Convention on Long-range Transboundary Air Pollution

emep

Co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe

TECHNICAL REPORT
MSC-W 3/2008

Estimation of atmospheric nitrogen deposition to the Baltic Sea in the periods 1997-2003 and 2000-2006

Jerzy Bartnicki
Semeena Valiyaveetil

msc-w

Estimation of atmospheric nitrogen deposition to the Baltic Sea in the periods 1997-2003 and 2000-2006

Summary Report for HELCOM

Jerzy Bartnicki and Semeena Valiyaveetil

Meteorological Synthesizing Centre-West (MSC-W) of EMEP

OSLO

December 2008

Content

Introduction 3

1. New version (2008) of the EMEP unified model 5

2. Nitrogen emissions in the period 1997-2006 7

3. Calculated annual depositions of nitrogen in the period 1997-2006 11

4. Contributions of country and shipping emissions to deposition 14
- 4.1 **Contributions to the Baltic Sea** 15
- 4.2 **Contributions to the Bothnian Bay sub-basin** 19
- 4.3 **Contributions to the Bothnian Sea sub-basin** 23
- 4.4 **Contributions to the Gulf of Finland sub-basin** 27
- 4.5 **Contributions to the Gulf of Riga sub-basin** 31
- 4.6 **Contributions to the Baltic Proper sub-basin** 35
- 4.7 **Contributions to the Danish Straits sub-basin** 39
- 4.8 **Contributions to the Kattegat sub-basin** 43

5. Contributions of emission sectors to deposition 47
- 5.1 **Contributions to the Baltic Sea** 48
- 5.2 **Contributions to the Bothnian Bay sub-basin** 49
- 5.3 **Contributions to the Bothnian Sea sub-basin** 50
- 5.4 **Contributions to the Gulf of Finland sub-basin** 51
- 5.5 **Contributions to the Gulf of Riga sub-basin** 52
- 5.6 **Contributions to the Baltic Proper sub-basin** 53
- 5.7 **Contributions to the Danish Straits sub-basin** 54
- 5.8 **Contributions to the Kattegat sub-basin** 55

Conclusions 56

References 58

Appendix A: List of files with the EMEP products 61

Introduction

In this report we describe the results of the project in which MSC/W of EMEP has performed a very large number of runs with the EMEP unified model for the HELCOM needs. The main goal of the project was estimation of nitrogen deposition to the Baltic Sea and its sub-basins in the periods 1997-2003 and 2000-2006, as well as identification of the main emission sources contributing to this deposition. The emission sources of special interest for the project were: all HELCOM Contracting parties and international ship traffic on the Baltic Sea. The results of the project are necessary for further work on implementation of the eutrophication segment of the Balti Sea Action Plan (BSAP).

The specific tasks for EMEP in the frame of the project are listed below:

1. Calculation of total nitrogen deposition to the Baltic Sea for each individual year of the period 1997-2003 and average for the entire period.
2. Calculation of total nitrogen deposition to the Baltic Sea sub-basins, as defined in BSAP, for each individual year of the period 1997-2003 and average for the entire period.
3. Estimation of the quantities of deposition originating from each of the HELCOM countries, other countries as a total sum and from shipping. Deposition to the Baltic Sea and each of its (BSAP) sub-basins, averaged over the entire period 1997-2003.
4. Calculation of blame matrices for oxidized and reduced nitrogen for one selected year of the period 1997-2003. Contribution of emissions from each of selected sector of each country to nitrogen deposition to the Baltic Sea and its BSAP sub-basins.
5. Calculation of total nitrogen deposition to the Baltic Sea for each individual year of the period 2000-2006 and average for the entire period.
6. Calculation of total nitrogen deposition to the Baltic Sea sub-basins, as defined in BSAP, for each individual year of the period 2000-2006 and average for the entire period.
7. Estimation of the quantities of deposition originating from each of the HELCOM countries, other countries as a total sum and from shipping to the Baltic Sea and each of its (BSAP) sub-basins averaged for the entire period 2000-2006.
8. Calculation of blame matrices for oxidized and reduced nitrogen for one selected year of the period 2000-2006. Contribution of emissions from each of selected sector of each country to nitrogen deposition to the Baltic Sea and its BSAP sub-basins.
9. Documentation of the work done. Electronic transfer of data.

More than 500 model runs were necessary in order to complete the above tasks. The model results were then subject of post-processing with the aim of calculating depositions to the entire basin of the Baltic Sea and its seven BSAP sub-basins:

1. Bothnian Bay
2. Bothnian Sea
3. Gulf of Finland
4. Gulf of Riga
5. Baltic Proper
6. Danish Straits
7. Kattegat

The locations of BSAP sub-basins are shown in Fig. 1.

Figure 1. The locations of the BSAP sub-basins of the Baltic Sea for which all depositions were calculated.

The deliverables from EMEP in the form of files in different formats are available in the EMEP web site: ftp://ftp.met.no/pub/emep/ in directory HELCOM and can be downloaded from there. Password is necessary in order to get access to the files. It was made available to HELCOM Secretariat. The complete list of deliverables from EMEP/files, which can be found on the EMEP web site is included in Appendix A.

1. New version (2008) of the EMEP unified model

The Unified EMEP model is an Eulerian model that has been developed at EMEP/MSC-W (Meteorological Synthesizing Centre - West of EMEP) for simulating atmospheric transport and deposition of acidifying and eutrophying compounds as well as photo-oxidants in Europe. The model has been documented in EMEP Status Report 2003, Part I [12] and updates of the model have been described in EMEP Status Reports 2004 [13], 2005 [14], 2006 [15] and 2007 [16]. Here we only give a short description of the basic features of the model. Model details and its applications can also be found on the EMEP web site [9].

The model domain covers Europe and the Atlantic Ocean (Fig. 2). The model grid (of the size 170×133) has a horizontal resolution of 50 km at 60° N, which is consistent with the resolution of emission data reported to CLRTAP. In the vertical, the model has 20 sigma layers reaching up to 100 hPa. Approximately 10 of these layers are placed below 2 km to obtain high resolution of the boundary layer which is of special importance to the long range transport of air pollution.

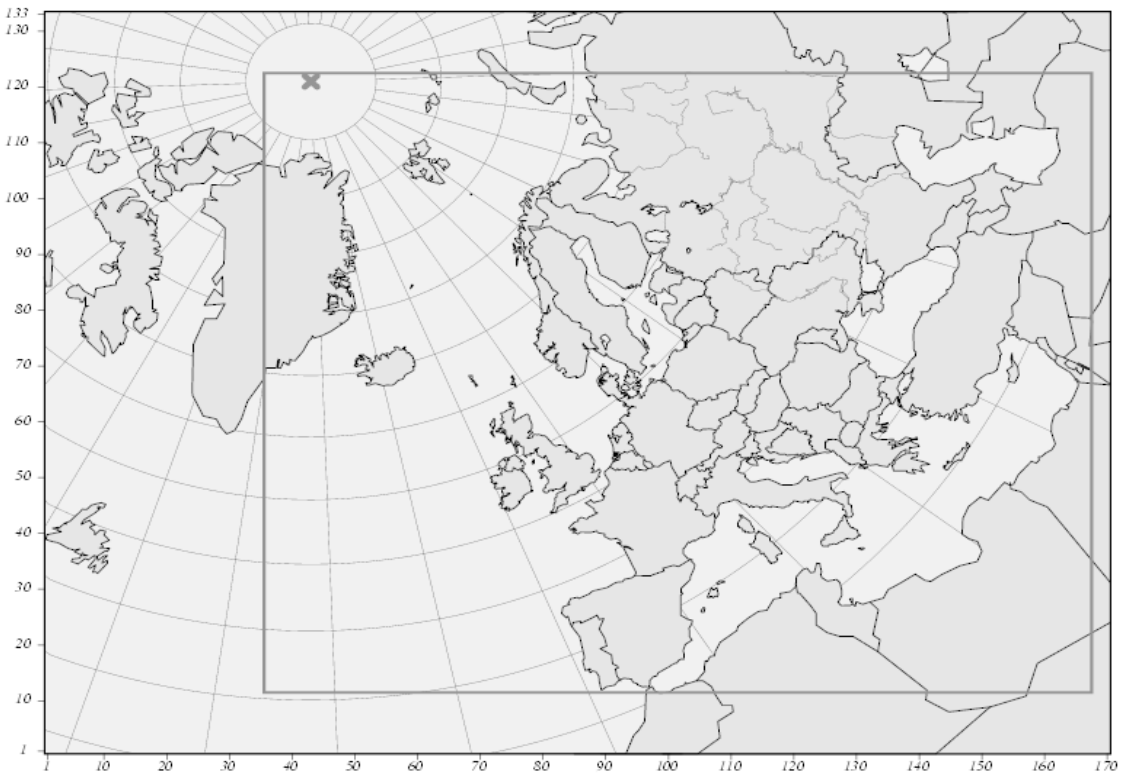


Figure. 2.Computational domain of the Unified EMEP model. The official EMEP area is included within the internal frame and the results of routine model applications are also provided in this area.

The Unified EMEP model uses 3-hourly resolution meteorological data from the PARLAM-PS model, a dedicated version of the HIRLAM (*High Resolution Limited Area Model*) Numerical Weather Prediction model [17].

The emissions consist of gridded national annual emissions of sulphur dioxide, nitrogen oxides, ammonia, non-methane **v**olatile **o**rganic **c**ompounds (VOC) and carbon monoxide. They are available in each of the 50 × 50 km^2 model grid. These emissions are distributed

temporally according to monthly and daily factors derived from data provided by the University of Stuttgart (IER).

Concentrations of 71 species are computed in the latest version of the Unified EMEP model (56 are advected, 15 are short-lived and not advected). The sulphur and nitrogen chemistry is coupled to the photo-chemistry, which allows a more sophisticated description of *e.g.* the oxidation of sulphur dioxide to sulphate.

Dry deposition is calculated using the resistance analogy and is a function of the pollutant type, meteorological conditions and surface properties. Parameterization of wet deposition processes includes both in-cloud and sub-cloud scavenging of gases and particles using scavenging coefficients.

The EMEP model has been thoroughly validated. Fagerli et al. [18] presented an extensive evaluation of the acidifying and eutrophying components for the years 1980, 1985, 1990 and 1995 to 2000. In Fagerli et al. [19], a comparison of observations and modelled results for 2001 was conducted, and in Fagerli [20] results for 2002 with an updated EMEP Unified model, version 2.0, was presented. This version differed slightly from the 2003 version, as described in Fagerli [20], however the main conclusions on the model performance were the same. In 2004, 2005 and 2006 the model results were presented for the years 2002, 2003 and 2004, respectively Fagerli [21], Fagerli et al. [22], Fagerli and Hjellbrekke [23]. It has been shown that the EMEP model performance is rather homogeneous over the years (Fagerli et al. [18]), but depends on geographical coverage and quality of the measurement data. The EMEP model has also been validated for nitrogen compounds in Simpson et al. [24] and for dry and wet deposition of sulphur, and wet depositions for nitrogen in Simpson et al. [25], with measurements outside the EMEP network. Calculated trends of total nitrate (HNO3 and NO_3^-) and ammonia + ammonium in air and precipitation have been evaluated in Fagerli and Aas [26] and show in general good correspondence with the observations.

In the latest model version, implemented in 2008, an important modification has been made. Since last year, the routine for calculation of night time production of HNO_3 has been updated when an error in the routine was found. The result was a decrease in the reaction rate of about a factor of 4.

The species most affected by the upgrade were nitrogen dioxide, nitric acid and nitrate and ammonium aerosols. For NO_2 concentrations increase by 10-20% for most of Europe, except in the Nordic countries where the concentrations increased by as much as 20-40%. Nitric acid changed less, within 10% for most of Europe, but up to 20% in some areas. The largest differences were found for nitrate aerosol, where changes up to around 40% appear for countries with high NO_x and NH_3 emissions. Coarse nitrate change less (around 10%) than fine nitrate (up to 50%). The reason why the largest changes appear in these countries is that ammonia emissions are rather large in this area and the formation of ammonium nitrate is limited by the availability of HNO_3 (lower formation rate of HNO_3 in the new code). As a consequence, ammonium aerosols decrease by 10-30% in central Europe, with the largest effects in the Netherlands, Belgium, Germany, Denmark and parts of the UK.

The latest modifications in the model have also an impact on the latest result for the Baltic Sea and its sub-basins presented in this report.

2. Nitrogen emissions in the period 1997-2006

All model calculations described in the present report have been performed with the latest version of the EMEP Unified model described in the previous Chapter and with the latest available emissions (ref). The time series with annual total nitrogen oxides and ammonia emissions from the HELCOM Contracting Parties in the period 1997-2006 used by the EMEP model are shown in Figure 1. The nitrogen emissions from the HELCOM Contracting Parties contribute significantly (60% and more) to nitrogen deposition in the Baltic Sea and its sub-basins.

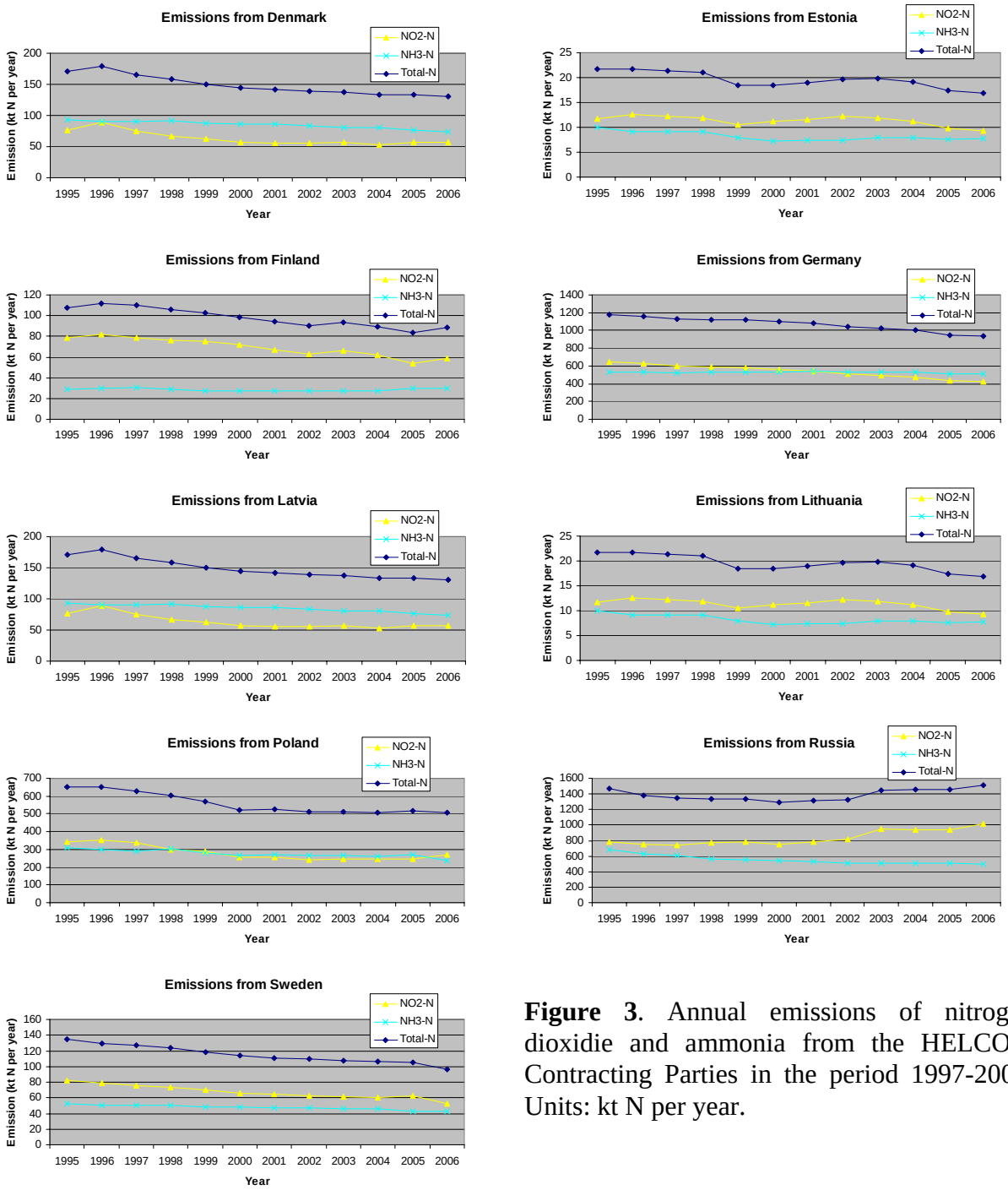


Figure 3. Annual emissions of nitrogen dioxidie and ammonia from the HELCOM Contracting Parties in the period 1997-2006. Units: kt N per year.

In all HELCOM Contracting Parties annual ammonia emissions are lower in 2006 than in 1997, despite some oscillations in this period. In eight out of nine HELCOM Contracting parties, annual nitrogen oxides emissions are also lower in 2006 than in 1997. The only exception is Russia, where nitrogen oxides emissions are approximately 200 kt higher in 2006 than in 1997.

Time series with annual emissions of nitrogen dioxides and ammonia from HELCOM, as the sum of emissions from all nine HELCOM Contracting Parties, in the period 1997-2006 are shown in Fig. 4. Both nitrogen oxides and ammonia emissions are lower in 2006 than in 1997, but not so much for the nitrogen oxides. This can be explained by the increasing emissions of nitrogen oxides in Russia in the considered period.

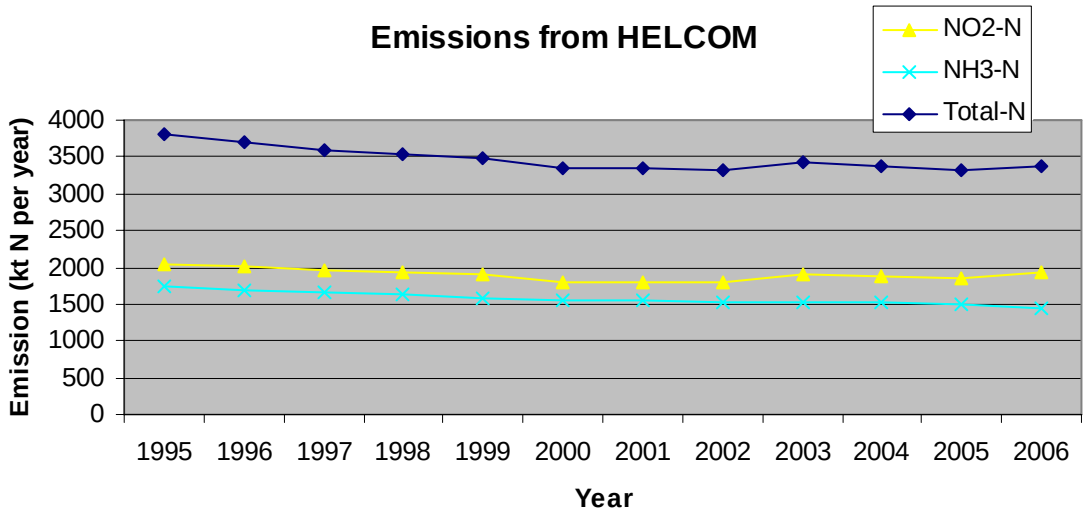


Figure 4. Annual emissions of nitrogen dioxide and ammonia from HELCOM, as the sum of emissions from all nine HELCOM Contracting Parties, in the period 1997-2006. Units: kt N per year.

Emissions from the international ship traffic on the Baltic Sea have also significant contribution to nitrogen deposition and are taken into account in the model runs. There are large uncertainties in the estimate for ship traffic emissions. The international ship emissions and their spatial distribution have been updated based on new emission estimates derived by ENTEC for the year 2000. Ship emissions for 2006, were deduced by applying an increase factor of 2.5 % per year on cargo vessel traffic and 3.9 % per year on passenger vessel traffic. The factors are the same as used by ENTEC (UK – Environmental and Engineering Consultancy) for predicting emissions of nitrogen in 2010 based on the emission estimates for 2000. The spatial distribution of annual nitrogen oxides emissions from the international ship traffic on the Baltic Sea in the year 2006 is shown in Fig. 5.

The spatial distribution of nitrogen emissions from HELCOM Contracting Parties and from the ship traffic does not change much from one year to another. Maps with the spatial distributions of annual 2006 emissions of nitrogen oxides and ammonia in the Baltic Sea region are shown in Fig. 6 and 7, respectively. Emissions from the international ship traffic are visible in the Baltic Sea basin (Fig. 6), whereas there are no ammonia emissions over the Baltic Sea (Fig. 7).

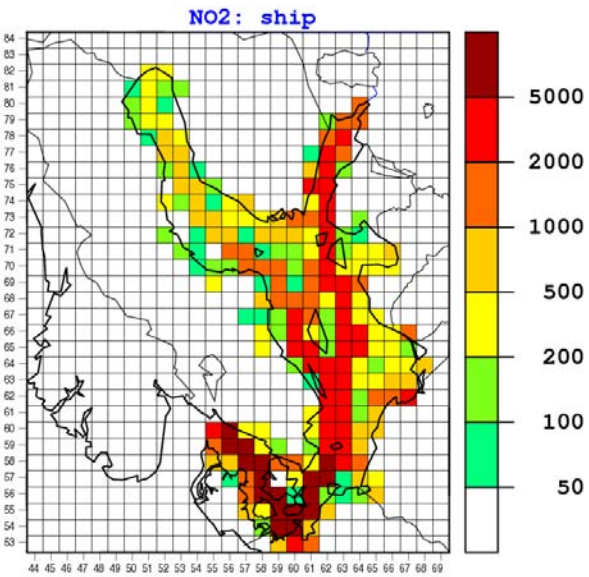


Figure 5 Map of annual emissions of nitrogen oxides from the international ship traffic on the Baltic Sea in 2006 used in the EMEP model calculations. Units: Mg of NO_2 per year and per 50×50 km grid cell.

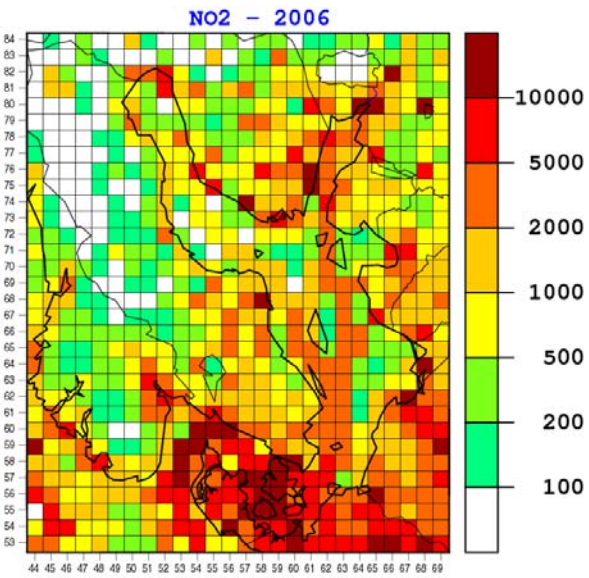


Figure 6. Map of annual emission of oxidized nitrogen (including emissions from the ship traffic) in the Baltic Sea region in 2006. Units: Mg (tones) of NO_2 per year and per 50×50 km grid cell.

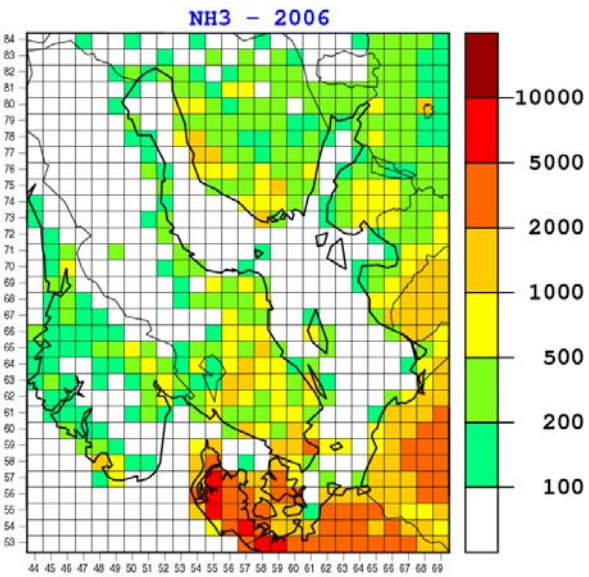


Figure 7. Map of annual emission of ammonia in the Baltic Sea region in 2006. Units: Mg of NH_3 per year and per 50×50 km grid cell.

The nitrogen emissions used in the EMEP model calculations are coming from 11 SNAP sectors. The list of 11 SNAP sectors is given in Table 1.

Table 1. The list of 11 SNAP emissions sectors as specified in the EMEP-CORINAIR Emission Inventory Guidebook.

Sector 1	Combustion in energy and transformation industry
Sector 2	Non-industrial combustion plants
Sector 3	Combustion in manufacturing industry
Sector 4	Production processes
Sector 5	Extraction and distribution of fossil fuels and geothermal energy
Sector 6	Solvent and other product use
Sector 7	Road transport
Sector 8	Other mobile sources and machinery (including ship traffic)
Sector 9	Waste treatment and disposal
Sector 10	Agriculture
Sector 11	Other sources and sinks

Most of the nitrogen oxides emissions are coming from the combustion sectors 1, 2 and 3 and from the transportation sectors 7 and 8. Dominating source of ammonia emissions is sector 10 – agriculture which usually contributes more 90% to the total emissions of ammonia. As an example, contributions of different sectors to annual 2006 emissions of nitrogen oxides and ammonia in Poland are shown in Fig. 8.

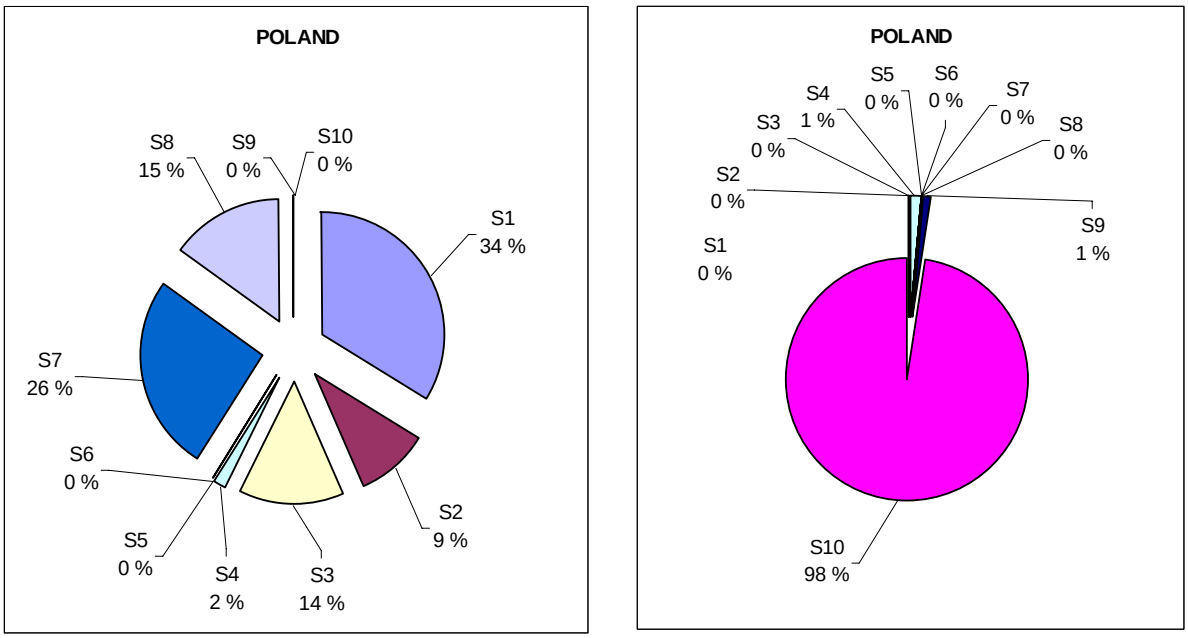


Figure 8. Relative contribution of different SNAP sectors to annual 2006 nitrogen oxides (left) and ammonia (right) emissions in Poland.

3. Annual depositions of nitrogen in the period 1997-2006.

Using the latest available emissions described in the previous Chapter, the EMEP Unified model has been used to calculate the annual depositions of oxidised, reduced and total nitrogen into the Baltic Sea and its sub-basins in the period 1997-2006. The results for the depositions to the entire Baltic Sea are shown in Figure 1, for oxidised, reduced and total nitrogen.

