155 mg/l on December 3, 1992 (Figure 48; lower panel). This observation has not been defined as an outlier since also other substances (both metals and nutrients) showed elevated concentrations on this date.

Other examples of deviations in single years (Figure 46) were:

- In *Otra* there were high particle loads in the years 1994 and 1995. This is due to single high particle concentrations in the end of 1994 and the beginning of 1995, despite normal water discharges.
- In *Orreelva* and *Suldalslågen* the high SPM load in 2005 can in both rivers be explained by high SPM concentrations of 152 mg/l and 19 mg/l respectively, during a winter flood in January.
- In *Vefsna*, the high load in 1995 is explained by a huge flood in June, with water discharge as high as 1250 m^3/s combined with high particle concentrations (see the discussion on the *Glomma* flood in 1995, above).
- *Altaelva* shows an extremely irregular pattern in loads between the years. This is due to generally low concentrations (around 0.5 mg/l) or at LoD at most sampling occasions within one single year, combined with elevated concentrations during high discharges in some years. It is likely that the water quality sampling might have missed some of the peak concentration certain years. In addition, the sampling frequency was only 5 times per year during 1990-1998. *Alta* is also heavily regulated for hydropower purposes, which can help explain the low particle concentrations during low flows.

In summary, both the observed and flow-normalised particle loads in 2006 showed both somewhat higher and lower loads compared to in 2005 (Figure 46). But overall, in a 17-year perspective, the loads of suspended particulate matter in 2006 were relatively normal in all the rivers.

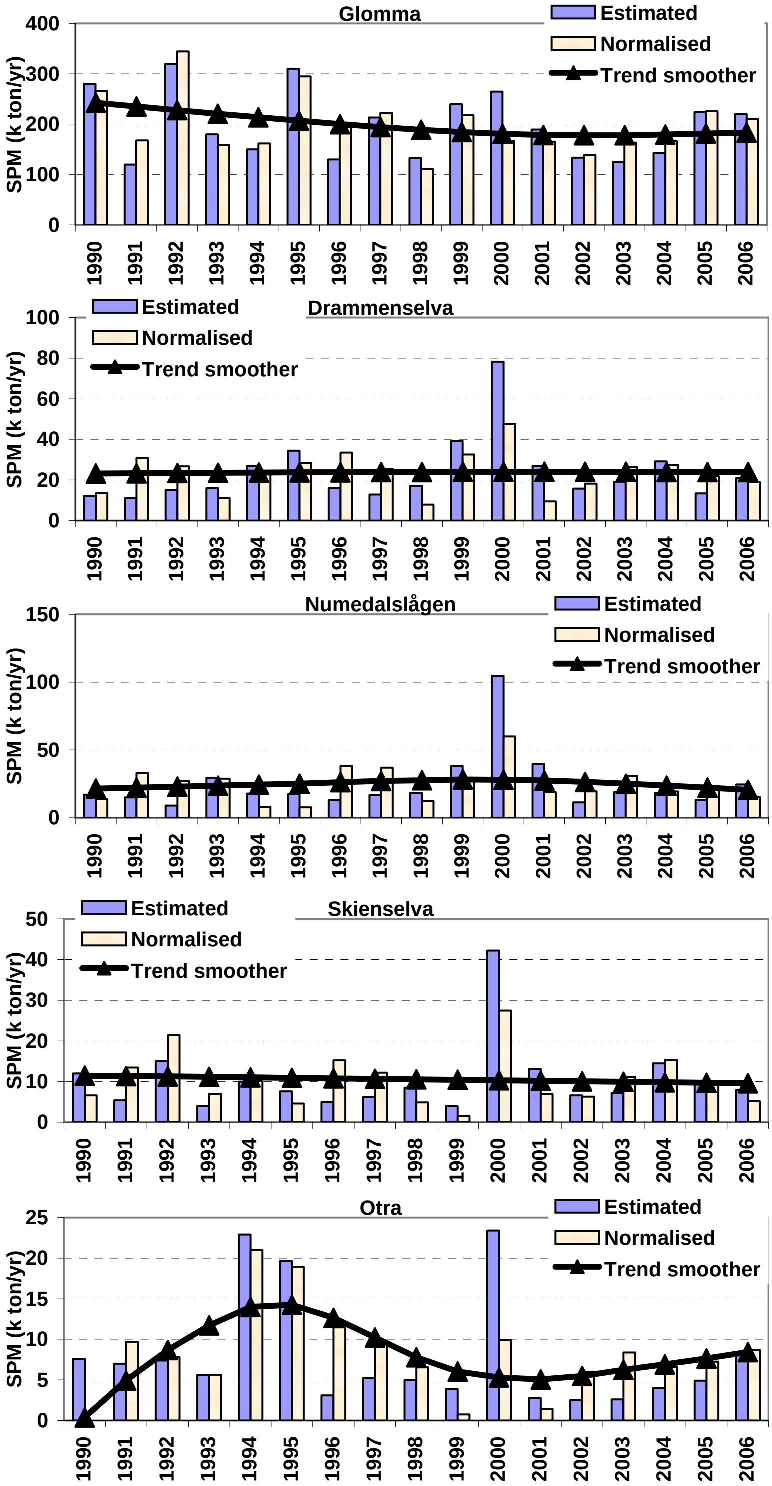

Figure 46A. Estimated, flow-normalised and trend line for annual riverine loads of <u>suspended particulate matter</u> in 5 main rivers in Norway, 1990-2006.

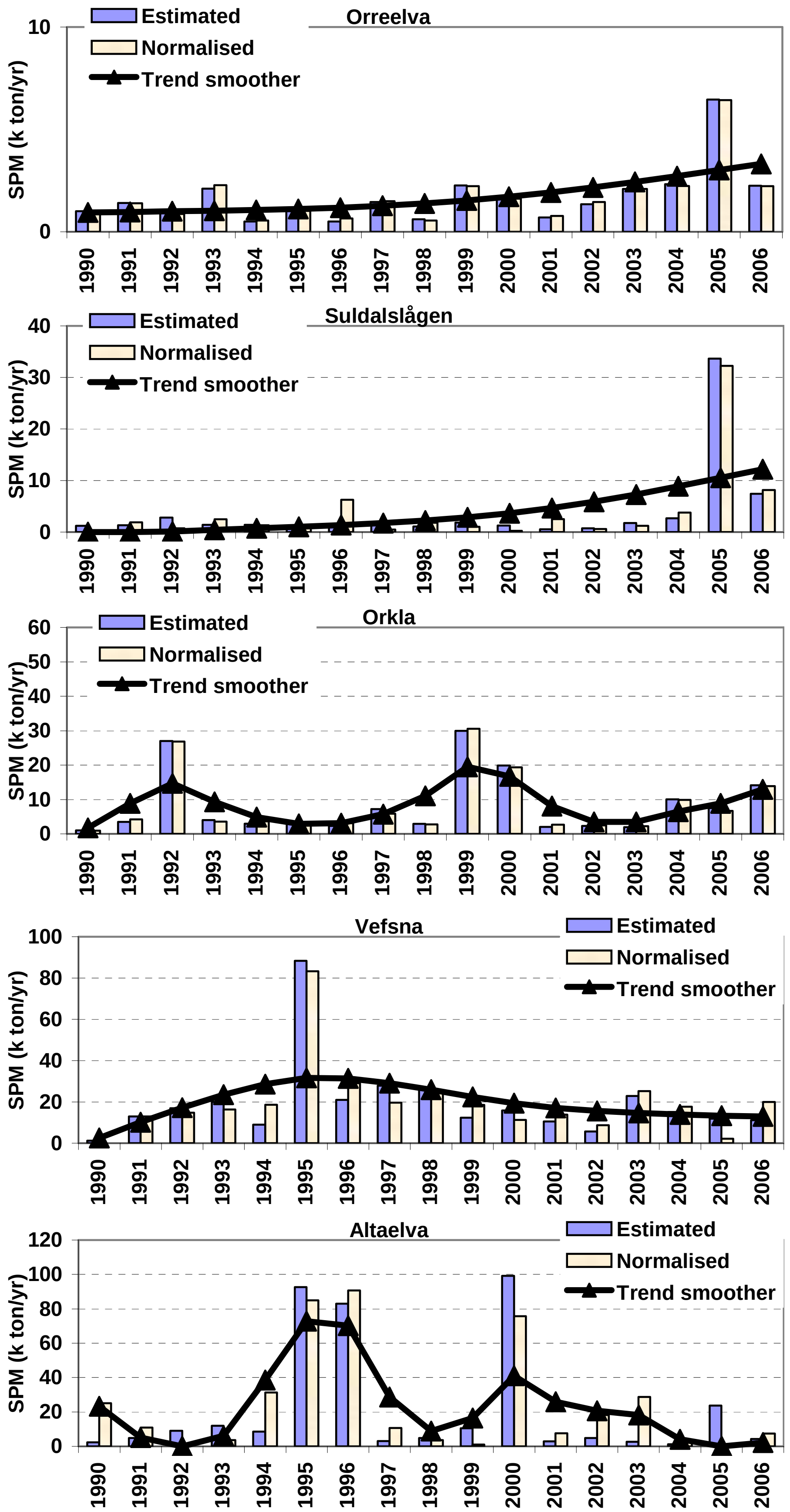

Figure 46B. Estimated, flow-normalised and trend line for annual riverine loads of <u>*suspended particulate matter*</u> *in 5 main rivers in Norway, 1990-2006.*

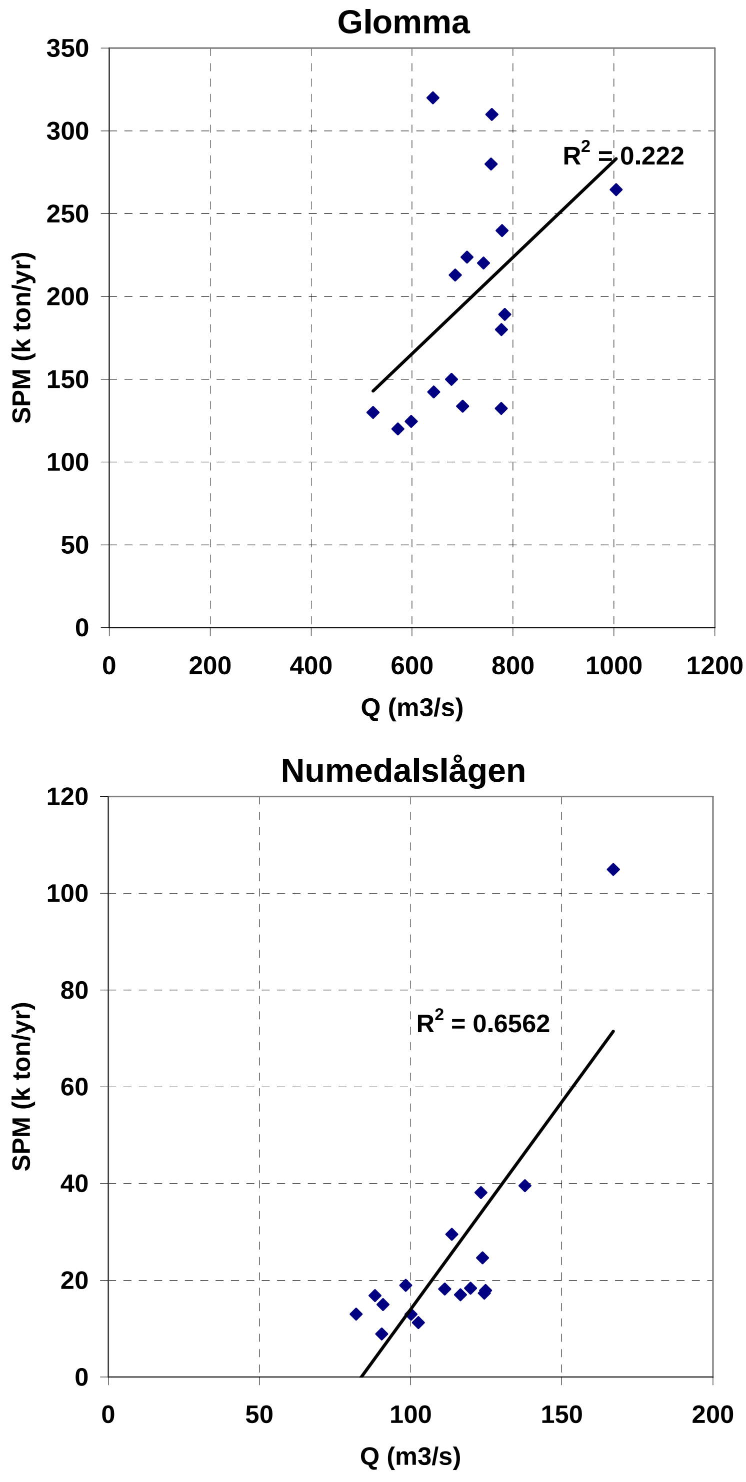

Figure 47. Scatterplot of the relationship between annual load of suspended particulate matter and annual water discharge in Glomma (upper panel) and Numedalslågen (lower panel).

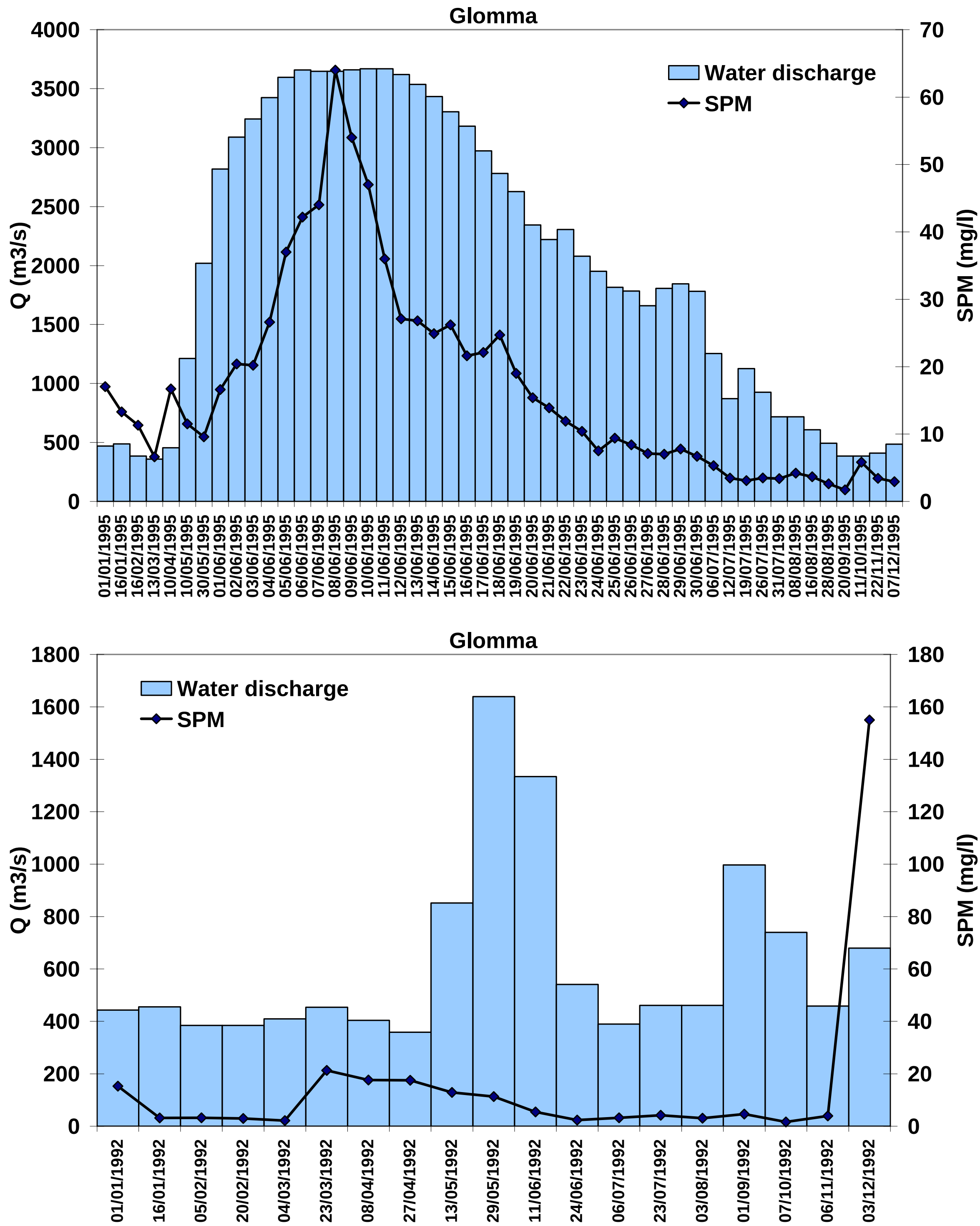

Figure 48. Suspended particulate matter (solid line) and water discharge (at the date of sampling; blue bars) in 1995 (upper panel) and 1992 (lower panel). Note that the time-steps between the observations vary.

7.5 Metals

In this section the annual riverine loads of six metals in 1990-2006 for the ten main rivers are assessed. The metals include:

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

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

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

As pointed out in the introduction to this Chapter, 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 III) 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 its uncertainty.

Copper (Cu)

Copper was the only metal with few LoD values and few changes in LoD over the monitoring period 1990-2006. Long-term trends have, in general, been difficult to identify in a majority of the rivers (Figure 49). However, the sharp trend-break in *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 (1999-2006) dropped down to 3-5 tonnes. The same pattern is also noted in *Vefsna* for lead (Annex III Figure III.4) and nitrogen (Figure 41). The reasons for this are 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 (Figure 49). 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.

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 (Figure A.5 in Annex II). 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 (Figure A.5 in Annex II). The high load in *Otra* in 1990 is explained by one single sample with high concentration (6 µg/l) in combination with several observations around or above 1 µg/l).

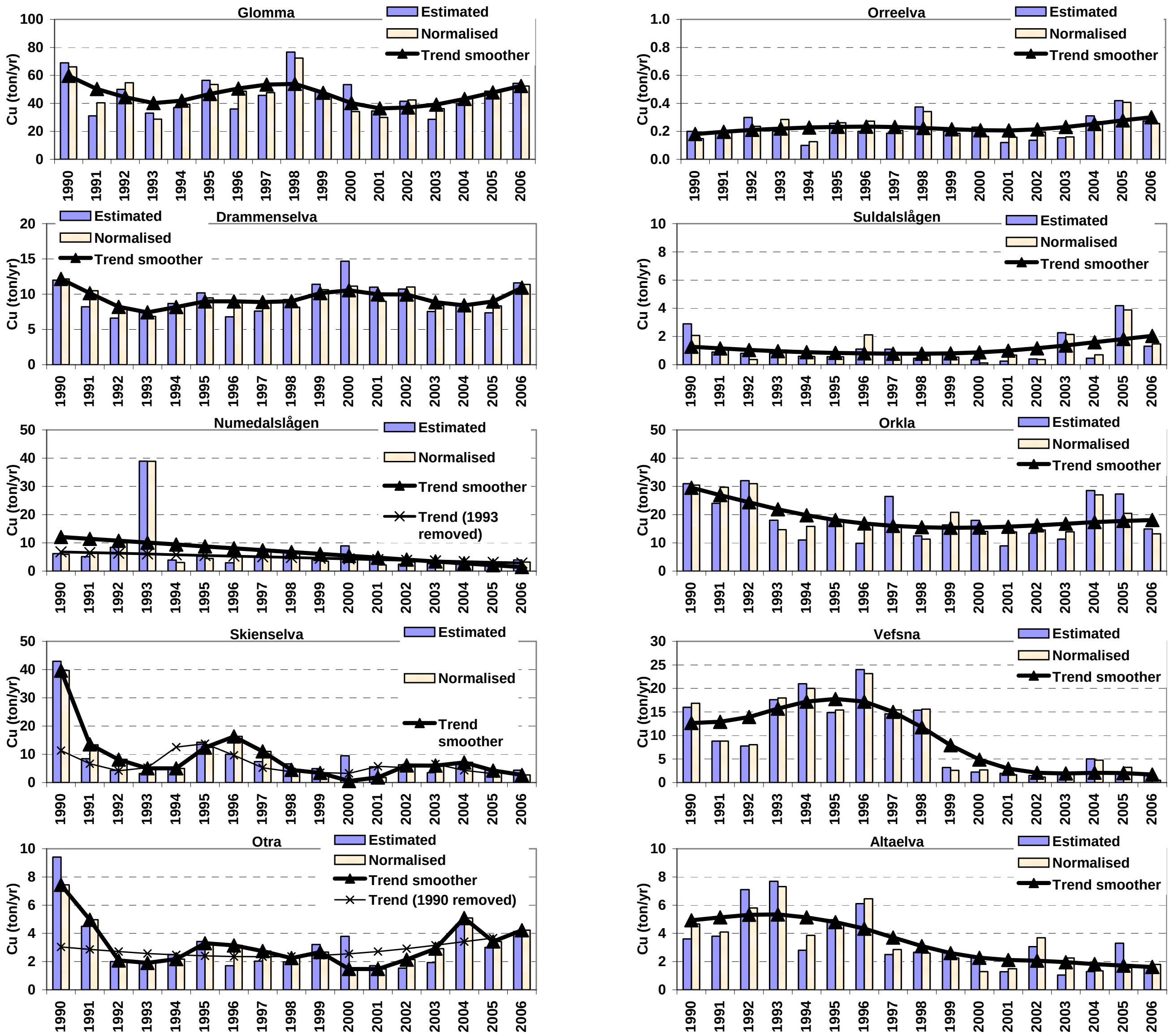

Figure 49. Estimated, flow-normalised and trend line for annual riverine loads of Copper in the 10 main rivers in Norway, 1990-2006.

Lead (Pb)

The interannual variability and trends of lead (Annex III Figure III.4) are mainly due to changes in LoD. Table 18 shows that the LoD for lead has changed with a factor of 100 during the monitoring period (1990-2006). This means that no reliable trend assessment of the annual loads of lead can be carried out.

Table 18. Changes in detection limits (LOD) for lead (µg/l).

Year	1990	1991	1992-1998	1999	2000	2001	2002-2003	2004-2006
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 values may have been given in wrong units.

Zink (Zn)
The zink loads showed a relative low interannual variability compared to many of the other metals (Annex III Figure III.5). No clear visible signs of long-term trends could be detected, apart from a tendency in *Orkla* of downward loads. High loads in single years were almost solely explained by high single concentration values (e.g. 1993 in *Numedalsågen*, 1990 in *Skienselva*, 2005 in *Orreelva*).

Cadmium (Cd)
More than 25% (638 out of 2379) of the total number of observations of cadmium in the ten rivers were 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 2004-2006). For this reason, no meaningful trend assessment of the annual loads is possible. The lower and upper load estimates given in Annex III Figure III.6 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% (1193 out of 2379 observations) of the total number of observations in the ten rivers were 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 are given in Annex III Figure III.7, but these should solely 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 are given in Annex III Figure III.8 and 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. The trends do, therefore, mainly reflect the changes in LOD.

The lower and upper load estimates that are given in Annex III Figure III.9 and Figure III.10 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 phenomena. More precisely, concentrations are at high levels compared to 1991 and the years after.
- 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 2004-2006 could be explained by LOD-values of 0.03-0.05 ng/l in the period 1991-1998 compared to 0.2 ng/l in the period 2004 and onwards. The higher LODs in recent years can be explained by the same reasons as given above for lindane.

8. Conclusions

In 2006, the total Norwegian inputs of nutrients, suspended solids, metals, one pesticide and PCB7s to coastal waters have been calculated as shown in Table 19. More detailed tables are given in the Data Report in Part B of this report.

Table 19. Overview of total inputs of RID parameters from mainland Norway in 2006; upper estimates[7]. In tonnes for all parameters, except PCB7 and Lindane which are given in kg.

Parameter	Skagerrak	North Sea	Norwegian Sea	Barents Sea	Total Norwegian Coastal Waters
Cadmium	1.32	0.66	0.61	0.21	2.80
Mercury	0.18	0.08	0.09	0.02	0.37
Copper	106.1	104.3	190.9	52.3	454
Zinc	322	126	129	22	599
Lead	18.9	11.2	6.788	0.95	37.9
Arsenic	13.9	6.0	6.1	2.6	28.6
Chromium	20.1	12.2	16.7	4.9	53.9
Nickel	50.3	20.5	34.2	153	258
Ammonium	5 673	13 083	21 144	1 815	41 715
Nitrate	23 731	19 091	14 729	1 540	59 091
Orthophosphate	481	2 111	3 726	296	6 613
Total Nitrogen	44 751	42 471	47 338	7 605	142 165
Total Phosphorus	1 061	3 350	5 849	558	10 819
Silicate	190	70	108	163 962	164 330
SPM	337 790	190 193	734 889	31 487	1 294 359
TOC	272 671	79 946	125 213	71 975	549 805
PCB7[8]	103.7	4.6	27.3	10.8	146
Lindane[7]	10.36	0.8	1.35	0.57	13

These 2006 inputs did not reflect any alarming changes from former years, and may, therefore, be characterised as being within normal fluctuations. This conclusion is drawn both from direct comparisons with the inputs estimated in 2005, and from comparisons based on flow normalised loads in the period 1990-2006.

The most obvious variations since 2005 include

- Increases in nutrient inputs since 2005, both from riverine and direct sources, explained partly by high water discharges in the Skagerrak area in 2006, partly by increased inputs from direct discharges;
- An increase in riverine inputs of nickel and a decrease in zinc as compared to 2005, explained by fluctuations in concentrations and water discharges in two particular rivers; namely *Pasvik* and *Orkla*.

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

In terms of long-term trends (1990-2006), the declines in riverine loads and concentrations of many metals that have been detected are mainly the result of subsequently lower detection limits. For nutrients and particulate matter, no overall conclusive trends were detected. This is believed to be partly due to fluctuations in water discharge during the sampling dates, partly to other hydro-meteorological variations.

More generally, variations from year to year in inputs from the Norwegian mainland may be explained by a number of reasons, including

- Changes in water discharge patterns from year to year and between regions and seasons;
- High stochastic temporal variation in the concentrations dynamics in rivers, which is 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.

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, of which 109 have been 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. However, and as noted in the introduction to this report, monitoring all of Norway's 247 rivers discharging to the sea will never be an option. Many Norwegian rivers also carry very low loads of pollutants, and pollutants pressures, concentrations of substances and water discharges are the main rationale behind the selection of the 46 monitored rivers. Within reasonable resources the present report therefore gives the best available estimates for 2006 inputs to the Norwegian coastal waters and OSPAR Convention waters, as well as scientifically based assessments of trends in river loads for the RID substances.

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Annexes to Part A

Annex I

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:

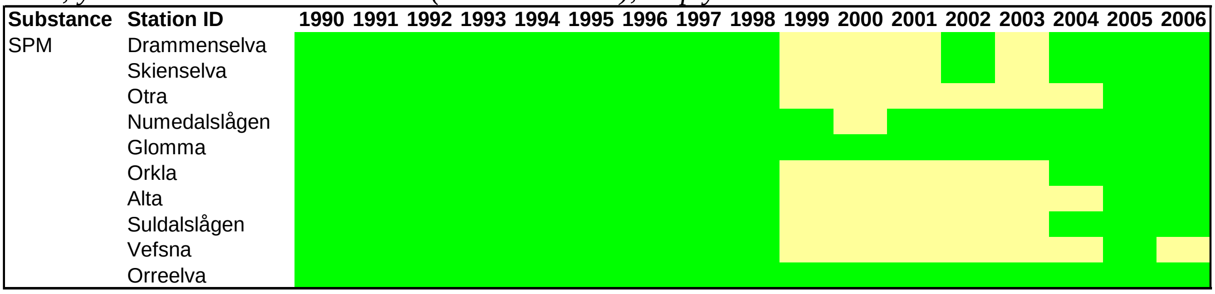
1. To assess, as accurately as possible, all riverborne and direct inputs of selected pollutants to Convention waters on an annual basis. Inputs from lakes, polders and storm overflows are to be included where information is available.
2. To contribute to the implementation of the JAMP by providing data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

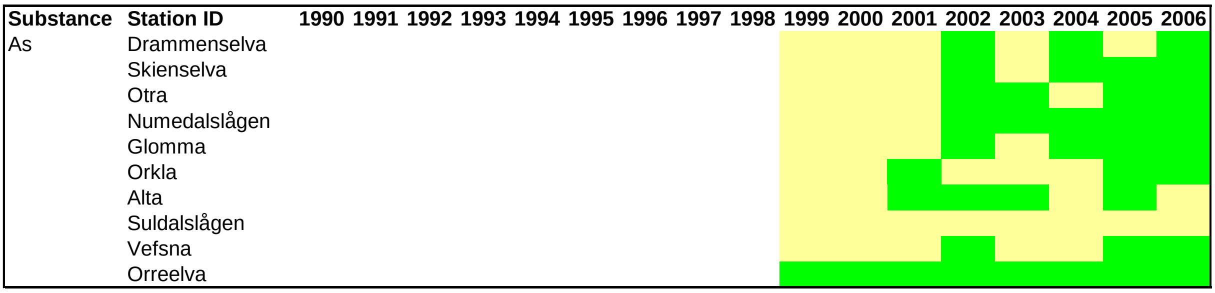
PARCOM Recommendation 88/2 stipulates that Contracting Parties should take effective national steps in order to reduce nutrient inputs into areas where these inputs are likely, directly or indirectly, to cause pollution, and to achieve a substantial reduction (of the order of 50%) in anthropogenic inputs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

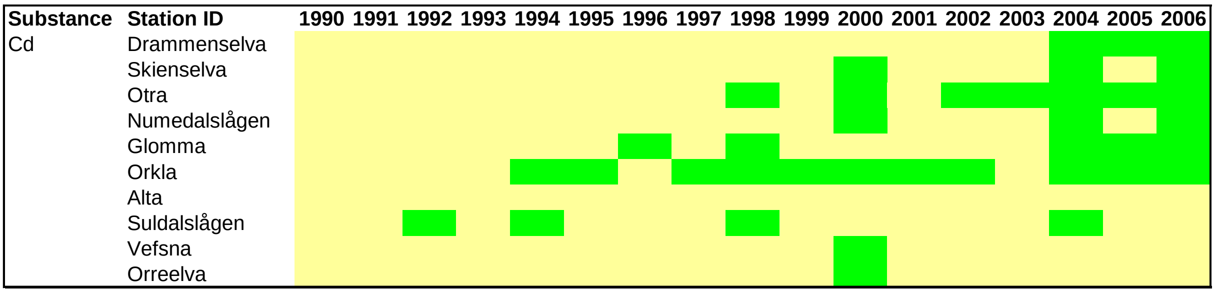
Annex II

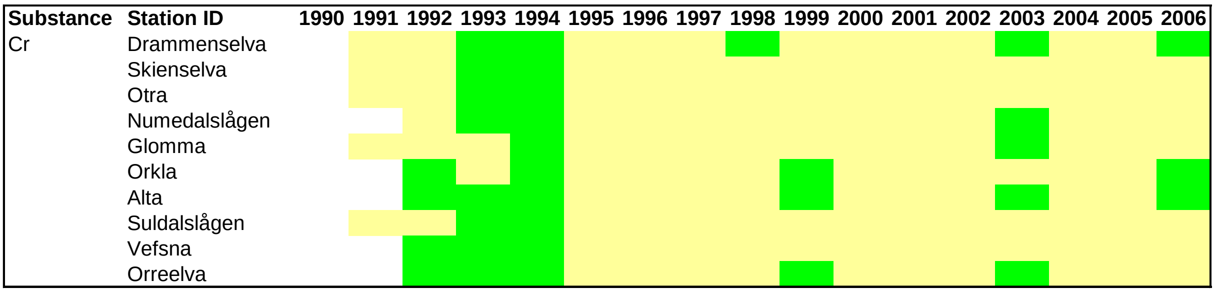
Trend analyses. Complimentary figures to chapter 6.

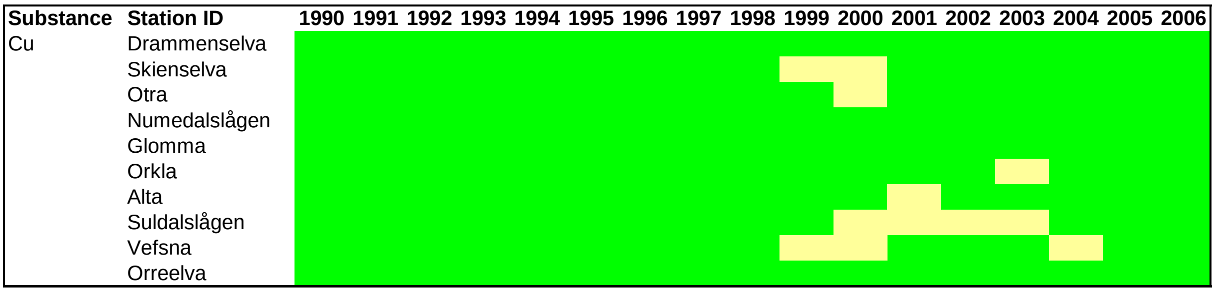
Data coverage for the substances in the Norwegian rivers 1990-2006. Green cell: Observations above LOD; yellow cell: at least one LOD (less-than-value); empty white cell: no observations











Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
HCHG	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hg	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
KOND	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
NH4-N	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Ni	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
NO3-N	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Pb	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
pH	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
PO4-P	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

Substance	Station ID	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Si	Drammenselva																	
	Skienselva																	
	Otra																	
	Numedalslågen																	
	Glomma																	
	Orkla																	
	Alta																	
	Suldalslågen																	
	Vefsna																	
	Orreelva																	

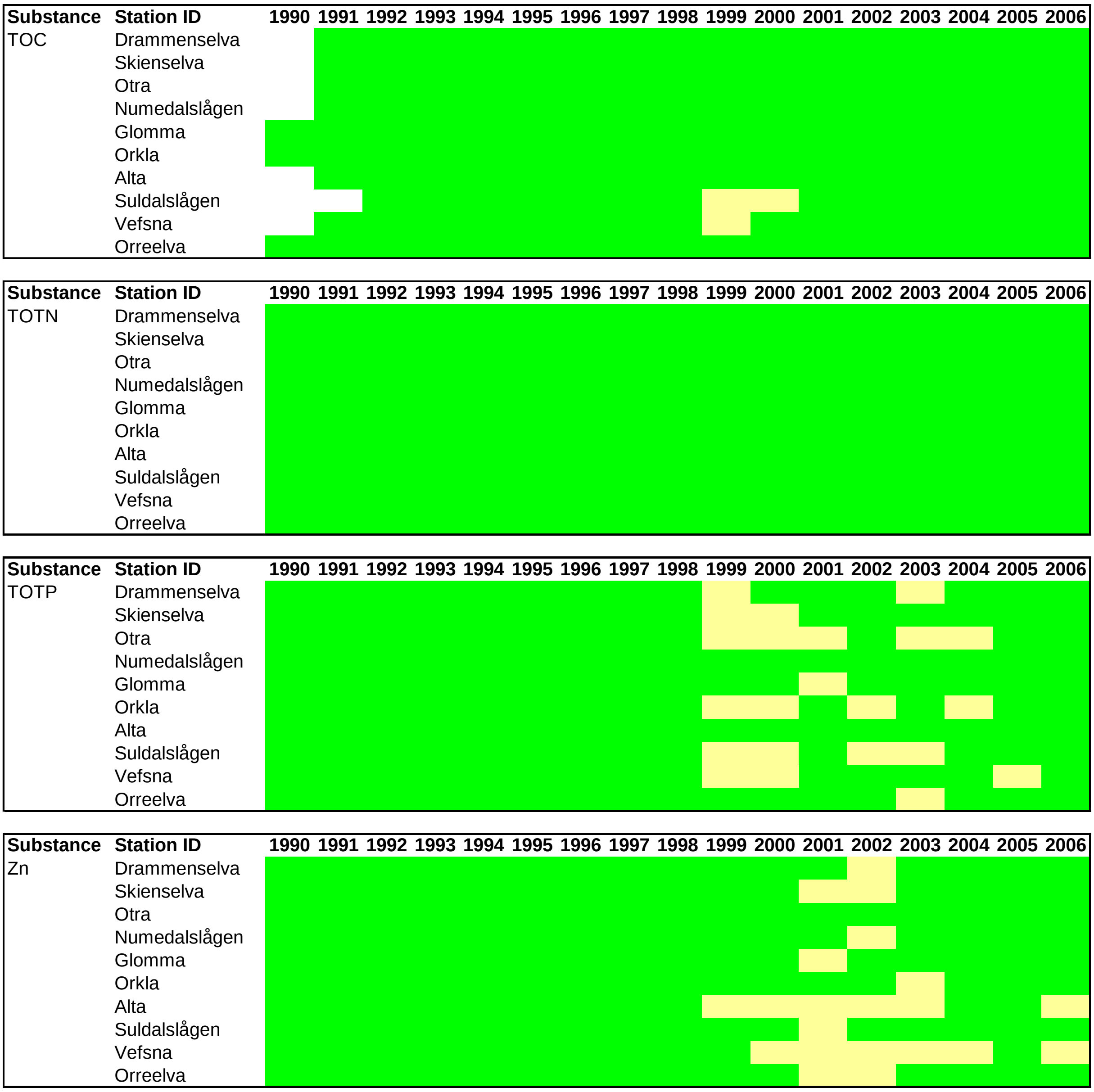


Figure II. 1. Data coverage for the substances in the Norwegian rivers 1990-2006. Green cell: Observations above LOD; yellow cell: at least one LOD (less-than-value); empty white cell: no observations

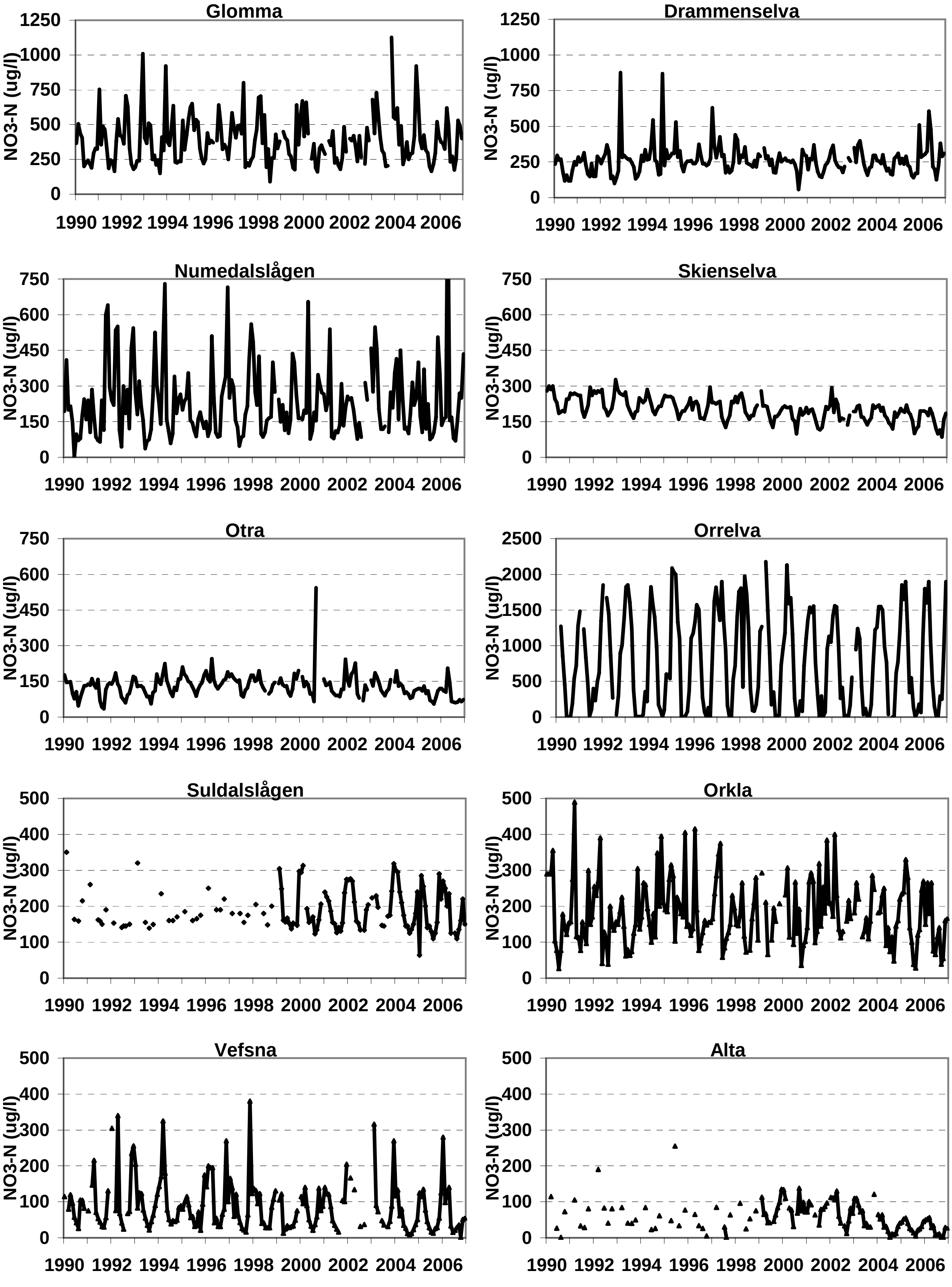


Figure II. 2. Monthly nitrate nitrogen *concentrations in the 10 Norwegian main rivers*

