3. Atmospheric Supply of Nitrogen to the Baltic Sea in 2006

Nitrogen emission data, as well as the model results presented here have been approved by the 32nd Session of the Steering Body of EMEP in Geneva in September 2008. The EMEP Unified Eulerian model system has been used for all nitrogen computations presented in this Chapter. Annual deposition of total nitrogen to the Baltic Sea basin in 2006 was 196 ktonnes approximately 6% less than in 2005. Deposition of oxidized nitrogen accounted for 54% of total nitrogen deposition in 2006.

3.1 Nitrogen emissions

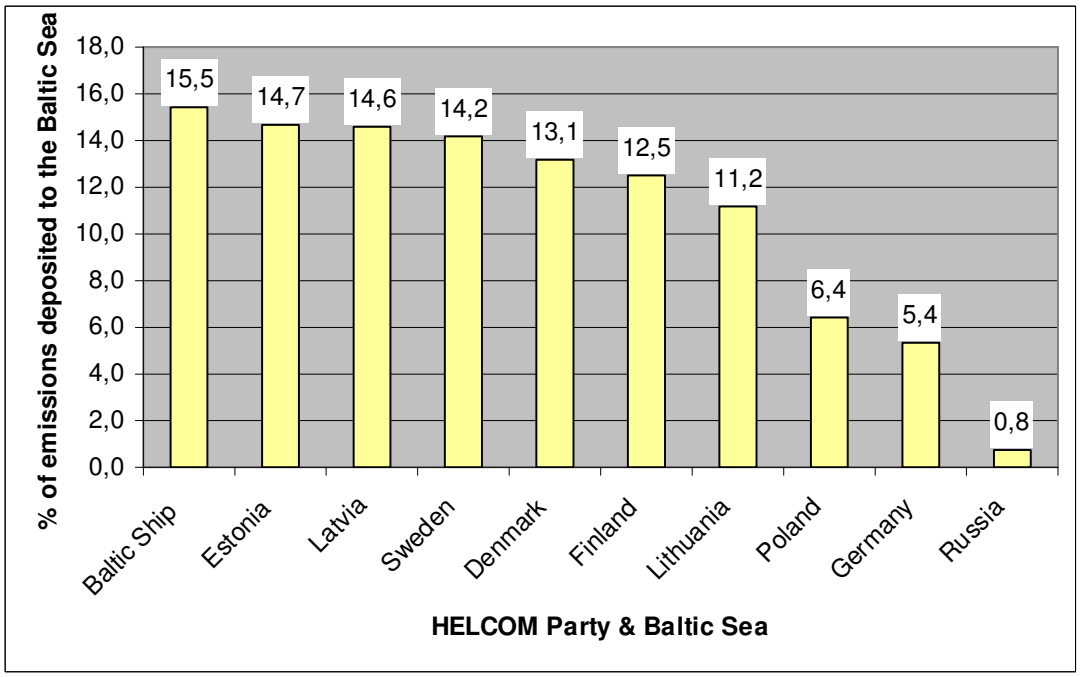

Figure 3.1. Percent of annual emissions of total (oxidized + reduced) nitrogen from the HELCOM Parties and international ship traffic emissions on the Baltic Sea (Baltic Ship) deposited to the Baltic Sea basin in 2006.