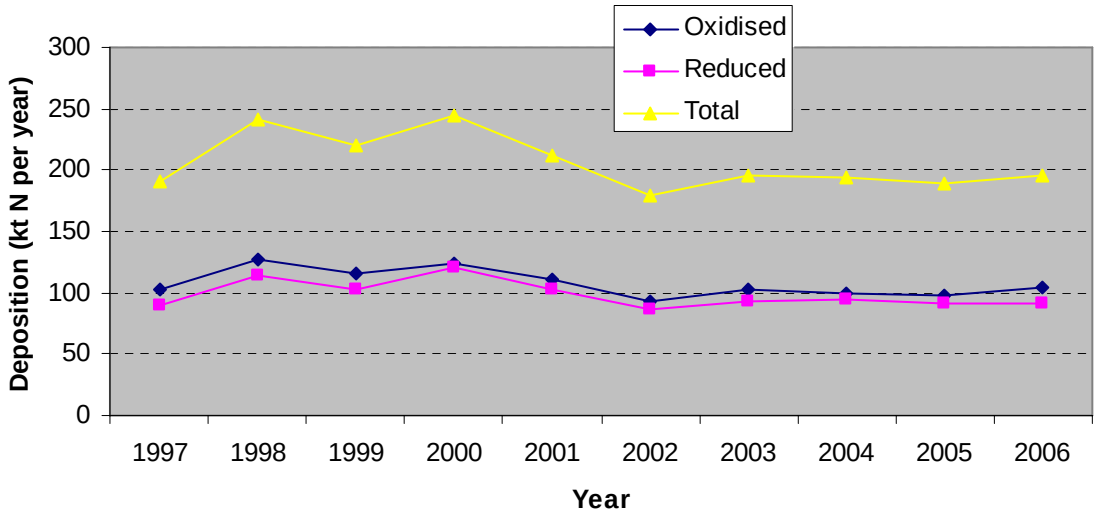


Figure 9. Calculated annual depositions of oxidised, reduced and total nitrogen to the Baltic Sea in the period 1997-2006. Units: kt N per year.

For all years, deposition of oxidised nitrogen is slightly higher than the deposition of reduced nitrogen and there are no apparent trends in the depositions. Compared to time series of nitrogen emissions in the Baltic region (Fig. 3 and 4) there is more inter-annual variability in the computed deposition, which is mainly caused by the variability in meteorological conditions for different years . Fig. 9 indicates that the depositions in the period 1997-2003 are slightly higher than the depositions in the period 2000-2006. This is confirmed in Figure 10 where the average depositions are compared for those two periods.

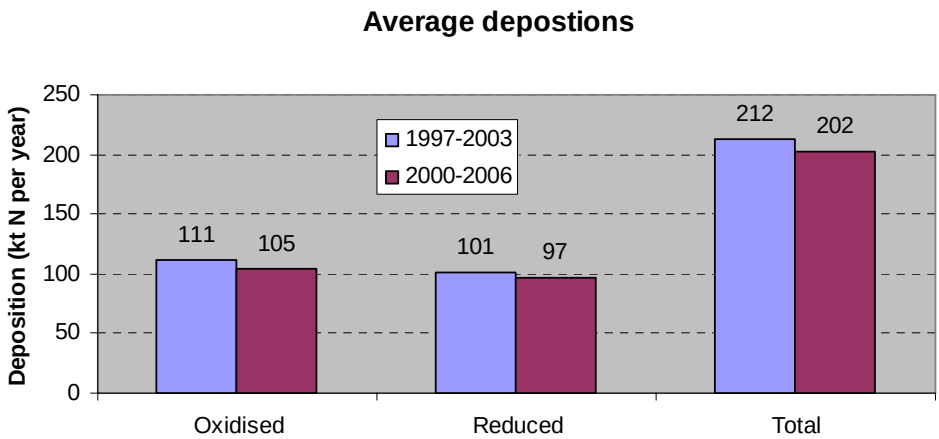


Figure 10. Comparison of calculated annual average depositions of oxidised, reduced and total nitrogen to the Baltic Sea in the periods: 1997-2003 and 2000-2003. Units: kt N per year.

The annual average depositions of oxidised, reduced and total nitrogen to the Baltic Sea in the period 2000-2006 are lower than in the period 1997-2003 by 6%, 4% and 5%, respectively.

Time series with annual depositions of oxidised, reduced and total nitrogen to BSAP sub-basins of the Baltic Sea in the period 1997-2006 are shown in Fig. 11.

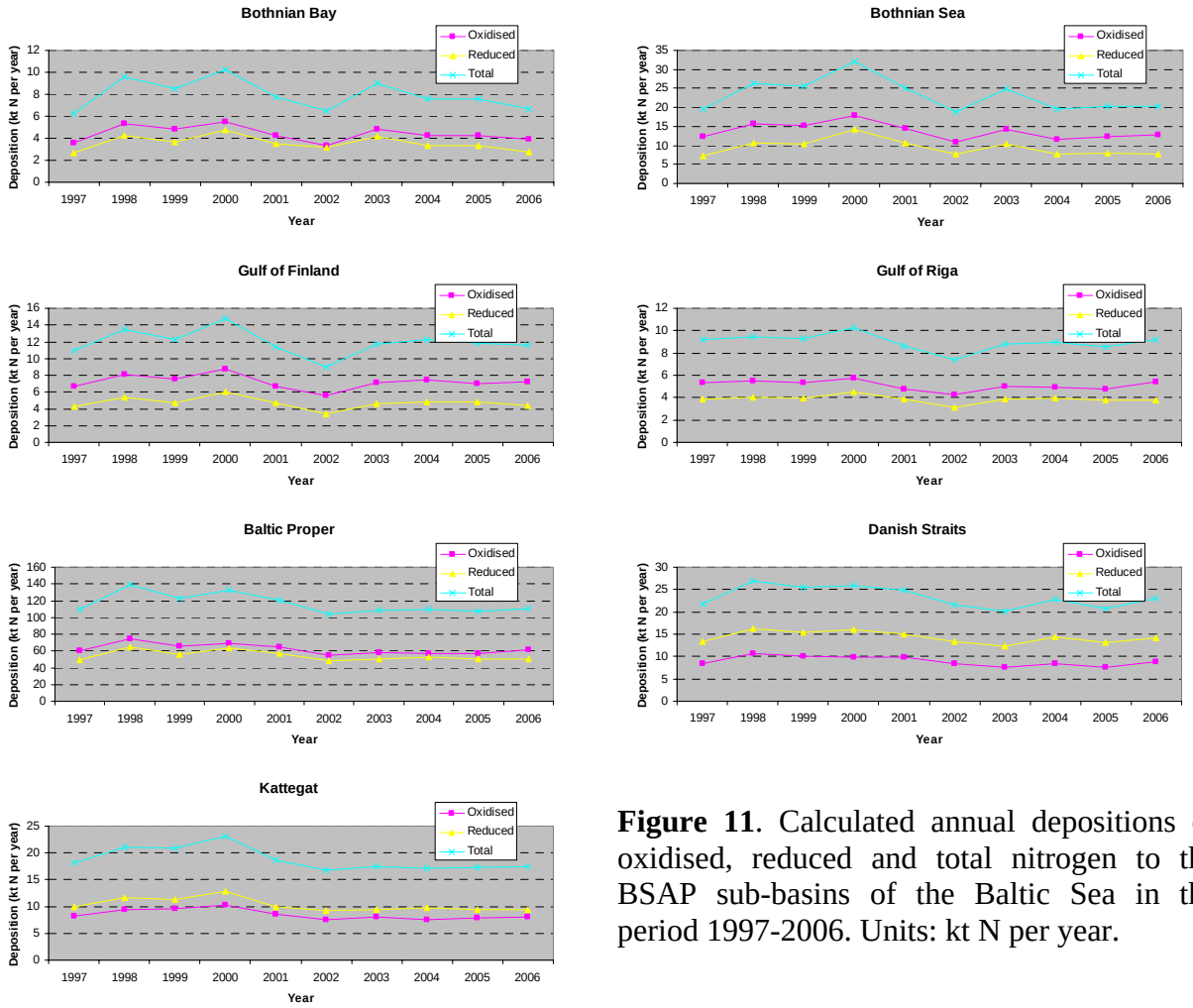


Figure 11. Calculated annual depositions of oxidised, reduced and total nitrogen to the BSAP sub-basins of the Baltic Sea in the period 1997-2006. Units: kt N per year.

For all sub-basins deposition of oxidised nitrogen is higher than the deposition of reduced nitrogen. For five out of seven sub-basins, the maximum of the deposition can be observed in the year 2000. Only in Baltic Proper and Danish Straits sub-basins maxima occur in the year 1998, but the depositions in 200 are also very high for these two sub-basins. As in the case of the entire Baltis Sea basin and for the same reason, there is a significant inter-annual variability in the computed depositions, especially in the first half of the considered period.

Comparison of annual average oxidised, reduced and total nitrogen depositions to BSAP subbasins of the Baltic Sea, for two periods: 1997-2003 and 2000-2006 is presented in Fig. 12. For all sub-basins and all types of the deposition, it is lower in the period 2000-2006. The percentage of deposition reduction is given in Table 2. The largest reduction: -6.5%, -6.6% and -6.5% for oxidised, reduced and total nitrogen deposition, respectively, can be noticed for the Bothnian Sea sub-basin. A small reduction only, : -1.4%, -1.0% and -1.5% for oxidised, reduced and total nitrogen deposition, respectively, can be seen for the Gulf of Finland sub-basin.

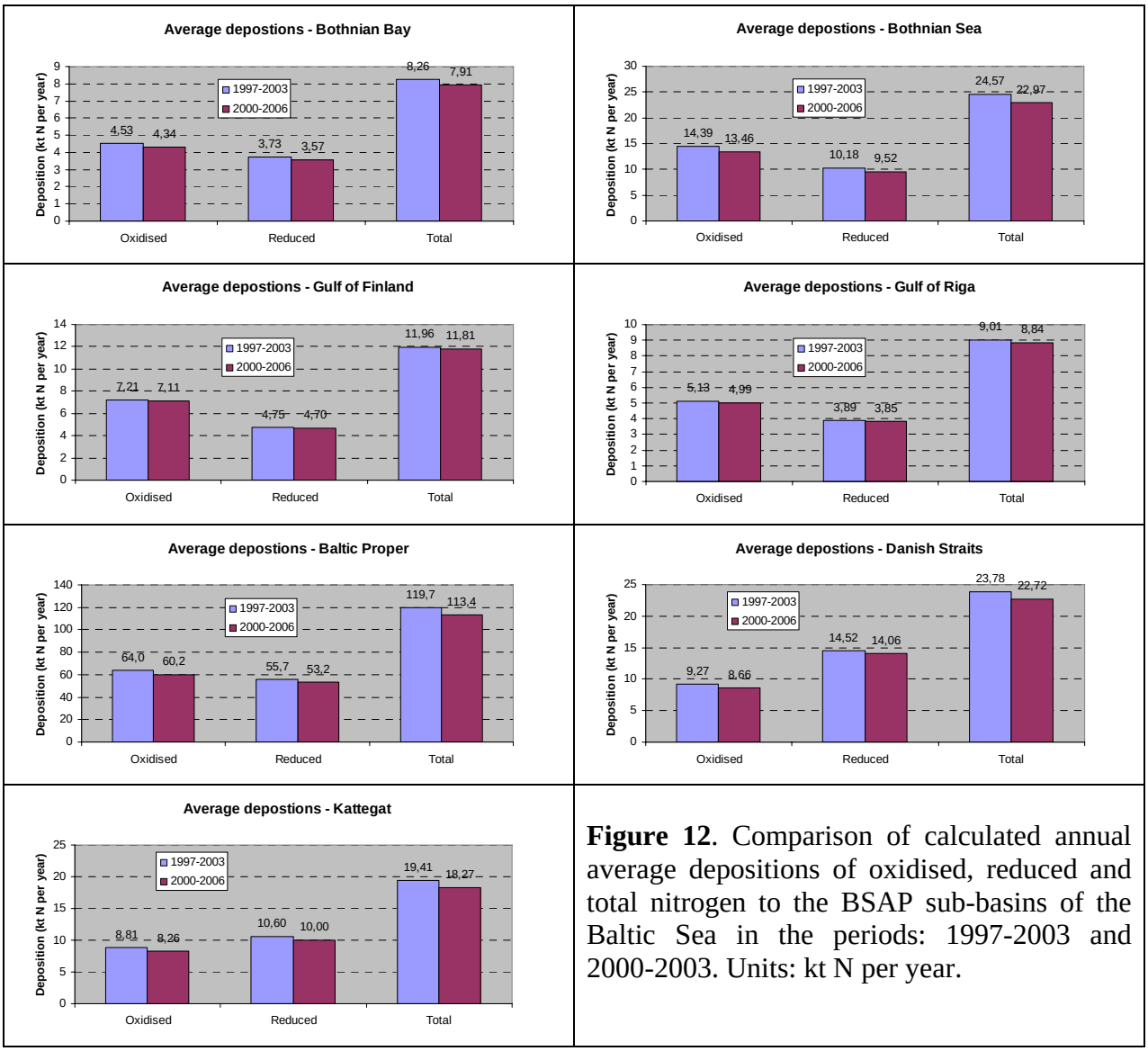


Figure 12. Comparison of calculated annual average depositions of oxidised, reduced and total nitrogen to the BSAP sub-basins of the Baltic Sea in the periods: 1997-2003 and 2000-2003. Units: kt N per year.

Table 2. The reduction of calculated annual average deposition of oxidised, reduced and total nitrogen to the BSAP sub-basins of the Baltic Sea in the period 2000-2003.compared to period 1997-2003, Units: the percent of annual deposition calculated for the period 1997-2003.

Sub-basin	Deposition		
	Oxidised	Reduced	Total
Bothnian Bay	-4,1	-4,4	-4,2
Bothnian Sea	-6,5	-6,6	-6,5
Gulf of Finland	-1,4	-1,0	-1,3
Gulf of Riga	-2,7	-1,0	-1,9
Baltic Proper	-6,0	-4,5	-5,3
Danish Straits	-3,2	-4,5	-4,5
Kattegat	-5,6	-5,9	-5,9

3. Annual depositions of nitrogen in the period 1997-2006.

Using the latest available emissions described in the previous Chapter, the EMEP Unified model has been used to calculate the annual depositions of oxidised, reduced and total nitrogen into the Baltic Sea and its sub-basins in the period 1997-2006. The results for the depositions to the entire Baltic Sea are shown in Figure 1, for oxidised, reduced and total nitrogen.

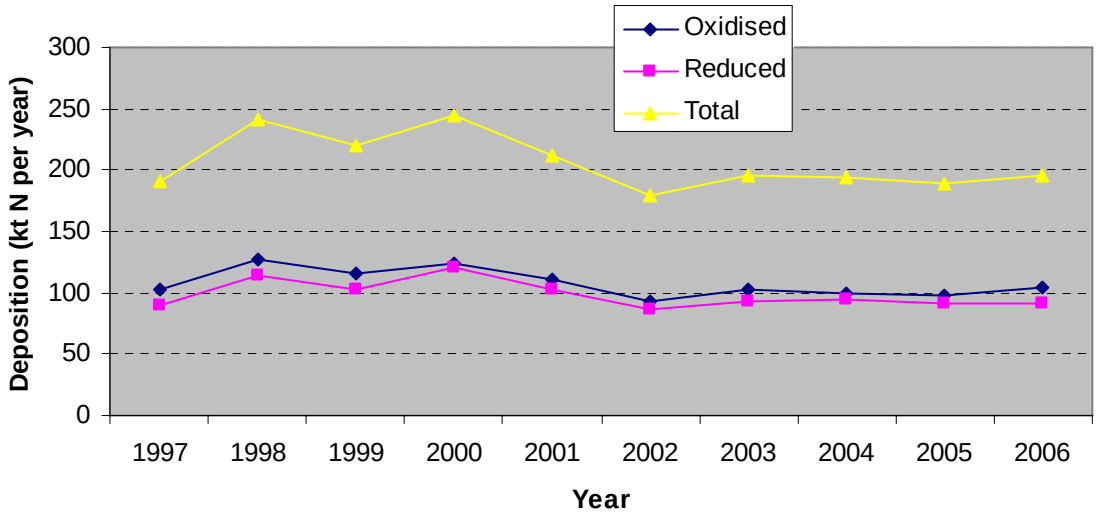


Figure 9. Calculated annual depositions of oxidised, reduced and total nitrogen to the Baltic Sea in the period 1997-2006. Units: kt N per year.

For all years, deposition of oxidised nitrogen is slightly higher than the deposition of reduced nitrogen and there are no apparent trends in the depositions. Compared to time series of nitrogen emissions in the Baltic region (Fig. 3 and 4) there is more inter-annual variability in the computed deposition, which is mainly caused by the variability in meteorological conditions for different years . Fig. 9 indicates that the depositions in the period 1997-2003 are slightly higher than the depositions in the period 2000-2006. This is confirmed in Figure 10 where the average depositions are compared for those two periods.

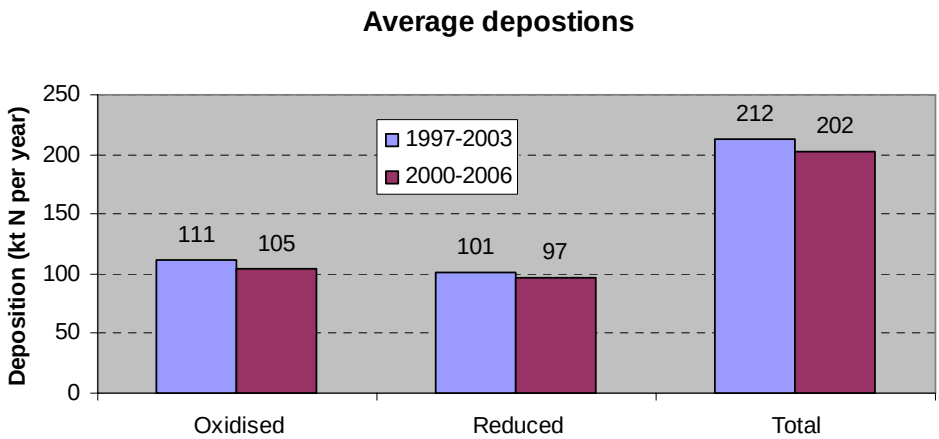


Figure 10. Comparison of calculated annual average depositions of oxidised, reduced and total nitrogen to the Baltic Sea in the periods: 1997-2003 and 2000-2003. Units: kt N per year.

The annual average depositions of oxidised, reduced and total nitrogen to the Baltic Sea in the period 2000-2006 are lower than in the period 1997-2003 by 6%, 4% and 5%, respectively.

Time series with annual depositions of oxidised, reduced and total nitrogen to BSAP sub-basins of the Baltic Sea in the period 1997-2006 are shown in Fig. 11.

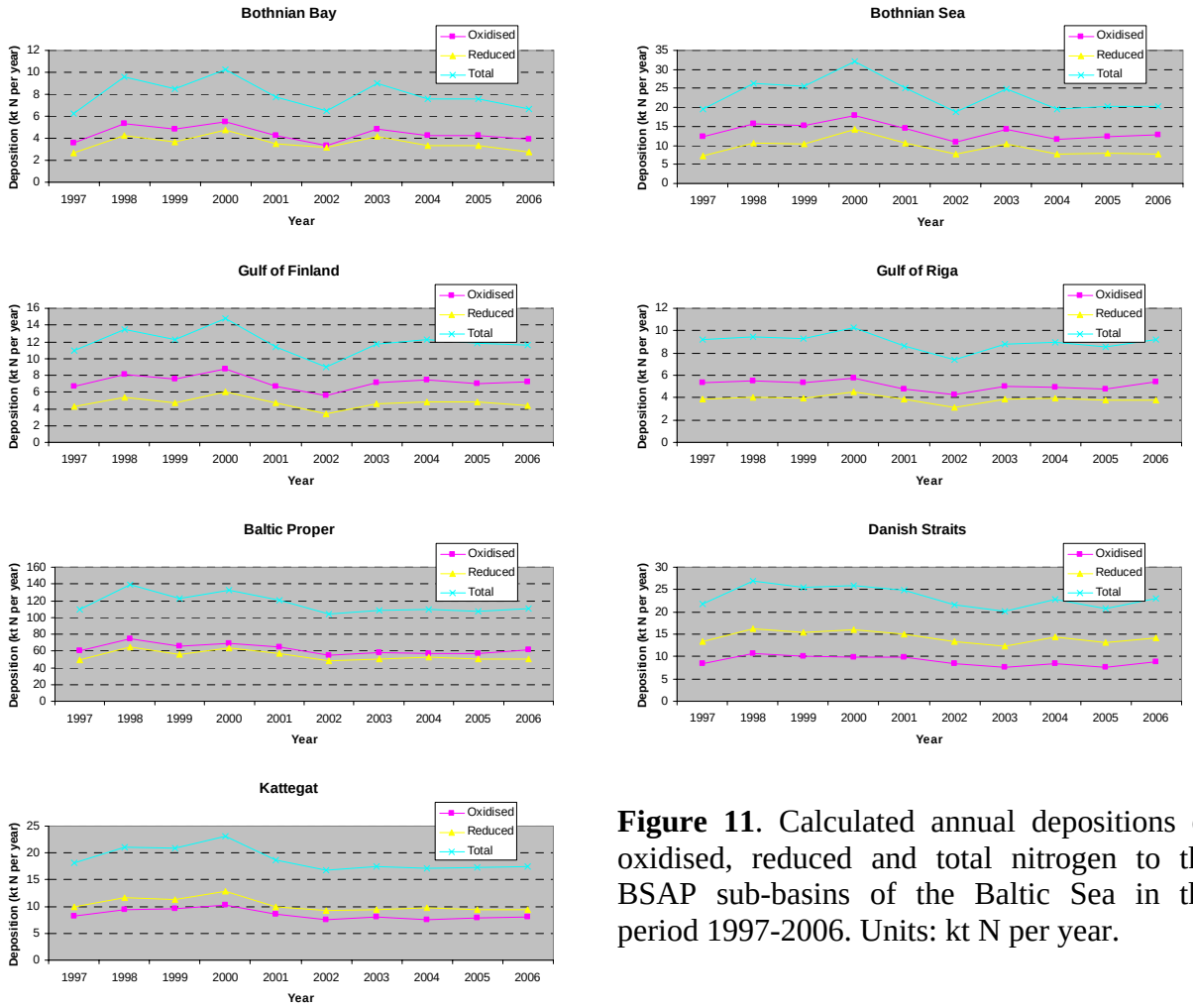


Figure 11. Calculated annual depositions of oxidised, reduced and total nitrogen to the BSAP sub-basins of the Baltic Sea in the period 1997-2006. Units: kt N per year.

For all sub-basins deposition of oxidised nitrogen is higher than the deposition of reduced nitrogen. For five out of seven sub-basins, the maximum of the deposition can be observed in the year 2000. Only in Baltic Proper and Danish Straits sub-basins maxima occur in the year 1998, but the depositions in 200 are also very high for these two sub-basins. As in the case of the entire Baltis Sea basin and for the same reason, there is a significant inter-annual variability in the computed depositions, especially in the first half of the considered period.

Comparison of annual average oxidised, reduced and total nitrogen depositions to BSAP subbasins of the Baltic Sea, for two periods: 1997-2003 and 2000-2006 is presented in Fig. 12. For all sub-basins and all types of the deposition, it is lower in the period 2000-2006. The percentage of deposition reduction is given in Table 2. The largest reduction: -6.5%, -6.6% and -6.5% for oxidised, reduced and total nitrogen deposition, respectively, can be noticed for the Bothnian Sea sub-basin. A small reduction only, : -1.4%, -1.0% and -1.5% for oxidised, reduced and total nitrogen deposition, respectively, can be seen for the Gulf of Finland sub-basin.

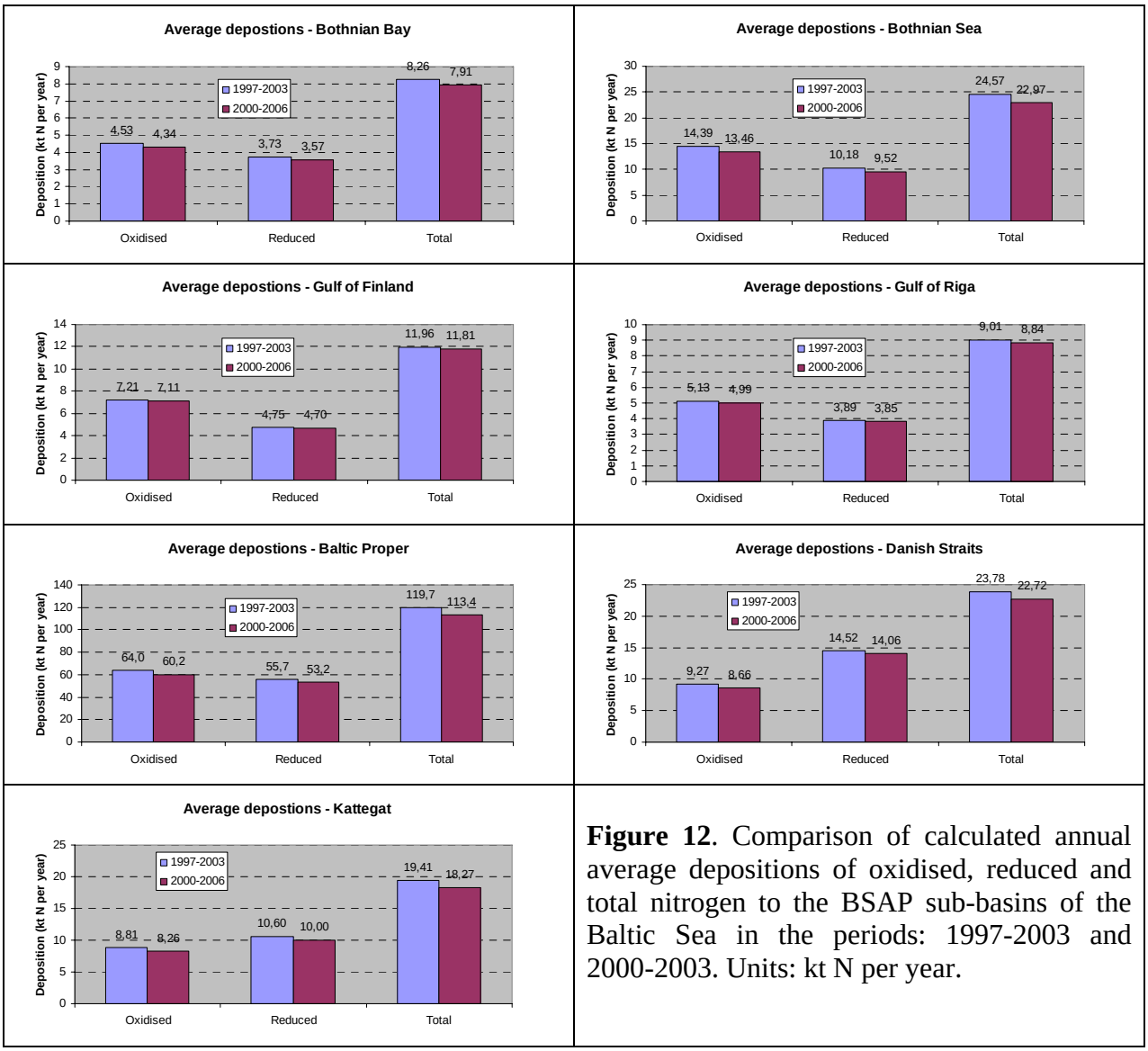


Figure 12. Comparison of calculated annual average depositions of oxidised, reduced and total nitrogen to the BSAP sub-basins of the Baltic Sea in the periods: 1997-2003 and 2000-2003. Units: kt N per year.

Table 2. The reduction of calculated annual average deposition of oxidised, reduced and total nitrogen to the BSAP sub-basins of the Baltic Sea in the period 2000-2003.compared to period 1997-2003, Units: the percent of annual deposition calculated for the period 1997-2003.

Sub-basin	Deposition		
	Oxidised	Reduced	Total
Bothnian Bay	-4,1	-4,4	-4,2
Bothnian Sea	-6,5	-6,6	-6,5
Gulf of Finland	-1,4	-1,0	-1,3
Gulf of Riga	-2,7	-1,0	-1,9
Baltic Proper	-6,0	-4,5	-5,3
Danish Straits	-3,2	-4,5	-4,5
Kattegat	-5,6	-5,9	-5,9

4. Contributions of country and shipping emissions to the deposition

The EMEP model was used to calculate contributions of emission sources in each HELCOM country and from the international shipping on the Baltic Sea to oxidised, reduced and total nitrogen deposition to the Baltic Sea and its BSAP sub-basins. Computations were made first for each year of the period 1997-2006 and than the average values were calculated for each of the periods: 1997-2003 and 2000-20006.

The contributions from HELCOM sources defined as a sum of contributions from all HELCOM Contracting Parties (CPs) and ship traffic are similar for the periods 1997-2003 and 2000-2006, with differences not larger than 3% for all of the sub-basins. The largest differences: 2% lower contribution of oxidised nitrogen and 3% higher contributions of reduced nitrogen were found for the Gulf of Riga sub-basin. The HELCOM contributions to oxidised, reduced and total nitrogen depositions in the entire Baltic Sea basin are 1% lower in the period 2000-2006 than in the period 1997-2000. The same pattern can be noticed for most of the sub-basins. In the period 2000-2006, the HELCOM contributions to oxidised, reduced and total nitrogen deposition are lower in the period 2000-2006 for majority of sub-basins.

The relative contribution of HELCOM sources is larger for the deposition of reduced nitrogen (61-86%) than for the deposition of oxidised nitrogen (36-58%).

The lowest contribution of HELCOM sources to oxidised nitrogen deposition can be noticed for the Danish Straits and the Gulf of Riga sub-basins, 36% and 37% for the periods 1997-2003 and 2000-2006, respectively. The highest contributions of the HELCOM sources to oxidised nitrogen deposition (58% for both periods) can be seen for the Bothnian Bay sub-basin. In general HELCOM contribution to oxidised nitrogen deposition is decreasing from the northern part to the southern part of the Baltic Sea.

