Baltic Sea Environment Proceedings No. 93

The Fourth Baltic Sea Pollution Load Compilation (PLC-4)

Helsinki Commission

Baltic Marine Environment Protection Commission

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Content

Preface

To achieve the objectives of the Convention, the Helsinki Commission needs reliable data on inputs into the Baltic Sea from land-based sources, as well as information about the significance of different pollution sources. This information is required to assess the effectiveness of measures taken to reduce pollution in the Baltic Sea catchment area and to support the development of HELCOM's environmental policy. It is also required to interpret and evaluate the environmental status and related changes in the open sea and coastal waters.

To satisfy these needs, the Baltic Seawide water-borne Pollution Load Compilations (PLCs) were carried out in 1987 (PLC-1), 1990 (PLC-2) and 1995 (PLC-3). The Commission decided at HELCOM 19 in 1998 to perform PLC-4 including monitoring of water-borne pollution loads from 1 January 2000 to 31 December 2000, and covering both point and non-point pollution sources throughout those parts of the Baltic Sea catchment area located within the borders of HELCOM's Contracting Parties.

The Fourth Pollution Load Compilation (PLC-4) represented a particularly significant step forward by quantifying discharges and losses from both point and non-point sources within the Contracting Parties' catchment area of the Baltic Sea. With the adoption of the Guidelines for the Fourth Pollution Load Compilation (PLC-4) by HELCOM 20 in 1999 two different approaches were employed to quantify all pollution inputs into the Baltic Sea:

1. **Source-orientated approach:** This approach was used for the first time to quantify the discharges from point sources and losses from diffuse sources into inland surface waters within the Baltic Sea catchment area.
2. **Load-orientated approach:** In accordance with earlier PLCs, this approach was used to quantify total loads of nutrients, organic matter and heavy metals from rivers, unmonitored coastal areas and point sources discharging directly into the Baltic Sea.

In this report a short description of the Baltic Sea catchment area, the quantification and analysis methods and of the quality assurance work is given in Chapters 1 to 4. In Chapter 5 discharges and losses from point and diffuse sources into inland surface waters within the Baltic Sea catchment area (Source-orientated approach) as well as the total load to the maritime area (Load-orientated approach) in 2000 are presented. Chapter 6 provides a comparison between the former pollution load compilations between 1994 and 2000.

The PLC-4 results clearly indicate that losses from diffuse sources in 2000 are still the main source of the excessive inputs of both nitrogen and phosphorus entering the Baltic Sea. The large catchment areas with the major rivers such as the Neva, Vistula, Oder, Nemunas and Daugava, are the main sources of nutrient inputs into the Baltic Sea. The area-specific load of nitrogen into the Baltic Sea can be high in sub-regions with small catchment areas, where there is intensive agricultural activity and high population density, such as the south-western part of the Baltic Sea catchment area. Correspondingly high area-specific phosphorus losses were found in catchment areas with high population density, many industries and heavy agricultural activity. To assess the effectiveness of reduction measures, and to evaluate whether reduction targets taken at source (e.g. 50% reduction target) are met, losses from diffuse sources should be quantified in an more accurate and comparable manner for the different catchment areas. Although riverine run-off, nitrogen and phosphorus loads have been compiled by the Baltic Sea sub-regions and by Contracting Parties annually since 1994, it is difficult to form a clear picture of the total inputs of nutrient into the Baltic Sea and their development over time and this should be improved.

In accordance with the decisions of the Helsinki Commission, the Fourth Baltic Sea Pollution Load Compilation (PLC-4) has been carried out as a project. Ms. Heike Herata, Federal Environmental Agency, Germany, acted as Project Manager. We wish to extend sincere thanks to the representatives of all the Contracting Parties who have contributed as members of the Project Team to the success of the work not only during the expert meetings but also in the presentation of national data, the checking of results and the preparation of the report: Ms. Jytte Erfurt and Mr. Lars M. Svendsen, National Environmental Research

Institute, Denmark, who has also acted as vice Project Manager and has provided valuable contribution to having the report finalized; Mr. Enn Loigu and Ms. Ulle Leisk, Ms. Maila Hannus and Ms. Irina Blinova, Tallinn Technical University, Estonia; Mr. Antti Räike, Mr. Heikki Pitkänen and Mr. Heikki Peltonen, Finnish Environment Institute (SYKE), Finland; Mr. Horst Behrendt, Institute of Freshwater Ecology and Inland Fisheries and Ms. Gerda Rünger, Schleswig-Holstein State Agency for Nature and Environment, Germany; Ms. Elga Apsite, Ms. Maruta Vaivada and Ms. Gunda Kleinberga, Latvian Environment Agency, Latvia; Ms. Gaudenta Sakalauskiene and Ms. Aurelija Ceponiene, Environment Protection Agency, Lithuania; Mr. Waldemar Jarosinski, Meteorological Institute, and Mr. Krzysztof Kurczynski, National Fund for Water Management, Poland; Ms. Larisa Makarova, Public Association "Ecology & Business", Russia; Mr. Anders Widell, Ms. Lena Lindevall, Ms. Annmari Blom and Ms. Marta Misterewicz, Swedish Environmental Protection Agency, Sweden. In the project invaluable support has been provided by our Consultant for Quality Assurance, the author of Chapter 4, Ms. Irma Mäkinen, Finnish Environment Institute (SYKE).

Special thanks go to our Consultant for Data Management Mr. Pekka Kotilainen, Finnish Environment Institute (SYKE), without whom the report would not have been possible to finalise.

The PLC-4 work was possible only with the close co-operation of all the Contracting Parties: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden, who carried out the measurements both in the rivers as well as at diffuse and point sources and reported the information to the data consultants.

We also wish to express our appreciation to the Finnish Environment Institute (SYKE) for its financial support in hosting a series of expert meetings for the PLC-4 project.

Finally, our special thanks go to the HELCOM Secretariat for its efficient technical and financial assistance throughout the project. In particular, we wish to thank Ms. Satu Tofferi-Bishai, Mr. Juha-Markku Leppänen and Mr. Kaj Forsius.

Project Manager
Heike Herata

List of Abbreviations

AAS	Atomic absorption spectroscopy (flame or graphite furnace technique)
AOX	Absorbable organic halogens
ARC	Archipelago Sea
b	Biological
BAP	The Baltic Proper
BOB	Bothnian Bay
BOD $(_{5,7})$	Biological oxygen demand within 5, 7 days (BOD_5, BOD_7); measured for the amount of oxygen which is used by micro-organisms in wastewater within 5, 7 days at a temperature of 20 °C
BOS	Bothnian Sea
BSEP	Baltic Sea Environment Proceedings
BY	Belarus
c	Chemical
CEN	European Committee for Standardisation
Cd	Cadmium
COD_{Mn}	Chemical oxygen demand; oxidation with permanganate
COD_{Cr}	Chemical oxygen demand; oxidation with dichromate
CP	Contracting Party
Cr	Chromium
Cu	Copper
CZ	Czech Republic
d	Denitrification
DE	Federal Republic of Germany
DK	Denmark
DIN	Deutsche Industrie Norm (German Industrial Norm)
EC	Environment Committee of the Helsinki Commission
EE	Estonia
EN	European Norm
EU-PHARE	European Union - Poland and Hungary Assistance for Reconstruction of the Economy
EU-EQUATE	European Union - Copernicus Programme “Equal Quality of Water - related Analyses Throughout Europe”
f	Filtration
FEI	Finnish Environment Institute
FI	Finland
GUF	Gulf of Finland
GUR	Gulf of Riga
HELCOM	Helsinki Commission
Hg	Mercury
ICP/AES	Inductively Coupled Plasma/Atomic Emission Spectroscopy
ICP/MS	Inductively Coupled Plasma/Mass Spectroscopy
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
IR	Infrared spectroscopy
KAT	The Kattegat
L	Load
LT	Lithuania
LV	Latvia
m	mechanical
MWWTP(s)	Municipal wastewater treatment plant(s)
n	Nitrification
NCPs	Non-Contracting Parties

NERI	Danish National Environmental Research Institute
Ni	Nickel
N_{Kjel}	Total Nitrogen measured as Kjeldal nitrogen (the content of organic and ammonium nitrogen)
NO	Norway
N_{NH4}	Ammonium nitrogen
N_{NO2}	Nitrite nitrogen
N_{NO3}	Nitrate nitrogen
NRL(s)	National reference laboratory(s)
N_{total}	Total nitrogen
Pb	Lead
PE	Population Equivalent (amount of wastewater per capita)
PL	Poland
PLC(s)	Baltic Sea Pollution Load Compilation(s)
PLC-1 (2,3)	First (Second, Third) Baltic Sea Pollution Load Compilation
P_{PO4}	Orthophosphate phosphorus
P_{total}	Total phosphorus
Q	Flow, runoff
RU	Russia
SE	Sweden
SLO	Republic of Slovakia
SOU	The Sound
SS	Suspended Solids
STC	Scientific Technological Committee
TC	Technological Committee of the Helsinki Commission
TC INPUT	Technological Committee: Working Group on Inputs to the Environment
TC POLO	Technological Committee: ad hoc Expert Group on Pollution Load to the Baltic Sea
TOC	Total Organic Carbon
UA	Ukraine
WEB	Western Baltic
WMO	World Meteorological Organisation
Zn	Zinc

1 Introduction

1.1 Objectives of the Pollution Load Compilations (PLCs)

According to Paragraph 1 of Article 6 of the Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 (the Helsinki Convention), the Contracting Parties undertake to prevent and reduce pollution of the marine environment of the Baltic Sea Area from land-based sources by using, inter alia, Best Environmental Practice for diffuse sources and Best Available Technology for point sources. The relevant measures to this end shall be taken by each Contracting Party in the catchment area of the Baltic Sea without prejudice to its sovereignty. According to Paragraph 2 of Article 6 of the Helsinki Convention in 1992 the Contracting Parties undertake to co-operate in the development and adoption of specific programmes concerning emissions and discharges of harmful substances into water.

In implementing the objectives of the Convention, the Helsinki Commission needs reliable data on inputs to the Baltic Sea from land-based sources in order to develop its environmental policy and to assess the effectiveness of measures taken to abate the pollution in the Baltic Sea catchment area. Such data is also required for evaluation of the state of the open sea and coastal waters.

The objectives of periodic pollution load compilations (PLCs) regarding pollution of the Baltic Sea from land-based sources are:

1. to compile information on the water-borne inputs of important pollutants entering the Baltic Sea from different sources in its catchment area, on the basis of harmonised monitoring methods;
2. to follow up long-term changes in pollution loads from various sources;
3. to determine the relative significance of different sources of pollutants;
4. to assess the effectiveness of measures taken to reduce pollution loads in the Baltic Sea catchment area; and
5. to provide information for the assessment of long-term changes and the state of the marine environment in the open sea and the coastal zones.

The tasks involved in PLC have been carried out in stages.

1.2 The four stages of the Pollution Load Compilations (PLCs)

The First Pollution Load Compilation (PLC-1)

The results of PLC-1 were published in the Baltic Sea Environment Proceedings, BSEP No. 20, in 1987. This was the first attempt to compile the various types of data previously submitted to the Commission. Because this information came from various sources, there were differences in the reliability and age of the data, as well as gaps in data sets. Values were often preliminary or based on very rough background information, so it was recommended that the results of PLC-1 should be carefully used with regard to these shortcomings.

The Second Pollution Load Compilation (PLC-2)

PLC-2 was implemented as a pilot programme for the survey year 1990, aiming to give basic coverage to all the major aspects of pollution. In order to improve the quality of this compilation, during the period 1988-1989 the former Scientific-Technological Committee (STC) developed a special set of Guidelines for PLC-2, which were adopted by the Commission in HELCOM Recommendation 10/4 (1989). These PLC-2 Guidelines defined the aims of the PLC and provided a harmonised methodological basis for the collection and evaluation of data on a national level (for example for the survey year 1990), for the evaluation of pollution source categories for parameter controls. It also provided a unified methodology for measurements, calculations and reporting.

The results of PLC-2 were published in the Baltic Sea Environment Proceedings, BSEP No. 45, in 1993. This report contained general data characterising major pollution sources and loads for nine sub-basins of the Baltic Sea, and for the Baltic Sea as a whole. Although the results of PLC-2 were not totally accurate, this second stage of the Project definitely represented a step forward, as it provided much more reliable data on total loads in the Baltic Sea than the first compilation had. Moreover, due to political changes in the Baltic Sea Region it became possible to improve reporting during the course of the project, and to collect more detailed data than had originally been intended.

The Third Pollution Load Compilation (PLC-3)

PLC-3 was carried out within the former ad hoc Expert Group on Pollution Loads to the Baltic

Sea (TC POLO). The Guidelines for PLC-3 were prepared by the lead countries - Estonia and Germany - with the assistance of experts from all the Contracting Parties, and were based on the recommendations of the Seminar on the Monitoring of Pollution Loads in 1993 in Gdansk, and an informal expert meeting on PLC-3 (1993, Tallinn). These Guidelines were adopted by the Commission in HELCOM Recommendation 15/2 in 1994, and published in the Baltic Sea Environmental Proceedings, BSEP No. 57, in 1994.

During the third stage of PLC the major remaining uncertainties and weaknesses of PLC-2 could be avoided by establishing a quality assurance system, and by creating a data-entry system closely connected to a database. The Finnish Environment Institute (SYKE), hired by HELCOM, took the lead on both these issues. The results of inter-laboratory comparison tests were discussed during a workshop in Helsinki in 1994, with the aim of ensuring that national laboratories could maintain a continuously high level of quality in their routine operations. The final version of the data-entry system was made available to all Contracting Parties in 1995, and was used for submission of all data compiled on a national level after the measuring period 1995.

Since much of the overall pollution load is introduced into the Baltic Sea via rivers, another important step forward was to distinguish between natural and anthropogenic contributions to riverine fluxes (by source apportionment). After a comparison of three different methods from Finland, Denmark and Germany, a guide was developed at an informal expert meeting held in 1995 in Silkeborg, Denmark. The results of PLC-3 were published in the Baltic Sea Environment Proceedings, BSEP No. 70, in 1998.

The Fourth Pollution Load Compilation (PLC-4)

The Commission decided at HELCOM 19 in 1998 to carry out PLC-4 in 2000 and made the following recommendations to the Governments of the Contracting Parties to the Helsinki Commission:

a) the monitoring of waterborne pollution loads should be performed from 1 January 2000 to 31 December 2000, and cover point and non-point pollution sources within the catchment area of the Baltic Sea located within the borders of the Contracting Parties in accordance with the Guidelines for the Fourth Pollution Load Compilation (PLC-4) adopted by HELCOM 20/1999.

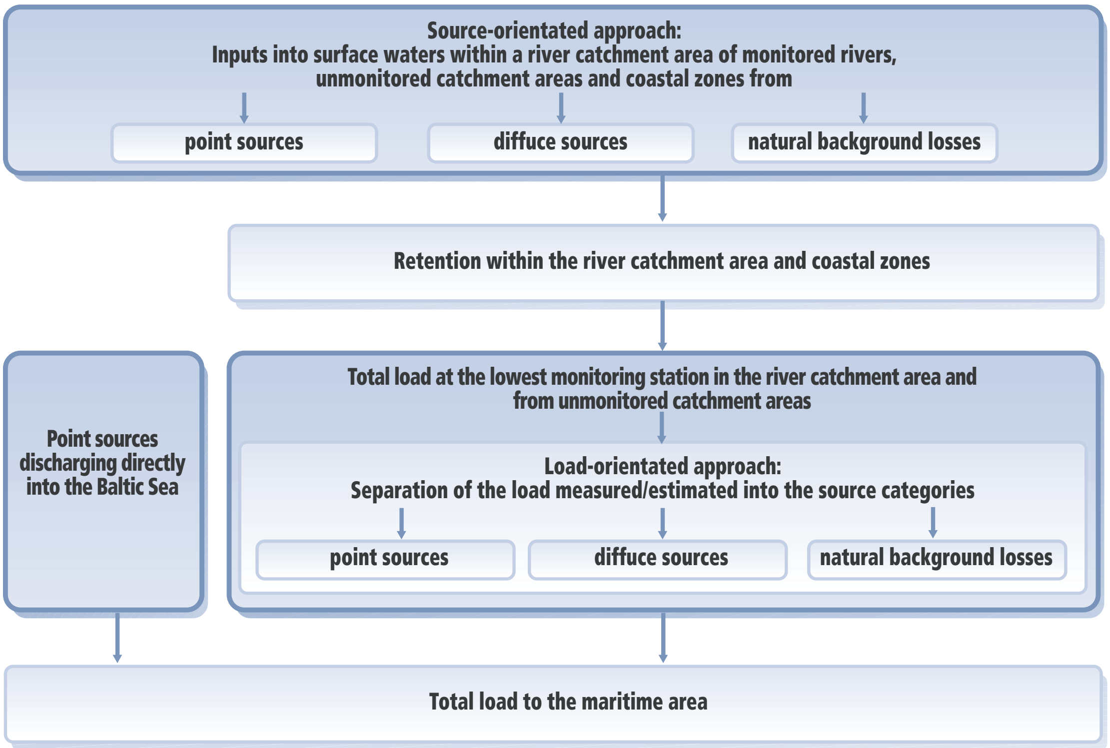
b) data on pollution loads collected in the year 2000 should be submitted by all the Contracting Parties to the Data manager in accordance with the agreed format as early as possible, but not later than 31 December 2001.

With reference to the decisions made by HELCOM 19/1998, PLC-4 represents another step forward in terms of quality, as it includes quantification of point and non-point pollution sources in the catchment area of the Baltic Sea located within the borders of the Contracting Parties.

The Guidelines for PLC-4 were prepared under the supervision of the Chairman of the former TC INPUT Working Group, in close co-operation with experts from all the Contracting Parties. These Guidelines take into account the development that point and non-point pollution sources in the Baltic Sea catchment area could now be determined, but that diffuse sources would be assessed with different methodology by the Contracting Parties. Ongoing work within the OSPAR framework concerning the „Harmonised Reporting Systems and Procedures for Nutrients“ (HARP) was also considered and partly included in the PLC-4 guidelines. The PLC-4 Guidelines are also largely based on the PLC-3 Guidelines, and reflect the experience gained during PLC-3 (e.g. from the two PLC-3 Workshops in Helsinki in 1996 and 1997). The topic of Quality Assurance is mainly based on the Guidelines prepared by the ICES/HELCOM Steering Group on Quality Assurance of Chemical Measurements in the Baltic Sea (ICES CM 1997/E:2).

1.3 Classification of the inputs considered in PLC-4

PLC-4 deals with the point and non-point pollution sources in the catchment area of the Baltic Sea located within the borders of the Contracting Parties. The main pollution sources are as follows:



For large rivers (runoff >100 m³/s), figures for source apportionment should be given separately for the monitored part and the unmonitored part of the river catchment area.

1.4 Parameters reported in PLC-4

Reported parameters are classified as obligatory or voluntary according to their nature, and by taking into account detection limits for the substances concerned in different water flows (Table 1.1).

Parameters*	point sources			diffuse	natural	rivers*
	Municipal Effluents*	Industrial Effluents*	Fish farm-ing*	sources	background load	and coastal areas
BOD_7[5]	+	+[3]	v			+[1]
COD_{Cr}		v[4]				
TOC	v	v[4]				v
AOX	v	+[3]				v
P_{total}	+	+	+	+	+	+
PO_4-P	+	v[3]				+
N_{total}	+	+	+	+	+	+
NH_4-N	+	v[3]				+
NO_2-N	v	v[3]				+
NO_3-N	+	v[3]				+
Hg	+[2]	+[3]				+[1]
Cd	+[2]	+[3]				+[1]
Zn	+[2]	+[3]				+[1]
Cu	+[2]	+[3]				+[1]
Pb	+[2]	+[3]				+[1]
Ni	+[2]	+[3]				v[1]
Cr	+[2]	+[3]				v[1]
Oil[6]		+[6]				+[6]

Table 1.1:
Parameters reported in PLC-4.

Footnotes:

+ obligatory
v voluntary
1 except for rivers where BOD_7 and heavy metal concentrations are below detection limits
2 heavy metals are obligatory for urban areas larger than 10,000 PE
3 BOD_7, AOX, nutrients and heavy metals are obligatory variables for relevant industries if these variables are regulated by sector-wise HELCOM Recommendations
4 only for untreated municipal or industrial effluents
5 If BOD_5 is measured, a conversion factor should be used in order to calculate BOD_7.
6 Oil measurements should be carried out in the following rivers: Neva, Vistula, Nemunas, Daugava, Oder, Narva, Göta älv, Kymijoki and at the largest oil refinery in each Contracting Party using ISO 9377-4.
* In those cases where the recorded results are below detection limits, load estimates should be supplied, with the assumption that real concentrations amount to half detection limits.

Sub-basins	Abbreviation	sub-basins used in PLC-4
1. GULF of BOTHNIA	**GUB**	**X**
1.1 Bothnian Bay	BOB	X
1.2 Bothnian Sea	BOS	X
1.3 Archipelago Sea	ARC	X
2. GULF of FINLAND	**GUF**	**X**
3. GULF of RIGA	**GUR**	**X**
4. BALTIC PROPER	**BAP**	**X**
4.1 Northern Baltic Proper	BPN	
4.2 Southern Baltic Proper	BPS	
5. BELT SEA	**BSK**	**X**
5.1 Belt Sea	BES	
5.1.1 Western Baltic and Belts	WEB	X
5.1.2 The Sound	SOU	X
5.2 The Kattegat	KAT	X

Table 1.2:
Sub-basins of the Baltic Sea.

1.5 Division of the Baltic Sea catchment area

An overview of the entire catchment area and the sub-basins is presented in Figure 1.1. To take into account the harmonisation within HELCOM regarding the Baltic Sea sub-basins, and to make this report comparable with the PLC-2 and PLC-3 reports, five main sub-basins were defined, each with their own sub-divisions (Table 1.2). To improve comparisons, load figures were presented separately for each sub-basin and for each Contracting Party.

Figure 1.1:
The Baltic Sea catchment area and sub-basins as defined for PLC-4.

2 Description of the Baltic Sea catchment area

The total Baltic Sea catchment area comprises 1720270 km², of which nearly 93% belongs to the Contracting Parties and 7% lies within the territories of Non-Contracting Parties. The division of each of the sub-basins of the catchment area between Contracting Parties and Non-Contracting Parties is presented in Table 2.1. This table was compiled on the basis of information presented by the Contracting Parties (CPs) and compared with previously published information (BSEP No. 45 and No. 70, Chapter 2).

The sub-basin catchment areas of the Baltic Proper and the Gulf of Finland are the largest, at 575000 km² and 410000 km², respectively. The Archipelago Sea and the Sound have the smallest catchment areas. Sweden possesses the largest portion of the Baltic Sea catchment area, 440000 km². The next largest national catchment areas are those of Poland, Russia and Finland, all of which are larger than 300000 km². Germany has the smallest proportion of the catchment area of all the Contracting Parties, with 28600 km². The total catchment area outside the borders of the Contracting Parties is 117520 km².

The total long-term mean flow rate via all rivers entering the Baltic Sea is 15190 m³/s (479 km³/a), of which nearly half drains into the Baltic Sea, via the seven largest rivers, namely the Neva, the Vistula, the Daugava, the Nemunas, the Kemijoki, the Oder and the Göta älv. The long-term mean flow rates of these rivers and the divisions of the river catchment areas among the different countries are presented in Table 2.2.

Much of the pollution load is introduced into the Baltic Sea via rivers. Airborne loads are a very important source of nitrogen, however, with a significant part of this load originating from areas outside the Baltic Sea catchment area. Since these river catchment areas often include the territory of more than one country, the pollution loads discharged by several of the Contracting Parties also include loads originating in other countries (both Contracting and Non-Contracting Parties) upstream or on the other side of border rivers. The pollution loads in rivers originating from Non-Contracting Parties are comparatively small, with the exception of the River Nemunas where only

Table 2.1: Division of the Baltic Sea catchment area between Contracting Parties and Non-Contracting Parties for each sub-basin in km².

Sub-basins/	Gulf of Bothnia			Gulf of Finland	Gulf of Riga	Baltic Proper	Belt Sea and Kattegat			Total
country	Bothnian Bay	Bothnian Sea	Archipe-lago Sea				Western Baltic	The Sound	The Kattegat	
Contracting Parties										
Finland	146000	39300	9000	107000	-	-	-	-	-	301300
Russia	-	-	-	276100	23700	15000	-	-	-	314800
Estonia	-	-	-	26400	17600	1100	-	-	-	45100
Latvia	-	-	-	3600	49600	11400	-	-	-	64600
Lithuania	-	-	-		11 140	54160	-	-	-	65300
Poland	-	-	-	-	-	311900	-	-	-	311900
Germany	-	-	-	-	-	18200	10400	-	-	28600
Denmark	-	-	-	-	-	1200	12340	1740	15830	31110
Sweden	113620	176610	-	-	-	83225	-	2885	63700	440040
Total	**259620**	**215910**	**9000**	**413100**	**102040**	**496185**	**22740**	**4625**	**79530**	**1602750**
Non-Contracting Parties										
Belarus					25800	58050				83850
Ukraine						11170				11170
Czech						7190				7190
Slovakia						1950				1950
Norway	1055	4855							7450	13360
Total Baltic Sea catchment areas including Contracting Parties and Non-Contracting Parties										
Total	**260675**	**220765**	**9000**	**413100**	**127840**	**574545**	**22740**	**4625**	**86980**	**1720270**

Rivers / States	Neva	Vistula	Nemunas	Daugava	Oder	Göta älv	Kemijoki	Total
Long-term mean flows and measurement periods for the seven largest rivers entering the Baltic Sea								
in m³/s	2488	1081	664	637	574	572	553	**6569**
period	1859-1988	1951-1990	1811-1995	1881-1914; 1924-2000	1951-1990	1961-1990	1961-1990	-
Length of the seven largest rivers								
in km	74[1]	1047	937	1020	854	90[2]	600	-
Catchment areas in Contracting Parties in km²								
Finland	56200						49470	**105670**
Russia	215600		3170	27000			1660	**244130**
Estonia				2360				
Latvia			90	23700				**23840**
Lithuania			46700	1860				**48560**
Poland		168700	2510		106060			**277270**
Germany					5590			**5590**
Denmark								
Sweden						42780		**42780**
Catchment area in Non-Contracting Parties in km²								
Belarus		12600	45450	33300				**83850**
Ukraine		11170						**11170**
Czech					7190			**7190**
Slovakia		1950						**1950**
Norway						7450		**7450**
Total catchment areas of rivers, including Contracting and Non-Contracting Parties								
Total	**271800**	**194420[3]**	**97920**	**88220**	**118840**	**50230**	**51130**	**859450**

Table 2.2
Division of river catchment area among Contracting and Non-Contracting Parties for the seven largest rivers flowing into the Baltic Sea.

[1] length of the Neva to Lake Ladoga
[2] length of the Göta älv to Lake Vänem
[3] without delta

48% of the pollution load originates in Lithuania. A first attempt was made:

- to distinguish between pollution load sources from different countries, and
- to estimate natural and anthropogenic contributions to riverine fluxes (both point source loads and diffuse source loads) for all larger and many smaller rivers within the Contracting Parties.

To get a better understanding of the loads originating in different sub-basins, general information is included here about population densities (Map 2.1) and land uses (Table 2.3 and Map 2.2) in the Baltic Sea catchment area for the year 2000. Large parts (60-70%) of the German, Danish and Polish sections of the catchment area consists of agricultural land (Table 2.3 and Map 2.3). The percentage of agricultural land in Estonia, Latvia and Lithuania is 30-50%, while only about 10% of the catchment areas in Sweden, Finland and Russia is agricultural land, mainly in the southern parts of Sweden and Finland. Forests, peatlands and inland waters constitute 65-90% of the catchment areas in Finland, Russia, Sweden and Estonia. In Poland, Lithuania and Latvia these features account for 30-50% of the catchment area, whereas in Denmark and Germany they cover only 19-25%.

More detailed descriptions of the nine sub-basins of the Baltic Sea are given below in geographical order.

Countries / **Land use**	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden
Urban areas	14	3	2	4	2	5	6	2	3
Forests (incl. mountains)	16	44	51	15	44	31	29	55	70
Farmland (incl. grasslands)	66	30	7	72	39	54	60	12	6
Inland waters (lakes)	1	5	10	4	1	4	3	17	8
Wetlands and peatlands	1	17	27	-	5	2	-	13	12
Other	2	1	3	5	9	4	2	1	1

Table 2.3
Percentages of the Baltic Sea catchment area under various land uses by country (1995).

2.1 Gulf of Bothnia

The Gulf of Bothnia consists of the Bothnian Bay, Bothnian Sea and Archipelago Sea, with a total catchment area of 490440 km² of which 40% (194300 km²) belongs to Finland, 59% (290230 km²) belongs to Sweden and less than 1% (5910 km²) to Norway.

2.1.1 Bothnian Bay

The Bothnian Bay catchment area comprises 260675 km² of which 56% (146000 km²) belongs to Finland, 44% (113620 km²) to Sweden and less than 1% (1055 km²) to Norway. The main rivers are the Swedish Lule älv and the Finnish Kemijoki, the latter being the seventh largest river entering the Baltic Sea.

Sweden

About 26% of the total Swedish catchment area belongs to the Bothnian Bay catchment area. This northern region of Sweden is very sparsely inhabited, with a population density of 3 inhabitants per km² (390000 inhabitants, 0.2% consisting of urban areas). It is also heavily forested, with only small areas farmed (43% forested; 0.8% agricultural land). There are also plenty of peat lands (17%) and lakes (5.9%). Other natural areas, including mountains, cover 33%. The length of the coastline, excluding islands, is 370 km.

The catchment area contains a large number of rivers. The main river is the Lule älv, with a long-term mean flow rate of 489 m³/s (1961-1990). Four rivers in this region have long-term mean flow rates exceeding 100 m³/s, including the Torne and Kalix älven. 86% of this Swedish sub-basin catchment area is monitored hydrologically and hydrochemically.

Finland

About 47% of the total Finnish catchment area consists of the catchment area of the Bothnian Bay. This sub-basin is sparsely populated with only 982570 inhabitants at an average population density of approximately 7 inhabitants per km². The land is dominated by forests (61%), peat lands (29%) and lakes (5.1%) with farmland accounting for 4.6%, mainly in the south. Urban areas cover 0.3% of the land. The length of the Finnish Bothnian Bay coastline, including islands, is 4400 km.

The catchment area also contains a large number of lakes and rivers. The total river flow from this catchment area into the Baltic Sea expressed as long-term mean flow rates is 1 794 m³/s. The main river, the Kemijoki, has a long-term mean flow rate of 553 m³/s (1960-1995). Three other rivers have flow rates exceeding 100 m³/s, and ten rivers have long-term mean flow rates between 5 and 100 m³/s. Some 92% of this Finnish sub-basin catchment area is monitored hydrologically and hydrochemically.

2.1.2 Bothnian Sea

The Bothnian Sea catchment area comprises 220765 km², of which 18% (39300 km²) belongs to Finland, 80% (176610 km²) to Sweden and 2% (4855 km²) to Norway. The main rivers in this Bothnian Sea catchment area are the Ångermanälven and Indalsälven in Sweden and the Kokemäenjoki in Finland.

Sweden

About 40% of the total Swedish catchment area belongs to the catchment area of the Bothnian Sea. This part of northern Sweden is sparsely inhabited with a population density of 6 inhabitants per km². It is also heavily forested, with small agricultural areas. There are 1123 million inhabitants; only 0.6% of the area is urbanised; 53% is forested; and 1.9% consists of farmland. Peat lands are also widespread (15%) and lakes account for 6.4% of the area, and other natural areas, including mountains, cover 23%. The length of the coastline, excluding islands, is 590 km.

The catchment area contains a large number of rivers. The main river is the Ångermanälven, with a long-term mean flow rate of 494 m³/s (1961-1990). There are also two other rivers with long-term mean flow rates exceeding 400 m³/s in this sub-basin, one of which is the Ulme älv. Eight more rivers in this catchment area have long-term mean flow rates above 5 m³/s. Around 87% of this Swedish sub-basin catchment area is monitored hydrologically and hydrochemically.

Finland

About 14% of the total Finnish catchment area belongs to the catchment area of the Bothnian Sea. This area has a population of 929260, with a population density of 24 inhabitants per km². The land is dominated by forests (66.4%), peat lands (9.1%) and lakes (8.1%). Agriculture (15.2%) is concentrated along the coast. Urban areas cover 1.2% of the land. The length of the Finnish Bothnian Sea coastline, including islands, is 6600 km.

The catchment area contains a large number of lakes and rivers. The total river flow from this catchment area into the Baltic Sea expressed as a long-term mean flow rate is 377 m³/s. The flow rate of one river exceeds 100 m³/s, whereas three rivers have long-term mean flow rates between 5 and 100 m³/s. Some 85% of this Finnish sub-basin catchment area is monitored hydrologically and hydrochemically.

2.1.3 Archipelago Sea

The catchment area of the Archipelago Sea comprises 9000 km² all within Finnish territory. The main river in this sub-basin catchment area is the Aurajoki.

Finland

About 3% of the total Finnish catchment area belongs to the catchment area of the Archipelago Sea. The population of this area is 458710, with a population density of 51 inhabitants per km². The land is dominated by forests (61%), agricultural land (30%), peat lands (4.3%) and lakes (3.1%). Urban areas cover 1.7% of the land. The length of the Archipelago Sea coastline, including islands, is 20100 km.

In all coastal rivers, the water flow is limited. These rivers also vary greatly in flow and water quality. The total river flow from this catchment area into the Baltic Sea expressed as long-term mean flow rate is 83 m³/s. None of the rivers have a flow rate exceeding 10 m³/s, and only four rivers have long-term mean flow rates of between 5 and 10 m³/s. Some 40% of this Finnish sub-basin catchment area is monitored hydrologically and hydrochemically.

2.2 Gulf of Finland

The catchment area of the Gulf of Finland comprises 413100 km² of which 107000 km² (26%) belongs to Finland, 276100 km² (67%) to Russia, 26400 km² (7%) to Estonia and less than 0.1% (3600 km²) to Latvia. The largest river flowing into the Baltic Sea, the Neva, is part of the Gulf of Finland catchment area, and drains from Russian territory directly into the Gulf of Finland.

A large proportion of the pollution load originating in this sub-basin is introduced into the Baltic Sea in two large rivers, the Neva and the Narva. Because the catchment areas of both rivers belong to more than one country, the measured loads also include loads originating from countries upstream or on the other side of border rivers.

In the case of the Neva, only 51300 km² of its catchment area is within Finnish territory. Water from this area flows into Lake Ladoga and then via the River Neva into the Gulf of Finland. The vast majority of the catchment area (215600 km), including the river estuary, is situated in Russia. Some 39000 km² (69%) of the catchment area of the Narva lies within Russia, and the remaining 17200 km² (31%) belongs to Estonia, including the mouth of the river.

Finland

About 36% of the total Finnish catchment area belongs to the catchment area of the Gulf of Finland. This area has a population of 2536330, at an average population density of 24 inhabitants per km². The land is dominated by forests (64%), peat lands (10%) and lakes (17%). Agricultural land (8%) is mainly near the coast. Urban areas cover 1% of the land. The length of the Finnish part of the Gulf of Finland’s coastline, including islands, is 8000 km.
The catchment area is rich in lakes, which make up almost 20% of the total catchment area. The total long-term mean flow rate from this catchment area into the Baltic Sea is 460 m³/s, including one river with a flow rate exceeding 100 m³/s, five rivers with long-term mean flow rates of between 5 and 100 m³/s and approximately ten rivers with flow rates of less than 5 m³/s. Some 89% of this Finnish sub-basin catchment area is monitored hydrologically and hydrochemically.

Russia

About 1.6% of the total Russian catchment area belongs to the catchment area of the Gulf of Finland. This area includes practically all the territory of the Saint Petersburg District, the eastern part of the Pskov District, almost all of the Novgorod District, the north-western parts of the Tver and the Vologda Districts, the western part of the Archangelsk District and the southern part of Karelia. Around 80% (215600 km²) of this total area is drained by the Neva. The total population in the Russian catchment area is 8 million, meaning a population density of 30 inhabitants per km². Some 80% of these inhabitants live in the Saint Petersburg District. The catchment area is low-lying and contains large areas of peat land. The length of the coastline, including islands, is 1700 km.

The main rivers flow through the lakes Ladoga, Ilmen and Chudskoe (Lake Pepsi in Estonia). The retention time in Lake Ladoga is 4.5 years, in

Lake Ilmen 1.5 years, and in Lake Chudskoe 2.5 years. This means that significant quantities of pollutants accumulate in these lakes. The Neva, which enters the Baltic Sea directly from Russian territory, has a long-term mean flow rate of 2488 m^3/s (1859-1988). Its catchment area includes urban areas (2%), forests (55%), farmland (12%), peat lands (13%), lakes (17%) and other types of land (1%). About 70% of this Russian sub-basin catchment area is monitored hydrologically and hydrochemically. An additional 10% is only monitored hydrologically.

Estonia
About 60% of Estonian territory belongs to the catchment area of the Gulf of Finland. This part of the catchment area has a population of 1265 million, with a population density of 48 inhabitants per km^2. On average, 30% of the catchment area consists of farmland (around 34% of which is not actively in use), 39% is covered by forests and 20% by peat lands. The northern section of this area belongs mainly to the Karst region. Southern Estonia mainly lies within the catchment area of Lake Pepsi (Lake Chudskoe in Russia), which discharges via the Narva into the Gulf of Finland. The sub-soils of Southern Estonia consist of sandstone from the Devonian Era. Landscapes consist of low hills, lakes and bogs.

The length of the Estonian part of the Gulf of Finland's coastline, without islands, is 600 km. The Narva, with a long-term mean flow rate of 399 m^3/s (1956-1993) is the principal river. About 81% of the catchment area is monitored hydrologically, and 85% hydrochemically.

Latvia
Over 5% of Latvian territory belongs to the catchment area of the Gulf of Finland. Population density in the Latvian catchment area of the Gulf of Finland is around 14 inhabitants per km^2. On average, 0.6% of the catchment area consists of urban areas, 45% is covered by forests and pea tlands, about 50% is agricultural land and 2% consists of lakes (CORINE Landcover, 1997). The land is flat and low-lying. This part of the catchment area is not monitored hydrologically or hydrochemically.

2.3 Gulf of Riga

The catchment area of the Gulf of Riga comprises 127840 km^2, of which 18% (23700 km^2) belongs to Russia, 14% (17600 km^2) to Estonia, 39% (49600 km^2) to Latvia, 9% (11140 km^2) to Lithuania and 20% (25800) km^2 to Belarus. The main river in the Gulf of Riga catchment area is the Daugava, the fourth largest river entering the Baltic Sea. The mouth of the Daugava is in Latvia.

In this sub-basin similar difficulties are encountered as in the Gulf of Finland, concerning distinguishing the sources of riverine pollution loads originating from different countries. More than half of the area drained by the Latvian rivers (77000 km^2) is situated within the territories of Russia, Belarus, Lithuania and Estonia. Latvia's rivers thus serve to transport large amounts of river water, and consequently pollution, originating from other countries into the Baltic Sea. The prime example of this is the Daugava. Although the whole Russian sub-basin catchment area discharges into the Daugava, the river outlet is located in Latvia.

Estonia
About 37% of Estonian territory belongs to the catchment area of the Gulf of Riga. This area has a population of 295000, with a population density of 17 inhabitants per km^2. About 20% of the catchment area is covered by farmland, 44% by forests and 26% by peat lands. The land is low-lying, with bogs and marshes.

The length of the Estonian part of the Gulf of Riga coastline, excluding islands, is 640 km. The main rivers are the Kasari and the Pärnu. The long-term mean flow rate of the Kasari is 29.9 m^3/s (1924-1994), and that of the Pärnu is 64.4 m^3/s (1921-1993). About 48% of the catchment area is monitored hydrologically and 56% hydrochemically. A small area of Southern Estonia drains into the Latvian River Gauja and into the Gulf of Riga.

Latvia
About 77% of Latvian territory belongs to the catchment area of the Gulf of Riga. Approximately 86% of the total population of Latvia lives in this sub-basin, which includes Latvia's two largest cities: Riga (788283 inhabitants) and Daugavpils (114510 inhabitants). This area consists of urban areas (1.3 %), forest (50%), agricultural land (43%) and lakes (about 2%). The length of the Latvian segment of the Gulf of Riga coastline is 315 kilometres.

The land is flat and low-lying. About 85% of the Latvian catchment area of the Gulf of Riga is monitored hydrologically and hydrochemically. The total mean flow rate in this catchment area is about 1000 m³/s, as measured over 45-100 years of observation. The main rivers are the Daugava, the Lielupe, the Gauja and the Salaca. The long-term mean flow rate of the Daugava is 637 m³/s (1881-1914 and 1924-2000). About 92% of the river catchment area is monitored hydrologically and hydrochemically.

Russia
About 0.14% of the total Russian catchment area belongs to the catchment area of the Gulf of Riga. This consists of the Russian catchment area of the River Daugava (known as the Sapadnaja Dvina in Russia) which enters the sea in Latvia. This area lies west of the Valday Uplands, and has a population of 150000, at a population density of 6 inhabitants per km². The main river is the Daugava, which has its source here, as do seven of its tributaries. The two largest tributaries are the Meza and the Lutshessa. The land is low and marshy, and there are no large industrial centres or cities. Forests and agricultural areas dominate.

Lithuania
About 17% of Lithuanian territory belongs to the catchment area of the Gulf of Riga. Water drains from this area through the rivers Musa (Meza in Russian), Birvyte and Laukesa (Lutshessa in Russian) via Latvian territory into the Gulf of Riga. Most of the area is monitored hydrologically and hydrochemically. The area has a population of 313600, with a population density of 26.5 inhabitants per km². This Lithuanian sub-basin catchment area is dominated by agriculture (53.6%) and forests (31.3%), with 4.8% urban areas, 4.1% water bodies, 2.4% peat lands, and 3.8% devoted to various other uses.

2.4 The Baltic Proper

The catchment area of the Baltic Proper comprises 574545 km², including territories belonging to all the Contracting Parties except Finland, as well as the Non-Contracting Parties Belarus, the Czech Republic, Ukraine and Slovakia – with a total area of 78360 km² (14%). The catchment areas of the Contracting Parties are divided as follows: 3% (15000 km²) belongs to Russia, 0.2% (1100 km²) to Estonia, 2% (11400 km²) to Latvia, 9% (54160 km²) to Lithuania, 54% (311900 km²) to Poland, 2.6% (18200 km²) to Germany, 0.2% (1210 km²) to Denmark and 15% (83225 km²) to Sweden.

Three of the seven largest rivers around the Baltic enter the Baltic Proper. Two of them, the Vistula and the Oder, enter the Baltic Sea from Polish territory. The third largest river, the Nemunas, flows from Lithuanian territory through the Curonian Lagoon into the Baltic Sea. In this sub-basin there are also many smaller rivers situated in the different countries. Measured river pollution loads also include loads originating in all other countries located upstream or on the other side of the border rivers.

The total catchment area of the Vistula comprises 194420 km², of which 87%, populated by 22.3 million inhabitants, belongs to Poland. Some 12600 km² belongs to Belarus, 11170 km² belongs to Ukraine and 1950 km² to Slovakia. The total catchment area of the Oder comprises 118840 km². 89% of which belongs to Poland, and is populated by about 13.1 million inhabitants. The catchment area of the Oder also includes 6% of the Czech Republic (1.4 million inhabitants) and 5% of Germany (0.4 million inhabitants). Another 10406 km² of Polish territory, populated by nearly 1 million inhabitants, lies within the catchment areas of the Pregel and the Nemunas and of smaller rivers, flowing into the Baltic Sea via Russia and Lithuania.

The Nemunas, which discharges into the Baltic Proper from Lithuanian territory (Lithuanian catchment area 46700 km²), also drains areas in Belarus (45450 km²), Poland (2512 km²), Russia (3170 km²) and Latvia (88 km²). Meanwhile, 7459 km² of Lithuanian territory belongs to the catchment areas of the River Venta and the River Bartuva, which flow into this Baltic Sea sub-basin through Latvian territory. The River Sventoji drains directly to the Baltic Sea.

Estonia
About 3% of Estonian territory, namely the western parts of the Islands Saaremaa and Hiiumaa, belongs to the catchment area of the Baltic Proper. This portion of the catchment area has a population of 10000, with a population density of 9 inhabitants per km². The length of Estonia’s Baltic Proper coastline, excluding small islands, is 570 km. The territory consists of 14% arable land, 55% forests and 25% peat lands. No rivers or direct pollution sources in this area were assessed in the PLC-3 monitoring programme.

Latvia
17% of the Latvian territory belongs to the catchment area of the Baltic Proper. Only 12% of the total Latvian population lives in this sub-basin.

The biggest city is Liepaja, with a population of 94807 in 2000. The area consists of 1.1% urban areas, 51% forests, 45% agricultural areas and 0.7% lakes. The length of Latvia's Baltic Proper coastline is 189 kilometres. The Latvian Baltic Proper catchment area is flat and low-lying. About 75% of the catchment area is monitored hydrologically and hydrochemically. Its total mean flow rate is 160 m³/s, measured over 50-100 years. The main rivers are the Venta, Barta (the Bartuva in Lithuania) and the Saka.

Lithuania

Nearly 83% of Lithuanian territory belongs to the catchment area of the Baltic Proper, including the river catchment areas of the Nemunas, the Bartuva, the Venta and the Akmena-Dane. The population of this territory is 3404400, meaning a population density of 57 inhabitants per km². The Lithuanian sub-basin catchment area is dominated by agricultural land (54%) and forests (31%), with 5% urban areas, 4% inland waters, 2% wetlands and 4% devoted to various other land uses.

The area's main river, the Nemunas, discharges into the semi-enclosed Curonian Lagoon. The retention time for Nemunas discharges in the Curonian Lagoon in the case of full mixing is four months. The length of the Lithuanian part of the Baltic Proper coastline, including the Curonian Lagoon, is 99 kilometres. The long-term mean flow rate of the Nemunas is 664 m³/s (1811-1995). About 96% of the catchment area of the Nemunas is monitored hydrologically, and about 95% hydrochemically.

Russia

About 0.1% of Russian territory belongs to the catchment area of the Baltic Proper, namely the Kaliningrad region. The main rivers are the Pregel and the Nemunas. The total population is 878000, meaning a population density of 58 inhabitants per km². The whole catchment area is monitored hydrologically and hydrochemically. The length of the Russian part of the Baltic Proper coastline, including islands, is 200 km. The largest parts of the catchment areas of the rivers Pregel and Nemunas are situated in Belarus and Lithuania.

Poland

Almost all of Polish territory (99.7%) belongs to the catchment area of the Baltic Proper. This area has a population of over 38 million, with a population density of 123 inhabitants per km². Around 62% of the population is concentrated in urban areas. The remainder live in agricultural regions, constituting 60% of the territory, (46% arable land, 1% orchards and 13% grasslands). The catchment area also includes forests (29%), inland waters (3%) and urban areas (6%). The usage of the remaining 2% is not specified. The length of the Polish coastline, including the Hel Peninsula and islands, is 528 km.

The main rivers in the Polish part of the Baltic Proper catchment area are the Vistula, which flows into the Gulf of Gdansk, and the Oder, which flows into the Pomeranian Bay through the Szczecin Lagoon. The Polish Vistula catchment area comprises 168700 km² with a long-term mean flow rate of 1 081 m³/s (1951-1990). The Polish Oder catchment area comprises 106060 km² with a long-term mean flow rate of 574 m³/s (1951-1990). About 96.1% of the Polish catchment area of the Baltic Proper is monitored hydrologically and hydrochemically.

About 35% of the monitored river water flows through lagoons and coastal lakes before entering the sea. These basins have retention times of several weeks, but are affected by periodic inflows of sea water. This can make pollution load monitoring in their outflows into the sea very difficult. The processes of degradation and pollution accumulation during these long retention times also cause a significant decrease in pollution loads in comparison with monitored loads.

Germany

Nearly 4% of German territory belongs to the catchment area of the Baltic Proper. This comprises most of Mecklenburg-Western Pomerania, as well as the Oder catchment basin within the Federal States of Brandenburg and Sachsen. Approximately 1.56 million people live in the German Baltic Proper catchment area, meaning a population density of 86 inhabitants per km². Stralsund, Greifswald and Neubrandenburg are the population centres of this region. Land use is divided between agriculture and forestry. About 75% of the total area consists of fields and grasslands, 20% is covered by forests and nearly 1% by water.

This sub-basin is characterised by a „Bodden“ coastline, typical of Mecklenburg-Western Pomerania. Bodden is German term for shallow bays separated by spits of land or islands and peninsulas along the coast. Because of changing water levels and currents, and the effect of the surf, the coastline is always shifting. The open sea coastline is particularly affected: 70% of the shoreline is receding by 0.2-0.4 m per year.

The main German rivers entering the Baltic Proper catchment area are the Peene and the Uecker. The catchment area of the Peene comprises 5110 km², and the long-term mean flow rate is 24.2 m³/s (1977-1999). The Uecker has a catchment area of 2401 km² and a long-term mean flow rate of 7.6 m³/s (1977-1999).

Denmark

Nearly 3% of Danish territory, consisting of the islands of Falster, Møn and Bornholm and a part of Zealand, belongs to the catchment area of the Baltic Proper. This area has a population of 82400, meaning a population density of 68 inhabitants per km². Some 65% of the Danish Baltic Proper catchment area consists of arable land, 62% of which has been used for cereal cultivation. Forests cover about 22%, while meadows, moorlands and lakes cover about 2%. In total, natural and cultivated areas cover nearly 89% of the land. The length of the coastline in this sub-basin is nearly 443 km. Only 28% of the Danish Baltic Proper catchment area is monitored using streams. The total long-term mean flow of the monitored Danish rivers entering the Baltic Proper is 1.68 m³/s (1971-2000). The main river, the Mern, has a long-term mean flow rate of 0.41 m³/ s (1971-1990).

Sweden

Nearly 19% of the Swedish territory belongs to the catchment area of the Baltic Proper. This area is heavily forested (52%), but is also more densely populated than catchment areas further north, with 4.1 million people inhabitants at a population density of 48 inhabitants per km², and urban areas making up 2.6% of the total area. Agricultural areas are larger than in the north, covering 16% of the catchment area. Peat lands and lakes cover 3% and 10% of the land, respectively. Other types of terrain, including mountains, cover 16%. The length of the coastline, excluding islands, is 1190 km. The major river is the Norrström, the outlet of Lake Mälaren, which flows through Stockholm. The Norrström has a long-term mean flow rate of 166 m³/s (1961-1990). Approximately ten further rivers in the catchment area have long-term mean flow rates above 5 m³/s. Approximately 68% of the Swedish catchment area is monitored.

2.5 The Belt Sea

This major sub-basin consists of the Belt Sea and the Kattegat. The Belt Sea is further subdivided into the Western Baltic and the Sound. The catchment area of this main sub-basin comprises 114345 km² of which 58% (66585 km²) belongs to Sweden, 26% (29910 km²) to Denmark, 9% (10400 km²) to Germany and 7% (7450 km²) to Norway.

2.5.1 The Belt Sea

2.5.1.1 Western Baltic and Belts

The catchment area of the Western Baltic comprises 22740 km², of which 46% (10400 km²) belongs to Germany and 54% (12346 km²) to Denmark. There are no large rivers. The pollution load mainly enters the marine environment via many small rivers with long-term mean flow rates of less than 20 m³/s.

Germany

About 3% of the German territory belongs to the catchment area of the Western Baltic. The eastern third of the Federal State of Schleswig-Holstein and the western part of the Federal State of Mecklenburg-Western Pomerania lie within this sub-basin catchment area. The total population of this area is approximately 1.74 million inhabitants (1.1 million in Schleswig-Holstein and 0.64 million in Mecklenburg-Western Pomerania), with a population density of 159 per km². The main centres of population in Mecklenburg-Western Pomerania are Rostock (230000 inhabitants) and Wismar (51000 inhabitants). In Schleswig-Holstein 50% of the total population lives in cities with more than 80000 inhabitants. The largest cities are Kiel, Lübeck, Flensburg and Schleswig.

The catchment area in Schleswig-Holstein consists of 10% forests, 16% urban areas, 7% inland waters and nearly 66% agricultural land. This area of post-glacial moraine landscapes drains into the southern part of the highly structured Western Baltic, which includes sub-basins known as Mecklenburg Bay, Wismar Bay, Lübeck Bay, the Kiel Bight and the Fehrman Belt. Sandy marl is the main soil type, but other types of soil prevail in the catchment area, including stagnic or other gleysoils, cambisoils and agrisoils. Humic gleysoils and fluvisoils are found in lowlands and along watercourses.

The main river in Mecklenburg-Western Pomerania is the Warnow with a catchment area of

2982 km² and a long-term mean flow rate of 14.2 m³/s (1975-1999). There are two large rivers in Schleswig-Holstein: the Trave with a catchment area of 2665 km² and a long-term mean flow of 19 m³/s (1971-2000); and the Schwentine with a catchment area of 714 km² and a long-term mean flow rate of 6.7 m³/s (1971-2000).

Denmark

Nearly 29% of Danish territory, with a population of 1.6 million, belongs to the catchment area of the Western Baltic. Population density in this area is approximately 128 inhabitants per km². The second and third largest Danish towns discharge into the Western Baltic. The Danish Western Baltic catchment area largely consists of arable land (68%, of which 62% has been used for cereal cultivation), and forests (14%), while meadows, moorlands and lakes, cover about 3%. Natural and cultivated areas thus cover nearly 87% of the land. The remainder consists of built-up areas: roads, villages and towns. The length of the coastline in this sub-basin is nearly 3650 km. The area is mainly covered by Pleistocene fluvio-glacial sedimentary deposits, with loams, sandy loams and loamy sands as the dominant soil types. The land is low-lying and slopes steeper than 6% only occur over about 2% of the total land area.

More than 48% of the Danish Western Baltic catchment area is intensively monitored via numerous stations along streams. The total long-term mean flow rate from these monitored Danish rivers into marine areas is 50 m³/s (1971-2000) for an area-specific runoff of about 267 mm. None of the seven largest Danish rivers flowing into the Western Baltic has a long-term mean flow rate exceeding 20 m³/s; for example the Suså has a flow rate of only 6.8 m³/s, the Vejle Å 6.6 m³/s and the Odense Å 6.5 m³/s.

2.5.1.2 The Sound

The catchment area of the Sound comprises 4625 km², of which nearly 38% (17140 km²) belongs to Denmark and 62% (2885 km²) to Sweden. The main rivers entering the Sound are the Tryggevaelde Å in Denmark and the Kävlingeån in Sweden.

Denmark

Nearly 4% of Danish territory, with 1.5 million inhabitants and including large parts of Copenhagen, belongs to the catchment area of the Sound. The population density of this region is 849 inhabitants per km². About 43% of the catchment area of the Sound consists of arable land, 58% of which has been used for cereal cultivation. Forests cover about 18%, while meadows, moorlands and lakes, together cover about 5%. All natural and cultivated areas cover nearly 66% of the land. The length of the coastline in this sub-basin is nearly 429 km.

Approximately 64% of the catchment area of the Danish Sound is monitored along streams. The total mean flow rate from these monitored Danish rivers into marine areas is 6.3 m³/s (1971-2000), equivalent to an area-specific runoff of about 175 mm. The main river is the Tryggevaelde Å, with a long-term mean flow rate of 2.2 m³/s (1971-1990).

Sweden

Approximately 0.6% of Swedish territory belongs to the catchment area of the Sound. This catchment area is clearly different from all other Swedish catchment areas in that it contains a large share of agricultural land (64%). It also differs in population density, as there are no less than 625000 inhabitants in this small area, meaning a population density of 240 inhabitants per km². Urban areas cover 6% of the land. Small areas are covered by forests (10%), wetlands (0.7%) and lakes (1.3%). Other types of terrain, including uplands, cover 18%. The length of the coastline, excluding islands, is 80 km. Five rivers have a mean flow rate of above 2 m³/s, for example the Saxån and the Segeå. The major river is the Kävlingeån, with a long-term mean flow rate of 12 m³/s (1961-1990). About 90% of the Swedish catchment area is monitored.

2.5.2 The Kattegat

The catchment area of the Kattegat comprises 86980 km², of which 18% (15830 km²) belongs to Denmark, 73% (63700 km²) to Sweden and 9% (7450 km²) to Norway. The main river is the Göta älv in Sweden, which is the seventh largest river flowing into the Baltic Sea.

Denmark

About 37% of the Danish territory, with 1.5 million inhabitants, belongs to the catchment area of the Kattegat. Population density in this region is 92 inhabitants per km². Some 66% of this catchment area consists of arable land, of which 54% has been used for cereal cultivation. Forests cover about 16%, while meadows, moorlands and lakes, cover about 5.5%. In all, natural and cultivated areas cover nearly 88% of the land. The remaining areas are built-up with roads, villages and towns. The length of the coastline in this sub-basin, including islands, is nearly 2500 km. The area is mainly covered by Pleistocene fluvio-glacial sedimentary deposits. The relief is low-lying, and slopes steeper than 6% only occur over about 2% of the total land area. Sandy soils dominate in western and northern Jutland.

More than 61% of the Danish Kattegat catchment area is intensively monitored via numerous stations along streams. The total long-term mean flow rate from these monitored Danish rivers into the marine areas is 96.5 m³/a (1971-2000), equivalent to an area-specific runoff of about 311 mm. There is one large river, the Gudenå, discharging into the Kattegat, with a long-term mean flow rate of 32.5 m³/s (1971-1990). The second and third largest rivers draining into the Kattegat are the Karup, with a long-term mean flow rate of 9.5 m³/s (1971-1990) and the Skals, with a long-term mean flow rate of 5.0 m³/s (1971-1990).

Sweden

About 14% of Swedish territory belongs to the catchment area of the Kattegat. Except for its size, this catchment area is basically similar to the Swedish part of the Baltic Proper catchment area. Around 1.8% of the area consists of urban areas, and a total of 2136 million inhabitants live in the area with a population density of 30 inhabitants per km². Forests cover 45% of the land and 12% is used for agriculture. Peat lands and lakes cover 7.3% and 14.2% of the land, respectively. Other types of terrain, including uplands, account for 20%. The length of the coastline, excluding islands, is 250 km. The major river is the Göta älv with a long-term mean flow rate of 572 m³/s (1961-1990). Approximately five other rivers have long-term mean flow rates exceeding 20 m³/s; for example the Lagan, the Nissam and the Åtran. About 90% of the Swedish catchment area is monitored.

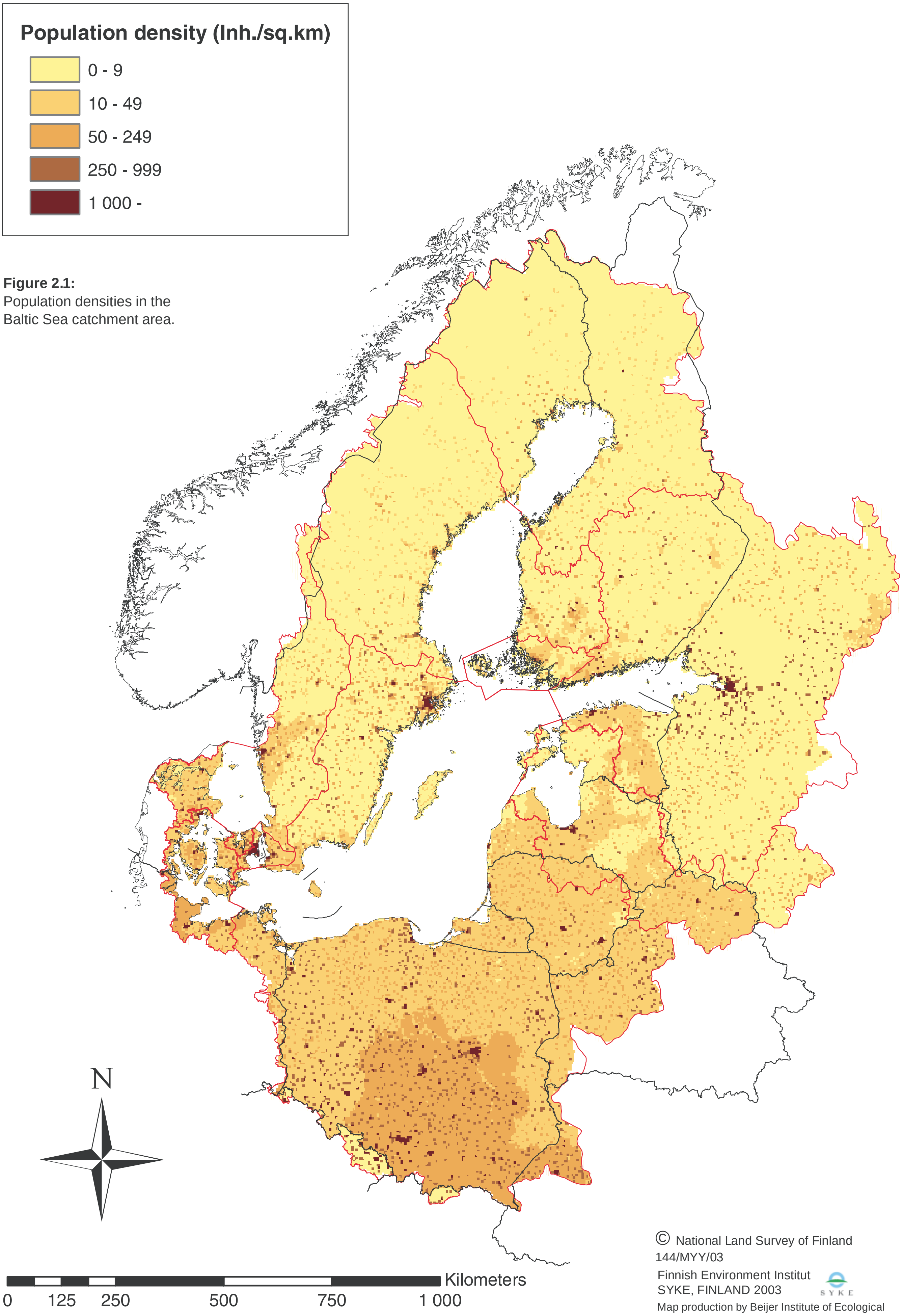
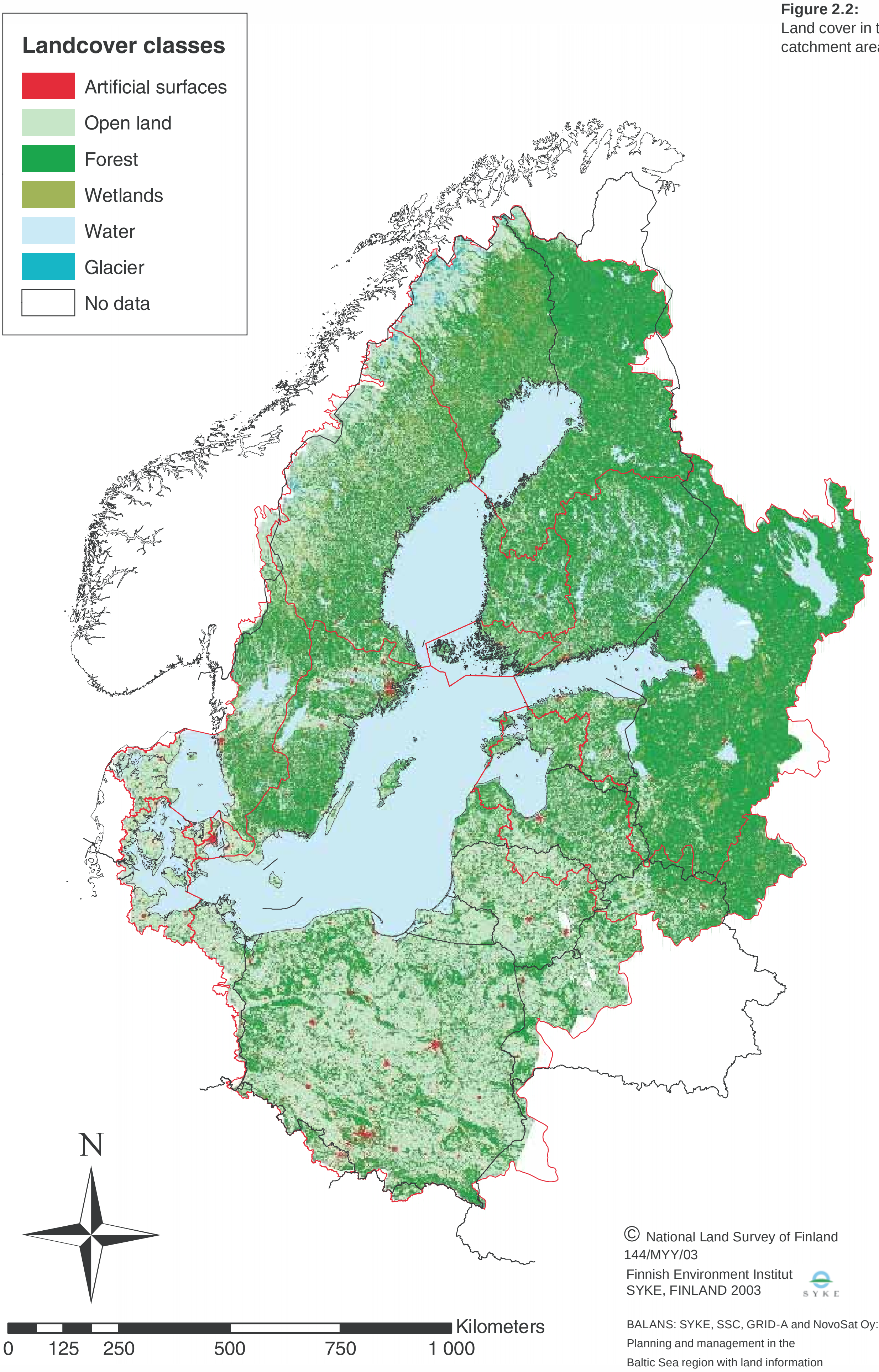


Figure 2.1:
Population densities in the Baltic Sea catchment area.

Figure 2.2:
Land cover in the Baltic Sea catchment area.



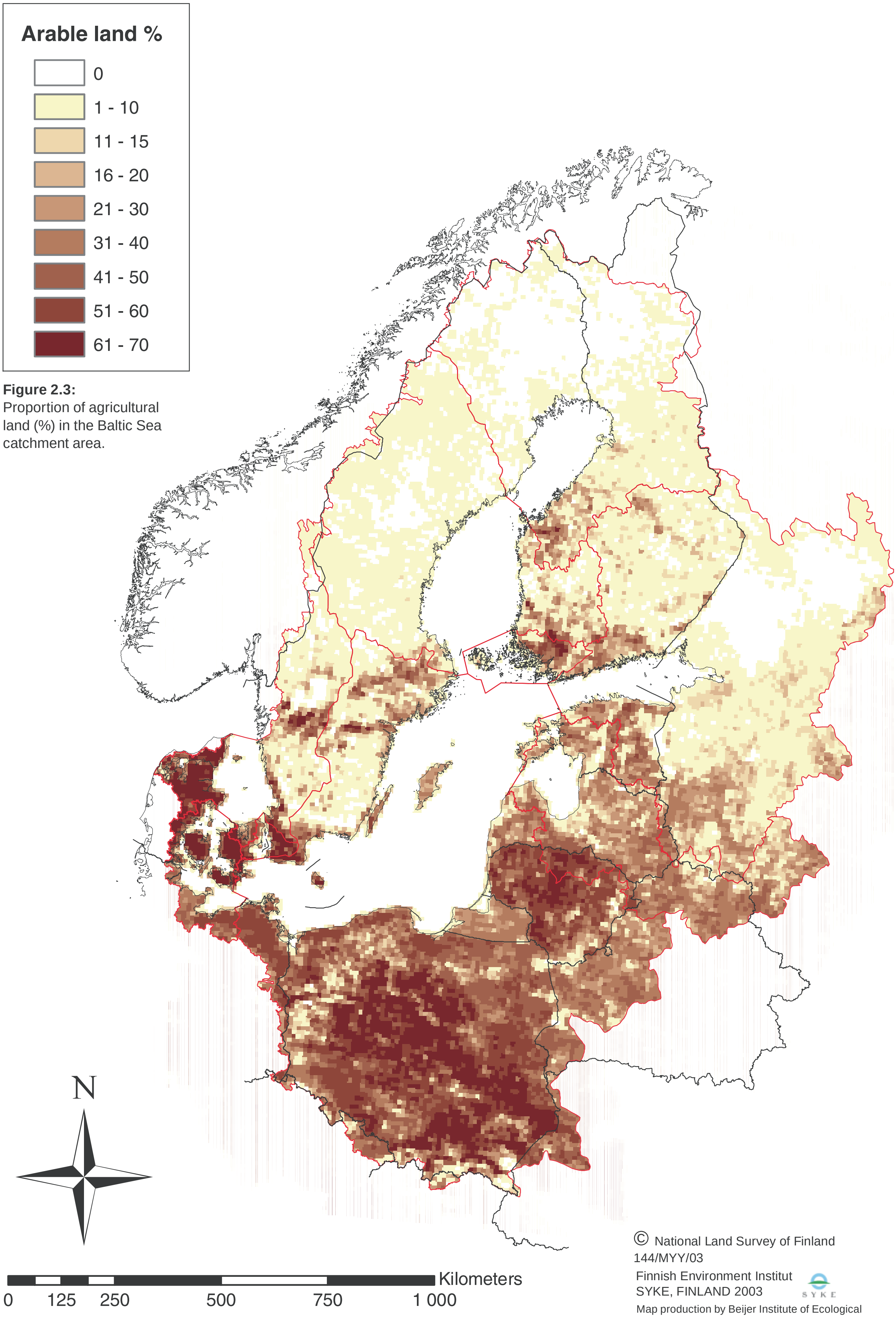


Figure 2.3:
Proportion of agricultural land (%) in the Baltic Sea catchment area.

Finnish Environment Institut
SYKE, FINLAND 2003
Map production by Beijer Institute of Ecological Economics, UNEP, GRID Arendal and Systems Ecology, Stockholm, University

3 Methodology used for assessing point sources, diffuse sources, natural background losses, riverine inputs, retention and source apportionment

This report quantifies point and non-point pollution sources in the catchment area of the Baltic Sea located within the borders of the Contracting Parties. Discharges from point sources include municipal effluents, industrial effluents and pollution from fish farms. Diffuse sources of nutrients are defined as any sources of nutrients not accounted for as point sources. Small, dispersed point source discharges (e.g. from scattered dwellings or localised agricultural sources such as farmyards) are considered as diffuse sources. Losses of nutrients from diffuse sources can be estimated either as the sum of all delivery pathways or by quantifying every individual pathway.

Obligatory measurement, sampling and calculation methods are described in the PLC-4 Guidelines. Arranging sampling at all major point sources and monitoring large areas are great challenges for all countries, especially for the countries in transition. This new challenge of quantifying diffuse sources is a complicated task, and no common agreement has been reached on the methodology to be applied. This chapter briefly describes the methods used by the Contracting Parties, in order to allow for a better understanding of how pollution from different sources has been quantified, and to facilitate comparisons of load figures.

3.1. Quantification methods used for discharges from point sources

3.1.1 Flow measurements for municipal and industrial effluents

According to the PLC-4 Guidelines, a relative margin of error of less than 5% should be the target for open and closed measurement systems in each case. Flow measurement systems and methods should correspond to ISO and DIN standards. Continuous measurement and registration systems should preferably be used. The measurement equipment should also be regularly calibrated on-site. A summary of the information provided by the Contracting Parties on flow measurement methods applied at point sources has been compiled in Table 3.1.

3.1.2 Sampling methods and sampling frequency for municipal and industrial effluents

According to the PLC-4 Guidelines, samples from treated and untreated wastewater should always be taken for comparative purposes as composite samples. Flow-weighted composite samples should be the target. Grab samples are acceptable only in exceptional cases. Sampling frequency varies very much, depending on the polluters concerned. The sampling methods

Table 3.1: Flow measurements for point sources reported separately in 2000.

Contracting Party	Number of point sources included in the report		Number of point sources where continuous flow measurement uses methods with accuracy more than 95%		Frequency of calibration of equipment	Number of point sources using other methods		Number of point sources where volume assessed on the basis of consumption	
	Municipalities	Industries	Municipalities	Industries		Municipalities	Industries	Municipalities	Industries
Denmark	155	63	153	63	regularly	0	0	0	0
Estonia	18	4	18	4	regularly	0	0	0	0
Finland	105	70	105	70	regularly	0	0	0	0
Germany	23	9	23	9	regularly	0	0	0	0
Latvia	14	3	7	3	regularly	0	0	7	0
Lithuania	6	19	6	19	every two years	0	0	0	0
Poland	164	70	4	0	regularly	160	70	0	0
Russia	56	59	53	59	regularly	3	0	0	0
Sweden	143	57	143	57	regularly	0	0	0	0

Table 3.2:
Sampling method and frequency for large municipal waste water treatment plants > 10000 PE in 2000.

* only selected plants monitored, covering 50% of total wastewater generated

Contracting Party	Type of sampling	Sampling frequency per year		Some measurements below the detection limit (Y=Yes / N= No)	
		BOD, COD, nutrients	Heavy metals	BOD, COD, nutrients	Heavy metals
Denmark	daily flow proportional, composite (for very small plants)	12-52	4*	N	Y
Estonia	composite, grab	4-48		N	Y
Finland	flow proportional, composite	12-100	1-12	Y	Y
Germany	grab samples	11-13	11-13	Y	Y
Latvia	flow proportional, composite, grab	4-366	1-71	N	Y
Lithuania	composite, grab	4-24	4-24	N	Y
Poland	composite, grab	6-366	1-12	N	Y
Russia	composite, grab	4-366	1-71	N	Y
Sweden	composite, daily or weekly flow proportional	12 to 366	52	N	N

Table 3.3:
Sampling method and frequency for industrial plants reported separately in 2000.

Contracting Party	Type of sampling	Sampling frequency per year		Some measurements below the detection limit (Y=Yes / N= No)	
		BOD, COD, nutrients	Heavy metals	BOD, COD, nutrients	Heavy metals
Denmark	daily flow proportional	2-12	4 times per year for 7 days/week	N	Y
Estonia	composite, grab	12-16	1-12	N	Y
Finland	flow proportional, composite	1-366	1-366	N	Y
Germany	grab samples	11-13	11-13	N	Y
Latvia	flow proportional, composite, grab	104-366	3-12	N	Y
Lithuania	composite, grab	12-24	4-12	N	Y
Poland	grab samples	1-19	1-13	N	N
Russia	composite, grab	4-366	4-12	N	Y
Sweden	composite, daily/ weekly or monthly flow proportional	1-366	4 times per year for 5 days/week	N	N

Table 3.4:
Sampling method and frequency for small municipal wastewater plants
(≤ 10000 PE) and small industrial plants in 2000.

* no small plants
** no information available for small industrial plants

Contracting Party	Type of sampling	Sampling frequency per year
Denmark	daily flow proportional	2-12
Estonia	grab	4-12
Finland	flow proportional, composite	2-12
Germany	*	*
Latvia	composite, grab	1-12
Lithuania	composite, grab	2-12
Poland	grab samples	1-12
Russia**	composite, grab	1-12
Sweden	flow proportion, composite or grab	2-12

Contracting Party	Pollution load calculation methods for point sources				
	Continuous flow measurements and continuous sampling (1)	Continuous flow measurements and non-continuous sampling (2)	Periodic flow and sampling 1-12 times per year (3)	Overflows and by-passes included ? (Y=Yes / N=No)	Estimation methods for untreated waste water
Denmark	+	-	-	Y	*
Estonia	-	+	+	N	* (for municipal) ** (for industrial)
Finland	+	-	-	Y	*
Germany	+	-	-	Y	*
Latvia	+	+	+	N	*
Lithuania	-	+	+	Y (usually overflows)	*
Poland	-	+	+	N	**
Russia	+	+	+	Y	(1), (2), (3)
Sweden	+	+	+	Y (usually overflows)	*

Table 3.5:
Pollution load calculation methods for point sources reported separately in 2000.

* no untreated waste water
** no information available

and sampling frequencies presented by the Contracting Parties vary greatly for both municipal effluents and industrial effluents (see Tables 3.2, 3.3 and 3.4). For large-scale polluters sampling frequencies vary from 1 to 366 times per year. For smaller-scale polluters frequencies are usually 1-12 times per year. Some Contracting Parties, e.g. Germany, only used samples taken by the authorities for pollution load calculations, so the sampling frequency in these cases is only 12 times per year. Nearly all the other Contracting Parties used self-control samples as well as samples taken by the authorities for pollution load calculations, so sampling frequencies are significantly higher elsewhere. Further information about the monitoring results (concentrations) below detection limits is given in Table 3.2.

3.1.3 Compilation of annual loads for municipal and industrial effluents

The main pollution load calculation methods are described in the PLC-4 Guidelines. According to the Guidelines, calculated load figures must also include overflows and by-passes. An overview of load calculation methods used, based on the information provided by the Contracting Parties, is presented in Table 3.5.

In **Denmark** discharges from municipal wastewater treatment plants and industries are monitored each year for each unit bigger than 30 PE in both monitored and unmonitored catchment areas. Samples for plants larger than 1000 PE are taken as daily flow proportional samples with continous registration of flow according to the guidelines. At least 12 samples are taken, and often 26 or more for bigger plants. For heavy metals, daily flow proportional samples are taken every four weeks and pooled into weekly samples. Industrial pollution loads are measured at units with outlets treated separately from municipal wastewater. In some cases it is not possible to distinguish between industrial effluents and municpal effluents, since both types of effluent are treated in the same municipal wastewater treatment plants.

Estonian pollution load data has been reported on the basis of the National Point Sources Database, which includes the following information for each source: N_{total} load; P_{total} load; BOD_7 load, suspended solids load, and annual discharge. Information on heavy metal concentrations was collected separately for large point sources. Heavy metal concentrations are often below detection limits. Since the monitoring of heavy metals is not obligatory for all plants in Estonia, this information is absent for some large sources.

In **Finland** nutrient load estimates for municipalities and industrial plants were based on regular measurements made according to guidelines set by the Finnish environmental authorities. In some cases it is impossible to separate municipal and industrial effluents, since wastewater from food production plants, for instance, is often treated in municipal wastewater treatment plants.

In **Germany** all municipal waste water treatment plants >10000 PE have been monitored separately. Relevant municipal plants ≤10000 PE do not exist. In Mecklenburg-Western Pomerania the annual load was calculated by multiplying the annual wastewater volume by the annual mean concentrations of pollutants. In Schleswig-Holstein the annual load was calculated on the basis of continuous flow measurement and continuous sampling. Since the monitoring of heavy metals is not obligatory for all point sources, an extra monitoring programme in two German federal states was established for PLC-4 purposes.

A similar situation occured in **Latvia**, where waste water treatment plants commonly have combined sewerage systems, making .it difficult to separate the amounts of industrial and municipal wastewater and rainwater. Consequently the PLC-4 database shows this data as mixed wastewater, even though much of it is composed of industrial effluents.

In **Lithuania,** data on point source loads has been reported on the basis of the National Point Sources Database. This database includes the following information for each source: point source name, co-ordinates, loads of nutrient matter, BOD_7 load, suspended solids load, heavy metal concentrations, annual discharges, and average and maximum concentrations. Point sources controls are carried out 2-24 times per year, depending on the size of the discharged pollution load. Chemical analyses were performed in accordance with ISO standards.

In **Poland,** data on point sources was collected in a national database established for the purposes of PLC-4. Data was collected according to a Polish control system conducted by Environmental Protection Inspectorates. Controls are done on both municipal and industrial outlets 1-6 times per year, depending on the size of the discharged pollution loads. Load data based on information received from laboratories belonging to municipal and industrial plants was also collected. In some cases this brought the sampling frequency up to 366 per year for municipal treatment plants and 19 per year for industrial plants.

In **Russia,** several methods were used to estimate the flows of untreated municipal wastewater, such as continuous flow measurements and continuous sampling, continuous flow measurements and non-continuous sampling, periodic flow and sampling measurements. Treated and untreated wastewater discharged from 16 industrial plants was assessed using continuous flow measurements and non-continuous sampling.

