2. State of Airborne Load in 1996 – 2000: Measured Concentrations in Air and Precipitation

In this Chapter we will present the state of airborne load to the Baltic Sea in the period 1996 – 2000, as seen form the observation perspective.

2.1 Overview of HELCOM stations and available measurements

HELCOM measurement database for nitrogen compounds, heavy metals and persistent organic pollutants is located at the Norwegian Institute for Air Research NILU in Kjeler, Norway. For the period 1996 – 2000, altogether 17 HELCOM stations reported measurements of concentrations in air and precipitation. The list of available measurements at the HELCOM stations, for nitrogen, heavy metals and POPs is given in Tables 2.1, 2.2 and 2.3, respectively. All stations reported measurements for nitrogen, 13 stations for heavy metals and results for lindane are available only from three stations. Shading in Tables 2.1 – 2.3 indicates data available for at least one compound.

A map with geographical locations of the HELCOM stations is shown in Figure 2.1. Most of these stations are placed in the southern sub-basins of the Baltic Sea.

2.2 Measured concentrations in air

Measurements of nitrogen concentrations in the air are available form 15 HELCOM stations for the entire period 1996 – 2000. Concerning heavy metals, 11 stations report data but only seven for the entire 5-year period. In case of lindane, measurements are available from only two Swedish stations, with one rteporting for the entire period on other for four years.

The pattern in air concentrations for nitrogen compounds in the years 1996-2000 has been uncertain. There is some suggestion of decline in concentrations on the southern Baltic shore, but otherwise the temporal pattern is somewhat erratic. This is consistent with the picture emerging from nitrogen in precipitation.

Air concentrations of heavy metals similarly do not indicate a consistent regional pattern in the years 1996-2000. As with precipitation, concentrations in Germany and Denmark indicate some decline, but with a variable pattern elsewhere.

Because, air concentrations of lindane (γ-HCH) were only reported by two Swedish stations, it is not possible to draw any general conclusion for this component. However, available measurements suggest large inter-annuaal variations of lindane (γ-HCH) concentrations in the air and lack of any significant trend for the considered 5-year period.

2.3 Measured concentrations in precipitation

Measurements of nitrate and ammonium in precipitation were performed at 16 HELCOM stations, but only 11 stations covered the entire period 1996 – 2000. In the case of heavy metals, 13 stations reported concentrations in precipitation, but only eight of them for the entire 5-year period. Lindane (γ-HCH) concentrations in precipitations are available only from one station Zingst located in Germany and only for two years: 1996 and 1997.

The observed concentrations of nitrate and of ammonium in precipitation do not themselves reveal clear temporal patterns in the period 1996-2000. Therefore, analysis has been made of the average rates of deposition of nitrogen in precipitation (i.e. concentration multiplied by total precipitation) to coastal waters in each year. All stations with available data for any year have been used, with values being precipitation weighted to create a single indicative value. This analysis covered the period 1990-2000. Even with this approach, no clear trend for the years 1996-2000 is apparent. During the first years of the decade there is an apparent decline by 30% or more in annual rates of nitrogen deposition, whilst in the latter years the picture appears one of relatively little change.

For metals temporal patterns are equally unclear. The analysis was started only from 1990 in order to maintain reasonable comparability in the stations with available data. However. The degree of inter-annual variability appears quite large, such that by this approach patterns are not apparent. Care should be taken, as stations utilized did vary slightly year-to-year. However, reviewing the observed concentrations at individual stations does not indicate consistent regional patterns. For example, for lead there appears to be decline at Zingst and Vilsandy in Germany and Estonia respectively, while between these there is a very variable pattern. The same can be said for other components.

For lindane (γ-HCH) there are not enough available measurements to draw any conclusion for the Baltic Sea region.

2.4 Quality of observations: the observation metadata

Interpretation of observations benefits from the accompanying "information about the data", or metadata. Information about the data availability in time and in space and expected quality of that data can be found in Chapter 5. Precise information on accuracy, detection limits and precision of the reported observations is found in the Annex.

Table 2.1. Available nitrogen measurements in the HELCOM stations for the period 1996 - 2000. Green color indicates data available for at least one component.

Station		Nitrogen in air					Nitrogen in precipitation				
Code	**Name**	**1996**	**1997**	**1998**	**1999**	**2000**	**1996**	**1997**	**1998**	**1999**	**2000**
FI53	Hailuoto										
FI9	Uto										
FI17	Virolahti										
EE09	Lahemaa										
LV16	Zoseni										
EE11	Vilsandy										
LV10	Rucava										
LT15	Preila										
PL04	Leba										
DE09	Zingst										
SE05	Bredkalen										
SE08	Hoburg										
SE12	Aspvreten										
SE02	Roervik										
SE11	Vavihill										
DK05	Keldsnor										
DK08	Anholt										

Table 2.2. Available heavy metals measurements in the HELCOM stations for the period1996 - 2000. Green color indicates data available for at least one component.

Station		Metals in air					Metals in precipitation				
Code	**Name**	**1996**	**1997**	**1998**	**1999**	**2000**	**1996**	**1997**	**1998**	**1999**	**2000**
FI53	Hailuoto										
FI9	Uto										
FI17	Virolahti										
EE09	Lahemaa										
LV16	Zoseni										
EE11	Vilsandy										
LV10	Rucava										
LT15	Preila										
PL04	Leba										
DE09	Zingst										
DK20	Bornholm										
SE12	Aspvreten										
DK05	Keldsnor										
DK08	Anholt										

Table 2.3. Available lindane (γ-HCH) *measurements in the HELCOM stations for the period 1996 - 2000. Green color indicates data available for at least one component.*

Station		γ-HCH in air					γ-HCH in precipitation				
Code	**Name**	**1996**	**1997**	**1998**	**1999**	**2000**	**1996**	**1997**	**1998**	**1999**	**2000**
DE09	Zingst										
SE02	Roervik										
SE12	Aspvreten										