The opposite deposition gradient appears for reduced nitrogen, with the largest contribution of the HELCOM sources visible in the south. The maximum contribution of the HELCOM sources to reduced nitrogen deposition (86% for both periods) can be noticed for the Danish Strait sub-basin and the minimum (62% for the period 1997-2003 and 61% for the period 2000-2006) for the Gulf of Finland sub-basin.

For the entire Baltic Sea sub-basin and its sub-basins contribution of HELCOM sources to total nitrogen deposition varies depending on sub-basin in range 36%-77%. The HELCOM sources contribute most to total nitrogen deposition in the Danish Strait sub-basin (77% for both periods) and least to total nitrogen deposition in the Gulf of Riga sub-basin (36% for both periods).

The contributions from the individual HELCOM CPs and ship traffic on the Baltic Sea are presented separately for the entire Baltic Sea basin and for each of its BSAP sub-basins. For the entire Baltic Sea and for all its sub-basins, the emission sources from Germany, Poland and the international ship traffic on the Baltic Sea are the major contributors to nitrogen deposition.

4.1 Contributions to the Baltic Sea

Calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised, reduced and total nitrogen to the Baltic Sea basin in the periods: 1997-2003 and 2000-2006 are shown in Fig.13, 14 and 15, respectively.

Concerning contributions to oxidised nitrogen depositions, situation is similar to both periods with HELCOM sources contributing to half of the oxidised nitrogen deposition. Emissions from Germany, ship traffic and Poland are three major contributors to the deposition. Contributions from most of the sources are slightly lower in the period 2000-2006 than in the period 1997-2006 with the exception of the Baltic Sea ship and Russian emissions contributions being 1% higher in the period 2000-2006. Contribution from Sweden is 1% lower in the same period.

Compared to oxidised nitrogen deposition, contribution of HELCOM sources to reduced nitrogen deposition is much higher: 74% in the period 1997-2003 and 73% in the period 2000-2006. Germany, Denmark, Poland and Sweden are the major contributors to reduced nitrogen deposition in the entire Baltic Sea basin. Contributions from Germany are higher and all other HELCOM sources are lower or remain on the same level in the period 2000-2006.

Contributions to total nitrogen depositions in both periods are very similar with contribution from all HELCOM sources being 1% lower in the period 2000-2006. Five major contributors to total nitrogen depositions in both periods are: Germany, Poland, Denmark, Sweden and the ship traffic. Only contributions from the ship traffic are higher in the period 2000-2006.

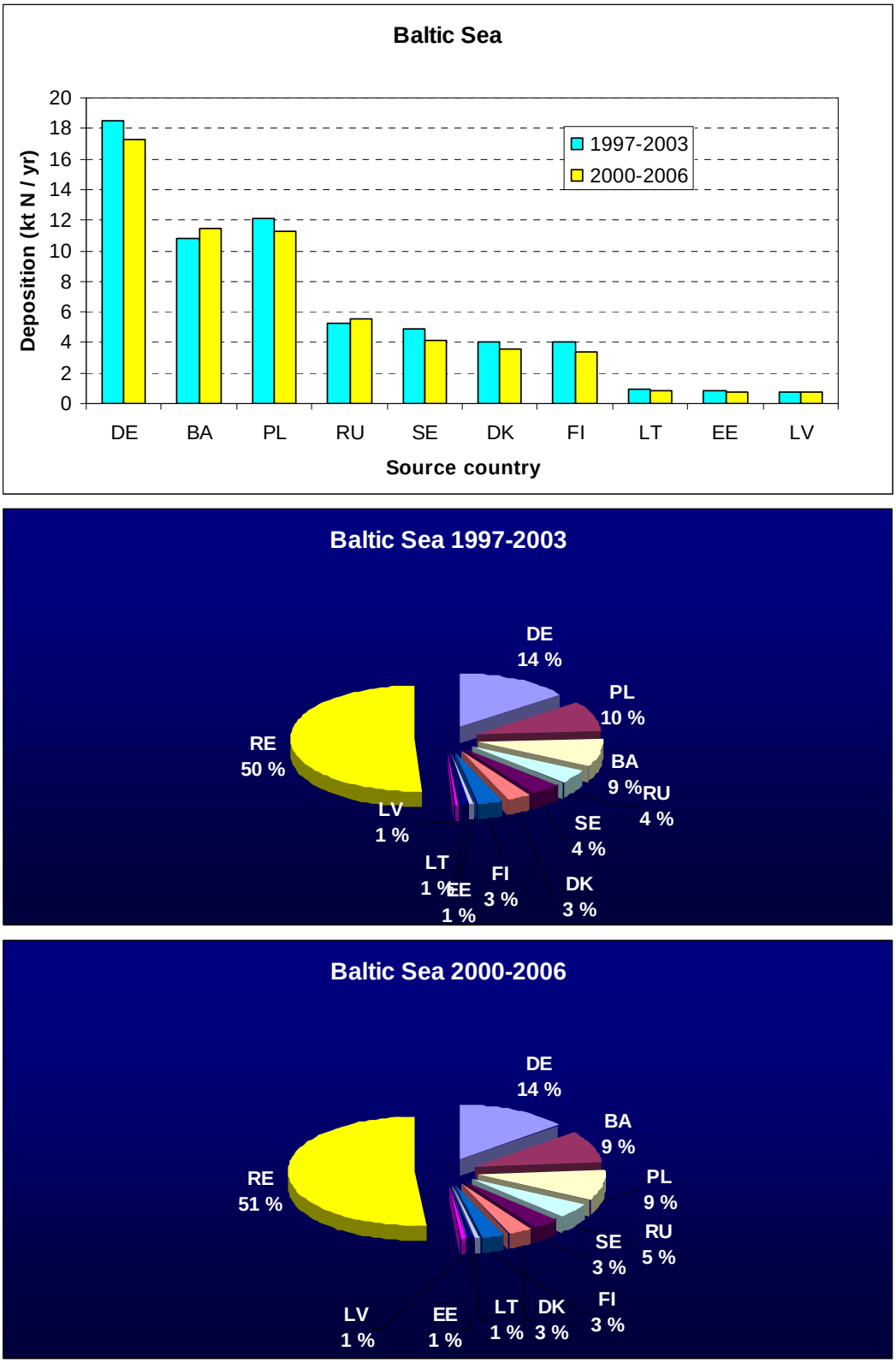


Figure 13. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the entire Baltic Sea basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

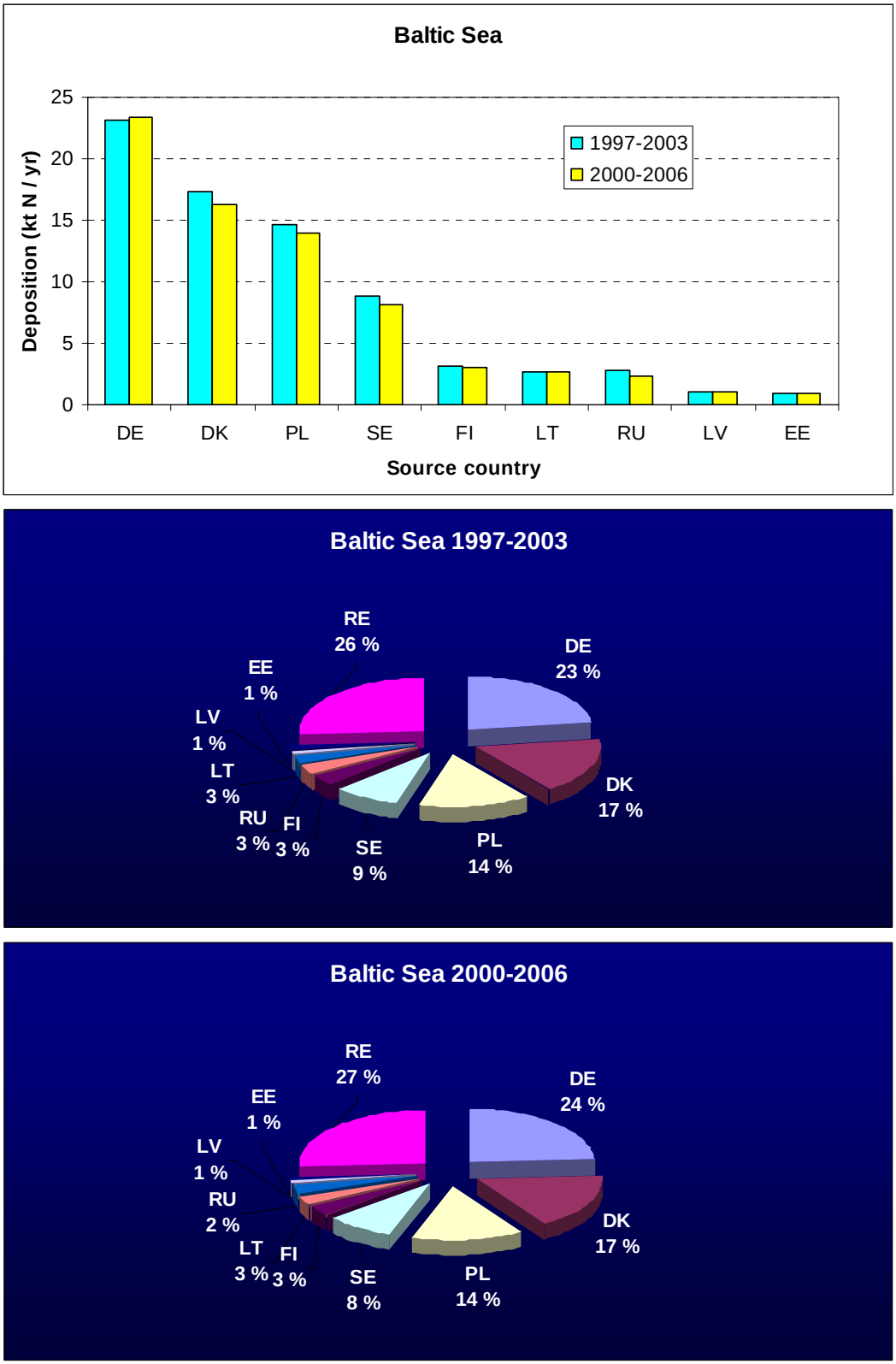


Figure 14. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of reduced nitrogen to the entire Baltic Sea basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

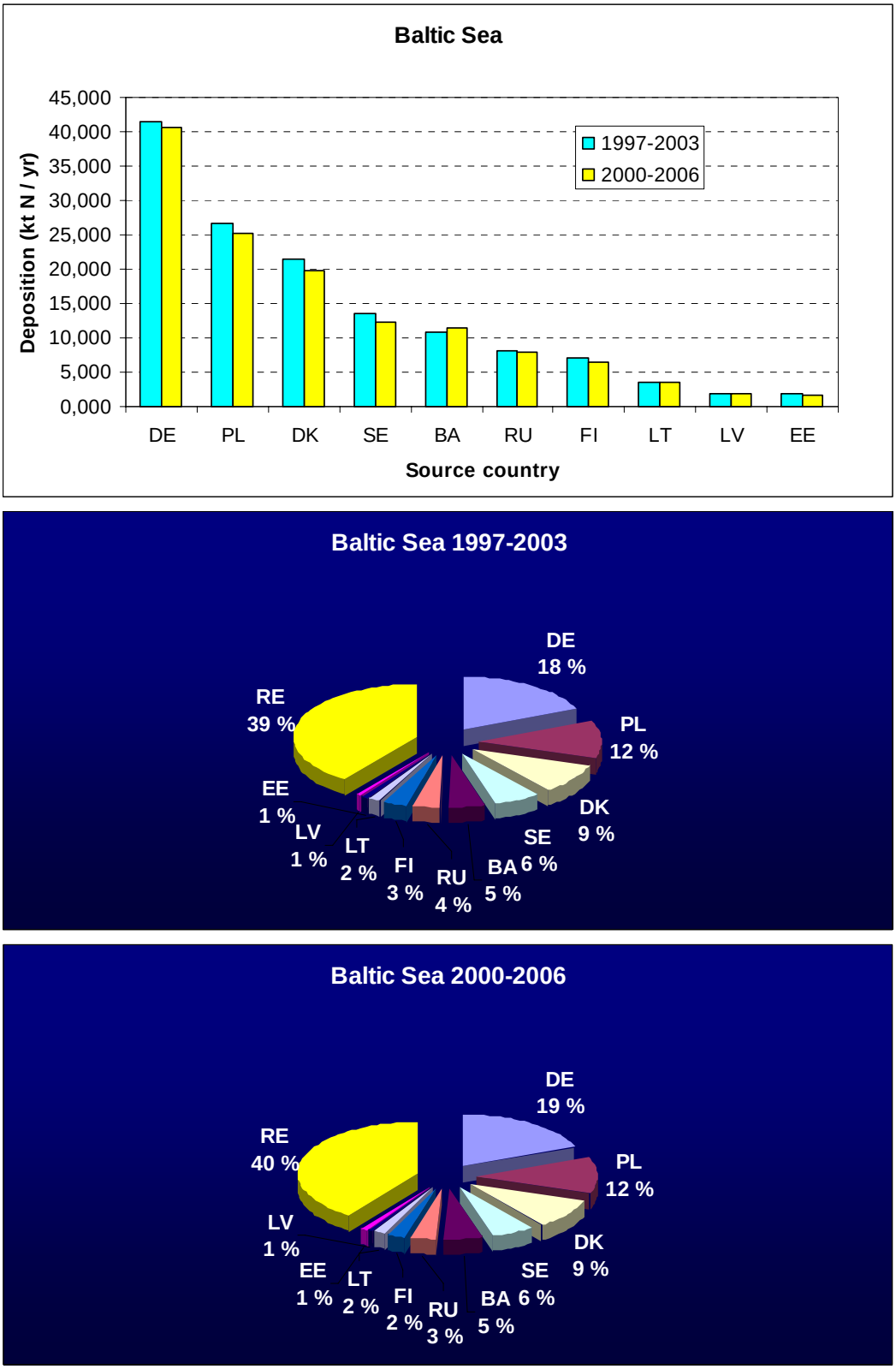


Figure 15. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of total nitrogen to the entire Baltic Sea basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

4.2 Contributions to the Bothnian Bay sub-basin

Calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised, reduced and total nitrogen to the Bothnian Bay sub-basin in the periods: 1997-2003 and 2000-2006 are shown in Fig.16, 17 and 18, respectively.

Contributions to oxidised nitrogen depositions to Bothnian Bay sub-basin are similar for both periods with HELCOM sources contributing 58%. Emissions from Finland, Germany, Russia, Sweden, ship traffic and Poland are the major contributors to the deposition. Contributions from Germany, Russia, and the ship traffic are higher and contributions from remaining sources lower in the period 2000-20006 than in the period 1997-2006.

Compared to oxidised nitrogen deposition, contributions of HELCOM sources to reduced nitrogen deposition are higher: 69% in the period 1997-2003 and 71% in the period 2000-2006. Finland, Sweden, Germany, Poland and Russia are the major contributors to reduced nitrogen deposition in the Bothnian Bay sub-basin. All contributions are lower, but the relative contributions from Sweden, Germany and Russia are 1% higher in the period 2000-2006.

Contributions to total nitrogen depositions in both periods are similar with contribution from all HELCOM sources being 1% lower in the period 2000-2006. Six major contributors to total nitrogen depositions in both periods are: Finland, Germany, Russia, Sweden, Poland, and the ship traffic. The relative contributions from Germany and the ship traffic are 1% higher and contributions from Finland, Russia, Sweden, and Poland are 1% lower in the period 2000-2006.

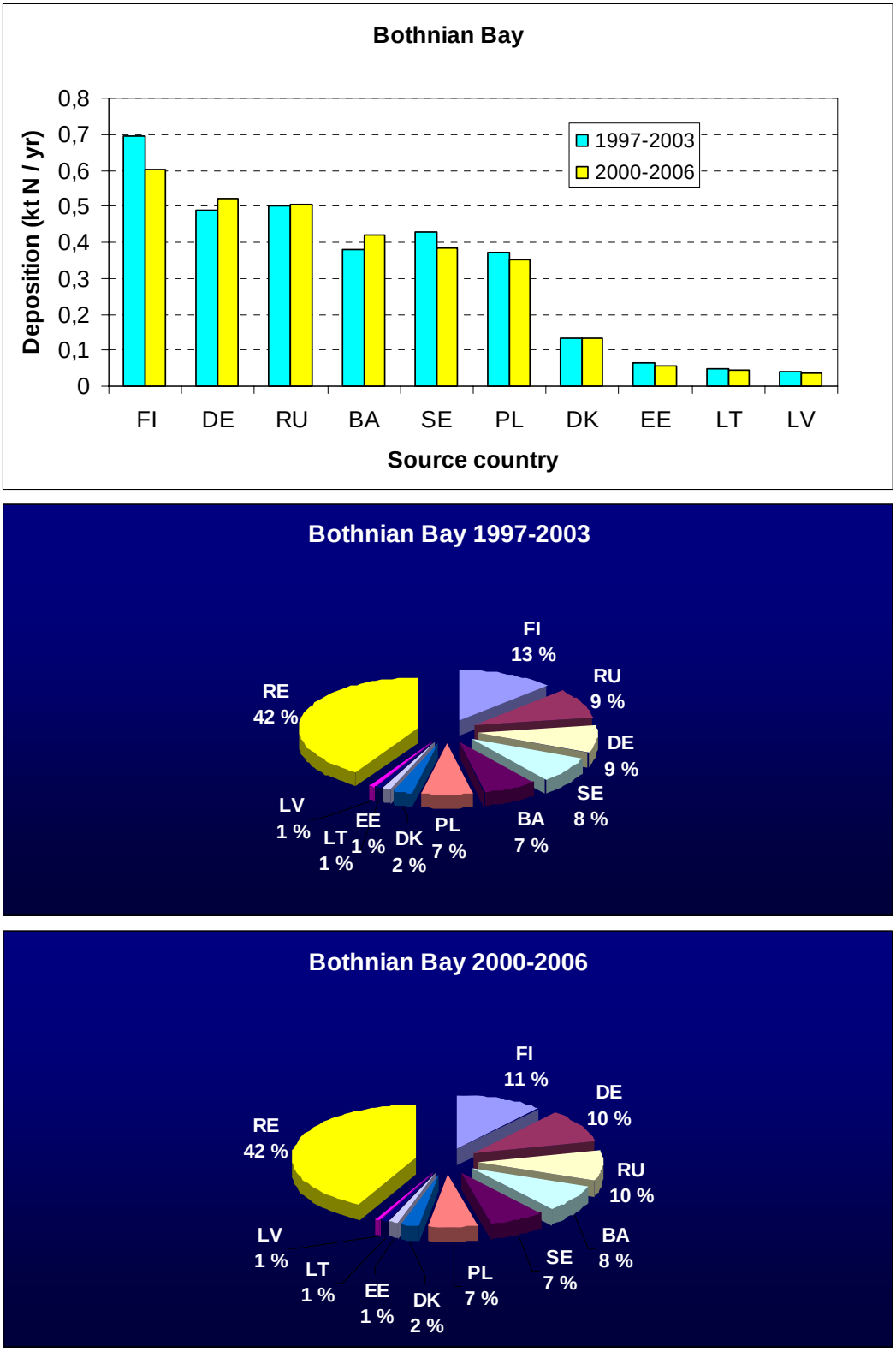


Figure 16. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the Bothnian Bay sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

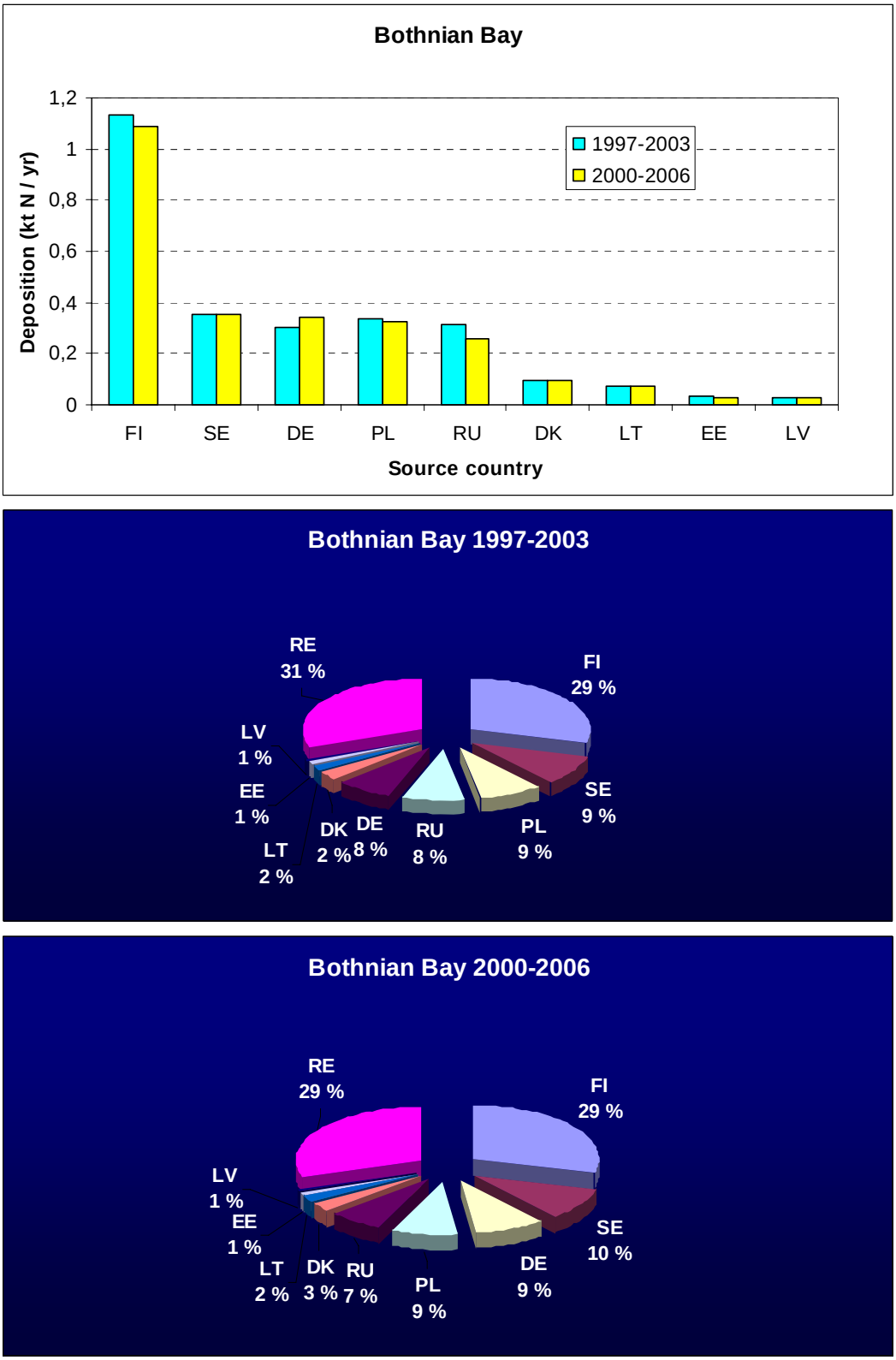
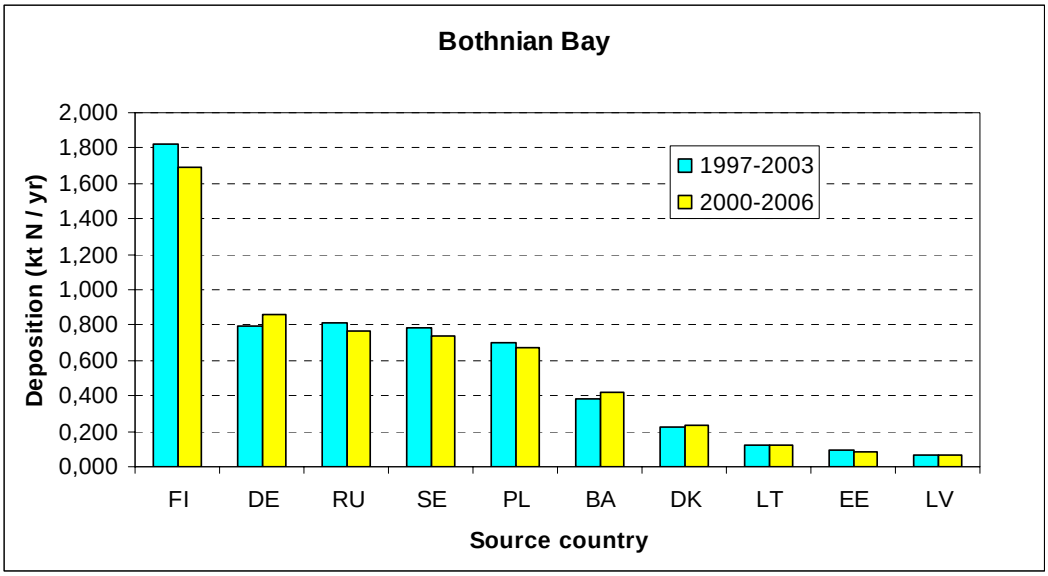
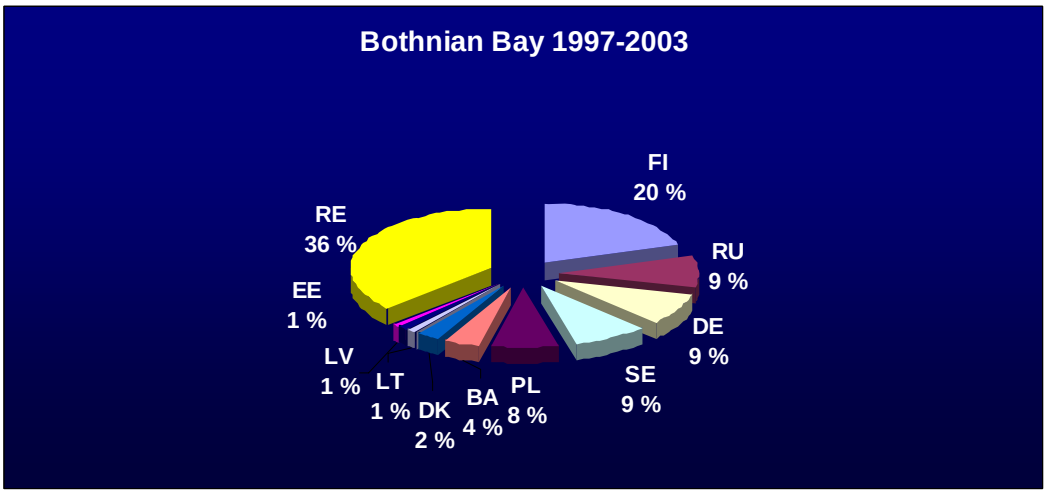


Figure 17. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of reduced nitrogen to the Bothnian Bay sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition.





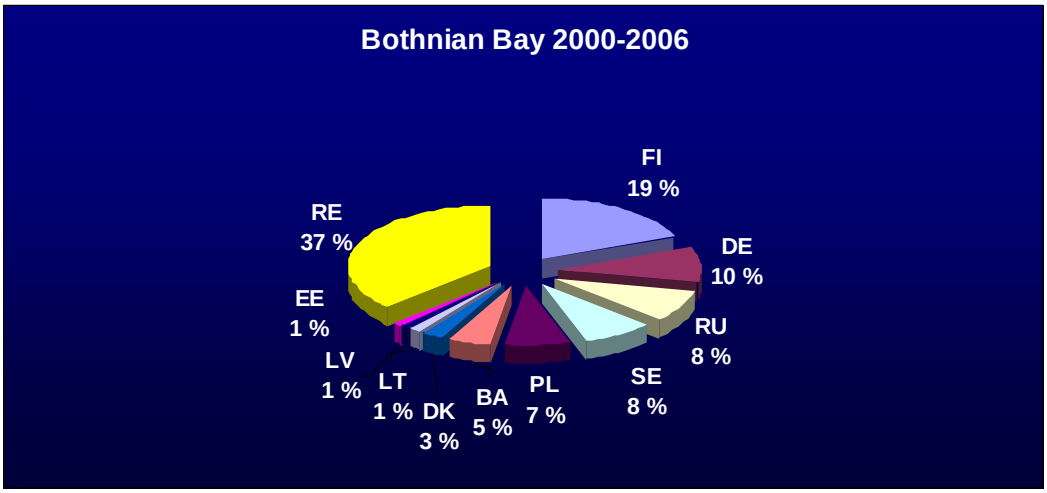


Figure 18. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of total nitrogen to the Bothnian Bay sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

4.3 Contributions to the Bothnian Sea sub-basin

Calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised, reduced and total nitrogen to the Bothnian Sea sub-basin in the periods: 1997-2003 and 2000-2006 are shown in Fig.19, 20 and 21, respectively.

Contributions to oxidised nitrogen depositions to Bothnian Sea sub-basin are similar for both periods with HELCOM sources contributing 54% and 55%. Emissions from Germany, ship traffic, Poland, Sweden, Russia and Finland are the major contributors to the deposition. Contributions from Germany and ship traffic are increasing in time, whereas contributions from other sources are lower in the period 2000-20006 than in the period 1997-2006. The relative contribution from Germany and ship traffic are higher and the relative contributions from lower in the period 2000-2006.

Compared to oxidised nitrogen deposition, contributions of HELCOM sources to reduced nitrogen deposition are higher again: 62% in the period 1997-2003 and 63% in the period 2000-2006. Poland, Sweden, Germany and Finland are the major contributors to reduced nitrogen deposition in the Bothnian Sea sub-basin. Only contribution from Germany is higher in the period 2000-2006. The relative contribution from Germany is 1% higher, whereas contribution from Poland is 1% lower in the period 2000-2006.