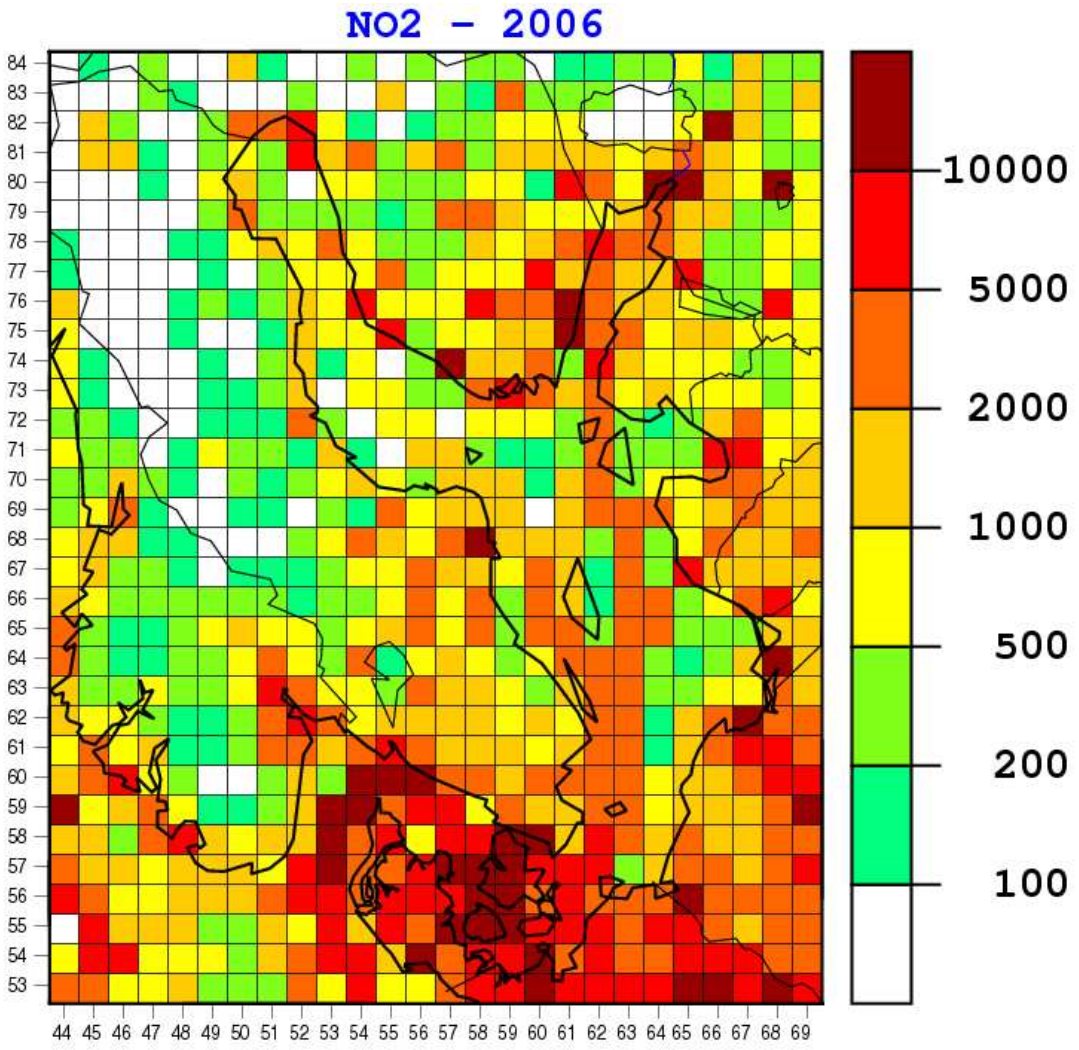

Figure 3.2. Map of annual emission of oxidized nitrogen (including emissions from the ship traffic) in the Baltic Sea region in 2006. Units: Mg (tones) of NO_2 per year and per 50×50 km grid cell.

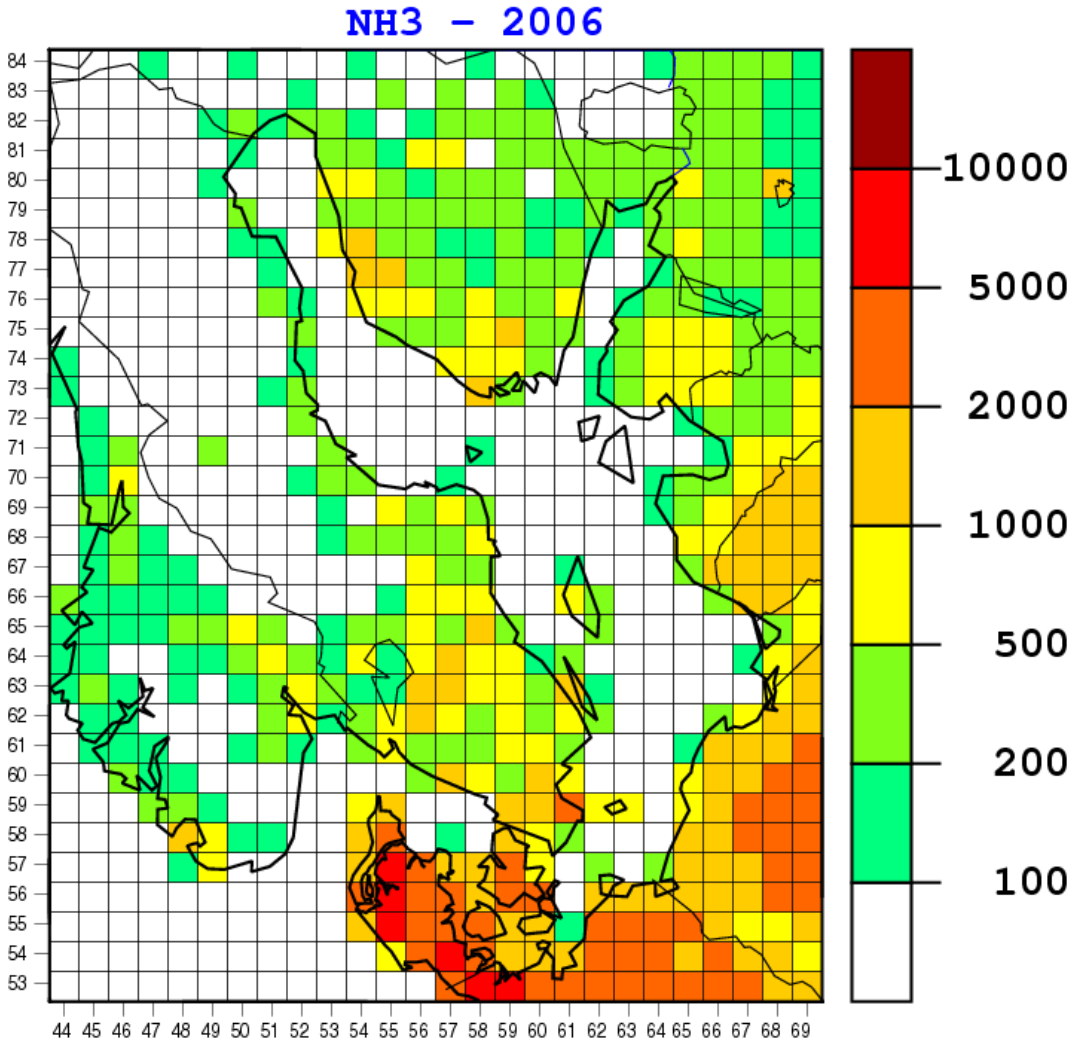

Figure 3.3. Map of annual emission of ammonia in the Baltic Sea region in 2006. Units: Mg of NH_3 per year and per 50×50 km grid cell.