In **Sweden,** pollution loads from the larger cities (>20000 PE) are calculated on the basis of at least 25 samples per year. The pollution load is calculated as the product of annual flow and flow-weighted concentrations with continuously measured wastewater flow. The pollution loads reported from municipal treatment plants are considered to be fairly accurate estimates of the true discharges. Overflows from larger municipalities are usually included in the figures. The chemical analyses were performed according to Nordic standards. The loads from industrial plants are calculated more or less in the same manner, but they are more site-specific due to variations in size and differences between plants in different industrial sectors.

3.1.4 Compilation of annual loads for fish farms

There are fish farms in Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Russia and Sweden. The loads from these plants are estimated on the basis of the amounts of nutrients in fish and the nutrient content of their feed, with calculations made according to equations described in the PLC-4 Guidelines. Based on the information provided by the Contracting Parties, an overview of the fish farms located in the Contracting Parties catchment area is presented in Table 3.6.

Table 3.6: Fish farms located in the Contracting Parties catchment area in 2000.

Contracting Party	Number of Fish farms		Fish farms without sludge removal (mainly net cages and pens)	Fish farms with sludge removal
	Total	Large		
Denmark	194	9	-	194
Estonia	13	0	13	0
Finland	319	2	319	0
Germany	*	*	*	*
Latvia	11	-	11	0
Lithuania	2	-	2	0
Poland	6	1	**	**
Russia	10	-	**	**
Sweden	37	0	4	33

* no fish farms

** no information available

3.2 Quantification methods used for nutrient losses from diffuse sources (Source-orientated approach)

Diffuse sources of nutrients are defined as any sources of nutrients not accounted for as point sources. Small, dispersed point source discharges (e.g. from scattered dwellings or localised agricultural sources such as farmyards) are considered as diffuse sources. Whereas point source discharges from wastewater treatment plants and industrial plants are directly discharged into rivers, diffuse nutrient losses into surface waters consist of the sum of many different delivery pathways with many separate flow components (Figure 3.1). It is necessary to separate the various components of diffuse sources, because nutrient concentrations and the processes involved in these pathways vary greatly.

Losses from diffuse sources of nutrients should be reported as total nitrogen and phosphorus inputs to inland surface waters within the Baltic Sea catchment area. However, these losses can be estimated either as the sum of all the delivery pathways or separately for every individual pathway. The various Contracting Parties have chosen to quantify nutrient loads from diffuse sources as described below.

Denmark

Denmark's source-orientated approach is possible because all point sources are monitored. Discharges from minor point sources (< 30 PE) and from scattered dwellings (< 30 PE) are calculated using an empirical equation. The source-orientated approach consists of the following components:

- Root-zone losses,
- Monitoring in several small agricultural catchment areas where point source discharges are low or non-existent,
- Monitoring of all point sources > 30 PE and estimation of the potential discarges from scattered dwelling (< 30PE),
- Natural background losses,
- Atmospheric deposition on inland surface waters,
- Retention in the catchment area,
- Empirical modelling.

Besides taking measurements in small agricultural catchment areas with no major discharges from point sources, Denmark is developing empirical models for diffuse nutrient (nitrogen) losses and transport. These models were originally developed to estimate discharges of water and nitrogen in unmonitored areas, but they can also be used to estimate nitrogen discharges/losses as well as transport in monitored catchments.

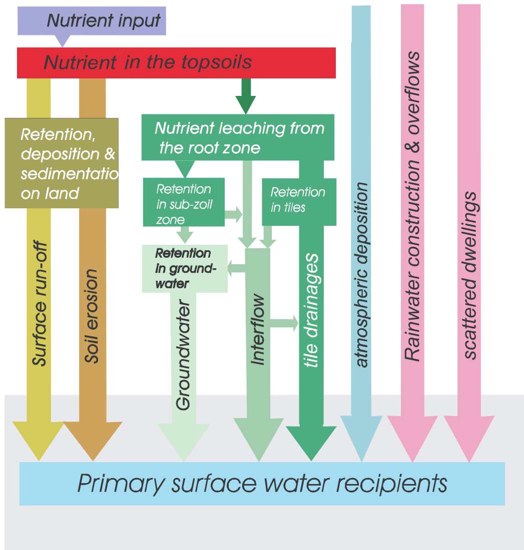


Figure 3.1: Pathways of nutrient losses from diffuse sources entering inland surface waters

Estonia

The ***background losses*** are calculated on the basis of nutrient loads measured in small forested catchment areas with no farmland. Discharge-weighted nitrogen and phosphorus concentrations are used to calculate loads from reference areas according to runoff conditions. Another method used to estimate background losses in Estonia is based on observed annual area leaching coefficients for nitrogen and phosphorus (kg/(ha a)) loads.

The method used in Estonia to estimate ***antropogenic diffuse nutrient losses*** is based on monitoring results from specially selected small agricultural catchment areas. There are three main agricultural catchment areas with varying climatic, landuse and agricultural characteristics in Estonia. Losses from agriculture are estimated according to area-specific nutrient leaching coefficients as determined in small selected agricultural catchment areas. Nutrient loads from scattered dwellings in sparsely populated areas are included in figures for agricultural losses, as they have not been assessed separately.

Finland

Estimates of the losses of phosphorus and nitrogen from ***agricultural*** land to inland surface waters in Finland are based on the monitoring of nitrogen and phosphorus fluxes from 11 small agricultural drainage basins and from four agriculturally loaded river basins in south and south-western Finland (Rekolainen et al. 1995, Vuorenmaa et al. 2001). The sizes of the small basins vary from 0.12 to 15 km^2, and the larger river basins range from 870 km^2 to 1300 km^2. The proportion of these basins consisting of agricultural land varies from 23% to 100%. The monitoring schemes are based on continuous water flow measurement and flow-weighted water quality sampling. Using this data, annual nitrogen and phosphorus flux estimates are calculated by subtracting any point-source discharges, estimated losses from forested areas and natural background losses. The extrapolation of these phosphorus losses to give a figure covering all farmland in Finland is based on the ICECREAM model, which takes into account topography, soil structure and the extent of agricultural production in different river basins (Tattari et al. 2001). The hydrology of the original model has been modified for Finnish conditions. The most notable adaptation to the model concerns the inclusion of snow accumulation, snow melt and soil frost processes. For nitrogen, the SOILN-N model was used (Johnsson et al. 1987).

The effects of ***forestry activities*** (ditching, clear-cut felling, ploughing, hummocking, fertilisation etc.) were evaluated on the basis of regional forestry statistics. The specific net annual load from forestry activities was approximated using leaching coefficients obtained from Finnish and Swedish surveys. Nutrient discharges from ***scattered dwellings*** were evaluated on the basis of estimated annual wastewater production per person and the general standards of the equipment used to process lavatory and sanitary wastes. ***Atmospheric deposition*** on lake surfaces was calculated by multiplying specific deposition rates by the total surface area of all lakes. Deposition was measured at 65 stations in the river catchment areas. Nutrient concentrations were analysed in integrated monthly samples of rain water.

Germany

The **MONERIS** (**MO**delling **N**utrient **E**missions in **RI**ver **S**ystems) model was developed and applied to estimate nutrient inputs entering inland as as source-orientated approach surface waters in river basins in Germany both from point sources and via all the diffuse pathways shown in Figure 3.1. For comparison purposes this model also includes the calculations for the load-orientated approach on the catchment basis. This model is based on conceptual approaches for the quantification of different pathways for point sources, diffuse sources and retention, and also applies a geographical information system (GIS) including digital maps and extensive statistical information (Behrendt et al. 1999 and 2003). This GIS-supported method means regionally-differentiated estimates can be obtained for river basins of more than 500 km^2. The sub-models used for the quantification of diffuse sources are described below:

- A sub-model for ***groundwater*** allows concentrations of nitrogen and phosphorus originating from the nitrogen and phosphorus surplus in agricultural areas to be calculated by means of a retention function. This retention function is dependent on the hydro-geological conditions, the rate of groundwater recharge and the nitrogen and phosphorus surplus itself. The retention model includes first rough estimates of the residence times of water within the unsaturated zone and of the river basin aquifers.
- A sub-model for discharges of nutrients and suspended solids caused by ***erosion***, can be applied to all investigated river basins. This model is based on the modified uniform soil loss equation, but only considers areas relevant for inputs into river systems. This sub-model has been validated by observed loads of suspended solids and particulate phosphorus for river basins.
- A sub-model for ***surface runoff*** is based on estimates of the proportions of the total flow within a catchment area consisting of surface runoff, and the calculation of area-weighted mean concentrations. For nitrogen, concentrations were estimated on the basis of data on mean atmospheric deposition (see below) and mean precipitation per catchment area. For arable land, it is assumed that concentrations are increased by a value of 3 mg N/l. For phosphorus, different concentrations were assumed for arable land, grassland and forested areas. The values for concentrations for these different land-uses are dependent on the phosphorus saturation rates of the soils, which are estimated on the basis of phosphorus accumulation over the last 50 years (using the sum of the phosphorus surpluses in agriculture since 1950).
- A GIS-supported sub-model can produce regionally-differentiated estimates for agricultural areas modified by ***tile***

drainage. This sub-model is based on soil types and a classification of soil water conditions, and is validated by overlaying digitised maps of tile-drained areas with soil maps.
- A sub-model for different pathways of nutrient discharges within ***urban areas*** considers regional differences in sewer systems, and also the development of storage volume, especially for combined sewer systems.
- A sub-model for ***atmospheric deposition*** on inland surface waters is based on results from EMEP regarding and deposition measurements in Germany regarding phosphorus. The results of NH_4-N and NO_x depositon for the EMEP grids (50 km) for 1999 were overlaid with the catchment areas to allow mean deposition to be estimated in the catchment areas. These mean deposition rates were multiplied by the total area of surface waters within the catchment areas. For phosphorus, a constant deposition rate was used for all catchment areas.

MONERIS was applied separately to 11 small German rivers entering the Baltic Sea, to the German part of the Oder catchment area, and to the remaining German Baltic Sea catchment area, so that the whole German Baltic Sea catchment area is covered (Behrendt, et al. 2003).

Latvia

No source-orientated approach has yet been developed. A load-orientated approach was applied to quantify nutrient loads from diffuse sources in Latvia (see chapter 3.5).

Lithuania

No source-orientated approach has yet been developed. A load-orientated approach was applied to quantify nutrient loads from diffuse sources in Lithuania (see chapter 3.5).

Poland

To quantify nutrient losses from diffuse sources, a nutrient balance was calculated for the Polish Baltic Sea catchment area, including the following sources of nutrients:
- Background nutrient losses,
- Soil cultivation – agriculture,
- Livestock – agriculture,
- Population not connected to sewerage systems.

The Polish part of the Baltic Sea catchment area was divided into 107 catchment areas for calculation purposes. The loads calculated for these catchments were then summarised and presented in the form of 12 monitored catchment areas, 11 unmonitored catchment areas and the coastal zones – where direct run-off of nutrient pollutants into the Baltic Sea is assumed.

Calculations for nutrients originating from ***soil cultivation activities*** were based on experimental data from 46 small agricultural and forested catchment areas, none of which contained any major point sources. These experimental catchment areas were selected to be representative of Poland's major topographical regions: lowlands, uplands and mountains. In the calculations it was assumed that the quantities of nutrients emitted are proportional to riverine run-off. In the modelling process, the following materials were used: morphology elevation maps, soil permeability maps (three categories of permeability: good, average, poor), statistical data on land-use and fertiliser consumption, and hydro-geological data for the 107 calculation catchment areas. Based on this experimental data, flow-weighted concentrations of nitrogen and phosphorus in outflows were calculated as the soil cultivation load.

Nutrient loads due to ***livestock*** farming were also calculated. These calculations were performed separately for each of 107 calculation catchment areas, based on statistical data from the Main Statistical Office. Calculations were based on the individual loads generated by certain types of livestock and expressed in units (1 unit – 500 kg of livestock).

The loads originating from ***population not connected to sewerage systems*** were calculated for each of the 107 calculation catchment areas, based on statistical data on the number of inhabitants in houses not connected to any sewerage system. The average loads discharged by individual inhabitants amount to approximately 4.4 kg/a N and 1 kg/a P. It is assumed that on average about 50% of this nitrogen load and 10% of the total phosphorus load eventually enter surface waters.

The total diffuse losses of nitrogen and phosphorus reaching inland surface waters (not including natural background) are calculated as the sum of losses from agriculture (soil cultivation, livestock farming) and discharges from the population not connected to the sewerage system.

Russia
No source-orientated approach has yet been developed. A load-orientated approach was applied to quantify nutrient loads from diffuse sources in Russia (see chapter 3.5).

Sweden
In Sweden the TRK (Transport, Retention and Source Apportionment) model was applied, which combines:

- GIS data on the areal distribution of different land-use categories and the location of point sources,
- Concentrations and areal losses fof nutrients from diffuse sources (calculated for nitrogen losses from arable land according to the dynamic soil profile model SOIL-NDB),
- Water balance estimates (calculated using the distributed dynamic HBV model),
- Nitrogen transportation and retention processes in water (calculated using the model HBV-N).

These results are presented in GIS, with source apportionment carried out for each sub-basin as well as for whole river basins. The results from this system have been used for international reports on transportation to the sea, for assessment of reductions in anthropogenic loads entering the sea, and to suggest effective measures for reducing these loads on the national scale.

Generalised **nitrogen root-zone leaching** estimates for arable land are calculated using the SOILNDB modelling tool. This method is based on the calculation of a number of standard leaching rates (i.e. the amounts of nitrogen leached from the root zone over a year given normal weather conditions and crop yields) for various combinations of soils, crops, fertilisation practices and gegraphical regions.

Phosphorus leaching from arable land is determined as follows: transportation figures are based on water discharges simulated through a combination of HBV and multiple regression models. The four parameters influencing phosphorus concentrations originating from arable land are livestock density, phoshorus concentrations in the topsoil, the duration of high water flow and local soil type (Ulén, et. al. 2001).

The HBV model used for **catchment water flow modelling** is a conceptual, continuous, dynamic and distributed rainfall-runoff model. When applying this model each catchment area is divided into several coupled sub-basins. The daily water balances are calculated for each sub-basin, using daily precipitation and temperature data from weather stations. This data includes daily values for local precipitation, snow accumulation and melt, soil moisture, groundwater level, run-off from every sub-basin, and the routing of water through lakes and larger basins. The model is calibrated and validated against observed time-series. The HBV model has been applied in more than 40 countries around the world, and is in operational use in the Nordic countries. Normalised water flows are based on averages based on 10-20 years of daily modelling.

3.3 Quantification methods used for natural background nutrient losses

Procedures for the quantification of losses of nitrogen and phosphorus from natural background sources to inland surface waters are described below. Natural background losses to surface waters include natural nutrient losses from unmanaged land, and the proportion of nutrient losses from managed land that would occur irrrespective of agricultural activities. This means that natural background losses form part of total diffuse losses. Two different approaches are used to estimate natural background losses:

- monitoring of small unmanaged catchment areas, and
- use of models.

Background nutrient losses are actively monitored in several countries. Where background losses are estimated with models, it is assumed that the agricultural surplus is zero. Figures for background losses from other countries with corresponding geological, topographical and climatic conditions may also be applied.

The results for Denmark consist of median monitored values for nine small catchment areas with very low or no human activity in 2000. For other countries, the figures given relate to the period 1990-2000, and are obtained from forested catchment areas and/or catchment areas with very low anthropogenic impact (except for impacts from atmospheric deposition). In Latvia, natural background losses were estimated in the Vienziemite River Basin (1995-2000). In Lithuania the Zeimena and Jura Rivers Basins were assessed.

Contracting Party	Total nitrogen in kg/ha	Total nitrogen in mg/l	Total phosphorus in kg/ha	Total phosphorus in mg/l
Denmark	2.5	1.2	0.05	0.04
Finland	0.5-2.0		0.02-0.06	
Estonia	3.0-3.2	1.1	0.11-0.12	0.04
Germany		1.0		0.25
Latvia	6.1		0.11	
Lithuania	1.8-3.9		0.06-0.08	
Poland	0.4-9.0	0.3-1.2	0.06-0.28	0.04
Russia		0.68		0.013
Sweden	0.75-1.2	0.2-0.9	0.03-0.1	0.01-0.02

Table 3.7:
Natural background concentrations and area-specific loads for the Contracting Parties.

Contracting Party	Number of rivers included in the report	Number of rivers with permanent hydrological station	Flow calculation method	Conformity with the WMAO Guide ? (Y=Yes / N=No)	Number of rivers or streams with estimated yearly run-off
Denmark	98	98	Stage-discharge relationship	Y	0
Estonia	16	11	Stage-discharge relationship	Y	5
Finland	32	32	Stage-discharge relationship	Y	0
Germany	31	31	Stage-discharge relationship	Y	0
Latvia	8	7	Stage-discharge relationship	Y	1
Lithuania	3	3	Stage-discharge relationship	Y	0
Poland	12	12	Stage-discharge relationship	Y	0
Russia	25	5	Stage-discharge relationship	Y	20
Sweden	114	41	Stage-discharge relationship	Y	73

Table 3.8:
Number of flow measurements and calculation methods in 2000.

Table 3.7 gives an overview of the flow-weighted concentrations and area-coefficients used by each Contracting Party for calculating natural background losses.

3.4 Quantification methods used for riverine inputs

3.4.1 Flow measurement and calculations

According to the PLC-4 Guidelines, locations of hydrological stations, frequencies of stage-discharge measurement and the methods used to calculate annual run-off are regulated by the WMO Guide to Hydrological Practices.

The rivers included in the PLC-4 Report are divided into two groups. The first group includes rivers with permanent hydrological stations, where stages are registered continuously, with flow measurements carried out according to WMO requirements. The second group includes rivers with no permanent hydrological stations, for which run-off was estimated on the basis of existing knowledge about the hydrology of a comparable neighbouring river basin.

Table 3.8 shows the numbers of flow measurements taken by each Contracting Party, also describing their conformity with the WMO Guide.

3.4.2 Sampling methods and sampling frequency

According to the PLC-4 Guidelines, the sampling regime should be designed on the basis of historical records, and should cover the whole flow cycle. The minimum sampling frequency is 12 times per year, and samples should appropriately reflect predicted river flow patterns. The sampling points should correspond to ISO Standards 5667-6 and 5667-9.

Table 3.9:
Sampling frequencies for the monitoring of different pollutants and measurements below detection limits in 2000.

Contracting Party	Sampling frequency per year		Some measurements below detection limits? (Y=Yes / N= No)	
	BOD, COD, nutrients	Heavy metals	BOD, COD, nutrients	Heavy metals
Denmark	12-366	12	N	Y
Estonia	12	10-12	N	Y
Finland	12-42	12-42	Y	Y
Germany	12-26	9-13	Y	Y
Latvia	12-13	6-12	N	Y
Lithuania	12	4	N	Y
Poland	12-26	12-26	N	Y
Russia	4-12	4-12	N	Y
Sweden	12	12	N	Y

Table 3.10:
Methods used for calculating riverine loads.

Contracting Party	Monitored rivers		Unmonitored areas
	Daily flow and daily concentration regression	Mean monthly concentration and monthly flow	Estimation on the basis of either area proportion, area- specific load or flow-weighted concentrations
Denmark	+		+
Estonia		+	+
Finland		+	+
Germany		+	+
Latvia		+	+
Lithuania		+	+
Poland		+	+
Russia		+	-
Sweden	+		+

For all the Contracting Parties the sampling frequencies for nutrient and organic matter monitoring in monitored rivers, are at least 12 times per year. The sampling frequency for heavy metals is in most cases 12 times per year or less, if measurements were performed.

Heavy metal concentrations in monitored rivers are more frequently below detection limits than concentrations of organic matter or nutrients. Details of sampling frequencies are presented in Table 3.9.

3.4.3 Compilation of annual load

The methods used for calculating loads in the monitored rivers and unmonitored areas are described in the PLC-4 Guidelines. According to the Guidelines, Contracting Parties are responsible for selecting calculation methods. Most of the Contracting Parties chose to assess mean monthly concentrations and mean monthly flows for the monitored rivers. For the calculation of annual loads in unmonitored areas, the Contracting Parties have either extrapolated figures from neighbouring rivers where conditions are similar, or used area-specific loads or discharge-weighted concentrations from the monitored stretches of rivers. Table 3.10 describes the calculation methods used by the Contracting Parties.

Estonia calculated heavy metal loads for 7 selected rivers with catchment areas varying from 530 km^2 to 56000 km^2. Since concentrations of heavy metals in most samples were under detection limits, the results were not extrapolated to the unmonitored parts of the catchment area, as this could lead to an overestimation of the total load from Estonia.

Denmark only monitored heavy metals in four rivers. Figures were extrapolated to estimate total riverine heavy metal loads in Danish rivers entering the Baltic Sea, by using the relationship between the monitored heavy metal loads for these four rivers and the total heavy metal riverine load from Denmark to the Baltic Sea.

Russia has 16 unmonitored rivers. The loads from these unmonitored rivers were not estimated because wastewater is not discharged into these rivers, and their flows are from the Russian point of view so small that anthropogenic loads are only considered to be of minor importance.

3.5 Quantification methods used for nutrient source apportionment (Load-orientated approach)

Source apportionment is a load-orientated approach. Source apportionment for nutrients is useful tool for evaluating the importance of different sources of riverine nutrient loads, and for quantifying the importance of anthropogenic sources, including loads from point sources and anthropogenic diffuse sources (e.g. agriculture, scattered dwellings, storm water overflows) as well as natural background losses. Source apportionment is an important tool for politicians and other decision makers, as it facilitates evaluations of the importance of different nutrient sources and delivery pathways. Nutrients originating from natural sources are usually bound to humic complexes, and are therefore not easily accessible for plants or algae. Nutrients originating from anthropogenic sources, such as phosphorus from point sources or nitrogen leaching from manure or fertilisers, are more likely to exist in an inorganic, soluble form that is easily available for plants to absorb.

Source apportionment is used to quantify diffuse riverine loads of nutrients either as a proportion of the monitored flow, or as a proportion the total load to marine areas from land-based sources. The commonly agreed source apportionment equation, which is also given in the PLC-4 guidelines, is:

$$\mathbf{L_{river} = D_P + LO_D + LO_B - R} \qquad \mathbf{(1),}$$

where LO_{river} is the total nutrient load in a selected river, D_P is the sum of the various components of discharges from point sources, LO_D denotes the losses of anthropogenic diffuse sources, LO_B the natural background losses, and R denotes retention in inland surface waters.

The source apportionment approach is based on the assumption that total riverine nutrient loads at selected river measurement sites are equal to the sum of the various components of the load originating from point sources, the loads of anthropogenic diffuse sources and the natural background losses, also taking into account the processes of river-internal and lake retention (R). The importance of including retention in the source apportionment is described in chapter 3.6.

In relation to (1), the loads from diffuse sources are quantified as follows:

$$\mathbf{LO_D = LO_{river} - D_P - LO_B + R} \qquad \mathbf{(2),}$$

The importance of different sources with regard to riverine loads is quantified as follows:

$$\textbf{Proportion of } \mathbf{LO_B = LO_B / (L_{river} + R) \cdot 100\%} \qquad \mathbf{(3)}$$

$$\textbf{Proportion of } \mathbf{D_P = D_P / (L_{river} + R) \cdot 100\%} \qquad \mathbf{(4)}$$

$$\textbf{Proportion of } \mathbf{LO_D = LO_D / (L_{river} + R) \cdot 100\%} \qquad \mathbf{(5)}$$

Some countries also use a load-orientated approach to separate the diffuse load in even further detail. In order to quantify the agricultural load (LO_{AG}), the respective loads from atmospheric deposition (LO_{AD}), scattered dwellings (LO_{SD}) and stormwater overflows (LO_{SO}) must be deducted from LO_D:

$$\mathbf{L_{AG} = LO_D - LO_{AD} - LO_{SD} - LO_{SO}} \qquad \mathbf{(6)}$$

Source apportionment has generally been reported for all monitored rivers, and for the unmonitored parts of catchment areas. All Contracting Parties have provided information on source apportionment, and have at least been able to report results for monitored parts of their river systems. Not all Contracting Parties have reported all the variables for equations 2 and 6; and while some Contracting Parties have divided retention between all sources, others have only assigned retention to agricultural loads (Table 3.11). The latter method is acceptable if most of the point sources are located near the coast, or discharge directly into the sea.

In the following, some remarks on the methodologie applied by selected Contracting Parties are given:

In **Germany,** source apportionment was conducted using a load-orientated approach according to the MONERIS model (Behrendt et al., 2000), independently of the source-orientated approach. In order to eliminate hydrological variations from year to year, averages of more than 1 year were used. Loads from point sources were obtained from monitoring data submitted by the German Federal States for municipal wastewater treatment

Table 3.11: Overview of source apportionment condicted by the Contracting Parties for PLC-4. (Under full source apportionment it is indicated whether the Contracting Parties have used retention to quantify the diffuse loads using a source apportionment approach. For unmonitored rivers, N is nitrogen and P is phosphorus; while + indicates that source apportionment has been performed, and – denotes that source apportionment has not been performed.).

Contracting Party	Full Source Apportionment Nitrogen	Full Source Apportionment Phosphorus	Source Apportion-ment unmonitored rivers	Point sources	Methodology used/reference
Finland	Y	Y	N (-) / P (-)	Monitored	PLC4/HELCOM 1998
Russia	N	N	N (-) / P (-)	Monitored[1]	PLC4/HELCOM 1998
Estonia	Y	Y	N (-) / P (-)	Monitored	PLC4/HELCOM 1998
Latvia	Y	Y	N (-) / P (-)	Monitored	PLC4/HELCOM 1998
Lithuania	Y	Y	N (+) / P (+)	Monitored	PLC4/HELCOM 1998
Poland	Y	Y	N (+) / P (+)	Monitored[2]	PLC4/HELCOM 1998
Germany	Y	Y	N (+) / P (+)	Monitored[3]	PLC4/HELCOM 1998, MONERIS/Behrendt et al. (2003)
Denmark	Y	Y	N (+) / P (+)	Monitored	PLC4/HELCOM (1998), Svend-sen (2002)
Sweden	Y	N	N (+) / P (+)	Monitored	TRK model/ Brandt & Ejhede (2002)

1 Only some major point sources monitored.
2 Largest 3000 point sources monitored; remain-ing point source loads estimated/ calculated.
3 MWWTP >=10000 PE are monitored; MWWTP <10000 PE calculated on the basis of the numbers of people connected and the treatment method.

plants (MWWTP) larger than 10000 PE for the year 2000, and from calculations for all MWWTP <10000 PE based on the number of inhabitants connected and the treatment method.

In **Poland** only selected point sources have been monitored, so theoretical values for the total point source discharges have been used in the source apportionment. An additional problem is that in some areas of Poland very high values have been used for natural background losses, making estimates of agricultural loads quite uncertain.

Russia has not estimated retention. Loads from diffuse sources are estimated by deducting the estimated loads from point sources and natural background losses from the total riverine loads. This methodology only gives a lower estimate for agricultural discharges.

Sweden has not estimated phosphorus reten-tion in the river system. Source apportionment has therefore been conducted on the basis of gross loads to inland surface waters calculated using the TRK (Transport, Retention and Source Apportionment) model (Brandt & Ejhede, 2002) in combination with monitored riverine loads. Nitrogen retention in inland surface waters was also calculated with the TRK model, according to the methodology recommended in the PLC-4 guidelines.

3.6 Quantification methods used for nutrient retention

In the context of PLC-4, nutrient retention is defined as the more permanent removal of phosphorus and nitrogen from inland surface waters of river systems, such as rivers, lakes, riparian areas and flood plains. Several processes are involved in retention, including denitrification, ammonia volatilisation, adsorption to river and lake bed sediments, and nutrient sedimentation in rivers and riparian areas. Biological processes are the most important for nitrogen retention, while physical processes are dominant in phosphorus retention. These processes can significantly reduce the nutrient loads entering the Baltic Sea. It should be noted that the retention rates in some river systems are negative, where lakes receive phosphorus inputs through leaching from bottom sediments.

Since nutrient retention rates vary considerably over a year, they are expressed as averages over a year or longer periods. Retention is a function of temperature, and of the physical characteristics of rivers and lakes, such as the residence time (for lakes) and specific runoff rates, hydraulic loads and bottom characteristics (for rivers). Many of these parameters are difficult to measure, and therefore difficult to incorporate into calculation procedures. In general, nitrogen retention is more influenced by biological processes, whereas phosphorus retention is more influenced by sedimentation processes.

It is important that retention is taken into account, otherwise diffuse sources within the source apportionment will be underestimated.

The PLC-4 guidelines describe and recommend three types of methodology, although other methods may also be acceptable. The guidelines recognise that it is difficult to fully harmonise the methods used to calculate nutrient retention in

Contracting Party	Nitrogen retention	Phosphorus retention	Retention estimates for each monitored river	Retention in lakes (L)/ rivers (R)/ river systems (S)	Retention assigned to	Methodology used/reference
Finland	Y	Y	Y[1]	S[3]	Diffuse sources	PLC4/HELCOM 1998
Russia	N	N	N	-	Not quantified	PLC4/HELCOM 1998
Estonia	Y	Y	Y	S[3]	Diffuse sources	PLC4/HELCOM 1998
Latvia	Y	Y	Y	S[3]	Diffuse sources	PLC4/HELCOM 1998
Lithuania	Y	Y	Y	L	Diffuse sources	PLC4/HELCOM 1998
Poland	Y	Y	n.i	n.i.	Diffuse sources	PLC4/HELCOM 1998
Germany	Y	Y	Y	S[3]	All sources	PLC4/HELCOM 1998, MONERIS/Behrendt et al. (2003)
Denmark	Y	Y	Y	L”	Agriculture	PLC4/HELCOM 1998 and Svendsen (2002)
Sweden	Y	N	Y[4]	L, R, S[4]	All sources	TRK model/ Brandt & Ejhede (2002)

Table 3.12: Overview of retention methodologies adopted by the Contracting Parties (CPs) for PLC-4. Not all CPs have estimated retention for all monitored rivers. Some CPs distinguishes between retention in lakes (L) and rivers (R), while others estimate retention totals for river systems (S). Y = yes, N = no.

1 Only estimates for large rivers.
2 Retention in rivers is of minor importance compared with lake retention.
3 This approach is identical to PLC4/Helcom 1998, but has been expanded with the addition of an equation for total nitrogen.
4 Only valid for nitrogen.
n.i. No information

inland surface waters. The three recommended methods are:

1. Models of nutrient retention based on the mass balances of river systems (including both rivers and lakes) and hydraulic loads as describe in Annex 1 of the PLC-4 guidelines; exemplified by the German methodology (MONERIS),
2. Models of nutrient retention based on the mass balances of lakes and transformations of these findings to cover whole river systems, as described in Annex 2 of the PLC-4 guidelines; exemplified by the Danish methodology for lakes,
3. In-situ measurements or other types of measurements which provide retention coefficients for nitrogen removal in streams and rivers.

Further representative values (retention coefficients obtained from other regions or countries) may also be applied.

According to the PLC-4 guidelines nutrient retention rates should be estimated for each monitored river and for unmonitored catchment areas and coastal areas, while each Contracting Party should also provide a total estimate.

Retention in nature affects both loads from point sources and loads from diffuse sources, including natural background losses. It is difficult to divide retention according to these different sources. The methodology applied in Sweden for nitrogen retention allocates retention in river systems according to loads from different sources. In Germany, retention approaches for both nitrogen and phosphorus are applied for point and diffuse sources within individual catchment areas. In the remaining Contracting Parties where retention is accounted for, retention in river systems is assigned to nutrient losses from diffuse sources.

In PLC-4, retention in soils and groundwater is only taken into account in the source-orientated approach. In the load-orientated approach, retention is only quantified within river systems. This means for agricultural loads that mineral balances and losses from the root zone cannot be used to estimate agricultural nutrient losses entering river systems, since these quantities need to be reduced to account for retention in soils, groundwater, etc, as described in the source-orientated approach (chapter 3.2).

A summary of the retention methodologies applied is given in table 3.11, followed by brief descriptions of the procedures adopted by the Contracting Parties. The nutrient retention results are shown in chapter 5.2.

The application of the retention approach within the model MONERIS is independent of any time scale for discharges from point sources and losses from diffuse sources, so it could be applied for a year or longer.

Denmark

In Denmark, retention rates in river systems were estimated using a combination of monitored mass balances for approximately 25 lakes which were intensively monitored in 2000, and method 2 from the PLC-4 guidelines. Previous Danish investigations have shown that permanent nitrogen and phosphorus removal in river channels only plays a minor role, although temporary retention is occasionally of importance for phosphorus, and that consequently most retention takes place in lakes (Svendsen et al. 1995). Retention rates are calculated for every monitored river, and for unmonitored and coastal areas.

Estonia

Estonia has generally used the German methodology proposed in the PLC-4 guidelines and applied in the MONERIS model (Behrendt & Opitz, 1999), although Estonian specific coefficients are applied. A nitrogen retention coefficient (R_N) and a phosphorus retention coefficient (R_P) were calculated as follows:

$$R_N = 41{,}456 \cdot Q^{-1{,}297} \cdot C_N^{-0{,}542}$$

$$R_P = 4.7 \cdot ((Q \cdot 86{,}4 \cdot 0{,}365) / A_S)^{-0{,}76}$$

where

Q = run-off in l s^{-1} km^{-2}

C_N = mean nitrogen concentration in the river system in g/m^3

A_S = area of inland surface waters in km^2.

Retention was calculated as a five-year average.

Finland

Retention is estimated from mass balance calculations. Retention rates are only calculated for large rivers and for the whole catchment area for minor river systems. Retention is calculated using data for 1990 to 1999. Retention is calculated as:

$$R = LO_{IN} + (LO_P + LO_{AG} + LO_{AD} + LO_{FO} + LO_{SD} + LO_B) – LO_{OUT},$$

where

LO_{IN} and LO_{OUT} denote incoming and outflowing riverine load

LO_P = load from point sources

LO_{AG} = load from agriculture

LO_{AD} = atmospheric deposition directly into lakes

LO_{FO} = load from forestry

LO_{SD} = load from scattered dwelling

LO_B = natural background losses.

It is assumed that retention in smaller unmonitored catchment areas and coastal areas is only of minor importance as these areas have few lakes.

Germany

Germany has developed an empirical model for calculating retention in rivers systems (Behrendt & Opitz, 1999) as a part of the MONERIS methodology (Behrendt et al., 2000). Based on data for nutrient discharges/losses and loads in 100 catchment areas with catchment areas between 100 km^2 and 200000 km^2, an empirical model for the retention of nitrogen (R_N) and phosphorus (R_P) was derived in relation to the specific run-off (q) or the hydraulic load (HL) in the catchment area. Retention is thus expressed as:

$$R_{L\,N,P} = a \cdot x^b, \qquad \textbf{(7)}$$

where

$R_{L\,N,P}$ = load-weighted retention of nitrogen and phosphorus, respectively

X = q – specific runoff [l/(km²·s)] or HL – hydraulic load [m/a]

a , b = model coefficients.

The values of a and b are based on a total of 100 river systems for nitrogen and 89 river basins for phosphorus.

The model's application for nitrogen accounts for dissolved inorganic nitrogen as well as total nitrogen. In estimating nitrogen retention, the dependence of retention on the hydraulic load was the only factor used. For Phosphorus, the mean of the retention according to the specific run-off and hydraulic load was applied (see Table 3.13).

The model is calibrated for several river systems, based on typical five-year averages according to periodic estimates made for point and diffuse sources, with the most recent period being 1998-2000.

Latvia

Latvia has also generally used the German methodology proposed in the PLC-4 guidelines, as well as equations in the MONERIS model (Behrendt & Opitz, 1999). A nitrogen retention coefficient (RN) and a phosphorus retention coefficient (RP) were calculated as follows:

$$R_N = 6.3 \cdot ((Q \cdot 86{,}4 \cdot 0{,}365) / A_S)^{-0{,}78}$$

	All river basins		river basins < 1000 km²		rivers between 1000 and 10000 km²		river basins > 10000 km²	
x	q	HL	q	HL	q	HL	q	HL
Phosphorus								
r^2	0.8090	0.6148	0.7529	0.5785	0.7988	0.5884	0.8765	0.6879
n	89	89	29	29	32	32	28	28
a	26.6	13.3	41.4	57.6	21.7	9.3	28.9	26.9
b	-1.71	-0.93	-1.93	-1.26	-1.55	-0.81	-1.80	-1.25
Dissolved Inorganic Nitrogen								
r^2	0.5096	0.6535	0.3936	0.4423	0.5763	0.6607	0.4548	0.7373
n	100	100	33	33	35	35	32	32
a	6.9	5.9	3.5	3.3	5.8	4.4	7.9	10.9
b	-1.10	-0.75	-1.01	-0.65	-0.96	-0.62	-1.03	-0.94
Total Nitrogen								
r^2		0.521						
n		56						
a		1.9						
b		-0.49						

Table 3.13:
Results of regressions between the nutrient retention per load (RL) of river systems and the specific run-off (q) and the hydraulic load (HL) for the investigated river systems (according to Behrendt & Opitz, 1999 and Behrendt et al., 2000)

1) results modelled according to Equation (7)

$R_P = 4.7 \cdot ((Q \cdot 86{,}4 \cdot 0{,}365) / A_S)^{-0{,}76}$
where
Q = run-off in m^3/S^{-1}
A_S = area of surface waters in km^2
$A_S = A_{lake} + 0.001 \cdot A^{1.185}$, where A_{lake} is the lake area in km^2 and A is the catchment area in km².

Retention was calculated for the year 2000 for both point source discharges and diffuse losses.

Lithuania

Total figures have been provided for nitrogen and phosphorus retention over the Lithuanian catchment area of the Baltic Sea. No information was provided on the methodology applied. Retention in lakes was calculated according to a mass balance method:

$RETENTION = (L_{in} - L_{out})/1000F$,
where
L_{in} – inflow to the lake (kg/year);
L_{out} – outflow to the lake (kg/year);
F – area of the lake (km^2).

Retention is calculated as a seven year average for nitrogen and is calculated for the year 2000 for phosphorus.

Poland

Total figures have been provided for nitrogen and phosphorus retention over the Polish catchment area of the Baltic Sea. Poland used in general the German methodology.

Russia

Russia has not estimated retention in river systems.

Sweden

Retention rates in river systems are calculated with the TRK (Transport, Retention and Source Apportionment) model, but only for nitrogen. A total figure for phosphorus retention has been provided for the whole Swedish catchment area, calculated from equation (1) in chapter 3.5.

The TRK model simulates nitrogen transport and retention in groundwater, rivers, lakes and at the catchment scale, with the HBV-N model (Arheimer and Brandt, 1998). The model mixes soil leakages from different land uses with discharges from rural households into groundwater. Nitrogen retention is calculated in lakes and rivers, with lakes being of primary importance. Routine processes are included to model denitrification, sedimentation and the biological uptake of inorganic nitrogen. The modelling also allows for the retention of organic nitrogen due to sedimentation and mineralisation, and takes into account increases in the concentration of organic nitrogen due to biological production. These processes are simulated with simple conceptual functions, and calibrated against observed time-series. The nitrogen retention rates are then normalised by calculating averages obtained over 10 to 20 years of daily modelling. More details about the TRK model are given in Brandt & Ejhed (2002).

4 Analytical methods and quality assurance

4.1 Analyses and method description

4.1.1 Analyses

4.1.1.1 Obligatory and non-obligatory

The variables to be reported were classified as obligatory or voluntary according to the pollution source, also taking into account detection limits in different water flows (PLC-4 guidelines, 1999). Most variables were obligatory in analyses of point sources and in river monitoring. Determinations of TOC, COD_{Cr} and AOX were mainly voluntary. Determination of mineral oil was included in the PLC programme for the first time. Oil measurements were obligatory in large rivers as nominated beforehand, and at the largest oil refinery in each Contracting Party.

4.1.1.2 Availability of results

Certain data was missing from the information submitted by the Contracting Parties. Only a few results were available for Cr, Ni, Hg and TOC in Poland. TOC was determined in Denmark, Germany, Finland, Sweden and partly in Poland. Estonia, Latvia, Lithuania and Poland were not able to carry out AOX analyses, due to a lack of equipment in 2000. Finland was not able to provide data on Hg in rivers in 2000, due to the lack of proper equipment for analysis of low Hg concentrations, although some Hg results subsequently obtained in 2001 were reported. Some Contracting Parties provided data on mineral oil in rivers and at their largest oil refineries.

Table 4.1:
Number of laboratories providing data for PLC-4.

Contracting Party[1]	Rivers and diffuse sources	Point sources
Estonia	2	6
Finland	20	50
Germany	1	1
Latvia	1	24
Lithuania	2	9
Poland	48	263
Russia	3	45
Sweden	1	25

[1] In Denmark a total of 20 laboratories have provided data for PLC-4.

4.1.2 Analytical methods

4.1.2.1 Variability of the methods applied, and correspondence with the PLC-4 guidelines

A total of about 500 laboratories were involved in PLC-4 (Table 4.1), so analytical methods inevitably varied somewhat within and between different Contracting Parties (Annex 1). The concentrations to be determined also varied between the Contracting Parties, along with their respective abilities to detect low concentrations.

The PLC-4 guidelines presented descriptions and recommendations for the determination of different variables. In particular, instructions for avoiding possible errors were presented. The indophenol blue method was recommended for the determination of ammonia levels, while cadmium reduction methods were favoured for the determination of nitrate concentrations. However, the Nessler method was still used for determination of ammonia in some Polish and Russian laboratories, while a salicylate method was used for determination of nitrate in some Latvian, Polish and Russian laboratories (Annex 1).

It was recommended that mineral oil should be measured using the GC-method, ISO 9377 (EN ISO 9377-2, 2000), which was duly used in determination of mineral oil in the rivers Kymijoki, Daugava, Narva and Vistula and at the largest oil refineries in Estonia, Latvia and Poland and Russia. The Russian GC-method is based on extraction in carbontetrachloride. The IR-method was used in determination of mineral oil in the river Nenumas and Narva as well at the Finnish, Lithuanian and Latvian oil refineries. The IR-method can provide different mineral oil content compared with the GC-procedure, however. Mineral oil was measured at least twice a year at the various sampling locations.

In Denmark, Poland and Russia, BOD_5 was measured, even though the PLC-4 guidelines required BOD_7 determination. Wherever BOD_5 levels were reported, they have been converted to BOD_7 using a factor of 1.15.

A variety of pre-treatment and measurement techniques were also used to determine metal concentrations. In Germany, all samples were digested with acid before measurement of their metal contents, allowing the total metal content of the water to be determined. Depending on the sample type, digestion pre-treatment procedures or other methods to determine the acid-soluble fraction were used before metals were analysed in Finland, in Latvia and in Poland. Particularly where organic matter contents are high, the digestion of samples can also leach away some metals bound to organic matter. These methods thus indicate higher metal contents than those determined with an acid-soluble fraction.

Analytical methods particularly appeared to correspond rather well to the PLC-4 guidelines for the determination of organic variables (BOD, COD_{Cr}, AOX and TOC), phosphate and total phosphorus, total nitrogen and heavy metals (Cd, Cr, Cu, Ni, Pb and Zn). Analytical methods varied more when analysing wastewater than when analysing river water. Wastewater samples were analysed at many laboratories, particularly in Finland, in Poland and in Russia; whereas the analysis of river water was centralised at just a few laboratories by each of the Contracting Parties, except Finland and Poland (Table 1).

Analytical methods have improved since PLC-3. Internationally standardised methods (CEN, ISO) and validated analytical methods have been more widely used than before. The laboratories in some of the Contracting Parties (Estonia, Latvia, Lithuania and Poland) have been able to use new, more appropriate equipment and facilities than during the previous stages of PLC.

4.1.2.2 Detection limits

Detection limits depend both on the sensitivity of the analytical method applied, and on the capabilities of the individual laboratory. Detection limits varied considerably between the Contracting Parties (Annexes 2a and 2b).

Detection limits are of great importance in the analysis of river water. Concentrations of many variables are, in general, lowest in rivers in the Nordic countries. In Finland and Sweden it is necessary to use highly sensitive methods as widely as possible, e.g. in determination of mercury and metals.

Detection limits particularly varied in analyses of mercury, metals and nitrogen compounds in river water (Annex 2a). Detection limits in wastewater could even vary within single Contracting Parties, when several laboratories were involved in PLC-4 (Annex 2b). In assessing wastewater, laboratories used methods valid for their specific purposes. It was not necessary, for instance, to use highly sensitive methods to determine ammonia levels in municipal wastewater if ammonia concentrations were several milligrams per litre.

To evaluate the PLC-4 data, according to the PLC-4 guidelines, for results below detection limits, load estimates have been conducted with the assumption that real concentrations amounted to half the detection limits. Where detection limits were fairly high, these load estimates might end up being much higher than the actual loads.

4.1.2.3 Measurement uncertainty

The PLC-4 guidelines also describe measurement uncertainty. Measurement uncertainty characterises the range of values within which the true value lies, with a certain probability. This uncertainty expresses the reliability of the measurement results. However, the evaluation of measurement uncertainty still seems to be under development in many Contracting Parties, as it is in many other parts of the world.

In environmental analyses, concentrations of variables often vary, and measurement uncertainty depends also on concentrations. Measurement uncertainty is generally highest when determining concentrations, as has been shown by the uncertainty estimations reported by Finnish laboratories (Annexes 3a and 3b). Uncertainties were particularly high in determinations of low Cd and Hg concentrations, and when determining concentrations of mineral oil. Measurement uncertainties also depend on the individual laboratory and the analytical method. The range of reported uncertainties was rather wide where several laboratories within a single Contracting Party where involved in PLC-4.

4.2 Quality assurance

4.2.1 Accreditation of analytical methods

In Denmark, Sweden and Latvia, it is assumed that the data provided to the environmental authorities has been obtained by laboratories using the accredited analytical methods. In other Contracting Parties, the implementation of a quality system for the accreditation of laboratories is under way, but not all laboratories have had their analytical methods accredited yet (Table 4.2). The German laboratory involved in PLC-4 also used accredited analytical methods. Accreditation is not yet mandatory in all Contracting Parties.

Table 4.2: Accredited laboratories in different Contracting Parties.

Contracting Party	Accredited laboratories
Denmark	All laboratories
Estonia	50% for river water, 17 % for wastewater
Finland	80% for river water, 40% for wastewater
Germany	Only one laboratory involved in PLC-4
Latvia	All laboratories
Lithuania	None
Poland	96% for river water, 21% for wastewater
Russia	All laboratories (Russian standard)
Sweden	All laboratories

4.2.2 Role of the national reference laboratories

National reference laboratories have had an important role in obtaining reliable PLC-4 data. They have provided training for the other national laboratories involved in PLC-4, in analytical methods, method validation, estimation of method uncertainty, quality assurance and accreditation. Furthermore, personnel from the national reference laboratories have participated in many international workshops organised within the frameworks of the EU-PHARE or EU-COPERNICUS programmes, for instance. Representatives from the Contracting Parties also participated in an ICES/HELCOM Workshop on Quality Assurance of Chemical Analytical Procedures for the COMBINE and PLC-4 programmes, held in Helsinki in 1999.

The national reference laboratories have also had the important task of organising inter-laboratory comparisons between the national laboratories involved in PLC-4.

4.2.3 Results of international and national inter-laboratory comparisons

An international inter-laboratory comparison was carried out to check the applicability of a new method for the determination of mineral oil by solvent extraction and gas chromatography before this method was adopted in routine monitoring within PLC-4. The results of this inter-laboratory comparison indicated that 11 of the 16 participating laboratories dealt with all the samples successfully (Woitke, P., 2001). Unsatisfactory results were mainly the consequence of interference from other substances present in samples. Within the framework of the PLC-4 programme, two Estonian and two Latvian laboratories participated in two Finnish inter-laboratory comparisons for analyses of metals, BOD, COD_{Cr}, AOX and TOC. The results were mainly satisfactory, and no systematic errors were discerned (Inter-laboratory comparison 1/1999, 1999 and Inter-laboratory comparison 4/1999, 2000). The reference laboratories have also participated in many other international inter-laboratory comparison tests, e.g. in tests organised within the framework of the IRMM/IMEP programme or other European programmes, as well as in the framework of the international programme “The Global Monitoring and Assessment of Water Quality”. Some Baltic laboratories have also participated in inter-laboratory comparisons organised by Nordic water and environmental laboratories (DHI, ITM, NIVA and SYKE).

The PLC-4 guidelines recommended that the national reference laboratories should carry out national inter-laboratory comparisons in order to monitor the performance of other laboratories in each Contracting Party. The PLC-4 guidelines also presented more specific recommendations for these purposes. Test materials were required to be as close as possible to the matrices of real samples, with concentration levels within samples comparable to the concentrations in the real samples collected for PLC-4. The national reference laboratories were asked to report the results of inter-laboratory comparisons conducted before PLC-4 (in 1999) and during PLC-4 (in 2000). Inter-laboratory comparisons were not necessary in Germany, because only one laboratory was involved in PLC-4. Similarly inter-laboratory comparisons were not necessary for the determination of heavy metals in Estonia and Lithuania, because only one or two laboratories were involved.

However, there were a few flaws in the way these inter-laboratory comparisons were carried out (Annex 4). Only artificial samples were distributed among Polish laboratories for analysis of metals and BOD. There were no samples for the analysis of nutrients in river water in Poland, for the analysis of low phosphorus contents (< 1 mg/l) in Latvia, or for the analysis of metals in Lithuania.

The concentrations of the variables in the samples distributed for the inter-laboratory comparisons varied between different Contracting Parties. Variations within the results of inter-laboratory comparisons can greatly depend on concentrations of a single variable, as can also be observed in the data on the inter-laboratory comparisons carried out for PLC-4 (Table 4.2). The distribution of artificial samples alone, or only of samples with high concentrations might lead to an overestimation of the performance of the participating laboratories. In the analysis of BOD and COD_{Cr}, the variations in the results were rather similar (Annex 4 and 5). The variations seen in the BOD results were highest in analyses of low concentrations (BOD < 10 mg/l). On the other hand, TOC and AOX measurements seemed to be more reliable analyses than those conducted for BOD or COD_{Cr}, although this conclusion is based on a limited amount of data, since few Contracting Parties have provided TOC data and AOX data for PLC-4.

In determination of nutrients, the variations within the Finnish results were smaller than for the other Contracting Parties, particularly where low concentrations were concerned (Annex 4 and 5). In general, results varied less for phosphorus compounds than for nitrogen compounds. Overall, the performance of the laboratories could be even better for the determination of all nitrogen compounds.

The concentrations of heavy metals in the samples distributed by different Contracting Parties varied considerably. Samples with low concentrations were distributed only in Finland, Sweden and Denmark, closely representing actual metal concentrations in rivers. In general, the variations in the results seemed to be less than 20% for high and intermediate concentrations, but were greater for lower concentrations of metals. In determination of Cd and Pb at concentration levels less than 1 µg/l the results varied by up to 37% and 39%, respectively. For the Finnish data obtained for determination of Hg at concentration levels less than 0.1 µg/l, results varied by 35%.

Table 4.3:
Summary of the relative standard deviations (RSD %) of the results from inter-laboratory comparisons[1].

Variable	RSD % at low concentrations[2]	RSD % at high concentrations[2]
BOD	4-36	7-26
COD_{Cr}	4-23	2-16
AOX	2-13	2-7
TOC	3-21	4-18
NH_4-N	6-34	3-27
NO_3-N	4-35	3-22
N_{total}	5-25	1-27
PO_4-P	3-31	2-21
P_{total}	3-33	3-22
Metals	3-39	4-28
Hg	35	8-20

[1] Russian laboratories participated in national inter-laboratory comparisons, but the results are not yet available.
[2] These results are presented in more detail in Annex 4.

4.2.4 Comments on reliability of the data

The Contracting Parties were asked to report their criteria for satisfactory performance for the laboratories assessed in the national inter-laboratory comparisons. However, these criteria varied considerably between different Contracting Parties, e.g. in determination of BOD, a criterion of 20% was used in Finland, but variations as high as 45-60% (at 95% confidence interval) were accepted within criteria applied by some Contracting Parties, where these criteria were based on the standard deviations of the data. This meant it was not possible to draw very detailed conclusions about the performances of the laboratories in the different Contracting Parties. Furthermore, information about the Russian inter-laboratory comparisons was missing, so no conclusions can be drawn on the quality of the Russian data.

There have been some problems related to the carrying out of the national inter-laboratory comparisons. Information about the variation of the results was not available for each variable, or information covered different concentration levels, representing the real ranges of sample variation in each Contracting Party. Results from the national inter-laboratory comparisons indicate that variation was generally less than 25% at high or intermediate concentrations of variables, but that in determination of low concentrations variation seemed to be up to 30-40%. Fairly few laboratories have been involved in determining low concentrations in river water. Variations of the results within a single laboratory or between a few laboratories are generally smaller than the variations between several laboratories. River data may therefore be more reliable than the data obtained for waste water, especially if laboratories have also been able to analyse satisfactorily low concentrations. Furthermore, most of the laboratories involved in determination of river water used accredited analytical methods, and were also able to participate in international inter-laboratory comparisons.

In general, the laboratories involved in PLC-4 performed regular internal laboratory quality control procedures, even if they were not able to participate in inter-laboratory comparisons for each variable. The number of laboratories using accredited analytical methods has also increased since PLC-3. Overall, the laboratories have worked towards improving data quality for PLC-4. Based on a comparison of the results obtained in the national inter-laboratory comparisons carried out for PLC-3 and PLC-4, notable improvements have been obtained in quality of the data used in this PLC-4 report. The variations within the results of the inter-laboratory comparisons have generally decreased since PLC-3, even though the more problematic low concentrations were compared more often for PLC-4 than for PLC-3.

4.3 Conclusions

The PLC-4 guidelines presented descriptions and recommendations for the determination of variables. Analytical methods appear to correspond rather well to the Guidelines in the determination of organic variables (BOD, COD_{Cr}, AOX and TOC), phosphate and total phosphorus, total nitrogen and heavy metals. Analytical methods varied more in determination of the samples collected from point sources than in determination of river water samples, due to the large number of laboratories involved in determination of wastewater. Internationally standardised methods (CEN, ISO) have been more commonly used, and some laboratories have been able to use new, more suitable equipment and facilities than were used in previous stages of PLC.

A total of about 500 laboratories were involved in the PLC-4 programme. The major issue at stake is ensuring good data quality from each laboratory, when so many laboratories are involved. Besides using validated analytical methods and internal laboratory quality control procedures, participation in inter-laboratory comparisons is important to ensure the accuracy and comparability of results. The results based on the national inter-laboratory comparisons showed improvements in the quality of the data. However, detailed conclusions about the performance of the laboratories in different Contracting Parties could not be drawn on the basis of the inter-laboratory comparisons, because the criteria for accepting the results varied so much between the different Contracting Parties. This means that detailed discussion will be needed before the next stage of PLC on analytical quality requirements and procedures for carrying out national inter-laboratory comparisons.

Detection limits also varied considerably between the Contracting Parties. Because problems arise with the evaluation of data reported below detection limits, it could be reasonable to set new requirements for detection limits for future stages of PLC, particularly for determination of loads in river water.

The evaluation of measurement uncertainty is still under development in many Contracting Parties. At present, many laboratories are still not able to report measurement uncertainties, particularly if they do not use accredited analytical methods.

Mineral oil inputs were measured for the first time within PLC. Before the start of PLC-4 an international inter-laboratory comparison was carried out. The results of this inter-laboratory comparison indicated that most laboratories processed all the samples successfully. However, further inter-laboratory comparisons should still be performed in the future.

5 Results in 2000

The impact of organic matter on the marine environment is a major concern. As early as the 1920s efforts were made to monitor oxygen depletion in waterbodies, since a lack of oxygen creates problems in some open sea areas. This is evident particularly in stagnant bottom layers in deep parts of the sea as well as in some coastal zones. The main problem in the Baltic Sea Area, however, is the nutrient load. Since the turn of the century, the Baltic Sea has changed from an oligotrophic clear-water sea into a highly eutrophic marine environment. (Larson, 1985). The deterioration of the Baltic Sea is also alarming in many of its sub-regions, since they have become overloaded with nutrients. Nitrogen and phosphorus as such do not pose any direct hazards to marine organisms or people, but excessive nutrient inputs may disturb the balance of the ecosystem. Intense primary production has resulted in high concentrations of nitrogen and phosphorus, and led to the proliferation of algae blooms, especially the blue-green variety, in the Baltic Sea. When these numerous algae colonies die and sink to the sea bed, their decomposition consumes excessive amounts of oxygen. The abundance of toxic algae populations has also increased, adding to the problem. Environmental problems in the Baltic Sea have also been aggravated by the presence of heavy metals such as mercury and cadmium, which have been shown to have harmful effects on aquatic life when accumulated over a period of time. The fate of such heavy metals when they finally come into contact with seafloor sediments, which are a habitat for many animal and plants, is another cause for concern.

This chapter summarises the principal results based on the data collected during PLC-4 with respect to waterborne load figures for the year 2000. The intention is to first present the results for the waterborne discharges/losses into inland surface waters within the Baltic Sea catchment area on the basis of the source-orientated approach (chapter 5.1). Chapter 5.1 is further divided into sub-chapters, which contain data on the waterborne discharges from point sources in the Baltic Sea catchment area (5.1.1), the nutrient losses from diffuse sources into inland surface waters (5.1.2), figures on natural background losses (5.1.3) and the total nutrient losses and discharges from point and diffuse sources into inland surface waters in the Baltic Sea catchment area (5.1.4). Chapter 5.2 presents the data collected on waterborne inputs entering the marine area according to the load-orientated approach. This data comprises information on point sources discharging directly into the Baltic Sea (5.2.1), and riverine inputs (5.2.2) as well as the load from unmonitored coastal areas (5.2.3). Finally, a source apportionment for the riverine load is presented (5.2.5), including figures on nitrogen and phosphorus retention in inland surface waters in the Baltic Sea catchment area (5.2.4). It should be noted that all results presented refer only to waterborne inputs, and that atmospheric inputs are not taken into account, except the for atmospheric deposition on inland surface waters included in the source-orientated approach.

5.1 Discharges and losses into inland surface waters within the Baltic Sea catchment area in 2000 (Source-orientated approach)

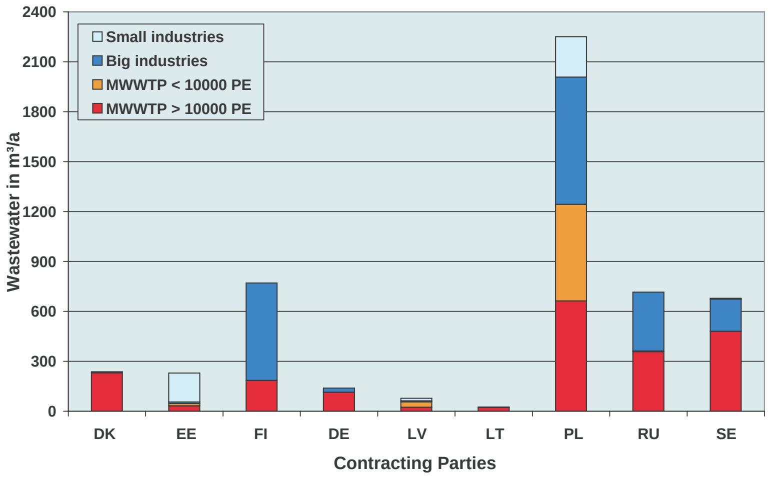
5.1.1 Discharges from point sources within the Baltic Sea catchment area in 2000

5.1.1.1 General information

PLC-4 assesses nutrients, organic matter and heavy metal discharges from point sources, such as municipalities, industrial plants and fish farms of the entire Baltic Sea catchment area within the borders of the Contracting Parties. It is the first time that an inventory of all point sources located in the Baltic Sea catchment area was performed. In this regard, and to satisfy the requirements of the PLC-4 guidelines, Contracting Parties collected information about selected obligatory substance pollutions presented in Table 1.1.

The results presented in this chapter refer to 585 municipal wastewater treatment plants with more than 10000 PE (Population Equivalents), 2180 small MWWTP, 200 large industrial plants, 1085 small industrial plants and 207 large fish farms located in the Baltic Sea catchment area. However, it should be clearly understood that **this point source inventory for 2000 for the entire Baltic Sea catchment area located within the borders of the Contracting Parties is far from complete**. Many figures relating to organic matter, nutrients and heavy metal discharge have not been submitted by some of the Contracting Parties. These figures have not been submitted for fish farms in particular, but also for small municipalities and industrial plants (Tables 5.5 to 5.24 in Annex 6). It is also important to point out that no data were reported for point source discharges in the Lithuanian (11140 km²) and Russian (23700 km²) catchment area of the Gulf of Riga. Additionally, no information was provided for the countries that are not Contracting Parties of HELCOM but whose catchment areas are part of the Baltic Sea catchment area, so that point source discharge data covering an area of 117520 km² is completely missing.

Figure 5.1: Wastewater discharged into inland surface waters within the Contracting Parties' Baltic Sea catchment area in 2000.



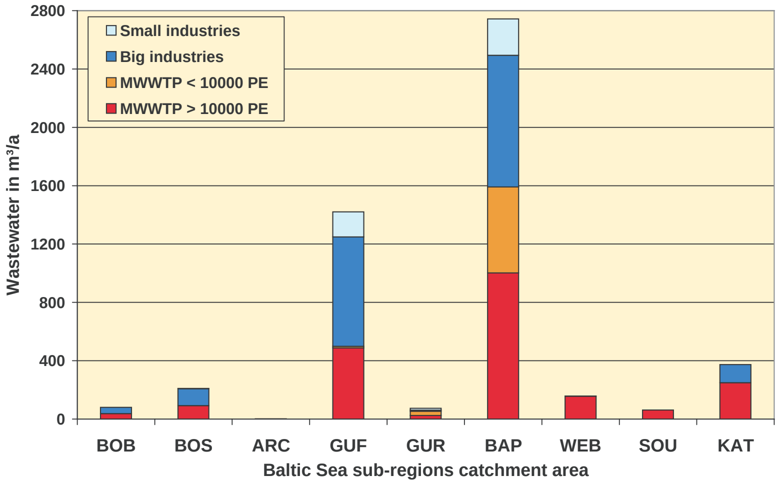


Figure 5.2: Wastewater discharged into inland surface waters within the sub-regions' Baltic Sea catchment area in 2000.

5.1.1.2 Wastewater discharge within the Baltic Sea catchment area

Wastewater discharges from point sources into inland surface waters in the Baltic Sea catchment area reported during PLC-4 were 5120 million m³/a. This figure was divided almost, equally between the wastewater outflows from municipalities and from industrial plants. The quantity of wastewater from fish farms could not be analysed due to insufficient information from nearly all of the Contracting Parties. The lack of data in this area was partly explained by the fact that the methodologies used in many Contracting Parties to estimate BOD and nutrient discharges were based on feed consumption, where the wastewater discharge is of no importance. Figures 5.1 and 5.2 show the distribution of the reported quantity of wastewater discharged into inland surface waters by municipalities and industrial plants for each Contracting Party and sub-region, respectively.

Untreated wastewater discharged into inland surface waters in the Baltic Sea catchment area amounted to approximately 340 million m³/a, from which untreated municipal wastewater discharge contributed 270 million m³/a. More than 250 million m³/a originated in Saint Petersburg and in the Leningrad region of Russia – areas with a total population of more than 6 million residing within the Gulf of Finland catchment area. The remaining 20 million m³/a of untreated municipal wastewater discharge emanated from the Russian Kaliningrad Region (10 million m³/a), Estonia (5.2 million m³/a), Latvia (4.7 million m³/a) and Lithuania (0.3 million m³/a) in the Baltic Proper, the Gulf of Riga and the Gulf of Finland catchment areas. None of the other Contracting Parties discharged untreated municipal wastewater into inland surface waters. Compared to the corresponding wastewater discharge from municipalities, untreated industrial wastewater discharges into inland surface waters in the Baltic Sea catchment area was negligible, and amounted to 71 million m³/a, which is less than 0.2% of the total wastewater discharges. 54 million m³/a of the untreated industrial discharges emanated from the Polish catchment area, while the remaining untreated industrial discharges originated in the Estonian, Danish, Russian and Latvian Baltic Sea catchment areas.

In 2000 the reported amount of **municipal wastewater discharge into inland surface waters** within the Baltic Sea catchment area was 2750 million m³/a, originating from a total of 2765 municipalities with roughly 31 million inhabitants. Approximately 580 municipal wastewater treatment plants (MWWTPs) with more than 10000 PE (Population Equivalents) produced nearly 2115 million m³/a wastewater. The wastewater discharges from 2180 small municipalities was only 45 million m³/a, or some 2% of the total municipal wastewater discharge in the Baltic Sea catchment area (Tables 5.3 and 5.4 in Annex 6).

In the Baltic Proper catchment area, the majority of municipal wastewater came from 276 MWWTPs with more than 10000 PE, and which treated 1000 million m³/a of wastewater. The second largest proportion of municipal wastewater, 490 million m³/a, was produced by 71 MWWTPs with more than 10000 PE and located in the Gulf of Finland catchment area. The municipal wastewater discharges from 150 MWWTPs with more than 10000 PE situated in the catchment areas of the Kattegat and the Western Baltic amounted to 250 million m³/a and 160 million m³/a, respectively. The municipal discharges in the Bothnian Sea and the Sound catchment areas amounted to approximately 90 million m³/a and 60 million m³/a, respectively. The largest municipal discharges from MWWTPs with more than 10000 PE originated in Poland (660 million m³/a), Sweden (480 million m³/a) and Russia (360 million m³/a), whereas the lowest discharges were observed in Lithuania and Latvia, in each case roughly 24 million m³/a.

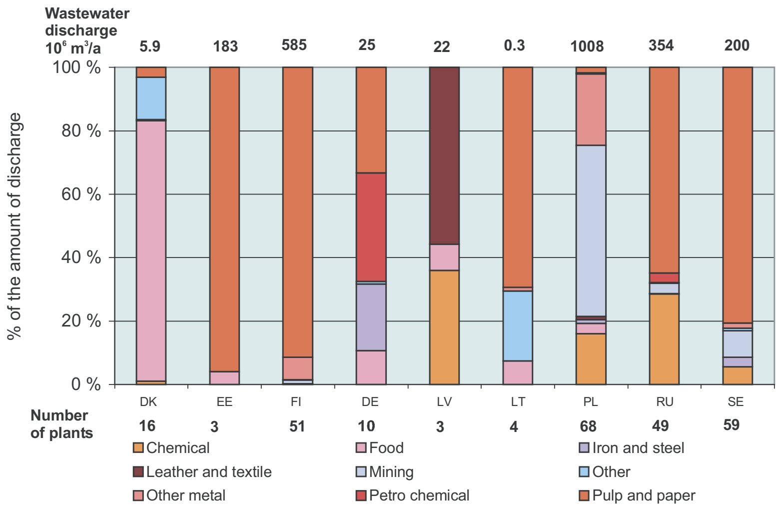
In Denmark, Germany, Finland and Sweden all municipal effluents were treated in municipal wastewater treatment plants. Nearly all of these plants used mechanical, chemical and biological treatment methods with phosphorus removal rates of between 80% and 97%. In the Danish and German plants, nitrogen removal occurred, with elimination rates between 70% and 99%. At the plants in Finland and Sweden, the nitrogen removal rate was generally less than 50%, except in some plants where the nitrogen removal rate reached 70%. The phosphorus removal rate in two of the Estonian plants was over 80%, while in Lithuania 34% of municipal wastewater treatments plants used biological treatment methods, achieving nitrogen removal rates of more than 75%.

During 2000, 274 large and 1085 small **industrial plants** within the Baltic Sea catchment area discharged 2380 million m³/a wastewater into inland surface waters. More than 70 million m³/a of this amount was untreated wastewater discharged by 23 industrial plants. Although only 4 of these plants are located in the Polish catchment area, they account for the vast majority of untreated wastewater - 54 million m³/a. 15 Russian industrial plants produced 2 million m³/a while the Estonian and Danish plants each discharged 7 million m³/a untreated wastewater.

The largest quantity of industrial wastewater, 900 million m³/a, was discharged by 110 large-scale industrial plants into inland surface waters of the Baltic Proper catchment area. Additionally, 610 small industrial plants produced 250 million m³/a wastewater within the Baltic Proper catchment area. In the Gulf of Finland catchment area almost the same amount of industrial wastewater was produced by 48 large (750 million m³/a) and 250 small industrial plants (170 million m³/a). These figures indicate that 87% (1810 million m³/a) of industrial wastewater was discharged into inland surface waters of the Baltic Proper and the Gulf of Finland catchment areas. Industrial wastewater discharges into surface waters of the catchment areas of the Archipelago Sea, Sound and Western Baltic were found to be negligible - approximately 3 million m³/a. The distribution of industrial wastewater produced by the nine branches of industry considered in PLC-4 is given in Figure 5.3 by Contracting Party and in Figure 5.4 by sub-region.

The majority of the industrial wastewater discharge, 990 million m³/a, was produced by 95 **pulp and paper and other wood processing industrial plants** located in Sweden, Finland,

Figure 5.3: Distribution of industrial wastewater discharge into inland surface water within the Baltic Sea catchment area by branch of industry and by Contracting Party in 2000.



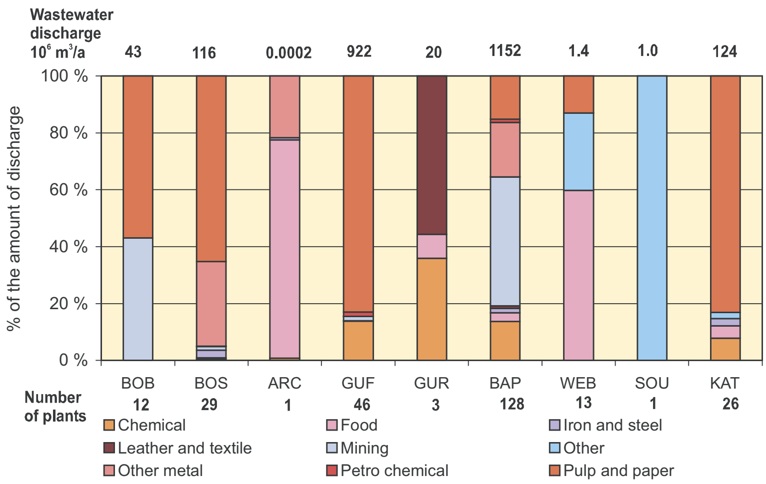


Figure 5.4: Distribution of industrial wastewater discharge into inland surface water within the Baltic Sea catchment area by branch of industry and by sub-region in 2000.

Russia, Poland, Estonia and Germany, Denmark and Estonia. Of this figure, the Danish and Estonian pulp and paper plants contributed 9.6 million m^3/a wastewater. The main wastewater discharge by this branch of industry originated from 33 Finnish (535 million m^3/a), 10 Russian (230 million m^3/a) and 37 Swedish (194 million m^3/a) pulp and paper plants. The second largest amount of industrial wastewater, 450 million m^3/a, was discharged by 25 plants in the **mining and metal enrichment industry**, with 11 Polish plants producing 410 million m^3/a. The remaining wastewater was discharged by similar industrial plants in Sweden (9 plants, 20 million m^3/a), Russia (1 plant, 11 million m^3/a) and Finland (4 plants, 7 million m^3/a). Wastewater discharges from 23 **chemical industry** plants amounted to 240 million m^3/a. Of this figure 120 million m^3/a emanated from 8 Polish plants and 100 million m^3/a from 7 Russian plants. 22 **non-ferrous metal plants** discharged 220 million m^3/a wastewater into inland surface waters, with 170 million m^3/a produced by 10 Polish plants, and 40 million m^3/a by 7 plants situated in Finland. In all Contracting Parties except Estonia, a total of 45 plants producing 35 million m^3/a wastewater discharged into inland surface waters within the Baltic Sea catchment area operating in the **food processing industry**. The largest quantity of wastewater from the food processing industry, 25 million m^3/a, was discharged from 16 Polish plants, 6 Danish plants (5 million m^3/a) and 4 German plants (2.5 million m^3/a). Industrial facilities in Finland, Russia and Latvia contributed less than 1 million m^3/a. 4 **petrochemical plants**, produced 22 million m^3/a of wastewater; of this amount, 11 million m^3/a was discharged from one Russian plant, 8 million m^3/a from one German plant and 3 million m^3/a from 2 Polish plants. The 11 plants in the **iron and steel industry** discharged 21 million m^3/a wastewater, with 6 Polish plants accounting for 8 million m^3/a, 4 Swedish plants producing 7 million m^3/a and one German plant discharging 5 million m^3/a. Wastewater from the **leather and textile industry** comprised 13 million m^3/a, of which 4 Polish plants produced 9 million m^3/a and one Latvian plant contributed 4 million m^3/a. The category **Other industry** accounted for the smallest quantities of wastewater, only 5 million m^3/a from 28 plants located in Sweden, Finland, Denmark, Russia and Germany.

5.1.1.3 Point source discharges of organic matters within the Baltic Sea catchment area

The PLC-4 guidelines require the Contracting Parties to measure organic matter discharged from point sources as BOD_7, COD_{Mn}, COD_{Cr} or as TOC. In this report, however, only the results for BOD_7 are given, largely because this parameter was measured in nearly all the Contracting Parties for most point sources. In some countries such as Denmark and Poland, the BOD_7 discharge was calculated on the basis of the BOD_5. This approach makes it possible to give an overview of the BOD_7 discharges by sub-region and by Contracting Party.

In 2000 the reported BOD_7 discharges into inland surface waters from point sources within the Baltic Sea catchment area amounted to 185000 tonnes, of which 124590 tonnes (67%) were discharged by municipal wastewater treatment plants (MWWTP), and 59025 tonnes (32%) by industrial plants. Further, 1385 tonnes (0.7%) was discharged from fish farms, but this figure is clearly underestimated, since only Denmark and Russia in part have submitted BOD_7 discharges from fish farms. The distribution of the point source BOD_7 discharges from municipal wastewater treatment plants, industrial plants and fish farms into inland surface waters within the sub-regions and Contracting Parties Baltic Sea catchment areas is recorded in Tables 5.5 and 5.6 in Annex 6.

In all the Contracting Parties except Finland, Lithuania and Sweden, the municipalities are the major source of BOD_7 discharges, comprising in each country roughly 80% of the reported point source discharges within the Baltic Sea catchment area. The highest municipal BOD_7 discharges of 92320 tonnes have been reported within the Polish Baltic Sea catchment area, followed by discharges of 18710 tonnes of BOD_7 in the Russian catchment area. Together these territories accounted for 90% of the total municipal point source discharges within the Baltic Sea catchment area. The BOD_7 discharges from industries located in the Swedish and Finnish Baltic Sea catchment area constituted more than 80% of the total point source discharges in these countries. Industrial BOD_7 discharges from Finland and Sweden represented half of all industrial discharges into inland surface waters within the Baltic Sea catchment area (Figures 5.5 and 5.6).

In 2000, 66% (121550 tonnes) of the reported BOD_7 point source discharges entered inland surface waters within the Baltic Proper catchment area. The main part of these BOD_7 discharges entered inland surface waters from the three largest river basins, where the efficiency of wastewater treatment is less than satisfactory: the Vistula (35320 tonnes), the Nemunas (7880 tonnes) and the Oder (6220 tonnes). These rivers flow through some of the most densely populated parts of the Baltic Sea catchment area, and receive approximately 30% of the total BOD_7 discharges. However, their corresponding wastewater discharge was only some 15% of the total wastewater discharges. The second largest proportion of BOD_7 discharges, 34850 tonnes (19%), originated in the Gulf of Finland catchment area. Of this figure, 23160 tonnes issued from the Neva basin, and comprised municipal and industrial discharges from Saint Petersburg and the Leningrad region, which still produced a large quantity of untreated wastewater. The municipal BOD_7 discharge originating within the catchment areas of the Bothnian Bay, the Bothnian Sea, the Archipelago Sea, the Western Baltic, the Sound and the Kattegat was low, due to effective treatment of municipal wastewater in Finland, Sweden, Germany and Denmark, where the BOD_7 removal rate, in general, is higher than 90%.

The Bothnian Bay was the only sub-region in which industrial organic matter discharges exceeded the municipal organic matter discharges. Pulp and paper mills were the main industries situated in that area, and plants from Finland and Sweden were the main sources of industrial organic matter load (BOD and COD) in the catchment areas of the Bothnian Bay, the Bothnian Sea and the Gulf of Finland. While in Finland all the plants use biologically-activated sludge removal treatment systems, in Sweden some plants use only mechanical wastewater treatment methods.

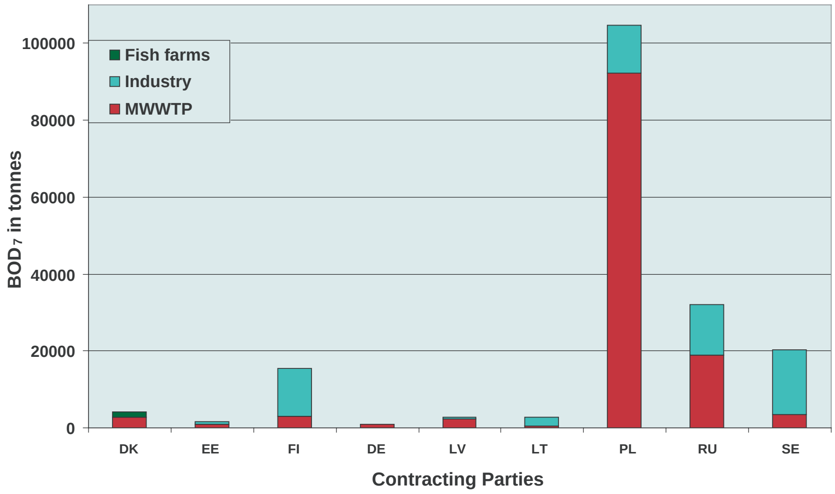
5.1.1.4 Point source discharges of nutrients within the Baltic Sea catchment area

5.1.1.4.1 Point source nitrogen discharges within the Baltic Sea catchment area

In 2000 the reported total nitrogen discharges into inland surface waters from point sources within the Baltic Sea catchment area amounted to 78640 tonnes, of which 66260 tonnes (84%) were discharged by municipal wastewater treatment plants (MWWTP) and 11500 tonnes (15%) by industrial plants. In all sub-regions and Contracting Parties' Baltic Sea catchment areas, the municipal nitrogen discharges are higher than the corresponding industrial discharges. The proportion of nitrogen discharged from fish farms in the Baltic Sea catchment area is quite low: 870 tonnes (1.1%), however, this figure seems to be more reliable than findings for BOD_7, as the Contracting Parties have submitted at least some data. The distribution of point source total nitrogen discharges into inland surface waters within the sub-regions and Contracting Parties' Baltic Sea catchment areas is shown in Figures 5.7 and 5.8 as well as in Tables 5.7 and 5.8 in Annex 6. In the same figures the area-specific total nitrogen discharges into inland surface waters (point source discharges related to the respective catchment areas) are given. Although the calculations can be considered more reliable, there are still many uncertainties in the findings due to incomplete data sets, especially from the Estonian, Lithuanian, Polish and Russian Baltic Sea catchment areas.

In 2000, approximately 62% (48530 tonnes) of the total nitrogen discharges were discharged into the catchment area of the Baltic Proper.

Figure 5.5: Point source BOD_7 discharges into inland surface waters within the Baltic Sea catchment area in 2000 by Contracting Party.



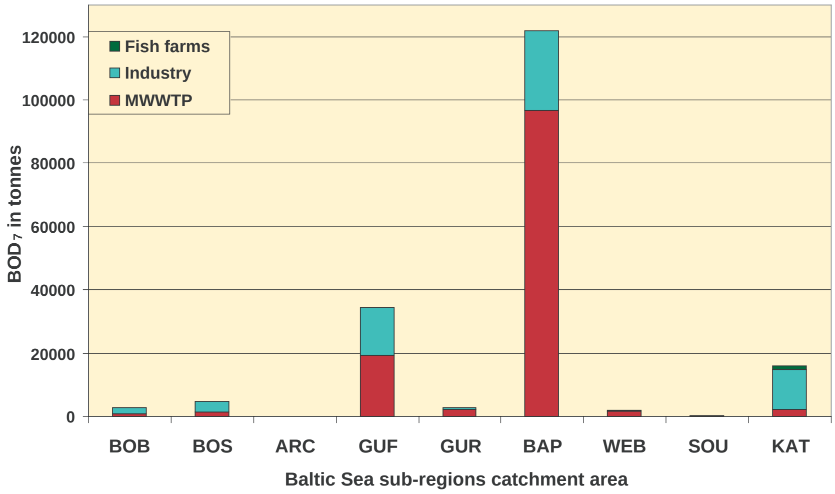


Figure 5.6: Point source BOD_7 discharges into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region.

