Statistical Analyses of the Baltic Maritime Traffic

Customer: Finnish Environment Institute

Ministry of Traffic and Communications

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Summary

The Baltic Sea, the largest brackish body of water in the world, has always been an important sea route connecting the Nordic countries and Russia to continental Europe. Surrounded by nine countries, it also has some of the densest maritime traffic in the world. In addition, the Baltic Sea has proved to be an important inter-modal link between various logistical chains, and moreover, a link to Russia. The Baltic Sea has also served a crucial role as a route for the gas pipeline from Russia to Europe.

During recent decades, there has been a significant increase in maritime traffic, specifically in container vessel traffic throughout the world. The traffic in the Baltic area has not only increased, but the nature of the traffic has also changed rapidly. Today, many of the shipping routes consist of frequent traffic, where fast ships are running between seaports on a fixed timetable. There are also certain routes that have dense passenger traffic, e.g., Helsinki–Stockholm and Helsinki–Tallinn.

Perhaps the most interesting development, however, has been the rapid development of Baltic and Russian seaports: old ports have been rehabilitated, new terminals and berths are under construction. One tendency has been the increase of oil transportation, especially in the Gulf of Finland (GOF).

This report contains an analysis of the current maritime traffic of the Baltic Sea. A special attention is focused on the oil transportation and the forecast of the future development. The main ports and their basic development plans are also presented. The work was funded by the Finnish Environment Institute and the Finnish Ministry of Transport and Communications.

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1 Introduction

The increased traffic and expected growth of oil transportation in the Gulf of Finland was the main reason the Finnish Environment Institute and the Finnish Ministry of Traffic and Communications decided to order an updated traffic survey. There were other facts, which pointed out the necessity to collect updated data on the transportation figures:

- The older HELCOM risk assessment studies in 1996 and 1998 were partly based on older data without the known development of the Baltic ports and the Gulf of Finland oil transportation figures as has been observed today,
- Some deductions and assumptions made in the COWI's research project of the Baltic Pipeline System did not give realistic view over the Gulf of Finland development (especially Primorsk, Muuga, Ust-Luga),
- Finland, Estonia and Russia started in 2000 to discuss on the need of the VTMIS (Vessel Traffic Management and Information System) for the Gulf of Finland. The preliminary survey made by VTT pointed out the need for the updated traffic survey and
- HELCOM has recently launched a project "an updated assessment of the risk for oil spills in the Baltic Sea area".

Due to the fact HELCOM launched the new risk assessment the goal of the work was widened to cover not only the Gulf of Finland sea area, but the whole Baltic Sea area. Moreover, the preliminary survey on the possibility to use FSA techniques as a risk assessment tool was also started as described later in this paper.

The basic goal of this work is to collect new seaborne transportation data including all the main groups of cargo. The prognoses on the development for the year 2010 will also be made. The main goal, however, is to define the oil transportation figures and main routes now and in the future. Due to the fact the parameterization of the oil transportation will not alone tell a lot of the total maritime safety development other important parameters will be collected and analyzed in the study. The parameterization and the risk assessment work will be carried out later, after the traffic inventory phase will be carried out.

Other data to be collected in the study are:
- Oil transportation figures and capacities of the ports and terminals,
- Transportation modes,
- Transportation units, especially the size and age of tankers and other relevant parameters such as single/double hull, need for ice classification, propulsion system, redundancy,
- Other main transportation figures, main routes,
- Approaches of the ports (one way, two way, difficult/easy),
- Defined wind limits for tanker manoeuvres (separate report by VTT).

2 Maritime transportation of the Baltic Sea

2.1 General

The strong economic development of trade in the Baltic Sea area is also reflected in the development of shipping. Consequently, when economies strengthen and trade increases, it is important that shipping and the transport system in general are not restricted by various barriers, bottlenecks and certain institutional differences. Development, however, is leaning to the more general trade with harmonized tools and legislation. The TEDIM (Telematics in Foreign Trade Logistics and Delivery Management) initiative of the Finnish Ministry of Transport and Communication is one example of this development, used to improve cross-border processes, such as fast and reliable customs services, intermodalisms and integrated information exchange.

A precondition for a market economy is a functioning legal system with well-developed contract, association, business and trade and competition legislation. Through EU membership, Finland, Germany, Denmark, and Sweden are already subject to the common regulatory system of the EU. The EU's transport and shipping policy comprises the framework for the regulatory system that controls shipping and ports in these countries (Sjöfartsverket, 1999).

Russian economy started to develop slowly after the collapse of the Soviet Union. The reform period started in the early 1990's, but it took several years until the new leadership and the support of the industry caused a new rehabilitation era for the Russian seaports in the Baltic Sea area. Due to the fact that the economic activity in Russia is primarily concentrated in major cities, the economic development elsewhere has been slow. The economic crisis in August 1998 further reduced economic activity in Russia, but exports from Russia survived through the crises better than imports did. Exports are dominated by raw materials, and are largely dependent on trends and world market prices.

After the disintegration of the Soviet Union, there have been a lot of different harbor and terminal proposals for the Gulf of Finland area. The Baltic countries have also rapidly rehabilitated their old harbors and built up new capacity mainly for transit traffic. At this point in time, there are a lot of development activities under way in the Russian and Baltic ports. The most well known rehabilitation projects have been in St. Petersburg Harbor and Muuga Harbor in Tallinn. The oil transit traffic for the Port of Muuga was approximately 19 million tons in 2000, and after the railway connections from Russia to the port will be rehabilitated, that may increase. Totally new harbor construction sites have been taken place at Primorsk, Lomonosov, Batareinya and Ust-Luga on the Russian side of the Gulf of Finland. It has been estimated that maritime traffic will increase two-fold in 2010–2015. Transportation of hydrocarbon products may even be three-fold compared to the existing figures. Port projects in the eastern Baltic are presented in Appendix 6.

The first phase of the Primorsk oil terminal will be completed by the end of 2001. The government of the Russian Federation, however, has already given a new order to start up the second phase of the Primorsk oil terminal (order dated 2.11.2001), which will raise the proposed first stage annual oil flow by 6 million tons up to an annual level of 18 million tons. Russian oil companies are planning other terminals, and one of the newest plan is the Vysotsk oil terminal off the City of Vyborg.

The Baltic States (Estonia, Latvia and Lithuania) have strong, growing structures for shipping and port activities. During Soviet rule, their ports were handling a significant amount of Soviet exports.

After gaining their independence, the Baltic Countries have retained, and even strengthened their role as transit regions for Russia exports and imports. The development of the Port of Tallinn, and especially of the Muuga Oil terminal has been rapid and intense.

The new capacity of the Gulf of Finland may cause the transit traffic of the Baltic States to decrease in the long term. The crude and raw materials market price, however, will, together with the need of western currency and political decisions inside and outside the EU influence the development. Here, the assumption is made that the new Russian capacity will not totally cut the traffic numbers for the Baltic States, decreasing development instead. The positive economic development of Russia and the Baltic States will influence maritime transport and speed up growth, which will then compensate for part of the existing transit. Russia will take care of a larger part of the shipping of its raw materials, but simultaneously new materials will be imported to Russia, which will keep the transit figure in balance, and even let it grow.

For several historical reasons, the situation in Poland differs from that of the Baltic States. The reform period with a transition period has been longer, and new ferry lines and traffic routes have been established (Sjöfartsverket, 1999). Poland's maritime development has been characterized by continuity and its progress towards a market economy has been less drastic than that of the Baltic States and Russia.

It is clear that from the regulatory viewpoint, the Baltic Sea is best protected both at the regional and national levels. The Helsinki Convention has provided the regional framework for co-operation in the Baltic for the last 25 years. It is evident (see the analysis in the report: Accidents, Prevention and Remediation in the Baltic Sea) that during this time, and particularly in the last 10 years of dramatic political and economic change, co-operation has developed and a regional legal framework has been agreed among the states concerned (COWI, 1998).

This regional co-operation has developed on a two-fold basis as regards the BPS project. First, through the HELCOM Maritime Committee, a number of HELCOM Recommendations have been elaborated and agreed with the objective of improving the quality of shipping visiting Baltic ports and also by seeking co-operation for better enforcement and control. Second, through the HELCOM Combatting Committee, the response capabilities of Baltic States have been improved through the means of guidance and procedures laid down in the HELCOM Combatting Manual, joint exercises, exchanges of information, etc.

At the national level, the Baltic Sea is well served by having half its riparian states at an advanced level of environmental management and supporting legislation. Denmark, Finland, Germany and Sweden have always been in the vanguard of environmental protection policies and their membership of the EU has contributed to the advancement of environmental protection and improved quality of shipping within the Community. The HELCOM countries in transition (Estonia, Latvia, Lithuania, Poland and the Russian Federation) have all made progress in the last decade. In particular, the 4 Baltic States which are trying to accede to the EU have made significant progress in updating their legislation and administrations in order to be able to comply with EU laws and considerable progress has been made in recent years to improve oil spill response capability, with the help of external donor support (COWI, 1998).

A thorough description of HELCOM is given along with relations with other bodies (IMO, EU). Also the views of the Baltic Sea states on the effectiveness of HELCOM are given. There is no need to create a new environmental body to cover the Baltic Sea. The very real needs are already met - to the general satisfaction of the Baltic States - by the Helsinki Commission. The present tri-lateral framework - HELCOM, IMO and the EU - each body with its individual strengths, seems to be an adequate mechanism to achieve the goal of preventing accidents in the Baltic Sea area and reducing the environmental impacts when they do occur, Figure 1.

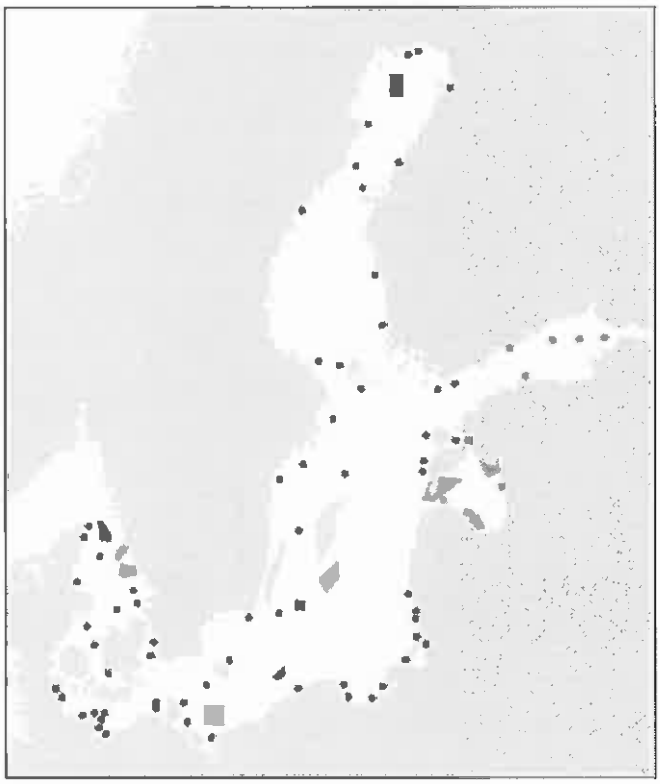


Figure 1. Location of the 62 coastal and offshore areas nominated in 1995 for HELCOM's system of Baltic Sea Protection Areas (HELCOM, 2001).

2.2 On the transport modes

The basic maritime transport modes of the Baltic Sea Region are:
- bulk or general cargo, semi-finished products. Oil products, chemicals, minerals, metals, coal and fertilizers belong to this category,
- high-value products, transported typically in containers or in packed form and
- ferry transport including passenger transport, cars, trucks and rail wagons.

The bulk type of cargo is still an important part of the sea transport in the Baltic region. For example in the Gulf of Finland area the oil transportation will form an important part of the total amount of cargo transported. Due to the new terminal construction works and rehabilitation of old harbors both in Russia and Estonia the oil transportation has increased and is increasing significantly.

There are often environmental problems related to the shipping of low value cargo including risks of oil spills, chemicals or other pollutants into the Baltic Sea. The ships used for transport are usually older ones, and the cargo forms a potential source for environmental problems if an unwanted hazard will occur. Other problems may be related to passages of large vessels carrying hazardous goods through narrow passages, ice infested waters or fragile coastal areas as well as heavy transport on the "hot spot areas", i.e. in important crossings to the intermodal connections.

Due to the fact Russia lost its main ports in the independence process of the Baltic countries, a lot of originally Russian, Ukrainian and Belorussian transito bulk products are transported via Baltic countries. Large projects are, however, currently being prepared in order to increase the capacity

and modernize several ports including ports and terminals in Russia and Estonia. These rehabilitation works will cause major changes in the product transportation chains through Baltic and Russian ports, and influence to Finnish ports in the Gulf of Finland, too. The rise of the economy and the increase of the GDP in Russia will increase the transited cargo volume especially in the Gulf of Finland area, and the southern part of the Baltic Sea.

For the high value cargo there are a set of items to illustrate the future development. The logistics requirements and the need to concentrate enough cargo with the organizational and commercial network development. Logistics systems must be an integral part of the business process rather than an independently supplied facility (Källström, L. & Ingo, S. 2000). The competition between ports will taken place with prizing, rapid handling, flexible opening hours and good service structure.

2.3 Transportation figures

2.3.1 Existing and Future Traffic of the Gulf of Finland

The Baltic Sea surrounded by nine countries is a sensitive sea area with intense maritime traffic. The Baltic Sea offers an important sea route for export and import both inside the Baltic region and outside of the area, through the Danish Strait or via the Russian inland canal network. Ports in the Baltic Sea are listed in Appendix 7.

The disintegration of the Soviet Union changed the picture of the maritime traffic in the Baltic Sea area essentially. Russia lost some important ports after the independence of Latvia, Lithuania and Estonia. The growth of the maritime and port operations has been rapid in Estonia. Especially the Muuga terminal is now a major oil transit sit for Russian oil export in the Gulf of Finland.

Due to the fact Russia lost a great deal of its Baltic ports there has been several proposals to improve existing ports and terminals and to build totally new ports. New port and terminal proposals have been familiar for the maritime world already several years (Rytkönen, 1994), but due to the lack of finance, legislation problems, etc the development has been slow so far. However, Russia is loosing a significant part of possible revenues as harbor fees especially for the Baltic countries, thus it is now investing to ports in its own territory. There are also several proposals to enhance existing ports and terminals.

The best known new development sites are:

- Lomonosov with the annual throughput of 2.1 - 4.5 Mton,
- Batareinya bay with plans of 15 Mton,
- Ust-Luga with planned 35 Mton and
- Primorsk for 18...45 Mton of oil products
- Vysotk oil terminal, proposed to be in operation in 2003 with the annual 10 Mton output.

The latest news concerning the Russian port development in the eastern part of the Gulf of Finland indicate, that the Primorsk oil terminal's first phase is completed, and the first oil tanker left the terminal in the end of December in 2001. The planned volume of the first phase will be approximately 12 million tons. In the first phase, especially during the winter time, the smaller tankers may be used, but the master plan of the terminal uses 100 000 - 150 000 dwt tankers as design ships.

Figure 2 shows the situation in December 2000 in Primorsk when the construction works were underway. Note the base of the VTS tower in the middle of the picture. Primorsk terminal belongs to the Russian VTS system and has its own sub-station.

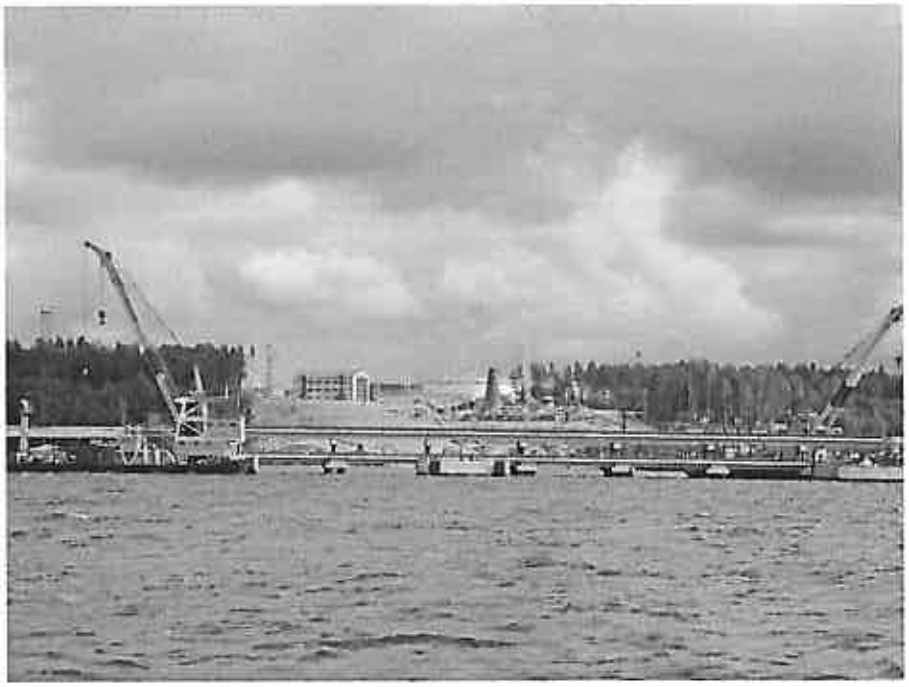


Figure 2. Primorsk oil terminal under construction in autumn 2001.

The St. Petersburg Sea port is also developing rapidly. The total cargo throughput of the St. Petersburg Sea port alone was 15.6 Mton in 1998, over 20.5 Mton in 1999 and will be over 24 Mton in 2000. The amount of oil products handled in 1999 amounted 5 Mton, in 2000 even more. The Batareinya port construction works seems to have been postponed. The Ust-Luga coal and fertilizer port, however, has received more funds for continuation of the works.

2.3.2 Overview on the Baltic Sea traffic

The total number of port calls in the Baltic Sea Region by cargo vessels according to Lloyds Voyage Record was approximately 75 000 during the second half of 1998. This figure does not include regular ferry traffic. Shipping services were performed by approximately 4 900 cargo ships in foreign and combined traffic, excluding domestic traffic. Taking into account the port calls by international ferry traffic in the Baltic area, the total amount of calls on a yearly basis is close to 426 000 (SMA, 1999).

Nearly 40% of the vessels were older than 20 years, which equalled approximately 50% of the total number of calls. Table 1 shows the number of calls in the Baltic Sea area by vessel type and country for the second half of 1998 (SMA, 1999).

Table 1. Number of port calls in the Baltic Sea, II/1998 (SMA, 1999).

Country	*Bulk/ comb*	*Tankers*	*Gas*	*Gen. cargo*	*Con-tainer*	*Reefers*	*RoRo*	*Pass-enger*	*Others*	*Total*
Germany	197	388	10	2 601	20	12	955	356	5	**4 544**
Denmark	653	2 100	85	6 642	480	91	967	213	45	**11 276**
Estonia	104	531	1	1 711	60	34	142	22	0	**2 605**
Finland	362	1 128	53	3 904	374	10	2 086	384	5	**8 306**
Lithuania	168	118	0	929	17	86	146	110	1	**1 575**
Latvia	357	490	53	1 969	67	58	237	63	3	**3 297**
Norway	1 149	3 041	458	11 358	791	706	1 998	885	50	**20 436**
Poland	478	707	55	2 544	168	166	230	48	10	**4 406**
Russia	240	411	1	2 291	179	267	143	323	17	**3 872**
Sweden	446	3 002	241	8 382	648	83	1 831	245	45	**14 923**
TOTAL	4 154	11 916	957	42 331	2 804	1 513	8 735	2 649	181	**75 240**

There are over 500 ports in the Baltic Sea with a total annual port throughput close to 700 million tons for 1997/98, nearly 600 million tons of which was cargo loaded or unloaded for export or import. The 1998 statistics for port throughput is shown in Table 2.

Table 2. Maritime traffic through Baltic Ports in 1998 (SMA, 1999).

Country	*Total number of calls*	*Total loaded and unloaded [million of tons]*	*Total loaded and unloaded in the Baltic Sea area*
Sweden	141 167	148.2	80.0
Finland	29 044	93.4	45.0
Russia/Baltic	7 744	28.5	17.1
Estonia	9 106	26.8	10.9
Latvia	6 707	47.0	21.6
Lithuania	3 150	15.0	7.0
Poland	14 318	50.0	20.2
Germany/Baltic	26 954	56.7	71.0
Denmark	108 229	102.4	40.9
Norway	79 161	110.8	31.4
TOTAL	425 580	678.9	345.2

The Baltic Sea has very dense sea traffic. The total sea-borne traffic of the Baltic Sea area was estimated in a research project "Baltic Pipeline – ERUS", funded by EU's Tacis (COWI, 1998). In 1995, the total volume was estimated to be close to 1.4 billion tons in the whole world. The percentage for the Baltic Sea was estimated to be approximately 15%.

The annual growth of traffic as well as several growth scenarios were presented in the study mentioned above. Depending on the certain economical assumptions and development potentials, the annual growth of the maritime traffic was expected to vary from 3–8%. The average growth volume was estimated to be 4–5%, and the following estimation up to 2017 was thus achieved (Table 3).

Table 3. Prognosis of the Baltic Sea maritime traffic from 1995 to 2017(COWI, 1998b).

Commodity	Volume in Baltic Sea (million tons)	Estimated future volume in Baltic Sea (million tons)	Growth from 1995 to 2017
Break Bulk	29	82	186%
Dry Bulk	61	113	84%
General Cargo	22	64	186%
Liquid Bulk	1	2	84%
Oil	81	112	39%
Total	194	372	92%

Source: COWI's estimate

Based on Table 3 above, the sea-borne volume will roughly double. The general cargo and container traffic will even be three-fold. The increase in oil transportation will be 40%. However, the figures for oil transportation are not well defined. There exist certain uncertainties after Russia have built up the new oil terminal potential in the Baltic area. There are speculations that the new terminals will cut part of the oil transit flow of the Baltic countries. The development of the oil market price and the internal affairs of Russia, however, may influence this development scenario a lot. It is expected here that the total increase for the oil transport figures may take place after the new terminals have been constructed. Since new terminals will be built and old harbors rehabilitated in the eastern part of the Gulf of Finland, the increase will have a strong influence there. Table 4 describes one estimate of the development scenarios in the most important oil terminals of the Baltic Sea area. The development of Muuga and St. Petersburg can be clearly noted.

Table 4. Oil transportation volumes of certain Baltic oil terminals in 1997 and in 2000 (G. Semanov/CNIIMF, 2001).

Country/port/terminal	In 2000	In 1997
Estonia/Muuga	17.8	9.2
Finland/Hamina	1.3	1.2
Finland/Porvoo	13.6	13.3 (other 5)
Latvia/Riga	3.0	1.3
Latvia/Ventspils	26.7	19.05
Latvia/Liepaja	0.1	-
Lithuania/Klaipeda	5.2	1.7
Lithuania/Butinge	3.5	-
Russia/St. Petersburg	7.5	3.5
Russia/Kaliningrad	1.1	0.3
Total [10^6 tons]	79.8 million tons	54.5 million tons

The total amount of cargo through the Baltic ports is presented below in 1998 level (Figure 3). Number of port calls in Baltic Sea States in the second half of the 1998 is presented in Figure 4. Forecast of the throughput development in the Baltic is presented in Appendix 26.

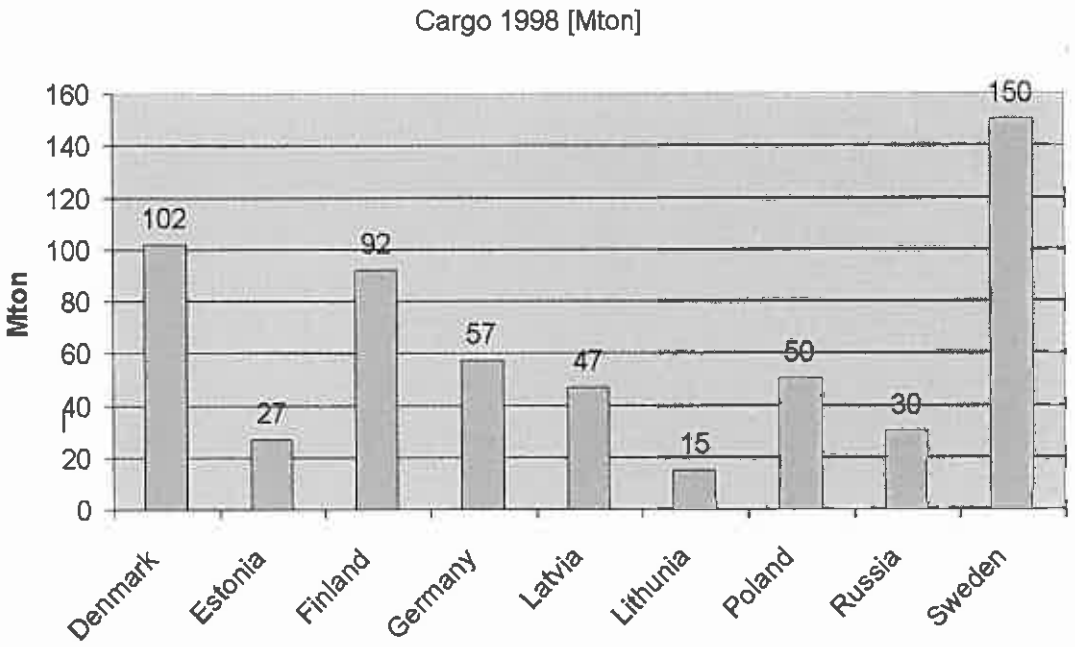


Figure 3. The total amount of cargo through the Baltic ports 1998 (Outlook 2000).

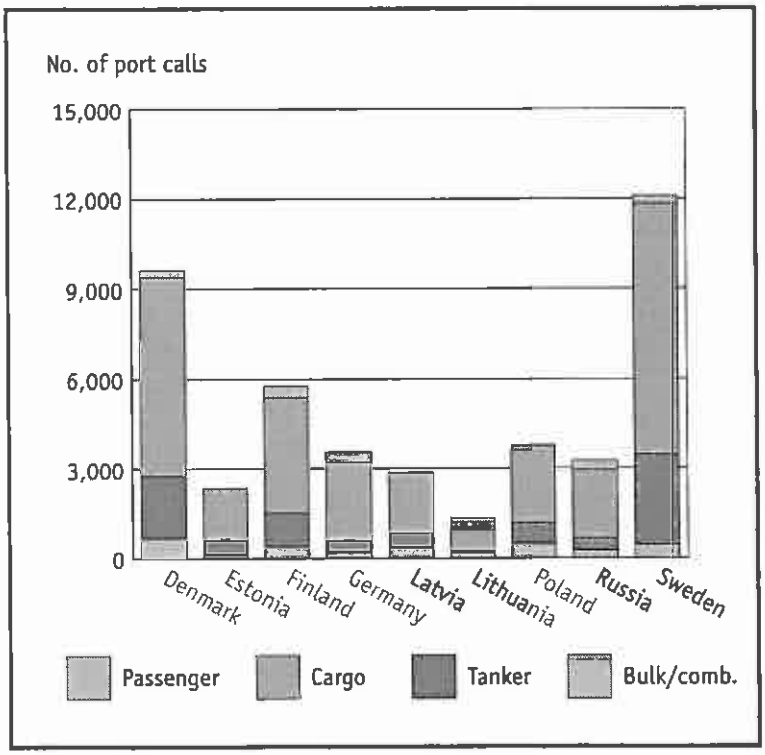


Figure 4. Number of port calls in Baltic Sea States in the second half of the 1998 apportioned by vessel type. Passenger vessels not reported by Estonia. One port call = ship arrival and departure (HELCOM, 2001).

2.3.3 Danish Straits and Kiel Canal

The total traffic intensity in the Great Belt and in the Sound was according to (COWI, Dec 1998) practically unchanged in the period 1978 to 1990, and has increased 20 % from 1990 to 1995. The increase is a result of a dramatically increase of 50 % in the traffic intensity in the Sound and a decrease in the traffic intensity in the Great Belt. The traffic in the Sound has doubled over the last ten years.

In the Little Belt traffic has decreased from around 8-9000 movements/year in 1998 to around 4000 in 1990. However a subsequent increase by 20 % in traffic is observed from 1990 to 1995.

Seen together the Great Belt, the Sound and the Little Belt show an increase of 20 % from 1990 to 1995. (A/S Great Belt, 1996).

The total traffic in the Kiel Canal has decreased over the past 7 years. The number of transit passages has decreased by 12 % from 1990 to 1995 and the tonnage has decreased by 15 % (Kiel, 1998; A/S Great Belt, 1996).

2.3.4 Cargo turnover in harbors

There is a little more than 200 commercial ports in the Baltic Sea. Approximately 60 of these each have an annual turnover of 1 million tons or more and represents 90 % of the total port turnover (EC 1997) . The ten largest ports in the region have a turnover of more than 14 million tons. These are shown in Table 5.

Table 5. Harbour cargo turnover and primary types of cargo in 1996 at the ten largest harbours in the Baltic Sea (EC 1997, Annual 1998)

Harbor	Country	Turnover (million tons)	Main Cargo types
Gothenburg / Brofjorden	Sweden	47.6	Bulk, general cargo, crude oil, oil products, containers and trailers
Ventspils	Latvia	35.7	Crude oil, oil products and bulk
Lübeck / Travemunde	Germany	21.9	Bulk general cargo, trailers and ferry cargo
Rostock	Germany	20.2	Bulk and general cargo
Gdansk/Gdynia	Poland	24.8	Bulk and general cargo
Porvoo	Finland	16.9	Oil and oil products
Swinoujscie / Szczecin	Poland	16.3	Bulk and general cargo
St. Petersburg	Russia	16.1	Bulk, general cargo, containers and trailers
Klaipeda	Lithuania	14.8	Bulk, oil products and general cargo
Tallinn	Estonia	14.1	Bulk, general Cargo and Trailers

In recent years there has been an increase in the annual turnover of cargo in the harbors located on the eastern coast of the Baltic Sea. Figure 5 shows the development in cargo turnover.

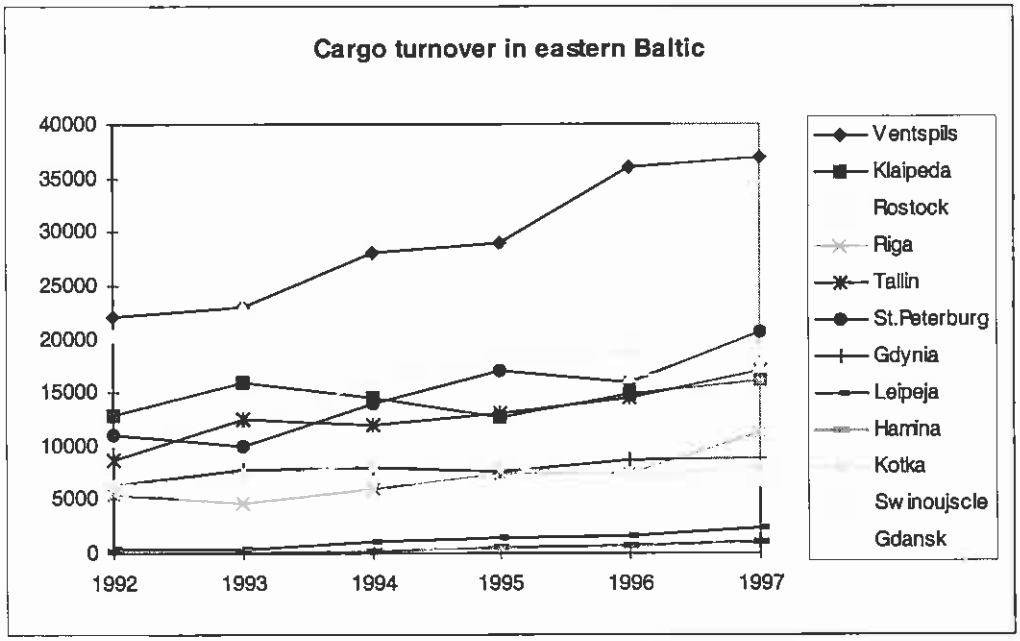


Figure 5. Annual cargo turnover in Eastern Baltic Ports in the period 1992 to 1997 (COWI, 1998).

2.3.5 Oil handling

The data received from the harbors show an annual turnover of oil and oil products in the Baltic Sea of approximately 160 million tons. Harbors handling more than 1 million tons of oil or oil products per year are listed in Table 6.

Table 6. The largest oil harbours in the Baltic Region (Annual 1998, HELCOM 1998)

Harbor	Million tons oil handled in 1997	Harbor	Million tons oil handled in 1997
Ventspils	27	Hamina	3.2
Brofjorden	21	Copenhagen	2.9
Gothenburg	17	St.Petersburg*	2.0
Porvoo	16	Nynäshamn	1.9
Fredericia	11	Aarhus	1.6
Kalundborg	8.1	Stockholm	1.4
Muuga*	7.2	Norrköping	1.3
Naantali	5.7	Malmo	1.2
Gdansk	5.2	Riga	1.1
Rostock	4.3	Tallinn*	1.0
Klaipeda	3.5	Gävle	1.0

*shaded figures have had the most significant changes since 1997 level

It can be seen here, that the table above do not reflect the current development stage of St. Petersburg and Tallinn. In 2000 the oil transportation figures both St. Petersburg and Tallinn were around 9 Mton and 20 Mton (Port of Muuga and other Tallinn ports), respectively. The new oil terminal Primorsk of the eastern part of the Gulf of Finland, will change the transportation figures of the Gulf of Finland. After the construction phase to be completed in December 2001, the first phase figure would be 12 million tons, soon expanded to 18 million tons. The largest crude oil terminals in the Baltic and in North Europe are listed in Appendices 27 and 28 respectively.