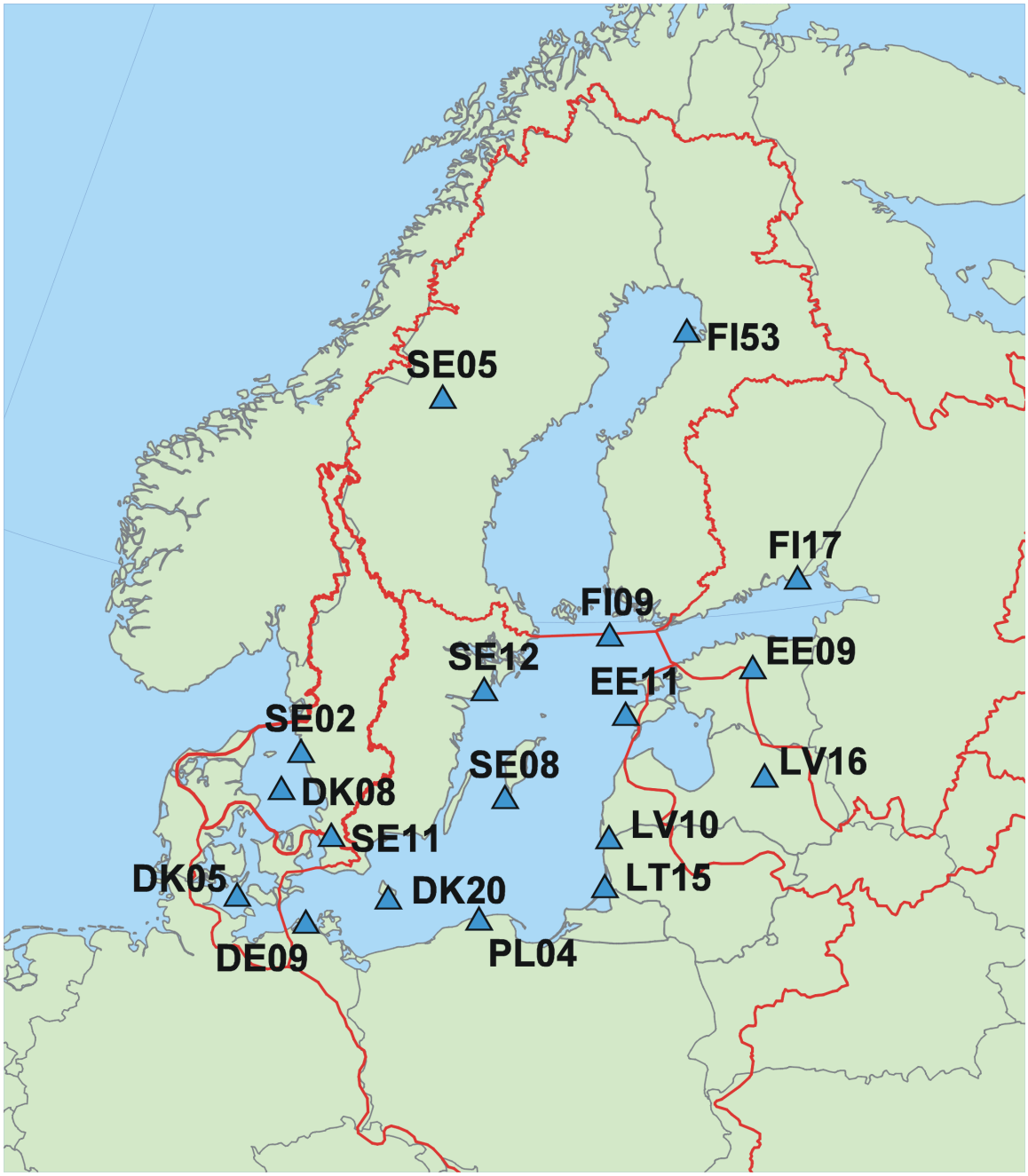

Figure 2.1. Geographical locations of the HELCOM stations with available measurements for the period 1996 - 2000.

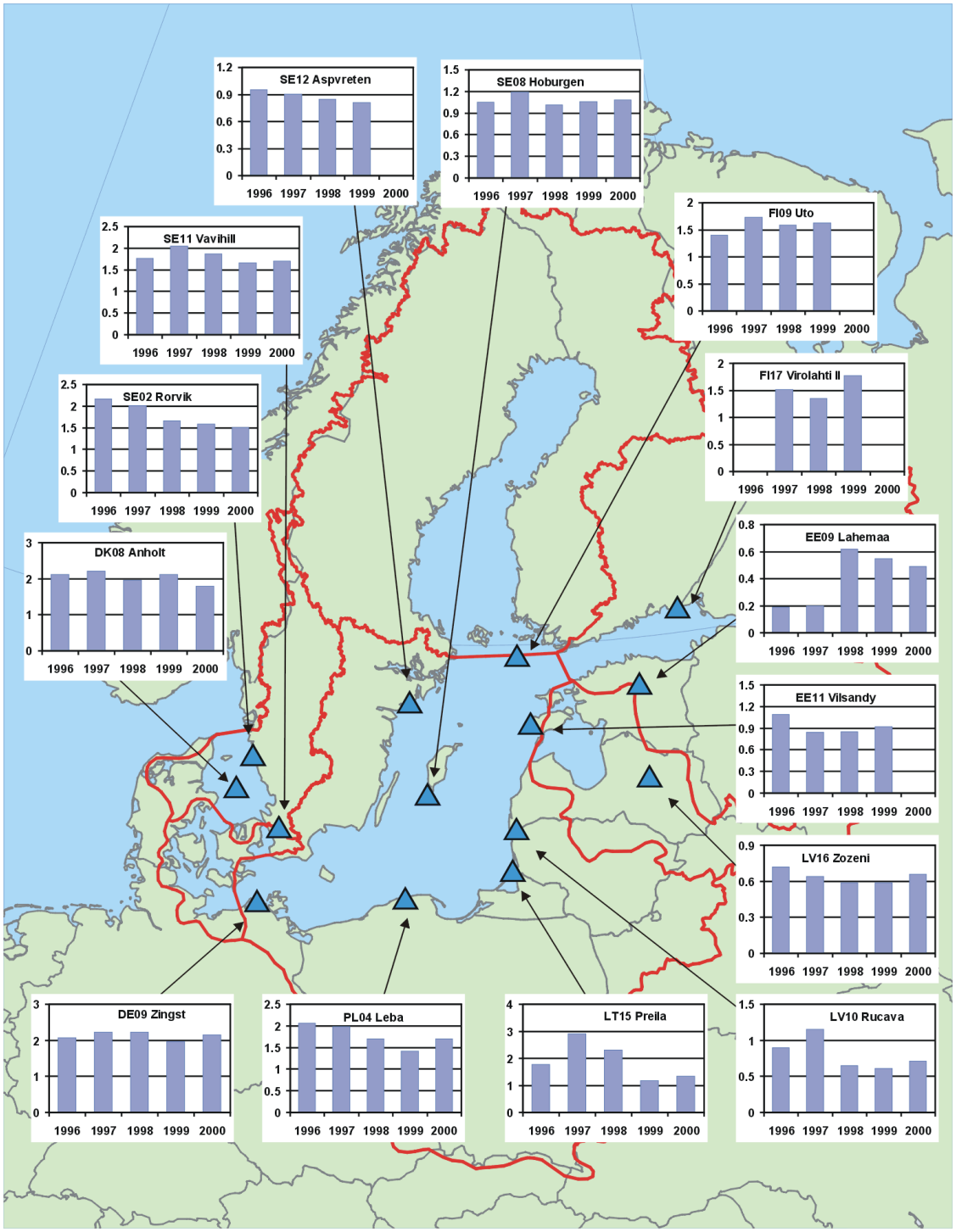

Figure 2.2. Measured, at HELCOM stations, annual average concentrations of nitrogen oxide in air in the period 1996-2000. Units: µg N/m^3.