The majority of these discharges entered inland surface waters from the three largest river basins: the Vistula (14020 tonnes), the Oder (2670 tonnes) and the Nemunas (1350 tonnes). The total nitrogen discharges within these three river catchment areas comprised approximately 35% of the reported total nitrogen discharges, but the corresponding wastewater discharge was only some 15% of total wastewater discharges. The second largest proportion of total nitrogen discharges amounted to 14520 tonnes (18%), and was discharged into inland surface waters within the Gulf of Finland catchment area. 10120 tonnes of this amount entered into the Neva and 405 tonnes discharges into the Narva basin. Municipal discharges from the Russian region in particular, constituted the main part of the total nitrogen load in the Gulf of Finland catchment area (7390 tonnes). Low municipal total nitrogen discharges originating in the catchment areas of the Western Baltic, the Sound and the Kattegat due to effective treatment of municipal wastewater in Germany and Denmark, where the nitrogen removal rate is generally, higher than 90%.

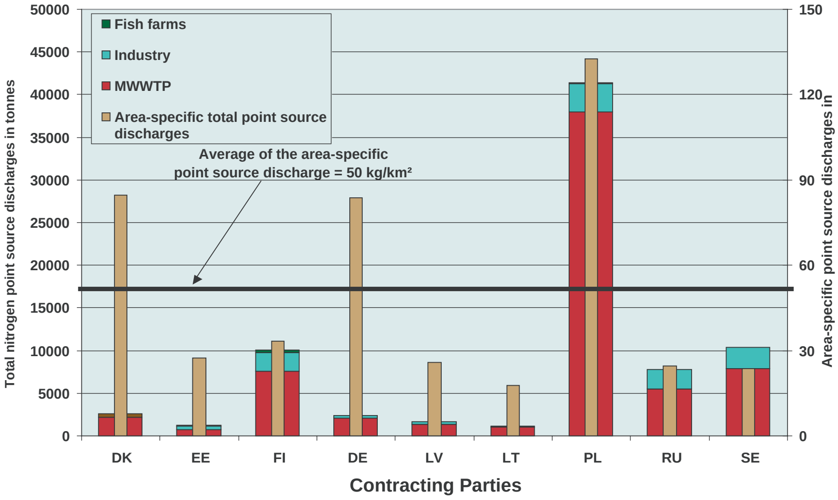


Figure 5.7:
Point source total nitrogen discharges into inland surface waters within the Baltic Sea catchment area in 2000 by Contracting Party.

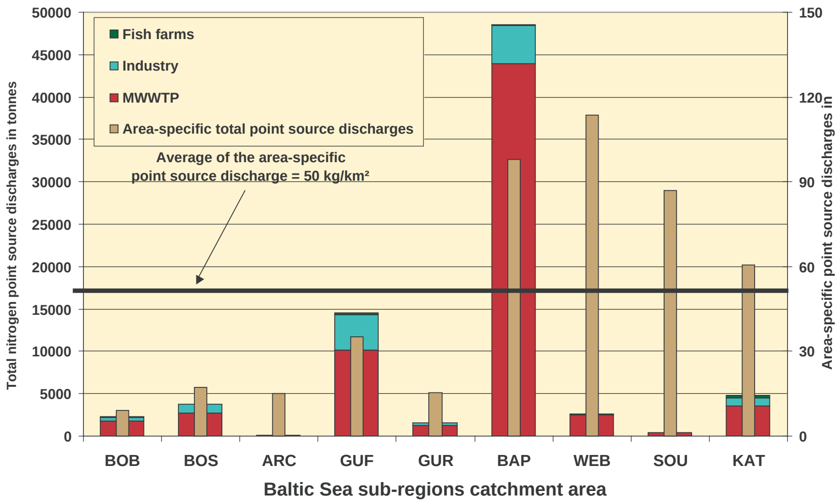


Figure 5.8:
Point source total nitrogen discharges into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region.

5.1.1.4.2 Point source phosphorus discharges within the Baltic Sea catchment area

In 2000 the reported total phosphorus discharges from point sources within the Baltic Sea catchment area totalled 8220 tonnes, of which 6980 tonnes (85%) were discharged by municipal wastewater treatment plants (MWWTP) and 1150 tonnes (14%) by industrial plants. The total phosphorus discharges from fish farms in the Baltic catchment area was found to be quite low: 90 tonnes (1.1%). The distribution of the point source total phosphorus discharges into surface waters within the sub-regions' and Contracting Parties' Baltic Sea catchment area is given in Figures 5.9 and 5.10 as well as in Tables 5.9 and 5.10 in Annex 6. The calculations performed during PLC-4 can be considered more reliable than in previous PLCs, however, incomplete data sets especially from the Estonian, Lithuanian, Polish and Russian Baltic Sea catchment area still give rise to many uncertainties.

In all the Contracting Parties except Finland and Sweden, the municipalities are the principal source of total phosphorus discharges, comprising in each country between 80 and 90% of the reported point source discharges in the Baltic Sea catchment area. The highest municipal total phosphorus discharges were found to be 5040 tonnes, and emanated from the Polish Baltic Sea catchment area, which comprises 72% of the total municipal point source discharges within the Baltic catchment area. In Sweden and Finland the industrial total phosphorus discharges are as important as the municipal total phosphorus discharges. In Poland industrial discharges of total phosphorus was 420 tonnes, or 37% of the total industrial discharges within the Baltic Sea catchment area.

In 2000 approximately 71% (5790 tonnes) of all phosphorus discharges originated in the Baltic Proper catchment area. The three largest rivers in this catchment area: the Vistula (1830 tonnes), the Oder (280 tonnes) and the Nemunas (100 tones) together contributed the majority of these discharges, or approximately 27% of the phosphorus discharges. The second largest proportion of total phosphorus point source discharges originated in the Gulf of Finland catchment area, and accounted for 19% or 1530 tonnes, of which 1230 tonnes entered the river basin of the Neva and 52 tonnes within the river basin of the Narva. The point source phosphorus discharges within the catchment areas in all other sub-regions was considerably lower, and totalled less than 3% of the reported point source discharges. The largest quantity of total phosphorus point source discharges in the Gulf of Finland catchment area originated in the Russian part of the catchment area, and amounted to 1220 tonnes, or 80% of reported discharges within the Gulf of Finland catchment area.

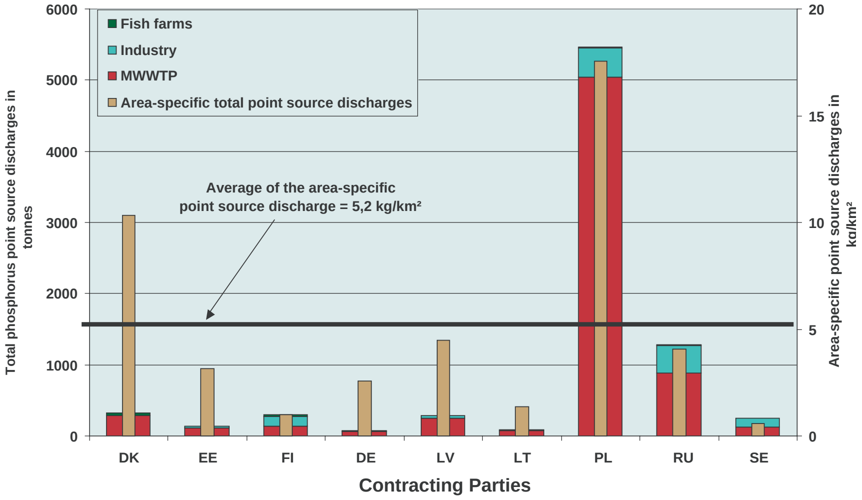
5.1.1.5 Heavy metal point source discharges within the Baltic Sea catchment area

Heavy metal point source discharges varied among the different sub-regions' catchment areas depending on population density, the location, type, size and number of industries and the exploitation of natural resources. These anthropogenic discharges/losses derives from industrial wastewater, leakage from products in use and those removed from service, „natural" degradation of products, and pollution from various types of land use (for example agriculture, due to excessive use of cadmium in fertilisers) and mining (mine waste deposits).

Due to incomplete data on heavy metals, it is not possible to compile a point source inventory of the heavy metal discharges entering inland surface waters within the Baltic Sea catchment area in 2000. Tables 5.11 to 5.24 in Annex 6 indicate that many entries are missing in the heavy metal point source inventory:

- In **Estonia** no point source discharges were presented for cadmium or mercury. For all the other heavy metals, figures were only given for municipalities situated in the Gulf of Finland catchment area, whereas point source discharges located in the catchment areas of the Baltic Proper and Gulf of Riga are totally missing.
- **Finland** did not present any point source discharges for heavy metals from municipalities in the Baltic Sea catchment area.
- **Lithuania** did not present any results concerning cadmium, mercury or lead point source discharges in its Baltic Sea catchment area. For all the other heavy metals, point source discharges were only given for the Baltic Proper catchment area. Point source discharges within the Gulf of Riga catchment area were not reported.
- **Latvia** presented mostly heavy metal point sources discharges from municipalities in the catchment area, except the Gulf of Finland catchment area where no data were presented.
- In **Russia** only heavy metal discharges from municipalities in the Gulf of Finland catchment area were submitted. No information was presented for the catchment areas of the Baltic Proper and Gulf of Riga.

Figure 5.9:
Point source total phosphorus discharges into inland surface waters within the Baltic Sea catchment area in 2000 by Contracting Party.



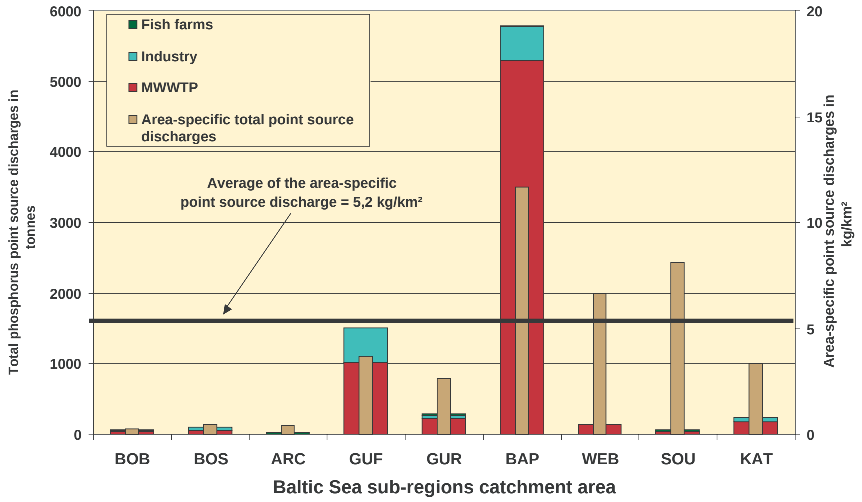


Figure 5.10:
Point source total phosphorus discharges into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region.

According to the PLC-4 Guidelines mercury, cadmium, copper, lead, zinc, chromium and nickel are obligatory parameters to analyse for urban areas larger than 10000 PE as well as for relevant industries if these variables are regulated by sector-wise HELCOM Recommendations. However, due to shortcomings in national monitoring programmes, and the lack of proper laboratory equipment, figures were not obtained in many cases.
Nevertheless, since PLC-3 was conducted in 1995, there have been methodological improvements, including for instance, more comprehensive sampling and new analysing equipment.

Table 5.1:
Heavy metal discharges from point sources into inland surface waters within the Baltic Sea catchment area in 2000 (Data is incomplete.[1,2,3,4]). Detailed data are presented in Tables 5.11 to 5.24 in Annex 6.

[1] All figures are missing from Finnish municipalities and from Estonian Industries.
[2] All industrial point source figures are missing from the Estonian GUF catchment area.
[3] All cadmium and lead figures are missing from Estonia and Lithuania. Lithuanian lead figures are also missing.
[4] All figures are missing from the Estonian and Russian BAP, the Estonian, Lithuanian and Russian GUR as well as the Latvian GUF catchment area.

	Heavy metal point source discharges in kg		
METAL	**Municipalities[1,2,3,4]**	**Industries[1,2,3,4]**	**TOTAL[1,2,3,4]**
Mercury	460	3025	**3485**
Cadmium	6680	8440	**15120**
Copper	61400	72300	**133700**
Lead	32080	38860	**70940**
Zinc	251320	341760	**593080**
Chromium	43420	12390	**55810**
Nickel	20470	20240	**40710**

5.1.2 Nutrient losses from diffuse sources in 2000

5.1.2.1 General information

Human activity increases losses of nutrients into the aquatic environment and this anthropogenic nutrient load results in eutrophication. Excessive nutrient inputs into the Baltic Sea produce harmful effects in 'favourable' weather conditions. Extensive blue-green algal blooms observed in the Baltic Sea in 1997 and again in 2002 are evident of these damaging effects. Filamentous macroalgae have also become more abundant in recent decades, interfering with recreational use of coastal waters.

Large proportions of nutrient loads originate far away from the sea, and many processes may take place before nutrients enter surface waters and finally reach the Baltic Sea. Phosphorus and nitrogen, the main sources of nutrients found in inland surface waters emanate from diffuse sources, particularly agriculture and atmospheric deposition. Rainfall is one of the controlling factors that determine the final amounts of nutrients entering the Baltic Sea, while a variety of biological, physical, morphological, and chemical factors also impact on the amounts of nutrients retained in watercourses.

The losses of nitrogen and phosphorus from diffuse sources into inland surface waters in monitored rivers, unmonitored rivers and coastal areas within the whole Baltic Sea catchment area are presented in this chapter. Denmark, Estonia, Finland, Germany, Poland, Lithuania and Sweden have compiled data for different diffuse sources such as agriculture and managed forestry, scattered dwellings, storm water overflows of urban areas and atmospheric deposition (see chapter 3.2). Latvia and Russia have provided the nutrient losses from diffuse sources as one total figure for each of the sub-region, but it should be noted that the Russian data was incomplete.

The figures in this chapter are based on the source-orientated approach; however the diffuse losses are not quoted at the source, but at the edge of the river or lake, where the load enters inland surface waters. Retention in soils and groundwater has reduced the diffuse losses compared with the losses at the source. In general the figures for diffuse losses entering inland surface waters in this sub-chapter will be different - and should be higher - than the figures for diffuse sources listed in chapter 5.2.5. In chapter 5.2.5 diffuse sources are estimated from the source apportionment of the riverine load (methodology described in chapter 3.5) and based on the load-orientated approach. Further, the used methodology to quantify the losses from diffuse sources entering inland surface waters differs between Contracting Parties. For instance Russia, Latvia and for some parts of Estonia only the totals of nitrogen and phosphorus losses have been reported (not divided on sources). Poland has not reported atmospheric deposition proportions of nitrogen and phosphorus and Sweden have not reported phosphorus. Therefore, the sums of different sources do not correspond with the total figures given for the source-orientated approach.

Therefore comparisons of diffuse losses into inland surface waters among Contracting Parties should be done with caution.

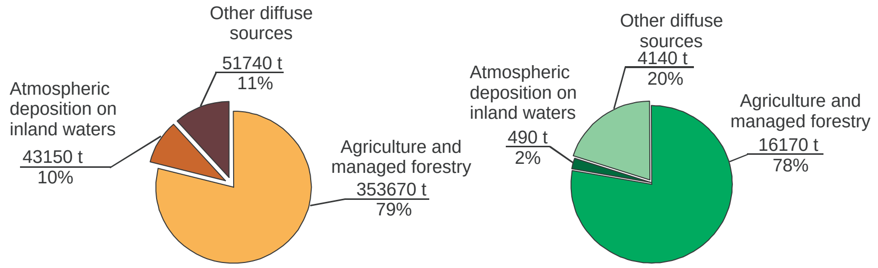
5.1.2.2 Nitrogen and phosphorus losses from diffuse sources

In 2000 the reported losses from diffuse sources into inland surface waters within the entire Baltic Sea catchment area amounted to approximately 484000 tonnes of total nitrogen and 22040 tonnes of total phosphorus, respectively. The major part of the nitrogen losses from diffuse sources, (79%) originated from agricultural activities or managed forestry in the Baltic Sea catchment area, while 12% derived from other diffuse sources and 9% from atmospheric deposition on inland surface waters (Figure 5.11 and Tables 5.25 and 5.27 in Annex 6).

Agriculture or managed forestry constituted the largest part of the phosphorus losses from diffuse sources (78%); other diffuse sources comprised 18% of the phosphorus losses and atmospheric deposition on inland surface waters accounted for 2% of these losses. (Figure 5.11 and Tables 5.26 and 5.28 in Annex 6).

In 2000, 220000 tonnes or 45% of the total nitrogen losses from diffuse sources in the Baltic

Figure 5.11: Distribution of total nitrogen and total phosphorus losses from diffuse sources within the Baltic Sea catchment area in 2000 based on the source-orientated approach. See text explaining why the sum of sources is less than the total figures.



Nitrogen : 484000 tonnes **Phosphorus : 22040 tonnes**

Sea catchment area entered inland surface waters within the catchment area of the Baltic Proper. The second largest proportion of diffuse nitrogen losses, 69300 tonnes or 14%, of the total diffuse losses into inland surface waters, was entering in the Kattegat catchment area (Figures 5.12 and 5.14). In 2000, 57% or 12500 tonnes of total phosphorus diffuse losses entered inland surface waters in the Baltic Proper catchment area (Figures 5.13 and 5.15). In all Contracting Parties the major proportion of the losses into inland surface waters from diffuse nitrogen and phosphorus sources originated from agricultural activities, followed by other diffuse sources, such as loads from scattered dwellings and storm water overflows (Figures 5.14 and 5.15).

The main proportion of the nitrogen diffuse losses into inland surface waters within the Baltic Proper catchment area was recorded within the catchment area of the area's three largest rivers: the Vistula (72200 tonnes of nitrogen or 33%), the Oder (61200 tonnes of nitrogen or 28%), and the Nemunas. The inland surface waters within these three river catchment areas flow through quite intensively managed agricultural areas. As a result, the nutrient losses from diffuse sources entering these inland surface waters comprised approximately 80% of the corresponding total nutrient losses in the Baltic Proper catchment area. The catchment area of these three rivers comprises 83% of the total Baltic Proper catchment area.

Figures 5.12 and 5.13 show that for all Contracting Parties agricultural activities and managed forestry account for the majority of diffuse losses of nitrogen and phosphorus from diffuse sources entering inland surface waters. The largest proportion of nitrogen losses from diffuse sources occurred in the Baltic Sea catchment areas of Poland (141600 t/a N), Sweden (97800 t/a N), Finland (80100 t/a N) and Denmark (53000 t/a N). The largest amounts of phosphorus losses from diffuse sources entered inland surface waters in the Baltic catchment areas of Poland (10100 t/a P), Finland (4600 t/a P) and Sweden (2800 t/a P).

The area-specific coefficients give a different picture of the diffuse nutrient losses into inland surface waters from the losses expressed in real amounts. A large catchment area may show high diffuse losses in tonnes but with a low area-specific coefficient. This factor should be taken into account when considering and applying measures to reduce diffuse nutrient losses.

Specific nitrogen and phosphorus diffuse losses into inland surface waters expressed as an **area coefficient** (kg/km^2) is shown in Figures 5.16 and 5.17. The highest area-specific losses of nitrogen in 2000 occurred in the catchment area of the Sound (more than 1900 kg N/km^2) followed by the catchment area of the Western Baltic (nearly 1400 kg N/km^2) and the catchment area of the Kattegat (870 kg N km^2). The catchment area of the Archipelago Sea also had a relatively high area-specific diffuse loss of nitrogen (770 kg N/km^2). The average area-specific nitrogen loss into the Baltic Sea catchment area was only 340 kg N/km^2; this is because the area-specific losses within the large catchment areas of the Bothnian Bay, Bothnian Sea and Gulf of Finland were low, just 120 to 340 kg N/km^2. In many of the big catchment areas, low area-specific diffuse losses may be observed in vast areas with low human impact and a high proportion of wetlands that reduce diffuse losses into inland surface waters.

The highest area-specific diffuse phosphorus losses occurred in the Archipelago Sea catchment area (80 kg P/km^2), followed by the catchment area of the Western Baltic (31 kg P/km^2), and the catchment areas of the Sound and the Baltic Proper (26 kg P/km^2). The average area-specific phosphorus loss into inland surface waters in the Baltic Sea catchment area was 17 kg P/km^2 in 2000. The lowest area-specific diffuse phosphorus losses occurred within the catchment areas of the Bothnian Bay and Bothnian Sea with 6 to 7 kg P/km^2 (Table 5.28 in Annex 6). High area-specific losses of phosphorus are related to intensively cultivated catchment areas but also to soil type and geology, topography, climate and other factors such as frozen soils and surface run-off.

Denmark is an intensely cultivated country and this fact, coupled with a relatively low incidence of wetlands resulted in by far the highest area-specific diffuse losses of nitrogen into inland surface waters in the Baltic Sea catchment area (1700 kg N/km^2). Germany followed with 820 kg N/km^2, with Estonia, Latvia, Lithuania and Poland not far behind (approximately 450 to 600 kg N/km^2). With respect to phosphorus, Poland (32 kg P/km^2), Germany (31 kg P/km^2), Denmark (30 kg P/km^2) and Estonia (22 kg P/km^2) were found to have the highest area-specific diffuse phosphorus losses into inland surface waters (Tables 5.25 and 5.26 in Annex 6).

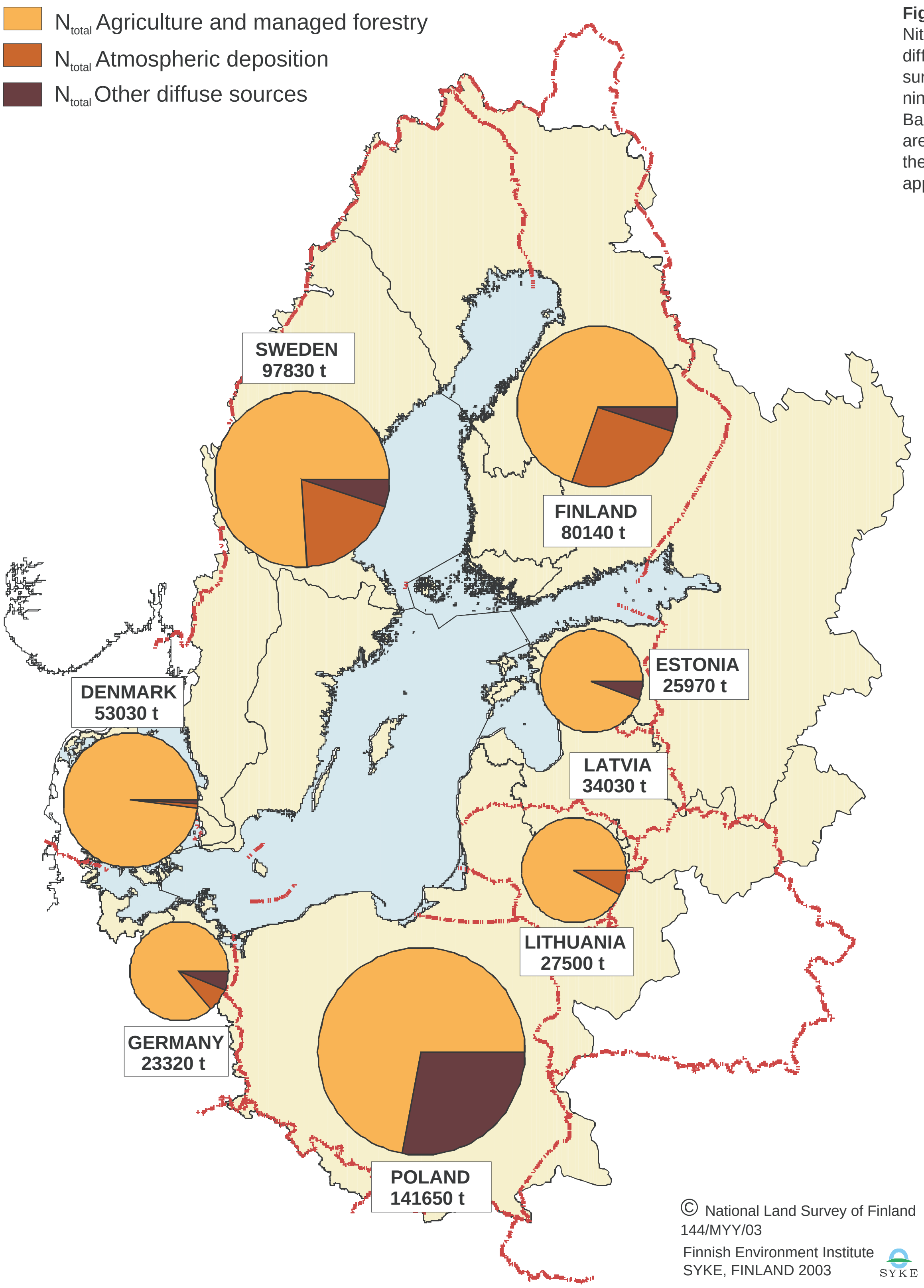


Figure 5.12: Nitrogen losses from diffuse sources into inland surface waters within the nine Contacting Parties' Baltic Sea catchment areas in 2000 based on the source-orientated approach.

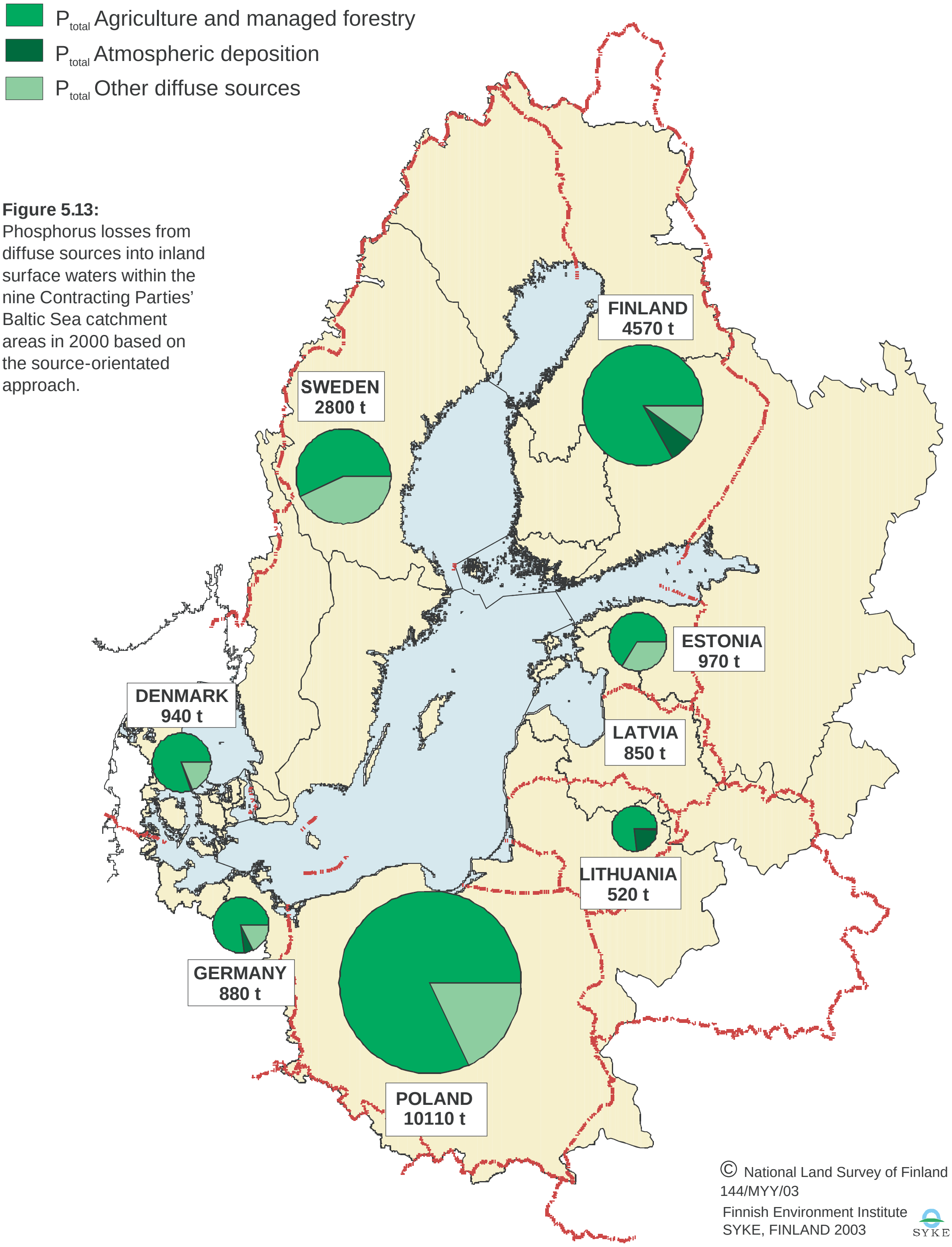


Figure 5.13: Phosphorus losses from diffuse sources into inland surface waters within the nine Contracting Parties' Baltic Sea catchment areas in 2000 based on the source-orientated approach.

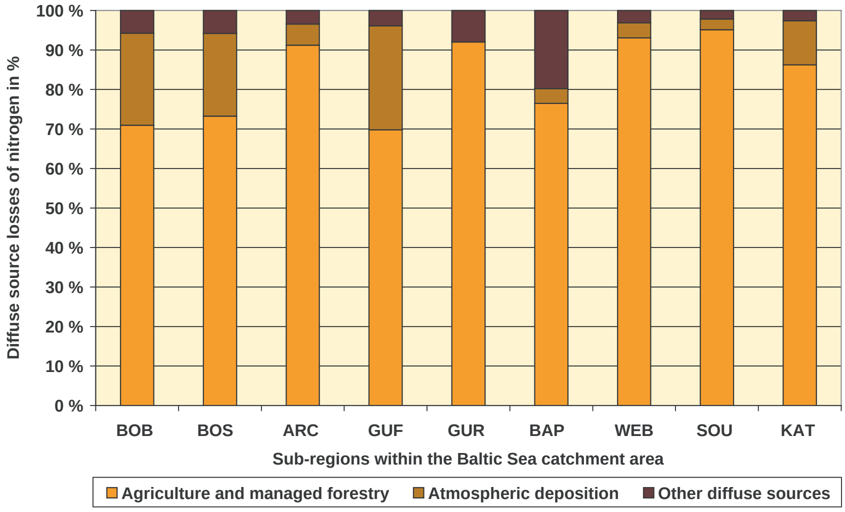


Figure 5.14:
Nitrogen losses from diffuse sources into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region based on the source-orientated approach.

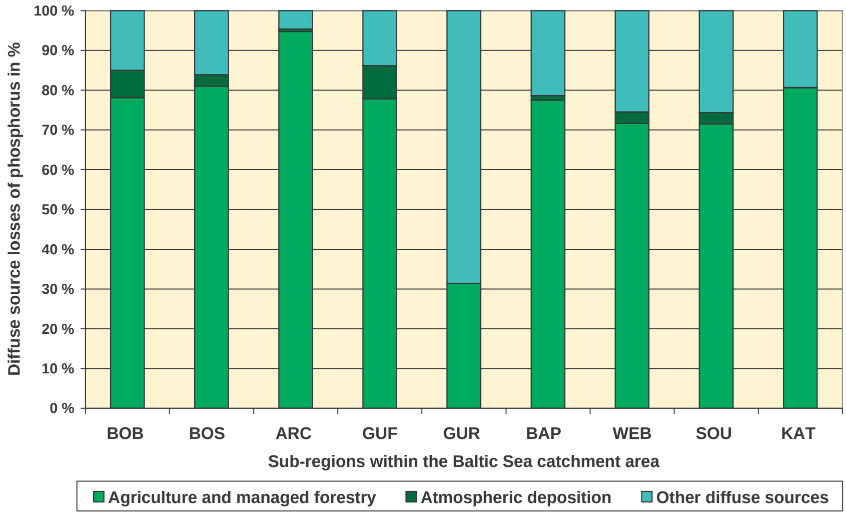
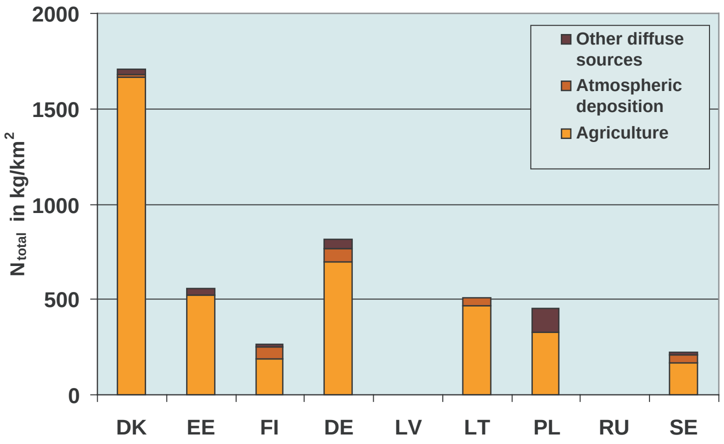
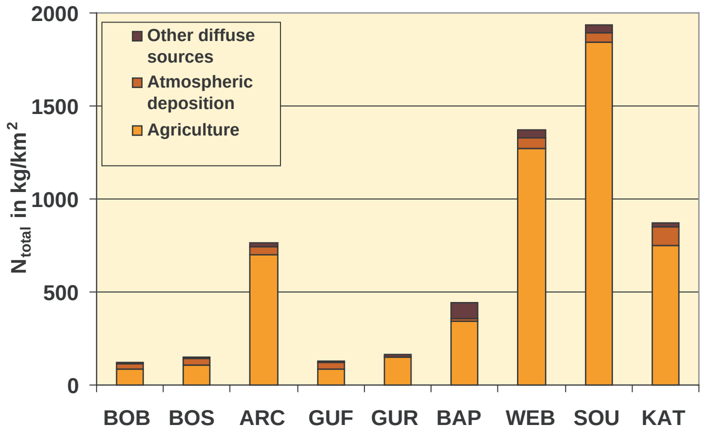


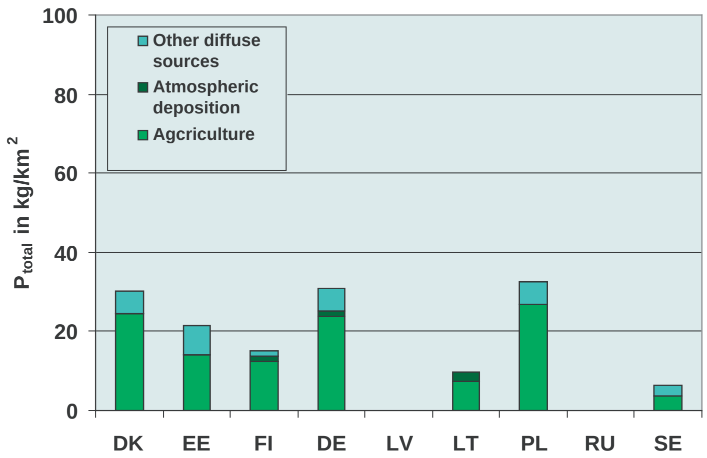
Figure 5.15:
Phosphorus losses from diffuse sources into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region based on the source-orientated approach. ‘

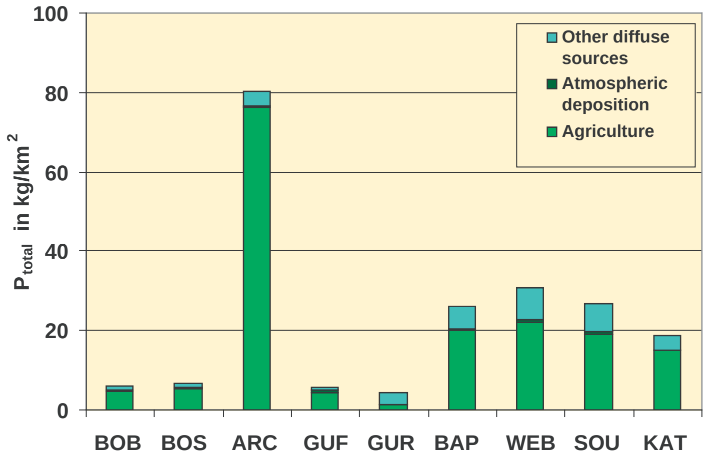
Figure 5.16:
Area-specific nitrogen (kg N/km^2) diffuse losses into inland surface waters within the Baltic Sea catchment area by Contracting Parties and per Baltic Sea sub-regions. The diffuse losses are divided into three categories: agricultural and managed forestry, atmospheric deposition, and other diffuse sources based on the source-orientated approach.





Figures 5.17:
Area-specific phosphorus (kg P/km^2) diffuse losses into inland surface waters within the Baltic Sea catchment area by Contracting Parties and per Baltic Sea sub-regions. The diffuse losses are divided into three categories: agricultural and managed forestry, atmospheric deposition, and other diffuse sources based on the source-orientated approach.





5.1.3. Natural background losses of nutrients in 2000

A large proportion of nutrient losses is caused by human activity. However, nutrients are also leached or eroded into inland surface waters from soils in natural conditions. The natural background loss is a estimate of the natural losses from a catchment area that has not been affected by human activities for many years. Finding such a catchment area in the Convention area is very difficult, because atmospheric deposition are very high at the present time and therefore, increase the nitrogen content of soils. One way to estimate natural background losses is to measure the load from small catchment areas with natural unmanaged forests and/or catchment areas which are sparsely populated and which experience very little agricultural and other human activity.

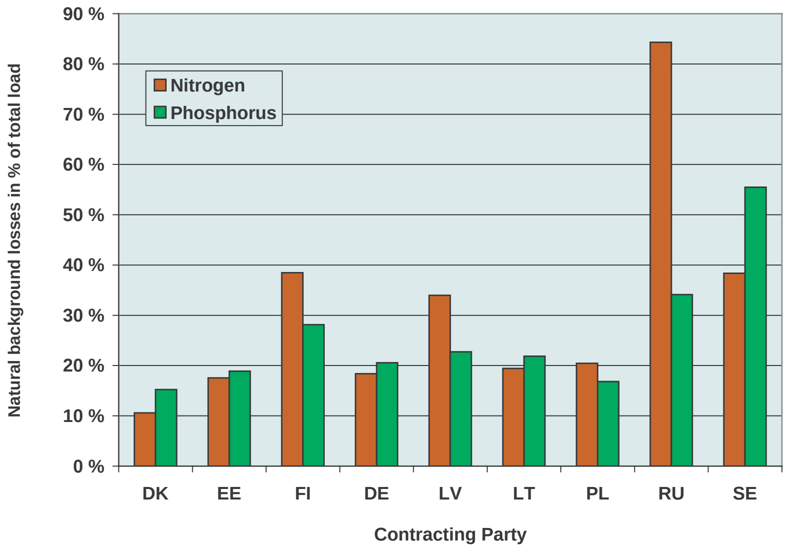
In 2000 the natural background losses of total nitrogen and total phosphorus into inland surface waters within the Baltic Sea catchment area amounted to 260000 tonnes of nitrogen and 11000 tonnes of phosphorus. Of these figures 226000 tonnes of nitrogen and 10000 tonnes of phosphorus were recorded in monitored river basins and 34300 tonnes of nitrogen and 1400 tonnes of phosphorus recorded in unmonitored river basins and coastal catchment areas (Tables 5.29 and 5.30 in Annex 6). The data seem to be nearly complete for all the Baltic Sea catchment areas, except the Gulf of Riga, where data was lacking for one third of the catchment area. However, these missing statistics represent only 3% of the entire Baltic Sea catchment area. The distribution of nutrient natural background losses of total nitrogen and total phosphorus within the catchment areas of the Contracting Parties and sub-regions are given in figures 5.18 and 5.19, respectively.

Nitrogen accounted for 32% and phosphorus 27% of the proportion of natural background losses to the sum of total losses from all diffuse sources and the total discharges from point sources to inland surface waters within the Baltic Sea catchment area. In Sweden more than half (55%) of the total phosphorus losses and discharges originated from natural areas (Figure 5.18), while the respective proportion of nitrogen losses was lower, approximately 38%. In Finland too, natural background losses constituted nearly 38% of the total nitrogen losses and discharges to inland surface waters with the Finnish catchment and nearly 28% for phosphorus. In the southern part of the Baltic Sea this proportion was found to be considerably lower. The natural background losses of total nitrogen compared to the total nitrogen losses and discharges from all sources represented 11% in Denmark, 18 to 22% in Estonia, Germany, Lithuania and Poland and roughly 30% in Latvia. With respect to total phosphorus, this proportion was 15 to 23% in Denmark, Estonia, Germany, Latvia, Lithuania and Poland. The natural background nutrient losses constituted more than half of the total nutrient discharges and losses into inland surface waters in the catchment areas of the Bothnian Sea and the Bothnian Bay (Figure 5.19). Natural background nutrient losses in Russia constituted a very high proportion of total nutrient losses and discharges into Russian inland surface waters, however it would appear that the total losses and discharges have been underestimated.

Area-specific natural background losses of nitrogen into inland surface waters for the entire Baltic Sea catchment area was approximately 170 kg

Figure 5.18:
Distribution of the nitrogen and phosphorus natural background losses within the Baltic Sea catchment area by Contracting Party in 2000 in tonnes based on the source-orientated approach.

Total amounts in 2000 = 259500 tonnes of nitrogen and 10960 tonnes of phosphorus.



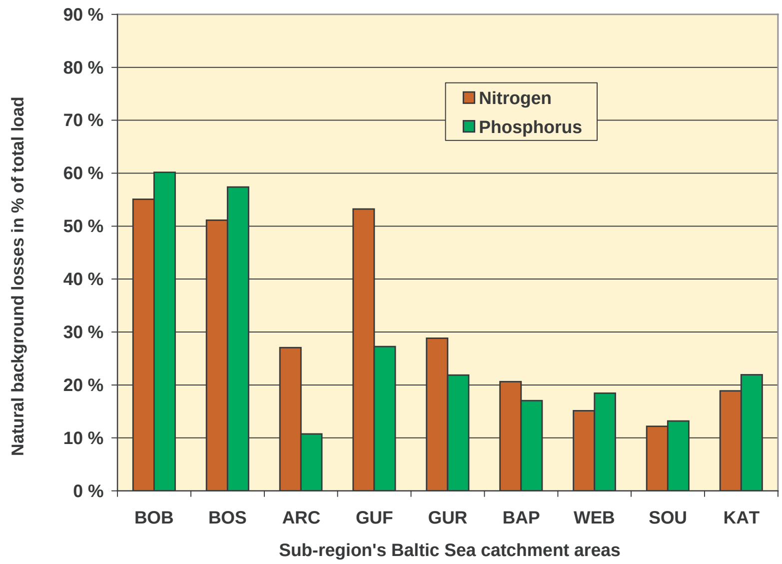


Figure 5.19:
Distribution of the nitrogen and phosphorus natural background losses within the Baltic Sea catchment area by sub-regions in 2000 in tonnes based on the source-orientated approach.

Total amounts in 2000 = 259500 tonnes of nitrogen and 10960 tonnes of phosphorus.

N/km². The area-specific nitrogen losses varied considerably between the different catchment areas of the Contracting Parties (Figure 5.20) and sub-regions (see Figure 5.21). The highest area-specific natural background nitrogen losses were reported in the catchment area of the Archipelago Sea (290 kg N/km²), the Sound (280 kg N/km²) and Western Baltic (260 kg N/km²). The lowest values were recorded for the catchment areas of the Baltic Proper (150 kg N/km²), the Bothnian Bay (160 kg N/km²) and Bothnian Sea (165 kg N/km²).

The area-specific natural background losses of phosphorus into inland surface waters for the entire Baltic Sea catchment area was 7.1 kg P/km² (Figure 5.21), while the highest specific natural background phosphorus losses occurred in the catchment areas of the Archipelago Sea (9.7 kg P/km²), the Bothnian Sea (9.6 kg/km²) and the Bothnian Bay (9.5 kg P/km²). In these areas heavy rains in 2000 increased the leaching and surface run-off of nutrients into inland surface waters. The low values for the Gulf of Finland catchment area (3.6 kg P/km²) could be partly explained by the large wetland area in this catchment area.

A comparison between area-specific losses of nitrogen and phosphorus indicates that the Latvian and Russian area-specific natural background losses of nitrogen are too high, and that the specific natural background losses of phosphorus from Poland also seems overestimated.

Figure 5.20: Area-specific natural background losses of nitrogen and phosphorus within the Baltic Sea catchment area by Contracting Party in 2000 in kg/km² based on the source-orientated approach.

Total amounts = 259500 tonnes of nitrogen and 10960 tonnes of phosphorus.

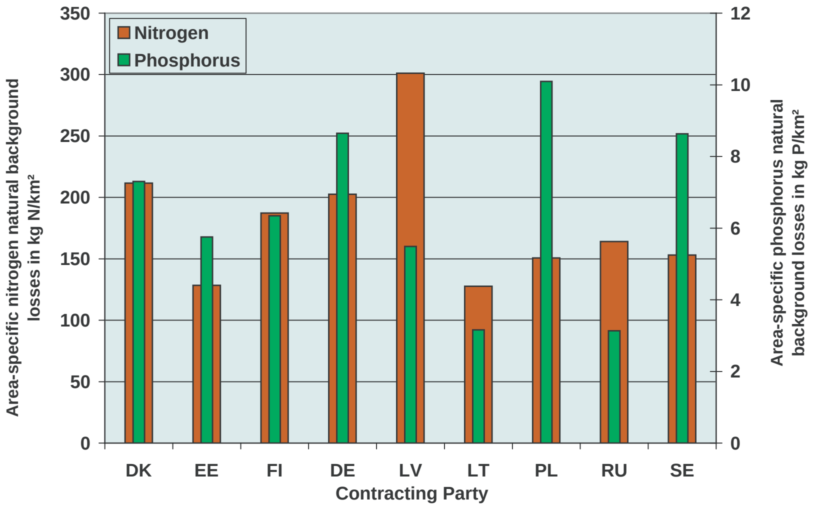
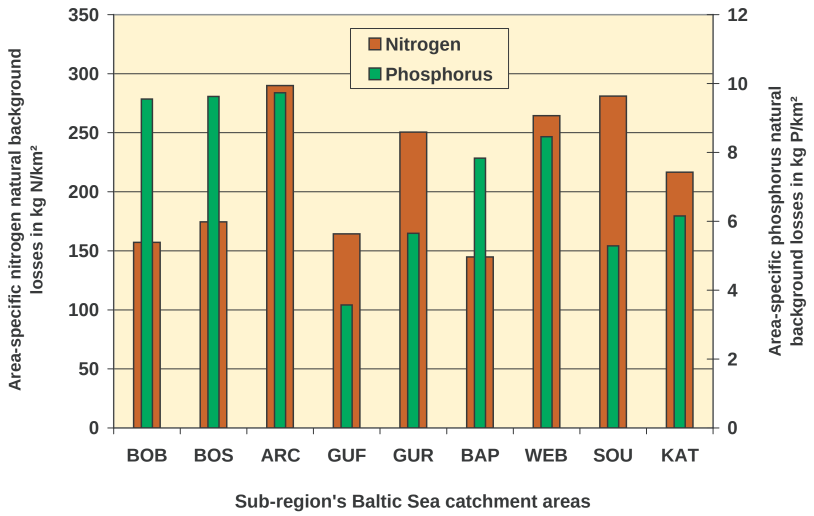


Figure 5.21: Area-specific natural background losses of nitrogen and phosphorus within the Baltic Sea catchment area by sub-regions in 2000 in kg/km² based on the source-orientated approach.

Total amounts = 259500 tonnes of nitrogen and 10960 tonnes of phosphorus.



5.1.4. Total nutrient losses from diffuse sources and discharges from point sources into inland surface waters within the Baltic Sea catchment area in 2000

The majority of nutrient losses and discharges into inland surface waters within the Baltic Sea catchment area are related to anthropogenic activities. Figures 5.23 to 5.26 show the total discharges from point sources, losses from diffuse source and natural background losses into inland surface waters within the Baltic Sea catchment area based on the source-orientated approach. In 2000 the discharges from point sources, the losses from diffuse sources and natural background losses into inland surface waters within the Baltic Sea catchment area for total nitrogen and total phosphorous amounted to 822000 tonnes of nitrogen and 41200 tonnes of phosphorous (Figure 5.22 and Tables 5.31 to 5.34 in Annex 6). The major portions of the total nitrogen losses and discharges (59%) and the total phosphorous losses and discharges (53%) originated from diffuse sources. Natural background losses and discharges from point sources for nitrogen amounted to 31% and 10% of the total losses and discharges entering inland surface waters within the Baltic Sea catchment area, respectively. The corresponding figures for phosphorus were 27% and 20%.

In 2000 up to 41% (337000 tonnes of nitrogen) of the total nitrogen and up to 54% (22100 tonnes of phosphorus) of the total phosphorus losses and discharges into inland surface waters in the Baltic catchment area originated from sources located in the Baltic Proper catchment area. These losses and discharges originated mainly in the Polish part of this catchment area, and constituted 68% of total nitrogen and 85% of total phosphorus losses and discharges. Nitrogen discharges from point sources and losses from diffuse sources including natural background losses originating in the catchment areas of the Gulf of Finland and the Kattegat represented 16% (129000 tonnes N) and 11% of total nitrogen (91000 tonnes N) the second and third largest amounts recorded, respectively. The corresponding values for phosphorus losses and discharges into inland surface waters within the same areas amounted to 13% of total phosphorus (5400 tonnes P) and 5% of total phosphorus (2200 tonnes P), respectively. The nitrogen and phosphorus losses and discharges into inland surface waters within the catchment areas of the Bothnian Bay, the Bothnian Sea, the Archipelago Sea, the Western Baltic, the Sound and the Gulf of Riga were found to be significantly lower.

To assist with comparison of the results, the total losses and discharges into inland surface waters from the different sub-regions' and Contracting Parties' catchment areas, are also presented as area-specific losses and discharges of total nitrogen and total phosphorus in terms of kg/km² (see Tables 5.2 and 5.3). Area-specific nitrogen losses and discharges into inland surface waters shown to be high in the Danish and German catchment areas (2000 and 1100 kg N/km^2, respectively) and low in the Swedish and Russian catchment areas (400 and 200 kg N/km^2). The corresponding figures for phosphorus revealed considerable area-specific losses and discharges within the Polish, Danish and German catchment areas (61, 48 and 42 kg P/km^2, respectively). In the Swedish, Lithuanian and Russian catchment areas, these losses and discharges were found to be relatively low - 16, 14 and 9 kg P/km^2, respectively. Data collected in the sub-regions show the area-specific nitrogen losses and discharges into inland surface waters to be large within the catchment areas of the Sound, Western Baltic, Kattegat and Archipelago Sea (2300, 1800, 1200 and 1100 kg N/km^2, respectively), and relatively minor within the catchment areas of the Bothnian Sea, Gulf of Finland and Bothnian Bay (340, 310 and 285 kg N/ km^2, respectively). Within the catchment areas of the Archipelago Sea, the Western Baltic and the Baltic Proper, the corresponding figures for phosphorus pointed to high area-specific losses and discharges (90, 46, and 46 kg P/km^2, respectively). In the catchment areas of the Bothnian Sea, Bothnian Bay and Gulf of Finland the area-specific phosphorus losses were much lower - 17, 16 and 13 kg P/ km^2, respectively.

According to the reported results, the **natural background losses** of nutrients into inland surface waters contributed with between 11 and 20% total nitrogen, and 14 to 23% total phosphorus relative to the total losses and discharges into inlands waters within the Danish, Estonian, German, Lithuanian and Polish regions of the Baltic Sea catchment area. With respect to Latvia (34% total nitrogen, 23% total phosphorus) and Finland (38% total nitrogen$_l$, 28% total phosphorus) it can be seen that phosphorus discharges from natural background losses is in the same range as for the aforementioned countries, but discharges of nitrogen from natural background losses is significantly higher. In the Russian and

Table 5.2:
Area-specific losses and discharges of nitrogen and phosphorus into inland surface waters within the Baltic Sea catchment area by Contracting Party in 2000.

Contracting Party	Catchment area in km²	Nitrogen in kg/km²	Phosphorus in kg/km²
Denmark	31110	2000	48
Estonia	44000	750	30
Finland	301300	485	23
Germany	28600	1100	42
Latvia	64600	890	24
Lithuania	54160	660	14
Poland	311900	740	60
Russia	314800	200	9
Sweden	440040	400	16
Baltic Sea catchment area	**1591610**	**513**	**27**

Table 5.3:
Area-specific losses and discharges of nitrogen and phosphorus into inland surface waters within the Baltic Sea catchment area by sub-region.

Sub-region	Catchment area in km²	Nitrogen in kg/km²	Phosphorus in kg/km²
Bothnian Bay	259620	285	16
Bothnian Sea	215910	340	17
Archipelago Sea	9000	1070	90
Gulf of Finland	413100	310	13
Gulf of Riga	90900	870	26
Baltic Proper	496185	680	46
Western Baltic	22740	1750	46
The Sound	4625	2,305	40
Kattegat	79530	1150	28
Baltic Sea catchment area	**1591610**	**513**	**27**

the Swedish parts of the Baltic Sea catchment area the importance of the natural background losses is much higher for both nitrogen and phosphorus. These figures were calculated at 81% nitrogen and 34% phosphorus for Russia, and 38% nitrogen and 55% phosphorus for Sweden. From the Russian figures at least it seems, that data for agriculture and managed forestry (and perhaps also point sources) discharged into inland surface waters may have been underestimated, resulting in findings of high proportions of natural background losses.

Diffuse losses from agriculture and managed forestry entering inland surface waters, were the main nutrient sources in many Contracting Parties, and constituted between 40% and 85% (total nitrogen) and between 25 and 65% (total phosphorus), respectively of the total diffuse losses of nutrients into their inland surface waters. Corresponding diffuse losses of nitrogen and phosphorus were of minor importance in Russia (1% N and 15% P), but once again, these figures appear to be undervalued. Diffuse nutrient losses were found to constitute the highest proportion of the total losses and discharges into inland surface waters in Denmark (87%), Estonia (74%) and Lithuania (73%) for total nitrogen, and in Denmark (65%), Poland (63%) and Germany (60%) for total phosphorus.

Point source discharges generally represented the minority of nutrient losses and discharges into inland surface waters within the Baltic Sea catchment area, constituting between 3 and 8% of the total nitrogen losses and discharges. In the cases of Poland and Russia, however, this figure was between 14 and 18%. The proportion of phosphorus point source discharges fell within a wider range - between 3 and 11% - in Estonia, Finland, Germany, Lithuania and Sweden. In Denmark, Latvia and Poland the finding was between 19 and 29% and in Russia, approximately 50% of the total losses and discharges into inland surface waters in the respective catchment areas. The Russian figure has been corrected to compensate for the assumed underestimation of losses from agriculture and managed forestry.

A total of 62200 tonnes of total nitrogen and 1490 tonnes of total phosphorus losses and discharges from all sources entered inland surface waters in the **Danish** Baltic Sea catchment area in 2000. The major part of these nutrient losses and discharges, 83% for total nitrogen and 51% for total phosphorus, were losses from agriculture and managed forestry within the Danish catchment area. The corresponding discharges from point sources amounted to only 4% of nitrogen and about 22% of phosphorus. Natural background losses constituted 11% for nitrogen and 15% for phosphorus of the discharges and losses into inland surface waters within the Danish Baltic Sea catchment area. The remaining losses - 2% of nitrogen and 13% of phosphorus - resulted from atmospheric deposition on inland surface waters and from other diffuse sources such as scattered dwellings. Of total Danish nutrient losses from point sources and losses from diffuse sources into inland surface waters in the Baltic Sea catchment area 58% nitrogen and 60% phosphorus originated in the Kattegat catchment area while 37% nitrogen and 38% phosphorus emanated from the Western Baltic catchment area.

The total nitrogen and total phosphorus losses and discharges of all sources into inland surface waters within the **Estonian** Baltic Sea catchment area amounted to 33000 tonnes for total nitrogen and 1370 tonnes for total phosphorus. Some 58% of Estonian nitrogen losses and 68% of Estonian phosphorus losses originated in the Gulf of Finland catchment area, while 40% of nitrogen losses and 31% phosphorus losses came from the Gulf of Riga catchment area. Losses from agriculture and managed forestry were the main source of losses and discharges into inland surface waters in Estonia, and comprised 72% of total nitrogen and 71% of total phosphorus losses and discharges. The natural background losses of nutrients into inland surface waters in Estonia contributed 18% total nitrogen and 19% total phosphorus of the total losses and discharges into inland surface waters in the Estonian Baltic Sea catchment area. Of the total losses and discharges into inland surface waters in the Estonian part of the Baltic Sea catchment area, total discharges from point sources accounted for 1230 tonnes nitrogen (4%) and 142 tonnes phosphorus (10%).

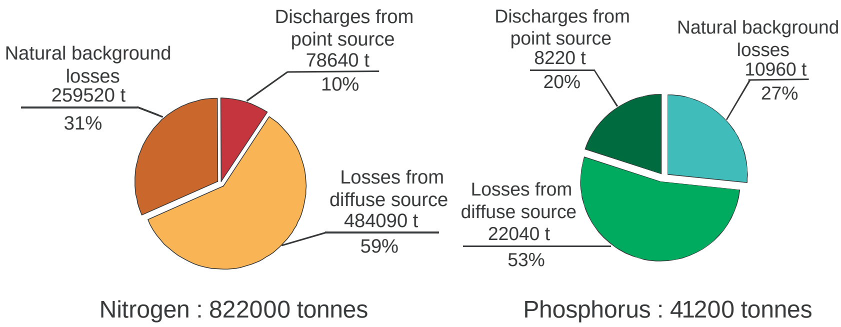


Figure 5.22: Distribution of point source discharges, losses from diffuse sources and natural background losses of N_{total} and P_{total} into inland surface waters within the Baltic Sea catchment area in 2000 based on the source-orientated approach.

The total nitrogen and total phosphorus discharges and losses into inland surface waters within the **Finnish** Baltic Sea catchment area amounted to 146600 tonnes nitrogen and 6790 tonnes phosphorus. Of these losses and discharges from diffuse sources, 55% and 67% represented nitrogen and phosphorus respectively, while nitrogen and phosphorus losses and discharges amounted to 38% and 28% respectively of the natural background losses. Point source discharges in the catchment area accounted for and 7% total nitrogen and 5% total phosphorus. Totalling 38% nitrogen and 56% phosphorus, losses from agriculture and managed forestry were the biggest sources of losses and discharges into inland surface waters within the Finnish Baltic Sea catchment area. The majority of nutrient losses and discharges, 35% for nitrogen and 39% for phosphorus, originated in the catchment area of the Bothnian Bay while 22% and 20%, respectively came from the Bothnian Sea catchment area and 37% and 29% respectively from the Gulf of Finland catchment area.

Total nitrogen and total phosphorus discharges from point sources, and losses from diffuse sources into inland surface waters in the **German** Baltic Sea catchment area (including the German part of the Oder catchment area) amounted to 32000 tonnes and 1200 tonnes, respectively. The majority of these losses and discharges of nitrogen (74%) and phosphorus (73%), originated from diffuse sources. These proportions for nitrogen and phosphorus were approximately the same for both catchment areas of Germany (the Baltic Proper and the Western Baltic catchment areas). The losses from agriculture and managed forestry represented the largest nutrient losses and discharges into inland surface waters within the German part of the Baltic Sea catchment area, with 64% for nitrogen and 57% for phosphorus, of total losses and discharges into inland surface waters. The second largest sources are the natural background losses, which accounted for 18% nitrogen and 21% phosphorus in total losses and discharges.

Approximately 50% of the German losses and discharges into inland surface waters for both nitrogen and phosphorus occurred within the catchment area of the Western Baltic and the remaining 50% within the Baltic Proper catchment area.

Within the **Latvian** Baltic Sea catchment area total nitrogen and total phosphorus discharges from point sources, and losses from diffuse sources into inland surface waters amounted to 54000 tonnes nitrogen and 1470 tonnes phosphorus of which 85% and 89%, respectively originated in the Gulf of Riga catchment area. The majority of nutrient losses and discharges (63% for nitrogen and 58% for phosphorus) within the Latvian part of the Baltic Sea catchment area originated from diffuse sources. The second largest proportion resulted from natural background losses - 34% for nitrogen and 23% for phosphorus. Latvia has not specified losses from agriculture and managed forestry.

Total nitrogen and total phosphorus discharges from point sources and losses from diffuse sources into inland surface waters within the **Lithuanian** Baltic Sea catchment area amounted to 36000 tonnes and 780 tonnes, respectively. The losses from diffuse sources comprised the bulk of nitrogen losses and discharges (77%) within the Lithuanian Baltic Sea catchment area. The second largest proportion of nitrogen losses and discharges was 19% and was caused by natural background losses. The corresponding figures for phosphorus were 67% from diffuse losses and 22% from natural background losses. The losses from agriculture and managed forestry are the biggest source of nutrient losses and discharges into inland surface waters within the Lithuanian part of the Baltic Sea catchment area, accounting for 71% of nitrogen and 51% of phosphorus of total losses and discharges. Lithuania has not provided any figures on losses and discharges into inland surface waters for the Lithuanian part of the Gulf of Riga catchment area, which covers approximately 11100 km^2.

In the **Polish** Baltic Sea catchment area total nitrogen and total phosphorus discharges from point sources, and losses from diffuse sources into inland surface waters amounted to 230000 tonnes and 18700 tonnes, respectively. Of these losses 62% nitrogen and 54% phosphorus emanated from diffuse sources, while18% and 29% issued from point sources, and 20% and 17% from natural background losses, respectively. Losses from agriculture and managed forestry were responsible for the majority of nutrient losses and discharges into inland surface waters within the Polish part of the Baltic Sea catchment area. These sources contributed 45% of both nitrogen and phosphorus of total losses and discharges. As the Polish catchment area drains only into the Baltic Proper, all reported losses and discharges entered inland surface waters through that sub-catchment area.

A total of 53700 tonnes of total nitrogen and 2540 tonnes of total phosphorus was reported as losses and discharges into inland surface waters within the **Russian** Baltic Sea catchment area. Russia has not provided any figures on losses and discharges into inland surface waters for the Russian part of the Gulf of Riga catchment area, which covers approximately 23700 km^2. Furthermore, only point source discharges were reported for the Russian part of the Baltic Proper catchment area (15000 km^2). Additional losses from diffuse sources (as a total figure) are only provided for the Russian catchment area of the Gulf of Finland, but the figures appear to be unrealistically low (637 nitrogen and 392 tonnes phosphorus. In total 84% of nitrogen losses and discharges resulted from natural background losses and 15% from point source discharges, while only 1% was produced by diffuse sources. The majority of phosphorus losses and discharges (50%) issued from point source discharges while natural background losses and diffuse sources constituted 34% and 16% of these losses respectively. It should be noted that the low reading for the proportion of losses from diffuse sources in Russians inland surface waters is not realistic.

In the **Swedish** Baltic Sea catchment area, total nitrogen and total phosphorus discharges from point sources, and losses from diffuse sources into inland surface waters amounted to 176000 tonnes and 6850 tonnes, respectively. Of these losses and discharges 56% nitrogen and 41% phosphorus originated from diffuse sources, 6% nitrogen and 4% phosphorus was discharged from point sources and 38% nitrogen and 55% phosphorus resulted from natural background losses. There is a high proportion of natural background losses compared to losses from diffuse sources, but this result is difficult to explain, although the northern part of Sweden has low agricultural activity. Of the total losses and discharges into inland surface waters within the Swedish Baltic Sea catchment area, losses from agriculture and managed forestry constituted 42% nitrogen and 23% phosphorus. The majority of nutrient losses and discharges into inland surface waters within the Swedish Baltic Sea catchment area originated in the Swedish Kattegat catchment area for nitrogen (32%) and the Swedish Bothnian Sea catchment area for phosphorus (33%). The second highest readings reported both occurred within the Swedish Baltic Proper catchment area, and are 27% for nitrogen and 24% for phosphorus.

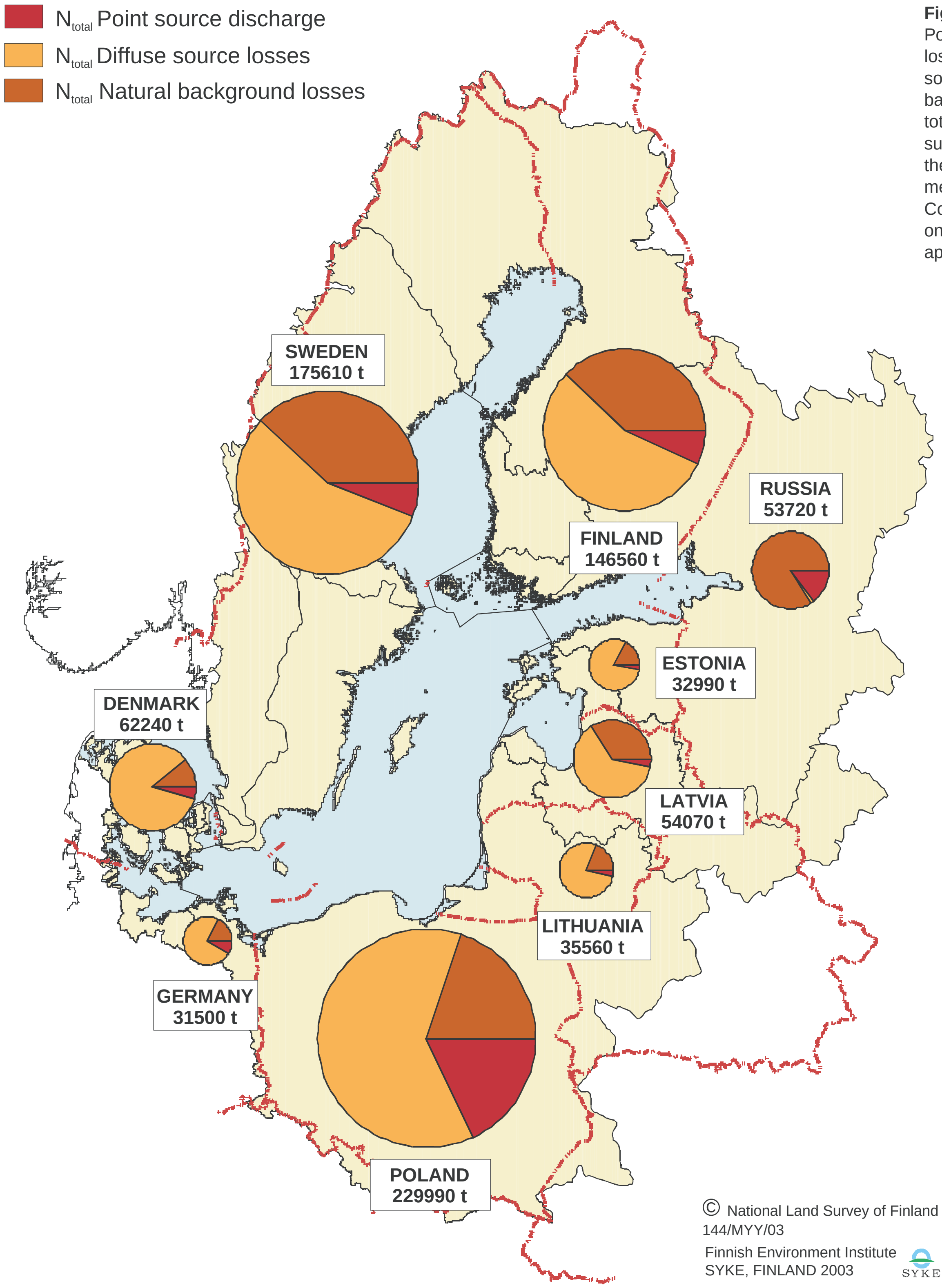
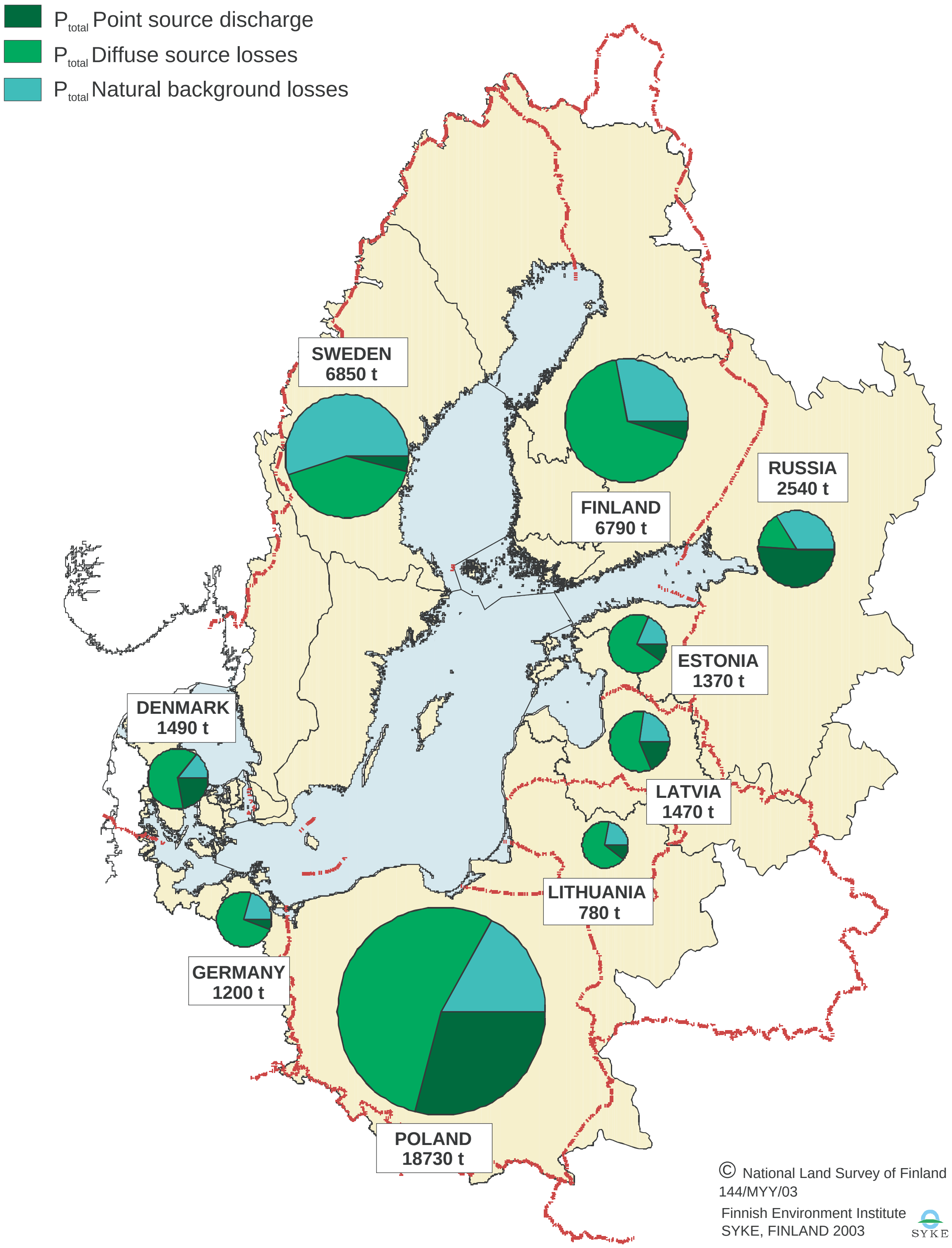


Figure 5.23:
Point source discharges, losses from diffuse sources and natural background losses of total nitrogen into inland surface waters within the Baltic Sea catchment area in 2000 by Contracting Party based on the source-orientated approach.

Figure 5.24: Point source discharges, losses from diffuse sources and natural background losses of total phosphorus into inland surface waters within the Baltic Sea catchment area in 2000 by Contracting Party based on the source-orientated approach.



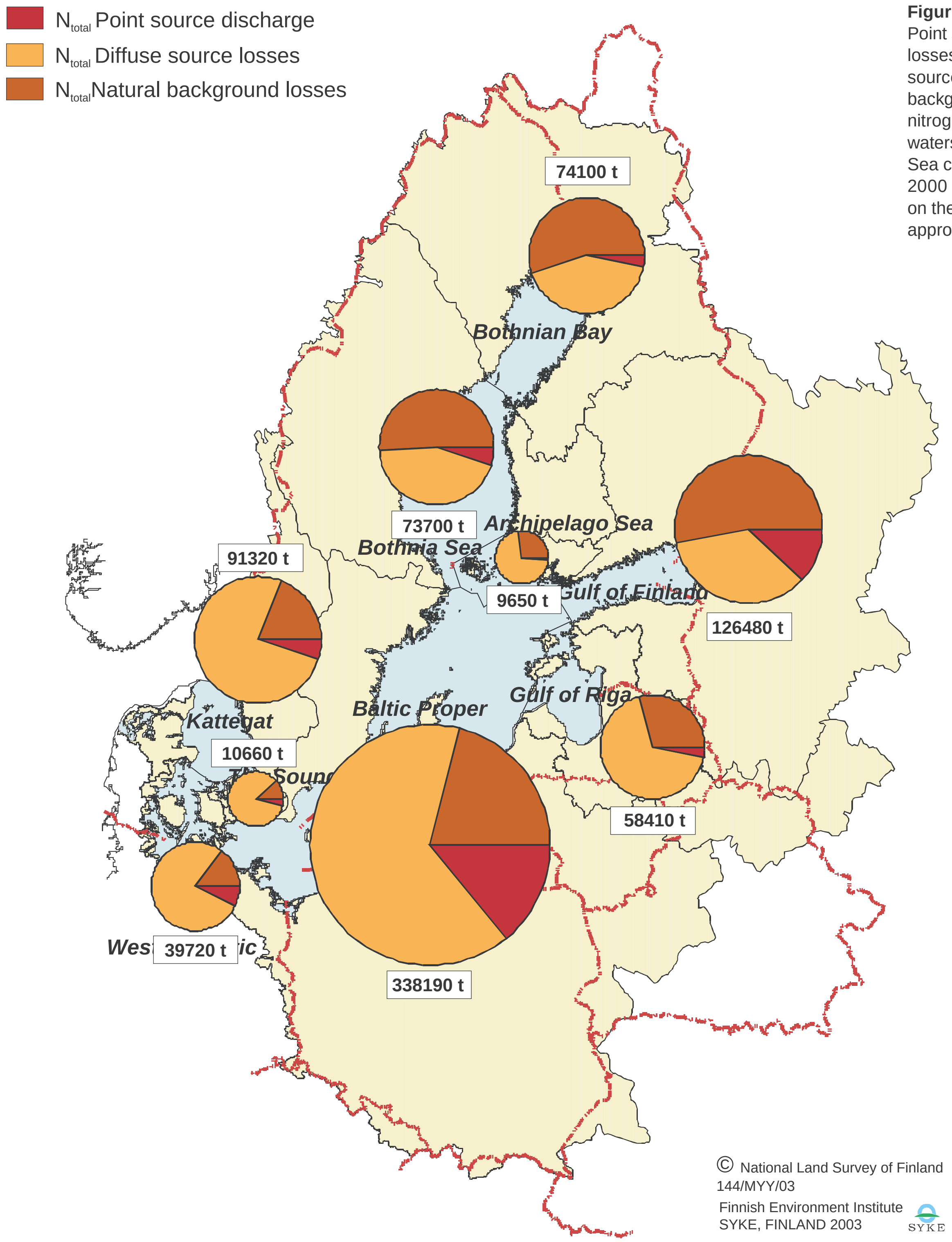
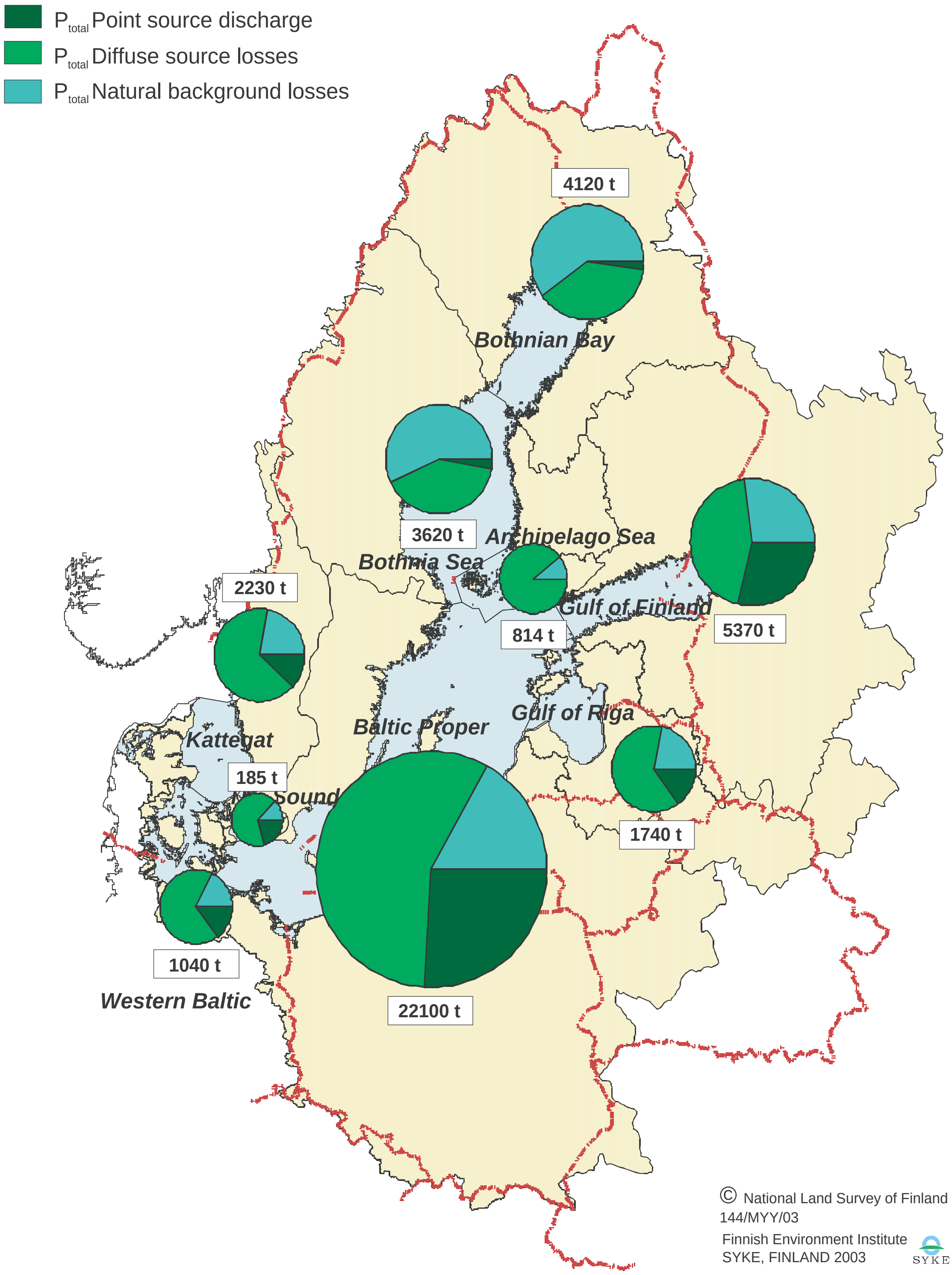


Figure 5.25:
Point source discharges, losses from diffuse sources and natural background losses of total nitrogen into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region based on the source-orientated approach.

Figure 5.26: Point source discharges, losses from diffuse sources and natural background losses of total phosphorus into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region based on the source-orientated approach.