Contributions to total nitrogen depositions in both periods are similar with contribution from all HELCOM sources being 1% higher in the period 2000-2006. Six major contributors to total nitrogen depositions in both periods are: Germany, Poland, Sweden, Finland, ship traffic. and Russia. Only contributions from Germany and ship traffic are higher in the period 2000-2006.The relative contributions from Germany and ship traffic are 1% higher and contribution from Russia is 1% lower in the period 2000-2006.

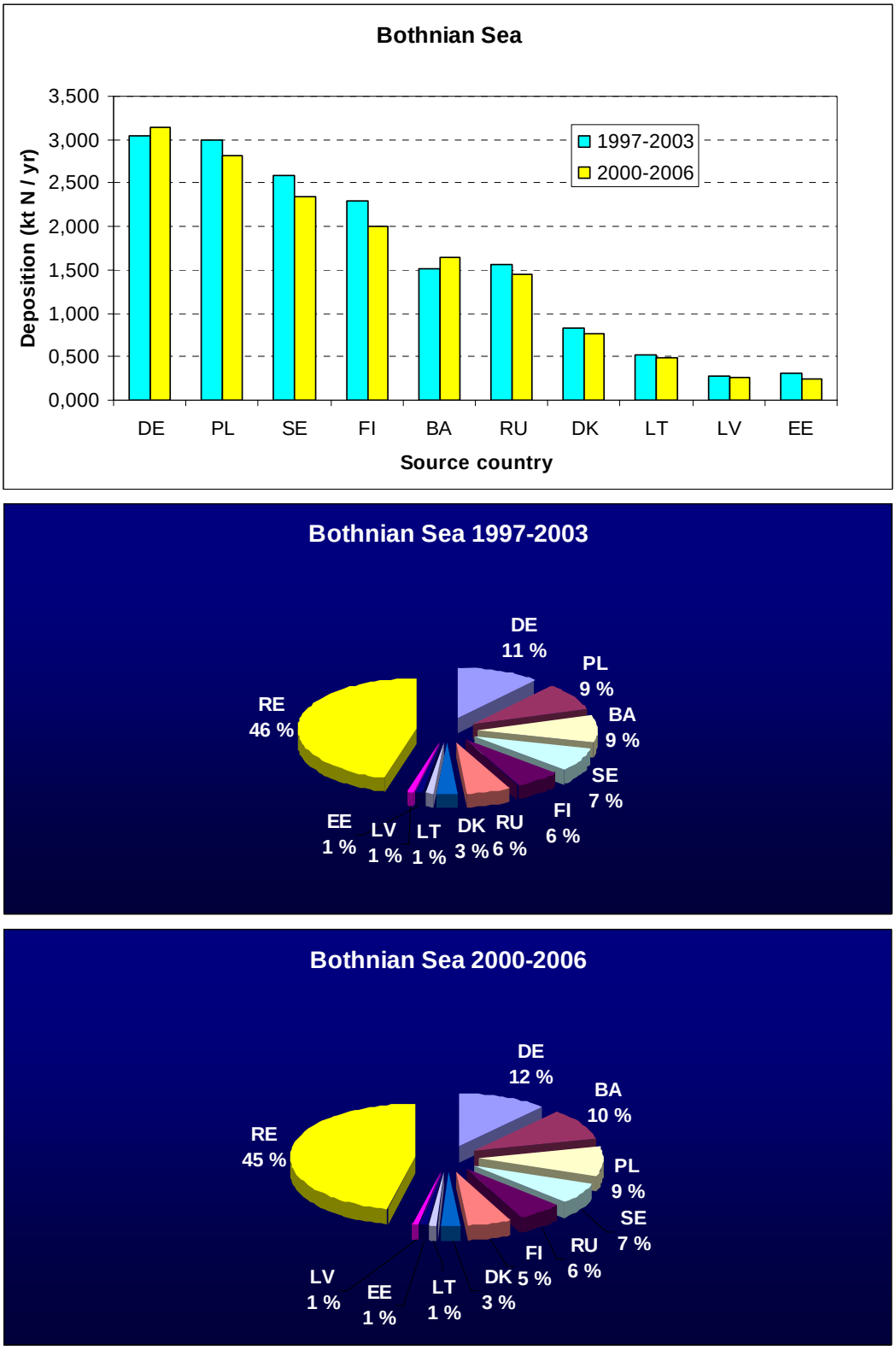


Figure 19. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the Bothnian Sea sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

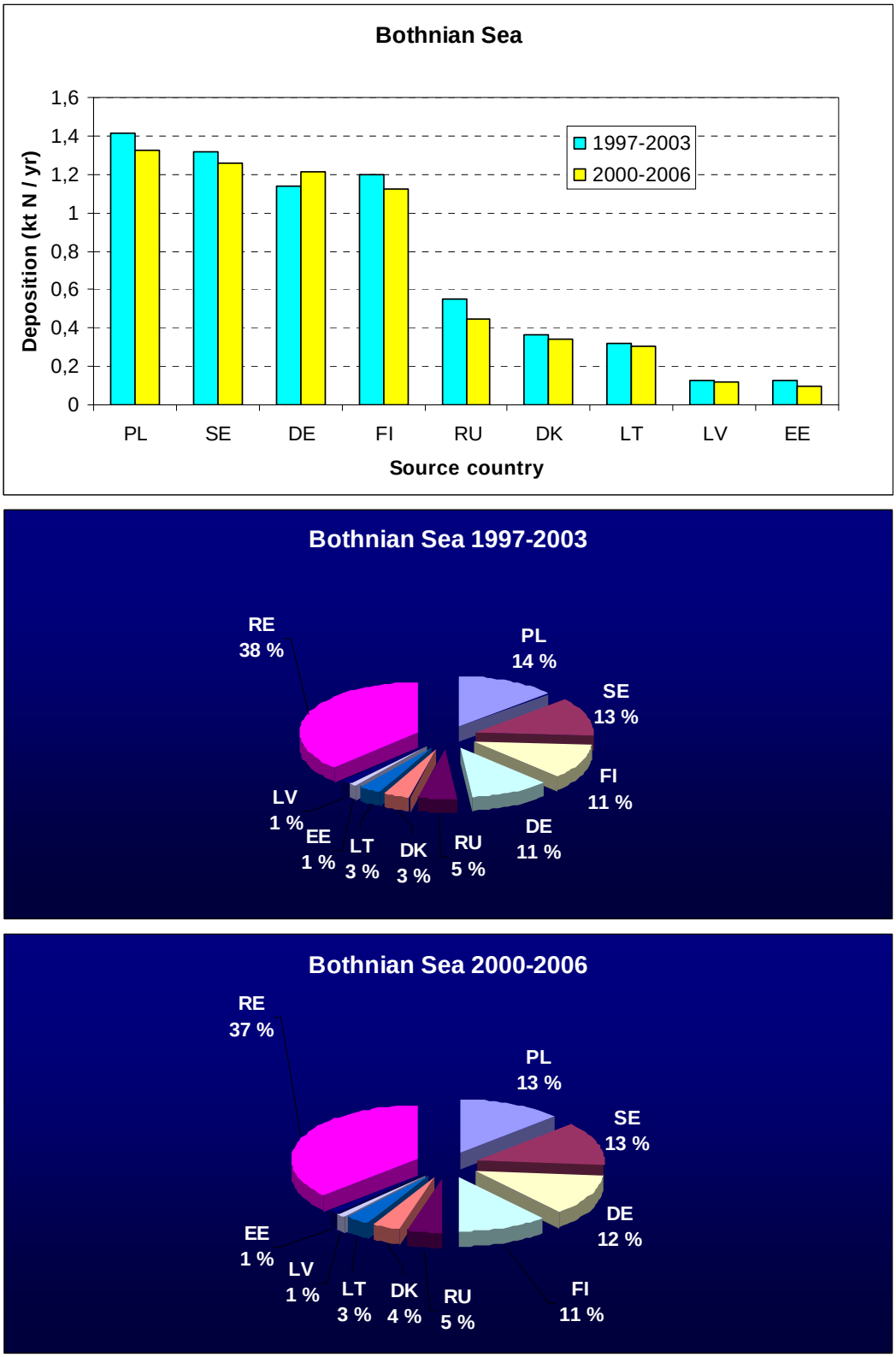
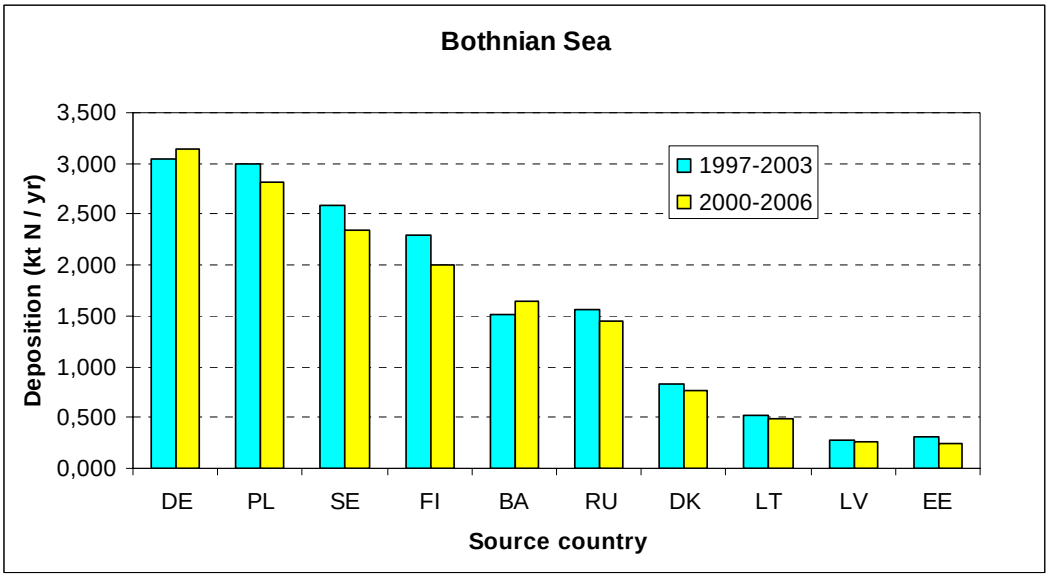
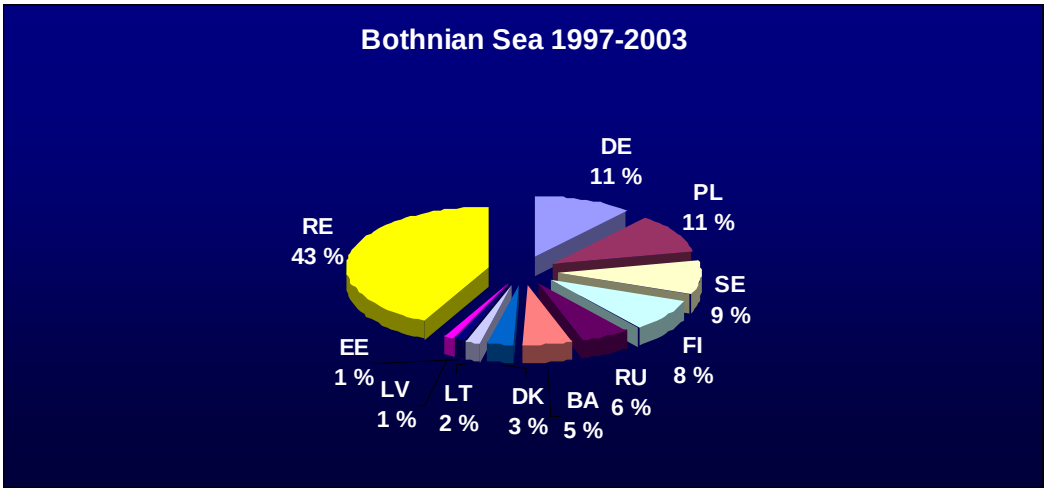


Figure 20. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of reduced nitrogen to the Bothnian Sea sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition.





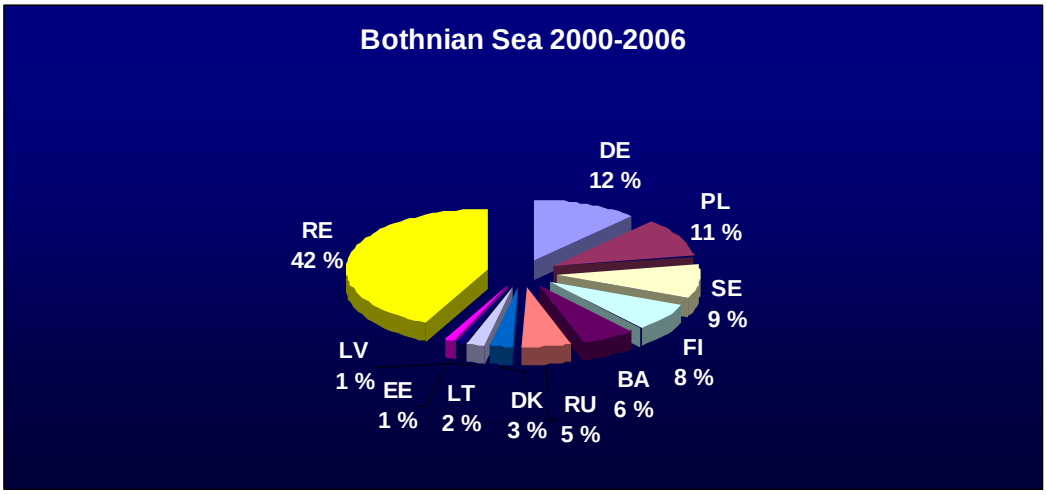


Figure 21. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of total nitrogen to the Bothnian Sea sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

4.4 Contributions to the Gulf of Finland sub-basin

Calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised, reduced and total nitrogen to the Gulf of Finland sub-basin in the periods: 1997-2003 and 2000-2006 are shown in Fig.22, 23 and 24, respectively.

Contributions to oxidised nitrogen depositions to the Gulf of Finland sub-basin are the same for both periods with HELCOM sources contributing 56%. Emissions from Russia, Germany, ship traffic, Poland, and Finland are the major contributors to the deposition. Contributions from Russia, ship traffic, Poland, Lithuania and Latvia are increasing in time, whereas contributions from Germany, Finland, Sweden, Estonia and Denmark are lower in the period 2000-20006 than in the period 1997-2006. The relative contributions from the ship traffic and Poland are increasing 1% from the first period to the second.

Compared to oxidised nitrogen deposition, contributions of HELCOM sources to reduced nitrogen deposition are higher again: 62% in the period 1997-2003 and 61% in the period 2000-2006. Russia, Germany, Poland, Estonia and Finland are the major contributors to reduced nitrogen deposition in the Gulf of Finland sub-basin. Contributions from Russia, Estonia, Sweden and Denmark Germany are higher, whereas contributions from Germany, Poland, Finland, Lithuania and Latvia are lower in the period 2000-2006.

Contributions to total nitrogen depositions in both periods are similar with contribution from all HELCOM sources being 2% lower in the period 2000-2006. Russia is the number one contributor to total nitrogen deposition in both periods. The contributions from Germany, Poland, ship traffic, Lithuania and Latvia are higher and contribution from Russia, Finland, Estonia, Sweden and Denmark are lower in the period 2000-2006. Th relative contributions from Russia, Estonia, and Denmark are 1% lower and the relative contributions from ship traffic 1% higher in the period 2000-2006

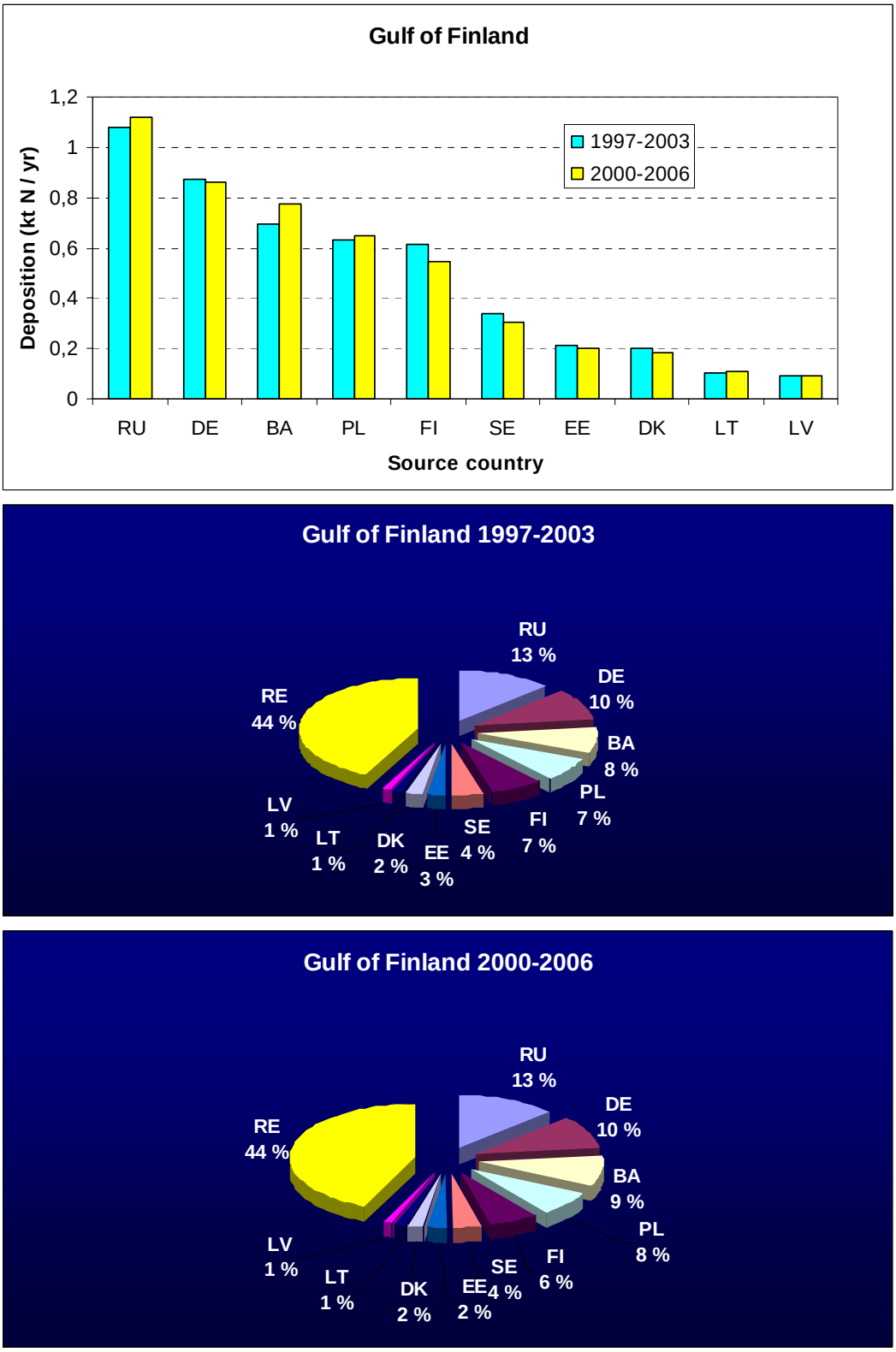


Figure 22. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the Gulf of Finland sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

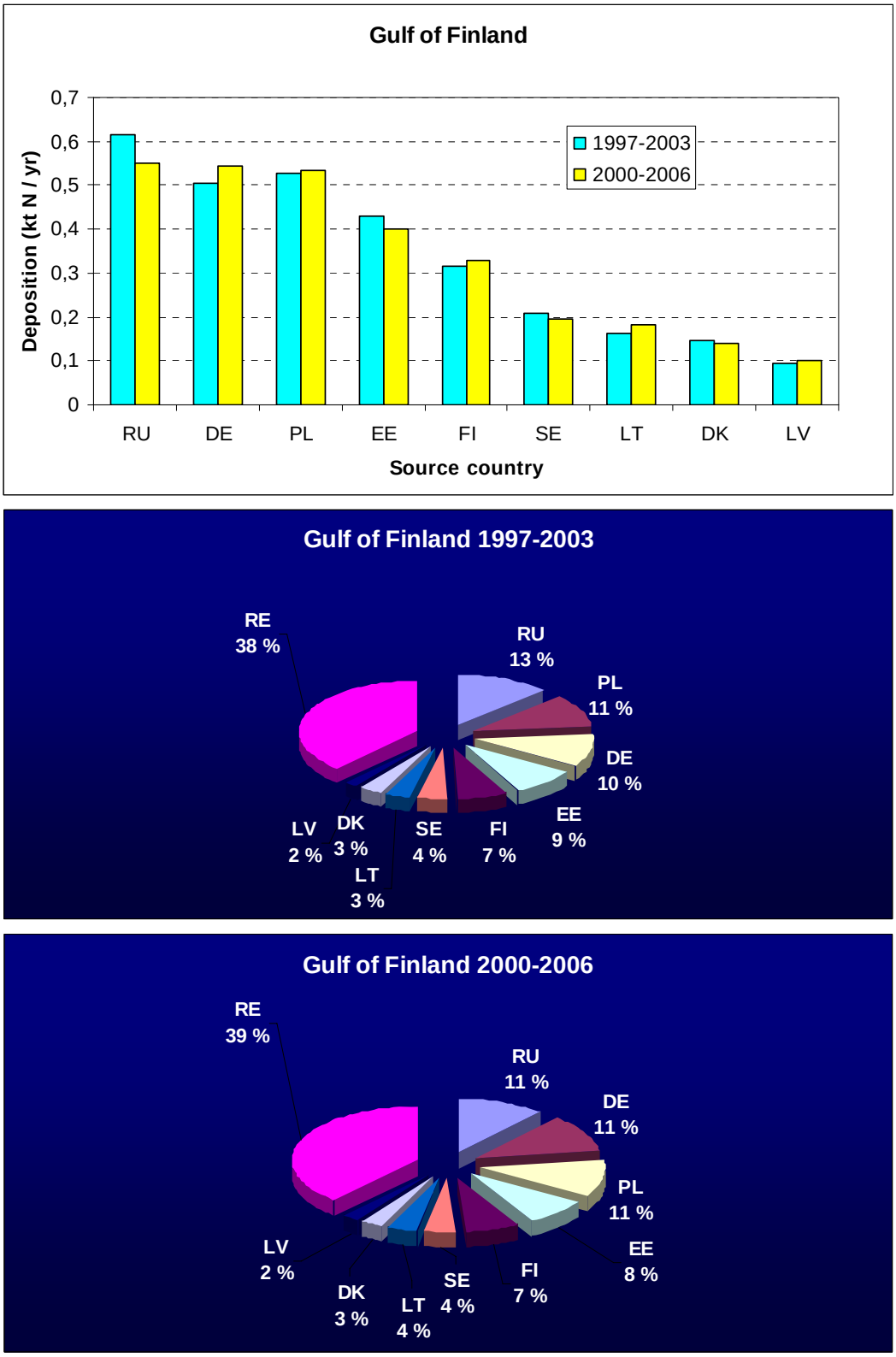


Figure 22. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the Gulf of Finland sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

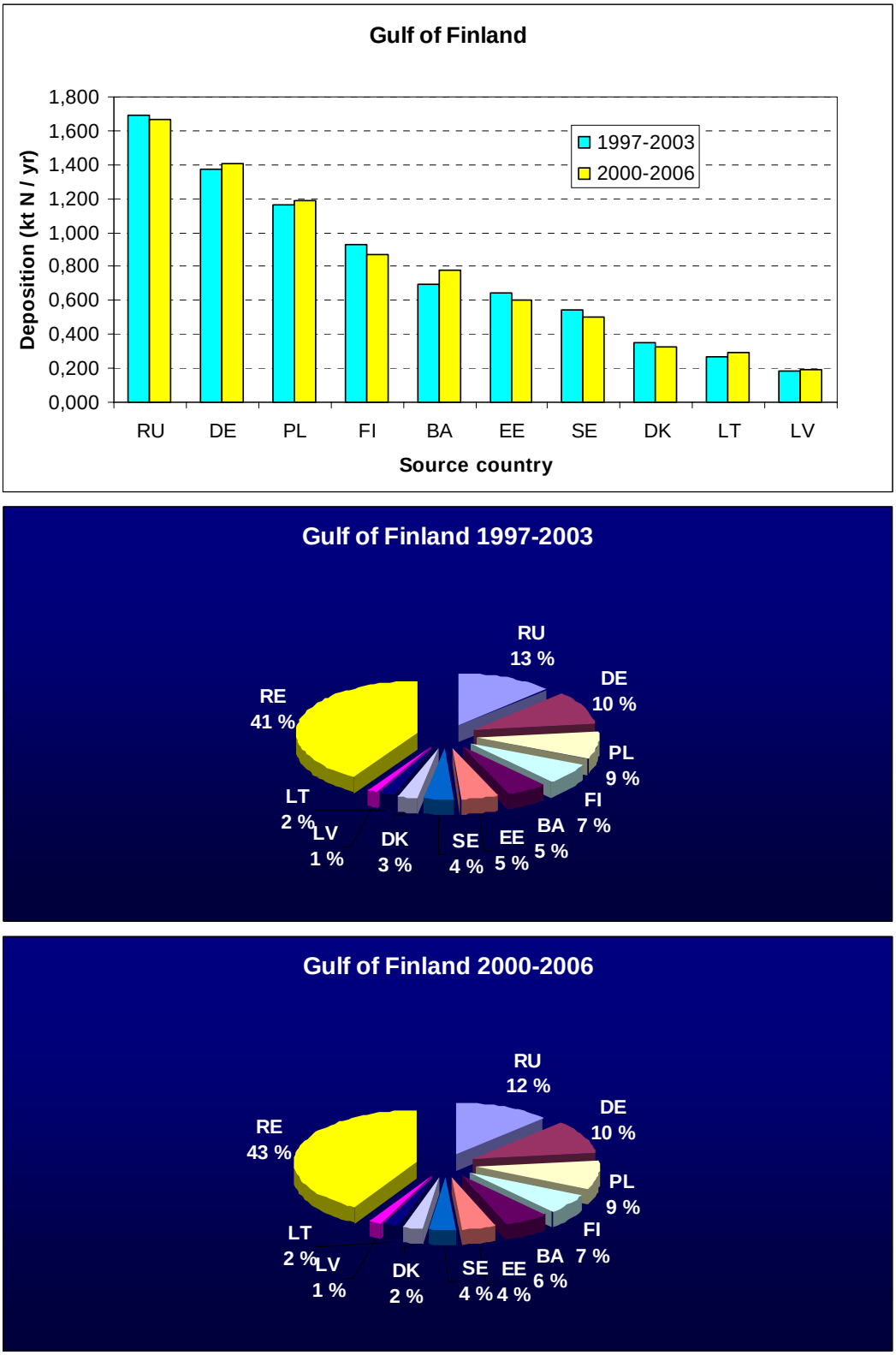


Figure 24. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of total nitrogen to the Gulf of Finland sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

4.5 Contributions to the Gulf of Riga sub-basin

Calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised, reduced and total nitrogen to the Gulf of Riga sub-basin in the periods: 1997-2003 and 2000-2006 are shown in Fig.25, 26 and 27, respectively.

Contributions to oxidised nitrogen depositions to the Gulf of Finland sub-basin are the same for both periods with HELCOM sources contributing 50% and 52%. Emissions from Russia, Germany, Poland and ship traffic are the major contributors to the deposition. Contributions from Poland, ship traffic and Russia are increasing whereas contributions from the rest of the sources are lower in the period 2000-206 than in the period 1997-2006. The relative contributions from Poland and ship traffic are increasing 1% from the first period to the second.

Compared to oxidised nitrogen deposition, contributions of HELCOM sources to reduced nitrogen deposition are higher again: 61% in the period 1997-2003 and 64% in the period 2000-2006. Poland, Germany, Lithuania and Latvia are the major contributors to reduced nitrogen deposition in the Gulf of Riga sub-basin. Contributions from Germany, Lithuania and Latvia are higher, whereas contributions from other sources are lower in the period 2000-2006. The relative contributions from Germany, Lithuania and Latvia are 1% higher in the period 2000-2006.

Contributions to total nitrogen depositions in both periods are similar with contribution from all HELCOM sources being 2% lower in the period 2000-2006. Two major contributors to total nitrogen depositions in both periods are: Germany and Poland. The contributions from Poland, ship traffic, Lithuania and Latvia are higher in the period 2000-2006. The relative contributions from ship traffic are 1% higher and relative contributions from Denmark 1% lower in the period 2000-2006.