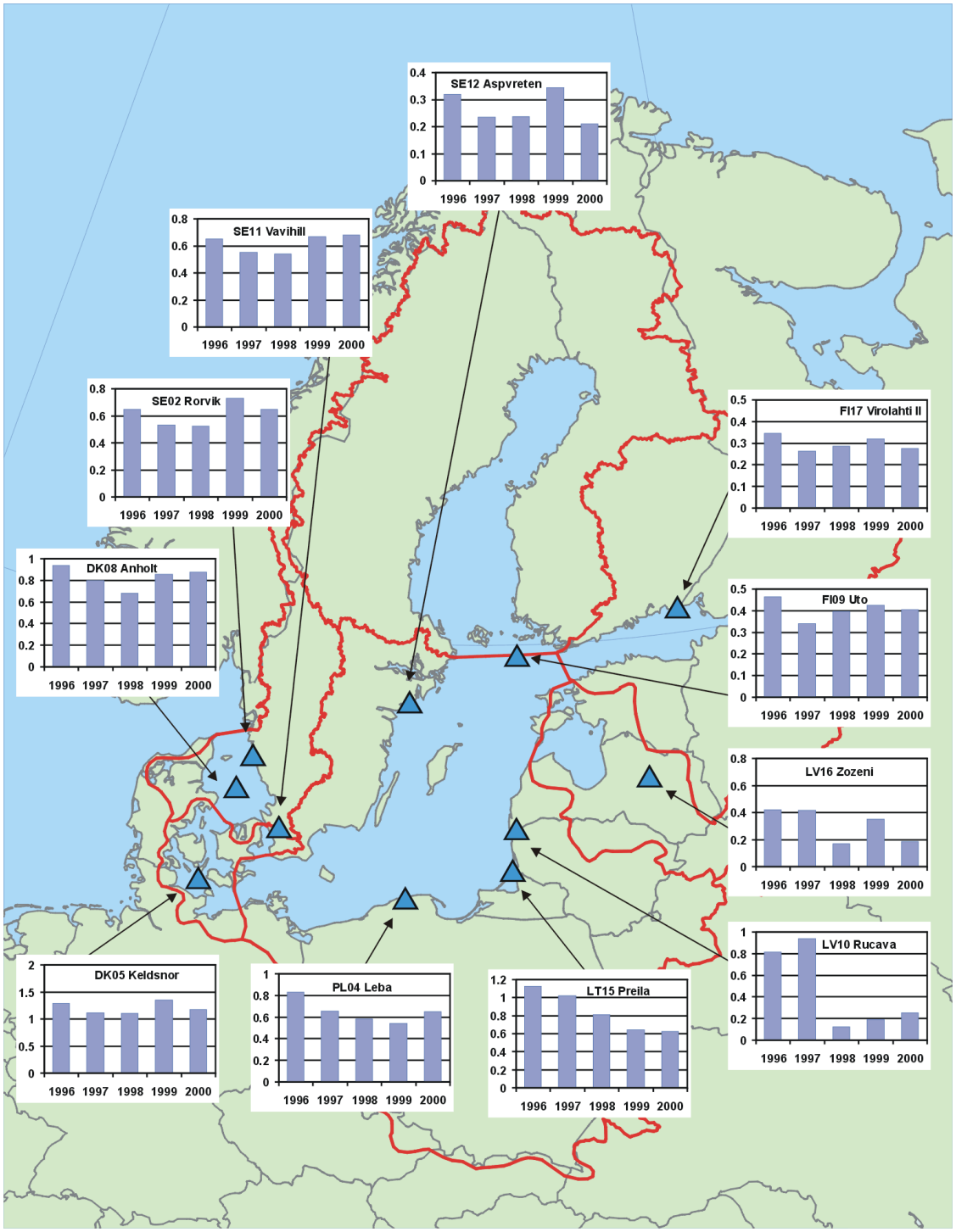

Figure 2.3. Measured, at HELCOM stations, annual average concentrations of total nitrate (HNO_3+NO_3-N) in the air in the period 1996-2000. Units: µg N/m^3.

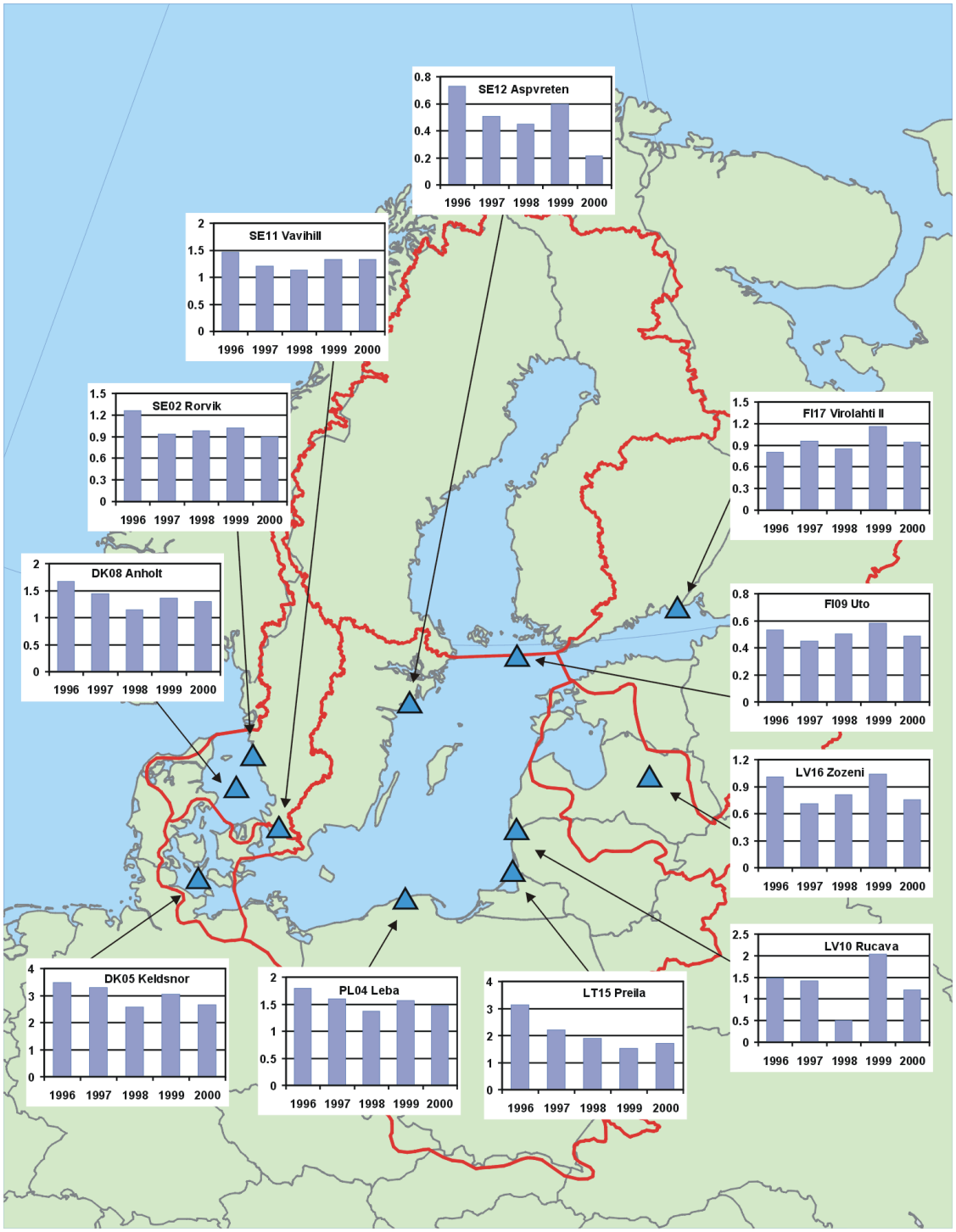

Figure 2.4. Measured, at HELCOM stations, annual average concentrations of reduced nitrogen (NH_3+NH_4^--N) in the air in the period 1996-2000. Units: µg N/m^3.