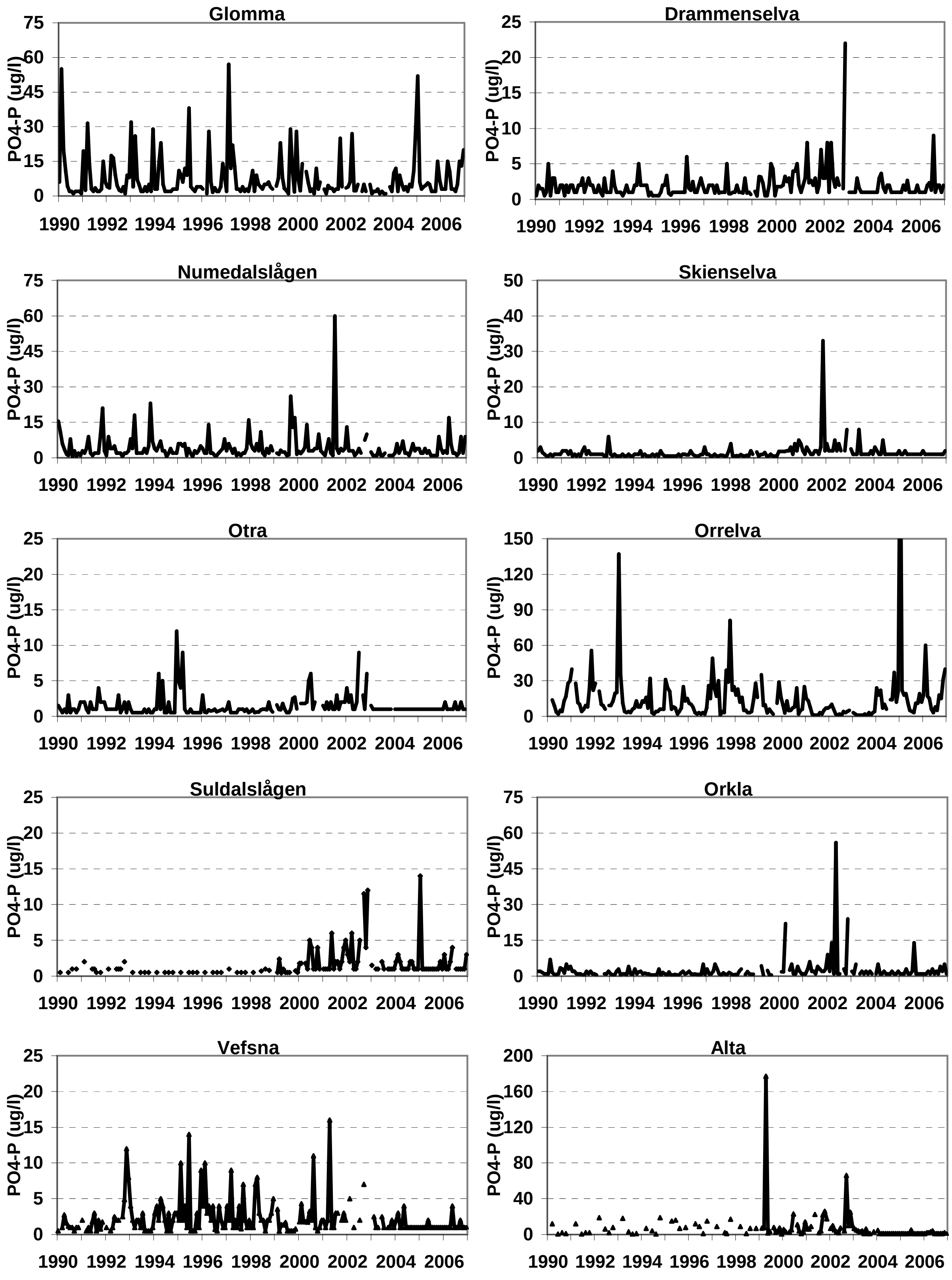


*Figure II. 3. Monthly orto*phosphate-P *concentrations in the 10 Norwegian main rivers*

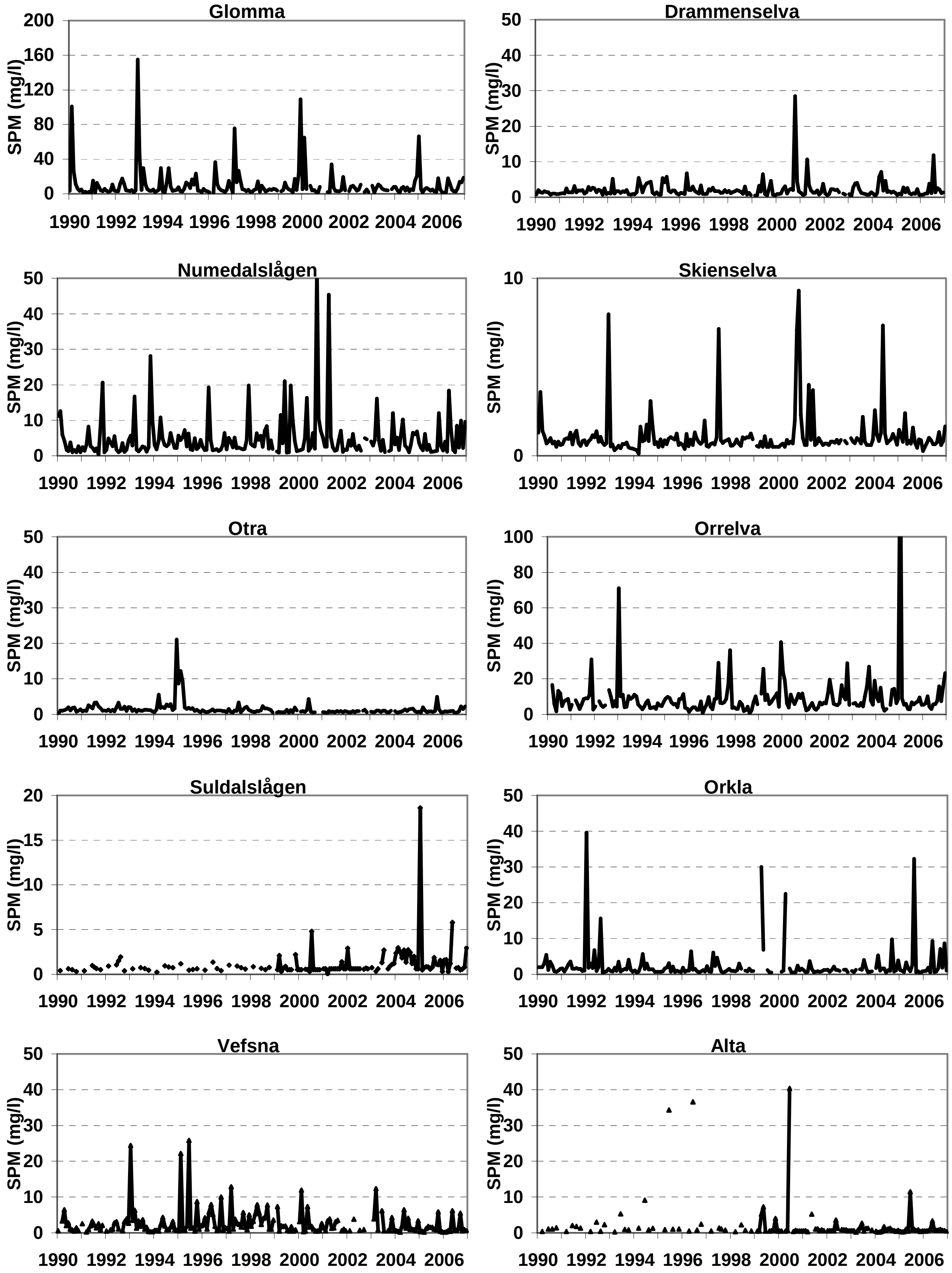


Figure II. 4. Monthly <u>SPM</u> *concentrations in the 10 Norwegian main rivers*

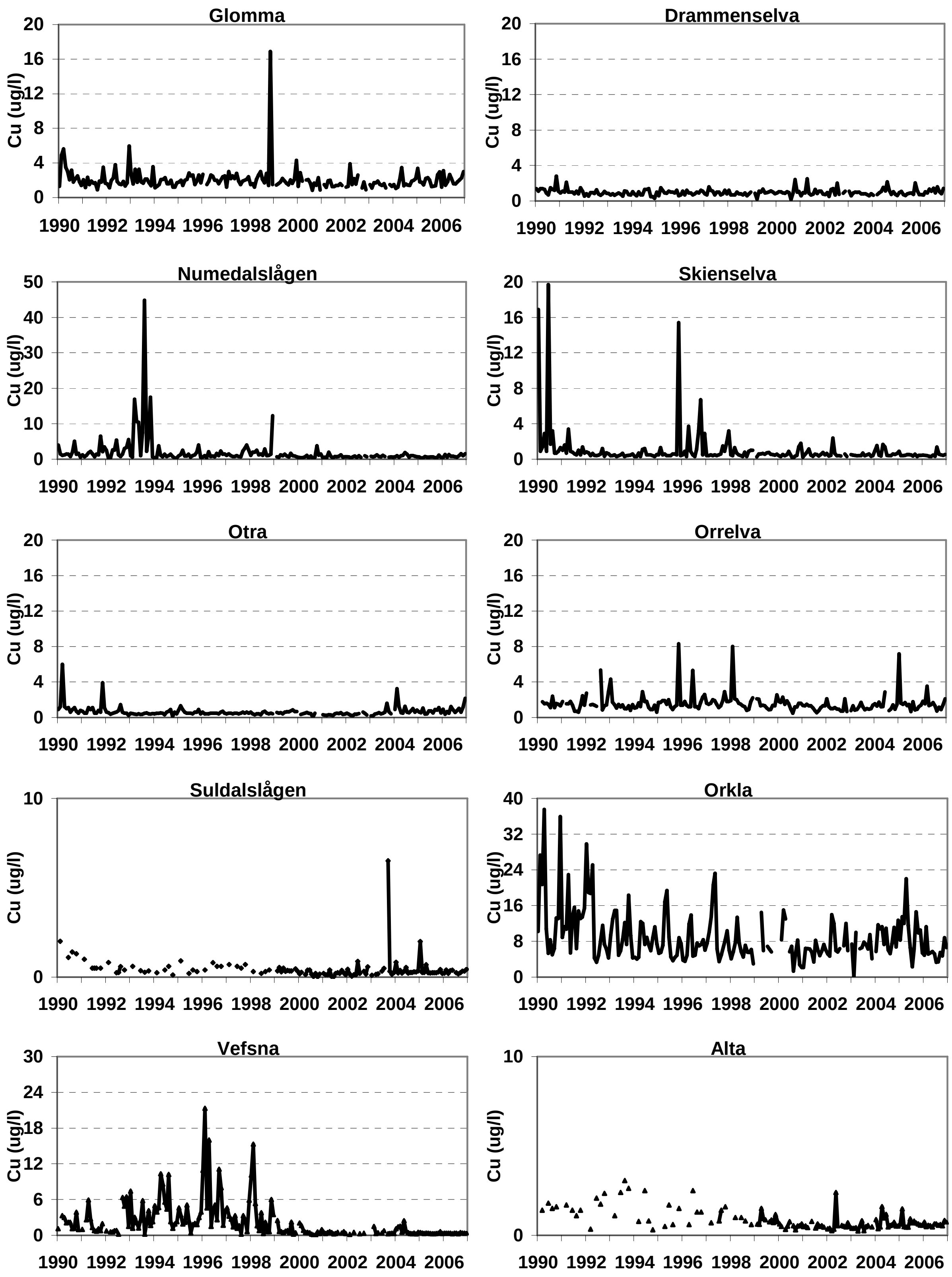


Figure II. 5. Monthly <u>Copper</u> concentrations in the 10 Norwegian main rivers

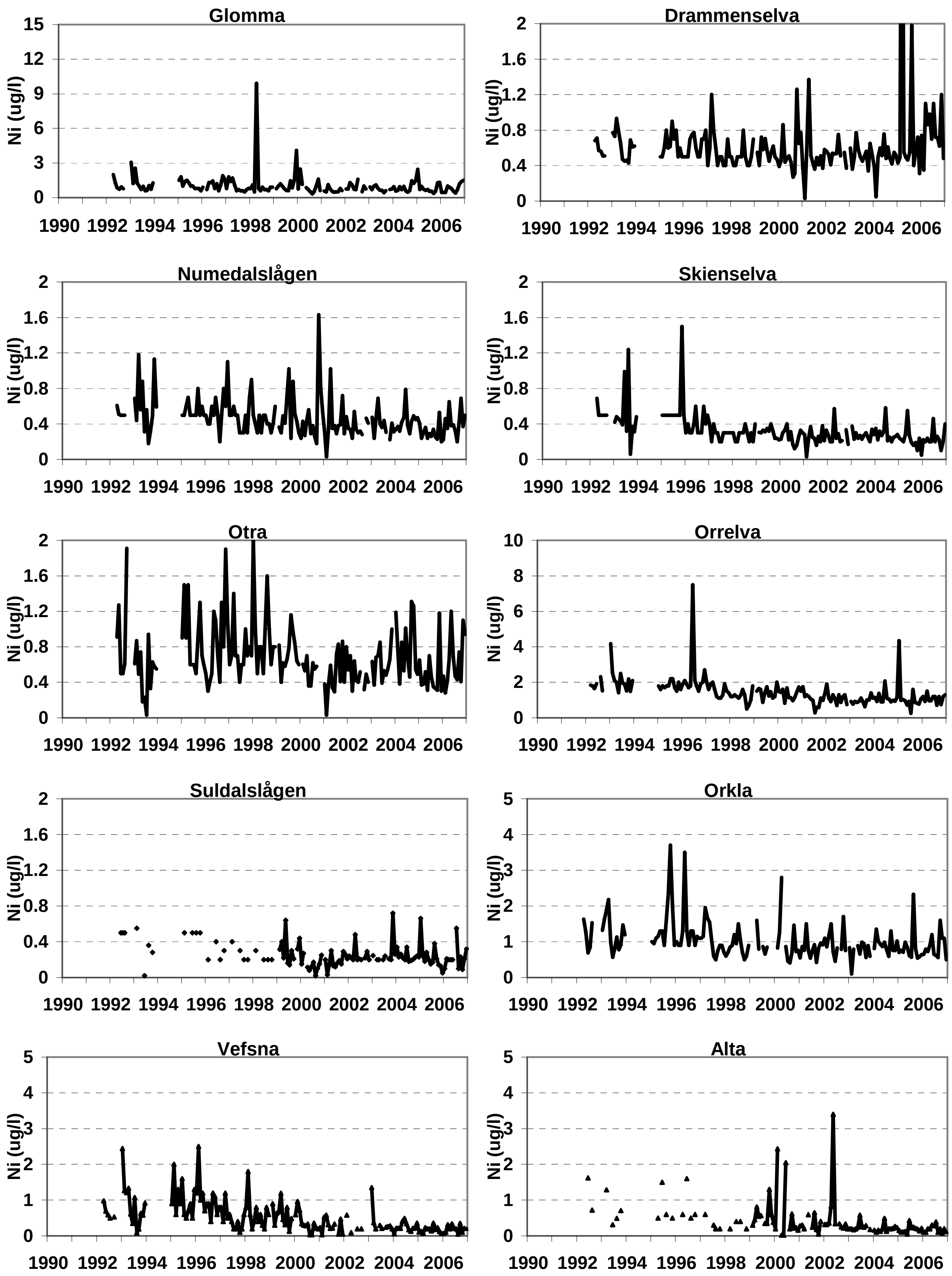


Figure II. 6. Monthly Nickel concentrations in the 10 Norwegian main rivers.

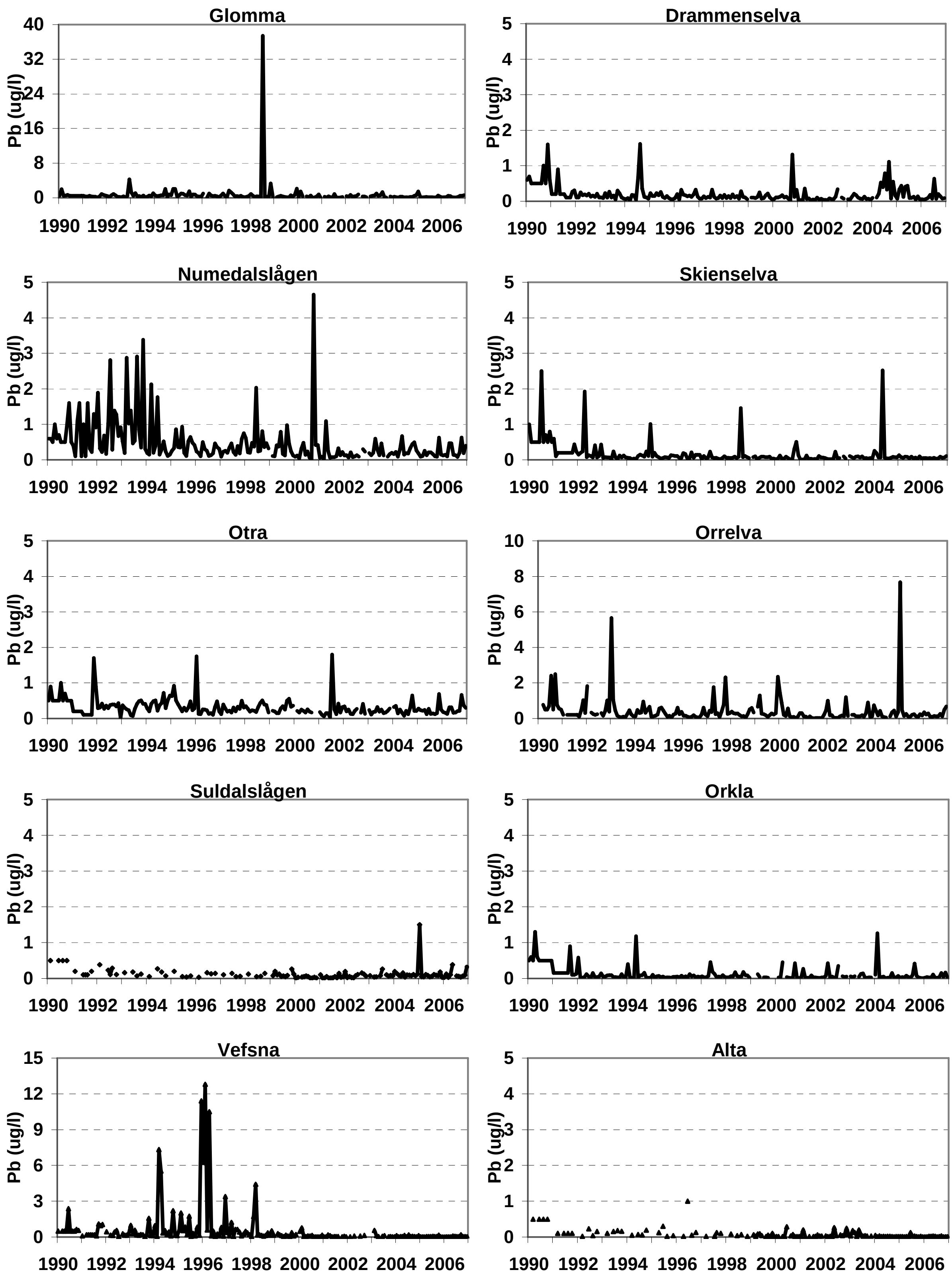


Figure II. 7. Monthly Led *concentrations in the 10 Norwegian main rivers*

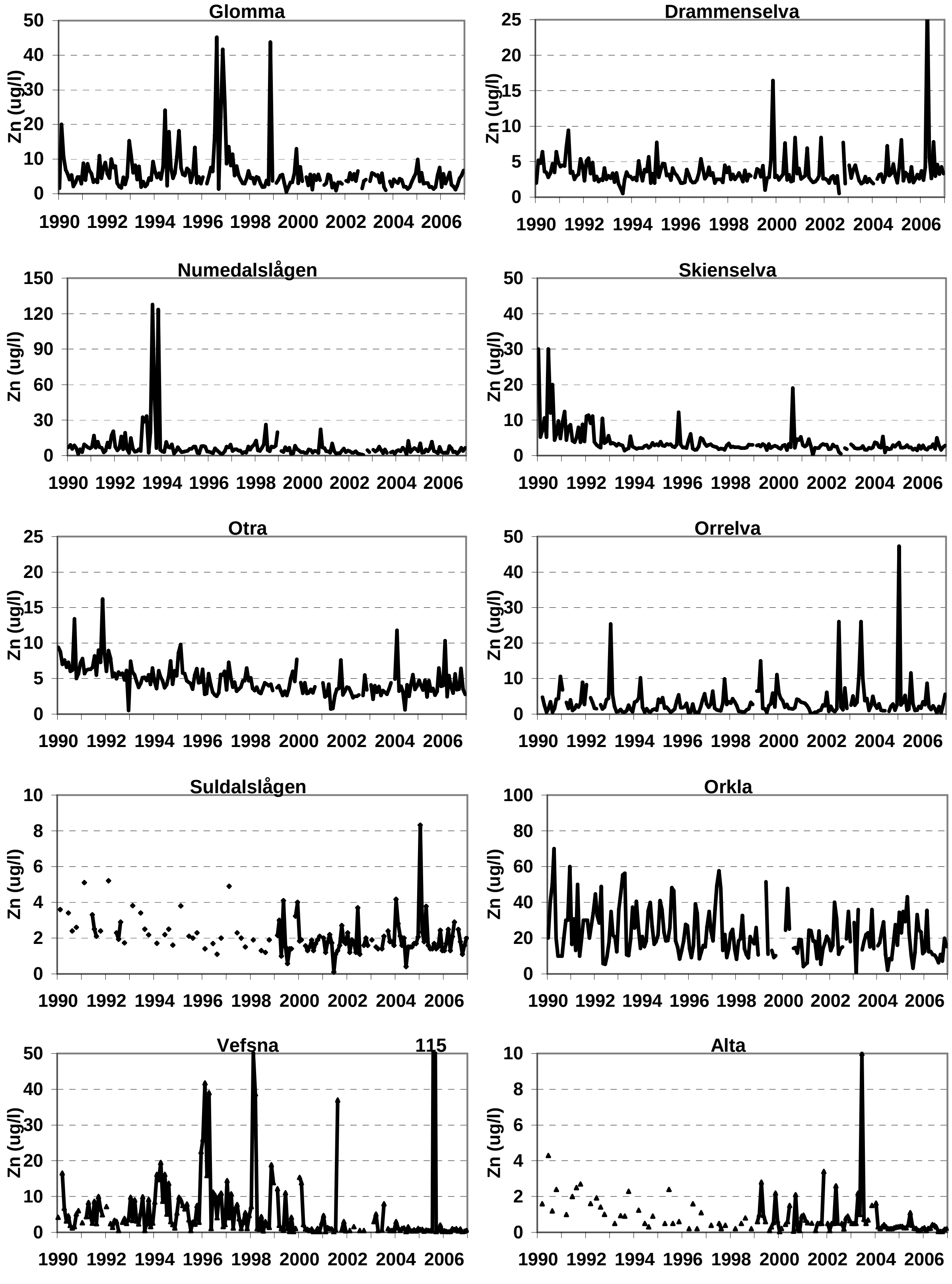


Figure II. 8. Monthly <u>Zink</u> *concentrations in the 10 Norwegian main rivers*

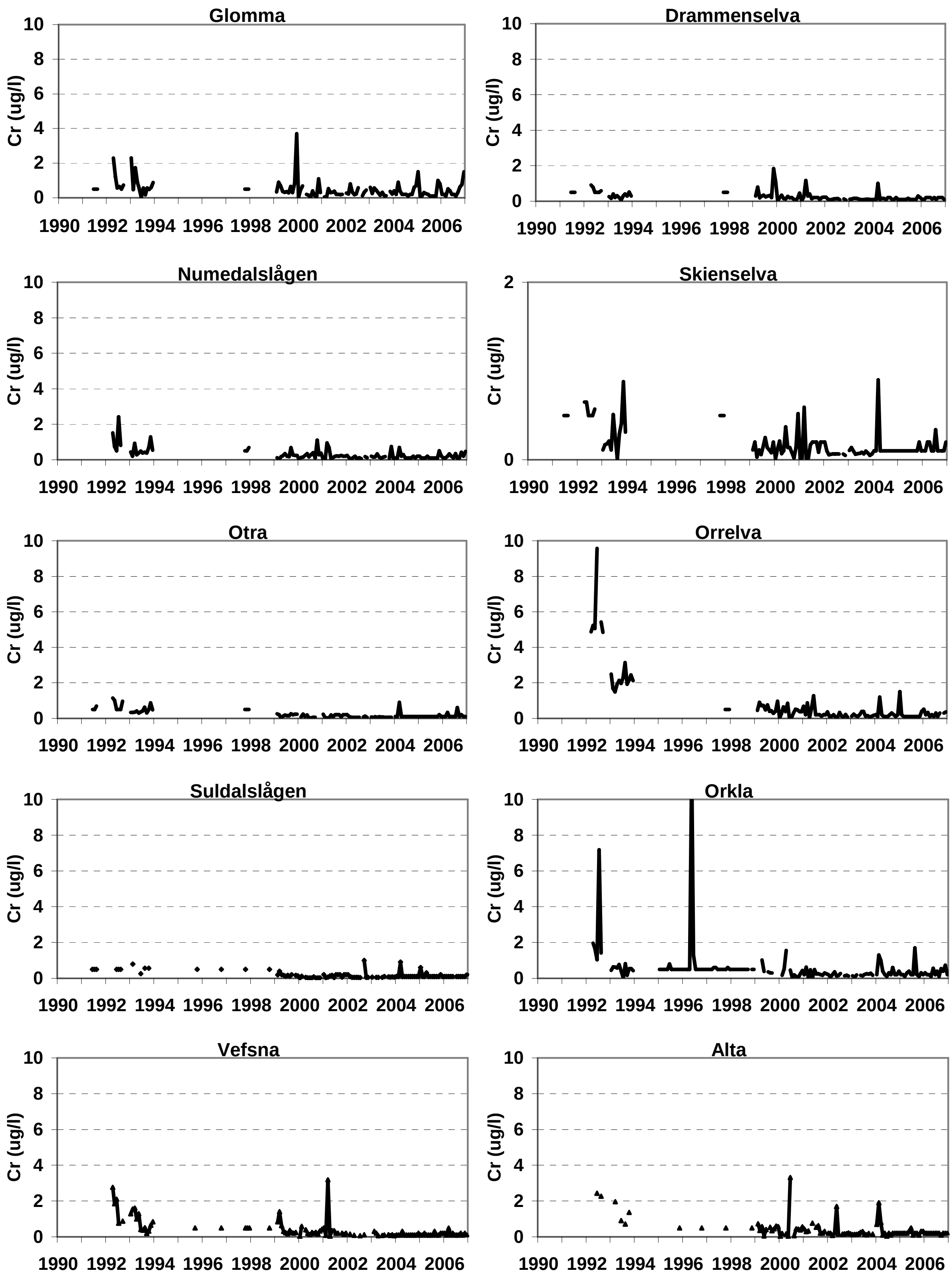


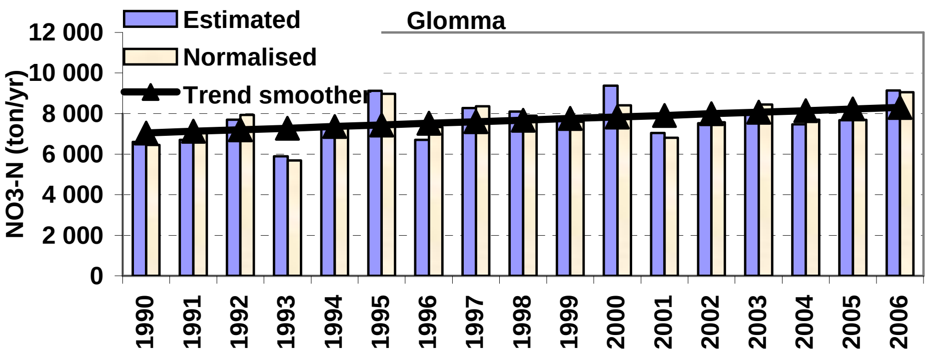
Figure II. 9. Monthly Chromium *concentrations in the 10 Norwegian main rivers.*

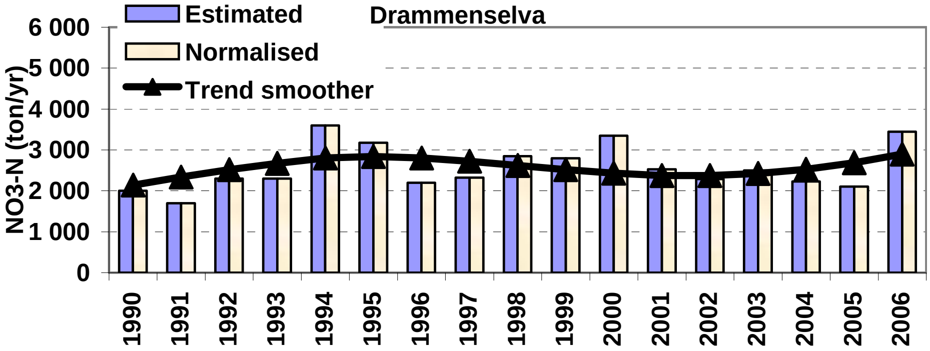
Annex III

The figures in this annex are complimentary to Chapter 7 and show the calculated lower and upper riverine loads. 'Lower' load estimates was calculated by setting all LOD-values to zero concentration while upper was calculated by setting all LOD-values to a concentration same as the given LOD-value.

The figures cover the following substances in the following consecutive order:

- Nitrate-N (NO_3-N)
- Ammonium (NH_4-N)
- Phosphate-P (PO_4-P)
- Lead (Pb)
- Zink (Zn)
- Cadmium (Cd)
- Mercury (Hg)
- Arsenic (As)
- Lindane (g-HCH)
- PCB7


Glomma
Estimated
Normalised
Trend smoother
NO3-N (ton/yr)
12 000
10 000
8 000
6 000
4 000
2 000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Drammenselva
Estimated
Normalised
Trend smoother
NO3-N (ton/yr)
6 000
5 000
4 000
3 000
2 000
1 000
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1990
1991
1992
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1994
1995
1996
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1998
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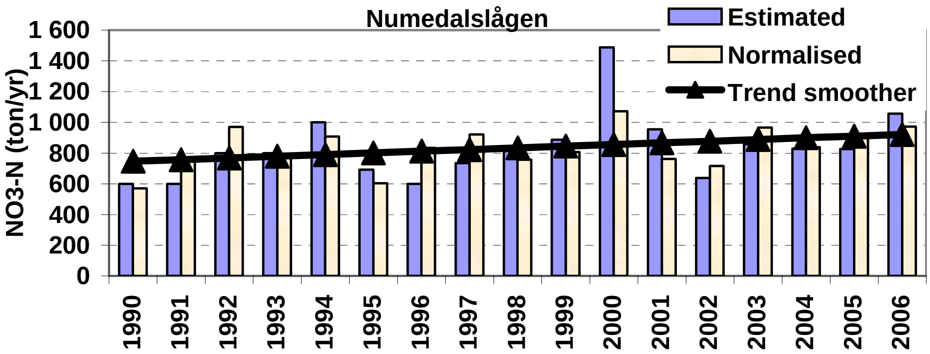
2001
2002
2003
2004
2005
2006


Numedalslågen
Estimated
Normalised
Trend smoother
NO3-N (ton/yr)
1 600
1 400
1 200
1 000
800
600
400
200
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1991
1992
1993
1994
1995
1996
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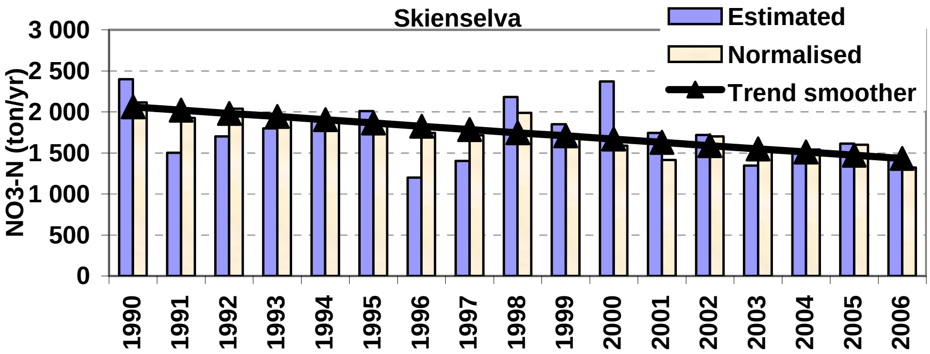
2002
2003
2004
2005
2006


Skienselva
Estimated
Normalised
Trend smoother
NO3-N (ton/yr)
3 000
2 500
2 000
1 500
1 000
500
0
1990
1991
1992
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1994
1995
1996
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1998
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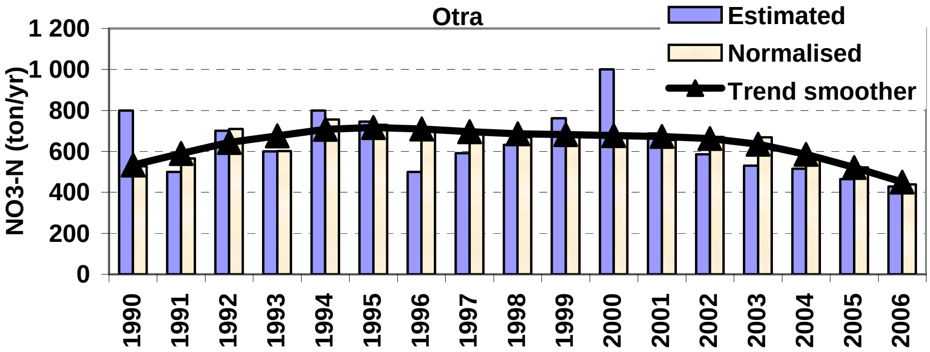
2000
2001
2002
2003
2004
2005
2006


Otra
Estimated
Normalised
Trend smoother
NO3-N (ton/yr)
1 200
1 000
800
600
400
200
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006

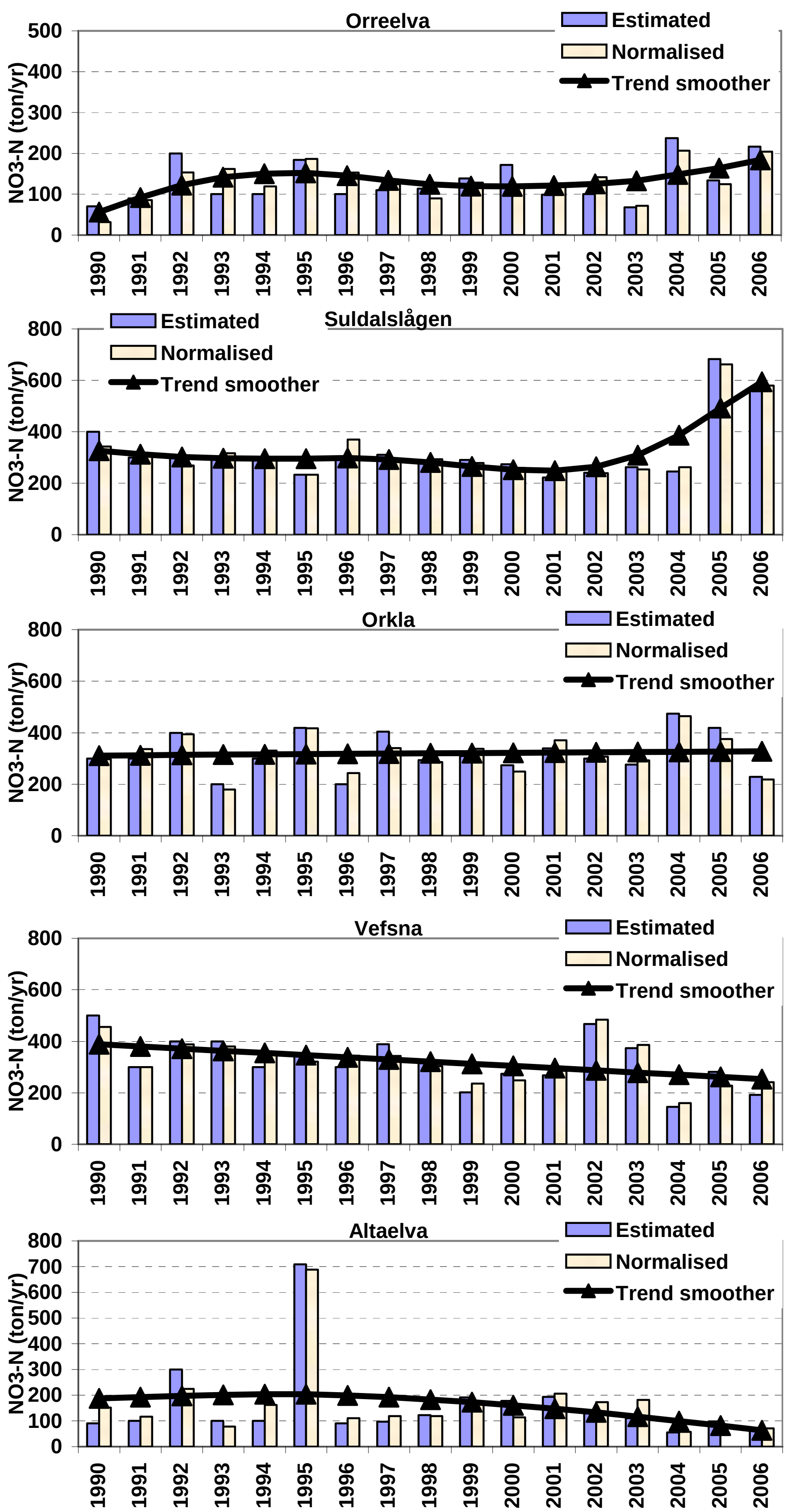
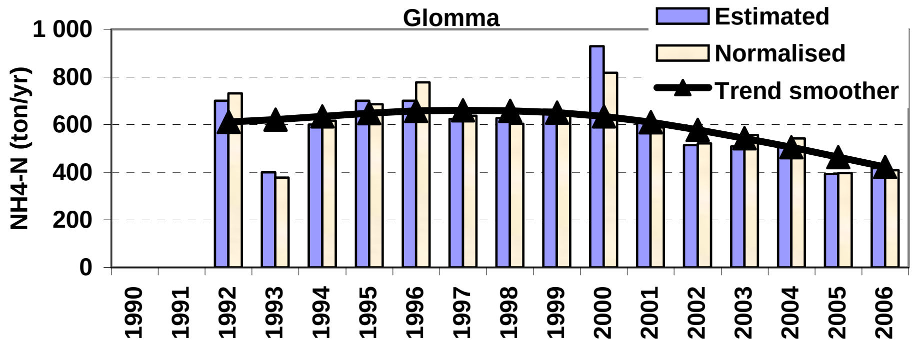
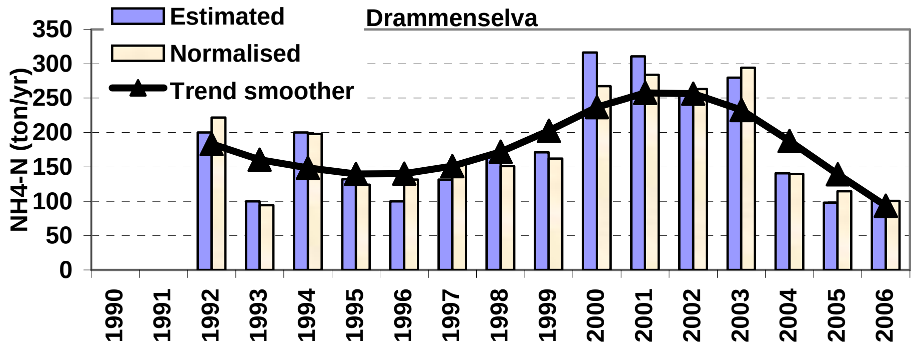
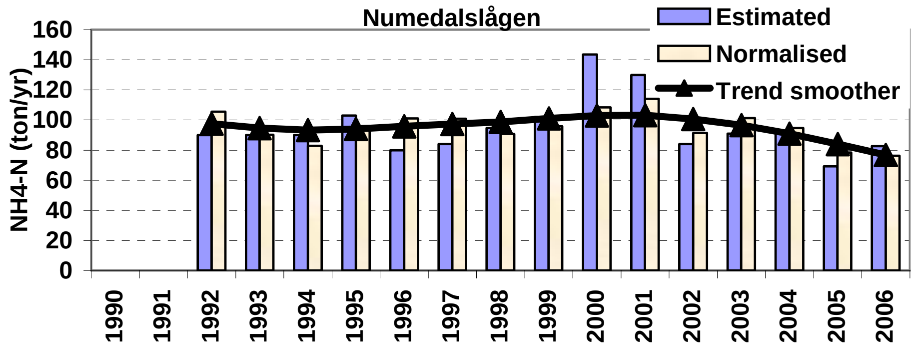
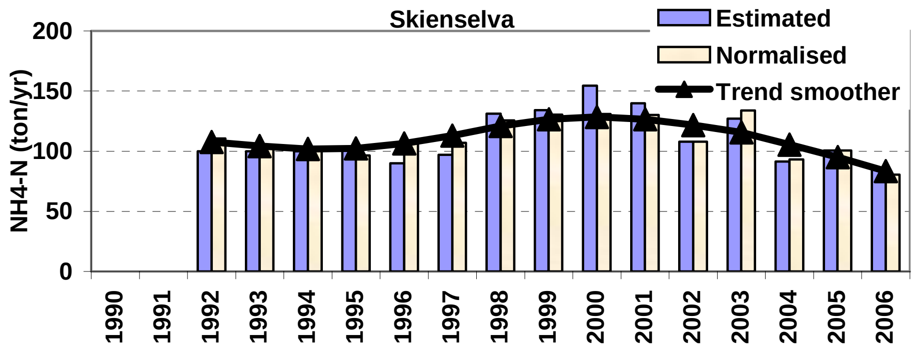


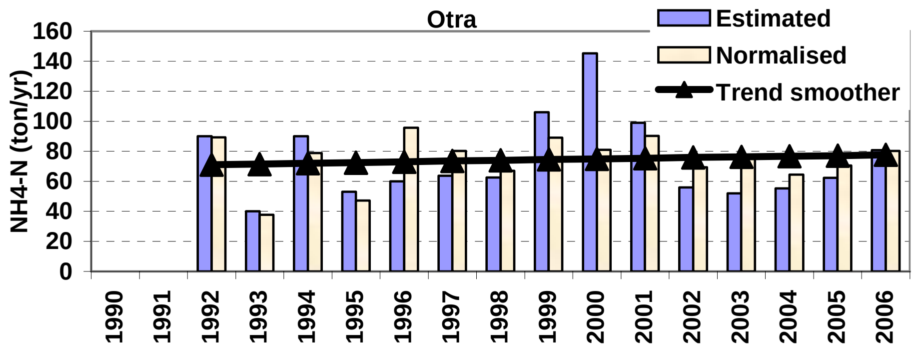
Figure III.1. Estimated, flow-normalised and trend line for annual riverine loads of <u>nitrate nitrogen</u> in the 10 main rivers in Norway, 1990-2006.