5.2 Total load discharged into the maritime area in 2000 (Load-orientated approach)

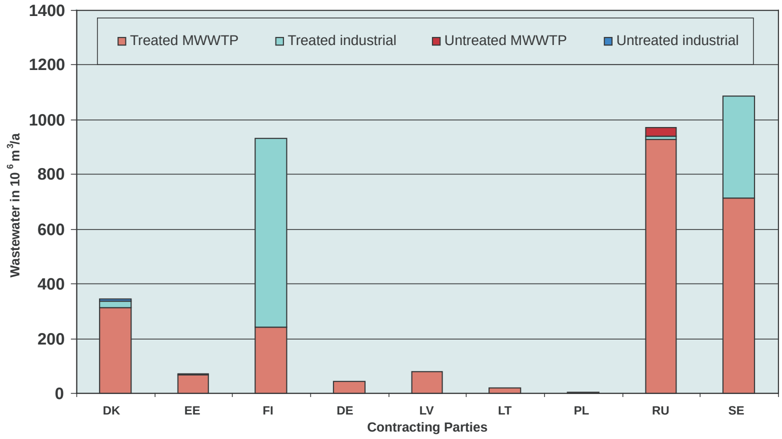
5.2.1 Point source discharges entering directly into the Baltic Sea in 2000

The reported nutrient, organic matter and heavy metal discharges entering the Baltic Sea marine environment from municipalities, industrial plants and fish farms discharging directly into the Baltic Sea (direct point sources) in 2000 are summarised in this chapter. More detailed information is presented in Tables 5.35 to 5.52 in Annex 6.

5.2.1.1 Wastewater discharges entering directly into the Baltic Sea

Wastewater from **point sources** discharging directly into the Baltic Sea in 2000 was reported at approximately 3600 million m^3. The actual quantity of wastewater discharged is larger, as information is absent for a small number of big municipalities and industries and for many minor point sources discharging directly into the Baltic Sea. Nearly 70% of the wastewater discharge originated from municipalities and the remaining 30% from industrial plants (Figure 5.27). According to the figures reported (Tables 5.1 to 5.4, 5.35 and 5.36), more than 99% of wastewater discharges from municipalities discharging directly into the Baltic was treated. The corresponding figure for industry was nearly 99%. The real proportion of treated wastewater would be lower if all figures have been reported. Only the fish farms based on land, but discharging directly into the Baltic Sea, are capable of treating wastewater, and the amount of treated wastewater produced by fish farms is low and negligible compared to other pollution sources.

The Contracting Parties have reported that 196 large and 74 small MWWTP discharged wastewater directly into the Baltic Sea. Also discharging directly into the Baltic were 129 big industrial plants and 46 small industrial plants, and 171 small fish farms. Excluding Russian figures, approximately 16.4 million PE (Population Equivalents) was connected to municipal wastewater treatment plants (MWWTPs) and industries discharging directly into the Baltic Sea. The data showed that 129 big industries and 217 MWWTPs with more than 10000 PE produced nearly 2400 million m^3 treated wastewater.



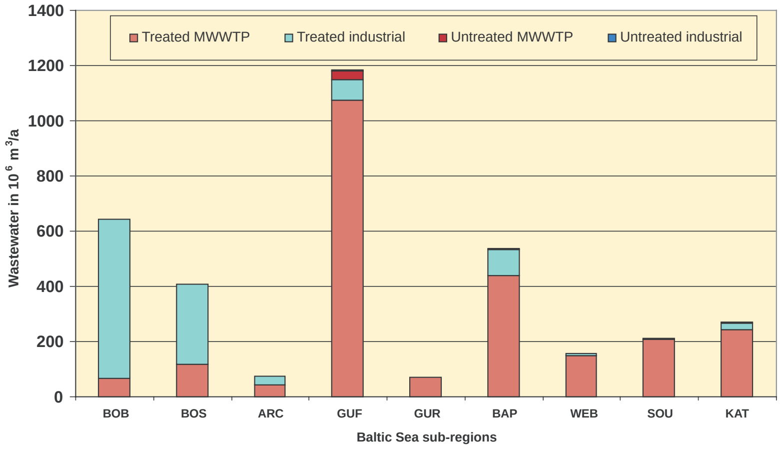


Figure 5.27: Distribution of wastewater from point sources discharging directly into the Baltic Sea in 2000 by Contracting Party and by sub-region of the Baltic Sea.

Altogether, 271 **MWWTPs** discharged approximately 2500 million m^3 wastewater directly into the Baltic Sea in 2000. Eight MWWTPs located in Russia and one in Estonia discharged untreated wastewater directly into the Baltic Sea (Gulf of Finland and Baltic Proper). The remaining Contracting Parties have not reported data on untreated wastewater discharges from MWWTPs directly into the Baltic Sea. In 2000, 45% of all reported wastewater from MWWTPs discharging directly into the Baltic Sea, or approximately 1100 million m^3/a wastewater was discharged into the Gulf of Finland. Approximately 460 million m^3/a or 19% of total direct wastewater discharges from MWWTP entered the Baltic Proper in 2000, while the Sound received 5% of total direct wastewater discharges.

A total of 175 **industrial plants** reported discharged more than 1100 million m^3/a wastewater directly into the Baltic Sea in 2000, of which nearly 99% was treated wastewater. While Poland has reported only one such plant, Latvia has not reported any, and Germany has no industries with direct discharges into the Baltic Sea. Roughly 19 industrial plants were found to have discharged untreated wastewater; 16 of them located in

Denmark, one in Estonia and two in Russia. The largest amount of industrial wastewater discharged directly into the Baltic Sea in 2000 was produced by 23 industrial plants discharging 580 million m³ wastewater into the Bothnian Bay. A further 290 million m³ entered the Bothnian Sea and 95 million m³ the Baltic Proper. These figures represented 51%, 26% and 8%, respectively of the total direct industrial discharges into the Baltic Sea in 2000.

Direct wastewater discharges from MWWTPs and industries constituted 46% of all wastewater discharged by these sources into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea. Direct wastewater discharge from MWWTPs and industries constituted only 0.4% and 0.2%, respectively, compared with the total amount of freshwater run-off by rivers and direct discharges into the Baltic Sea.

5.2.1.2 Organic matter discharges (BOD_7) entering directly into the Baltic Sea

In 2000 total reported BOD_7 discharges from point sources entering directly into the Baltic Sea amounted to 88700 tonnes (Tables 5.37 and 5.38 in Annex 6). The distribution of BOD_7 discharged directly into the Baltic Sea, categorized by Contracting Party and by Baltic Sea sub-region is given in Figure 5.28. The majority of BOD_7, 58000 tonnes (65%), was discharged into the Baltic Sea from industrial plants. The BOD_7 from municipalities discharging directly into the Baltic Sea contributed with 33% (29000 t) of total direct BOD_7 discharges. BOD_7 discharges from these sources constituted a considerably higher proportion of total BOD_7 discharges into the Baltic Sea (8%) than the corresponding proportion of wastewater (see chapter 5.1.1). The proportion of untreated municipal BOD_7 discharges was quite low, only 13%, but it should be noted that data on the untreated discharges from the Russian Kaliningrad region which entered the Baltic Proper directly are missing. The proportion of direct industrial untreated BOD_7 discharges was found to be very low, only 0.002% (chapter 5.1.1). It should be mentioned that in most of the Contracting Parties many industries are served by wastewater treatment plants, and therefore data from these sources are not reported separately.

Direct discharges of BOD_7 by fish farms were of minor importance constituting only 2% of the total direct discharges of BOD_7 into the Baltic Sea.

Sweden was the largest contributor of BOD_7 direct discharges into the Baltic Sea with 55% of the total direct BOD_7 discharges follow by Russia with 19% and Finland with 12%.

5.2.1.3 Nutrient discharges (N_{total} and P_{total}) entering directly into the Baltic Sea

In 2000 reported total nitrogen and total phosphorus discharges entering directly into the Baltic Sea amounted to 38900 t for nitrogen and 2850 t for phosphorus, respectively (Tables 5.39 to 5.42 in Annex 6). The distribution from point sources of total nitrogen and phosphorus discharges directly into the Baltic Sea according to Contracting Party and sub-region is given in Figure 5.29 for total nitrogen and Figure 5.30 for total phosphorus. The majority of total nitrogen and total phosphorus direct discharges were produced by MWWTPs, which accounted for more than 80% of both total direct nitrogen and total direct phosphorus discharges. Direct discharges from industry constituted 16% of the total direct nitrogen discharges and 14% of total direct phosphorus discharges into the Baltic Sea. Direct nitrogen discharges from industry into the Bothnian Bay and the Both-

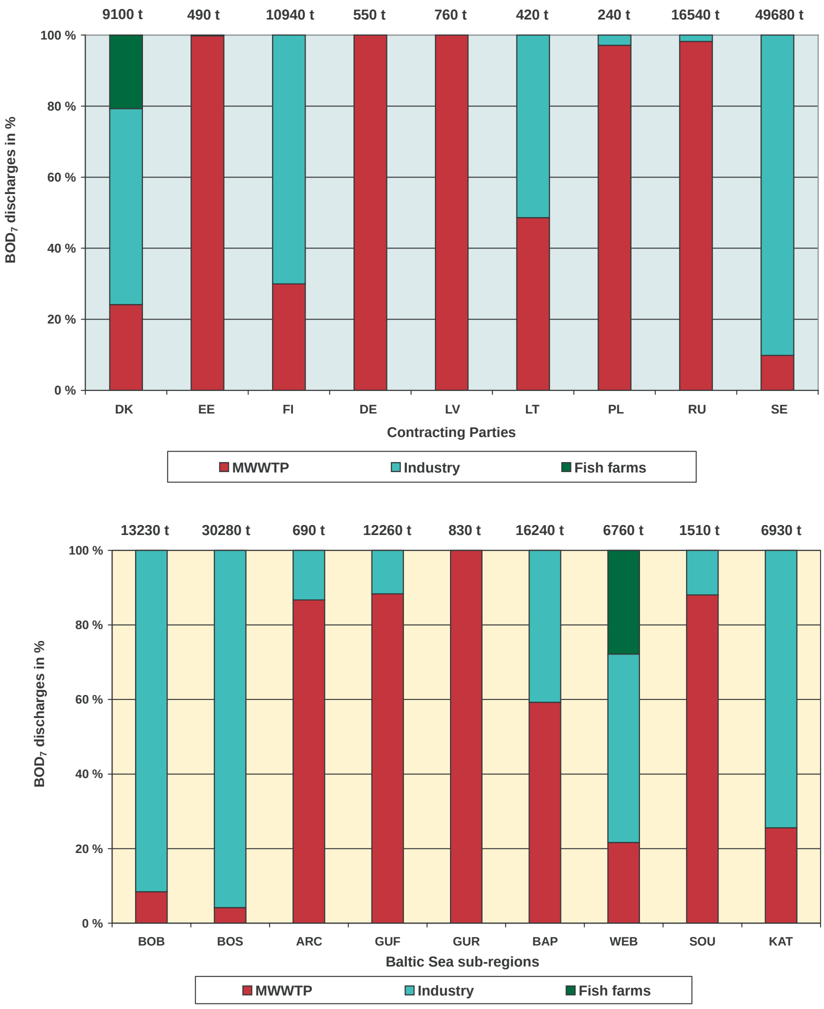


Figure 5.28: Distribution of organic matter discharges (BOD_7) by Contracting Party and by sub-region from point sources discharging directly into the Baltic Sea in 2000.

nian Sea are similar to the direct total nitrogen discharges from MWWTPs. The direct total phosphorus discharges from industry to these regions are about 3 times higher than the corresponding MWWTP discharges, while the direct discharges from fish farms are insignificant.

The proportion of direct total nitrogen and total phosphorus discharges from industry and fish farms constituted 5% and 8% of the total nitrogen and total phosphorus input into the Baltic Sea via rivers and direct discharges, figures which are considerably higher than the corresponding proportion of wastewater discharges (0.5%, see chapter 5.1.1). The proportion of untreated municipal total nitrogen and phosphorus discharges was quite low, 2.4% and 5%, respectively, but it should be noted that data for the untreated portion of the load from the Russian Kaliningrad region discharging directly into the Baltic Proper have not been reported. The proportion of untreated direct industrial total nitrogen and phosphorus discharges was also quite low, 14% and 5.5%, respectively. However, actual industrial direct discharges would have been larger as industrial wastewater is commonly fed into municipal wastewater treatment systems, and therefore not reported separately.

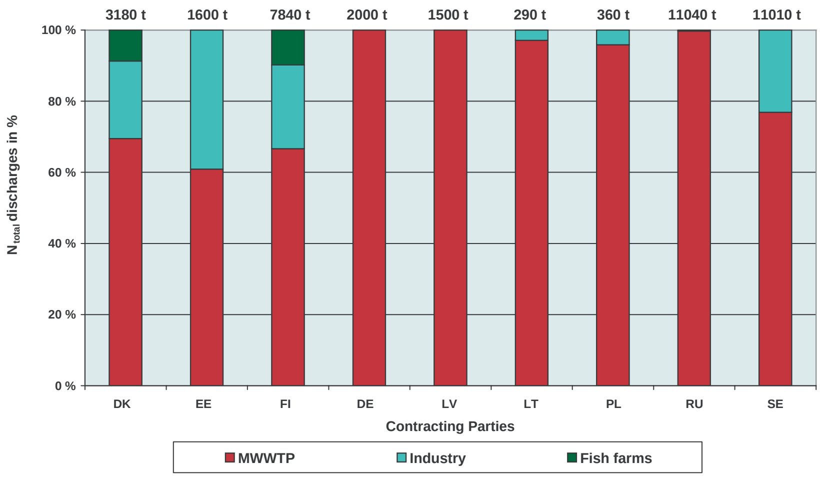
Sweden, Russia and Finland were the main contributors of direct total nitrogen discharges into the Baltic Sea, accounting for 30%, 24% and 21%, respectively of this contaminant. Russia, Sweden and Denmark were the main contributors of direct total phosphorus discharges into the Baltic Sea, and produced 44%, 17% and 14%, respectively of these discharges. The high Russian proportion of direct phosphorus discharges is surprising taking into account that direct discharges of both total nitrogen and phosphorus produced by MWWTPs accounted for 82% of the total direct discharges of nutrients into the Baltic Sea.

5.2.1.4 Heavy metal discharges entering directly into the Baltic Sea

It should be noted that data for BOD and direct nutrient discharges were incomplete for some Contracting Parties. Furthermore, data relating to direct discharges of heavy metals into the Baltic Sea were very incomplete, and it was not possible to calculate total figures. Only Denmark, Germany, Poland and Sweden have estimates of direct heavy metal discharges from all their sub-regions into the Baltic Sea. Restricted funding was the main factor contributing to difficulties in obtaining comparable heavy metals discharge data in 1995 and again in 2000. But the situation was also complicated by insufficient laboratory equipment for analysis, an inability to ensure adequate sampling and difficulty in analysing very low concentrations of some metals. These problems were common to both countries in transition and other Contracting Parties. Heavy metal concentrations were typically monitored only at a few selected large wastewater treatment plants and industries, and in many cases no estimates on the total direct heavy metal discharges have been produced by the Contracting Parties.

Many statistics are missing about direct total discharges of heavy metals into the Baltic Sea, but the reported results seem to indicate that direct discharges by MWWTPs were the largest source of total direct discharges of mercury, copper and nickel. In the cases of cadmium, lead, zinc and chrome MWWTPs and industry appeared to be equally important sources of direct discharges.

Data from Russian municipalities and industrial plants seem to indicate high levels of cadmium



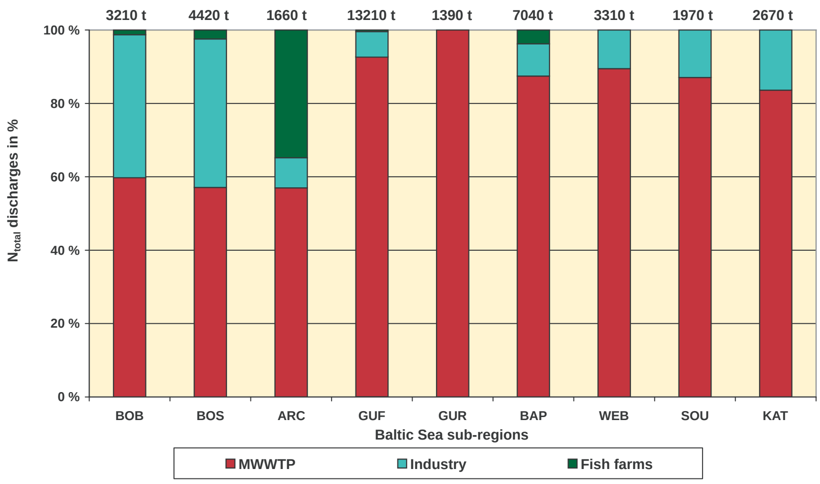


Figure 5.29: Distribution of total nitrogen discharges (N_{total}) by Contracting Party and by sub-region from point sources discharging directly into the Baltic Sea in 2000.

discharging directly into the Gulf of Finland. In Tables 5.43 to 5.52 in Annex 6 a more detailed review of the heavy metals discharges reported by Contracting Party is given, but total figures were not compiled due to the lack of data in many cases.

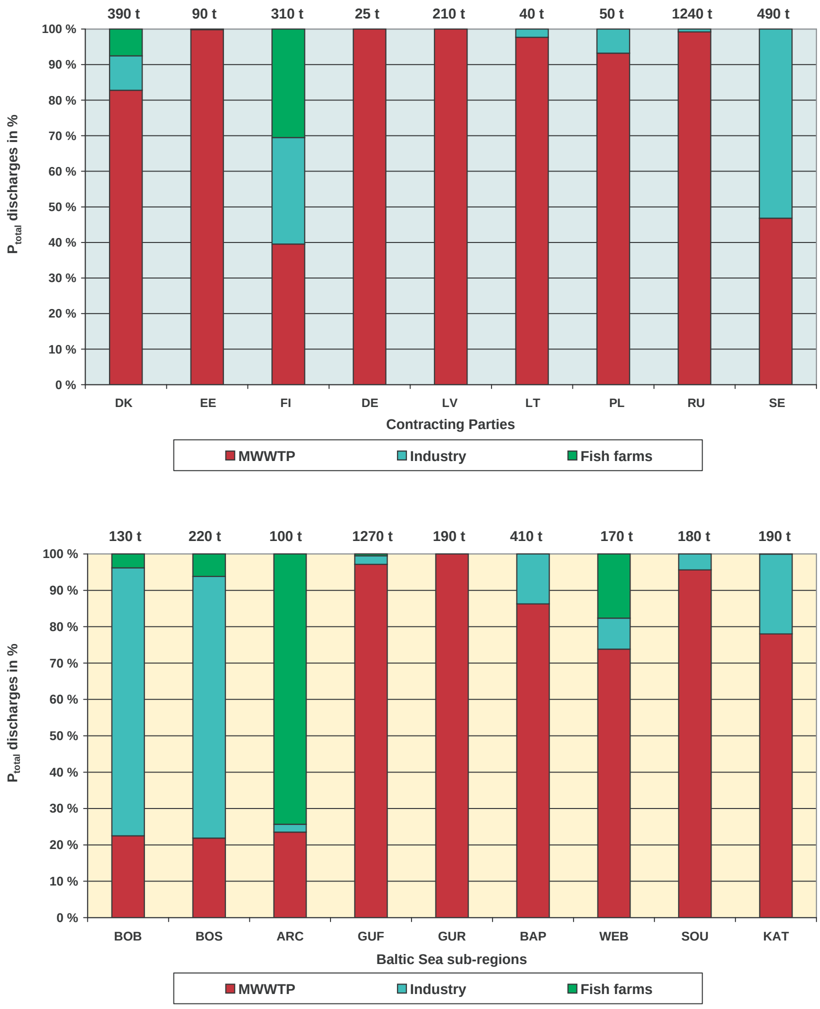


Figure 5.30:
Distribution of total phosphorus discharges (P_{total}) by Contracting Party and by sub-region from point sources discharging directly into the Baltic Sea in 2000.

5.2.2 Riverine inputs into the Baltic Sea in 2000

Riverine load consists of discharges and losses from different sources within a river's catchment area, and include discharges from industrial plants, municipal wastewater treatment plants (MWWTP), scattered dwellings, dicharges from rainwater contructions not connected to MWWTPs', fish farms and losses from agriculture and managed forests, as well as natural background losses and atmospheric deposition on inland surface waters. Point source discharges are usually quite constant during the seasons. However, the recorded discharges may change markedly over a longer period of time under certain circumstances, for example when new measures are implemented or more PE data are collected. Changes in weather conditions greatly affect the diffuse losses leached or eroded into surface waters. A major proportion of the total annual loads entering the northern parts of the Baltic Sea comes during the spring thaw; while heavy autumn rains produce a second seasonal peak in river run-off. In the southern and south-western parts of the Baltic catchment area, the majority of run-off occurs during autumn and winter, during early spring following heavy rainfall and low evaporation, but also spring thaw can cause heavy run-off.

Apart from total riverine inputs into the sea it is also important to examine the relationship between the riverine load and the size of the catchment area. Quantification of this relationship yields a measure called the area-specific load, which is calculated by dividing the total riverine load by the size of the corresponding catchment area. Both total loads and area-specific loads of nutrients are lowered by processes such as retention (see chapter 5.2.4), nutrient turnover through denitrification, and high groundwater inflow into the rivers. These processes generally are of greater significance in large river systems with lakes than in small river systems without lakes, and lead to lower area-specific nutrient loads and reduced flow-weighted concentrations (riverine load divided with the corresponding run-off) in larger rivers systems than in the smaller ones.

5.2.2.1 Hydrology

In 2000, 232 rivers were monitored for run-off. The total run-off for these rivers amounted to 532900 million m³/a (see Tables 5.35 and 5.36 in Annex 6), monitored over a total catchment area of 1.33 million km², or about 97% of the total Baltic Sea catchment area. The corresponding area-specific run-off figure is 11 l/(s km²). In 2000, the five largest rivers contributing to run-off in the Baltic Sea catchment area were the Neva (average flow rate 2110 m³/s or 7.8 l/(s km²)), the Vistula (1350 m³/s, 6.9 l/(s km²)), the Göta älv (760 m³/s, 15 l/(s km²)), the Kemijoki (740 m³/s, 15 l/(s km²)), and the Ångermanälven (660 m³/s, 21 l/(s km²)). The total run-off for unmonitored rivers and coastal areas amounted to approximately 47700 million m³/a. However, this figure must be underestimated, since data concerning unmonitored riverine run-off were not supplied by four of the Contracting Parties - Estonia, Latvia, Lithuania and Russia. Over 40% or 246000 million m³/a of the total Baltic Sea run-off entered from the Swedish catchment area (Figure 5.31), and the sum of the Danish and the German contributions to total run-off were less than 2%.

The Bothnian Bay and the Bothnian Sea received the highest quantities of riverine run-off in 2000, registering 155000 million m³/a, 19 l/(s km²) and

Figure 5.31: Monitored and unmonitored run-off from rivers and coastal areas into the Baltic Sea as well as area-specific run-off in 2000 by Contracting Party

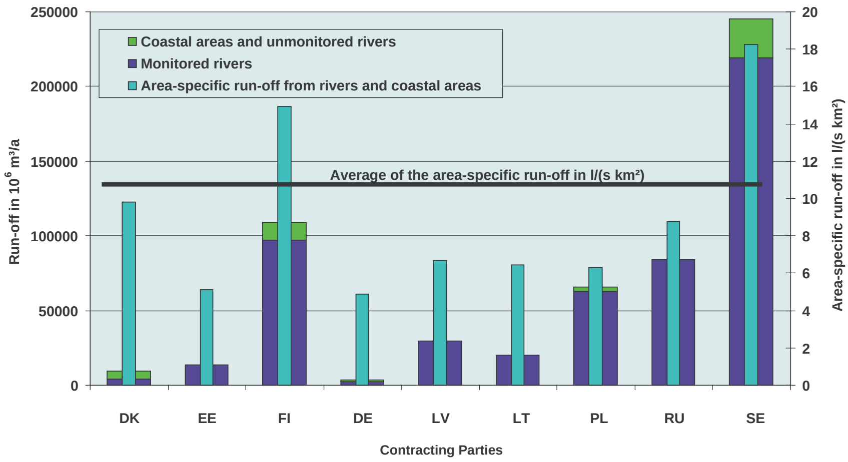
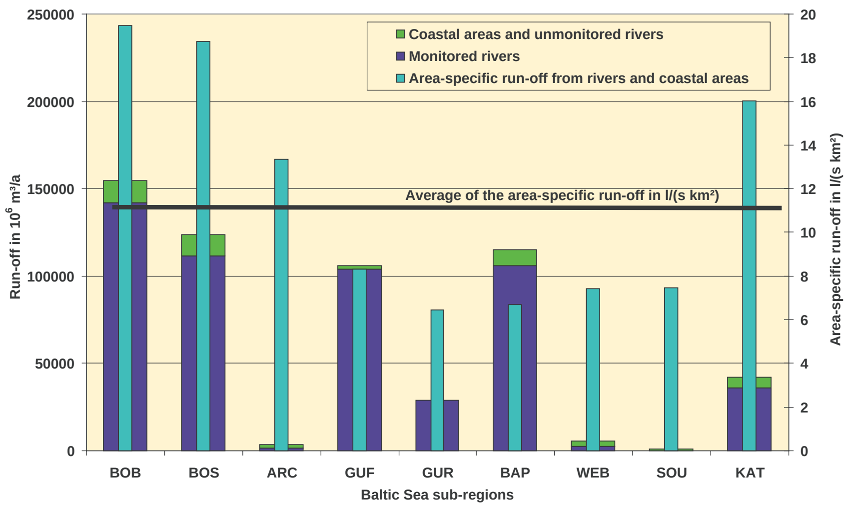
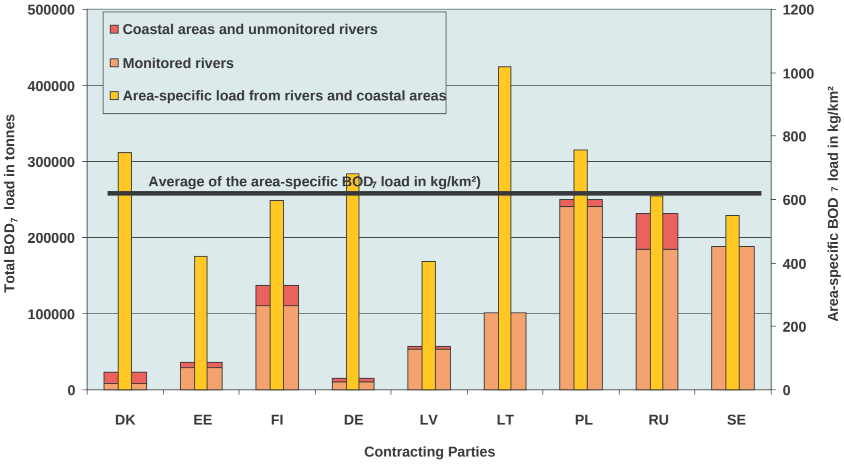


Figure 5.32: Monitored and unmonitored run-off from rivers and coastal areas into the Baltic Sea as well as area-specific run-off in 2000 by sub-regions.



124000 million m³/a, 19 l/(s km^2) respectively. This was mainly due to heavier precipitation and lower evaporation in the northern parts of the Baltic Sea. The area-specific run-off rate was three times higher in the Bothnian Bay catchment area than in the southern parts, except for the Kattegat, where the area-specific run-off was 16 l/(s km²) (Figure 5.32).

Figure 5.33:
Riverine BOD_7 load into the Baltic Sea as well as area-specific BOD_7 load in 2000 by Contracting Party.



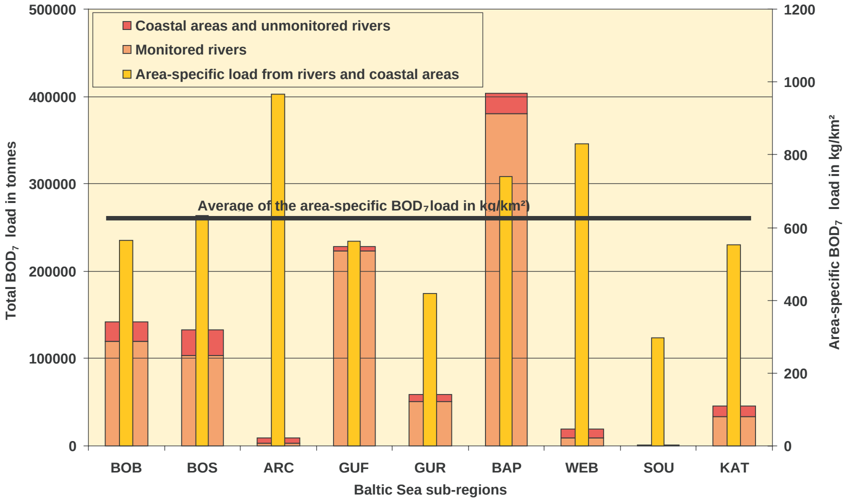


Figure 5.34:
Riverine BOD_7 load into the Baltic Sea as well as area-specific BOD_7 load in 2000 by sub-region.

5.2.2.2 Riverine organic matter load into the Baltic Sea

Some components of organic matter create environmental problems when their decomposition consumes oxygen, leading to oxygen depletion in deeper waters, and harming aquatic life in seabed waters. Anoxic conditions, which also may release nutrients from sediments, have occurred frequently in the deeper basins of the Baltic Proper for a long time, and more recently they have also affected vast areas in the Belt Sea and the Gulf of Finland (Kauppila & Bäck 2001, HELCOM 2002). Organic matter in rivers originates from various sources, including municipal and industrial wastes, fish farms, scattered dwellings, agricultural land, natural leaching, and from primary production in lakes and larger rivers. Rivers transport a major proportion of the annual organic matter load into the Baltic Sea.

According to the PLC-4 guidelines riverine organic matter is measured as BOD_5, BOD_7, COD_{Cr} or as TOC. In this report, however, only the results for BOD_7 are given, since this parameter was measured by almost all of the Contracting Parties for most pollution sources (Chapter 4). In Swedish rivers and in some of the Finnish rivers, BOD_7 discharges were estimated on the basis of TOC. The organic matter load from rivers draining into the northern part of the Baltic Sea (Bothnian Bay and Bothnian Sea) mostly originated from areas with low human impact where high amounts of humus leached from peat lands and forest soils increase total organic carbon concentration in inland surface waters. Because of low-level human activity BOD_7 concentration in these rivers is usually below the detection limit. TOC loads in these rivers were converted to BOD_7 however BOD_7 is often used as an estimate of easily degradable organic matter from anthropogenic sources. Because humic matter is averse to biological degradation, the findings in this report likely overestimate actual riverine BOD_7 loads into the Bothnian Bay and the Bothnian Sea.

In 2000, the total BOD_7 load entering the Baltic Sea from rivers and coastal areas amounted to 1040000 tonnes (610 kg BOD_7/km^2, Figures 5.33 and 5.34), with monitored rivers accounting for 89% of the total riverine load. Approximately 403700 tonnes or 40% of the total BOD_7 load entered the Baltic Sea from the catchment area of the Baltic Proper (740 kg/km^2, Figure 5.34). Much of the BOD_7 load was transported into the Baltic Proper via the region's three largest rivers: the Vistula (163000 tonnes, 840 kg BOD_7/km^2), the Nemunas (101000 tonnes, 1030 kg BOD_7/km^2) and the Oder (63400 tonnes, 540 kg BOD_7/km^2). The second largest proportion of the total BOD_7 load into the Baltic Sea, 230000 tonnes (500 kg BOD_7/km^2), issued from the Gulf of Finland catchment area, where the River Neva discharged 147000 tonnes (540 kg BOD_7/km^2). Roughly 25% of the total riverine BOD_7 load came from Poland, which also has the highest population in the Baltic Sea catchment area (Tables 5.37 and 5.38 in Annex 6). The highest area-specific BOD_7 loads (Figure 5.34) occurred in the Archipelago Sea

(970 kg/km²), the Western Baltic (830 kg BOD_7/km²) and the Baltic Proper (740 kg BOD_7/km²).

5.2.2.3 Riverine nutrient load into the Baltic Sea

5.2.2.3.1 Riverine nitrogen load into the Baltic Sea

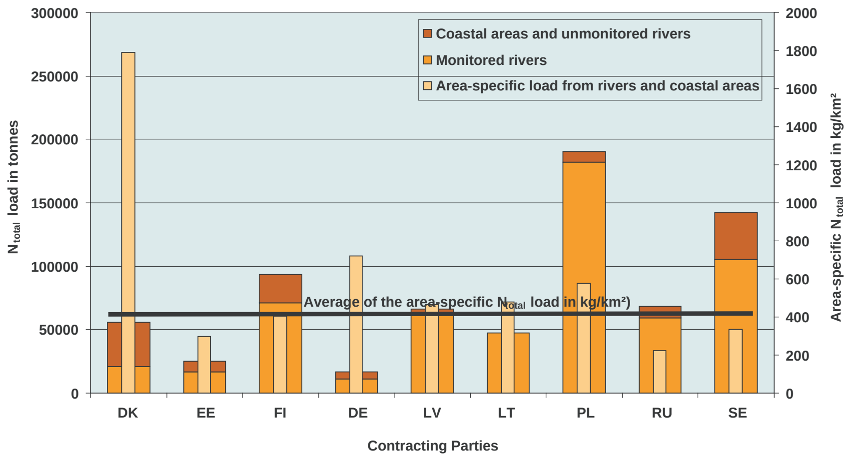
In 2000, the total riverine nitrogen load entering the Baltic Sea amounted to 706000 tonnes (420 kg/km², Figures 5.35 and 5.36 and Tables 5.39 and 5.40 in Annex 6). The bulk (81%) of this load was discharged by monitored rivers, with about 40% of the total load originating from the catchment area of the Baltic Proper. Approximately 75% of the riverine nitrogen load in the Baltic Proper (286000 tonnes, 525 kg N/km²) was discharged by the region's three large rivers: the Vistula (117000 tonnes, 600 kg N/km²), the Oder (53600 tonnes, 450 kg N/km²) and the Nemunas (46830 tonnes, 480 kg N/km²). The second largest proportion of the total nitrogen load entering the Baltic Sea was 17% or 100400 tonnes (230 kg N/km²), and was discharged from the Gulf of Finland catchment area, where the River Neva discharged 52500 tonnes (195 kg N/km²).

Countries with large catchment areas also tend to have the highest total nitrogen loads (Figure 5.35). Russia is an exception, however, mainly because Lake Ladoga efficiently retains nutrients. The largest proportions of the total riverine nitrogen load came from Poland, Sweden and Finland, with 28%, 21%, and 14% respectively.

Figure 5.36 shows that the highest area-specific nitrogen load occurred in the catchment areas of the Sound (1470 kg N/km²), the Western Baltic (1330 kg N/km²) and the Archipelago Sea (1060 kg N/km²). The highest figures recorded by the Contracting Parties located in these areas are 1790 kg N/km² for Denmark followed by 720 kg N/km² recorded in Germany, 580 kg N/km² in Poland and 480 kg N/km² in Lithuania. High area-specific nitrogen loads are often related to intense agricultural activity, which may include large livestock densities, widespread use of manure and fertiliser and a high proportion of farming in the catchment area, as is the case in Denmark, Germany and southern Sweden.

In rivers draining into the Bothnian Bay, dissolved inorganic nitrogen (NO_2-N, NO_3-N and NH_4-N) comprised about 30% of the total nitrogen load. In the Bothnian Bay catchment area peat lands and forested areas dominate the landscape, and nitrogen is mainly bound to organic substances. In the intensively cultivated southern parts of the Baltic Sea and the Archipelago Sea, 60 tonnes or 80% of the riverine nitrogen load exists in dissolved inorganic form.

Figure 5.35: Riverine nitrogen load (N_{total}) into the Baltic Sea as well as area-specific N_{total} load in 2000 by Contracting Party.



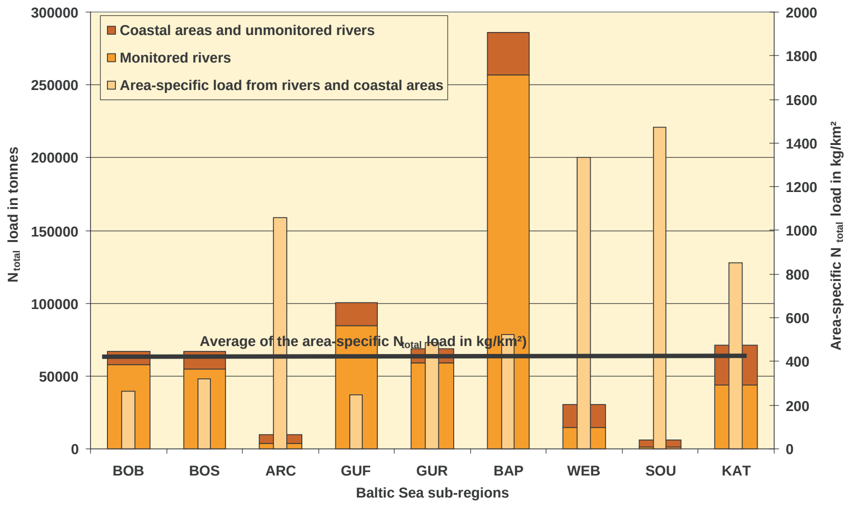


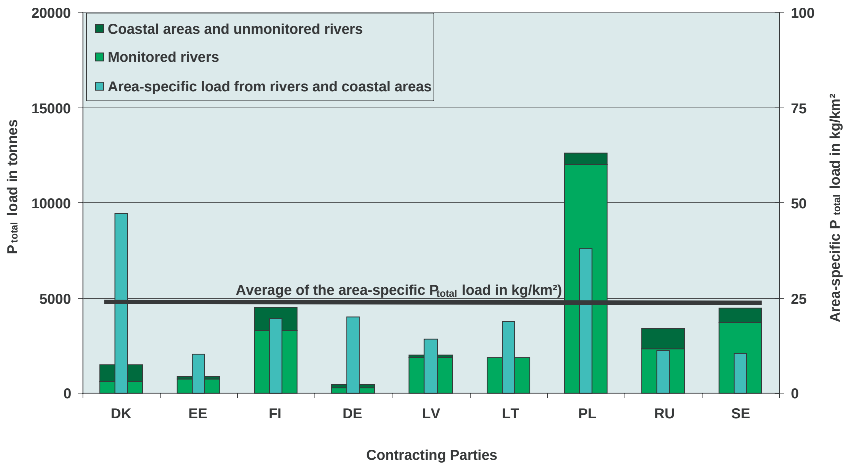
Figure 5.36: Riverine nitrogen load (N_{total}) into the Baltic Sea as well as area-specific N_{total} load in 2000 by sub-region.

5.2.2.3.2 Riverine phosphorus load into the Baltic Sea

In 2000, the total riverine phosphorus load entering into the Baltic Sea amounted to 31800 tonnes (19 kg P/km²), (Figures 5.37 and 5.38 and Tables 5.41 and 5.42 in Annex 6). The majority (84%) of this load was discharged by monitored rivers, with up to 50% of the total load or 15640 tonnes (29 kg P/km²) originating in the catchment area of the Baltic Proper. Approximately 83% of the load fed to the Baltic Proper, was discharged by the region's three large rivers: the Vistula (7490 tonnes, 39 kg P/km²), the Oder (3740 tonnes, 31 kg P/km²) and the Nemunas (1840 t/a, 19 kg P/km²). Roughly 15% or 4760 tonnes (11 kg P/km²) of the total riverine phosphorus load flowing into the Baltic Sea came from the Gulf of Finland catchment area where the River Neva discharged 2380 tonnes (9 kg P/km^2).

Countries with large catchment areas also tended to register the highest phosphorus loads, with Russia as an exception. Poland, Finland and Sweden were responsible for the largest proportion of the total riverine phosphorus loads entering the Baltic Sea, contributing 40%, 15% and 15% respectively. The highest proportion of phosphate-phosphorus (PO_4-P) load (73%) was observed in rivers draining into the Sound, which received large amounts of industrial and municipal treated wastewater. In the rivers draining into the Gulf of Finland, PO_4-P accounted for 22% of the phosphorus load.

Figure 5.37:
Riverine phosphorus load (P_{total}) into the Baltic Sea as well as area-specific P_{total} loads in 2000 by Contracting Party.



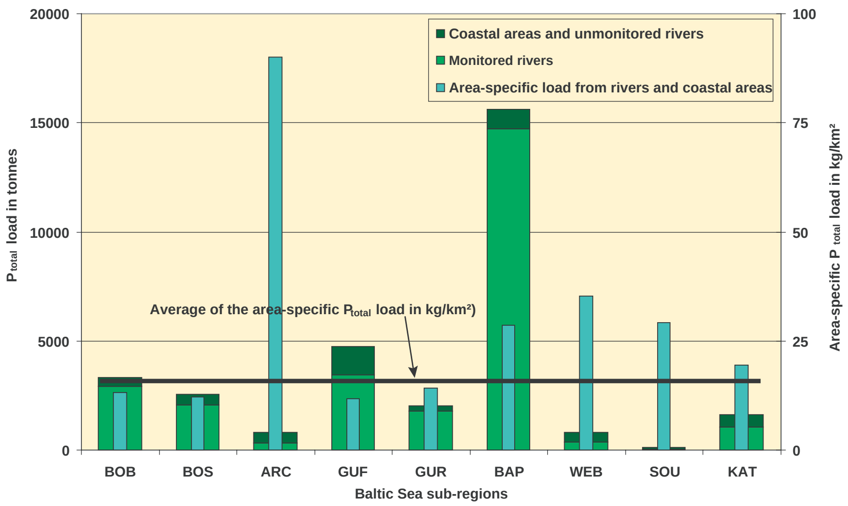


Figure 5.38:
Riverine phosphorus load (P_{total}) into the Baltic Sea as well as area-specific P_{total} loads in 2000 by sub-region.

The highest area-specific phosphorus loads occurred in the catchment areas of the Archipelago Sea (90 kg P/km^2), the Western Baltic (35 kg P/km^2), the Sound (30 kg P/km^2) and the Baltic Proper (29 kg P/km^2) (Figure 5.24). Heavy rains in 2000 increased the leaching and surface run-off of nutrients from fields in the catchment area of the Archipelago Sea. The highest corresponding figures by Contracting Party were recorded for Denmark (47 kg P/km^2) and Poland (38 kg P/km^2), followed by Finland (20 kg P/km^2), Germany (20 kg P/km^2) and Lithuania (19 kg P/km^2). High area-specific phosphorus loads are often related to high population densities (as in the Western Baltic and the Sound), and extensive industrial activity. To some extent the intensity of agricultural activity, soil type and geology of the catchment areas (as around the Archipelago Sea), may also contribute to high area-specific phosphorus loads.

5.2.2.4 Riverine heavy metal loads into the Baltic Sea

Heavy metals in rivers may originate from natural or anthropogenic sources, and excessive metal levels in surface waters may pose a health risk to humans and to the biota in the environment. In the Baltic Sea, unnaturally high mercury concentrations have been detected in samples such as fish tissue. Industrial activity, high population density, soil properties, the exploitation of minerals and other natural resources, and the application of fertiliser in agricultural areas are the main factors which contribute to heavy metal inputs.

Shortcomings in national monitoring programmes and the lack of proper laboratory equipment, meant that heavy metal figures were not obtained in many cases. As a result, a clear picture of the heavy metal loads entering the Baltic Sea could not be determined in PLC-4, and many figures are missing from the heavy metal summary. Nevertheless there have been methodological improvements compared to the data gathering procedures employed during PLC-3 in 1995. These refinements included more comprehensive sampling and new analysers, among other methods, and some countries are now able to measure lower concentrations of certain heavy metals (Figures 5.39 and 5.40).

According to the PLC-4 guidelines, mercury, cadmium, zinc, copper, and lead are obligatory parameters which should be reported wherever concentrations in rivers are not below the detection limit. On the other hand, some of the Contracting Parties have calculated heavy metal loads even if the concentrations have been below the detection limit. In those cases where the recorded results were below the detection limit, the PLC-4 guidelines indicate that the load estimate should be based on the assumption that the actual concentration is half of the detection limit. Four

Contracting Parties, Denmark, Finland, Germany and Sweden, have reported the estimated heavy metal loads from unmonitored rivers and coastal areas.

Based on the reported heavy metal figures the Gulf of Finland received the largest cadmium, lead and copper loads, while mercury inputs were highest for the Baltic Proper. A few major rivers accounted for very large proportions of the total riverine heavy metal loads. For instance, the lead and copper loads in Russian rivers (mainly the Neva) comprised 60% and 40%, respectively, of the total riverine loads for these pollutants; while Polish rivers accounted for approximately 90% of the total riverine mercury load.

According to Table 5.4 and the corresponding Tables 5.43 to 5.52 in Annex 6, a major part of heavy metal load data on inputs from rivers, coastal areas and unmonitored rivers are missing, making it impossible to present an overview of the total riverine inputs into the Baltic Sea by each sub-region. In spite of the lack of data, Figure 5.39 presents an overview of riverine inputs into the Baltic Sea by each Contracting Party.

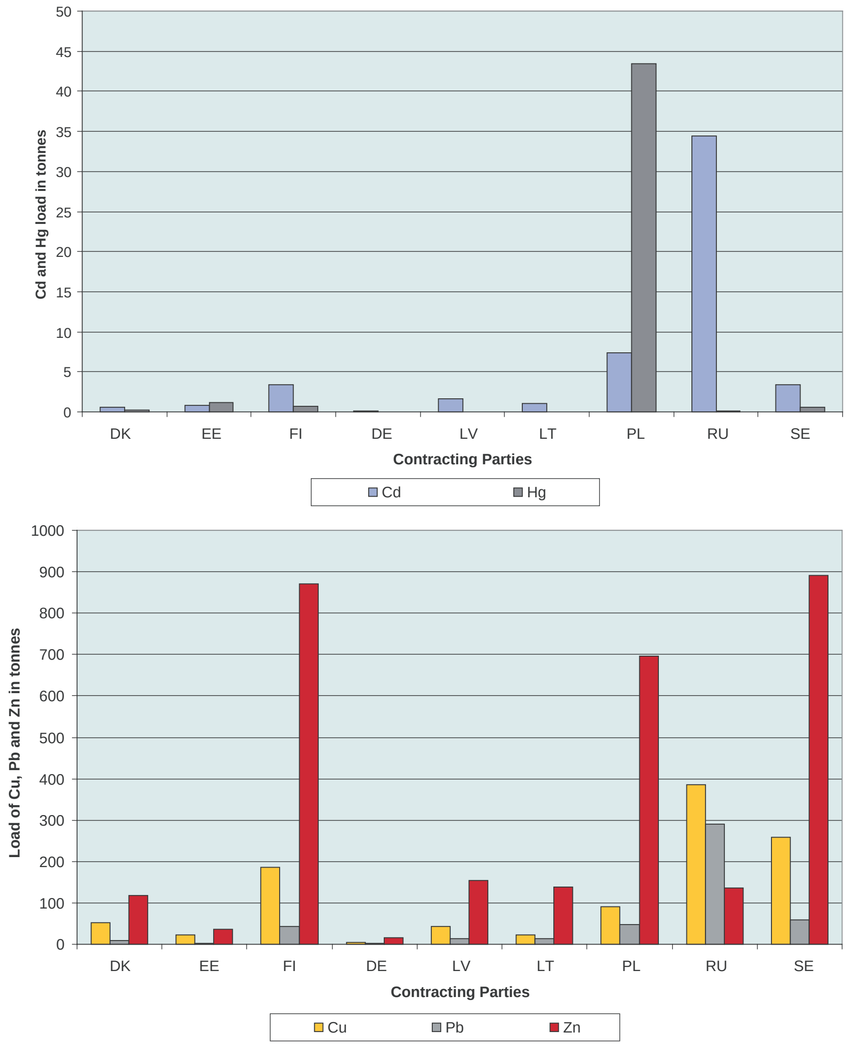


Figure 5.39: Riverine heavy metal load of A) cadmium, mercury and B) copper, lead, zinc into the Baltic Sea in 2000 by Contracting Party.

Table 5.4: Proportion of riverine catchment area where heavy metals (cadmium, mercury, copper, lead and zinc) were measured of the total monitored catchment area in 2000 by Contracting Party.

	Monitored rivers Proportions in %					Coastal areas and unmonitored rivers, Proportions in %				
	Cd	Hg	Cu	Pb	Zn	Cd	Hg	Cu	Pb	Zn
Denmark[1]	26	26	26	26	26	100	100	100	100	100
Estonia	96	96	96	96	96	0	0	0	0	0
Finland	100	71	100	100	100	100	0	100	100	100
Germany	97	97	97	97	97	100	100	100	100	100
Latvia	100	0	100	100	100	0	0	0	0	0
Lithuania	100	100	100	100	100	0	0	0	0	0
Poland	99	98	100	99	100	0	0	0	0	0
Russia	84	0	84	84	80	0	0	0	0	0
Sweden	98	71	98	98	98	100	100	100	100	100

[1] Denmark has reported many monitored concentration values below the detection limit. For these the load is calculated using a maximum value (the detection limit) and a minimum value (zero). This gives a maximum and a minimum estimate for the loads.

5.2.3 Total water-borne inputs into the Baltic Sea in 2000

5.2.3.1 Total run-off into the Baltic Sea

In 2000 the total run-off from monitored rivers, unmonitored rivers and coastal areas as well as point sources discharging directly into the Baltic Sea amounted to 584200 million m^3/a (see Tables 5.35 and 5.36 in Annex 6), monitored over a total catchment area of 1671000 km^2 or roughly 97% of the total Baltic Sea catchment area. The corresponding area-specific run-off for the monitored catchment area was 11 l/(s km^2). The run-off from monitored rivers amounted to 532900 million m^3/a or 92% of total run-off into the Baltic Sea during 2000. The total recorded run-off for unmonitored rivers and coastal areas was 47700 million m^3/a or 8% of the total run-off into the Baltic Sea. According to chapter 5.2.2 the actual run-off from these areas may have been higher, since data for unmonitored riverine run-off were not supplied by four of the Contracting Parties. The distribution of the run-off figures among Contracting Parties and sub-regions is nearly identical with the results in chapter 5.2.2 (Figures 5.31 and 5.32), and supports the finding that the amount of wastewater discharged directly into the Baltic Sea from point sources comprised only 3590 million m^3/a or 0.5% of the total run-off that entered the Baltic Sea in 2000.

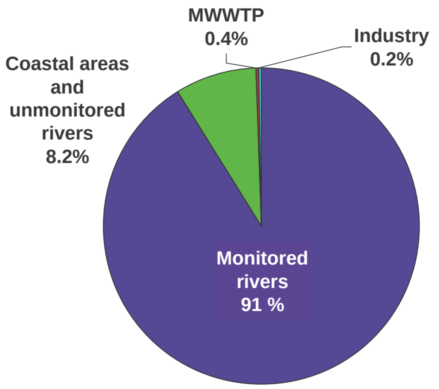


Figure 5.40:
Distribution of the run-off from monitored rivers, unmonitored rivers and coastal areas as well as point sources discharging directly into the Baltic Sea in 2000.

Total run-off in 2000 was 584200 million m^3/a.

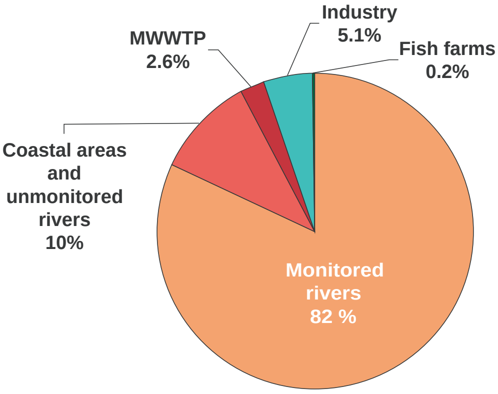


Figure 5.41:
Distribution of BOD_7 inputs from monitored rivers, unmonitored rivers and coastal areas as well as point sources discharging directly into the Baltic Sea in 2000.

Total BOD_7 inputs in 2000 was 1130000 tonnes.

5.2.3.2 Organic matter inputs (BOD_7) into the Baltic Sea

In 2000, the total BOD_7 load from monitored rivers, unmonitored rivers and coastal areas as well as point sources discharging directly into the Baltic Sea amounted to 1130000 tonnes (680 kg BOD_7/km^2, Tables 5.37 and 5.38 in Annex 6). Monitored rivers accounted for 82% or 925000 tonnes of the total BOD_7 inputs into the Baltic Sea, whereas the proportion produced by unmonitored rivers and coastal areas was 10% or 116000 tonnes. The remaining 8% or 88700 tonnes of BOD_7 was discharged by municipalities, industrial plants and fish farms located along the coastline and discharging directly into the Baltic Sea (Figures 5.41, 5.44 and 5.45).

Approximately 38% of the total BOD_7 load entered the Baltic Sea from the catchment area of the Baltic Proper (420000 tonnes, 770 kg BOD_7/km^2). The second largest contribution to the total BOD_7 load to the Baltic Sea, 240000 tonnes (590 kg BOD_7/km^2), entered from the catchment area of the Gulf of Finland. Just about 23% of the total riverine BOD_7 load came from Poland, which also has the highest population in the Baltic Sea catchment area (Tables 5.37 and 5.38 in Annex 6). The highest area-specific BOD_7 inputs into the Baltic Sea occurred in the Western Baltic (1130 kg BOD_7/km^2), the Archipelago Sea (1045 kg BOD_7/km^2), the Bothnian Bay (780 kg BOD_7/km^2) and the Baltic Proper (770 kg BOD_7/km^2), while the lowest loads occurred in the Gulf of Riga (420 kg BOD_7/km^2).

5.2.3.3 Nutrient inputs into the Baltic Sea

5.2.3.3.1 Nitrogen inputs (N_{total}) into the Baltic Sea

In 2000, the load of total nitrogen from monitored rivers, unmonitored rivers and coastal areas as well as point sources discharging directly into the Baltic Sea amounted to 745000 tonnes (440 kg/km^2, Tables 5.39 and 5.40 in Annex 6). Monitored rivers accounted for 77% or 576000 tonnes of the total nitrogen inputs into the Baltic Sea, whereas unmonitored rivers and coastal areas contributed 17% or 130000 tonnes. Municipalities, industrial plants and fish farms located at the coastline and discharging directly into the Baltic Sea accounted for the remaining approximately 6% or 38900 tones (Figures 5.42, 5.46 and 5.47).

Approximately 38% of the total nitrogen load entered the Baltic Sea from the catchment area of the Baltic Proper (293000 tonnes, 540 kg N/km²). The second largest contribution to the load of total nitrogen to the Baltic Sea, 113600 tonnes (280 kg N/km²), emanated from the Gulf of Finland catchment area. Roughly 26% of the riverine load of total nitrogen came from Poland, which also has the highest population in the Baltic Sea catchment area (Tables 5.39 and 5.40 in Annex 6). The largest area-specific nitrogen inputs into the Baltic Sea occurred in the Sound (1950 kg N/km²), the Western Baltic (1480 kg N/km²), the Archipelago Sea (1245 kg N/km²), all small catchment areas in terms of size, but with intensive agricultural activity, high population intensity and widespread industry. In contrast to these findings, the area-specific nitrogen load from the Gulf of Finland, the Bothnian Bay and the Bothnian Sea – each with extensive pristine areas - are considerably lower and in the order of 300 kg N/km².

5.2.3.3.2 Phosphorus inputs (P_{total}) into the Baltic Sea

In 2000, the load of total phosphorus from monitored rivers, unmonitored rivers and coastal areas as well as point sources discharging directly into the Baltic Sea amounted to 34600 tonnes (21 kg P/km², Tables 5.41 and 5.42 in Annex 6). Monitored rivers accounted for 26700 tonnes or 77% of inputs of total phosphorus into the Baltic Sea, while unmonitored rivers and coastal areas had inputs of 15% or 5060 tonnes. Municipalities, industrial plants and fish farms located along the coastline and discharging directly into the Baltic Sea contributed the remaining 8% or 2850 tonnes (Figures 5.43, 5.48 and 5.49).

Approximately 47% or 16100 tonnes (30 kg P/km²) of the load of total phosphorus entered the Baltic Sea from the catchment area of the Baltic Proper. The second largest proportion of the load of total phosphorus to the Baltic Sea, 6030 tonnes (15 kg P/km²), came from the catchment area of the Gulf of Finland. Some 37% of the riverine total phosphorus load came from Poland, which also has the highest population in the Baltic Sea catchment area (Tables 5.41 and 5.42 in Annex 6). The highest area-specific phosphorus inputs into the Baltic Sea occurred in the Archipelago Sea (101 kg P/km²), the Sound (72 kg P/km²) and the Western Baltic (43 kg P/km²), all small catchment areas with respect to size, but with intensive agricultural activity, and high population densities. In addition to these factors, during 2000 heavy rainfall in the catchment area of the Archipelago resulted in high leaching of nutrients and surface run-off of phosphorus. The area-specific phosphorus inputs into the Baltic Sea from the Gulf of Finland, the Bothnian Bay and the Bothnian Sea - each with extensive pristine areas - are considerably lower and in the order of 15 kg P/km².

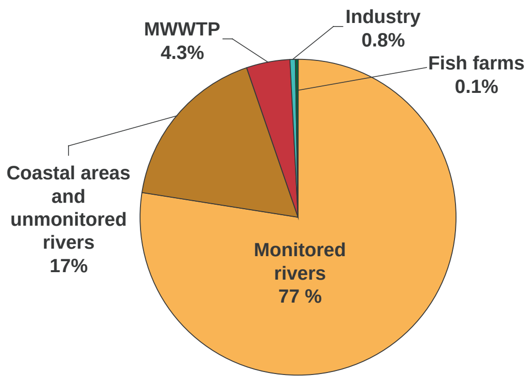


Figure 5.42:
Distribution of the N_{total} inputs from monitored rivers, unmonitored rivers and coastal areas as well as point sources discharging directly into the Baltic Sea in 2000.

Total N_{total} inputs in 2000 was 745000 tonnes N.

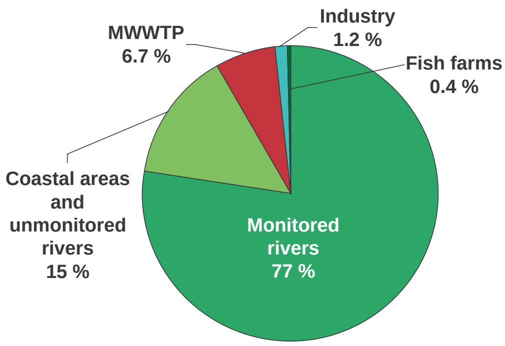


Figure 5.43:
Distribution of the P_{total} inputs from monitored rivers, unmonitored rivers and coastal areas as well as point sources discharging directly into the Baltic Sea in 2000.

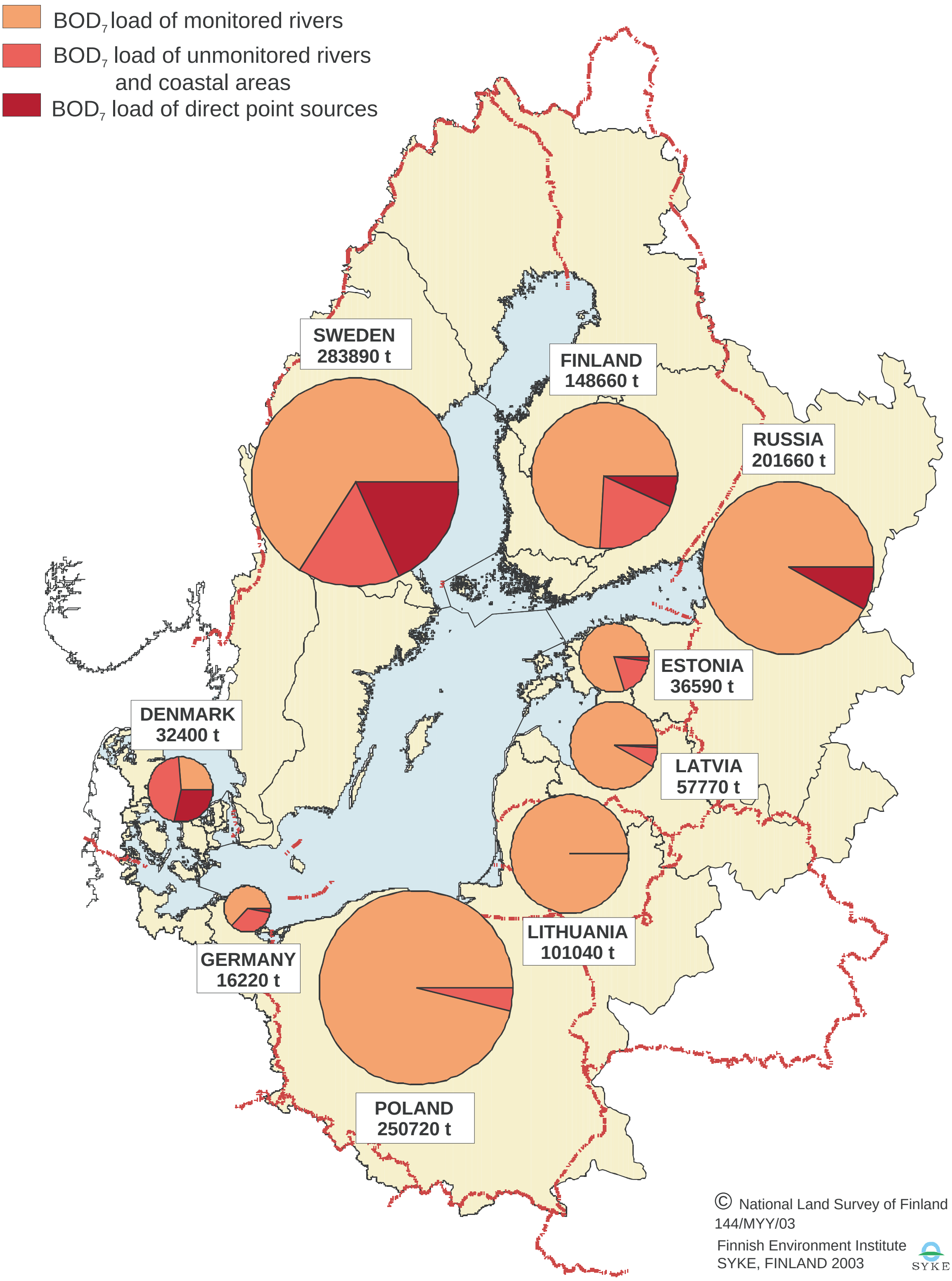
Total P_{total} inputs in 2000 was 34600 tonnes P.

5.2.3.4 Heavy Metal inputs into the Baltic Sea

Much heavy metal load data with respect to riverine inputs including coastal areas and unmonitored rivers as well as point sources discharging directly into the Baltic Sea, have not been reported or are non existent. It is therefore impossible to present an overview of the total inputs into the Baltic Sea by sub-region and Contracting Parties. Tables 5.43 to 5.52 in Annex 6, give a more detailed overview of the heavy metal inputs from monitored rivers, coastal areas, unmonitored rivers as well as point sources discharging directly into the Baltic Sea reported by Contracting Parties.

Only Denmark, Germany, Poland and Sweden provided estimates for the heavy metal inputs from point sources discharging directly into the Baltic Sea. Although many figures are missing for the heavy metal inputs from point sources, the reported results could indicate that direct discharges from MWWTPs constituted the largest source of total direct discharges of mercury, copper and nickel. MWWTPs and industry

Figure 5.44:
BOD_7 load from monitored rivers, unmonitored rivers and coastal areas as well as from point sources discharging directly into the Baltic Sea in 2000 by Contracting Party based on the load-orientated approach.



seemed to be equally significant in terms of point source discharges of cadmium, lead, zinc and chromium, directly into the Baltic Sea. The reported data from Russia concerning municipalities and industrial plants discharging cadmium directly into the Gulf of Finland seemed to be very high.

Four Contracting Parties: Denmark, Finland, Germany and Sweden, have reported the estimated heavy metal loads from unmonitored rivers and coastal areas, and some Contracting Parties, as described in the PLC4 guidelines, have reported heavy metal loads even if the concentrations have been below the detection limit. Mercury inputs are the heavy metal with the lowest coverage in the report, due to missing data from a lot of Contract-

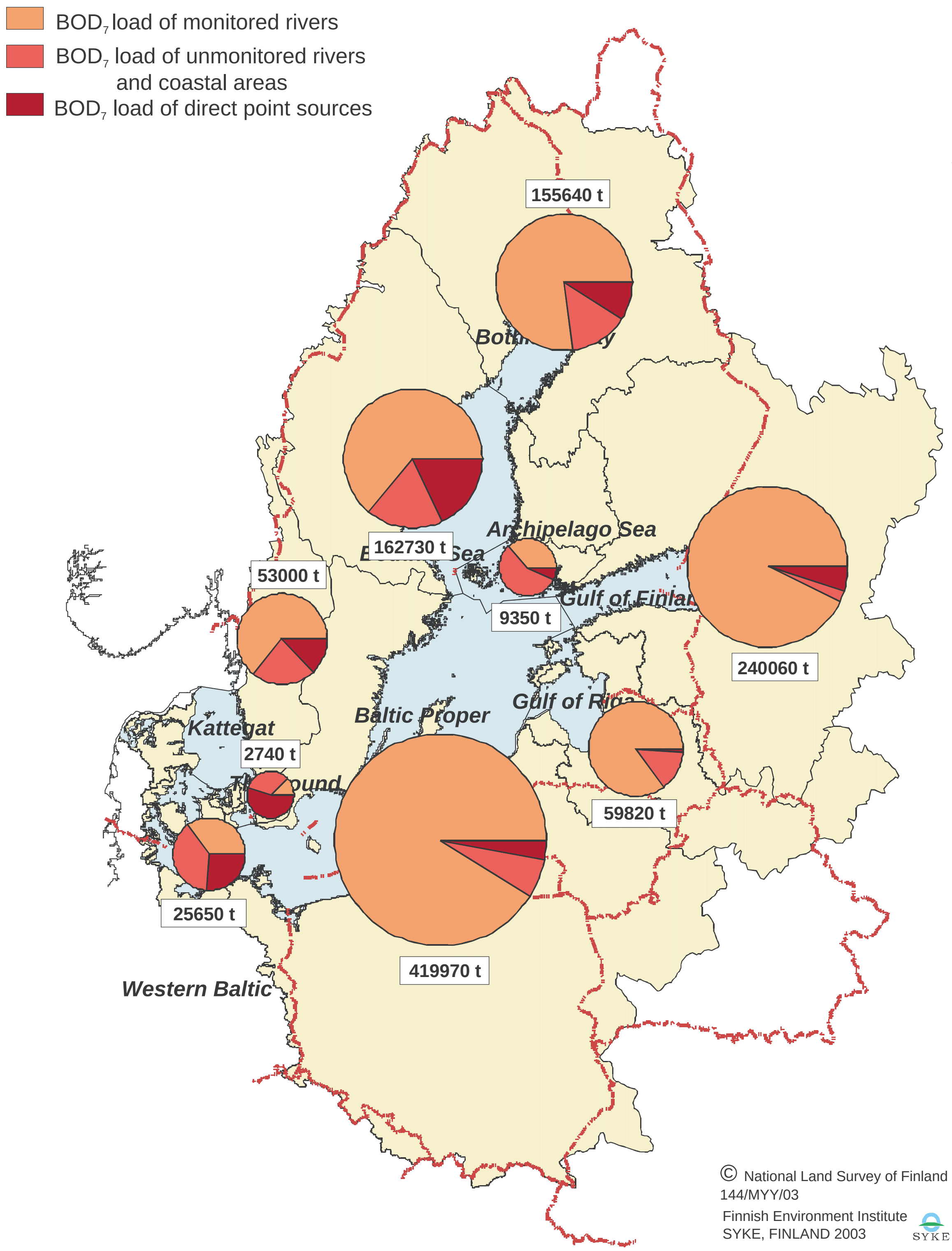
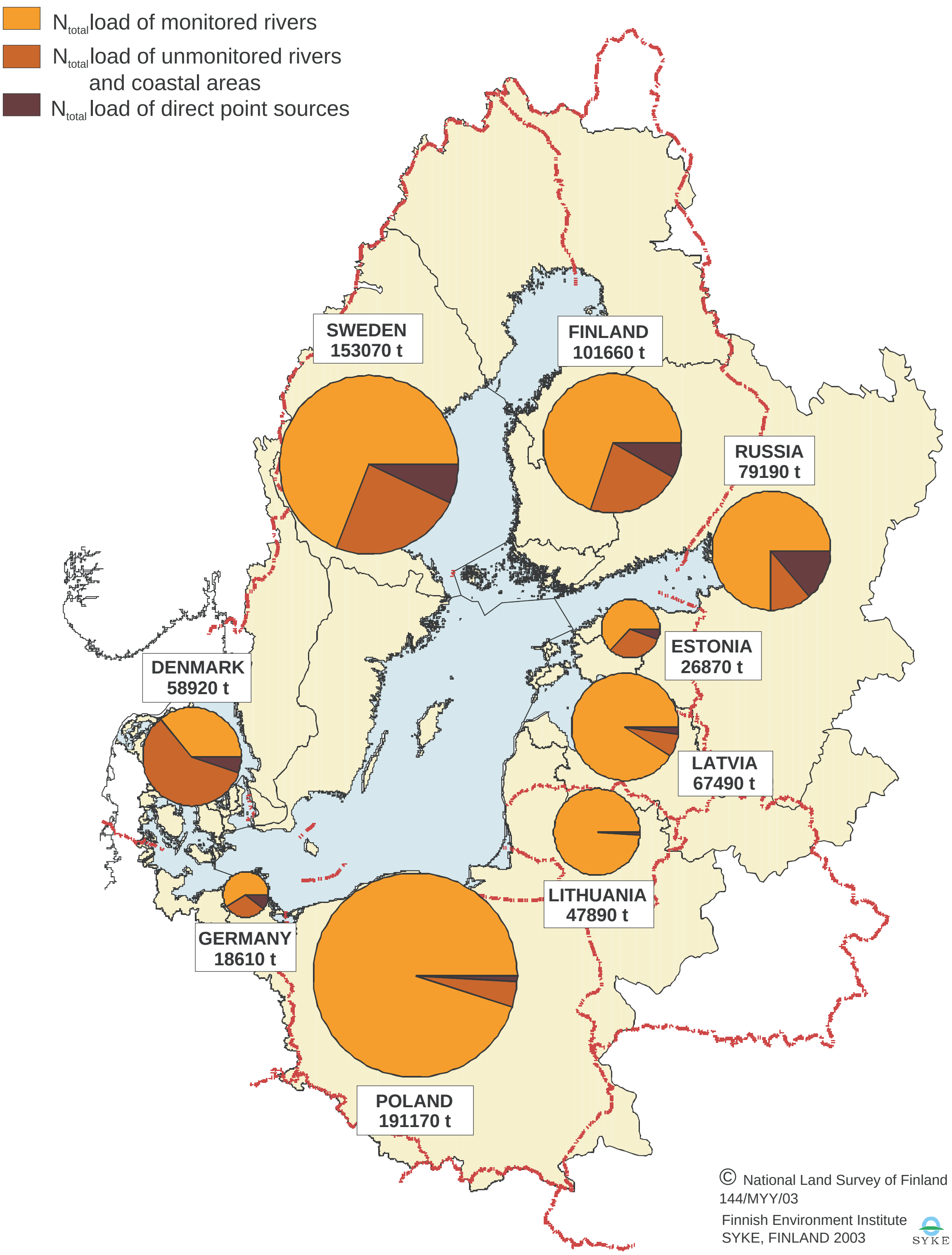


Figure 5.45: BOD_7 load from monitored rivers, unmonitored rivers and coastal areas as well as from point sources discharging directly into the Baltic Sea in 2000 by sub-region based on the load-orientated approach.

ing Parties. Based on the reported heavy metal riverine inputs into the Baltic Sea, the Gulf of Finland received the highest cadmium, lead and copper loads, while mercury inputs were highest for the Baltic Proper. A few major rivers accounted for very large proportions of the total reported riverine heavy metal loads. For instance, the lead and copper loads in Russian rivers (mainly the Neva) constituted 60% and 40%, respectively, of the total reported riverine loads for these pollutants; Polish rivers accounted for roughly 90% of the reported total riverine mercury load.

Restricted funding was the major difficulty which hindered the compilation of comparable heavy metals load data in 1995 and 2000. Other factors contributing to this situation were insufficient laboratory equipment for analysis, inadequate

Figure 5.46: N_{total} load from monitored rivers, unmonitored rivers and coastal areas as well as from point sources discharging directly into the Baltic Sea in 2000 by Contracting Party based on the load-orientated approach.



sampling methods, and difficulty in analyzing very low concentrations of some metals. Countries in transition as well as other Contracting Parties encountered one or all of these problems in some form. Heavy metal concentrations were typically monitored in only a few selected large wastewater treatment plants and industries and in many cases the total direct heavy metal loads have not been provided by the Contracting Parties.

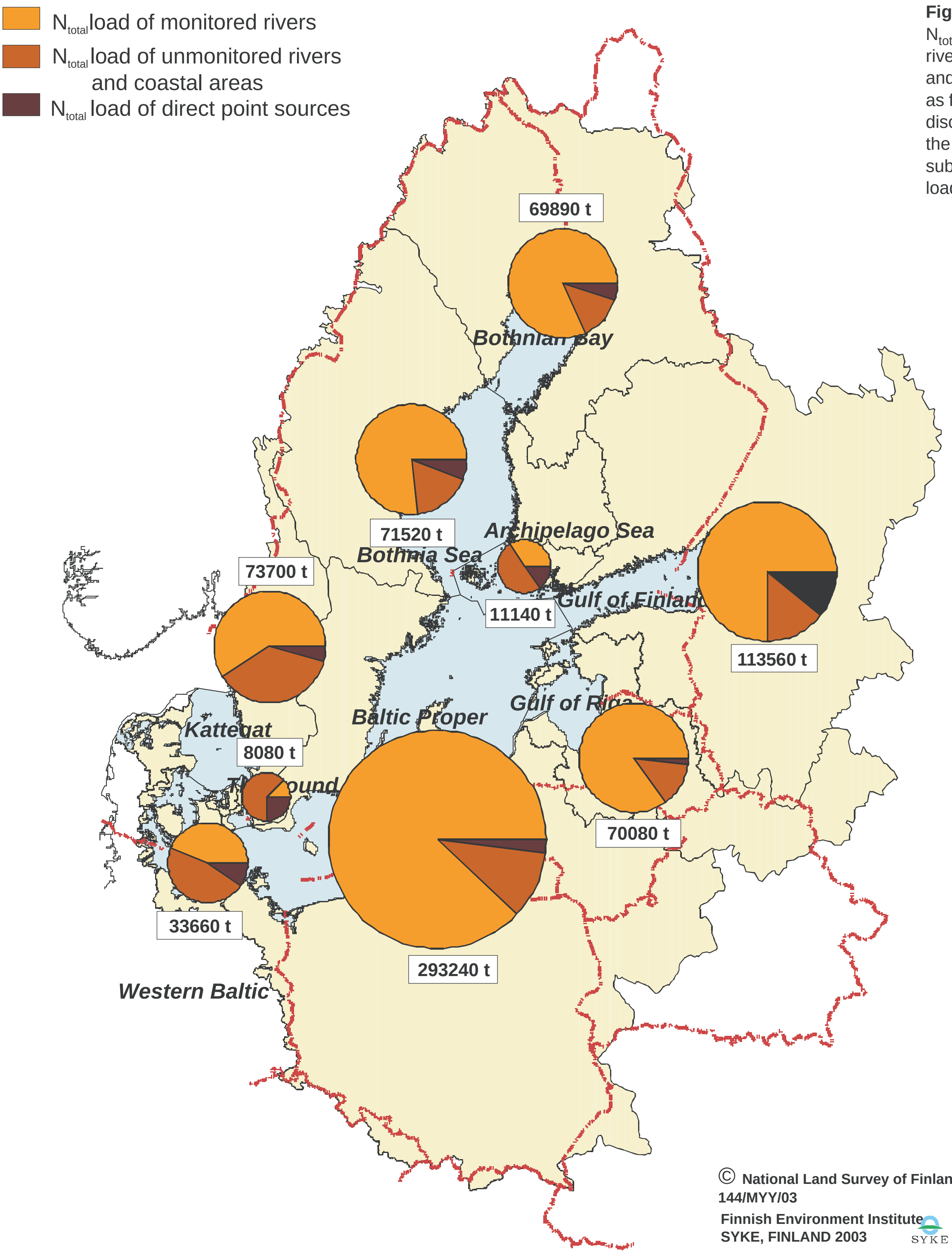
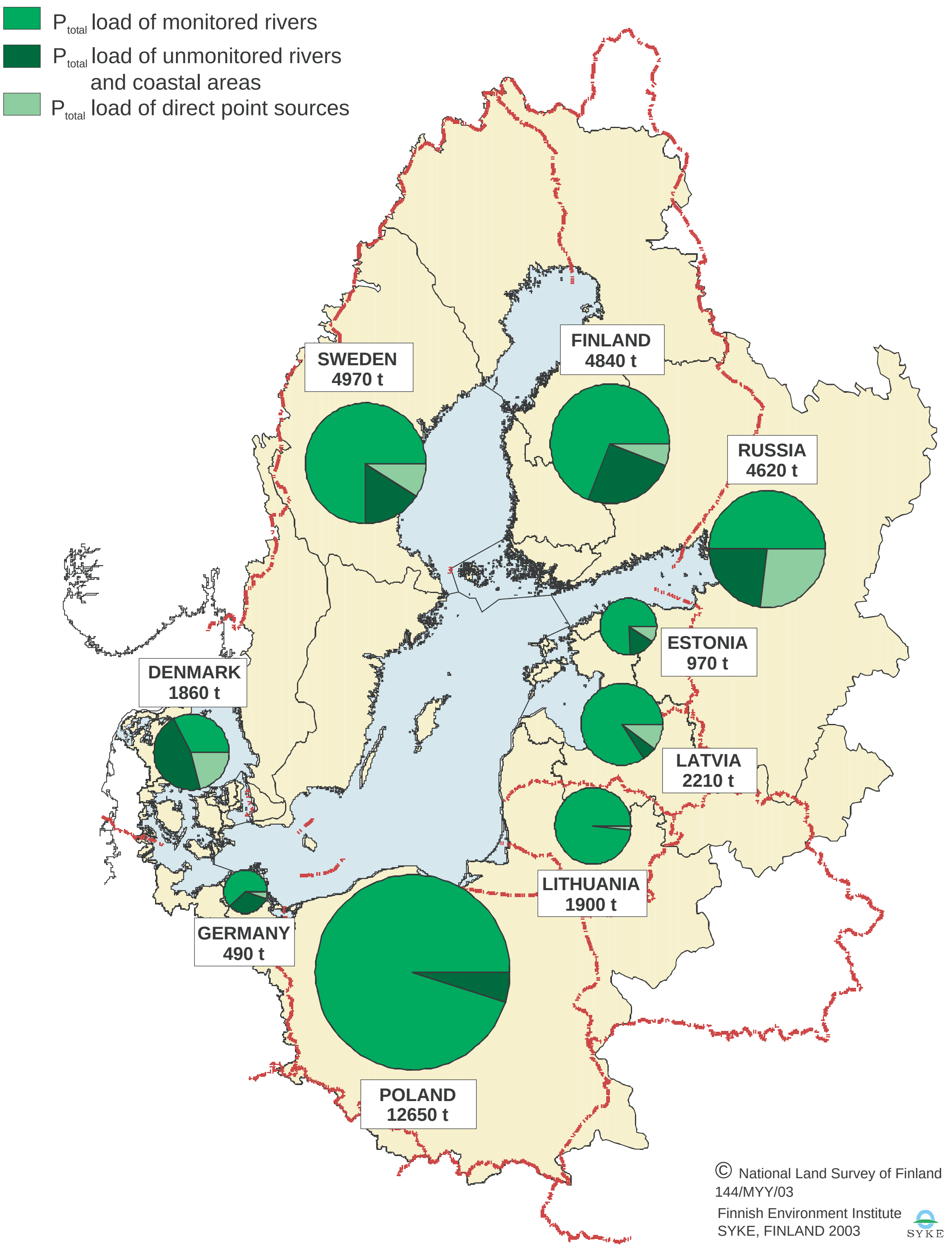


Figure 5.47:
N_{total} load from monitored rivers, unmonitored rivers and coastal areas as well as from point sources discharging directly into the Baltic Sea in 2000 by sub-region based on the load-orientated approach.

Figure 5.48:
P_{total} load from monitored rivers, unmonitored rivers and coastal areas as well as from point sources discharging directly into the Baltic Sea in 2000 by Contracting Party based on the load-orientated approach.