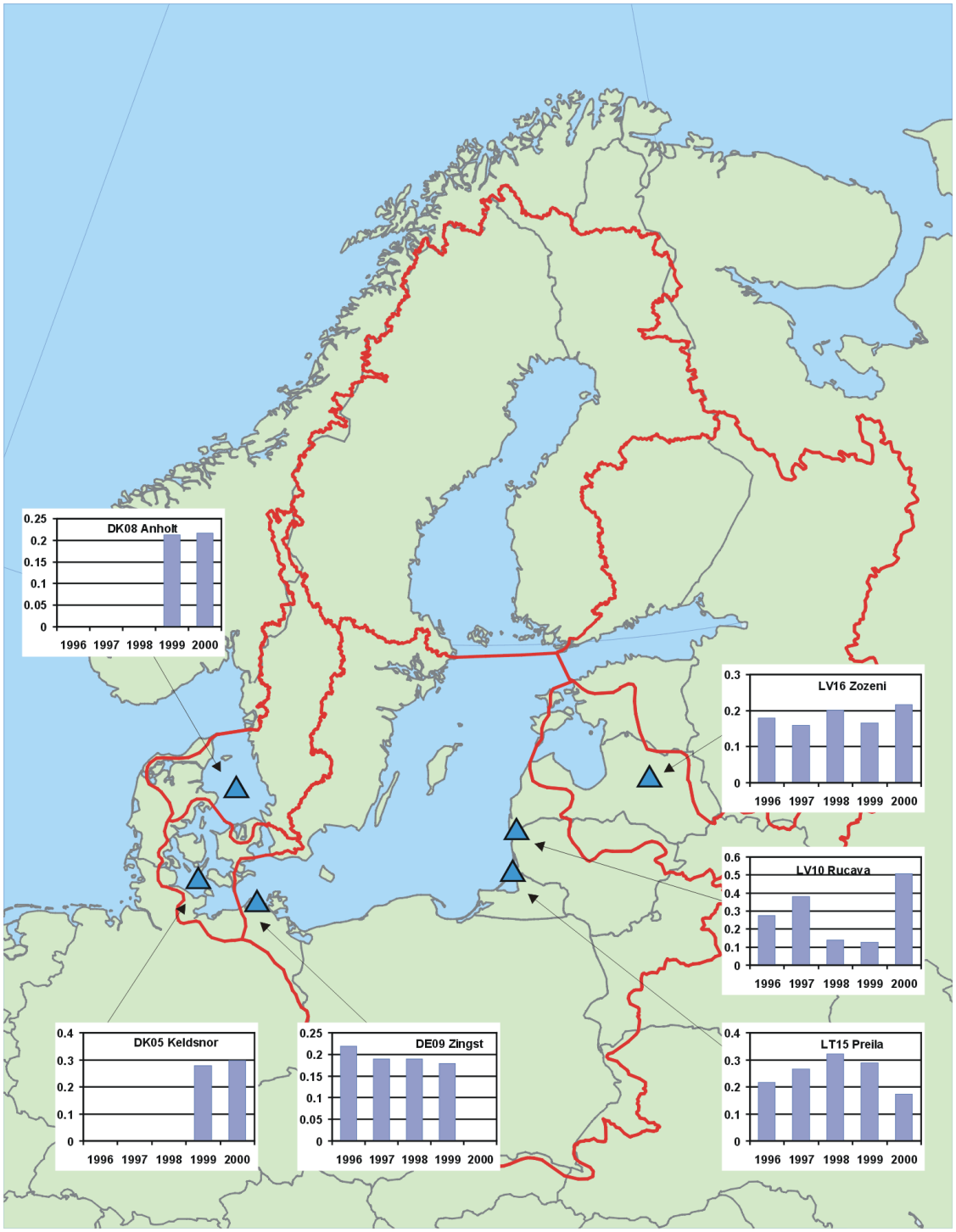

Figure 2.5. Measured, at HELCOM stations, annual average concentrations of cadmium in the air in the period 1996-2000. Units: ng/m^3.

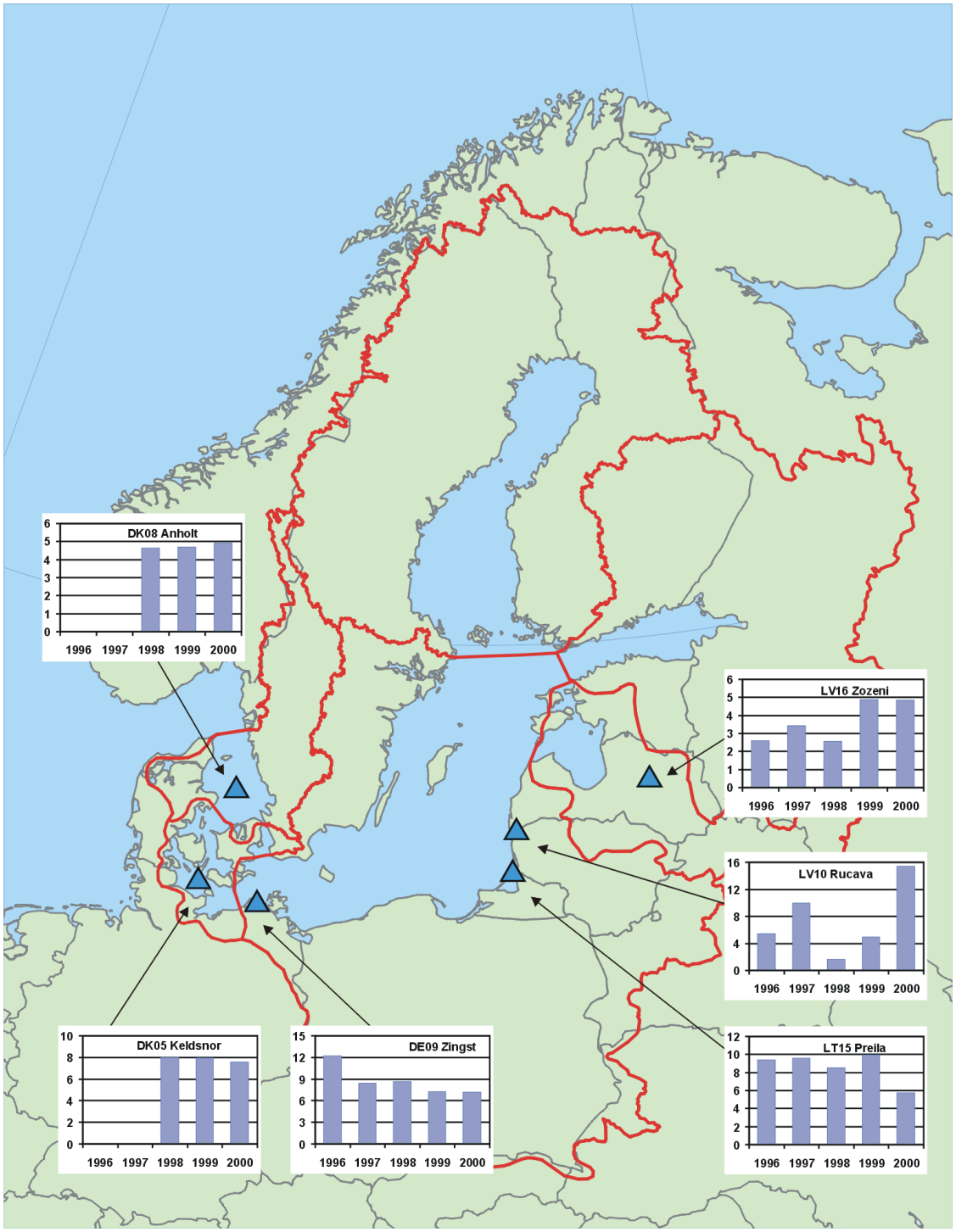

Figure 2.6. Measured, at HELCOM stations, annual average concentrations of lead in the air in the period 1996-2000. Units: ng/m^3.