Glomma
Estimated
Normalised
Trend smoother
NH4-N (ton/yr)
1 000
800
600
400
200
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Drammenselva
Estimated
Normalised
Trend smoother
NH4-N (ton/yr)
350
300
250
200
150
100
50
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Numedalslågen
Estimated
Normalised
Trend smoother
NH4-N (ton/yr)
160
140
120
100
80
60
40
20
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Skienselva
Estimated
Normalised
Trend smoother
NH4-N (ton/yr)
200
150
100
50
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Otra
Estimated
Normalised
Trend smoother
NH4-N (ton/yr)
160
140
120
100
80
60
40
20
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

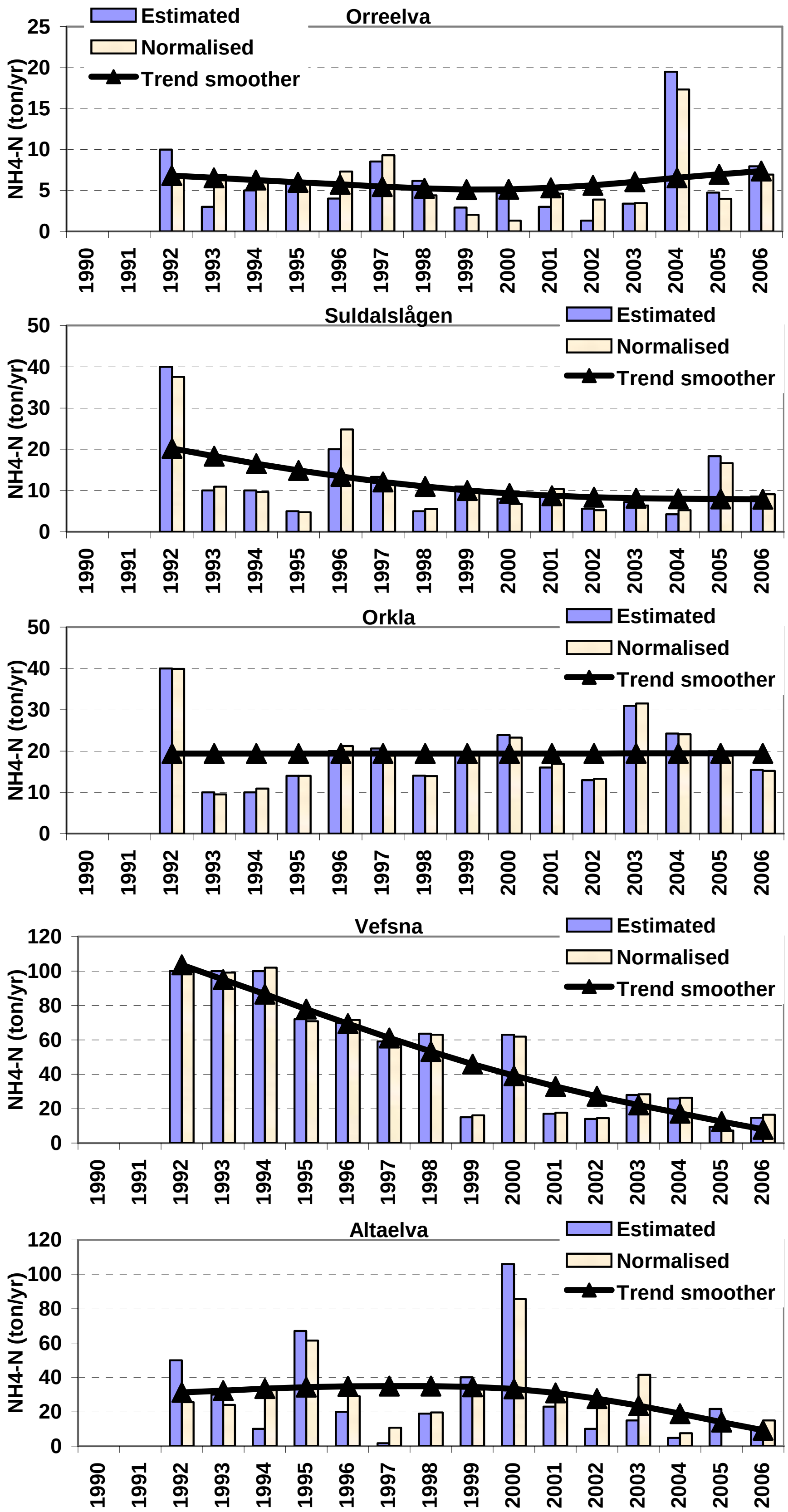
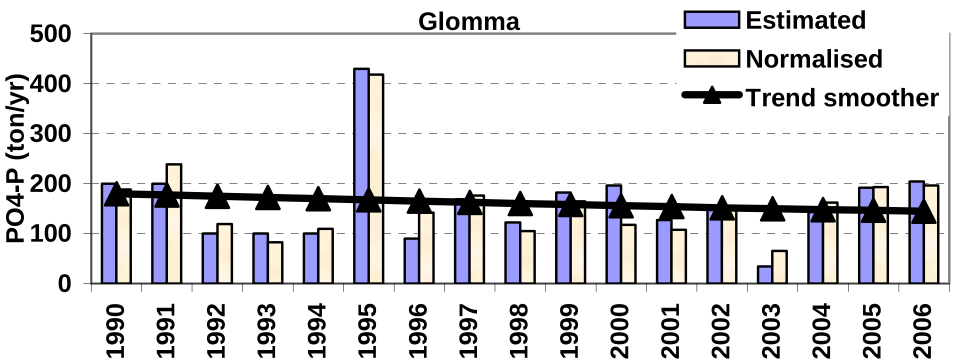
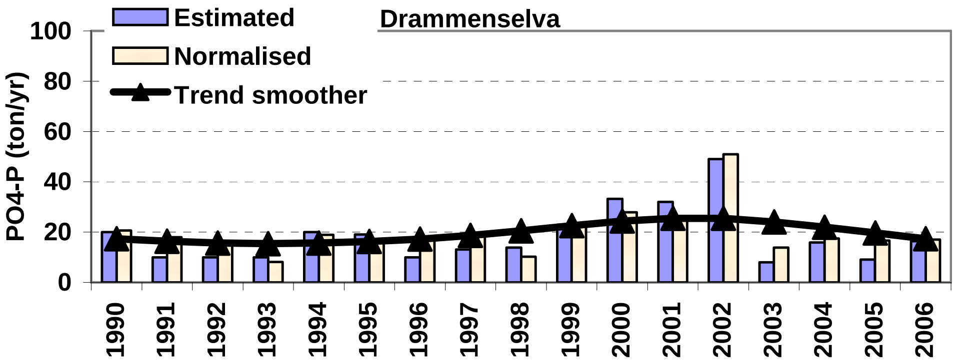
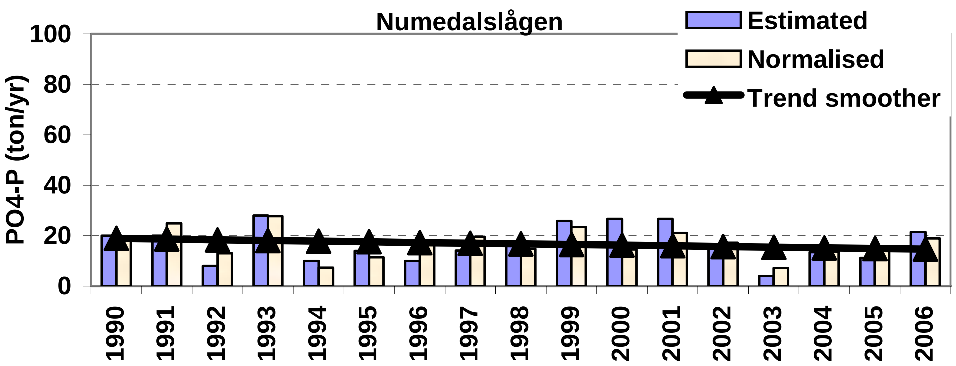
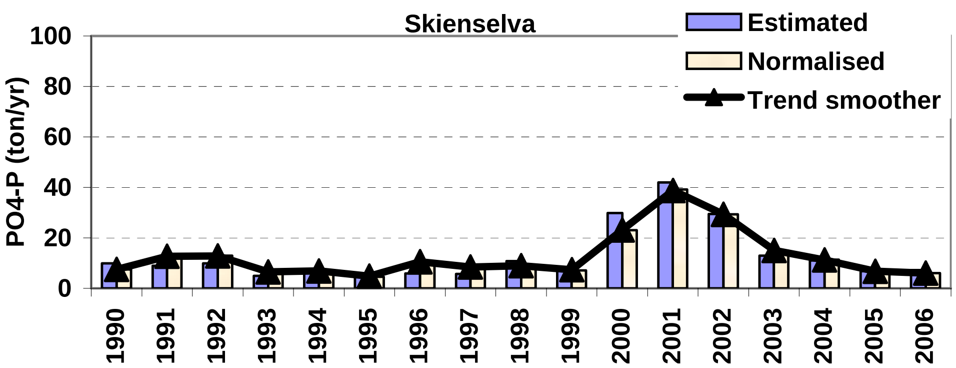


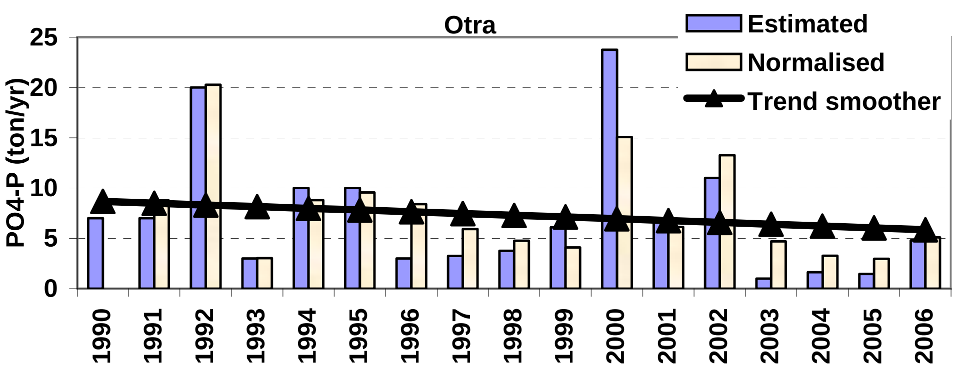
Figure III.2. Estimated, flow-normalised and trend line for annual riverine loads of $\underline{NH_4\text{-}N}$ *in the 10 main rivers in Norway, 1990-2006.*


Glomma
Estimated
Normalised
Trend smoother
PO4-P (ton/yr)
0
100
200
300
400
500
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Drammenselva
Estimated
Normalised
Trend smoother
PO4-P (ton/yr)
0
20
40
60
80
100
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Numedalslågen
Estimated
Normalised
Trend smoother
PO4-P (ton/yr)
0
20
40
60
80
100
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Skienselva
Estimated
Normalised
Trend smoother
PO4-P (ton/yr)
0
20
40
60
80
100
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Otra
Estimated
Normalised
Trend smoother
PO4-P (ton/yr)
0
5
10
15
20
25
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

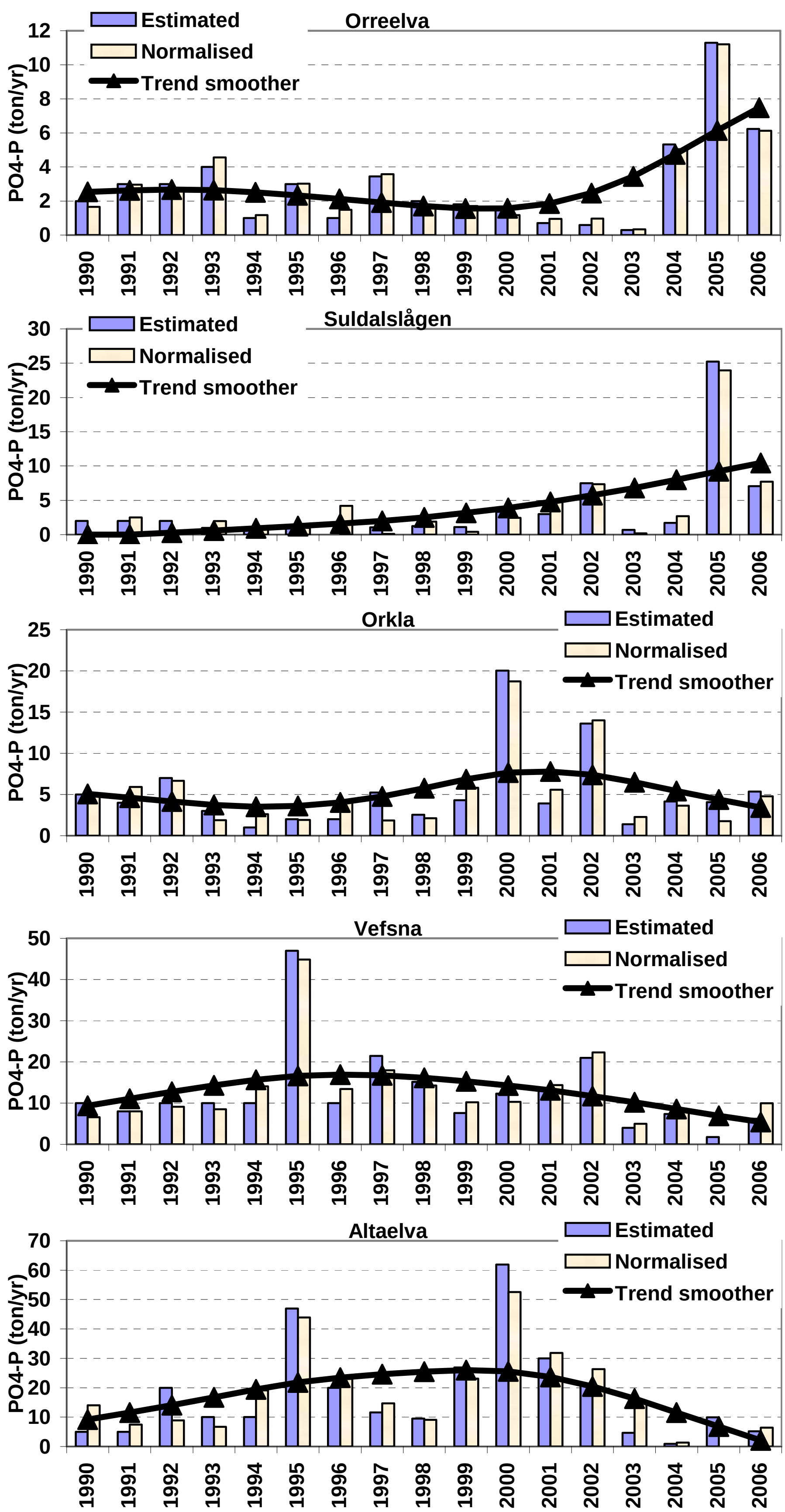
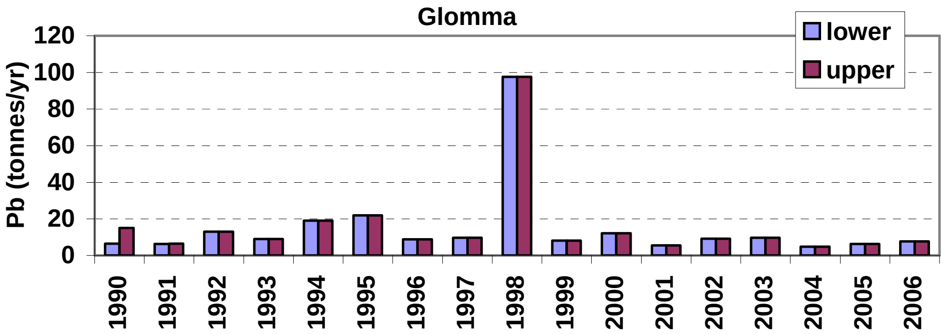
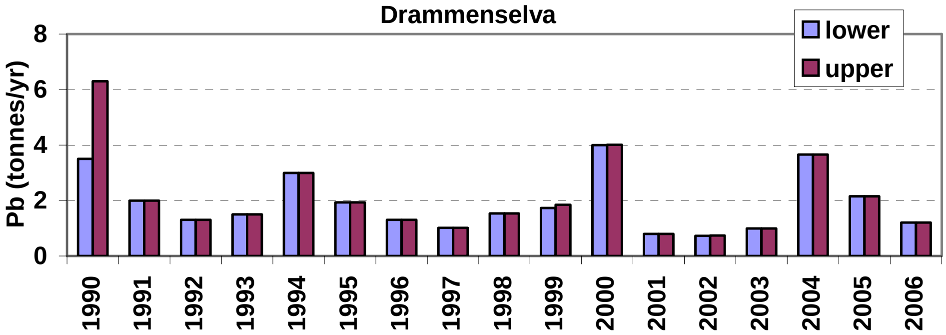
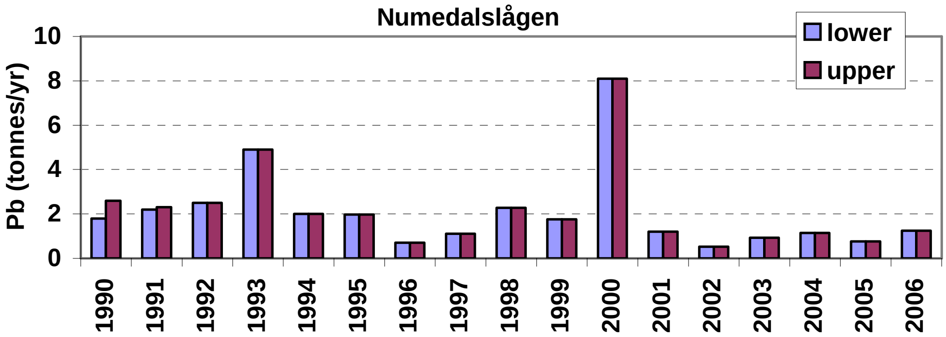
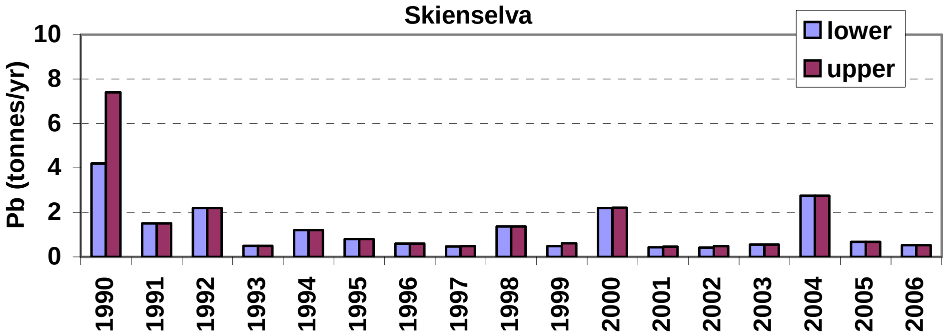


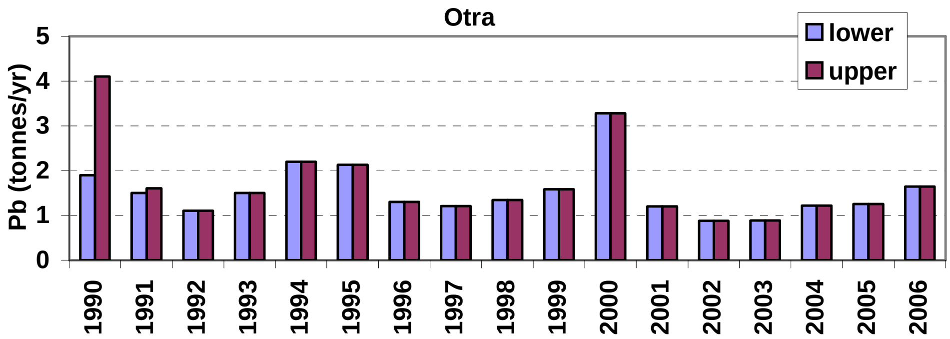
Figure III.3. Estimated, flow-normalised and trend line for annual riverine loads of phosphate phosphorus in the 10 main rivers in Norway, 1990-2006.


Glomma
lower
upper
Pb (tonnes/yr)
0
20
40
60
80
100
120
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Drammenselva
lower
upper
Pb (tonnes/yr)
0
2
4
6
8
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Numedalslågen
lower
upper
Pb (tonnes/yr)
0
2
4
6
8
10
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Skienselva
lower
upper
Pb (tonnes/yr)
0
2
4
6
8
10
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Otra
lower
upper
Pb (tonnes/yr)
0
1
2
3
4
5
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

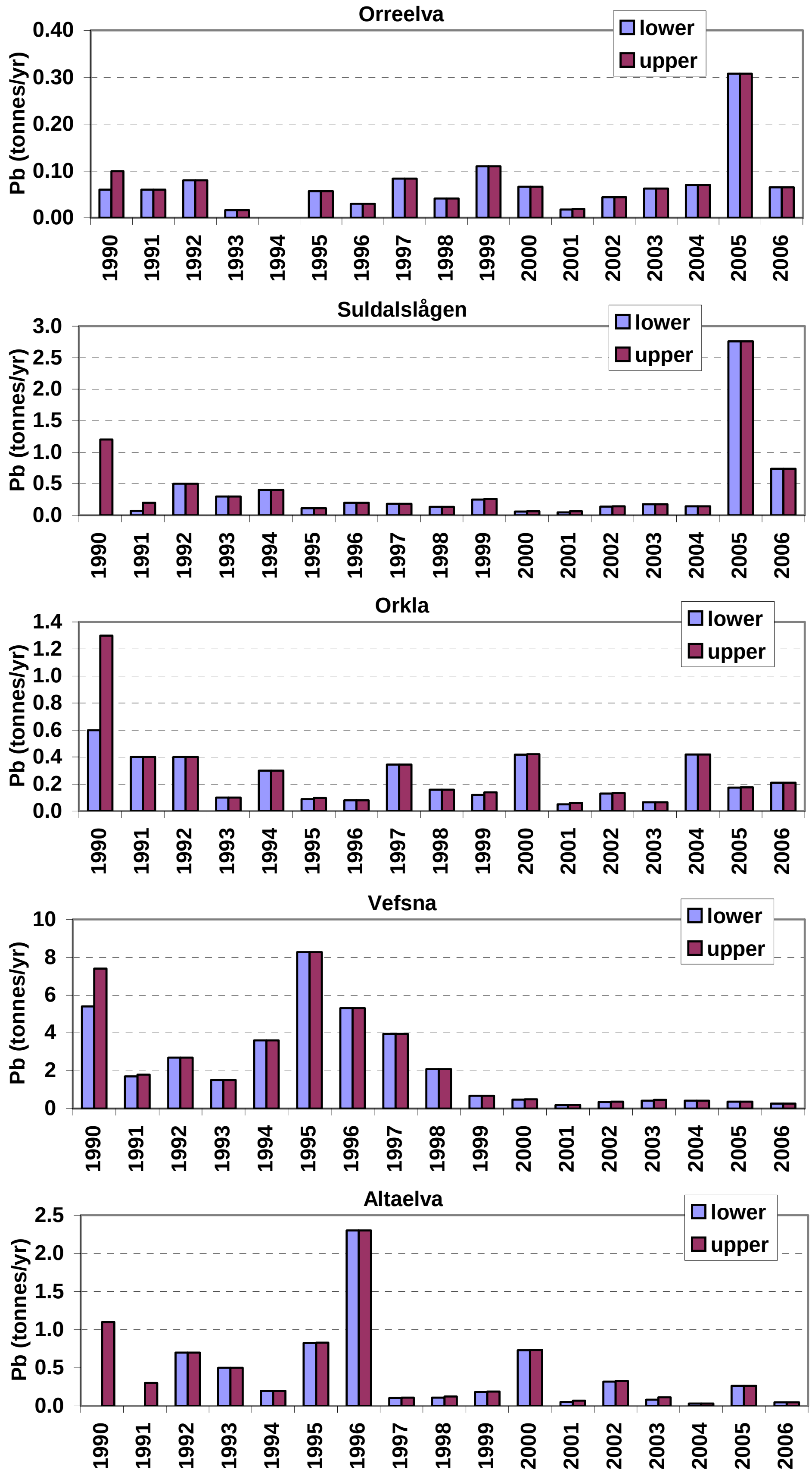
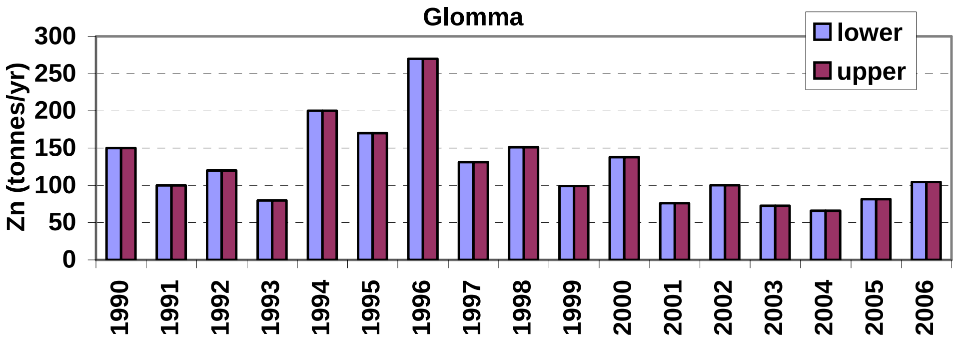
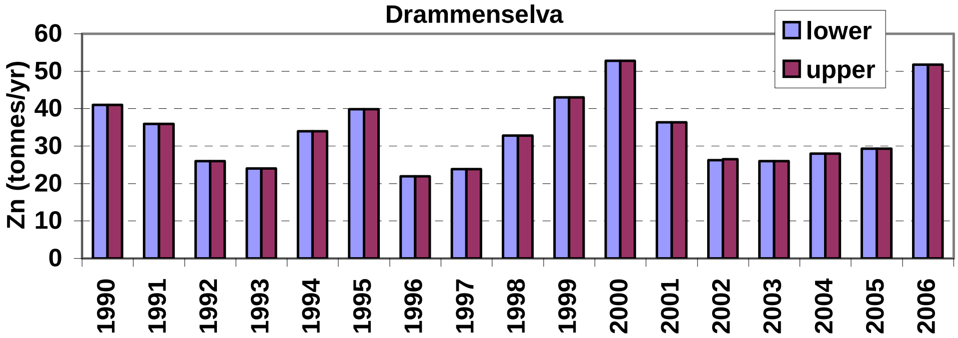
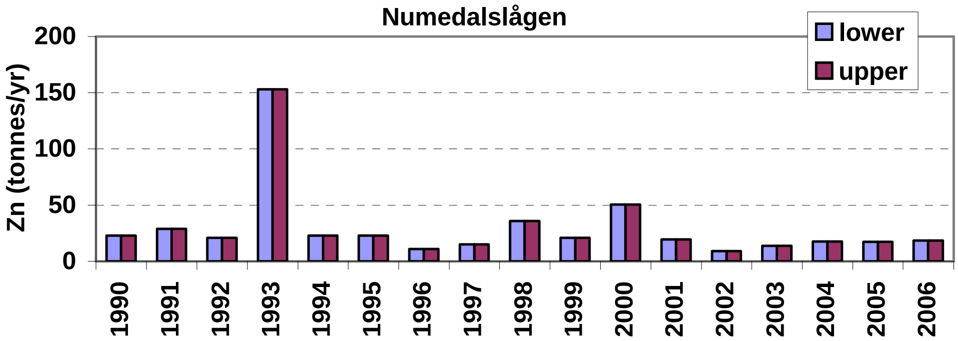
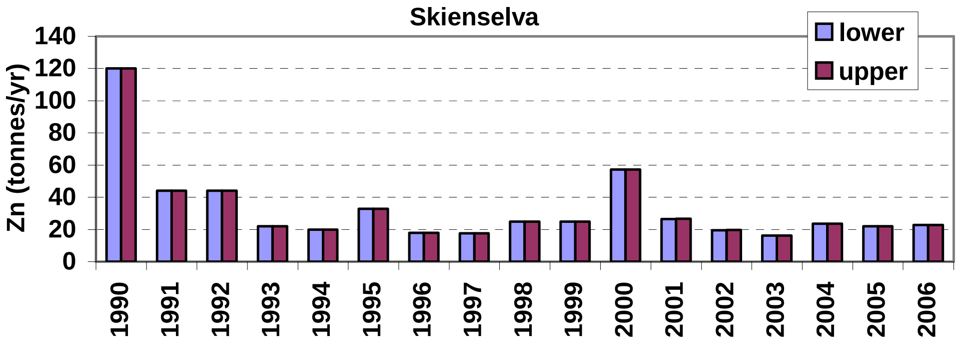


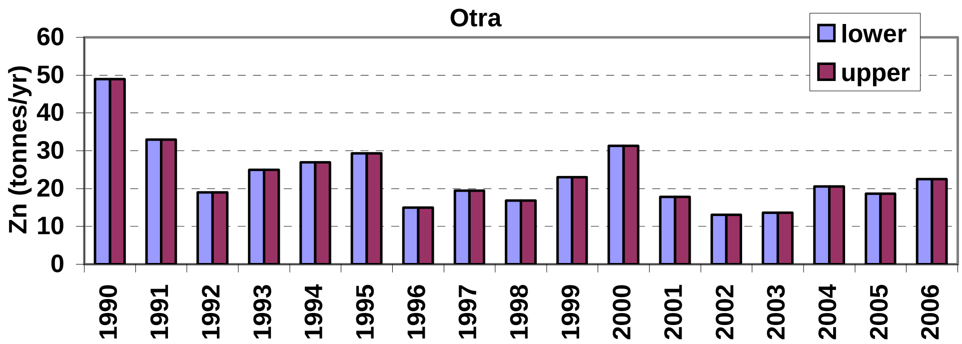
Figure III.4. Lower and upper annual riverine loads of <u>Lead</u> in the 10 main rivers in Norway, 1990-2006.


Glomma
lower
upper
Zn (tonnes/yr)


Drammenselva
lower
upper
Zn (tonnes/yr)


Numedalslågen
lower
upper
Zn (tonnes/yr)


Skienselva
lower
upper
Zn (tonnes/yr)


Otra
lower
upper
Zn (tonnes/yr)

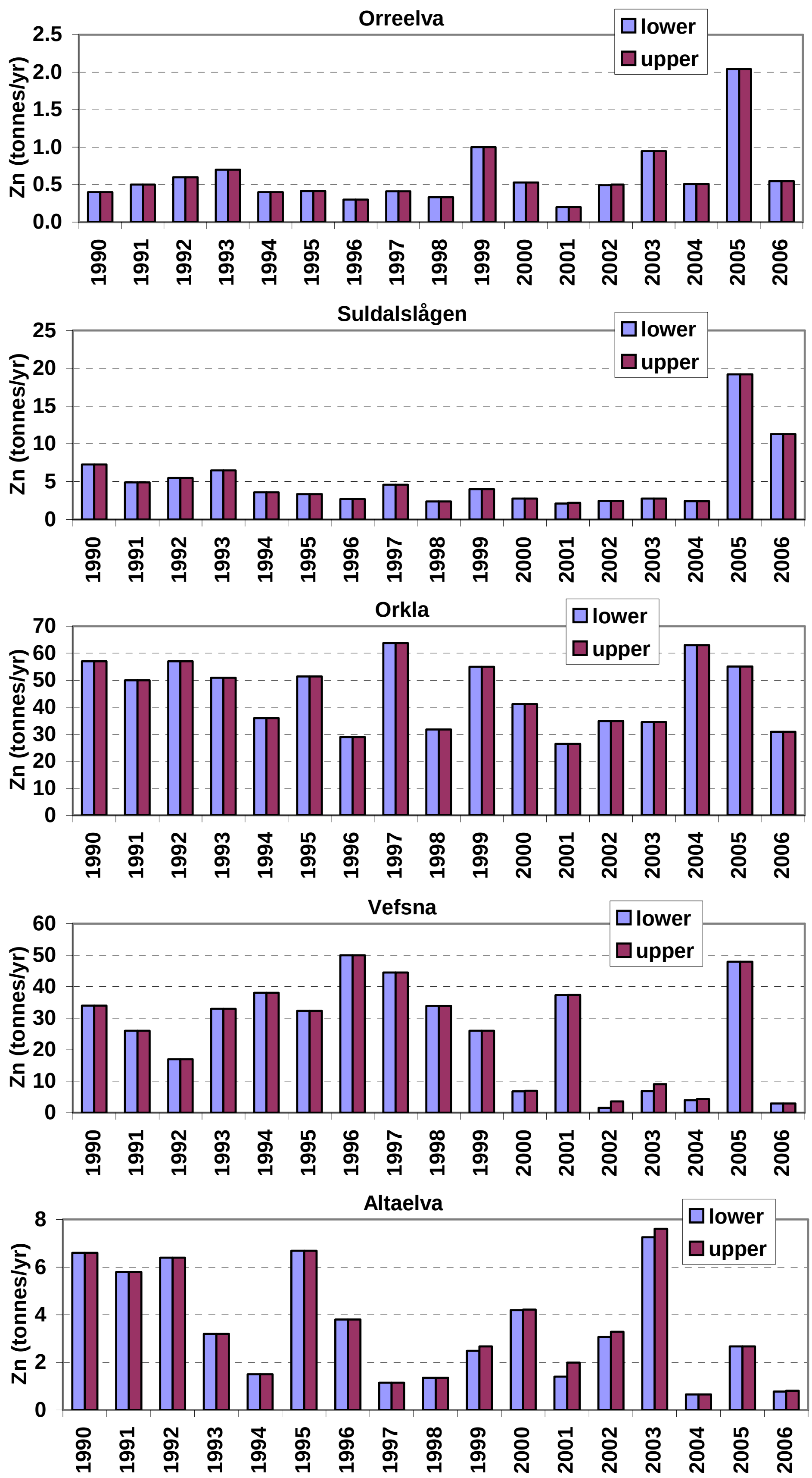
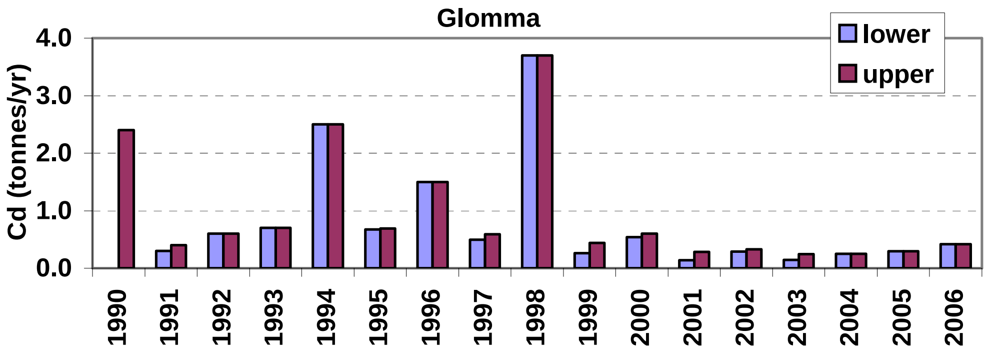
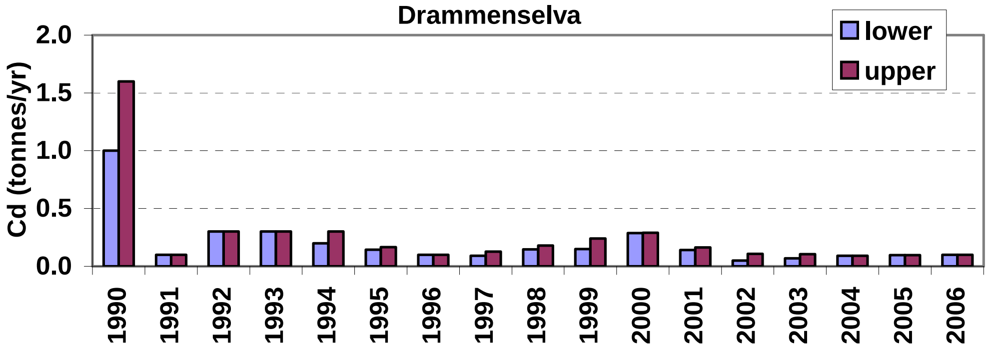
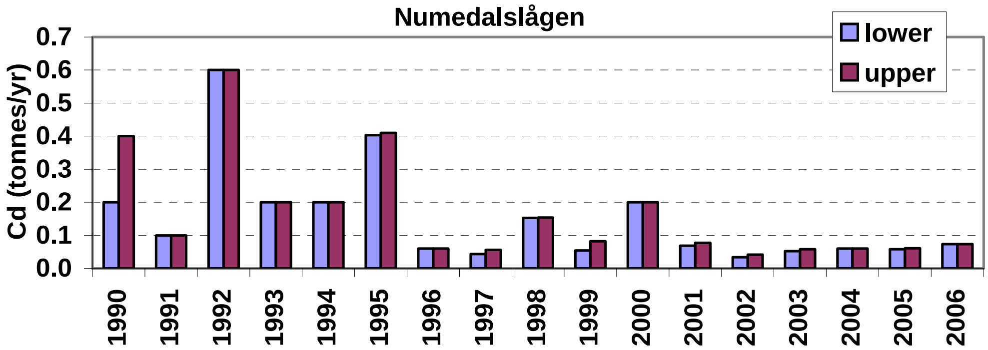
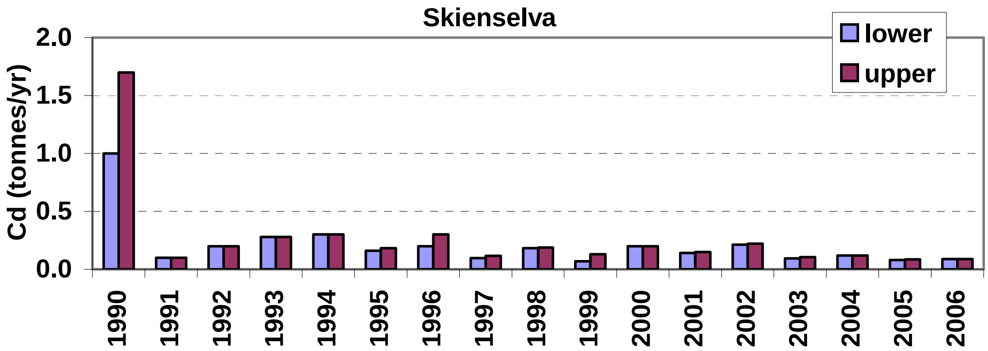