Table 3.1. 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

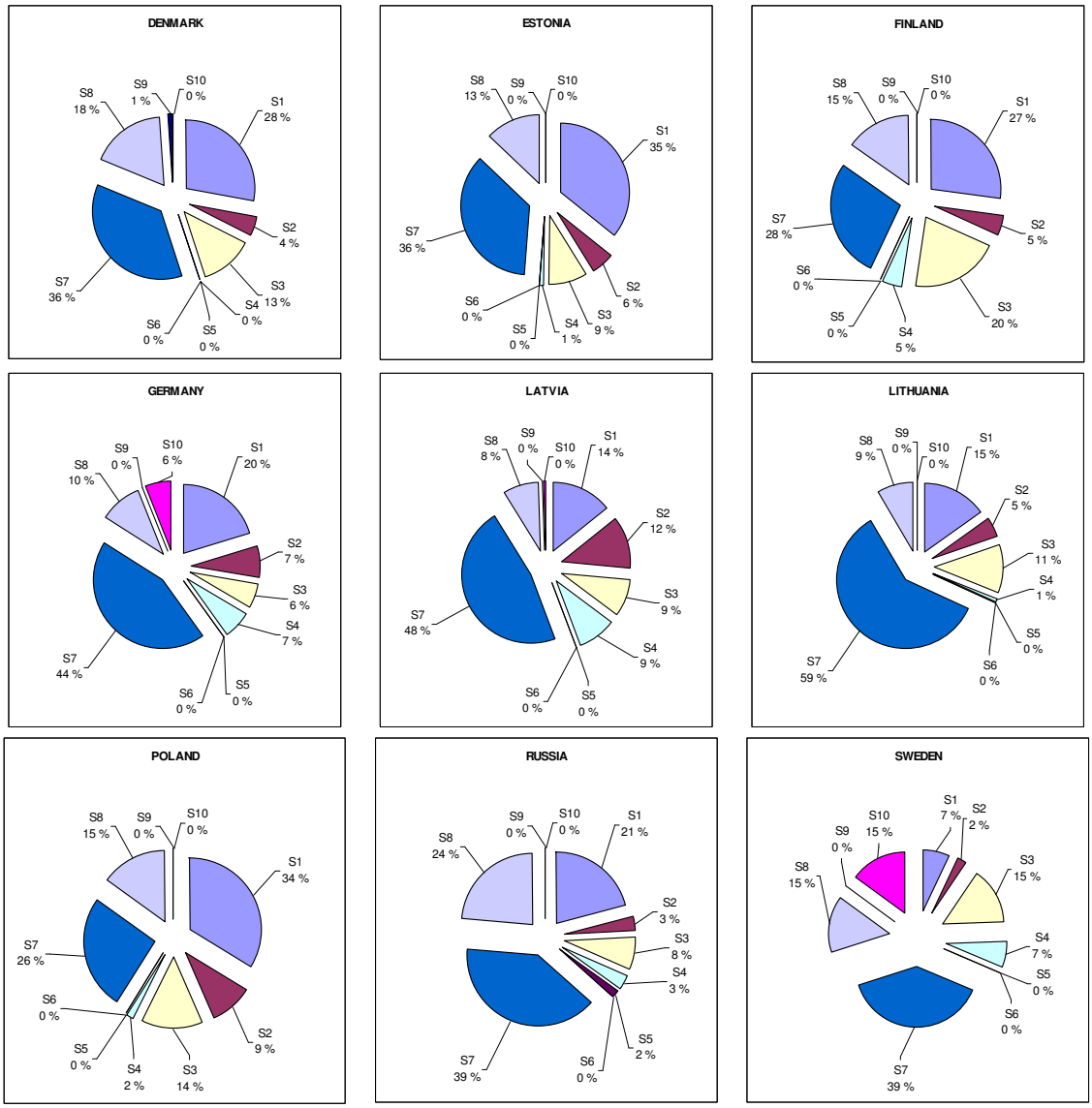

Figure 3.4. Annual 2006 nitrogen oxides emissions from the HELCOM Parties split into the SNAP sectors.