2.4 Corridor development

The bridge connection across the Great Belt was opened to the traffic in June 1998. This link has increased the vehicle traffic, and the traffic prognosis forecasts that this link will attract 10 – 20 % of the existing volume of private cars crossing Kattegat and the Baltic Sea. Discussions have also been carried out to construct a new railway tunnel between Helsingborg and Elisinore. The most important maritime traffic links of the Oresund area are:

- Fyn/Zealand-Scania-Latvia/Lithuania,
- Rödby – Puttgarten,

Bridges are also under design for the links both between Zealand in Copenhagen and the Hamburg in northern Germany and a link crossing the Fehmarn Belt between Denmark and Germany.

Southern Baltic Sea region offers direct links between Finland and Germany. The important services for Finnish export and import, but also transit traffic to Russia. Other links are:

- Lithuania/Latvia/Russia/Belarus – Germany,
- Oslo region – Gothenburg – Denmark (Scania) – Rostock/Saanitz – Southern Germany – Austria - Italy,
- Oslo – Travemunde/Rostock – Western Europe,
- Oslo – Poland/Swinoujscie/Gdynia/Warsaw – South-Eastern Europe,

From the middle part of Sweden links and corridors are well established to Scania, Rostock/Sassnitz via Italy and Austria or to Travemunde/Rostock via Western Europe or Poland.

The central Baltic Sea region covers the main links between Leningrad area – Southern Finland – Aland – Swedish part near Mälaren/Bergslagen and Gothenburg. The Mälaren area has also links to Belarus and Latvia, which is an old route with a certain potential for growth in the future. One interesting link is between Finnish and Russian inland waterways using river going-sea going fleet. The integration to the West and Central European inland river and canal network is one challenging task to be developed. The traffic flow through the Baltic countries linking Finland to the Baltic states and Kaliningrad and Poland is called the Via Baltica corridor. Finally, the main corridor in the Gulf of Bothnia is between the Northern part of Sweden, mainly Umeå/Sundsvall, and Vasa in Finland. Figure 6 represents the main links of the Baltic Sea area. Baltic railways network is presented in Appendix 24.

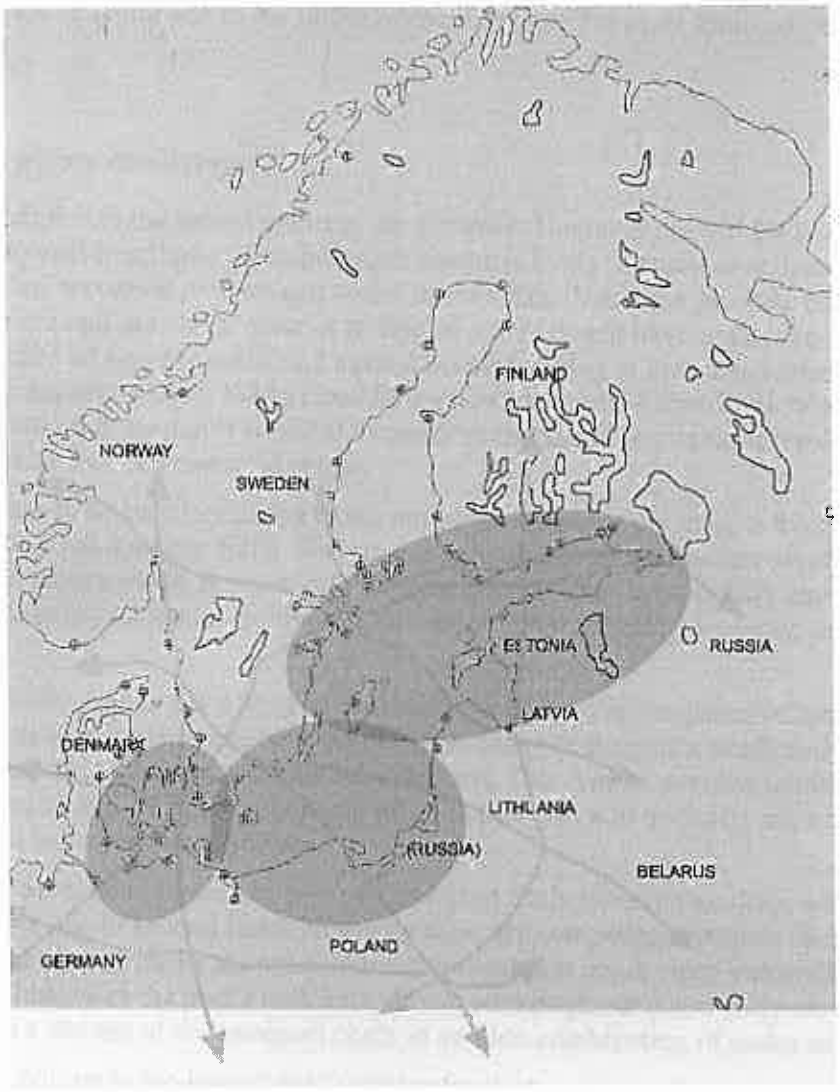


Figure 6. Main sea-borne corridors in the Baltic Sea region (Källström, L. & Ingo, S. 2000).

There has been a lot of EU funded Interreg II C Corridor development projects where more detailed description of the maritime links are presented. The Figure 7 shows a map based on these studies, thus giving a view over the corridor studies of the Interreg program.

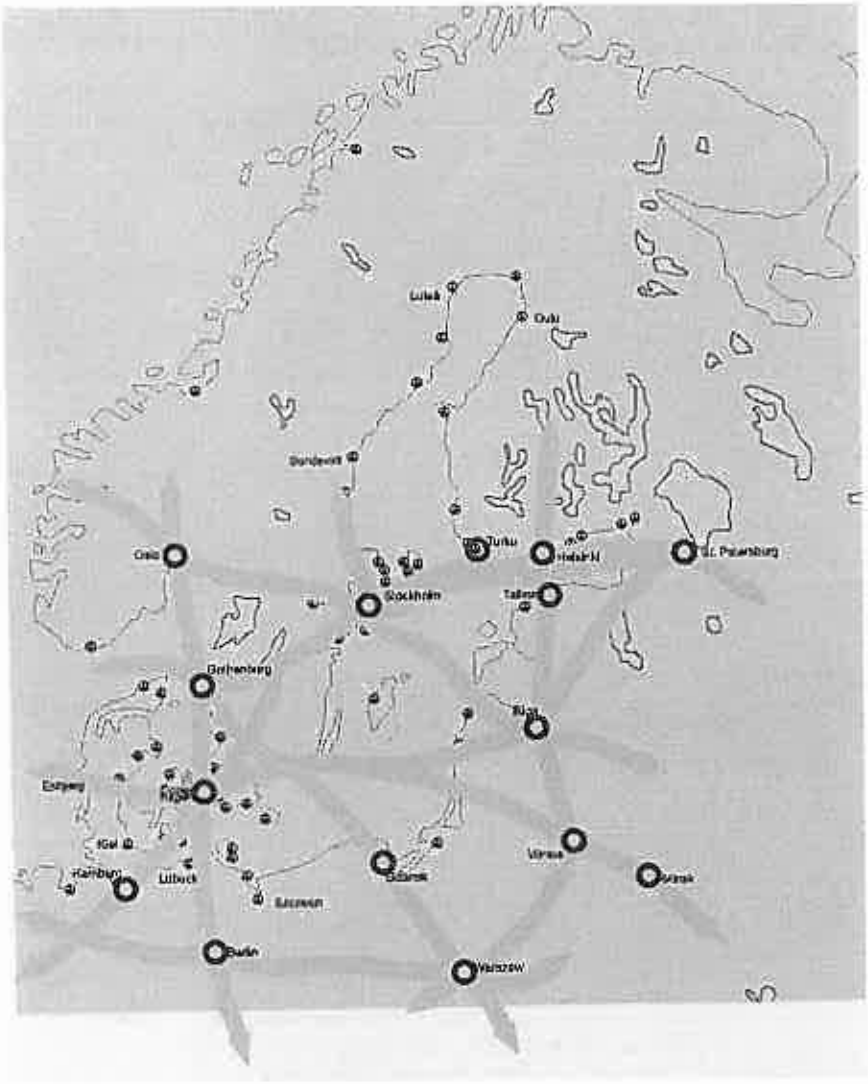


Figure 7. A map showing an overview of links studied in various Interreg II C projects (Källström, L. & Ingo, S. 2000).

2.5 Tanker fleet

The inquiry of the existing oil tankers was sent to the main oil terminals, and ports in the Baltic Sea. The calls concerning the data on the tankers for one month period was asked from St. Petersburg, Muuga, Sköldvik, Ventspils and Klaipeda. The following parameters were asked:
- main characteristics,
- hull (single hull or double hull),
- name of the ship,
- IMO number for further analyses,
- owner,
- destination (in & out),
- cargo (degree of loading).

Simultaneously the tanker data in the Baltic Sea was analyzed using the data of Lloyds for May 2000. The tanker data of the four weeks period in May 2001 was studied and the results are shown in Appendices 1-5.

2.5.1 Summary of the analyzed data

Table 7 below summarizes the defined tanker data and the average age of the tankers in the selected ports and terminals. When comparing with the data shown in Figure 8 (COWI, 1998) no essential development has been taken place since 1997.

Table 7. A comparison between the main oil terminals of the Baltic Sea.

Terminal	*August 2000*			*May/June 2001*			*Age (average) in years*
	DH	*DB*	*SH*	*DH*	*DB*	*SH*	
Muuga (Estonia)	39 %	22 %	39 %	48 %	17 %	35 %	> 15
St. Petersburg (Russia)				48 %	14 %	38 %	11
Sköldvik (Finland)				42 %	27 %	-	13
Klaipeda (Lithuania)	not analyzed			20 %	13 %	67 %	> 19
Ventspils (Latvia)	not analyzed			37 %	23 %	40 %	13.2

DH means double hull,
DB means double bottom,
SH means single hull.

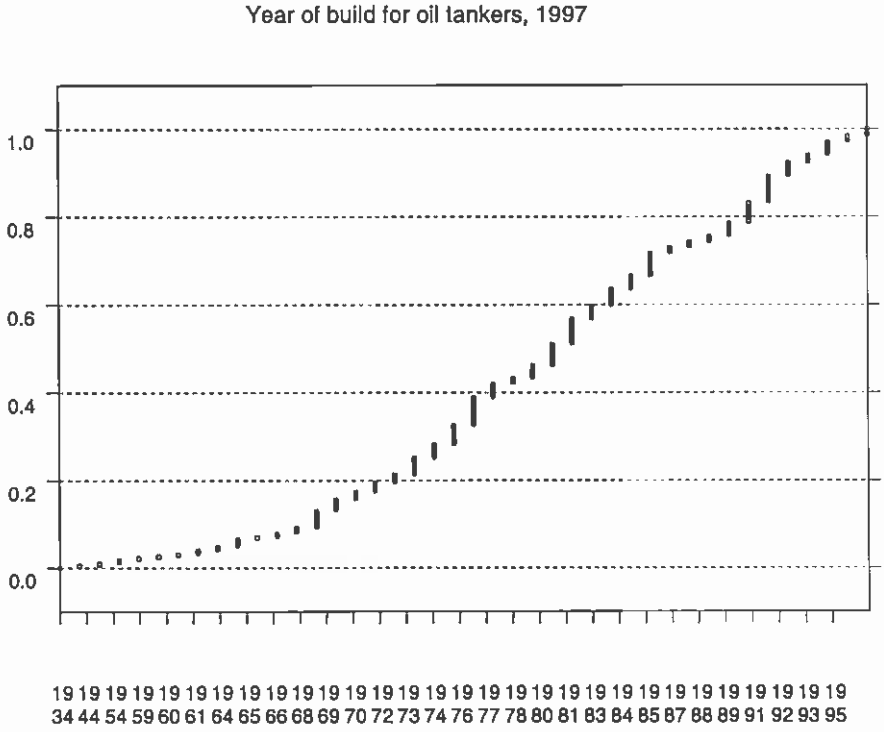


Figure 8. The distribution of tanker age according to (COWI; 1998).

3 Main Ports in the Baltic area

3.1 Finland

In Finland the annual growth rate of GDP is expected to be in the order of 2.5 %, which will ensure the maritime growth rate will follow this figure. In the 1990s domestic waterborne cargo traffic has been around 7 million tons annually, and no major changes to this volume are expected. The total projected maritime cargo transport would be over 100 million tons in 2010 and will be near 130 million tons in 2020. The main international traffic routes are the Baltic Sea Route, the Nordic Triangle, The Corridor No. 9A (Helsinki – St. Petersburg- Moscow) and the Via Baltica (Corridor No 1). The Baltic Sea Route is the basic sea route for Finnish industry, due to the fact almost all the transit traffic through Finland uses the sea route.

About 90 % of Finnish seaborne transport is inside the EU countries. Roughly 58 % of import have its origin inside the Baltic Sea area, and 40 % of export the destination ports are in the Baltic Sea area. Biggest commodity groups in export have been paper, paperboard, sawn wood, general cargo and mineral oil while in import mineral oils, general cargo, coal, coke, ore and concrete. The annual development rate of the seaborne trade in Finland has been about 3.3. % in the 1990-1999.

All Finnish ports are ice-bound in normal winter. Northern ports in the Gulf of Bothnia are ice-bound approximately six months and ports along the Gulf of Finland for about three months. There are around 50 ports having international trade, and 23 of them are kept open throughout the winter by icebreakers. The inland ports are closed for traffic usually from the middle of January up to middle of March.

Largest ports are Sköldvik, Helsinki, Kotka, Naantali, Rautaruukki, Rauma, Hamina, Pori, Turku and Kokkola. Sköldvik and Naantali are Fortum's oil terminals, thus important ports for the import of mineral oils. Helsinki is the largest container port, where the share between import and export are almost 50 – 50 %. Helsinki is a large multipurpose port with handling of the unitized cargo. Rautaruukki handles ores and metals, and mainly serves the Finnish Rautaruukki steel company. Kokkola handles ores, minerals (fertilizers) and chemicals. Rauma and Pori handle mostly export of forest products. Kotka and Hamina were earlier known as transito ports, but aro also handling a lot of forest products, minerals and chemicals. The oil transito has been declined due to the oil transito boom in Estonia. There are a lot of expectations for the growth of the Kotka-Hamina ports, not only due to the new Mussalo Harbour in Kotka.

3.1.1 Port of Helsinki

The Port of Helsinki is Finland's largest general cargo port and passenger harbor.It's market share is 39 % of Finland's imports and 18 % of exports. It is also Finland's largest container port, accounting for 54 % of incoming and 40 % of outgoing units. There was around 10 000 calls in 2000 and the total transport has been over 10 million tons annually during the recent years. There are four harbors, and the maximum draught of the approaching fairway is 11.0 m. Three of the four harbors (West Harbor/cargo terminals, North Harbor and Laajasalo Oil Terminal) will move to the new Vuosaari harbor in 2008. The entire South Harbor and the ferry terminals of West Harbor will remain in their current locations.

3.1.2 Sköldvik

Fortum's oil harbour Sköldvik locates around 50 km east of the Port of Helsinki, and is the largest port in Finland, in terms of cargo turnover. The volume of the port has annually varied between 12 to 15 million tonnes, but exceeded 16,2 million tonnes in the year 2001. This was due to the increased import of the crude oil mainly. Of the total throughput, 3,2 million tonnes were shipped in coastal traffic (Sjöström, P, 2002).

3.1.3 Port of Turku

The Port of Turku is like the Port of Helsinki a multipurpose port. Passenger traffic and unitized cargo are the main issues. RoRo-traffic represents around 90 % of the freight (15 500 TEU or 3.5...3.9 million tons annually). The amount of passengers is around 4.0 million annually. The port contains ferry-, RoRo, Container and passenger terminals. The Train Ferry harbor is also close to the city, in Pansio. Approaching fairways are 10.0 m draught to the passenger harbor, and 9.0 m to the train ferry harbor. A new fairway "the Örö fairway" is under design and EIA process.

3.1.4 Naantali

The capacity of the port of Naantali was utilized to its full extent in 2001. The total cargo volume reached close to 7 million tonnes, being 8 % larger than in the year 2000. Outgoing cargo went up by 15 % and incloming by 4 %. The entrance channel of the Naantali port will be deepened to the depth of 15, 3 m, thus the large tankers can enter the port in fully laden after the dredging works have been completed in 2004 – 2005.

3.1.5 Kotka and Hamina

The ports of Kotka and Hamina are located in the south-eastern coastline of Finland near the Russian border. Kotka and Hamina were during the Soviet time known both as transito ports and export ports for forest products. After the disintegration of the Soviet Union the transito has decreased temporarily, but is assumed to grow again based on the forecasts of the growth of container traffic and forest products. Kotka is concentrated on exporting Finnish forest products. The total traffic volume of the Port of Kotka LtD grew almost 15,7 % in 2001 compared to the year 2000. The total cargo throughput was near 8,1 million tonnes, whileas the container traffic exceeded 200 000 TEU. The main part of the port operations were shifted to the newest harbour, the Mussalo harbour: Its terminals accounted 55 % of the traffic volume in 2001. The new container terminal of Mussalo started in January 2001, having the annual capacity for 300 000 TEU in the first stage and later around 500 000 TEU. Almost all of the container traffic goes now through the Mussalo harbour (Sjöström, P, 2002). The approaching channels have draught of 10.0 m for the inner harbors and 15.3 m for the Mussalo Deepwater terminal.

Port of Hamina is located 25 km east of Kotka, and is representing around 5.5. million tons annually. It is concentrated on ferry- and RoRo traffic, container traffic, liquid bulk transport and LPG. The approaching channel has a minimum draught of 10.0 m. The plans to widen the container handling capacity are underway. The construction of a new rail ferry terminal and the new approaching fairway with the draught of 11.5 – 12 meters are also listed including to the ports investment plans until 2010.

3.1.6 Raahe

The municipal port of Raahe and the industrial port owned by Rautaruukki totalled 6,2 million tons in 2001. The increase compared to the year 2000 was 2,1 %. The deepening of the entrance channel to ten meters belong to the governments new fiarway masterplan, and is scheduled to the years 2005 – 2006.

3.1.7 Shipping statistics

The term shipping statistics is used for statistical returns on the transport of cargo and passengers by sea between Finland and foreign countries as well as statistics on vessels in international traffic calling at Finnish ports. The Finnish Maritime Administration has produced shipping statistics since 1918. The purpose of the statistics is to serve the makers of shipping policy as efficiently as possible by generating statistical information for their use in planning, monitoring, supervision and decision-making. Industry, trade, research and the shipping industry also need statistical data on shipping.

The shipping statistics cover all cargo that is loaded or unloaded in Finnish ports, including transit cargo en route to third countries (Table 8). Cargo loaded in vehicles and containers is reported also separately. Statistics on pure transit traffic are also given separately. The statistics on passenger traffic cover all passenger movements on passenger vessels and passenger/car ferries as well as passengers travelling on cargo vessels that regularly carry passengers. Passengers on cruise liners that call at Finnish ports are counted as both arriving in and departing from Finland. The tonnage of the vessels in the vessel traffic statistics is given in net figures as most navigation charges (including fairway charges, pilotage and harbor dues) are set according to the net tonnage. Finnish Maritime Administration collects data and maintains shipping statistics according to law on Finnish Maritime Administration 1248/1997.

Table 8. International cargo traffic through Finnish ports in 2001 [tons](Sjöström, 2002 and Finnish Maritime Administration).

Port	*Throughput 2001*		
	In	*Out*	*Total*
Hamina	1,072,334	3,150,737	4,223,071
Kotka	2,035,263	5,968,687	8,003,950
Loviisa	407,301	727,751	1,135,053
Isnäs	908		908
Tolkkinen	134,730	116,024	250,754
Sköldvik	8,460,379	4,569,184	13,029,563
Helsinki	5,583,200	5,036,098	10,619,298
Kantvik	479,179	28,538	507,717
Inkoo	1,252,193	321,141	1,573,334
Pohjankuru	132,321		132,321
Lappohja	3,733	496,146	499,879
Koverhar	977,713	125,864	1,103,577
Hanko	803,276	1,383,032	2,186,308
Turku	2,005,967	1,681,853	3,687,820

Taalintehdas	827	273,561	274,388
Kemiö	42,895	13,206	56,101
Parainen	602,563	57,867	660,430
Naantali	4,278,748	1,397,706	5,676,454
Marienhamn	72,399	46,948	19,347
Färjsund	20,686	89,494	110,180
Uusikaupunki	496,335	713,449	1,209,84
Rauma	1,359,260	3,943,767	5,303,027
Eurajoki	84,221	94,533	178,754
Pori	3,135,990	1,571,407	4,707,397
Merikarvia	4,800		4,800
Krisiinankaupunki	531,500	11,960	543,460
Kaskine	455,272	649,938	1,105,210
Vaasa	1,011,606	254,693	1,266,299
Pietarsaari	408,273	619,243	1,027,516
Kokkola	1,197,477	1,749,873	2,947,350
Rahja	40,996	283,389	324,385
Rautaruukki	4,499,520	754,056	5,253,576
Raahe	7,484	175,382	182,866
Oulu	810,530	743,488	1,554,018
Kemi	946,324	1,254,420	2,220,744
Tornio	310,816	270,103	580,919
Other seaports	230,477	38,409	268,856
Lappeenranta	498,666	154,974	653,640
Joutseno	126,622	100,040	226,662
Imatra	58,542	235,326	293,868
Savonlinna	19,638	1,418	21,056
Varkaus	194,876	149,743	344,619
Kuopio	20,685	46,018	66,703
Kitee	10,925	69,342	80,267
Joensuu	20,703	259,483	280,186
Other lake Saimaa	55,518	9,491	65,009
Grand total	**44,903,642**	**39,637,782**	**84,541,424**

Whenever a Finnish or foreign vessel engaged in international shipping arrives at or leaves a Finnish port, its captain or, as is more often the case, its agent is obliged to supply the Finnish Maritime Administration with information on the vessel and its cargo according to the ports where it was loaded or unloaded . The information is given as an EDI-message or on an arrival/departure notification form. These data are supplemented by reports sent in by the port authorities. Currently the data is collected within the framework of the nation-wide Portnet system.

In all 84, 5 million tonnes of cargo were carried by ships between Finland and other countries in 2001. This was 3,9 million tnonnes more than in year 2000. The export through Finnish Ports was 39, 6 million tonnes. If the transito traffic will be excluded, the export rate was around 35,6 million tonnes, thus showing small decrease compared to the year 2000. The Import mode totaled 44,9 million tons including transit. The total amount of the transito traffic totaled 5,7 million tonnes in 2001, which was the highest annual figure in Finland so far. The increase was more than 2,3 million tonnes compared to the year 2000.

3.2 Russia

3.2.1 General

The total throughput of the Russian ports was 120 million tons in 1998. The share of the Russia's main Baltic ports, St. Petersburg and Kaliningrad, was about 22 %, whereas the ports in the Black Sea represented more than 50 %, Far Eastern ports 18 % and the rest were due to the Far Northern ports, around 8 % of the cargo. Taking into account the large figures of the Russian transito handled by the Baltic States, it is evident, that in spite of the apparent larger volume through the Black Sea, the Baltic Sea has a great importance for the Russian trade and transport.

Russia will increase the oil production to approximately 340 million tons in 2001 (Figure 9). In 2000 the oil production rate of Russia was 312.7 million tons, 5.9 % more than in 1999 (Interfax, 26.09.2001).

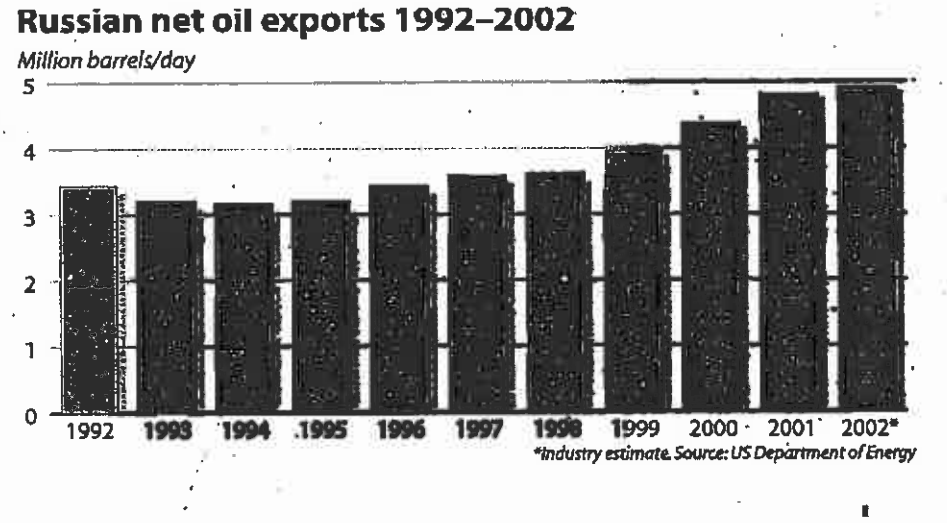


Figure 9. The development of the Russian net oil export in 1992 - 2002 (Arentz, 2002a).

3.2.2 St. Petersburg Sea Port

The Port of St. Petersburg is divided into four areas:
- Gutuevsky Kovsh along the Neva River,
- Sea Channel & Barochny Basin,
- Lesnoy Mole and
- Coal Harbor.

Dry bulk and general cargo are handled in the Gutuevsky Kovsh Harbor, while cellulose, paper and fertilizers are handled in the Harbor along the Sea Channel. Lesnoy Mole is the main container terminal, which also handles general cargo, coal and metals. Coal harbor is also handling a significant amount of oil products. In 2000 the figures of oil transportation of St. Petersburg Sea Port exceeded 8 million tons (Figure 10). The total port throughput in 1999 was 28 million tons, 31 % more compared to the year 1998 (Table 9).

Table 9. Cargo Traffic in St. Petersburg in 1999 (St. Petersburg Port Authority, 2000).

Oil products	7,354 Million tons,	27 %
Metals	6,520 Million tons,	23 %
Timber	1,930 Million tons,	7 %
Container	2,835 Million tons,	10 %
Reefer	1,214 Million tons,	4 %
Bulk cargo	3,233 Million tons,	11 %
Chemicals	3,757 Million tons,	13 %
Others	1,331 Million tons.	5 %
TOTAL	28,174 Million tons.	100 %

The draught of the approaching fairway is 11.0 m. There are plans to widen and deepen the fairway. Other major investments will be the new container terminal on berth 101 of the Coal Harbor, handling complex for universal and food goods, reefer terminal and modernization of container terminal of the Area 3, fertilizer terminal reconstruction and reconstruction of roads of the port area.

A new fertilizer terminal has been constructed in St. Petersburg Sea Port. The Baltic Bulker Terminal has a projected capacity of 5 - 7 million tons per year. The storage capacity for potassium warehouse is 150 000 tons, and the nitrogen-phosphate warehouse is 120 000 tons.

The new export pipeline to the Primorsk port will be constructed in 2004 - 2005 together with the new oil product export terminal. (Reuters, 3.6.2002). The new 1 200 km long pipeline have a capacity of 10 million tons of oil gas per year. Russia exported 60,82 million tons of oil products (excluding crude oil) in 2000. In 2001, however, the total oil product export figure was 70,43 million tons.

There are also proposals to start produce oil off the Kaliningrad. The Russian oil company Lukoil has published a plan to open a new oil field having the estimated crude oil capacity of 21, 5 million tons. The annual production rate would be 600 000 tons per year during the first 10 - 12 years.

Lukoil has also started design phase of a new oil terminal of Vysotsk harbor. The new terminal under design will have the capacity of 10 million tons in the first phase with the design tanker of 70 000 dwt. The fairway leading to the port, however, is narrow and shallow, thus the fairway maintenance works would require a lot of work to reach the required safety aspects for the safe tanker traffic. Moreover the sea area off the harbor is affected by the ice ridges during the winter time, which will cause additional harm for the traffic management. The new oil terminal would be opened for the traffic in the late 2003.

Primorsk oil terminal accepts vessels meeting following requirements: draft max 15.0 m, LOA max 307 m and beam max 50 m. All the ships must have double hull and segregated ballast water tanks. In certain cases double-bottom tankers are allowed to enter with obligatory tug assistance from Rodsher Island to the port. Furthermore there are a set of other rules concerning the winter navigation, pilotage and routing.

The main port of Eastern GoF is St.Petersburg Sea Port (
Figure 11). In 2000 there were 9771 ships calling out St. Petersburg Sea Port. The port handled 32.1 million tons of cargo in 2000, which was 14 % more than in 1999, and 49 % more compared to 1998. The port handled more than 8 million tons of oil products. River Neva connects the inland water system with sea. 40 % of vessel passes observed on St.Petersburg approach channel are the

sea-river ships which are bound for West Europe ports. This quantity includes approximately 750 of sea going inland tankers. The annual volume of ship movements is approximately 12 000. 233 cruise vessels visited St. Petersburg in 2000. Main stevedoring companies in St.Petersburg are presented in Table 10 below.

Table 10. Main Stevedoring Companies in St. Petersburg Sea Port (St. Petersburg Port Authority, 2000).

Name	*Note*
Holding JSC "Sea Port of Saint Petersburg"	largest company, more than 20 million tons annually.
Close JCS "First Stevedoring Company" FirSteCo	berths 14-41, metals, fertilizers, paper, containers, bulk & reefer
Close JSC "Second Stevedoring Company"	berths 1313 m, draft 9.8 m and 11.0 m, 23 cranes
Close JSC "First Container Terminal"	handles 33 % of the containers arriving Russia via Baltic Ports. Berths 84-87
Close JSC "Fourth Stevedoring Company "FStC	Deep water berths 102&103 at Coal Harbor. bulk cargoes, coal, scrap metal, potash, fertilizers..
Close JSC "Stevedoring Timber Company"	Berths 67,69 and 70 on Timber Harbor. handling capacity 2 300 m3 per day of round timber.
CJC "Neva Metal"	berths 71-73 on Timber harbor. Ferrous metals.
Private Stevedoring Company "Barbaletta"	since 1993, two deep water berths, sea cargo & refrigerated goods
Open JSC "Baltic Ship Mechanical Plant"	construction and repair of vessels
Stevedoring Company "Nevsky Gates"	Berths 16 and 17, general cargoes, food, containers
Petrolesport (Timber Port)	over 100 hectares, sawngoods, sheet goods, paper, cellulose, containers, reefer cargoes, scrap metals, chemicals
CPSU Plant with VIKAN ltd.	380 m berth, draught 7.5 m. foods, non-foods
JSC St. Petersburg Oil Terminal	95 000 m3 storage capacity. pipeline connections to "Kirishinefteorsyntez"

Nowadays the port has 53 berths, with the total length of 8393 m, and can accommodate vessels not exceeding the following dimensions: 260 m length, 40 m width, 11 m draught in fresh water. The port operates 24 hours a day the year round. In winter, when the Gulf of Finland is covered with ice, pilotage is effected by icebreakers. The port of St.Petersburg is managed by the Maritime Port Administration (MPA), a state body attached directly to the Maritime Administration of the Russian Ministry of Transport. There are 28 stevedoring companies licensed to handle the cargo in St. Petersburg.

The approaches to the port of St.Petersburg stretch for the Eastern part of the Gulf of Finland. The Gulf is limited with islands and shallows at close distances to ship routes. Essential features of the Gulf are the stormy winds, fog and precipitation in autumn, the snowfall and ice in winter. Environmental vulnerability of the region is strengthened with the presence of the Nuclear Electric Power Station (NEPS) in Sosnovyi Bor town (100 km from St.Petersburg) which is situated in the vicinity of the main fairway.

Figure 10. The oil terminal of St. Petersburg sea port.

Figure 11. Plan of the St. Petersburg sea port (Port Authority).

Main development plans of the near future are:
- dredging works of the approaching fairway,
- reconstruction of berths No. 28 - 29 for metal and fertilizers, throughput 1.4 million tons annually,
- reconstruction of berth No. 70 for metal handling,
- fertilizer terminal, berth No. 107, 2 million tons annually,
- oil terminal construction with throughput of 9.6 million tons annually,
- container terminal, berth 101 with throughput of 150 000 TEU,
- berths 42/43 of perishable cargo with the annual throughput of 430 000 tons and
- development of safety system for navigation, VTS.

The cargo operations in St. Petersburg sea port are going year round. During the open water season, (May – November) river-sea going tankers of 4 300 - 5 500 dwt can transport oil along the Neva river. These tanker will be unloaded to the 30 000 - 50 000 dwt tankers. In 1999 the number of sea-river tankers was 818 of which sea tankers corresponded 150. For the year 2000 the amount of 4 million tons of mazute oil was planned to export. The total amount of oil products in 2000 exceeded 8.1 million tons in St. Petersburg, and the throughput of the oil terminal only (Emelkina, 2000) .

3.2.3 Kaliningrad

The Port of Kaliningrad (formerly Königsberg) was opened for the international vessel traffic in the beginning of 1990s. The port areas are connected to the Baltic Sea by a 42 km long channel. Kaliningrad's annual throughput, around 5 million tons, consist of break bulk (49%), general cargo (35 %), timber (18 %) and grain (7 %). Containerization has in rapid growth, and exceeded already 10 000 TEU in 1998.The total capacity of the Port is varying according to different sources between 14 – 18 million tons, thus there is a lot of reserve for the growth. Optimistic scenarios have made forecast up to 10 – 12 million throughput in the near future. Maximum draught to the port is 8.0 m.

The location of Kaliningrad, some 400 kilometers from Russia and near the Port of Klaipeda of Lithuania has been a complex issue in politics. The Kaliningrad needs a land route to Russia, which goes via Belarus and Lithuania.