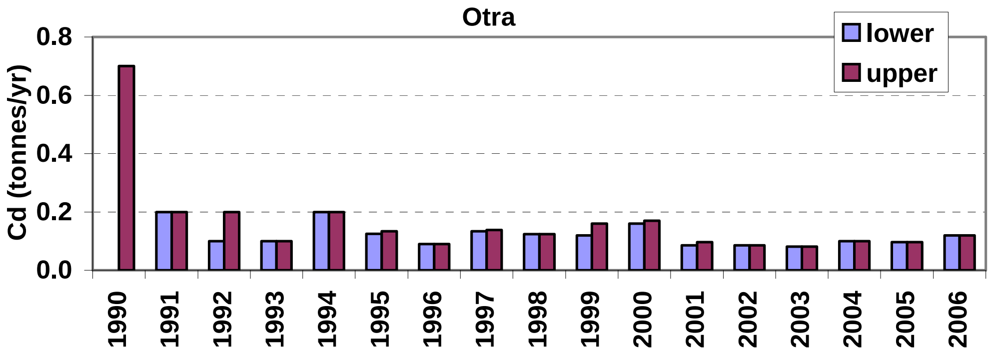
Figure III.5. Lower and upper annual riverine loads of _Zink_ *in the 10 main rivers in Norway, 1990-2006.*


Glomma
Cd (tonnes/yr)
4.0
3.0
2.0
1.0
0.0
lower
upper
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Drammenselva
Cd (tonnes/yr)
2.0
1.5
1.0
0.5
0.0
lower
upper
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Numedalslågen
Cd (tonnes/yr)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
lower
upper
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Skienselva
Cd (tonnes/yr)
2.0
1.5
1.0
0.5
0.0
lower
upper
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Otra
Cd (tonnes/yr)
0.8
0.6
0.4
0.2
0.0
lower
upper
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

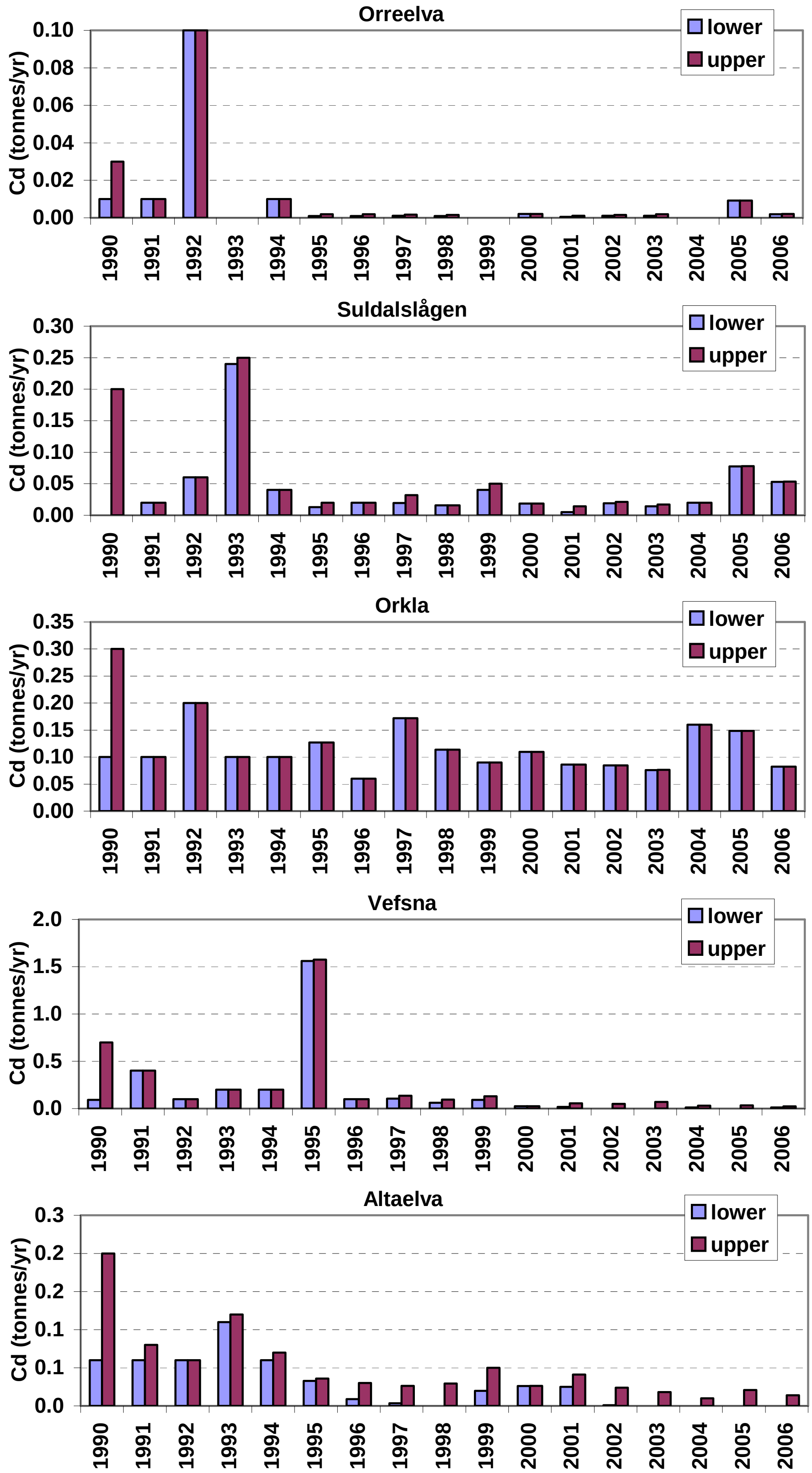
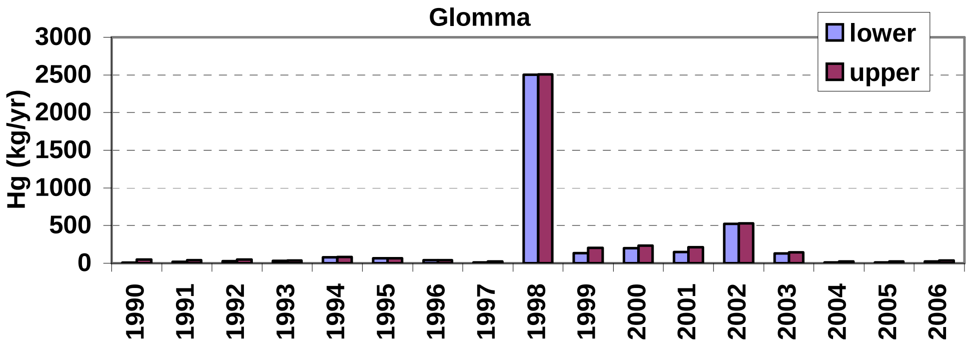
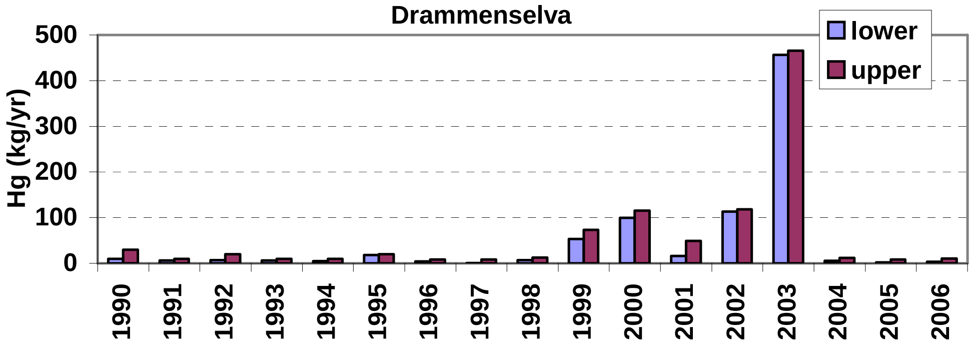
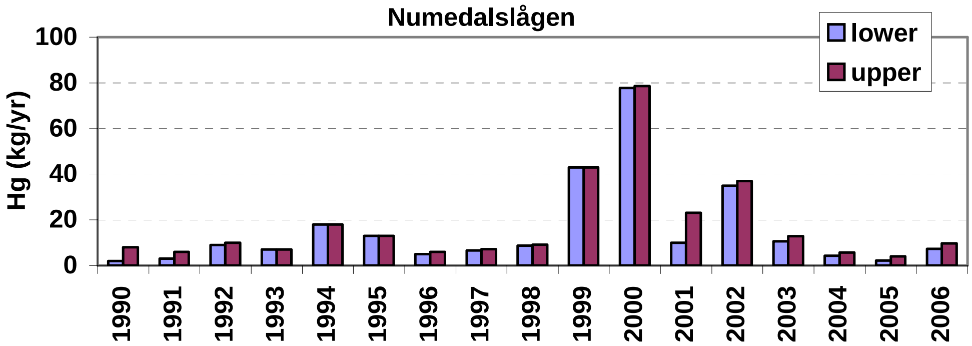
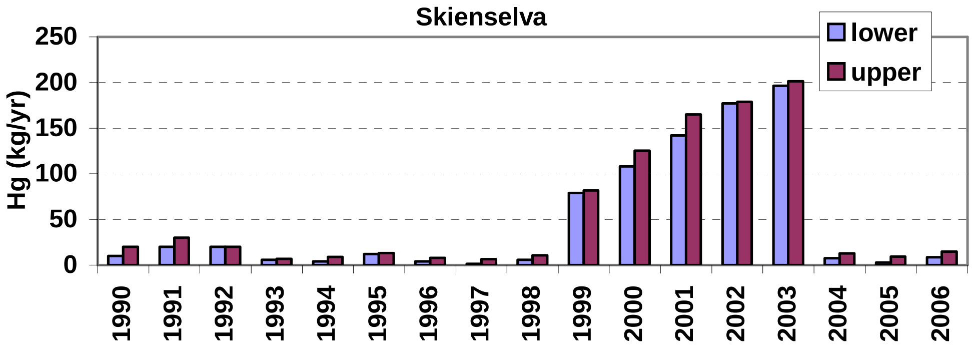


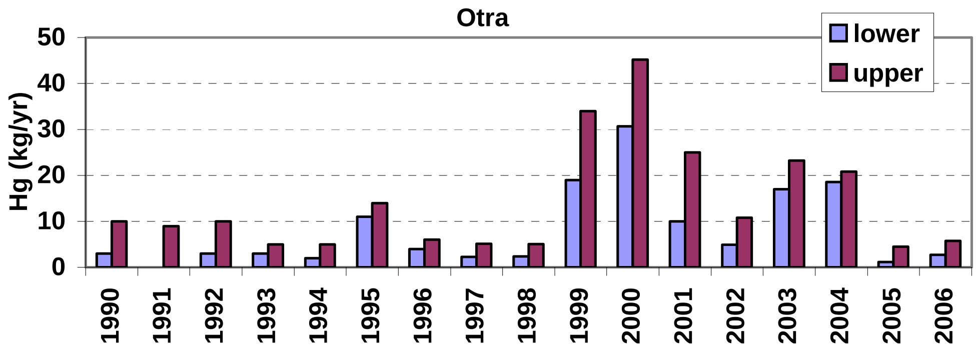
Figure III.6. Lower and upper annual riverine loads of <u>Cadmium</u> in the 10 main rivers in Norway, 1990-2006.


Glomma
lower
upper
Hg (kg/yr)
3000
2500
2000
1500
1000
500
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Drammenselva
lower
upper
Hg (kg/yr)
500
400
300
200
100
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Numedalslågen
lower
upper
Hg (kg/yr)
100
80
60
40
20
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Skienselva
lower
upper
Hg (kg/yr)
250
200
150
100
50
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Otra
lower
upper
Hg (kg/yr)
50
40
30
20
10
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

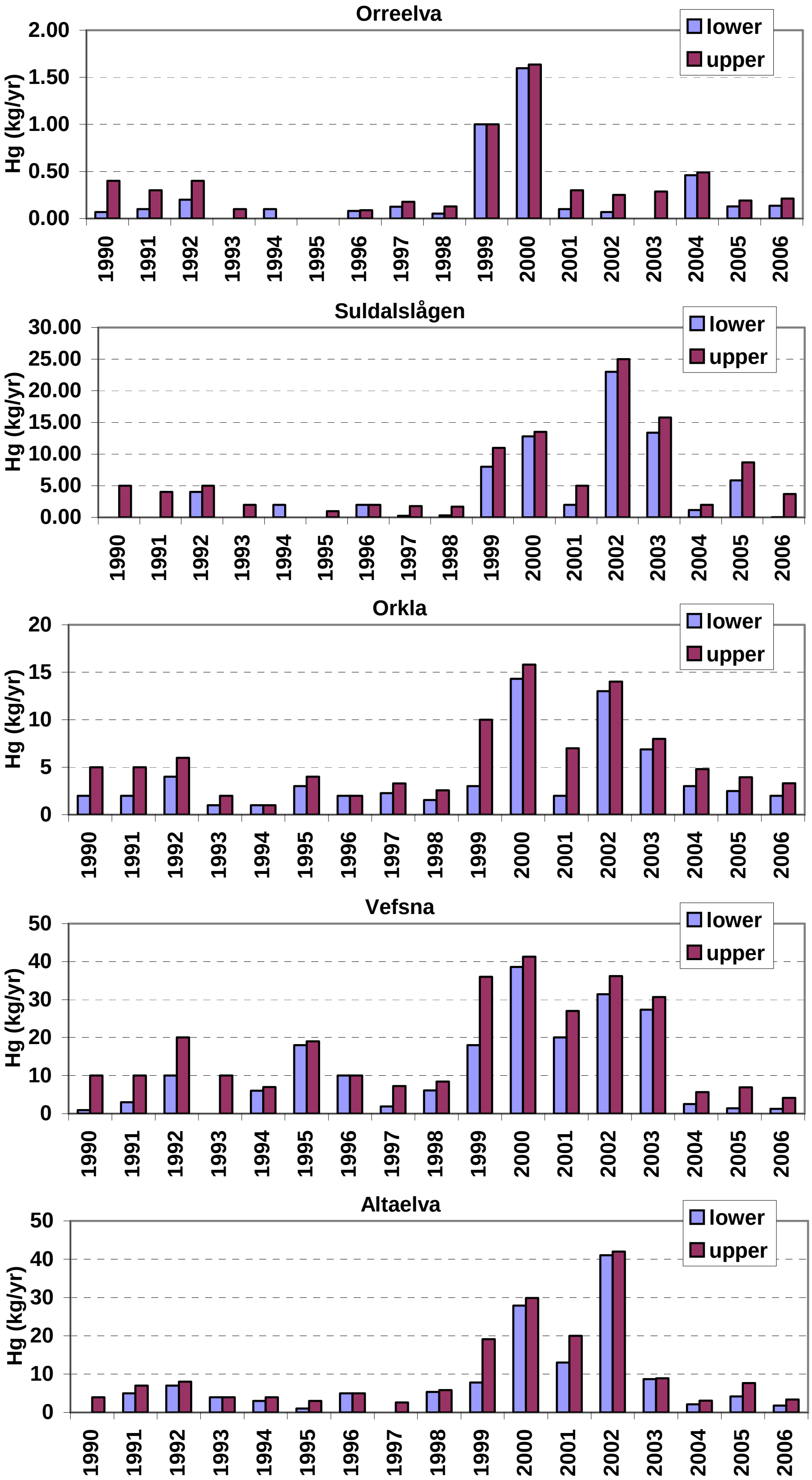
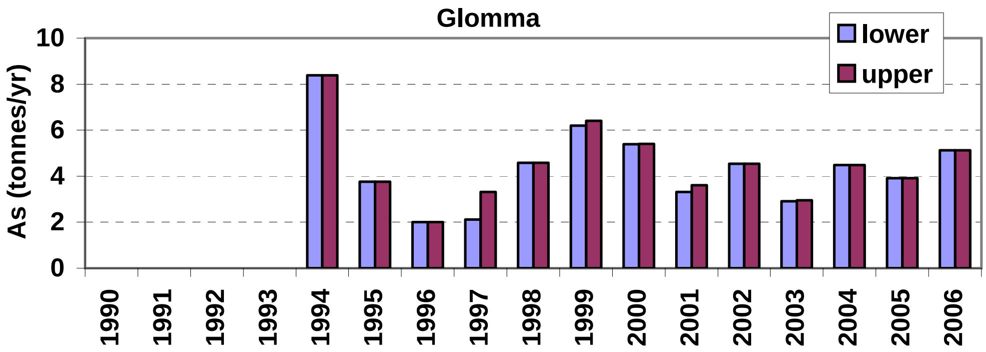
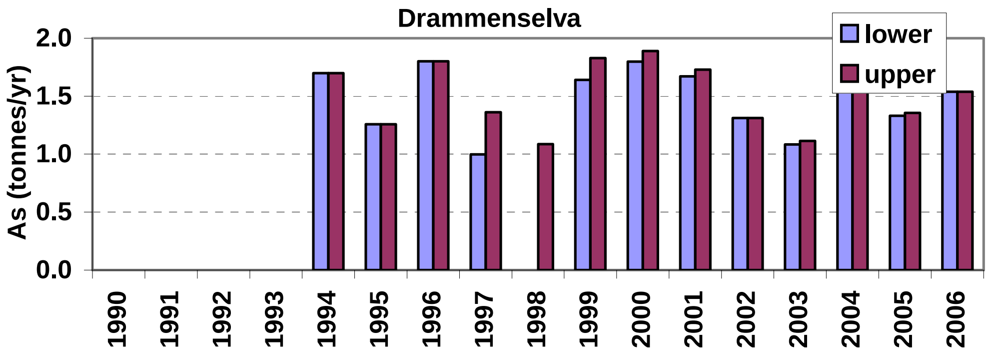
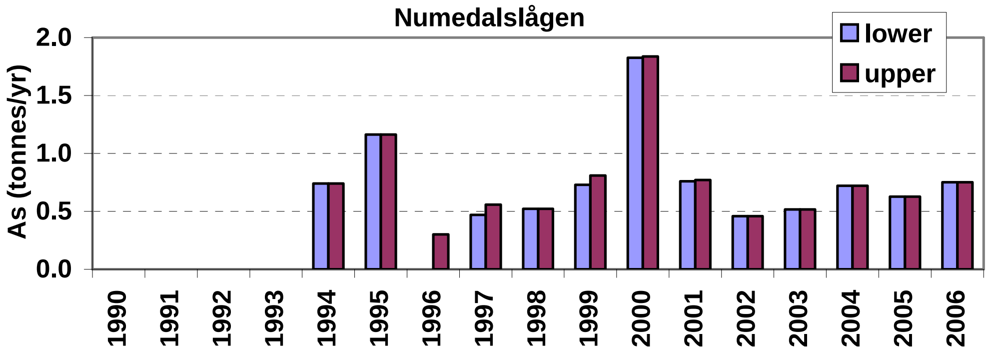
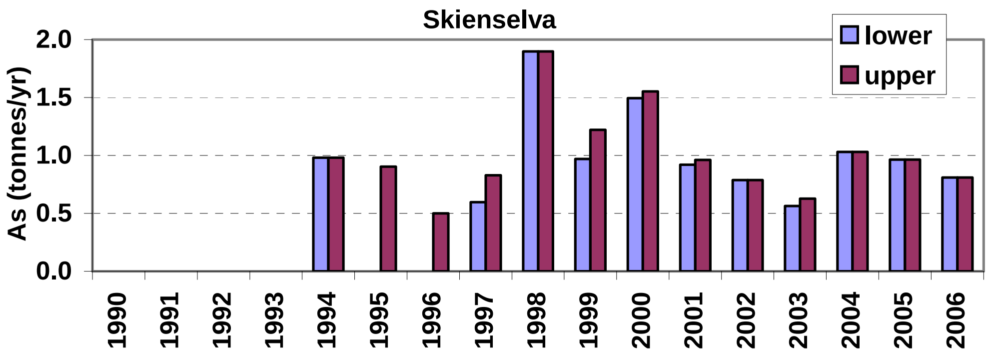


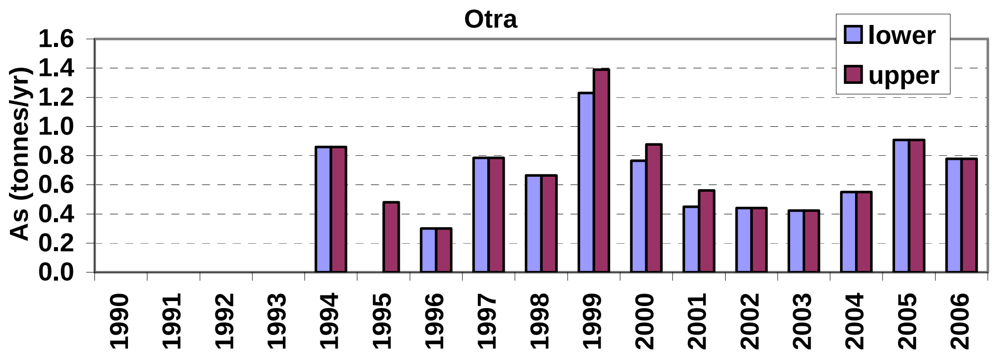
Figure III.7. Lower and upper annual riverine loads of *<u>Mercury</u>* *in the 10 main rivers in Norway, 1990-2006.*


Glomma
lower
upper
As (tonnes/yr)
10
8
6
4
2
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Drammenselva
lower
upper
As (tonnes/yr)
2.0
1.5
1.0
0.5
0.0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Numedalslågen
lower
upper
As (tonnes/yr)
2.0
1.5
1.0
0.5
0.0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Skienselva
lower
upper
As (tonnes/yr)
2.0
1.5
1.0
0.5
0.0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Otra
lower
upper
As (tonnes/yr)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006

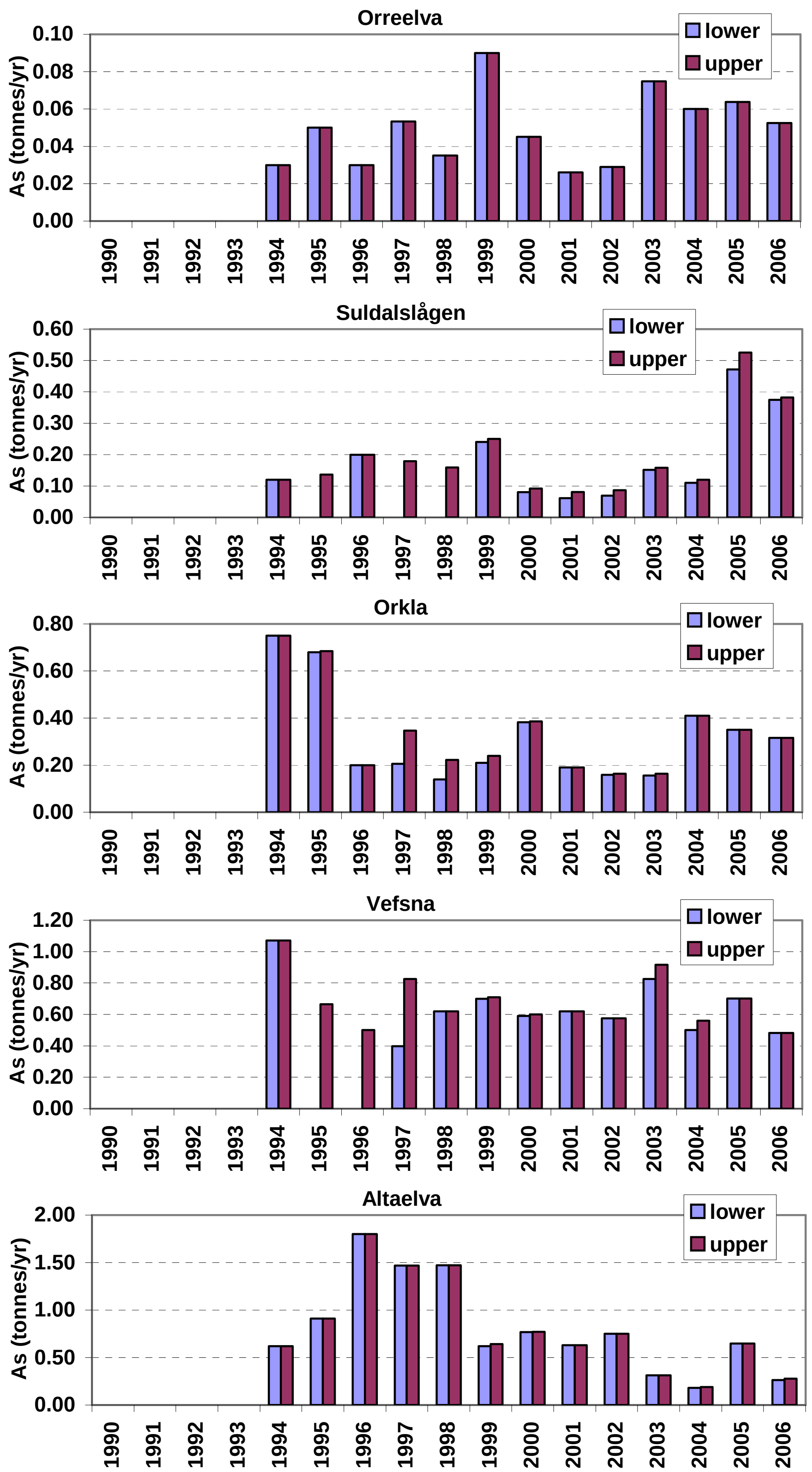
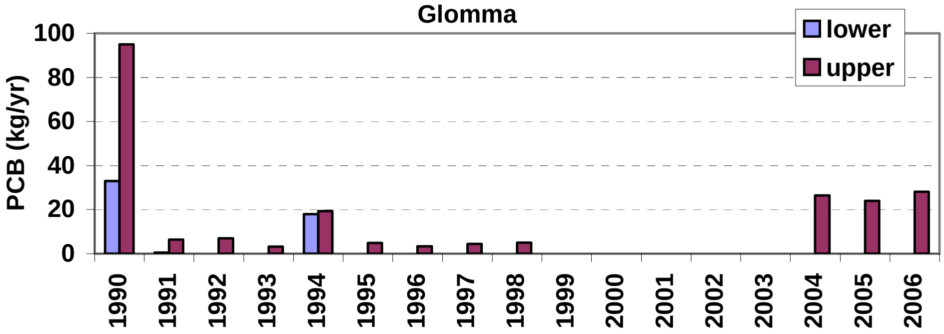
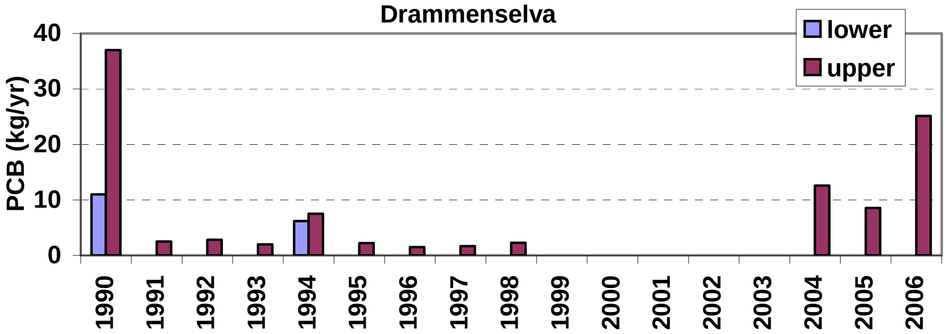
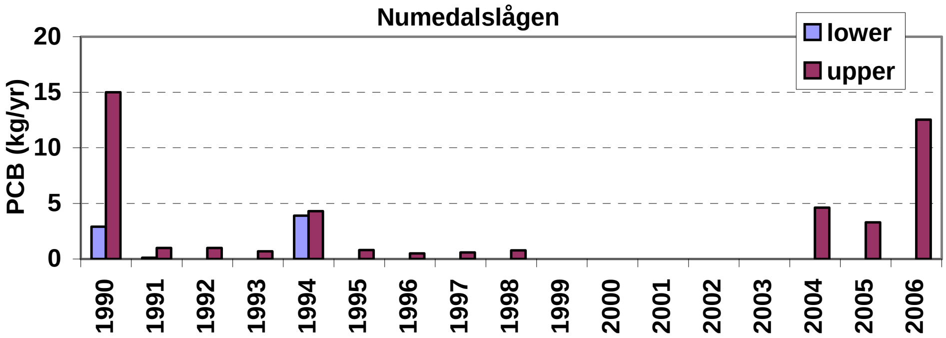
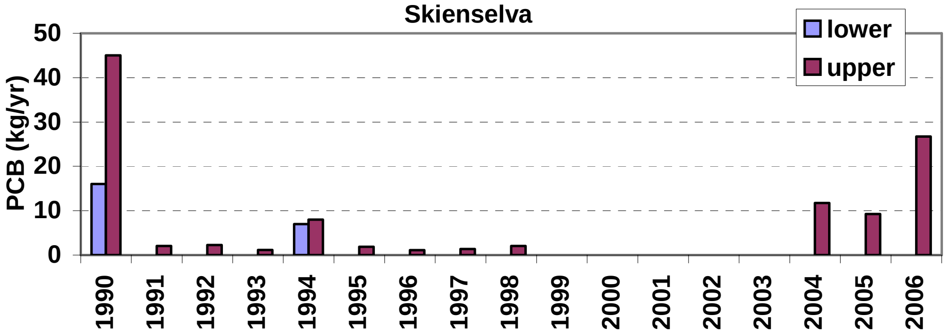


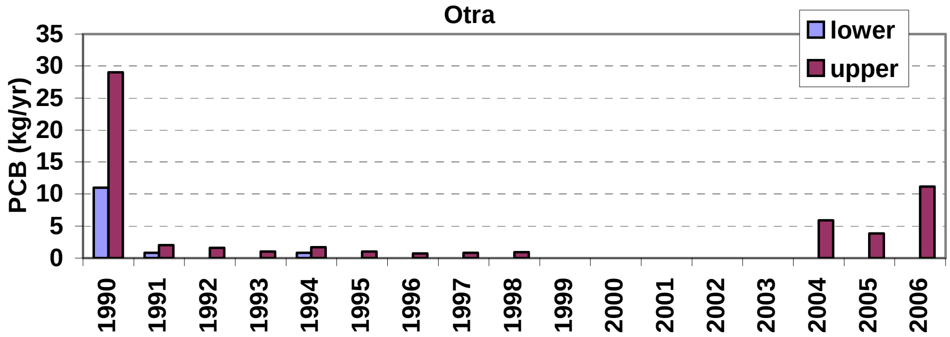
Figure III.8. Lower and upper annual riverine loads of <u>*Arsenic*</u> *in the 10 main rivers in Norway, 1990-2006.*


Glomma
lower
upper
PCB (kg/yr)
100
80
60
40
20
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Drammenselva
lower
upper
PCB (kg/yr)
40
30
20
10
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Numedalslågen
lower
upper
PCB (kg/yr)
20
15
10
5
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Skienselva
lower
upper
PCB (kg/yr)
50
40
30
20
10
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


Otra
lower
upper
PCB (kg/yr)
35
30
25
20
15
10
5
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006

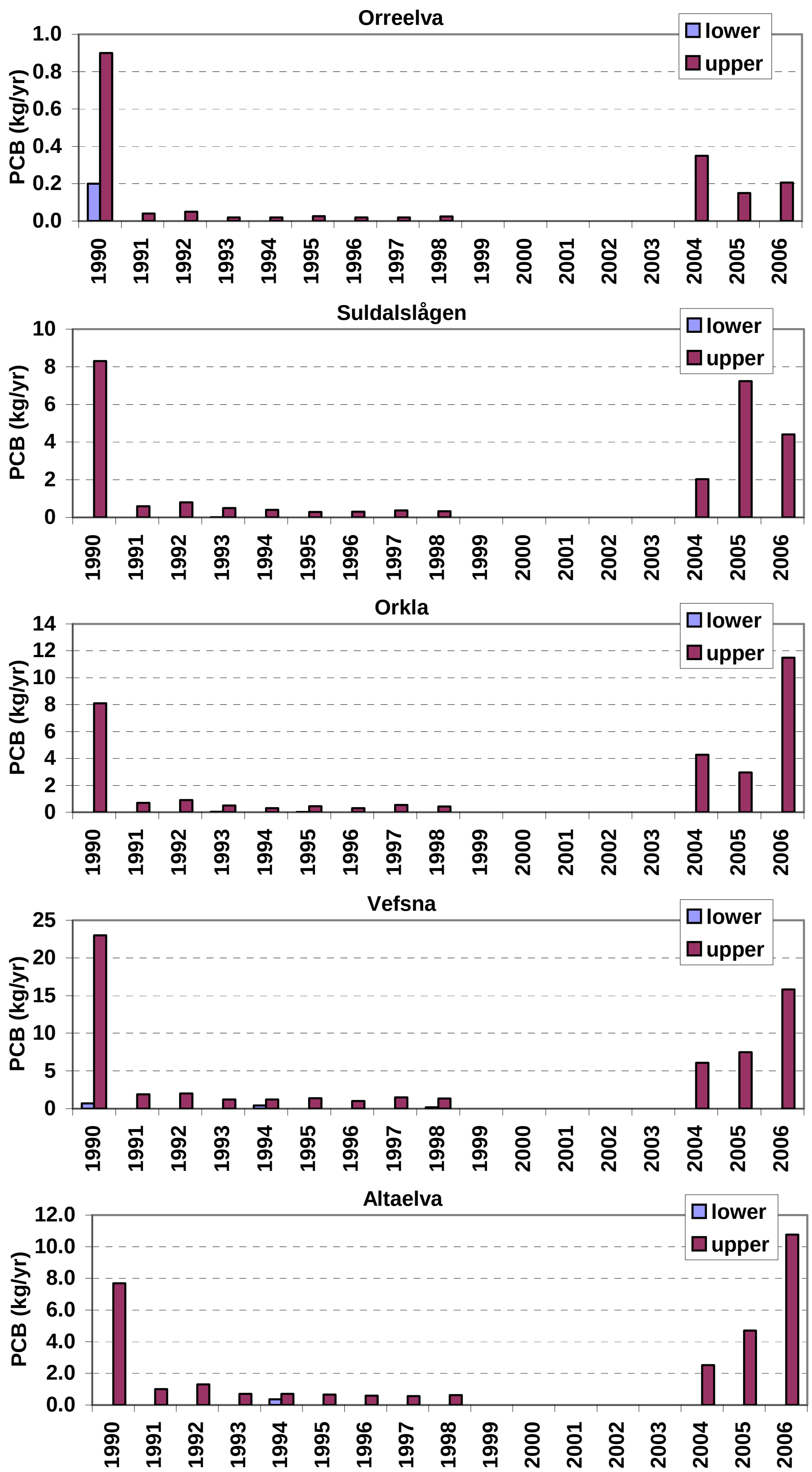
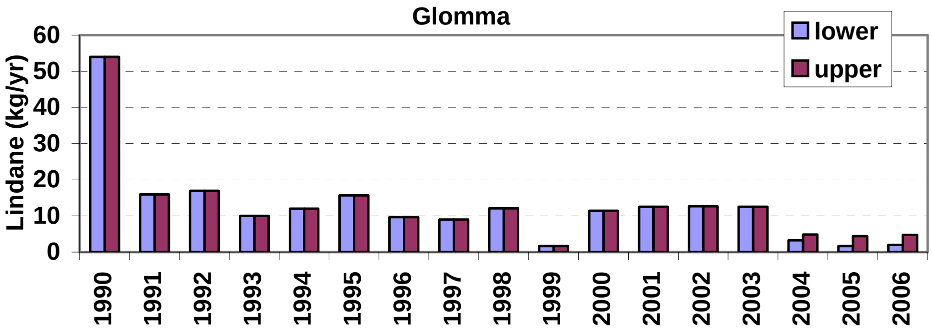
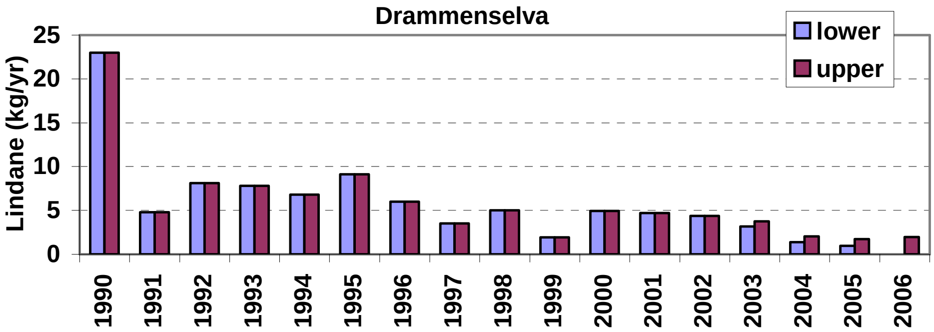
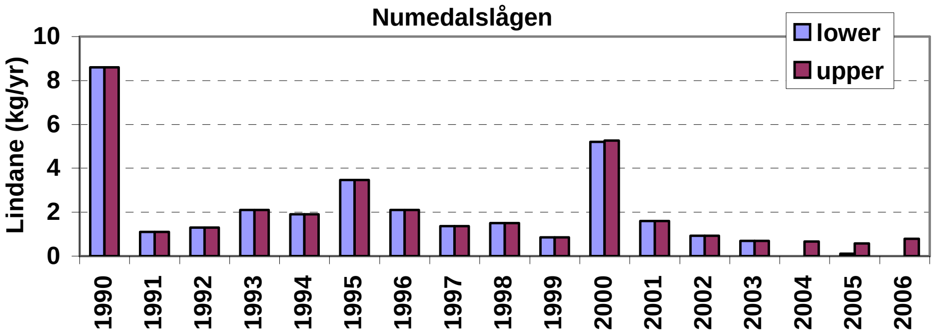
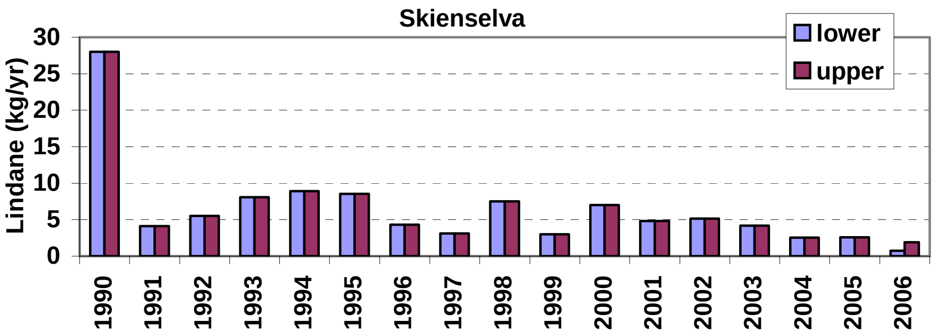


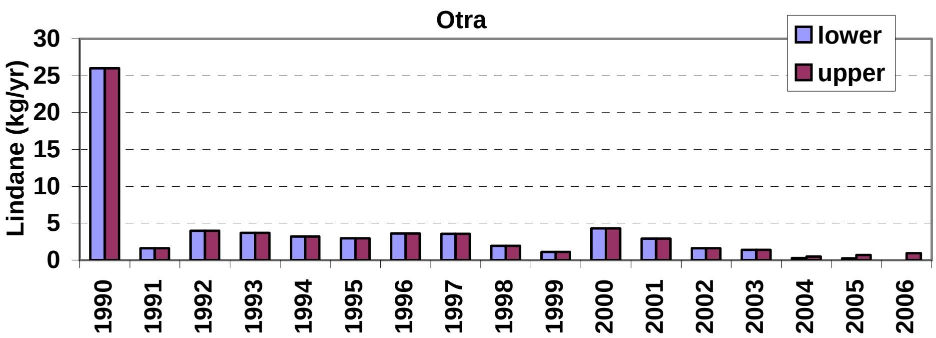
Figure III.9. Lower and upper annual riverine loads of <u>PCB7</u> in the 10 main rivers in Norway, 1990-2006. No data available for the years 1999-2003.