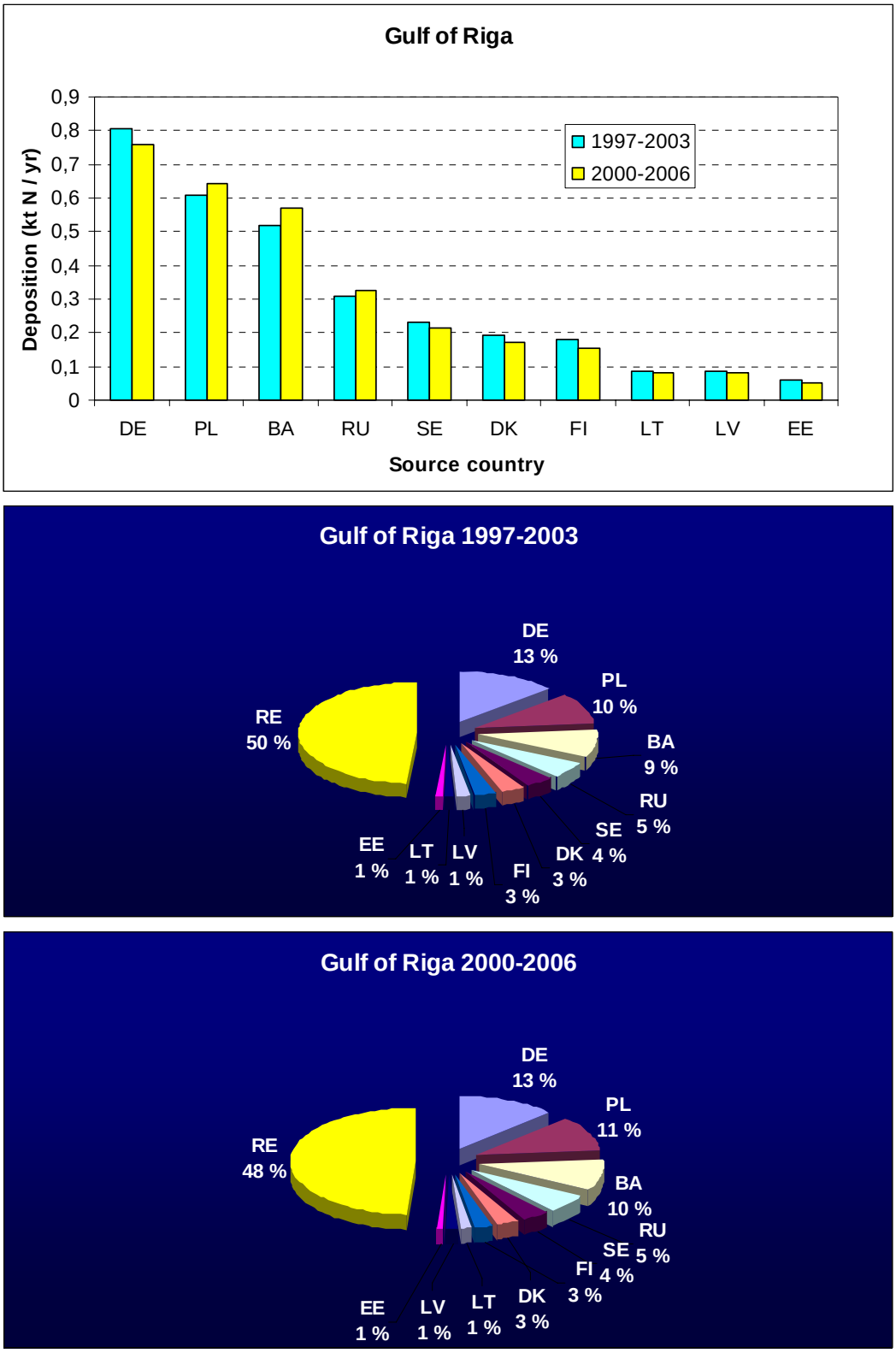


Figure 25. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the Gulf of Riga sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

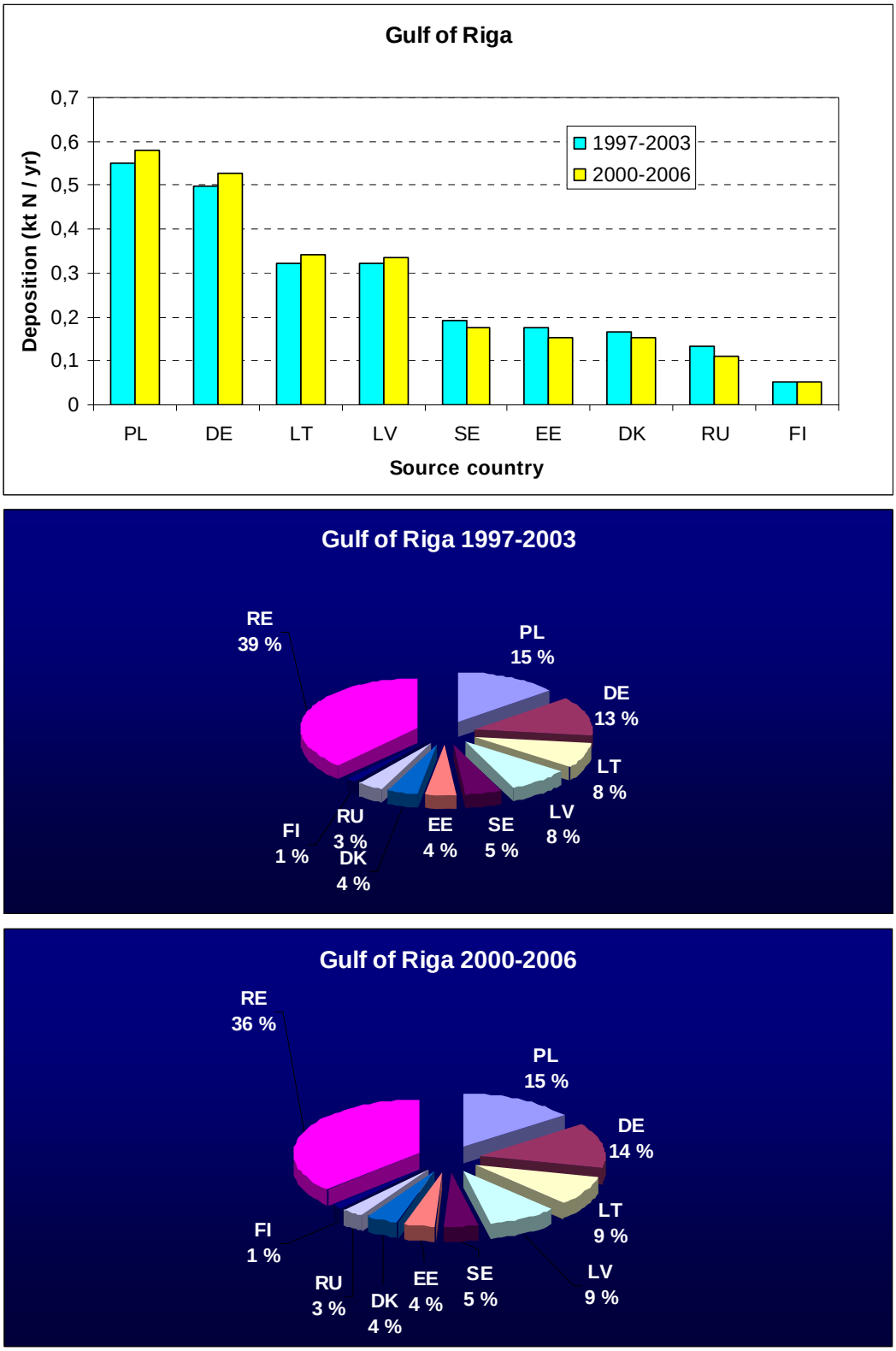


Figure 26. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of reduced nitrogen to the Gulf of Riga sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

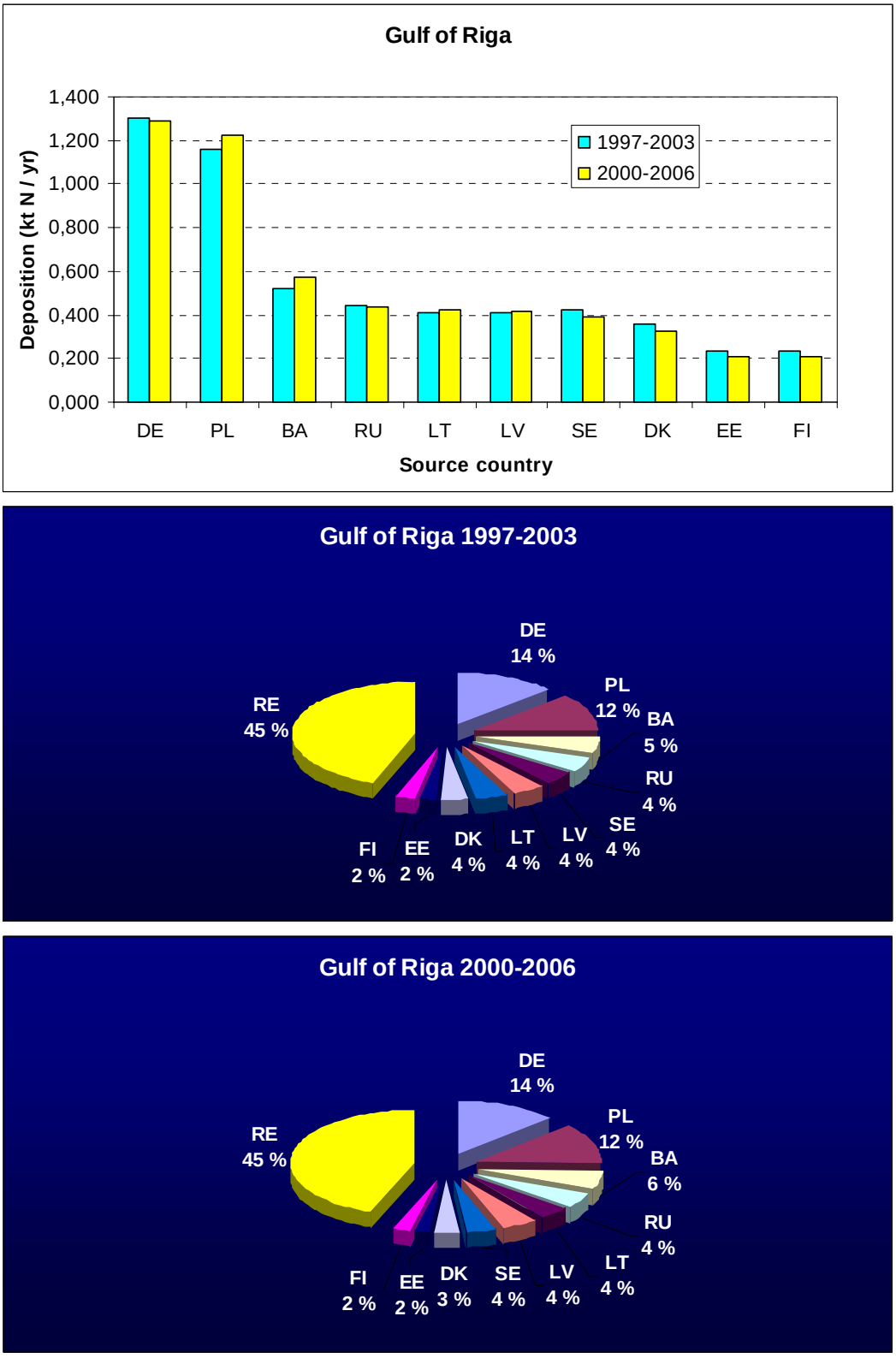


Figure 27. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of total nitrogen to the Gulf of Riga sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

4.6 Contributions to the Baltic Proper sub-basin

Calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised, reduced and total nitrogen to the Baltic Proper sub-basin in the periods: 1997-2003 and 2000-2006 are shown in Fig.28, 29 and 30, respectively.

Contributions to oxidised nitrogen depositions to the Baltic Proper sub-basin are the same for both periods with HELCOM sources contributing 48% and 49%. Emissions from Germany, Poland and ship traffic are the major contributors to the deposition. Only contributions from the ship traffic and Denmark are increasing whereas contributions from the rest of the sources are lower in the period 2000-20006 than in the period 1997-2006. The relative contributions from the ship traffic and Russia are increasing 1% and contributions from Germany decreasing 1% from the first period to the second.

Compared to oxidised nitrogen deposition, contributions of HELCOM sources to reduced nitrogen deposition are much higher: 73% in tboth periods. Germany, Poland, Sweden and Denmark are the major contributors to reduced nitrogen deposition in the Baltic Proper sub-basin. Contributions from Germany and Latvia are higher, whereas from other sources are lower in the period 2000-2006. The relative contributions from Germany increase 2% in the period 2000-2006.

Contributions to total nitrogen depositions in both periods are similar with contribution from all HELCOM sources being 2% lower in the period 2000-2006. Five major contributors to total nitrogen depositions in both periods are: Germany, Poland, Sweden, Denmark and the ship traffic. Contributions from all sources except the ship traffic, Russia and Latvia are lower in the period 2000-2006 than in the period 1997-2003. The relative contributions from Germany and Baltic Sea traffic increase 2% in the period 2000-2006.

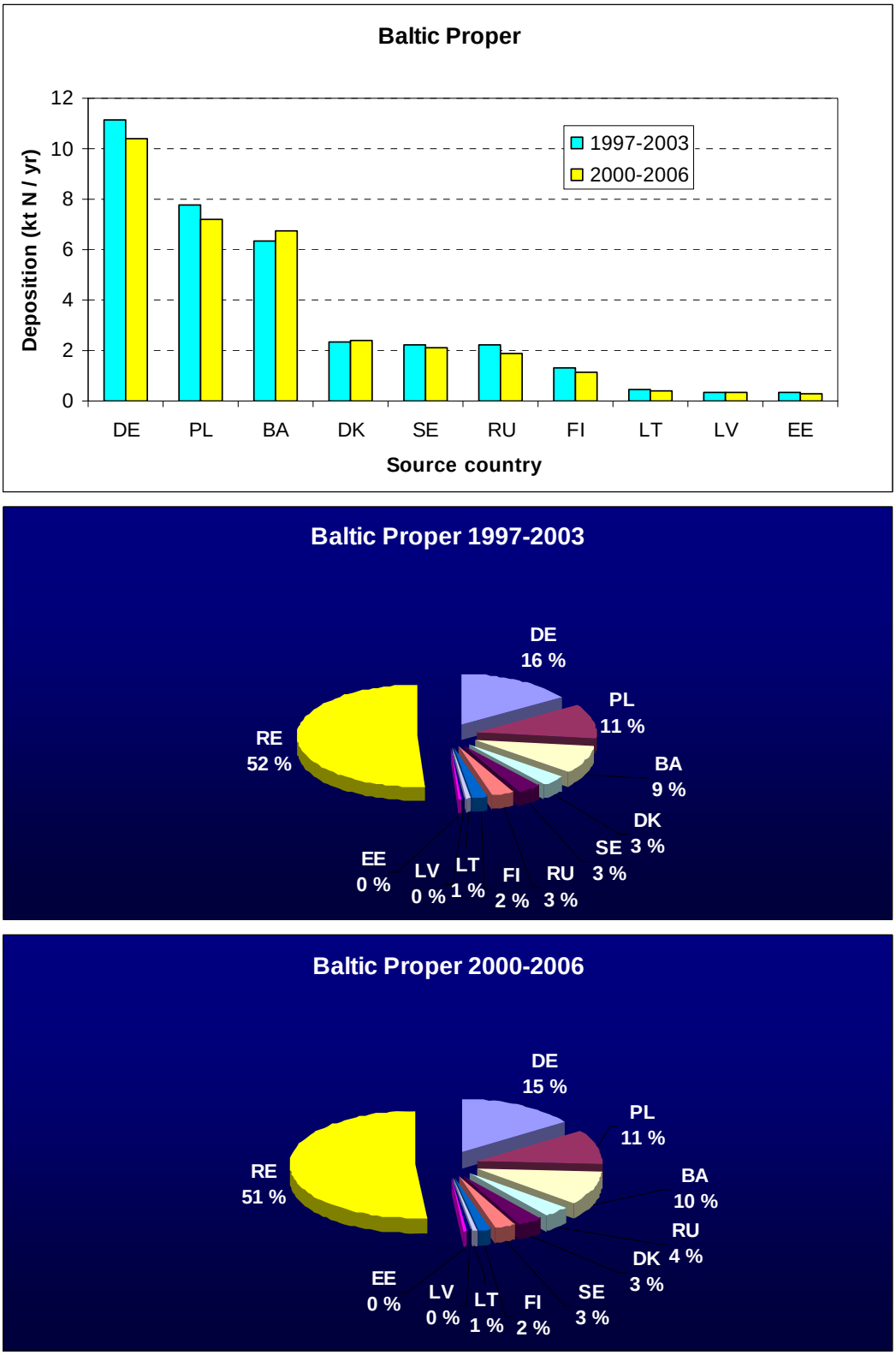


Figure 28. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the Baltic Proper sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

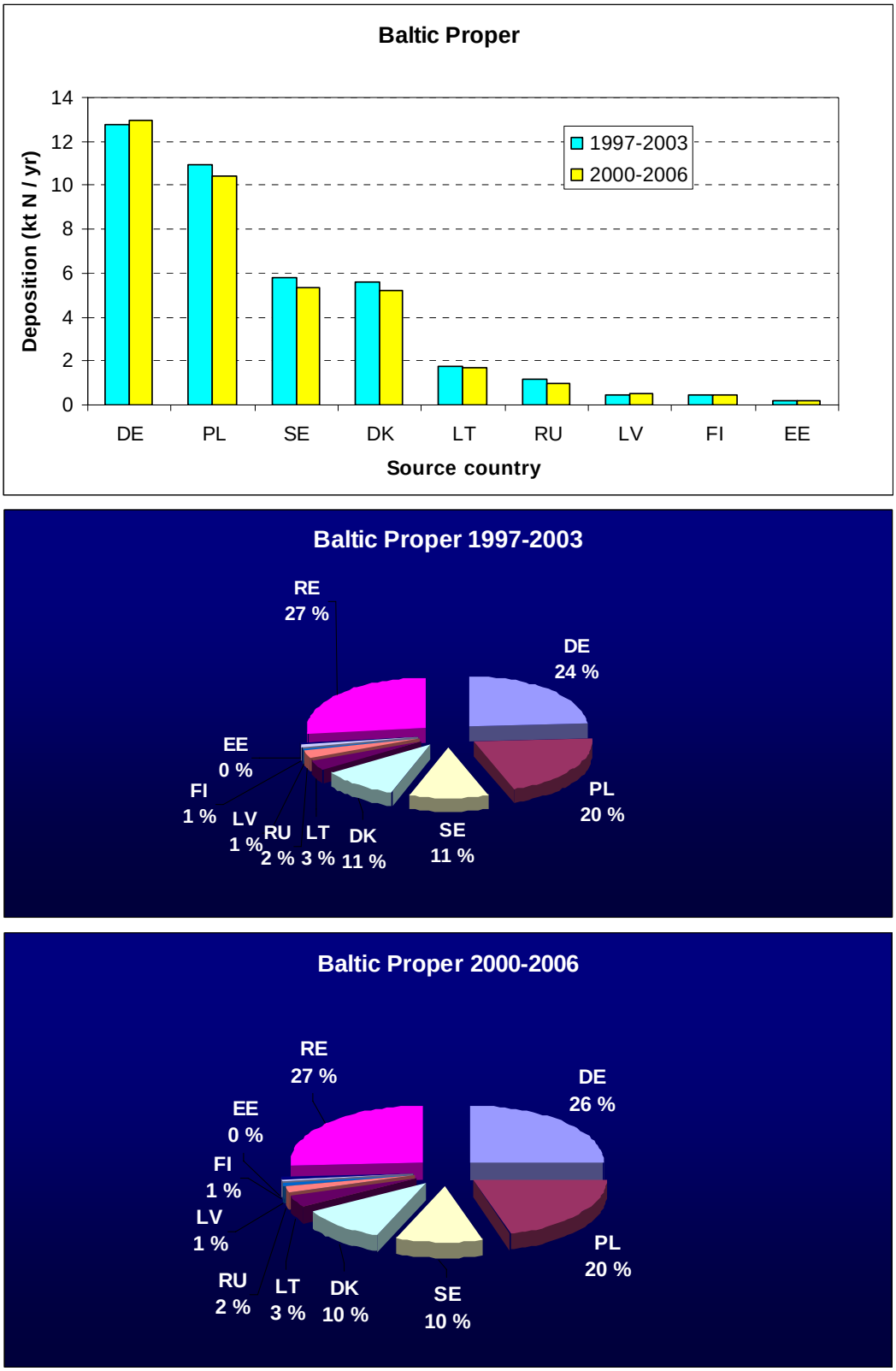


Figure 29. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of reduced nitrogen to the Baltic Proper sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

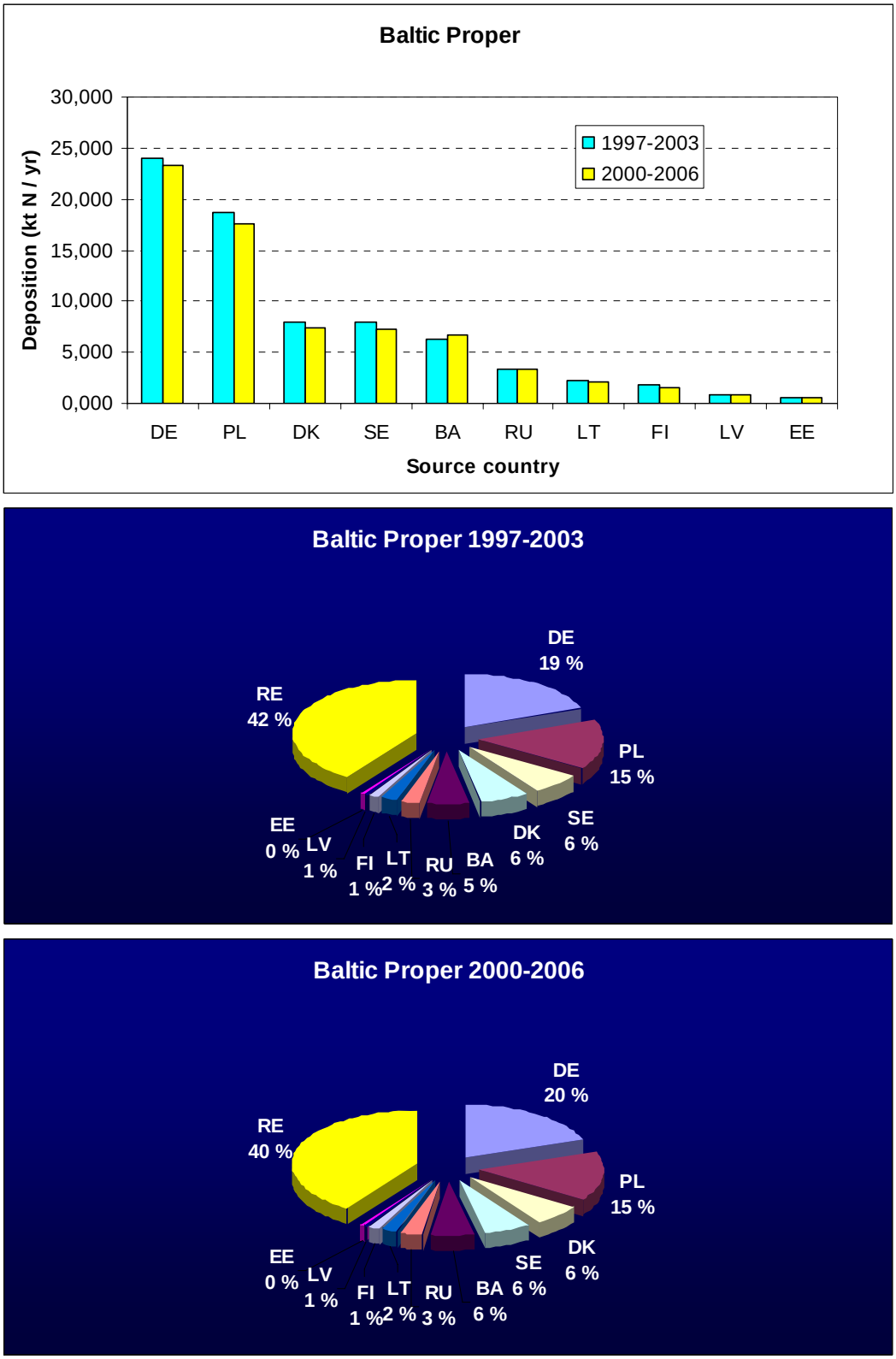


Figure 30. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of total nitrogen to the Baltic Proper sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

4.7 Contributions to the Danish Straits sub-basin

Calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised, reduced and total nitrogen to the Danish Straits sub-basin in the periods: 1997-2003 and 2000-2006 are shown in Fig.31, 32 and 33, respectively.

Contributions to oxidised nitrogen depositions to the Danish Straits sub-basin are similar for both periods with HELCOM sources contributing 37% and 36%, however these contributions are relatively small compared to other sub-basins. Emissions from Germany, ship traffic, Poland and Denmark are the major contributors to the deposition with the dominating position of Germany's contribution: 20% in the period 1997-2003 and 18%. In the period 2000-2006. Contributions from the ship traffic and Russia are increasing whereas contributions from Germany are decreasing in the period 2000-2006. The relative contributions from the ship traffic are increasing 1% and contributions from Germany decreasing 2% from the first period to the second.

Compared to oxidised nitrogen deposition, contributions of HELCOM sources to reduced nitrogen deposition are very high: 86% in the period 1997-2003 and in the period 2000-2006. Germany and Denmark are the major and dominating contributors to reduced nitrogen deposition in the Danish Straits sub-basin. Contribution from Germany is higher, whereas contributions from Denmark and Poland are lower in the period 2000-2006.

Contributions to total nitrogen depositions in both periods are the same – 67%. There are two major and dominating contributors to total nitrogen depositions in both periods: Germany and Denmark. Absolute contributions from these two sources are lower in the period 2000-2006 than in the period 1997-2003, but relative contributions from Germany are 1% higher, whereas contributions from Denmark are 1% lower in the period 2000-20006.