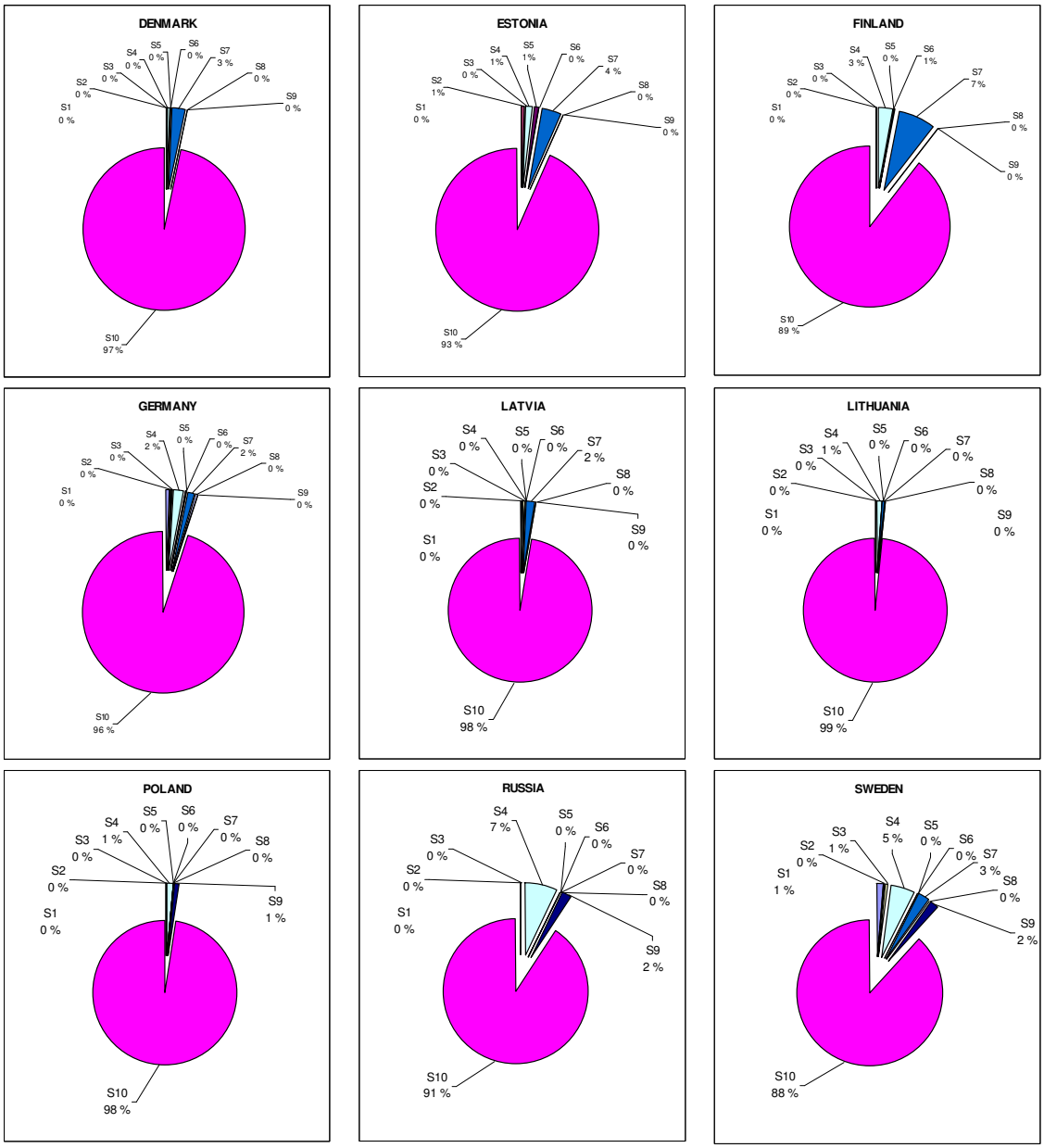

Figure 3.5. Annual 2004 ammonia emissions from the HELCOM Parties split into the SNAP sectors.

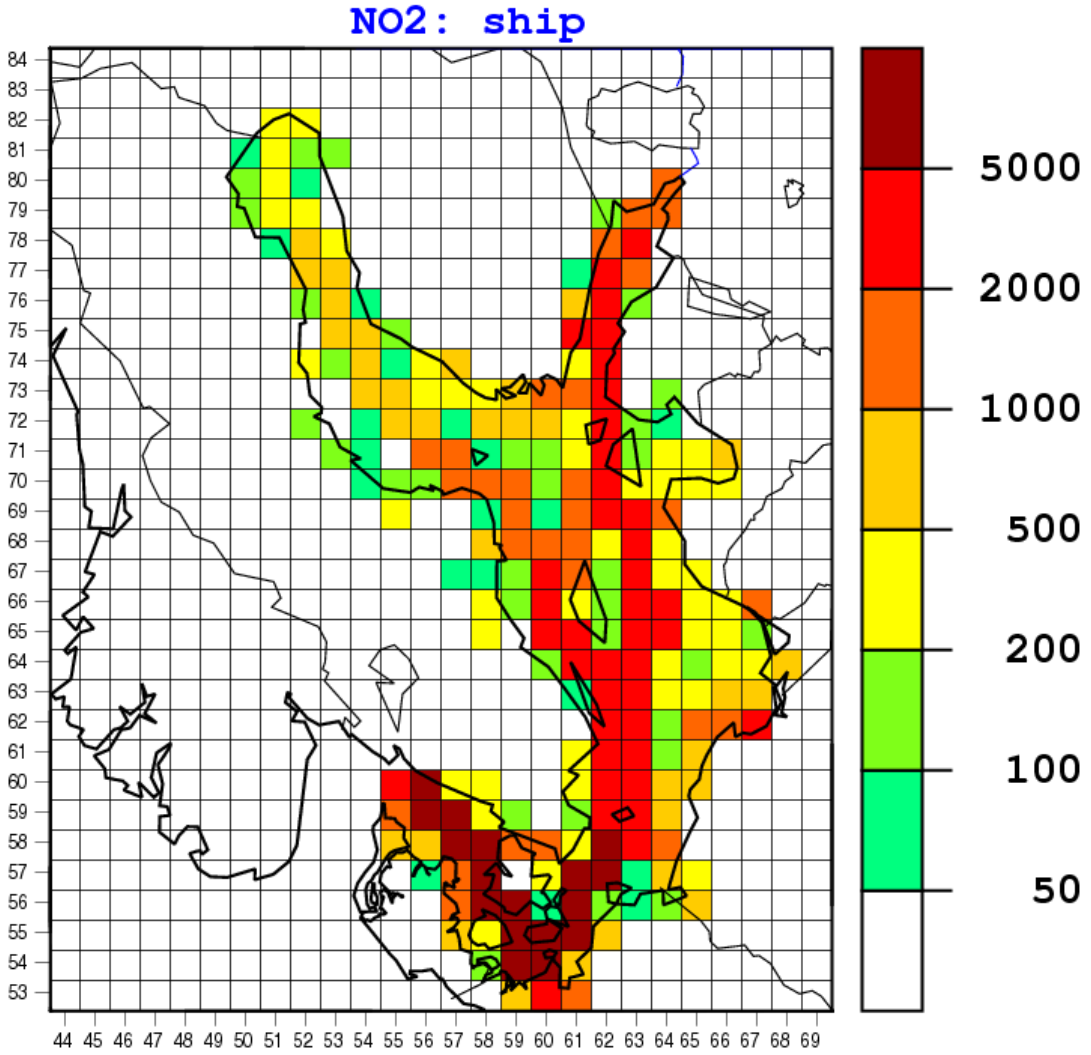

Figure 3.6 Map of annual emissions of nitrogen oxides from the international ship traffic on the Baltic Sea in 2006 used in the EMEP model calculations. Units: Mg of NO_2 per year and per 50×50 km grid cell. There are large uncertainties in the estimate for ship traffic emissions. The international ship 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.