Glomma
Lindane (kg/yr)
lower
upper
0
10
20
30
40
50
60
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Drammenselva
Lindane (kg/yr)
lower
upper
0
5
10
15
20
25
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Numedalslågen
Lindane (kg/yr)
lower
upper
0
2
4
6
8
10
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Skienselva
Lindane (kg/yr)
lower
upper
0
5
10
15
20
25
30
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Otra
Lindane (kg/yr)
lower
upper
0
5
10
15
20
25
30
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

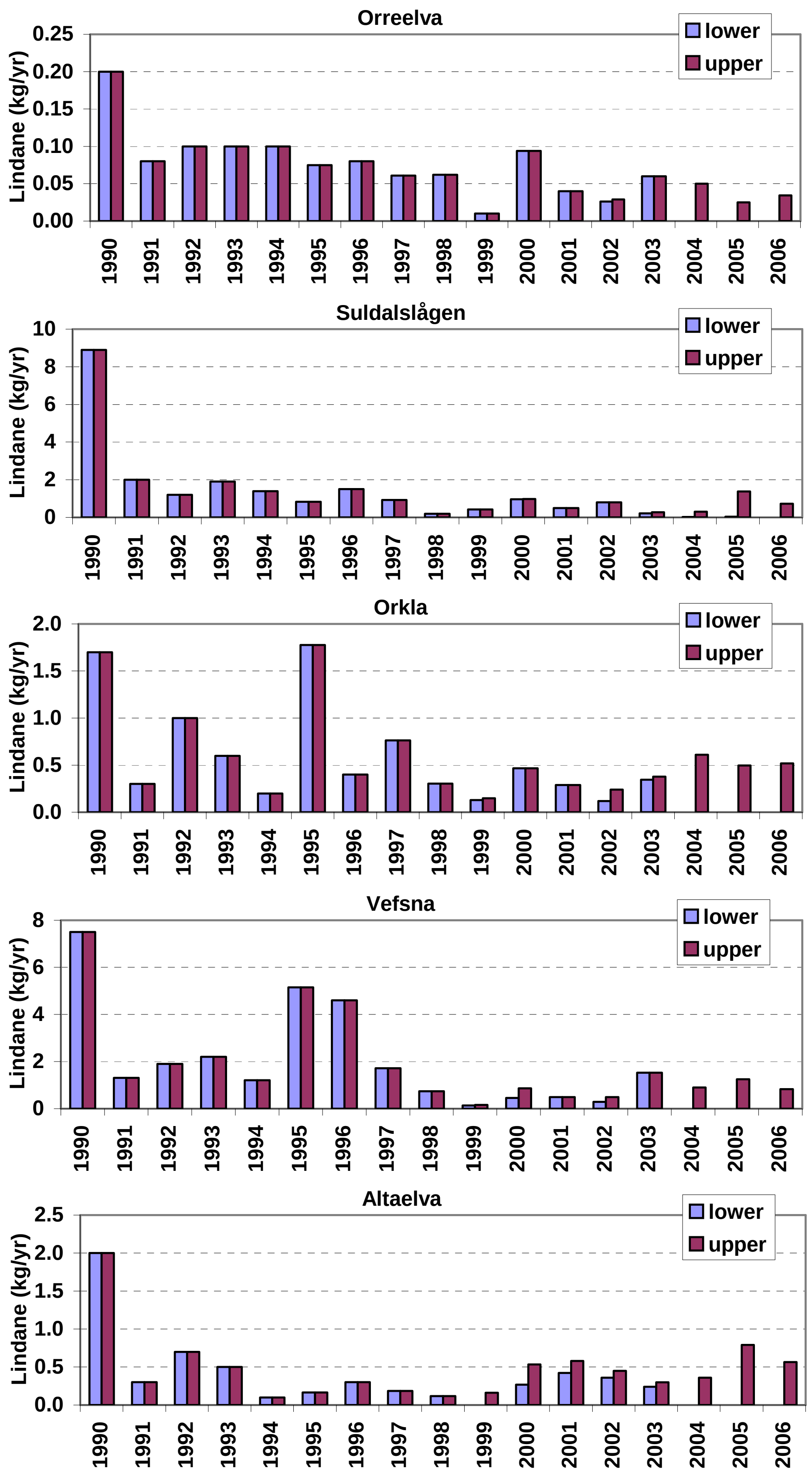


Figure III.10. Lower and upper annual riverine loads of <u>Lindane</u> in the 10 main rivers in Norway, 1990-2006.

Annex IV

River basin characteristics for the 36 rivers monitored quarterly in the Norwegian RID programme. (Q: Water discharge).

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	Passvikelv	18404	18400	5398

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Title – English and Norwegian
Riverine inputs and direct discharges to Norwegian coastal waters – 2006. OSPAR Commission.
Elvetilførsler og direkte tilførsler til norske kystområder – 2006. OSPAR Commission.

Summary
The report presents results from the 2006 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, the Norwegian inputs to coastal waters of all RID substances in 2006 may be characterised as being within normal fluctuations as compared to former years. A relatively small increase in nutrient inputs are partly explained by high water discharges in the Skagerrak area in 2006, partly by increased inputs from direct discharges. In terms of metals, an increase in riverine inputs of nickel and a decrease in zinc since 2005 were explained by fluctuations in concentrations and water discharges in the rivers *Pasvik* and *Orkla*. Long-term trends (1990-2006) show declines in riverine loads and concentrations of many metals, but this is mainly the result of subsequently lower detection limits. For nutrients and particulate matter, no overall conclusive long-term trends were detected.

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

Part B

Data Report

Table 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Riverine inputs and direct discharges to Norwegian coastal waters - 2006 (TA-2327/2007)

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Glomma ved Sarpsfoss

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg	HCHG	PCBS
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
09.01.2006	547	7.04	4.43	1.61	3.20	3	7	375	16	485	3.14	0.10	0.08	0.01	1.20	1.90	0.20	0.46	<1		
07.02.2006	469	7.08	4.84	1.24	3.30	3	6	365	32	530	3.47	0.10	0.16	0.02	3.10	5.72	0.20	0.46	<1		
06.03.2006	313	6.96	4.89	1.59	3.10	3	6	325	37	485	3.64	0.10	0.14	0.03	1.42	2.96	<0.10	0.45	<1		
11.04.2006	469	7.11	6.52	17.8	4.20	15	26	620	50	895	4.39	0.23	0.45	0.02	1.85	4.52	0.52	1.00	3.00		
08.05.2006	1355	7.14	4.52	16.4	7.50	15	28	475	22	750	5.43	0.48	0.50	0.03	2.00	5.93	0.51	1.10	3.00		
22.05.2006	1407	7.06	3.90	10.5	5.20	9	20	420	21	755	3.57	0.21	0.51	0.03	2.88	7.07	0.30	0.82	<1		
29.05.2006	1720	6.96	4.08	9.53	4.80	8	19	575	25	905	3.64	0.15	0.32	0.02	3.08	5.44	0.38	0.77	2.50		
06.06.2006	860	7.06	3.99	4.87	4.50	4	13	280	5	545	3.23	0.05	0.17	0.01	2.64	2.99	0.30	0.65	2.00		
16.06.2006	912	7.03	4.19	3.95	3.10	2	8	167	16	375	2.85	0.10	0.13	0.01	1.97	2.13	0.10	0.54	<1		
26.06.2006	860	7.11	4.24	5.42	2.70	3	10	250	10	440	2.50	0.23	0.16	0.01	1.95	2.68	0.20	1.20	1.50		
03.07.2006	677	7.15	4.33	2.87	2.70	3	9	272	8	460	2.40	0.20	0.09	0.01	1.62	2.14	0.20	0.55	<1		
07.08.2006	469	7.27	4.59	2.64	2.40	2	8	175	11	390	1.82	0.20	0.11	0.01	1.58	1.20	0.10	0.40	<1	0.21	1.20
04.09.2006	782	6.96	4.59	6.11	3.60	5	13	250	<2	485	2.55	0.20	0.21	0.01	1.82	2.45	0.30	0.69	<1		
09.10.2006	677	7.11	5.39	13.9	4.70	15	27	530	7	950	3.66	0.25	0.47	0.02	2.03	4.41	0.62	1.20	2.00	<0.20	1.20
06.11.2006	730	7.23	4.87	13.2	6.30	13	25	485	12	780	5.01	0.25	0.47	0.02	2.27	5.24	0.77	1.40	2.00		
04.12.2006	1303	6.98	4.24	18.7	6.70	20	33	400	22	735	5.50	0.35	0.61	0.02	3.00	6.73	1.50	1.50	<1		
Lower avg.	847	7.08	4.60	8.15	4.25	7.69	16.1	373	18.4	623	3.55	0.20	0.29	0.02	2.15	3.97	0.39	0.82	1.00	0.11	0
Upper avg.	847	7.08	4.60	8.15	4.25	7.69	16.1	373	18.5	623	3.55	0.20	0.29	0.02	2.15	3.97	0.39	0.82	1.56	0.21	1.20
Minimum	313	6.96	3.90	1.24	2.40	2	6	167	2	375	1.82	0.05	0.08	0.01	1.20	1.20	0.10	0.40	1.00	0.20	1.20
Maximum	1720	7.27	6.52	18.7	7.50	20	33	620	50	950	5.50	0.48	0.61	0.03	3.10	7.07	1.50	1.50	3.00	0.21	1.20
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	2	2
Info																					
St.dev	402	0.09	0.64	6.17	1.54	5.99	9.21	138	12.8	196	1.08	0.11	0.18	0.01	0.61	1.88	0.35	0.36	0.75	0.01	0

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Drammenselva

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]	HCHG [ng/l]	PCBS [ng/l]
04.01.2006	304	7.00	3.87	0.69	2.80	1	5	295	8	400	2.67	0.10	0.06	0.01	0.72	3.68	0.10	0.74	<1		
08.02.2006	271	7.02	4.14	0.79	2.70	<1	4	305	8	435	2.63	0.27	0.04	0.01	0.68	2.41	0.10	0.35	<1	<0.20	1.20
09.03.2006	276	7.10	4.22	1.01	2.40	<1	4	325	12	430	2.59	0.10	0.07	0.01	1.02	4.20	0.20	1.10	1.50		
04.04.2006	245	6.99	4.99	1.06	2.60	2	5	605	13	770	2.65	0.09	0.09	0.01	0.90	27.7	0.20	0.86	1.00		
03.05.2006	296	7.18	6.20	6.81	4.50	3	8	600	15	825	4.09	0.21	0.29	0.03	1.55	7.58	0.20	1.30	1.00	<0.20	5.20
22.05.2006	787	7.13	4.43	3.06	3.80	2	7	545	9	790	3.00	0.10	0.15	0.01	0.99	6.68	0.20	1.10	<1		
31.05.2006	579	7.11	3.88	1.78	3.60	2	7	285	14	510	2.82	0.15	0.10	0.01	1.45	2.53	0.20	0.54	1.50		
06.06.2006	437	7.03	3.81	1.25	3.40	1	5	235	5	395	2.72	0.05	0.07	0.01	1.77	2.54	0.20	0.52	<1		
21.06.2006	208	6.99	3.93	1.06	3.40	<1	5	215	5	410	2.50	0.24	0.08	0.01	0.70	2.47	0.10	0.85	<1		
28.06.2006	183	6.90	3.67	1.24	3.40	2	6	200	9	375	2.48	0.20	0.08	0.01	0.88	2.85	0.10	0.73	<1		
05.07.2006	85	7.13	4.03	11.8	3.70	9	18	200	10	415	2.46	0.23	0.64	0.02	1.43	7.79	0.20	1.10	<1		
09.08.2006	79	6.90	3.79	1.34	3.30	1	6	125	18	285	1.96	0.20	0.07	0.01	0.94	2.97	0.10	0.72	<1	<0.20	1.20
06.09.2006	431	6.96	3.86	2.55	4.70	2	6	230	12	460	2.57	0.23	0.20	0.01	1.60	4.58	0.20	0.71	<1		
03.10.2006	234	6.97	4.24	2.17	3.80	2	6	380	24	635	2.72	0.10	0.14	0.01	1.06	3.26	0.20	0.62	<1	<0.20	1.20
08.11.2006	407	7.35	4.14	1.17	3.80	1	4	290	6	490	2.95	0.20	0.08	0.01	0.82	4.28	0.20	1.20	<1		
07.12.2006	498	7.13	4.10	1.33	3.60	2	4	310	7	525	3.14	0.20	0.09	0.01	1.42	3.32	0.10	0.48	<1		
Lower avg.	333	7.06	4.21	2.44	3.47	1.88	6.28	322	10.9	509	2.75	0.17	0.14	0.01	1.12	5.55	0.16	0.81	0.31	0	2.20
Upper avg.	333	7.06	4.21	2.44	3.47	2.06	6.28	322	10.9	509	2.75	0.17	0.14	0.01	1.12	5.55	0.16	0.81	1.06	0.20	2.20
Minimum	79	6.90	3.67	0.69	2.40	1	4	125	5	285	1.96	0.05	0.04	0.01	0.68	2.41	0.10	0.35	1.00	0.20	1.20
Maximum	787	7.35	6.20	11.8	4.70	9	18	605	24	825	4.09	0.27	0.64	0.03	1.77	27.7	0.20	1.30	1.50	0.20	5.20
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
Info																					
St.dev	184	0.12	0.62	2.90	0.63	1.95	3.36	144	5.09	161	0.45	0.07	0.15	0.01	0.36	6.17	0.05	0.28	0.17	0	2

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Numedalslågen

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg	HCHG	PCBS
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
09.01.2006	174	6.83	2.54	1.45	2.60	2	6	135	36	280	2.80	0.10	0.12	0.01	0.46	2.27	0.10	0.22	<1		
08.03.2006	101	6.88	2.80	3.97	2.40	3	6	160	30	280	2.91	0.20	0.14	0.01	1.34	2.47	<0.10	0.46	2.50	<0.2	
20.03.2006	82	6.86	3.12	1.17	2.30	2	5	170	43	305	2.93	0.09	0.10	0.01	0.56	2.30	0.20	0.35	<1		
18.04.2006	112	6.89	6.07	18.40	4.20	17	26	1150	29	1400	6.14	0.26	0.47	0.03	1.30	8.11	0.33	0.65	2.50		
09.05.2006	330	6.43	1.97	7.61	6.80	6	13	155	7	360	3.34	0.20	0.46	0.03	0.86	6.16	0.20	0.38	<1	<0.2	5.20
12.06.2006	88	6.83	2.78	1.70	3.90	2	7	169	27	355	2.87	0.20	0.14	0.01	0.84	2.92	<0.10	0.39	14.50		
20.07.2006	57	7.04	2.73	1.03	2.30	2	4	80	20	230	1.85	0.10	0.13	0.01	0.72	3.34	0.35	0.33	<1		
14.08.2006	56	6.83	3.02	8.49	2.00	1	5	69	25	250	1.61	0.20	0.09	0.01	0.55	1.80	<0.10	0.20	<1	<0.2	1.20
11.09.2006	99	6.79	2.81	2.34	5.90	2	7	160	20	390	2.87	0.20	0.20	0.01	0.98	3.46	<0.10	0.43	2.00		
09.10.2006	191	6.80	3.69	9.88	7.20	9	18	270	19	650	4.49	0.26	0.63	0.02	1.56	6.59	0.43	0.69	5.00	<0.2	1.20
07.11.2006	131	7.18	3.31	2.18	4.40	2	6	250	25	475	3.94	0.20	0.19	0.01	0.96	3.93	0.20	0.37	<1		
12.12.2006	170	6.81	3.69	9.56	5.20	9	16	435	9	665	4.96	0.21	0.40	0.03	1.55	6.54	0.47	0.50	<1		
Lower avg.	133	6.85	3.21	5.65	4.10	4.75	9.92	267	24.2	470	3.39	0.19	0.26	0.02	0.97	4.16	0.19	0.41	2.21	0	2.53
Upper avg.	133	6.85	3.21	5.65	4.10	4.75	9.92	267	24.2	470	3.39	0.19	0.26	0.02	0.97	4.16	0.22	0.41	2.79	0.2	2.53
Minimum	56	6.43	1.97	1.03	2.00	1	4	69	7	230	1.61	0.09	0.09	0.01	0.46	1.80	0.10	0.20	1.00	0.2	1.20
Maximum	330	7.18	6.07	18.40	7.20	17	26	1150	43	1400	6.14	0.26	0.63	0.03	1.56	8.11	0.47	0.69	14.50	0.2	5.20
More than 70%>LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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	3
Info																					
St.dev	76	0.17	1.02	5.29	1.85	4.77	6.86	295	10.2	326	1.29	0.06	0.18	0.01	0.38	2.12	0.14	0.15	3.88	0	2.31

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Skienselva

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]	HCHG [ng/l]	PCBS [ng/l]
10.01.2006	337	6.69	2.15	0.27	2.40	2	6	195	7	285	2.04	0.10	0.05	0.01	0.47	2.87	0.10	0.22	1.00		
15.02.2006	264	6.63	2.01	0.52	2.20	<1	4	190	11	270	2.03	0.09	0.05	0.01	0.44	1.90	<0.10	0.20	1.50	0.22	1.20
17.03.2006	291	6.76	1.87	0.74	2.30	<1	3	175	6	240	2.05	0.09	0.05	0.01	0.42	1.70	0.20	0.24	<1		
27.04.2006	383	6.65	2.08	1.01	7.10	1	4	205	6	290	2.31	0.10	0.05	0.01	0.33	2.37	0.20	0.20	<1		
10.05.2006	599	6.65	1.97	0.89	2.10	1	3	185	5	265	2.16	0.06	0.04	0.01	0.30	2.35	<0.10	0.20	5.00	<0.20	5.20
19.06.2006	173	6.55	1.96	0.66	2.60	<1.0	4	155	12	310	2.04	0.10	0.06	0.01	0.47	3.19	<0.10	0.46	<1		
24.07.2006	214	6.75	1.91	0.66	2.20	<1.0	3	120	11	240	1.66	0.10	0.03	0.01	0.33	1.90	0.34	0.20	<1		
15.08.2006	224	6.69	1.86	0.75	1.90	<1.0	3	99	14	235	1.59	0.10	0.04	0.01	1.37	5.04	<0.10	0.26	<1	0.24	1.20
07.09.2006	314	6.85	2.00	1.34	2.20	1	4	115	11	260	1.72	0.10	0.09	0.01	0.58	2.83	<0.10	0.22	<1		
04.10.2006	278	6.65	2.00	0.61	2.60	1	3	86	14	285	1.98	0.06	0.06	0.01	0.49	1.60	<0.10	0.10	<1	<0.20	1.20
07.11.2006	335	7.18	2.07	0.82	2.70	<1.0	4	160	17	305	2.13	0.10	0.07	0.01	0.45	2.36	0.10	0.20	<1		
04.12.2006	426	6.75	2.19	1.66	2.70	2	4	185	7	325	2.42	0.10	0.11	0.01	0.53	2.83	0.20	0.40	<1		
Lower avg.	320	6.73	2.01	0.83	2.75	0.667	3.75	156	10.1	276	2.01	0.09	0.06	0.01	0.51	2.58	0.10	0.24	0.63	0.115	2.20
Upper avg.	320	6.73	2.01	0.83	2.75	1.17	3.75	156	10.1	276	2.01	0.09	0.06	0.01	0.51	2.58	0.15	0.24	1.38	0.215	2.20
Minimum	173	6.55	1.86	0.27	1.90	1	3	86	5	235	1.59	0.06	0.03	0.01	0.30	1.60	0.10	0.10	1.00	0.200	1.20
Maximum	599	7.18	2.19	1.66	7.10	2	6	205	17	325	2.42	0.10	0.11	0.01	1.37	5.04	0.34	0.46	5.00	0.240	5.20
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	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
Info																					
St.dev	113	0.16	0.10	0.37	1.39	0.389	0.866	40.7	3.85	29.3	0.250	0.02	0.02	0.00	0.28	0.926	0.08	0.10	1.15	0.019	2

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Otra

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]	HCHG [ng/l]	PCBS [ng/l]
10.01.2006	146	6.13	1.59	0.64	1.90	<1	3	120	19	230	1.59	0.10	0.18	0.02	0.92	4.02	<0.10	0.47	2.00		
13.02.2006	121	6.21	1.53	0.81	2.10	2	7	110	17	235	1.68	0.10	0.16	0.02	0.37	10.3	0.10	0.28	2.00	<0.20	1.20
16.03.2006	116	6.32	1.44	0.79	1.80	<1	3	105	29	215	1.63	0.10	0.13	0.01	0.67	2.45	0.33	0.42	<1		
18.04.2006	142	6.04	2.24	0.81	2.90	<1	4	205	22	355	2.03	0.09	0.32	0.03	0.48	5.44	<0.10	0.66	1.00		
09.05.2006	156	5.80	1.71	0.90	3.10	<1	4	145	10	285	1.67	0.20	0.31	0.02	1.24	3.90	<0.10	1.20	1.00	<0.20	5.20
12.06.2006	77	6.25	1.51	0.95	2.20	<1	2	66	5	195	1.11	0.10	0.16	0.01	0.85	2.96	<0.10	0.69	<1		
11.07.2006	58	6.20	1.47	0.28	2.40	2	5	63	8	235	0.899	0.10	0.17	0.02	0.58	5.67	0.10	0.47	<1		
17.08.2006	53	6.56	1.63	0.51	2.30	<1	5	61	30	250	1.09	0.26	0.21	0.02	0.77	3.45	0.61	0.43	<1	<0.20	1.20
12.09.2006	148	6.18	1.29	0.83	3.00	<1	3	63	8	220	1.24	0.10	0.21	0.02	1.03	3.50	<0.10	0.74	<1		
17.10.2006	183	5.76	1.49	1.48	4.30	1	5	65	17	240	1.63	0.10	0.36	0.02	1.15	3.51	0.10	1.10	<1	<0.20	1.20
08.11.2006	191	5.93	1.43	2.28	3.50	1	4	73	13	250	1.79	0.20	0.30	0.02	2.16	2.77	<0.10	0.94	<1		
08.12.2006	565	5.81	1.90	3.42	3.00	2	4	75	15	245	1.94	0.20	0.53	0.03	0.66	5.88	0.10	0.86	<1		
Lower avg.	163	6.10	1.60	1.14	2.71	0.667	4.08	95.9	16.1	246	1.52	0.14	0.25	0.02	0.90	4.49	0.11	0.69	0.50	0	2.20
Upper avg.	163	6.10	1.60	1.14	2.71	1.25	4.08	95.9	16.1	246	1.52	0.14	0.25	0.02	0.90	4.49	0.16	0.69	1.17	0.20	2.20
Minimum	53	5.76	1.29	0.28	1.80	1	2	61	5	195	0.899	0.09	0.13	0.01	0.37	2.45	0.10	0.28	1.00	0.20	1.20
Maximum	565	6.56	2.24	3.42	4.30	2	7	205	30	355	2.03	0.26	0.53	0.03	2.16	10.3	0.61	1.20	2.00	0.20	5.20
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	no	yes
n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12.00	12	12	12	12	4	4
Info																					
St.dev	134	0.24	0.25	0.88	0.73	0.452	1.31	44.1	8.02	40.7	0.356	0.06	0.12	0.01	0.48	2.15	0.16	0.29	0.39	0	2

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Orreelva

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]	HCHG [ng/l]	PCBS [ng/l]
04.01.2006	1	7.40	18.00	5.38	5.60	18	49	1800	44	2200	2.50	0.36	0.35	0.02	1.82	3.45	0.51	1.20	<1		
08.02.2006	22	7.50	21.50	6.20	5.70	60	86	1600	72	2135	2.57	0.24	0.22	0.01	1.54	2.65	0.20	0.93	1.00	<0.20	1.20
13.03.2006	1	7.58	18.50	10.20	5.30	17	49	1900	70	2265	0.963	0.23	0.28	0.02	3.53	8.70	0.33	1.50	1.50		
18.04.2006	7	7.34	18.50	4.43	4.80	15	42	1065	49	1660	6.05	0.20	0.10	0.01	1.34	2.08	0.10	0.97	1.00		
15.05.2006	1	7.58	18.90	2.90	5.30	6	35	500	98	1230	0.257	0.19	0.09	0.01	1.43	1.30	0.20	0.96	<1	<0.20	1.20
19.06.2006	0	7.68	20.10	5.63	5.70	3	37	152	43	210	0.492	0.29	0.14	0.01	1.66	2.33	<0.10	1.20	<1		
04.07.2006	1	7.95	20.80	5.80	6.00	8	32	<1	99	735	0.727	0.28	0.12	0.01	1.29	1.40	0.30	1.20	<1		
07.08.2006	1	8.23	20.90	7.46	6.40	5	50	<10	100	655	2.05	0.42	0.11	0.01	0.72	0.250	0.10	0.71	<1	<0.20	1.20
06.09.2006	8	7.87	19.70	15.80	6.10	18	99	295	12	1410	5.16	0.40	0.26	0.01	1.16	2.12	0.30	1.20	<1		
02.10.2006	3	7.58	20.00	7.42	5.90	15	55	250	96	995	3.72	0.21	0.11	<0.01	0.91	0.400		0.74	<1	<0.20	1.20
07.11.2006	20	7.60	20.20	15.60	6.00	31	109	970	44	2090	4.83	0.32	0.49	0.01	1.44	2.68	0.30	1.20	<1		
05.12.2006	18	7.70	18.20	23.30	6.50	40	136	1900	17	2910	5.31	0.38	0.68	0.02	2.11	5.60	0.36	1.30	2.00		
Lower avg.	7	7.67	19.61	9.18	5.78	19.7	64.9	869	62	1541	2.89	0.29	0.25	0.01	1.58	2.75	0.25	1.09	0.46	0	1.20
Upper avg.	7	7.67	19.61	9.18	5.78	19.7	64.9	870	62	1541	2.89	0.29	0.25	0.01	1.58	2.75	0.25	1.09	1.13	0.20	1.20
Minimum	0	7.34	18.00	2.90	4.80	3	32	1	12	210	0.257	0.19	0.09	0.01	0.72	0.250	0.10	0.71	1.00	0.20	1.20
Maximum	22	8.23	21.50	23.30	6.50	60	136	1900	100	2910	6.05	0.42	0.68	0.02	3.53	8.70	0.51	1.50	2.00	0.20	1.20
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	11	12	12	4	4
Info																					
St.dev	8	0.25	1.17	6.04	0.48	16.6	34.0	765	31.8	804	2.08	0.08	0.18	0.01	0.72	2.35	0.13	0.23	0.31	0	0

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Suldalslågen

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg	HCHG	PCBS
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
04.01.2006	19	6.52	1.80	1.58	0.88	3	7	270	18	370	1.18	0.07	0.04	0.01	0.22	1.70	<0.10	0.10	<1		
08.02.2006	53	6.49	1.93	1.63	1.50	1	4	250	8	310	1.30	0.31	0.12	0.01	0.39	2.49	<0.10	0.21	<1	<0.20	1.20
10.03.2006	10	6.41	1.55	0.28	0.55	<1.00	2	200	2	215	0.899	0.07	0.03	0.01	0.20	1.30	<0.10	0.20	<1		
07.04.2006	18	6.46	1.85	1.21	1.40	2	5	235	3	310	1.18	0.06	0.10	0.01	0.35	2.09	0.10	0.20	1.00		
15.05.2006	54	6.49	1.30	5.79	0.79	4	8	125	5	195	0.749	0.10	0.38	0.01	0.38	2.89	<0.10	0.20	<1	<0.20	1.20
11.07.2006	304	6.35	1.25	0.70	0.76	1	3	125	4	180	0.706	0.10	0.07	0.01	0.24	2.49	<0.10	0.55	<1		
14.08.2006	42	6.64	1.43	0.75	0.50	<1.00	2	110	4	170	0.663	0.07	0.06	0.01	0.18	1.80	<0.10	0.10	<1	<0.20	1.20
11.09.2006	53	6.55	1.23	0.49	0.80	<1.00	1	135	4	185	0.663	<0.05	0.04	0.01	0.24	1.10	<0.10	0.23	<1		
18.10.2006	35	6.51	1.35	0.58	0.75	<1.00	2	160	6	225	0.834	0.10	0.06	<0.01	0.33	1.60	<0.10	0.09	<1	<0.20	1.20
10.11.2006	118	6.43	1.63	0.78	1.60	<1.00	2	220	2	305	1.20	0.10	0.09	0.01	0.33	2	0.10	0.21	<1		
14.12.2006	644	6.19	2.33	2.94	1.40	3	5	150	<2	240	1.16	0.10	0.32	0.02	0.44	4.04	0.20	0.32	<1		
Lower avg.	123	6.46	1.60	1.52	0.99	1.27	3.73	180	5.09	246	0.957	0.10	0.12	0.01	0.30	2.14	0.04	0.22	0.09	0	1.20
Upper avg.	123	6.46	1.60	1.52	0.99	1.73	3.73	180	5.27	246	0.957	0.10	0.12	0.01	0.30	2.14	0.11	0.22	1.00	0.20	1.20
Minimum	10	6.19	1.23	0.28	0.50	1	1	110	2	170	0.663	0.05	0.03	0.01	0.18	1.10	0.10	0.09	1.00	0.20	1.20
Maximum	644	6.64	2.33	5.79	1.60	4	8	270	18	370	1.30	0.31	0.38	0.02	0.44	4.04	0.20	0.55	1.00	0.20	1.20
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	no	yes
n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	4	4
Info																					
St.dev	192	0.12	0.34	1.60	0.40	1.10	2.28	56.8	4.61	67.0	0.247	0.07	0.12	0.00	0.09	0.826	0.03	0.13	0.00	0	0

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Orkla

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]	HCHG [ng/l]	PCBS [ng/l]
10.01.2006	17	7.38	5.86	0.87	1.90	<1	4	150	8	245	2.72	0.10	0.02	0.03	4.88	12.6	0.30	0.65	<1		
09.02.2006	61	7.31	6.62	0.96	3.70	<1	4	265	4	400	2.95	0.20	0.04	0.09	11.30	35.5	0.20	0.79	<1	<0.20	1.20
13.03.2006	17	7.39	5.98	1.88	1.80	2	4	180	7	270	2.74	0.09	0.03	0.03	5.17	12.4	0.20	0.73	1.00		
06.04.2006	15	7.47	7.45	0.48	1.70	<1	3	265	4	395	3.21	0.10	0.02	0.04	5.40	12.5	0.10	0.90	<1		
08.05.2006	658	7.06	3.22	9.33	4.40	3	13	76	8	260	2.61	0.10	0.11	0.03	5.72	10.9	0.56	1.20	1.50	<0.20	5.20
12.06.2006	362	7.23	4.36	0.62	2.00	<1	3	66	4	175	1.84	0.10	0.02	0.03	5.22	10.5	0.20	0.65	<1		
05.07.2006	48	7.50	6.11	0.76	1.80	2	4	115	5	245	1.85	0.10	0.02	0.02	3.30	8.61	0.39	0.62	<1		
09.08.2006	46	7.49	6.35	1.63	2.10	<1	3	140	7	285	2.18	0.10	0.03	0.01	3.40	6.28	0.10	0.56	<1	<0.20	1.20
06.09.2006	197	7.26	4.64	7.08	7.60	4	11	39	4	285	2.61	0.21	0.15	0.04	5.51	10.9	0.53	1.60	<1		
04.10.2006	50	7.26	5.01	1.85	5.70	2	6	55	4	260	2.82	0.10	0.05	0.02	4.75	7.20	0.40	1.10	1.50	<0.20	1.20
06.11.2006	55	7.42	5.47	8.67	5.50	5	14	160	5	425	3.02	0.25	0.17	0.06	8.84	19.9	0.73	1.10	2.50		
11.12.2006	51	7.51	6.34	1.00	2.20	<1	3	165	6	325	2.82	0.07	0.03	0.04	6.56	15.3	0.20	0.50	<1		
Lower avg.	131	7.36	5.62	2.93	3.37	1.50	6	140	5.50	298	2.61	0.13	0.06	0.04	5.84	13.5	0.33	0.87	0.54	0	2.20
Upper avg.	131	7.36	5.62	2.93	3.37	2	6	140	5.50	298	2.61	0.13	0.06	0.04	5.84	13.5	0.33	0.87	1.21	0.20	2.20
Minimum	15	7.06	3.22	0.48	1.70	1	3	39	4	175	1.84	0.07	0.02	0.01	3.30	6.28	0.10	0.50	1.00	0.20	1.20
Maximum	658	7.51	7.45	9.33	7.60	5	14	265	8	425	3.21	0.25	0.17	0.09	11.30	35.5	0.73	1.60	2.50	0.20	5.20
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
Info																					
St.dev	194	0.14	1.15	3.34	1.99	1.35	4.16	74.8	1.62	74.7	0.438	0.06	0.05	0.02	2.24	7.80	0.20	0.33	0.45	0	2

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Vefsna

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg	HCHG	PCBS
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
04.01.2006	65	7.40	10.30	<0.10	1.20	<1	2	280	3	345	2.20	0.20	<0.01	<0.01	0.35	0.470	0.20	0.07	<1		
08.02.2006	75	7.44	8.48	0.27	1.60	<1	3	98	4	175	1.74	0.10	0.02	<0.01	0.33	0.280	0.10	0.10	<1	<0.20	1.20
13.03.2006	39	7.69	10.40	0.66	1.30	<1	2	120	2	180	2.01	0.20	0.01	<0.01	0.35	0.100	0.48	0.31	<1		
10.04.2006	36	7.60	11.40	0.45	0.98	1	3	140	<2	235	1.93	0.20	0.02	<0.01	0.35	0.260	0.10	0.20	<1		
08.05.2006	502	7.23	4.36	6.16	1.50	4	7	33	4	96	1.26	0.09	0.08	0.01	0.28	1	0.20	0.34	1.00	<0.20	5.20
12.06.2006	274	6.94	3.45	0.81	0.81	<1	2	15	<2	62	0.792	0.10	0.05	<0.01	0.35	0.760	<0.10	0.22	<1		
07.07.2006	116	6.89	4.31	0.69	0.77	1	2	21	6	65	0.682	0.10	0.04	<0.01	0.34	1	0.10	0.20	<1		
07.08.2006	62	7.47	5.07	1.12	0.61	<1	5	29	7	95	0.770	0.20	0.05	<0.01	0.25	0.370	<0.10	<0.01	<1	<0.20	1.20
06.09.2006	142	7.36	4.26	5.46	2.40	2	5	36	4	180	1.30	0.22	0.20	0.01	0.47	0.940	0.20	0.35	<1		
04.10.2006	123	7.47	5.82	0.56	1.90	<1	1	<1	3	108	1.37	0.07	0.03	<0.01	0.39	<0.05	0.10	0.10	<1	<0.20	1.20
06.11.2006	89	7.39	5.77	0.91	2.10	1	2	51	6	155	1.71	0.10	0.04	<0.01	0.34	0.340	0.20	0.21	<1		
04.12.2006	167	7.66	6.73	0.66	2.00	<1	2	54	5	155	1.50	0.10	0.03	<0.01	0.39	0.600	0.10	0.20	<1		
Lower avg.	141	7.38	6.70	1.48	1.43	0.750	3	73.1	3.67	154	1.44	0.14	0.05	0.00	0.35	0.510	0.15	0.19	0.08	0	2.20
Upper avg.	141	7.38	6.70	1.49	1.43	1.33	3	73.2	4	154	1.44	0.14	0.05	0.01	0.35	0.514	0.17	0.20	1.00	0.20	2.20
Minimum	36	6.89	3.45	0.10	0.61	1	1	1	2	62	0.682	0.07	0.01	0.01	0.25	0.050	0.10	0.05	1.00	0.20	1.20
Maximum	502	7.69	11.40	6.16	2.40	4	7	280	7	345	2.20	0.22	0.20	0.01	0.47	1	0.48	0.35	1.00	0.20	5.20
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	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
Info																					
St.dev	131	0.25	2.76	2.04	0.58	0.888	1.76	78.1	1.71	79.9	0.505	0.06	0.05	0.00	0.05	0.341	0.11	0.10	0.00	0	2

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Altaelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg	HCHG	PCBS
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]	[ng/l]	[ng/l]
03.01.2006	37	7.28	6.34	0.49	3.30	1	4	50	4	165	5.75	0.10	0.01	<0.01	0.74	0.250	0.20	0.10	<1		
09.02.2006	31	7.39	7.04	0.53	3.30	2	5	53	3	175	6.05	0.20	0.01	<0.01	0.49	0.100	0.20	0.10	2.50	<0.20	1.20
13.03.2006	30	7.45	7.61	0.66	3.10	2	4	56	<2	160	6.55	0.10	0.02	<0.01	0.56	0.220	0.20	0.20	<1		
18.04.2006	39	7.42	8.01	0.98	3.00	3	6	29	<2	180	6.65	<0.01	0.02	<0.01	0.53	0.230	0.20	0.20	1.00		
09.05.2006	294	7.42	7.31	3.29	3.40	4	9	34	4	175	5.37	0.10	0.03	<0.01	0.47	0.430	0.20	0.30	1.50	<0.20	5.20
12.06.2006	155	7.27	4.10	0.80	3.50	1	6	8	3	138	3.19	0.10	0.02	<0.01	0.64	0.400	0.20	0.28	<1		
10.07.2006	149	7.24	4.52	0.69	3.70	1	5	8	3	150	3.00	0.10	0.01	<0.01	0.63	0.300	0.20	0.39	<1		
07.08.2006	63	7.37	5.24	0.74	3.10	<1.00	4	11	5	114	3.32	0.10	0.01	<0.01	0.56	<0.05	0.20	0.10	1.00	<0.20	1.20
07.09.2006	56	7.58	5.88	0.94	3.00	<1.00	3	2	4	143	2.91	0.10	0.03	<0.01	0.60	<0.05	0.10	0.20	<1		
02.10.2006	64	7.46	6.31	0.69	2.80	<1.00	2	<1.00	4	116	3.44	<0.01	<0.01	<0.01	0.54	<0.05	0.20	0.08	<1	<0.20	1.20
06.11.2006	42	7.67	6.46	0.63	2.60	2	4	29	4	160	4.09	0.10	<0.01	<0.01	0.83	0.170	0.20	0.20	<1		
04.12.2006	45	7.66	6.52	0.41	2.70	<1.00	3	26	6	150	4.51	0.10	0.02	<0.01	0.73	0.200	0.20	0.10	<1		
Lower avg.	84	7.43	6.28	0.90	3.13	1.33	4.58	25.5	3.33	152	4.57	0.09	0.01	0.00	0.61	0.192	0.19	0.19	0.50	0	2.20
Upper avg.	84	7.43	6.28	0.90	3.13	1.67	4.58	25.6	3.67	152	4.57	0.10	0.02	0.01	0.61	0.204	0.19	0.19	1.17	0.20	2.20
Minimum	30	7.24	4.10	0.41	2.60	1	2	1	2	114	2.91	0.05	0.01	0.01	0.47	0.050	0.10	0.08	1.00	0.20	1.20
Maximum	294	7.67	8.01	3.29	3.70	4	9	56	6	180	6.65	0.20	0.03	0.01	0.83	0.430	0.20	0.39	2.50	0.20	5.20
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	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
Info																					
St.dev	79	0.14	1.19	0.77	0.33	0.985	1.83	19.9	1.15	21.7	1.44	0.04	0.01	0.00	0.11	0.130	0.03	0.10	0.44	0	2

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Tista utløp Femsjøen

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.02.2006	13	6.79	5.89	1.91	8.30	4	11	645	5	890	3.79	0.17	0.12	0.01	0.64	1.67	<0.100	0.44	<1
08.05.2006	23	6.96	5.72	3.09	8.40	4	15	590	3	905	3.96	0.38	0.26	0.02	2.55	3.60	0.32	0.74	1.50
07.08.2006	12	6.92	5.98	3.44	7.50	3	12	510	9	930	2.52	0.37	0.28	0.01	1.49	2.35	0.36	0.74	<1
09.10.2006	11	6.89	5.97	1.30	7.40	2	9	565	16	875	2.25	0.29	0.25	0.01	1.72	3.69	0.30	0.88	1.00
Lower avg.	15	6.89	5.89	2.44	7.90	3.25	11.8	578	8.25	900	3.13	0.30	0.23	0.01	1.60	2.83	0.25	0.70	0.63
Upper avg.	15	6.89	5.89	2.44	7.90	3.25	11.8	578	8.25	900	3.13	0.30	0.23	0.01	1.60	2.83	0.27	0.70	1.13
Minimum	11	6.79	5.72	1.30	7.40	2	9	510	3	875	2.25	0.17	0.12	0.01	0.64	1.67	0.10	0.44	1.00
Maximum	23	6.96	5.98	3.44	8.40	4	15	645	16	930	3.96	0.38	0.28	0.02	2.55	3.69	0.36	0.88	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
Info																			
St.dev	6	0.07	0.12	1.00	0.52	0.957	2.50	56.1	5.74	23.5	0.869	0.10	0.08	0.01	0.79	0.985	0.12	0.19	0.25

Tokkeelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
13.02.2006	11	6.31	2.33	2.57	6.50	1	7	190	3	395	3.08	0.21	0.18	0.04	0.48	6.30	0.10	0.40	<1
22.05.2006	53	6.21	2.17	1.12	5.10	<1	5	195	3	410	2.93	0.20	0.22	0.03	0.47	6.02	0.10	0.44	<1
08.08.2006	13	5.93	2.33	6.83	5.70	3	17	<1	22	295	2.55	0.23	0.24	0.03	0.60	6.15	0.20	0.41	<1
11.10.2006	25	6.13	2.14	1.49	5.80	1	4	100	5	390	2.78	0.26	0.23	0.03	0.72	5.28	0.20	0.52	2.00
Lower avg.	25	6.15	2.24	3.00	5.78	1.25	8.25	121	8.25	373	2.83	0.23	0.22	0.03	0.57	5.94	0.15	0.44	0.50
Upper avg.	25	6.15	2.24	3.00	5.78	1.50	8.25	122	8.25	373	2.83	0.23	0.22	0.03	0.57	5.94	0.15	0.44	1.25
Minimum	11	5.93	2.14	1.12	5.10	1	4	1	3	295	2.55	0.20	0.18	0.03	0.47	5.28	0.10	0.40	1.00
Maximum	53	6.31	2.33	6.83	6.50	3	17	195	22	410	3.08	0.26	0.24	0.04	0.72	6.30	0.20	0.52	2.00
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	4.00	4.00	4.00	4.00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Info																			
St.dev	19	0.16	0.10	2.62	0.57	1	5.97	91.4	9.22	52.4	0.228	0.03	0.02	0.00	0.12	0.453	0.06	0.05	0.50