3.2.4 Other Russian ports in the Gulf of Finland area

The Ports of Vyborg (Appendix 20) and Vysotsk (Appendix 21) are situated around 60 km to the east from the Finnish border. Both ports are export oriented; Vysotsk with coal and iron pellets, Vyborg with scrap metal, paper and timber. Altogether these ports equals around 2.5 – 3.0 million tons annually. New plans to build up new chemical terminals and deepening the approaching fairways, the throughput will be increased by one million ton each.

Primorsk oil terminal (Appendix 18) was opened to the traffic in late December in 2001. The first construction phase consisted of a berth for two 150 000 dwt tankers and 500 000 storage capacity. The second phase was started officially in 2.11.2001 to increase the first phase capacity 12 million tons annually to 18 million tons. The Russian plan is to widen the terminal area up to 2010 so, that the oil export will be 45 million tons annually. According to the Russian future plans the terminal area will also consist of terminals for trans-shipment of bulk, general cargo with the designed capacity of 5.3 million tons.

The second stage of the Baltic Pipeline system (BPS) will increase the capacity up to 18 – 19 million tons annually. The new 720 mm diameter oil pipeline is 245 km including three pumping stations. The pipeline will be modernized in Yaroslavl – Kirishi. The tank capasity is 400 000 m^3 (Interfax, 26.9.2001) in Primorsk. After completion of all the project phases the annual output of the Primorsk oil terminal is expected to be 36 million tons annually (Ria Oreanda, 16.10.2001).

The Primorsk oil terminal will later to be extended by other terminals. Russian ZAO (severnij gazopererabativajushij zavod) has published general plan to build up a gas terminal to the southern bank of the Jermilov Bay, around 2 km south from the Primorsk oil terminal. The new gas pipeline would be led to the terminal, and its first phase will cover one million tons of gas annually. The plan includes also an ammonia terminal of one million tons capacity in the first phase (Delavoi Petersburg 12.9.2000).

After the Primorsk Oil terminal has been constructed discussions have started in Russia to build up the second oil terminal to Batareinya bay (Appendix 23). This proposal has been presented already ten years ago, with the planned capacity in the first phase 7.5 million tons and after completed 15 million tons annually. The first phase of oil export would be taken care by rails, and later by pipeline.

The Ust-Luga Coal Port has been under construction for few years already and a part of the planned activities have been started. The design throughput is 35 million tons of cargo per year, mainly consisting of coal export but also chemicals, sugar, timber and grain and container handling. New harbors will be built in Lomonosov and in Luzhskaja Guba. The draft lay-outs of these ports are shown in Appendices 19 and 22 respectively.

3.3 Estonia

The development of maritime transport in Estonia has been rapid. For example from 1995 to 1999 the increase of the annual transport rate was doubled. More than 90 % of the transit via Estonia and a major part of the cargo imported to or exported from Estonia goes through the Estonian seaports, and most of this cargo is handled in ports of the Port of Tallinn ltd. In 1999 more than 32 million tons of cargo was handled in Estonia. The international corridors affecting of the development of the Estonian maritime transport are the Crete Corridor No.1 of the Pan-European Network with its East-West branches 1A and 1B running through Estonia.

There are certain national objectives defined in the Transport Development Plan for 1999 - 2006. The increase of the Gross Domestic Product is one of the main item, which will raise the competitiveness of the economy (Moppel, 2000). The export of transport services plays here an important role.

In Estonia the most intense traffic is concerted in the Tallinn region. The total number of vessel movements in the Tallinn bay is around 60 per day. Majority of the vessels are small ones < 500 GRT and medium size vessels 500<GRT< 10 000.Other significant groups are fast ferries and passenger ferries. Old City port handles about 65 % of all traffic in numbers of ships.

In Paldiski there are no plans to unite any ports, which has been the development trend for example in Bekker harbor in Tallinn. The rapidly developing Paldiski South harbor falls under the Port of Tallinn. In 2001 the Oil Company Alexela opened oil terminal there, and this year a ro-ro terminal will be completed (Vitismann, A. 2002a).

The northern part of Paldiski needs a lot of investments. There has been speculations this part of the port to be concentrated on the export of fertilizers and shale oil and timber. In Tallinn, the timber stacks in ports are the smallest. The Vene-Balti port mainly serves the needs of fuel transit. In the Loksa harbor, timber is also just a side activity, as they mostly tend to the needs of the Loksa shipyard, as can be seen from the Table 11.

Table 11. Cargo turnover at Estonian port in 2001 (Vitismann, A. 2002a).

Port	*Ships*	*Cargo*	*Passengers*
Pärnu sadam	733	1 179 380	
Pärnu shipyard	319	715 000	
Roomassaare	185	109 625	
Virtsu	62	183 855	
Lehtma	70	139 860	
Heltermaa	5	11 190	
Rohuküla	5	3 709	
Paldiski South harbour	1 035	1 460 000	111 915
Paldiski Northern harbour	71	83 452	
Bekkeri	240	395 662	
Vene-Balti	401	2 851 000	
Paljassaare	46	1 960 000	
Tallinn City Port			156 000
Old City Port	6 507	3 500 000	5 621 716
Miiduranna	285	1 748 400	
Muuga	2 180	25 400 000	5 896
Loksa	134	54 500	
Kunda	658	1 709 100	

Despite the fact that large operators are located in Muuga, oil is also loaded in Tallinn's Vene-Balti, Paljassaare, Miiduranna and Paldiski South Harbour. Miiduranna port handled more than 1,6 million tons of oil in 2000 which was nearly 70 % of the total cargo turnover of the port. The Port of Aseri, close to the the Russian border will be build for transit of oil, too. A port handling oil, chemicals and containers with a projected total business of 10 million tons is planned to be built in Sillamäe (Vitismann, M. 2002a). A new passenger port is also under design at the Narva Jõesuu close to the Russian Border, too.

The calls in Kopli Bay are approximately 20 per day. Vene-Balti takes 45 % of the traffic (bigger vessels), Meeruse Port about 43 % (small vessels) and Bekkeri port the rest 12 %, mainly smaller vessels.

3.3.1 The development of the Port of Tallinn

The Port of Tallinn is one of Estonia's largest enterprises. It accounts for 78 % of the total volume of business in Estonia. However, the state-owned public limited company, Port of Tallinn, owns just two of the four ports in Tallinn – the Paljassaare Harbour and the Old City Harbour. Together with the associating partner companies it contributes around a fifth of the national gross product and plays a significant role in securing economic development of the entire country.

The Port of Tallinn consists of four harbors. The largest harbors are the Old City harbor dedicated for the passenger liners, and the Port of Muuga, a large oil and fertilizer harbor. Muuga harbor includes six oil terminals, dry bulk and general cargo terminals, a Ro/Ro and container terminal, reefer terminal and storage areas for vehicles and timber.

The Old City Harbor is the main passenger terminal, but also provides RoRo and LoLo services, and has a container and general cargo terminals. The Old City harbor has 23 berths, four passenger terminals, general cargo and container terminal (Appendix 8). The area is of 56.6 ha. The harbor water basin area is 35.9 ha. The passenger rate was near 6 million passenger in 2000, Moreover, there is a special fast catamaran link between Helsinki and Tallinn. Last summer there were more than 30 calls of passenger vessels each day from the Port of Helsinki to Tallinn. Half of these vessels are high-speed craft having a maximum speed up to 35..40 knots. The fastest one has a top speed of 55 knots.

Muuga Harbor (Appendix 9) handles liquid and dry bulk, general and reefer cargo, and has a new RoRo terminal with container handling capacity. It also has storage areas for vehicles and timber. Paljassaare harbor has terminals for liquid and dry bulk and general cargo, including reefer complex.

Smaller harbors are Paljassaare Harbor and Paldiski South Harbor. The Paldiski South harbor lies westwards of the Old City area, as shown in Figure 12. Paldiski harbor has an area of 55.2 ha. It is a former Soviet naval base, which was incorporated into the port complex of the Port of Tallinn in 1993. Today Paldiski harbor handles mainly metal, fertilizers, peat and RoRo cargo. It has a regular liner connection to Sweden. It has 5 berths and a potential to increase the cargo turnover to 3 million tons per year. Its warehouse area is 1 200 m^2 and the open storage area 41 000 m^2.

Paljassaare harbor, located on Paljassaare peninsula was originally built for the Estonian fishing fleet. Today it is a cargo port specialized in handling mixed cargo, coal and oil products, as well timber and perishables. the storage capacity of the port contains warehouse area 18 400 m^2, open storage area 79 000 m^2, oil tank capacity 33 250 m^3 and reefer warehouse area 8 300 m^2.

Inside the Tallinn Bay there are a large groups of ports with different business fields: Vanasadam, Piritasadam, Aegna, Patareisadam for passenger traffic, Miiduranna, Merivälja kai, Lennusadam, Peetri sadam, Paljassaare for merchant, Miinisadam for Navy and Hundipea for ENMB hydrography.

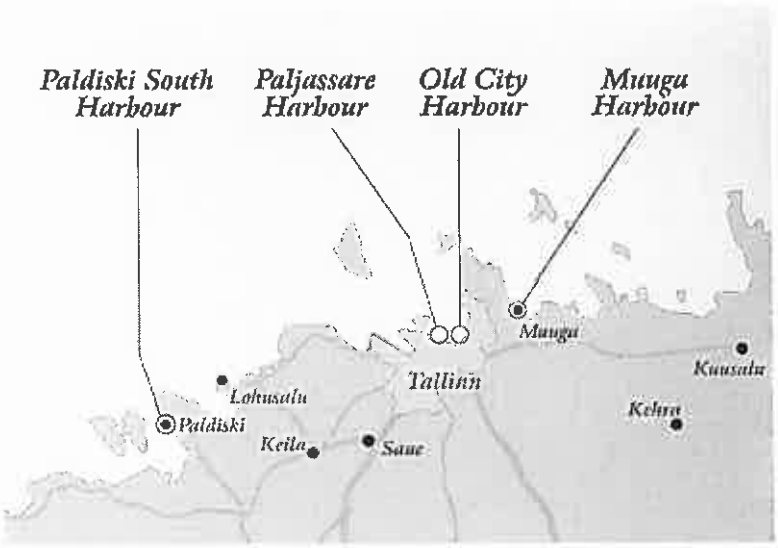


Figure 12. The location of the Tallinn main harbors (Port Authority).

The fourth port in the Tallinn port area is the Vene-Balti. The principal dimensions of these four ports are presented in Table 12 below.

Table 12. The main ports and the maximal ship dimensions in Tallinn.

Port	*length [m]*	*max beam [m]*	*max draft [m]*
Muuga	280	40	16.8
Paljassaare	190	30	9.0
Tallinn Bay	240	40	10.7
Vene-Balti	170	20	8.2

The total transportation rate in 1999 was around 34 million tons. The amount of oil exported was around 20 million tons. The Muuga harbor represented alone near 13 millions tons of oil (export) and 400 000 tons of oil import. Other ports, i.e. Miiduranta, Paljassaari and Kopli equaled around 5 million tons. New oil terminals are under the planning phase in Sillamae, Aser and Kunda. The oil tanker size in Muuga harbor has increased from the average 19 000 tons in 1998 to 23 300 tons in 1999 and was already over 40 000 dwt in May, 2000.

The Muuga harbor handles 70 % of the total cargo through the Port of Tallinn, and more than 90 % of the transito traffic. In 2000, 20,4 million tons of cargo was handled in Muuga of which 15.9 million tons was oil products. In 2001, the amount of oil products was already 18,6 million tons (Ympäristöministeriö, 2002).

There are six oil terminals in the Muuga port and new terminal with the annual 4 million tons increment is under design. Furthermore, Muuga port includes dry bulk and general cargo terminals, a RoRo (Figure 13) and container terminal, reefer terminal, grain terminal and storage areas for vehicles and timber. The territory of Muuga harbor is 367,3 ha with the water basin of 752 ha. The size of the oil terminal is 40 ha. In 2000 the cargo handled in Muuga was 20,4 million tons of which petroleum and oil products consisted of 15.9 million tons.

The largest oil terminal in Muuga is Pakterminal, which handled around 8.5 million tons of oil products in 2000. Other oil terminals are Oiltanking in Muuga which handles light products, E.O.S in Muuga and ScanTrans in Paljassaare (heavy fuel), Eurodek in Muuga and its subsidiary Dekoil in the Vene-Balti handling both crude oil and heavy fuel oil, Milstrand in the Miiduranda port with diesel oil and Neste and Nybit which are only importing fuels (Arentz, 2002a).

Figure 13. New pier for the RoRo terminal of the Port of Muuga under construction, summer 2000.

The total number of movements in Muuga bay are near 30 per day. A large number of vessels are > 10 000 GRT cargo vessels and tankers.

Estonia and Russia are also exporting paper-wood to the Swedish paper industry which is mainly located along the coastline. The annual transport rate is close to the 5 million tons by small coastal ships and barges.

In 2000, the Tallinn port handled 29.4 million tons of cargo, from which transit (21.9 million tons) constituted the main part. Compared to 1999, the throughput has increased by 10.8%. By the increase of total cargo throughput the Port of Tallinn holds one of the leading positions in the Baltic Sea region. This serves as a confirmation of the favorable geographical location of the port in relation to the Russian raw materials market and of the competitiveness of our service as compared to the other ports of the region.

Liquid bulk presented 60.7% of the cargo volume passing through the Port of Tallinn in 2000. Compared to the previous year, the handling of liquid cargo has increased by 22.8% - by 3.3 million tons. The share of break bulk was 27.3% and dry bulk 11.6%. The volume of containerized cargo reached 76 692 TEU, which is 17% more than in 1999. In 2000, noticeable increase was observed in the export of peat (51.6%) and transit of coal (69.5%). By cargo direction transit constituted 74.8 %, export 14.9% and import 10%. Compared to 1999, the volume of transit cargo increased 8.4%, export 28.4% and import 10.9% (http://www.ts.ee/cargo_traffic.htm).

The Port of Tallinn handled 32,32 million tons in 2001 which was more than 10 % larger than in 2000. The number of containers handled in 2001 was 78 000 TEU. Most of the cargo turnover was taken care of the Muuga Harbor.

According to the pessimistic forecast of the Port of Tallinn the total cargo turnover will reach 38 million by 2010, while the optimistic forecast predicts over 70 million tonnes. The amount of passengers will stay in the current level of near 6.5 million or drop slightly (Figure 14).

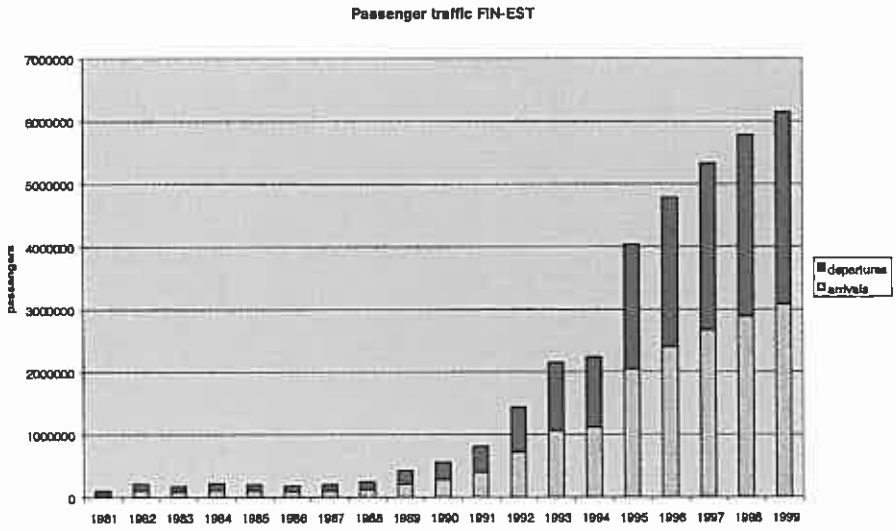


Figure 14. The development of passenger traffic between Finland and Estonia.

3.4 Latvia

3.4.1 General

The main transit flows through Latvia are in the east-west direction. The three main sea ports are Ventspils, Liepaja and Riga. These have a good railway connections to Estonia (Tartu), Russia (Pskov, St. Petersburg, Moscow), Belarus (Vicebck) and Lithuania (Siauliai, Panevezys, Vilnus). They also have special economic conditions of free ports and free economic zones, which have encouraged the investors to develop port infrastructures. More than 80 % of the cargo is going in the east-west direction. In the North-South direction the traffic is mainly going through the Crete Corridor No 1, i.e. Corridor Via Baltica. Transport and communications sector is one of the priority sectors of the Latvia's government. In 1997 it accounted for 16.8 % of GDP, and 35 % of direct international investment. The National Program on Transport Development for the period 1996 – 2010 is based on the sustainable development, but in the short term development the main emphasis is put on the modernization of the domestic transport infrastructure.

Due to the fact Russia is building up new oil terminals (Primorsk, Batareinyaya) and reconstructing existing ports, the role of the Baltic ports as main transito links may be endangered: part of the current transito may be handled in the Russian own ports and terminals in the future. However, the special economic conditions, modern facilities and advantageous climate for investments may keep the business running ahead. The Port of Ventspils do not see Russian new oil terminals in the Gulf of Finland as a threat to the oil transito business. The growing oil production rates in Russia, especially in the Caspian area, keep the port authority confident in the future. Furthermore, Ventspils has lowered the transito fees in order to maintain the competitiveness (Finnish Embassy, 2002).

Ventspils port is trying to maintain its position as one of the leading ports in the Baltic Sea and is investing to the new container terminal having the capacity of 250 000 TEU annually. Also the oil transito will be supported by expanding the oil throughput capacity by a new company JSC "Western Pipeline System".

The Latvian Marine Administration has considered the problem of increased tanker traffic which would result from the Primorsk terminal and have identified the following environmental concerns:

- an increase in legal discharges of operational wastes from tankers and the probability of failure of on-board pollution prevention equipment;
- the probability of an increased incidence of illegal discharges of oily sludge and oil cargo residues, including supposedly segregated ballast water contaminated with oil cargo due to leakage;
- the potential hazards of polyaromatic hydrocarbons and emissions of volatile organic compounds;
- threats from the transportation of heavy fuel oil and persistent oils.

Owing to the prevailing wind direction (north and north-west), Latvia's coast and related interests are particularly susceptible to any incidents occurring off its coastline.

There are also proposals in Latvia to have a new oil terminal in Riga to be in operation in 2003. This proposal made of the Latvian Dinaz oil company has a design capacity of 10 million tons of refined oil annually. The development of the Port of Riga is very closely dependent on Russia. The cargo turnover of the Freeport Riga was 13, 5 million tonnes in 2000, but rose over 14,8 million tons in 2001 as can be seen from Table 13. The total throughput of the Latvian ports was more than 56 million tonnes in 2001. It is expected, that especially the passenger figures of the Port of Riga will be increased in the future. In 2002 new lines were started to Nynäshamn and Helsinki, and new lines are planned to Saaremaa and Germany.

Table 13. Cargo turnover at Latvian ports in 2001 (Vitismann,M. 2002b).

Port	*Ship Calls*	*Cargo [ton]*	*Passengers*
Liepaja	1 326	3 260 400	12 356
Pavilosta		2 700	
Ventspils	1 602	37 936 700	8 370
Roja		7 800	
Mersrags	99	229 500	
Engure		1 800	
Lielupe		3 900	
Riga	3 874	14 883 400	50 164
Skulte	167	413 400	
Salacgriva	114	174 400	
TOTAL		56 914 500	

3.4.2 Ventspils

The ice-free port of Ventspils is the leading export port on the Baltic Sea. The transit cargo turnover of the port was 34,1 million tons in 1999 which ranks Ventspils Free Port among the 15 leading European ports. In 2001 the cargo turnovers was 37 million tons.The traffic capacity of the port is more than 80 million tons. 15 % of the total volume of oil and oil products exported from Russia are transshipped through the port of Ventspils. Twenty per cent of world potash, 10 per cent of the ammonia and 14 per cent of Russian oil exports have gone through the Ventspils port annually. Oil forms around 80 % of the total throughput of the cargo, which is the reason for Ventspils Nafta being the largest port operator (Vitismann, M. 2002b).

The cargo turnover of the Port of Ventspils has already reached 35 million tonnes annually during the last six years. Pulp wood has decreased by a fifth in one year in 2001, wood ships, however, have tripled. The total capacity of the Ventspils port might be even 60 million tonnes annually, but due to the Russian new terminal developments this figure is a very unlikely to be reached.

Over two thirds of Latvia's cargo is going through Ventspils. The "Law of Ventspils Free Port" was established in 1997, which have given the exemptions for certain companies of customs duty, tax and VAT. Ventspils is mainly the transito port for oil products. In 1998 more than 72 % of the total throughput of 36.5 million tons was oil. Other main products are bulk cargoes (14.4 %), general cargoes (9.5 %) and liquid cargoes (3.5 %).

Ventspils takes part of 15 % of Russian Crude oil and can take large tanker up to 120 000 dwt to the port. There are 60 berths in the port, and the maximum draught of the ship is 15.0 m (Appendix 11). In 1998 almost 2 000 calls per year.

Enormous changes have taken place in the port during the last years. After the completion of the reconstruction and modernization works, the services and equipment of the port correspond to modern technical, safety and environmental protection standards. After the completion of the dredging works in the sea entrance channel and the port area, the largest vessels capable of entering the Baltic Sea can be accepted by the port. The Ventspils Free Port development program plans to increase the port capacity up to 70-80 million tons per annum by the year 2010.

The crude oil and oil product transshipment terminals form the largest terminal complex on the Baltic Sea. There are six berths for the transshipment of crude oil and oil products with maximum capacity of 65 million tons per annum. The maximum permissible vessel draft at the oil product berths is 15 m. The transshipment takes place at the jetties where simultaneous loading of six tankers of 2 500 – 120 000 DWT can be done. The total tank farm capacity exceeds 1 300 000 m^3. There are 5 railway platforms, the local pipeline network of the terminal complex, pump stations and many other auxiliaries that ensure an effective servicing of tankers. The companies Ventspils Nafta and Ventbunkers operating within the terminal complex can annually transship approximately 30 million tons of crude oil and oil products.

The liquid chemical transshipment terminal is the largest of its kind in the Baltic Sea Region. The company Ventamonjaks operates in the terminal. There are three berths of 12.5 m maximum permissible vessel draft for the transshipment of liquid chemicals. The total throughput capacity of the berths is 2.7 million tons. 1.4 million tons of liquid chemicals were transshipped in 1999.

The common carrier pipeline system within Latvia, operated by the Latvian-Russian joint venture LatRosTrans, is the most important component of the Latvian Oil Transit Route. The pipeline system is an interdependent, high technology network with integrated maintenance, telecommunications, and fire-safety systems. Three pipelines – two for crude oil and one for petroleum products – cross Latvia.

- The Polotsk-Ventspils pipeline was put into operation in 1968. The total length of the pipeline is 516.8 km of which 334 km are in Latvia. The capacity of the pipeline is 16 million tons annually or 45.7 tons per day.
- The second pipeline, Polotsk-Birzai-Mazeikiai, was constructed to supply the Mazeikiai oil refinery. The capacity of the pipeline is 16 million tons annually. The pipeline runs parallel to the Polotsk-Ventspils pipeline along the Polotsk-Birzai segment.

-The oil product pipeline, that runs parallel to the Polotsk-Ventspils crude oil pipeline, was put into operation in 1971. The capacity of the pipeline is 4.03 million tons per year.

Ventspils has seen tremendous changes during the last years and the city has regained its historical role as a leading east-west transit centre. The Ventspils of today is a world class port and the leading port on the Baltic Sea.

3.4.2.1 Dry cargo terminals

The potash transshipment terminal is the second largest in the world, through which 20 % of the world potash trade is shipped. The terminal is leased to the company Kalija Parks. There is one berth of 14.1 m maximum permissible vessel draft. Capacity of the terminal is 5.5 million tons per annum and with the completion of reconstruction works the capacity will reach 7.5 million tons. 5.2 million tons were transshipped through the terminal in 1999.

The general cargo terminals have 14 berths of 6.0 – 14.1 m depth. The terminals occupy a territory of 260 ha. The companies Ventspils Tirdzniecibas Osta, Ventplac, Enkurs, Kalija Parks, Nord Natie Ventspils terminal, operating in the terminals transship metal, wood and timber, fruit, sugar, frozen products etc.

3.4.3 Riga

The port of Riga represents around 13 million tons throughput of which 62 % was general cargo, 38 % dry bulk and 16 % liquid bulk. Port of Riga is the main port of Latvia for the general cargo. The port is specialized on ferry and RoRo traffic and bulk transports. The amount of containers was more than 130 000 TEU in 1998. The approaching channel has a minimum draught of 10.0 m. The approaching channel will be widened and dredging projects are under construction to deepen certain terminal areas.

The Riga port is located along a 15-kilometer stretch on both shores of the Daugava River (Appendix 10). The port covers a total territory of 1,036 hectares. The total length of the port's berths is 12,662 meters. The port is open for shipping throughout the year and in all seasons.

Approximately 80% of cargo turnover at the Riga port involves the shipment of transit freight to and from the countries of the CIS. More than 30 stevedore companies offer their services at the Riga port. The main types of cargo are general cargo, containers, various metals, wood, coal, mineral fertilizers, chemical cargoes, oil products and food products. A planned reconstruction of the port will allow the port to handle up to 20 million tons of cargo each year. The Riga port is a member of the European Sea Ports Organization (ESPO).

3.4.4 Port of Liepaja

The Port of Liepaja (Appendix 12) is part of the Liepaja free zone, where 13 stevedore companies and 11 vessel agents operate. It was a former military port during the Soviet time, but has rapidly transferred to the business oriented port. It is growing fast due to the status as a special economic zone. The cargo throughput of the port has gradually increased exceeding the 3 million tonnes of level in the year 2001. Largest items are metals, timber and liquid cargo. The share of grain and wood chips has also increased substantially The port has RoRo connections to Sweden, Denmark and Germany. There are a lot of investment plans in a long period: to dredge the approaching

channel deeper (i.e. from 8.5 m to 11.0 m), reconstruct the road network, which in this very moment is rather poor, establish new terminals for bulk and containers, railway improvements and general port improvements.

In March 1997, the law about Liepajas Special Economic Zone (SEZ) was accepted. Nucleus of the SEZ is the port, which becomes a Freeport. SEZ also includes the most important industrial areas and transport junctions - railway, international airport, and warehouses. Consequently, considerable tax allowances and simplified customs procedures are available. It should be stressed, that operation of Liepaja port as a commercial port is being formed from the start, therefore it is unknown for many of potential partners. Yet it is possible to provide the prospective partners with the most suitable and efficient specialization. Owing flexible organization the port will be convenient also for the companies forwarding small amounts of cargo.

In Latvia the maritime transport figures are expected to double between the end of 1990s and 2020. Especially the Port of Liepaja is expected to grow significantly, up to 14 million tons in 2020. National forecast for the transport figures of the Ventspils oil terminal show up to 75 million tons annually in 2020. However, due to the new Russian oil terminal constructions, it is likely that the amount of oil handled in Ventspils will not grow so rapidly, even if more capacity will be designed and constructed.

3.5 Lithuania

3.5.1 General

Lithuanias main ports are Klaipeda and Butinge's oil terminal. It is bordered by Latvia, Belarus, Poland and Kaliningrad area. Klaipeda has good links to highways, to Via Baltica and Crete Corridor 9 and good railway connections. The main policy of the port authority is to link the port well to the existing European transport network. The east-west traffic corresponds 85 % of the total transport.

Butinge oil terminal was opened in July 1999. It is located near the Latvia-Lithuania border. The terminals loading principle is the loading buoy, which has proofed to be sensitive for oil spills: two major hazards have been taken place, the latest in the end of 2001. Butinge oil terminal had the throughput of 3 million tons of oil in 2000, and has the capacity of 8 million tons annually.

In Lithuania, the strongest development will take place in Klaipeda port. The port authority expects the port will handle more than 31 million tons cargo in 2010, and nearly 40 million tons in 2020. The prognoses of the Butinge oil terminal is not so clear due to the other significant oil terminal construction projects in the Baltic Sea area.

3.5.2 Port of Klaipeda

The Klaipeda State Oil terminal (Figure 15) was constructed in 1959 for export of heavy fuel oil to western countries. The original design capacity was 4.5 million tons, and after reconstruction plan in 1993 (Tebodin & Pramprojektas, 1993) the annual capacity was increased to 6.6. million tons for heavy fuel oil and diesel oil.

Figure 15. The Port of Klaipeda (Port Authority).

More than 65 % of the Port of Klaipeda's throughput is transito, mainly from Russia. The total throughput in 1998 was 15 million tons of which export represented roughly 80 % and import 20 % (Figure 17). General cargo represents 60 % of the total freight. Other important cargo groups are dry bulk, 21 % and liquid bulk, 19 % (Figure 19). Metals and fertilizers represented together more than 7 million tons in 1998. There have been a lot of new investments and investment proposals in the Port of Klaipeda. The turnover development is presented in Figure 18. The new container terminal has a capacity of 150 000 TEU and new RoRo terminal has been constructed too. Other new investments are a dry bulk terminal, passenger terminal, and fairway deepening works to deepen the existing 10. 6 m fairway to 15 – 18 meters in front of entrance (Figure 16). A Baltic seaport, Klaipeda is situated in a narrow strait called the "Sea Canal" on the Eastern Baltic Seashore. The port is open for navigation all the year round.

Figure 16. The Port of Klaipeda entrance. Lat: 55°43'N Lon: 21°07'E.

The width of the approaching channel to the port is 100 m and depth 11.5 m. The entrance of the sea canal protected by the Northern and Southern moles. The length of the fairway from the port entrance up to the Kiaulies Nugara shoal at the entrance to the Kurshiu Marios gulf is 4 miles, width varies from 180 m to 300 m and the depths are from 6 m to 9 m at the mean water level. The permissible drafts for vessels navigating along the Sea Canal are 10.6 m to 8.0 m from the Canal entrance up to the Winter Harbor, further up to the Klaipeda's Smelte Company and Ferry Terminal - not more than 7.5 m. The layout of the port is shown in Appendix 13.

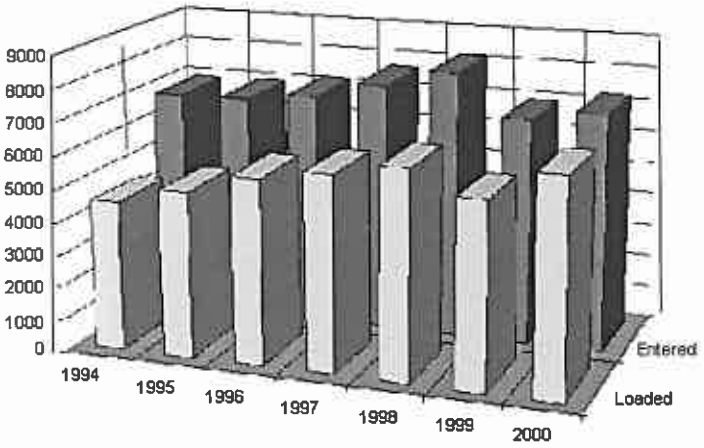


Figure 17. Ship traffic development of Klaipeda port in 1994 - 2000.

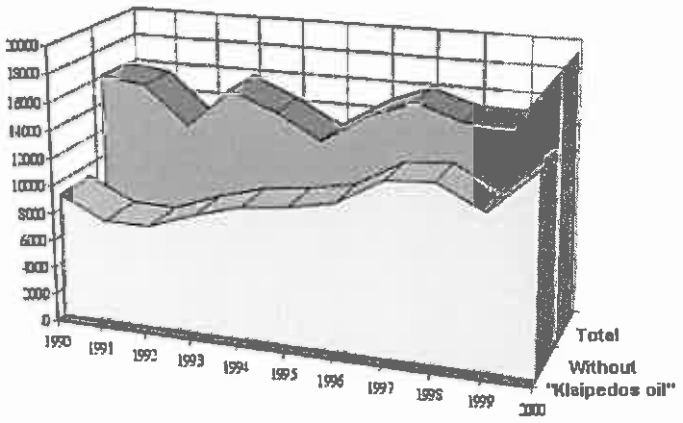


Figure 18. The turnover development of Klaipeda in 2000.

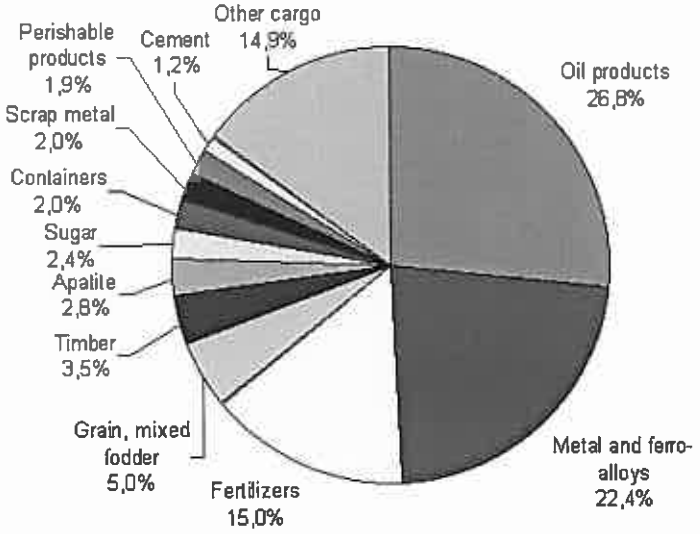


Figure 19. Cargo distribution of Klaipeda in 2000.