3.2 Annual deposition of nitrogen

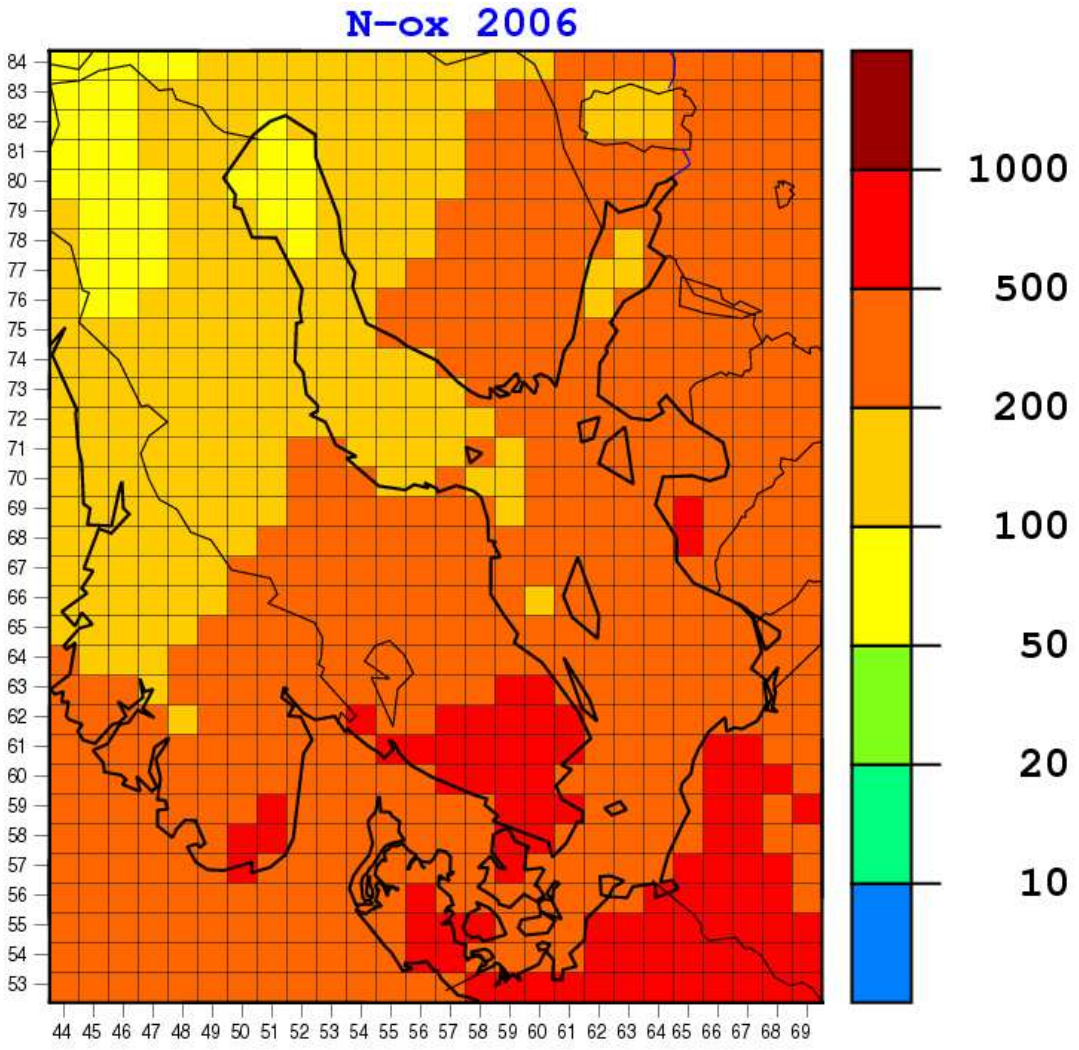

Figure 3.7. Map of annual deposition flux of oxidized nitrogen (dry + wet) in 2006. Units: mg N m^{-2} yr^{-1}.