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Nidelva Arendal

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
13.02.2006	33	6.47	3.17	0.98	3.20	2	6	315	34	455	2.95	0.20	0.22	0.03	0.78	5.37	0.10	0.23	1.00
22.05.2006	305	6.52	5.58	6.14	4.50	16	31	995	125	1405	3.57	0.25	0.48	0.04	1.13	10.1	0.10	0.44	<1
08.08.2006	44	6.43	1.57	1.55	2.10	<1	3	105	7	235	1.26	0.10	0.11	0.01	0.66	2.23	<0.100	0.10	<1
11.10.2006	149	6.54	3.09	2.18	5.20	2	6	135	21	385	2.67	0.23	0.39	0.03	0.86	5.39	0.20	0.33	1.50
Lower avg.	133	6.49	3.35	2.71	3.75	5	11.5	388	46.8	620	2.62	0.20	0.30	0.03	0.86	5.77	0.10	0.28	0.63
Upper avg.	133	6.49	3.35	2.71	3.75	5.25	11.5	388	46.8	620	2.62	0.20	0.30	0.03	0.86	5.77	0.13	0.28	1.13
Minimum	33	6.43	1.57	0.98	2.10	1	3	105	7	235	1.26	0.10	0.11	0.01	0.66	2.23	0.10	0.10	1.00
Maximum	305	6.54	5.58	6.14	5.20	16	31	995	125	1405	3.57	0.25	0.48	0.04	1.13	10.1	0.20	0.44	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
Info																			
St.dev	126	0.05	1.66	2.34	1.38	7.18	13.1	415	53.3	531	0.977	0.07	0.17	0.01	0.20	3.24	0.05	0.14	0.25

Tovdalselva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
13.02.2006	18	6.39	2.66	1.74	5.30	2	11	210	36	435	3.04	0.23	0.61	0.05	0.68	11.7	0.30	0.53	<1
09.05.2006	285	6.41	1.92	1.58	4.40	<1	4	160	23	330	2.18	0.21	0.48	0.03	0.36	5.74	<0.10	0.36	2.00
17.08.2006	22	6.50	2.20	1.00	3.50	<1	6	80	15	340	0.884	0.27	0.21	0.03	2.00	4.39	0.20	0.33	<1
10.10.2006	80	6.34	2.02	2.28	7.10	2	9	72	38	435	2.05	0.37	0.66	0.05	0.60	6.42	0.20	0.41	2.50
Lower avg.	101	6.41	2.20	1.65	5.08	1	7.50	131	28	385	2.04	0.27	0.49	0.04	0.91	7.06	0.18	0.41	1.13
Upper avg.	101	6.41	2.20	1.65	5.08	1.50	7.50	131	28	385	2.04	0.27	0.49	0.04	0.91	7.06	0.20	0.41	1.63
Minimum	18	6.34	1.92	1.00	3.50	1	4	72	15	330	0.884	0.21	0.21	0.03	0.36	4.39	0.10	0.33	1.00
Maximum	285	6.50	2.66	2.28	7.10	2	11	210	38	435	3.04	0.37	0.66	0.05	2.00	11.7	0.30	0.53	2.50
More than 70%>LOD	yes	yes	yes	yes	yes	no	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
Info																			
St.dev	125	0.07	0.33	0.53	1.54	0.577	3.11	66.2	10.9	57.9	0.886	0.07	0.20	0.01	0.74	3.20	0.08	0.09	0.75

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Mandalselva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
15.02.2006	24	6.03	2.01	0.65	3.90	<1.00	5	210	38	385	1.77	0.22	0.47	0.02	0.79	4.89	0.10	0.20	<1
14.05.2006	141	6.43	1.95	1.41	3.70	2	4	170	15	350	1.66	0.20	0.46	0.02	0.53	3.48	<0.100	0.20	<1
22.08.2006	25	6.45	1.64	1.69	2.70	<1.00	4	175	22	315	1.03	0.20	0.25	0.02	0.80	2.70	0.20	0.10	<1
19.10.2006	33	6.27	1.91	1.55	4.90	<1.00	5	130	13	360	1.71	0.30	0.48	0.03	0.79	3.35	0.10	0.20	<1
Lower avg.	56	6.30	1.88	1.33	3.80	0.500	4.50	171	22	353	1.54	0.23	0.42	0.02	0.73	3.61	0.10	0.18	0.00
Upper avg.	56	6.30	1.88	1.33	3.80	1.25	4.50	171	22	353	1.54	0.23	0.42	0.02	0.73	3.61	0.13	0.18	1.00
Minimum	24	6.03	1.64	0.65	2.70	1	4	130	13	315	1.03	0.20	0.25	0.02	0.53	2.70	0.10	0.10	1.00
Maximum	141	6.45	2.01	1.69	4.90	2	5	210	38	385	1.77	0.30	0.48	0.03	0.80	4.89	0.20	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	yes	no
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Info																			
St.dev	57	0.19	0.16	0.46	0.90	0.500	0.577	32.8	11.3	29.0	0.346	0.05	0.11	0.00	0.13	0.922	0.05	0.05	0.00

Lyngdalselva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
15.02.2006	20	6.00	3.23	1.01	3.40	2	8	465	57	715	2.52	0.20	0.40	0.04	0.26	5.78	0.10	0.10	2.50
14.05.2006	44	6.63	2.55	1.59	3.70	1	6	195	7	390	1.43	0.20	0.49	0.02	0.62	3.75	<0.100	0.20	2.00
22.08.2006	12	6.70	3.15	2.79	2.80	<1.00	6	220	10	410	1.35	0.22	0.26	0.02	0.44	1.96	<0.100	0.10	<1
19.10.2006	12	6.39	2.54	1.21	4.50	1	5	255	4	460	1.82	0.27	0.38	0.02	0.31	3.34	<0.100	0.06	1.50
Lower avg.	22	6.43	2.87	1.65	3.60	1	6.25	284	19.5	494	1.78	0.22	0.38	0.02	0.41	3.71	0.03	0.12	1.50
Upper avg.	22	6.43	2.87	1.65	3.60	1.25	6.25	284	19.5	494	1.78	0.22	0.38	0.02	0.41	3.71	0.10	0.12	1.75
Minimum	12	6.00	2.54	1.01	2.80	1	5	195	4	390	1.35	0.20	0.26	0.02	0.26	1.96	0.10	0.06	1.00
Maximum	44	6.70	3.23	2.79	4.50	2	8	465	57	715	2.52	0.27	0.49	0.04	0.62	5.78	0.10	0.20	2.50
More than 70%>LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes
n	4	4.00	4.00	4.00	4.00	4	4	4	4	4	4	4.00	4.00	4.00	4.00	4	4.00	4.00	4.00
Info																			
St.dev	15	0.32	0.37	0.80	0.71	0.500	1.26	123	25.1	150	0.537	0.03	0.09	0.01	0.16	1.58	0.00	0.06	0.65

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Kvina

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
15.02.2006	18	6.19	4.20	2.36	3.30	2	8	495	115	775	2.31	0.20	0.69	0.03	1.39	9.25	0.33	0.22	2.50
14.05.2006	77	6.34	1.88	1.19	3.40	1	6	140	19	340	0.642	0.20	0.44	0.02	1.50	3.33	<0.100	0.20	<1
22.08.2006	14	7.05	2.27	1.03	2.40	<1	5	76	4	275	0.471	0.20	0.32	0.01	1.28	2.01	0.10	0.10	<1
19.10.2006	25	6.29	2.60	1.55	6.90	2	6	165	5	440	2.06	0.33	0.61	0.02	1.52	4.18	0.10	0.20	<1
Lower avg.	33	6.47	2.74	1.53	4.00	1.25	6.25	219	35.8	458	1.37	0.23	0.51	0.02	1.42	4.69	0.13	0.18	0.63
Upper avg.	33	6.47	2.74	1.53	4.00	1.50	6.25	219	35.8	458	1.37	0.23	0.51	0.02	1.42	4.69	0.16	0.18	1.38
Minimum	14	6.19	1.88	1.03	2.40	1	5	76	4	275	0.471	0.20	0.32	0.01	1.28	2.01	0.10	0.10	1.00
Maximum	77	7.05	4.20	2.36	6.90	2	8	495	115	775	2.31	0.33	0.69	0.03	1.52	9.25	0.33	0.22	2.50
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	4.00	4.00	4.00	4.00	4	4.00	4.00	4.00
Info																			
St.dev	29	0.39	1.02	0.59	1.98	0.577	1.26	188	53.3	222	0.949	0.07	0.17	0.01	0.11	3.17	0.12	0.05	0.75

Sira

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
15.02.2006	39	5.55	1.29	0.47	1.80	<1	4	100	17	200	0.877	0.10	0.26	0.01	0.24	2.29	<0.10	0.06	1.00
14.05.2006	135	5.47	1.34	0.62	1.80	<1	4	110	67	375	0.877	0.09	0.26	0.01	0.40	3.38	<0.10	0.20	1.00
22.08.2006	22	5.80	1.28	0.71	1.20	<1	2	130	13	195	0.727	0.10	0.22	0.01	0.33	1.56	<0.10	0.07	<1
19.10.2006	44	5.53	1.18	0.42	2.20	<1	6	96	30	315	0.856	0.10	0.28	0.01	0.40	1.80	<0.10	0.07	<1
Lower avg.	60	5.59	1.27	0.56	1.75	0	4	109	31.8	271	0.834	0.10	0.25	0.01	0.34	2.26	0.00	0.10	0.50
Upper avg.	60	5.59	1.27	0.56	1.75	1	4	109	31.8	271	0.834	0.10	0.25	0.01	0.34	2.26	0.10	0.10	1.00
Minimum	22	5.47	1.18	0.42	1.20	1	2	96	13	195	0.727	0.09	0.22	0.01	0.24	1.56	0.10	0.06	1.00
Maximum	135	5.80	1.34	0.71	2.20	1	6	130	67	375	0.877	0.10	0.28	0.01	0.40	3.38	0.10	0.20	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	51	0.15	0.07	0.13	0.41	0	1.63	15.2	24.6	88.6	0.072	0.01	0.03	0.00	0.08	0.808	0.00	0.07	0.00

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Bjerkreimselva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
17.02.2006	55	6.37	4.30	2.53	1.50	4	11	600	7	660	1.98	0.10	0.57	0.02	0.30	3.64	0.20	0.20	2.00
13.05.2006	50	6.46	2.90	0.24	1.20	1	3	275	6	385	1.28	0.10	0.18	0.02	0.18	2.54	<0.10	0.10	<1
04.08.2006	15	6.65	3.53	0.72	1.30	2	7	355	25	455	1.35	0.21	0.61	0.02	0.41	2.28	0.10	0.20	<1
13.10.2006	32	6.47	3.10	0.58	1.50	<1	4	285	9	475	1.30	<0.050	0.19	0.02	0.32	2.47	<0.10	0.08	<1
Lower avg.	38	6.49	3.46	1.02	1.38	1.75	6.25	379	11.8	494	1.48	0.10	0.39	0.02	0.30	2.73	0.08	0.15	0.50
Upper avg.	38	6.49	3.46	1.02	1.38	2	6.25	379	11.8	494	1.48	0.12	0.39	0.02	0.30	2.73	0.13	0.15	1.25
Minimum	15	6.37	2.90	0.24	1.20	1	3	275	6	385	1.28	0.05	0.18	0.02	0.18	2.28	0.10	0.08	1.00
Maximum	55	6.65	4.30	2.53	1.50	4	11	600	25	660	1.98	0.21	0.61	0.02	0.41	3.64	0.20	0.20	2.00
More than 70%>LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	18	0.12	0.62	1.03	0.15	1.41	3.59	152	8.92	117	0.334	0.07	0.24	0.00	0.09	0.615	0.05	0.06	0.50

Figgjoelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
08.02.2006	29	6.74	7.50	6.17	3.10	20	32	1150	38	1420	2.74	0.20	1.14	0.03	1.34	7.37	0.30	0.42	2.50
08.05.2006	3	7.19	9.87	4.45	2.40	11	22	935	29	1285	1.81	0.21	0.44	0.02	0.74	3.91	0.20	0.37	1.00
07.08.2006	2	7.23	10.00	1.71	2.30	8	16	365	94	615	1.49	0.27	0.16	0.01	0.57	0.900	0.36	0.20	1.50
02.10.2006	3	7.11	14.10	5.79	3.70	20	35	66	18	1455	3.17	0.20	0.49	0.01	1.15	6.74	0.20	0.51	3.50
Lower avg.	9	7.07	10.37	4.53	2.88	14.8	26.3	629	44.8	1194	2.30	0.22	0.56	0.02	0.95	4.73	0.27	0.38	2.13
Upper avg.	9	7.07	10.37	4.53	2.88	14.8	26.3	629	44.8	1194	2.30	0.22	0.56	0.02	0.95	4.73	0.27	0.38	2.13
Minimum	2	6.74	7.50	1.71	2.30	8	16	66	18	615	1.49	0.20	0.16	0.01	0.57	0.900	0.20	0.20	1.00
Maximum	29	7.23	14.10	6.17	3.70	20	35	1150	94	1455	3.17	0.27	1.14	0.03	1.34	7.37	0.36	0.51	3.50
More than 70%>LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Info																			
St.dev	13	0.22	2.74	2.02	0.66	6.18	8.81	501	33.8	393	0.783	0.03	0.41	0.01	0.36	2.96	0.08	0.13	1.11

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Lyseelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
08.02.2006	14	6.34	1.67	0.41	0.87	<1.00	2	225	4	360	1.50	0.06	0.13	0.01	0.30	3.74	<0.100	<0.050	<1
07.05.2006	36	6.58	1.39	0.32	0.81	<1.00	2	195	4	240	0.813	<0.050	0.13	0.01	0.06	1.10	<0.100	0.08	<1
06.08.2006	2	6.79	2.30	0.11	0.39	2	4	215	3	235	2.05	0.07	0.05	0.01	0.18	0.20	0.10	<0.050	<1
01.10.2006	9	6.45	1.44	0.57	1.30	<1.00	2	73	7	141	1.41	0.09	0.12	0.01	0.28	1	<0.100	0.05	<1
Lower avg.	15	6.54	1.70	0.35	0.84	0.500	2.50	177	4.50	244	1.44	0.06	0.11	0.01	0.21	1.51	0.03	0.03	0.00
Upper avg.	15	6.54	1.70	0.35	0.84	1.25	2.50	177	4.50	244	1.44	0.07	0.11	0.01	0.21	1.51	0.10	0.06	1.00
Minimum	2	6.34	1.39	0.11	0.39	1	2	73	3	141	0.813	0.05	0.05	0.01	0.06	0.200	0.10	0.05	1.00
Maximum	36	6.79	2.30	0.57	1.30	2	4	225	7	360	2.05	0.09	0.13	0.01	0.30	3.74	0.10	0.08	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	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
Info																			
St.dev	15	0.19	0.42	0.19	0.37	0.500	1	70.4	1.73	89.7	0.506	0.02	0.04	0.00	0.11	1.54	0.00	0.02	0.00

Storåna (Årdalselva)

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2006	21	6.74	6.29	0.35	1.20	<1	5	1735	3	1955	4.43	0.06	0.05	0.01	0.53	1.80	0.20	0.10	1.00
22.05.2006	54	6.39	2.57	0.56	1.10	<1	2	1400	<2	1475	1.94	0.06	0.15	0.01	0.44	1.60	<0.100	0.10	<1
21.08.2006	8	6.71	2.73	0.50	0.85	<1	2	345	3	400	1.58	0.06	0.08	<0.005	0.19	0.710	0.20	0.07	<1
13.10.2006	19	6.54	2.14	0.85	1.30	<1	2	255	14	415	0.856	0.20	0.13	0.01	0.51	1.60	<0.10	0.28	<1
Lower avg.	25	6.60	3.43	0.57	1.11	0	2.75	934	5	1061	2.20	0.10	0.10	0.01	0.42	1.43	0.10	0.14	0.25
Upper avg.	25	6.60	3.43	0.57	1.11	1	2.75	934	5.50	1061	2.20	0.10	0.10	0.01	0.42	1.43	0.15	0.14	1.00
Minimum	8	6.39	2.14	0.35	0.85	1	2	255	2	400	0.856	0.06	0.05	0.01	0.19	0.710	0.10	0.07	1.00
Maximum	54	6.74	6.29	0.85	1.30	1	5	1735	14	1955	4.43	0.20	0.15	0.01	0.53	1.80	0.20	0.28	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	20	0.16	1.92	0.21	0.19	0	1.50	745	5.69	780	1.55	0.07	0.05	0.00	0.16	0.488	0.06	0.10	0.00

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Ulladalsåna (Ulla)

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]
10.02.2006	21	6.66	1.89	0.18	0.93	<1	1	140	3	180	1.82	0.08	0.04	0.01	0.23	1.60	<0.10	<0.050	1.00
22.05.2006	36	6.58	1.50	0.06	1.30	<1	1	54	<2	131	1.33	0.05	0.05	0.01	0.19	1.10	<0.10	0.08	<1
21.08.2006	6	6.95	2.47	0.45	0.54	<1	1	155	<2	210	2.35	0.07	0.02	<0.005	0.18	0.320	0.10	0.08	<1
10.10.2006	49	6.37	1.54	0.47	3.00	<1	2	79	15	205	1.74	<0.050	0.19	0.01	0.45	2.65	0.10	0.10	<1
Lower avg.	28	6.64	1.85	0.29	1.44	0	1.25	107	4.50	182	1.81	0.05	0.08	0.01	0.26	1.42	0.05	0.07	0.25
Upper avg.	28	6.64	1.85	0.29	1.44	1	1.25	107	5.50	182	1.81	0.06	0.08	0.01	0.26	1.42	0.10	0.08	1.00
Minimum	6	6.37	1.50	0.06	0.54	1	1	54	2	131	1.33	0.05	0.02	0.01	0.18	0.320	0.10	0.05	1.00
Maximum	49	6.95	2.47	0.47	3.00	1	2	155	15	210	2.35	0.08	0.19	0.01	0.45	2.65	0.10	0.10	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	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
Info																			
St.dev	18	0.24	0.45	0.20	1.08	0	0.500	48.3	6.35	36.1	0.422	0.02	0.08	0.00	0.13	0.976	0.00	0.02	0.00

Storelva

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]
10.02.2006	14	6.25	1.79	0.23	0.62	<1	3	410	4	435	1.18	0.10	0.07	0.02	0.28	2.78	<0.10	0.10	<1
23.05.2006	37	5.79	1.01	0.21	0.85	<1	2	140	<2	200	0.599	0.08	0.13	0.01	0.22	1.70	<0.10	0.10	1.00
15.08.2006	7	6.33	1.44	0.25	0.36	<1	2	245	<2	320	0.920	0.08	0.18	0.01	0.32	1.50	<0.10	0.10	<1
13.10.2006	16	6.35	1.31	0.56	0.80	<1	2	160	3	250	0.963	<0.050	0.06	0.01	0.33	0.570	<0.10	0.07	<1
Lower avg.	19	6.18	1.39	0.31	0.66	0	2.25	239	1.75	301	0.915	0.07	0.11	0.01	0.29	1.64	0.00	0.09	0.25
Upper avg.	19	6.18	1.39	0.31	0.66	1	2.25	239	2.75	301	0.915	0.08	0.11	0.01	0.29	1.64	0.10	0.09	1.00
Minimum	7	5.79	1.01	0.21	0.36	1	2	140	2	200	0.599	0.05	0.06	0.01	0.22	0.570	0.10	0.07	1.00
Maximum	37	6.35	1.79	0.56	0.85	1	3	410	4	435	1.18	0.10	0.18	0.02	0.33	2.78	0.10	0.10	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	yes	yes	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
Info																			
St.dev	13	0.26	0.32	0.17	0.22	0	0.500	123	0.957	102	0.238	0.02	0.06	0.01	0.05	0.907	0.00	0.02	0.00

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Vikedalselva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2006	16	6.51	2.34	1.45	1.00	<1	4	280	15	345	0.920	0.20	0.15	0.02	0.34	2.34	<0.100	0.31	1.00
23.05.2006	6	6.31	2.08	0.40	1.00	1	3	185	5	280	0.834	0.23	0.13	0.01	0.41	2.52	<0.100	0.27	<1
15.08.2006	2	6.83	3.54	0.68	1.00	<1	3	270	72	530	0.727	0.45	0.05	0.01	0.33	0.170	<0.100	0.10	<1
10.10.2006	16	6.98	11.00	0.70	1.90	<1	3	4100	40	4350	4.66	<0.050	0.10	<0.005	0.84	0.990	0.10	0.08	<1
Lower avg.	10	6.66	4.74	0.81	1.23	0.250	3.25	1209	33	1376	1.79	0.22	0.11	0.01	0.48	1.51	0.03	0.19	0.25
Upper avg.	10	6.66	4.74	0.81	1.23	1	3.25	1209	33	1376	1.79	0.23	0.11	0.01	0.48	1.51	0.10	0.19	1.00
Minimum	2	6.31	2.08	0.40	1.00	1	3	185	5	280	0.727	0.05	0.05	0.01	0.33	0.170	0.10	0.08	1.00
Maximum	16	6.98	11.00	1.45	1.90	1	4	4100	72	4350	4.66	0.45	0.15	0.02	0.84	2.52	0.10	0.31	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	7	0.30	4.22	0.45	0.45	0	0.500	1928	29.9	1985	1.92	0.17	0.04	0.01	0.24	1.12	0.00	0.12	0.00

Vosso Bolstadelvi

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
27.02.2006	11	6.50	1.42	0.22	0.83	<1	4	155	7	205	0.984	0.09	0.03	0.01	0.27	0.990	<0.10	0.27	<1
20.05.2006	204	6.61	1.72	0.74	1.20	1	5	190	23	310	1.24	0.28	0.06	0.01	0.63	2.53	<0.10	0.33	1.00
09.08.2006	24	6.44	0.99	0.54	0.60	<1	3	61	8	135	0.492	0.07	0.05	0.01	0.32	0.450	<0.10	0.22	20.50
10.10.2006	135	6.47	1.27	0.55	1.50	1	4	130	10	220	1.01	0.09	0.09	<0.005	0.53	0.660	0.10	0.27	<1
Lower avg.	94	6.51	1.35	0.51	1.03	0.500	4	134	12	218	0.931	0.13	0.06	0.01	0.44	1.16	0.03	0.27	5.38
Upper avg.	94	6.51	1.35	0.51	1.03	1	4	134	12	218	0.931	0.13	0.06	0.01	0.44	1.16	0.10	0.27	5.88
Minimum	11	6.44	0.99	0.22	0.60	1	3	61	7	135	0.492	0.07	0.03	0.01	0.27	0.450	0.10	0.22	1.00
Maximum	204	6.61	1.72	0.74	1.50	1	5	190	23	310	1.24	0.28	0.09	0.01	0.63	2.53	0.10	0.33	20.50
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	92	0.07	0.30	0.22	0.40	0	0.816	54.5	7.44	71.9	0.315	0.10	0.02	0.00	0.17	0.942	0.00	0.05	9.75

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Jostedøla

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.03.2006	3	6.77	4.89	0.44	0.65	<1.00	2	320	8	380	4.96	0.07	0.01	<0.005	0.43	0.410	<0.10	<0.050	<1
14.06.2006	193	6.37	1.10	101	0.36	70	74	100	5	143	5.61	0.06	0.99	0.01	2.65	8.74	3.02	2.06	1.00
09.08.2006	118	6.27	0.55	33.30	0.17	50	54	4	5	57	3.32	<0.050	0.44	0.01	0.95	4.21	1.10	0.85	1.50
28.09.2006	143	6.30	0.98	13.30	0.35	12	13	<1	19	137	2.00	<0.050	0.26	<0.005	0.86	2.79	0.79	0.63	<1
Lower avg.	114	6.43	1.88	37.01	0.38	33	35.8	106	9.25	179	3.97	0.03	0.43	0.00	1.22	4.04	1.23	0.89	0.63
Upper avg.	114	6.43	1.88	37.01	0.38	33.3	35.8	106	9.25	179	3.97	0.06	0.43	0.01	1.22	4.04	1.25	0.90	1.13
Minimum	3	6.27	0.55	0.44	0.17	1	2	1	5	57	2.00	0.05	0.01	0.01	0.43	0.410	0.10	0.05	1.00
Maximum	193	6.77	4.89	101	0.65	70	74	320	19	380	5.61	0.07	0.99	0.01	2.65	8.74	3.02	2.06	1.50
More than 70%>LOD	yes	yes	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	80	0.23	2.02	44.75	0.20	32.3	33.9	150	6.65	139	1.63	0.01	0.42	0.00	0.98	3.51	1.25	0.85	0.25

Gaular

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.03.2006	8	6.23	1.40	0.34	1.20	<1	4	165	3	225	1.26	0.10	0.03	0.01	0.27	1.08	<0.10	0.08	1.00
15.06.2006	89	6.17	1.06	0.91	1.00	<1	4	89	7	155	0.856	<0.050	0.04	<0.005	0.22	1	<0.10	0.09	<1
10.08.2006	35	6.49	1.05	1.16	1.20	<1	5	55	6	150	0.578	0.22	0.03	<0.005	0.21	0.390	<0.10	0.25	1.50
09.11.2006	161	5.97	1.29	1.39	1.90	4	8	96	18	240	1.05	0.10	0.11	0.01	0.32	1.50	0.10	0.10	<1
Lower avg.	73	6.22	1.20	0.95	1.33	1	5.25	101	8.50	193	0.936	0.11	0.05	0.00	0.25	0.993	0.03	0.13	0.63
Upper avg.	73	6.22	1.20	0.95	1.33	1.75	5.25	101	8.50	193	0.936	0.12	0.05	0.01	0.25	0.993	0.10	0.13	1.13
Minimum	8	5.97	1.05	0.34	1.00	1	4	55	3	150	0.578	0.05	0.03	0.01	0.21	0.390	0.10	0.08	1.00
Maximum	161	6.49	1.40	1.39	1.90	4	8	165	18	240	1.26	0.22	0.11	0.01	0.32	1.50	0.10	0.25	1.50
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	68	0.21	0.17	0.45	0.39	1.50	1.89	46.1	6.56	46.6	0.291	0.07	0.04	0.00	0.05	0.458	0.00	0.08	0.25

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Jølstra

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
02.03.2006	12	6.28	1.66	0.27	1.00	<1.0	4	185	3	240	1.20	0.07	0.02	0.01	0.22	1.30	<0.10	0.07	<1
15.06.2006	80	6.32	1.44	0.73	0.88	<1.0	3	110	6	170	0.856	<0.050	0.02	<0.005	0.21	1.10	<0.10	0.07	<1
11.08.2006	27	6.46	1.35	0.41	0.78	<1.0	3	86	7	175	0.642	0.06	0.03	<0.005	0.24	1.40	<0.10	0.20	5.00
09.11.2006	159	5.96	1.54	1.51	1.80	3	6	125	11	295	1.20	0.10	0.07	<0.005	0.29	1.70	0.10	0.09	<1
Lower avg.	69	6.26	1.50	0.73	1.12	0.750	4	127	6.75	220	0.973	0.06	0.04	0.00	0.24	1.38	0.03	0.11	1.25
Upper avg.	69	6.26	1.50	0.73	1.12	1.50	4	127	6.75	220	0.973	0.07	0.04	0.01	0.24	1.38	0.10	0.11	2.00
Minimum	12	5.96	1.35	0.27	0.78	1	3	86	3	170	0.642	0.05	0.02	0.01	0.21	1.10	0.10	0.07	1.00
Maximum	159	6.46	1.66	1.51	1.80	3	6	185	11	295	1.20	0.10	0.07	0.01	0.29	1.70	0.10	0.20	5.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	67	0.21	0.13	0.55	0.47	1	1.41	42.2	3.30	59.3	0.274	0.02	0.02	0.00	0.03	0.250	0.00	0.06	2.00

Nausta

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.03.2006	4	6.42	1.88	0.22	1.10	<1	3	175	3	235	2.08	0.08	0.04	0.01	0.25	1.30	<0.10	0.08	2.00
12.06.2006	33	6.06	0.84	0.58	1.00	1	3	10	3	72	0.471	0.05	0.06	<0.005	0.17	0.640	<0.10	0.08	<1
10.08.2006	11	6.55	1.67	1.82	1.80	14	26	<1	62	270	0.963	0.10	0.05	<0.005	0.31	0.600	<0.10	0.20	<1
09.11.2006	61	6.01	1.51	0.82	1.90	3	6	180	44	305	1.22	0.09	0.09	0.01	0.25	1.70	0.10	0.10	<1
Lower avg.	27	6.26	1.48	0.86	1.45	4.50	9.50	91.3	28	221	1.18	0.08	0.06	0.00	0.24	1.06	0.03	0.12	0.50
Upper avg.	27	6.26	1.48	0.86	1.45	4.75	9.50	91.5	28	221	1.18	0.08	0.06	0.01	0.24	1.06	0.10	0.12	1.25
Minimum	4	6.01	0.84	0.22	1.00	1	3	1	3	72	0.471	0.05	0.04	0.01	0.17	0.600	0.10	0.08	1.00
Maximum	61	6.55	1.88	1.82	1.90	14	26	180	62	305	2.08	0.10	0.09	0.01	0.31	1.70	0.10	0.20	2.00
More than 70%>LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	26	0.27	0.45	0.69	0.47	6.24	11.1	99	29.8	103	0.673	0.02	0.02	0.00	0.06	0.534	0.00	0.06	0.50

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Gloppenelva (Breimselva)

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
23.02.2006	8	6.58	1.84	0.29	0.94	1	3	250	2	275	1.61	<0.050	0.03	<0.005	0.29	0.680	<0.100	0.07	<1
13.06.2006	114	6.52	1.71	0.74	0.82	<1	3	150	5	230	1.26	<0.050	0.01	<0.005	0.39	0.920	<0.100	0.10	<1
01.09.2006	31	6.43	1.11	1.51	0.51	<1	4	<1.00	7	118	0.535	<0.050	0.23	<0.005	0.32	0.270	0.10	0.10	2.00
25.10.2006	14	6.49	1.40	1.36	0.74	1	3	120	8	215	0.899	<0.050	0.04	<0.005	0.23	0.499	<0.100	0.09	<1
Lower avg.	42	6.51	1.52	0.98	0.75	0.500	3.25	130	5.50	210	1.08	0.00	0.08	0.00	0.31	0.592	0.03	0.09	0.50
Upper avg.	42	6.51	1.52	0.98	0.75	1	3.25	130	5.50	210	1.08	0.05	0.08	0.01	0.31	0.592	0.10	0.09	1.25
Minimum	8	6.43	1.11	0.29	0.51	1	3	1	2	118	0.535	0.05	0.01	0.01	0.23	0.270	0.10	0.07	1.00
Maximum	114	6.58	1.84	1.51	0.94	1	4	250	8	275	1.61	0.05	0.23	0.01	0.39	0.920	0.10	0.10	2.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	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
Info																			
St.dev	49	0.06	0.33	0.57	0.18	0	0.500	103	2.65	66.1	0.463	0.00	0.10	0.00	0.07	0.275	0.00	0.01	0.50

Driva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
27.02.2006	15	7.00	3.46	0.43	1.30	<1	3	190	4	255	2.82	<0.050	0.02	<0.005	0.62	0.770	<0.10	0.10	1.50
18.05.2006	86	7.04	3.56	0.94	1.50	<1	3	145	5	260	2.91	<0.050	0.01	<0.005	0.66	0.470	0.20	0.20	<1
18.08.2006	66	6.97	2.77	1.29	0.62	<1	3	56	5	160	2.12	0.10	0.02	<0.005	0.64	2.04	0.20	0.10	<1
17.10.2006	32	7.15	4.12	0.34	0.61	<1	1	140	3	240	3.34	<0.050	<0.005	<0.005	0.70	1.30	0.10	<0.050	<1
Lower avg.	50	7.04	3.48	0.75	1.01	0	2.50	133	4.25	229	2.80	0.03	0.01	0.00	0.66	1.15	0.13	0.10	0.38
Upper avg.	50	7.04	3.48	0.75	1.01	1	2.50	133	4.25	229	2.80	0.06	0.01	0.01	0.66	1.15	0.15	0.11	1.13
Minimum	15	6.97	2.77	0.34	0.61	1	1	56	3	160	2.12	0.05	0.01	0.01	0.62	0.470	0.10	0.05	1.00
Maximum	86	7.15	4.12	1.29	1.50	1	3	190	5	260	3.34	0.10	0.02	0.01	0.70	2.04	0.20	0.20	1.50
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	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
Info																			
St.dev	32	0.08	0.55	0.45	0.46	0	1	55.9	0.957	46.6	0.503	0.03	0.01	0.00	0.04	0.688	0.06	0.06	0.25

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Surna

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]
14.02.2006	33	6.84	2.88	0.77	2.30	<1	3	165	7	250	1.85	0.05	0.01	<0.005	0.44	0.390	<0.100	0.21	1.50
24.05.2006	105	6.65	2.02	2.48	3.30	2	6	92	7	255	1.47	<0.050	0.04	<0.005	0.56	0.500	0.20	0.32	<1
16.08.2006	21	6.89	1.99	0.94	1.10	<1	3	50	4	128	1.07	0.06	0.02	<0.005	0.32	<0.050	<0.100	0.10	<1
03.10.2006	22	6.87	2.59	1.74	2.50	1	4	61	3	195	1.39	<0.050	0.03	<0.005	0.58	0.300	0.10	0.30	<1
Lower avg.	45	6.81	2.37	1.48	2.30	0.750	4	92	5.25	207	1.44	0.03	0.02	0.00	0.47	0.298	0.08	0.23	0.38
Upper avg.	45	6.81	2.37	1.48	2.30	1.25	4	92	5.25	207	1.44	0.05	0.02	0.01	0.47	0.310	0.13	0.23	1.13
Minimum	21	6.65	1.99	0.77	1.10	1	3	50	3	128	1.07	0.05	0.01	0.01	0.32	0.050	0.10	0.10	1.00
Maximum	105	6.89	2.88	2.48	3.30	2	6	165	7	255	1.85	0.06	0.04	0.01	0.58	0.500	0.20	0.32	1.50
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	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
Info																			
St.dev	40	0.11	0.44	0.79	0.91	0.500	1.41	51.8	2.06	59.3	0.319	0.01	0.01	0.00	0.12	0.192	0.05	0.10	0.25

Gaula

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]
14.02.2006	44	7.42	10.00	0.76	3.40	<1	4	280	20	420	3.55	0.07	0.02	0.01	1.00	2.14	0.30	1.10	<1
09.05.2006	716	7.01	3.87	15.50	3.00	1	14	53	7	175	2.67	0.10	0.22	0.02	2.18	4.40	1.00	1.90	2.00
16.08.2006	77	7.49	9.52	4.65	2.10	2	6	73	13	275	2.78	0.09	0.07	0.01	1.01	2.51	0.43	1.30	<1
08.11.2006	119	7.18	11.00	6.64	8.00	5	9	330	3	660	4.13	0.24	0.15	0.01	2.02	3.79	0.83	2.24	2.00
Lower avg.	239	7.28	8.60	6.89	4.13	2	8.25	184	10.8	383	3.28	0.13	0.11	0.01	1.55	3.21	0.64	1.64	1.00
Upper avg.	239	7.28	8.60	6.89	4.13	2.25	8.25	184	10.8	383	3.28	0.13	0.11	0.01	1.55	3.21	0.64	1.64	1.50
Minimum	44	7.01	3.87	0.76	2.10	1	4	53	3	175	2.67	0.07	0.02	0.01	1.00	2.14	0.30	1.10	1.00
Maximum	716	7.49	11.00	15.50	8.00	5	14	330	20	660	4.13	0.24	0.22	0.02	2.18	4.40	1.00	2.24	2.00
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
Info																			
St.dev	319	0.22	3.21	6.24	2.64	1.89	4.35	141	7.41	211	0.686	0.08	0.09	0.01	0.64	1.06	0.33	0.53	0.58

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Nidelva Trondheim

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]
14.02.2006	52	7.14	3.40	3.77	2.80	2	5	100	6	215	2.11	0.10	0.10	<0.005	1.04	2.60	0.38	0.90	<1
09.05.2006	524	7.06	3.13	1.97	2.60	2	4	73	4	165	1.75	0.10	0.06	<0.005	1.08	1.60	0.20	0.66	<1
16.08.2006	56	7.07	3.20	1.29	2.30	<1	4	23	18	180	1.30	0.10	0.03	0.01	0.68	0.820	0.20	0.55	<1
08.11.2006	147	7.12	4.48	9.06	3.30	7	10	260	5	445	2.87	0.10	0.16	<0.005	1.84	2.79	1.20	1.60	<1
Lower avg.	195	7.10	3.55	4.02	2.75	2.75	5.75	114	8.25	251	2.01	0.10	0.09	0.00	1.16	1.95	0.50	0.93	0.00
Upper avg.	195	7.10	3.55	4.02	2.75	3	5.75	114	8.25	251	2.01	0.10	0.09	0.01	1.16	1.95	0.50	0.93	1.00
Minimum	52	7.06	3.13	1.29	2.30	1	4	23	4	165	1.30	0.10	0.03	0.01	0.68	0.820	0.20	0.55	1.00
Maximum	524	7.14	4.48	9.06	3.30	7	10	260	18	445	2.87	0.10	0.16	0.01	1.84	2.79	1.20	1.60	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
Info																			
St.dev	224	0.04	0.63	3.52	0.42	2.71	2.87	102	6.55	131	0.660	0.00	0.06	0.00	0.49	0.918	0.48	0.47	0.00

Stjørdalselva

Date DD.MM.YYYY	Q [m3/s]	pH	Cond [mS/m]	SPM [mg/l]	TOC [mg/l C]	PO4_P [µg/l P]	Tot_P [µg/l P]	NO3_N [µg/l N]	NH4_N [µg/l N]	Tot_N [µg/l N]	SiO2 [mg/l]	As [µg/l]	Pb [µg/l]	Cd [µg/l]	Cu [µg/l]	Zn [µg/l]	Cr [µg/l]	Ni [µg/l]	Hg [ng/l]
14.02.2006	48	7.11	3.59	2.73	2.70	1	5	130	10	235	1.56	0.09	0.06	0.01	1.00	2.25	0.30	0.47	<1
10.05.2006	301	6.82	2.12	4.92	2.30	6	6	43	4	125	1.09	0.10	0.09	0.01	2.22	3.02	0.20	0.53	1.50
16.08.2006	25	7.05	4.22	1.84	2.20	<1	3	58	5	205	0.706	0.10	0.20	0.01	1.60	3.59	0.37	0.55	<1
08.11.2006	201	6.99	4.94	10.20	6.10	8	12	325	4	555	2.46	0.20	0.21	0.01	3.21	5.71	0.68	1.30	2.00
Lower avg.	144	6.99	3.72	4.92	3.33	3.75	6.50	139	5.75	280	1.45	0.12	0.14	0.01	2.01	3.64	0.39	0.71	0.88
Upper avg.	144	6.99	3.72	4.92	3.33	4	6.50	139	5.75	280	1.45	0.12	0.14	0.01	2.01	3.64	0.39	0.71	1.38
Minimum	25	6.82	2.12	1.84	2.20	1	3	43	4	125	0.706	0.09	0.06	0.01	1.00	2.25	0.20	0.47	1.00
Maximum	301	7.11	4.94	10.20	6.10	8	12	325	10	555	2.46	0.20	0.21	0.01	3.21	5.71	0.68	1.30	2.00
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
Info																			
St.dev	131	0.13	1.20	3.75	1.86	3.56	3.87	130	2.87	189	0.756	0.05	0.08	0.00	0.94	1.48	0.21	0.39	0.48

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Verdalselva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
14.02.2006	30	7.40	6.28	3.76	2.90	3	6	190	8	310	2.12	0.10	0.12	0.01	0.90	5.30	0.34	0.63	<1
10.05.2006	180	7.08	2.55	8.79	2.70	7	9	35	4	125	1.43	0.10	0.17	0.01	0.91	1.10	0.30	0.63	1.00
16.08.2006	14	7.65	11.60	3.71	1.90	2	4	95	12	295	2.05	0.24	0.09	<0.005	1.00	0.180	0.30	0.41	<1
08.11.2006	159	7.33	6.93	44.40	5.20	39	46	535	5	795	3.47	0.38	0.78	0.01	2.90	4.69	1.60	2.47	2.00
Lower avg.	96	7.37	6.84	15.17	3.18	12.8	16.3	214	7.25	381	2.27	0.21	0.29	0.01	1.43	2.82	0.64	1.04	0.75
Upper avg.	96	7.37	6.84	15.17	3.18	12.8	16.3	214	7.25	381	2.27	0.21	0.29	0.01	1.43	2.82	0.64	1.04	1.25
Minimum	14	7.08	2.55	3.71	1.90	2	4	35	4	125	1.43	0.10	0.09	0.01	0.90	0.180	0.30	0.41	1.00
Maximum	180	7.65	11.60	44.40	5.20	39	46	535	12	795	3.47	0.38	0.78	0.01	2.90	5.30	1.60	2.47	2.00
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
Info																			
St.dev	86	0.23	3.71	19.64	1.42	17.6	19.9	223	3.59	288	0.857	0.13	0.33	0.00	0.98	2.55	0.64	0.96	0.50