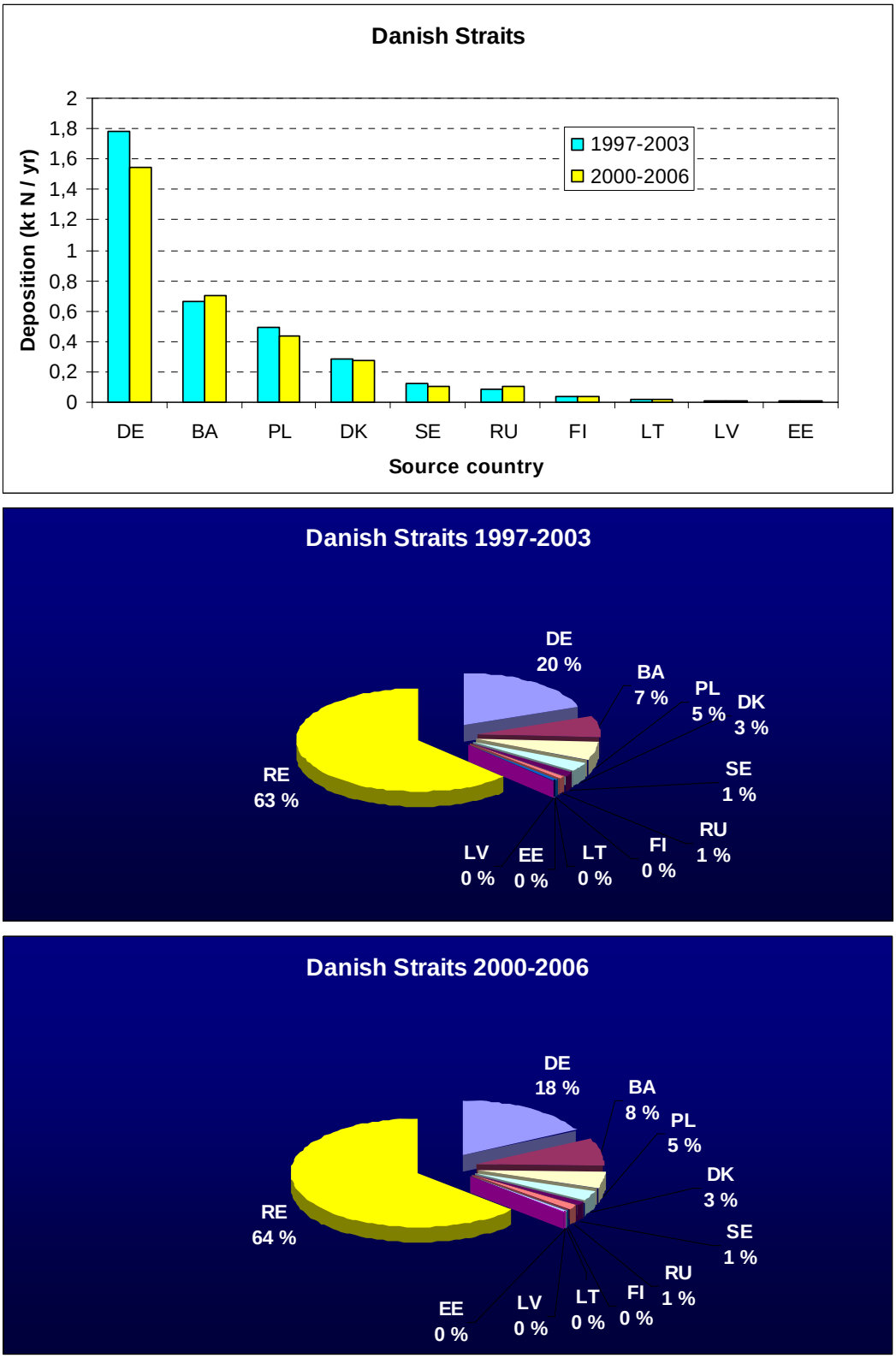


Figure 31. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the Danish Straits sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

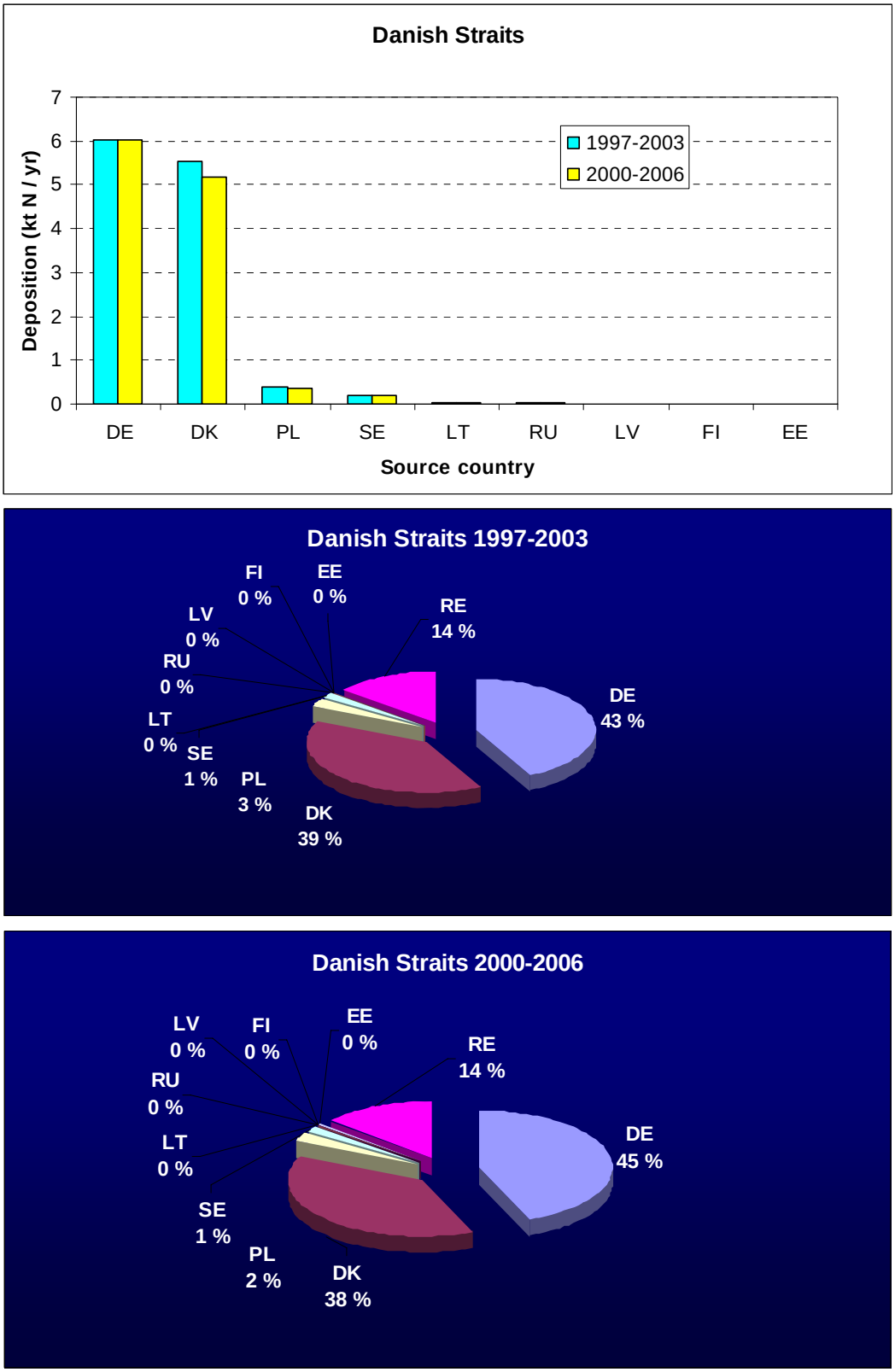


Figure 32. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of reduced nitrogen to the Danish Straits sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

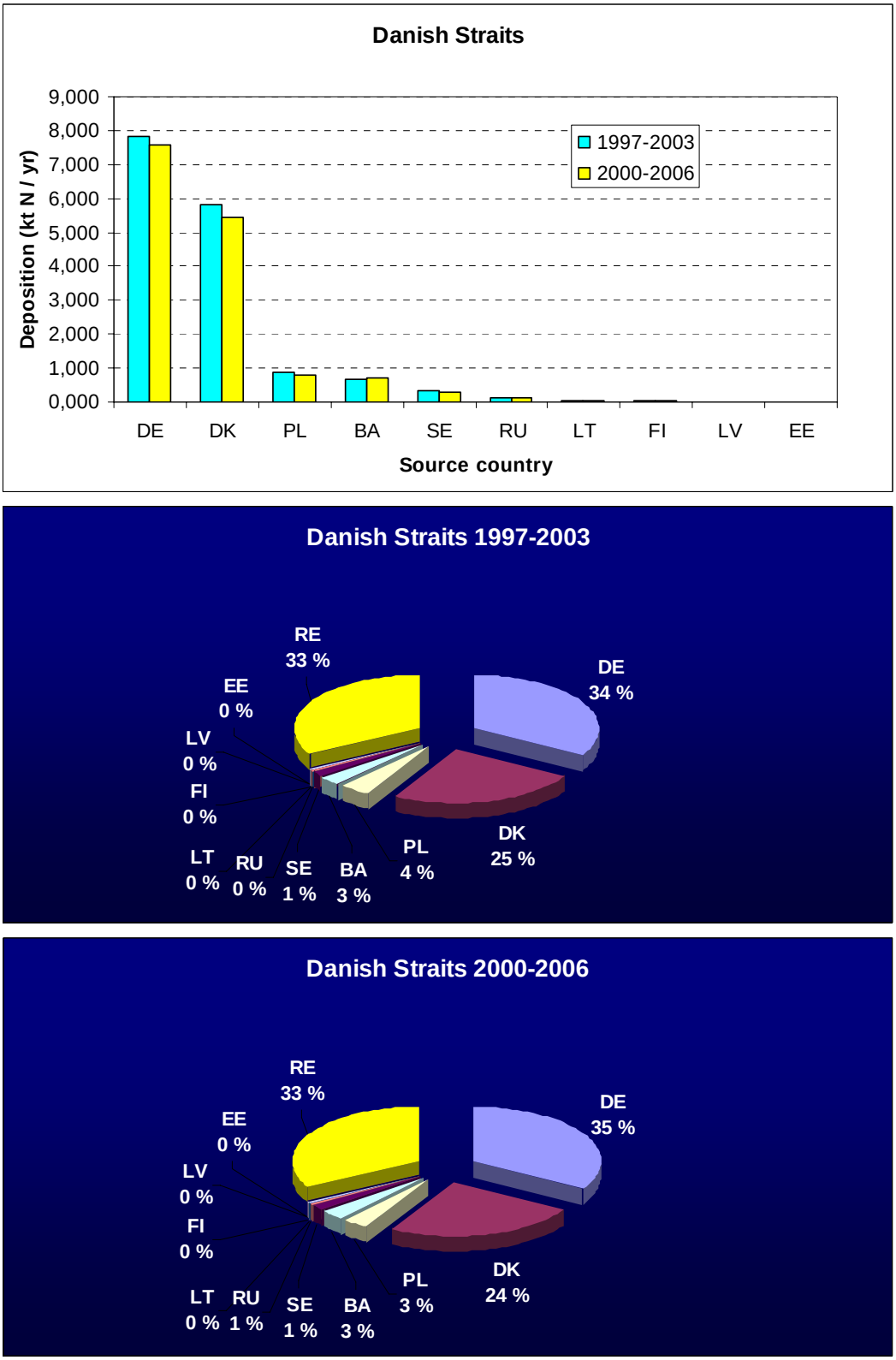


Figure 33. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of total nitrogen to the Danish Straits sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

4.8 Contributions to the Kattegat sub-basin

Calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised, reduced and total nitrogen to the Kattegat sub-basin in the periods: 1997-2003 and 2000-2006 are shown in Fig.34, 35 and 36, respectively.

Contributions to oxidised nitrogen depositions to the Kattegat sub-basin are similar for both periods with HELCOM sources contributing 37% and 36%. These contributions are relatively small compared to other sub-basins except the Danish Straits sub-basin. Emissions from Germany, ship traffic and Poland are the major contributors to the deposition with the dominating position of Germany's contribution (16%). Contributions from the ship traffic and Russia are increasing whereas contributions from Germany are lower in the period 2000-20006 than in the period 1997-2006. The relative contributions from the ship traffic are increasing 1% and contributions from Germany decreasing 1% from the first period to the second.

Compared to oxidised nitrogen deposition, contributions of HELCOM sources to reduced nitrogen deposition are very high: again: 83% in the period 1997-2003 and in the period 2000-2006. Emissions from Denmark are dominating (53%) the contributors to reduced nitrogen deposition in the Kattegat sub-basin. This very high contribution of Denmark does not change from the first period to the second.

Contributions to total nitrogen depositions in both periods are the same – 61%. There are two major and dominating contributors to total nitrogen depositions in both periods: Denmark and Germany. Absolute contributions from these two sources are lower in the period 2000-2006 than in the period 1997-2003, but relative contributions from from Denmark remains on the same level in the period 2000-2006.

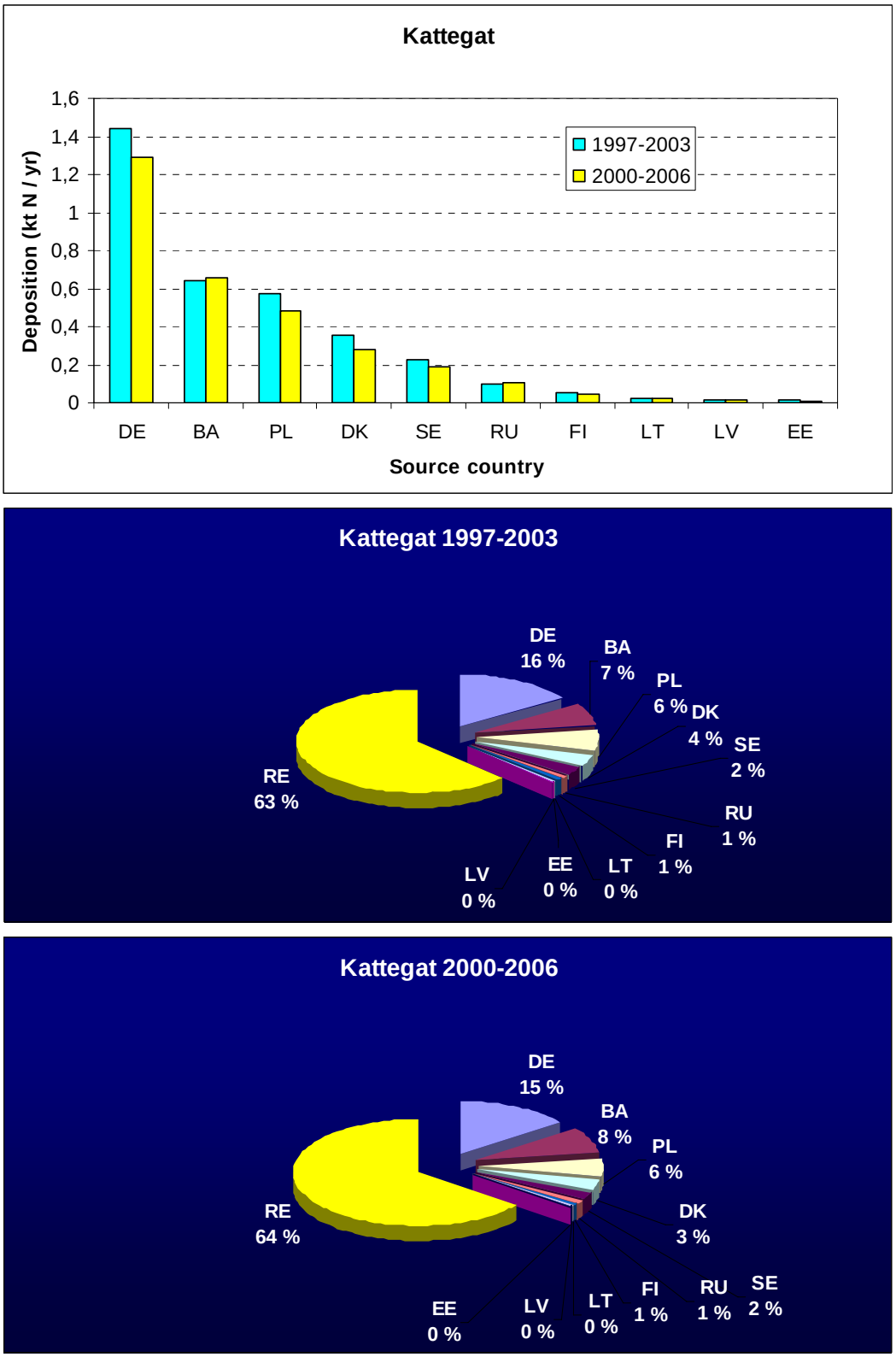
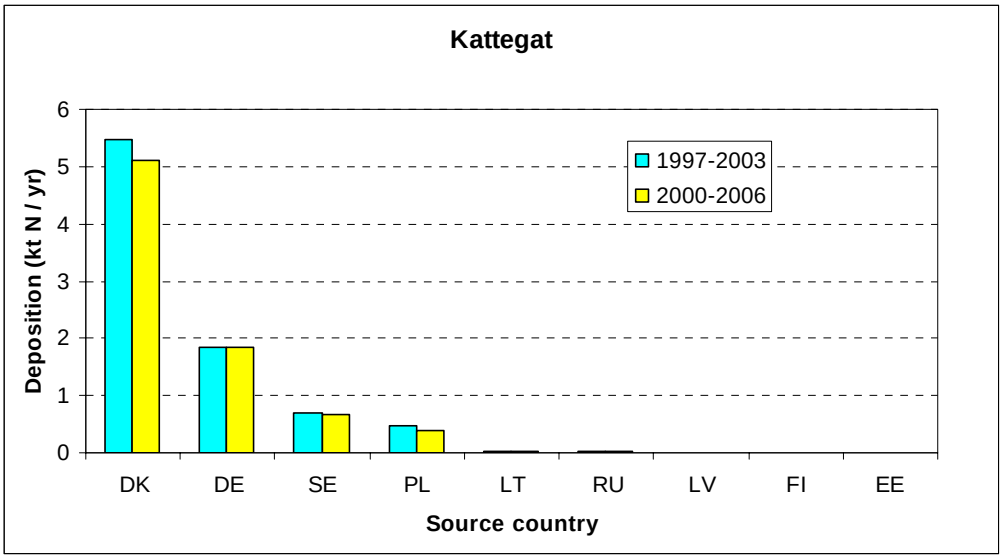
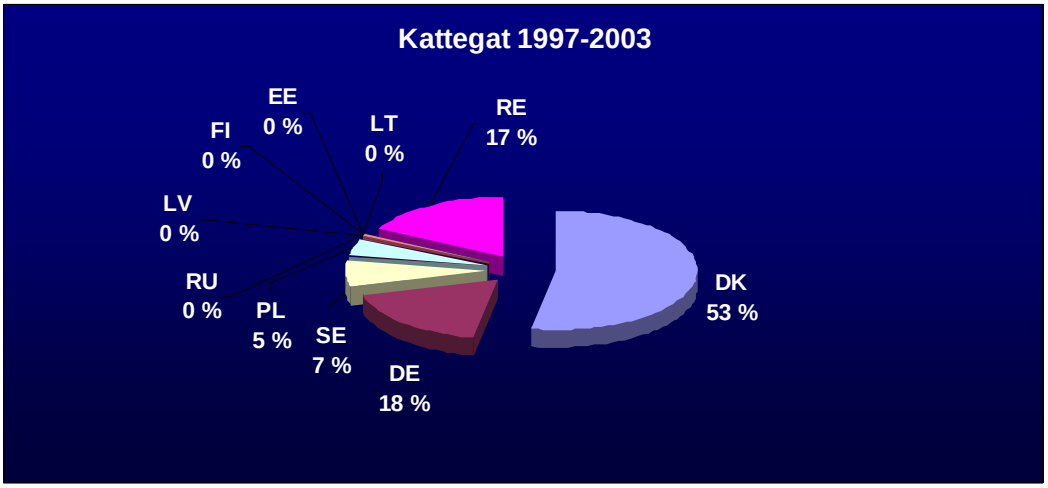


Figure 34. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of oxidised nitrogen to the Kattegat sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic

Sea.





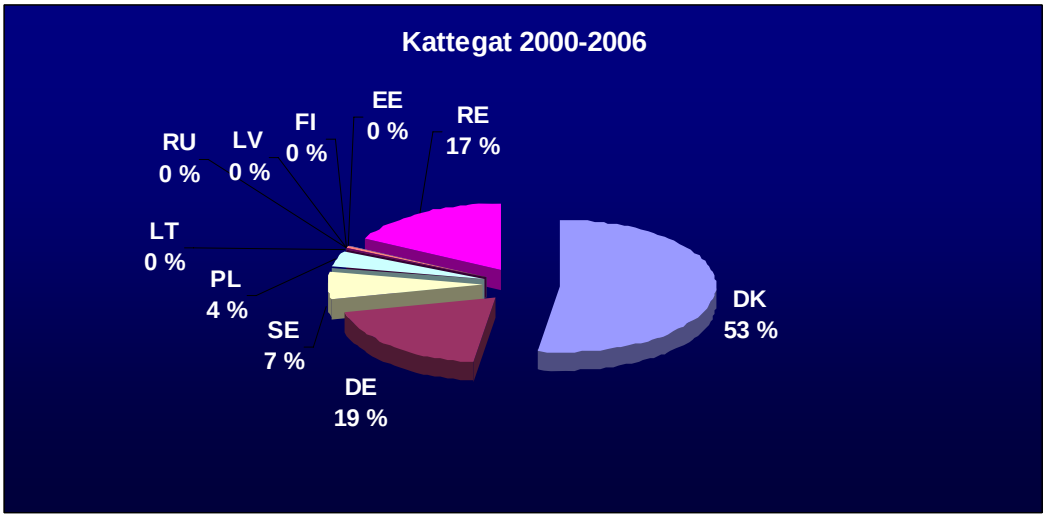


Figure 35. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of reduced nitrogen to the Kattegat sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

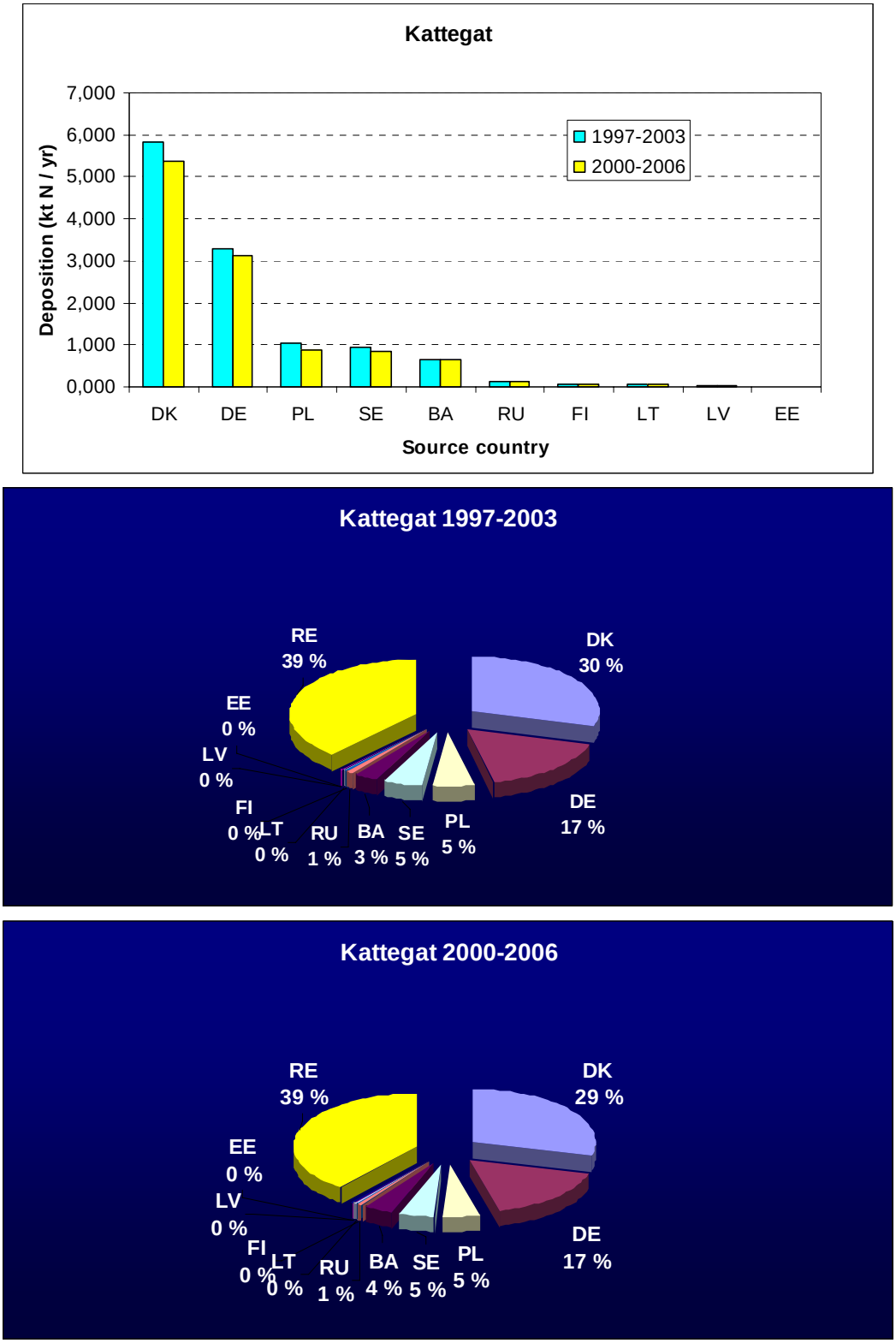


Figure 36. Comparison of calculated annual average contributions of emissions from the HELCOM Contracting Parties and ship traffic on the Baltic Sea to the deposition of total nitrogen to the Kattegat sub-basin in the periods: 1997-2003 and 2000-2006. Units: kt N per year and % of total deposition. BA denotes the emissions from the ship traffic on the Baltic Sea.

5. Contributions of emission sectors to nitrogen deposition

In the frame of the project the EMEP model was for the first time used to calculate contributions of selected emission sectors in each HELCOM country to oxidised, reduced and total nitrogen deposition to the Baltic Sea and its BSAP sub-basins. Computations were made for two different years: 2000 and 2003. The assumption was that these two years should represent the two considered periods, but it is difficult to judge how good this representation is. The ideal solution would be to perform the calculations for each year of the period 1997-2006 and than average the results in the same way as described in the previous Chapter. Unfortunately, this operation requires a very large number of the model runs and is limited by the project resources.

Contributions from three groups of emission sectors were calculated for each of the HELCOM Contracting Party:

- Sectors 1, 2 and 3 – related to emissions from combustion processes;
- Sectors 7 mand 8 – related to emissions from the transportation;
- Sector 10 – related to emissions from agriculture.

All these selected sectors are the major contributors to the deposition of oxidised, reduced and total nitrogen in the Baltic Sea and its sub-basins.

The results are presented later on, separately for each sub-basin of the Baltic Sea and for the entire basin of the Baltic Sea however there are some common features for all sub-basins, which we describe first.

The transportation and combustion emission sectors are the major contributors to oxidised nitrogen deposition to all sub-basins of the Baltic Sea. For all emitters except Poland, transportation sectors are the major contributors. From Poland, the combustion sectors contribute more into oxidised nitrogen deposition than the transportation sectors, for all sub-basins. The contributions from the agriculture sector are visible, but significantly smaller in the oxidised nitrogen deposition.

The agriculture sector entirely dominates contributions from nine out of ten HELCOM Contracting Parties to reduced nitrogen depositions in all Baltic Sea sub-basins. The only exception is Russia, where the contributions from the transportation and combustion sectors are often larger than the contributions from the agriculture sector.

The agriculture sector is also the major contributor to total nitrogen deposition in most of the sub-basins of the Baltic Sea, especially for countries with large emissions. There are only several exceptions especially for Russia, but also for Finland and Estonia, where the contributions from the transportation and combustion sectors to total nitrogen deposition are higher tan the contributions from the agriculture sector.

For all sub-basins, contributions to all kinds of nitrogen deposition are lower in 2003 than in the year 2000. However, the proportions between contributions from different sectors are very similar for both years and for all HELCOM countries except Finland. The contribution of Finnish combustion sectors to oxidised and total nitrogen deposition is significantly higher in the year 2003 than in the year 2000.

5.1 Contributions to the Baltic Sea basin

Contributions of selected emission sectors from individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the entire Baltic Sea basin in the years 2000 and 2003 are shown in Fig. 37.

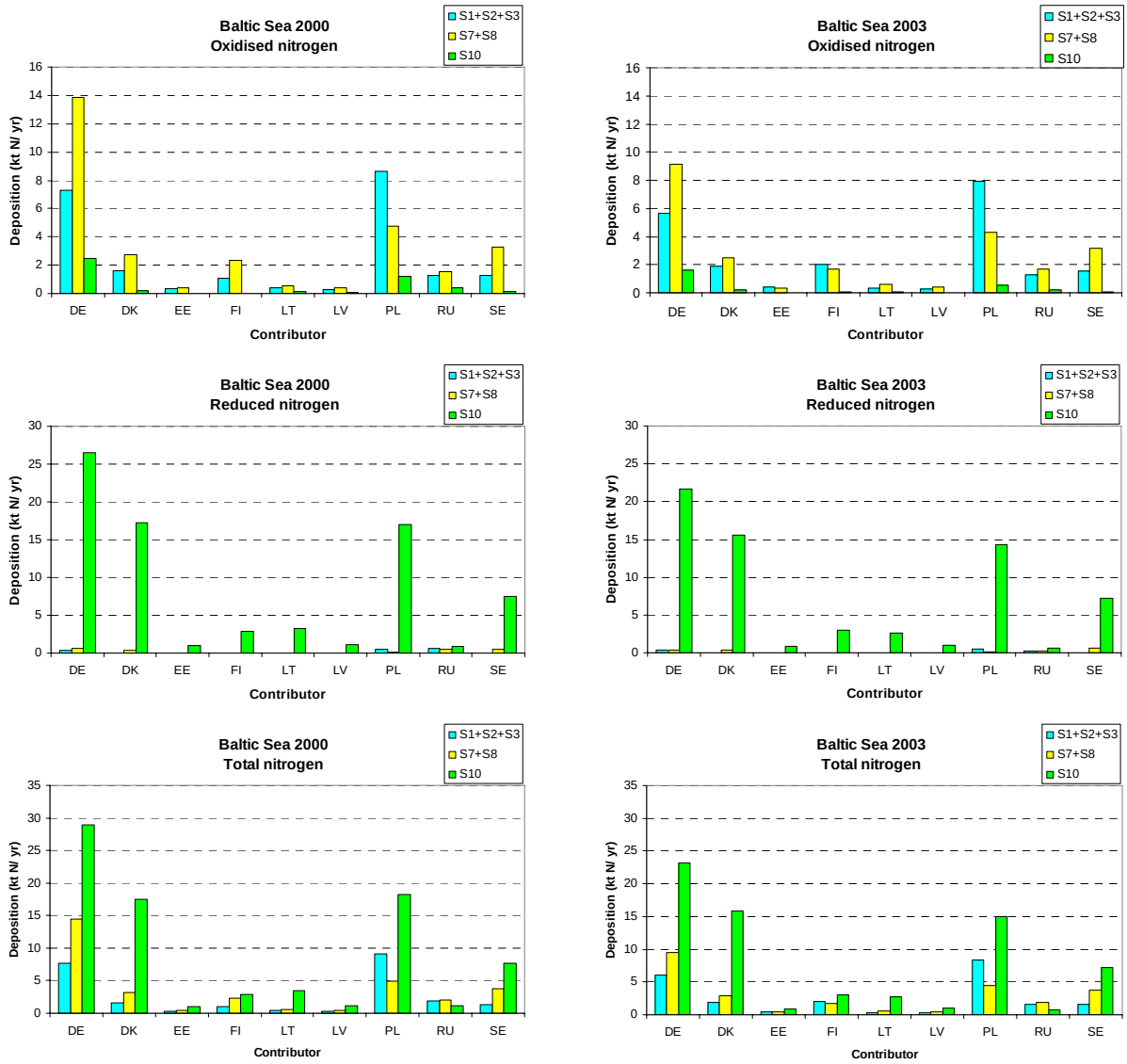


Figure 37. Contributions of selected emission sectors in individual HELCOM Contracting Parties to the depositions of oxidised, reduced and total nitrogen in the entire Baltic Sea basin in the years 2000 and 2003. Units: kt N per year.

The major changes between the year 2000 and 2003 are lower contributions of transportation sectors from Germany and higher contributions of combustion sectors from Finland to oxidised nitrogen deposition in 2003.

5.2 Contributions to the Botnian Bay sub-basin

Contributions of selected emission sectors from individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the Bothnian Bay sub-basin in the years 2000 and 2003 are shown in Fig. 38.