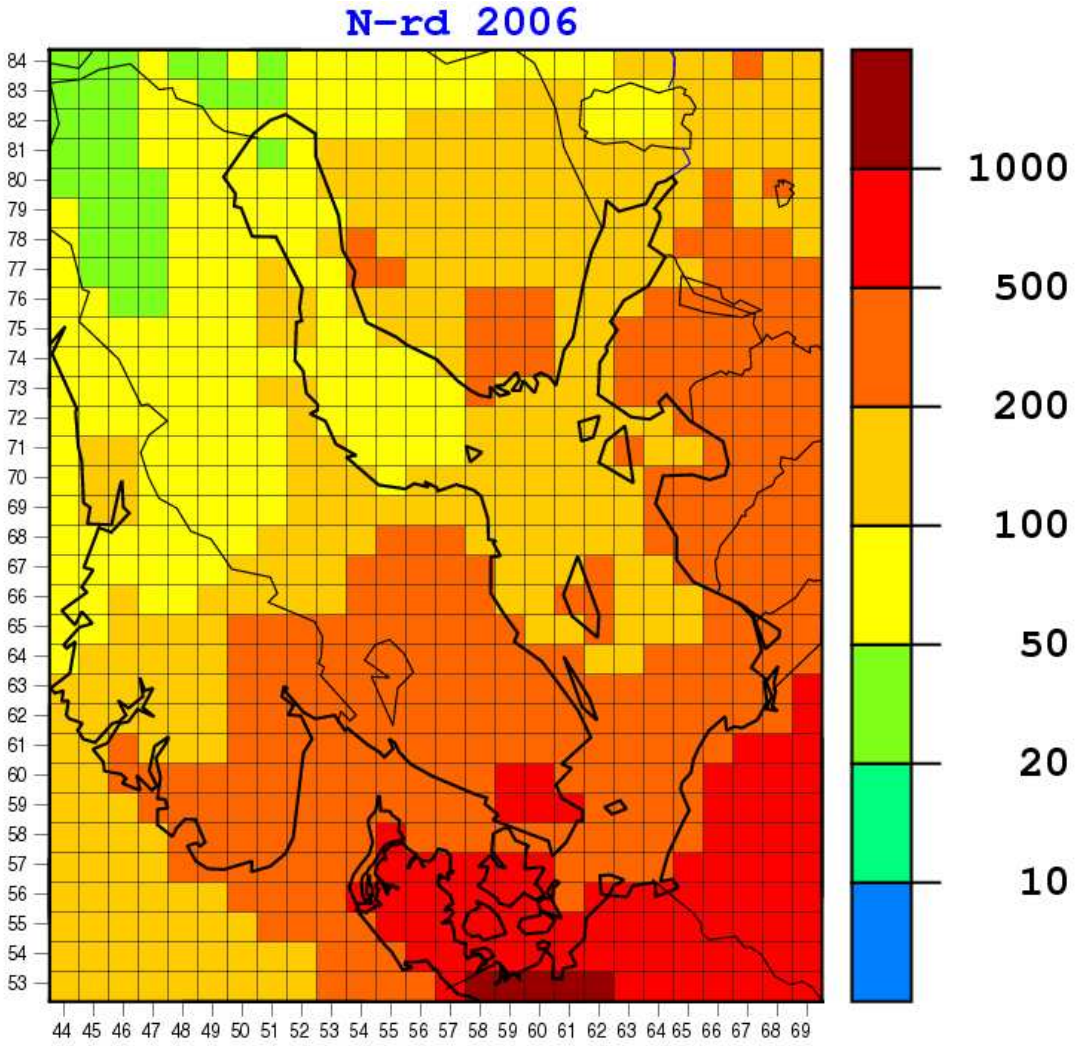

Figure 3.8. Map of annual deposition flux of reduced nitrogen (dry + wet) in 2006. Units: mg N m^{-2} yr^{-1}.

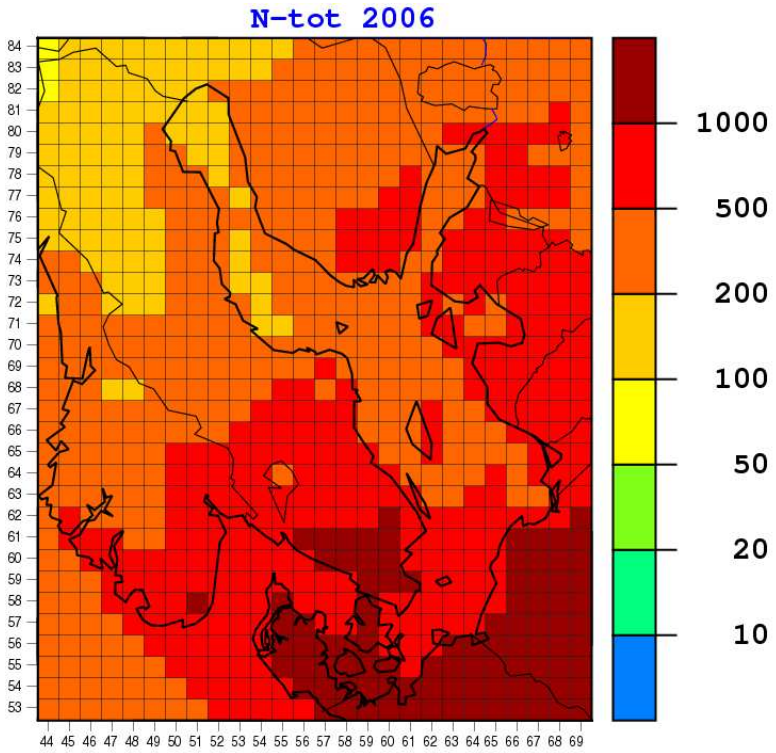

Figure 3.9. Map of annual deposition flux of total (oxidized + reduced) nitrogen in 2006. Units: mg N m^{-2} yr^{-1}.