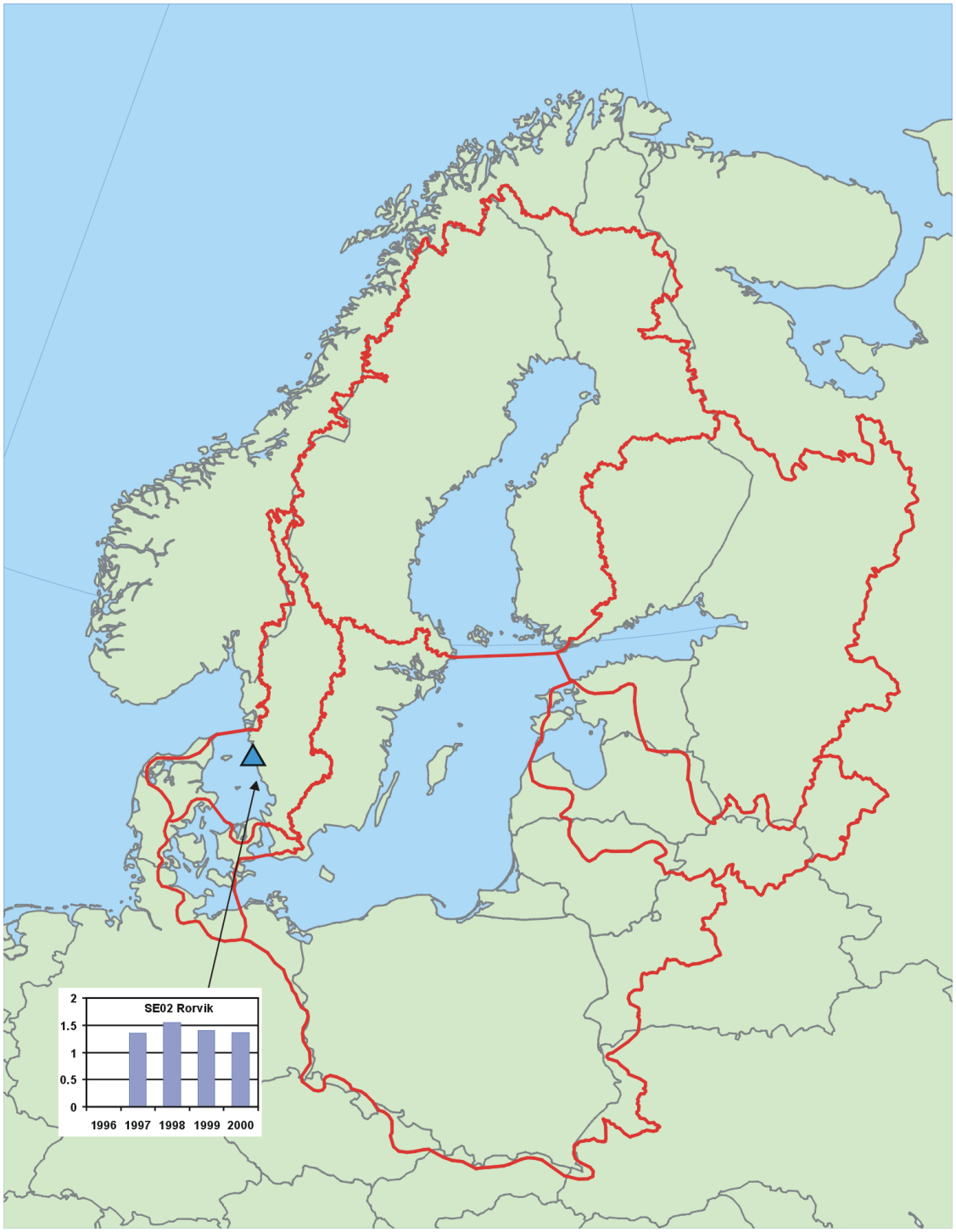

Figure 2.7. Measured, at HELCOM stations, annual average concentrations of mercury in the air in the period 1996-2000. Units: ng/m^3.

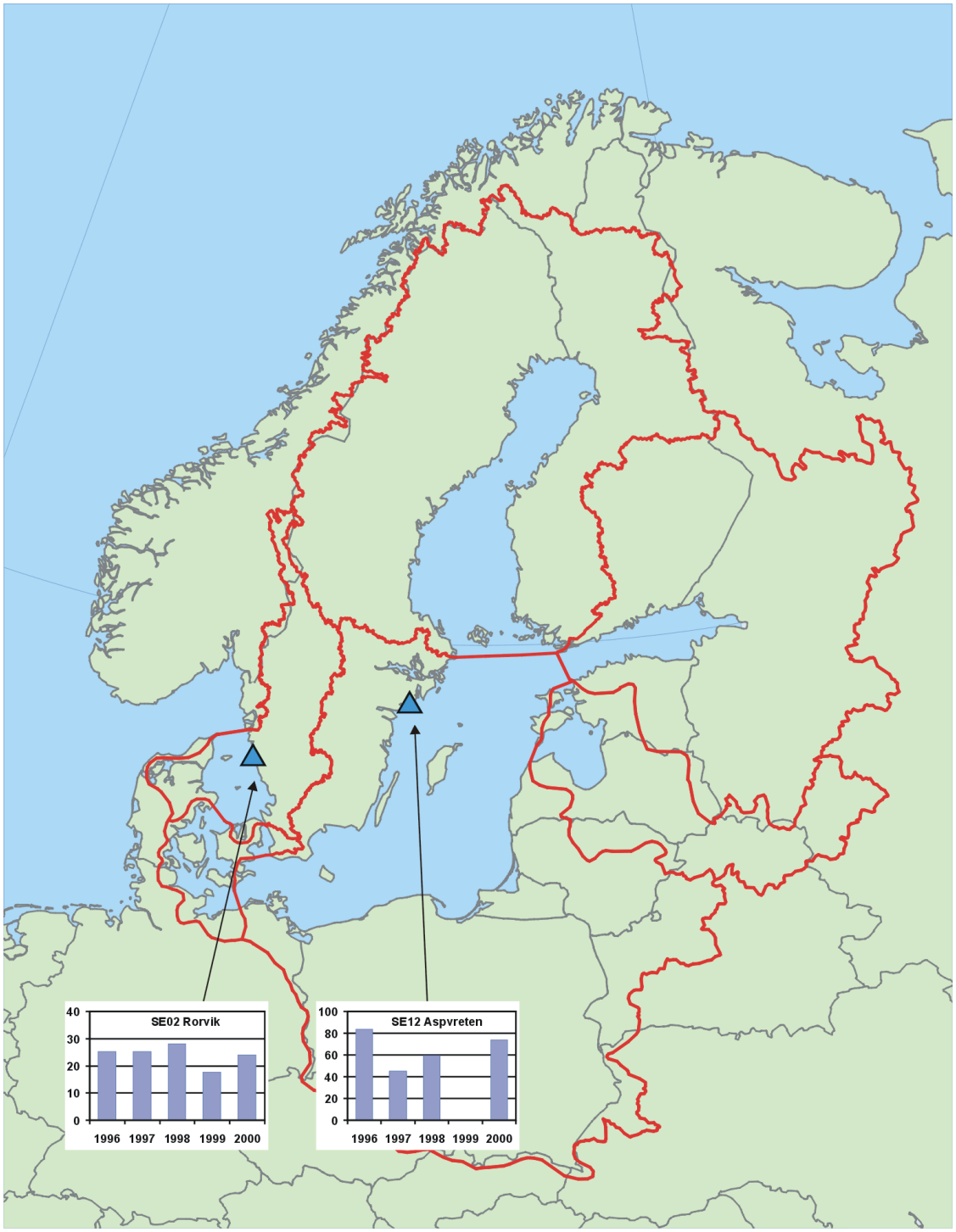

Figure 2.8. Measured, at HELCOM stations, annual average concentrations of lindane in the air in the period 1996-2000. Units: pg/m^3.