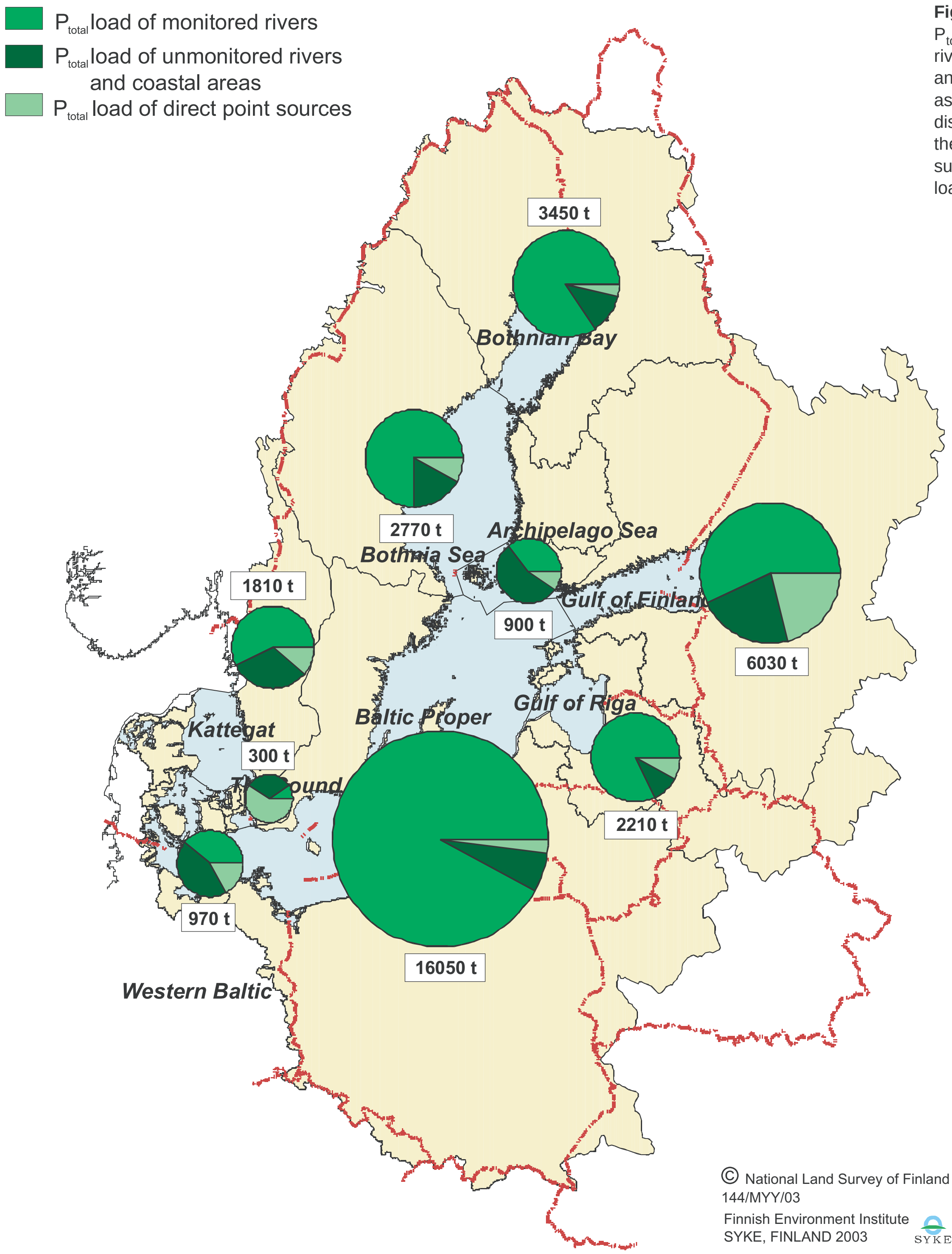


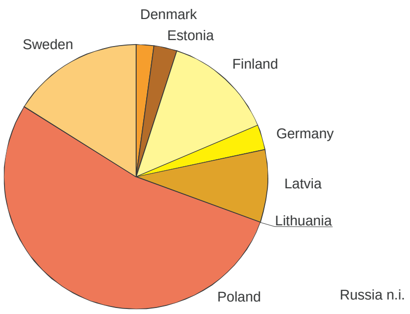
Figure 5.49:
P_{total} load from monitored rivers, unmonitored rivers and coastal areas as well as from point sources discharging directly into the Baltic Sea in 2000 by sub-region based on the load-orientated approach.

5.2.4 Retention in river systems and coastal areas in 2000

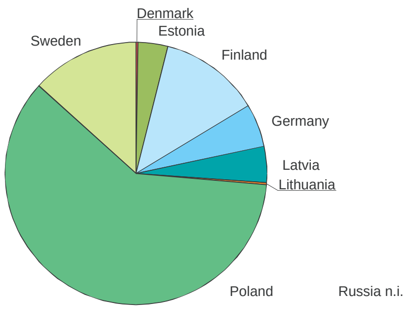
Nutrient retention involves a more permanent removal of nitrogen and phosphorus within river systems including rivers, lakes, riparian areas and flood plains. These processes in river systems can significantly reduce nutrient loads entering the Baltic Sea. By taking into account nitrogen and phosphorus retention processes in rivers, lakes and other watercourses, it is possible to compare the nitrogen and phosphorus discharges/losses entering inland surface waters including natural background losses (source-orientated approach) with the water-borne loads entering the maritime area (load-orientated approach). Nitrogen and phosphorus retention in river systems represents the connecting link between the "source-orientated approach" and the "load-orientated approach".

In PLC-4 the retention calculations have been performed for nitrogen and phosphorus, as these two nutrients have a significant impact on the eutrophication of the Baltic Sea. The different calculation methods are described in chapter 3.4. The Contracting Parties have estimated the retention in their river systems and/or coastal areas (Figure 5.50 and Table 5.4 as well as and Tables 5.53 to 5.56 in Annex 6).

Figure 5.50: Nitrogen and phosphorus retention in river systems (lakes and rivers) within the Baltic Sea catchment area by each Contracting Party in 2000.



Nitrogen retention: 278200 tonnes



Phosphorus retention: 13100 tonnes

The largest proportions of nitrogen and phosphorus retention in rivers systems occurred in Poland and Sweden, whereas the lowest proportions of nitrogen and phosphorus retention in river systems occurred in Lithuania and Denmark.

The PLC-4 guidelines have been implemented in different ways, as many Contracting Parties have often used individual methods to calculate retention in river systems. Additionally, minor differences exist between each Contracting Party of which parts of the retention results should be reported. Moreover, the calculation of retention has been further complicated as the importance of the different processes involved has varied across the Baltic Sea. Finally, many of the Contracting Parties have had access to limited monitoring results and statistical information to compile the retention rates.

Because of former excessive loads of phosphorus and present low oxygen values at the bottom of the lakes, some Danish and Swedish lakes currently display low or even negative phosphorus retention. On the other hand, the Vistula in Poland is a very long river, which floods frequently, with a long residence period in its waters; it therefore behaves like a lake with high retention capacity. These two examples illustrate the difficulties involved in retention assessment.

Finland, Russia and Sweden have larger surface areas of lakes than other Contracting Parties. Along with Estonia, these countries rivers systems have larger areas with marshes, swamps and wetlands where retention is likely to occur.

The total area-specific nitrogen and phosphorus retention expressed as retention in grams per square meter of lake surface area is shown in Table 5.5. It should be noted that the retention rates in Table 5.5 include retention taking place both in rivers and lakes. However, it is not quite clear whether the surface area of the rivers is included in the calculations as the information submitted by the Contracting Parties is not exhaustive.

Many Danish lakes have negative phosphorus retention values and therefore the figures in Table 5.5 represent average values for a range of specific retention values. This could be the case for lakes previously receiving high wastewater discharges, whose sediments then become oxygen deficient, and release some of their accumulated phosphorus pool. The Lithuanian area-specific nitrogen and phosphorus retention rates appeared to be extremely low, whereas the German area-specific phosphorus retention seemed to be very high.

	Nitrogen retention in river systems			Phosphorus retention in river systems		
	Grossload	Retention	Retention	Grossload	Retention	Retention
	in t N	in t N	N in %	in t P	in t P	P in %
Denmark	62200	6500	10	1490	27	1.8
Estonia	33000	7700	23	1370	500	36
Finland	131500	37600	29	6150	1600	26
Germany	25200	8600	34	1170	710	60
Latvia*	54000	24400	45	1460	590	40
Lithuania*	332000	290	0,9	1260	30	2.3
Poland	339000	148000	44	20500	7900	38
Russia	61100	n.i.	n.i.	3020	n.i.	n.i.
Sweden	187000	44800	24	6200	1700	28
Total	**926000**	**278000**	**30**	**42600**	**131090**	**31**

Table 5.4:
Retention in river systems (lakes and rivers) in the Contracting Parties in tonnes and in % of total riverine load for each Contracting Party in 2000.

* All figures for Latvia and Lithuania refer only to the Latvian and Lithuanian territory, respectively.

	Lake surface area		Retention per lake surface area	
	in km²	in % of total catchment area	N_{total} in g/m²	P_{total} in g/m²
Denmark	310	1	21	0.08
Estonia	2260	5	4.0	0.2
Finland	19450	10	1.2	0.05
Germany	1140	4	7.5	1.0
Latvia	1040	1	24	0.6
Lithuania	2610	4	0.1	0.01
Poland	9360	3	16	0.8
Russia	53520	17	n.i.	n.i.
Sweden	35200	8	0.8	0.05

Table 5.5:
Total retention in river systems per square meter of lake surface area by Contracting Party in g/m^2 in 2000.

5.2.5 Source apportionment of riverine nutrient loads in 2000

Source apportionment is used to evaluate the relative contributions of different sources to riverine nitrogen and phosphorus loads. The objective of separating riverine loads is to assess the importance of anthropogenic sources, and the assessment also includes the measurement of natural background losses from areas that are relatively free from human influence.

When comparing the figures in this chapter it is important to note that the Contracting Parties have not always followed the PLC-4 guidelines. This has led to the use of different source apportionment methodologies and quantification methods, and these factors have in turn influenced the findings (see chapter 3). As a result, only general conclusions can be drawn about the contributions of different sources to riverine nitrogen and phosphorus loads. The Swedish and the Finnish figures for source apportionment provided for PLC-4 also differ from the figures presented in their national reports (Arheimer, 1998; Rekolainen et al. 1995 and Vuorenmaa et al. 2001). The discrepancy is explained by the use of different calculation methods (see chapter 3) for the PLC-4 assessment in Finland and by missing data on phosphorus retention in Sweden.

The data indicate that with the exception of the Bothnian Bay sub-region, a major proportion of riverine nitrogen and phosphorus loads into the Baltic Sea, originated from anthropogenic sources (Figures 5.51 to 5.54 and Tables 5.53 to 5.56 in Annex 6). The load from Sweden entering the Bothnian Bay mainly originated from pristine areas without any direct human activity. Hence the importance of natural background losses, also in the catchment area to the Bothnian Sea was high. These background losses in the Swedish catchment area of the Bothnian Bay constituted 60% for nitrogen and 96% for phosphorus of the total riverine load. According to the reported data, the main proportion (74%) of the nitrogen load from Russia in the Gulf of Finland catchment originated from pristine areas. In the other sub-regions with higher levels of human activity, such as agriculture, managed forestry, industry and which were more densely populated, the anthropogenic riverine load increased both in absolute figures and in relative importance.

The significance of point source discharge was more notable with respect to phosphorus than nitrogen. Only in Finland, Germany and Sweden did the nitrogen discharges from point sources constitute a higher proportion of the total riverine loads than the corresponding phosphorus loads. In Finland and Germany this was explained by the fact that phosphorus had been removed efficiently from wastewater since the 1980s. An improved nitrogen removal process was introduced in recent years, and therefore in Germany a significant reduction of nitrogen discharges from point sources could be expected. With respect to Finland, nitrogen removal processes were initiated mainly in treatment plants discharging wastewaters directly into the Baltic Sea. In Russia and Poland in particular, the phosphorus discharges from point sources appeared to have high importance, accounting for 40% and 27% respectively of the corresponding total phosphorus riverine loads (Figure 5.53). In sub-regions with high population density and extensive industrial activity, such as in the catchment area of the Sound, point source discharges were a very important phosphorus source even if there was no untreated wastewater from point sources (Figure 5.54). Point source discharges in Poland and Russia were also important contributors to the total riverine nitrogen load, with proportions of 15 and 12%, respectively. In Sweden phosphorus discharges from point sources constituted the lowest proportion of riverine loads (4%) and Latvia had the lowest corresponding proportion for nitrogen (2%). In countries such as Russia and Poland, there were problems quantifying total pollution discharges from industrial and municipal sources, therefore some of the reported data are uncertain.

Approximately 57% of the total riverine phosphorus and 65% of the nitrogen loads into the Baltic Sea originated from diffuse sources. The majority of the diffuse losses often came from agricultural sources, but in countries such as Denmark discharges from scattered dwellings and storm water overflows also constituted a substantial part of the total phosphorus losses from diffuse sources.

Diffuse losses were the largest source of total riverine nitrogen load including load from coastal areas, in every Contracting Party except Russia (Figure 5.51). Russia has generally not reported any figures on diffuse losses, but has mainly provided data on background losses and discharges from point sources. In areas with very intensive agriculture and/or with a high proportion of cultivated areas such as in Germany, Denmark and the southern part of Sweden, the anthropogenic diffuse nitrogen sources contributed between 71 and 88% of the total riverine load entering the Baltic Sea.

With the exception of Sweden and Russia, diffuse losses were the most important source of riverine phosphorus loads in all of the Contracting Parties, (Figure 5.53). The highest proportions were assessed in Germany (80%), Lithuania (79%) and Latvia (76%). Additionally, in the Archipelago Sea and the Swedish region of the Sound the majority of the load originated from diffuse sources (89% and 87%, respectively) (Figure 5.54).

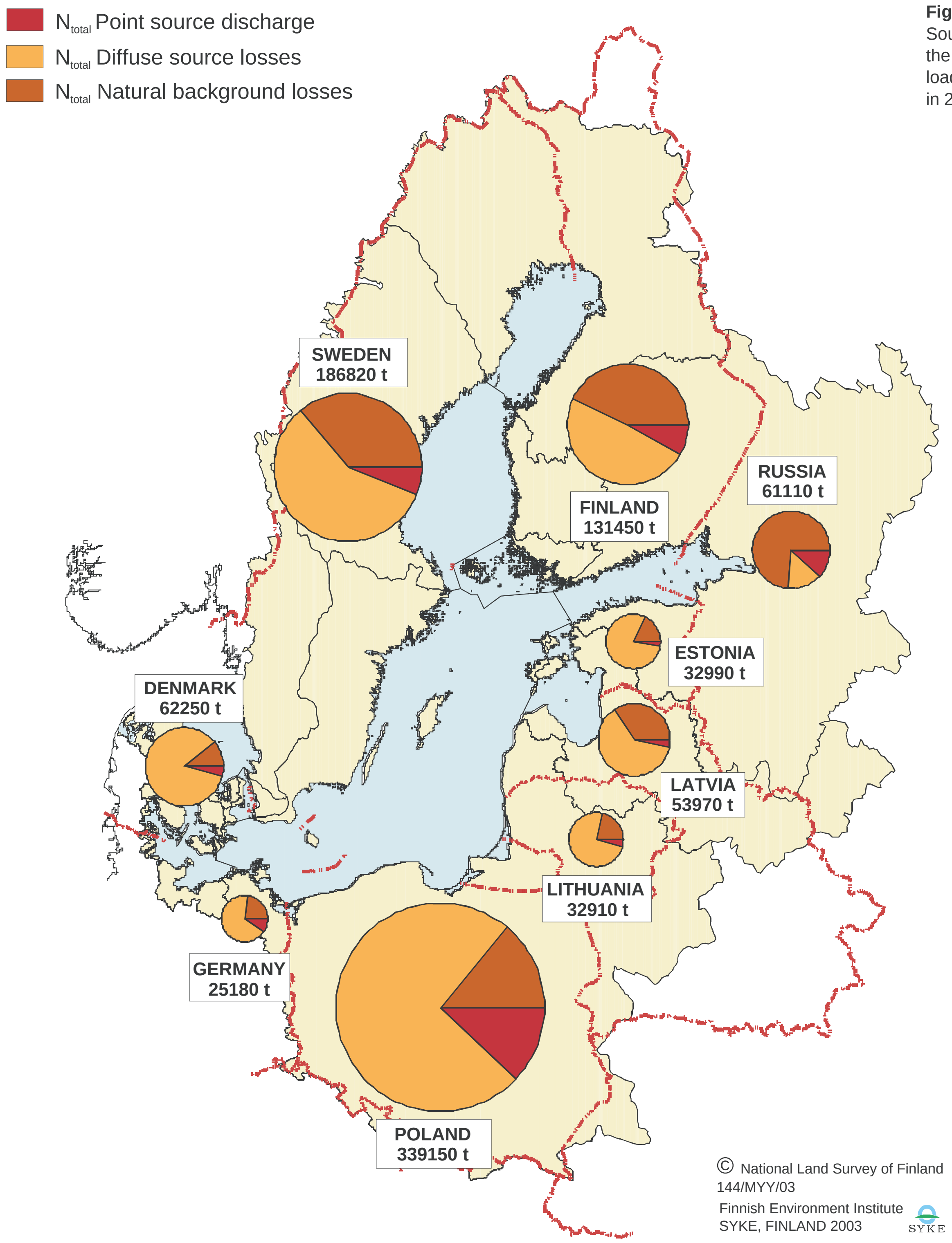
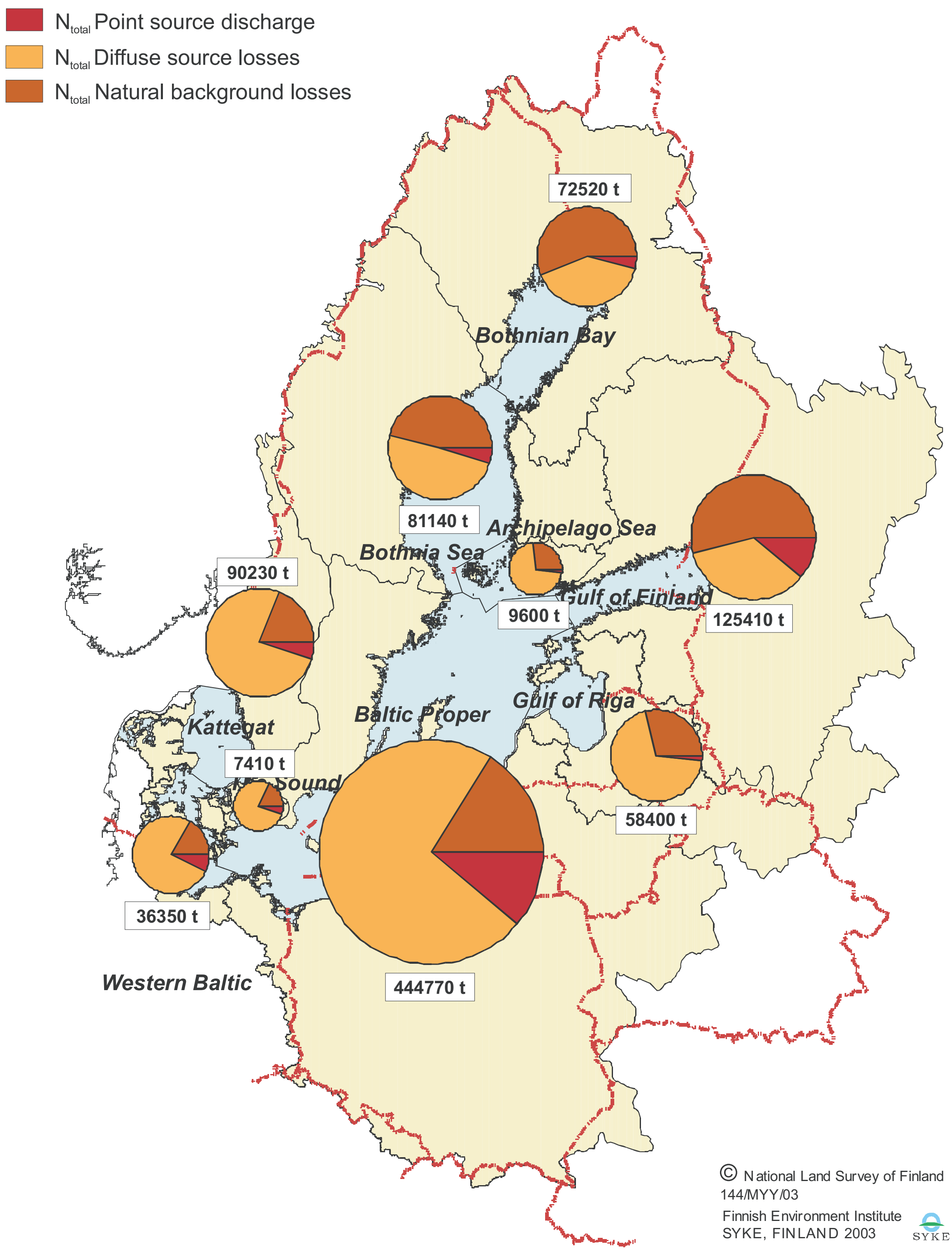


Figure 5.51:
Source apportionment for the total riverine nitrogen load by Contracting Party in 2000.

Figure 5.52: Source apportionment for the total riverine nitrogen load by sub-region in 2000.



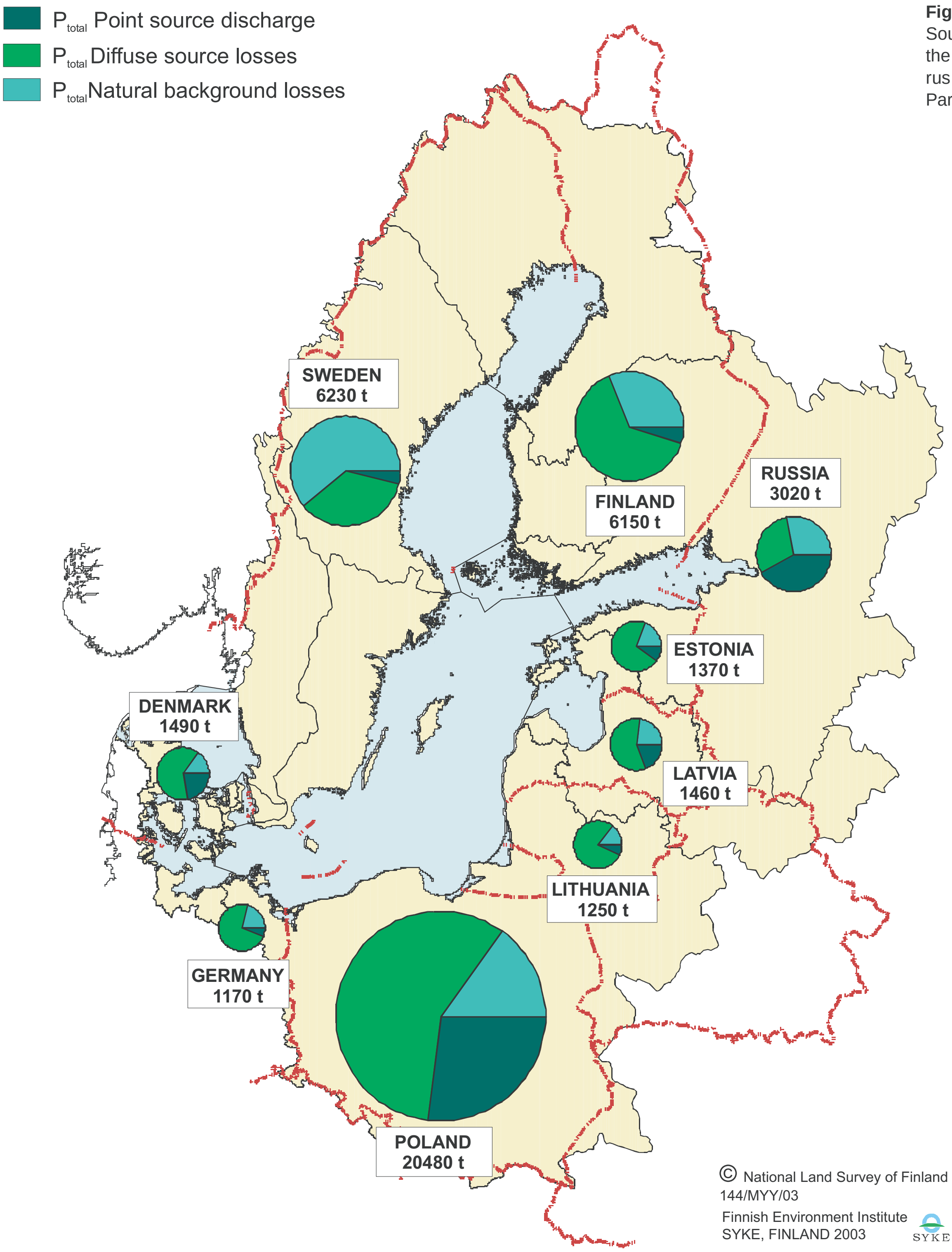
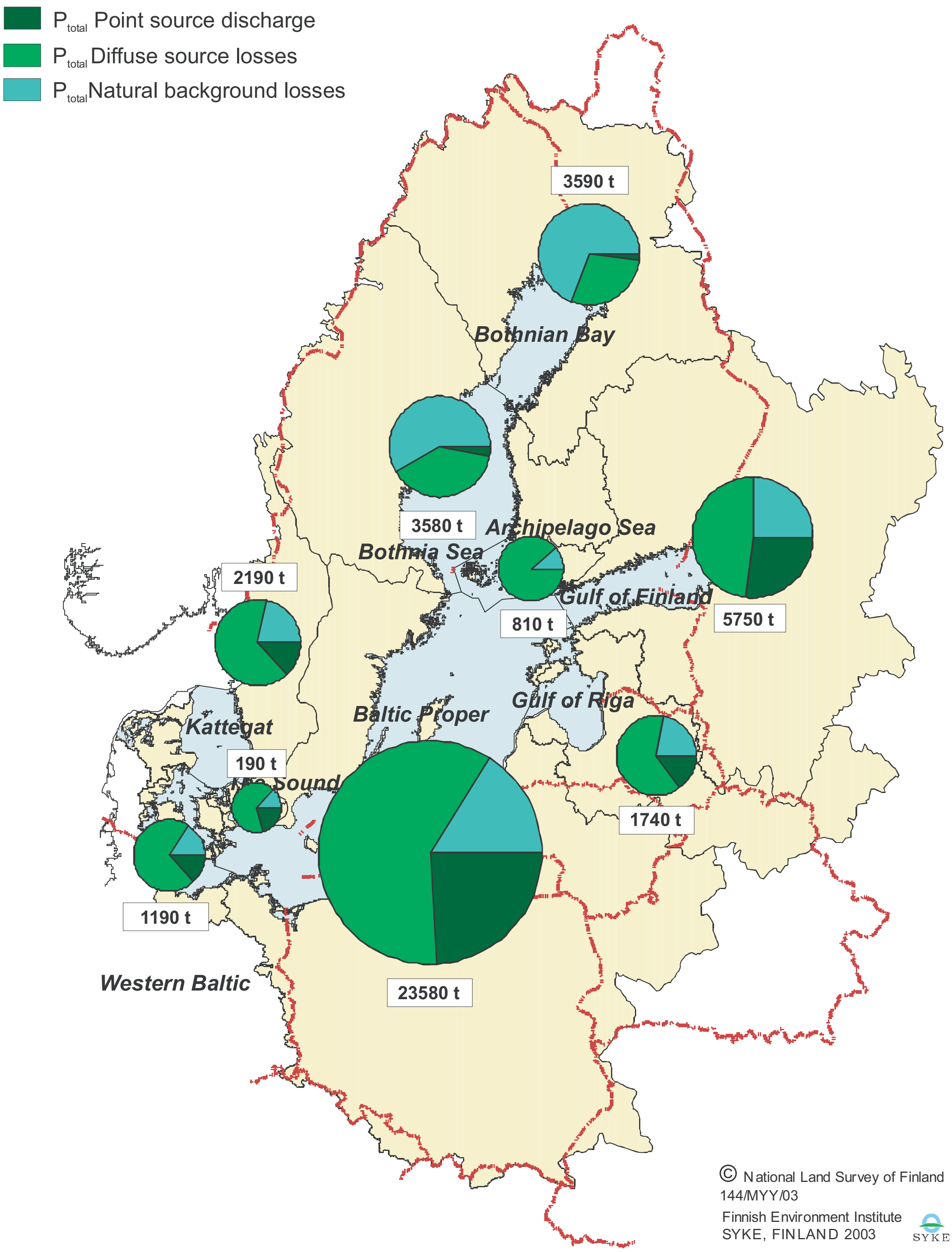


Figure 5.53: Source apportionment for the total riverine phosphorus load by Contracting Party in 2000

Figure 5.54:
Source apportionment for the total riverine phosphorus load by sub-region in 2000.



6 Comparison between former PLCs

6.1 General remarks

Comparison of this waterborne pollution load compilation (PLC-4 from 2000) with the previous pollution load compilations (PLC-1, PLC 2 and PLC-3) should be done with great caution. The PLC-1 report from 1987 was a first attempt and the results were very uncertain (see chapter 1). In the PLC-2 report from 1990 there are many shortcomings relating to the coverage of the watersheds and the methodologies used (see chapter 1). In PLC-3 the major remaining uncertainties and weaknesses of PLC-2 were avoided by establishing a quality assurance system and by creating a data-entry system closely connected to a database. In spite of these modifications, many difficulties with respect to total water-borne inputs into the Baltic Sea were revealed, making it impossible to give an overview especially for heavy metals. PLC-4 represents another step forward in terms of inclusion of the quantification of point and non-point pollution sources in the catchment area of the Baltic Sea located within the borders of the Contracting Parties. It should therefore be possible to compare the water-borne inputs into the Baltic Sea with the discharges from point sources and losses from diffuse sources discharging into inland surface waters within the Baltic Sea catchment area (see chapter 1).

It is not possible to give any reliable evaluation concerning any changes in the **total water-borne pollution load** into the Baltic Sea based on the load-orientated approach for nutrients, heavy metals and persistent organic pollutants. Comparable data for most of the Contracting Parties are missing, mostly for unmonitored areas and for coastal areas of the Baltic Sea catchment area (see chapters 5.2.1 and 5.2.2). With respect to persistent organic pollutants, some screening measurements in a small number of rivers, municipalities and industrial plants started in the beginning of the 1990s, but we are still far from an assessment for all Contracting Parties or for the entire Baltic Sea catchment area. Some information for heavy metals is available, but these figures are often estimates, and only cover a minor proportion of the water-borne inputs from monitored rivers, unmonitored rivers, coastal areas and point sources discharging directly into the Baltic Sea (see chapter 5.2.1.4 and 5.2.2.4).

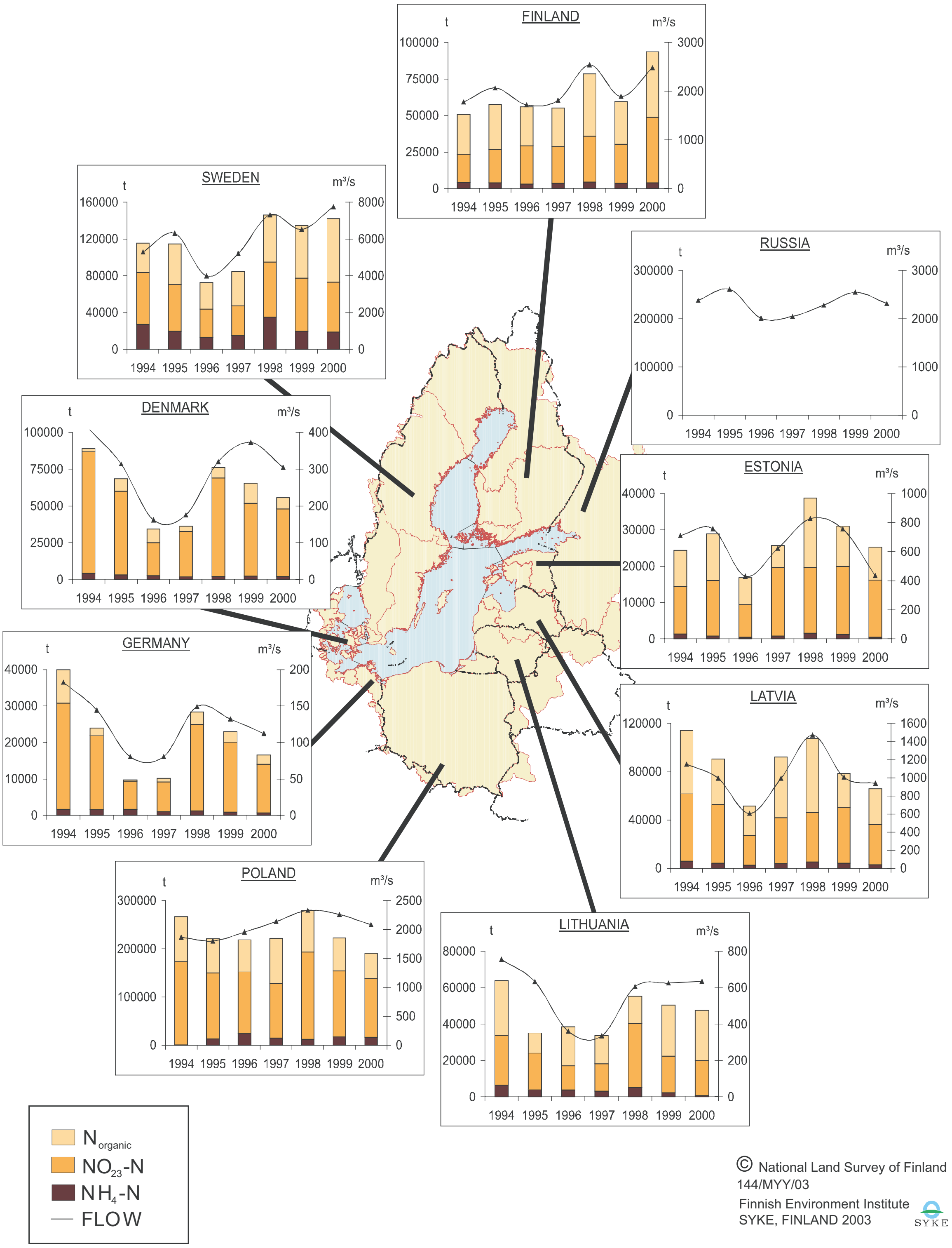
Data compiled during PLC-2, PLC-3 and PLC-4 with respect to **riverine inputs** are not fullly comparable. This is due to incomplete data sets, different sampling, calculation and analysing methodology, and different levels of coverage of the Baltic Sea catchment area. In addition to this, different sources of pollution were considered in PLC-2, PLC-3 and PLC-4. Nevertheless, a comparison was performed for nutrient riverine inputs and for heavy metal riverine inputs for cadmium and lead between 1994 and 2000 by Contracting Party as well as by sub-region. For that purpose all Contracting Parties have submitted additional information for the riverine inputs in the years 1994, and from 1996 to 1999. Additionally, the 1995 data submitted during PLC-3 were reviewed and partly corrected, in order to refer to the same river catchment areas. This may lead to, that the run-off and also the load figures for 1995 and 2000 included in this chapter can be different from the figures published in the PLC-3 report and the other chapters of this report. Data gathered before 1994 could not be taken into account for this overview due to considerable shortcomings.

6.2 Comparison of riverine nutrient inputs between 1994 to 2000

In the twentieth century the nitrogen and phosphorus content in the rivers increased steadily with the highest concentrations measured during the 1980s and 1990s. Compared with the riverine load 100 years ago, the riverine nitrogen and phosphorus loads today are approximately 7 times and 4 times higher respectively than at that time. When comparing riverine inputs into the Baltic Sea from different years the controlling influence of the run-off (climate) should be taken into account, since there is a close correlation between run-off and nutrient loads. During years with heavy precipitation and associated high run-off, more nitrogen is leached from cultivated areas than during dry years, resulting in higher riverine nitrogen inputs into the Baltic Sea. Phosphorus inputs into the Baltic Sea would also tend to be higher in years with high precipitation. For these reasons all figures for the years 1994 to 2000 include the riverine run-off in addition to the input figures.

In 2000, approximately 738000 tonnes of nitrogen and 34100 tonnes of phosphorus drained into the Baltic Sea via rivers. The rivers Vistula, Nemunas, Oder, and Neva accounted for the majority of the nutrient inputs into the Baltic Sea. When comparing riverine nitrogen and phosphorus inputs into the Baltic Sea for 2000 with those from earlier years, it is important to remember the controlling influence of variations in the riverine run-off, which were very significant during the period 1994-2000. It could be clearly seen that riverine nitrogen inputs closely followed the variations in run-off, and there is no apparent trend in the nitrogen load (see Figures 6.1

Figure 6.1: Annual average riverine run-off in m³/s and riverine nitrogen inputs in tonnes into the Baltic Sea from 1994 to 2000 by Contracting Party. Different scales have been used for the various Contracting Parties in the figures. For Denmark the total water-borne nitrogen input into the Baltic Sea is used.

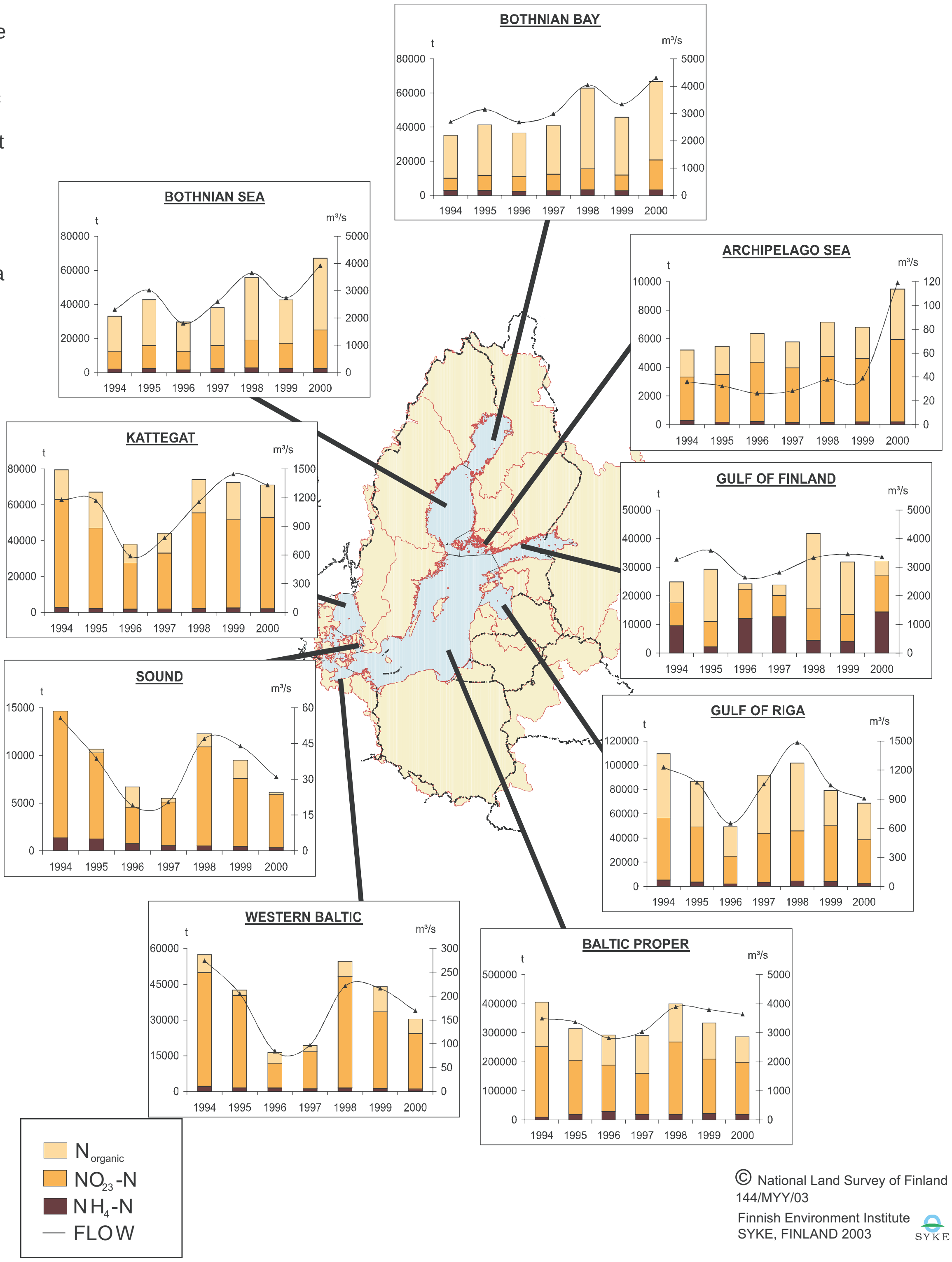


and 6.3). Heavy rainfall results in increased leakage and runoff from farmland, leading to increased nitrogen inputs to and concentrations and loads in inland surface waters. Riverine phosphorus inputs into the Baltic Sea are also highly dependent on flow rates, which is shown by higher phosphorus loads with increasing runoff (see Figures 6.4 and 6.6). The effect of different run-off levels between 1994 and 2000 can partly be delimited by comparing the annual flow-weighted concentrations of

Figure 6.2: Flow-weighted nitrogen concentrations in mg N/l of rivers for the time period 1994 to 2000 by Contracting Party. Different scales have been used for the various Contracting Parties. For Denmark the total water-borne nitrogen input into the Baltic Sea is used.

nitrogen and phosphorus. By doing so a change in the inputs into the Baltic Sea can be seen between 1994 and 2000 for some Contracting Parties (Figures 6.2 and 6.5). The flow-weighted concentrations are calculated by dividing the annual nutrient transport with the corresponding run-off.

Figure 6.3:
Annual average riverine run-off in m³/s and riverine nitrogen inputs in tonnes into the Baltic Sea from 1994 to 2000 by sub-region. Different scales have been used for the various sub-regions in the figures. For Denmark the total water-borne nitrogen input into the Baltic Sea is used.



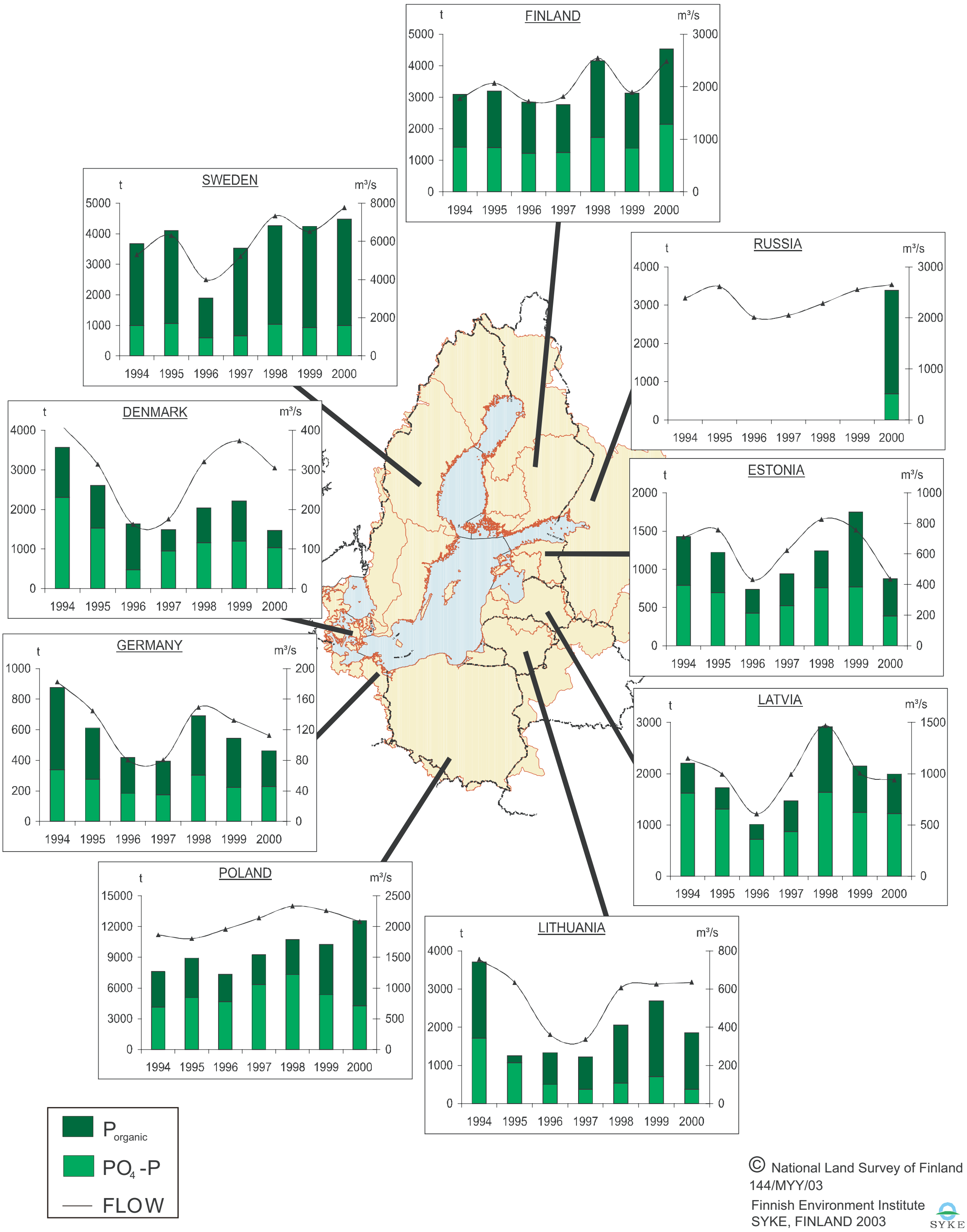
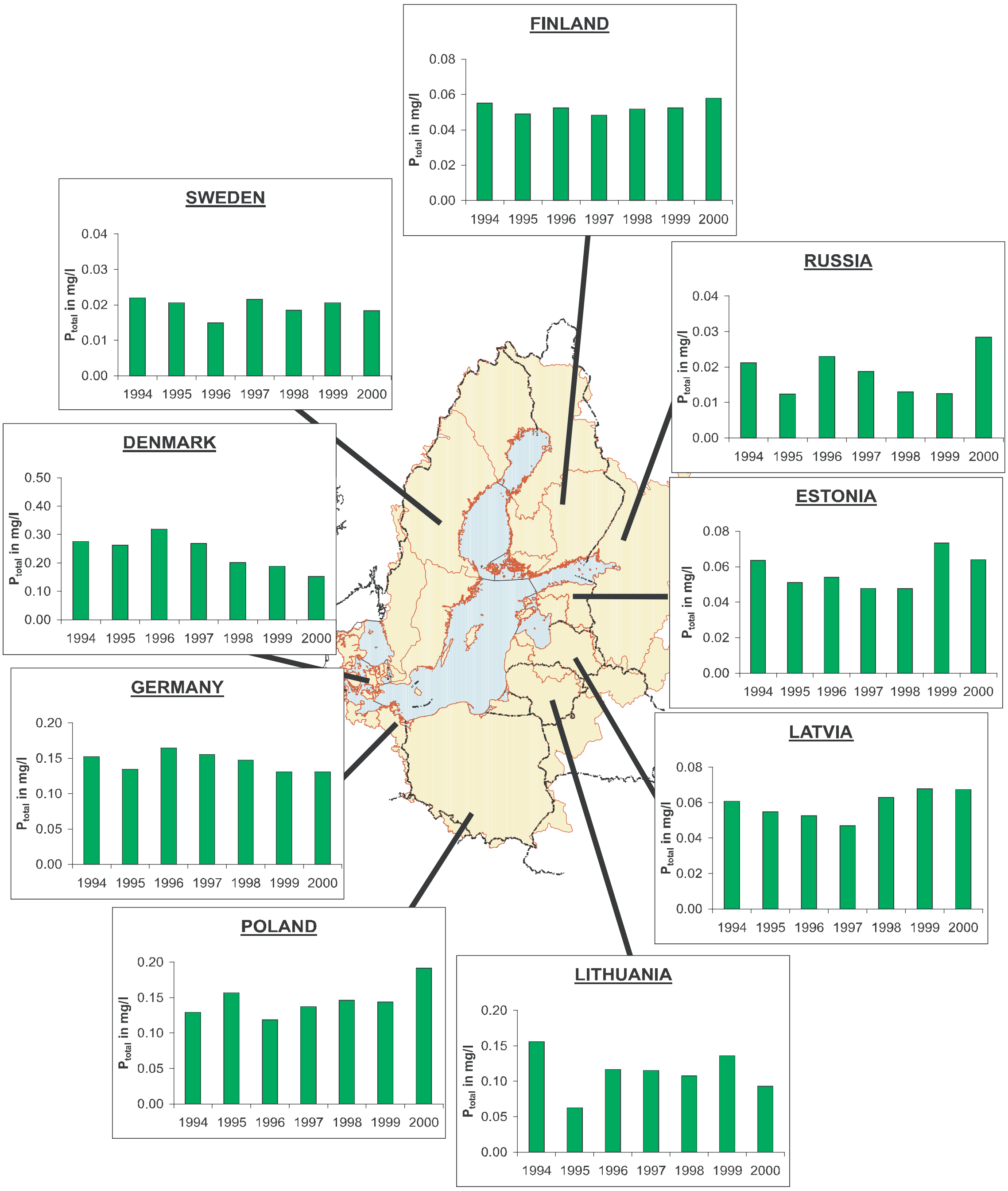


Figure 6.4: Annual average riverine run-off in m³/s and riverine phosphorus inputs in tonnes into the Baltic Sea from 1994 to 2000 by Contracting Party. Different scales have been used for the various Contracting Parties in the figures. For Denmark the total water-borne phosphorus input into the Baltic Sea is used.

Figure 6.5:
Flow-weighted phosphorus concentrations in mg P/l for the time period 1994 to 2000 by Contracting Party. Different scales have been used for the various Contracting Parties in the figures. For Denmark the total water-borne phosphorus input into the Baltic Sea is used.



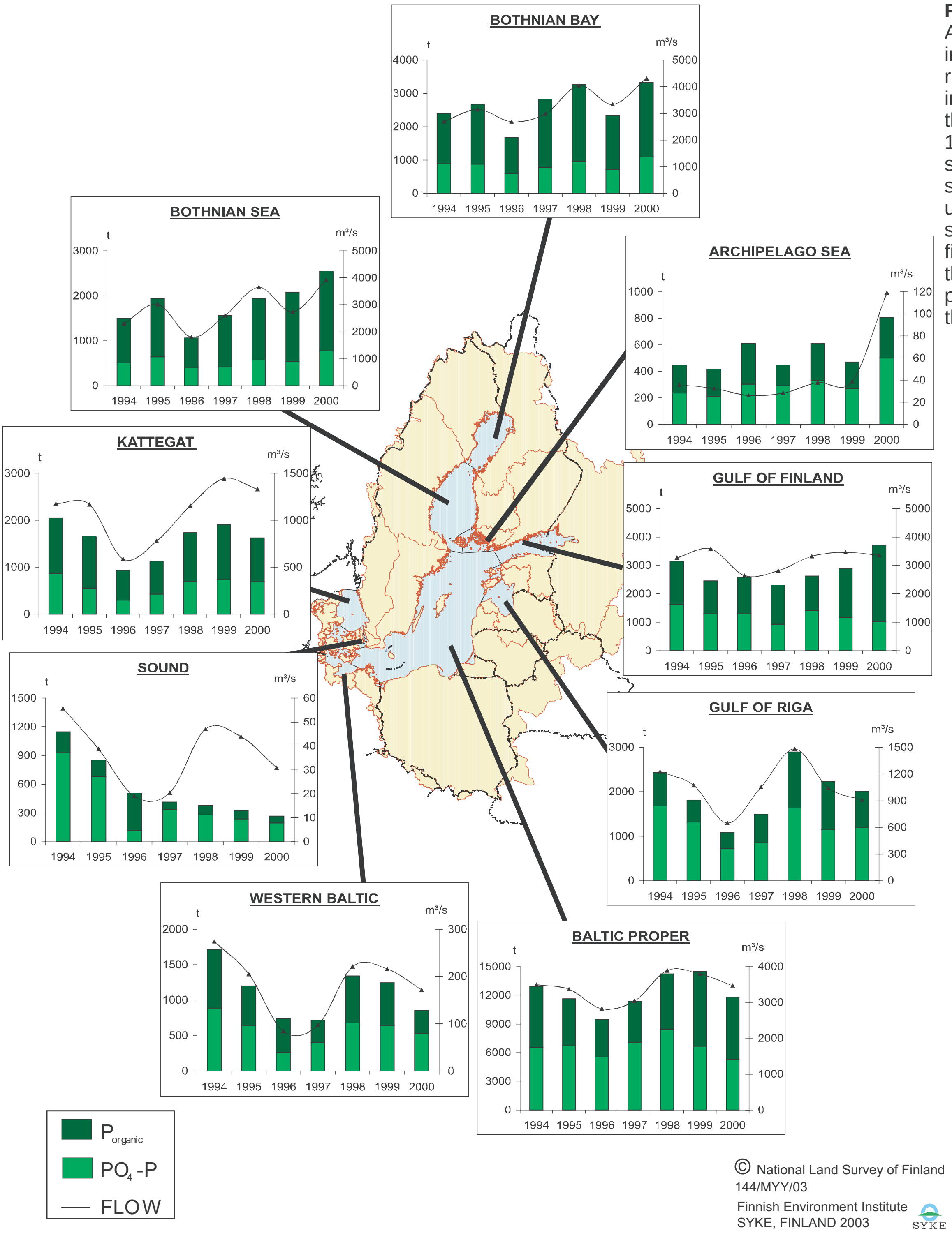
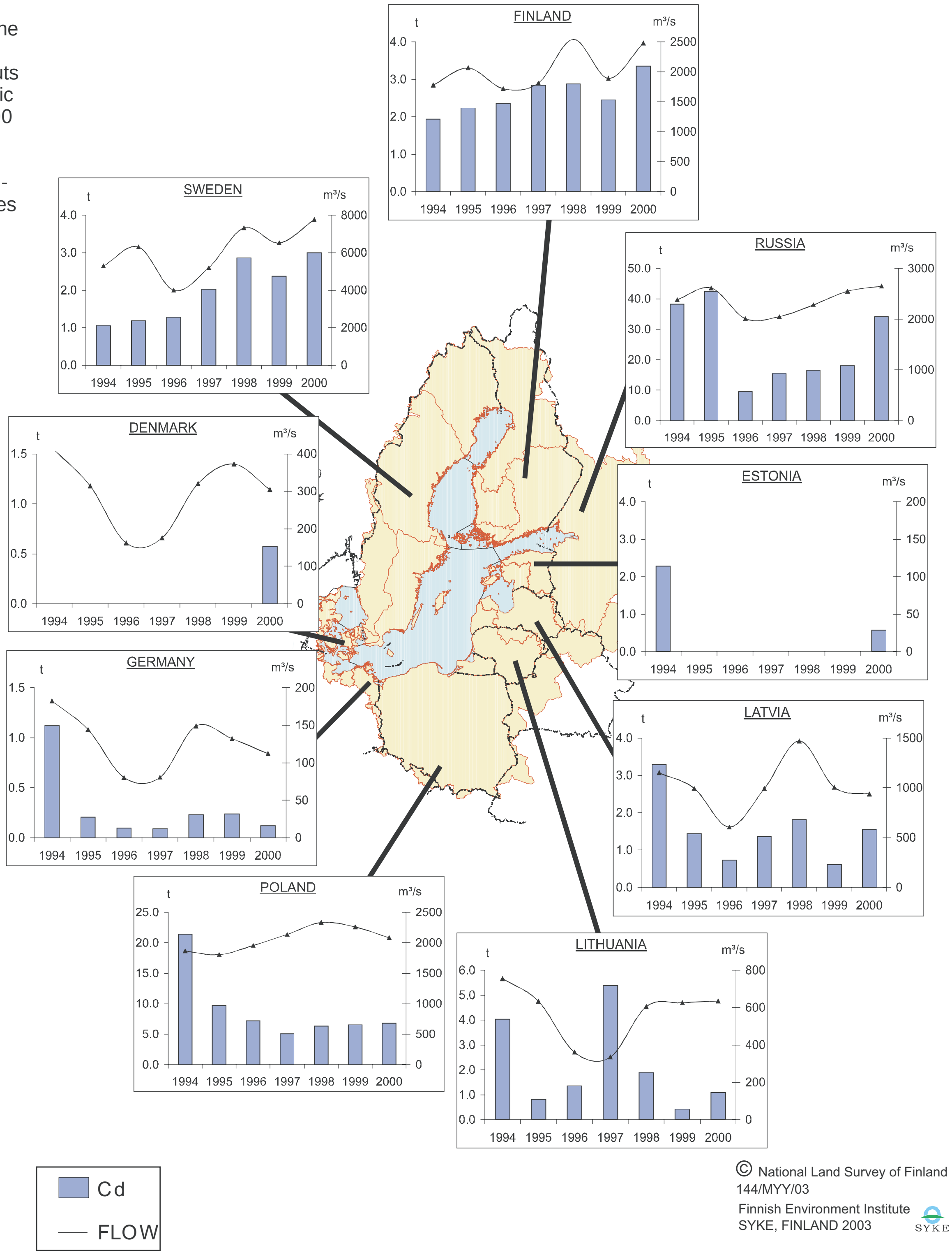


Figure 6.6:
Annual average riverine run-off in m³/s and riverine phosphorus inputs in tonnes into the Baltic Sea from 1994 to 2000 by sub-region. Different scales have been used for the various sub-regions in the figures. For Denmark the total water-borne phosphorus input into the Baltic Sea is used.

6.3 Comparison of riverine heavy metal inputs from 1994 to 2000

Due to insufficient data, the riverine heavy metal inputs into the Baltic Sea for cadmium and lead shown in Figures 6.5 to 6.8 do not cover the total riverine input. As an example Danish and Estonian data have been excluded, because they are not compiled for all years between 1994 and 2000. Further only Russian input to Gulf of Finland is included.

Figure 6.7:
Annual average riverine run-off in m³/s and riverine cadmium inputs in tonnes into the Baltic Sea from 1994 to 2000 by Contracting Party. Different scales have been used for the various Contracting Parties in the figures.



The Gulf of Finland and the Baltic Proper received most of the reported riverine heavy metal inputs into the Baltic Sea. The inputs of lead and cadmium varied to some extent according to the run-off (see Figures 6.7 to 6.10), but the relationship was not as clearly defined as in the case of nutrients. Inputs of cadmium and lead into the Baltic Sea decreased in some sub-regions and from some Contracting Parties. This appears to be a credible finding, because of considerable

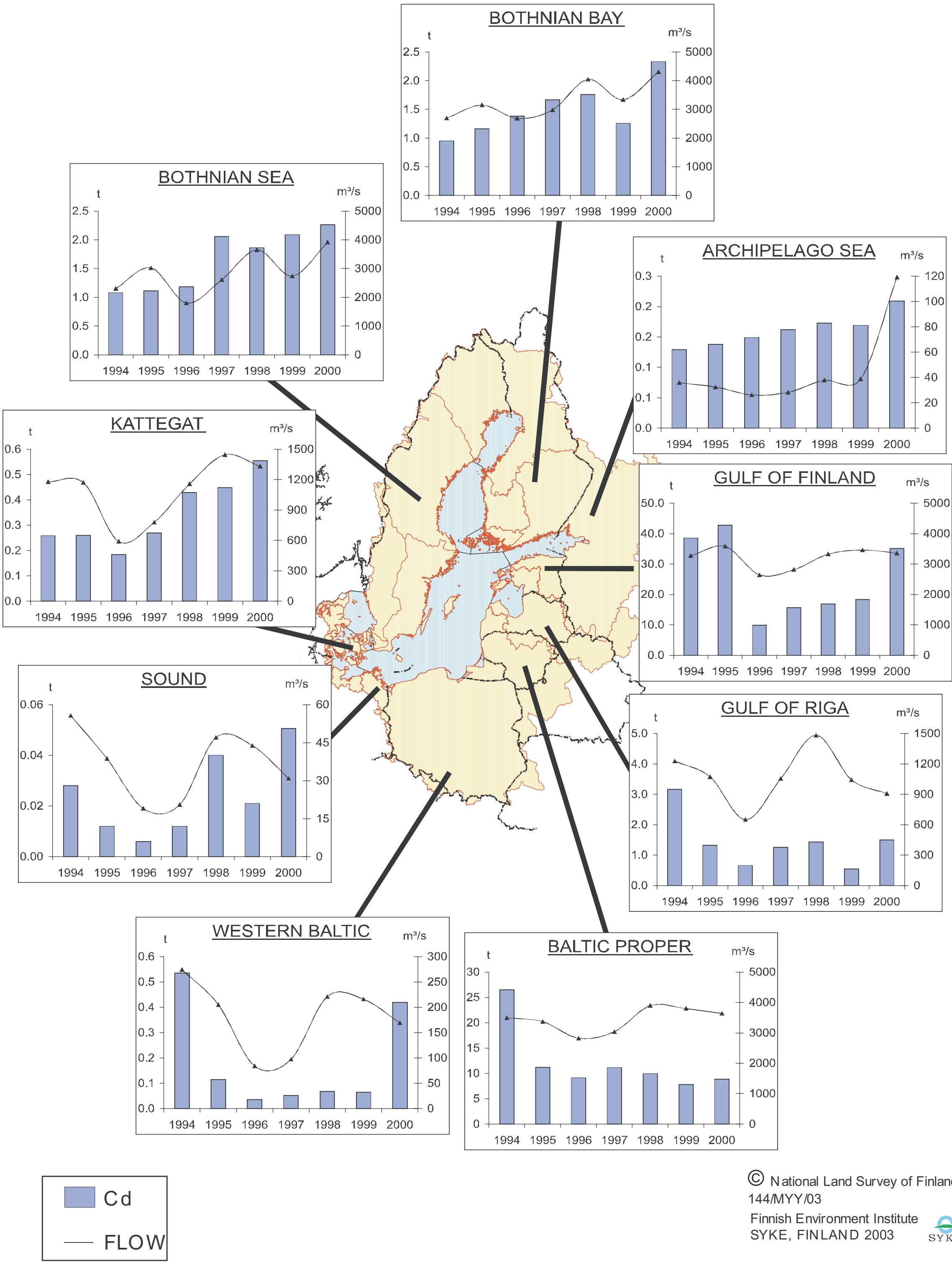


Figure 6.8:
Annual average riverine run-off in m³/s and riverine cadmium inputs in tonnes into the Baltic Sea from 1994 to 2000 by sub-region. Different scales have been used for the various sub-regions in the figures.

reductions in heavy metal discharges from point sources within the Baltic Sea catchment area.

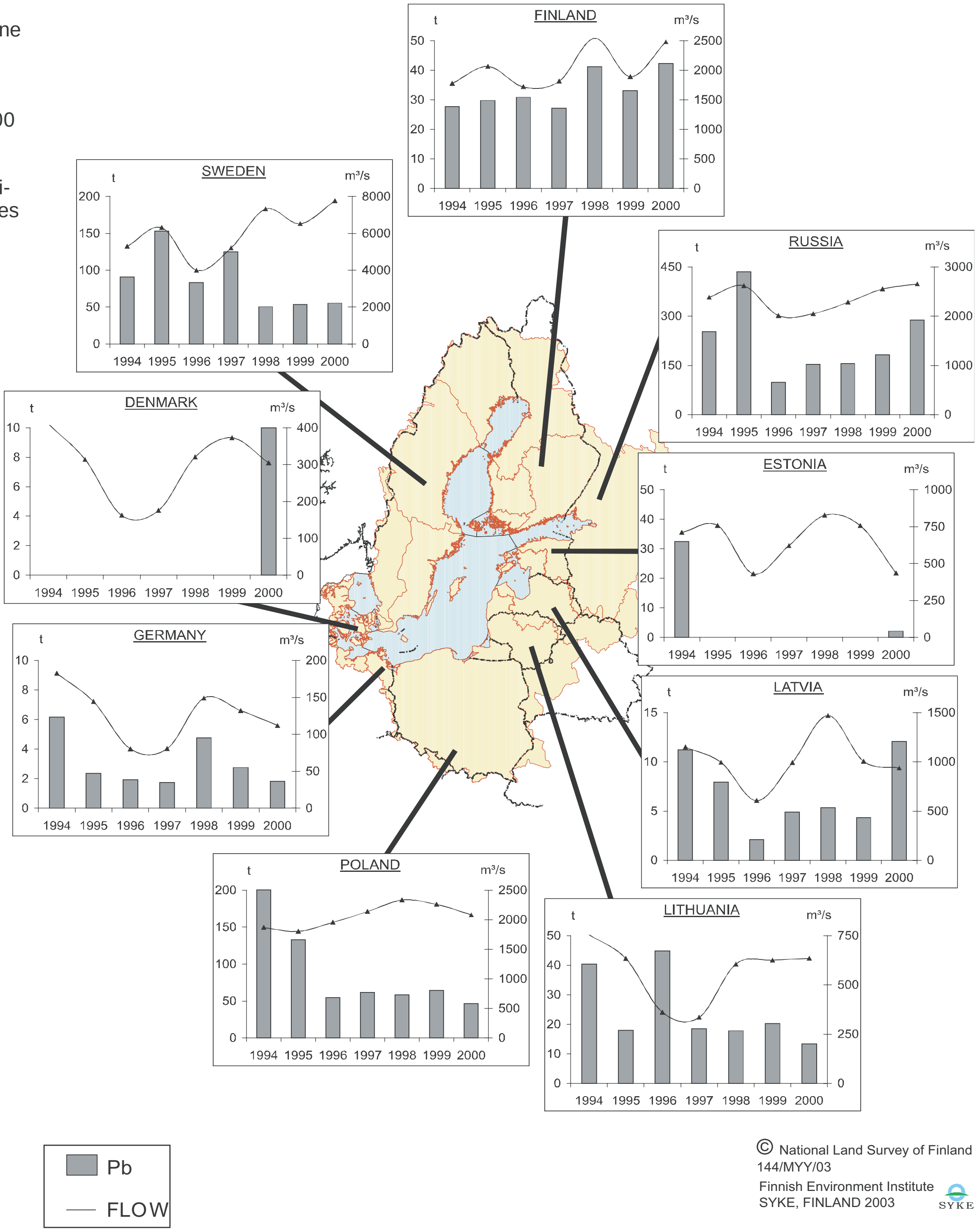


Figure 6.9:
Annual average riverine run-off in m³/s and riverine lead inputs in tonnes into the Baltic Sea from 1994 to 2000 by Contracting Party. Different scales have been used for the various Contracting Parties in the figures.

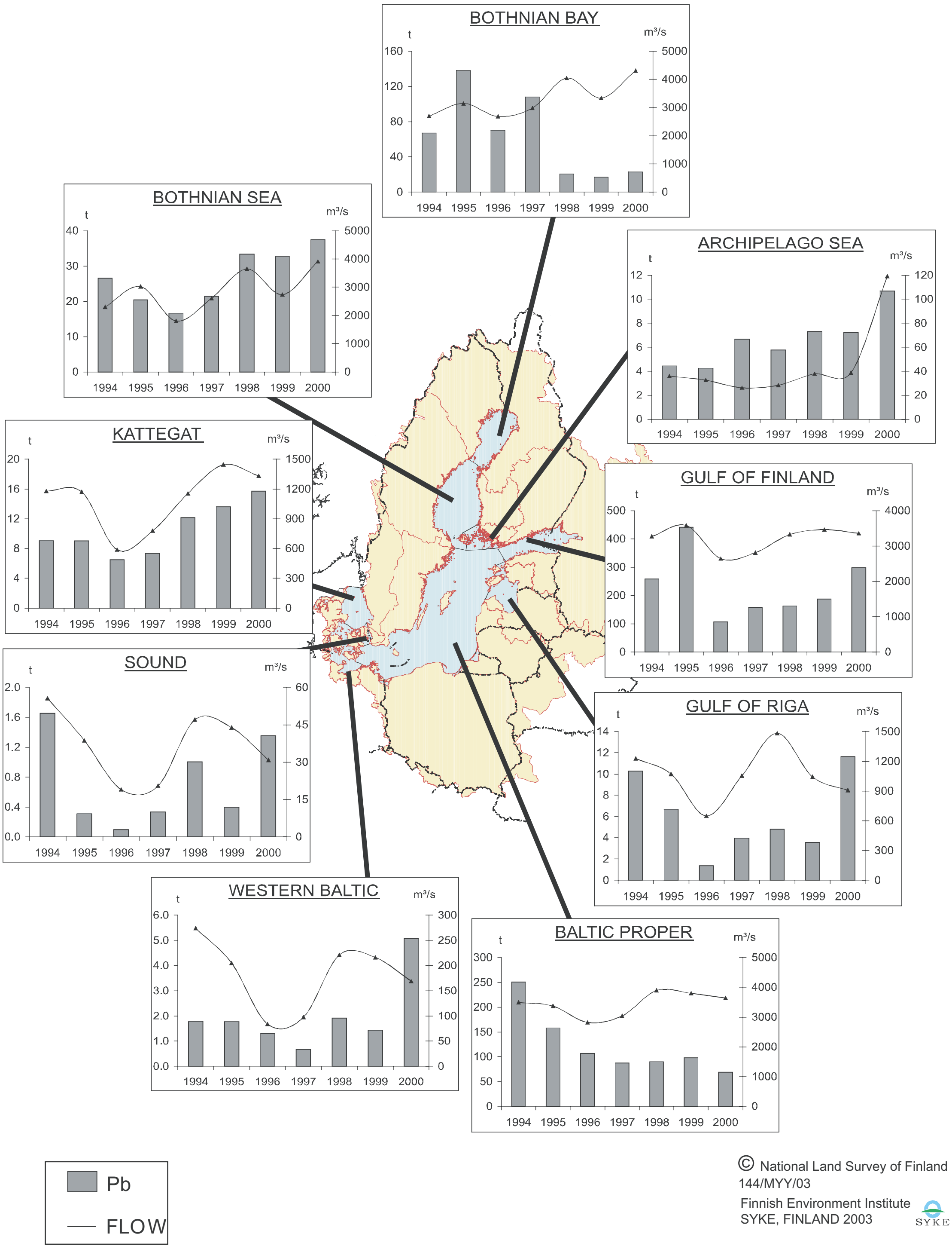


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Figure 6.10:
Annual average riverine run-off in m³/s and riverine lead inputs in tonnes into the Baltic Sea from 1994 to 2000 by sub-region. Different scales have been used for the various sub-regions in the figures.

7 Summary, conclusion and recommendations

7.1 Objectives of the Fourth Pollution Load Compilation (PLC-4)

To achieve the objectives of the Convention, the Helsinki Commission needs reliable data on inputs into the Baltic Sea from land-based sources, as well as information about the significance of different pollution sources. This information is required to assess the effectiveness of measures taken to reduce pollution in the Baltic Sea catchment area and to support the development of HELCOM's environmental policy. It is also required to interpret and evaluate the environmental status and related changes in the open sea and coastal waters.

To satisfy these needs, the Baltic Seawide water-borne Pollution Load Compilations (PLCs) were carried out in 1987 (PLC-1), 1990 (PLC-2) and 1995 (PLC-3). The Commission decided at HELCOM 19 in 1998 to perform PLC-4 including monitoring of water-borne pollution loads from 1 January 2000 to 31 December 2000, and covering both point and non-point pollution sources throughout those parts of the Baltic Sea catchment area located within the borders of HELCOM's Contracting Parties. The objectives of the periodic pollution load compilations (PLCs) regarding pollution of the Baltic Sea from land-based sources are:

1. to compile information on the water-borne inputs of important pollutants entering the Baltic Sea from different sources in its catchment area, on the basis of harmonised monitoring methods;
2. to follow up long-term changes in pollution loads from various sources;
3. to determine the relative significance of different sources of pollutants;
4. to assess the effectiveness of measures taken to reduce pollution loads in the Baltic Sea catchment area; and
5. to provide information for the assessment of long-term changes and the state of the marine environment in the open sea and the coastal zones.

The main content of the former PLCs is described in chapter 1. There have been considerable improvements in the extent, reliability and comparability of the data produced for PLC-3 and PLC-4, with the introduction of harmonised methodologies for measurements (chapter 3), quality assurance (chapter 4), calculations (chapter 3) and reporting of data on different source categories (chapter 5).

The Fourth Pollution Load Compilation (PLC-4) represented a particularly significant step forward by quantifying discharges and losses from both point and non-point sources within the Contracting Parties' catchment area of the Baltic Sea. With the adoption of the guidelines for the Fourth Pollution Load Compilation (PLC-4) by HELCOM 20 in 1999 two different approaches were employed to quantify all pollution inputs into the Baltic Sea:

1. **Source-orientated approach:** This approach was used for the first time to quantify the discharges from point sources and losses from diffuse sources into inland surface waters within the Baltic Sea catchment area. This required the measurement of nutrient discharges from point sources, and losses from diffuse sources within the Baltic Sea catchment area in each Contracting Party.

2. **Load-orientated approach:** In accordance with earlier PLCs, this approach was used to quantify total loads of nutrients, organic matter and heavy metals from rivers, unmonitored coastal areas and point sources discharging directly into the Baltic Sea.

Diffuse sources of nutrients were defined as any source of nutrients not accounted for as point sources. Small, dispersed point source discharges (e.g. from scattered dwellings or localised agricultural sources such as farmyards) were considered to be diffuse sources. Whereas point source discharges from wastewater treatment plants and industrial plants are directly discharged into rivers or directly into the Baltic Sea, diffuse nutrient losses enter inland surface waters by many different delivery pathways (section 1.3 in chapter 1 and chapter 3.2). By separating the various components of diffuse sources, it is possible to take into account the importance of the different processes and delivery pathways, which may vary greatly.

7.2 Overall results

7.2.1 Introduction

The main results of PLC-4 are described in chapter 5 and with more detailed summary tables in Annex 6. During 2000, point source discharges of organic matter, nutrients (including different components of nitrogen and phosphorus) and heavy metals were reported for all municipal wastewater treatment plants, industrial plants and fish farms within the Contracting Parties Baltic Sea catchment area, and also for the corresponding sources discharging directly into the Baltic Sea. The data were reported for large point sources plant by plant and as a sum for the remaining small point sources for each Baltic Sea sub-region among the Contracting Parties. Further, riverine loads for each monitored catchment area as well as sums for Baltic Sea sub-regions for each Contracting Party relating to unmonitored catchment areas and coastal areas have been reported together with source apportionment and diffuse losses from different sources. All reported data is stored in the HELCOM PLC-water database. In this sub-chapter only the most general results are summarised and discussed.

7.2.2 Source-orientated approach

According to the results of the source-orientated approach, in 2000 the sums of the discharges from point sources and the losses from diffuse sources, including natural background losses entering inland surface waters, amounted to 822000 tonnes of total nitrogen (N_{total}) and 41200 tonnes of total phosphorus (P_{total}) (chapter 5.1.4, figure 5.22). The majority of both N_{total} losses and discharges (59%), and the P_{total} losses and discharges (54%) originated from diffuse sources (chapter 5.1.2). Natural background losses (chapter 5.1.3) and discharges from point sources (chapter 5.1.1) of N_{total} amounted to 32% and 10% respectively of the total losses and discharges entering inland surface waters. The corresponding figures for P_{total} were 27% and 20%, respectively. Diffuse losses entering inland surface waters from agriculture and managed forestry were the main nutrient source in many Contracting Parties. These losses constituted between 40% and 85% for N_{total} and between 25% and 65% of P_{total} respectively of total nutrient losses/discharges into inland surface waters; the highest proportions of these losses were observed in Denmark.
The Russian results for diffuse losses from agriculture and managed forestry seemed quite underestimated compared with corresponding catchments, constituting only 1% N_{total} and 15% P_{total} of the losses/discharges into inland surface waters in the Russian Baltic Sea catchment area. This leaded to very high proportions of natural background losses of nitrogen and phosphorus, and extremely low area-specific losses from agriculture and managed forestry.

In 2000, 41% of N_{total} and 54% of P_{total} losses and discharges into inland surface waters within the whole Baltic catchment area originated from the basin of the Baltic Proper (chapter 5.1.4, figures 5.23 to 5.26). This catchment area constituted 31% of the total Baltic Sea catchment area. The largest proportions of these loads came from the Polish catchment area – 68% and 85% of the nitrogen and phosphorus loads respectively. The losses/discharges are also expressed as area-specific coefficients (chapter 5.1.4, tables 5.2 and 5.3). High area-specific losses do not necessarily correspond with high absolute losses/discharges. With respect to nitrogen, high area-specific losses occurred within the catchment areas of the Sound (2300 kg N/km^2), the Western Baltic (1150 kg N/km^2) and the Kattegat (1150 kg/km^2), and within the Archipelago Sea (90 kg P/km^2), the Baltic Proper (46 kg P/km^2) and the Western Baltic (46 kg P/km^2) with respect to phosphorus. The lowest area-specific losses/discharges occurred within the catchment areas of the Bothnian Bay (285 kg N/km^2; 16 kg P/km^2) and the Bothnian Sea (340 kg N/km^2; 17 kg P/km^2). High agricultural activity, high population density and industrial activity often lead to high area-specific losses/discharges. Geology, topography, soil-type and climate also play a major role in this process. The high nitrogen and phosphorus losses in 2000 within the catchment area of the Archipelago Sea is explained by heavy precipitation leading to considerable nutrient leakage and surface run-off from cultivated areas.

The natural background losses of nutrients contributed between 5% and 20% of the total losses/discharges into inland surface waters in Estonia, Germany, Denmark and Lithuania. In catchment areas with many pristine areas and low impact from human activity, the natural background losses are a more important source, such as in Latvia (34%), Finland (40%) and Russia (74%), although the high Russian figures are a result of unrealistic low reported anthropogenic diffuse losses. Point source discharges in many Contracting Parties contributed a minor proportion of the total nutrient losses/discharges into inland surface waters within the Baltic catchment area. These constituted between 3 and 25% of N_{total} and less than 10% of P_{total} losses/discharges in Finland, Germany and Sweden. In other Contracting Parties the P_{total} discharges from point sources constituted between 30% and 45% of the P_{total} losses/discharges entering inland surface waters.

Discharges from municipal wastewater treatment plants accounted for 84% of N_{total} and 85% of P_{total} point source discharges into inland surface waters within the Baltic Sea catchment area. The corresponding figures for discharges from industry are 5% N_{total} and 14% P_{total}, respectively. The remaining 1% of total discharges from point sources entering inland surface waters within the Baltic Sea catchment area was discharged from freshwater fish farms.

7.2.3 Load-orientated approach

The results in the following sub-chapters are based on the load-orientated approach.

7.2.3.1 Retention

Many transformations may occur before the nutrient loads that enter inland surface waters within the Baltic catchment area - far away from the marine environment - reach the Baltic Sea. Nutrient retention is one of the very important controlling factors that determine the final amounts of nutrients entering the Baltic Sea via rivers. Retention in general reduces the amounts of nutrients entering the Baltic Sea compared with the corresponding amounts entering inland surface waters within the catchment area. Retention has been estimated as a part of the PLC-4 assessment (chapter 5.2.4). Total retention in 2000 within river systems (rivers, lakes and inundated floodplains) has been recorded at 278000 tonnes of N_{total} and 13200 tonnes of P_{total} which constituted 30% of nitrogen and 31% of phosphorous, respectively of the riverine gross load. The riverine gross load is defined as retention added to the total monitored riverine load. Retention is typically high in large catchment areas with many lakes and large rivers that frequently inundate the surrounding river valleys. This normally results in a long residence time before nutrients reach the Baltic Sea from big catchment areas. Poland, Latvia and Germany have reported high retention proportions of the gross loads of both N_{total} (34-45%) and P_{total} (38-60%). Lithuania has reported very low retention with only 0.9% N_{total} and 2.3% P_{total} of the gross load. However, phosphorus retention may be low, when lakes that previously received high phosphorus loads, release high quantities of phosphorus and act as net contributors (negative retention) to the gross loads. This phenomenon occurred in some Danish lakes, but also in some large rivers within the eastern part of the Baltic Sea catchment area.

7.2.3.2 Source apportionment of riverine nutrient loads

Source apportionment is used to evaluate the impact of different sources on the riverine nitrogen and phosphorus loads. Not all Contracting Parties followed the PLC-4 guidelines, therefore, the comparison of source apportionment among Contracting Parties and Baltic Sea sub-regions should be performed carefully.