Klaipeda State port will soon become a freeport. A law relating to this change has been passed, but regulations for its implementation have not yet been prepared. Lithuania's two largest ports, Klaipeda and Butinge made more than 22,2 million tonnes turnover in 2001. Klaipeda alone corresponded 17,2 million tonnes with ship calls more than 7 300.

Two oil operators take care of one half of the total supply of goods. The Lithuanian-American company Klaipedos Nafta in Klaipeda has recently completed the renovations of the terminal. Its capacity has been improved to seven million tonnes. The other company, Mazheikiu Nafta, holds the loading terminal in Butinge with the total planned capacity of 8 million tons. A 22 inch diameter oil pipeline connects the Mazheikiu oil plant with Butinge, and the loading platform at the distance of few hundred meters offshore allowing large tankers to be served. Largest vessel thus far visiting the port has been the 150 000 dwt tanker loading 120 000 tonnes of crude oil (Vitismann, M. 2002b). In the year 2001 51 vessels visited Butinge oil terminal corresponding slightly over 5 million tons of crude oil share. Butinge mainly serves Russian oil companies such as Yukos, Tatneft and Slavneft.

Klaipedos Nafta loaded 5,1 million tonnes of oil products in 2001, including 3 million tonnes of fuel oil and one million tons of diesel oil. The other important item is fertilizers having the share of almost three million tonnes in 2001.

Lithuania's importance to Russia will become important, especially after Lithuania has joined the European Union. There has been already now plans to develop Klaipeda and the Russian Kaliningrad together, and to avoid competition by dividing flow of goods between these two ports. The important issue will be the general development of the railway tariff-policy of Russia which will influence on the development of these ports significantly. Kaliningrad has also a crude oil terminal and handling around 2 million tons per year.

3.6 Poland

Poland and Estonia are to be found in the first applicants of the EU membership, which might be realized before 2005. Poland main ports are characterized by two twin-ports, i.e. Ports of Szczecin and Swinoujscie and Ports of Gdansk and Gdynia. The former two ports are run be the same port authority, but the latter two ports are in direct competition to each other (Ingo, S. 1999).

The Polish seaborne cargo transport (Table 14) is also expected to nearly double by the year 2020. The most significant development will take place in the port of Gdansk, which is expected to have near 50 million tons volume in 2020.

Table 14. Cargo turnover in Polish Ports in 2001 [million tons] (Szymanski, L. 2002).

Port	*Total*	*Coal*	*Ore*	*Grain*	*Timber*	*Oil*	*Bulk*	*General*	*Calls (x1000)*
Gdansk	47,7	15,8	2,7	2,5	0,75	8,0	7,9	10,7	9 743
Gdynia	8,4	1,7	0,01	0,7	0,02	0,4	1,3	4,2	10 644
Szczecin	10,3	3,9	0,5	1,1	0,04	0,3	2,1	2,4	4 394
Swinoujscie	8,9	4,1	2,1	0,1	-	0,2	0,3	2,1	12 896
Police	2,0	0,04	0,07	-	-	-	1,9	-	688

3.6.1 Gdansk

The Port of Gdansk is the largest port of Poland. In 1998 the throughput was 20.5 million tons and the development can be seen in Table 15 and Figure 20. It has two separate ports: the Inland Port along the Vistula River and the Northern Port. Inland Port is specialized on the container handling. Moreover there are terminals (Eastern River bank) for sulfur, salts, soda, chemicals, fertilizers, coal, grain etc. Inland port also has the general cargo and container terminals in the Western River bank, and the ferry connections to Scandinavia. The draught of the inner port is 10.2 m. The Northern (outer) port has a channel depth of 17 meters and can be accessed large vessels up to 150 000 dwt fully laden. Two main terminals are the coal terminal having the daily handling capacity of 50 000 tons and the Fuel Terminal having the daily capacity of 100 000 tons. Its current annual capacity is 18 million tons, but will be increased to 30 million tons annually. Handling is focused on bulk goods with a capacity of ten million tones of coal per year, 34 million tons of oil and other petroleum products and 0.5 million tons of gas per year (Szymanski, L. 2002). The inner port has 36 berths on 10 km of quays for vessels having the maximum draught of 10,2 meters and the maximum deadweight of 75 000 tons. The layout of the port is shown in Appendix 15.

The investment proposals include a lot of new terminals mainly in the large reserved land areas of the Northern Port: liquid and gas terminal, chemical terminal, ore and container terminals and further development of existing fuel terminals. There are also plans to establish a duty free zone for investment attractions. However, after Poland has became the member state of the EU, the general policy of duty free regulations, taxes and VAT's should follow the EU's policy.

Table 15. Cargo Handling in The Port of Gdansk [in thousand tons] (http://www.portgdansk.pl/en/CargoHandling.htm)

	1995	1996	1997	1998	1999	2000
Coal	7 116	6 128	6 636	7 441	7 095	5 909
Ore	-	200	465	298	183	74
Grain	139	301	247	392	421	496
Liquid Fuels	6 437	5 036	5 199	8 268	7 039	6 061
Other bulk cargo	2 758	2 906	3 117	2 986	2 570	2 457
General cargo	1 739	1 919	1 711	1 209	1 376	1 543
TOTAL	**18 262**	**16 490**	**17 375**	**20 594**	**18 691**	**16 544**
Containers [TEU]	3 064	2 165	2 347	2 738	4 627	18 037

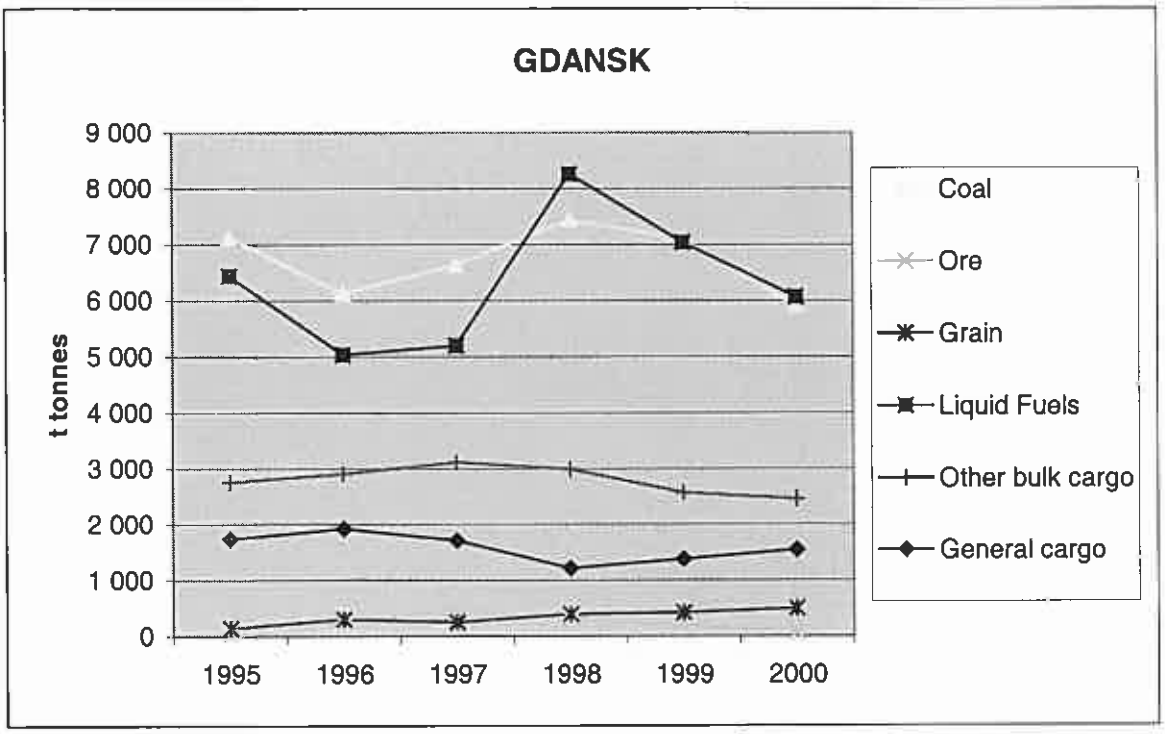
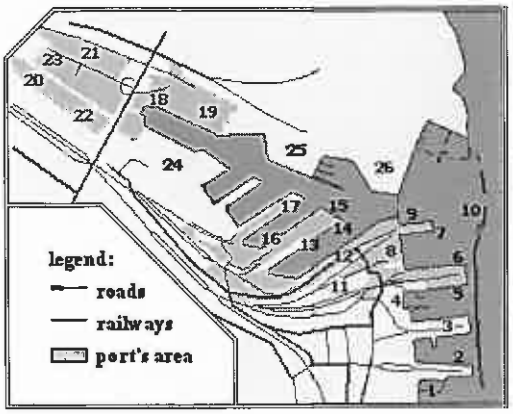


Figure 20. Cargo handled in Gdansk 1995-2000.

3.6.2 Gdynia

The Port of Gdynia (Figure 21, Figure 22 and Table 16) locates to the north west of Gdansk, on the Bay of Gdansk. This modern port is specialized on the container handling.

Figure 21. Entrance to the port.



1 Yacht basin
2 Tourist area
3 Fisheries Harbor
4 Ship Repair Yard 'Nauta'
5 LPG terminal - SEMGAZ
6 Baltic Bulk Terminal BBM
7 Reclaimed land
8 Maritime Bulk Terminal
9 Fruit terminal *
10 Liquid Fuels Terminal **
11 Development area
12 General cargo terminal
*) in progress
**) temporary
13 Liquid products t. WESTWAY
14 Grain terminal
15 Fodder terminal *
16 RoRo Terminal *
17 Bulk cement t. - SCANCEM
18 Ferry terminal
19 Container terminal
20 Depot terminal
21 BCT back-up facilities
22 Development area
23 Baltic Auto Center
24 Ship Yard 'Gdynia'
25 Naval Ship Yard
26 Naval Harbor

Figure 22. Gnydia Port map.

Table 16. General info about Gdynia

Total site area :	240 hectares
Total quay length:	10 km
Water depth at quays:	6.5-13m
Number of berths:	40
Cranes:	Fixed, mobile, floating with lifting capacity up to 100 tons
Warehouses:	230,000 sq. m (including cold storage space)
Open storage:	400,000 sq. m

The main harbor entrance is 150 meters wide and has a water depth of 14.1 meters. The outer breakwater extends for 2.5 km. Two main deep-water channels provide safe approach to Port Gdynia. The roadstead is protected by the Hel Peninsula ensuring safe anchorage throughout the year. Fine compact sand in the roadstead provides safe anchorage ground. The layout of the port is shown in Appendix 14.

Gdynia is a non-tidal port with no currents or high waves although water levels can rise up to 60 cm during strong westerly winds and fall 60 cm when subjected to strong easterly winds. The port is essentially ice-free. The terminals are described in Table 17.

Pilotage is compulsory for vessels over 40 meters LOA. Pilots board at roadstead. Towage is compulsory for all vessels over 90 meters and from 70 meters for vessels carrying hazardous goods. Shipping agents can be contacted on Channel 7. Pilot station can be contacted on VHF channel 12. Port Gdynia is a 24-hours-a-day gateway. The port operates around-the-clock on a three-shift system. Table 18 presents tonnage in Gdynia 1996-2000. The cargo distribution is presented in Figure 23.

Table 17. Terminal operators.

Baltic Container Terminal	
Number of quays:	2
Total quay length:	980 m
Water depth at quays:	8-10m
Cranes:	Max. capacity of 55t
Warehouses:	23,000 sq. m
Open storage:	210,000 sq. m
Maritime Bulk Terminal	
Number of quays:	4
Total quay length:	2,000 m
Water depth at quays:	6.5-10.8m
Cranes: Max. capacity	16 tons
Total storage area:	102,000 sq. m
Baltic General Cargo Terminal	
Number of quays:	7
Total quay length:	4.3 km Water depth at quays: 8.5-13.00m
Cranes:	Fixed, mobile floating with max capacity of 100t
Warehouses:	165,000 sq. m
Open storage:	160,000 sq. m
Baltic GrainTerminal	
Number of quays:	1
Total quay length:	275 m
Water depth at quay:	11.10m
Silo cap:	26,000 tons
The Bulk Terminal Ltd.	
Number of quays:	1
Total quay length:	713m
Water depth at quay:	10.5m
Storage capacity:	67 000 t

Table 18. Tonnage in thousand tons in Port of Gdynia 1996-2000 (http://www.port.gdynia.pl/Port_Gdynia/a_statystyka.htm.February 2001.).

	1996	**1997**	**1998**	**1999**	**2000**
Coal & Coke	1 717	1 867	1 911	2075,5	1753,9
Iron Ore	110	93	57	4,7	11,3
Grain & fodder	1 619	826	433	621,2	510,4
Other Bulk Cargo	838	801	576	769,4	1 675,6
Timber	2	1	7	49,1	27,7
General Cargo	3 632	4 521	4 185	4 267,8	4 286,7
Oil Products	648	736	403	348,4	333,5
Total	**8 565**	**8 845**	**7 573**	**8 136**	**8 599**

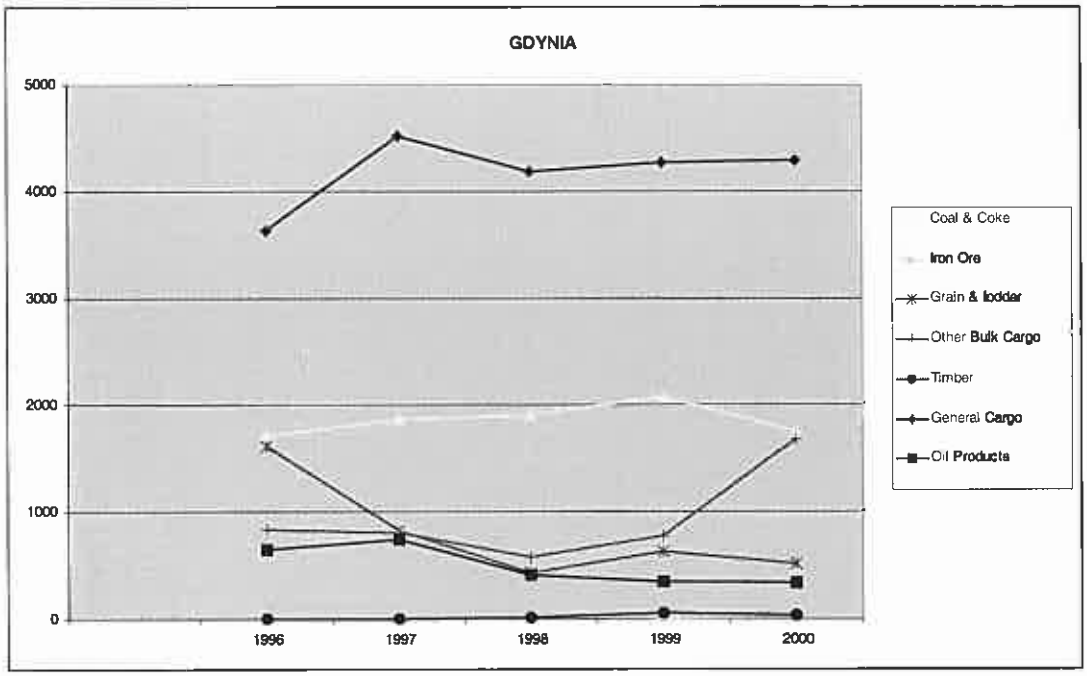


Figure 23. Cargo handled in Gdynia 1996-2000.

3.6.3 Swinoujscie

The Port of Swinouwijcie is located at the mouth of River Swina and can handle larger vessel the Port of Szczecin can not take due to the draft restrictions. The port has more than 8,8 million tons of throughput in 2001, and a terminals for coal, chemicals and raw materials. The number of calls in 2001 was 10 998. It also has links for passengers, cars, trains and ferry services to Germany, Denmark, Sweden and Finland. Cargo statistics are presented in Table 19 and Table 20. The connections to the road and railway network exist, and a link to German inland waterway systems via River Odra. Port of Swinouwijcie has a modern oil terminal and modernized ferry terminal.

Table 19. Cargo turnover in 2000 (http://www.phs.com.pl/stats.html).

	thousand tons	%
export	4 081	61,63
import	2 050	30,96
transit ex.	351	5,30
transit imp.	140	2,11
Total	**6 622**	**100,0**

Table 20. Main types of cargo reloaded (http://www.phs.com.pl/stats.html).

	thousand tons	%
Coal	4 058,58	61,30
Ore	2 031,37	39,67
Aggregate	61,03	0,92
Other dry bulk	106,9	51,62
Grain	185,4	72,79
Steel prod.	161,32	2,43
Liquid pitch	17,59	0,27
Total	**6 622,31**	**100,00**

3.6.4 Port of Szczesin

The Port of Szczecin is located 65 km from the open sea, along the River Odra. The navigation channel along the river is 90 m wide and the depth of entrance is 9.5 m. The low water level has caused temporary problems to the port (River Odra). The port corresponds around 10 million tons cargo per year (10, 324 million tons in 2001), and has connections to road and railway accesses. The number of calls in 2001 was 3 723. Port is also connected to the German inland waterway network up to vessels having the loading capacity of 1 500 tons. There are several modernization projects of port facilities underway, and new terminal construction for unitized cargo. The layout of the port is shown in Appendices 16 and 17.

3.7 Germany

German ports are specialized to certain commodities or to certain type of sea transport. Hamburg and Bremerhaven are the biggest ports. Hamburg alone is representing around 75 million tons annually, Bremerhaven representing around 33 million tons. Other large ports are Rostock, Lubeck/Travemunde, Puttgarden, Kiel and Sassnitz.

The German maritime transport figures is estimated to grow to 70 - 80 million tons by the year 2010 (Venäläinen & Viitanen, 2001). In the German Baltic Sea ports the expected handling rate is around 64 million tons in 2010. The main driving forces in Germany's port development are the general growth rate in the Baltic area with Scandinavian and Baltic countries and Russia, improvements of hinterland connections of Mecklenburg - Vorpommenr ports, infrastructure investments in the ports, location of the industry near the main ports.

Hamburg and Bremerhaven are large container ports, Rostock and Lubeck-Travemunde are ferry ports and ports for general cargo, Puttgarden and Kiel are ferry ports. The former railway link of Puttgarden has declined after the completion of the Great Belt Bridge. The annual number of containers in Hamburg and Bremen Ports were in 1998 over 3.5 million TEU and 1.8 million TEU, respectively. The average annual growth of the seanborbe cargo of the main German ports has also been quite large: in 1990s the average annual growth rate of Hamburg was 3.2, and 2.6 for the Bremenhaven. Rostock and Lubeck-Travemunde increased their transportation figure even more, 5.0 and 6.4, respectively.

There is a marked difference between the maritime traffic that passes through the North Sea and that which traverses the Baltic Sea. The reunification of Germany has resulted in a longer Baltic coastline and the German authorities are improving aids to navigation in their Baltic ports. This is being achieved through the positioning of additional buoys and lighthouses; by traffic radar; and by the establishment of a VTS at Rostock.There is not continuous coastal radar the length of the Baltic coastline. The regulations of the Shipping and Waterways Administration is enforced by the Coast Guard on a 24-hour basis.

A primary concern of the German authorities is the difference in the standard of tankers using the North Sea and the Baltic Sea. In practice, ship charterers are setting the standards in advance of the development of international rules. North Sea operators require higher technical standards because of the adverse weather conditions and difficult terminal operations. Although weather conditions in the Baltic are less extreme, the environmental sensitivity of the Baltic Sea is higher than the North Sea. Both sea areas are designated as Special Areas for the purpose of MARPOL Annex I (oil). The German response authorities fear that the lower standard of tankers using the Baltic terminals could increase the risk of oil pollution incidents (COWI, 2000).

3.7.1 Lübeck - Travemunde

In 1999, the total turnover of the ports of Lübeck was 25.2 million tons. In 1998, the turnover reached 24.9 million tons and in 1997, a total of 24.4 million tons were handled. Lübeck has liner services at the terminal Skandinavienkai and at the city ports (a total of more than 110 per week to 16 destinations in the entire area of the Baltic Sea) and has good hinterland-connections. (saksa\luebeck\stat00.htm). Cargo throughput is presented in Table 21. The Port of Lubeck-Travemunde consists of five different port terminals. The main transportation modes are RoRo and ferry traffic, paper and forest products, general cargo, fruits, break bulk, automobiles, passenger ferries and cruise liners.

Table 21. The cargo throughput in the Port of Lübeck (saksa\luebeck\stat00.htm).

Total handling of the LHG (in Mio. t)	Import	Export	Total
2000	13,428,100	10,182,082	23,610,182
1999	13,123,708	10,161,492	23,285,182

		1999	2000
Piece goods (in Mio. t)	Paper	2,806,512	3,188,471
	Cellulose	275,784	312,6
Means of loading (in units)	Trucks accompanied	302,927	304,096
	Trucks not accompanied	330,471	347,419
	Container	56,489	64,204
	Railcars	26,848	18,931
	Cars	159,634	159,634
Travelling Traffic (in units)	Passengers	573,373	484,189
	Passenger cars	117,413	110,758
LHG-Terminals (in Mio. t)	Terminal Skandinavienkai	15,143,598	15,011,299
	Terminal Nordlandkai	5,249,705	5,481,163
	Terminal Konstinkai	1,818,194	1,783,341
	Terminal Schlutup	1,150,715	1,185,919

Integrated Harbor Logistic System (IHS) is put into practice at the LHG terminals in Schlutup, Konstinkai, Nordlandkai and Skandinavienkai. Further implementation of this system is planned at the Seelandterminal and for the 50% LHG subsidiary CBT (Cross Baltic Terminal Operator) in Szczecin (Stettin). The main functions of the Integrated Harbor Logistic System are the administration of the lots for trailers, containers, railcars and RoRo-units by means of data-radio set. All loading procedures on the ships or on the ground are also conducted by data-radio set. Completely parametrically communication intersurfaces to the shippers, forest-product companies, automobile companies as well as to port authorities (also linking different countries) allow an efficient transfer of data. Modules, permitting a process-oriented gathering of data of the different

kinds of performances at the port and of the application of personnel and equipment, are used for a better steering at the terminals. A gate system, connectable to any desired technical video-checksystems is also part of the IHS. Further, the IHS contains a complete storage administration program, administering approx. 200,000 m² in more than 40 sheds within the LHG. The integration into the international business standard SAP R/3 has already been realized. Numerous statistics and reports are available for the operational and administrative steering of the terminals.

3.7.2 Hamburg

Hamburg is the largest universal seaport of Germany and the eighth biggest container handler in the world. The throughput was more than 92 million tons in 2001 and is expected to be near 100 million tons in 2002. The container throughput was 4,7 million TEU in the year 2001. Hamburg can easily handle more containers, thus its annual container capacity has been estimated to be near 9 million TEU. Moreover, the further deepening of River Elbe to 14, 5 meters will soon enable Hamburg to take large container ships of up to 7 000 TEU (Todd, T. 2002). The Port of Hamburg forms the most important gateway for the exchange of the EU and Eastern European cargos. Nordic countries represent a significant part of the total throughput of the port. From its annual 75 million tons cargo approximately half is bulk cargo and the rest general cargo, mainly in containers. The amount of liquid cargo has been in 14 - 17 million tons annually, depending on the year.

Hamburg is also investing to the new Altenwerder container terminal getting additional area of 215 ha giving additional capacity of 1200 million TEU in 2001 and 1900 million TEU in 2003. Other improvements are several extensions of container terminals, dredging works to get better access for large container vessels in the Elbe River, railroad and road improvements.

3.7.3 Rostock

The Port of Rostock has become a modern ferry port having still a strong reputation of a bulk port. Main ferry routes goes to Trelleborg in Sweden, Gedser in Denmark and during the open water season Helsinki in Finland (Silja Line GTS Finnjet). Rostock has connection to the central motorways and links with Berlin.

The fairway approaching the Rostock Port is 3.6 nautical miles long and has a draught of 14.5 m. The port is currently enlarged to get easier access for larger vessels. There are 42 berths for ships to enter. The throughput of the port was 16.8 million tons in 1998.

3.7.4 Other ports

Puttgarden is located on the island Ferhman and has ferry links to Denmark (Rödby). The amount of passengers in 1998 was 5.85 million and cargo handled has exceeded 5 million tons annually (5.8 million in 1997).

The Port of Kiel is an important ferry port and has links to Norway and Sweden. It is also the beginning of the Kiel Canal, which links the Baltic Sea to the River Elbe. There are 9 different terminals. Due to the centralization and new fixed bridge link between Denmark and Sweden the transport figures have been decreased slightly since 1997. The annual amount of cargo has been in the order of 4.6 - 5.2 million tons, and the number of passengers 1.8 - 1.9 million.

The ferry port of Sassnitz (Mukran) is located on the island of Rugen. It is a former military port, but has been transformed to a ferry port. It has links to Trelleborg, Klaipeda, Swinoujscie and Rönne. It also has a rail ferry connection with Klaipeda serving the East European rail network. The future investments are directed to improve the links between the hinterland and the mainland.

The North-Sea port of Hamburg is the 6th largest port worldwide. The overseas container volumes are concentrated to Hamburg and to Bremerhaven. Hamburg has two large container operators, HHLA and Eurokai. The management behind Eurokai is also managing and operating Bremen and Bremerhaven and their container terminals. Hamburg is also an important gateway for the Eastern Europe due to the good intermodal railway connections with the East European hinterland.

The relatively high tonnage in Wilhelmshaven is due to the oil and oil products. Rostock and Lübeck-Travemünde are both ferry ports and ports for general cargo from Scandinavia and Finland. Rostock has also oil product facilities and is a ferry port. Brünsbuttel and Bützfleth are bulk ports in the industrial region of the lower Elbe (SWA, 1999).

Emden is a bulk port but is also used by Volkswagen for shipping cars. Puttgarden is a ferry port only, but has lost the railway volumes due to the opening of the Great Belt bridge link. Nordenhamn and Brake are bulk ports on the river Weser.

3.8 Denmark

According to the (COWI, 2000) the Danish authorities are not concerned by the increased tanker traffic which would be engendered by the Baltic Pipeline-project, i.e. due to the realization of the Primorsk oil terminal. The construction of the bridges across the Great Belt has resulted in better routing of ships' traffic and improved navigation aids such as buoys and lighthouses. All large traffic will pass under the main bridge, which has an open span of 1650 m.

However, the former Erika accident followed by the ship collision in March 2001 has changed this view remarkably. HELCOM arranged a ministerial meeting in September 10, initiated by Denmark; to discuss on all the possible measures to improve maritime safety and to avoid oil spills.

Ships are required to inform the center at Aarhus when entering Danish waters (the Ship Position System (SHIPPOS) as required by IMO). Access to the system is free of charge and masters can hear on the radio about ship traffic movements in the Sound. This SHIPPOS has been reinforced by a Vessel Traffic Service (VTS) introduced for the Great Belt. The VTS center is located at the Korsoer naval base. The VTS gives guidance to ships' masters if they are not following the traffic schemes and, if necessary, control vessels can go out and intercept ships, which are off course. A temporary VTS for the Sound has been dismantled now that the construction works have been completed.

There is no provision for mandatory pilots. At the request of the Danish Parliament, in 1991 Denmark made proposals in HELCOM that all laden tankers above 20,000 DWT should be required to take on pilots when navigating the Danish Straits. However, the proposal received little support and was withdrawn after 4 years. However, in accordance with IMO Resolution A.620 (15) adopted in 1987, all ships with a draught of 13 meters or more are recommended to use the pilotage services. The recommendation is generally well followed with only about a dozen vessels a year failing to take on board pilots; the Danish Maritime Authority informs the flag state authorities of the vessel concerned in such cases and this avoids repetition of the circumstances.

3.8.1 The Danish ports

Denmark has a total have about 130 cargo and ferry ports distributed throughout the country. These ports differ considerably in terms of size and profile. Owing to the geography of Denmark, large proportions of these ports are small ferry ports. In 1999 a total of 572,500 calls were made at Danish ports to load/unload cargo or passengers. 95% of these were ferry calls.

Between 1998 and 1999 the number of calls made by ships at Danish ports fell by about 17,000 (3%), which must be attributed primarily to the opening of the Great Belt Bridge. The Danish ports are shown on the map in Figure 24.

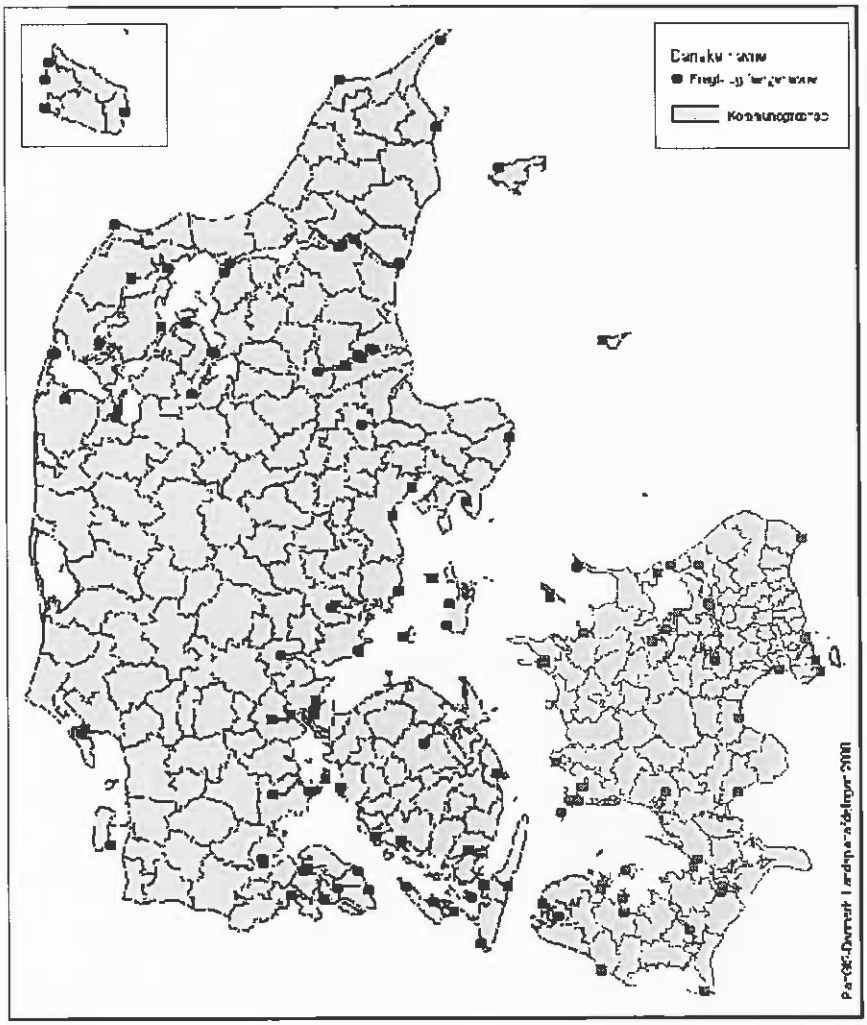


Figure 24. Danish ports[1].

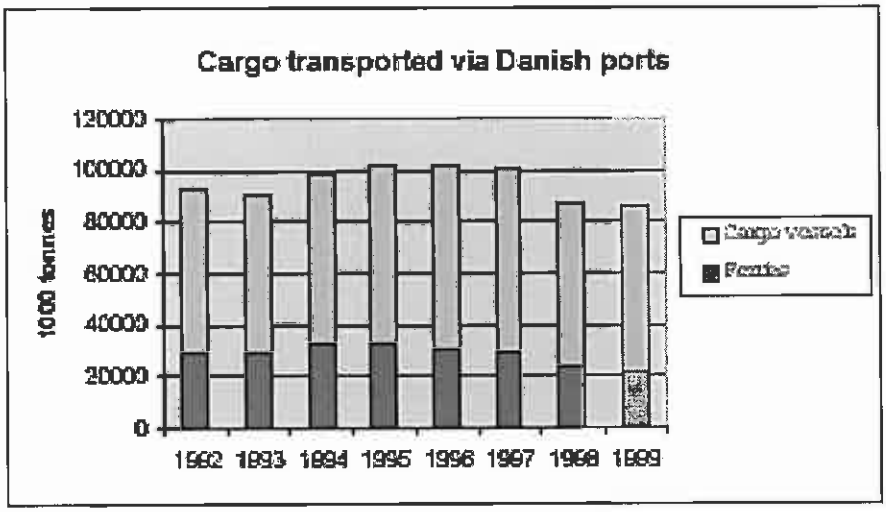
The map shows all the Danish ports included in Danmarks Statistik's summary of shipping in Denmark.

[1] Comprising Danish "traffic" ports and separate ferry berths outside such ports. Marinas and fishing ports are not included. The most noticeable thing is that the fishing ports at Thorsminde and Hvide Sande on the west coast of Jutland are not marked. Ferry ports that no longer have regular ferry crossings are not included either (e.g. the ferry berth at Lohals on Langeland).

3.8.2 Cargo transport at Danish ports

The total volume of cargo[2] transported via Danish ports grew steadily in the period 1992-97 to more than 100 million tons. However, the tendency has changed since the opening of the Great Belt Bridge and the total volume of cargo fell by 15% from 101 million tons in 1997 to 85 million tons in 1999.

Figure 25 shows the total volume of cargo passing one or more Danish port in the transport chain. Some of this cargo may have been unloaded and/or loaded in several Danish ports, but is only registered once. The statistics mention that "national (loaded)" cargo is not included.



Source: Danmarks Statistik

Figure 25. Cargo transported via Danish ports (source: Danmarks Statistik).