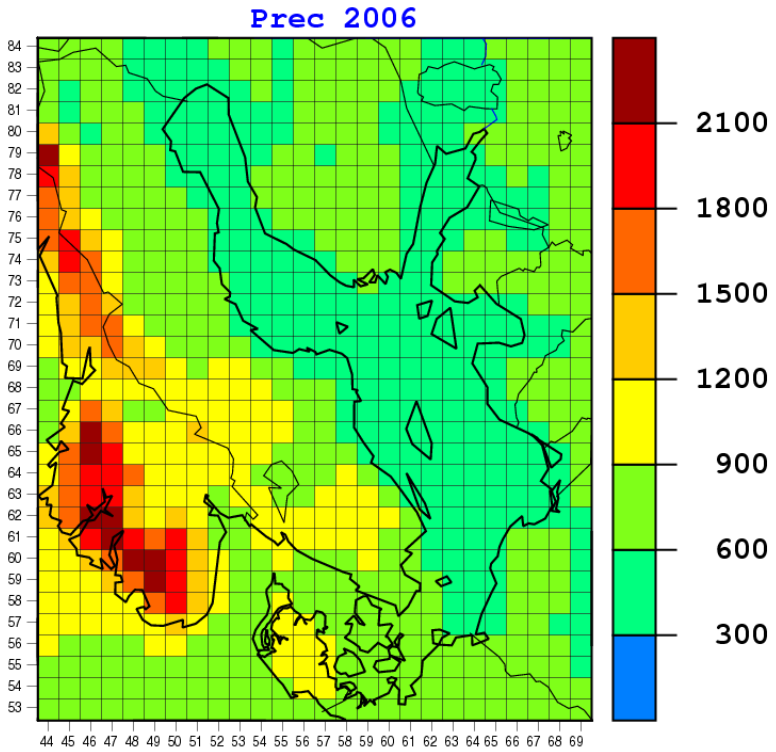

Figure 3.10. Map of annual precipitation in 2006. Units: mm yr^{-1}.

3.3 Monthly depositions of nitrogen

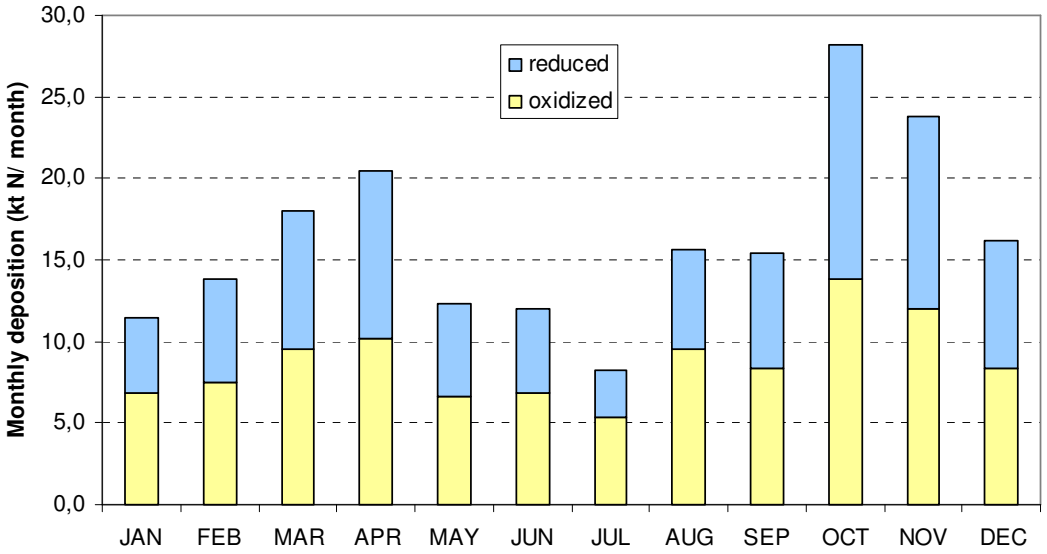

Figure 3.11. Monthly depositions of oxidized, reduced and total (oxidized +reduced) nitrogen to the entire Baltic Sea basin in 2006. Units: ktonnes N month^{-1}.

Table 3.2. Values of monthly depositions of oxidized, reduced and total (oxidized +reduced) nitrogen to the entire Baltic Sea basin in 2006. Units: ktonnes N month^{-1}.

Month	Oxidized	Reduced	Total
January	6,8	4,6	11,4
February	7,5	6,4	13,8
March	9,6	8,5	18,1
April	10,2	10,3	20,5
May	6,7	5,7	12,4
June	6,8	5,1	12,0
July	5,4	2,9	8,3
August	9,5	6,2	15,7
September	8,4	7,0	15,4
October	13,8	14,4	28,2
November	12,0	11,8	23,8
December	8,4	7,8	16,1