A major proportion of riverine nitrogen and phosphorus loads originated from anthropogenic sources (chapter 5.2.5), whereas natural background losses constituted the most important source only in the catchment area of the Bothnian Bay. On average approximately 65% of the total riverine nitrogen load and 57% of the total riverine phosphorus load originated from diffuse sources, with the major component originating from agriculture and managed forestry. In some sub-regions discharges from scattered dwellings were also an important source.

Discharges from point sources were generally less significant sources for nitrogen and phosphorus riverine loads in all Contracting Parties and Baltic Sea sub-regions. The importance of point source discharges was generally higher for the phosphorus load than for the nitrogen load in all areas except for Finland, Germany and Sweden.

7.2.3.3 Total water-borne inputs into the Baltic Sea in 2000

7.2.3.3.1 Run-off

In 2000, run-off for 232 rivers was monitored. The total recorded run-off for these rivers amounted to 532900 million m^3/a, monitored over a total catchment area of 1.33 million km^2 - or roughly 75% of the total Baltic Sea catchment area. Total run-off including unmonitored rivers and coastal areas was 680600 million m^3/a from a total area of 1.67 million km^2 or 11 l/ (s km^2). Wastewater from point sources discharging directly into the Baltic Sea only constituted approximately 0.5% of the total run-off. It should be noted that the run-off from unmonitored rivers and coastal areas and some point sources discharging directly to the Baltic Sea is underestimated, while data from the Kaliningrad region are not reported at all.

7.2.3.3.2 BOD_7, nutrient and heavy metal inputs into the Baltic Sea

Based on the load-orientated approach, in 2000 total water-borne inputs entering the Baltic Sea by rivers, coastal areas and point sources discharging directly into the Baltic Sea amounted to 745000 tonnes of total nitrogen and 34600 tonnes of total phosphorus. The corresponding figure for total BOD_7 was 1130000 tonnes (chapter 5.2.3). Most of this load entered the Baltic Sea through monitored rivers (chapter 5.2.2), however it is not possible to give a full picture of water-borne heavy metal inputs into the Baltic Sea, due to insufficient data.

BOD_7

Monitored rivers accounted for 82% of the 1130000 tonnes of total **BOD_7** water-borne input into the Baltic Sea in 2000. Of this figure, point sources discharging directly into the Baltic Sea accounted for 8% of the total water-borne inputs while municipal wastewater treatment plants accounted for 32% and industrial plants 65% of the direct discharges. The remaining 10% of the total water-borne inputs emanated from unmonitored catchment areas and coastal areas. Approximately 38% of the total BOD_7 load entered the Baltic Sea from the catchment area of the Baltic Proper, and roughly 25% of the total water-borne BOD_7 input came from Poland, which also has the highest population in the Baltic Sea catchment area. The Archipelago Sea (1045 kg BOD_7/km^2) and the Bothnian Bay (770 kg BOD_7/km^2) received the highest area-specific BOD_7 loads and the Gulf of Riga the lowest (420 kg BOD_7/km^2).

Nitrogen

In 2000 77% of the total water-borne input of total nitrogen was discharged by monitored rivers, with nearly 38% of this input originating from the catchment area of the Baltic Proper. Point sources discharging directly into the Baltic Sea accounted for 5% of the nitrogen water-borne inputs, with municipal wastewater treatment plants accounting for 83% of the direct discharges. The remaining 17% of discharges entered the Baltic Sea from unmonitored catchment areas and coastal areas.

Contracting Parties with large catchment areas also tended to have the highest nitrogen loads, with the exception of Russia, mainly because Lake Ladoga efficiently retains nutrients (high retention capacity). The largest proportions of the total water-borne nitrogen load came from Poland (26%) and Sweden (21%). The highest area-specific nitrogen loads occurred in the catchment area of the Sound (1950 kg N/km^2), the Western Baltic (1480 kg N/km^2) and the Archipelago Sea (1245 kg N/km^2). The corresponding lowest area-specific coefficient occurred within the catchment area of the Gulf of Finland (270 kg N/km^2). In 2000, high area-specific nitrogen loads were related to high agricultural activity. In Denmark, Germany and southern Sweden this was connected to large livestock densities and intensive use of manure and fertiliser, while in the catchment area of the Archipelago Sea high area-specific nitrogen loads were linked to significant nutrient leakage and surface run-off following heavy precipitation.

Phosphorus

Monitored rivers discharged 77% of the total water-borne input of total phosphorus into the Baltic Sea in 2000, with up to 50% of the total load originating from the catchment area of the Baltic Proper. Point sources discharging directly into the Baltic Sea accounted for 8% of the water-borne input of phosphorus, with municipal wastewater treatment plants accounting for 81% of the direct discharges. The remaining 15% entered the Baltic Sea from unmonitored catchment areas and coastal areas.

With the exception of Russia, the highest phosphorus loads originated from the large catchment areas. The largest proportion of the total water-borne phosphorus load came from Poland (40%), Finland (15%) and Sweden (14%). The highest proportion of phosphate-phosphorus (PO_4-P) load (73%) was observed in rivers draining into the Sound, which received large amounts of industrial and municipal wastewater. In the rivers draining into the Gulf of Finland, PO_4-P accounted for 22% of the phosphorus load.

The highest corresponding area-specific figures by Contracting Party were recorded within the catchment area of the Archipelago Sea (101 kg P/km^2), the Sound (72 kg P/km^2) and the Western Baltic (43 kg P/km^2), while the lowest area-specific figures occurred in the catchment area of the Gulf of Finland (11 kg P/km^2). High area-specific phosphorus loads are related to a number of factors such as high population densities (as can be seen in the Western Baltic and the Sound), elevated rates of industrial activity, the intensity of agricultural activity to some extent, and also too heavy precipitation (nutrient leakage and surface run-off e.g. around the Archipelago Sea in 2000).

Heavy metals

Because of insufficient data on heavy metals, a full picture of the loads entering the Baltic Sea could not be given in PLC-4. However, since PLC-3 was conducted in 1995, there have been considerable methodological improvements (including more comprehensive sampling and new analysers, for instance), that have enabled some countries to measure lower concentrations of certain heavy metals.

A comparison of the riverine inputs into the Baltic Sea for the different heavy metals under consideration shows that the Gulf of Finland received the highest cadmium, lead and copper loads, while mercury inputs were highest for the Baltic Proper. A small number of major rivers account for very large proportions of the total riverine heavy metal loads. For instance, the lead and copper loads in Russian rivers (mainly the Neva) make up 60% and 40%, respectively of the total reported riverine loads of these pollutants, while Polish rivers account for roughly 90% of the total riverine mercury load.

7.2.4 Comparison between PLC-3 and PLC-4

During the time the four PLCs have been conducted, the proportions of the catchment area that have been monitored and the methodologies that have been employed have changed. In the earlier PLCs the total water-borne inputs of nutrients and heavy metals to the Baltic Sea were not assessed because of missing information from unmonitored catchment areas, coastal areas and point sources discharging directly into the Baltic Sea, and not reported obligatory parameters for some rivers. Many of these shortcomings have been resolved in PLC-4, but some deficiencies remain, especially with respect to the measurement of heavy metals. Furthermore, PLC-4 represents the first attempt to quantify the sources and pathways of losses from diffuse sources as well as discharges from point sources into inland surface waters. Because of these factors, no direct comparison is possible between PLC-3 and PLC-4.

To perform an assessment of the riverine inputs into the Baltic Sea, the Contracting Parties have reported monitored annual run-offs and loads of nitrogen and phosphorus compounds from 1994 to 2000, and some Contracting Parties even reported total water-borne inputs to the Baltic Sea. In principle, each Contracting Party should have reported data for the same riverine monitoring stations during the period, to ensure that figures could be compared year by year based on the same level of coverage.

Run-off is clearly an important and decisive factor in determining the total reported riverine loads of nitrogen and phosphorus, since riverine nutrient loads have been observed to closely follow variations in run-off (chapter 6, Figures 6.1, 6.3, 6.4 and 6.6). Increased run-off often results in reductions in phosphorus concentrations through a dilution effect, but it is also possible that concentrations can rise due to surface run-off and resuspension of particulate matter. In any event, higher run-off leads to increased phosphorus loads, and in the case of nitrogen, higher run-off often leads to greater concentrations since heavy rainfall results in increased leakage and run-off from farmland, and consequently increased nitrogen inputs to inland surface waters.

The overall pattern for the period 1994 to 2000 indicates that years with heavy precipitation and run-off resulted in high nitrogen and phosphorus loads. However, it is also possible to detect a reduction in phosphorus loads from point sources. For example in Denmark during 1999 and 2000, high run-off levels resulted in lower phosphorus loads compared with the same level of run-off in 1994. By expressing loads in flow-weighted concentrations (by dividing the total load with the corresponding run-off expressed in mg/l, see Figures 6.2 and 6.5) the effect of run-off (or climate) is taken into account. As a result, the phosphorus loads for Denmark were found to be 0.30 mg P/l in 1994 and 0.20 mg P/l in 2000. When approximately ten years of annual load records have been compiled, it should statistically be possible to detect a trend in recorded loads if any exist.

To some extent riverine heavy metal loads also vary with run-off rates, but not as directly as do nutrient loads. During the period 1994 to 2000, riverine heavy metal loads (notably cadmium and lead) decreased for some of the Contracting Parties.

7.3 Discussion and recommendations

The Contracting Parties are responsible for the quality and reliability of the data they submit to the PLC-water HELCOM database, which is managed by SYKE. The procedures for the collection of data, quality assurance, and compilation and reporting methodology are described in the PLC-4 Guidelines and are summarised in chapters 3 and 4. The recommended analytical methods have been more closely followed in PLC-4 than in previous PLCs. Additionally, intercalibration among some laboratories and improved analytical equipment have made the chemical analyses easier to compare in PLC-4 than in its predecessors.

During PLC-4 the major difficulty encountered with the **load-orientated approach** was that some obligatory parameters relating to rivers were not measured or reported by all of the Contracting Parties. For instance, the flow rate is a key factor when calculating riverine loads. Particularly for small rivers without permanent hydrological stations, measurements of this variable should be improved, both in terms of the numbers of monitoring sites and annual observations. Another important factor is the frequency of water samples, which has been increased to at least 12 times per year for organic matter and nutrients in the monitored rivers. Compared to PLC-2 and PLC-3, heavy metal load data has to some extent improved, but is still problematic and not complete. The Contracting Parties have used different methods to measure heavy metal concentration under the detection limit, and in some cases there have been analytical problems or constraints on resources. Moreover, coverage of the Baltic Sea catchment area and the number of obligatory parameters monitored or reported still do not permit the presentation of figures for the total heavy metal loads entering the Baltic Sea.

There were particularly serious problems with data from Russia, since many figures were only estimated in sub-regional totals, and no figures at all were available from the Kaliningrad Region. The main challenge of the next PLC is to ensure that each of the Contracting Party monitors and reports reliable and complete data sets on pollution loads, so that the total pollution loads entering the Baltic Sea may be estimated with reasonable accuracy. Furthermore, all the Contracting Parties must employ consistent handling procedures for results under the detection limit.

The adoption of the **source-orientated approach** represented a major challenge, and there were many methodological problems and uncertainties. Particularly for countries with large catchment areas and less experience on point source inventories, it was a complex task to collect the required data on point sources on a plant by plant basis in the entire Baltic Sea catchment area. This exercise was necessary to obtain information about the anthropogenic factors contributing to riverine loads, and to evaluate whether the reduction goals for different sources had been fulfilled. Some of the Contracting Parties monitored the discharges from all wastewater treatment plants and industrial plants with more than 30 PE, while others omitted to monitor even municipalities larger than 10 000 PE. This first attempt indicates that further improvements are needed, to get reliable point source data for the whole of the Baltic Sea catchment area.

The compiled data on diffuse sources are more uncertain than the data from point sources, particularly for agriculture and managed forestry, since methods have not yet been harmonised, and results for diffuse losses are not directly comparable. Further, it is not always clear how the Contracting Parties have distributed the data between losses from agriculture and managed forestry and natural background losses, and what kind of retention rates have been included in the assessment.

In spite of these shortcomings in the data, the PLC-4 results clearly indicate that losses from diffuse sources in 2000 are still the main source of the excessive inputs of both nitrogen and phosphorus entering the Baltic Sea. The large catchment areas with the major rivers such as the Neva, Vistula, Oder, Nemunas and Daugava, are the main sources of nutrient inputs into the Baltic Sea. Moreover, for the coastal waters the upstream catchment area is often the main source. In addition to these findings, the area-specific load of nitrogen into the Baltic Sea can be high in sub-regions with small catchment areas, where there is intensive agricultural activity and high population density, such as the south-western part of the Baltic Sea catchment area. Correspondingly high area-specific phosphorus losses were found in catchment areas with high population density, many industries and heavy agricultural activity.

To combat eutrophication problems, joint and co-ordinated nutrient reduction measures should be planned for the whole Baltic Sea catchment area, and should particularly address the impact of agriculture. To assess the effectiveness of such measures, and to evaluate whether reduction targets taken at source (e.g. 50% reduction target) are met, losses from diffuse sources should be quantified in an more accurate and comparable manner for the different catchment areas. Additionally, total water-borne inputs into the Baltic Sea should be quantified in a more harmonised way and more accurately, by improving the estimates of loads from unmonitored catchment areas including coastal zones. As a minimum, discharges from big municipal wastewater treatment plants, industries and fish farms must be included. The main task for the next PLC must therefore be to harmonise methods for quantifying diffuse sources throughout the Baltic Sea catchment area and the load from unmonitored areas. These procedures should be developed in close co-operation with OSPAR and the EU, and should also be based on the results of the EU-funded EUROHARP project. Consideration should also be given to the need to report on all individual municipal wastewater treatment plants, industrial plants and fish farms larger than 10000 PE. To avoid possible mistakes and onerous reporting obligations, the Contracting Parties should provide sums of the monitoring results for these sources for each monitored river. These results should be further divided into results from large and small point sources as well as the different diffuse pathways. Results for unmonitored catchment areas including coastal areas and for point sources discharging directly into the Baltic Sea should also be reported for each main Baltic Sea sub-region in each Contracting Party.

Although riverine run-off, nitrogen and phosphorus loads have been compiled by the Baltic Sea sub-region and by Contracting Parties annually since 1994, it is difficult to form a clear picture of the total inputs of nutrient into the Baltic Sea and their development over time. Not many Contracting Parties have reported total water-borne inputs and some Contracting Parties have not monitored the same catchment areas every year. Annual reporting and load compilations for total nitrogen, total phosphorus, organic matter and some heavy metals from the monitored parts of the Baltic Sea sub-regions are therefore recommended. In addition to these data, estimates from unmonitored catchment areas and coastal areas should also be provided. Discharges from point sources entering directly into the Baltic Sea could be reported annually, but they could also be reported every third or fifth year as these discharges change quite slowly over time.

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Annex 1: Analytical methods

Variable	Principle	Contracting Party
BOD	Incubation for 7 days	DE, EE, FI, LV, SE
	Incubation for 5 days. BOD_5 converted to BOD_7 using a factor 1.15	DK, LV (point sources), LT, PL, RU
COD_{Cr}	Digestion with potassium dichromate and determination by titration – the macro method	DK, EE, LV, LT, PL, RU
	Digestion with potassium dichromate and determination by titration or spectro-photometric determination–the semimicro method or the tube method	FI, SE
AOX	Absorption on carbon, titrimetric determination, measurement of conductivity	DE, FI, SE
TOC	Combustion at 600°-1000°C or UV-radiation, determination by IR-spectroscopy (DK: non-volatile organic carbon was determined)	DE, DK, FI, SE, PL
PO_4-P	Molybdenum blue method – spectrophotometric, autoanalyzer or continous flow determination	All Contracting Parties
P_{total}	Digestion with peroxodisulphate, determination of orthophosphate by molybdenum blue method	All Contracting Parties
	Digestion with H_2SO_4 and HNO_3, determination of orthophosphate by molybdenum blue method	PL
NH_4-N	Indophenol blue method – spectrophotometric, autoanalyzer or continous flow determination	DE, DK, EE, FI, LT, LV, PL, SE
	Distillation and titration	PL
	Nessler method	PL, RU
NO_3-N (+NO_2-N)	Cd-reduction, spectrophotometric, autoanalyzer or continous flow determination	DE, DK, EE, FI, LV, SE, PL, RU
	Salisylate method + NO_2 determination	LV, PL, RU
N_{total}	Digestion with peroxodisulphate, spectrophotometric, autoanalyzer or continous flow determination of nitrate	DE, DK, EE, FI, LT, LV, PL, SE, RU
	Distillation and titration (Dewarda, Kjeldahl + N_{NO3}-determination or its modification, waste waters)	EE, FI, LV, PL, RU

Variable	Principle	Contracting Party
Hg	Atomic absorption spectrometry, cold vapor	DK, EE, FI, LV, PL, SE, RU
	Enrichment, atomic absorption spectrometry, cold vapor	DE
	Flow injection mercury system, FIMS analyzer	FI
	Fluorescence	FI, LT, SE
	Enrichment, fluorescence	SE
Metals	Atomic absorption spectrometry, flame	DK, EE, FI, LT, LV, PL
	Digestion, atomic absorption spectrometry, flame	FI, LT, LV, PL
	Atomic absorption spectrometry, graphite furnace	DK, EE, FI, LT, LV,PL, SE
	Digestion, atomic absorption spectrometry, graphite furnace	DE, FI, LT, LV, PL
	Atomic emission spectrometry	FI
	Digestion, atomic emission spectrometry	FI
	Inductively coupled plasma, mass spectrometry	DK, EE, FI, SE
	Digestion, inductively coupled plasma, mass spectrometry	EE, FI
	Inductively coupled plasma, atomic emission spectrometry	FI, PL
	Digestion, inductively coupled plasma, atomic emission spectrometry	SE
	Voltametry	DE (Zn)
Mineral oil	Extraction in hexane, GC detection	DE, EE, FI (river), LV
	Extration in carbontetracloride, IR-detection	LT, FI, (point sources), RU (rivers)
	Extration in carbontetracloride, GC detection	RU (point sources)

Annex 2a: Detection limits – River water

Contracting Party	DE	DK	EE	FI	LI	LV	PL	RU	SE
AOX in µg/l	10			5					
BOD in mg/l	0.5	0.5	0.5-2	1-5	0.5	0.5-3.6	0.1-1	1.0	
COD_{Cr} in mg/l			5			5		1-5	4
TOC in mg/l	0.5	0.5		0.5-2					0.3
NH_4-N in µg/l	10	10	2	1-30	3-8	10	8-20	20	0.5
NO_3-N (+NO_2-N) in µg/l		20	20, 100	2-50	10	1, 10	10-100	10	1
N_{total} in µg/l	30	60	150	20-100	10	7	100	50	50
PO_4-P in µg/l		5	2	0.5-8	5	4	10-15	10	1
P_{total} in µg/l	10	10	2	0.5-10	5	6	15	40	2
Cd in µg/l	0.04	0.0054	0.02	0.03-1	0.05	0.03	0.1-1	0.5	0.005
Cr in µg/l	0.04	0.04		0.1-10	0.5		0.2-3	2.0	0.05
Cu in µg/l	0.04	0.04	0.1	0.1-20	0.5	0.28	0.5-5	0.5	0.04
Ni in µg/l	0.03	0.03		0.03-10	1.0		0.4-5	2.0	0.05
Pb in µg/l	0.025	0.02	0.2	0.03-10	1.0	0.32	0.3-5	2.0	0.02
Zn in µg/l	0.5	0.05	2	0.1-10	2.5	2	0.1-5	1.0	0.2
Hg in µg/l	0.005	0.005	0.1	0.002-0.2	0.1		0.1-0.5	0.2	0.0005
Mineral oil in µg/l			10	100	50	30, 90	100	40	

Annex 2b: Detection limits – Wastewater

Contracting Party	DE	DK	EE	FI	LI	LV	PL	RU	SE
AOX in µg/l	10			5					
BOD in mg/l	3	2	3	1-7	0.5	3		0.5-5	
COD_{Cr} in mg/l			15	14	3-50	30			4.0-5.0
TOC in mg/l	0.5	0.5		0.5-20					
NH_4-N in µg/l	10	100	10	2-2000	3-8	6-200		20-50	
NO_3-N (+NO_2-N) in µg/l	1		20, 40	5-500	10	3-20		6-500	
N_{total} in µg/l	100	50	1000	20-200	10	60-1000		50-1000	
PO_4-P in µg/l			2	0.5-20	5	2-70		20-200	
P_{total} in µg/l	10	50	2	2-100	5	5-10		10-40	
Cd in µg/l	0.05	0.05	0.1	0.03-5	0.05	10-100	0.1-10	0.05-0.1	
Cr in µg/l	0.1	0.2		0.1-100	0.5	0.2-300	0.2-20	0.2-10	
Cu in µg/l	0.1	0.5	1	0.1-100	0.5	0.5-100	0.5-20	0.1-1.0	
Ni in µg/l	0.05	0.1		0.04-100	1.0	7- 40	0.4-20	0.2-1.0	
Pb in µg/l	0.1	0.5	1	0.03-20	1.0	0.5-50	0.5-20	0.2-1.0	
Zn in µg/l	1	5.0	10	1-50	2.5	10-100	0.3-5	1.0-5.0	
Hg in µg/l	0.05	0.05	0.05	0.1-1	0.1	0.04-0.58	0.5-1	0.01-0.05	
Mineral oil in µg/l			10		50	40-120		5-50	

Annex 3a: Measurement uncertainties, % (95% confidence interval) – River water

Contracting Party	DE	EE	FI	LV	PL	RU	SE
AOX in µg/l	10		15 (5-50 µg/l) 10 (>50 µg/l)				
BOD in mg/l		6-17	10-20	15	5-15		
COD_{Cr} in mg/l			10-20		2-10		
TOC in mg/l	5		10-20 (<5 mg/l) 10 (>5 mg/l)				6
NH_4-N inµg/l	4	8-12 (< 20 µg/l) 2.5-5(>20 µg/l)	20-30 (< 20 µg/l) 5-15 (>20 µg/l)	5	2-15 (> 50 µg/l)	10	10
NO_3-N (+NO_2-N) in µg/l	3	4-10	5-15 (<100 µg/l)	6	1-10 (>100 µg/l)	6	10
N_{total} in µg/l	5	4-13(>100µg/l)	10-20 (<100 µg/l) 5-20 (>100 µg/l)		2-18 (> 100 µg/l)	24	10
PO_4-P in µg/l	3.5	10-25(<20µg/l) 3-10(>20 µg/l)	10-20 (< 20 µg/l) 5-10 (>20 µg/l)		7-20 (>20 µg/l)	5	10
P_{total} in µg/l	3.5	7-17(<20µg/l) 2-5(>20 µg/l)	10-20 (< 20 µg/l) 5-15 (>20 µg/l)		7-20 (>20 µg/l)	25	10
Cd in µg/l	10		25-50 (<0.1 µg/l) 10-20 (0.1-1 µg/l) 5-15 (>1µg/l)	10-15	15-30 (<2 µg/l) 3-15 (>2 µg/l)		15
Cr in µg/l	10		15-20 (< 10 µg/l) 10-15 (>10) µg/l)	10-15	8-20 (< 5 µg/l) 5-10 (>5 µg/l)		15
Cu in µg/l	10		10-30 (< 10 µg/l) 10-20 (>10 µg/l)	7-10	20 (< 5 µg/l) 2-15 (>5 µg/l)		6

Contracting Party	DE	EE	FI	LV	PL	RU	SE
Ni in µg/l	10		10-25 (< 10 µg/l) 5-15 (>10 µg/l)		30 (< 5 µg/l) 5-17 (>5 µg/l)		5
Pb in µg/l	10		20 (< 1 µg/l) 10-20 (>1 µg/l)	10-15	15-30 (< 3 µg/l) 5-15 (>3 µg/l)		10
Zn in µg/l	5	25	7-25	10-15	15 (< 10 µg/l) 2-15 (>10 µg/l)		10
Hg in µg/l	5		20-40		20-35 (< 1 µg/l) 15-20 (>1 µg/l)		5
Mineral oil in µg/l			30		25-50		28

DK: National requirements for uncertainties have been 7% for the determination of two identical samples with a known concentration.
LT : not reported

Annex 3b: Measurement uncertainties, % (95% confidence interval) – Wastewater

Contracting Party	DE	EE	FI	LV	RU
AOX in µg/l	10		15 (5-50 µg/l) 10 (>50 µg/l)		
BOD_7 in mg/l		15	10-20	7-20	9-30
COD_{Cr} in mg/l			10-20		5-39
TOC in mg/l	5		10-20 (<20 mg/l) 5 (>20 mg/l)		
NH_4-N in µg/l	4	5-12	5-15	5-13	10-25
NO_3-N (+NO_2-N) in µg/l	3	5-10	5-15	5-9	10-25
N_{total} in µg/l	5	9-12	10-20 (<500 µg/l) 10-25 (>500 µg/l)	4-24	10-25
PO_4-P in µg/l	3.5	5-20	10-20 (< 100 µg/l) 5-20 (>100 µg/l)	5-18	10-15
P_{total} in µg/l	3	5-20	10-25(< 50 µg/l) 5-15 (>50 µg/l)	4-14	5-25
Cd in µg/l	10	30	25-50 (<0.1 µg/l) 10-20 (0.1-1) µg/l 5-15 (>1µg/l)	8-10	10-30
Cr in µg/l	10		15-20 (< 10 µg/l) 10-15 (>10 µg/l)	7-10	10-20
Cu in µg/l	10	25	10-30 (< 10 µg/l) 10-20 (>10 µg/l)	7-10	10-50

Contracting Party	DE	EE	FI	LV	RU	
Ni in µg/l	10	10	10-25 (< 10 µg/l) 5-15 (>10 µg/l)	6-10	10-40	
Pb in µg/l	10	20	20 (< 1 µg/l) 10-20 (>1 µg/l)	6-10	25-50	
Zn in µg/l	5	25	7-25	10	15-35	
Hg in µg/l	5		15-40	10-11	20-70	
Mineral oil in µg/l					25-50	25-50

DK: National requirements for uncertainties have been 7% for the determination of two identical samples with a known concentration.
LT, PL and SE: not report

Annex 4: Standard deviations (%) of the results obtained in national inter-laboratory comparisons

Variable and Concentration range	Contracting Parties DK	EE	FI	LV	LT	PL	SE
BOD							
< 10 mg /l	3.7-33 %	21-29 %		23-36 %	27-30 %		
10 – 100 mg/l	5.7 %	9.0-17 %	7.3-9.5 %	17-18 %	7.0-25 %	18-24 %	10-14 %
> 100 mg/l	10 %		8.8-12 %			16-26 %	12-15 %
COD_{Cr}							
< 100 mg/l	4.2-32 %	12-16 %	7.8-23 %	5.0-18 %	2.2-16 %	13-15 %	7.0 %
> 100 mg/l	2.0-4.2 %	8.3-7.7 %	4.3-6.7 %	8 %		11 %	4.2-16 %
AOX							
< 0.2 mg/l			1.6-8.3 %				6.8-13 %
> 0.2 mg/l			2.1-6.6 %				5.2-6.2 %
TOC							
< 20 mg/l	3.4-21 %		6.1-11 %				6.2-11 %
> 20 mg/l	5.4 %		4.0-9.8 %				6.1-18 %
NH_4-N							
< 0.1 mg/l	30 %	18-33 %	6.4-9.3 %		18 %		30-34 %
0.1- 1 mg/l	6.4-27 %	14-20 %	5.9-14 %	3-20 %	6.3 %	6.5-24 %	
> 1 mg/l	3.7 %	6.2 %	3.7-8.1 %	6-10 %	7.0-12 %	5.2	7.5-7.7 %
NO_3-N							
< 1 mg/l		17-28 %	3.7-7.0 %	13 %	8.5 -15 %	35 %	8.6-27 %
> 1 mg/l		7.6-13 %	2.7-3.3 %	8-22 %		3.1-12 %	5.3-6.5 %
N_{total}							
< 3 mg/l	5.1 %	7.5-20 %	7.0-11 %		2.3-25 %	6.0 %	
> 3 mg/l	0.5-5.8 %	5.1-11 %	5.3-11%	2.0-11 %	4.2 %	6.5-20 %	22-27 %

Variable and concentration range	Contracting Parties DK	EE	FI	LV	LT	PL[1)]	SE
PO_4-P							
< 0.1 mg/l	6.0-13 %	8.3-31 %	2.9-6.9 %		4.3-5.5 %		
> 0.1 mg/l	1.9-4.2		2.4 – 6.6 %		8.3 %	6.4-8.7 %	5.8-17 %
P_{total}							
< 0.1 mg/l	5.5-18	11-23 %	2.9-6.3 %	33 %	11 %		
> 0.1 mg/l	2.5-3.6	4.9-6.7 %	2.6-7.0 %	7.0-20 %	6.1-20 %	8.0-14 %	4.8-7.7 %
Cd							
< 1µg/l	8.6 %		7.6-37 %				15-24 %
1-50 µg/l			5.5-23 %	9-19 %		14.3 %	14 %
50-1000 µg/l				7 %		4.1 %	
Cr							
< 10 µg/l	7.1 %						20 %
10-100 µg/l			7.2-21 %	15 %		8.9 %	18 %
> 100 µg/l			7.1-14 %	9-28 %			
Cu							
< 25 µg/l	4.3 %		13-22 %			10 %	12-23 %
25-100 µg/l			9.6-13 %	8-10 %			
> 100 µg/l			5.8-21 %	2-4 %		3.5 %	
Ni							
< 25 µg/l	2.7 %		7.1-18 %			10 %	12-21 %
25-100 µg/l			13-18 %				13 %
> 100 µg/l			8.4-13 %	4-12 %			
Pb							
< 10 µg/l	9.0 %		13-39 %				15-27 %
10-100 µg/l			8.6-14 %			18 %	
> 100 µg/l				3-16 %		8.9 %	

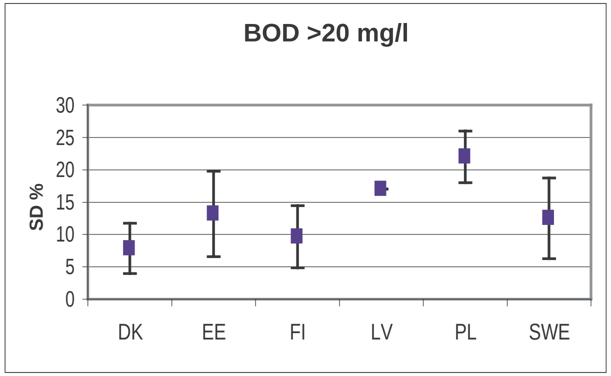
Variable and				Contracting Parties			
Concentration range	**DK**	**EE**	**FI[2)]**	**LV**	**LT**	**PL[1)]**	**SE**
Zn							
< 25 µg/l	17 %		2.1-28 %				13-26 %
> 25 µg/l			3.7-20 %	3-10 %		5.1-9.1 %	
Hg							
< 0.1 µg/l			35 %				
0.1-1 µg/l	18 %		16-18 %				12-17 %
> 1 µg/l			20 %	4-15 %		13 %	11-15 %

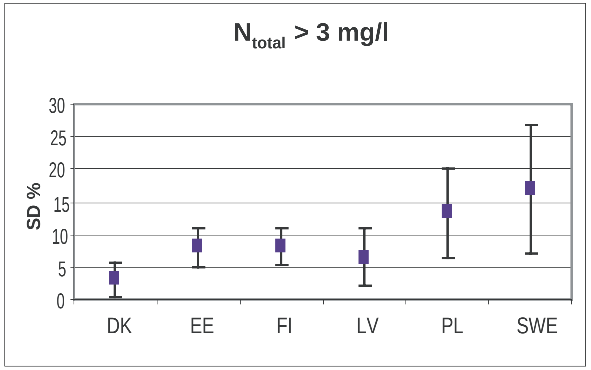
RU: not reported

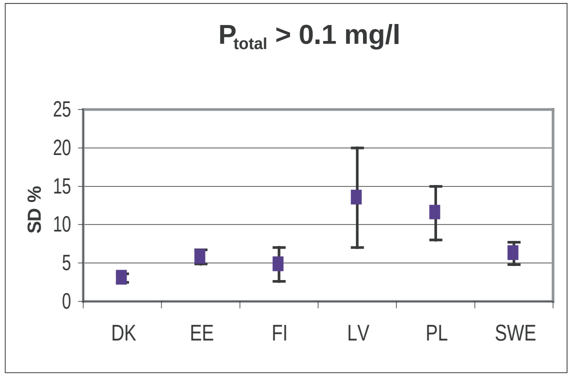
[1)] Only artificial samples for metal analysis

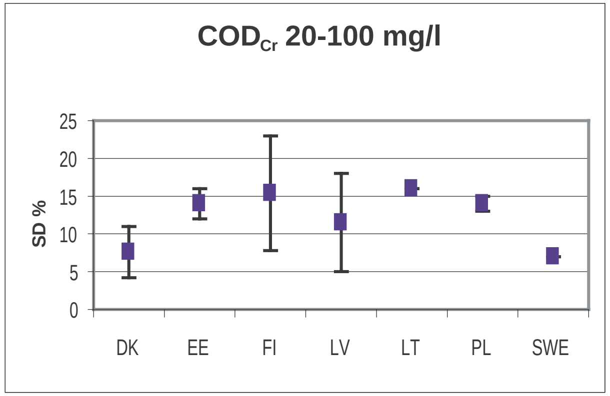
[2)] Hg: in 2001

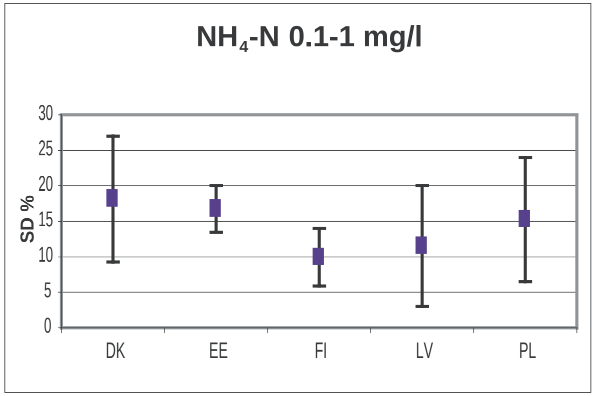
Annex 5: Variations within the results of inter-laboratory comparisons carried out by different Contracting Parties

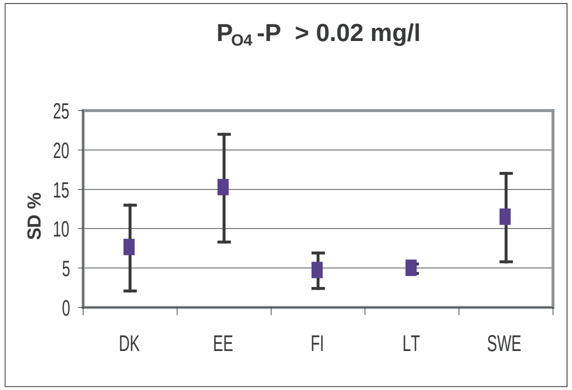












Annex 6:
Overview tables of the results in chapter 5

Table 5.1: Amount of treated and untreated wastewater discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region	TREATED point source discharges within the Baltic Sea catchment area and entering directly into the Baltic Sea			UN-TREATED point source discharges within the Baltic Sea catchment area and entering directly into the Baltic Sea			TOTAL WASTEWATER DISCHARGES
Wastewater	MWWTP	Industry	Total	MWWTP	Industry	Total	
	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a
DENMARK	**544**	**30**	**575**	**—**	**7.3**	**7.3**	**582**
BAP	8.4	0.04	8.4	—	—	—	8.4
KAT	166	15	181	—	3.0	3.0	184
SOU	168	4.2	172	—	0.2	0.2	172
WEB	202	11	213	—	4.1	4.1	218
ESTONIA	**109**	**182**	**290**	**5.2**	**6.7**	**12**	**302**
BAP	0.09	0.03	0.1	—	—	—	0.12
GUF	95	180	276	5.2	6.5	12	287
GUR	13	1.5	15	0.02	0.2	0.2	15
FINLAND	**426**	**1277**	**1703**	**—**	**0.03**	**0.03**	**1703**
ARC	43	33	76	—	—	—	76
BOB	63	522	584	—	0.03	0.03	584
BOS	64	232	295	—	—	—	295
GUF	257	491	748	—	—	—	748
GERMANY	**160**	**25**	**185**	**—**	**—**	**—**	**185**
BAP	54	24	78	—	—	—	78
WEB	106	0.7	106	—	—	—	106
LATVIA	**131**	**21**	**152**	**4.7**	**1.1**	**5.8**	**158**
BAP	21	3.4	24	0.4	0.1	0.5	25
GUF	1.2	0.003	1.2	0.02	0.02	0.03	1.2
GUR	109	17	127	4.2	1.0	5.2	132
LITHUANIA	**43**	**3.4**	**47**	**0.3**	—	**0.3**	**47**
BAP	43	3.4	47	0.3	—	0.3	47
GUR	n.i	n.i	n.i	n.i	n.i	n.i	n.i.
POLAND	**1255**	**957**	**2212**	—	**54**	**54**	**2266**
BAP	1255	957	2212	—	54	54	2266
RUSSIA	**1064**	**363**	**1427**	**258**	**2.0**	**260**	**1687**
BAP	68	59	127	10	0.2	11	138
GUF	996	304	1300	247	1.8	249	1549
GUR	n.i	n.i	n.i	n.i	n.i	n.i	n.i.
SWEDEN	**1206**	**574**	**1780**	**—**	**—**	**—**	**1780**
BAP	586	147	733	—	—	—	733
BOB	40	99	139	—	—	—	139
BOS	144	196	340	—	—	—	340
SOU	109	1.5	111	—	—	—	111
KAT	327	130	457	—	—	—	457
Baltic Sea catchment area	**4939**	**3432**	**8371**	**268**	**71**	**339**	**8710**

— This source does not exit.

n.i. No information

Table 5.2: Amount of treated and untreated wastewater discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region	TREATED point source discharges within the Baltic Sea catchment area and entering directly into the Baltic Sea			UN-TREATED point source discharges within the Baltic Sea catchment area and entering directly into the Baltic Sea			TOTAL WASTEWATER DISCHARGES
Wastewater	MWWTP	Industry	Total	MWWTP	Industry	Total	
	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a
FI	63	522	584	—	0.03	0.03	584
SE	40	99	139	—	—	—	139
BOB	**103**	**621**	**724**	**—**	**0.03**	**0.03**	**724**
FI	64	232	295	—	—	—	295
SE	144	196	340	—	—	—	340
BOS	**208**	**428**	**635**	**—**	**—**	**—**	**635**
FI	43	33	76	—	—	—	76
ARC	**43**	**33**	**76**	**—**	**—**	**—**	**76**
EE	95	180	276	5.2	6.5	12	287
FI	257	491	748	—	—	—	748
LV	1.2	0.003	1.2	0.02	0.02	0.03	1.2
RU	996	304	1300	247	1.8	249	1549
GUF	**1349**	**975**	**2325**	**252**	**8.3**	**261**	**2585**
EE	13	1.5	15	0.02	0.2	0.2	15
LT	n.i	n.i	n.i	n.i	n.i	n.i	n.i.
LV	109	17	127	4.2	1.0	5.2	132
RU	n.i	n.i	n.i	n.i	n.i	n.i	n.i.
GUR	**122**	**19**	**141**	**4.2**	**1.2**	**5.4**	**147**
DE	54	24	78	—	—	—	78
DK	8.4	0.04	8.4	—	—	—	8.4
EE	0.1	0.03	0.1	—	—	—	0.1
LT	43	3.4	47	0.3	—	0.3	47
LV	21	3.4	24	0.4	0.1	0.5	25
PL	1255	957	2212	—	54	54	2266
RU	68	59	127	10	0.2	11	138
SE	586	147	733	—	—	—	733
BAP	**2036**	**1194**	**3230**	**11**	**54**	**66**	**3295**
DE	106	0.7	106	—	—	—	106
DK	202	11	213	—	4.1	4.1	218
WEB	**308**	**12**	**320**	**—**	**4.1**	**4.1**	**324**
DK	168	4.2	172	—	0.2	0.2	172
SE	109	1.5	111	—	—	—	111
SOU	**277**	**5.7**	**282**	**—**	**0.2**	**0.2**	**282**
DK	166	15	181	—	3.0	3.0	184
SE	327	130	457	—	—	—	457
KAT	**493**	**145**	**638**	**—**	**3.0**	**3.0**	**641**
Baltic Sea catchment area	**4939**	**3432**	**8371**	**268**	**71**	**339**	**8710**

— This source does not exit.

n.i. No information

Table 5.3: Amount of wastewater discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region Wastewater	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL WASTEWATER DISCHARGES
	MWWTP	Industry	Total	MWWTP	Industry	Total	
	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a
DENMARK	**231**	**5.9**	**237**	**313**	**32**	**345**	**582**
BAP	3.8	—	3.8	4.6	0.04	4.6	8.4
KAT	95	5.2	100	107	8.9	116	216
SOU	40	0.01	40	128	4.3	132	172
WEB	93	0.7	94	73	19	92	185
ESTONIA	**46**	**183**	**229**	**68**	**5.3**	**73**	**302**
BAP	0.1	0.03	0.1	—	—	—	0.1
GUF	40	181	221	61	5.3	66	287
GUR	6.4	1.7	8.1	6.7	—	6.7	15
FINLAND	**186**	**585**	**770**	**240**	**692**	**933**	**1703**
ARC	1.9	0.0002	1.9	41	33	74	76
BOB	31	40	71	32	482	514	584
BOS	43	101	144	21	111	131	276
GUF	110	443	553	146	67	214	767
GERMANY	**115**	**25**	**139**	**45**	**—**	**45**	**185**
BAP	51	24	75	3.5	—	3.5	78
WEB	64	0.7	65	42	—	42	106
LATVIA	**55**	**22**	**77**	**81**	**—**	**81**	**158**
BAP	6.0	3.5	10	15	—	15	25
GUF	1.2	0.02	1.2	—	—	—	1.2
GUR	48	18	66	66	—	66	132
LITHUANIA	**25**	**0.3**	**25**	**19**	**3.2**	**22**	**47**
BAP	25	0.3	25	19	3.2	22	47
GUR	n.i	n.i	n.i	n.i	n.i	n.i	n.i.
POLAND	**1243**	**1008**	**2251**	**12**	**2.8**	**15**	**2266**
BAP	1243	1008	2251	12	2.8	15	2266
RUSSIA	**362**	**354**	**715**	**960**	**11**	**971**	**1686**
BAP	14	57	71	64	1.8	66	137
GUF	347	297	644	896	9.0	905	1549
GUR	n.i	n.i	n.i	n.i	n.i	n.i	n.i.
SWEDEN	**481**	**198**	**678**	**726**	**376**	**1103**	**1781**
BAP	248	60	308	338	87	425	733
BOB	7.4	3.1	11	33	96	129	140
BOS	49	14	63	95	181	276	339
SOU	22	1.0	23	87	1.5	88	111
KAT	154	119	273	173	11	184	457
Baltic Sea catchment area	**2744**	**2379**	**5123**	**2465**	**1123**	**3588**	**8710**

— This source does not exit.

n.i. No information

Table 5.4: Amount of wastewater discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region Wastewater	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL WASTEWATER DISCHARGES
	MWWTP	Industry	Total	MWWTP	Industry	Total	
	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a
FI	31	40	71	32	482	514	584
SE	7.4	3.1	11	33	96	129	140
BOB	**38**	**43**	**81**	**65**	**578**	**643**	**724**
FI	43	101	144	21	111	131	276
SE	49	14	63	95	181	276	339
BOS	**92**	**116**	**208**	**116**	**291**	**407**	**615**
FI	1.9	0.0002	1.9	41	33	74	76
ARC	**1.9**	**0.0002**	**1.9**	**41**	**33**	**74**	**76**
EE	40	181	221	61	5.3	66	287
FI	110	443	553	146	67	214	767
LV	1.2	0.02	1.2	—	—	—	1.2
RU	347	297	644	896	9.0	905	1549
GUF	**498**	**922**	**1420**	**1103**	**81**	**1185**	**2605**
EE	6.4	1.7	8.1	6.7	—	6.7	15
LT	n.i	n.i	n.i	n.i	n.i	n.i	n.i.
LV	48	18	66	66	—	66	132
RU	n.i	n.i	n.i	n.i	n.i	n.i	n.i.
GUR	**54**	**20**	**74**	**72**	**n.i.**	**72**	**147**
DE	51	24	75	3.5	—	3.5	78
DK	3.8	—	3.8	4.6	0.04	4.6	8.4
EE	0.1	0.03	0.1	—	—	—	0.1
LT	25	0.3	25	19	3.2	22	47
LV	6.0	3.5	9.6	15	—	15	25
PL	1243	1008	2251	12	2.8	15	2266
RU	14	57	71	64	1.8	66	137
SE	248	60	308	338	87	425	733
BAP	**1591**	**1152**	**2744**	**457**	**95**	**552**	**3295**
DE	64	0.7	65	42	—	42	106
DK	93	0.7	94	73	19	92	185
WEB	**157**	**1.4**	**158**	**115**	**19**	**134**	**292**
DK	40	0.01	40	128	4.3	132	172
SE	22	1.0	23	87	1.5	88	111
SOU	**62**	**1.0**	**63**	**215**	**5.9**	**220**	**283**
DK	95	5.2	100	107	8.9	116	216
SE	154	119	273	173	11	184	457
KAT	**249**	**124**	**373**	**280**	**20**	**301**	**674**
Baltic Sea catchment area	**2744**	**2379**	**5123**	**2465**	**1123**	**3588**	**8710**

— This source does not exit.
n.i. No information

Table 5.5: Point source discharges of organic matter (BOD_7) discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area				Point source discharges entering directly into the Baltic Sea				TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
BOD_7	MWWTP	Industry	Fish farms	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
DENMARK	**2762**	**25**	**1359**	**4147**	**2197**	**5017**	**1883**	**9097**	**13244**	**31110**	**133**	**426**
BAP	60	—	—	60	99	83	2.0	184	244	1200	50	203
KAT	1169	12	1087	2268	529	1339	1.0	1869	4137	15830	143	261
SOU	291	0.07	—	291	639	177	—	816	1107	1740	167	636
WEB	1243	13	272	1528	930	3418	1880	6228	7756	12340	124	629
ESTONIA	**868**	**654**	**n.i.**	**1522**	**486**	**1.2**	—	**487**	**2009**	**45100**	**34**	**45**
BAP	1.1	8.0	n.i.	9.1	—	—	—	—	9.1	1100	8.3	8.3
GUF	772	592	n.i.	1364	347	1.2	—	348	1711	26400	52	65
GUR	95	54	n.i.	149	140	—	—	140	289	17600	8.5	16
FINLAND	**3044**	**12375**	**n.i.**	**15419**	**3282**	**7662**	**n.i.**	**10944**	**26363**	**301300**	**51**	**87**
ARC	51	14	n.i.	64	595	91	n.i.	686	750	9000	7.1	83
BOB	821	1102	n.i.	1923	591	5172	n.i.	5764	7686	146000	13	53
BOS	723	2461	n.i.	3184	301	1268	n.i.	1570	4753	39300	81	121
GUF	1451	8798	n.i.	10249	1795	1130	n.i.	2924	13173	107000	96	123
GERMANY	**811**	**220**	**—**	**1031**	**549**	**—**	**—**	**549**	**1580**	**28600**	**36**	**55**
BAP	387	216	—	603	16	—	—	16	619	18200	33	34
WEB	424	3.7	—	428	533	—	—	533	961	10400	41	92
LATVIA	**2268**	**613**	**n.i.**	**2881**	**764**	**—**	**—**	764	**3644**	**64600**	**45**	**56**
BAP	214	46	n.i.	260	71	—	—	71	331	11400	23	29
GUF	17	0.3	—	17	—	—	—	—	17	3600	4.8	4.8
GUR	2037	567	n.i.	2604	692	—	—	692	3296	49600	52	66
LITHUANIA	**415**	**2428**	**n.i.**	**2844**	**204**	**215**	**n.i.**	**419**	**3263**	**65300**	**44**	**60**
BAP	415	2428	n.i.	2844	204	215	n.i.	419	3263	54160	53	60
GUR	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**92323**	**12348**	**n.i.**	**104671**	**230**	**6.9**	**n.i.**	**237**	**104908**	**311900**	**336**	**336**
BAP	92323	12348	n.i.	104671	230	6.9	n.i.	237	104908	311900	336	336
RUSSIA	**18956**	**13065**	**26**	**32048**	**16239**	**296**	**n.i.**	**16535**	**48582**	**314800**	**102**	**167**
BAP	1778	7330	—	9108	7536	12	n.i.	7547	16656	15000	607	1110
GUF	17178	5735	26	22939	8703	284	n.i.	8987	31926	276100	83	116
GUR	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**3384**	**17000**	**n.i.**	**20384**	**4881**	**44795**	**n.i.**	**49676**	**70060**	**440040**	**46**	**159**
BAP	1427	2803	n.i.	4230	1466	6294	n.i.	7760	11990	83225	51	144
BOB	129	650	n.i.	779	523	6938	n.i.	7461	8240	113620	6.9	73
BOS	580	969	n.i.	1549	961	27745	n.i.	28706	30255	176610	8.8	171
SOU	92	n.i.	n.i.	92	686	3.0	n.i.	689	781	2885	32	271
KAT	1156	12578	n.i.	13734	1243	3815	n.i.	5059	18793	63700	216	295
Baltic Sea catchment area	**124831**	**58729**	**1386**	**184946**	**28832**	**57993**	**1883**	**88708**	**273654**	**1602750**	**118**	**175**

— This source does not exit.
n.i. No information

Table 5.6: Point source discharges of organic matter (BOD_7) discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area				Point source discharges entering directly into the Baltic Sea				TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
BOD_7	MWWTP	Industry	Fish farms	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
FI	821	1102	n.i.	1923	591	5172	n.i.	5764	7686	146000	13	53
SE	129	650	n.i.	779	523	6938	n.i.	7461	8240	113620	6.9	73
BOB	**950**	**1752**	**n.i.**	**2702**	**1115**	**12110**	**n.i.**	**13225**	**15927**	**259620**	**10**	**61**
FI	723	2461	n.i.	3184	301	1268	n.i.	1570	4753	39300	81	121
SE	580	969	n.i.	1549	961	27745	n.i.	28706	30255	176610	8.8	171
BOS	**1303**	**3430**	**n.i.**	**4733**	**1263**	**29013**	**n.i.**	**30276**	**35009**	**215910**	**22**	**162**
FI	51	14	n.i.	64	595	91	n.i.	686	750	9000	7.1	83
ARC	**51**	**14**	**n.i.**	**64**	**595**	**91**	**n.i.**	**686**	**750**	**9000**	**7.1**	**83**
EE	772	592	n.i.	1364	347	1.2	—	348	1711	26400	52	**65**
FI	1451	8798	n.i.	10249	1795	1130	n.i.	2924	13173	107000	96	123
LV	17	0.3	—	17	—	—	—	—	17	3600	4.8	n.i.
RU	17178	5735	26	22939	8703	284	n.i.	8987	31926	276100	83	116
GUF	**19418**	**15125**	**26**	**34569**	**10844**	**1415**	**n.i.**	**12259**	**46828**	**413100**	**84**	**113**
EE	95	54	n.i.	149	140	—	—	140	289	17600	8.5	16
LT	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	11140	n.i.	n.i.
LV	2037	567	n.i.	2604	692	—	—	692	3296	49600	52	66
RU	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**2131**	**621**	**n.i.**	**2753**	**832**	**—**	**—**	**832**	**3584**	**102040**	**27**	**53**
DE	387	216	—	603	16	—	—	16	619	18200	33	34
DK	60	—	—	60	99	83	2.0	184	244	1200	50	203
EE	1.1	8.0	n.i.	9.1	—	—	—	—	9.1	1100	8.3	8.3
LT	415	2428	n.i.	2844	204	215	n.i.	419	3263	54160	53	60
LV	214	46	n.i.	260	71	—	—	71	331	11400	23	29
PL	92323	12348	n.i.	104671	230	6.9	n.i.	237	104908	311900	336	336
RU	1778	7330	—	9108	7536	12	n.i.	7547	16656	15000	607	1110
SE	1427	2803	n.i.	4230	1466	6294	n.i.	7760	11990	83225	51	144
BAP	**96605**	**25180**	**n.i.**	**121785**	**9622**	**6611**	**2.0**	**16235**	**138020**	**496185**	**245**	**278**
DE	424	3.7	—	428	533	—	—	533	961	10400	41	92
DK	1243	13	272	1528	930	3418	1880	6228	7756	12340	124	629
WEB	**1667**	**17**	**272**	**1956**	**1463**	**3418**	**1880**	**6761**	**8717**	**22740**	**86**	**383**
DK	291	0.1	—	291	639	177	—	816	1107	1740	167	636
SE	92	n.i.	n.i.	92	686	3.0	n.i.	689	781	2885	32	271
SOU	**383**	**0.1**	**n.i.**	**383**	**1325**	**180**	**n.i.**	**1505**	**1889**	**4625**	**83**	**408**
DK	1169	12	1087	2268	529	1339	1.0	1869	4137	15830	143	261
SE	1156	12578	n.i.	13734	1243	3815	n.i.	5059	18793	63700	216	295
KAT	**2325**	**12590**	**1087**	**16002**	**1772**	**5154**	**1.0**	**6928**	**22930**	**79530**	**201**	**288**
Baltic Sea catchment area	**124831**	**58729**	**1386**	**184946**	**28832**	**57993**	**1883**	**88708**	**273654**	**1602750**	**118**	**175**

— This source does not exit.

n.i. No information

Table 5.7: Point source discharges of total nitrogen (N_{total}) discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area				Point source discharges entering directly into the Baltic Sea				TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
N_{total}	MWWTP	Industry	Fish farms	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
DENMARK	**2195**	**8.8**	**427**	**2631**	**2210**	**692**	**278**	**3180**	**5811**	**31110**	**85**	**187**
BAP	39	—	—	39	58	11	0.4	69	108	1200	33	90
KAT	964	4.4	335	1303	506	283	0.27	789	2093	15830	82	132
SOU	190	0.01	—	190	917	79	—	995	1185	1740	109	681
WEB	1002	4.4	92	1099	730	319	277	1326	2425	12340	89	197
ESTONIA	**690**	**500**	**39**	**1229**	**975**	**626**	—	**1601**	**2830**	**45100**	**27**	**63**
BAP	1.8	0.4	1.0	3.2	—	—	—	—	3.2	1100	2.9	2.9
GUF	593	478	35	1106	902	626	—	1528	2634	26400	42	100
GUR	96	21	3.0	120	73	—	—	73	193	17600	6.8	11
FINLAND	**7562**	**2216**	**236**	**10015**	**5224**	**1844**	**769**	**7838**	**17853**	**301300**	**33**	**59**
ARC	108	27	—	136	948	136	579	1663	1798	9000	15	200
BOB	1508	283	117	1908	1102	1208	41	2351	4259	146000	13	29
BOS	1730	230	8.1	1969	822	220	108	1150	3119	39300	50	79
GUF	4216	1676	111	6003	2352	281	41	2674	8676	107000	56	81
GERMANY	**2030**	**363**	**—**	**2393**	**1998**	**—**	**—**	**1998**	**4392**	**28600**	**84**	**154**
BAP	571	340	—	910	20	—	—	20	930	18200	50	51
WEB	1459	24	—	1483	1978	—	—	1978	3461	10400	143	333
LATVIA	**1327**	**294**	**50**	**1670**	**1551**	**—**	**—**	**1551**	**3221**	**64600**	**26**	**50**
BAP	139	12	43	194	239	—	—	239	434	11400	17	38
GUF	22	0.02	—	22	—	—	—	—	22	3600	6.2	6.2
GUR	1165	282	6.6	1454	1312	—	—	1312	2765	49600	29	56
LITHUANIA	**1062**	**58**	**29**	**1149**	**285**	**8.5**	**n.i.**	**293**	**1442**	**65300**	**18**	**27**
BAP	1062	58	29	1149	285	8.5	n.i.	293	1442	54160	21	27
GUR	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**37995**	**3268**	**79**	**41342**	**341**	**15**	**n.i.**	**355**	**41697**	**311900**	**133**	**134**
BAP	37995	3268	79	41342	341	15	n.i.	355	41697	311900	133	134
RUSSIA	**5495**	**2282**	**9.0**	**7786**	**11008**	**33**	**n.i.**	**11041**	**18827**	**314800**	**25**	**65**
BAP	198	201	n.i.	400	2032	1.0	n.i.	2033	2432	15000	27	162
GUF	5297	2081	9.0	7387	8977	32	n.i.	9008	16395	276100	27	59
GUR	n.i.	n.i.	n.i.	n.i.	—	—	—	n.i.	n.i.	23700	n.i.	n.i.
SWEDEN	**7904**	**2515**	**n.i.**	**10419**	**8463**	**2548**	**n.i.**	**11011**	**21429**	**440040**	**24**	**49**
BAP	3954	542	n.i.	4496	3426	607	n.i.	4033	8530	83225	54	102
BOB	227	217	n.i.	443	813	364	n.i.	1177	1620	113620	3.9	14
BOS	952	808	n.i.	1760	1700	1247	n.i.	2947	4707	176610	10	27
SOU	208	5.0	n.i.	213	800	176	n.i.	976	1188	2885	74	412
KAT	2564	943	n.i.	3508	1724	154	n.i.	1877	5385	63700	55	85
Baltic Sea catchment area	**66260**	**11505**	**870**	**78635**	**32055**	**5767**	**1047**	**38868**	**117503**	**1602750**	**50**	**75**

— This source does not exit.

n.i. No information

Table 5.8: Point source discharges of total nitrogen (N_{total}) discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area				Point source discharges entering directly into the Baltic Sea				TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
N_{total}	MWWTP	Industry	Fish farms	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
FI	1508	283	117	1908	1102	1208	41	2351	4259	146000	13	29
SE	227	217	n.i.	443	813	364	n.i.	1177	1620	113620	3.9	14
BOB	**1734**	**500**	**117**	**2351**	**1915**	**1572**	**41**	**3528**	**5879**	**259620**	**9.1**	**23**
FI	1730	230	8.1	1969	822	220	108	1150	3119	39300	50	79
SE	952	808	n.i.	1760	1700	1247	n.i.	2947	4707	176610	10	27
BOS	**2682**	**1038**	**8.1**	**3728**	**2522**	**1467**	**108**	**4097**	**7825**	**215910**	**17**	**36**
FI	108	27	—	136	948	136	579	1663	1798	9000	15	200
ARC	**108**	**27**	**—**	**136**	**948**	**136**	**579**	**1663**	**1798**	**9000**	**15**	**200**
EE	593	478	35	1106	902	626	—	1528	2634	26400	42	100
FI	4216	1676	111	6003	2352	281	41	2674	8676	107000	56	81
LV	22	0.02	—	22	—	—	—	—	22	3600	6.2	6.2
RU	5297	2081	9.0	7387	8977	32	n.i.	9008	16395	276100	27	59
GUF	**10128**	**4235**	**155**	**14518**	**12231**	**939**	**41**	**13210**	**27727**	**413100**	**35**	**67**
EE	96	21	3.0	120	73	—	—	73	193	17600	6.8	11
LT	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	11140	n.i.	n.i.
LV	1165	282	6.6	1454	1312	—	—	1312	2765	49600	29	56
RU	n.i.	n.i.	n.i.	n.i.	—	—	—	n.i.	n.i.	23700	n.i.	n.i.
GUR	**1261**	**303**	**9.6**	**1573**	**1385**	**—**	**—**	**1385**	**2958**	**102040**	**15**	**44**
DE	571	340	—	910	20	—	—	20	930	18200	50	51
DK	39	—	—	39	58	11	0.4	69	108	1200	33	90
EE	1.8	0.4	1.0	3.2	—	—	—	—	3.2	1100	2.9	2.9
LT	1062	58	29	1149	285	8.5	n.i.	293	1442	54160	21	27
LV	139	12	43	194	239	—	—	239	434	11400	17	38
PL	37995	3268	79	41342	341	15	n.i.	355	41697	311900	133	134
RU	198	201	n.i.	400	2032	1.0	n.i.	2033	2432	15000	27	162
SE	3954	542	n.i.	4496	3426	607	n.i.	4033	8530	83225	54	102
BAP	**43960**	**4421**	**152**	**48534**	**6400**	**642**	**0.4**	**7043**	**55577**	**496185**	**98**	**112**
DE	1459	24	—	1483	1978	—	—	1978	3461	10400	143	333
DK	1002	4.4	92	1099	730	319	277	1326	2425	12340	89	197
WEB	**2462**	**28**	**92**	**2582**	**2708**	**319**	**277**	**3305**	**5887**	**22740**	**114**	**259**
DK	190	0.01	—	190	917	79	—	995	1185	1740	109	681
SE	208	5.0	n.i.	213	800	176	n.i.	976	1188	2885	74	412
SOU	**397**	**5.0**	**n.i.**	**402**	**1716**	**255**	**n.i.**	**1971**	**2373**	**4625**	**87**	**513**
DK	964	4.4	335	1303	506	283	0.3	789	2093	15830	82	132
SE	2564	943	n.i.	3508	1724	154	n.i.	1877	5385	63700	55	85
KAT	**3528**	**948**	**335**	**4811**	**2230**	**437**	**0.3**	**2667**	**7478**	**79530**	**60**	**94**
Baltic Sea catchment area	**66260**	**11505**	**870**	**78635**	**32055**	**5767**	**1047**	**38868**	**117503**	**1602750**	**50**	**75**

— This source does not exit.

n.i. No information

Table 5.9: Point source discharges of total phosphorus (P_{total}) discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region P_{total}	Point source discharges entering inland surface waters within the Baltic Sea catchment area				Point source discharges entering directly into the Baltic Sea				TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
	MWWTP	Industry	Fish farms	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
DENMARK	**288**	**0.9**	**33**	**322**	**325**	**38**	**30**	**392**	**714**	**31110**	**10**	**23**
BAP	6.1	—	—	6.1	9.5	1.7	0.03	11	17	1200	5.1	14
KAT	127	0.2	26	153	71	19	0.04	90	243	15830	9.6	15
SOU	33	0.001	—	33	144	2.7	—	147	180	1740	19	103
WEB	122	0.7	7.4	130	101	14	30	144	274	12340	11	22
ESTONIA	**115**	**23**	**4.0**	**142**	**88**	**0.1**	**—**	**88**	**231**	**45100**	**3.2**	**5.1**
BAP	0.4	1.2	n.i.	1.6	—	—	—	—	1.6	1100	1.5	1.5
GUF	97	15	4.0	116	77	0.1	—	77	193	26400	4.4	7.3
GUR	18	6.8	n.i.	24	11	—	—	11	35	17600	1.4	2.0
FINLAND	**135**	**139**	**29**	**302**	**123**	**93**	**95**	**310**	**613**	**301300**	**1.0**	**2.0**
ARC	3.3	0.5	—	3.8	22	2.1	71	96	99	9000	0.4	11
BOB	30	18	15	63	16	51	4.8	72	134	146000	0.4	0.9
BOS	28	21	1.1	50	13	17	14	43	94	39300	1.3	2.4
GUF	73	99	13	186	72	23	5.3	100	286	107000	1.7	2.7
GERMANY	**65**	**8.3**	**—**	**74**	**25**	**—**	**—**	**25**	**98**	**28600**	**2.6**	**3.4**
BAP	44	7.9	—	52	0.9	—	—	0.9	53	18200	2.9	2.9
WEB	21	0.4	—	21	24	—	—	24	45	10400	2.1	4.3
LATVIA	**247**	**37**	**6.3**	**290**	**213**	**—**	—	**213**	**503**	**64600**	**4.5**	**7.8**
BAP	34	2.5	5.6	42	31	—	—	31	73	11400	3.7	6.4
GUF	4.4	0.01	—	4.4	—	—	—	—	4.4	3600	1.2	1.2
GUR	209	34	0.7	244	182	—	—	182	426	49600	4.9	8.6
LITHUANIA	**77**	**9.8**	**1.9**	**88**	**38**	**0.9**	**n.i.**	**39**	**127**	**65300**	**1.4**	**2.3**
BAP	77	9.8	1.9	88	38	0.9	n.i.	39	127	54160	1.6	2.3
GUR	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**5037**	**418**	**14**	**5469**	**49**	**3.6**	**n.i.**	**53**	**5521**	**311900**	**18**	**18**
BAP	5037	418	14	5469	49	3.6	n.i.	53	5521	311900	18	18
RUSSIA	**884**	**391**	**3.7**	**1279**	**1231**	**10**	**—**	**1240**	**2519**	**314800**	**4.1**	**8.7**
BAP	45	13	—	59	149	0.9	—	150	209	15000	3.9	14
GUF	839	378	3.7	1220	1081	8.9	—	1090	2310	276100	4.4	8.4
GUR	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**129**	**121**	**n.i.**	**250**	**228**	**259**	**n.i.**	**487**	**737**	**440040**	**0.6**	**1.7**
BAP	53	27	n.i.	80	75	49	n.i.	124	204	83225	1.0	2.5
BOB	3.9	0.5	n.i.	4.4	12	41	n.i.	53	58	113620	0.0	0.5
BOS	18	29	n.i.	48	36	141	n.i.	177	225	176610	0.3	1.3
SOU	4.0	0.4	n.i.	4.4	28	5.20	n.i.	33	37	2885	1.5	13
KAT	50	64	n.i.	113	77	22	n.i.	100	213	63700	1.8	3.3
Baltic Sea catchment area	**6977**	**1147**	**92**	**8216**	**2320**	**404**	**124**	**2848**	**11064**	**1602750**	**5.2**	**7.1**

— This source does not exit.
n.i. No information

Table 5.10: Point source discharges of total phosphorus (P_{total}) discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region P_{total}	Point source discharges entering inland surface waters within the Baltic Sea catchment area				Point source discharges entering directly into the Baltic Sea				TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
	MWWTP	Industry	Fish farms	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
FI	30	18	15	63	16	51	4.8	72	134	146000	0.4	0.9
SE	3.9	0.5	n.i.	4.4	12	41	n.i.	53	58	113620	0.04	0.5
BOB	**34**	**18**	**15**	**67**	**28**	**92**	**4.8**	**125**	**192**	**259620**	**0.3**	**0.7**
FI	28	21	1.1	50	13	17	14	43	94	39300	1.3	2.4
SE	18	29	n.i.	48	36	141	n.i.	177	225	176610	0.3	1.3
BOS	**47**	**50**	**1.1**	**98**	**48**	**158**	**14**	**220**	**318**	**215910**	**0.5**	**1.5**
FI	3.3	0.5	—	3.8	22	2.1	71	96	99	9000	0.4	11
ARC	**3.3**	**0.5**	**—**	**3.8**	**22**	**2.1**	**71**	**96**	**99**	**9000**	**0.4**	**11**
EE	97	15	4.0	116	77	0.1	—	77	193	26400	4.4	**7.3**
FI	73	99	13	186	72	23	5.3	100	286	107000	1.7	2.7
LV	4.4	0.01	—	4.4	—	—	—	—	4.4	3600	1.2	1.2
RU	839	378	3.7	1220	1081	8.9	—	1090	2310	276100	4.4	8.4
GUF	**1014**	**492**	**21**	**1526**	**1230**	**32**	**5.3**	**1267**	**2794**	**413100**	**3.7**	**6.8**
EE	18	6.8	n.i.	24	11	—	—	11	35	17600	1.4	2.0
LT	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	11140	n.i.	n.i.
LV	209	34	0.7	244	182	—	—	182	426	49600	4.9	8.6
RU	n.i.	n.i.	n.i.	n.i.	—	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**226**	**41**	**0.7**	**268**	**193**	**—**	**—**	**193**	**462**	**102040**	**2.6**	**6.9**
DE	44	7.9	—	52	0.9	—	—	0.9	53	18200	2.9	2.9
DK	6.1	—	—	6.1	9.5	1.7	0.03	11	17	1200	5.1	14
EE	0.4	1.2	n.i.	1.6	—	—	—	0	1.6	1100	1.5	1.5
LT	77	9.8	1.9	88	38	0.9	n.i.	39	127	54160	1.6	2.3
LV	34	2.5	5.6	42	31	—	—	31	73	11400	3.7	6.4
PL	5037	418	14	5469	49	3.6	n.i.	53	5521	311900	18	18
RU	45	13	n.i.	59	149	0.9	n.i.	150	209	15000	3.9	14
SE	53	27	n.i.	80	75	49	n.i.	124	204	83225	1.0	2.5
BAP	**5297**	**480**	**21**	**5798**	**353**	**56**	**0.03**	**409**	**6207**	**496185**	**12**	**13**
DE	21	0.4	—	21	24	—	—	24	45	10400	2.1	4.3
DK	122	0.7	7.4	130	101	14	30	144	274	12340	11	22
WEB	**143**	**1.1**	**7.4**	**151**	**124**	**14**	**30**	**168**	**319**	**22740**	**6.7**	**14**
DK	33	0.001	—	33	144	2.7	—	147	180	1740	19	103
SE	4.0	0.4	n.i.	4.4	28	5.2	n.i.	33	37	2885	1.5	13
SOU	**37**	**0.4**	**n.i.**	**38**	**172**	**7.9**	**n.i.**	**180**	**217**	**4625**	**8.1**	**47**
DK	127	0.2	26	153	71	19	0.04	90	243	15830	9.6	15
SE	50	64	n.i.	113	77	22	n.i.	100	213	63700	1.8	3.3
KAT	**177**	**64**	**26**	**266**	**148**	**42**	**0.04**	**190**	**456**	**79530**	**3.3**	**5.7**
Baltic Sea catchment area	**6977**	**1147**	**92**	**8216**	**2320**	**404**	**124**	**2848**	**11064**	**1602750**	**5.2**	**7.1**

— This source does not exit.

n.i. No information

Table 5.11: Point source discharges of cadmium discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Cd	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km²	in g/km²	in g/km²
DENMARK	**38**	**0.05**	**38**	**63**	**2.1**	**65**	**103**	**31110**	**1.2**	**3.3**
BAP	1.1	—	1.1	1.8	0.1	1.9	3.0	1200	0.9	2.5
KAT	18	0.01	18	12	1.1	13	31	15830	1.2	2.0
SOU	2.6	n.i.	2.6	30	0.1	30	33	1740	1.5	19
WEB	16	0.04	16	19	0.8	20	36	12340	1.3	2.9
ESTONIA	**n.i.**	**n.i.**	**n.i.**	**190**	**—**	**190**	**190**	**44000**	**n.i.**	**4.3**
BAP	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.	n.i.
GUF	n.i.	n.i.	n.i.	190	—	190	190	26400	n.i.	7.2
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	17600	n.i.	n.i.
FINLAND	**n.i.**	**53**	**53**	**n.i.**	**40**	**40**	**93**	**301300**	**0.2**	**0.3**
ARC	n.i.	—	n.i.	n.i.	1.0	1.0	1.0	9000	n.i.	0.1
BOB	n.i.	7.6	7.6	n.i.	39	39	46	146000	0.1	0.3
BOS	n.i.	46	46	n.i.	n.i.	n.i.	46	39300	1.2	1.2
GUF	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	107000	n.i.	n.i.
GERMANY	**39**	**22**	**61**	**1.5**	**—**	**1.5**	**62**	**28600**	**2.1**	**2.2**
BAP	30	22	52	0.3	—	0.3	52	18200	2.9	2.9
WEB	8.8	0.004	8.8	1.3	—	1.3	10	10400	0.8	1.0
LATVIA	**17**	**39**	**56**	**95**	**n.i.**	**95**	**151**	**64600**	**0.9**	**2.3**
BAP	7.0	n.i.	7.0	82	n.i.	82	89	11400	0.6	7.8
GUF	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
GUR	10	39	49	13	n.i.	13	62	49600	1.0	1.3
LITHUANIA	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**54160**	**n.i.**	**n.i.**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	54160	n.i.	n.i.
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**6273**	**8176**	**14449**	**100**	**498**	**598**	**15047**	**311900**	**46**	**48**
BAP	6273	8176	14449	100	498	598	15047	311900	46	48
RUSSIA	**243**	**n.i.**	**243**	**211**	**n.i.**	**211**	**454**	**314800**	**0.8**	**1.4**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
GUF	243	n.i.	243	211	n.i.	211	454	276100	0.9	1.6
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**71**	**148**	**219**	**67**	**360**	**427**	**646**	**440040**	**0.5**	**1.5**
BAP	32	37	69	34	97	131	200	83225	0.8	2.4
BOB	7.0	—	7.0	5.0	48	53	60	113620	0.1	0.5
BOS	16	7.0	23	5.0	189	194	217	176610	0.1	1.2
SOU	1.0	—	1.0	9.0	—	9.0	10	2885	0.3	3.5
KAT	15	104	119	14	26	40	159	63700	1.9	2.5
Baltic Sea catchment area	**6681**	**8438**	**15119**	**728**	**900**	**1627**	**16746**	**1602750**	**9.4**	**10**

— This source does not exit.
n.i. No information

Table 5.12: Point source discharges of cadmium discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Cd	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
FI	n.i.	7.6	7.6	n.i.	39	39	46	146000	0.1	0.3
SE	7.0	—	7.0	5.0	48	53	60	113620	0.1	0.5
BOB	**7.0**	**7.6**	**15**	**5.0**	**87**	**92**	**106**	**259620**	**0.1**	**0.4**
FI	n.i.	46	46	n.i.	n.i.	n.i.	46	39300	1.2	1.2
SE	16	7.0	23	5.0	189	194	217	176610	0.1	1.2
BOS	**16**	**53**	**69**	**5.0**	**189**	**194**	**263**	**215910**	**0.3**	**1.2**
FI	n.i.	—	n.i.	n.i.	1.0	1.0	1.0	9000	n.i.	0.1
ARC	**n.i.**	**—**	**n.i.**	**n.i.**	**1.0**	**1.0**	**1.0**	**9000**	**n.i.**	**0.1**
EE	n.i.	n.i.	n.i.	190	—	190	190	26400	n.i.	7.2
FI	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	107000	n.i.	n.i.
LV	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
RU	243	n.i.	243	211	n.i.	211	454	276100	0.9	1.6
GUF	**243**	**n.i.**	**243**	**401**	**n.i.**	**401**	**644**	**413100**	**0.6**	**1.6**
EE	n.i.	n.i.	n.i.	—	—	—	n.i.	17600	n.i.	n.i.
LT	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
LV	10	39	49	13	n.i.	13	62	49600	1.0	1.3
RU	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**10**	**39**	**49**	**13**	**n.i.**	**13**	**62**	**78340**	**0.6**	**0.8**
DE	30	22	52	0.3	—	0.3	52	18200	2.9	2.9
DK	1.1	—	1.1	1.8	0.09	1.9	3.0	1200	0.9	2.5
EE	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.	n.i.
LT	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	54160	n.i.	n.i.
LV	7.0	n.i.	7.0	82	n.i.	82	89	11400	0.6	7.8
PL	6273	8176	14449	100	498	598	15047	311900	46	48
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
SE	32	37	69	34	97	131	200	83225	0.8	2.4
BAP	**6343**	**8235**	**14578**	**218**	**595**	**813**	**15391**	**496185**	**29**	**31**
DE	8.8	0.004	8.8	1.3	—	1.3	10	10400	0.8	1.0
DK	16	0.04	16	19	0.8	20	36	12340	1.3	2.9
WEB	**25**	**0.04**	**25**	**20**	**0.8**	**21**	**46**	**22740**	**1.1**	**2.0**
DK	2.6	n.i.	2.6	30	0.1	30	33	1740	1.5	19
SE	1.0	—	1.0	9.0	—	9.0	10	2885	0.3	3.5
SOU	**3.6**	**n.i.**	**3.6**	**39**	**0.1**	**39**	**43**	**4625**	**0.8**	**9.3**
DK	18	0.01	18	12	1.1	13	31	15830	1.2	2.0
SE	15	104	119	14	26	40	159	63700	1.9	2.5
KAT	**33**	**104**	**137**	**26**	**27**	**53**	**190**	**79530**	**1.7**	**2.4**
Baltic Sea catchment area	**6681**	**8438**	**15119**	**728**	**900**	**1627**	**16746**	**1602750**	**9.4**	**10**

— This source does not exit.
n.i. No information

Table 5.13: Point source discharges of mercury discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region Hg	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
DENMARK	**35**	**0.05**	**35**	**58**	**2.2**	**60**	**95**	**31110**	**1.1**	**3.1**
BAP	1.0	—	1.0	1.7	0.1	1.8	2.8	1200	0.8	2.3
KAT	17	0.01	17	11	1.1	12	29	15830	1.1	1.8
SOU	2.4	n.i.	2.4	28	0.2	28	30	1740	1.4	17
WEB	15	0.04	15	17	0.8	18	33	12340	1.2	2.7
ESTONIA	**—**	**—**	**—**	**100**	**—**	**100**	**100**	**44000**	**—**	**2.3**
BAP	—	—	—	—	—	—	—	1100	—	—
GUF	—	—	—	100	—	100	100	26400	—	3.8
GUR	—	—	—	—	—	—	—	17600	—	—
FINLAND	**n.i.**	**10**	**10**	**n.i.**	**8.9**	**8.9**	**19**	**301300**	**0.03**	**0.1**
ARC	n.i.	—	n.i.	n.i.	n.i.	n.i.	n.i.	9000	n.i.	n.i.
BOB	n.i.	1.5	1.5	n.i.	8.9	8.9	10	146000	0.01	0.1
BOS	n.i.	8.1	8.1	n.i.	n.i.	n.i.	8.1	39300	0.2	0.2
GUF	n.i.	0.2	0.2	n.i.	n.i.	n.i.	n.i.	107000	0.002	n.i.
GERMANY	**18**	**1.1**	**19**	**0.7**	**—**	**0.7**	**20**	**28600**	**0.7**	**0.7**
BAP	15	1.1	16	0.2	—	0.2	16	18200	0.9	0.9
WEB	3.2	0.003	3.2	0.6	—	0.6	3.8	10400	0.3	0.4
LATVIA	**4.5**	**0.4**	**4.9**	**n.i.**	**n.i.**	**n.i.**	**4.9**	**64600**	**0.08**	**0.08**
BAP	1.0	n.i.	1.0	n.i.	n.i.	n.i.	1.0	11400	0.09	0.09
GUF	n.i.	n.i.	n.i.	—	—	n.i.	n.i.	3600	n.i.	n.i.
GUR	3.5	0.4	3.9	n.i.	—	n.i.	3.9	49600	0.08	0.1
LITHUANIA	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**54160**	**n.i.**	**n.i.**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	54160	n.i.	n.i.
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**356**	**3009**	**3365**	**221**	**82**	**303**	**3668**	**311900**	**11**	**12**
BAP	356	3009	3365	221	82	303	3668	311900	11	12
RUSSIA	**19**	**n.i.**	**19**	**129**	**n.i.**	**129**	**148**	**314800**	**0.06**	**0.5**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
GUF	19	n.i.	19	129	n.i.	129	148	276100	0.07	0.5
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**26**	**4.9**	**31**	**41**	**49**	**90**	**121**	**440040**	**0.07**	**0.3**
BAP	13	1.0	14	11	0.5	12	26	83225	0.2	0.3
BOB	n.i.	—	n.i.	2.0	40	42	42	113620	n.i.	0.4
BOS	3.0	0.2	3.2	8.0	6.8	15	18	176610	0.02	0.1
SOU	n.i.	—	n.i.	4.0	—	4.0	4.0	2885	n.i.	1.4
KAT	10	3.7	14	16	1.7	18	31	63700	0.2	0.5
Baltic Sea catchment area	**458**	**3025**	**3484**	**549**	**143**	**692**	**4175**	**1602750**	**2.2**	**2.6**