However, to investigate the level of activity at Danish ports - i.e. the total volume of cargo unloaded and loaded in all the ports - "national (loaded)" cargo should also be included. This would give an all-round picture of cargo turnover at the ports. Cargo turnover at Danish ports in 1999 amounted to more than 97 million tons. This is 22% lower than in 1997 prior to the opening of the Great Belt Bridge.

In particular, the reduction has affected former ferry ports like Nyborg and Korsør. In some of the small Danish ports cargo turnover has actually stopped completely. Among the major Danish ports, ferry ports such as Kalundborg have been particularly hard hit by the opening of the bridge. The Danish ports predict further losses of cargo turnover owing to the opening of the Øresund Bridge to Sweden.

Each year Danmarks Statistik publishes detailed statistics on ports with a cargo turnover of more than 1 million tons. In 1999 the 19 largest ports turned over more than 78 million tons of cargo, corresponding to almost 80% of total cargo turnover at Danish ports.

Measured in terms of total cargo turnover (all cargo types), the Port of Fredericia is Denmark's largest cargo port with an annual turnover of 14.5 million tons (1999). The major proportion of cargo turnover at the Port of Fredericia consists of oil. Crude oil from the Danish oil fields in the North Sea is conveyed through a pipeline across Jutland to the Fredericia terminal. Here the oil is

[2] Total volume of cargo loaded and unloaded in Danish ports for both import and export.

dispatched by sea or sent to the Shell Re-finery in Fredericia, where it is refined. In most cases finished products are also dispatched from the Port of Fredericia. 82% of cargo turnover at the Port of Fredericia in 1999 consisted of tanker consignments.

The Port of Copenhagen has Denmark's second-largest cargo turnover (9.4 million tons). One-third of this is transported via the many ferry routes sailing to and from Copenhagen. Denmark's third-largest cargo port is the Statoil Port (8.8 million tons), which is only used for oil. The fourth largest is the Port of Århus with a turnover of 7.7 million tons - 10% of which is by ferry. Cargo turnover in Danish ports, Table 22.

Table 22. Cargo turnover in Danish ports (Bakka, D. 2002).

Port	*Turnover in 2001*	*Containers [TEU]*
Fredericia/Nyborg	16,0	
Århus	10,1	409 000
Koepenhagen	8,6	149 000
Esbjerg	4,6	
Kalundborg	3,9	
Frederikshavn	2,9	
Alborg	2,6	43 000
Kolding	1,3	
Rönne	1,2	
Aabenraa	1,1	
Randers	1,0	
Köge	0,8	
Nästved	0,5	
Horsens	0,5	

Almost half of the product carriers had the capacity of 2 000 dwt, while around 13 % os the tankers were larger than 25 000 dwt. The age of the ship goes well with the size of the ship: more older the ship – more smaller the ship.

The amount of refined oil products transported by ships in Europe was around 150 million tons, and gave contracts for 180 ships having the size of 3 000 – 20 000 dwt. Chemical tankers had a size scale of 3 000 - 40 000 dwt. The Europa's internal chemical transport rate was around 10 million tons of chemicals in 2 000.

Table 23 shows cargo turnover categorized by cargo type. On a national scale cargo was divided more or less equally in 1999 between liquid bulk (32%), solid bulk (32%) and general cargo (36%). Naturally, it is noticeable that the ferry ports only handle general cargo (Helsingør, Sjællands Odde, Ebeltoft and Frederikshavn).

Table 23. Cargo turnover categorized by cargo type, 1999 (source: Danmarks Statistik).

Abs., 1000 tonnes	
Liquid bulk (1000 tonnes)	31.169
Dry bulk (1000 tonnes)	31.355
General cargo (1000 tonnes)	34.687
I alt	**97.211**

%	
Liquid bulk	32
Dry bulk	32
General cargo	36
I alt	**100**

3.8.3 Exports, imports, and national transport

The total volume of cargo handled at the major Danish ports is categorized by Danmarks Statistik according to its point of origin and point of destination respectively, as well as being categorized as "national" or "international" cargo. This makes it possible to divide the cargo at each of the major Danish ports into 4 categories: exports (cargo loaded for export), imports (cargo unloaded for import), national (unloaded) cargo, and national (loaded) cargo. Total cargo turnover at the Danish ports can be divided as follows: 43% imports, 32% exports, and 12-13% national transport between Danish ports[3].

3.8.4 Aabenraa Port

The Aabenraa Port (Figure 26) is situated at a position 55°02'5 N - 9°25'7 E at the deep Aabenraa Fjord. The port is composed of 3 basins, Nyhavn Gammelhavn and Sydhavn and of the Sønderjyllandsquay and the RoRo terminal. Further to that there are the tankship piers 1 and 2. The waterdepths vary from 4 to 11 m. From the Aabenraa Fiord an approx. 1 000-m long and 11 m deep dredged channel leads to the port. The minimum width of the channel is 120 meters. There are no significant tidal ranges, but northeasterly/easterly gales can result in high waterlevel on occasions, and southwesterly/westerly gales can result in low water level on occasions. The water level in the port is recorded at the Danish Meteorological Institute. The Aabenraa Port can accommodate drycargo vessels of up to 250 m length, and tankvessels up to 200 m length. The port is lighted and is accessible for navigation day and night. The port is kept open during eventual ice-winters.

[3] Differences in the freight statistics between national (unloaded) cargo, apart from dredged stone, sand and gravel, and national (loaded) cargo are due among other things to the transport of oil to vessels at sea or to ferry berths outside port areas; and to the transport of construction material for bridge building.

Figure 26. The Aabenraa port (Port Authority).

The Aabenraa Port's total turnover is about 18 Mio DKK, and origins mainly from harbordues and cargofees, together with rent for port space, cranes and machines. The income is mainly used for administration, maintenance of cranes, machines and facilities, depreciation, and payment of interests of the port's debts. The annual cargo turnover is about 1.1 Mio tons and is composed of liquid products, such as oil and molasses, together with bulkgoods, such as cement, limestone, broken stones and split, foodstuffs, grain and fertilizers (Figure 27). Furthermore the port handles general cargo, iron, wood products and trailers. Approximately 700 ships per year call the port (Figure 28).

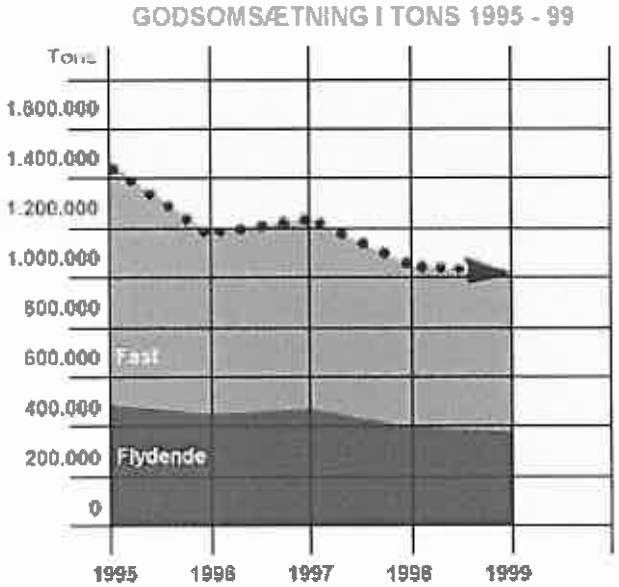


Figure 27. Goods transported during 1995-1999 [tons].

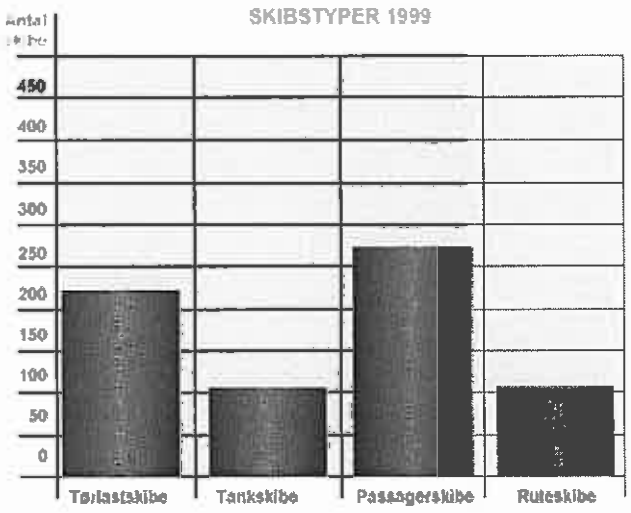


Figure 28. Visits in port Aabendraa by shiptype year 1999.

3.8.5 Aarhus Port

Since the first basins, the Port of Aarhus (Figure 29) has been extended significantly and is today one of the largest in Denmark and within most areas the largest. The infrastructure of the port is now fully developed inside the existing breakwaters and has a capacity of 11 million tons and 450,000 TEUs and 600,000 containers. The Port of Aarhus has in recent 5 years invested DKK 600 million in port installations and equipment. The budget is DKK 200 million in 2001. Quays measure a total of 13 kilometers with a water depth of up to 14 meters. Future plans for the development include a doubling of the harbor's cargo-handling capacity, requiring an investment of additional two billion Danish crowns over the next 25 years. All types of commodity are handled by the harbor. The total amount of cargo handled corresponds to almost 10 million tons annually. Just less than 3 million tons of cargo are handled via the container services. The ferries to Zealand carry more than 2 million tons of cargo. The oil terminal handles more than 2 million tons. The remaining 2.5 million tons include, in particular, bulk goods such as foodstuffs and coal. The Port of Aarhus employs its own pilots who assist the ships upon arrival and departure. The harbor officials command the pilot boats, provide mooring services and supervise the harbor area. Ships that cannot moor on their own can request assistance from the harbor's tugboats.

Figure 29. Port of Aarhus (Port Authority).

3.9 Sweden

According to the Swedish national transport forecast, the total goods volumes transported by all modes are expected to grow by 27 % from 1997 to 2010, which equals an average annual growth rate near 1.9 %. The expectations for the maritime transport is slightly smaller, around 20 % between 1997 and 2010.

There are a large number of ports in Sweden, 52 public ports mainly owned by local municipalities. The ferry traffic in concentrated to few ports – 5 largest ferry ports are holding 90 % of the truck traffic and passenger volume. Biggest ports are Gothenburg, Brofjorden, Helsingborg and Trellborg. The container traffic is mainly concentrated to Gothenburg and Helsingborg. They handle together more than 70 % of the total volume. The oil traffic is also concentrated to Gothenburg and Brofjorden where the oil refinery facilities exist. The share of the oil products of the total ship-borne transport is around 38 – 40 %. Machines, and general cargo equals around 15 %, forest products 13 %, unprocessed minerals and goods manufactured from these mineral 11 % and rest 23 %.

Geographically, around 50 % of the total volume is transported via port of the West Coast. Slightly more than 10 % through the ports of the South Coast, 20 % through ports on the Baltic Coast and rest trough ports along the Northern Coast. Most common flag of the ship is Russian (16 % of the number of ships), while the Swedish flags dominate in the oil tanker, special-type tanker and RoRo-traffic.

3.9.1 Port of Gothenburg

The port of Gothenburg is the largest port of the Nordic region of the Baltic Sea. The cargo turnover comprises almost 60 % oil and almost 40 % general cargo. It serves the whole northern part of the Baltic Sea area. There are good connections with railways and motorways.

The port has nine different harbors specialized on different functions: Northern side of the port, i.e. Skandia Harbor, is the container harbor and passenger and car terminal. The Älvsborg Harbor is RoRo harbor with trailers and the Free port handles bulk cargo. Three other harbors on the north side handle with oil, and on the south side there are three harbors along the riverside with freight and passenger terminals.

There are two main approaching channels to the port: Torshamnsleden for large vessels having draught between 13 – 20 meters and Böttöleden with the depth of 10 meters. The River Göta fairway has a depth of 5.4 meters to Gothenburg's inner harbor.

3.9.2 Other Harbors

Helsingborg located in the very southern part of Sweden has four separate harbors: West harbor for unitized cargo, North harbor for ferry traffic, South Harbor having more diversified operations and the Bulk Harbor. The minimum water depth offered for the ships is 9.0 meters.

Trelleborg is also situated in the southern part of Sweden, around 85 km of the German border. It is the third largest port in Sweden, almost all the share coming from the ferry traffic. Passenger ferry services are operating to Sassnitz, Rostock and Travemunde.

Sweden's largest port in the Gulf of Bothnia is the port of Luleå, a largest bulk port of Sweden. Nearly 70 % of the total cargo is iron ore for export, nearly 30 % coal, steel, chalk stone and oil are imported. Luleå's main fairways, Sandöleden and Sandgrönnleden are 12.2 m and 9.8 m deep, respectively. Some of the ports are listed in Table 25.

The cargo traffic through the Swedish ports in 2000 was 159.3 million tons, divided into the groups shown in Table 24. The passenger traffic exceeded 33.5 million passenger having the densest traffic between Denmark and Sweden, near 20 million passengers. The corresponding figures between Finland-Sweden and Germany-Sweden were 8.52 million and 2.62 million, respectively. The cargo throughputs (in and out) in Swedish ports in 2000 and 2001 are shown in Appendix 29.

Table 24. Cargo transport through the Swedish ports (source: SIKA/SCB).

Cargo item	*Volume [x 1000 tons]*
foreign trade	
oil and oil products	40 788
timber & forestry	16 638
metals & ore	67 551
others	69 025
internal (domestic) all items	25 299
Total	159 310

Table 25. Largest ports of Sweden in 2000 on the basis of the volume handled (Svensk Sjöfarts Tidning, 2001.

Port	*Cargo handled [x 1000 ton]*	*Note*
Gothenburg	33 261	Biggest port in the Scandinavia. Fullservice port, concentrated to bulk traffic
Brofjorden	19 302	crude oil and refined oil terminal
Trelleborg	10 334	ferry terminal
Helsingborg	9 894	fullservice port with a large ferry terminal
Luleå	7 001	bulk, ore, coal and liquid cargo
Malmö	5 985	fullservice port, mainly oil, general cargo, ferry traffic
Stockholm	5 072	altogether three harbors: Stockholm, Nynäshamn and Kapellskär. All types of cargo, ferry terminals
Oxelösund	4 715	fullservice port, mainly raw materials for the steel industry and oil
Karlshamn	4 186	fullservice port and bulk
Norrköping	4 022	fullservice port, oil and forest products

The total amount of cargo handled via Swedish ports was 159, 3 million tons in 2000, which was three million tons more than in 1999.

4 Total maritime transport and oil transportation in the Baltic Sea

4.1 General

In order to update the former statistics of the maritime transport a Lloyd's database was analyzed. The traffic season May 2000 was selected to represent the basic database of ship movements in the Baltic Sea area. The database consisted of all the port calls, and was modified in order to get understanding on the intra regional ship movements and especially on the oil tanker movements of the area.

Other statistics were used as support. Here the www-pages of different ports, information received from ports directly, other data bases supported the analyses carried out played an important role.

The Baltic Sea area was divided into five categories, roughly:
Area I. The Gulf of Bothnia,
Area II. The Gulf of Finland,
Area III. The Central Baltic Sea area between Sweden and the Baltic States,
Area IV. The Southern Baltic Sea and
Area V. The Danish Straits.

The traffic statistics were divided into two groups: first the oil tanker traffic was analyzed. Tables were performed where the destinations and origins were listed with the data concerning the ship and the cargo.

The main ports of the Baltic Sea area for the analyses were selected using the port distribution figure shown in (COWI, 1998b) in order to understand better the development. This Figure 30 is enclosed below. However, more ports were added to get better coverage over the selected areas.

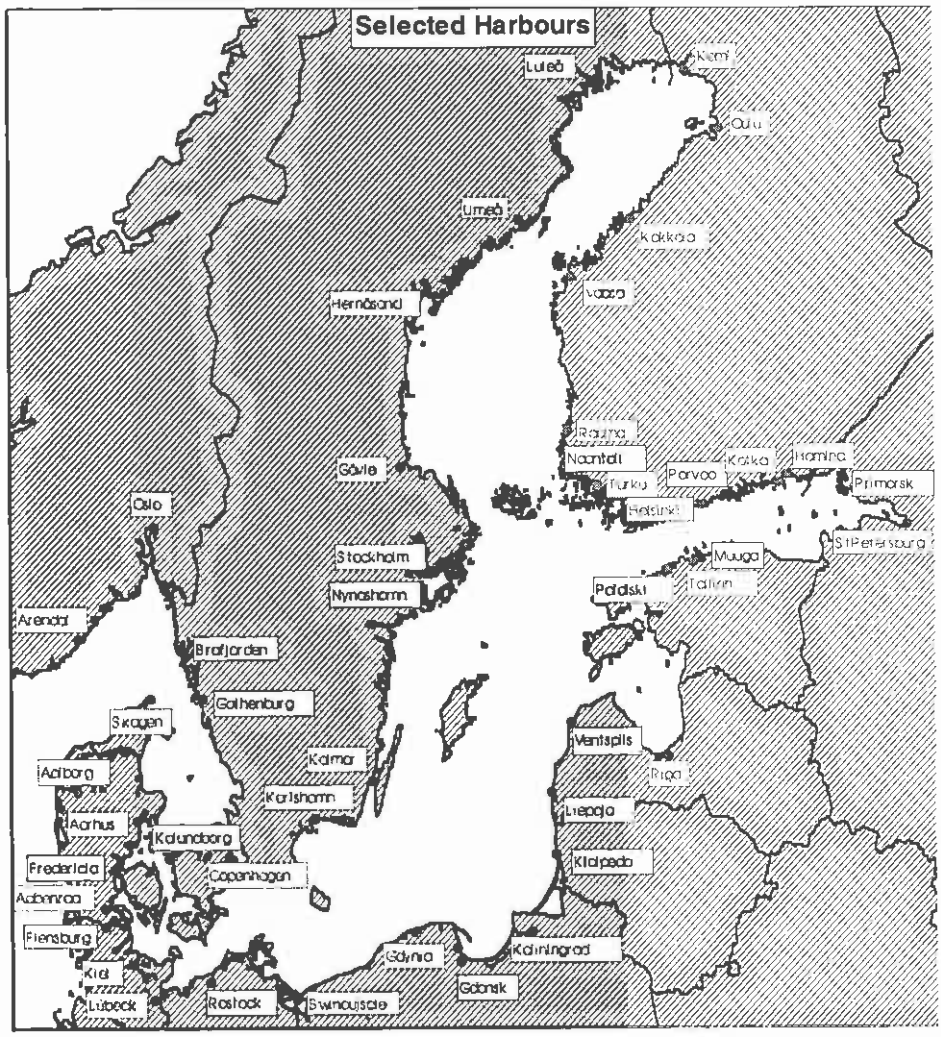


Figure 30. Selected harbors in the Baltic Sea. Harbors marked with blue handle more than 3 million tons of oil per year (COWI, 1998b).

Finally the movements of ships were plotted to the map, and schematic figures and columns were attached as shown below. Note: the figures do not include the ferry traffic of the Baltic sea area.

4.2 The Gulf of Bothnia

The new railway and improved road connections to the North –Western side of Russia may increase the shipping and transito traffic of the ports of the Gulf of Bothnia. New railway short cut between Kostamus and Kotskoma in Russia will shorten the transportation distance from Kola to the Bothnian ports by 500 km. There are a lot of sawmills and mines who might need transito services in the future. Logistically the distance to the European market area is even shorter from the Botnian ports than elsewhere from Baltic ports. Furthermore the Bothnian ports have a lot of free capacity to be used for transito.

Figure 31 represents the number of oil tankers in the Area I, i.e. in the Gulf of Bothnia in 2000. The left-hand side columns represent the ship movements with the selected ports, and the right hand side columns of all the tanker traffic.

Figure 32 represents the movements of tankers in the Gulf of Bothnia. Numbers near the selected ports represents tanker calls of the ports. There are two figures presented in the end of the arrow summarizing the amount of traffic going outside of the area. The figure in parenthesis represent the ship movements between the selected ports and the area outside the selected Area I. These two figures represent the yearly passages of the tankers in the boarder-line between Area I and Area III. Thus they represent both movement into the port and outside the port. This presentation has been selected for the other figures due to the fact it describes well the real traffic density of the selected boarder-line areas. In the point of view of the maritime safety issues, it is more realistic to have the number of ship passages in a certain points as the weight of the cargo transported. These transport rates are well presented elsewhere in this report.

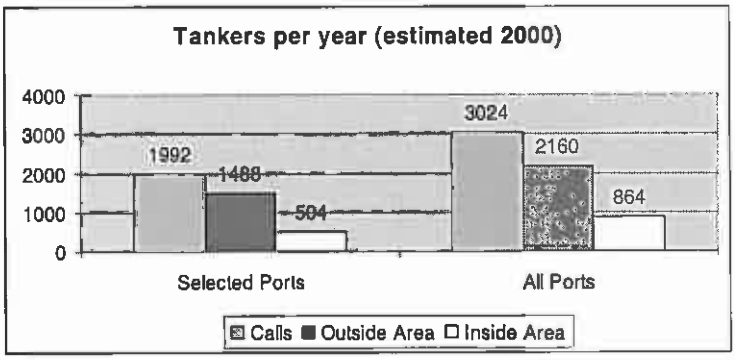


Figure 31. Estimated tanker movements in the Gulf of Bothnia in 2000.

Figure 32. The tanker traffic of the Gulf of Bothnia in 2000.

4.3 The Gulf of Finland

The curves and columns below represent the maritime transportation figures in the Gulf of Finland area. First the total transport rate in 2000 is presented due to the fact the most intensive maritime development in 1990s has been in the GOF area, Figure 33. Certain selected ports have two numbers: figures in parenthesis include the movements inside the port area. these movements may include loading of the ship in a certain berth and the movement of the ship into another berth of the port. Thus these numbers are bigger than the figures without parentheses. Then, in Figure 34 and Figure 35, the future oil tanker movements in the GoF are estimated.

It must be noted, that Figure 33 represent selected ports, thus the 29 544 passages near the mouth of the GOF is smaller than the total number of passages which was in 2000 near 34 000.

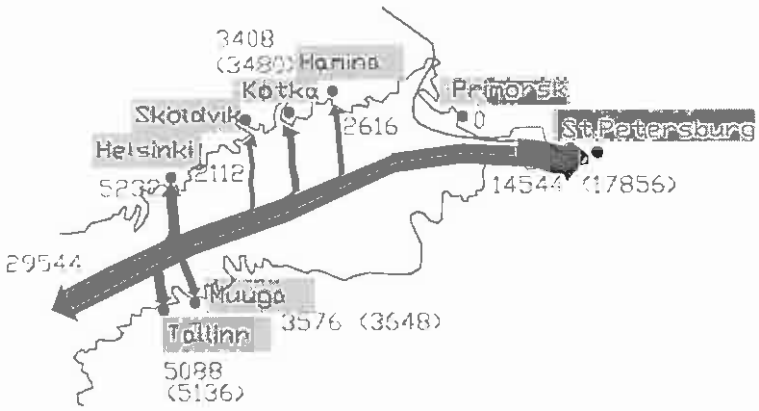


Figure 33. The total figures of the maritime transport in the Gulf of Finland in 2000 in selected ports.

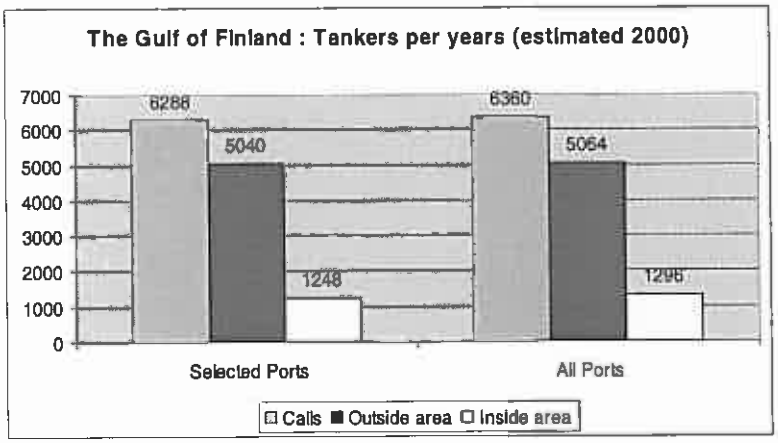


Figure 34. The columns representing oil tanker movements with the selected ports and all the ports (terminals in the Gulf of Finland) in 2000.

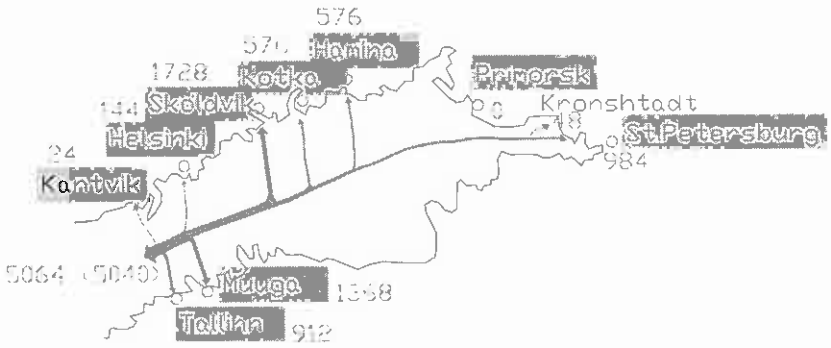


Figure 35. The oil tanker movements in the Gulf of Finland in 2000.

4.4 Central part of the Baltic Sea

The tanker movements of the area III is presented in Figure 36 and Figure 37.

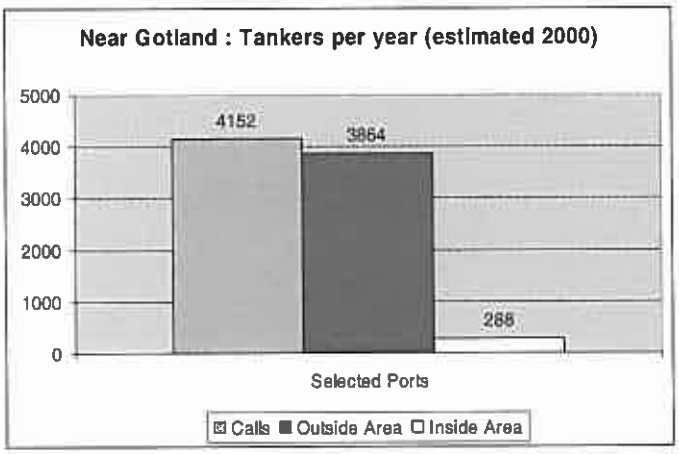


Figure 36. Oil tanker traffic in area III in 2000.

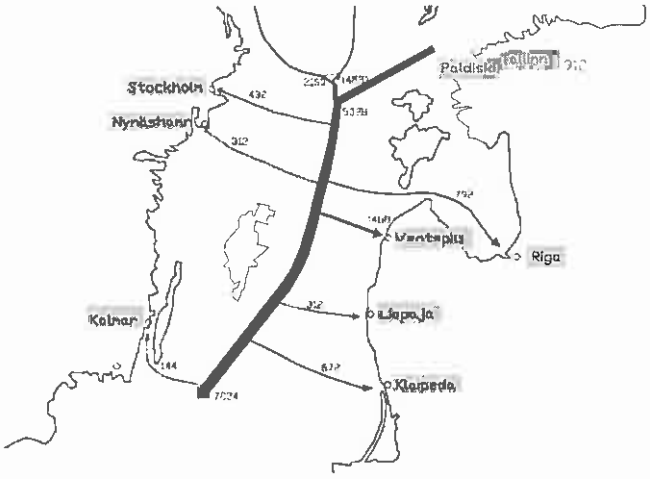


Figure 37. Tanker traffic in the Area III in 2000.

4.5 Southern Baltic Sea

The oil tanker traffic in the area IV, i.e. in the southern part of the Baltic Sea is presented in Figure 38 and in Figure 39.

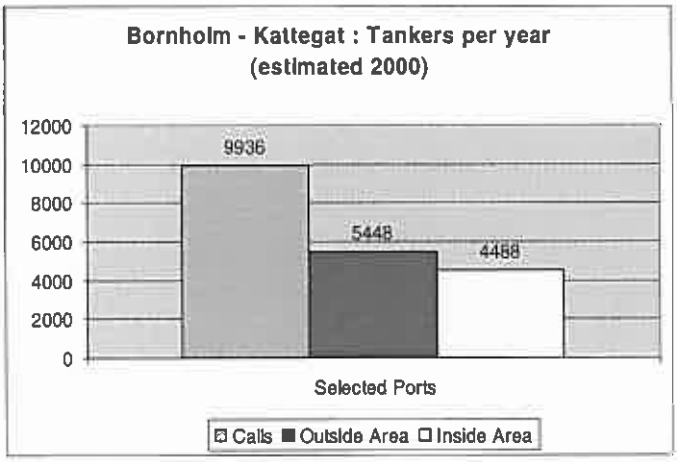


Figure 38. Oil tanker movements. Total calls, calls outside the area and internal traffic in 2001.

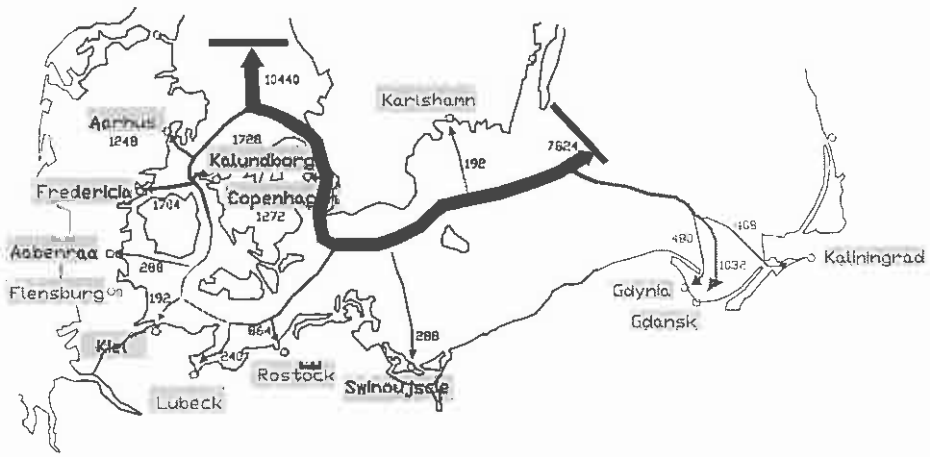


Figure 39. The oil tanker movements in the southern part of the Baltic Sea in 2000.

4.5.1 Danish Straits

In Figure 40 and Figure 41, the oil tanker movements between Kattegat and Skagerrak are presented (estimation).

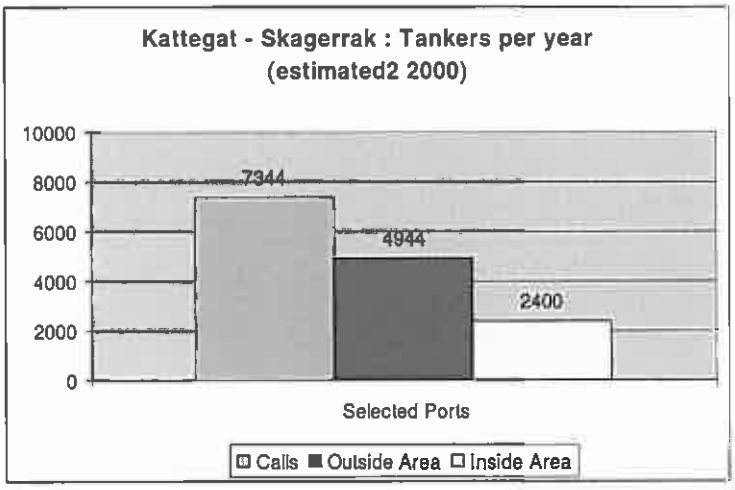


Figure 40. Oil tanker movements in Danish Straits in 2000.

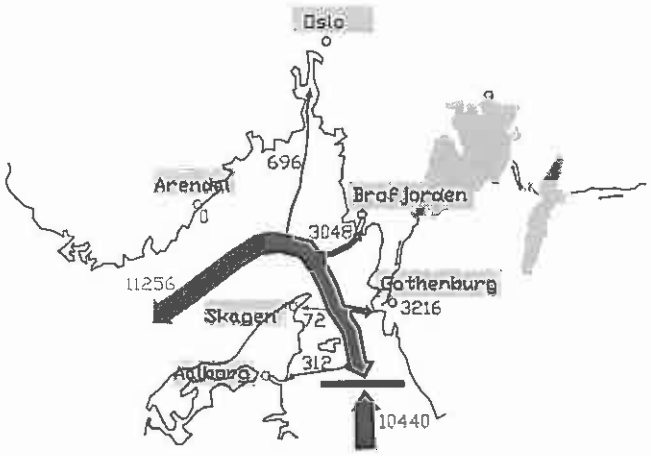


Figure 41. Oil tanker movements in area V in 2000.

4.5.2 Total seaborne traffic in 2000

The total movements of ships in 2000 is shown in Figure 42. The figure consists of all the ports excluding the ferry traffic. Numbers in the projections are listed in .