Snåsavassdraget

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
14.02.2006	23	7.17	4.65	3.12	4.20	3	7	195	4	325	1.60	0.10	0.13	0.01	0.73	3	0.30	0.50	<1
10.05.2006	50	7.24	4.78	4.39	4.00	3	5	160	6	300	1.18	0.10	0.05	<0.005	0.93	0.930	0.20	0.42	1.00
16.08.2006	8	7.16	5.05	1.01	3.60	<1	5	53	12	260	1.01	0.10	0.04	<0.005	0.98	1.10	0.10	0.47	<1
08.11.2006	114	7.23	5.00	11.60	5.60	6	14	260	7	515	2.33	0.23	0.27	0.01	1.42	3.51	0.67	1.00	1.50
Lower avg.	49	7.20	4.87	5.03	4.35	3	7.75	167	7.25	350	1.53	0.13	0.12	0.00	1.02	2.14	0.32	0.60	0.63
Upper avg.	49	7.20	4.87	5.03	4.35	3.25	7.75	167	7.25	350	1.53	0.13	0.12	0.01	1.02	2.14	0.32	0.60	1.13
Minimum	8	7.16	4.65	1.01	3.60	1	5	53	4	260	1.01	0.10	0.04	0.01	0.73	0.930	0.10	0.42	1.00
Maximum	114	7.24	5.05	11.60	5.60	6	14	260	12	515	2.33	0.23	0.27	0.01	1.42	3.51	0.67	1.00	1.50
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
Info																			
St.dev	47	0.04	0.19	4.60	0.87	2.06	4.27	86.6	3.40	113	0.591	0.07	0.10	0.00	0.29	1.31	0.25	0.27	0.25

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Namsen

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
14.02.2006	21	7.02	4.34	3.01	1.90	3	5	150	7	235	1.91	0.10	0.13	0.01	0.94	5.03	0.34	0.67	1.50
10.05.2006	135	6.83	2.39	4.12	1.90	3	6	45	5	300	1.11	0.10	0.10	0.01	0.80	1.40	0.20	0.40	1.50
16.08.2006	8	7.11	4.25	1.25	1.30	4	9	29	11	165	0.770	0.10	0.04	<0.005	0.96	0.950	0.10	0.31	<1
08.11.2006	116	6.97	3.40	13.50	6.20	8	13	68	43	260	2.97	0.20	0.28	0.01	2.16	5.57	0.97	1.20	1.50
Lower avg.	70	6.98	3.60	5.47	2.83	4.50	8.25	73	16.5	240	1.69	0.13	0.14	0.01	1.22	3.24	0.40	0.65	1.13
Upper avg.	70	6.98	3.60	5.47	2.83	4.50	8.25	73	16.5	240	1.69	0.13	0.14	0.01	1.22	3.24	0.40	0.65	1.38
Minimum	8	6.83	2.39	1.25	1.30	3	5	29	5	165	0.770	0.10	0.04	0.01	0.80	0.950	0.10	0.31	1.00
Maximum	135	7.11	4.34	13.50	6.20	8	13	150	43	300	2.97	0.20	0.28	0.01	2.16	5.57	0.97	1.20	1.50
More than 70%>LOD	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Info																			
St.dev	65	0.12	0.91	5.48	2.27	2.38	3.59	53.8	17.8	56.7	0.979	0.05	0.10	0.00	0.63	2.40	0.39	0.40	0.25

Røssåga

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
08.02.2006	39	7.29	4.19	0.31	0.76	<1	2	59	5	101	0.856	0.09	0.02	<0.005	0.64	3.32	<0.100	0.38	<1
05.05.2006	300	7.38	4.78	0.34	1.10	<1	3	40	3	102	0.899	0.10	0.10	0.01	0.32	4.61	<0.100	0.41	<1
07.08.2006	68	7.34	3.82	0.34	0.75	<1	3	27	5	66	0.642	0.10	0.06	<0.005	0.33	3.62	0.10	0.34	<1
03.10.2006	102	7.23	4.16	0.53	1.10	<1	3	24	6	117	0.727	0.07	0.09	0.01	0.43	4.28	<0.100	0.37	<1
Lower avg.	127	7.31	4.24	0.38	0.93	0	2.75	37.5	4.75	96.5	0.781	0.09	0.07	0.00	0.43	3.96	0.03	0.38	0.00
Upper avg.	127	7.31	4.24	0.38	0.93	1	2.75	37.5	4.75	96.5	0.781	0.09	0.07	0.01	0.43	3.96	0.10	0.38	1.00
Minimum	39	7.23	3.82	0.31	0.75	1	2	24	3	66	0.642	0.07	0.02	0.01	0.32	3.32	0.10	0.34	1.00
Maximum	300	7.38	4.78	0.53	1.10	1	3	59	6	117	0.899	0.10	0.10	0.01	0.64	4.61	0.10	0.41	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	118	0.06	0.40	0.10	0.20	0	0.500	15.9	1.26	21.6	0.118	0.01	0.03	0.00	0.15	0.592	0.00	0.03	0.00

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Ranaelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
08.02.2006	49	7.39	4.68	0.29	0.75	<1	2	59	10	105	1.24	0.09	0.01	<0.005	0.33	0.460	<0.100	0.21	<1
05.05.2006	663	7.39	5.84	1.60	1.40	1	3	33	4	93	1.41	0.10	0.07	0.01	0.33	1.30	0.10	0.31	<1
07.08.2006	210	7.25	3.93	0.36	0.52	<1	2	20	4	48	0.899	0.10	0.03	<0.005	0.33	0.600	<0.100	0.23	<1
03.10.2006	211	7.41	5.87	0.63	1.50	<1	2	28	3	117	1.26	0.08	0.05	<0.005	0.54	0.910	0.10	0.26	1.00
Lower avg.	283	7.36	5.08	0.72	1.04	0.250	2.25	35	5.25	90.8	1.20	0.09	0.04	0.00	0.38	0.818	0.05	0.25	0.25
Upper avg.	283	7.36	5.08	0.72	1.04	1	2.25	35	5.25	90.8	1.20	0.09	0.04	0.01	0.38	0.818	0.10	0.25	1.00
Minimum	49	7.25	3.93	0.29	0.52	1	2	20	3	48	0.899	0.08	0.01	0.01	0.33	0.460	0.10	0.21	1.00
Maximum	663	7.41	5.87	1.60	1.50	1	3	59	10	117	1.41	0.10	0.07	0.01	0.54	1.30	0.10	0.31	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	264	0.07	0.95	0.60	0.48	0	0.500	16.9	3.20	30.1	0.217	0.01	0.02	0.00	0.10	0.373	0.00	0.04	0.00

Beiarelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
15.03.2006	8	7.38	10.50	9.39	2.00	7	24	118	62	1140	4.62	0.20	0.41	0.05	4.26	93.3	0.69	1.50	<1
08.05.2006	157	7.29	5.06	3.67	1.50	4	6	29	3	80	1.68	0.07	0.06	0.01	0.41	0.950	0.20	0.61	1.00
23.08.2006	22	6.89	3.00	5.36	0.30	2	4	9	4	65	1.87	0.20	0.16	<0.005	0.64	4.85	0.41	0.66	<1
11.10.2006	27	7.28	5.02	0.79	1.10		2	26	3	108	2.44	<0.050	0.36	0.10	0.38	0.200	0.10	0.49	<1
Lower avg.	54	7.21	5.90	4.80	1.23	3.25	9	45.5	18	348	2.65	0.12	0.25	0.04	1.42	24.8	0.35	0.82	0.25
Upper avg.	54	7.21	5.90	4.80	1.23	3.50	9	45.5	18	348	2.65	0.13	0.25	0.04	1.42	24.8	0.35	0.82	1.00
Minimum	8	6.89	3.00	0.79	0.30	1	2	9	3	65	1.68	0.05	0.06	0.01	0.38	0.200	0.10	0.49	1.00
Maximum	157	7.38	10.50	9.39	2.00	7	24	118	62	1140	4.62	0.20	0.41	0.10	4.26	93.3	0.69	1.50	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
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Info																			
St.dev	70	0.22	3.22	3.59	0.72	2.65	10.1	49.1	29.3	528	1.35	0.08	0.17	0.05	1.89	45.7	0.26	0.46	0.00

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Målselv

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.02.2006	24	7.56	9.45	0.28	0.92	<1	4	97	7	160	2.95	0.06	0.01	0.02	0.46	0.860	0.20	0.10	<1
08.05.2006	512	7.48	5.72	16.10	2.40	10	21	25	8	175	2.70	0.07	0.20	<0.005	1.02	1.70	0.45	0.77	1.50
06.08.2006	100	7.49	8.20	1.02	0.67	<1	4	17	7	95	1.92	<0.050	0.02	<0.005	0.37	<0.050	<0.100	<0.050	<1
01.10.2006	54	7.56	8.74	0.69	1.10	1	2	32	<2	117	2.37	<0.050	0.02	<0.005	0.46	0.270	0.10	0.20	<1
Lower avg.	172	7.52	8.03	4.52	1.27	2.75	7.75	42.8	5.50	137	2.49	0.03	0.06	0.01	0.58	0.708	0.19	0.27	0.38
Upper avg.	172	7.52	8.03	4.52	1.27	3.25	7.75	42.8	6	137	2.49	0.06	0.06	0.01	0.58	0.720	0.21	0.28	1.13
Minimum	24	7.48	5.72	0.28	0.67	1	2	17	2	95	1.92	0.05	0.01	0.01	0.37	0.050	0.10	0.05	1.00
Maximum	512	7.56	9.45	16.10	2.40	10	21	97	8	175	2.95	0.07	0.20	0.02	1.02	1.70	0.45	0.77	1.50
More than 70%>LOD	yes	yes	yes	yes	yes	no	yes	yes	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
Info																			
St.dev	229	0.04	1.62	7.72	0.77	4.50	8.88	36.7	2.71	37.1	0.445	0.01	0.09	0.01	0.30	0.737	0.17	0.33	0.25

Barduelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
07.02.2006	22	7.38	5.52	3.82	1.00	2	4	66	12	141	2.20	0.08	0.06	0.03	0.53	1	0.20	0.27	<1
08.05.2006	465	7.77	9.05	11.00	1.70	8	12	35	3	150	2.31	<0.050	0.10	<0.005	0.67	1	0.31	0.45	<1
06.08.2006	91	7.25	6.82	2.46	0.82	2	4	8	9	86	1.64	0.07	0.03	<0.005	0.39	<0.050	0.10	0.10	<1
01.10.2006	49	7.54	8.83	1.89	1.30	2	5	34	2	134	2.16	<0.050	0.04	<0.005	0.53	0.370	0.10	0.39	<1
Lower avg.	157	7.49	7.56	4.79	1.21	3.50	6.25	35.8	6.50	128	2.08	0.04	0.06	0.01	0.53	0.593	0.18	0.30	0.00
Upper avg.	157	7.49	7.56	4.79	1.21	3.50	6.25	35.8	6.50	128	2.08	0.06	0.06	0.01	0.53	0.605	0.18	0.30	1.00
Minimum	22	7.25	5.52	1.89	0.82	2	4	8	2	86	1.64	0.05	0.03	0.01	0.39	0.050	0.10	0.10	1.00
Maximum	465	7.77	9.05	11.00	1.70	8	12	66	12	150	2.31	0.08	0.10	0.03	0.67	1	0.31	0.45	1.00
More than 70%>LOD	yes	yes	yes	yes	yes	yes	yes	yes	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
Info																			
St.dev	208	0.22	1.69	4.22	0.38	3	3.86	23.7	4.80	28.6	0.300	0.02	0.03	0.01	0.12	0.474	0.10	0.15	0.00

TABLE 1. Rawdata and summary statistics for the 10 main and 36 tributary rivers in Norway in 2006

Tanaelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
10.02.2006	30	7.15	7.73	0.72	1.90	2	8	90	18	275	10.6	0.09	0.04	0.01	1.12	5.25	0.48	0.32	1.00
09.05.2006	1063	6.73	2.62	2.27	5.70	4	15	7	24	280	3.70	0.06	0.05	0.01	0.79	1.30	0.30	0.61	<1
07.08.2006	62	7.21	4.93	0.72	2.30	2	6	<1	11	125	5.78	0.06	0.02	<0.005	0.43	0.050	0.30	0.30	<1
28.09.2006	104	7.24	4.97	0.74	2.50	2	6	4	7	120	6.57	<0.050	0.05	<0.005	0.64	1.40	0.30	0.25	<1
Lower avg.	315	7.08	5.06	1.11	3.10	2.50	8.75	25.3	15	200	6.66	0.05	0.04	0.00	0.74	2	0.35	0.37	0.25
Upper avg.	315	7.08	5.06	1.11	3.10	2.50	8.75	25.5	15	200	6.66	0.07	0.04	0.01	0.74	2	0.35	0.37	1.00
Minimum	30	6.73	2.62	0.72	1.90	2	6	1	7	120	3.70	0.05	0.02	0.01	0.43	0.050	0.30	0.25	1.00
Maximum	1063	7.24	7.73	2.27	5.70	4	15	90	24	280	10.6	0.09	0.05	0.01	1.12	5.25	0.48	0.61	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
Info																			
St.dev	500	0.24	2.09	0.77	1.75	1	4.27	43.1	7.53	89.5	2.89	0.02	0.01	0.00	0.29	2.25	0.09	0.16	0.00

Pasvikelva

Date	Q	pH	Cond	SPM	TOC	PO4_P	Tot_P	NO3_N	NH4_N	Tot_N	SiO2	As	Pb	Cd	Cu	Zn	Cr	Ni	Hg
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]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[ng/l]
11.02.2006	42	6.99	3.22	0.29	3.00	<1	3	56	8	190	5.09	0.07	0.03	0.01	0.81	2.24	0.20	0.72	<1
09.05.2006	1415	6.93	4.98	1.41	3.50	2	8	30	25	290	4.77	0.29	0.08	0.02	5.32	1.80	0.20	28.10	1.00
07.08.2006	101	7.04	3.57	5.12	3.30	2	9	<1.00	26	275	3.55	0.10	0.03	0.02	1.47	0.160	0.10	6.38	<1
29.09.2006	124	6.99	3.71	1.24	2.90	2	6	2	14	150	3.94	0.10	0.04	0.01	1.32	1.60	0.20	7.13	<1
Lower avg.	420	6.99	3.87	2.02	3.18	1.50	6.50	22	18.3	226	4.34	0.14	0.04	0.01	2.23	1.45	0.18	10.58	0.25
Upper avg.	420	6.99	3.87	2.02	3.18	1.75	6.50	22.3	18.3	226	4.34	0.14	0.04	0.01	2.23	1.45	0.18	10.58	1.00
Minimum	42	6.93	3.22	0.29	2.90	1	3	1	8	150	3.55	0.07	0.03	0.01	0.81	0.160	0.10	0.72	1.00
Maximum	1415	7.04	4.98	5.12	3.50	2	9	56	26	290	5.09	0.29	0.08	0.02	5.32	2.24	0.20	28.10	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
n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Info																			
St.dev	664	0.05	0.77	2.13	0.28	0.500	2.65	26.2	8.73	67.3	0.715	0.10	0.03	0.01	2.08	0.901	0.05	12.02	0.00

Part B

Table 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->									
	Estimate	Flow rate (1000 m3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	PCBs [kg]	gHCH [kg]
MAIN RIVERS (10)												
Glomma ved Sarpsfoss	lower avg.	64085	0.42	0.03	54.25	104.32	7.68	5.13	10.51	20.75	0.00	2.01
	upper avg.	64085	0.42	0.04	54.25	104.32	7.68	5.13	10.56	20.75	28.07	4.77
Drammenselva	lower avg.	27094	0.10	0.00	11.59	51.76	1.21	1.54	1.69	7.93	0.00	0.00
	upper avg.	27094	0.10	0.01	11.59	51.76	1.21	1.54	1.69	7.93	25.15	1.98
Numedalslågen	lower avg.	10696	0.07	0.01	3.97	18.52	1.24	0.75	0.85	1.68	0.00	0.00
	upper avg.	10696	0.07	0.01	3.97	18.52	1.24	0.75	0.93	1.68	12.55	0.78
Skienselva	lower avg.	26599	0.09	0.01	4.37	22.85	0.53	0.81	0.85	2.14	0.00	0.74
	upper avg.	26599	0.09	0.01	4.37	22.85	0.53	0.81	1.28	2.14	26.72	1.90
Otra	lower avg.	12684	0.11	0.00	4.27	21.90	1.52	0.70	0.39	3.58	0.00	0.00
	upper avg.	12684	0.11	0.01	4.27	21.90	1.52	0.70	0.59	3.58	11.17	0.93
Orreelva	lower avg.	472	0.00	0.00	0.27	0.55	0.06	0.05	0.05	0.19	0.00	0.00
	upper avg.	472	0.00	0.00	0.27	0.55	0.06	0.05	0.05	0.19	0.21	0.03
Suldalslågen	lower avg.	10084	0.05	0.00	1.31	11.30	0.74	0.37	0.39	1.22	0.00	0.00
	upper avg.	10084	0.05	0.00	1.31	11.30	0.74	0.38	0.54	1.22	4.40	0.73
Orkla	lower avg.	7119	0.08	0.00	14.88	30.95	0.21	0.32	1.09	2.67	0.00	0.00
	upper avg.	7119	0.08	0.00	14.88	30.95	0.21	0.32	1.09	2.67	11.48	0.52
Vefsna	lower avg.	11302	0.01	0.00	1.40	2.88	0.26	0.48	0.56	0.98	0.00	0.00
	upper avg.	11302	0.02	0.00	1.40	2.89	0.27	0.48	0.64	0.98	15.81	0.83
Altaelva	lower avg.	7759	0.00	0.00	1.64	0.78	0.05	0.26	0.55	0.69	0.00	0.00
	upper avg.	7759	0.01	0.00	1.64	0.81	0.05	0.28	0.55	0.69	10.76	0.57
TRIBUTARY RIVERS (36)												
Tista utløp Femsjøen	lower avg.	2019	0.01	0.00	1.30	2.17	0.17	0.23	0.19	0.52		
	upper avg.	2019	0.01	0.00	1.30	2.17	0.17	0.23	0.20	0.52		
Tokkeelva	lower avg.	2717	0.03	0.00	0.54	5.82	0.22	0.22	0.14	0.45		
	upper avg.	2717	0.03	0.00	0.54	5.82	0.22	0.22	0.14	0.45		

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->									
	Estimate	Flow rate (1000 m3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	PCBs [kg]	gHCH [kg]
Nidelva(Rykene)	lower avg.	11720	0.15	0.00	4.24	33.42	1.74	0.98	0.51	1.57		
	upper avg.	11720	0.15	0.00	4.24	33.42	1.74	0.98	0.55	1.57		
Tovdalselva	lower avg.	6259	0.08	0.00	1.17	13.82	1.15	0.56	0.15	0.86		
	upper avg.	6259	0.08	0.00	1.17	13.82	1.15	0.56	0.31	0.86		
Mandalselva	lower avg.	8841	0.08	0.00	2.01	11.35	1.43	0.70	0.15	0.61		
	upper avg.	8841	0.08	0.00	2.01	11.35	1.43	0.70	0.36	0.61		
Lyngdalselva	lower avg.	3334	0.03	0.00	0.57	4.74	0.51	0.26	0.03	0.18		
	upper avg.	3334	0.03	0.00	0.57	4.74	0.51	0.26	0.12	0.18		
Kvina	lower avg.	6742	0.05	0.00	3.60	10.18	1.21	0.55	0.18	0.47		
	upper avg.	6742	0.05	0.00	3.60	10.18	1.21	0.55	0.32	0.47		
Sira	lower avg.	12751	0.05	0.00	1.71	12.76	1.20	0.44	0.00	0.66		
	upper avg.	12751	0.05	0.00	1.71	12.76	1.20	0.44	0.46	0.66		
Bjerkreimselva	lower avg.	4337	0.03	0.00	0.43	4.57	0.58	0.14	0.13	0.22		
	upper avg.	4337	0.03	0.00	0.43	4.57	0.58	0.16	0.21	0.22		
Figgjoelva	lower avg.	661	0.01	0.00	0.29	1.59	0.23	0.05	0.07	0.10		
	upper avg.	661	0.01	0.00	0.29	1.59	0.23	0.05	0.07	0.10		
Lyseelva	lower avg.	1517	0.00	0.00	0.08	0.92	0.07	0.02	0.00	0.03		
	upper avg.	1517	0.00	0.00	0.08	0.92	0.07	0.03	0.06	0.04		
Årdalselva	lower avg.	4158	0.01	0.00	0.68	2.38	0.18	0.13	0.09	0.20		
	upper avg.	4158	0.01	0.00	0.68	2.38	0.18	0.13	0.19	0.20		
Ulladalsåna (Ulla)	lower avg.	2901	0.01	0.00	0.33	1.92	0.11	0.04	0.05	0.08		
	upper avg.	2901	0.01	0.00	0.33	1.92	0.11	0.06	0.11	0.09		
Saudaelva	lower avg.	3048	0.01	0.00	0.29	1.82	0.12	0.07	0.00	0.10		
	upper avg.	3048	0.01	0.00	0.29	1.82	0.12	0.09	0.11	0.10		
Vikedalselva	lower avg.	842	0.00	0.00	0.17	0.53	0.04	0.04	0.01	0.06		
	upper avg.	842	0.00	0.00	0.17	0.53	0.04	0.05	0.03	0.06		
Vosso(Bolstadelvi)	lower avg.	10233	0.02	0.01	2.09	6.24	0.26	0.72	0.13	1.12		

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->									
	Estimate	Flow rate (1000 m3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	PCBs [kg]	gHCH [kg]
	upper avg.	10233	0.03	0.01	2.09	6.24	0.26	0.72	0.37	1.12		
Jostedøla	lower avg.	5701	0.01	0.00	3.39	11.72	1.27	0.05	3.75	2.67		
	upper avg.	5701	0.01	0.00	3.39	11.72	1.27	0.11	3.75	2.67		
Gaular	lower avg.	5188	0.01	0.00	0.52	2.27	0.15	0.16	0.10	0.22		
	upper avg.	5188	0.01	0.00	0.52	2.27	0.15	0.19	0.19	0.22		
Jølstra	lower avg.	5451	0.00	0.00	0.51	2.94	0.10	0.13	0.11	0.19		
	upper avg.	5451	0.01	0.00	0.51	2.94	0.10	0.16	0.20	0.19		
Nausta	lower avg.	2099	0.00	0.00	0.18	0.96	0.06	0.06	0.04	0.08		
	upper avg.	2099	0.00	0.00	0.18	0.96	0.06	0.06	0.08	0.08		
Gloppenelva(Breimselva)	lower avg.	4214	0.00	0.00	0.55	1.16	0.08	0.00	0.03	0.15		
	upper avg.	4214	0.01	0.00	0.55	1.16	0.08	0.08	0.15	0.15		
Driva	lower avg.	7719	0.00	0.00	1.85	3.22	0.04	0.09	0.48	0.36		
	upper avg.	7719	0.01	0.00	1.85	3.22	0.04	0.19	0.50	0.38		
Surna	lower avg.	4673	0.00	0.00	0.87	0.67	0.05	0.03	0.22	0.46		
	upper avg.	4673	0.01	0.00	0.87	0.68	0.05	0.09	0.27	0.46		
Gaula	lower avg.	8501	0.05	0.01	6.22	12.58	0.58	0.36	2.79	5.74		
	upper avg.	8501	0.05	0.01	6.22	12.58	0.58	0.36	2.79	5.74		
Nidelva(Tr.heim)	lower avg.	7998	0.00	0.00	3.47	5.34	0.22	0.29	1.17	2.46		
	upper avg.	7998	0.01	0.00	3.47	5.34	0.22	0.29	1.17	2.46		
Stjørdalselva	lower avg.	6636	0.02	0.00	5.89	9.48	0.32	0.32	0.93	1.92		
	upper avg.	6636	0.02	0.00	5.89	9.48	0.32	0.32	0.93	1.92		
Verdalselva	lower avg.	4299	0.01	0.00	2.72	4.51	0.65	0.35	1.32	2.17		
	upper avg.	4299	0.01	0.00	2.72	4.51	0.65	0.35	1.32	2.17		
Snåsavassdraget	lower avg.	2330	0.00	0.00	1.01	2.28	0.16	0.15	0.41	0.65		
	upper avg.	2330	0.01	0.00	1.01	2.28	0.16	0.15	0.41	0.65		
Namsen	lower avg.	3285	0.01	0.00	1.65	4.05	0.21	0.17	0.63	0.90		
	upper avg.	3285	0.01	0.00	1.65	4.05	0.21	0.17	0.63	0.90		

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->									
	Estimate	**Flow rate (1000 m3/d)**	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	PCBs [kg]	gHCH [kg]
Røssåga	lower avg.	7713	0.02	0.00	1.03	12.11	0.23	0.26	0.04	1.10		
	upper avg.	7713	0.02	0.00	1.03	12.11	0.23	0.26	0.28	1.10		
Ranaelva	lower avg.	16983	0.03	0.00	2.29	6.56	0.33	0.59	0.48	1.74		
	upper avg.	16983	0.04	0.01	2.29	6.56	0.33	0.59	0.62	1.74		
Beiarelva	lower avg.	4728	0.03	0.00	0.98	8.02	0.20	0.14	0.39	1.09		
	upper avg.	4728	0.03	0.00	0.98	8.02	0.20	0.15	0.39	1.09		
Målselv	lower avg.	9652	0.00	0.00	3.03	4.61	0.54	0.19	1.23	2.07		
	upper avg.	9652	0.02	0.00	3.03	4.64	0.54	0.23	1.28	2.10		
Barduelva	lower avg.	8766	0.00	0.00	1.96	2.57	0.26	0.04	0.83	1.24		
	upper avg.	8766	0.02	0.00	1.96	2.59	0.26	0.17	0.83	1.24		
Tanaelva	lower avg.	15834	0.03	0.00	4.43	7.72	0.28	0.32	1.75	3.22		
	upper avg.	15834	0.03	0.01	4.43	7.72	0.28	0.35	1.75	3.22		
Pasvikelva	lower avg.	16289	0.12	0.00	27.76	10.07	0.45	1.54	1.15	145.69		
	upper avg.	16289	0.12	0.01	27.76	10.07	0.45	1.54	1.15	145.69		
TRIBUTARY RIVERS (109)												
Mosselva	upp.avg	834	0.00	0.00	0.38	0.34	0.07	0.12	0.09	0.31		
Hølenelva	upp.avg	135	0.00	0.00	0.12	0.14	0.02	0.03	0.03	0.16		
Årungelva	upp.avg	55	0.00	0.00	0.04	0.02	0.00	0.01	0.01	0.03		
Gjersjøelva	upp.avg	93	0.00	0.00	0.05	0.03	0.00	0.01	0.01	0.07		
Ljanselva	upp.avg	68	0.00	0.00	0.06	0.08	0.01	0.01	0.01	0.04		
Loelva	upp.avg	114	0.00	0.00	0.32	0.94	0.11	0.02	0.04	0.08		
Akerselva	upp.avg	372	0.00	0.00	0.22	0.80	0.09	0.03	0.03	0.06		
Frognerelva	upp.avg	33	0.00	0.00	0.06	0.07	0.00	0.01	0.01	0.02		
Lysakerelva	upp.avg	356	0.00	0.00	0.10	0.20	0.02	0.02	0.02	0.03		
Sandvikselva	upp.avg	304	0.00	0.00	0.15	0.16	0.03	0.03	0.05	0.06		
Åroselva	upp.avg	147	0.00	0.00	0.12	0.24	0.03	0.03	0.06	0.05		
Lierelva	upp.avg	488	0.01	0.00	0.41	1.40	0.16	0.11	0.21	0.26		

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->									
	Estimate	Flow rate (1000 m3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	PCBs [kg]	gHCH [kg]
Sandeelva	upp.avg	278	0.01	0.00	1.01	1.25	0.05	0.08	0.38	0.14		
Aulielva	upp.avg	609	0.01	0.00	1.65	0.46	0.06	0.77	0.55	0.98		
Farriselva-Siljanvassdraget	upp.avg	1138	0.01	0.00	0.18	3.00	0.02	0.06	0.07	0.08		
Gjerstadelva	upp.avg	1054	0.01	0.00	0.24	2.01	0.14	0.09	0.06	0.23		
Vegårdselva	upp.avg	1093	0.01	0.00	0.22	2.01	0.10	0.10	0.06	0.18		
Søgneelva-Songdalselva	upp.avg	943	0.02	0.00	0.21	2.16	0.15	0.09	0.02	0.20		
Audnedalselva	upp.avg	1690	0.03	0.00	0.20	3.89	0.28	0.15	0.06	0.16		
Soknedalselva	upp.avg	1996	0.03	0.00	0.39	3.36	0.22	0.12	0.06	2.46		
Hellelandselva	upp.avg	1478	0.01	0.00	0.22	2.13	0.23	0.08	0.05	0.17		
Håelva	upp.avg	485	0.00	0.00	0.16	1.05	0.04	0.07	0.02	0.07		
Imselva	upp.avg	405	0.00	0.00	0.09	0.32	0.02	0.03	0.04	0.06		
Oltedalselva	upp.avg	910	0.01	0.00	0.14	1.03	0.10	0.04	0.03	0.15		
Dirdalsåna	upp.avg	1424	0.01	0.00	0.15	0.80	0.13	0.06	0.04	0.10		
Frafjordelva	upp.avg	1604	0.01	0.00	0.17	0.79	0.15	0.06	0.05	0.11		
Espedalselva	upp.avg	1244	0.01	0.00	0.07	0.38	0.06	0.06	0.07	0.10		
Førrelva	upp.avg	1203	0.00	0.00	0.07	0.35	0.04	0.05	0.07	0.08		
Åbøelva	upp.avg	708	0.00	0.00	0.05	0.33	0.03	0.03	0.04	0.06		
Etneelva	upp.avg	1578	0.01	0.00	0.25	1.08	0.07	0.11	0.08	0.28		
Opo	upp.avg	4109	0.03	0.00	0.50	4.75	0.63	0.16	0.34	0.37		
Tysso	upp.avg	2508	0.02	0.00	0.58	2.99	0.10	0.10	0.25	0.28		
Kinso	upp.avg	1189	0.00	0.00	0.09	0.27	0.06	0.04	0.13	0.07		
Veig	upp.avg	2099	0.01	0.00	0.19	1.04	0.13	0.08	0.23	0.33		
Bjoreio	upp.avg	2505	0.01	0.00	0.31	0.92	0.12	0.07	0.12	0.33		
SIMA	upp.avg	614	0.00	0.00	0.05	0.20	0.05	0.01	0.04	0.06		
Austdøla	upp.avg	583	0.00	0.00	0.04	0.21	0.02	0.01	0.03	0.02		
Nordøla /Austdøla	upp.avg	175	0.00	0.00	0.02	0.09	0.02	0.01	0.02	0.03		

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->									
	Estimate	Flow rate (1000 m3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	PCBs [kg]	gHCH [kg]
Tysselvi	upp.avg	1791	0.01	0.00	0.22	0.96	0.15	0.07	0.07	0.11		
Oselva	upp.avg	806	0.00	0.00	0.27	0.71	0.07	0.05	0.07	0.11		
Daleelvi	upp.avg	1705	0.01	0.00	0.24	1.23	0.13	0.04	0.10	0.14		
Ekso -Storelvi	upp.avg	3968	0.01	0.00	0.27	1.53	0.18	0.09	0.14	0.21		
Modalselva -Moelvi	upp.avg	3665	0.01	0.00	0.15	1.41	0.18	0.07	0.18	0.31		
Nærøydalselvi	upp.avg	1628	0.00	0.00	0.11	0.41	0.03	0.03	0.08	0.08		
Flåmselvi	upp.avg	1043	0.00	0.00	0.07	0.31	0.03	0.02	0.04	0.10		
Aurlandselvi	upp.avg	3030	0.01	0.00	0.51	1.01	0.17	0.07	0.15	0.22		
Erdalselvi	upp.avg	440	0.00	0.00	0.02	0.08	0.01	0.01	0.01	0.02		
Lærdalselva /Mjeldo	upp.avg	3735	0.01	0.00	0.52	0.86	0.09	0.06	0.12	0.22		
Årdalselvi	upp.avg	4373	0.02	0.00	1.73	1.73	0.10	0.08	0.23	0.33		
Fortundalselva	upp.avg	2496	0.01	0.00	0.79	1.46	0.16	0.06	0.19	0.24		
Mørkrisdalselvi	upp.avg	1385	0.00	0.00	0.28	1.03	0.09	0.03	0.26	0.22		
Årøyelva	upp.avg	2528	0.01	0.00	0.16	0.75	0.05	0.04	0.13	0.13		
Sogndalselva	upp.avg	975	0.00	0.00	0.06	3.92	0.03	0.04	0.06	0.05		
Oselva	upp.avg	2425	0.01	0.00	0.36	1.54	0.10	0.10	0.19	0.22		
Hopselva	upp.avg	718	0.00	0.00	0.02	0.21	0.03	0.02	0.05	0.03		
Åelva	upp.avg	1652	0.01	0.00	0.08	0.52	0.06	0.05	0.12	0.08		
Oldenelva	upp.avg	1450	0.01	0.00	0.12	0.40	0.04	0.07	0.11	0.08		
Loelvi	upp.avg	1676	0.01	0.00	0.20	0.41	0.05	0.05	0.16	0.08		
Stryneelva	upp.avg	3416	0.01	0.00	0.95	0.75	0.07	0.08	0.26	0.18		
Hornindalselva(Horndøla)	upp.avg	2488	0.01	0.00	0.26	0.87	0.07	0.08	0.17	0.22		
Ørstaelva	upp.avg	1040	0.00	0.00	0.11	0.26	0.02	0.03	0.07	0.09		
Valldøla	upp.avg	2108	0.01	0.00	0.22	0.50	0.04	0.06	0.14	0.09		
Rauma	upp.avg	5226	0.02	0.00	0.52	1.24	0.11	0.15	0.29	0.28		
Isa	upp.avg	768	0.00	0.00	0.11	0.16	0.02	0.02	0.12	0.06		

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->									
	Estimate	Flow rate (1000 m3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	PCBs [kg]	gHCH [kg]
Eira	upp.avg	4504	0.01	0.00	0.57	0.92	0.10	0.10	0.30	0.21		
Litledalselva	upp.avg	1046	0.00	0.00	0.12	0.19	0.02	0.02	0.09	0.06		
Ålvunda	upp.avg	895	0.00	0.00	0.28	0.34	0.02	0.01	0.06	0.06		
Toåa	upp.avg	1129	0.00	0.00	0.16	0.24	0.02	0.02	0.05	0.05		
Bøvra	upp.avg	946	0.00	0.00	0.12	0.18	0.01	0.02	0.05	0.07		
Børselva	upp.avg	233	0.00	0.00	0.12	0.07	0.01	0.02	0.03	0.12		
Vigda	upp.avg	349	0.00	0.00	0.13	0.10	0.01	0.02	0.06	0.09		
Homla	upp.avg	405	0.00	0.00	0.11	0.10	0.01	0.07	0.03	0.07		
Gråe	upp.avg	292	0.00	0.00	0.12	0.07	0.01	0.04	0.04	0.06		
Figga	upp.avg	604	0.00	0.00	0.24	0.25	0.04	0.05	0.09	0.17		
Årgårdselva	upp.avg	1549	0.00	0.00	0.36	0.53	0.06	0.06	0.15	0.18		
Moelva(Salsvatenelva)	upp.avg	1657	0.01	0.00	0.14	0.76	0.04	0.03	0.11	0.09		
Åelva(Åbjøra)	upp.avg	2657	0.01	0.00	0.26	0.67	0.10	0.06	0.19	0.30		
Skjerva	upp.avg	420	0.00	0.00	0.17	0.66	0.05	0.05	0.04	0.47		
Fusta	upp.avg	2852	0.01	0.00	0.31	0.69	0.05	0.27	0.10	0.22		
Drevja	upp.avg	924	0.00	0.00	0.08	0.17	0.02	0.02	0.04	0.06		
Bjerkaelva	upp.avg	1423	0.00	0.00	0.27	0.39	0.03	0.03	0.06	0.23		
Dalselva	upp.avg	932	0.00	0.00	0.13	0.18	0.02	0.01	0.03	0.15		
Fykanåga	upp.avg	1894	0.01	0.00	0.11	0.33	0.04	0.03	0.06	0.11		
Saltelva	upp.avg	4001	0.01	0.00	0.50	1.11	0.12	0.13	0.12	0.68		
Sulitjelmavassdraget	upp.avg	2886	0.02	0.00	0.84	0.67	0.04	0.06	0.09	0.20		
Kobbelva	upp.avg	1736	0.01	0.00	0.06	0.46	0.03	0.03	0.05	0.07		
Elvegårdselva	upp.avg	3216	0.01	0.00	0.56	1.27	0.12	0.12	0.09	0.81		
Spanselva	upp.avg	475	0.00	0.00	0.09	0.10	0.01	0.01	0.03	0.14		
Salangselva	upp.avg	1838	0.01	0.00	0.17	0.35	0.03	0.03	0.06	0.19		
Lakselva(Rossfjordelva)	upp.avg	573	0.00	0.00	0.04	0.09	0.01	0.01	0.02	0.07		

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->									
	Estimate	Flow rate (1000 m3/d)	Cd [tonnes]	Hg [tonnes]	Cu [tonnes]	Zn [tonnes]	Pb [tonnes]	As [tonnes]	Cr [tonnes]	Ni [tonnes]	PCBs [kg]	gHCH [kg]
Nordkjoselva	upp.avg	485	0.00	0.00	0.06	0.08	0.01	0.02	0.01	0.03		
Signaldalselva	upp.avg	1453	0.00	0.00	0.29	0.28	0.03	0.04	0.06	0.19		
Skibotnelva	upp.avg	2069	0.01	0.00	0.36	0.41	0.02	0.04	0.06	0.72		
Kåfjordelva	upp.avg	1049	0.00	0.00	0.46	0.50	0.03	0.02	0.04	0.23		
Reisaelva	upp.avg	5807	0.02	0.00	1.74	2.60	0.26	0.24	0.23	1.49		
Mattiselva	upp.avg	363	0.00	0.00	0.09	0.08	0.00	0.01	0.02	0.03		
Tverrelva	upp.avg	260	0.00	0.00	0.07	0.06	0.00	0.01	0.02	0.03		
Repparfjordelva	upp.avg	2529	0.01	0.00	1.68	0.40	0.02	0.05	0.19	0.27		
Stabburselva	upp.avg	1614	0.00	0.00	0.20	0.47	0.01	0.03	0.07	0.09		
Lakseelv	upp.avg	1550	0.00	0.00	0.40	0.38	0.03	0.02	0.17	0.29		
Børselva	upp.avg	1279	0.00	0.00	0.07	0.35	0.01	0.02	0.09	0.09		
Mattusjåkka	upp.avg	144	0.00	0.00	0.02	0.19	0.02	0.00	0.19	0.03		
Stuorrajåkka	upp.avg	984	0.00	0.00	0.03	0.33	0.01	0.02	0.06	0.07		
Soussjåkka	upp.avg	131	0.00	0.00	0.01	0.04	0.00	0.00	0.01	0.01		
Adamselva	upp.avg	837	0.00	0.00	0.06	0.24	0.01	0.02	0.06	0.03		
Syltefjordelva(Vesterelva)	upp.avg	1589	0.00	0.00	0.06	0.23	0.01	0.11	0.09	0.03		
Jakobselv	upp.avg	1092	0.00	0.00	0.08	0.16	0.01	0.03	0.10	0.05		
Neidenelva	upp.avg	2833	0.01	0.00	0.64	0.47	0.03	0.09	0.13	1.69		
Grense Jakobselv	upp.avg	275	0.00	0.00	0.22	0.25	0.02	0.02	0.22	0.78		

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->							
	Estimate	Flow rate (1000 m3/d)	NH4-N [tonnes]	NO3-N [tonnes]	PO4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	SiO2 [tonnes]	SPM [1000 [tonnes]	TOC 1000 [tonnes]
MAIN RIVERS (10)										
Glomma ved Sarpsfoss	lower avg.	64085	416.68	9142.87	204.04	15456.37	424.91	40.73	220.13	109.22
	upper avg.	64085	419.38	9142.87	204.04	15456.37	424.91	40.73	220.13	109.22
Drammenselva	lower avg.	27094	101.47	3443.94	16.34	5389.91	57.39	13.14	20.93	35.19
	upper avg.	27094	101.47	3443.94	17.75	5389.91	57.39	13.14	20.93	35.19
Numedalslågen	lower avg.	10696	82.71	1056.62	21.47	1898.38	44.21	6.60	24.61	18.66
	upper avg.	10696	82.71	1056.62	21.47	1898.38	44.21	6.60	24.61	18.66
Skienselva	lower avg.	26599	84.58	1468.34	7.30	2512.06	33.98	8.69	7.91	25.56
	upper avg.	26599	84.58	1468.34	10.84	2512.06	33.98	8.69	7.91	25.56
Otra	lower avg.	12684	72.40	436.08	4.41	1151.17	18.75	3.64	8.08	13.39
	upper avg.	12684	72.40	436.08	6.39	1151.17	18.75	3.64	8.08	13.39
Orreelva	lower avg.	472	7.93	216.18	6.24	362.63	16.64	0.34	2.25	1.02
	upper avg.	472	7.93	216.19	6.24	362.63	16.64	0.34	2.25	1.02
Suldalslågen	lower avg.	10084	8.57	568.84	7.06	847.51	14.85	1.72	7.42	4.29
	upper avg.	10084	12.07	568.84	7.77	847.51	14.85	1.72	7.42	4.29
Orkla	lower avg.	7119	15.45	228.69	5.37	669.51	22.65	2.96	14.14	10.38
	upper avg.	7119	15.45	228.69	6.28	669.51	22.65	2.96	14.14	10.38
Vefsna	lower avg.	11302	14.69	192.28	6.18	508.05	15.84	2.46	11.14	6.06
	upper avg.	11302	16.20	192.58	8.15	508.05	15.84	2.46	11.15	6.06
Altaelva	lower avg.	7759	10.04	61.82	5.19	435.80	16.42	5.72	4.16	9.30
	upper avg.	7759	10.43	62.01	5.83	435.80	16.42	5.72	4.16	9.30
TRIBUTARY RIVERS (36)										
Tista utløp Femsjøen	lower avg.	2019	5.26	427.12	2.51	661.95	9.09	1.13	1.88	5.88
	upper avg.	2019	5.26	427.12	2.51	661.95	9.09	1.13	1.88	5.88
Tokkeelva	lower avg.	2717	5.82	144.89	0.72	384.69	6.41	1.32	2.06	5.43
	upper avg.	2717	5.82	145.01	1.24	384.69	6.41	1.32	2.06	5.43