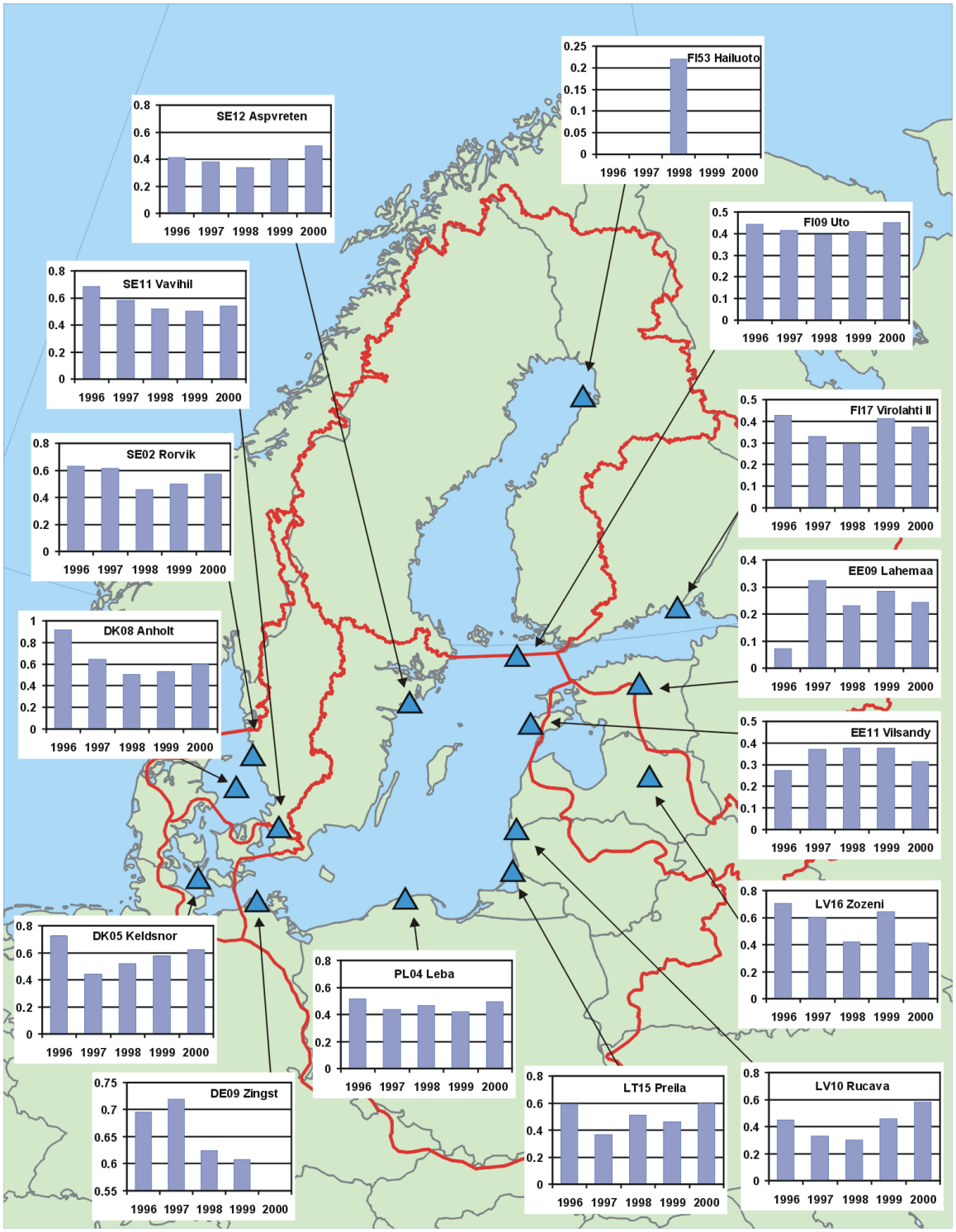

Figure 2.9. Measured, at HELCOM stations, annual average concentrations of nitrate in precipitation in the period 1996-2000. Units: mg N/l.

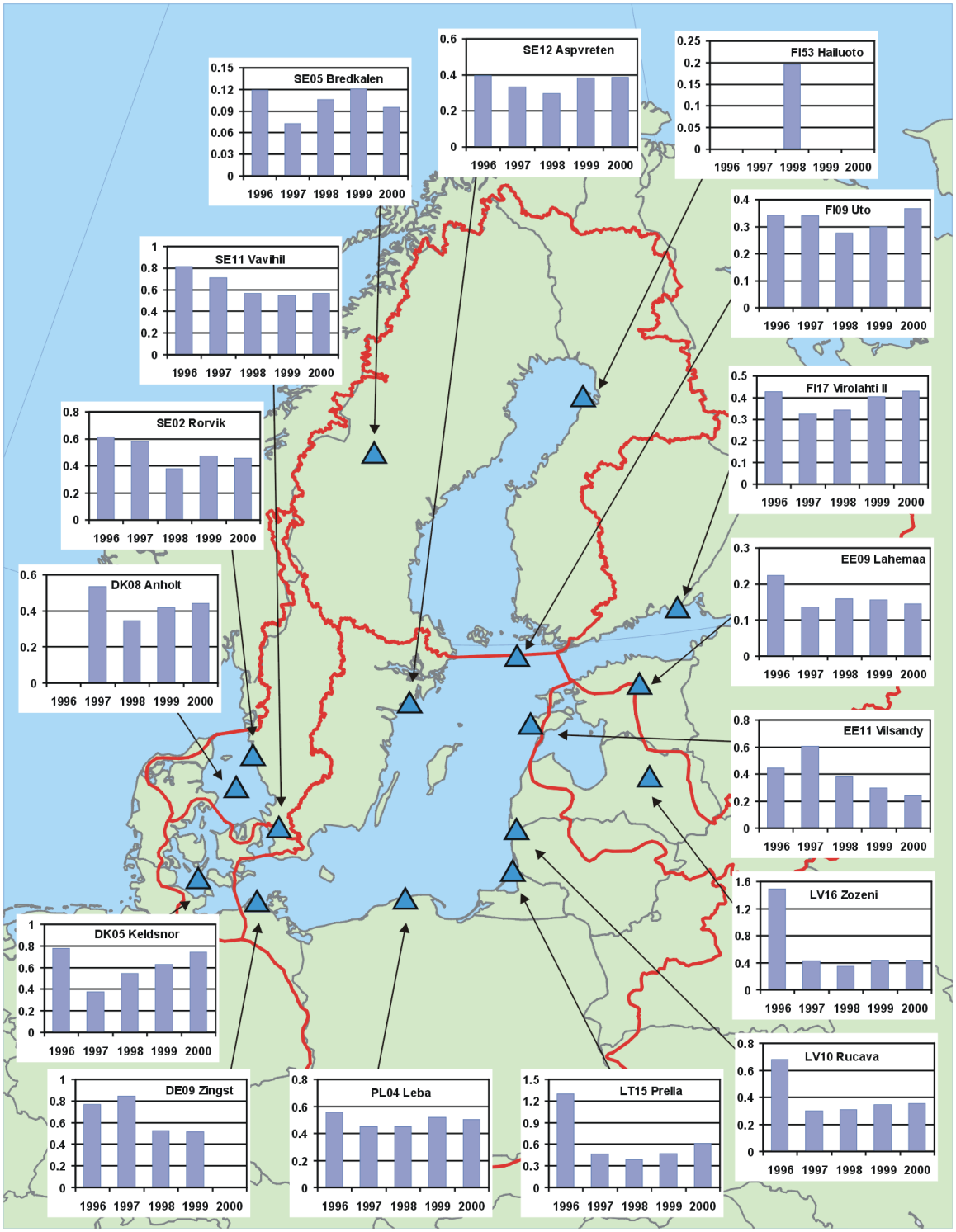

Figure 2.10. Measured, at HELCOM stations, annual average concentrations of NH_4 in precipitation in the period 1996-2000. Units: mg N/l.