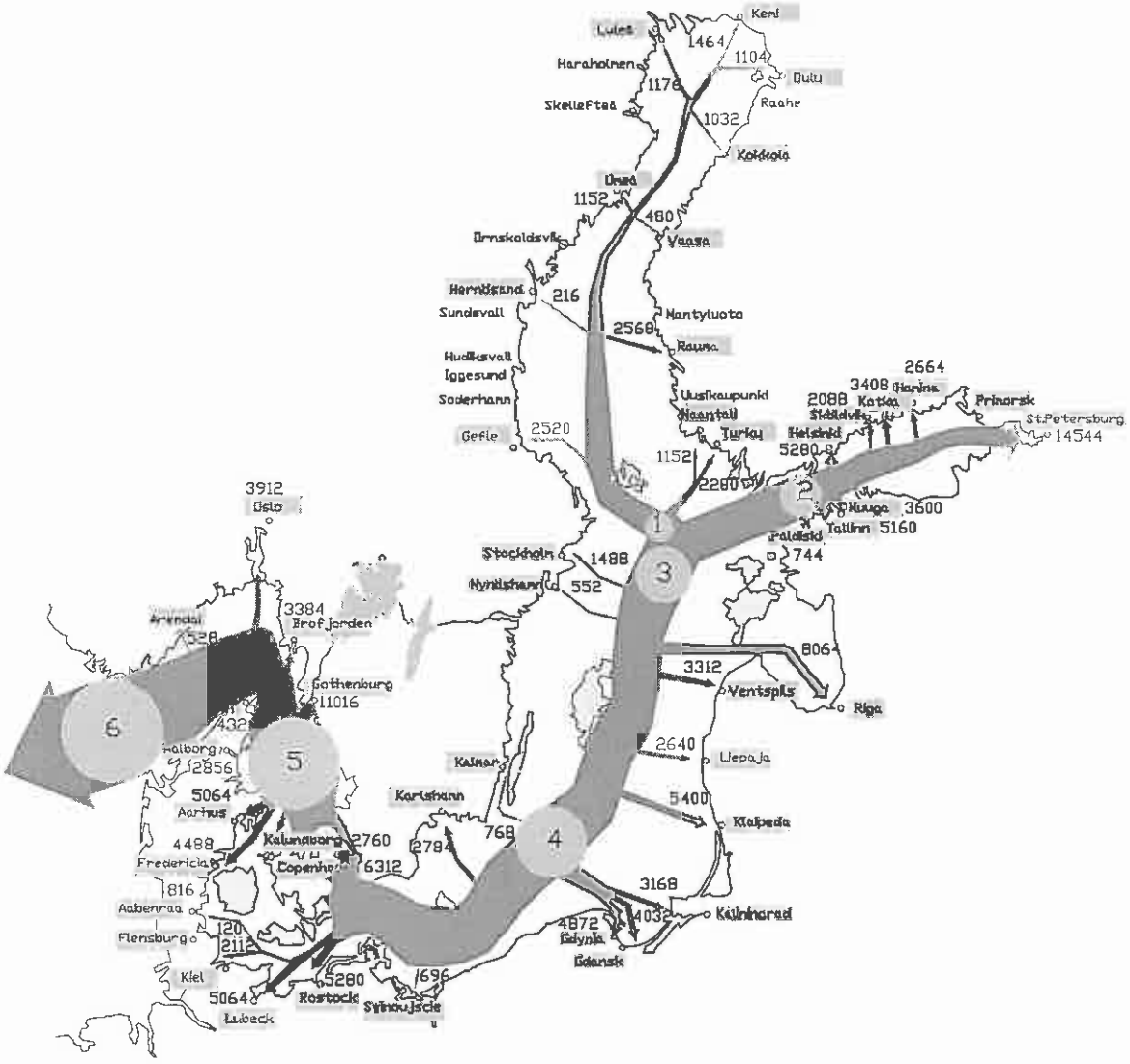


Figure 42. The total transport figures of the Baltic Sea in 2000.

Point	v.2000
1	23388
2	34692
3	46476
4	58500
5	75696
6	85296

Table 26. Numbers in the six projections.

5 Oil Transportation

Worlds oil production in 2000 was near 3 600 million tons. OPEC countries corresponded 42 % of this figure. Russia's product rate today is near 395 million tons, while the largest production takes place in the Middle East (31 %). More than 1 600 million tons was transported by tankers, and 420 million tons of this figure were refined oil products. The know oil reserves of the world have been near 140 billion tons since 1993, which corresponds around 40 years consumption with the current production level (Sjöfartens bok. 2002).

In beginning of year 2000 the world's tanker fleet consisted approximately 1 790 crude oil tankers having the capacity of 255 million dwt. Furthermore there was around 255 combi-tankers with the total capacity of 15 million dwt. These ships have the possibility to carry oil or ore or other bulk. The amount of tankers for refined oil products was around 5 220 with the total capacity of 44 million tons. Furthermore there were more than 2 500 chemical tankers and 1 126 ships for gas transportations, such as LNG ships (Svensk sjöfarts tidning, 2001).

The North European oil transport market is typically a medium or short haul area where for example Aframax type of tankers comes to fit into its own. The fleet of Aframax size tankers world wide is around 45 million dwt, but its share of the total tanker fleet has increased by 2,5 percent in the past ten years to a good 20 per cent (Arentz, 2002c). It is also younger than the average and the share of double hull vessels is a healthy 45 %.

Based on fleet data the 24,1 % of the Aframax fleet are five years old or less and around 21,4 % are between six and ten years. 27,7 %, nearly all of which are single hull are 21 years old or older. The current average age is twelve years and it will get younger quite fast. The Aframax delivery and order book world wide shows 34 vessels for the year 2002 and 57 ships having the total 6 million dwt capacity in 2003 (Arentz, 2002c).

Comparison with number of harbor calls

A spot check on selected harbors where annual number of calls in 1997 is shown in Table 27 below (COWI, 1998b).

Table 27. Comparison of the number of harbour calls in selected harbours (COWI, 1998b).

Harbor	Oil tankers		Total calls	
	Model	Reported	Model	Reported
Fredericia	592	844	1827	3044
Kalundborg	537	912		
Göteborg	1375	2550	4991	12691
Klaipeda	198	135	4672	7661
Gdansk	518	258		
Rostock	191	325		
Aabenraa	207	167		
Helsinki			2472	9229
Muuga	367	569	1878	2169
Hamina			1373	1563

The oil transportation development of the proper Baltic can be divided into two main areas: The Gulf of Finland and the Danish Straits. Due to the fact Russia is reconstructing the existing ports and terminals of the Eastern part of the Gulf of Finland, and building new terminals the most dynamic development is going on there. Also the development of Muuga may still continue, depending on the oil price development and the policy of the Russian oil companies. A new company will soon start reconstruction works of the new oil terminal behind the existing oil terminal area, and the oil transportation rate of the first phase is expected to be around 3 million tons annually. In 1997, oil tanker movements were distributed as presented below in Figure 43. Table 28 on the other hand shows the proportion of sea borne traffic in the Baltic Sea.

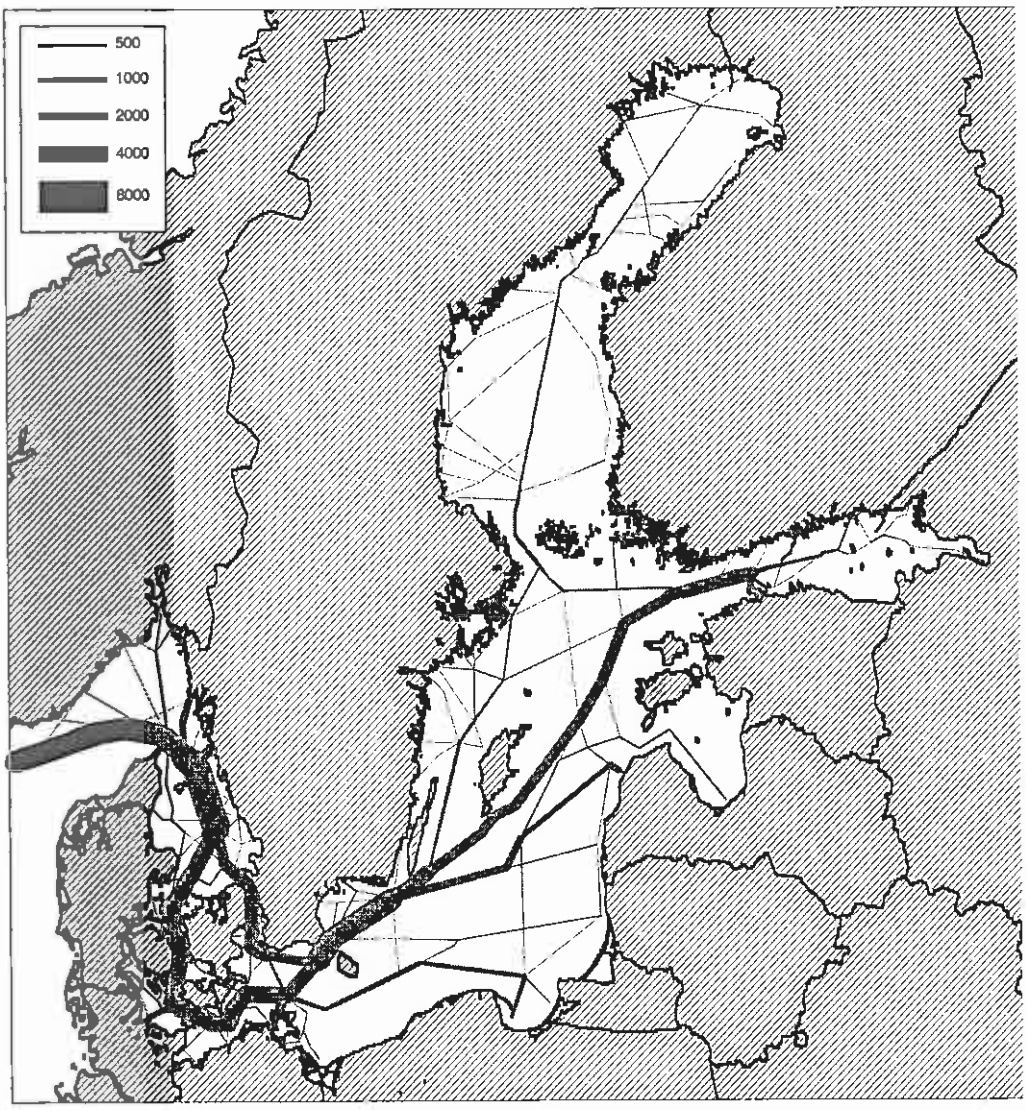


Figure 43. Distribution of oil tanker movements in 1997 (COWI, 1998b).

Table 28. Proportion of sea borne traffic in the Baltic Sea (COWI, 1998b). Data in 1994.

Commodity	Total volume of trade (Mio tons)	Volume in Baltic Sea (Mio tons)	Percentage
Break Bulk	168	29	17%
Dry Bulk	529	61	12%
General Cargo	159	22	14%
Liquid Bulk	26	1	4%
Oil	550	81	15%
Total	1432	194	14%

Source: Eurostat 1995 numbers and COWI's estimate. Eurostat includes the following information: Imports to the EC countries from a number of countries and Exports from the EC countries to a number of countries

Table 29 shows that the total amount of seaborne traffic was approximately 1.4 billion tons in 1995 of which roughly 15% is estimated to be carried fully or partly through the Baltic Sea. The above result on the volume of trade in the Baltic Sea is in accordance with formerly published EU figures.

Table 29. The development of the Gulf of Finland oil transportation between 1997 - 2000 (Semanov,2001).

Country/Port /terminal	year 2000	year 1997
Estonia / Muuga	17.8	9.2
Finland/Hamina	1.3	1.2
Porvoo	13.6	13.3 (other 5)
Latvia / Riga	3.0	1.3
Ventspils	26.7	19.05
Liepaja	0.1	-
Lithuania/Klaipeda	5.2	1.7
Butinge	3.5	-
Russia / St. Petersburg	7.5	3.5
Kaliningrad	1.1	0.3
TOTAL	79 - 85	54.5

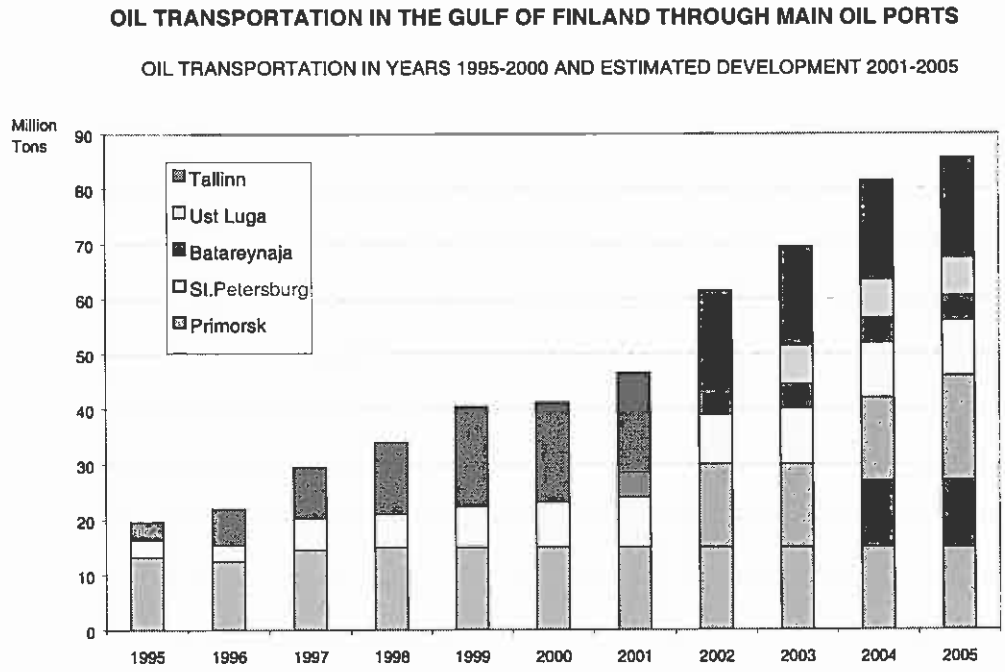


Figure 44. Estimated development of oil transportation in the Gulf of Finland (FEI, 2000).

The most significant oil export terminals are located in Norway and in Baltic countries. The Transneft's pipeline network covers NIC countries and reach the Baltic countries (Ventspils). Ventspils represents around 15 % of Russia's export outside the NIC countries. Klaipeda and Butinge in Lithuania are smaller oil terminals in spite the fact the Klaipeda has temporarily exceeded 100 000 bpd exports rate in 1990's. In the Gulf of Finland, the future is estimated as presented above in Figure 44.

The largest refineries on the Baltic area are Kirishi in Russia, Plock in Poland and Mazeikiai in Lithuania, Figure 45. The refinery capacity of Porvoo in Finland is near 200 000 bpd, i.e. around 12 million tons annually. Germany's refinement capacity is around 2.2 billion bpd, Norway's is 300 000 bpd and Sweden's around 420 000 bpd (Lausala & Varjonen, 2001).

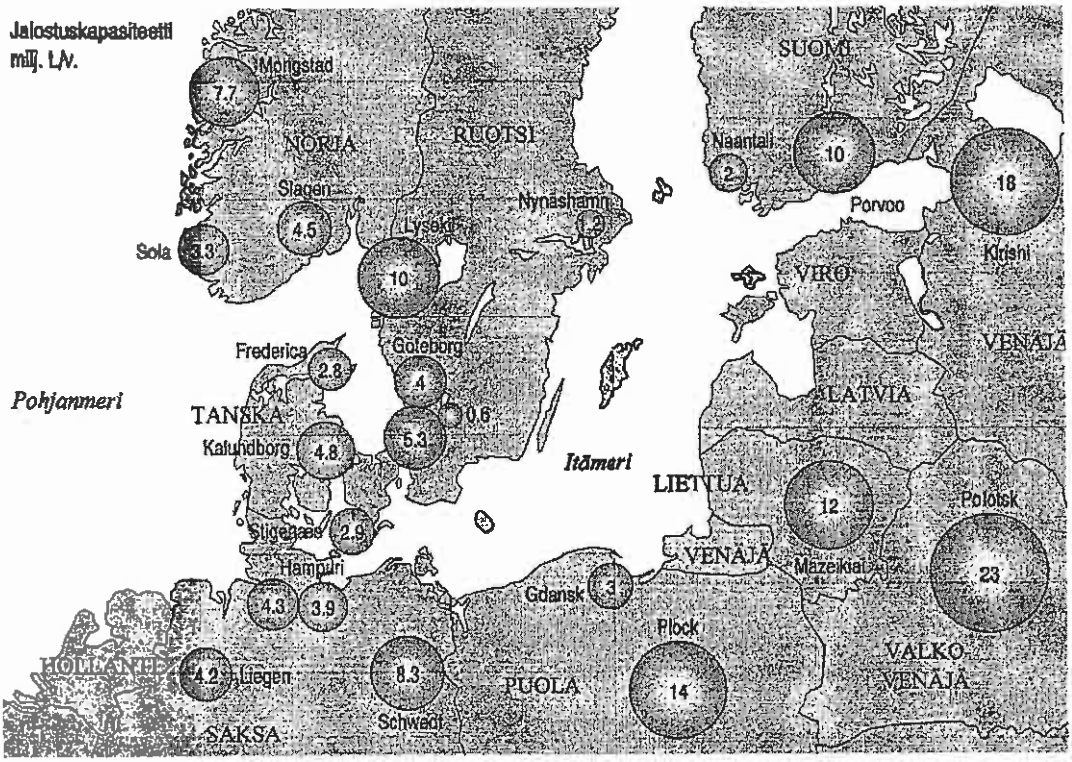


Figure 45. The largest oil refineries in the Baltic Sea region (Lausala & Varjonen, 2001).

In 1997 approximately 77 million tons was transported in the Baltic with 7 168 shipments. The largest part, 30 - 32 million tons, came from the east, originally from Russia. The largest oil export terminals were Ventspils (18.4 million tons), Sköldvik (5.1 million tons), Muuga (2.7 million tons), Klaipeda (1.7 million tons), Hamina (1.0 million tons) and Tallinn (1.0 million tons) (SSPA, 1996). When considering the amount of oil handling, the Sköldvik's oil volume rose up to 13.3. million tons while Venspils stayed near 19 million tons annually. Gdansk handled 6.8 million tons of oil, Muuga 3.3. million tons and Naantali in Finland 3.0 million tons.

5.1 Oil production in Russia

The crude oil production of Russia was 323,28 million ton in 2000 based on the official announcement of the Russian Ministry of Energy (Figure 46). The production figure was 5,97 % higher than in 1999 (305,06 million ton). The export rate of crude oil was 142,41 million ton in 2001 which includes some amount of crude produced in Azerbaidzhan, Kazakstan and Turkmenstan (Mannerjalustatyöryhmä, 2001).

Other oil producers, 112 enterprises	4,8 %
Lukoil	19,2 %
Jukos	15,4 %
Surgutneftegaz	12,6 %
Tatneft	7,5 %
Tjumen's oil company	7,3 %
Other integrated companies, 6 enterprises	23,3 %
Joint Ventures, 48 enterprises	6,6 %
Non-spezialized Governemental enterprises	3,3 %

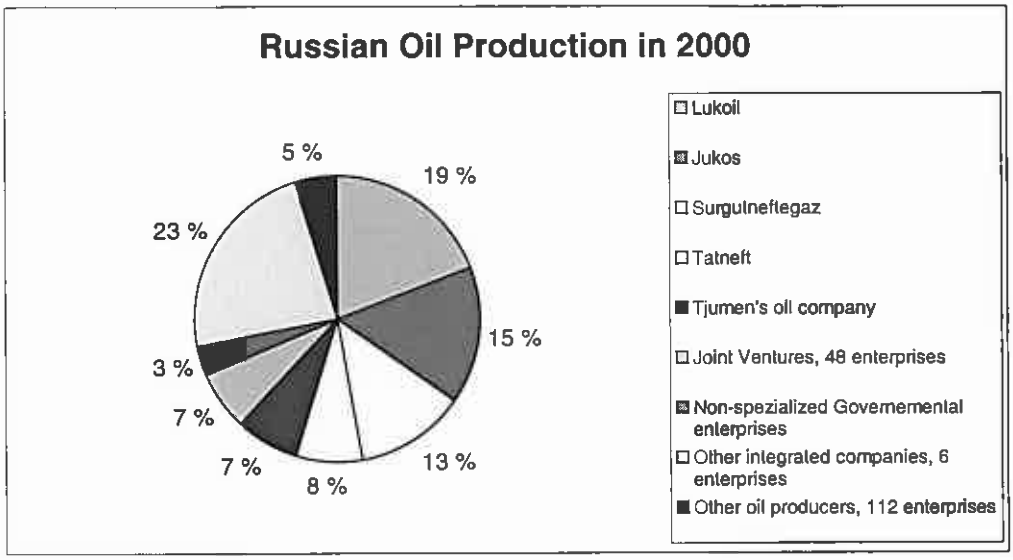


Figure 46. Russian oil production in 2000, total 323,2 million tons.

The Russian oil company Jukos and Williams of USA made a contract with the Lithuanian government in 2001 on the holding of the Mazeiku Nafta oil company. According to the preliminary contract Jukos should also invest to the modernization of the refinery station and quarantee oil delivery rate of 4 million tons annually for the following ten years for the Nafta refinery. Additional 4 million tons annually should be delivered to the Butinge oil terminal for the following ten years period, too (Mannerjalustatyöryhmä, 2001).

The second phase of the oil terminal construction will require a construction of the new parallel oil pipeline of 245 km, three new pumping stations and additional storage capacity of 400 000 m^3. The second phase will increase the annual capacity of the terminal from the current 12 million tons up to 18 million tons. The second phase will be terminated by the end of 2002. The proposed future capacity can be near 30 million tons.

The Caspian Pipeline Consortium's (CPC) new pipeline from Tengitz to Novorossiisk was finalized in 2001. The new pipeline is 1580 km long and has a capasity of 28, 2 million tons in the first phase. The capacity will be gradually increased up to 67 million tons annually.

The design tankers to transport oil from the Russian oil terminals in Black Sea are large oil tankers of Novoship and Sovkomflot. The CPC try to decrease the oil transportation risks by using douple hull tankers (Suezmax) and having pilotage through the Bhospor strait. Additional transit fees of the Turkish Government to use the Bhosphor Strait may rise the transportation fees, thus other more economical transport alternatives are under studies. Proposals to construct a pipeline from Romanian Constanta to Trieste in Italy has been discussed in this connection (Mannerjalustatyöryhmä, 2001).

Another major oil transportation route can be the proposed oil pipeline from Nenets oil fields to Indiga (Barents Sea area). This pipeline in the northern Russia may have the transfer capasity of 30 million tons.The proposed schedule of the project is complete the first phase in 2003. The transport capacity will be 10 million tons in 2005 . The full capacity of 30 million tons would be in operation in 2010. Another proposal in the North Western area is LukOIl's new terminal proposal near Murmansk.. LukOil has already a terminal in Varandein.

Russian government approved the new programme to exploit natural resources in August 2001. According to the programme the annual oil production rates of Hanti-Mansi and Jamal-Nenets will be 220 million tons up to the year 2010. The annual oil production rate of Nenets, Barents and Kara Sea offshoe fields will be 40 million tons, and Sakhalin area around 20 million tons.

There are also proposals to start offshore oil production in the Baltic Sea area. The known offshore oil reserves near Kaliningrad are 24 million tons. This (Kratsovskoye) oil field locates around 40 km offshore from Kaliningrad in the water depth of 30 m.

The Port of Ust Luga is free of ice around 250 days per year. The entrance channel will de deepened to –14.0 m which enables the use of 75 000 dwt bulkers fully loaded. The new ferry line between Ust-Luga and German ports are under design. This new line will be financed by the EBRD Bank.

The Russian Railroads Ministry and Oil Company LUKoil have signed a cooperation agreement stipulating the delivery of crude oil inside railroad tankers to an oil-export terminal on Vysotsk island. Plans are in place to use this terminal for exporting oil to the Western Europe and the United States. Five million tons of oil will be delivered to Vysotsk from Siberia over the 2003 – 2004 period. The total annual capacity will be 10 – 12 million tons by the year 2005 (Russian Economic News, 26.12.2001).

The Primorsk oil terminal's location in the eastern part of the Gulf of Finland requires special arrangements for the winter time. Already the first oil tanker (MT Petrokrepost) visiting Primorsk oil terminal in December 2001 needed a lot of icebreaking assistance after loaded and starting her voyage from the port. The departure scenario included also an impressive and expensive icebreaker convoy (Kroutikhin, 2002). Ice cover for 120 days per year, shallow waters and abundance of small islands along the approaches to the terminal make Primorsk a challenging location for large tankers.

There has been a lot of speculations on the economics of the Primorsk terminal. The main argument is the transito money Russia is now paying to the Baltic counties will remain in Russia. The fact is the maximum loading fee at Primorsk plus the port dues made $ 4,58 per ton in December 2001. The corresponding figure for Ventspils was $ 4,7 per ton. In spite of the apparent benefit, the other expenses tip the scales in favour of the Latvian route: Shipping costs are more expensive and the need for ice breaking assistance during the winter time is higher in Primorsk.

However, now also LUKOil is building up a new terminal, Vysotsk, to the end of the Gulf of Finland. here the favourable rail tansport fees might be one part of the story the other part being the getting an independent oil route. It should be remembered, that a special additional tariff of $ 1,43 for each ton oil shipped via Transneft's pipelines was launched by the Government in order to finance the Baltic Pipeline System's pipeline (Kroutikin, 2002).

LUKoil's new terminal in Varandei will also give some advantage to the oil company. The costs of delivery to Rotterdam for example from varandei is according to LUKoil $ 18 per ton if 20 000 dwt tankers are used, and only $ 11 in the case of shipping oil in 60 000 dwt tankers. On average, this is only 40 % of transportation costs via the BPS or Ventspils. Thus, it is likely, that economics may change the develeopment scnenarios a lot in a longer term.

Currently the Varandei terminal is capable of exporting 1,2 million tons per year, but LUKoil is planning to expand it by 2005 to accomodate up to 7,5 million tons of Timan-Pechora crude oil (Kroutikhin, 2002). The estinated costs to reach 7.5 million tons boarder line is $ 200 million, and upgrading Varandei's annual loading capacity to 30 million tons requires another $ 1,5 billion.

LUKoil is also recently published new plans to build up a terminal near Murmansk for loading oil intgo ocean-going tankers. This plan has encountered a positive reaction of oil producers in northern Russia. However, this proposal faces competition from Gazprom, which advocates a similar terminal in Pechenga (Zhuravlev, M. & Simonenko, R. 2002).

The new Russian oil terminals and designed rehabilitation projects of exisisting ports will affect on the main oil transport routes also in the Baltic Sea area. Surgutneftegaz is building the oil terminal in Batareinya, the St. Petersburg Sea port is expanding its capacity to handle petroleum products, Ust-Luga and Primorsk oil terminals are in operations and expanding, new Vysotsk terminal will be in operation in 2003. Furthermore Varandei and other possible new terminals in the North-western Russia may change the view a lot. Even the Kandalaksha port in the White Sea may have more importance when transporting gasoline, diesel oil and furnace oil from Russia and Kazakhstan.

In a long term The Russian new transport and loading capacity will decrease the transito oil traffic through the Baltic countries. However, here the Baltic ports can compete with the port dues and loading tariffs. It is also fact, that now larger export capacities are alrfeady impacting Russia. two year ago producers were able to export roughly 35 % of their oil and had to sell rest at the domestic market at low market prices. In 2001 they could sell up to 38 – 40 % of production abroad, and even more in the future. Thus, if the annual production rate will still incease by 10 % and the markets to export oil are favourable the scenario where also the Baltic transito terminals keep their current volumes up to 2010 is possible. This scenario means the main oil routes in the Gulf of Finland and in the Danish Strait will be more crowded than expected in this report. This increase may by more than 20 % in connection of the oil transportation and the number of ships passing certain points under discussion.

The oil production development of the Caspian area may and will also influence on the Baltic Sea development. Table 30 and Table 31 show the forecasts for the Caspian offshore oil production development and the total export rate of the area up to 2015. These development figures are huge and may dampen the expected increase of the oil transportations along the Baltic Sea area.

Table 30. Oil [million tons] and gas [bln m3] production rates at Caspian offshore (Gribov,S. 2002).

2005		2010		2015	
oil	gas	oil	gas	oil	gas
5	3	30	12	150	17

Table 31. Forecast of the exported oil in million tons from the Caspian region (Gribov,S. 2002).

Country	2005	2010	2015
Azerbaijan	25	50	45
Kazakhstan	46	80	170
Turkmenistan	2	10	15

There are a lot of different scenarios, which all have slightly different assumptions on the development trends and the future oil transportation rate. The past Baltic Oil Pipeline project (BOPS) consisted of the construction of the Primorsk oil terminal, pipeline alternatives bringing an additional 30 - 40 million tons of Russian oil to the markets. The project included also an analyses to continue the oil pipeline from Primorsk to Sköldvik in Finland to be further transported as transito oil.

An other project parallel to BOPS was the Western Pipeline Network (WPN) to build up a new pipeline from Polotsk of Belarus to Ventspils. The new pipeline connection will increase the capacity by 18 million tons. if constructed this would increase the Ventspils capacity up to 57 million tons annually.

The objectives of the Northen Gateway Project, NGP is to construct oil pipeline network and the terminals to the Pechora coastline, in order to pump the oil of the Timan-Petchora region to the markets. The sea transport would be arranged by ice strengthened tankers of 25 000 - 30 000 dwt. For the overseas transport the oil will further upload into the 300 000 dwt tankers. A suitable unloading/uploading place would be the Pechanga Bay near Murmansk which is open bay also during the winter area (Jolma, 1999).

Perhaps the most urgent construction or rehabilitation need exists with the poor condition of the main pipelines. The main pipelines go in east-west direction from the Siberia to the eastern part of Europe. The main pipeline "Druzhba" had a capacity of 55 - 60 million tons annually. The sub pipeline to Ventspils can carry 16. 5 million tons, and the southern sub line leads to the Black Sea terminals, Novorossiik and Tuapse, and furthermore to Odessa in Ukraine (Jolma, 1999).

6 Future development

6.1 Transportation development

There have been published several forecasts on the transport development of the Baltic Sea area. The general trend, i.e. the growth of the maritime traffic is expected to continue, as stated in (COWI, 1998b) and presented in Table 32.

Table 32. Expected growth in volume of trade in the Baltic Sea from 1995 to 2017 (COWI, 1998b).

Commodity	Volume in Baltic Sea (Mio tons)	Estimated future volume in Baltic Sea (Mio tons)	Growth from 1995 to 2017
Break Bulk	29	82	186%
Dry Bulk	61	113	84%
General Cargo	22	64	186%
Liquid Bulk	1	2	84%
Oil	81	112	39%
Total	194	372	92%

Source: COWI's estimate

Table 33 shows that the volume of maritime traffic is expected to double in average, with a growth by a factor of three for general cargo and break bulk. Oil transport is only estimated to grow approximately 40 %. This might be a slight underestimation, since the trade with oil from Russia may potentially grow even more.

Table 33. Average annual growth rates (COWI, 1998b).

Cargo Type	Average Annual Increase (%)
General Cargo, container, Reefer, RoRo	4.7%
Bulk	2.2%
Bulk/Oil, Oil, Gas	1.4%

During 1992-1997 there has been an average annual growth rate of 8% in the eastern harbors of the Baltic Sea. According to Ref (COWI, 1998b)this large growth is assumed to moderate over the coming years and the growth rates shown above seem plausible for the Baltic region as a whole.

In order to understand the possible development trends some of the main factors affecting on the development are discussed below.

Prognosis for the following decade up to 2015

The average number of calls in Finnish ports (Hamina, Kotka, Loviisa, Helsinki, Inkoo and Hanko) has been estimated to be 14 500–15 000 per year in 2015. If the capacity of Russian seaports will then reach 100 million tons, and Estonia 25–35 million tons, the rough estimate for the Gulf of Finland would then be 35 000–38 888 port calls per year, i.e., 100–120 calls per day. Due to the fact that traffic is not evenly distributed throughout the year, there will be days when the traffic density of the Gulf of Finland may easily be more than 250–350 calls per day.

It is a fact that tanker size has increased for oil transportation; for example, the average tanker size visiting the port of Muuga was 19 000 tons in 1998, but in 1999, it was already 23 300 tons. This year (May 2001), the average tanker size was already 41 900 tons, and will probably increase even further, which is why a new pier for two 130 000 dwt tankers is being designed.

If the average annual growth rate varies between 2–7%, the following statistics can be calculated, based on the statistics of Table 34. Here it has been assumed that the average long-term growth rate for Finland, Sweden and Germany is 2%, for the Baltic countries and Poland 4%, and for Russia 7%. The Russian growth rate is mainly based on expectations for oil transportation.

Table 34. Prognosis for maritime traffic in the Baltic Sea area in 2015 (VTT, 2001).

Country	***Total loaded and unloaded [million ton]***	***Total loaded and unloaded in the Baltic Sea area***
Sweden (2%)	200.5	108.0
Finland (2%)	125.0	80.0
Russia/Baltic (7%)	80.0	55.0
Estonia (4%)	48.5	19.5
Latvia (2%)	60.5	24.0
Lithuania (4%)	20.5	10.5
Poland (4%)	90.0	36.0
Germany/Baltic (2%)	76.5	95.5
Denmark (2%)	138.0	55.5
Norway (2%)	132.5	56.0
TOTAL	972.0	540.0

6.1.1 Oil tanker movements in 2015

The forecast of oil tanker movements in 2015 is shown in Figure 47. The general assumption has been made, that the maritime transport development will continue as stated in Table 34. Thus the annual growth rates vary between 2 and 7 % depending on the country or port under survey. The most rapid growth of the oil tanker traffic is assumed to take place in Russia and in Baltic Countries. It is also assumed, that due to the increased demands for energy in all the baltic countries, the oil transportation will increase in all the Baltic Countries, at least in the minimum level of 2 % annually.