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->							
	Estimate	Flow rate (1000 m3/d)	NH4-N [tonnes]	NO3-N [tonnes]	PO4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	SiO2 [tonnes]	SPM [1000 [tonnes]	TOC 1000 [tonnes]
Nidelva(Rykene)	lower avg.	11720	342.94	2720.40	42.13	4107.37	85.79	6.16	18.46	18.85
	upper avg.	11720	342.94	2720.40	42.48	4107.37	85.79	6.16	18.46	18.85
Tovdalselva	lower avg.	6259	59.46	319.87	1.10	811.00	12.33	2.26	3.86	11.22
	upper avg.	6259	59.46	319.87	2.83	811.00	12.33	2.26	3.86	11.22
Mandalselva	lower avg.	8841	57.85	543.85	4.07	1130.76	13.70	2.42	4.44	12.19
	upper avg.	8841	57.85	543.85	5.26	1130.76	13.70	2.42	4.44	12.19
Lyngdalselva	lower avg.	3334	22.21	324.83	1.32	577.38	7.66	0.97	1.91	4.39
	upper avg.	3334	22.21	324.83	1.49	577.38	7.66	0.97	1.91	4.39
Kvina	lower avg.	6742	67.87	455.66	3.00	1007.34	15.13	1.28	3.43	9.69
	upper avg.	6742	67.87	455.66	3.25	1007.34	15.13	1.28	3.43	9.69
Sira	lower avg.	12751	219.13	499.82	0.00	1481.57	19.40	1.86	2.64	8.43
	upper avg.	12751	219.13	499.82	4.64	1481.57	19.40	1.86	2.64	8.43
Bjerkreimselva	lower avg.	4337	14.06	633.68	3.10	804.02	10.22	1.14	1.86	2.18
	upper avg.	4337	14.06	633.68	3.43	804.02	10.22	1.14	1.86	2.18
Figgjoelva	lower avg.	661	9.31	238.77	4.45	328.23	7.32	0.29	1.38	0.73
	upper avg.	661	9.31	238.77	4.45	328.23	7.32	0.29	1.38	0.73
Lyseelva	lower avg.	1517	2.44	101.78	0.04	139.52	1.14	0.29	0.20	0.49
	upper avg.	1517	2.44	101.78	0.57	139.52	1.14	0.29	0.20	0.49
Årdalselva	lower avg.	4158	5.19	1777.68	0.00	1957.29	3.95	1.57	0.86	1.72
	upper avg.	4158	6.81	1777.68	1.51	1957.29	3.95	1.57	0.86	1.72
Ulladalsåna (Ulla)	lower avg.	2901	7.46	91.58	0.00	186.66	1.51	0.82	0.30	2.03
	upper avg.	2901	8.26	91.58	1.06	186.66	1.51	0.82	0.30	2.03
Saudaelva	lower avg.	3048	1.59	229.13	0.00	297.08	2.43	0.43	0.33	0.83
	upper avg.	3048	2.89	229.13	1.11	297.08	2.43	0.43	0.33	0.83
Vikedalselva	lower avg.	842	7.98	562.47	0.05	609.43	1.04	0.35	0.29	0.42
	upper avg.	842	7.98	562.47	0.31	609.43	1.04	0.35	0.29	0.42
Vosso(Bolstadelvi)	lower avg.	10233	62.81	592.15	3.37	979.97	16.69	1.91	2.40	4.69

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006		Quantities --->								
	Estimate	Flow rate (1000 m3/d)	NH4-N [tonnes]	NO3-N [tonnes]	PO4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	SiO2 [tonnes]	SPM [1000 [tonnes]	TOC 1000 [tonnes]
	upper avg.	10233	62.81	592.15	3.72	979.97	16.69	1.91	2.40	4.69
Jostedøla	lower avg.	5701	19.49	94.74	95.87	250.49	102.20	3.77	114.91	0.64
	upper avg.	5701	19.49	95.39	95.89	250.49	102.20	3.77	114.91	0.64
Gaular	lower avg.	5188	24.24	171.39	4.16	383.47	11.94	0.83	2.25	2.88
	upper avg.	5188	24.24	171.39	5.01	383.47	11.94	0.83	2.25	2.88
Jølstra	lower avg.	5451	17.54	236.84	3.41	486.17	9.45	0.97	2.24	2.78
	upper avg.	5451	17.54	236.84	4.26	486.17	9.45	0.97	2.24	2.78
Nausta	lower avg.	2099	24.50	84.19	2.61	174.77	5.37	0.36	0.63	1.22
	upper avg.	2099	24.50	84.27	2.64	174.77	5.37	0.36	0.63	1.22
Gloppenelva(Breimselva)	lower avg.	4214	8.40	190.91	0.20	322.35	4.88	0.80	1.40	1.17
	upper avg.	4214	8.40	191.19	1.53	322.35	4.88	0.80	1.40	1.17
Driva	lower avg.	7719	12.95	331.56	0.00	627.34	7.53	3.56	2.59	2.95
	upper avg.	7719	12.95	331.56	2.81	627.34	7.53	3.56	2.59	2.95
Surna	lower avg.	4673	10.47	164.25	2.17	394.22	8.25	1.18	3.22	4.70
	upper avg.	4673	10.47	164.25	2.68	394.22	8.25	1.18	3.22	4.70
Gaula	lower avg.	8501	23.49	307.91	4.74	787.79	37.96	4.20	39.73	11.03
	upper avg.	8501	23.49	307.91	4.88	787.79	37.96	4.20	39.73	11.03
Nidelva(Tr.heim)	lower avg.	7998	15.50	309.91	8.15	646.75	15.13	2.66	9.83	7.93
	upper avg.	7998	15.50	309.91	8.36	646.75	15.13	2.66	9.83	7.93
Stjørdalselva	lower avg.	6636	10.98	361.54	14.55	696.31	19.05	1.80	15.59	8.84
	upper avg.	6636	10.98	361.54	14.65	696.31	19.05	1.80	15.59	8.84
Verdalselva	lower avg.	4299	7.84	401.75	30.97	662.75	37.47	1.72	35.98	5.83
	upper avg.	4299	7.84	401.75	30.97	662.75	37.47	1.72	35.98	5.83
Snåsavassdraget	lower avg.	2330	5.59	185.31	3.93	362.52	8.92	0.75	7.07	4.20
	upper avg.	2330	5.59	185.31	3.97	362.52	8.92	0.75	7.07	4.20
Namsen	lower avg.	3285	25.17	74.02	6.10	328.70	10.65	1.08	9.38	4.38
	upper avg.	3285	25.17	74.02	6.10	328.70	10.65	1.08	9.38	4.38

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->							
	Estimate	Flow rate (1000 m3/d)	NH4-N [tonnes]	NO3-N [tonnes]	PO4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	SiO2 [tonnes]	SPM [1000 [tonnes]	TOC 1000 [tonnes]
Røssåga	lower avg.	7713	11.30	102.53	0.00	281.06	8.21	1.08	1.05	2.88
	upper avg.	7713	11.30	102.53	2.81	281.06	8.21	1.08	1.05	2.88
Ranaelva	lower avg.	16983	25.20	190.40	3.62	554.28	15.98	3.70	7.00	7.59
	upper avg.	16983	25.20	190.40	6.18	554.28	15.98	3.70	7.00	7.59
Beiarelva	lower avg.	4728	9.08	51.32	5.86	208.07	10.25	1.53	6.36	2.31
	upper avg.	4728	9.08	51.32	6.07	208.07	10.25	1.53	6.36	2.31
Målselv	lower avg.	9652	25.29	94.48	26.35	556.35	57.83	4.22	42.72	7.01
	upper avg.	9652	25.83	94.48	26.98	556.35	57.83	4.22	42.72	7.01
Barduelva	lower avg.	8766	13.10	102.36	20.59	443.98	31.95	3.28	28.08	4.84
	upper avg.	8766	13.10	102.36	20.59	443.98	31.95	3.28	28.08	4.84
Tanaelva	lower avg.	15834	125.73	48.27	21.26	1492.99	78.66	11.32	11.70	29.84
	upper avg.	15834	125.73	48.55	21.26	1492.99	78.66	11.32	11.70	29.84
Pasvikelva	lower avg.	16289	141.26	158.90	11.56	1638.25	46.17	12.87	9.44	20.35
	upper avg.	16289	141.26	159.26	11.71	1638.25	46.17	12.87	9.44	20.35
TRIBUTARY RIVERS (109)										
Mosselva	upp.avg	834	20.22	148.84	1.26	322.01	9.89	0.30	1647.98	2.22
Hølenelva	upp.avg	135	5.58	171.31	2.21	209.01	3.96	0.25	563.01	0.49
Årungelva	upp.avg	55	0.80	37.89	0.21	56.72	1.00	0.04	138.24	0.09
Gjersjøelva	upp.avg	93	0.84	37.59	0.09	51.92	0.72	0.13	83.66	0.20
Ljanselva	upp.avg	68	3.12	20.99	0.82	38.93	1.68	0.15	291.70	0.14
Loelva	upp.avg	114	8.43	52.40	2.25	88.74	6.70	0.33	1224.97	0.24
Akerselva	upp.avg	372	5.38	36.12	0.78	75.63	3.29	0.48	430.18	0.52
Frognerelva	upp.avg	33	0.96	11.90	0.51	19.27	0.91	0.07	86.22	0.05
Lysakerelva	upp.avg	356	3.16	39.71	0.68	73.41	2.71	0.40	721.92	0.62
Sandvikselva	upp.avg	304	4.16	88.17	0.90	128.54	2.42	0.36	415.98	0.55
Åroselva	upp.avg	147	4.06	67.07	0.64	96.83	2.31	0.28	727.95	0.33
Lierelva	upp.avg	488	5.91	177.63	3.93	228.90	11.44	1.12	6492.33	0.87

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->								
	Estimate	Flow rate (1000 m3/d)	NH4-N [tonnes]	NO3-N [tonnes]	PO4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	SiO2 [tonnes]	SPM [1000 [tonnes]	TOC 1000 [tonnes]
Sandeelva	upp.avg	278	7.37	95.65	0.95	144.82	3.39	0.33	984.40	0.43
Aulielva	upp.avg	609	39.32	372.63	6.02	568.24	14.73	0.55	4383.87	1.26
Farriselva-Siljanvassdraget	upp.avg	1138	5.49	158.45	0.89	236.27	2.93	1.62	345.15	1.74
Gjerstadelva	upp.avg	1054	13.27	78.76	0.60	155.98	4.39	0.71	476.71	1.88
Vegårdselva	upp.avg	1093	11.96	68.80	0.76	149.16	2.79	0.43	576.93	1.76
Søgneelva-Songdalselva	upp.avg	943	10.44	197.60	0.79	253.37	4.12	0.54	544.31	1.50
Audnedalselva	upp.avg	1690	15.84	185.66	0.81	292.90	4.96	0.81	839.11	2.19
Soknedalselva	upp.avg	1996	15.56	190.49	1.66	272.78	9.25	0.88	733.72	1.35
Hellelandselva	upp.avg	1478	6.91	171.95	1.31	246.17	6.04	0.56	500.50	1.14
Håelva	upp.avg	485	11.27	197.41	3.70	303.26	8.43	0.50	477.48	0.85
Imselva	upp.avg	405	2.76	82.11	0.19	115.16	1.43	0.06	183.79	0.50
Oltedalselva	upp.avg	910	6.90	94.47	0.81	139.82	5.60	0.65	353.80	0.51
Dirdalsåna	upp.avg	1424	4.23	122.51	1.71	166.82	4.64	0.60	327.64	0.71
Frafjordelva	upp.avg	1604	6.18	120.37	0.72	164.16	3.17	0.55	270.69	0.79
Espedalselva	upp.avg	1244	2.77	93.13	0.49	135.36	2.21	0.76	227.64	0.54
Førrelva	upp.avg	1203	2.08	81.97	1.17	93.51	3.02	0.75	162.06	0.74
Åbøelva	upp.avg	708	1.29	39.69	0.29	53.86	0.82	0.14	115.60	0.24
Etneelva	upp.avg	1578	11.32	173.07	0.72	231.78	3.34	0.41	532.17	0.53
Opo	upp.avg	4109	35.52	177.56	2.21	395.83	14.52	1.47	2347.21	1.24
Tysso	upp.avg	2508	4.11	113.40	1.37	168.63	4.42	1.15	314.31	0.75
Kinso	upp.avg	1189	2.27	28.87	0.77	50.33	2.94	0.15	282.23	0.27
Veig	upp.avg	2099	3.50	39.83	0.95	100.13	3.47	0.95	913.96	0.78
Bjoreio	upp.avg	2505	4.03	57.83	1.58	145.49	5.27	0.86	568.54	1.22
SIMA	upp.avg	614	0.99	24.12	0.24	35.83	0.70	0.39	188.07	0.12
Austdøla	upp.avg	583	1.08	26.40	0.38	34.40	3.30	0.11	91.34	0.09
Nordøla /Austdøla	upp.avg	175	0.29	10.02	0.07	11.87	0.47	0.08	112.89	0.02

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->							
	Estimate	Flow rate (1000 m3/d)	NH4-N [tonnes]	NO3-N [tonnes]	PO4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	SiO2 [tonnes]	SPM [1000 [tonnes]	TOC 1000 [tonnes]
Tysselvi	upp.avg	1791	4.02	62.58	0.75	145.93	2.71	0.27	537.81	0.95
Oselva	upp.avg	806	2.30	44.95	1.44	99.70	3.49	0.23	355.79	0.71
Daleelvi	upp.avg	1705	4.19	55.49	0.54	101.81	3.08	0.41	376.30	0.82
Ekso -Storelvi	upp.avg	3968	10.47	125.65	2.13	236.65	6.29	0.62	921.20	1.97
Modalselva -Moelvi	upp.avg	3665	6.11	153.80	1.59	223.07	5.81	0.85	719.44	1.15
Nærøydalselvi	upp.avg	1628	3.01	72.84	0.62	99.72	3.79	1.15	331.40	0.33
Flåmselvi	upp.avg	1043	2.69	45.00	0.31	57.48	1.17	0.27	399.35	0.16
Aurlandselvi	upp.avg	3030	9.28	153.92	1.14	202.28	5.39	1.15	854.67	0.74
Erdalselvi	upp.avg	440	0.60	11.10	0.17	18.37	0.53	0.16	86.46	0.13
Lærdalselva /Mjeldo	upp.avg	3735	6.40	148.79	1.27	220.95	8.11	1.99	1283.96	1.20
Årdalselvi	upp.avg	4373	11.44	384.59	2.47	524.14	7.12	2.55	2402.70	1.51
Fortundalselva	upp.avg	2496	4.77	93.31	0.91	128.42	4.18	1.08	1804.64	0.47
Mørkrisdalselvi	upp.avg	1385	2.27	57.06	0.56	85.52	2.46	0.75	1153.81	0.27
Årøyelva	upp.avg	2528	5.29	80.32	0.69	134.74	5.55	1.12	1187.04	0.62
Sogndalselva	upp.avg	975	2.19	42.61	0.81	66.39	1.99	0.23	402.02	0.72
Oselva	upp.avg	2425	10.30	46.97	0.69	167.01	8.44	0.29	574.98	2.36
Hopselva	upp.avg	718	1.39	25.57	0.23	35.16	0.80	0.08	155.47	0.21
Åelva	upp.avg	1652	5.01	44.76	0.57	88.01	2.86	0.31	421.79	0.91
Oldenelva	upp.avg	1450	4.44	82.27	0.46	117.63	2.49	0.63	593.81	0.43
Loelvi	upp.avg	1676	4.17	72.98	1.25	100.38	3.81	0.85	764.17	0.38
Stryneelva	upp.avg	3416	11.50	133.84	1.36	222.74	5.04	1.42	3593.26	0.81
Hornindalselva(Horndøla)	upp.avg	2488	7.52	106.49	0.92	176.46	3.62	1.04	784.57	1.09
Ørstaelva	upp.avg	1040	6.41	58.17	1.43	106.77	4.37	0.60	629.07	0.51
Valldøla	upp.avg	2108	3.84	53.10	0.53	85.92	2.39	0.76	536.48	0.43
Rauma	upp.avg	5226	12.05	124.05	1.35	192.79	5.73	2.58	1403.50	1.24
Isa	upp.avg	768	2.17	21.26	0.29	35.66	0.98	0.43	251.75	0.20

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->								
	Estimate	Flow rate (1000 m3/d)	NH4-N [tonnes]	NO3-N [tonnes]	PO4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	SiO2 [tonnes]	SPM [1000 [tonnes]	TOC 1000 [tonnes]
Eira	upp.avg	4504	9.29	196.51	1.11	281.53	4.88	3.16	932.18	1.01
Litledalselva	upp.avg	1046	1.46	23.53	0.34	39.22	1.90	1.06	218.94	0.26
Ålvunda	upp.avg	895	2.74	61.93	0.51	95.18	2.49	0.82	365.26	0.60
Toåa	upp.avg	1129	1.61	15.76	0.51	49.59	1.80	0.47	275.25	0.55
Bøvra	upp.avg	946	2.55	48.44	0.27	86.48	1.64	0.42	295.73	0.88
Børselva	upp.avg	233	1.29	29.68	0.38	52.75	1.86	0.12	302.94	0.42
Vigda	upp.avg	349	1.09	30.19	0.62	58.77	2.45	0.26	1449.70	0.47
Homla	upp.avg	405	2.92	7.41	0.27	39.89	1.52	0.22	177.34	0.87
Gråe	upp.avg	292	1.50	57.94	0.70	87.85	1.54	0.17	320.76	0.56
Figga	upp.avg	604	3.66	66.08	1.09	111.42	3.39	0.33	1507.54	1.43
Årgårdselva	upp.avg	1549	13.62	78.19	3.44	221.97	10.36	0.75	1973.29	4.33
Moelva(Salsvatenelva)	upp.avg	1657	3.17	36.22	0.52	79.86	1.80	0.58	318.30	1.24
Åelva(Åbjøra)	upp.avg	2657	6.21	28.19	1.21	95.14	9.65	0.46	1184.92	1.82
Skjerva	upp.avg	420	7.61	23.16	2.52	61.22	4.23	0.21	727.42	0.50
Fusta	upp.avg	2852	16.18	30.26	1.70	131.86	5.33	0.51	2081.65	1.63
Drevja	upp.avg	924	1.43	14.06	1.15	41.32	2.33	0.15	954.02	0.40
Bjerkaelva	upp.avg	1423	5.40	13.32	0.51	54.24	3.68	0.41	596.75	0.88
Dalselva	upp.avg	932	4.01	6.98	0.58	39.68	1.72	0.27	452.75	0.62
Fykanåga	upp.avg	1894	5.29	31.12	1.13	61.70	3.19	0.35	900.61	0.44
Saltelva	upp.avg	4001	12.99	46.60	4.47	139.71	15.69	2.49	13916.71	1.38
Sulitjelmavassdraget	upp.avg	2886	7.62	29.19	1.10	85.38	5.21	0.61	1160.72	1.00
Kobbelva	upp.avg	1736	3.95	21.08	0.88	58.77	2.65	0.58	727.17	0.38
Elvegårdselva	upp.avg	3216	10.73	14.13	1.75	74.76	4.43	1.91	1315.42	2.09
Spanselva	upp.avg	475	0.84	5.15	0.26	12.45	0.73	0.20	181.08	0.18
Salangselva	upp.avg	1838	4.01	17.15	0.88	50.74	2.50	0.52	700.88	0.60
Lakselva(Rossfjordelva)	upp.avg	573	1.86	2.00	0.36	25.17	1.14	0.13	149.75	0.38

TABLE 2. Riverine inputs from the 10 main and 36+109 tributary rivers in Norway in 2006.

RIVERINE LOADS 2006			Quantities --->							
	Estimate	Flow rate (1000 m3/d)	NH4-N [tonnes]	NO3-N [tonnes]	PO4-P [tonnes]	TOT-N [tonnes]	TOT-P [tonnes]	SiO2 [tonnes]	SPM [1000 [tonnes]	TOC 1000 [tonnes]
Nordkjoselva	upp.avg	485	0.79	3.27	0.35	12.07	0.74	0.34	211.64	0.18
Signaldalselva	upp.avg	1453	2.91	10.35	1.06	39.21	2.49	1.01	1380.17	1.94
Skibotnelva	upp.avg	2069	3.83	18.94	0.88	61.38	2.91	1.26	583.18	1.05
Kåfjordelva	upp.avg	1049	1.46	24.66	0.46	48.36	2.40	0.66	320.47	0.30
Reisaelva	upp.avg	5807	13.56	81.83	2.49	220.44	10.49	6.46	2683.00	3.53
Mattiselva	upp.avg	363	1.03	2.23	0.14	13.74	0.41	0.18	78.83	0.28
Tverrelva	upp.avg	260	0.73	5.58	0.16	18.46	0.53	0.20	82.07	0.34
Repparfjordelva	upp.avg	2529	6.90	29.53	1.32	113.37	3.73	1.17	590.50	2.54
Stabburselva	upp.avg	1614	4.26	15.32	0.63	56.69	1.59	1.30	372.63	1.32
Lakseelv	upp.avg	1550	4.07	5.24	0.75	58.43	3.56	1.42	2117.49	1.40
Børselva	upp.avg	1279	4.62	4.16	0.53	32.05	1.19	1.50	322.78	0.42
Mattusjåkka	upp.avg	144	0.35	1.42	0.05	3.91	0.14	0.07	33.68	0.06
Stuorrajåkka	upp.avg	984	2.99	13.97	0.32	28.00	1.02	0.98	140.76	0.26
Soussjåkka	upp.avg	131	0.29	0.91	0.05	3.65	0.11	0.15	25.22	0.05
Adamselva	upp.avg	837	3.15	3.18	0.30	28.56	1.07	0.82	175.10	0.53
Syltefjordelva(Vesterelva)	upp.avg	1589	4.92	9.00	0.89	60.02	4.30	1.37	298.22	0.45
Jakobselv	upp.avg	1092	3.28	3.89	0.68	47.09	2.06	1.72	260.59	0.79
Neidenelva	upp.avg	2833	14.01	13.55	1.11	192.69	5.74	2.46	1582.17	3.78
Grense Jakobselv	upp.avg	275	1.61	1.39	0.11	13.81	0.35	0.23	111.88	0.25

Part B

Table 3. Total inputs from Norway 2006

3A. TOTAL NORWAY

TOTAL INPUTS Discharge region	Estimate	Flow rate (1000 m^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																				
Main Rivers	low avg.		0,94	0,05	98,0	265,8	13,5	10,4	16,9	41,8	815	16 816	284	29 231	666	25 979	320 785	233 086	0	3
	upp avg.	177 895	0,97	0,09	98,0	265,8	13,5	10,4	17,9	41,8	823	16 816	295	29 231	666	25 979	320 801	233 086	146	13
Tributary Rivers (36)	low avg.		0,93	0,05	89,8	227,1	15,4	10,4	19,7	181,3	1 448	13 326	332	26 763	742	109 277	397 461	222 545		
	upp avg.	230 137	1,06	0,10	89,8	227,1	15,4	11,0	22,3	181,4	1 453	13 328	359	26 763	742	109 277	397 461	222 545		
Tributary Rivers (109)	low avg.		0,69	0,10	30,2	84,0	7,2	6,6	10,9	23,3	641	7 376	110	12 918	412	29 073	96 761	94 174		
	upp avg.	158 931	0,69	0,09	30,2	84,0	7,2	6,6	10,9	23,3	641	7 376	110	12 918	412	29 073	96 761	94 174		
Total Riverine Inputs	**low avg.**		**2,56**	**0,20**	**218,0**	**577**	**36,051**	**27,4**	**47,4**	**246,4**	**2 904**	**37 518**	**726**	**68 912**	**1 820**	**164 330**	**815 007**	**549 805**	**0**	**3**
	upp avg.	**566 962**	**2,71**	**0,29**	**218,0**	**577**	**36,055**	**28,0**	**51,1**	**246,5**	**2 916**	**37 521**	**764**	**68 912**	**1 820**	**164 330**	**815 023**	**549 805**	**146**	**13**
DIRECT DISCHARGES																				
Sewage Effluents	low avg.		0,03	0,08	5,02	15,35	0,40	0,17	0,44	3,26	8 279	552	503	11 038	838		10 818			
	upp avg.		0,03	0,08	5,02	15,35	0,40	0,17	0,44	3,26	8 279	552	504	11 038	838		10 818			
Industrial Effluents	low avg.		0,06	0,01	9,66	6,48	1,43	0,44	2,40	8,34	1 276	85	111	1 701	186	0,02	468 518			
	upp avg.		0,06	0,01	9,66	6,48	1,43	0,44	2,40	8,34	1 276	85	111	1 701	186	0,02	468 518			
Fish Farming	low avg.				220,86						27 700	4 155	5 050	34 625	7 318					
	upp avg.				220,86						27 700	4 155	5 062	34 625	7 318					
Total Direct Inputs	**low avg.**		**0,09**	**0,09**	**235,5**	**22**	**1,83**	**0,6**	**2,8**	**11,6**	**37 255**	**4 792**	**5 663**	**47 365**	**8 342**	**0,02**	**479 336**			
	upp avg.		**0,09**	**0,09**	**235,5**	**22**	**1,83**	**0,6**	**2,8**	**11,6**	**37 255**	**4 792**	**5 677**	**47 365**	**8 342**	**0,02**	**479 336**			
UNMONITORED AREAS																				
Unmonitored Areas	low avg.		0	0	0	0	0	0	0	0	1 544	16 779	172	25 888	657					
	upp avg.	348 312	0	0	0	0	0	0	0	0	1 544	16 779	172	25 888	657					
REGION TOTAL	**low avg.**		**2,65**	**0,29**	**454**	**599**	**37,9**	**28,0**	**50,3**	**258**	**41 703**	**59 089**	**6 561**	**142 165**	**10 819**	**164 330**	**1294343**	**549 805**	**0**	**3**
	upp avg.	**566 962**	**2,80**	**0,37**	**454**	**599**	**37,9**	**28,6**	**53,9**	**258**	**41 715**	**59 091**	**6 613**	**142 165**	**10 819**	**164 330**	**1294359**	**549 805**	**146**	**13**

3B. SKAGERRAK

TOTAL INPUTS																				
Discharge region	Estimate	Flow rate (1000 m^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: Skagerrak																				
RIVERINE INPUTS																				
Main Rivers	low avg.		0,79	0,05	78,4	219	12	9	14	36	758	15 548	254	26 408	579	153	281 677	202033	0	2,75
	upp avg.	141 158	0,79	0,08	78,4	219	12	9	15	36	761	15 548	260	26 408	579	153	281 677	202033	103,7	10,36
Tributary Rivers (36)	low avg.		0,36	0,01	9,3	67	5	3	1	4	471	4 156	51	7 096	127	28	30 692	53 568		
	upp avg.	31 555	0,36	0,01	9,3	67	5	3	2	4	471	4 156	54	7 096	127	28	30 692	53 568		
Tributary Rivers (109)	low avg.		0,13	0,01	5,7	19	1	2	2	3	166	2 047	25	3 191	84	9	20 975	17 070		
	upp avg.	9 805	0,13	0,01	5,7	19	1	2	2	3	166	2 047	25	3 191	84	9	20 975	17 070		
Total Riverine Inputs	**low avg.**		**1,28**	**0,06**	**93,5**	**305**	**18**	**13**	**17**	**43**	**1 395**	**21 751**	**329**	**36 694**	**791**	**190**	**333 344**	**272 671**	**0**	**2,75**
	upp avg.	**182 518**	**1,28**	**0,10**	**93,5**	**305**	**18**	**13**	**18**	**43**	**1 398**	**21 751**	**340**	**36 694**	**791**	**190**	**333 344**	**272 671**	**103,7**	**10,36**
DIRECT DISCHARGES																				
Sewage Effluents	low avg.		0	0,025	0,07	3,2	12	0	0	0	3	3 288	219	64	4 383	107				
	upp avg.		0	0,025	0,07	3,2	12	0	0	0	3	3 288	219	64	4 383	107				
Industrial Effluents	low avg.		0	0,02	0,01	9,2	4	0	0	1	4	800	53	53	1 067	88				
	upp avg.		0	0,02	0,01	9,2	4	0	0	1	4	800	53	53	1 067	88				
Fish Farming	low avg.		0	0	0,00	0,3	0	0	0	0	0	27	4	5	33	7				
	upp avg.		0	0	0,00	0,3	0	0	0	0	0	27	4	5	33	7				
Total Direct Inputs	**low avg.**			**0,05**	**0,08**	**12,7**	**16**	**0,7**	**0,6**	**1,7**	**7,1**	**4 114**	**276**	**122**	**5 484**	**202**				
	upp avg.			**0,05**	**0,08**	**12,7**	**16**	**0,7**	**0,6**	**1,7**	**7,1**	**4 114**	**276**	**122**	**5 484**	**202**				
UNMONITORED AREAS																				
Unmonitored Areas	low avg.		0	0	0	0	0	0	0	0	160	1703	19	2573	69					
	upp avg.	8976	0	0	0	0	0	0	0	0	160	1703	19	2573	69					
REGION TOTAL	**low avg.**	**191**	**1,32**	**0,15**	**106,1**	**322**	**18,9**	**13,9**	**18,9**	**50,3**	**5 670**	**23 730**	**471**	**44 751**	**1 061**	**190**	**337 790**	**272 671**	**0**	**2,75**
	upp avg.	**494**	**1,32**	**0,18**	**106,1**	**322**	**18,9**	**13,9**	**20,1**	**50,3**	**5 673**	**23 731**	**481**	**44 751**	**1 061**	**190**	**337 790**	**272 671**	**103,7**	**10,36**

3C. NORTH SEA

TOTAL INPUTS																				
Discharge region	Estimate	Flow rate (1000 m^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																				
Main Rivers	low avg.		0,05	0	1,6	12	0,8	0,4	0,4	1,4	17	785	13	1 210	31	4	9 678	5 314	0,0	0,0
	upp avg.	10 556	0,06	0,00	1,6	12	0,8	0,4	0,6	1,4	20	785	14	1 210	31	4	9 678	5 314	4,6	0,8
Tributary Rivers (36)	low avg.		0,25	0,02	15,4	67	6,2	2,9	4,7	6,5	514	6 286	122	9 986	220	37	137 009	44 293		
	upp avg.	73 177	0,29	0,04	15,4	67	6,2	3,1	6,4	6,5	518	6 287	135	9 986	220	37	137 009	44 293		
Tributary Rivers (109)	low avg.		0,32	0,04	10,9	44	4,1	2,4	4,6	8,5	242	3 890	41	6 118	172	28	28 408	30 340		
	upp avg.	74 207	0,32	0,04	10,9	44	4,1	2,4	4,6	8,5	242	3 890	41	6 118	172	28	28 408	30 340		
Total Riverine Inputs	**low avg.**		**0,62**	**0,06**	**27,9**	**123**	**11,1**	**5,7**	**9,8**	**16,4**	**773**	**10 961**	**176**	**17 314**	**424**	**70**	**175 096**	**79 946**	**0**	**0**
	upp avg.	**157 940**	**0,66**	**0,08**	**27,9**	**123**	**11,1**	**6,0**	**11,6**	**16,4**	**780**	**10 962**	**190**	**17 314**	**424**	**70**	**175 096**	**79 946**	**4,6**	**0,8**
Sewage Effluents	low avg.		0,000	0,002	1,9	3,0	0,14	0,04	0,2	0,1	2 423	162	190	3 230	316		4 294			
	upp avg.		0,004	0,002	1,9	3,0	0,14	0,04	0,2	0,1	2 423	162	190	3 230	316		4 294			
Industrial Effluents	low avg.		0		0,2	0,4	0,00	0,00	0,5	3,9	336	22	40	448	66		10 803			
	upp avg.		0		0,2	0,4	0,00	0,00	0,5	3,9	336	22	40	448	66		10 803			
Fish Farming	low avg.		0	0	74,3	0,0	0,00	0,00	0,0	0,0	8 944	1 342	1 631	11 180	2 363					
	upp avg.		0	0	74,3	0,0	0,00	0,00	0,0	0,0	8 944	1 342	1 643	11 180	2 363					
Total Direct Inputs	**low avg.**		**0,00**		**76,3**	**3,4**	**0,14**	**0,04**	**0,6**	**4,0**	**11 703**	**1 525**	**1 860**	**14 859**	**2 746**		**15 097**			
	upp avg.		**0,00**	**0,00**	**76,3**	**3,4**	**0,14**	**0,04**	**0,6**	**4,0**	**11 703**	**1 525**	**1 873**	**14 859**	**2 746**		**15 097**			
Unmonitored Areas	low avg.		0	0	0	0	0	0	0	0	600	6 604	48	10 299	181					
	upp avg.	117 811	0	0	0	0	0	0	0	0	600	6 604	48	10 299	181					
REGION TOTAL	**low avg.**		**0,62**	**0,06**	**104,3**	**126**	**11,219**	**5,7**	**10,4**	**20,4**	**13 076**	**19 090**	**2 084**	**42 471**	**3 350**	**70**	**190 193**	**79 946**	**0**	**0**
	upp avg.	**275 751**	**0,66**	**0,08**	**104,3**	**126**	**11,219**	**6,0**	**12,2**	**20,5**	**13 083**	**19 091**	**2 111**	**42 471**	**3 350**	**70**	**190 193**	**79 946**	**4,6**	**0,8**

3D. NORWEGIAN SEA

Discharge region	Estimate	Flow rate (1000 m^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	low avg.		0,09	0,00	16,3	34	0,48	0,8	1,6	3,6	30	421	12	1 178	38	11	25 274	16 437	0	0
	upp avg.	18 421	0,10	0,01	16,3	34	0,48	0,8	1,7	3,6	32	421	14	1 178	38	11	25 290	16 437	27,29	1,35
Tributary Rivers (36)	low avg.		0,18	0,02	33,0	76	3,80	3,0	10,9	21,9	196	2 677	127	6 550	269	65	208 620	74 494		
	upp avg.	93 282	0,27	0,04	33,0	76	3,80	3,3	11,4	22,0	196	2 677	137	6 550	269	65	208 620	74 494		
Tributary Rivers (109)	low avg.		0,20	0,04	9,9	17	1,54	1,9	3,1	8,1	180	1 330	37	2 939	131	31	41 186	34 282		
	upp avg.	59 440	0,20	0,04	9,9	17	1,54	1,9	3,1	8,1	180	1 330	37	2 939	131	31	41 186	34 282		
Total Riverine Inputs	**low avg.**		**0,47**	**0,07**	**59,2**	**127**	**5,82**	**5,7**	**15,6**	**33,7**	**406**	**4 428**	**176**	**10 667**	**438**	**108**	**275 081**	**125 213**	**0**	**0**
	upp avg.	**171 143**	**0,57**	**0,09**	**59,2**	**127**	**5,82**	**6,0**	**16,2**	**33,7**	**408**	**4 428**	**189**	**10 667**	**438**	**108**	**275 096**	**125 213**	**27,3**	**1,35**
Sewage Effluents	low avg.		0	0	0	0	0	0	0	0	2 402	160	232	3 202	386		3 707			
	upp avg.		0	0	0	0	0	0	0	0	2 402	160	233	3 202	386		3 707			
Industrial Effluents	low avg.		0,04		0,3	1,9	0,97	0,02	0,5	0,5	140	9	19	186	31		456 086			
	upp avg.		0,04		0,3	1,9	0,97	0,02	0,5	0,5	140	9	19	186	31		456 086			
Fish Farming	low avg.		0	0	131,45	0	0	0	0	0	17 492	2 624	3 189	21 865	4 621					
	upp avg.		0	0	131,45	0	0	0	0	0	17 492	2 624	3 189	21 865	4 621					
Total Direct Inputs	**low avg.**		**0,04**	**0,00**	**131,8**	**1,9**	**0,97**	**0,0**	**0,5**	**0,5**	**20 034**	**2 793**	**3 439**	**25 253**	**5 038**		**459 793**			
	upp avg.		**0,04**	**0,00**	**131,8**	**1,9**	**0,97**	**0,0**	**0,5**	**0,5**	**20 034**	**2 793**	**3 440**	**25 253**	**5 038**		**459 793**			
Unmonitored Areas	low avg.		0	0	0	0	0	0	0	0	702	7 508	97	11 417	372					
	upp avg.	184 429	0	0	0	0	0	0	0	0	702	7 508	97	11 417	372					
REGION TOTAL	**low avg.**		**0,51**	**0,07**	**190,9**	**129**	**6,785**	**5,7**	**16,1**	**34,1**	**21 142**	**14 729**	**3 712**	**47 338**	**5 849**	**108**	**734 874**	**125 213**	**0**	**0**
	upp avg.	**355 572**	**0,61**	**0,09**	**190,9**	**129**	**6,788**	**6,1**	**16,7**	**34,2**	**21 144**	**14 729**	**3 726**	**47 338**	**5 849**	**108**	**734 889**	**125 213**	**27,3**	**1,35**

3E. BARENTS SEA

TOTAL INPUTS																				
Discharge region	Estimate	Flow rate (1000 m^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: Barents Sea																				
RIVERINE INPUTS																				
Main Rivers	low avg.		0,00	0,00	1,6	1	0,05	0,3	0,6	1	10	62	5	436	16	25 810	4 156	9 302	0,0	0,0
	upp avg.	7 759	0,01	0,00	1,6	1	0,05	0,3	0,6	1	10	62	6	436	16	25 810	4 156	9 302	10,8	0,57
Tributary Rivers (36)	low avg.		0,15	0,01	32,2	18	0,73	1,9	2,9	149	267	207	33	3 131	125	109 147	21 139	50 190		
	upp avg.	32 123	0,15	0,01	32,2	18	0,73	1,9	2,9	149	267	208	33	3 131	125	109 147	21 139	50 190		
Tributary Rivers (109)	low avg.		0,05	0,01	3,6	4	0,17	0,4	1,4	3	52	109	7	670	26	29 005	6 192	12 483		
	upp avg.	15 478	0,05	0,00	3,6	4	0,17	0,4	1,4	3	52	109	7	670	26	29 005	6 192	12 483		
Total Riverine Inputs	**low avg.**		**0,19**	**0,02**	**37,5**	**22**	**0,95**	**2,6**	**4,9**	**153**	**329**	**378**	**45**	**4 238**	**167**	**163 962**	**31 487**	**71 975**	**0,0**	**0,0**
	upp avg.	**55 360**	**0,21**	**0,02**	**37,5**	**22**	**0,95**	**2,6**	**4,9**	**153**	**330**	**379**	**46**	**4 238**	**167**	**163 962**	**31 487**	**71 975**	**10,8**	**0,57**
Sewage Effluents	low avg.		0	0	0	0	0	0	0	0	167	11	17	222	29					
	upp avg.		0	0	0	0	0	0	0	0	167	11	17	222	29					
Industrial Effluents	low avg.																			
	upp avg.																			
Fish Farming	low avg.		0	0	14,8	0	0	0	0	0	1 237	186	226	1 547	327					
	upp avg.		0	0	14,8	0	0	0	0	0	1 237	186	226	1 547	327					
Total Direct Inputs	**low avg.**				**14,8**						**1 404**	**197**	**243**	**1 769**	**355**					
	upp avg.				**14,8**						**1 404**	**197**	**243**	**1 769**	**355**					
Unmonitored Areas	low avg.		0	0	0	0	0	0	0	0	81	964	7	1 599	35					
	upp avg.	37 096	0	0	0	0	0	0	0	0	81	964	7	1 599	35					
REGION TOTAL	**low avg.**		**0,19**	**0,02**	**52,3**	**22**	**0,95**	**2,6**	**4,9**	**153**	**1 814**	**1 540**	**295**	**7 605**	**558**	**163 962**	**31 487**	**71 975**	**0,0**	**0,0**
	upp avg.	**92 457**	**0,21**	**0,02**	**52,3**	**22**	**0,95**	**2,6**	**4,9**	**153**	**1 815**	**1 540**	**296**	**7 605**	**558**	**163 962**	**31 487**	**71 975**	**10,8**	**0,57**

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