— This source does not exit.
n.i. No information

Table 5.14: Point source discharges of mercury discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Hg	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
FI	n.i.	1.5	1.5	n.i.	8.9	8.9	10	146000	0.01	0.1
SE	n.i.	—	n.i.	2.0	40	42	42	113620	n.i.	0.4
BOB	**n.i.**	**1.5**	**1.5**	**2.0**	**49**	**51**	**53**	**259620**	**0.01**	**0.2**
FI	n.i.	8.1	8.1	n.i.	n.i.	n.i.	8.1	39300	0.2	0.2
SE	3.0	0.2	3.2	8.0	6.8	15	18	176610	0.02	0.1
BOS	**3.0**	**8.3**	**11**	**8.0**	**6.8**	**15**	**26**	**215910**	**0.1**	**0.1**
FI	n.i.	—	n.i.	n.i.	n.i.	n.i.	n.i.	9000	n.i.	n.i.
ARC	**n.i**	**n.i**	**n.i**	**n.i**	**n.i**	**n.i**	**n.i**	**9000**	**n.i.**	**n.i.**
EE	—	—	—	100	—	100	100	26400	—	3.8
FI	n.i.	0.2	0.2	n.i.	n.i.	n.i.	n.i.	107000	0.002	n.i.
LV	n.i.	n.i.	n.i.	—	—	n.i.	n.i.	3600	n.i.	n.i.
RU	19	n.i.	19	129	n.i.	129	148	276100	0.07	0.5
GUF	**19**	**0.2**	**19**	**100**	**n.i.**	**100**	**119**	**413100**	**0.05**	**0.3**
EE	—	—	—	—	—	—	—	17600	—	—
LT	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
LV	3.5	0.4	3.9	n.i.	—	n.i.	3.9	49600	0.1	0.1
RU	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**3.5**	**0.4**	**3.9**	**n.i.**	**—**	**n.i.**	**3.9**	**78340**	**0.05**	**0.1**
DE	15	1.1	16	0.2	—	0.2	16	18200	0.9	0.9
DK	1.0	—	1.0	1.7	0.1	1.8	2.8	1200	0.8	2.3
EE	—	—	—	—	—	—	—	1100	—	—
LT	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	54160	n.i.	n.i.
LV	1.0	n.i.	1.0	n.i.	n.i.	n.i.	1.0	11400	0.1	0.1
PL	356	3009	3365	221	82	303	3668	311900	11	12
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
SE	13	1.0	14	11	0.5	12	26	83225	0.2	0.3
BAP	**386**	**3011**	**3397**	**234**	**83**	**317**	**3713**	**496185**	**6.8**	**15**
DE	3.2	0.003	3.2	0.6	—	0.6	3.8	10400	0.3	0.4
DK	15	0.04	15	17	0.8	18	33	12340	1.2	2.7
WEB	**18**	**0.04**	**18**	**18**	**0.8**	**19**	**37**	**22740**	**0.8**	**3.0**
DK	2.4	n.i.	2.4	28	0.2	28	30	1740	1.4	17
SE	n.i.	—	n.i.	4.0	—	4.0	4.0	2885	n.i.	1.4
SOU	**2.4**	**n.i.**	**2.4**	**32**	**0.2**	**32**	**34**	**4625**	**0.5**	**19**
DK	17	0.01	17	11	1.1	12	29	15830	1.1	1.8
SE	10	3.7	14	16	1.7	18	31	63700	0.2	0.5
KAT	**27**	**3.7**	**30**	**27**	**2.8**	**30**	**60**	**79530**	**0.4**	**2.3**
Baltic Sea catchment area	**458**	**3025**	**3484**	**549**	**143**	**692**	**4175**	**1602750**	**2.2**	**2.6**

— This source does not exit.
n.i. No information

Table 5.15: Point source discharges of copper discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Cu	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
DENMARK	**1.8**	**3.3**	**5.1**	**2.9**	**138**	**141**	**146**	**31110**	**0.2**	**4.7**
BAP	0.05	—	0.05	0.08	6.1	6.1	6.2	1200	0.04	5.2
KAT	0.8	0.8	1.7	0.6	70	71	73	15830	0.1	4.6
SOU	0.1	0.004	0.1	1.4	9.8	11	11	1740	0.1	6.5
WEB	0.8	2.5	3.2	0.9	52	53	56	12340	0.3	4.5
ESTONIA	**33**	**—**	**33**	**1538**	**281**	**1819**	**1852**	**44000**	**0.7**	**42**
BAP	—	—	—	—	—	—	—	1100	—	—
GUF	33	—	33	1538	281	1819	1852	26400	1.2	70
GUR	—	—	—	—	—	—	—	17600	—	—
FINLAND	**n.i.**	**9551**	**9551**	**n.i.**	**693**	**693**	**10244**	**301300**	**32**	**34**
ARC	n.i.	5.0	5.0	n.i.	65	65	70	9000	0.6	7.8
BOB	n.i.	329	329	n.i.	580	580	909	146000	2.3	6.2
BOS	n.i.	9104	9104	n.i.	6.0	6.0	9110	39300	232	232
GUF	n.i.	113	113	n.i.	42	42	154	107000	1.1	1.4
GERMANY	**4356**	**125**	**4481**	**564**	**—**	**564**	**5045**	**28600**	**157**	**176**
BAP	3625	108	3733	10	—	10	3743	18200	205	206
WEB	731	17	748	554	—	554	1302	10400	72	125
LATVIA	**78**	**124**	**202**	**1887**	**n.i.**	**1887**	**2089**	**64600**	**3.1**	**32**
BAP	5.0	4.0	9.0	40	n.i.	40	49	11400	0.8	4.3
GUF	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
GUR	73	120	193	1847	n.i.	1847	2040	49600	3.9	41
LITHUANIA	**117**	**522**	**639**	**137**	**64**	**201**	**840**	**54160**	**12**	**16**
BAP	117	522	639	137	64	201	840	54160	12	16
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**40732**	**56884**	**97616**	**200**	**18**	**218**	**97834**	**311900**	**313**	**314**
BAP	40732	56884	97616	200	18	218	97834	311900	313	314
RUSSIA	**9952**	**1672**	**11624**	**3700**	**140**	**3840**	**15465**	**314800**	**37**	**49**
BAP	n.i.	2.0	2.0	n.i.	n.i.	n.i.	2.0	15000	0.1	n.i.
GUF	9952	1670	11622	3700	140	3840	15463	276100	42	56
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**6127**	**3421**	**9548**	**6518**	**3493**	**10011**	**19559**	**440040**	**22**	**44**
BAP	3357	353	3710	2608	649	3257	6967	83225	45	84
BOB	137	—	137	555	621	1176	1313	113620	1.2	12
BOS	795	36	831	1093	1816	2909	3740	176610	4.7	21
SOU	64	—	64	911	—	911	975	2885	22	338
KAT	1774	3032	4806	1351	407	1758	6564	63700	75	103
Baltic Sea catchment area	**61397**	**72301**	**133698**	**14546**	**4827**	**19374**	**153071**	**1602750**	**83**	**96**

— This source does not exit.
n.i. No information

Table 5.16: Point source discharges of copper discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Cu	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
FI	n.i.	329	329	n.i.	580	580	909	146000	2.3	6.2
SE	137	—	137	555	621	1176	1313	113620	1.2	12
BOB	**137**	**329**	**466**	**555**	**1201**	**1756**	**2222**	**259620**	**1.8**	**8.6**
FI	n.i.	9104	9104	n.i.	6.0	6.0	9110	39300	232	232
SE	795	36	831	1093	1816	2909	3740	176610	4.7	21
BOS	**795**	**9140**	**9935**	**1093**	**1822**	**2915**	**12850**	**215910**	**46**	**60**
FI	n.i.	5.0	5.0	n.i.	65	65	70	9000	0.6	7.8
ARC	**n.i.**	**5.0**	**5.0**	**n.i.**	**65**	**65**	**70**	**9000**	**0.6**	**7.8**
EE	33	—	33	1538	281	1819	1852	26400	1.2	70
FI	n.i.	113	113	n.i.	42	42	154	107000	1.1	1.4
LV	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
RU	9952	1670	11622	3700	140	3840	15463	276100	42	56
GUF	**9985**	**1783**	**11767**	**1538**	**323**	**1861**	**13628**	**413100**	**28**	**33**
EE	—	—	—	—	—	—	—	17600	—	—
LT	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
LV	73	120	193	1847	n.i.	1847	2040	49600	3.9	41
RU	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**73**	**120**	**193**	**1847**	**n.i.**	**1847**	**2040**	**78340**	**2.5**	**26**
DE	3625	108	3733	10	—	10	3743	18200	205	206
DK	0.05	—	0.05	0.08	6.1	6.1	6.2	1200	0.04	5.2
EE	—	—	—	—	—	—	—	1100	—	—
LT	117	522	639	137	64	201	840	54160	12	16
LV	5.0	4.0	9.0	40	n.i.	40	49	11400	0.8	4.3
PL	40732	56884	97616	200	18	218	97834	311900	313	314
RU	n.i.	2.0	2.0	n.i.	n.i.	n.i.	2.0	15000	0.1	n.i.
SE	3357	353	3710	2608	649	3257	6967	83225	45	84
BAP	**47836**	**57872**	**105708**	**2995**	**737**	**3732**	**109440**	**496185**	**213**	**221**
DE	731	17	748	554	—	554	1302	10400	72	125
DK	0.8	2.5	3.2	0.9	52	53	56	12340	0.3	4.5
WEB	**732**	**19**	**751**	**554**	**52**	**606**	**1358**	**22740**	**33**	**60**
DK	0.1	0.004	0.1	1.4	9.8	11	11	1740	0.1	6.5
SE	64	—	64	911	—	911	975	2885	22	338
SOU	**64**	**0.004**	**64**	**912**	**9.8**	**922**	**986**	**4625**	**14**	**213**
DK	0.8	0.8	1.7	0.6	70	71	73	15830	0.1	4.6
SE	1774	3032	4806	1351	407	1758	6564	63700	75	103
KAT	**1775**	**3033**	**4808**	**1352**	**477**	**1829**	**6637**	**79530**	**60**	**83**
Baltic Sea catchment area	**61397**	**72301**	**133698**	**14546**	**4827**	**19374**	**153071**	**1602750**	**83**	**96**

— This source does not exit.
n.i. No information

Table 5.17: Point source discharges of lead discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Pb	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
DENMARK	**0.6**	**1.6**	**2.2**	**1.0**	**66**	**67**	**69**	**31110**	**0.1**	**2.2**
BAP	0.02	—	0.02	0.03	2.9	2.9	2.9	1200	0.02	2.4
KAT	0.3	0.4	0.7	0.2	33	34	34	15830	0.04	2.2
SOU	0.04	0.002	0.04	0.5	4.7	5.1	5.2	1740	0.02	3.0
WEB	0.3	1.2	1.4	0.3	25	25	26	12340	0.1	2.1
ESTONIA	**2.0**	**—**	**2.0**	**13**	**—**	**13**	**15**	**44000**	**0.05**	**0.3**
BAP	—	—	—	—	—	—	—	1100	—	—
GUF	2.0	—	2.0	13	—	13	15	26400	0.1	0.6
GUR	—	—	—	—	—	—	—	17600	—	—
FINLAND	**n.i.**	**144**	**144**	**n.i.**	**14**	**14**	**158**	**301300**	**0.5**	**0.5**
ARC	n.i.	30	30	n.i.	3.0	3.0	33	9000	3.3	3.7
BOB	n.i.	8.0	8.0	n.i.	4.0	4.0	12	146000	0.1	0.1
BOS	n.i.	103	103	n.i.	n.i.	n.i.	103	39300	2.6	2.6
GUF	n.i.	3.0	3.0	n.i.	6.6	6.6	9.6	107000	0.03	0.1
GERMANY	**45**	**510**	**555**	**7.3**	**—**	**7.3**	**562**	**28600**	**19**	**20**
BAP	1.0	510	511	1.0	—	1.0	512	18200	28	28
WEB	44	0.03	44	6.3	—	6.3	51	10400	4.3	4.9
LATVIA	**30**	**271**	**301**	**431**	**n.i.**	**431**	**732**	**64600**	**4.7**	**11**
BAP	19	—	19	194	n.i.	194	213	11400	1.7	19
GUF	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
GUR	11	271	282	237	n.i.	237	519	49600	5.7	10
LITHUANIA	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**54160**	**n.i.**	**n.i.**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	54160	n.i.	n.i.
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**26520**	**37025**	**63544**	**232**	**582**	**814**	**64358**	**311900**	**204**	**206**
BAP	26520	37025	63544	232	582	814	64358	311900	204	206
RUSSIA	**4715**	**240**	**4955**	**1896**	**n.i.**	**1896**	**6851**	**314800**	**16**	**22**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
GUF	4715	240	4955	1896	n.i.	1896	6851	276100	18	25
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**767**	**671**	**1438**	**697**	**1856**	**2553**	**3991**	**440040**	**3.3**	**9.1**
BAP	456	140	596	235	334	569	1165	83225	7.2	14
BOB	84	—	84	47	603	650	734	113620	0.7	6.5
BOS	73	44	117	83	841	924	1041	176610	0.7	5.9
SOU	15	—	15	62	—	62	77	2885	5.2	27
KAT	139	487	626	270	78	348	974	63700	9.8	15
Baltic Sea catchment area	**32080**	**38862**	**70942**	**3277**	**2517**	**5795**	**76737**	**1602750**	**44**	**48**

— This source does not exit.
n.i. No information

Table 5.18: Point source discharges of lead discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region Pb	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
FI	n.i.	8.0	8.0	n.i.	4.0	4.0	12	146000	0.1	0.1
SE	84	—	84	47	603	650	734	113620	0.7	6.5
BOB	**84**	**8.0**	**92**	**47**	**607**	**654**	**746**	**259620**	**0.4**	**2.9**
FI	n.i.	103	103	n.i.	n.i.	n.i.	103	39300	2.6	2.6
SE	73	44	117	83	841	924	1041	176610	0.7	5.9
BOS	**73**	**147**	**220**	**83**	**841**	**924**	**1144**	**215910**	**1.0**	**5.3**
FI	n.i.	30	30	n.i.	3.0	3.0	33	9000	3.3	3.7
ARC	**n.i.**	**30**	**30**	**n.i.**	**3.0**	**3.0**	**33**	**9000**	**3.3**	**3.7**
EE	2.0	—	2.0	13	—	13	15	26400	0.1	**0.6**
FI	n.i.	3.0	3.0	n.i.	6.6	6.6	9.6	107000	0.03	0.1
LV	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
RU	4715	240	4955	1896	n.i.	1896	6851	276100	18	25
GUF	**4717**	**243**	**4960**	**13**	**6.6**	**20**	**4980**	**413100**	**12**	**12**
EE	—	—	—	—	—	—	—	17600	—	—
LT	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
LV	11	271	282	237	n.i.	237	519	49600	5.7	10
RU	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**11**	**271**	**282**	**237**	**n.i.**	**237**	**519**	**78340**	**3.6**	**6.6**
DE	1.0	510	511	1.0	—	1.0	512	18200	28	28
DK	0.02	—	0.02	0.03	2.9	2.9	2.9	1200	0.02	2.4
EE	—	—	—	—	—	—	—	1100	—	—
LT	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	54160	n.i.	n.i.
LV	19	—	19	194	n.i.	194	213	11400	1.7	19
PL	26520	37025	63544	232	582	814	64358	311900	204	206
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
SE	456	140	596	235	334	569	1165	83225	7.2	14
BAP	**26996**	**37674**	**64670**	**662**	**919**	**1581**	**66251**	**496185**	**130**	**134**
DE	44	0.03	44	6.3	—	6.3	51	10400	4.3	4.9
DK	0.3	1.2	1.4	0.3	25	25	26	12340	0.1	2.1
WEB	**45**	**1.2**	**46**	**6.6**	**25**	**31**	**77**	**22740**	**2.0**	**3.4**
DK	0.04	0.002	0.04	0.5	4.7	5.1	5.2	1740	0.02	3.0
SE	15	—	15	62	—	62	77	2885	5.2	27
SOU	**15**	**0.002**	**15**	**62**	**4.7**	**67**	**82**	**4625**	**3.3**	**18**
DK	0.3	0.4	0.7	0.2	33	34	34	15830	0.04	2.2
SE	139	487	626	270	78	348	974	63700	9.8	15
KAT	**139**	**487**	**627**	**270**	**111**	**382**	**1008**	**79530**	**7.9**	**13**
Baltic Sea catchment area	**32080**	**38862**	**70942**	**3277**	**2517**	**5795**	**76737**	**1602750**	**44**	**48**

— This source does not exit.
n.i. No information

Table 5.19: Point source discharges of zinc discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Zn	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
DENMARK	**30**	**5.7**	**36**	**50**	**237**	**287**	**323**	**31110**	**1.2**	**10**
BAP	0.9	—	0.9	1.4	10	12	13	1200	0.7	11
KAT	14	1.4	16	9.6	120	130	146	15830	1.0	9.2
SOU	2.0	0.01	2.0	24	17	41	43	1740	1.2	25
WEB	13	4.3	17	15	89	104	121	12340	1.4	9.8
ESTONIA	**103**	**—**	**103**	**3134**	**300**	**3434**	**3537**	**44000**	**2.3**	**80**
BAP	—	—	—	—	—	—	—	1100	—	—
GUF	103	—	103	3134	300	3434	3537	26400	3.9	134
GUR	—	—	—	—	—	—	—	17600	—	—
FINLAND	**n.i.**	**20650**	**20650**	**n.i.**	**7642**	**7642**	**28292**	**301300**	**69**	**94**
ARC	n.i.	704	704	n.i.	65	65	769	9000	78	85
BOB	n.i.	2914	2914	n.i.	4393	4393	7307	146000	20	50
BOS	n.i.	4700	4700	n.i.	3085	3085	7785	39300	120	198
GUF	n.i.	12332	12332	n.i.	99	99	12431	107000	115	116
GERMANY	**12924**	**15060**	**27984**	**956**	**—**	**956**	**28941**	**28600**	**978**	**1012**
BAP	11481	15053	26534	45	—	45	26579	18200	1458	1460
WEB	1444	6.7	1450	912	—	912	2362	10400	139	227
LATVIA	**461**	**367**	**828**	**5674**	**n.i.**	**5674**	**6502**	**64600**	**13**	**101**
BAP	6.0	43	49	407	n.i.	407	456	11400	4.3	40
GUF	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
GUR	455	324	779	5267	n.i.	5267	6046	49600	16	122
LITHUANIA	**1077**	**20**	**1097**	**1269**	**208**	**1477**	**2574**	**54160**	**20**	**48**
BAP	1077	20	1097	1269	208	1477	2574	54160	20	48
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**178707**	**287133**	**465840**	**1350**	**0.6**	**1351**	**467191**	**311900**	**1494**	**1498**
BAP	178707	287133	465840	1350	0.6	1351	467191	311900	1494	1498
RUSSIA	**40600**	**1191**	**41791**	**40713**	**—**	**40713**	**82505**	**314800**	**133**	**262**
BAP	20	1.0	21	—	—	—	21	15000	1.4	1.4
GUF	40580	1190	41770	40713	—	40713	82484	276100	151	299
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**17420**	**17334**	**34754**	**16614**	**40491**	**57105**	**91859**	**440040**	**79**	**209**
BAP	5300	2417	7717	9055	8349	17404	25121	83225	93	302
BOB	1239	—	1239	1404	5010	6414	7653	113620	11	67
BOS	6299	5673	11972	1930	25104	27034	39006	176610	68	221
SOU	179	—	179	1318	—	1318	1497	2885	62	519
KAT	4403	9244	13647	2907	2028	4935	18582	63700	214	292
Baltic Sea catchment area	**251323**	**341761**	**593084**	**69761**	**48878**	**118639**	**711723**	**1602750**	**370**	**444**

— This source does not exit.
n.i. No information

Table 5.20: Point source discharges of zinc discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region Zn	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
FI	n.i.	2914	2914	n.i.	4393	4393	7307	146000	20	50
SE	1239	—	1239	1404	5010	6414	7653	113620	11	67
BOB	**1239**	**2914**	**4153**	**1404**	**9403**	**10807**	**14960**	**259620**	**16**	**58**
FI	n.i.	4700	4700	n.i.	3085	3085	7785	39300	120	198
SE	6299	5673	11972	1930	25104	27034	39006	176610	68	221
BOS	**6299**	**10373**	**16672**	**1930**	**28189**	**30119**	**46791**	**215910**	**77**	**217**
FI	n.i.	704	704	n.i.	65	65	769	9000	78	85
ARC	**n.i.**	**704**	**704**	**n.i.**	**65**	**65**	**769**	**9000**	**78**	**85**
EE	103	—	103	3134	300	3434	3537	26400	3.9	**134**
FI	n.i.	12332	12332	n.i.	99	99	12431	107000	115	116
LV	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
RU	40580	1190	41770	40713	—	40713	82484	276100	151	299
GUF	**40683**	**13522**	**54205**	**3134**	**399**	**3533**	**57738**	**413100**	**131**	**140**
EE	—	—	—	—	—	—	—	17600	—	—
LT	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
LV	455	324	779	5267	n.i.	5267	6046	49600	16	122
RU	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**455**	**324**	**779**	**5267**	**n.i.**	**5267**	**6046**	**78340**	**9.9**	**77**
DE	11481	15053	26534	45	—	45	26579	18200	1458	1460
DK	0.9	—	0.9	1.4	10	12	13	1200	0.7	11
EE	—	—	—	—	—	—	—	1100	—	—
LT	1077	20	1097	1269	208	1477	2574	54160	20	48
LV	6.0	43	49	407	n.i.	407	456	11400	4.3	40
PL	178707	287133	465840	1350	0.6	1351	467191	311900	1494	1498
RU	20	1.0	21	—	—	—	21	15000	1.4	1.4
SE	5300	2417	7717	9055	8349	17404	25121	83225	93	302
BAP	**196592**	**304667**	**501259**	**12128**	**8568**	**20696**	**521954**	**496185**	**1010**	**1052**
DE	1444	6.7	1450	912	—	912	2362	10400	139	227
DK	13	4.3	17	15	89	104	121	12340	1.4	9.8
WEB	**1457**	**11**	**1468**	**927**	**89**	**1015**	**2483**	**22740**	**65**	**109**
DK	2.0	0.01	2.0	24	17	41	43	1740	1.2	25
SE	179	—	179	1318	—	1318	1497	2885	62	519
SOU	**181**	**0.01**	**181**	**1342**	**17**	**1359**	**1540**	**4625**	**39**	**333**
DK	14	1.4	16	9.6	120	130	146	15830	1.0	9.2
SE	4403	9244	13647	2907	2028	4935	18582	63700	214	292
KAT	**4417**	**9245**	**13663**	**2917**	**2148**	**5065**	**18728**	**79530**	**172**	**235**
Baltic Sea catchment area	**251323**	**341761**	**593084**	**69761**	**48878**	**118639**	**711723**	**1602750**	**370**	**444**

— This source does not exit.

n.i. No information

Table 5.21: Point source discharges of chromium discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region Cr	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
DENMARK	**0.4**	**3.7**	**4.1**	**0.6**	**151**	**152**	**156**	**31110**	**0.1**	**5.0**
BAP	0.01	—	0.01	0.02	6.6	6.7	6.7	1200	0.01	5.6
KAT	0.2	0.9	1.1	0.1	77	77	78	15830	0.1	4.9
SOU	0.03	0.004	0.03	0.3	11	11	11	1740	0.02	6.4
WEB	0.2	2.7	2.9	0.2	57	57	60	12340	0.2	4.9
ESTONIA	**24**	**—**	**24**	**100**	**70**	**170**	**194**	**44000**	**0.5**	**4.4**
BAP	—	—	—	—	—	—	—	1100	—	—
GUF	24	—	24	100	70	170	194	26400	0.9	7.3
GUR	—	—	—	—	—	—	—	17600	—	—
FINLAND	**n.i.**	**644**	**644**	**n.i.**	**3005**	**3005**	**3649**	**301300**	**2.1**	**12**
ARC	n.i.	9.0	9.0	n.i.	12	12	21	9000	1.0	2.3
BOB	n.i.	79	79	n.i.	2571	2571	2650	146000	0.5	18
BOS	n.i.	456	456	n.i.	416	416	872	39300	12	22
GUF	n.i.	100	100	n.i.	5.9	5.9	106	107000	0.9	1.0
GERMANY	**349**	**2.3**	**351**	**13**	**—**	**13**	**364**	**28600**	**12**	**13**
BAP	320	1.5	321	1.2	—	1.2	322	18200	18	18
WEB	29	0.7	30	12	—	12	42	10400	2.9	4.0
LATVIA	**101**	**85**	**186**	**302**	**n.i.**	**302**	**488**	**64600**	**2.9**	**7.6**
BAP	4.0	2.0	6.0	40	n.i.	40	46	11400	0.5	4.0
GUF	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
GUR	97	83	180	262	n.i.	262	442	49600	3.6	8.9
LITHUANIA	**49**	**547**	**595**	**26**	**25**	**51**	**647**	**54160**	**11**	**12**
BAP	49	547	595	26	25	51	647	54160	11	12
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**29825**	**9201**	**39027**	**370**	**350**	**720**	**39747**	**311900**	**125**	**127**
BAP	29825	9201	39027	370	350	720	39747	311900	125	127
RUSSIA	**11867**	**24**	**11891**	**2843**	**510**	**3353**	**15244**	**314800**	**38**	**48**
BAP	20	4.0	24	—	—	—	24	15000	1.6	1.6
GUF	11847	20	11867	2843	510	3353	15220	276100	43	55
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**1202**	**1880**	**3082**	**1331**	**1453**	**2784**	**5866**	**440040**	**7.0**	**13**
BAP	541	111	652	709	331	1040	1692	83225	7.8	20
BOB	266	—	266	159	55	214	480	113620	2.3	4.2
BOS	81	12	93	153	1011	1164	1257	176610	0.5	7.1
SOU	22	—	22	68	—	68	90	2885	7.6	31
KAT	292	1757	2049	242	56	298	2347	63700	32	37
Baltic Sea catchment area	**43417**	**12387**	**55804**	**4987**	**5564**	**10551**	**66355**	**1602750**	**35**	**41**

— This source does not exit.
n.i. No information

Table 5.22: Point source discharges of chromium discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Cr	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
FI	n.i.	79	79	n.i.	2571	2571	2650	146000	0.5	18
SE	266	—	266	159	55	214	480	113620	2.3	4.2
BOB	**266**	**79**	**345**	**159**	**2626**	**2785**	**3130**	**259620**	**1.3**	**12**
FI	n.i.	456	456	n.i.	416	416	872	39300	12	22
SE	81	12	93	153	1011	1164	1257	176610	0.5	7.1
BOS	**81**	**468**	**549**	**153**	**1427**	**1580**	**2129**	**215910**	**2.5**	**9.9**
FI	n.i.	9.0	9.0	n.i.	12	12	21	9000	1.0	2.3
ARC	**n.i.**	**9.0**	**9.0**	**n.i.**	**12**	**12**	**21**	**9000**	**1.0**	**2.3**
EE	24	—	24	100	70	170	194	26400	**0.9**	**7.3**
FI	n.i.	100	100	n.i.	5.9	5.9	106	107000	0.9	1.0
LV	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
RU	11847	20	11867	2843	510	3353	15220	276100	43	55
GUF	**11871**	**120**	**11991**	**100**	**76**	**176**	**12167**	**413100**	**29**	**29**
EE	—	—	—	—	—	—	—	17600	—	—
LT	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
LV	97	83	180	262	n.i.	262	442	49600	3.6	8.9
RU	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**97**	**83**	**180**	**262**	**n.i.**	**262**	**442**	**78340**	**2.3**	**5.6**
DE	320	1.5	321	1.2	—	1.2	322	18200	18	18
DK	0.01	—	0.01	0.02	6.6	6.7	6.7	1200	0.01	5.6
EE	—	—	—	—	—	—	—	1100	—	—
LT	49	547	595	26	25	51	647	54160	11	12
LV	4.0	2.0	6.0	40	n.i.	40	46	11400	0.5	4.0
PL	29825	9201	39027	370	350	720	39747	311900	125	127
RU	20	4.0	24	—	—	—	24	15000	1.6	1.6
SE	541	111	652	709	331	1040	1692	83225	7.8	20
BAP	**30759**	**9867**	**40625**	**1147**	**713**	**1860**	**42485**	**496185**	**82**	**86**
DE	29	0.7	30	12	—	12	42	10400	2.9	4.0
DK	0.2	2.7	2.9	0.2	57	57	60	12340	0.2	4.9
WEB	**29**	**3.5**	**33**	**12**	**57**	**69**	**102**	**22740**	**1.4**	**4.5**
DK	0.03	0.004	0.03	0.3	11	11	11	1740	0.02	6.4
SE	22	—	22	68	—	68	90	2885	7.6	31
SOU	**22**	**0.004**	**22**	**68**	**11**	**79**	**101**	**4625**	**4.8**	**22**
DK	0.2	0.9	1.1	0.1	77	77	78	15830	0.1	4.9
SE	292	1757	2049	242	56	298	2347	63700	32	37
KAT	**292**	**1758**	**2050**	**242**	**133**	**375**	**2425**	**79530**	**26**	**30**
Baltic Sea catchment area	**43417**	**12387**	**55804**	**4987**	**5564**	**10551**	**66355**	**1602750**	**35**	**41**

— This source does not exit.
n.i. No information

Table 5.23: Point source discharges of nickel discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each Contracting Party in 2000

Chapter 5.1.1

CP/Sub-region	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
Ni	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
DENMARK	**1.9**	**3.2**	**5.1**	**3.1**	**131**	**135**	**140**	**31110**	**0.2**	**4.5**
BAP	0.1	—	0.1	0.1	5.8	5.9	5.9	1200	0.04	4.9
KAT	0.9	0.8	1.7	0.6	67	68	69	15830	0.1	4.4
SOU	0.1	0.003	0.1	1.5	9.3	11	11	1740	0.1	6.3
WEB	0.8	2.4	3.2	0.9	49	50	54	12340	0.3	4.3
ESTONIA	**256**	**—**	**256**	**5490**	**—**	**5490**	**5746**	**44000**	**5.8**	**131**
BAP	—	—	—	—	—	—	—	1100	—	—
GUF	256	—	256	5490	—	5490	5746	26400	9.7	218
GUR	—	—	—	—	—	—	—	17600	—	—
FINLAND	**n.i.**	**6541**	**6541**	**n.i.**	**3397**	**3397**	**9937**	**301300**	**22**	**33**
ARC	n.i.	58	58	n.i.	40	40	98	9000	6.4	11
BOB	n.i.	353	353	n.i.	2737	2737	3090	146000	2.4	21
BOS	n.i.	4498	4498	n.i.	611	611	5109	39300	114	130
GUF	n.i.	1632	1632	n.i.	8.8	8.8	1640	107000	15	15
GERMANY	**2264**	**320**	**2584**	**238**	**—**	**238**	**2822**	**28600**	**90**	**99**
BAP	1977	311	2288	7.8	—	7.8	2295	18200	126	126
WEB	287	9.2	296	230	—	230	527	10400	28	51
LATVIA	**41**	**153**	**194**	**251**	**n.i.**	**251**	**445**	**64600**	**3.0**	**6.9**
BAP	9.0	3.0	12	251	n.i.	251	263	11400	1.1	23
GUF	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
GUR	32	150	182	n.i.	n.i.	n.i.	182	49600	3.7	3.7
LITHUANIA	**43**	**679**	**723**	**155**	**76**	**231**	**954**	**54160**	**13**	**18**
BAP	43	679	723	155	76	231	954	54160	13	18
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
POLAND	**9622**	**11906**	**21528**	**402**	**569**	**971**	**22499**	**311900**	**69**	**72**
BAP	9622	11906	21528	402	569	971	22499	311900	69	72
RUSSIA	**6047**	**90**	**6137**	**7703**	**350**	**8053**	**14190**	**314800**	**19**	**45**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
GUF	6047	90	6137	7703	350	8053	14190	276100	22	51
GUR	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
SWEDEN	**2192**	**550**	**2742**	**4767**	**1941**	**6708**	**9450**	**440040**	**6.2**	**21**
BAP	26	120	146	2280	403	2683	2829	83225	1.8	34
BOB	252	—	252	189	261	450	702	113620	2.2	6.2
BOS	1296	84	1380	440	1212	1652	3032	176610	7.8	17
SOU	42	—	42	285	—	285	327	2885	15	113
KAT	576	346	922	1573	65	1638	2560	63700	14	40
Baltic Sea catchment area	**20467**	**20242**	**40710**	**19009**	**6464**	**25474**	**66184**	**1602750**	**25**	**41**

— This source does not exit.

n.i. No information

Table 5.24: Point source discharges of nickel discharging into inland surface waters within the Baltic Sea catchment area and directly into the Baltic Sea from each sub-region in 2000

Chapter 5.1.1

CP/Sub-region Ni	Point source discharges entering inland surface waters within the Baltic Sea catchment area			Point source discharges entering directly into the Baltic Sea			TOTAL POINT SOURCE DISCHARGES	Total drainage area considered	Area-specific point source discharges into inland surface waters	Area-specific total point source discharges
	MWWTP	Industry	Total	MWWTP	Industry	Total				
	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in km^2	in g/km^2	in g/km^2
FI	n.i.	353	353	n.i.	2737	2737	3090	146000	2.4	21
SE	252	—	252	189	261	450	702	113620	2.2	6.2
BOB	**252**	**353**	**605**	**189**	**2998**	**3187**	**3792**	**259620**	**2.3**	**15**
FI	n.i.	4498	4498	n.i.	611	611	5109	39300	114	130
SE	1296	84	1380	440	1212	1652	3032	176610	7.8	17
BOS	**1296**	**4582**	**5878**	**440**	**1823**	**2263**	**8141**	**215910**	**27**	**38**
FI	n.i.	58	58	n.i.	40	40	98	9000	6.4	11
ARC	**n.i.**	**58**	**58**	**n.i.**	**40**	**40**	**98**	**9000**	**6.4**	**11**
EE	256	—	256	5490	—	5490	5746	26400	9.7	218
FI	n.i.	1632	1632	n.i.	8.8	8.8	1640	107000	15	15
LV	n.i.	n.i.	n.i.	—	—	—	n.i.	3600	n.i.	n.i.
RU	6047	90	6137	7703	350	8053	14190	276100	22	51
GUF	**6303**	**1722**	**8025**	**13193**	**359**	**13552**	**21576**	**413100**	**19**	**52**
EE	—	—	—	—	—	—	—	17600	—	—
LT	n.i.	n.i.	n.i.	—	—	—	n.i.	11140	n.i.	n.i.
LV	32	150	182	n.i.	n.i.	n.i.	182	49600	3.7	3.7
RU	n.i.	n.i.	n.i.	—	—	—	n.i.	23700	n.i.	n.i.
GUR	**32**	**150**	**182**	**n.i.**	**n.i.**	**n.i.**	**182**	**78340**	**2.3**	**2.3**
DE	1977	311	2288	7.8	—	7.8	2295	18200	126	126
DK	0.1	—	0.1	0.1	5.8	5.9	5.9	1200	0.04	4.9
EE	—	—	—	—	—	—	—	1100	—	—
LT	43	679	723	155	76	231	954	54160	13	18
LV	9.0	3.0	12	251	n.i.	251	263	11400	1.1	23
PL	9622	11906	21528	402	569	971	22499	311900	69	72
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
SE	26	120	146	2280	403	2683	2829	83225	1.8	34
BAP	**11677**	**13019**	**24696**	**3096**	**1054**	**4150**	**28846**	**496185**	**50**	**58**
DE	287	9.2	296	230	—	230	527	10400	28	51
DK	0.8	2.4	3.2	0.9	49	50	54	12340	0.3	4.3
WEB	**288**	**12**	**300**	**231**	**49**	**281**	**580**	**22740**	**13**	**26**
DK	0.1	0.003	0.1	1.5	9.3	11	11	1740	0.1	6.3
SE	42	—	42	285	—	285	327	2885	15	113
SOU	**42**	**0.003**	**42**	**287**	**9.3**	**296**	**338**	**4625**	**9.1**	**73**
DK	0.9	0.8	1.7	0.6	67	68	69	15830	0.1	4.4
SE	576	346	922	1573	65	1638	2560	63700	14	40
KAT	**577**	**347**	**924**	**1574**	**132**	**1706**	**2629**	**79530**	**12**	**33**
Baltic Sea catchment area	**20467**	**20242**	**40710**	**19009**	**6464**	**25474**	**66184**	**1602750**	**25**	**41**

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n.i. No information

Table 5.25: Nitrogen losses from diffuse sources into inland surface waters within the Baltic Sea catchment area for the 9 Contracting Parties and their sub-region catchment areas in 2000

Chapter 5.1.2

N_{total} CP/Sub-region	Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	Total diffuse losses	Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	Total diffuse losses	TOTAL DIFFUSE LOSSES INTO INLAND SURFACE WATERS	Total drainage area considered	Area-specific diffuse losses into inland surface waters
	Within monitored river catchment areas				Within unmonitored river catchment areas and coastal areas						
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km²
DENMARK	**19440**	**212**	**276**	**19928**	**32289**	**295**	**519**	**33103**	**53030**	**31110**	**1705**
BAP	190	0.5	7.0	198	1056	3.4	33	1092	1290	1200	1075
KAT	10881	64	88	11033	19915	81	178	20174	31207	15830	1971
SOU	452	78	11	541	880	115	18	1013	1553	1740	893
WEB	7917	70	170	8157	10438	95	290	10823	18980	12340	1538
ESTONIA	**17808**	**2.0**	**1452**	**19262**	**5850**	**n.i.**	**n.i.**	**6708**	**25970**	**44000**	**590**
BAP	—	—	—	—	n.i.	n.i.	n.i.	858	858	1100	780
GUF	11606	1.0	572	12179	1890	n.i.	n.i.	1890	14069	26400	533
GUR	6202	1.0	880	7083	3960	n.i.	n.i.	3960	11043	17600	627
FINLAND	**45000**	**18419**	**3135**	**66554**	**11220**	**1736**	**632**	**13588**	**80142**	**301300**	**266**
ARC	2540	149	95	2784	3760	221	141	4122	6906	9000	767
BOB	16400	4480	1380	22260	2330	202	158	2690	24950	146000	171
BOS	10700	3400	636	14736	3280	133	208	3621	18357	39300	467
GUF	15360	10390	1024	26774	1850	1180	125	3155	29929	107000	280
GERMANY	**12521**	**1157**	**825**	**14503**	**7480**	**811**	**521**	**8812**	**23315**	**28600**	**815**
BAP	7206	604	623	8433	2189	342	211	2742	11175	18200	614
WEB	5315	553	202	6070	5291	469	310	6070	12140	10400	1167
LATVIA	**n.i.**	**n.i.**	**n.i.**	**27443**	**n.i.**	**n.i.**	**n.i.**	**6581**	**34024**	**64600**	**558**
BAP	n.i.	n.i.	n.i.	4027	n.i.	n.i.	n.i.	1034	5061	11400	444
GUF	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	3600	n.i.
GUR	n.i.	n.i.	n.i.	23416	n.i.	n.i.	n.i.	5547	28963	49600	584
LITHUANIA	**25136**	**2227**	**8.0**	**27371**	**120**	**4.0**	**1.0**	**125**	**27496**	**65300**	**508**
BAP	25136	2227	8.0	27371	120	4.0	1.0	125	27496	54160	508
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.
POLAND	**98071**	**n.i.**	**38379**	**136450**	**4417**	**n.i.**	**780**	**5197**	**141647**	**311900**	**454**
BAP	98071	n.i.	38379	136450	4417	n.i.	780	5197	141647	311900	454
RUSSIA	**n.i.**	**n.i.**	**n.i.**	**637**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**637**	**314800**	**n.i.**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
GUF	n.i.	n.i.	n.i.	637	n.i.	n.i.	n.i.	n.i.	637	276100	n.i.
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.
SWEDEN	**43177**	**15840**	**3423**	**62440**	**31143**	**2450**	**1792**	**35385**	**97825**	**440040**	**222**
BAP	11974	4174	1332	17480	13333	698	919	14950	32430	83225	390
BOB	1612	1328	125	3065	1602	1205	113	2920	5985	113620	53
BOS	7135	2914	677	10726	2537	311	358	3206	13932	176610	79
SOU	623	n.i.	12	635	6568	51	152	6771	7406	2885	2567
KAT	21833	7424	1277	30534	7103	185	250	7538	38072	63700	598
Baltic Sea catchment area	**261153**	**37857**	**47498**	**374588**	**92519**	**5296**	**4245**	**109499**	**484086**	**1602750**	**302**

— This source does not exit.
n.i. No information

Table 5.26: Phosphorus losses from diffuse sources into inland surface waters within the Baltic Sea catchment area for the 9 Contracting Parties and their sub-region catchment areas in 2000

Chapter 5.1.2

P_{total}	Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	Total diffuse losses	Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	Total diffuse losses	TOTAL DIFFUSE LOSSES INTO INLAND SURFACE WATERS	Total drainage area considered	Area-specific diffuse losses into inland surface waters
CP/Sub-region	Within monitored river catchment areas				Within unmonitored river catchment areas and coastal areas						
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km²
DENMARK	**304**	**2.3**	**62**	**368**	**454**	**3.2**	**119**	**576**	**944**	**31110**	**30**
BAP	0.3	0.004	1.7	2.0	0.1	0.03	7.4	7.5	9.5	1200	7.9
KAT	235	0.4	20	255	324	0.5	41	365	620	15830	39
SOU	-6.8	1.4	2.0	-3.5	8.1	2.1	4.7	15	11	1740	6.6
WEB	75	0.5	39	114	122	0.6	66	189	303	12340	25
ESTONIA	**577**	**1.1**	**330**	**908**	**60**	**n.i.**	**n.i.**	**64**	**971**	**45100**	**22**
BAP	—	—	—	—	n.i.	n.i.	n.i.	3.4	3.4	1100	3.1
GUF	517	1.0	130	648	28	n.i.	n.i.	28	676	26400	26
GUR	60	0.1	200	260	32	n.i.	n.i.	32	292	17600	17
FINLAND	**2907**	**296**	**397**	**3600**	**881**	**23**	**70**	**974**	**4574**	**301300**	**15**
ARC	276	1.9	13	291	409	2.8	20	432	723	9000	80
BOB	1040	105	185	1330	129	3.9	17	150	1480	146000	10
BOS	710	41	70	821	222	0.8	16	239	1060	39300	27
GUF	881	149	128	1158	121	16	17	154	1312	107000	12
GERMANY	**473**	**24**	**91**	**588**	**205**	**18**	**70**	**293**	**881**	**28600**	**31**
BAP	299	14	64	377	75	9.1	24	108	485	18200	27
WEB	173	10	27	211	130	9.0	46	185	396	10400	38
LATVIA	**n.i.**	**n.i.**	**n.i.**	**711**	**n.i.**	**n.i.**	**n.i.**	**137**	**848**	**64600**	**14**
BAP	n.i.	n.i.	n.i.	33	n.i.	n.i.	n.i.	18	51	11400	4.5
GUF	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	3600	n.i.
GUR	n.i.	n.i.	n.i.	678	n.i.	n.i.	n.i.	119	797	49600	16
LITHUANIA	**396**	**121**	**3.1**	**520**	**2.8**	**0.2**	**0.1**	**3.1**	**523**	**65300**	**9.7**
BAP	396	121	3.1	520	2.8	0.2	0.1	3.1	523	54160	9.7
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.
POLAND	**8099**	**n.i.**	**1745**	**9844**	**229**	**n.i.**	**35**	**264**	**10108**	**311900**	**32**
BAP	8099	n.i.	1745	9844	229	n.i.	35	264	10108	311900	32
RUSSIA	**n.i.**	**n.i.**	**n.i.**	**392**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**392**	**314800**	**n.i.**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
GUF	n.i.	n.i.	n.i.	392	n.i.	n.i.	n.i.	n.i.	392	276100	n.i.
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.
SWEDEN	**1001**	**n.i.**	**869**	**1870**	**581**	**n.i.**	**346**	**928**	**2798**	**440040**	**6.4**
BAP	337	n.i.	569	906	227	n.i.	217	444	1350	83225	16
BOB	30	n.i.	17	47	30	n.i.	17	47	94	113620	0.8
BOS	161	n.i.	95	256	78	n.i.	52	130	386	176610	2.2
SOU	5.5	n.i.	1.9	7.4	81	n.i.	23	104	112	2885	39
KAT	467	n.i.	187	654	165	n.i.	38	203	857	63700	13
Baltic Sea catchment area	**13756**	**444**	**3497**	**18800**	**2413**	**45**	**641**	**3240**	**22040**	**1602750**	**17**

— This source does not exit.

n.i. No information

Table 5.27: Nitrogen losses from diffuse sources into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region

Chapter 5.1.2

N_{total} CP/Sub-region	Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	Total diffuse losses	Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	Total diffuse losses	TOTAL DIFFUSE LOSSES INTO INLAND SURFACE WATERS	Total drainage area considered	Area-specific diffuse losses into inland surface waters
	Within monitored river catchment areas				Within unmonitored river catchment areas and coastal areas						
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km²	in kg/km²
FI	16400	4480	1380	22260	2330	202	158	2690	24950	146000	171
SE	1612	1328	125	3065	1602	1205	113	2920	5985	113620	53
BOB	**18012**	**5808**	**1505**	**25325**	**3932**	**1407**	**271**	**5610**	**30935**	**259620**	**119**
FI	10700	3400	636	14736	3280	133	208	3621	18357	39300	467
SE	7135	2914	677	10726	2537	311	358	3206	13932	176610	79
BOS	**17835**	**6314**	**1313**	**25462**	**5817**	**444**	**566**	**6827**	**32289**	**215910**	**150**
FI	2540	149	95	2784	3760	221	141	4122	6906	9000	767
ARC	**2540**	**149**	**95**	**2784**	**3760**	**221**	**141**	**4122**	**6906**	**9000**	**767**
EE	11606	1.0	572	12179	1890	n.i.	n.i.	1890	14069	26400	533
FI	15360	10390	1024	26774	1850	1180	125	3155	29929	107000	280
LV	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	3600	n.i.
RU	n.i.	n.i.	n.i.	637	n.i.	n.i.	n.i.	n.i.	637	276100	n.i.
GUF	**26966**	**10391**	**1596**	**39590**	**3740**	**1180**	**125**	**5045**	**44635**	**413100**	**335**
EE	6202	1.0	880	7083	3960	n.i.	n.i.	3960	11043	17600	627
LT	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.
LV	n.i.	n.i.	n.i.	23416	n.i.	n.i.	n.i.	5547	28963	49600	584
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.
GUR	**6202**	**1.0**	**880**	**30499**	**3960**	**n.i.**	**n.i.**	**9507**	**40006**	**102040**	**595**
DE	7206	604	623	8433	2189	342	211	2742	11175	18200	614
DK	190	0.5	7.0	198	1056	3.4	33	1092	1290	1200	1075
EE	—	—	—	—	n.i.	n.i.	n.i.	858	858	1100	780
LT	25136	2227	8.0	27371	120	4.0	1.0	125	27496	54160	508
LV	n.i.	n.i.	n.i.	4027	n.i.	n.i.	n.i.	1034	5061	11400	444
PL	98071	n.i.	38379	136450	4417	n.i.	780	5197	141647	311900	454
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
SE	11974	4174	1332	17480	13333	698	919	14950	32430	83225	390
BAP	**142577**	**7006**	**40349**	**193959**	**21115**	**1047**	**1944**	**25998**	**219957**	**496185**	**457**
DE	5315	553	202	6070	5291	469	310	6070	12140	10400	1167
DK	7917	70	170	8157	10438	95	290	10823	18980	12340	1538
WEB	**13232**	**623**	**372**	**14227**	**15729**	**564**	**600**	**16893**	**31120**	**22740**	1369
DK	452	78	11	541	880	115	18	1013	1553	1740	893
SE	623	n.i.	12	635	6568	51	152	6771	7406	2885	2567
SOU	**1075**	**78**	**23**	**1176**	**7448**	**166**	**170**	**7784**	**8959**	**4625**	**1937**
DK	10881	64	88	11033	19915	81	178	20174	31207	15830	1971
SE	21833	7424	1277	30534	7103	185	250	7538	38072	63700	598
KAT	**32714**	**7488**	**1365**	**41567**	**27018**	**266**	**428**	**27712**	**69279**	**79530**	**871**
Baltic Sea catchment area	**261153**	**37857**	**47498**	**374588**	**92519**	**5296**	**4245**	**109499**	**484086**	**1602750**	**302**

— This source does not exit.
n.i. No information

Table 5.28: Phosphorus losses from diffuse sources into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region

Chapter 5.1.2

P_{total} CP/Sub-region	Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	Total diffuse losses	Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	Total diffuse losses	TOTAL DIFFUSE LOSSES INTO INLAND SURFACE WATERS	Total drainage area considered	Area-specific diffuse losses into inland surface waters
	Within monitored river catchment areas				Within unmonitored river catchment areas and coastal areas						
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km²
FI	1040	105	185	1330	129	3.9	17	150	1480	146000	10
SE	30	n.i.	17	47	30	n.i.	17	47	94	113620	0.8
BOB	**1070**	**105**	**202**	**1377**	**159**	**3.9**	**34**	**197**	**1574**	**259620**	**6.1**
FI	710	41	70	821	222	0.8	16	239	1060	39300	27
SE	161	n.i.	95	256	78	n.i.	52	130	386	176610	2.2
BOS	**871**	**41**	**165**	**1077**	**300**	**0.8**	**68**	**369**	**1445**	**215910**	**6.7**
FI	276	1.9	13	291	409	2.8	20	432	723	9000	80
ARC	**276**	**1.9**	**13**	**291**	**409**	**2.8**	**20**	**432**	**723**	**9000**	**80**
EE	517	1.0	130	648	28	n.i.	n.i.	28	676	26400	26
FI	881	149	128	1158	121	16	17	154	1312	107000	12
LV	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	3600	n.i.
RU	n.i.	n.i.	n.i.	392	n.i.	n.i.	n.i.	n.i.	392	276100	n.i.
GUF	**1398**	**150**	**258**	**2198**	**149**	**16**	**17**	**182**	**2380**	**413100**	**18**
EE	60	0.1	200	260	32	n.i.	n.i.	32	292	17600	17
LT	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.
LV	n.i.	n.i.	n.i.	678	n.i.	n.i.	n.i.	119	797	49600	16
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.
GUR	**60**	**0.1**	**200**	**938**	**32**	**n.i.**	**n.i.**	**151**	**1089**	**102040**	**16**
DE	299	14	64	377	75	9.1	24	108	485	18200	27
DK	0.3	0.004	1.7	2.0	0.1	0.03	7.4	7.5	9.5	1200	7.9
EE	—	—	—	—	n.i.	n.i.	n.i.	3.4	3.4	1100	3.1
LT	396	121	3.1	520	2.8	0.2	0.1	3.1	523	54160	9.7
LV	n.i.	n.i.	n.i.	33	n.i.	n.i.	n.i.	18	51	11400	4.5
PL	8099	n.i.	1745	9844	229	n.i.	35	264	10108	311900	32
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
SE	337	n.i.	569	906	227	n.i.	217	444	1350	83225	16
BAP	**9132**	**134**	**2382**	**11682**	**534**	**9.3**	**284**	**849**	**12530**	**496185**	**26**
DE	173	10	27	211	130	9.0	46	185	396	10400	38
DK	75	0.5	39	114	122	0.6	66	189	303	12340	25
WEB	**249**	**11**	**66**	**325**	**252**	**10**	**112**	**374**	**699**	**22740**	31
DK	-6.8	1.4	2.0	-3.5	8.1	2.1	4.7	15	11	1740	6.6
SE	5.5	n.i.	1.9	7.4	81	n.i.	23	104	112	2885	39
SOU	**-1.3**	**1.4**	**3.9**	**3.9**	**89**	**2.1**	**28**	**119**	**123**	**4625**	**27**
DK	235	0.4	20	255	324	0.5	41	365	620	15830	39
SE	467	n.i.	187	654	165	n.i.	38	203	857	63700	13
KAT	**702**	**0.4**	**207**	**909**	**489**	**0.5**	**78**	**568**	**1477**	**79530**	**19**
Baltic Sea catchment area	**13756**	**444**	**3497**	**18800**	**2413**	**45**	**641**	**3240**	**22040**	**1602750**	**17**

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n.i. No information

Table 5.29: Natural background losses of nitrogen and phosphorus into inland surface waters within the Baltic Sea catchment area in 2000 by Contracting Party

Chapter 5.1.3

CP/Sub-region	Nitrogen natural background losses			Phosphorus natural background losses			Total drainage area considered	Area-specific nitrogen natural background losses	Area-specific phosphorus natural background losses
	Within monitored river catchment areas	Within unmonitored river catchment areas and coastal areas	Within the Baltic Sea catchment area	Within monitored river catchment areas	Within unmonitored river catchment areas and coastal areas	Within the Baltic Sea catchment area			
	in t	in t	in t	in t	in t	in t	in km^2	in kg/km²	in kg/km²
DENMARK	**2755**	**3828**	**6583**	**96**	**131**	**227**	**31110**	**212**	**7.3**
BAP	35	221	256	1.2	7.6	8.8	1200	213	7.4
KAT	1468	1878	3346	51	64	115	15830	211	7.3
SOU	145	216	361	5.1	7.4	12	1740	207	7.1
WEB	1107	1513	2620	39	52	90	12340	212	7.3
ESTONIA	**4832**	**960**	**5792**	**176**	**83**	**259**	**45100**	**128**	**5.8**
BAP	—	252	252	—	9.2	9.2	1100	229	8.3
GUF	3419	546	3965	125	21	146	26400	150	5.5
GUR	1413	162	1575	51	53	105	17600	89	5.9
FINLAND	**47594**	**8810**	**56404**	**1677**	**234**	**1911**	**301300**	**187**	**6.3**
ARC	1050	1560	2610	35	52	88	9000	290	9.7
BOB	22200	1800	24000	1050	57	1107	146000	164	7.6
BOS	8160	3560	11720	192	72	264	39300	298	6.7
GUF	16184	1890	18074	400	52	452	107000	169	4.2
GERMANY	**3318**	**2476**	**5794**	**192**	**55**	**247**	**28600**	**203**	**8.6**
BAP	1563	837	2400	123	22	145	18200	132	8.0
WEB	1755	1639	3394	69	33	102	10400	326	9.8
LATVIA	**14596**	**3774**	**18370**	**263**	**72**	**335**	**64600**	**301**	**5.5**
BAP	1929	1182	3111	35	25	60	11400	273	5.2
GUF	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	3600	n.i.	n.i.
GUR	12667	2592	15259	229	47	275	49600	308	5.5
LITHUANIA	**6838**	**80**	**6918**	**170**	**1.2**	**171**	**65300**	**128**	**3.2**
BAP	6838	80	6918	170	1.2	171	54160	128	3.2
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.	n.i.
POLAND	**44732**	**2270**	**47002**	**2996**	**152**	**3148**	**311900**	**151**	**10**
BAP	44732	2270	47002	2996	152	3148	311900	151	10
RUSSIA	**45291**	**n.i.**	**45291**	**866**	**n.i.**	**866**	**314800**	**164**	**3.1**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
GUF	45291	n.i.	45291	866	n.i.	866	276100	164	3.1
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.	n.i.
SWEDEN	**56213**	**11151**	**67364**	**3097**	**702**	**3799**	**440040**	**153**	**8.6**
BAP	6092	3667	9759	158	69	227	83225	117	2.7
BOB	14875	1944	16819	958	414	1372	113620	148	12
BOS	23304	2658	25962	1644	170	1814	176610	147	10
SOU	66	873	939	1.0	11	12	2885	325	4.2
KAT	11876	2009	13885	336	38	374	63700	218	5.9
Baltic Sea catchment area	**226170**	**33349**	**259519**	**9534**	**1430**	**10964**	**1602750**	**168**	**7.1**

— This source does not exit.

n.i. No information

Table 5.30: Natural background losses of nitrogen and phosphorus into inland surface waters within the Baltic Sea catchment area in 2000 by sub-region

Chapter 5.1.3

CP/Sub-region	Nitrogen natural background losses			Phosphorus natural background losses			Total drainage area considered	Area-specific nitrogen natural background losses	Area-specific phosphorus natural background losses
	Within monitored river catchment areas	Within unmonitored river catchment areas and coastal areas	Within the Baltic Sea catchment area	Within monitored river catchment areas	Within unmonitored river catchment areas and coastal areas	Within the Baltic Sea catchment area			
	in t	in t	in t	in t	in t	in t	in km^2	in kg/km²	in kg/km²
FI	22200	1800	24000	1050	57	1107	146000	164	7.6
SE	14875	1944	16819	958	414	1372	113620	148	12
BOB	**37075**	**3744**	**40819**	**2008**	**471**	**2479**	**259620**	**157**	**9.5**
FI	8160	3560	11720	192	72	264	39300	298	6.7
SE	23304	2658	25962	1644	170	1814	176610	147	10
BOS	**31464**	**6218**	**37682**	**1836**	**242**	**2078**	**215910**	**175**	**9.6**
FI	1050	1560	2610	35	52	88	9000	290	9.7
ARC	**1050**	**1560**	**2610**	**35**	**52**	**88**	**9000**	**290**	**9.7**
EE	3419	546	3965	125	21	146	26400	150	5.5
FI	16184	1890	18074	400	52	452	107000	169	4.2
LV	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	3600	n.i.	n.i.
RU	45291	n.i.	45291	866	n.i.	866	276100	164	3.1
GUF	**64894**	**2436**	**67330**	**1391**	**73**	**1463**	**413100**	**164**	**3.6**
EE	1413	162	1575	51	53	105	17600	89	5.9
LT	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.	n.i.
LV	12667	2592	15259	229	47	275	49600	308	5.5
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.	n.i.
GUR	**14080**	**2754**	**16834**	**280**	**100**	**380**	**102040**	**251**	**5.7**
DE	1563	837	2400	123	22	145	18200	132	8.0
DK	35	221	256	1.2	7.6	8.8	1200	213	7.4
EE	—	252	252	—	9.2	9.2	1100	229	8.3
LV	1929	1182	3111	35	25	60	11400	273	5.2
LT	6838	80	6918	170	1.2	171	54160	128	3.2
PL	44732	2270	47002	2996	152	3148	311900	151	10
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.	n.i.
SE	6092	3667	9759	158	69	227	83225	117	2.7
BAP	**61190**	**8509**	**69699**	**3483**	**287**	**3770**	**496185**	**145**	**7.8**
DE	1755	1639	3394	69	33	102	10400	326	9.8
DK	1107	1513	2620	39	52	90	12340	212	7.3
WEB	**2862**	**3152**	**6014**	**108**	**85**	**192**	**22740**	**264**	**8.5**
DK	145	216	361	5.1	7.4	12	1740	207	7.1
SE	66	873	939	1.0	11	12	2885	325	4.2
SOU	**211**	**1089**	**1300**	**6.1**	**18**	**24**	**4625**	**281**	**5.3**
DK	1468	1878	3346	51	64	115	15830	211	7.3
SE	11876	2009	13885	336	38	374	63700	218	5.9
KAT	**13344**	**3887**	**17231**	**387**	**102**	**489**	**79530**	**217**	**6.2**
Baltic Sea catchment area	**226170**	**33349**	**259519**	**9534**	**1430**	**10964**	**1602750**	**168**	**7.1**

— This source does not exit.

n.i. No information

Table 5.31: Total nitrogen discharges from point sources, losses from diffuse sources and the natural background losses into inland surface waters within the Baltic Sea catchment area by Contracting Party in 2000

Chapter 5.1.4

N_{total} CP/Sub-region	NATURAL BACK-GROUND LOSSES	DIFFUSE LOSSES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA				POINT SOURCE DISCHARGES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA				TOTAL DISCHARGES/ LOSSES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA	Total drainage area considered	Area-specific discharges/ losses into inland surface waters with the Baltic Sea catchment area
		Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	TOTAL	Industrial plants	MWWTP	Fish farms	TOTAL			
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km²
DENMARK	**6583**	**51729**	**506**	**795**	**53030**	**8.8**	**2195**	**427**	**2631**	**62244**	**31110**	**2001**
BAP	256	1246	4.0	40	1290	—	39	—	39	1585	1200	1321
KAT	3346	30796	145	266	31207	4.4	964	335	1303	35857	15830	2265
SOU	361	1332	192	29	1553	0.01	190	—	190	2104	1740	1209
WEB	2620	18355	165	460	18980	4.4	1002	92	1099	22699	12340	1839
ESTONIA	**5792**	**23658**	**2.0**	**1452**	**25970**	**500**	**690**	**39**	**1229**	**32991**	**44000**	**750**
BAP	252	n.i.	n.i.	n.i.	858	0.4	1.80	1.0	3.2	1114	1100	1012
GUF	3965	13496	1.0	572	14069	478	593	35	1106	19139	26400	725
GUR	1575	10162	1.0	880	11043	21	96	3.0	120	12738	17600	724
FINLAND	**56404**	**56220**	**20155**	**3767**	**80142**	**2216**	**7562**	**236**	**10015**	**146561**	**301300**	**486**
ARC	2610	6300	370	236	6906	27	108	—	136	9651	9000	1072
BOB	24000	18730	4682	1538	24950	283	1508	117	1908	50858	146000	348
BOS	11720	13980	3533	844	18357	230	1730	8.1	1969	32046	39300	815
GUF	18074	17210	11570	1149	29929	1676	4216	111	6003	54006	107000	505
GERMANY	**5794**	**20001**	**1968**	**1346**	**23315**	**363**	**2030**	**—**	**2393**	**31502**	**28600**	**1101**
BAP	2400	9395	946	834	11175	340	571	—	910	14485	18200	796
WEB	3394	10606	1022	512	12140	24	1459	—	1483	17017	10400	1636
LATVIA	**18370**	**n.i.**	**n.i.**	**n.i.**	**34024**	**294**	**1327**	**50**	**1670**	**54065**	**64600**	**886**
BAP	3111	n.i.	n.i.	n.i.	5061	12	139	43	194	8367	11400	734
GUF	n.i.	n.i.	n.i.	n.i.	n.i.	0.02	22	—	22	22	3600	n.i.
GUR	15259	n.i.	n.i.	n.i.	28963	282	1165	6.6	1454	45676	49600	921
LITHUANIA	**6918**	**25256**	**2231**	**9.0**	**27496**	**58**	**1062**	**29**	**1149**	**35563**	**65300**	**657**
BAP	6918	25256	2231	9.0	27496	58	1062	29	1149	35563	54160	657
GUR	n.i.	n.i.	n.i.	n.i.	n.i	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.
POLAND	**47002**	**102488**	**n.i.**	**39159**	**141647**	**3268**	**37995**	**79**	**41342**	**229991**	**311900**	**737**
BAP	47002	102488	n.i.	39159	141647	3268	37995	79	41342	229991	311900	737
RUSSIA	**45291**	**n.i.**	**n.i.**	**n.i.**	**637**	**2282**	**5496**	**9.0**	**7787**	**53715**	**314800**	**195**
BAP	n.i.	n.i.	n.i.	n.i.	n.i	201	198	n.i.	400	400	15000	n.i.
GUF	45291	n.i.	n.i.	n.i.	637	2081	5298	9.0	7387	53315	276100	193
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.
SWEDEN	**67364**	**74320**	**18290**	**5215**	**97825**	**2515**	**7904**	**n.i.**	**10419**	**175608**	**440040**	**399**
BAP	9759	25307	4872	2251	32430	542	3954	n.i.	4496	46685	83225	561
BOB	16819	3214	2533	238	5985	217	227	n.i.	443	23247	113620	205
BOS	25962	9672	3225	1035	13932	808	952	n.i.	1760	41654	176610	236
SOU	939	7191	51	164	7406	5.0	208	n.i.	213	8558	2885	2966
KAT	13885	28936	7609	1527	38072	943	2564	n.i.	3508	55465	63700	871
Baltic Sea catchment area	**259519**	**353672**	**43152**	**51743**	**484086**	**11505**	**66261**	**870**	**78635**	**822240**	**1602750**	**513**

— This source does not exit.
n.i. No information

Table 5.32: Total phosphorus discharges from point sources, losses from diffuse sources and natural background losses into inland surface waters within the Baltic Sea catchment area by Contracting Party in 2000

Chapter 5.1.4

P_{total} CP/Sub-region	NATURAL BACKGROUND LOSSES	DIFFUSE LOSSES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA				POINT SOURCE DISCHARGES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA				TOTAL DISCHARGES/ LOSSES INTO SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA	Total drainage area considered	Area-specific discharges/ losses into inland surface waters with the Baltic Sea catchment area
		Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	TOTAL	Industrial plants	MWWTP	Fish farms	TOTAL			
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2
DENMARK	**227**	**758**	**5.5**	**181**	**944**	**0.9**	**288**	**33**	**322**	**1493**	**31110**	**48**
BAP	8.8	0.4	0.03	9.1	9.5	—	6.1	—	6.1	24	1200	20
KAT	115	559	0.9	61	620	0.2	127	26	153	888	15830	56
SOU	12	1.3	3.5	6.6	11	0.001	33	—	33	57	1740	33
WEB	90	197	1.1	105	303	0.7	122	7.4	130	523	12340	42
ESTONIA	**259**	**637**	**1.1**	**330**	**971**	**23**	**115**	**4.0**	**142**	**1373**	**45100**	**30**
BAP	9.2	n.i.	n.i.	n.i.	3.4	1.2	0.4	n.i.	1.6	14	1100	13
GUF	146	545	1.0	130	676	15	97	4.0	116	938	26400	36
GUR	105	92	0.1	200	292	6.8	18	n.i.	24	421	17600	24
FINLAND	**1911**	**3788**	**319**	**467**	**4574**	**139**	**135**	**29**	**302**	**6788**	**301300**	**23**
ARC	88	685	4.8	33	723	0.5	3.3	—	3.8	814	9000	90
BOB	1107	1169	109	202	1480	18	30	15	63	2649	146000	18
BOS	264	932	42	86	1060	21	28	1.1	50	1375	39300	35
GUF	452	1002	164	146	1312	99	73	13	186	1949	107000	18
GERMANY	**247**	**678**	**42**	**161**	**881**	**8.3**	**65**	**—**	**74**	**1202**	**28600**	**42**
BAP	145	375	23	88	485	7.9	44	—	52	683	18200	38
WEB	102	303	19	73	396	0.4	21	—	21	519	10400	50
LATVIA	**335**	**n.i.**	**n.i.**	**n.i.**	**848**	**37**	**247**	**6.3**	**290**	**1473**	**64600**	**24**
BAP	60	n.i.	n.i.	n.i.	51	2.5	34	5.6	42	152	11400	13
GUF	n.i.	n.i.	n.i.	n.i.	n.i.	0.005	4.4	—	4.4	4.4	3600	1.2
GUR	275	n.i.	n.i.	n.i.	797	34	209	0.7	244	1316	49600	27
LITHUANIA	**171**	**399**	**121**	**3.2**	**523**	**9.8**	**77**	**1.9**	**88**	**783**	**65300**	**14**
BAP	171	399	121	3.2	523	9.8	77	1.9	88	783	54160	14
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.
POLAND	**3148**	**8328**	**n.i.**	**1780**	**10108**	**418**	**5037**	**14**	**5469**	**18725**	**311900**	**60**
BAP	3148	8328	n.i.	1780	10108	418	5037	14	5469	18725	311900	60
RUSSIA	**866**	**n.i.**	**n.i.**	**n.i.**	**392**	**391**	**884**	**3.7**	**1279**	**2537**	**314800**	**9.2**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	13	45	n.i.	59	59	15000	n.i.
GUF	866	n.i.	n.i.	n.i.	392	378	839	3.7	1220	2478	276100	9.0
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.
SWEDEN	**3799**	**1582**	**n.i.**	**1216**	**2798**	**121**	**129**	**n.i.**	**250**	**6846**	**440040**	**16**
BAP	227	564	n.i.	786	1350	27	53	n.i	80	1657	83225	20
BOB	1372	60	n.i.	34	94	0.5	3.9	n.i.	4.4	1470	113620	13
BOS	1814	239	n.i.	146	386	29	18	n.i.	48	2247	176610	13
SOU	12	87	n.i.	25	112	0.4	4.0	n.i.	4.4	128	2885	44
KAT	374	632	n.i.	225	857	64	50	n.i.	113	1344	63700	21
Baltic Sea catchment area	**10964**	**16169**	**489**	**4138**	**22040**	**1147**	**6977**	**92**	**8216**	**41219**	**1602750**	**26**

— This source does not exist.
n.i. No information

Table 5.33: Total nitrogen discharges from point sources, losses from diffuse sources and the natural background losses into inland surface waters within the Baltic Sea catchment area by sub-region in 2000

Chapter 5.1.4

N_{total} CP/Sub-region	NATURAL BACK-GROUND LOSSES	DIFFUSE LOSSES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA				POINT SOURCE DISCHARGES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA				TOTAL DISCHARGES/ LOSSES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA	Total drainage area considered	Area-specific discharges/ losses into inland surface waters with the Baltic Sea catchment area
		Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	TOTAL	Industrial plants	MWWTP	Fish farms	TOTAL			
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km²
FI	24000	18730	4682	1538	24950	283	1508	117	1908	50858	146000	348
SE	16819	3214	2533	238	5985	217	227	n.i.	443	23247	113620	205
BOB	**40819**	**21944**	**7215**	**1776**	**30935**	**500**	**1734**	**117**	**2351**	**74105**	**259620**	**285**
FI	11720	13980	3533	844	18357	230	1730	8.1	1969	32046	39300	815
SE	25962	9672	3225	1035	13932	808	952	n.i.	1760	41654	176610	236
BOS	**37682**	**23652**	**6758**	**1879**	**32289**	**1038**	**2682**	**8.1**	**3728**	**73699**	**215910**	**341**
FI	2610	6300	370	236	6906	27	108	—	136	9651	9000	1072
ARC	**2610**	**6300**	**370**	**236**	**6906**	**27**	**108**	**—**	**136**	**9651**	**9000**	**1072**
EE	3965	13496	1.0	572	14069	478	593	35	1106	19139	26400	725
FI	18074	17210	11570	1149	29929	1676	4216	111	6003	54006	107000	505
LV	n.i.	n.i.	n.i.	n.i.	n.i.	0.02	22	—	22	22	3600	n.i.
RU	45291	n.i.	n.i.	n.i.	637	2081	5298	9.0	7387	53315	276100	193
GUF	**67330**	**30706**	**11571**	**1721**	**44635**	**4235**	**10129**	**155**	**14518**	**126483**	**413100**	**309**
EE	1575	10162	1.0	880	11043	21	96	3.0	120	12738	17600	724
LT	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.
LV	15259	n.i.	n.i.	n.i.	28963	282	1165	6.6	1454	45676	49600	921
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.
GUR	**16834**	**10162**	**1.0**	**880**	**40006**	**303**	**1261**	**9.6**	**1573**	**58413**	**102040**	**869**
DE	2400	9395	946	834	11175	340	571	—	910	14485	18200	796
DK	256	1246	4.0	40	1290	—	39	—	39	1585	1200	1321
EE	252	n.i.	n.i.	n.i.	858	0.4	1.8	1.0	3.2	1114	1100	1012
LT	6918	25256	2231	9.0	27496	58	1062	29	1149	35563	54160	657
LV	3111	n.i.	n.i.	n.i.	5061	12	139	43	194	8367	11400	734
PL	47002	102488	n.i.	39159	141647	3268	37995	79	41342	229991	311900	737
RU	n.i.	n.i.	n.i.	n.i.	n.i.	201	198	n.i.	400	400	15000	27
SE	9759	25307	4872	2251	32430	542	3954	n.i.	4496	46685	83225	561
BAP	**69699**	**163692**	**8053**	**42293**	**219957**	**4421**	**43960**	**152**	**48534**	**338190**	**496185**	**682**
DE	3394	10606	1022	512	12140	24	1459	—	1483	17017	10400	1636
DK	2620	18355	165	460	18980	4.4	1002	92	1099	22699	12340	1839
WEB	**6014**	**28961**	**1187**	**972**	**31120**	**28**	**2462**	**92**	**2582**	**39716**	**22740**	**1747**
DK	361	1332	192	29	1553	0.01	190	—	190	2104	1740	1209
SE	939	7191	51	164	7406	5.0	208	n.i.	213	8558	2885	2966
SOU	**1300**	**8523**	**243**	**193**	**8959**	**5.0**	**397**	**n.i.**	**402**	**10661**	**4625**	**2305**
DK	3346	30796	145	266	31207	4.4	964	335	1303	35857	15830	2265
SE	13885	28936	7609	1527	38072	943	2564	n.i.	3508	55465	63700	871
KAT	**17231**	**59732**	**7754**	**1793**	**69279**	**948**	**3528**	**335**	**4811**	**91321**	**79530**	**1148**
Baltic Sea catchment area	**259519**	**353672**	**43152**	**51743**	**484086**	**11505**	**66261**	**870**	**78635**	**822240**	**1602750**	**513**

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Table 5.34: Total phosphorus discharges from point sources, losses from diffuse sources and natural background losses into inland surface waters within the Baltic Sea catchment area by sub-region in 2000

Chapter 5.1.4

P_{total} CP/Sub-region	NATURAL BACKGROUND LOSSES	DIFFUSE LOSSES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA				POINT SOURCE DISCHARGES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT AREA				TOTAL DISCHARGES/ LOSSES INTO INLAND SURFACE WATERS WITHIN THE BALTIC SEA CATCHMENT	Total drainage area considered	Area-specific discharges/ losses into inland surface waters with the Baltic Sea catchment area
		Agriculture and managed forestry	Atmospheric deposition	Other diffuse sources	TOTAL	Industrial plants	MWWTP	Fish farms	TOTAL			
	in t	in t	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2
FI	1107	1169	109	202	1480	18	30	15	63	2649	146000	18
SE	1372	60	n.i.	34	94	0.5	3.9	n.i.	4.4	1470	113620	13
BOB	**2479**	**1229**	**109**	**236**	**1574**	**18**	**34**	**15**	**67**	**4120**	**259620**	**16**
FI	264	932	42	86	1060	21	28	1.1	50	1375	39300	35
SE	1814	239	n.i.	146	386	29	18	n.i.	48	2247	176610	13
BOS	**2078**	**1171**	**42**	**233**	**1445**	**50**	**47**	**1.1**	**98**	**3622**	**215910**	**17**
FI	88	685	4.8	33	723	0.5	3.3	—	3.8	814	9000	90
ARC	**88**	**685**	**4.8**	**33**	**723**	**0.5**	**3.3**	**—**	**3.8**	**814**	**9000**	**90**
EE	146	545	1.0	130	676	15	97	4.0	116	938	26400	36
FI	452	1002	164	146	1312	99	73	13	186	1949	107000	18
LV	n.i.	n.i.	n.i.	n.i.	n.i.	0.005	4.4	—	4.4	4.4	3600	1.2
RU	866	n.i.	n.i.	n.i.	392	378	839	3.7	1220	2478	276100	9.0
GUF	**1463**	**1547**	**165**	**276**	**2380**	**492**	**1014**	**21**	**1526**	**5370**	**413100**	**13**
EE	105	92	0.1	200	292	6.8	18	n.i.	24	421	17600	24
LT	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	11140	n.i.
LV	275	n.i.	n.i.	n.i.	797	34	209	0.7	244	1316	49600	27
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	23700	n.i.
GUR	**380**	**92**	**0.1**	**200**	**1089**	**41**	**226**	**0.7**	**268**	**1737**	**102040**	**26**
DE	145	375	23	88	485	7.9	44	—	52	683	18200	38
DK	8.8	0.4	n.i.	9.1	9.5	—	6.1	—	6.1	24	1200	20
EE	9.2	n.i.	n.i.	n.i.	3.4	1.2	0.4	n.i.	1.6	14	1100	13
LT	171	399	121	3.2	523	9.8	77	1.9	88	783	54160	14
LV	60	n.i.	n.i.	n.i.	51	2.5	34	5.6	42	152	11400	13
PL	3148	8328	n.i.	1780	10108	418	5037	14	5469	18725	311900	60
RU	n.i.	n.i.	n.i.	n.i.	n.i.	13	45	n.i.	59	59	15000	3.9
SE	227	564	n.i.	786	1350	27	53	n.i	80	1657	83225	20
BAP	**3770**	**9666**	**144**	**2666**	**12530**	**480**	**5297**	**21**	**5798**	**22097**	**496185**	**46**
DE	102	303	19	73	396	0.4	21	—	21	519	10400	50
DK	90	197	1.1	105	303	0.7	122	7.4	130	523	12340	42
WEB	**192**	**501**	**20**	**178**	**699**	**1.1**	**143**	**7.4**	**151**	**1043**	**22740**	**46**
DK	12	1.3	3.5	6.6	11	0.001	33	—	33	57	1740	33
SE	12	87	n.i.	25	112	0.4	4.0	n.i.	4.4	128	2885	44
SOU	**24**	**88**	**3.5**	**32**	**123**	**0.4**	**37**	**n.i.**	**38**	**185**	**4625**	**40**
DK	115	559	0.9	61	620	0.2	127	26	153	888	15830	56
SE	374	632	n.i.	225	857	64	50	n.i.	113	1344	63700	21
KAT	**489**	**1191**	**0.9**	**285**	**1477**	**64**	**177**	**26**	**266**	**2232**	**79530**	**28**
Baltic Sea catchment area	**10964**	**16169**	**489**	**4138**	**22040**	**1147**	**6977**	**92**	**8216**	**41219**	**1602750**	**26**

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Table 5.35: Run-off from rivers and coastal areas as well as amount of wastewater entering the Baltic Sea from each Contracting Party in 2000

Chapter 5.2.2

CP/Sub-region River run-off / wastewater	Run-off from rivers and unmonitored coastal areas			Amount of wastewater entering directly into the Baltic Sea			TOTAL run-off and wastewater into the BALTIC SEA	Total drainage area considered	Area-specific run off from rivers and coastal areas	Area-specific total run-off
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total				
	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in km²	in l/(s km²)	in l/(s km²)
DENMARK	**4367**	**5267**	**9634**	**313**	**32**	**345**	**9979**	**31111**	**9.8**	**10**
BAP	29	191	220	4.6	0.04	4.6	225	1206	5.8	5.9
KAT	2697	3281	5978	107	8.9	116	6094	15826	12	12
SOU	121	71	192	128	4.3	132	324	1737	3.5	5.9
WEB	1520	1724	3244	73	19	92	3336	12342	8.3	8.6
ESTONIA	**13749**	**n.i.**	**13749**	**68**	**5.3**	**73**	**13822**	**85475**	**5.1**	**5.1**
BAP	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.	n.i.
GUF	11719	n.i.	11719	61	5.3	66	11785	67357	5.5	5.5
GUR	2030	n.i.	2030	6.7	—	6.7	2037	17018	3.8	3.8
FINLAND	**97017**	**11795**	**108812**	**240**	**692**	**933**	**109745**	**231123**	**15**	**15**
ARC	1504	2261	3765	41	33	74	3839	8952	13	14
BOB	73813	4206	78019	32	482	514	78533	133167	19	19
BOS	10328	3384	13711	21	111	131	13843	39301	11	11
GUF	11372	1945	13317	146	67	214	13530	49703	8.5	8.6
GERMANY	**2351**	**1197**	**3548**	**45**	**—**	**45**	**3593**	**23010**	**4.9**	**5.0**
BAP	1116	339	1454	3.5	—	3.5	1458	12610	3.7	3.7
WEB	1235	859	2094	42	—	42	2136	10400	6.4	6.5
LATVIA	**29649**	**n.i.**	**29649**	**81**	**—**	**81**	**29730**	**141112**	**6.7**	**6.7**
BAP	2998	n.i.	2998	15	—	15	3013	17119	5.6	5.6
GUR	26651	n.i.	26651	66	—	66	26717	123993	6.8	6.8
LITHUANIA	**20065**	**n.i.**	**20065**	**18**	**3.2**	**21**	**20086**	**98912**	**6.4**	**6.4**
BAP	20065	n.i.	20065	18	3.2	21	20086	98912	6.4	6.4
POLAND	**62559**	**3288**	**65847**	**12**	**2.8**	**15**	**65862**	**331196**	**6.3**	**6.3**
BAP	62559	3288	65847	12	2.8	15	65862	331196	6.3	6.3
RUSSIA	**83842**	**n.i.**	**83842**	**960**	**11**	**971**	**84813**	**302641**	**8.8**	**8.9**
BAP	2726	n.i.	2726	64	1.8	66	2792	15000	5.8	5.9
GUF	81116	n.i.	81116	896	9.0	905	82021	287641	8.9	9.0
SWEDEN	**219279**	**26175**	**245454**	**726**	**376**	**1103**	**246557**	**426408**	**18**	**18**
BAP	16608	5109	21717	338	87	425	22142	67766	10	10
BOB	68238	8578	76816	33	96	129	76945	118710	21	21
BOS	101015	9019	110034	95	181	276	110309	170088	21	21
SOU	57	725	782	87	1.5	88	870	2409	10	11
KAT	33362	2744	36106	173	11	184	36290	67435	17	17
Baltic Sea	**532878**	**47722**	**580601**	**2464**	**1123**	**3587**	**584188**	**1670988**	**11**	**11**