Also it has been assumed, that 40 % of the new Russian oil transportation will stay inside the Baltic Sea area, and 60 % will go outside the area. The proposed increase of the oil transportation of the new oil terminals is based on the following assumptions:
- Primorsk oil terminal will reach 24 million tons in 2015,
- Batareinya oil terminal will be in operation in 2015 with the annual throughput of 6 million tons,
- St Petersburg Sea port will have only moderate growth of oil transito, increment arround 2 million tons in 2015 compared to the level 2001,
- Port of Muuga will grow in spite of the Russian own terminals. The new terminal proposal (seventh terminal of the area) will bring 2 - 4 million tons of oil additionally to the figures of 2001, thus it is more likely the Muuga Port may still have a growth, but later the development will slow down. The increment up to the 2015 has assumed to be 6 million tons compared to the current situation,
- Riga, Ventspils and Liepaja will have increments of the annual oil throughput of 2.2 and 0.4 million tons, respectively and
- Klaipeda and Butinge will have 3.0 and 5.5 million tons increments cmpared to the current situation.

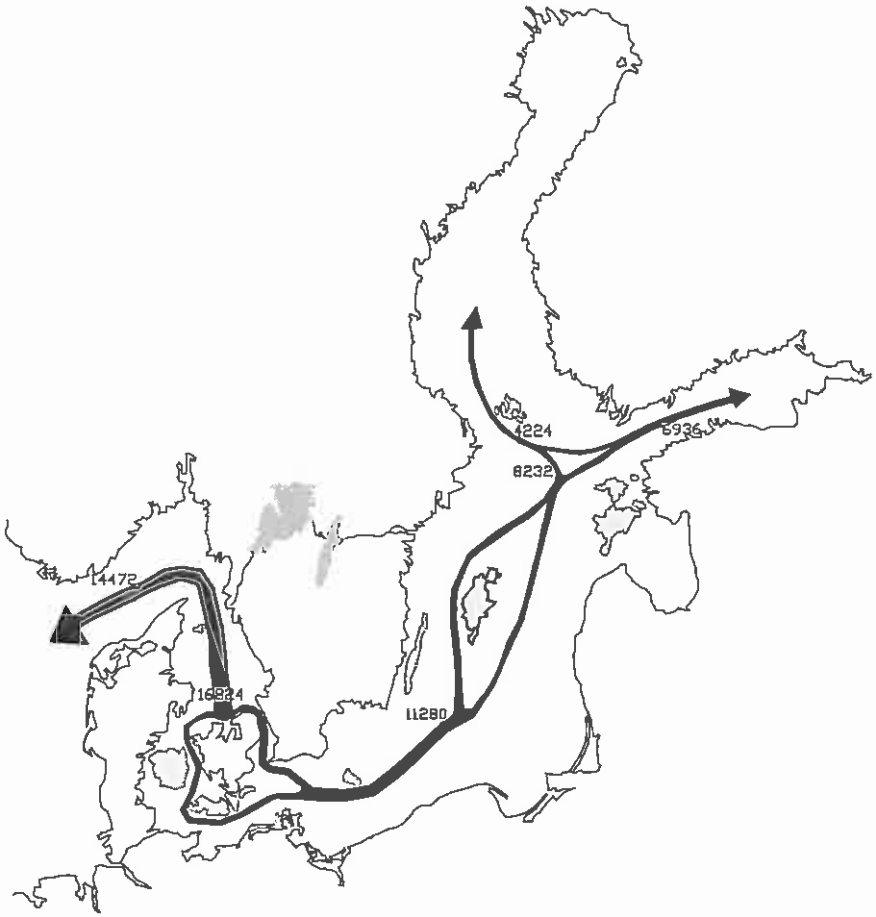


Figure 47. Forecast of the oil tanker movements in 2015.

For oil transportation in certain ports the following prognosis can be presented for up to 2015, Table 35:

Table 35. Prognosis for the oil transportation volumes of certain Baltic oil terminals in 2000 and 2015.

Country/port/terminal	*In 2000*	*In 2015*
Estonia/Muuga/Miiduranda/etc.	17.8	24.0
Finland/Hamina	1.3	1.5
Finland/Porvoo	13.6	15.0
Latvia/Riga	3.0	5.0
Latvia/Ventspils	26.7	30.0
Latvia/Liepaja	0.1	0.5
Lithuania/Klaipeda	5.2	8.0
Lithuania/Butinge	3.5	8.0
Russia/St. Petersburg	7.5	10.0
Russia/Primorsk	-	24.0
Russia/Batareinya	-	6.0
Russia/Kaliningrad	1.1	2.0
Total [10^6 tons]	79.8 million tons	134.0 million tons

As can be seen, the annual oil transportation volume should exceed 130 million tons in 2015.

6.1.2 Preliminary risk assessment for the Gulf of Finland

The marine traffic between Finland and Estonia has grown significantly during recent years. The figures for passenger traffic increased in the period of 1983–1995 by 23-fold. For example, there were more than 6 million passengers between Finland and Estonia in 2000. Also the longitudinal traffic along the Gulf of Finland is great, and will increase during the next 10-15 years, after the new terminals and port rehabilitation have been completed both in Russia and Estonia.

An interesting feature of the development has been the new fast catamarans and hydrofoils together with the traditional car ferries. The fast catamarans only run during open water season. They cannot be used in ice conditions or in heavy weather, even in open water season. There are, however, more than 30 port calls a day between Helsinki and Tallinn in summer. The intense sea traffic may decrease, at least temporarily, when Estonia enters the European Union. The free capacity of the transportation vehicles may then be transferred to other routes, for example, to other Baltic or Russian ports.

Another feature that has changed the traffic image of the central part of the Gulf of Finland is the sea-borne traffic between Sweden and Tallinn. During recent years, the increase in traffic has been significant; in 1980, turnover was over 3 million tons; in 1997, it was already at 9 million tons. It has been estimated that this rapid growth will continue, but it will stop soon and reach a level of 6–9% of the total marine transportation volume for Sweden. This would equal approximately 10–15 million tons annually (VTT; 2001).

After the accident of MT Erika near the French coastline, followed by a chemical tanker accident, and later the ship collision in March 2001 (Baltic Carrier's oil spill), a strong debate has been carried out in the EU to find out methods of improving maritime safety and protecting the environment against oil spills. The Union's traffic ministers, for example, discussed safety matters on the tighter control of classification societies, ship structural matters and port state control 28 March in Brussels. The establishment of the European Maritime Safety Agency is also under progress, and at the HELCOM level, the safety issues were discussed in the special ministerial meeting in September 2001.

6.1.3 Ship routing and mandatory reporting system of GOF

The design work has been completed as a joint technical working group between Russia, Estonia and Finland. The Finnish work has been coordinated by the Ministry of Traffic and Communications. The Finnish Maritime Administration appointed two working groups to finalize the plan according to the Finnish point of view.

The work will be presented to the international working group in November 2001. After the international working group has evaluated and studied the proposal, the proposal will be left to IMO in February 2002 for further measures. The new routing and mandatory reporting system should come into force in 2004, after which all ships of 300 gross tonnage or over on voyage to GOF ports or on voyage between GOF ports through the reporting area (Figure 48) must report to the authorities. The contracting states will agree on the information requested. The eastbound vessel traffic will report to Tallinn VTS Centrer and the westbound traffic to Helsinki Traffic Center. The reporting format contains basically the same data that can be accessed later on from AIS, which will be an acceptable means of giving the report. The System will cover the international waters of the GOF eastward from 022°30' E.

HELCOM's Extra-Ordinary Ministerial meeting 10 September in Hamburg pointed out the importance of creating a ship routing and mandatory reporting system to improve maritime safety. The new system will enhance the safety of navigation by reducing the risk of collision or grounding and thus protect the fragile ecosystems of the Gulf of Finland.

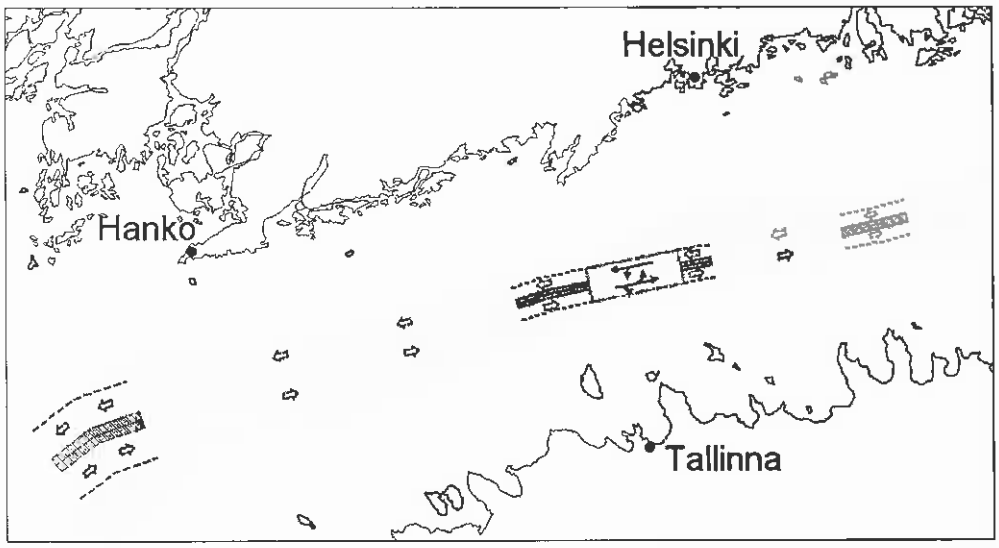


Figure 48. The mandatory routing system proposed for the Gulf of Finland starting in 2004. The routing system is part of the VTMIS system for the Gulf of Finland.

6.2 Passenger traffic development

The main routes for the passenger traffic have been traditionally between Finland – Åland, Finland – Sweden and Finland – Estonia (especially after the disintegration of Soviet Union) and Denmark – Germany and Denmark – Sweden. The Great Belt bridge may change the water borne passenger traffic figures between Sweden and Denmark in the future, as has been happened in the traffic between UK and France after the Eurotunnel. A new fast Ropax line has been opened between Germany and Finland (Hanko) recently.

In 1998 level more than 40 million tones of cargo are transported on the main international ferry routes. This means approximately 1.8 million trucks and trailers and 350 000 railway wagons. Also more than 50 million passenger are using international ferry lines annually. For example the ferry lines between Helsinki – Stockholm and Helsinki – Tallinn represent around 10 million and 6 million passengers annually, respectively.

Other main passenger links are Denmark – Sweden and Denmark – Germany. These main links together with the Finland – Sweden – Tallinn represents around 40 million passengers annually. The busiest link has been the Öresund area between Sweden and Denmark around 18,9 million passengers in 1998. Other passenger links are Gothernburg – Fredrikshavn and Varberg – Grenå.

Between Denmark and Germany main route is between Rödby – Puttgarten or Gedser – Rostock, around 9 million passengers annually. Swedish – German traffic is concentrated in the ports of Trelleborg, Gothenburg and Malmö in Sweden and Rostock, Travemunde and Sassnitz in Germany (Ingo, S et al. 1999).

Depending on the distance of the sea link, ferries vary in size and type. Car ferries between Helsinki and Stockholm or Turku and Stockholm are luxurious ships with a lot of cabins, restaurants and attractions for passengers. Simultaneously these ships can transport a lot of cars and trucks. Also the new Ro-Pax type vessels between Hanko in Finland and Rostock in Germany have much more room for the passenger comfort compared to the ships of older generation. The changes in regulations concerning duty free sales or bridges are the main driving forces affecting on the

passenger traffic. The bridge over the Great Belt was opened in July 2000, and a lot of traffic and cargo which before was transported via ferries are now going by trucks over the bridge.

The EU duty free rules have also led to the development that passenger ferry traffic in the Gulf of Bothnia has decreased a lot. The link between Vasa – Umeå was even closed, but has been reopened with a certain subsidization of the governments of Sweden and Finland. Other threatened or already closed ferry links have been Halmstadt – Grenå, Skellefteå – Jacobstad, Bagenkop – Kiel and Gothenburg – Copenhagen (Ingo, S. et al. 1999).

Traffic to the non-EU countries has been continuos and the duty free sales has given a big deal of the share of the shipping companies. Due to the new regulations the formerly direct links between Sweden and Finland are routed via the Åland Islands. New ferry routes having a good forecast for more intensive traffic are Stockholm – Riga, Karlshamn – Liepaja, Frederica – Klaipeda and Århus – Klaipeda routes. Expansion with the existing routes from Sweden to Poland is also expected.

Ingo et al. 1999 has made an estimate that the passenger traffic will decrease in the near future. The figures of the southern Baltic and Öresund have already declined slightly since the beginning of 1990. The abolition of the duty free sales will decrease the total passenger volume of the Baltic Sea from the level 96 million passengers to the level 75 million in 2005. However, if the duty free-sales would continue the traffic figures can stay in current level. In other words, if the shipping companies can find compensating routes for the ex-duty free lines, the passenger traffic will not decrease as stated in the forecast above.

Last year the passenger traffic between Tallinn and Helsinki was around 6 million passenger. This figure is not expected to grow anymore. After Estonia would be the member of EU, the passenger traffic will decrease due to the disappearance of tax free shopping. However, in a short term this apparent decrease on the passenger traffic will be transferred to other routes, i.e. to other Baltic Countries and Russia.

Passenger ferries transport also a large amount of lorries and trucks with high value goods. A ferry is more expensive to operate than a conventional RoRo-vessel, which in turn is more expensive than a LoLo-vessel. When the distance increases the competition with the airlines or even longer land routes increase.

Ferries usually sail according to a certain timetable where the arrival and departure times have been fixed to suit well for the customers, both passengers and the truck traffic. Due to the fact the statistical presentation above does not include passenger traffic (car ferries), the following chapter will highlight this side of the traffic development:

The two main routes for passenger traffic have been the links between Finland and Sweden and Finland and Estonia. The amount of passengers from the ports of Turku and Helsinki to Stockholm and Kapellskär was nearly 10 million passengers in 2000. In the route Helsinki – Tallinn the figure has been around 6 million in 2000. These figures are not expected to grow anymore. By the year 2004 the allowed amount of alcohol imported by the passengers is lifted in Finland to the same level of other countries, and as a result the sale income of the passenger ships may be cut. Ref. (Venäläinen & Viitanen, 2001) suggest even 15 – 25 % decrease in shipping capacity, which may be realistic after Estonia after joining EU will loose the tax free sales. The greatest share of a passenger ship's gross income consists of sales income from restaurants and shops. This fact combined with new taxation policy will encourage shipping companies to establish new routes between EU countries and other Baltic countries and Russia. Thus it is expected, that the passenger traffic volume in Finland will remain in its current level also in the future.

In Estonia the EU membership and good relationship with Russia can increase the passenger traffic figure significantly in the future. All the scenarios presented in (Venäläinen & Viitanen, 2001) show growth figures 120 % up to 300 % up to year 2010.

Other Baltic countries will have more moderate growth figures than Estonia. The most intensive growth will be taken place in Riga in Latvia where the 0.5 million passenger rate in 1998 is expected to rise up to 1.4 million passengers in 2020. This might be underestimated, especially when Estonia will join EU, and the ferry companies will find out alternative routes to keep their competitiveness as good as possible.

In the southern Baltic the most intensive growth rate of the passenger traffic is expected to take place in Poland, where the passenger traffic is forecast to more than double by the year 2020. Both Gdansk and Gdynia is expected to get more importance as passenger ports. The 1.6 million passenger level in 1998 is expected to exceed 2 million in 2010 and to reach 2.4 million passengers in 2020.

6.3 General cargo transport development

The total traffic forecast for Sweden is expected to be 27 % from 1997 to 2010, which gives the average annual growth rate around 1.9 %. The biggest growth is expected to be in road transportation, while railway transportation growth is assumed to be lowest. The maritime transport is expected to grow by around 20 % between 1997 and 2010, thus the annual growth rate near 2 % is well supported also by the Ref (Venäläinen & Viitanen, 2001).

Reference (Venäläinen & Viitanen, 2001) estimates Finnish maritime transport to reach the level 110 million tons annually in 2010 and to be close 130 million tons in 2020.

Latvian maritime transports are forecasted to double by the year 2020, which would equal around 120 million tons by the year 2020.However, the prognoses presented in (Venäläinen & Viitanen, 2001) expect, that the Ventspils oil terminal will increase its throughput significantly, in spite of the new Russian oil terminal developments. Ventspils oil terminal of the 22.1 m tons in 1998 is expected to reach 55 million tons in 2010 and 75 m tons in 2020. This might be overestimated due to the Russian own terminal and port developments. However, Riga and Liepaja will have a good potential for a higher growth rate due to the following reasons:

- free territories will attract investors,
- rehabilitation and modernization of infrastructure,
- new terminals,
- passenger and cargo development in Riga,
- good geographical location and
- advantageous conditions for industry.

As in Latvia the expected maritime transport rate is expected to increase significantly. Ref (Venäläinen & Viitanen, 2001) propose the Klaipeda port will double its transport compared to the year 1998. Thus the cargo transport rate would be around 35 million tons in 2015 and over 40 million tons in 2020.

Poland seaborne cargo transport development as presented in (Venäläinen & Viitanen, 2001) is shown in Table 36.

Table 36. Forecast for the maritime cargo transport development in Poland. (Venäläinen & Viitanen, 2001).

Poland / main port	*1998*	*2010*	*2020*
Poland (main ports)	50,6	76,5	94,5
Gdansk	20,6	40,0	50,0
Gdynia	8,0	11,0	12,5
Szczecin - Swinoujscie	22,0	25,5	32,0

In Germany the growth is expected to follow the foreign trade development of Scandinavia, Baltic countries and Russia (Table 37). The infrastructure development in Mecklenburg – Vorpommern area will eliminate current transport bottlenecks, thus the competitiveness of ports will be increased. Most advantageous prospects for the future development in German Baltic Sea ports have been put to Wismar, Rostock and Sassnitz.

Table 37. Forecast of the main German ports development and their capacity in 2015 in million tons (ISL. 2000).

Port	*Throughput 1998*	*Throughput in 2015*	*Capacity in 2015*	
			min	*max*
Kiel	4,13	5,44	6,48	7,55
Puttgarten	6,23	8,91	8,45	
Lubeck	24,69	38,67	39,28	39,87
Wismar	1,85	3,22	3,01	
Rostock	18,49	32,78	31,76	32,37
Stralsund	0,60	0,75	0,93	
Sassnitz	5,54	11,47	11,46	12,48
Total	61,90	101,24	101,36	104,56

The prognoses of the Baltic Sea traffic, i.e. the ship passages in 2015 has been shown in Figure 49. The numerical values are also shown in Table 38.

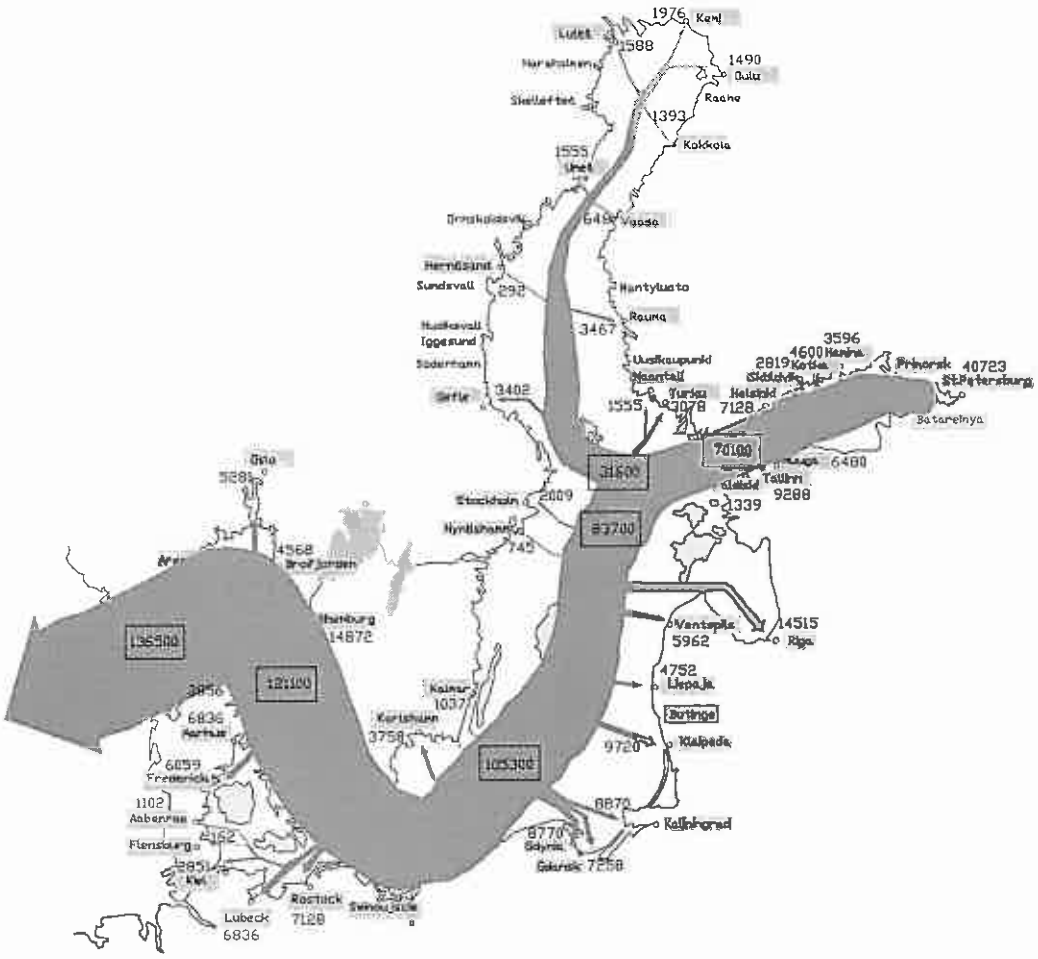


Figure 49. Forecast for the ship movements in 2015. Note: the passenger traffic is excluded.

Point	*v.2000*	*v.2015*
1	23388	31600
2	34692	70100
3	46476	83700
4	58500	105300
5	75696	121100
6	85296	136500

Table 38. Traffic volumes in Figure 49.

6.4 The maritime traffic development of the Gulf of Bothnia

Export shipments through the Finnish ports in Bay of Bothnia are forecast to grow to 7.5 million tons by the year 2010. In tonnage the largest increases will come from exports of paper and metals. The average growth rate will be 2.4 % annually for the basic industry export. This is based on the industrial investment of the area carried out during the recent years and proposed new investments (Iikkanen, 1999).

Seaborne import through the Finnish ports of the Bay of Bothnia is assumed to grow to 9.9 million tons by the year 2010. The largest increases will be in the import of ores, concentrates, coal and coke. Large investment have been carried out in Tornio and Raahe which will support the expectations for the increased need of raw materials. The import of minerals required in the paper and chemical industries is also assumed to grow. The annual growth rate will equals the export rate, i.e. 2.5 % per year. The export and import through the Finnish Ports of the Bay of Bothnia is shown graphically in 1981 up to 2010 in Appendix 25.

The annual growth rate of 2.5 % for the export and import is in balance with other forecasts, i.e. inside the range of 4...7 % for the general annual growth rate of the seaborne traffic. Later, however, a growth rate of 2.0 % is used due to the following reasons: The road network to the Northern Russia's is poor, without significant investment and reconstruction the link through the bay of Bothnia is not attractive. The present economic situation of the Russia's northern economic area is still poor, which also will decrease the economy. Sea area is ice bound six months per year which will increase transportation costs. Most of the cargo is raw materials with low added value of industrial products and finally the population centers of the Northern area are small and scarce. Thus the 2.0 % annual growth rate is even an optimistic forecast.

However, if the oil and gas resources of the northern part of the Russia will be exploited in larger scale, the proposed Barents and Archangel Corridors may cause rapid increase of port throughput in the Bothian Bay area. The uncertainties of the Russian legislation do not encourage foreign investors to develop the huge oil and gas resources, which would be the prerequisite for the fast development. there are railway proposal as connections between Ledmozero / Kockoma, Salla - Alakurtti and Karpogory - Vendiga between Finland and northwest Russia which can turn the development to the better growth rate, Figure 50.

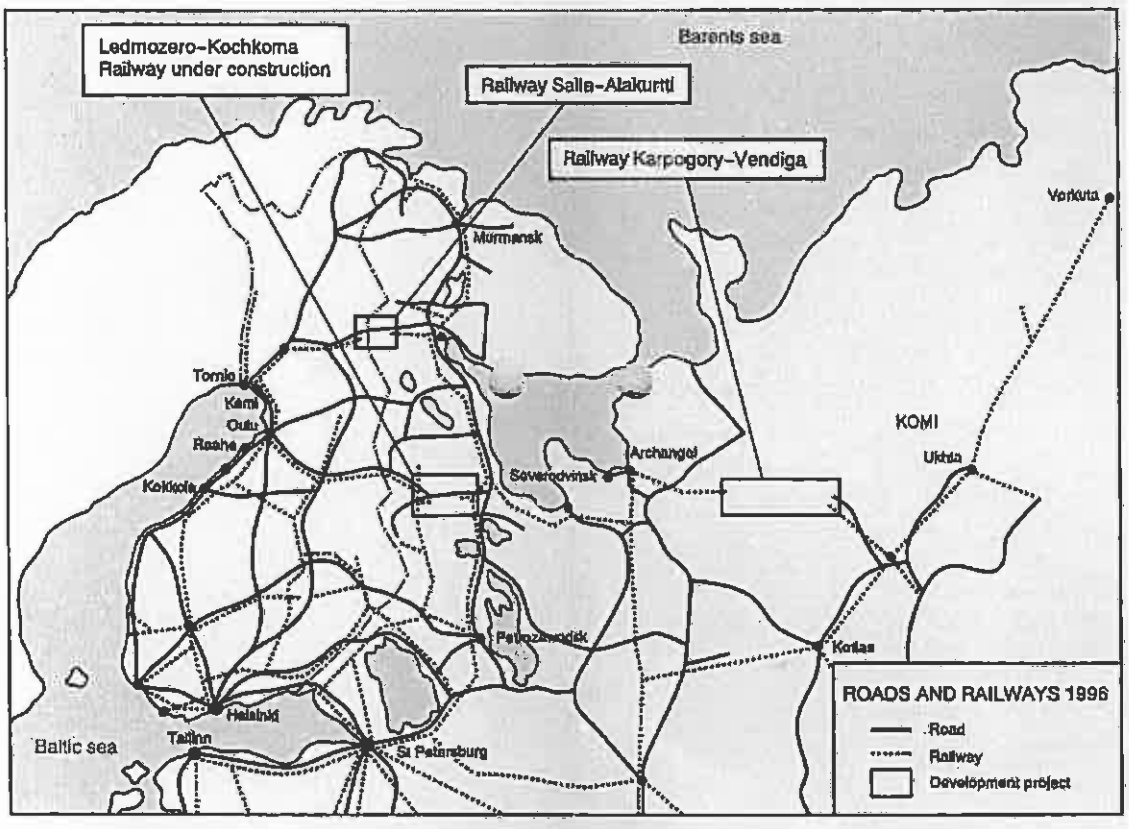


Figure 50. Itineraries between the Northern Finland and NW Russia (Viatek, 1996).

6.5 EU's contribution

European Union has regulations related to maritime sector. Main EU regulations concerning the competition in the maritime sector are 4055/86, 4056/86, 4057/86, 4058/86 and 3577/92 (Perälä, H. & Venäläinen, P. 2001). Free competition is one of the main issues and following aspects must be fulfilled in port operations:

- no discriminatory aids,
- no abuse of dominant position,
- no anti-competitive arrangements,
- essential facilities and an operation of such facility may not, without a objectively valid reason, refuse to supply a service.

EU has principles concerning the pricing in transport sector. The Green paper on Towards fair and efficient pricing in transport policy (EU 1995) emphasizes the user pays principle. More recent the White Paper on Fair Payment for Infrastructure Use (EU 1998) recognizes the relatively low infrastructure costs of shipping and external costs with the other transport modes. The paper proposes environmentally differentiated fuel or fairway charges. However, there are a lot of different fees and dues of the ports, such as fairway and lighthouse dues, pilotage fees, port, vessel and cargo dues etc. Usually ports may have published tariffs of their services, but in practice the pricing is more often based on negotiated rates than the tariff.

EU is also controlling subsidizing measures in the maritime sector, and is against such politics. However, at the moment there are no agreements on the application of competition rules for maritime transport, including restriction of national aid schemes. The Community Guidelines on state aid to maritime transport (97/C205/05) states that in principle operating aid should be exceptional, temporary and digressive (Perälä, H. & Venäläinen, P. 2001).

The outflagging of merchant fleets has been widely used operation also among the Countries of the Baltic Sea area. The main reasons for outflagging are usually high crew costs, bureaucracy, high compliance costs with the requirements of the domestic flag, unavailability of skilled labor and fiscal reasons. Table 39 shows the outflagging rate of the Baltic Sea region.

Table 39. Fleet controlled by the shipowners of the Baltic Sea area according to countries of domicile as January 1st. 1999. Ships 1000 GT and more (ISL, 1999).

Country	*Number of ships controlled*	*1000 dwt*	*Foreign flag dwt % share*
Sweden	390	21 068	92.2 %
Finland	150	3 369	67.1 %
Russia	1 613	14 151	47.6 %
Estonia	93	439	14.6 %
Latvia	98	1 451	98.0 %
Lithuania	66	398	3.0 %
Poland	128	2 243	38.1 %
Germany	1 737	26 098	63.8 %
Denmark	572	12 993	48.1 %
TOTAL	**4 847**	**82 210**	**65.3 %**

6.6 Development trends

Sea transport plays an important role in the Baltic Sea region where around one hundred million people live around a common water basin (Källström & Ingo, 2000). Throughout the centuries sailing has been the base for trade and contacts. There have been long periods of significant maritime cooperation, e.g. during the Hansa period, but also periods of hard competition.

Most of the ships are only calling at ports inside the Baltic Sea. Ports in northern Germany have been and continue to be important centers of trade in this area. The role of Poland is increasing together with the intense development of Baltic countries.

There are several trends describing the future development of the Baltic Sea area. Trade and the development of human capital are the most important prerequisites for the economic growth. The development of the waterborne transport has consequences for land use and infrastructure while ferry transport also has a structuring impact in the Baltic Sea area. These flows have a tendency to be part of transport corridors linking urban centers in a network of road and rail (multimodalism) on land with a sea transportation meeting all kinds of needs for commercial and non-commercial activities (Källström & Ingo, 2001).

The estimated trends may relate to manufactured goods with a comparatively high value. However, many ports make their living from handling of low value bulk cargo, as the typical transito ports. These transport systems are not so complex than the systems for finished and semi-finished products. Oil transportation will form one interesting trend affected by the changing world market price changes and the oil exploitation development of the whole market area.

The most probable trends affecting on the logistics will be product specialization and the production development requiring frequent deliveries and smaller consignments. The frequent traffic and new RoRo-connections reflect this development. The adaptation of the new information and telematic systems, for example internet, will influence on the maritime traffic logistics, too. Internationalization and new alliances will also change the geographical pattern of transport demand. Globalization and realignment of supply chains will taken place. It is also likely, that the strong development of containerization will continue together with the inter-modal transport to reduce the transport costs.

New technologies and changes in regulations have also a considerable effect on the sea transport. New generation vessels have offered better economics, faster transport ability and more competitive routes. Also in the winter time traffic certain new hull forms and operational concepts may offer advance operations in the future (for example the DAS concept).

European Commission promotes the introduction of a European policy towards more efficient ports and improved maritime infrastructure through their integration in a multimodal trans-European network including the main network of the neighboring regions (Källström & Ingo, 2001). The measures supporting the short-sea shipping and ports with multimodalism are supported by EC. One of the issues to be mentioned is how to create a fair transport pricing system covering all transport modes.

6.6.1 General development trends – area perspective

Geographically, the future water borne traffic of the Baltic sea area can be divided into three main areas:
- the Central Baltic Sea, mainly due to the rapid development of the Baltic countries and Russian sea ports and new terminals,
- southern parts of the Baltic Sea, mainly due to the proposed traffic links between Poland, Latvia, Lithuania, Kaliningrad and
- the Øresund area where the development of the former eastern Germany, bridges and proposed new infrastructure development will promote the growth and new links.

Trade in the Baltic Sea is dominated by the exchange with Germany. In 1996 the value of Swedish trade with the Baltic countries, Poland and Russia was less than the Swedish – Finnish trade.

According to (Outlook, 2000) the total seaborne trade was estimated 425 million tons, 40 % which is intra-regional. Almost 80 % of the ships making a call in a NBSR port are either coming from or going to another Baltic Sea area's port. Depending on the ship type the following table can be drawn (Figure 51). It can be noted, that passenger ferries have the largest part of their voyages inside the Baltic Sea area (around 90 %) while the share of gas and container vessels in the Baltic Sea area is around 60 %. The dominance of tank and bulk in the ports was clear, as can be seen from Figure 52.