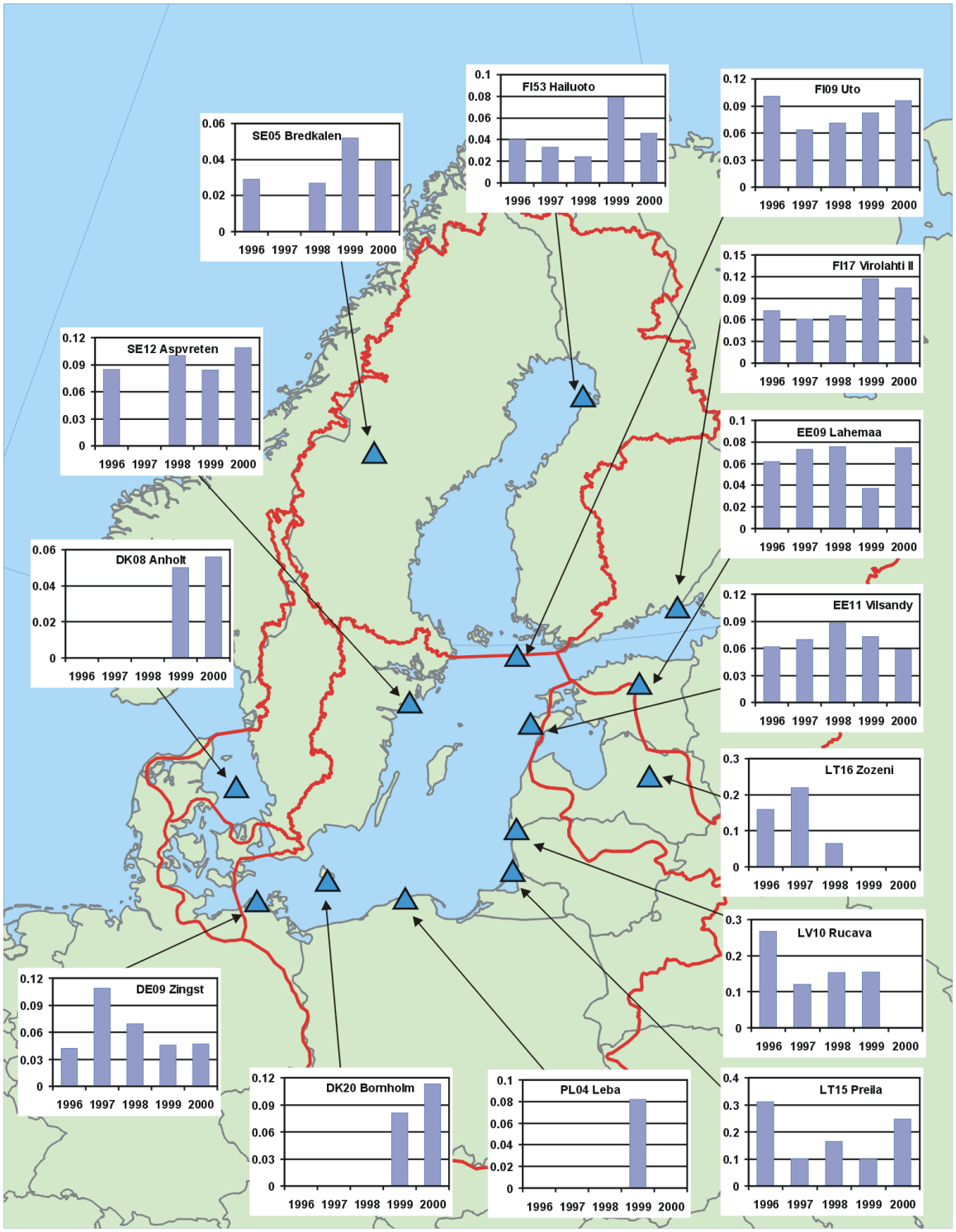

Figure 2.11. Measured, at HELCOM stations, annual average concentrations of cadmium in precipitation in the period 1996-2000. Units: µg/l.

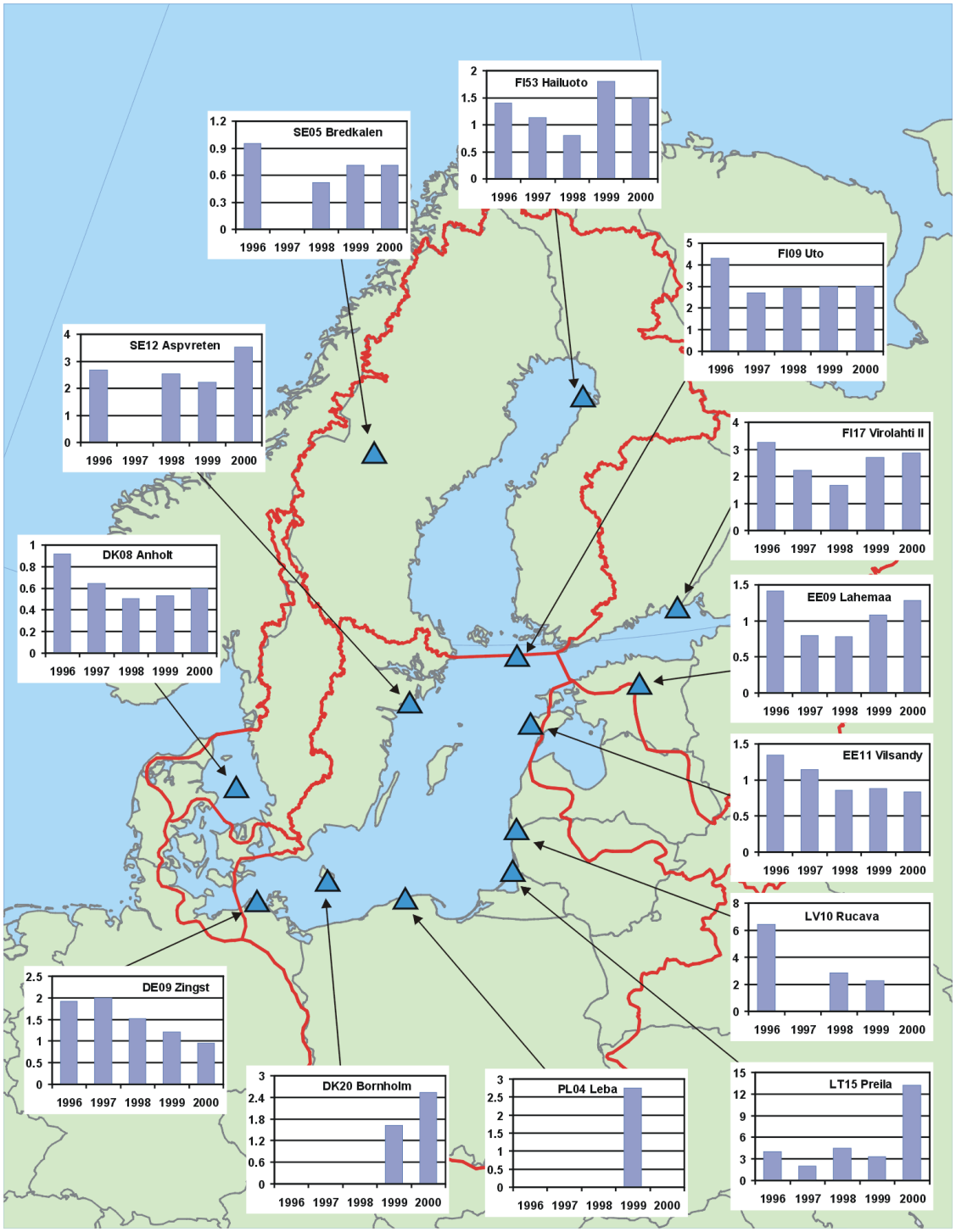

Figure 2.12. Measured, at HELCOM stations, annual average concentrations of lead in precipitation in the period 1996-2000. Units: µg/l.