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Table 5.36: Run-off from rivers and coastal areas as well as amount of wastewater entering the Baltic Sea from each sub-region in 2000

Chapter 5.2.2

CP/Sub-region River run-off / wastewater	Run-off from rivers and unmonitored coastal areas			Amount of wastewater entering directly into the Baltic Sea			TOTAL run-off and wastewater into the BALTIC SEA	Total drainage area considered	Area-specific run-off from rivers and coastal areas	Area-specific total run-off
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total				
	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in 10^6 m³/a	in km²	in l/(s km²)	in l/(s km²)
FI	73813	4206	78019	32	482	514	78533	133167	19	19
SE	68238	8578	76816	33	96	129	76945	118710	21	21
BOB	**142051**	**12784**	**154835**	**65**	**578**	**643**	**155478**	**251877**	**19**	**20**
FI	10328	3384	13711	21	111	131	13843	39301	11	11
SE	101015	9019	110034	95	181	276	110309	170088	21	21
BOS	**111342**	**12403**	**123745**	**116**	**291**	**407**	**124152**	**209389**	**19**	**19**
FI	1504	2261	3765	41	33	74	3839	8952	13	14
ARC	**1504**	**2261**	**3765**	**41**	**33**	**74**	**3839**	**8952**	**13**	**14**
EE	11719	n.i.	11719	61	5.3	66	11785	67357	5.5	5.5
FI	11372	1945	13317	146	67	214	13530	49703	8.5	8.6
RU	81116	n.i.	81116	896	9.0	905	82021	287641	8.9	9.0
GUF	**104207**	**1945**	**106152**	**1103**	**81**	**1185**	**107337**	**404701**	**8.3**	**8.4**
EE	2030	n.i.	2030	6.7	—	6.7	2037	17018	3.8	3.8
LV	26651	n.i.	26651	66	—	66	26717	123993	6.8	6.8
GUR	**28682**	**n.i.**	**28682**	**72**	**—**	**72**	**28754**	**141011**	**6.4**	**6.5**
DE	1116	339	1454	3.5	—	3.5	1458	12610	3.7	3.7
DK	29	191	220	4.6	0.04	4.6	225	1206	5.8	5.9
EE	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.	n.i.
LT	20065	n.i.	20065	18	3.2	21	20086	98912	6.4	6.4
LV	2998	n.i.	2998	15	—	15	3013	17119	5.6	5.6
PL	62559	3288	65847	12	2.8	15	65862	331196	6.3	6.3
RU	2726	n.i.	2726	64	1.8	66	2792	15000	5.8	5.9
SE	16608	5109	21717	338	87	425	22142	67766	10	10
BAP	**106100**	**8927**	**115027**	**457**	**95**	**551**	**115578**	**544909**	**6.7**	**6.7**
DE	1235	859	2094	42	—	42	2136	10400	6.4	6.5
DK	1520	1724	3244	73	19	92	3336	12342	8.3	8.6
WEB	**2755**	**2583**	**5338**	**115**	**19**	**134**	**5471**	**22742**	**7.4**	**7.6**
DK	121	71	192	128	4.3	132	324	1737	3.5	5.9
SE	57	725	782	87	1.5	88	870	2409	10	11
SOU	**178**	**796**	**974**	**215**	**5.9**	**220**	**1194**	**4146**	**7.4**	**9.1**
DK	2697	3281	5978	107	8.9	116	6094	15826	12	12
SE	33362	2744	36106	173	11	184	36290	67435	17	17
KAT	**36059**	**6025**	**42084**	**280**	**20**	**301**	**42384**	**83261**	**16**	**16**
Baltic Sea	**532878**	**47722**	**580601**	**2464**	**1123**	**3587**	**584188**	**1670988**	**11**	**11**

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Table 5.37: Load of organic matter (BOD_7) entering the Baltic Sea from each Contracting Party in 2000

Chapter 5.2.2

CP/Sub-region	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea				TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area-specific load from rivers and coastal areas	Area-specific total inputs into the Baltic Sea
BOD_7	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
DENMARK	**8343**	**14966**	**23309**	**2197**	**5017**	**1883**	**9097**	**32406**	**31111**	**749**	**1042**
BAP	49	717	766	99	83	2.0	184	950	1206	635	788
KAT	5108	8009	13117	529	1339	1.0	1869	14986	15826	829	947
SOU	279	565	844	639	177	—	816	1660	1737	486	956
WEB	2907	5675	8582	930	3418	1880	6228	14810	12342	695	1200
ESTONIA	**29429**	**6669**	**36098**	**486**	**1.2**	**—**	**487**	**36586**	**85475**	**422**	**428**
BAP	—	505	505	—	—	—	—	505	1100	459	459
GUF	25484	1330	26814	347	1.2	—	348	27161	67357	398	403
GUR	3946	4834	8780	140	—	—	140	8919	17018	516	524
FINLAND	**110001**	**27710**	**137711**	**3282**	**7662**	**n.i.**	**10944**	**148655**	**231123**	**596**	**643**
ARC	3459	5200	8659	595	91	n.i.	686	9345	8952	967	1044
BOB	65777	6140	71917	591	5172	n.i.	5764	77681	133167	540	583
BOS	21555	13000	34555	301	1268	n.i.	1570	36125	39301	879	919
GUF	19210	3370	22580	1795	1130	n.i.	2924	25504	49703	454	513
GERMANY	**10168**	**5501**	**15669**	**549**	**—**	**—**	**549**	**16218**	**23010**	**681**	**705**
BAP	4113	1248	5361	16	—	—	16	5378	12610	425	426
WEB	6055	4253	10308	533	—	—	533	10841	10400	991	1042
LATVIA	**52954**	**4053**	**57007**	**764**	**—**	**—**	**764**	**57771**	**141112**	**404**	**409**
BAP	6077	727	6804	71	—	—	71	6876	17119	397	402
GUR	46877	3326	50203	692	—	—	692	50895	123993	405	410
LITHUANIA	**100620**	**n.i.**	**100620**	**204**	**215**	**n.i.**	**419**	**101039**	**98912**	**1017**	**1022**
BAP	100620	n.i.	100620	204	215	n.i.	419	101039	98912	1017	1022
POLAND	**240150**	**10333**	**250483**	**230**	**6.9**	**n.i.**	**237**	**250720**	**331196**	**756**	**757**
BAP	240150	10333	250483	230	6.9	n.i.	237	250720	331196	756	757
RUSSIA	**185127**	**n.i.**	**185127**	**16239**	**296**	**n.i.**	**16535**	**201661**	**302641**	**612**	**666**
BAP	6718	n.i.	6718	7536	12	n.i.	7548	14265	15000	448	951
GUF	178409	n.i.	178409	8703	284	n.i.	8987	187396	287641	620	651
SWEDEN	**187937**	**46280**	**234217**	**4881**	**44795**	**n.i.**	**49676**	**283893**	**426408**	**549**	**666**
BAP	22406	10069	32475	1466	6294	n.i.	7760	40235	67766	479	594
BOB	54365	16139	70504	523	6938	n.i.	7461	77965	118710	594	657
BOS	82260	15636	97896	961	27745	n.i.	28706	126602	170088	576	744
SOU	39	346	385	686	3.0	n.i.	689	1074	2409	160	446
KAT	28867	4090	32957	1243	3815	n.i.	5059	38016	67435	489	564
Baltic Sea	**924729**	**115513**	**1040242**	**28832**	**57993**	**1883**	**88708**	**1128950**	**1670988**	**623**	**676**

— This source does not exit.

n.i. No information

Table 5.38: Load of organic matter (BOD_7) entering the Baltic Sea from each sub-region in 2000

Chapter 5.2.2

CP/Sub-region BOD_7	Load entering the Baltic Sea via rivers and unmonitored coastal areas: Monitored rivers	Coastal areas and unmonitored rivers	Total	Point source discharges entering directly into the Baltic Sea: MWWTP	Industry	Fish farms	Total	TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area-specific load from rivers and coastal areas	Area-specific total inputs into the Baltic Sea
	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
FI	65777	6140	71917	591	5172	n.i.	5764	77681	133167	540	583
SE	54365	16139	70504	523	6938	n.i.	7461	77965	118710	594	657
BOB	**120142**	**22279**	**142421**	**1115**	**12110**	**n.i.**	**13225**	**155646**	**251877**	**565**	**618**
FI	21555	13000	34555	301	1268	n.i.	1570	36125	39301	879	919
SE	82260	15636	97896	961	27745	n.i.	28706	126602	170088	576	744
BOS	**103815**	**28636**	**132451**	**1263**	**29013**	**n.i.**	**30276**	**162727**	**209389**	**633**	**777**
FI	3459	5200	8659	595	91	n.i.	686	9345	8952	967	1044
ARC	**3459**	**5200**	**8659**	**595**	**91**	**n.i.**	**686**	**9345**	**8952**	**967**	**1044**
EE	25484	1330	26814	347	1.2	—	348	27161	67357	398	403
FI	19210	3370	22580	1795	1130	n.i.	2924	25504	49703	454	513
RU	178409	n.i.	178409	8703	284	n.i.	8987	187396	287641	620	651
GUF	**223103**	**4700**	**227803**	**10844**	**1415**	**n.i.**	**12259**	**240062**	**404701**	**563**	**593**
EE	3946	4834	8780	140	—	—	140	8919	17018	516	524
LV	46877	3326	50203	692	—	—	692	50895	123993	405	410
GUR	**50822**	**8160**	**58983**	**832**	**—**	**—**	**832**	**59815**	**141011**	**418**	**424**
DE	4113	1248	5361	16	—	—	16	5378	12610	425	426
DK	49	717	766	99	83	2.0	184	950	1206	635	788
EE	—	505	505	—	—	—	—	505	1100	459	459
LT	100620	n.i.	100620	204	215	n.i.	419	101039	98912	1017	1022
LV	6077	727	6804	71	—	—	71	6876	17119	397	402
PL	240150	10333	250483	230	6.9	n.i.	237	250720	331196	756	757
RU	6718	n.i.	6718	7536	12	n.i.	7548	14265	15000	448	951
SE	22406	10069	32475	1466	6294	n.i.	7760	40235	67766	479	594
BAP	**380133**	**23599**	**403732**	**9623**	**6611**	**2.0**	**16235**	**419968**	**544909**	**741**	**771**
DE	6055	4253	10308	533	—	—	533	10841	10400	991	1042
DK	2907	5675	8582	930	3418	1880	6228	14810	12342	695	1200
WEB	**8962**	**9928**	**18890**	**1463**	**3418**	**1880**	**6761**	**25651**	**22742**	**831**	**1128**
DK	279	565	844	639	177	—	816	1660	1737	486	956
SE	39	346	385	686	3.0	n.i.	689	1074	2409	160	446
SOU	**318**	**911**	**1229**	**1325**	**180**	**n.i.**	**1505**	**2735**	**4146**	**296**	**660**
DK	5108	8009	13117	529	1339	1.0	1869	14986	15826	829	947
SE	28867	4090	32957	1243	3815	n.i.	5059	38016	67435	489	564
KAT	**33975**	**12099**	**46074**	**1772**	**5154**	**1.0**	**6928**	**53002**	**83261**	**553**	**637**
Baltic Sea	**924729**	**115513**	**1040242**	**28832**	**57993**	**1883**	**88708**	**1128950**	**1670988**	**623**	**676**

— This source does not exit.
n.i. No information

Table 5.39: Load of total nitrogen (N_{total}) entering the Baltic Sea from each Contracting Party in 2000

Chapter 5.2.2

CP/Sub-region N_{total}	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea				TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area-specific load from rivers and coastal areas	Area-specific total inputs into the Baltic Sea
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in km²	in kg/km²	in kg/km²
DENMARK	**20922**	**34822**	**55743**	**2210**	**692**	**278**	**3180**	**58923**	**31111**	**1792**	**1894**
BAP	235	1331	1566	58	11	0.4	69	1635	1206	1299	1356
KAT	11658	21203	32861	506	283	0.3	789	33650	15826	2076	2126
SOU	470	979	1449	917	79	—	995	2445	1737	834	1407
WEB	8559	11309	19868	730	319	277	1326	21194	12342	1610	1717
ESTONIA	**16836**	**8438**	**25273**	**975**	**626**	—	**1601**	**26874**	**85475**	**296**	**314**
BAP	n.i.	1061	1061	—	—	—	—	1061	1100	965	965
GUF	12365	2012	14377	902	626	—	1528	15905	67357	213	236
GUR	4471	5365	9835	73	—	—	73	9908	17018	578	582
FINLAND	**71411**	**22410**	**93821**	**5224**	**1844**	**769**	**7838**	**101659**	**231123**	**406**	**440**
ARC	3790	5690	9480	948	136	579	1663	11143	8952	1059	1245
BOB	36263	4490	40753	1102	887	41	2030	42783	133167	306	321
BOS	18581	7180	25761	822	541	108	1471	27232	39301	655	693
GUF	12777	5050	17827	2352	281	41	2674	20501	49703	359	412
GERMANY	**10970**	**5637**	**16607**	**1998**	**—**	**—**	**1998**	**18605**	**23010**	**722**	**809**
BAP	4692	1424	6116	20	—	—	20	6136	12610	485	487
WEB	6278	4213	10491	1978	—	—	1978	12469	10400	1009	1199
LATVIA	**61152**	**4790**	**65942**	**1551**	—	—	**1551**	**67493**	**141112**	**467**	**478**
BAP	6346	739	7085	239	—	—	239	7325	17119	414	428
GUR	54806	4051	58856	1312	—	—	1312	60168	123993	475	485
LITHUANIA	**47592**	**n.i.**	**47592**	**285**	**8.5**	**n.i.**	**293**	**47885**	**98912**	**481**	**484**
BAP	47592	n.i.	47592	285	8.5	n.i.	293	47885	98912	481	484
POLAND	**182325**	**8486**	**190811**	**341**	**15**	**n.i.**	**355**	**191166**	**331196**	**576**	**577**
BAP	182325	8486	190811	341	15	n.i.	355	191166	331196	576	577
RUSSIA	**59517**	**8630**	**68147**	**11008**	**33**	**n.i.**	**11041**	**79188**	**302641**	**225**	**262**
BAP	n.i.	n.i.	n.i.	2032	1.0	n.i.	2033	2033	15000	n.i.	n.i.
GUF	59517	8630	68147	8977	32	n.i.	9008	77155	287641	237	268
SWEDEN	**105659**	**36404**	**142063**	**8463**	**2548**	**n.i.**	**11011**	**153074**	**426408**	**333**	**359**
BAP	15740	16222	31962	3426	607	n.i.	4033	35995	67766	472	531
BOB	21268	4665	25933	813	364	n.i.	1177	27110	118710	218	228
BOS	36218	5125	41343	1700	1247	n.i.	2947	44290	170088	243	260
SOU	516	4140	4656	800	176	n.i.	976	5632	2409	1933	2338
KAT	31917	6252	38169	1724	154	n.i.	1877	40046	67435	566	594
Baltic Sea	**576384**	**129615**	**705999**	**32054**	**5767**	**1047**	**38867**	**744867**	**1670988**	**423**	**446**

— This source does not exit.
n.i. No information

Table 5.40: Load of total nitrogen (N_{total}) entering the Baltic Sea from each sub-region in 2000

Chapter 5.2.2

CP/Sub-region	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea				TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area-specific load from rivers and coastal areas	Area-specific total inputs into the Baltic Sea
N_{total}	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
FI	36263	4490	40753	1102	887	41	2030	42783	133167	306	321
SE	21268	4665	25933	813	364	n.i.	1177	27110	118710	218	228
BOB	**57531**	**9155**	**66686**	**1915**	**1251**	**41**	**3207**	**69893**	**251877**	**265**	**277**
FI	18581	7180	25761	822	541	108	1471	27232	39301	655	693
SE	36218	5125	41343	1700	1247	n.i.	2947	44290	170088	243	260
BOS	**54799**	**12305**	**67104**	**2522**	**1788**	**108**	**4418**	**71523**	**209389**	**320**	**342**
FI	3790	5690	9480	948	136	579	1663	11143	8952	1059	1245
ARC	**3790**	**5690**	**9480**	**948**	**136**	**579**	**1663**	**11143**	**8952**	**1059**	**1245**
EE	12365	2012	14377	902	626	—	1528	15905	67357	213	236
FI	12777	5050	17827	2352	281	41	2674	20501	49703	359	412
RU	59517	8630	68147	8977	32	n.i.	9008	77155	287641	237	268
GUF	**84659**	**15692**	**100351**	**12231**	**939**	**41**	**13211**	**113562**	**404701**	**248**	**281**
EE	4471	5365	9835	73	—	—	73	9908	17018	578	582
LV	54806	4051	58856	1312	—	—	1312	60168	123993	475	485
GUR	**59276**	**9415**	**68691**	**1385**	**—**	**—**	**1385**	**70076**	**141011**	**487**	**497**
DE	4692	1424	6116	20	—	—	20	6136	12610	485	487
DK	235	1331	1566	58	11	0.4	69	1635	1206	1299	1356
EE	n.i.	1061	1061	—	—	—	—	1061	1100	965	965
LT	47592	n.i.	47592	285	8.5	n.i.	293	47885	98912	481	484
LV	6346	739	7085	239	—	—	239	7325	17119	414	428
PL	182325	8486	190811	341	15	n.i.	355	191166	331196	576	577
RU	n.i.	n.i.	n.i.	2032	1.0	n.i.	2033	2033	15000		n.i.
SE	15740	16222	31962	3426	607	n.i.	4033	35995	67766	472	531
BAP	**256931**	**29263**	**286194**	**6400**	**642**	**n.i.**	**7042**	**293236**	**544909**	**525**	**538**
DE	6278	4213	10491	1978	—	—	1978	12469	10400	1009	1199
DK	8559	11309	19868	730	319	277	1326	21194	12342	1610	1717
WEB	**14837**	**15522**	**30358**	**2708**	**319**	**277**	**3305**	**33663**	**22742**	**1335**	**1480**
DK	470	979	1449	917	79	—	995	2445	1737	834	1407
SE	516	4140	4656	800	176	n.i.	976	5632	2409	1933	2338
SOU	**986**	**5119**	**6105**	**1716**	**255**	**n.i.**	**1971**	**8076**	**4146**	**1473**	**1948**
DK	11658	21203	32861	506	283	0.3	789	33650	15826	2076	2126
SE	31917	6252	38169	1724	154	n.i.	1877	40046	67435	566	594
KAT	**43575**	**27455**	**71030**	**2229**	**437**	**n.i.**	**2666**	**73696**	**83261**	**853**	**885**
Baltic Sea	**576384**	**129615**	**705999**	**32054**	**5767**	**1047**	**38867**	**744867**	**1670988**	**423**	**446**

— This source does not exit.
n.i. No information

Table 5.41: Load of total phosphorus (P_{total}) entering the Baltic Sea from each Contracting Party in 2000

Chapter 5.2.2

CP/Sub-region	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea				TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area-specific load from rivers and coastal areas	Area-specific total inputs into the Baltic Sea
P_{total}	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
DENMARK	**607**	**859**	**1466**	**324**	**38**	**30**	**391**	**1857**	**31111**	**47**	**60**
BAP	3.8	20	24	9.5	1.7	0.03	11	35	1206	20	29
KAT	369	505	874	71	19	0.04	90	965	15826	55	61
SOU	20	33	53	144	2.7	—	147	200	1737	30	115
WEB	213	301	514	100	14	30	143	658	12342	42	53
ESTONIA	**731**	**146**	**877**	**88**	**0.1**	**—**	**88**	**965**	**85475**	**10**	**11**
BAP	n.i.	11	11	—	—	—	—	11	1100	10	10
GUF	657	44	701	77	0.1	—	77	779	67357	10	12
GUR	74	90	164	11	—	—	11	175	17018	9.6	10
FINLAND	**3322**	**1208**	**4530**	**123**	**93**	**95**	**310**	**4840**	**231123**	**20**	**21**
ARC	321	484	805	22	2.1	71	96	901	8952	90	101
BOB	1790	207	1997	16	51	4.8	72	2068	133167	15	16
BOS	740	311	1051	13	17	14	43	1094	39301	27	28
GUF	471	206	677	72	23	5.3	100	777	49703	14	16
GERMANY	**301**	**161**	**462**	**25**	**—**	**—**	**25**	**487**	**23010**	**20**	**21**
BAP	134	41	174	0.9	—	—	0.9	175	12610	14	14
WEB	167	121	288	24	—	—	24	312	10400	28	30
LATVIA	**1854**	**140**	**1994**	**213**	**—**	**—**	**213**	**2207**	**141112**	**14**	**16**
BAP	128	14	142	31	—	—	31	173	17119	8.3	10
GUR	1727	125	1852	182	—	—	182	2034	123993	15	16
LITHUANIA	**1857**	**n.i.**	**1857**	**38**	**0.9**	**n.i.**	**39**	**1896**	**98912**	**19**	**19**
BAP	1857	n.i.	1857	38	0.9	n.i.	39	1896	98912	19	19
POLAND	**12021**	**571**	**12592**	**49**	**3.6**	**n.i.**	**53**	**12645**	**331196**	**38**	**38**
BAP	12021	571	12592	49	3.6	n.i.	53	12645	331196	38	38
RUSSIA	**2333**	**1050**	**3383**	**1231**	**9.8**	**—**	**1240**	**4623**	**302641**	**11**	**15**
BAP	n.i.	n.i.	n.i.	149	0.9	—	150	150	15000	n.i.	n.i.
GUF	2333	1050	3383	1081	8.9	—	1090	4473	287641	12	16
SWEDEN	**3704**	**778**	**4482**	**228**	**259**	**n.i.**	**487**	**4969**	**426408**	**11**	**12**
BAP	581	255	836	75	49	n.i.	124	961	67766	12	14
BOB	1124	206	1330	12	41	n.i.	53	1383	118710	11	12
BOS	1327	172	1499	36	141	n.i.	177	1676	170088	8.8	9.9
SOU	6.3	62	68	28	5.2	n.i.	33	101	2409	28	42
KAT	666	84	749	77	22	n.i.	100	849	67435	11	13
Baltic Sea	**26730**	**4912**	**31642**	**2319**	**404**	**124**	**2847**	**34489**	**1670988**	**19**	**21**

— This source does not exit.
n.i. No information

Table 5.42: Load of total phosphorus (P_{total}) entering the Baltic Sea from each sub-region in 2000

Chapter 5.2.2

CP/Sub-region P_{total}	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea				TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area-specific load from rivers and coastal areas	Area-specific total inputs into the Baltic Sea
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Fish farms	Total				
	in t	in t	in t	in t	in t	in t	in t	in t	in km^2	in kg/km^2	in kg/km^2
FI	1790	207	1997	16	51	4.8	72	2068	133167	15	16
SE	1124	206	1330	12	41	n.i.	53	1383	118710	11	12
BOB	**2914**	**413**	**3327**	**28**	**92**	**4.8**	**125**	**3451**	**251877**	**13**	**14**
FI	740	311	1051	13	17	14	43	1094	39301	27	28
SE	1327	172	1499	36	141	n.i.	177	1676	170088	8.8	9.9
BOS	**2066**	**483**	**2549**	**48**	**158**	**14**	**220**	**2769**	**209389**	**12**	**13**
FI	321	484	805	22	2.1	71	96	901	8952	90	101
ARC	**321**	**484**	**805**	**22**	**2.1**	**71**	**96**	**901**	**8952**	**90**	**101**
EE	657	44	701	77	0.1	—	77	779	67357	10	12
FI	471	206	677	72	23	5.3	100	777	49703	14	16
RU	2333	1050	3383	1081	8.9	—	1090	4473	287641	12	16
GUF	**3462**	**1300**	**4762**	**1230**	**32**	**5.3**	**1267**	**6029**	**404701**	**12**	**15**
EE	74	90	164	11	—	—	11	175	17018	9.6	10
LV	1727	125	1852	182	—	—	182	2034	123993	15	16
GUR	**1800**	**215**	**2016**	**193**	**—**	**—**	**193**	**2209**	**141011**	**14**	**16**
DE	134	41	174	0.9	—	—	0.9	175	12610	14	14
DK	3.8	20	24	9.5	1.7	0.03	11	35	1206	20	29
EE	n.i.	11	11	—	—	—	—	11	1100	10	10
LT	1857	n.i.	1857	38	0.9	n.i.	39	1896	98912	19	19
LV	128	14	142	31	—	—	31	173	17119	8.3	10
PL	12021	571	12592	49	3.6	n.i.	53	12645	331196	38	38
RU	n.i.	n.i.	n.i.	149	0.9	—	150	150	15000	n.i.	10
SE	581	255	836	75	49	n.i.	124	961	67766	12	14
BAP	**14724**	**912**	**15637**	**353**	**56**	**0.03**	**409**	**16046**	**544909**	**29**	**29**
DE	167	121	288	24	—	—	24	312	10400	28	30
DK	213	301	514	100	14	30	143	658	12342	42	53
WEB	**381**	**422**	**802**	**123**	**14**	**30**	**167**	**969**	**22742**	**35**	**43**
DK	20	33	53	144	2.7	—	147	200	1737	30	115
SE	6.3	61.6	68	28	5.2	n.i.	33	101	2409	28	42
SOU	**26**	**95**	**121**	**172**	**7.9**	**n.i.**	**180**	**300**	**4146**	**29**	**72**
DK	369	505	874	71	19	0.04	90	965	15826	55	61
SE	666	84	749	77	22	n.i.	100	849	67435	11	13
KAT	**1035**	**589**	**1624**	**148**	**42**	**0.04**	**190**	**1814**	**83261**	**20**	**22**
Baltic Sea	**26730**	**4912**	**31642**	**2319**	**404**	**124**	**2847**	**34489**	**1670988**	**19**	**21**

— This source does not exit.

n.i. No information

Table 5.43: Load of cadmium entering the Baltic Sea from each Contracting Party in 2000
Chapter 5.2.2

CP/Sub-region	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea			TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
Cd	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total			
	in t	in t	in t	in t	in t	in t	in t	in km²	in g/km²
DENMARK	**0.05**	**0.5**	**0.6**	**0.06**	**0.002**	**0.1**	**0.6**	**31111**	**21**
BAP	n.i.	n.i.	n.i.	0.002	0.0001	0.002	0.002	1206	1.6
KAT	0.02	0.1	0.2	0.01	0.001	0.01	0.2	15826	12
SOU	0.0006	0.03	0.03	0.03	0.0001	0.03	0.1	1737	36
WEB	0.02	0.4	0.4	0.02	0.0008	0.02	0.4	12342	32
ESTONIA	**0.6**	**n.i.**	**0.6**	**0.2**	**—**	**0.2**	**0.8**	**85475**	**6.7**
BAP	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
GUF	0.5	n.i.	0.5	0.2	—	0.2	0.7	67357	11
GUR	0.04	n.i.	0.04	—	—	—	0.04	17018	2.1
FINLAND	**2.6**	**0.8**	**3.4**	**n.i.**	**0.04**	**0.04**	**3.4**	**231123**	**15**
ARC	0.1	0.1	0.2	n.i.	0.001	0.001	0.2	8952	23
BOB[1]	1.6	0.2	1.7	n.i.	0.04	0.04	1.8	133167	13
BOS	0.7	0.4	1.1	n.i.	n.i.	n.i.	1.1	39301	27
GUF[2]	0.3	0.1	0.4	n.i.	n.i.	n.i.	0.4	49703	7.1
GERMANY	**0.1**	**0.04**	**0.1**	**0.002**	**—**	**0.002**	**0.1**	**23010**	**4.9**
BAP	0.05	0.02	0.07	0.0003	—	0.0003	0.1	12610	5.3
WEB	0.03	0.02	0.05	0.001	—	0.001	0.05	10400	4.6
LATVIA	**1.5**	**0.1**	**1.6**	**0.1**	**n.i.**	**0.1**	**1.7**	**141112**	**11**
BAP	0.1	0.009	0.1	0.08	n.i.	0.08	0.2	17119	10
GUR	1.4	0.1	1.5	0.01	n.i.	0.01	1.5	123993	12
LITHUANIA	**1.1**	**n.i.**	**1.1**	**n.i.**	**n.i.**	**n.i.**	**1.1**	**57438**	**19**
BAP[3]	1.1	n.i.	1.1	n.i.	n.i.	n.i.	1.1	57438	19
POLAND	**6.1**	**0.7**	**6.8**	**0.1**	**0.5**	**0.6**	**7.4**	**331196**	**21**
BAP	6.1	0.7	6.8	0.1	0.5	0.6	7.4	331196	22
RUSSIA	**34**	**0.3**	**34**	**0.2**	**n.i.**	**0.2**	**34**	**302641**	**113**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
GUF	34	0.3	34	0.2	n.i.	0.2	34	287641	120
SWEDEN	**2.7**	**0.3**	**3.0**	**0.1**	**0.4**	**0.4**	**3.4**	**426408**	**7.0**
BAP	0.7	0.1	0.8	0.03	0.1	0.1	0.9	67766	14
BOB[1]	0.5	0.1	0.6	0.01	0.05	0.1	0.7	118710	5.5
BOS	1.1	0.1	1.2	0.01	0.2	0.2	1.4	170088	8.2
SOU	0.001	0.02	0.02	0.01	—	0.01	0.03	2409	11
KAT	0.4	0.01	0.4	0.01	0.03	0.04	0.4	67435	6.3
Baltic Sea	**49**	**2.7**	**51**	**0.7**	**0.9**	**1.6**	**53**	**1629514**	**32**

— This source does not exit.
n.i. No information
[1] Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
[2] Load data and the surface area of the river Vuoksi is excluded
[3] Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
[4] Load data of the river Narva is included only in the Estonian figures

Table 5.44: Load of cadmium entering the Baltic Sea from each sub-region in 2000
Chapter 5.2.2

CP/Sub-region Cd	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea			TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total			
	in t	in t	in t	in t	in t	in t	in t	in km^2	in g/km^2
FI[1]	1.6	0.2	1.7	n.i.	0.04	0.04	1.8	133167	13
SE[1]	0.5	0.05	0.6	0.005	0.05	0.05	0.7	118710	5.5
BOB	**2.1**	**0.2**	**2.3**	**0.01**	**0.09**	**0.09**	**2.4**	**251877**	**9.6**
FI	0.7	0.4	1.1	n.i.	n.i.	n.i.	1.1	39301	27
SE	1.1	0.1	1.2	0.01	0.2	0.2	1.4	170088	8.2
BOS	**1.7**	**0.5**	**2.3**	**0.01**	**0.2**	**0.2**	**2.5**	**209389**	**12**
FI	0.08	0.1	0.2	n.i.	0.001	0.001	0.2	8952	23
ARC	**0.08**	**0.1**	**0.2**	**n.i.**	**0.001**	**0.001**	**0.2**	**8952**	**23**
EE[4]	0.5	n.i.	0.5	0.2	—	0.2	0.7	67357	11
FI[2]	0.3	0.09	0.4	n.i.	n.i.	n.i.	0.4	49703	7.1
RU[4]	34	0.3	34	0.2	n.i.	0.2	34	287641	120
GUF	**35**	**0.3**	**35**	**0.4**	**n.i.**	**0.4**	**35**	**404701**	**88**
EE	0.04	n.i.	0.04	—	—	—	0.04	17018	2.1
LV	1.4	0.1	1.5	0.01	n.i.	0.01	1.5	123993	12
GUR	**1.4**	**0.1**	**1.5**	**0.01**	**n.i.**	**0.01**	**1.5**	**141011**	**11**
DE	0.05	0.02	0.07	0.0003	—	0.0003	0.07	12610	5.3
DK	n.i.	n.i.	n.i.	0.002	0.0001	0.002	0.002	1206	1.6
EE	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
LT[3]	1.1	n.i.	1.1	n.i.	n.i.	n.i.	1.1	57438	19
LV	0.09	0.009	0.1	0.08	n.i.	0.1	0.2	17119	10
PL	6.1	0.7	6.8	0.1	0.5	0.6	7.4	331196	22
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	0	15000	n.i.
SE	0.7	0.1	0.8	0.03	0.1	0.1	0.9	67766	14
BAP	**8.1**	**0.8**	**8.9**	**0.2**	**0.6**	**0.8**	**9.7**	**503435**	**19**
DE	0.03	0.02	0.05	0.001	—	0.001	0.05	10400	4.6
DK	0.02	0.4	0.4	0.02	0.001	0.02	0.4	12342	32
WEB	**0.05**	**0.4**	**0.4**	**0.02**	**0.001**	**0.02**	**0.4**	**22742**	**19**
DK	0.0006	0.03	0.03	0.03	0.0001	0.03	0.06	1737	36
SE	0.001	0.02	0.0	0.01	—	0.01	0.03	2409	11
SOU	**0.0**	**0.05**	**0.05**	**0.04**	**0.0001**	**0.04**	**0.09**	**4146**	**22**
DK	0.02	0.1	0.2	0.01	0.001	0.01	0.2	15826	12
SE	0.4	0.008	0.4	0.01	0.03	0.04	0.4	67435	6.3
KAT	**0.4**	**0.2**	**0.6**	**0.03**	**0.03**	**0.1**	**0.6**	**83261**	**7.3**
Baltic Sea	**49**	**2.7**	**51**	**0.7**	**0.9**	**1.6**	**53**	**1629514**	**32**

— This source does not exit.
n.i. No information
[1] Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
[2] Load data and the surface area of the river Vuoksi is excluded
[3] Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
[4] Load data of the river Narva is included only in the Estonian figures

Table 5.45: Load of mercury entering the Baltic Sea from each Contracting Party in 2000

Chapter 5.2.2

CP/Sub-region	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea			TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
Hg	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total			
	in t	in t	in t	in t	in t	in t	in t	in km^2	in g/km^2
DENMARK	**0.007**	**0.2**	**0.2**	**0.06**	**0.002**	**0.06**	**0.2**	**31111**	**7.9**
BAP	n.i.	n.i.	n.i.	0.002	0.0001	0.002	0.002	1206	1.5
KAT	0.004	0.03	0.03	0.01	0.001	0.01	0.04	15826	2.7
SOU	0.0003	0.1	0.1	0.03	0.0002	0.03	0.1	1737	79
WEB	0.003	0.04	0.05	0.02	0.001	0.02	0.06	12342	5.2
ESTONIA	**1.1**	**n.i.**	**1.1**	**0.1**	**—**	**0.1**	**1.2**	**85475**	**14**
BAP	n.i.	n.i.	n.i.	—	—	—	—	1100	—
GUF	0.9	n.i.	0.9	0.1	—	0.1	1.0	67357	15
GUR	0.1	n.i.	0.1	—	—	—	0.1	17018	8.3
FINLAND	**0.7**	**n.i.**	**0.7**	**n.i.**	**0.01**	**0.01**	**0.7**	**231123**	**3.0**
ARC	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	8952	n.i.
BOB[1]	0.2	n.i.	0.2	n.i.	0.009	0.009	0.2	133167	1.3
BOS	0.5	n.i.	0.5	n.i.	n.i.	n.i.	0.5	39301	13
GUF[2]	0.04	n.i.	0.04	n.i.	n.i.	n.i.	0.04	49703	0.7
GERMANY	**0.03**	**0.01**	**0.04**	**0.001**	**—**	**0.001**	**0.04**	**23010**	**1.7**
BAP	0.01	0.004	0.01	0.0002	—	0.0002	0.02	12610	1.2
WEB	0.02	0.007	0.02	0.0006	—	0.0006	0.02	10400	2.3
LATVIA	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**141112**	**n.i.**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	17119	n.i.
GUR	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	123993	n.i.
LITHUANIA	**0.002**	**n.i.**	**0.002**	**n.i.**	**n.i.**	**n.i.**	**0.002**	**57438**	**0.04**
BAP[3]	0.002	n.i.	0.002	n.i.	n.i.	n.i.	0.002	57438	0.04
POLAND	**42**	**0.9**	**43**	**0.2**	**0.08**	**0.3**	**43**	**331196**	**131**
BAP	42	0.9	43	0.2	0.08	0.3	43	331196	131
RUSSIA	**n.i.**	**0.01**	**0.01**	**0.1**	**n.i.**	**0.1**	**0.1**	**302641**	**0.5**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
GUF	n.i.	0.01	0.01	0.1	n.i.	0.1	0.1	287641	0.5
SWEDEN	**0.5**	**0.1**	**0.5**	**0.04**	**0.05**	**0.09**	**0.6**	**426408**	**1.5**
BAP	0.03	0.006	0.03	0.01	0.001	0.01	0.05	67766	0.7
BOB[1]	0.2	0.02	0.2	0.002	0.04	0.04	0.3	118710	2.3
BOS	0.2	0.03	0.2	0.008	0.007	0.01	0.2	170088	1.2
SOU	0.0002	0.002	0.002	0.004	—	0.004	0.0	2409	2.7
KAT	0.1	0.001	0.09	0.02	0.002	0.02	0.1	67435	1.5
Baltic Sea	**45**	**1.1**	**46**	**0.5**	**0.1**	**0.7**	**46**	**1629514**	**28**

— This source does not exit.
n.i. No information
[1] Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
[2] Load data and the surface area of the river Vuoksi is excluded
[3] Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
[4] Load data of the river Narva is included only in the Estonian figures

Table 5.46: Load of mercury entering the Baltic Sea from each sub-region in 2000
Chapter 5.2.2

CP/Sub-region Hg	Load entering the Baltic Sea via rivers and unmonitored coastal areas: Monitored rivers	Load entering the Baltic Sea via rivers and unmonitored coastal areas: Coastal areas and unmonitored rivers	Load entering the Baltic Sea via rivers and unmonitored coastal areas: Total	Point source discharges entering directly into the Baltic Sea: MWWTP	Point source discharges entering directly into the Baltic Sea: Industry	Point source discharges entering directly into the Baltic Sea: Total	TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
	in t	in t	in t	in t	in t	in t	in t	in km^2	in g/km^2
FI[1]	0.2	n.i.	0.2	n.i.	0.01	0.01	0.2	133167	1.3
SE[1]	0.2	0.02	0.2	0.002	0.04	0.04	0.3	118710	2.3
BOB	**0.4**	**0.02**	**0.4**	**0.002**	**0.05**	**0.05**	**0.4**	**251877**	**1.8**
FI	0.5	n.i.	0.5	n.i.	n.i.	n.i.	0.5	39301	13
SE	0.2	0.03	0.2	0.01	0.01	0.01	0.2	170088	1.2
BOS	**0.7**	**0.03**	**0.7**	**0.01**	**0.01**	**0.01**	**0.7**	**209389**	**3.3**
FI	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	8952	n.i.
ARC	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**n.i.**	**8952**	**n.i.**
EE[4]	0.9	n.i.	0.9	0.1	—	0.1	1.0	67357	15
FI[2]	0.04	n.i.	0.04	n.i.	n.i.	n.i.	0.04	49703	0.7
RU[4]	n.i.	0.008	0.008	0.1	n.i.	0.1	0.1	287641	0.5
GUF	**1.0**	**0.008**	**1.0**	**0.2**	**n.i.**	**0.2**	**1.2**	**404701**	**3.0**
EE	0.1	n.i.	0.1	—	—	—	0.1	17018	8.3
LV	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	123993	n.i.
GUR	**0.1**	**n.i.**	**0.1**	**n.i.**	**n.i.**	**n.i.**	**0.1**	**141011**	**1.0**
DE	0.01	0.004	0.01	0.0002	—	0.0002	0.02	12610	1.2
DK	n.i.	n.i.	n.i.	0.002	0.0001	0.002	0.002	1206	1.5
EE	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
LT[3]	0.002	n.i.	0.002	n.i.	n.i.	n.i.	0.002	57438	0.04
LV	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	17119	n.i.
PL	42	0.9	43	0.2	0.1	0.3	43	331196	131
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
SE	0.03	0.006	0.03	0.01	0.001	0.01	0.05	67766	0.7
BAP	**42**	**0.9**	**43**	**0.2**	**0.1**	**0.3**	**43**	**503435**	**86**
DE	0.02	0.007	0.02	0.001	—	0.001	0.02	10400	2.3
DK	0.003	0.04	0.05	0.02	0.001	0.02	0.06	12342	5.2
WEB	**0.02**	**0.05**	**0.07**	**0.02**	**0.001**	**0.02**	**0.09**	**22742**	**3.9**
DK	0.0003	0.1	0.1	0.03	0.0002	0.03	0.1	1737	79
SE	0.0002	0.002	0.002	0.004	—	0.004	0.01	2409	2.7
SOU	**0.0005**	**0.1**	**0.1**	**0.03**	**0.0002**	**0.03**	**0.1**	**4146**	**35**
DK	0.004	0.03	0.03	0.01	0.001	0.01	0.04	15826	2.7
SE	0.08	0.001	0.09	0.02	0.002	0.02	0.1	67435	1.5
KAT	**0.09**	**0.03**	**0.1**	**0.03**	**0.003**	**0.03**	**0.1**	**83261**	**1.8**
Baltic Sea	**45**	**1.1**	**46**	**0.5**	**0.1**	**0.7**	**46**	**1629514**	**28**

— This source does not exit.
n.i. No information
[1] Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
[2] Load data and the surface area of the river Vuoksi is excluded
[3] Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
[4] Load data of the river Narva is included only in the Estonian figures

Table 5.47: Load of copper entering the Baltic Sea from each Contracting Party in 2000
Chapter 5.2.2

CP/Sub-region Cu	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea			TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total			
	in t	in t	in t	in t	in t	in t	in t	in km²	in g/km²
DENMARK	**6.0**	**45**	**51**	**0.003**	**0.1**	**0.1**	**51**	**31111**	**1645**
BAP	n.i.	n.i.	n.i.	0.0001	0.006	0.006	0.006	1206	5.1
KAT	5.2	32	37	0.001	0.07	0.07	37	15826	2363
SOU	0.1	2.2	2.3	0.001	0.01	0.01	2.3	1737	1318
WEB	0.7	11	11	0.001	0.05	0.05	11	12342	931
ESTONIA	**21**	**n.i.**	**21**	**1.5**	**0.3**	**1.8**	**23**	**85475**	**273**
BAP	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
GUF	19	n.i.	19	1.5	0.3	1.8	21	67357	306
GUR	2.7	n.i.	2.7	—	—	—	2.7	17018	158
FINLAND	**135**	**51**	**186**	**n.i.**	**0.7**	**0.7**	**186**	**231123**	**806**
ARC	13	19	31	n.i.	0.07	0.07	32	8952	3525
BOB[1]	60	7.1	67	n.i.	0.6	0.6	67	133167	506
BOS	40	15	55	n.i.	0.01	0.01	55	39301	1399
GUF[2]	23	9.8	32	n.i.	0.04	0.04	32	49703	652
GERMANY	**2.3**	**1.7**	**4.0**	**0.6**	**—**	**0.6**	**4.6**	**23010**	**199**
BAP	0.7	0.3	1.0	0.01	—	0.01	1.0	12610	77
WEB	1.6	1.4	3.1	0.6	—	0.6	3.6	10400	348
LATVIA	**39**	**3.0**	**42**	**1.9**	**n.i.**	**1.9**	**44**	**141112**	**311**
BAP	3.3	0.4	3.6	0.04	n.i.	0.04	3.7	17119	215
GUR	36	2.6	38	1.8	n.i.	1.8	40	123993	325
LITHUANIA	**21**	**n.i.**	**21**	**0.1**	**0.06**	**0.2**	**22**	**57438**	**377**
BAP[3]	21	n.i.	21	0.1	0.06	0.2	22	57438	377
POLAND	**90**	**1.7**	**92**	**0.2**	**0.02**	**0.2**	**92**	**331196**	**277**
BAP	90	1.7	92	0.2	0.02	0.2	92	331196	277
RUSSIA	**377**	**n.i.**	**382**	**3.7**	**0.1**	**3.8**	**386**	**302641**	**1274**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
GUF	377	4.4	382	3.7	0.1	3.8	386	287641	1341
SWEDEN	**231**	**18**	**249**	**6.5**	**3.5**	**10**	**259**	**426408**	**608**
BAP	38	4.7	43	2.6	0.6	3.3	46	67766	681
BOB[1]	54	3.0	57	0.6	0.6	1.2	58	118710	489
BOS	101	8.8	109	1.1	1.8	2.9	112	170088	660
SOU	0.1	1.3	1.4	0.9	—	0.9	2.3	2409	961
KAT	38	0.6	39	1.4	0.4	1.8	41	67435	602
Baltic Sea	**924**	**125**	**1049**	**15**	**4.8**	**19**	**1068**	**1629514**	**655**

— This source does not exit.
n.i. No information
[1] Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
[2] Load data and the surface area of the river Vuoksi is excluded
[3] Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
[4] Load data of the river Narva is included only in the Estonian figures

Table 5.48: Load of copper entering the Baltic Sea from each sub-region in 2000
Chapter 5.2.2

CP/Sub-region Cu	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea			TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total			
	in t	in t	in t	in t	in t	in t	in t	in km^2	in g/km^2
FI[1]	60	7.1	67	n.i.	0.6	0.6	67	133167	506
SE[1]	54	3.0	57	0.6	0.6	1.2	58	118710	489
BOB	**114**	**10**	**124**	**0.6**	**1.2**	**1.8**	**125**	**251877**	**498**
FI	40	15	55	n.i.	0.01	0.01	55	39301	1399
SE	101	8.8	109	1.1	1.8	2.9	112	170088	660
BOS	**141**	**23**	**164**	**1.1**	**1.8**	**2.9**	**167**	**209389**	**799**
FI	13	19	31	n.i.	0.1	0.1	32	8952	3525
ARC	**13**	**19**	**31**	**n.i.**	**0.1**	**0.1**	**32**	**8952**	**3525**
EE[4]	19	n.i.	19	1.5	0.3	1.8	21	67357	306
FI[2]	23	9.8	32	n.i.	0.04	0.04	32	49703	652
RU[4]	377	4.4	382	3.7	0.1	3.8	386	287641	1341
GUF	**419**	**14**	**433**	**5.2**	**0.5**	**5.7**	**439**	**404701**	**1084**
EE	2.7	n.i.	2.7	—	—	—	2.7	17018	158
LV	36	2.6	38	1.8	n.i.	1.8	40	123993	325
GUR	**38**	**2.6**	**41**	**1.8**	**n.i.**	**1.8**	**43**	**141011**	**304**
DE	0.7	0.3	1.0	0.01	—	0.01	1.0	12610	77
DK	n.i.	n.i.	n.i.	0.0001	0.006	0.006	0.006	1206	5.1
EE	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
LT[3]	21	n.i.	21	0.1	0.1	0.2	22	57438	377
LV	3.3	0.4	3.6	0.04	n.i.	0.04	3.7	17119	215
PL	90	1.7	92	0.2	0.02	0.2	92	331196	277
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
SE	38	4.7	43	2.6	0.6	3.3	46	67766	681
BAP	**153**	**7.1**	**161**	**3.0**	**0.7**	**3.7**	**164**	**503435**	326
DE	1.6	1.4	3.1	0.6	—	0.6	3.6	10400	348
DK	0.7	11	11	0.0009	0.05	0.05	11	12342	931
WEB	**2.3**	**12**	**14**	**0.6**	**0.05**	**0.6**	**15**	**22742**	**664**
DK	0.1	2.2	2.3	0.001	0.01	0.01	2.3	1737	1318
SE	0.1	1.3	1.4	0.9	—	0.9	2.3	2409	961
SOU	**0.2**	**3.5**	**3.7**	**0.9**	**0.01**	**0.9**	**4.6**	**4146**	**1111**
DK	5.2	32	37	0.0006	0.07	0.07	37	15826	2363
SE	38	0.6	39	1.4	0.4	1.8	41	67435	602
KAT	**43**	**33**	**76**	**1.4**	**0.5**	**1.8**	**78**	**83261**	**937**
Baltic Sea	**924**	**125**	**1049**	**15**	**4.8**	**19**	**1068**	**1629514**	**655**

— This source does not exit.
n.i. No information
[1] Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
[2] Load data and the surface area of the river Vuoksi is excluded
[3] Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
[4] Load data of the river Narva is included only in the Estonian figures

Table 5.49: Load of lead entering the Baltic Sea from each Contracting Party in 2000

Chapter 5.2.2

CP/Sub-region Pb	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea			TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total			
	in t	in t	in t	in t	in t	in t	in t	in km^2	in g/km^2
DENMARK	**1.0**	**9.0**	**10**	**0.001**	**0.07**	**0.07**	**10**	**31111**	**323**
BAP	n.i.	n.i.	n.i.	0.00003	0.003	0.003	0.003	1206	2.4
KAT	0.7	4.2	4.9	0.0002	0.03	0.03	4.9	15826	311
SOU	0.03	1.0	1.0	0.0005	0.005	0.005	1.0	1737	576
WEB	0.2	3.9	4.1	0.0003	0.02	0.02	4.1	12342	334
ESTONIA	**2.1**	**n.i.**	**2.1**	**0.01**	**—**	**0.01**	**2.2**	**85475**	**25**
BAP	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
GUF	1.9	n.i.	1.9	0.01	—	0.01	1.9	67357	28
GUR	0.3	n.i.	0.3	—	—	—	0.3	17018	17
FINLAND	**29**	**13**	**42**	**n.i.**	**0.01**	**0.01**	**42**	**231123**	**183**
ARC	4.3	6.4	11	n.i.	0.003	0.003	11	8952	1194
BOB[1]	12	1.4	13	n.i.	0.004	0.004	13	133167	99
BOS	8.2	2.2	10	n.i.	n.i.	n.i.	10	39301	264
GUF[2]	5.3	2.8	8.1	n.i.	0.007	0.007	8.1	49703	163
GERMANY	**1.2**	**0.6**	**1.8**	**0.01**	**—**	**0.01**	**1.8**	**23010**	**79**
BAP	0.6	0.2	0.8	0.001	—	0.001	0.8	12610	67
WEB	0.6	0.4	1.0	0.006	—	0.01	1.0	10400	94
LATVIA	**11**	**0.8**	**12**	**0.4**	**n.i.**	**0.4**	**13**	**141112**	**89**
BAP	0.7	0.07	0.7	0.2	n.i.	0.2	0.9	17119	54
GUR	11	0.8	11	0.2	n.i.	0.2	12	123993	94
LITHUANIA	**13**	**n.i.**	**13**	**n.i.**	**n.i.**	**n.i.**	**13**	**57438**	**233**
BAP[3]	13	n.i.	13	n.i.	n.i.	n.i.	13	57438	233
POLAND	**39**	**7.0**	**46**	**0.2**	**0.6**	**0.8**	**47**	**331196**	**142**
BAP	39	7.0	46	0.2	0.6	0.8	47	331196	142
RUSSIA	**286**	**2.0**	**288**	**1.9**	**n.i.**	**1.9**	**290**	**302641**	**958**
BAP	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
GUF	286	2.0	288	1.9	n.i.	1.9	290	287641	1008
SWEDEN	**50**	**5.1**	**55**	**0.7**	**1.9**	**2.6**	**58**	**426408**	**136**
BAP	6.0	1.5	7.5	0.2	0.3	0.6	8.0	67766	119
BOB[1]	9.0	0.8	9.7	0.05	0.6	0.7	10	118710	87
BOS	25	2.4	27	0.1	0.8	0.9	28	170088	165
SOU	0.03	0.3	0.4	0.1	—	0.06	0.4	2409	174
KAT	11	0.2	11	0.3	0.08	0.3	11	67435	165
Baltic Sea	**434**	**38**	**472**	**3.3**	**2.5**	**5.8**	**477**	**1629514**	**293**

— This source does not exit.
n.i. No information
[1] Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
[2] Load data and the surface area of the river Vuoksi is excluded
[3] Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
[4] Load data of the river Narva is included only in the Estonian figures

Table 5.50: Load of lead entering the Baltic Sea from each sub-region in 2000
Chapter 5.2.2

CP/Sub-region Pb	Load entering the Baltic Sea via rivers and unmonitored coastal areas: Monitored rivers	Coastal areas and unmonitored rivers	Total	Point source discharges entering directly into the Baltic Sea: MWWTP	Industry	Total	TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
	in t	in t	in t	in t	in t	in t	in t	in km²	in g/km²
FI[1]	12	1.4	13	n.i.	0.004	0.004	13	133167	99
SE[1]	9.0	0.8	9.7	0.05	0.6	0.7	10	118710	87
BOB	**21**	**2.2**	**23**	**0.05**	**0.6**	**0.7**	**24**	**251877**	**93**
FI	8.2	2.2	10	n.i.	n.i.	n.i.	10	39301	264
SE	25	2.4	27	0.1	0.8	0.9	28	170088	165
BOS	**33**	**4.6**	**37**	**0.1**	**0.8**	**0.9**	**38**	**209389**	**183**
FI	4.3	6.4	11	n.i.	0.003	0.003	11	8952	1194
ARC	**4.3**	**6.4**	**11**	**n.i.**	**0.003**	**0.003**	**11**	**8952**	**1194**
EE[4]	1.9	n.i.	1.9	0.01	—	0.01	1.9	67357	28
FI[2]	5.3	2.8	8.1	n.i.	0.01	0.01	8.1	49703	163
RU[4]	286	2.0	288	1.9	n.i.	1.9	290	287641	1008
GUF	**293**	**4.9**	**298**	**1.9**	**0.01**	**1.9**	**300**	**404701**	**741**
EE	0.3	n.i.	0.3	—	—	—	0.3	17018	17
LV	11	0.8	11	0.2	n.i.	0.2	12	123993	94
GUR	**11**	**0.8**	**12**	**0.2**	**n.i.**	**0.2**	**12**	**141011**	**84**
DE	0.6	0.2	0.8	0.001	—	0.001	0.8	12610	67
DK	n.i.	n.i.	n.i.	0.00003	0.003	0.003	0.003	1206	2.4
EE	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
LT[3]	13	n.i.	13	n.i.	n.i.	n.i.	13	57438	233
LV	0.7	0.07	0.7	0.2	n.i.	0.2	0.9	17119	54
PL	39	7.0	46	0.2	0.6	0.8	47	331196	142
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	15000	n.i.
SE	6.0	1.5	7.5	0.2	0.3	0.6	8.0	67766	119
BAP	**60**	**8.8**	**69**	**0.7**	**0.9**	**1.6**	**70**	**503435**	140
DE	0.6	0.4	1.0	0.006	—	0.006	1.0	10400	94
DK	0.2	3.9	4.1	0.0003	0.02	0.02	4.1	12342	334
WEB	**0.8**	**4.2**	**5.1**	**0.007**	**0.02**	**0.03**	**5.1**	**22742**	**225**
DK	0.03	1.0	1.0	0.0005	0.005	0.01	1.0	1737	576
SE	0.03	0.3	0.4	0.1	—	0.1	0.4	2409	174
SOU	**0.05**	**1.3**	**1.4**	**0.1**	**0.005**	**0.1**	**1.4**	**4146**	**342**
DK	0.7	4.2	4.9	0.0002	0.03	0.03	4.9	15826	311
SE	11	0.2	11	0.3	0.1	0.3	11	67435	165
KAT	**11**	**4.4**	**16**	**0.3**	**0.1**	**0.4**	**16**	**83261**	**193**
Baltic Sea	**434**	**38**	**472**	**3.3**	**2.5**	**5.8**	**477**	**1629514**	**293**

— This source does not exit.
n.i. No information
[1] Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
[2] Load data and the surface area of the river Vuoksi is excluded
[3] Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
[4] Load data of the river Narva is included only in the Estonian figures

Table 5.51: Load of zinc entering the Baltic Sea from each Contracting Party in 2000

Chapter 5.2.2

CP/Sub-region Zn	Load entering the Baltic Sea via rivers and unmonitored coastal areas: Monitored rivers	Coastal areas and unmonitored rivers	Total	Point source discharges entering directly into the Baltic Sea: MWWTP	Industry	Total	TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
	in t	in t	in t	in t	in t	in t	in t	in km^2	in g/km^2
DENMARK	**11**	**107**	**118**	**0.05**	**0.2**	**0.3**	**119**	**31111**	**3814**
BAP	n.i.	n.i.	n.i.	0.001	0.01	0.01	0.01	1206	9.8
KAT	7.6	46	54	0.01	0.1	0.1	54	15826	3413
SOU	0.2	10	10	0.02	0.02	0.04	10	1737	5895
WEB	3.3	51	54	0.01	0.09	0.1	54	12342	4405
ESTONIA	**33**	**n.i.**	**33**	**3.1**	**0.3**	**3.4**	**36**	**85475**	**426**
BAP	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
GUF	28	n.i.	28	3.1	0.3	3.4	32	67357	473
GUR	4.6	n.i.	4.6	—	—	—	4.6	17018	269
FINLAND	**607**	**255**	**862**	**n.i.**	**7.6**	**7.6**	**870**	**231123**	**3763**
ARC	42	63	105	n.i.	0.1	0.1	106	8952	11786
BOB[1]	373	58	431	n.i.	4.4	4.4	435	133167	3268
BOS	121	97	218	n.i.	3.1	3.1	221	39301	5618
GUF[2]	71	37	108	n.i.	0.1	0.1	108	49703	2177
GERMANY	**8.2**	**5.6**	**14**	**1.0**	**—**	**1.0**	**15**	**23010**	**642**
BAP	3.9	1.4	5.3	0.04	—	0.04	5.3	12610	421
WEB	4.4	4.2	8.5	0.9	—	0.9	9.5	10400	909
LATVIA	**137**	**11**	**148**	**5.7**	**n.i.**	**5.7**	**154**	**141112**	**1090**
BAP	18	2.2	20	0.4	n.i.	0.4	20	17119	1183
GUR	120	8.6	128	5.3	n.i.	5.3	134	123993	1077
LITHUANIA	**138**	**n.i.**	**138**	**1.3**	**0.2**	**1.5**	**139**	**57438**	**2425**
BAP[3]	138	n.i.	138	1.3	0.2	1.5	139	57438	2425
POLAND	**685**	**10**	**695**	**1.4**	**0.6**	**2.0**	**697**	**331196**	**2105**
BAP	685	10	695	1.4	0.6	2.0	697	331196	2105
RUSSIA	**55**	**42**	**96**	**41**	**—**	**41**	**137**	**302641**	**453**
BAP	n.i.	n.i.	n.i.	—	—	—	n.i.	15000	n.i.
GUF	55	42	96	41	—	41	137	287641	477
SWEDEN	**772**	**63**	**835**	**17**	**40**	**57**	**892**	**426408**	**2091**
BAP	63	17	80	9.1	8.3	17	97	67766	1436
BOB[1]	156	11	167	1.4	5.0	6.4	174	118710	1462
BOS	431	31	461	1.9	25	27	489	170088	2872
SOU	0.2	2.9	3.1	1.3	—	1.3	4.4	2409	1830
KAT	122	1.4	123	2.9	2.0	4.9	128	67435	1896
Baltic Sea	**2446**	**493**	**2939**	**70**	**49**	**119**	**3059**	**1629514**	**1877**

— This source does not exit.
n.i. No information
1 Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
2 Load data and the surface area of the river Vuoksi is excluded
3 Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
4 Load data of the river Narva is included only in the Estonian figures

Table 5.52: Load of zinc entering the Baltic Sea from each sub-region in 2000
Chapter 5.2.2

CP/Sub-region Zn	Load entering the Baltic Sea via rivers and unmonitored coastal areas			Point source discharges entering directly into the Baltic Sea			TOTAL LOAD into the BALTIC SEA	Total drainage area considered	Area specific total inputs into the Baltic Sea
	Monitored rivers	Coastal areas and unmonitored rivers	Total	MWWTP	Industry	Total			
	in t	in t	in t	in t	in t	in t	in t	in km²	in g/km²
FI[1]	373	58	431	n.i.	4.4	4.4	435	133167	3268
SE[1]	156	11	167	1.4	5.0	6.4	174	118710	1462
BOB	**529**	**69**	**598**	**1.4**	**9.4**	**11**	**609**	**251877**	**2417**
FI	121	97	218	n.i.	3.1	3.1	221	39301	5618
SE	431	31	461	1.9	25	27	489	170088	2872
BOS	**552**	**127**	**679**	**1.9**	**28**	**30**	**709**	**209389**	**3388**
FI	42	63	105	n.i.	0.1	0.1	106	8952	11786
ARC	**42**	**63**	**105**	**n.i.**	**0.1**	**0.1**	**106**	**8952**	**11786**
EE[4]	28	n.i.	28	3.1	0.3	3.4	32	67357	473
FI[2]	71	37	108	n.i.	0.1	0.1	108	49703	2177
RU[4]	55	42	96	41	—	41	137	287641	477
GUF	**154**	**79**	**233**	**44**	**0.4**	**44**	**277**	**404701**	**685**
EE	4.6	n.i.	4.6	—	—	—	4.6	17018	269
LV	120	8.6	128	5.3	n.i.	5.3	134	123993	1077
GUR	**124**	**8.6**	**133**	**5.3**	**n.i.**	**5.3**	**138**	**141011**	**979**
DE	3.9	1.4	5.3	0.04	—	0.04	5.3	12610	421
DK	n.i.	n.i.	n.i.	0.001	0.01	0.01	0.01	1206	9.8
EE	n.i.	n.i.	n.i.	—	—	—	n.i.	1100	n.i.
LT[3]	138	n.i.	138	1.3	0.2	1.5	139	57438	2425
LV	18	2.2	20	0.4	n.i.	0.4	20	17119	1183
PL	685	10	695	1.4	0.6	2.0	697	331196	2105
RU	n.i.	n.i.	n.i.	—	—	—	n.i.	15000	n.i.
SE	63	17	80	9.1	8.3	17	97	67766	1436
BAP	**907**	**31**	**938**	**12**	**9.2**	**21**	**959**	**503435**	1906
DE	4.4	4.2	8.5	0.9	—	0.9	9.5	10400	909
DK	3.3	51	54	0.01	0.09	0.1	54	12342	4405
WEB	**7.7**	**55**	**63**	**0.9**	**0.09**	**1.0**	**64**	**22742**	**2807**
DK	0.2	10	10	0.02	0.02	0.04	10	1737	5895
SE	0.2	2.9	3.1	1.3	—	1.3	4.4	2409	1830
SOU	**0.4**	**13**	**13**	**1.3**	**0.02**	**1.4**	**15**	**4146**	**3533**
DK	7.6	46	54	0.01	0.1	0.1	54	15826	3413
SE	122	1.4	123	2.9	2.0	4.9	128	67435	1896
KAT	**129**	**48**	**177**	**2.9**	**2.1**	**5.1**	**182**	**83261**	**2184**
Baltic Sea	**2446**	**493**	**2939**	**70**	**49**	**119**	**3059**	**1629514**	**1877**

— This source does not exit.
n.i. No information
1 Load data of the river Tornionjoki is included only in the Swedish figures (Torne älv)
2 Load data and the surface area of the river Vuoksi is excluded
3 Load data of the river Nemunas includes only the territory of Lithuania not the whole catchment
4 Load data of the river Narva is included only in the Estonian figures

Table 5.53: Source apportionment for the total riverine nitrogen load by Contracting Party in 2000

Contracting Parties/sub-regions	Natural background losses		Anthropogenic losses and discharges				Grossload	Retention		Total waterborne load (rivers and unmonitored areas)
			Diffuse losses		Point source discharges					
	in t	in %	in t	in %	in t	in %	in t	in t	in %	in t
DENMARK	**6583**	**10.6%**	**53032**	**85.2%**	**2631**	**4.2%**	**62245**	**6502**	**10.4%**	**55743**
BAP	256	16.2%	1290	81.4%	39	2.5%	1585	19	1.2%	1566
KAT	3346	9.3%	31208	87.0%	1303	3.6%	35858	2997	8.4%	32861
SOU	360	17.1%	1553	73.9%	190	9.0%	2102	653	31.1%	1449
WEB	2621	11.5%	18981	83.6%	1099	4.8%	22700	2833	12.5%	19867
ESTONIA	**5792**	**17.6%**	**25971**	**78.7%**	**1229**	**3.7%**	**32991**	**7718**	**23.4%**	**25273**
BAP	252	22.7%	858	77.1%	3.2	0.3%	1114	53	4.8%	1061
GUF	3965	20.7%	14069	73.5%	1106	5.8%	19139	4762	24.9%	14377
GUR	1575	12.4%	11043	86.7%	120	0.9%	12738	2903	22.8%	9835
FINLAND	**56404**	**42.9%**	**65034**	**49.5%**	**10015**	**7.6%**	**131453**	**37632**	**28.6%**	**93821**
ARC	2610	27.2%	6856	71.4%	136	1.4%	9602	122	1.3%	9480
BOB	24000	54.0%	18577	41.8%	1908	4.3%	44485	3732	8.4%	40753
BOS	11720	36.4%	18514	57.5%	1969	6.1%	32203	6442	20.0%	25761
GUF	18074	40.0%	21086	46.7%	6003	13.3%	45163	27336	60.5%	17827
GERMANY	**5794**	**23.0%**	**16991**	**67.5%**	**2393**	**9.5%**	**25179**	**8572**	**34.0%**	**16607**
BAP	2400	20.8%	8221	71.3%	910	7.9%	11531	5415	47.0%	6116
WEB	3394	24.9%	8770	64.3%	1483	10.9%	13648	3157	23.1%	10491
LATVIA[1]	**18370**	**34.0%**	**34023**	**63.0%**	**1581**	**2.9%**	**53973**	**24419**	**45.2%**	**29554**
BAP	3111	37.4%	5060	60.9%	140	1.7%	8310	2642	31.8%	5668
GUR	15259	33.4%	28963	63.4%	1441	3.2%	45663	21777	47.7%	23886
LITHUANIA[2]	**6918**	**21.0%**	**24839**	**75.5%**	**1149**	**3.5%**	**32906**	**294**	**0.9%**	**32612**
BAP	6918	21.0%	24839	75.5%	1149	3.5%	32906	294	0.9%	32612
POLAND[3]	**47002**	**13.9%**	**250803**	**74.0%**	**41342**	**12.2%**	**339147**	**148336**	**43.7%**	**190811**
BAP	47002	13.9%	250803	74.0%	41342	12.2%	339147	148336	43.7%	190811
RUSSIA	**45291**	**74.1%**	**8426**	**13.8%**	**7787**	**12.7%**	**61105**	**n.i.**	**n.i.**	**61105**
BAP	n.i.	n.i.	n.i.	n.i.	400	n.i.	n.i.	n.i.	n.i.	n.i.
GUF	45291	74.1%	8426	13.8%	7387	12.1%	61105	n.i.	n.i.	61105
SWEDEN	**67364**	**36.1%**	**109037**	**58.4%**	**10419**	**5.6%**	**186820**	**44757**	**24.0%**	**142063**
BAP	9759	19.4%	35921	71.6%	4496	9.0%	50176	18214	36.3%	31962
BOB	16819	60.0%	10769	38.4%	443	1.6%	28031	2098	7.5%	25933
BOS	25962	53.1%	21217	43.4%	1760	3.6%	48938	7595	15.5%	41343
SOU	939	17.7%	4155	78.3%	213	4.0%	5306	650	12.3%	4656
KAT	13885	25.5%	36977	68.0%	3508	6.5%	54369	16200	29.8%	38169
Baltic Sea	**259518**	**28%**	**588156**	**64%**	**78546**	**8.5%**	**925819**	**278230**	**30%**	**647589**

n.i. No information
[1] All figures refer only to the Latvian territory.
[2] All figures refer only to the Lithuanian territory.
[3] Polish point source load data are based on inventory, diffuse load data include also point source load data not covered by the inventory

Table 5.54: Source apportionment for the total riverine phosphorus load by Contracting Party in 2000

Contracting Parties/sub-regions	Natural background losses		Anthropogenic losses and discharges				Grossload	Retention		Total waterborne load (rivers and unmonitored areas)
			Diffuse losses		Point source discharges					
	in t	in %	in t	in %	in t	in %	in t	in t	in %	in t
DENMARK	**227**	**15.2%**	**943**	**63.2%**	**322**	**21.6%**	**1492**	**27**	**1.8%**	**1465**
BAP	8.8	36.2%	9.5	38.8%	6.1	25.0%	24	0.1	0.5%	24
KAT	115	13.0%	620	69.8%	153	17.2%	888	14	1.6%	874
SOU	12	21.8%	11	20.0%	33	58.1%	57	4.3	7.6%	53
WEB	90	17.3%	302	57.8%	130	24.9%	522	8.4	1.6%	514
ESTONIA	**259**	**18.9%**	**971**	**70.7%**	**142**	**10.4%**	**1373**	**496**	**36.1%**	**877**
BAP	9.2	64.7%	3.4	23.7%	1.6	11.6%	14	3.0	21.1%	11
GUF	146	15.5%	675	72.0%	116	12.4%	936	235	25.1%	701
GUR	105	24.8%	293	69.4%	24	5.8%	422	258	61.1%	164
FINLAND	**1911**	**31.1%**	**3933**	**64.0%**	**302**	**4.9%**	**6146**	**1616**	**26.3%**	**4530**
ARC	88	10.8%	722	88.8%	3.8	0.5%	813	8.0	1.0%	805
BOB	1107	51.2%	993	45.9%	63	2.9%	2163	166	7.7%	1997
BOS	264	19.2%	1061	77.1%	50	3.7%	1376	325	23.6%	1051
GUF	452	25.2%	1157	64.5%	186	10.3%	1794	1117	**62.2%**	677
GERMANY	**247**	**21.1%**	**849**	**72.6%**	**74**	**6.3%**	**1170**	**708**	**60.5%**	**462**
BAP	145	28.7%	310	61.0%	52	10.3%	507	333	65.6%	174
WEB	102	15.4%	540	81.4%	21	3.2%	663	375	56.6%	288
LATVIA[1]	**335**	**22.9%**	**848**	**58.1%**	**276**	**18.9%**	**1458**	**588**	**40.3%**	**870**
BAP	60	41.1%	51	35.2%	35	23.8%	145	38	26.2%	107
GUR	275	21.0%	797	60.7%	242	18.4%	1314	550	41.9%	764
LITHUANIA[2]	**171**	**13.7%**	**990**	**79.2%**	**88**	**7.1%**	**1249**	**29**	**2.3%**	**1220**
BAP	171	13.7%	990	79.2%	88	7.1%	1249	29	2.3%	1220
POLAND[3]	**3148**	**15.4%**	**11858**	**57.9%**	**5469**	**26.7%**	**20475**	**7883**	**38.5%**	**12592**
BAP	3148	15.4%	11858	57.9%	5469	26.7%	20475	7883	38.5%	12592
RUSSIA	**866**	**28.7%**	**930**	**30.8%**	**1279**	**42.4%**	**3016**	**n.i.**	**n.i.**	**3016**
BAP	n.i.	n.i.	n.i.	n.i.	59	n.i.	n.i.	n.i.	n.i.	n.i
GUF	866	28.7%	930	30.8%	1220	40.5%	3016	n.i.	n.i.	3016
SWEDEN	**3799**	**61.0%**	**2178**	**35.0%**	**250**	**4.0%**	**6226**	**1744**	**28.0%**	**4482**
BAP	227	19.5%	859	73.7%	80	6.9%	1166	330	28.3%	836
BOB	1372	96.4%	48	3.3%	4.4	0.3%	1424	94	6.6%	1330
BOS	1814	82.1%	347	15.7%	48	2.2%	2209	710	32.1%	1499
SOU	12	9.4%	111	87.1%	4.4	3.5%	128	60	46.9%	68
KAT	374	28.8%	812	62.5%	113	8.7%	1299	550	42.3%	749
Baltic Sea	**10963**	**26%**	**23499**	**55%**	**8202**	**19%**	**42605**	**13091**	**31%**	**29514**

n.i. No information

[1] All figures refer only to the Latvian territory.

[2] All figures refer only to the Lithuanian territory.

[3] Polish point source load data are based on inventory, diffuse load data include also point source load data not covered by the inventory

Table 5.55: Source apportionment for the total riverine nitrogen load by sub-region in 2000

Contracting Parties/sub-regions	Natural background losses		Anthropogenic losses and discharges				Grossload	Retention		Total waterborne load (rivers and unmonitored areas)
			Diffuse losses		Point source discharges					
	in t	in %	in t	in %	in t	in %	in t	in t	in %	in t
FI	24000	54.0%	18577	41.8%	1908	4.3%	44485	3732	8.4%	40753
SE	16819	60.0%	10769	38.4%	443	1.6%	28031	2098	7.5%	25933
BOB	**40819**	**56.3%**	**29346**	**40.5%**	**2351**	**3.2%**	**72516**	**5830**	**8.0%**	**66686**
FI	11720	36.4%	18514	57.5%	1969	6.1%	32203	6442	20.0%	25761
SE	25962	53.1%	21217	43.4%	1760	3.6%	48938	7595	15.5%	41343
BOS	**37682**	**46.4%**	**39731**	**49.0%**	**3728**	**4.6%**	**81141**	**14037**	**17.3%**	**67104**
FI	2610	27.2%	6856	71.4%	136	1.4%	9602	122	1.3%	9480
ARC	**2610**	**27.2%**	**6856**	**71.4%**	**136**	**1.4%**	**9602**	**122**	**1.3%**	**9480**
EE	3965	20.7%	14069	73.5%	1106	5.8%	19139	4762	24.9%	14377
FI	18074	40.0%	21086	46.7%	6003	13.3%	45163	27336	60.5%	17827
RU	45291	74.1%	8426	13.8%	7387	12.1%	61105	n.i.	n.i.	61105
GUF	**67330**	**53.7%**	**43581**	**34.8%**	**14496**	**11.6%**	**125407**	**32098**	**25.6%**	**93309**
EE	1575	12.4%	11043	86.7%	120	0.9%	12738	2903	22.8%	9835
LV[1]	15259	33.4%	28963	63.4%	1441	3.2%	45663	21777	47.7%	23886
GUR	**16834**	**28.8%**	**40006**	**68.5%**	**1561**	**2.7%**	**58401**	**24680**	**42.3%**	**33721**
DE	2400	20.8%	8221	71.3%	910	7.9%	11531	5415	47.0%	6116
DK	256	16.2%	1290	81.4%	39	2.5%	1585	19	1.2%	1566
EE	252	22.7%	858	77.1%	3	0.3%	1114	53	4.8%	1061
LV[1]	3111	37.4%	5060	60.9%	140	1.7%	8310	2642	31.8%	5668
LT[2]	6918	21.0%	24839	75.5%	1149	3.5%	32906	294	0.9%	32612
PL[3]	47002	13.9%	250803	74.0%	41342	12.2%	339147	148336	43.7%	190811
RU	n.i.	n.i.	n.i.	n.i.	400	n.i.	n.i.	n.i.	n.i.	n.i.
SE	9759	19.4%	35921	71.6%	4496	9.0%	50176	18214	36.3%	31962
BAP	**69699**	**15.7%**	**326992**	**73.5%**	**48479**	**10.9%**	**444769**	**174973**	**39.3%**	**269796**
DE	3394	24.9%	8770	64.3%	1483	10.9%	13648	3157	23.1%	10491
DK	2621	11.5%	18981	83.6%	1099	4.8%	22700	2833	12.5%	19867
WEB	**6015**	**16.5%**	**27751**	**76.3%**	**2582**	**7.1%**	**36348**	**5990**	**16.5%**	**30358**
DK	360	17.1%	1553	73.9%	190	9.0%	2102	653	31.1%	1449
SE	939	17.7%	4155	78.3%	213	4.0%	5306	650	12.3%	4656
SOU	**1299**	**17.5%**	**5707**	**77.0%**	**402**	**5.4%**	**7408**	**1303**	**17.6%**	**6105**
DK	3346	9.3%	31208	87.0%	1303	3.6%	35858	2997	8.4%	32861
SE	13885	25.5%	36977	68.0%	3508	6.5%	54369	16200	29.8%	38169
KAT	**17231**	**19.1%**	**68184**	**75.6%**	**4811**	**5.3%**	**90227**	**19197**	**21.3%**	**71030**
Baltic Sea	**259518**	**28%**	**588156**	**64%**	**78546**	**8.5%**	**925819**	**278230**	**30%**	**647589**

n.i. No information

1 All figures refer only to the Latvian territory.

2 All figures refer only to the Lithuanian territory.

3 Polish point source load data are based on inventory, diffuse load data include also point source load data not covered by the inventory

Table 5.56: Source apportionment for the total riverine phosphorus load by sub-region in 2000

Contracting Parties/sub-regions	Natural background losses		Anthropogenic losses and discharges				Grossload	Retention		Total waterborne load (rivers and unmonitored areas)
			Diffuse losses		Point source discharges					
	in t	in %	in t	in %	in t	in %	in t	in t	in %	in t
FI	1107	51.2%	993	45.9%	63	2.9%	2163	166	7.7%	1997
SE	1372	96.4%	48	3.3%	4.4	0.3%	1424	94	n.i.	1330
BOB	**2479**	**69.1%**	**1041**	**29.0%**	**67**	**1.9%**	**3587**	**260**	7.2%	**3327**
FI	264	19.2%	1061	77.1%	50	3.7%	1376	325	23.6%	1051
SE	1814	82.1%	347	15.7%	48	2.2%	2209	710	32.1%	1499
BOS	**2078**	**58.0%**	**1408**	**39.3%**	**98**	**2.7%**	**3584**	**1035**	**28.9%**	**2549**
FI	88	10.8%	722	88.8%	3.8	0.5%	813	8.0	1.0%	805
ARC	**88**	**10.8%**	**722**	**88.8%**	**3.8**	**0.5%**	**813**	**8.0**	**1.0%**	**805**
EE	146	15.5%	675	72.0%	116	12.4%	936	235	25.1%	701
FI	452	25.2%	1157	64.5%	186	10.3%	1794	1117	**62.2%**	677
RU	866	28.7%	930	30.8%	1220	40.5%	3016	n.i.	n.i.	3016
GUF	**1463**	**25.5%**	**2761**	**48.0%**	**1522**	**26.5%**	**5746**	**1352**	23.5%	**4394**
EE	105	24.8%	293	69.4%	24	5.8%	422	258	61.1%	164
LV[1]	275	21.0%	797	60.7%	242	18.4%	1314	550	41.9%	764
GUR	**380**	**21.9%**	**1090**	**62.8%**	**266**	**15.3%**	**1736**	**808**	**46.6%**	**928**
DE	145	28.7%	310	61.0%	52	10.3%	507	333	65.6%	174
DK	8.8	36.2%	9.5	38.8%	6.1	25.0%	24	0.1	0.5%	24
EE	9	64.7%	3.4	23.7%	1.6	11.6%	14	3.0	21.1%	11
LV[1]	60	41.1%	51	35.2%	35	23.8%	145	38	26.2%	107
LT[2]	171	13.7%	990	79.2%	88	7.1%	1249	29	2.3%	1220
PL[3]	3148	15.4%	11858	57.9%	5469	26.7%	20475	7883	38.5%	12592
RU	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
SE	227	19.5%	859	73.7%	80	6.9%	1166	330	28.3%	836
BAP	**3770**	**16.0%**	**14080**	**59.7%**	**5732**	**24.3%**	**23581**	**8616**	**36.5%**	**14965**
DE	102	15.4%	540	81.4%	21	3.2%	663	375	56.6%	288
DK	90	17.3%	302	57.8%	130	24.9%	522	8.4	1.6%	514
WEB	**192**	**16.2%**	**842**	**71.0%**	**151**	**12.8%**	**1185**	**383**	**32.3%**	**802**
DK	12	21.8%	11	20.0%	33	58.1%	57	4.3	7.6%	53
SE	12	9.4%	111	87.1%	4.4	3.5%	128	60	46.9%	68
SOU	**24**	**13.2%**	**123**	**66.4%**	**38**	**20.3%**	**185**	**64**	**34.8%**	**121**
DK	115	13.0%	620	69.8%	153	17.2%	888	14	1.6%	874
SE	374	28.8%	812	62.5%	113	8.7%	1299	550	42.3%	749
KAT	**489**	**22.4%**	**1432**	**65.5%**	**266**	**12.2%**	**2187**	**564**	**25.8%**	**1623**
Baltic Sea	**10963**	**26%**	**23499**	**55%**	**8143**	**19%**	**42605**	**13091**	**31%**	**29514**

n.i. No information

[1] All figures refer only to the Latvian territory.

[2] All figures refer only to the Lithuanian territory.

[3] Polish point source load data are based on inventory, diffuse load data include also point source load data not covered by the inventory

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