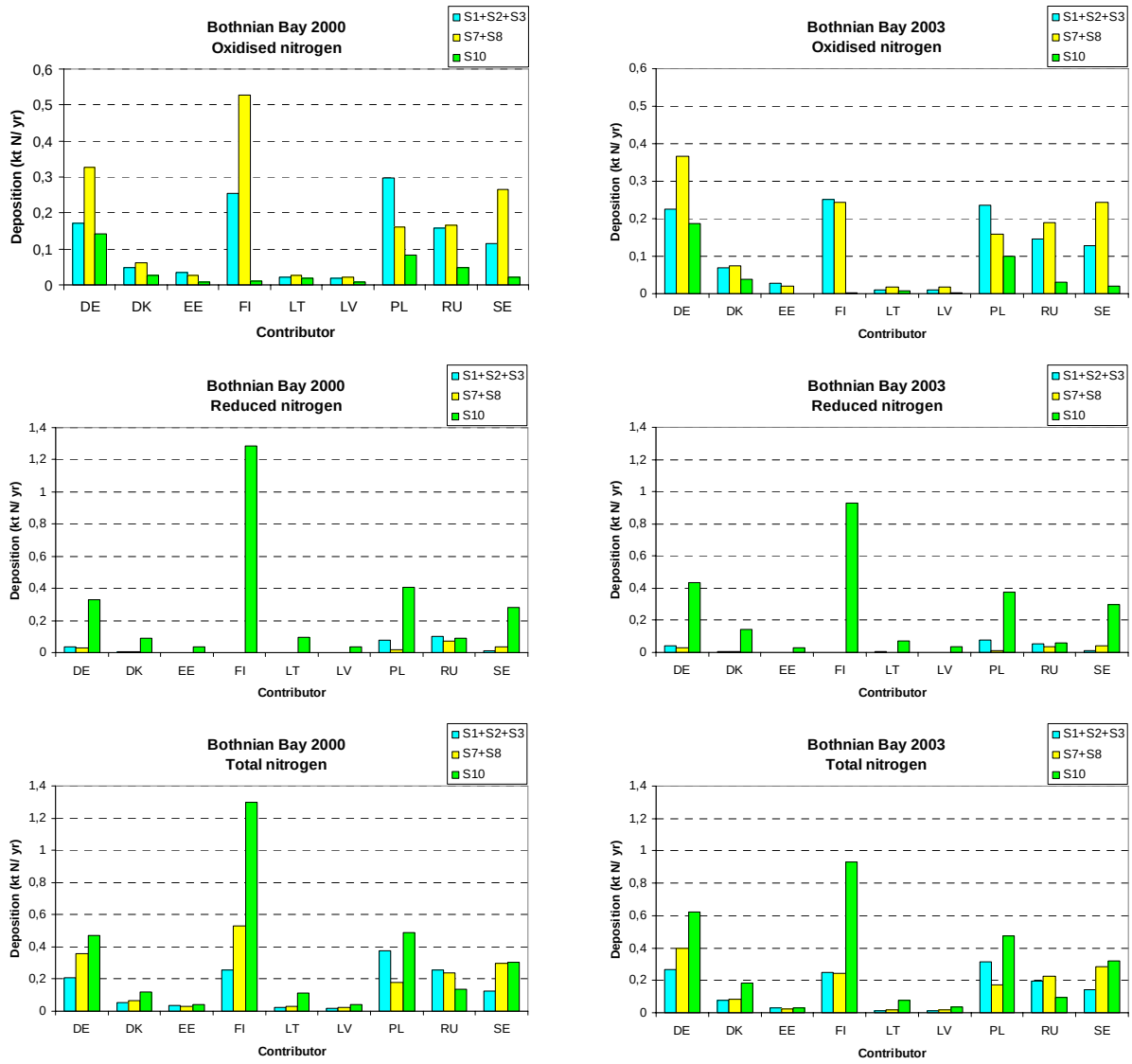


Figure 38. Contributions of selected emission sectors in individual HELCOM Contracting Parties to the depositions of oxidised, reduced and total nitrogen in the Bothnian Bay sub-basin in the years 2000 and 2003. Units: kt N per year.

Contributions from all German emission sectors to oxidised and total nitrogen deposition in 2003 are higher than the contributions in 2000. Contributions of transportation and agriculture emission sectors from Finland to all kinds of nitrogen deposition are lower in 2003 than in 2000. In both years, there are relatively high contributions of combustion and transportation sectors from Russia to reduced nitrogen deposition. Contribution of these sectors to reduced nitrogen deposition is also visible, however small for Germany, Poland and Sweden as emitters.

5.3 Contributions to the Botnian Sea sub-basin

Contributions of selected emission sectors from individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the Bothnian Sea sub-basin in the years 2000 and 2003 are shown in Fig. 39.

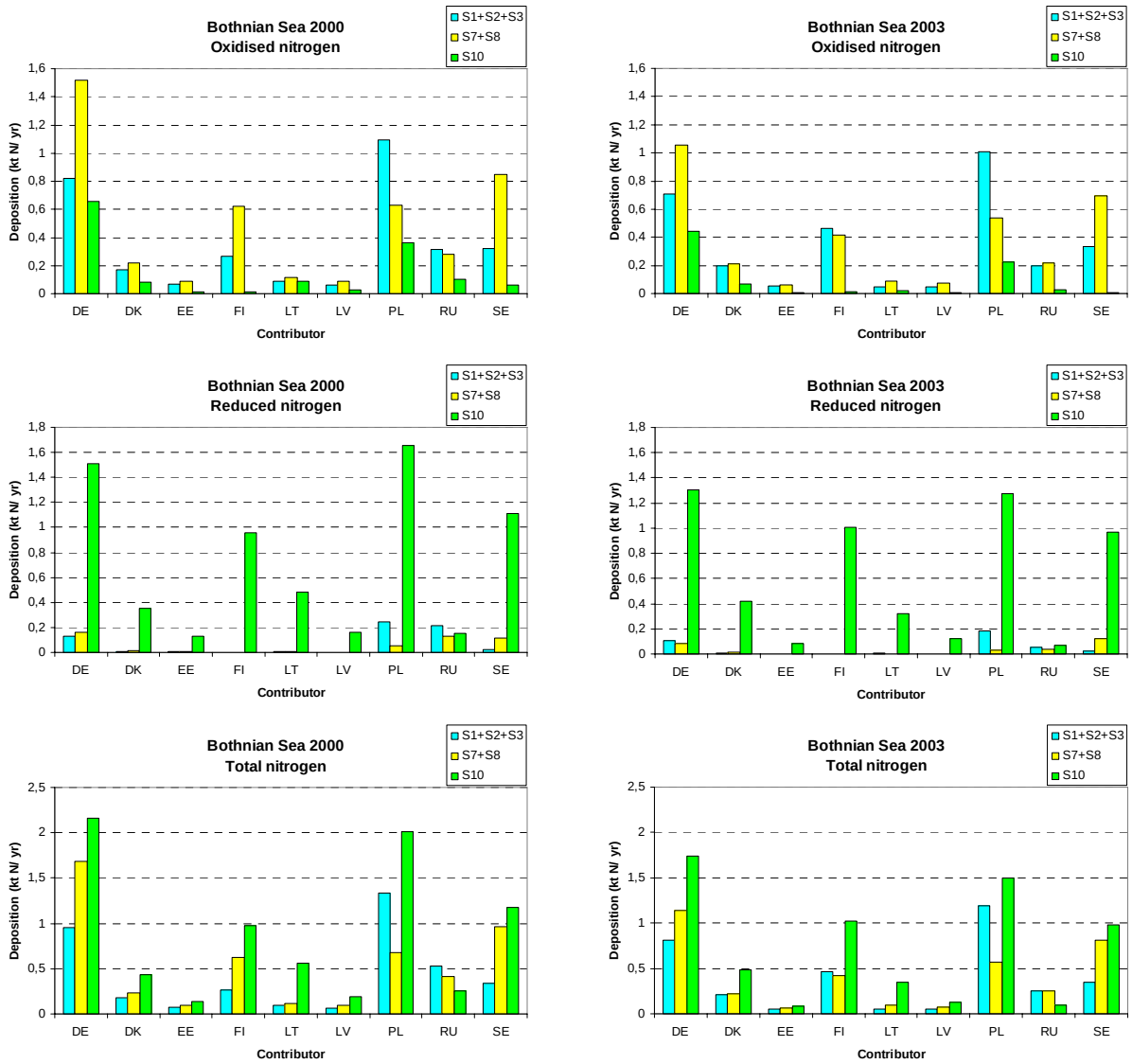


Figure 39. Contributions of selected emission sectors in individual HELCOM Contracting Parties to the depositions of oxidised, reduced and total nitrogen in the Bothnian Sea sub-basin in the years 2000 and 2003. Units: kt N per year.

The major change from the year 2000 to 2003 is the increase of the contribution from combustion sources in Finland to oxidised and total nitrogen deposition. Contributions of combustion and transportation sectors in Russia to reduced nitrogen deposition are relatively smaller in 2003 than in the year 2000. Contributions of combustion and transportation sectors located in Germany, Poland and Sweden to reduced nitrogen deposition are also visible, but small. They remain on the same level in 2000 and in 2003.

5.4 Contributions to the Gulf of Finland sub-basin

Contributions of selected emission sectors from individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the Gulf of Finland sub-basin in the years 2000 and 2003 are shown in Fig. 40.

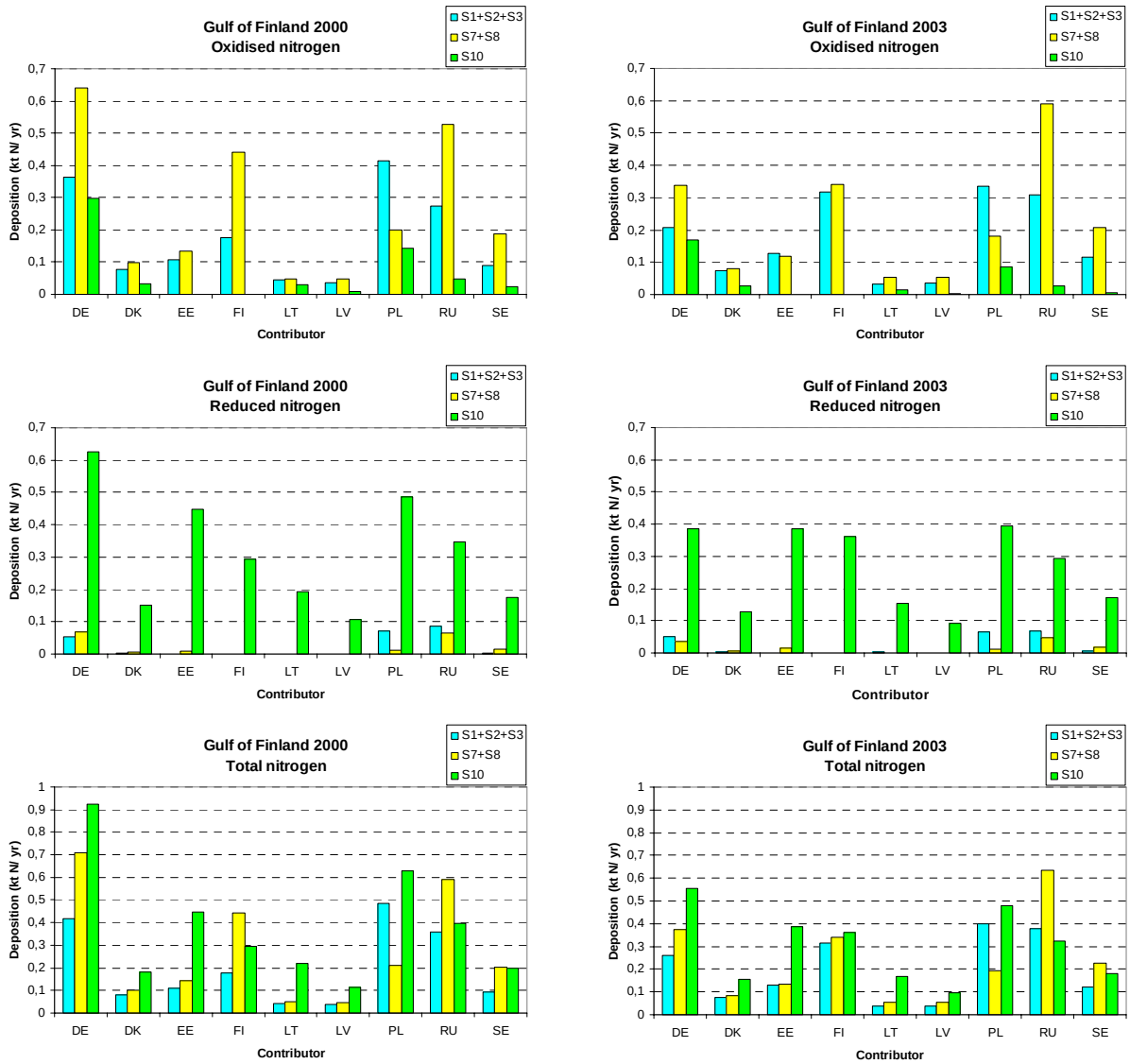


Figure 40. Contributions of selected emission sectors in individual HELCOM Contracting Parties to the depositions of oxidised, reduced and total nitrogen in the Gulf of Finland sub-basin in the years 2000 and 2003. Units: kt N per year.

The contributions of combustion sectors in Estonia and Finland to oxidised nitrogen deposition are higher in 2003 than in 2000, whereas the relative contributions of transportation sectors, in these countries are lower. Contributions of agricultural sectors in Germany and Poland to reduced nitrogen deposition are lower in 2003 than in 2000. Contributions of combustion and agriculture sectors from Finland to total nitrogen deposition increase in 2003 compared to 2000.

5.5 Contributions the to the Gulf of Riga sub-basin

Contributions of selected emission sectors from individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the Gulf of Riga sub-basin in the years 2000 and 2003 are shown in Fig. 41.

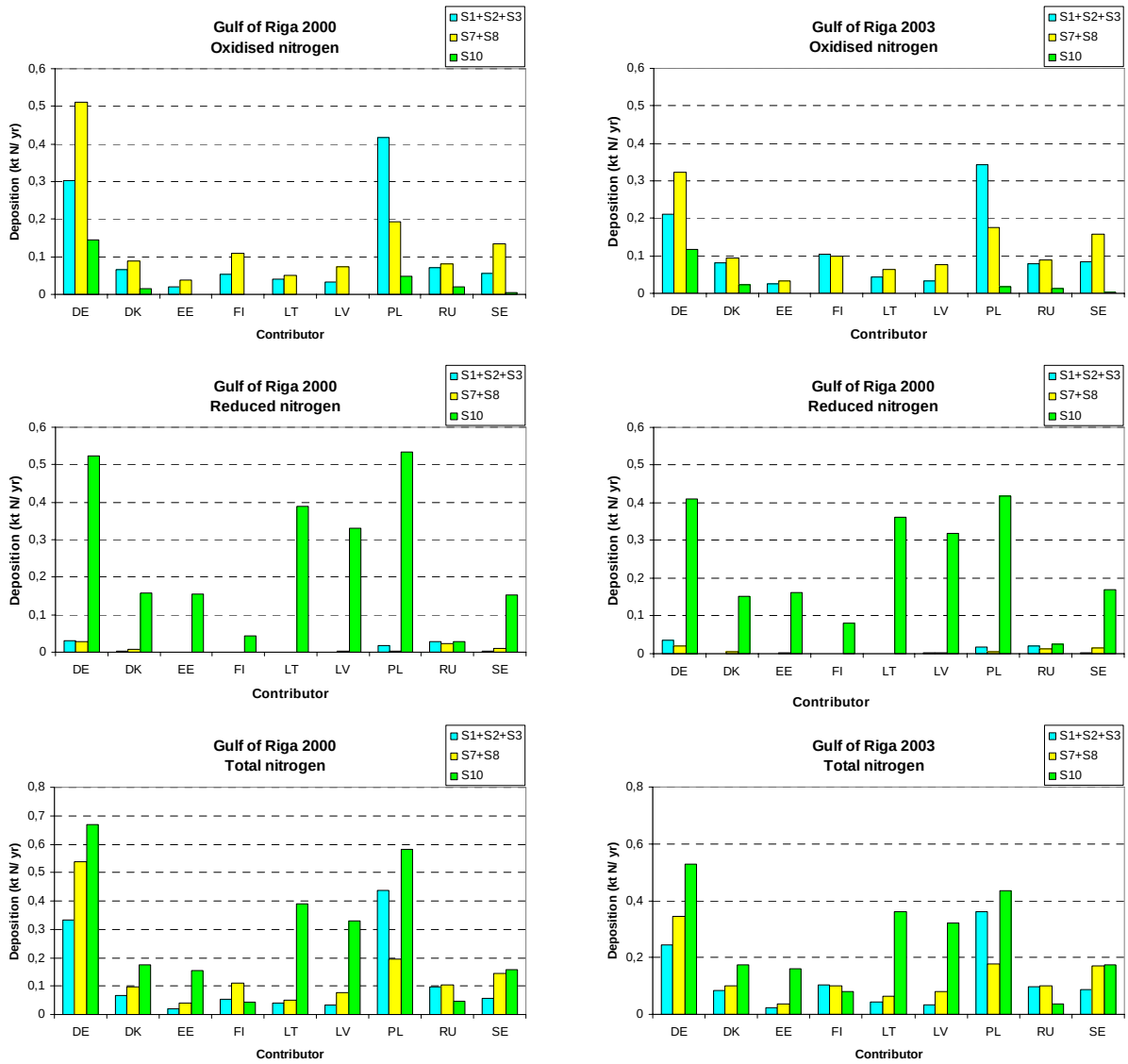


Figure 41. Contributions of selected emission sectors in individual HELCOM Contracting Parties to the depositions of oxidised, reduced and total nitrogen in the Gulf of Riga sub-basin in the years 2000 and 2003. Units: kt N per year.

Concerning oxidised nitrogen deposition the major difference between the years 2000 and 2003 is the increase of combustion sectors contribution from Finland in the year 2003. There is not much change from 2000 to 2003 in the contributions to reduced nitrogen deposition, but it is interesting to see,.still very small, but more visible contributions of combustion and transportation sectors from Germany, Russia, Poland and Sweden. Contributions to deposition of total nitrogen are very similar in both years.

5.6 Contributions to the Baltic Proper sub-basin

Contributions of selected emission sectors from individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the Baltic Proper sub-basin in the years 2000 and 2003 are shown in Fig. 42.

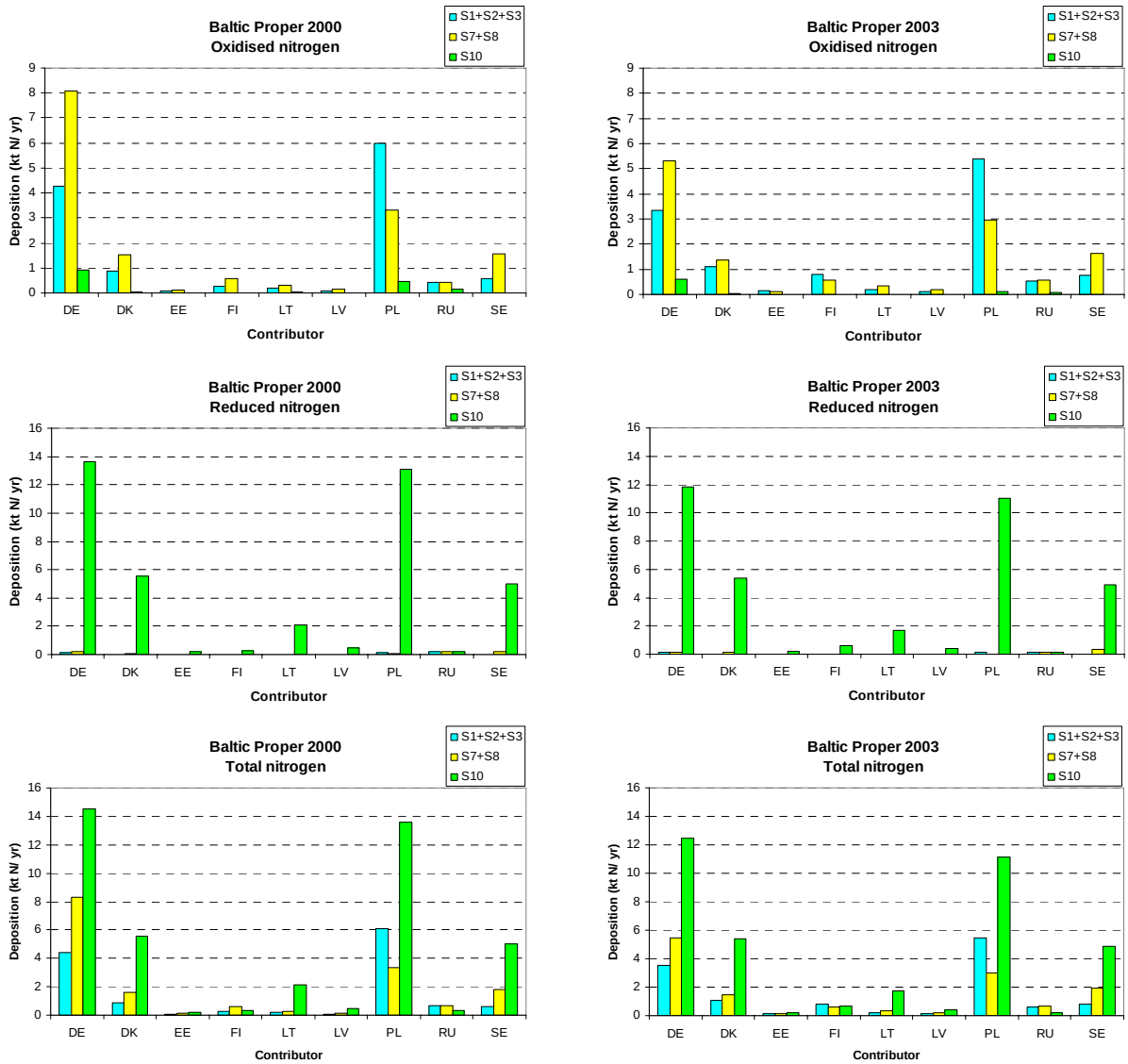


Figure 42. Contributions of selected emission sectors in individual HELCOM Contracting Parties to the depositions of oxidised, reduced and total nitrogen in the Baltic Proper sub-basin in the years 2000 and 2003. Units: kt N per year.

Contributions to oxidised, reduced and total nitrogen depositions are very similar for both years. The only difference can be noticed for higher contributions of combustion sectors from Finland to oxidised and total nitrogen deposition in the year 2003.

5.7 Contributions to the Danish Straits sub-basin

Contributions of selected emission sectors from individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the Danish Straits sub-basin in the years 2000 and 2003 are shown in Fig. 43.

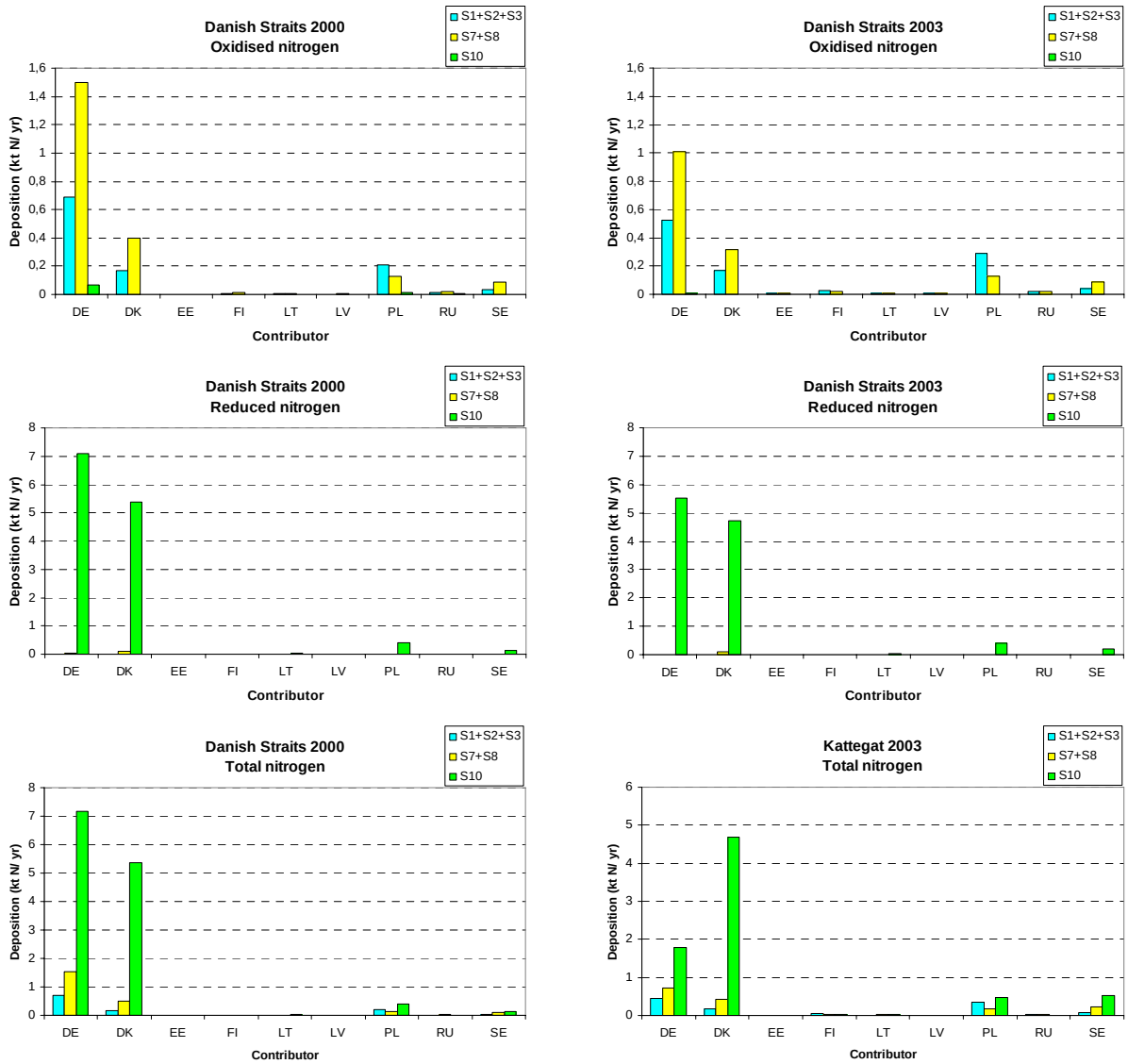


Figure 43. Contributions of selected emission sectors in individual HELCOM Contracting Parties to the depositions of oxidised, reduced and total nitrogen in the Danish Straits sub-basin in the years 2000 and 2003. Units: kt N per year.

Practically there are only four contributors to all kinds of nitrogen deposition: Germany, Denmark Poland and Sweden, with contributions from Germany and Denmark being much higher than all others. The pattern for the contributions is very similar for 2000 and 2003.

5.8 Contributions to the Kattegat sub-basin

Contributions of selected emission sectors from individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the Kattegat sub-basin in the years 2000 and 2003 are shown in Fig. 44.

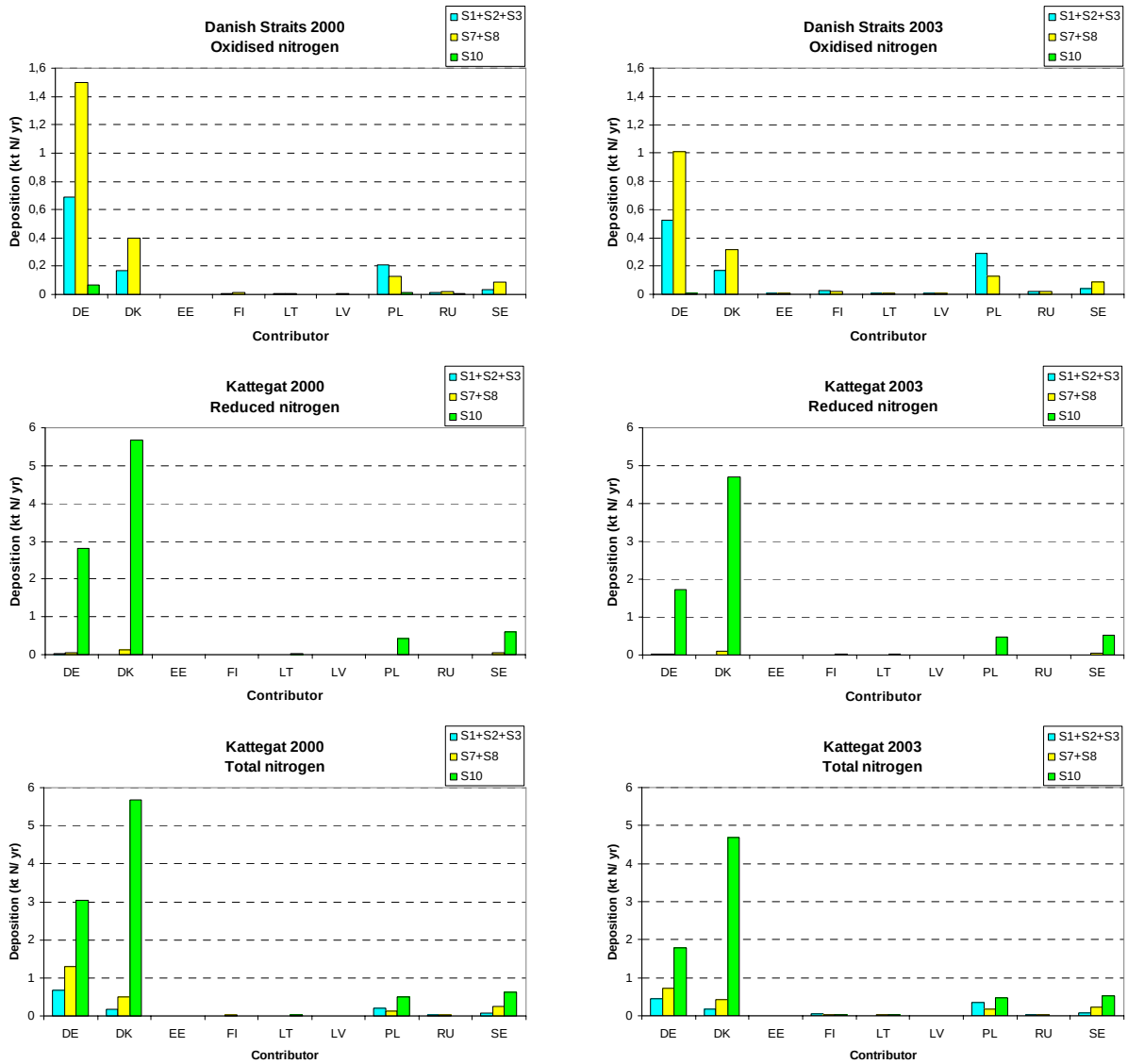


Figure 44. Contributions of selected emission sectors in individual HELCOM Contracting parties to the depositions of oxidised, reduced and total nitrogen in the Kattegat sub-basin in the years 2000 and 2003. Units: kt N per year.