3.4 Source allocation of nitrogen deposition

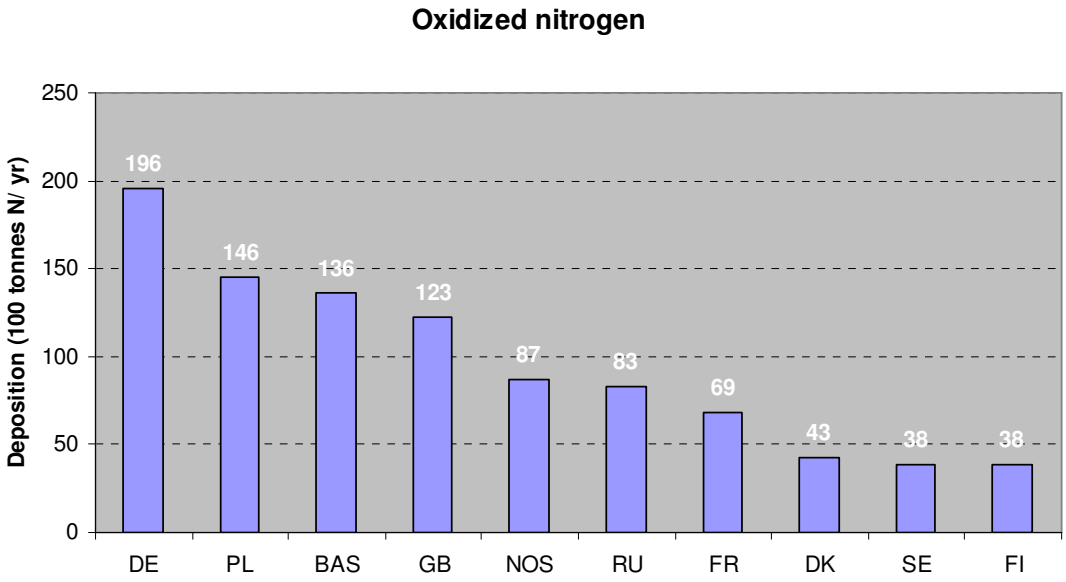

Figure 3.12. Top ten countries with highest contributions of nitrogen emissions to annual deposition of oxidized nitrogen into the Baltic Sea basin in the year 2006. Units: 100 tonnes N year^{-1}. BAS and NOS denote ship emissions form the Baltic Sea and from the North Sea, respectively.

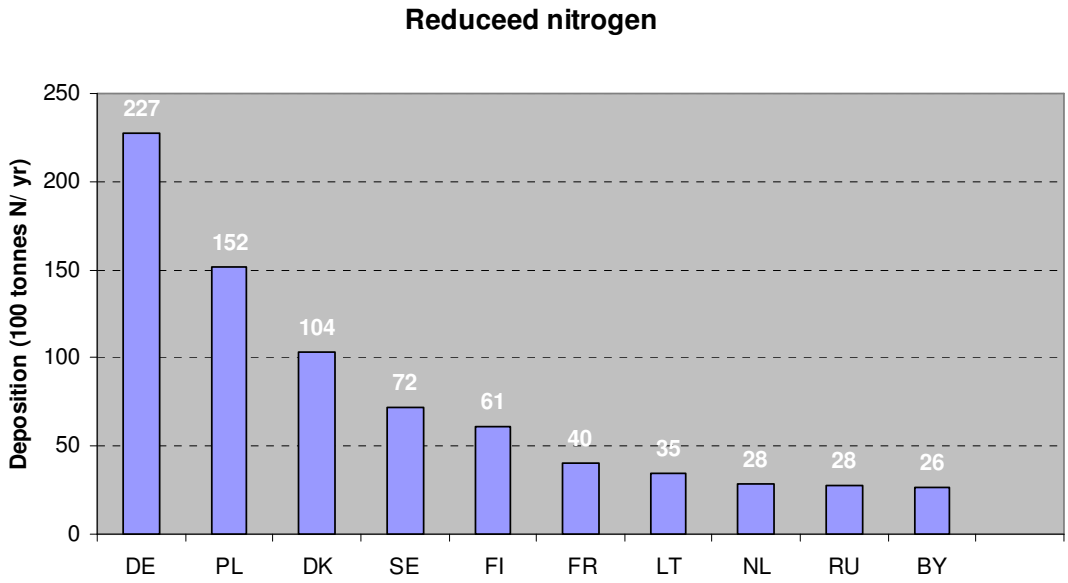

Figure 3.13. Top ten countries with highest contributions of nitrogen emissions to annual deposition of reduced nitrogen into the Baltic Sea basin in the year 2006. Units: 100 tonnes N year^{-1}. BAS and NOS denote ship emissions form the Baltic Sea and from the North Sea, respectively.

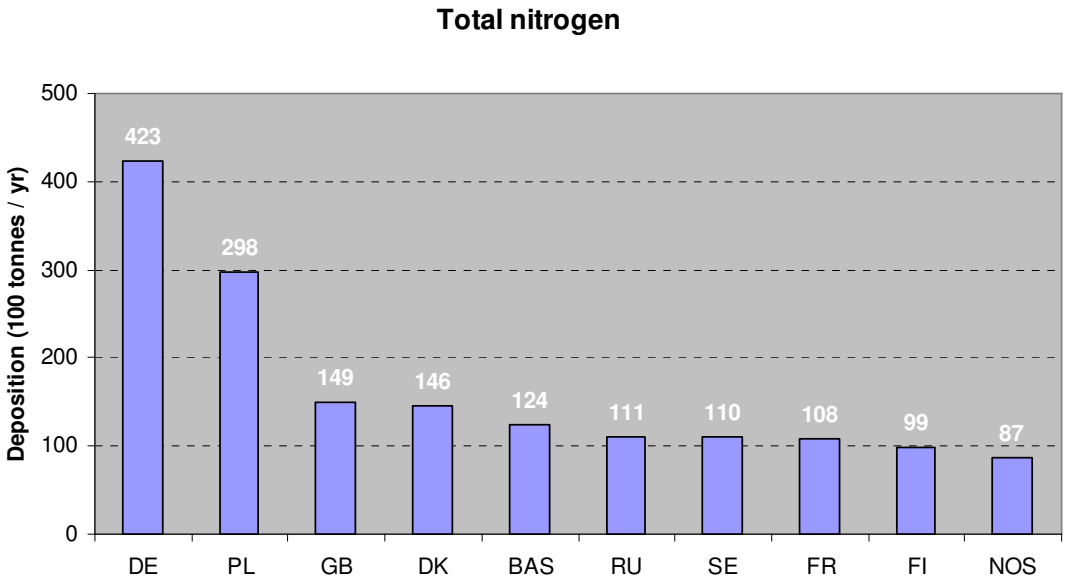

Figure 3.14. Top ten countries with highest contributions of nitrogen emissions to annual deposition of total (oxidized + reduced) nitrogen into the Baltic Sea basin in the year 2006. Units: 100 tonnes N $year^{-1}$. BAS and NOS denote ship emissions form the Baltic Sea and from the North Sea, respectively.