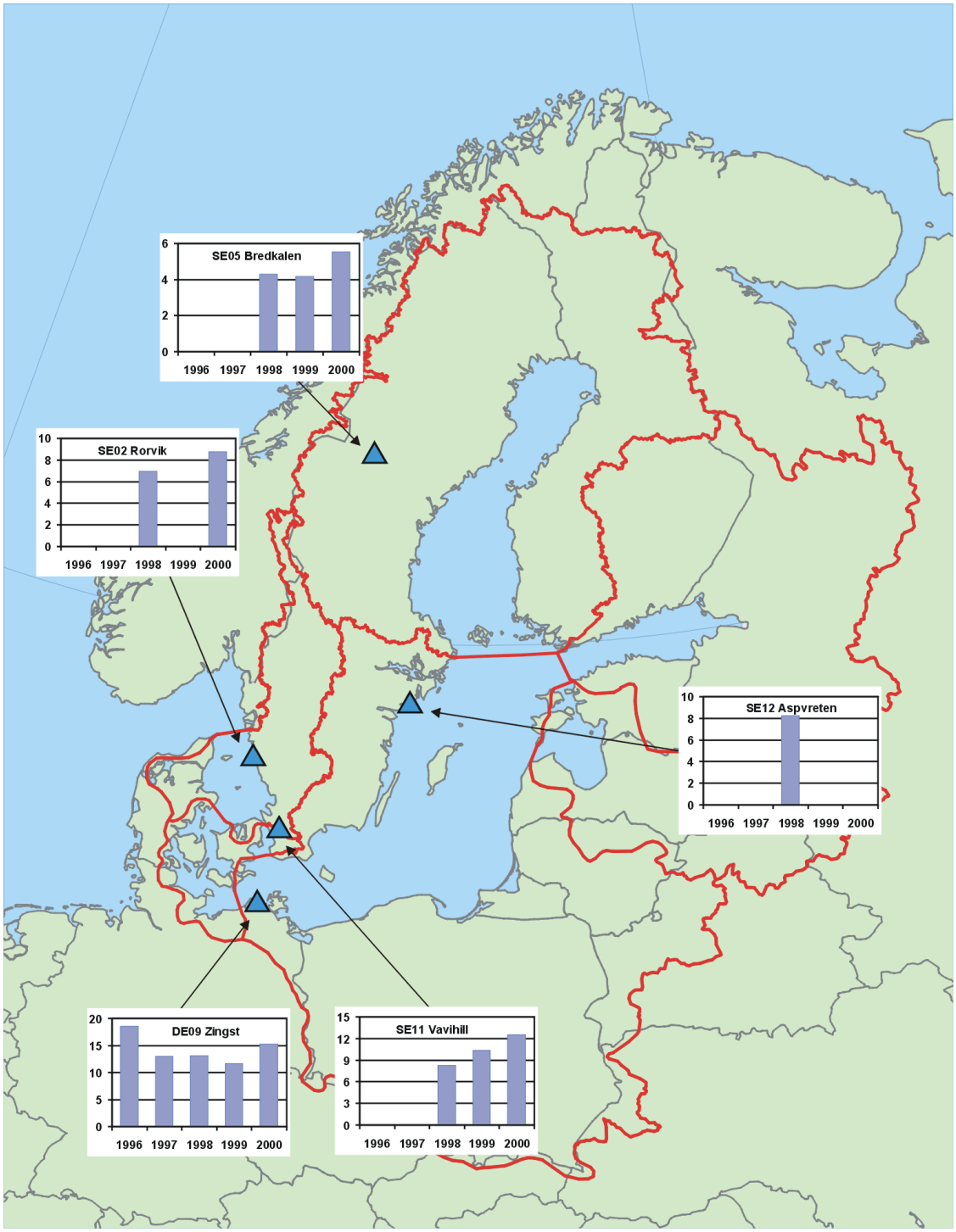

Figure 2.13. Measured, at HELCOM stations, annual average concentrations of mercury in precipitation in the period 1996-2000. Units: ng/l.

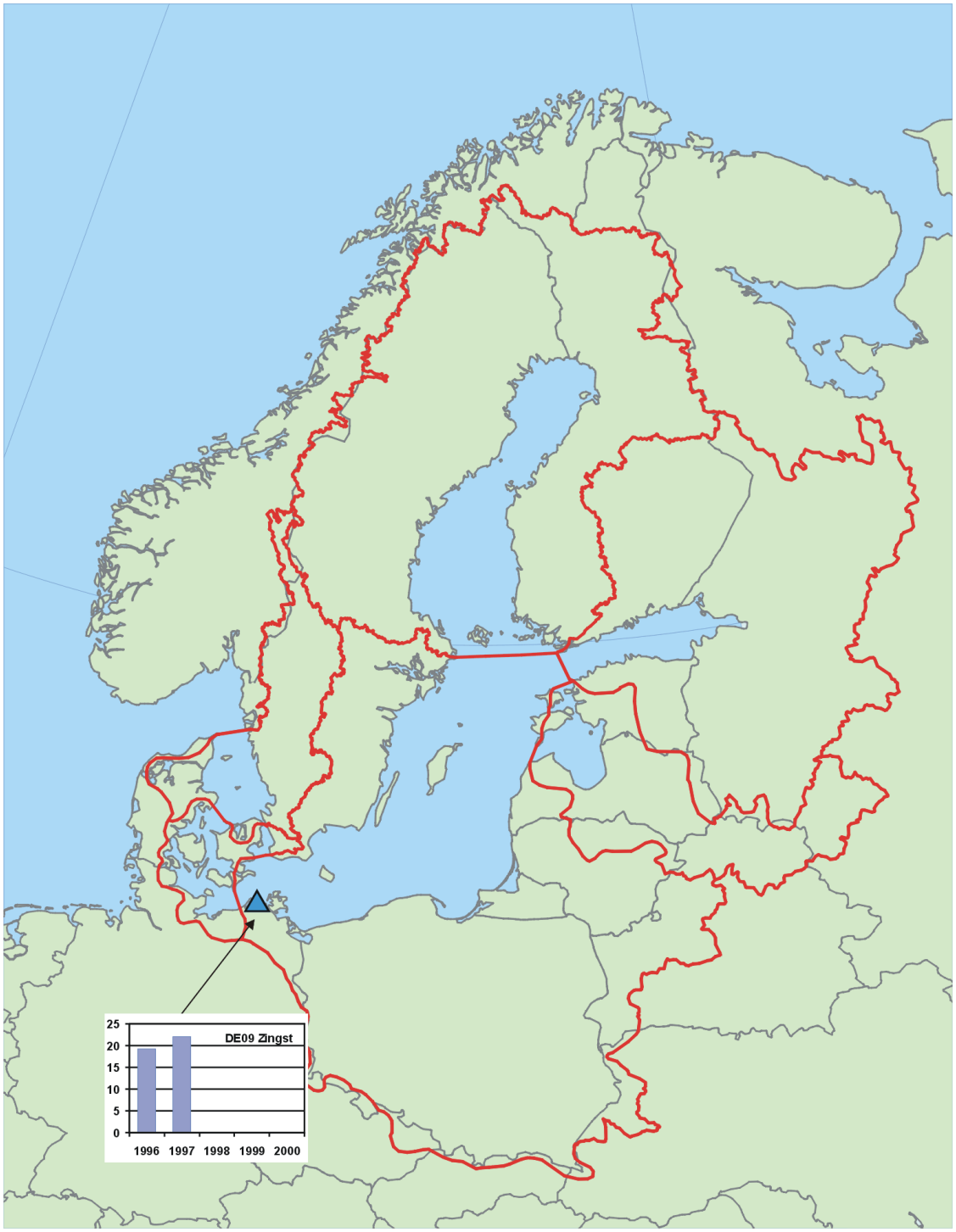

Figure 2.14. Measured, at HELCOM stations, annual average concentrations of lindane in precipitation in the period 1996-2000. Units: ng/l.