This case is quite similar to the previous one - contributions to the Danish Straits sub-basin. Also, here, there are only four contributors to all kinds of nitrogen deposition: Germany, Denmark Poland and Sweden, with dominating contributions from Germany and Denmark . The pattern for the contributions is very similar for 2000 and 2003.

Conclusions

The following conclusion can be formulated based on the results of the project presented in this report:

- The changes made in the chemical reactions for nitrogen in latest version of the EMEP unified model have impact not only on nitrogen concentrations, but nitrogen depositions as well. Particularlly, depositions of oxidised nitrogen computed with the latest version are 10-20% lower than those computed with the previous version. Differences for reduced nitrogen are of the order of few percent.

- For all years of the period 1997-2006 calculated annual depositions of oxidised, nitrogen are higher than the depositions of reduced nitrogen for the Baltic Sea and its all sub-basins.

- A large inter-annual variation of calculated depositions is visible for the entire considered period, but especially for the first part of it.

- Calculated annual average depositions of oxidised, reduced and total nitrogen to the Baltic Sea and its sub-basins are slightly lower in the period 2000-2006 than in the period 2000-20006. The annual average depositions of oxidised, reduced and total nitrogen to the Baltic Sea in the period 2000-2006 are lower than in the period 1997-2003 by 6%, 4% and 5%, respectively

- The contributions from HELCOM sources defined as a sum of contributions from all HELCOM Contracting Parties (CPs) and ship traffic are similar for the periods 1997-2003 and 2000-2006, with differences not larger than 3% for all of the sub-basins. The largest differences: 2% lower contribution of oxidised nitrogen and 3% higher contributions of reduced nitrogen were found for the Gulf of Riga sub-basin.

- The relative contribution of HELCOM sources is larger for the deposition of reduced nitrogen (61-86%) than for the deposition of oxidised nitrogen (36-58%).

- The lowest contribution of HELCOM sources to oxidised nitrogen deposition can be noticed for the Danish Straits and the Gulf of Riga sub-basins, 36% and 37% for the periods 1997-2003 and 2000-2006, respectively. The highest contributions of the HELCOM sources to oxidised nitrogen deposition (58% for both periods) can be seen for the Bothnian Bay sub-basin. In general HELCOM contribution to oxidised nitrogen deposition is decreasing from the northern part to the southern part of the Baltic Sea.

- The opposite deposition gradient appears for reduced nitrogen, with the largest contribution of the HELCOM sources visible in the south. The maximum contribution of the HELCOM sources to reduced nitrogen deposition (86% for both periods) can be noticed for the Danish Strait sub-basin and the minimum (62% for the period 1997-2003 and 61% for the period 2000-2006) for the Gulf of Finland sub-basin.

- For the entire Baltic Sea sub-basin and its sub-basins contribution of HELCOM sources to total nitrogen deposition varies depending on sub-basin in range 36%-77%. The HELCOM sources contribute most to total nitrogen deposition in the Danish Strait sub-basin (77% for both periods) and least to total nitrogen deposition in the Gulf of Riga sub-basin (36% for both periods).

- The transportation and combustion emission sectors are the major contributors to oxidised nitrogen deposition to all sub-basins of the Baltic Sea. For all emitters except Poland, transportation sectors are the major contributors. From Poland, the combustion sectors contribute more into oxidised nitrogen deposition than the transportation sectors, for all sub-basins. The contributions from the agriculture sector are visible, but significantly smaller in the oxidised nitrogen deposition.

- The agriculture sector entirely dominates contributions from nine out of ten HELCOM Contracting Parties to reduced nitrogen depositions in all Baltic Sea sub-basins. The only exception is Russia, where the contributions from the transportation and combustion sectors are often larger than the contributions from the agriculture sector.

- The agriculture sector is also the major contributor to total nitrogen deposition in most of the sub-basins of the Baltic Sea, especially for countries with large emissions. There are only several exceptions especially for Russia, but also for Finland and Estonia, where the contributions from the transportation and combustion sectors to total nitrogen deposition are higher tan the contributions from the agriculture sector.

- For all sub-basins, contributions to all kinds of nitrogen deposition are lower in 2003 than in the year 2000. However, the proportions between contributions from different sectors are very similar for both years and for all HELCOM countries except Finland. The contribution of Finnish combustion sectors to oxidised and total nitrogen deposition is significantly higher in the year 2003 than in the year 2000.

References

[1] HELCOM web-site (2008): http://www.helcom.fi/

[2] Rönnberg C. and Bonsdorff E.: *Baltic Sea eutrophication: area-specific ecological consequences*. Hydrobiologia, 2004, **40**, 227-241.

[3] Patsch J.and Radach G.: *Long-term simulation of the eutrophication of the North Sea: temporal development of nutrients, chlorophyll and primary production in comparison to observations*. J. Sea Res., 1997, **38**(3), 2275-2310.

[4] UNEP/FAO/WHO: Assessment of the State of Eutrophication in the Mediterranean Sea. MAP Technical Series No. 106, UNEP, Athens 1996.

[5] Bucharest Convention web site (2008): http://www.blacksea-commission.org/main.htm

[6] OSPAR Convention web site (2008): http://www.ospar.org /

[7] Barcelona Convention web site (2008): http://www.unep.ch/regionalseas/regions/med/t_barcel.htm

[8] LRTAP Convention (1979): 1979 Convention on Long-range Transboundary Air Pollution. UN Economic Commission for Europe. Palais des Nations, CH - 1211 Geneva 10, Switzerland.

[9] EMEP web site (2008): http://www.emep.int/

[10] Bartnicki J., Gusev A. and Fagerli H.: *Atmospheric Supply of Nitrogen, Lead, Cadmium, Mercury and Dioxins/Furans to the Baltic Sea in 2005*. Meteorological Synthesizing Centre - West of EMEP. EMEP MSC-W Technical Report 3/2007.

[11] Bartnicki J. and Fagerli H.: *Atmospheric nitrogen in OSPAR Convention area in the period 1990-2004.* Meteorological Synthesizing Centre - West of EMEP. EMEP MSC-W Technical Report 4/2006.

[12] Simpson D., Fagerli H., Jonson J.E., Tsyro S., Wind P. and Tuovinen J.P.: *Transboundary acidification and eutrophication and ground level ozone in Europe: Unified EMEP model description.* EMEP Status Report 2004. EMEP Report 1/2004 Part 1. Meteorological Synthesizing Centre West, Oslo, Norway.

[13] Tarrason L., Fagerli H., Jonson J.E., Klein H., von Loon M., Posh M., Simpson D., Solberg S., Tsyro S., Thunis P., Vestreng V., White L. and Wind P.: *Transboundary acidification Eutrophication and ground level ozone in Europe.* EMEP Status Report 2004. EMEP Report 1/2004. Meteorological Synthesizing Centre West, Oslo, Norway.

[14] Tarrason L., Benedictow A.C., Fagerli H., Jonson J.E., Klein H., von Loon M., Simpson D., Tsyro S., Vestreng V., Wind P., Forster C., Stohl A., Amman M., Cofala J., Langner J., Andersson C. and Bergström R.: *Transboundary acidification, eutrophication and ground level ozone in Europe in 2005.* EMEP Status Report 2005. EMEP Report 1/2005. Meteorological Synthesizing Centre West, Oslo, Norway.

[15] Tarrason L., Fagerli H., Klein H., Simpson D., Benedictow A.C., Vestreng V., Rigler E., Emberson L., Posch P. and Spranger T.: *Transboundary acidification, eutrophication and ground level ozone in Europe since 1990 to 2004.* EMEP Status Report 2006. EMEP Report 1/2006. Meteorological Synthesizing Centre West, Oslo, Norway.

[16] Tarrason L., Fagerli H., Hjellbrekke A.G., Jonson J.E., Klein H., von Loon M., Posh M., Simpson D. and Aas W.: *Transboundary acidification Eutrophication and ground level ozone in Europe in 2005.* EMEP Status Report 2007. EMEP Report 1/2007. Meteorological Synthesizing Centre West, Oslo, Norway.

[17] Bjørge D. and Skålin R.: *PARLAM - the parallel HIRLAM version at DNMI*, Research Report No. 27, Norwegian Meteorological Institute, Oslo, Norway 1995.

[18] Fagerli H., Simpson D. and Aas W.: *Model performance for sulphur and nitrogen compounds for the period 1980 to 2000.* [In:] L. Tarras´on, (editor), Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe. EMEP Status Report 1/2003, Part II Unified EMEP Model Performance, pages 1-66. The Norwegian Meteorological Institute, Oslo, Norway, 2003.

[19] Fagerli H., Jonson J. E., Wind P. and Tarras´on L.: *Air concentrations and depositions: Status 2000 and 2001.* [In:] L. Tarras´on, (editor), Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe. EMEP Status Report 1/2003, Part III Source-Receptor Relationships, pages 7-19. The Norwegian Meteorological Institute, Oslo, Norway, 2003.

[20] Fagerli H.: *Air concentrations and deposition of acidifying and eutrophying components, status 2002.* EMEP Report 1/2004, Transboundary acidification, eutrophication and ground level ozone in Europe. Status Report 1/2004, pages 77-103. The Norwegian Meteorological Institute, Oslo, Norway, 2004.

[21] Fagerli H.: *Acidifying and eutrophying components, status in 2003.* [In:] Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe. EMEP Status Report 1/2005, pages 9-30. The Norwegian Meteorological Institute, Oslo, Norway, 2005.

[22] Fagerli H., Spranger T. and Posch M.: *Acidification and eutrophication - progress towards the Gothenburg target year (2010).* [In:] Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe. EMEP Status Report 1/2006, pages 29-53. The Norwegian Meteorological Institute, Oslo, Norway, 2006.

[23] Fagerli H. and Hjellbrekke A. G.: *Acidification and eutrophication, status in 2005.* [In:] Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe. EMEP Status Report 1/2007, pages 33–53. The Norwegian Meteorological Institute, Oslo, Norway, 2007.

[24] Simpson D., Butterbach-Bahl K., Fagerli H., Kesik M. and Skiba U.: *Deposition and Emissions of Reactive Nitrogen over European Forests: A Modelling Study*. Atmos. Environ., 2006, **40**(29), 5712-5726.

[25] Simpson D., Fagerli H., Hellsten S., Knulst K. and Westling O.: *Comparison of modelled and monitored deposition fluxes of sulphur and nitrogen to ICP-forest sites in Europe*. Biogeosciences, 2006, 337-355.

[26] Fagerli H. and Aas W.: *Trends of nitrogen in air and precipitation: Model results and observations at EMEP sites in Europe, 1980-2003*. Environ. Pollut., 2008. In press, doi:10.1016/j.envpol.2008.01.024.

[27] Endresen Ø., Sørgård E., Sundet J.K., Dalsøren S.B., Isaksen I.S.A., Berglen T.F. and Gravir G.: *Emission from international sea transport and environmental impact*. J. Geophys. Res., 2003, **108**(3), 45-60.

[28] EEB. The European Environmental Bureau (EEB), The European Federation for Transport and Environment (T\&E), Seas at Risk (SAR) and The Swedish NGO Secretariat on Acid Rain: A briefieng document by The European Environmental Bureau (EEB), The European Federation for Transport and Environment (T&E), Seas at Risk (SAR) and The Swedish NGO Secretariat on Acid Rain (2003). Available on www.eeb.org/activities/air/ship-briefing-nov04-(1).pdf

[29] Bartnicki J. and Van Loon M.: *Estimation of atmospheric nitrogen deposition to the Baltic Sea in 2010 based on agreed emission ceilings under the EU NEC Directive and the Gothenburg Protocol.* Met. note No. 26, 2005. The Norwegian Meteorological Institute, Oslo, Norway.

Appendix A: List of files with the EMEP products

In this Appendix we present the alphabetic list of files available on the EMEP web site together with their content. The content is also included in the beginning of each file on the web.

File name on the web	Product and description
BAS_dep_1997-2003.txt	Table with oxidized, reduced and total nitrogen depositions to the Baltic Sea for each year of the period 1997-2003.Units: kt N per year.
BAS_dep_2000-2006.txt	Table with oxidized, reduced and total nitrogen depositions to the Baltic Sea for each year of the period 2000-2006.Units: kt N per year.
BSAP_ox_1997-2003.txt	Table with oxidized nitrogen depositions to BSAP sub-basins for each year of the period 1997-2003 and average over this period. Units: kt N per year.
BSAP_ox_2000-2006.txt	Table with oxidised nitrogen depositions to BSAP sub-basins for each year of the period 2000-2006 and average over this period. Units: kt N per year.
BSAP_rd_1997-2003.txt.	Table with reduced nitrogen depositions to BSAP sub-basins for each year of the period 1997-2003 and average over this period. Units: kt N per year.
BSAP_rd_2000-2006.txt	Table with reduced nitrogen depositions to BSAP sub-basins for each year of the period 2000-2006 and average over this period. Units: kt N per year.
BSAP_tot_1997-2003.txt.	Table with total nitrogen depositions to BSAP sub-basins for each year of the period 1997-2003 and average over this period. Units: kt N per year.
BSAP_tot_2000-2006.txt	Table with total nitrogen depositions to BSAP sub-basins for each year of the period 2000-2006 and average over this period. Units: kt N per year.
grid_ox_dep-1977.txt	Gridded annual oxidised nitrogen depositions in the year 1997. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep-1978.txt	Gridded annual oxidised nitrogen depositions in the year 1998. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep-1979.txt	Gridded annual oxidised nitrogen depositions in the year 1999. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep-2000.txt	Gridded annual oxidised nitrogen depositions in the year 2000. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep-2001.txt	Gridded annual oxidised nitrogen depositions in the year 2001. EMEP model co-ordinates Units: mg N per m^2 and year.

grid_ox_dep-2002.txt	Gridded annual oxidised nitrogen depositions in the year 2002. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep-2003.txt	Gridded annual oxidised nitrogen depositions in the year 2003. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep-2004.txt	Gridded annual oxidised nitrogen depositions in the year 2004. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep-2005.txt	Gridded annual oxidised nitrogen depositions in the year 2005. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep-2006.txt	Gridded annual oxidised nitrogen depositions in the year 2006. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep_av-1977-2003.txt	Gridded average annual oxidised nitrogen depositions for the period 1997-2003. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_ox_dep_av-2000-2006.txt	Gridded average annual oxidised nitrogen depositions for the period 2000-2006. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-1977.txt	Gridded annual reduced nitrogen depositions in the year 1997. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-1978.txt	Gridded annual reduced nitrogen depositions in the year 1998. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-1979.txt	Gridded annual reduced nitrogen depositions in the year 1999. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-2000.txt	Gridded annual reduced nitrogen depositions in the year 2000. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-2001.txt	Gridded annual reduced nitrogen depositions in the year 2001. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-2002.txt	Gridded annual reduced nitrogen depositions in the year 2002. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-2003.txt	Gridded annual reduced nitrogen depositions in the year 2003. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-2004.txt	Gridded annual reduced nitrogen depositions in the year 2004. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-2005.txt	Gridded annual reduced nitrogen depositions in the year 2005. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep-2006.txt	Gridded annual reduced nitrogen depositions in the year 2006. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_rd_dep_av-1977-2003.txt	Gridded average annual reduced nitrogen depositions for the period 1997-2003. EMEP model co-ordinates Units: mg N per m^2 and

	year.
grid_rd_dep_av-2000-2006.txt	Gridded average annual reduced nitrogen depositions for the period 2000-2006. EMEP model co-ordinates Units: mg N per m^2 and year.
grid_tot_dep-1977.txt	Gridded annual total nitrogen depositions in the year 1997. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-1978.txt	Gridded annual total nitrogen depositions in the year 1998. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-1979.txt	Gridded annual total nitrogen depositions in the year 1999. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-2000.txt	Gridded annual total nitrogen depositions in the year 2000. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-2001.txt	Gridded annual total nitrogen depositions in the year 2001. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-2002.txt	Gridded annual total nitrogen depositions in the year 2002. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-2003.txt	Gridded annual total nitrogen depositions in the year 2003. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-2004.txt	Gridded annual total nitrogen depositions in the year 2004. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-2005.txt	Gridded annual total nitrogen depositions in the year 2005. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep-2006.txt	Gridded annual total nitrogen depositions in the year 2006. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep_av-1977-2003.txt	Gridded average annual total nitrogen depositions for the period 1997-2003. EMEP model co-ototinates Units: mg N per m^2 and year.
grid_tot_dep_av-2000-2006.txt	Gridded average annual total nitrogen depositions for the period 2000-2006. EMEP model co-ototinates Units: mg N per m^2 and year.
src_nox_BA_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: BA. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_BA_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: BA. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_DE_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: DE. EMEP model grid:

	i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_DE_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: DE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_DK_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: DK. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_DK_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: DK. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_EE_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: EE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_EE_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: EE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_FI_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: FI. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_FI_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: FI. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_LT_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: LT. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_LT_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: LT. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_LV_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: LV. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_LV_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: LV. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.

src_nox_PL_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: PL. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_PL_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: PL. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_RE_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: RE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_RE_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: RE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_RU_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: RU. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_RU_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: RU. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_SE_1977-2003.ascii	Average deposition of oxidised nitrogen in the period 1997-2003 emitted from the source: SE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nox_SE_2000-2006.ascii	Average deposition of oxidised nitrogen in the period 2000-2006 emitted from the source: SE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_BA_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: BA. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_BA_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: BA. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_DE_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: DE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_DE_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: DE. EMEP model grid:

	i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_DK_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: DK. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_DK_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: DK. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_EE_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: EE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_EE_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: EE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_FI_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: FI. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_FI_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: FI. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_LT_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: LT. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_LT_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: LT. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_LV_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: LV. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_LV_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: LV. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_PL_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: PL. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.

src_nrd_PL_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: PL. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_RE_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: RE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_RE_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: RE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_RU_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: RU. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_RU_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: RU. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_SE_1977-2003.ascii	Average deposition of reduced nitrogen in the period 1997-2003 emitted from the source: SE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_nrd_SE_2000-2006.ascii	Average deposition of reduced nitrogen in the period 2000-2006 emitted from the source: SE. EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
src_tab_oxn_1977-2003.txt	Contribution of selected emission sources to the deposition of oxidised nitrogen to sub-basins of the Baltic Sea in the period 1997 - 2003. Units: kt N / year.
src_tab_oxn_2000-2006.txt	Contribution of selected emission sources to the deposition of oxidised nitrogen to sub-basins of the Baltic Sea in the period 2000 - 2006. Units: kt N / year.
src_tab_rdn_1977-2003.txt	Contribution of selected emission sources to the deposition of reduced nitrogen to sub-basins of the Baltic Sea in the period 1997 - 2003. Units: kt N / year.
src_tab_rdn_2000-2006.txt	Contribution of selected emission sources to the deposition of reduced nitrogen to sub-basins of the Baltic Sea in the period 2000 - 2006. Units: kt N / year.
src_tab_tot_1977-2003.txt	Contribution of selected emission sources to the deposition of total nitrogen to sub-basins of the Baltic Sea in the period 1997 - 2003. Units: kt N / year.
src_tab_tot_2000-2006.txt	Contribution of selected emission sources to the deposition of total nitrogen to sub-

	basins of the Baltic Sea in the period 2000 - 2006. Units: kt N / year.
srs_nox_DE_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: DE to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DE_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: DE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DE_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: DE to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DE_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: DE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DE_S3_2000.ascii	Contribution of emissions in sector 10 from the source: DE to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DE_S3_2003.ascii	Contribution of emissions in sector 10 from the source: DE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DK_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: DK to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DK_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: DK to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DK_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: DK to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DK_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: DK to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_DK_S3_2000.ascii	Contribution of emissions in sector 10 from the source: DK to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.

srs_nox_DK_S3_2003.ascii	Contribution of emissions in sector 10 from the source: DK to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_EE_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: EE to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_EE_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: EE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_EE_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: EE to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_EE_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: EE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_EE_S3_2000.ascii	Contribution of emissions in sector 10 from the source: EE to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_EE_S3_2003.ascii	Contribution of emissions in sector 10 from the source: EE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_FI_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: FI to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_FI_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: FI to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_FI_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: FI to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_FI_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: FI to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_FI_S3_2000.ascii	Contribution of emissions in sector 10 from the source: FI to deposition of oxidised nitrogen in the year 2000 EMEP model grid:

	i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_FI_S3_2003.ascii	Contribution of emissions in sector 10 from the source: FI to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LT_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: LT to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LT_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: LT to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LT_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: LT to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LT_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: LT to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LT_S3_2000.ascii	Contribution of emissions in sector 10 from the source: LT to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LT_S3_2003.ascii	Contribution of emissions in sector 10 from the source: LT to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LV_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: LV to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LV_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: LV to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LV_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: LV to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LV_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: LV to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.

srs_nox_LV_S3_2000.ascii	Contribution of emissions in sector 10 from the source: LV to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_LV_S3_2003.ascii	Contribution of emissions in sector 10 from the source: LV to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_PL_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: PL to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_PL_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: PL to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_PL_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: PL to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_PL_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: PL to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_PL_S3_2000.ascii	Contribution of emissions in sector 10 from the source: PL to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_PL_S3_2003.ascii	Contribution of emissions in sector 10 from the source: PL to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RE_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: RE deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RE_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: REo deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RE_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: RE deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RE_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: RE to deposition of oxidised nitrogen in the year 2003 EMEP

	model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RE_S3_2000.ascii	Contribution of emissions in sector 10 from the source: RE to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RE_S3_2003.ascii	Contribution of emissions in sector 10 from the source: RE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RU_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: RU deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RU_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: RU deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RU_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: RU deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RU_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: RU to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RU_S3_2000.ascii	Contribution of emissions in sector 10 from the source: RU to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_RU_S3_2003.ascii	Contribution of emissions in sector 10 from the source: RU to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_SE_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: SE deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_SE_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: SE deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_SE_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: SE deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.

srs_nox_SE_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: SE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_SE_S3_2000.ascii	Contribution of emissions in sector 10 from the source: SE to deposition of oxidised nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nox_SE_S3_2003.ascii	Contribution of emissions in sector 10 from the source: SE to deposition of oxidised nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DE_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: DE to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DE_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: DE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DE_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: DE to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DE_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: DE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DE_S3_2000.ascii	Contribution of emissions in sector 10 from the source: DE to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DE_S3_2003.ascii	Contribution of emissions in sector 10 from the source: DE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DK_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: DK to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DK_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: DK to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DK_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: DK to deposition of reduced nitrogen in the year 2000 EMEP model grid:

	i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DK_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: DK to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DK_S3_2000.ascii	Contribution of emissions in sector 10 from the source: DK to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_DK_S3_2003.ascii	Contribution of emissions in sector 10 from the source: DK to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_EE_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: EE to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_EE_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: EE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_EE_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: EE to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_EE_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: EE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_EE_S3_2000.ascii	Contribution of emissions in sector 10 from the source: EE to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_EE_S3_2003.ascii	Contribution of emissions in sector 10 from the source: EE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_FI_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: FI to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_FI_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: FI to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.

srs_nrd_FI_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: FI to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_FI_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: FI to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_FI_S3_2000.ascii	Contribution of emissions in sector 10 from the source: FI to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_FI_S3_2003.ascii	Contribution of emissions in sector 10 from the source: FI to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LT_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: LT to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LT_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: LT to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LT_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: LT to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LT_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: LT to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LT_S3_2000.ascii	Contribution of emissions in sector 10 from the source: LT to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LT_S3_2003.ascii	Contribution of emissions in sector 10 from the source: LT to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LV_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: LV to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LV_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: LV to deposition of reduced nitrogen in the year 2003 EMEP model

	grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LV_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: LV to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LV_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: LV to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LV_S3_2000.ascii	Contribution of emissions in sector 10 from the source: LV to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_LV_S3_2003.ascii	Contribution of emissions in sector 10 from the source: LV to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_PL_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: PL to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_PL_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: PL to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_PL_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: PL to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_PL_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: PL to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_PL_S3_2000.ascii	Contribution of emissions in sector 10 from the source: PL to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_PL_S3_2003.ascii	Contribution of emissions in sector 10 from the source: PL to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RE_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: RE deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.

srs_nrd_RE_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: REo deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RE_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: RE deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RE_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: RE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RE_S3_2000.ascii	Contribution of emissions in sector 10 from the source: RE to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RE_S3_2003.ascii	Contribution of emissions in sector 10 from the source: RE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RU_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: RU deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RU_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: RU deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RU_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: RU deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RU_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: RU to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RU_S3_2000.ascii	Contribution of emissions in sector 10 from the source: RU to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_RU_S3_2003.ascii	Contribution of emissions in sector 10 from the source: RU to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_SE_S1_2000.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: SE deposition of reduced nitrogen in the year 2000 EMEP model

	grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_SE_S1_2003.ascii	Contribution of emissions in sectors 1, 2 and 3 from the source: SE deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_SE_S2_2000.ascii	Contribution of emissions in sectors 7 and 8 from the source: SE deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_SE_S2_2003.ascii	Contribution of emissions in sectors 7 and 8 from the source: SE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_SE_S3_2000.ascii	Contribution of emissions in sector 10 from the source: SE to deposition of reduced nitrogen in the year 2000 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_nrd_SE_S3_2003.ascii	Contribution of emissions in sector 10 from the source: SE to deposition of reduced nitrogen in the year 2003 EMEP model grid: i=1,170,j=1,133. Format: i,j, value. Units: mg N/m^2.
srs_tab_oxn_S1_2000.txt	Contribution of emission sectors 1, 2 and 3 in the selected source to the deposition of oxidised nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_oxn_S1_2003.txt	Contribution of emission sectors 1, 2 and 3 in the selected source to the deposition of oxidised nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.
srs_tab_oxn_S2_2000.txt	Contribution of emission sectors 7 and 8 in the selected source to the deposition of oxidised nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_oxn_S2_2003.txt	Contribution of emission sectors 7 and 8 in the selected source to the deposition of oxidised nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.
srs_tab_oxn_S3_2000.txt	Contribution of emission sector 10 in the selected source to the deposition of oxidised nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_oxn_S3_2003.txt	Contribution of emission sector 10 in the selected source to the deposition of oxidised nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.

srs_tab_rdn_S1_2000.txt	Contribution of emission sectors 1, 2 and 3 in the selected source to the deposition of reduced nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_rdn_S1_2003.txt	Contribution of emission sectors 1, 2 and 3 in the selected source to the deposition of reduced nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.
srs_tab_rdn_S2_2000.txt	Contribution of emission sectors 7 and 8 in the selected source to the deposition of reduced nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_rdn_S2_2003.txt	Contribution of emission sectors 7 and 8 in the selected source to the deposition of reduced nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.
srs_tab_rdn_S3_2000.txt	Contribution of emission sector 10 in the selected source to the deposition of reduced nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_rdn_S3_2003.txt	Contribution of emission sector 10 in the selected source to the deposition of reduced nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.
srs_tab_tot_S1_2000.txt	Contribution of emission sectors 1, 2 and 3 in the selected source to the deposition of total nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_tot_S1_2003.txt	Contribution of emission sectors 1, 2 and 3 in the selected source to the deposition of total nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.
srs_tab_tot_S2_2000.txt	Contribution of emission sectors 7 and 8 in the selected source to the deposition of total nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_tot_S2_2003.txt	Contribution of emission sectors 7 and 8 in the selected source to the deposition of total nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.
srs_tab_tot_S3_2000.txt	Contribution of emission sector 10 in the selected source to the deposition of total nitrogen to sub-basins of the Baltic Sea in the year 2000. Units: kt N / year.
srs_tab_tot_S3_2003.txt	Contribution of emission sector 10 in the selected source to the deposition of total nitrogen to sub-basins of the Baltic Sea in the year 2003. Units: kt N / year.