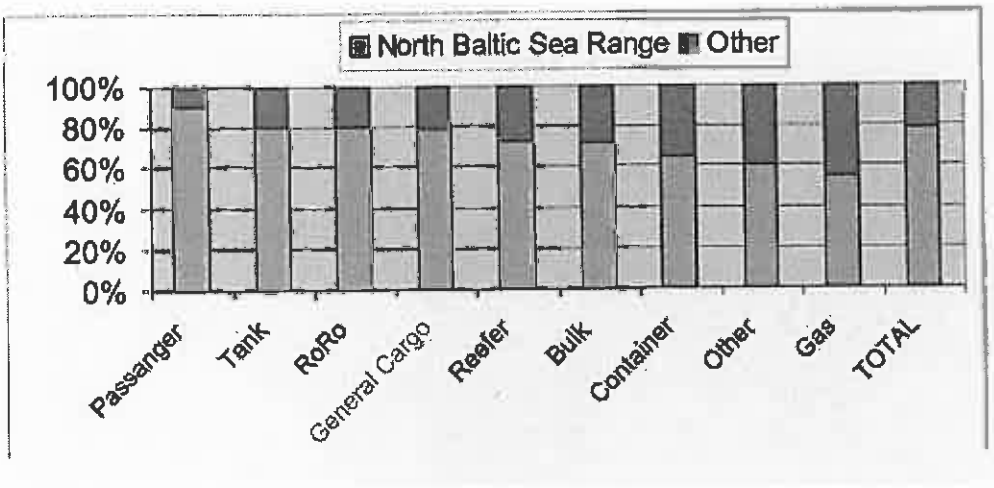


Figure 51. Share of intra Baltic Sea region based on the ship types (Source: Outlook, 2000).

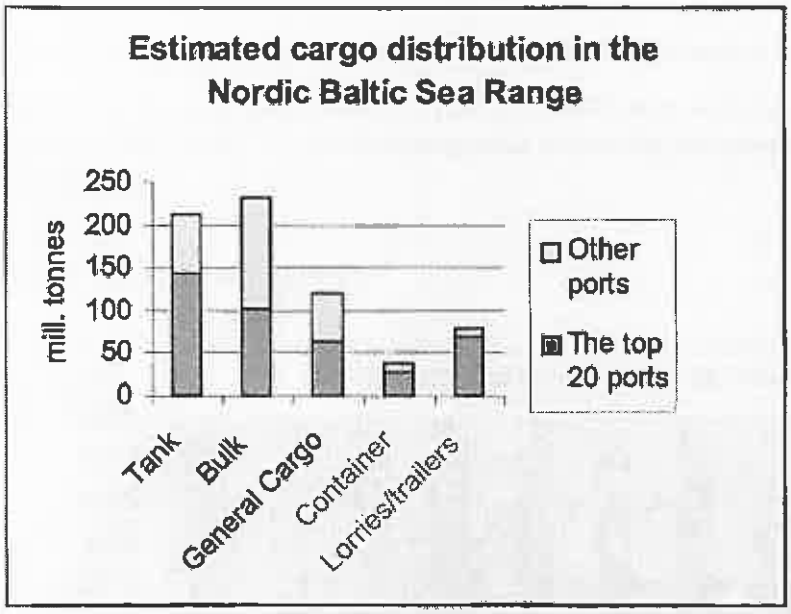


Figure 52. Estimated waterborne cargo distribution in the Nordic Baltic Sea Range.

6.6.2 GDP development

Thew long-term growth expectations of the GDP for the Baltic countries is shown in Figure 53. The figure presents the GDP development forecast for three periods, i.e. 1997 – 2005, 2006 – 2010 and 2011 – 2015. The figures presented show the average annual growth as percentage based on the foreign trade model of the Swedish national model system for goods transports (Venäläinen & Viitanen, 2001).

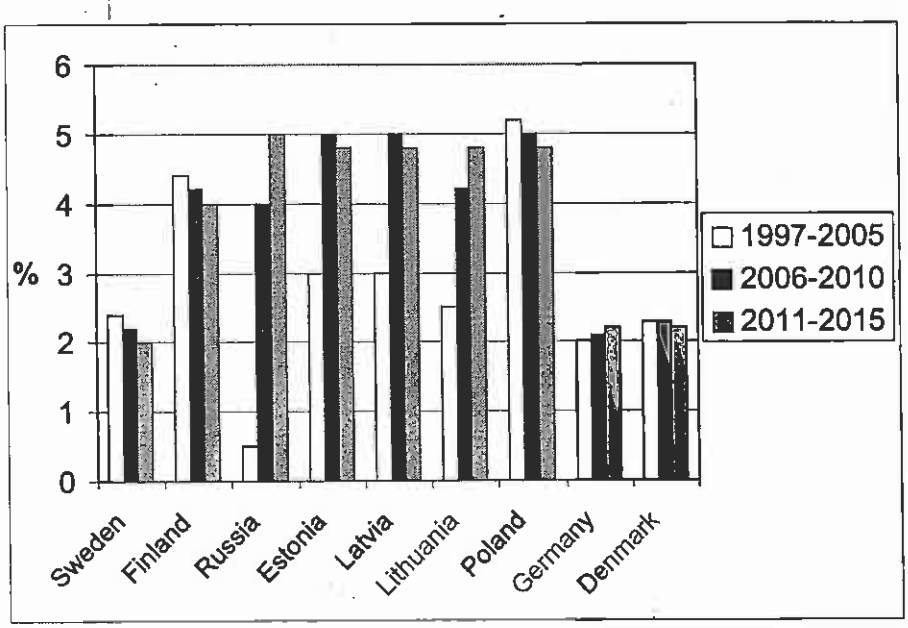


Figure 53. The long-term GDP growth [%] of the Baltic countries.

The figures show rather high growth rates for Russia, Poland and Baltic countries. There are other published forecasts which indicate smaller growth rates for Russia, i.e. 1.5 – 2.0 annually (Ocean Shipping Consultants 1999). According to this reference, EU's growth rate up to year 2009 has been estimated to vary between 2.1 – 2.3 annually.

Another forecast for the GDP development is shown in Table 40 below. As can be seen the latter forecast gives slightly smaller figures for Finland and Baltic countries in 2010 and 2015. The general development trends, however, are close each other.

Table 40. GDP development which is one good measure to evaluate the future maritime transport development (Källström, L. & Ingo, S. 2000).

GDP Development 1995 - 2010	1995 - 2005	2005 - 2010
Sweden	2,1	2,1
Norway	2,6	2,4
Denmark	2,5	2,5
Finland	2,4	2,2
Germany	2,2	2,0
Russia	2,5	4,0
Poland	4,0	5,0
Lithuania	3,0	4,0
Latvia	3,0	4,0
Estonia	4,0	5,0

6.7 Oil production scenarios

During the Soviet Union time the annual oil production rate was over 600 million tons (12 million bpd in the mid-eighties). In 1992 the supply collapsed in the former Soviet republics, and the production rate of Russia collapsed, too. The lowest rate has been around 300 million tons, but has been increased around 20 million tons annually, and exceeded already 340 million tons last year (4 million barrels per day). Russian oil companies have also made contracts in Iraq and Iran, thus strengthening their positions compared to Saudi Arabia and other producers (Mitchell, A, 12.12.2002).

Western oil companies are preparing to invest $45 billion to the development of Sakhalin oil field to serve China, India, Korea and other parts of Asia (Fulford, B, 10.12.2001). Shell alone has already invested more than $2 billion and plans to use an additional $9 billion to develop Sakhalin II. The proven reserves of Sakhalin II are 20 trillion cubic feet of gas and 1 billion barrels of oil. Exxon is the leading western oil company in Sakhalin I.

Other factors affecting to the Baltic development is the new oil pipeline to pump Kazakhstan oil across southern Russia to the Black sea.

Russia' share of the world oil market is currently around 10 percent in terms of export volume and a little more than 6 percent by value. OPEC's market share is today around 40 percent. The unused capacity of OPEC countries is roughly 4.5 bpd.

If the oil price will increase it will not be so beneficial for Russia than the low oil market price. A $1 drop in oil prices means an increase in GDP growth rate of about 0.9 percent. A lot of new jobs could be preserved, as happened in the period 1998 – 2000. During the last low oil price period (September 1998 – April 1999) industrial growth was 18 percent in Russia with machine building growth by 50 % and light industry by 52 %. When oil price rose to $20 per barrel, industrial growth slowed to 9 %, and later from October 2000 to June 2001 with a very high oil price, industrial growth fell to 2 %, and some months ceased completely (Ilarionov, A. 2001).

The low oil price will slow down the growth of the budget revenues in dollars, but the decrease will no be a catastrophe in Russia. However, Russian economy remains very sensitive to changes in the oil price.

There has been discussions originally initiated by the OPEC countries to reduce the Russian exports of crude by 150 000 barrels per day from January 2002. However, there have been similar discussion in the past, but Russia has continued to export oil as much it can do to help to repay the $140 billion foreign debt (Zhdannikov, D. 5.12.2001).

First pipeline to pump out Kazakhstan oil has been built. The aim is to deliver 3 million bpd in the following 15 years to the markets. Pipeline was built by the 11 member Caspian Pipeline Consortium. The capacity of the pipeline will be later 1.3 million bpd, which will easily handle the current output of the Tengiz oil field around 270 000 bpd. The output of the Tengiz field is expected to rise up to 700 000 bpd by the end of this decade (Pala, C. 2001).

6.7.1 Middle Asian development

The oil and gas resources of the Middle Asian are under a severe competition of national oil companies, foreign investors and enterprises. The new oil findings of the Caspian Sea and Afghanistan have raised the interest of European, American, Russian, Chinese and Iranian capital to invest on the giant project plans of the area.

The resources have been estimated huge: It has been estimated, that Kazakhstan can produce more than two million barrels oil per day in 2010. Also the new pipe line proposal of Azerbaidzhan could increase the oil production by 1.5 million barrel per day (Kankare, 2001). It may be realistic to assume, that Kazakhstan and Azerbaidzhan can sel oil in 2010 – 2015 around four million barrels per day. Furthermore the new oil findings of the Kashagan area in Kazakhstan may even rise these speculations. The Kashagan oil field has been estimated to be larger than 30 million barrels. However, it is the largest oil field found for decades.

The exploitation of these resources can change the oil transportation development of the Baltic Sea area. The oil companies will invest to the Middle Asian oil & gas production in the following five years more than 15 billion dollars, which may affect on the main oil and gas transportation routes to Europe too.

6.8 Impact scenarios

The most important impacts of the Baltic Oil Pipeline project, i.e. the execution of the new oil terminals of the Gulf of Finland will be according to the Ref.(COWI, 1998) :

The probability of a sensitive area being affected by oil due to BPS is highest in Danish waters, the Western Baltic south of Sweden and the Gulf of Finland west of Porvoo.
The long time average amount of oil spilled into the Baltic will increase by approximately 10% (~170 t/year) compared to the expected "background" spill in the year 2017. In the Gulf of Finland this increase will be approximately 20% (~24 t/year).

The risk for spills smaller than 10,000 tons in the Baltic Sea is not changed significantly.
The risk for spills between 10,000 and 100,000 tons is increased from 1/75 years to 1/50 years for the Baltic region in the year 2017 due to the BPS project.
The risk for a spill of this large size increases by 35% for the entire Baltic Sea and by 100% for the Gulf of Finland.

Compared to alternatives the Baltic Sea route is the best prepared for coping with an increase in tanker traffic regarding background environmental organizations, legal framework and oil spill response capabilities, nationally and in the region. The most noticeable effect of BPS is an increase of more than a factor of 7 in oil tanker traffic larger than 100,000 DWT in the Gulf of Finland. The effect is down to a factor of 1.6 in the Great Belt (COWI, 1998).

The total volume passing through the Gulf of Finland will increase markedly. The effects of BPS are smaller when the increased traffic is related to the total traffic increase in the Baltic Sea.

7 Applicability of FSA-method in producing effective risk control options in order to reduce the risk of oil spills in the Baltic Sea area

7.1 What is FSA

Shipping is governed by several rules. The safety-related rules of today are predominantly prescriptive, quite often derived as a reaction to a disaster at sea. Thus, the traditional way of rule-making has lead to a multitude of rules. The cost-effectiveness of a new rule and its coherence with other rules have probably not been the leading thoughts in the rule-making process. As a result of public pressure and haste to make a change, the new rule may not be an optimal solution to the problem. The effects of some rules may be even questionable. In this respect, a new, more scientific way of thinking, i.e. a formal methodology supporting the regulatory process, might be more useful. FSA (Formal Safety Assessment) is a method which is recommended by the IMO to be used in the regulatory process IMO, 1997.

FSA is a risk-based, systematic and sturdy approach to safety management. It is a rather new methodology for rule-making, which applies a scientific approach of thinking. If correctly applied, FSA applications are transparent, traceable and repeatable. FSA acts in a pro-active way: it should put emphasis not only on risks which have lead to accidents, but also on risks which may have severe consequences. FSA consists of the following five steps (Figure 54):

1. Identification of hazards
2. Assessment of risks
3. Generation of risk control options
4. Cost benefit assessment of the risk control options
5. Decision making recommendations concerning the options available

The first step, identification of hazards, should give a comprehensive answer to the question: "What can go wrong?" The result of this phase is a list of all relevant accident scenarios.

The purpose of the second step in the FSA process, risk assessment, is to quantify the distribution of risk, i.e. to make the risk measurable or, at least comparable to other risks. This step gives an answer to the questions: "How likely is the event?" and "What consequences might it have?"

In the third step of FSA different kind of risk control measures should be sought by considering systematically the possibilities of prevention, mitigation, active and passive, technical and procedural etc. alternatives. The third step should give an answer to the question "What can be done in order to avoid the event?"

The fourth step of FSA is an established technique, which makes it possible to find what are the most effective measures that are available to reduce the risks. This involves assigning a monetary value to the change of risk as well as to the costs of the risk control option. The fourth step gives an answer to the questions "How much do different risk control options cost?" and "How effective are the risk control options considered for the regulatory process?"

The fifth step of the FSA is the recommendations for decision making and it should give an answer to the question "What should the regulator do?" FSA has to be considered as a tool for decision making, not a decision maker by itself. All the information generated in steps 1-4 should be used to help in decision making. The risks, costs and benefits may affect differently on the various persons, groups of persons or organizations in the context. Thus, all relevant aspects connected to the risk control option(s) under consideration have to be thoroughly considered, when performing the final stage of FSA.

The different groups of stakeholders should always be identified at the outset of each FSA procedure, and to some extent be included in the expert panel, to ensure comprehensive views in those FSA-analysis' steps that rely on expert opinion. This is also the most important way of building up commitment to and understanding of the decisions made. All the information gathered during the previous steps of FSA should be reviewed to identify the preferred regulatory option(s) in general, and then in more detail in order to reach a sufficient equability for each relevant stakeholder.

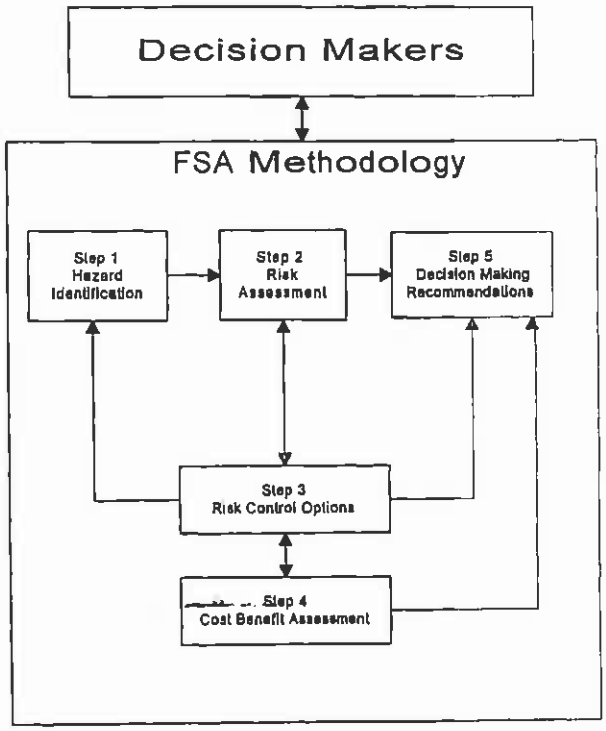


Figure 54. The block diagram of the FSA-procedure.

7.2 FSA and the risk of oil spills in the Baltic Sea area

The FSA-studies performed so far have concentrated on some ship type and on some details in the ship to improve the safety. Application of FSA to minimize the risk of oil spills is more complex: In addition to the characteristics of the oil tankers the matters related to the fairways and ship operations should be considered. In the following some examples of the objects of the risk control options to be considered for oil transports on the Baltic Sea area are listed.

Objects of risk control options related to oil tankers:
- double hull,
- ice strengthening,
- azimuth propulsion vs. conventional rudder-propeller construction,

- redundancy of the navigation, propulsion and steering systems and
- loading and unloading systems.

Objects of risk control options related to fairways:
- one-way vs. two-way fairways,
- difficult fairway legs,
- crossing fairways and
- consideration of different ice conditions on the fairways.

Objects of risk control options related to ship operations:
- the extent of piloting and VTS,
- escort towing,
- icebreaker assistance vs. sufficient ice performance for autonomous passage and
- traffic restrictions.

The results of the work performed by VTT Manufacturing Technology to update the statistics of the sea transports on the Baltic Sea can be used for the FSA analysis as for:
- ship traffic densities on different fairways,
- characteristics of the oil tankers,
- amounts of transported oil on different fairways and
- characteristics of the entrance fairways of the oil terminals.

The amount of stakeholders of the regulatory process considering the minimization of the risk of oil spills in the Baltic Sea area is very large. For example in all the countries around the Baltic Sea the people working in oil tankers, the shipping and oil companies, the maritime administrators etc.

The experts panels needed in the different steps of the FSA process could include experts as follows:
- from shipping and oil companies,
- from maritime and environment authorities,
- from ship crews,
- from VTS,
- from piloting,
- from shipbuilding and
- from rescue personnel.

At least in some phase of the FSA process representatives of all the countries around the Baltic Sea should be included in the expert panel.

7.3 The work performed in the UK

The work performed in the UK to identify the Marine Environmental High Risk Areas (MEHRA´s) in the UK (MEHRA, 1999) could be applied also in risk assessment for the Baltic Sea area. The referred document presents the assessment carried out by Safetec UK Ltd. to assist the UK Department of the Environment, Transport and the Regions identify potential Marine Environmental High Risk Areas (MEHRA´s) in UK waters. The concept of MEHRA´s was to identify comparatively limited areas of high environmental sensitivity, which are also at risk from shipping (i.e. marine pollution). Once MEHRA´s were formally identified, the location of these sites could be brought to the attention of ship owners and insurers to encourage shipping to plan routeing to avoid these sites and hence reduce the risk of pollution.

The assessment was carried out by identifying the environmental sensitivity of the UK coastline and coastal waters based on a number of different sensitivity features (e.g. wildlife, landscape, amenity/economy, geology and fishing). The different sensitive features were mapped on a Geographical Information System (GIS) and a scoring methodology applied to rank sensitivity of both coastal and sea areas.

The marine pollution risks were estimated using the most up to date shipping traffic data in the UK (COAST database) as well as recognized accident models which were calibrated against historical incidents in UK waters. As with the environmental sensitivity, the risk results generated were mapped on a GIS system that presents a transparent means for the assessment process.

The pollution and environmental sensitivity results were combined to identify potential MEHRA´s. The procedure of the performed work is presented in

Figure 55 and the map of MEHRA´s in the UK is presented in Figure 56. It should be noted that the this procedure doesn't include all the steps of the FSA procedure but only the first two ones. However, this is the first time when the environmental risks are assessed in more detail.

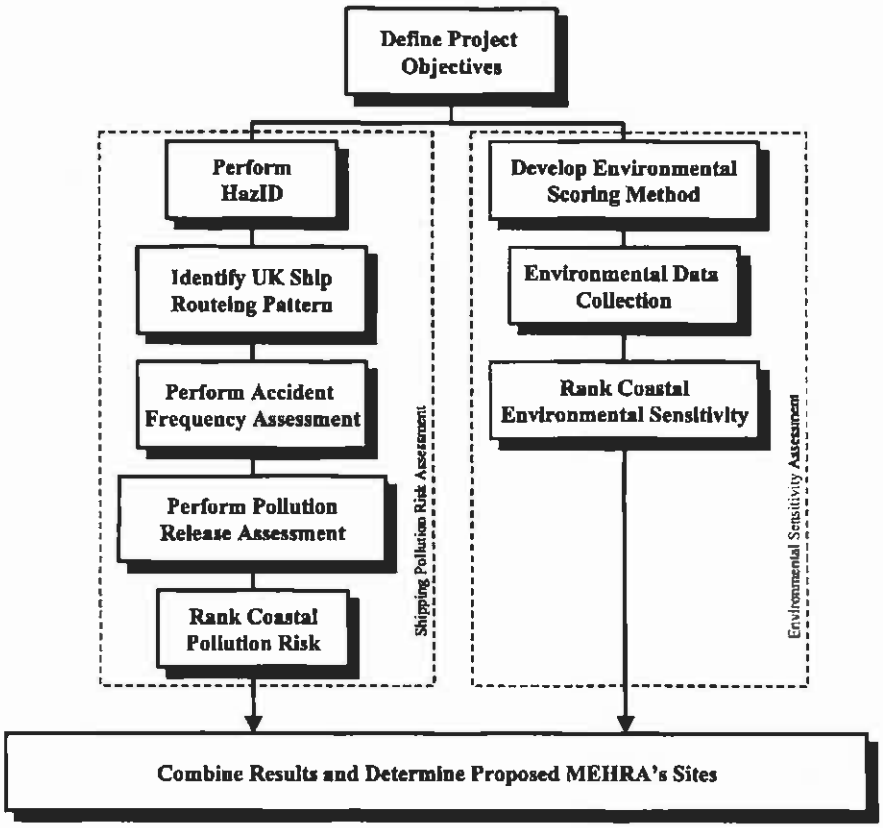


Figure 55. Scheme of the procedure used to determine the MEHRA´s.

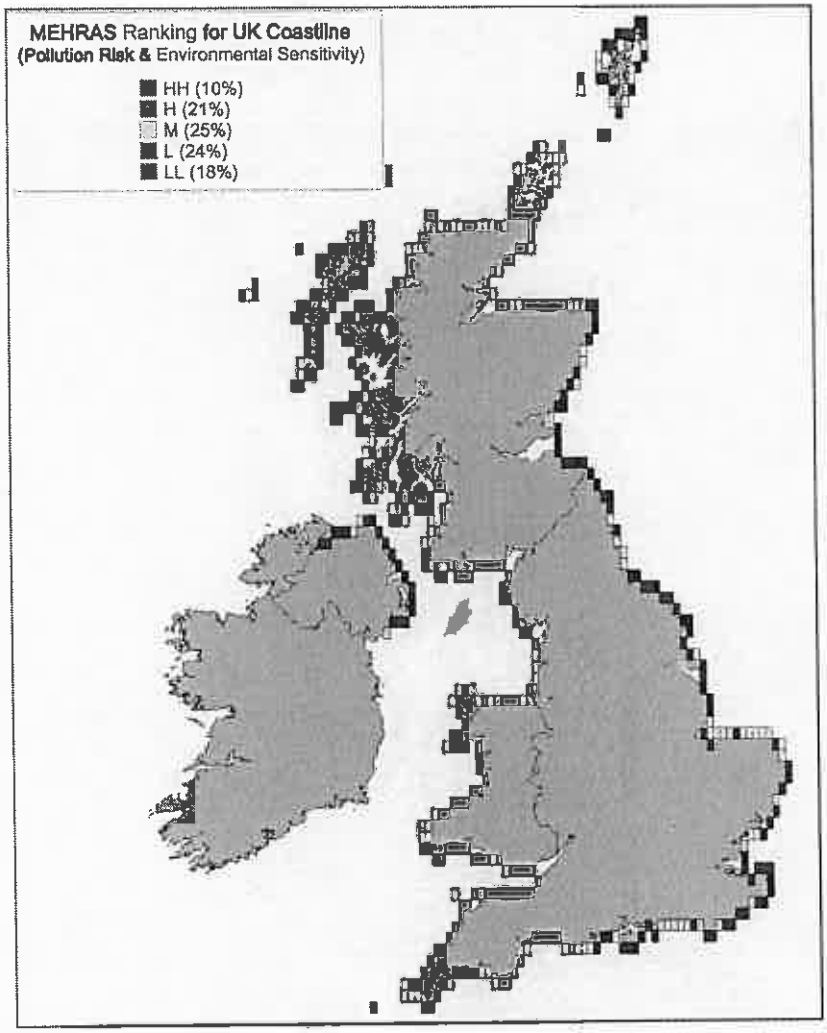


Figure 56. Potential Marine Environmental High Risk Areas (MEHRA´s) ranking for the UK coastline. It combines the results of the pollution risk from shipping in UK waters as well as the environmental sensitivity of the coastline.

7.4 Transportation risks in the Gulf of Finland

The concerns of the Finnish environmental authorities can be summarized as follows:

- sub-standard ships being allowed to collect oil from the terminal at Primorsk;
- ships entering the Baltic Sea for the first time;
- the vulnerability of single hull tankers in severe weather conditions;
- the heavy vessel traffic in the Gulf of Finland;
- the escort service.

The Finnish authorities require mandatory pilotage for all vessels carrying oil or other dangerous cargoes entering Finnish ports (COWI, 2000). Pilots are taken on board at the Archipelago Sea in Finland's western borders. The question arises as to whether there should be compulsory pilotage for all vessels entering the Gulf of Finland, requirements which could be limited to the season (e.g. in winter only), or to the size of vessel or the cargo carried.

Although Finnish legislation allows for single hull tankers to visit Finnish ports, the levy is double that for double hull tankers. In practice, all ships visiting the Fortum's oil terminal at Porvoo are required to have double bottoms (not double hulls) according to Neste's own regulations. In fact, most product tankers have usually double hull.

During the winter the ice cover in the eastern end of the Gulf of Finland can reach 70 - 95 cm thickness. However, a bigger problem is shifting pack ice which can be as much as 10 m high. The Board of Navigation operates 9 ice breakers to keep the coastal waters clear but only 2 are suitable for open sea conditions. They do not operate in the Gulf of Finland properly.

The Gulf of Finland experiences an average of 100 vessel movements per 24 hours, with a minimum of 60 vessels. Although much of this is concerned with traffic to and from the port of St. Petersburg, there is a large cross-Gulf traffic between Finland and Estonia. Finland would agree that oil terminals should contribute to the State's Tier Two oil spill capability. In Finland there is a fund levied on the transport of oil, the proceeds of which are used to build up the national Tier Two and Tier Three requirements without resorting to tax payers' money. The fund was established in 1976 and receives about 30 million Finnmarks (FMK) per year based on a levy of 2.2 FMK per ton/oil.

The Finnish authorities acknowledge that the oil spill response capability in the Gulf of Finland is generally too low, especially in the East. This also applies to Finnish capability as well as inadequate resources in both Russia and Estonia. A study by VTT Manufacturing Technology predicts enormous growth in maritime traffic to the year 2010 as a result of which the authorities could expect 6 significant spills per annum. If realized, this would represent a significant increase in the spill frequency in the Gulf of Finland compared with the record of the past 30 years (Rytkönen, 1999). Another recent study has shown the incidence of the 70 cm depth of pack ice which showed a high prevalence in the southern part of the Gulf of Finland comparable to that in the extreme north of the Gulf of Bothnia. These ice conditions would pose a severe problem to the movement of large (140,000 DWT) tankers because most ice breakers do not have sufficient width to open a large enough navigation channel.

Concerning the requirements for tankers visiting Primorsk, the Finnish authorities emphasized the importance of double bottom tankers. There have been two recent incidents in Finland (MT Natura and MT Ekturus) where large (80,000 ton) tankers have grounded but, owing to double bottoms, no oil has been spilled. It was important to note that the northern part of the Gulf of Finland (including the Primorsk area) generally has a rocky bottom compared with the sandy shores of the south.

Concerning environmental safety and the reduction of risk, the Finnish authorities believe that a lot will depend on whether the Russian authorities will allow tankers based on the old Soviet system or will insist on modern, international standards. The Finnish authorities also favor the use of Porvoo in winter conditions. They consider this to be a better solution with less risk for the environment and an economic study has shown that this could be a feasible option even if low oil prices persisted for six months.

The Finnish authorities strongly favor the use of multi-purpose vessels rather than specific oil recovery vessels. Finland has 12 such vessels, eight managed by the Maritime Administration, two by the Navy and two by the Coast Guard. In the case of the Primorsk terminal, it could be useful to think of ice breakers being made available for multi-purpose functions and fitted with a sweeping arm system for oil spill recovery. Such vessels could also be used for escorting purposes in the open sea when ice conditions are not prevalent.

The Finnish authorities confirmed that they would assist Russia in a Tier Two or Tier Three response but there would be no Finnish assistance for a Tier One spill. The Finnish authorities also strongly favor a requirement that tankers should be escorted into Primorsk. They acknowledge that no legislation exists, either nationally or internationally, to insist upon escort service. Nevertheless, the Finnish experience which now requires tankers entering Porvoo to be escorted has proved beneficial.

7.5 Risk assessment - Estonian perspective

Although Estonia's neighbors recognize that the Estonian response capability has been much improved, the Estonian Oil Combating authorities remains concerned about the lack of oil spill combating equipment outside the Tallinn area. Local ice conditions can also cause problems during the winter time.

Estonia itself has an oil trade of approximately 17 - 20 million tons per annum. The draft Estonian National Contingency Plan has not yet been approved. The matter has been deferred following elections earlier in 1999. There remain many problems with the budget. Currently the responsibility for oil combating was given to the Coast Guard, thus the reorganising and rearrangements of the operations would require some time.

The Estonian authorities consider that the construction of a terminal at Primorsk will present them with a heightened oil spill risk. All tankers would pass very near to the Estonian coast line and, depending on the weather conditions and northerly winds, oil spilled would arrive on the Estonian coast within two-three hours. The clean-up operations would be mostly manual. The Estonian authorities would therefore welcome any recommendations (such as double bottom tankers and escorting vessels into Primorsk) which would reduce the oil spill risk.

7.6 Special measures to minimize risk in Poland

In order to minimize the risk of pollution incidents in special areas, the Polish authorities have designated the following coastal areas where oil tankers are excluded: Mierzeja Wislana, Kepa Redlowska, Zatoka Pucka, Slowinski Pakt Narodowy, Lawica Slupska and Wolinski Park Narodowy.

The Polish authorities are concerned about the increased tanker traffic which would be generated by a new terminal at Primorsk. They support the HELCOM forum as the most suitable for establishing appropriate rules for the Baltic Sea. Appropriate measures which could be considered in the views of the Polish authorities are:

- a ceiling on the size of tankers using the Baltic (e.g. 14 m draught);
- the establishment of more traffic separation zones and specific routes for tankers away from shallow waters;
- measures to avoid the use of vessels which, although within legal limits, are on the verge of acceptability.

7.7 Risk assessment in Sweden

The Swedish Coast Guard expressed in general terms its view that the environmental hazards arising from ship traffic in the Baltic Sea may be expected to increase. Sea traffic in the Baltic Sea is increasing, and so is oil transported by ship. The reasons for the Coast Guard's concern are that the oil transport tends to be provided by substandard ships, sailed by crews with too little environmental knowledge and a lack of environmental concern among the crew. Generally there is a connection between low standard ships and lack of environmental concern among the crew. It was expected, furthermore, that the increased handling of oil will lead to extensions of terminals, refineries and single buoy moorings. A typical picture envisaged by the Swedish authorities is of substandard tankers awaiting good selling options while sheltering in coastal areas. This would lead to increased risk of oil spills in sensitive areas which often are sheltered and near shore.

Statistics reporting the number of flight observation hours and the number of recorded oil spills (deliberate discharges, not accidents) over the last 20 years or so support the Coast Guard's general concerns. Until recently, the fluctuations in the number of flight observation hours and the number of reported oil spills were in agreement, reflecting the fact that many flight hours lead to observation of many oil spills. However, during the last two to four years, fewer flight hours have led to the observation of more oil spills indicating a higher rate of spills. Though these statistics relate to deliberate discharges, the Swedish authorities believe that it is reasonable to assume a corresponding increase in the number of accidental spills.

8 Conclusions

Maritime transportation between the countries bordering the Baltic Sea is an essential element in the region's trading patterns. More than 500 million tons of cargo are transported across the Baltic Sea each year. Approximately 50 ferries have fixed routes between the Baltic Ports, and approximately more than 2 000 bigger ships, including cargo carriers, oil tankers and ferries are at sea in the Baltic at any given time. Moreover, the general trend of the growth rate of the maritime traffic shows a steady increase.

The expected growth rate of the oil transportation, however, is assumed to be much larger in the Baltic, and especially in the Gulf of Finland area. Russian oil export is expected to increase by 25 - 30 percent. Old terminals are under rehabilitation, and new terminals have been constructed and under design. More than 36 % of the Russian export oil is shipped in tankers through the Baltic Sea. At the same time the Baltic States have increased their oil transito traffic significantly. Also the import of oil to the eastern Baltic region is increasing from countries other than Russia, and this oil will mainly be transported by sea (Crockford, 2001).

The domestic crude oil price at below 30 % of the world prices Russia has a certain interest to produce more oil to the western markets. In spite of the agreements with OPEC to cut certain part of the production, the market experts believe more oil will be transported from Russia to the markets. This added export rate will mainly go to the European countries. With a suitable price, the production would be 20 million tons higher every year as stated in (Scandinavian Shipping Gazette, January 2002).

The Primorsk oil terminal 's first phase was completed in the end of 2001. Soon the production rate will be raised to 18 million tons annually, i.e. to 240 000 bbl/day. The modernization of the Yaroslav - Kirishi pipeline is under construction and will add the capacity after the work completion (Arentz, 2002a).

The prognoses for the Baltic Sea area shows the annual growth rate of 4.2 % for general cargo, 3.6 % for bulk and 1,6 % for oil. The oil growth rate here defined by COWI is underestimated due to the Baltic and Russian terminal development: The general Baltic Sea oil transportation rate will increase by 2-3 %, but geographically the rise is much larger. The heaviest growth rate of oil transportation is expected to be in the Gulf of Finland, in the Baltic proper the tankers passing the Gotland island and in the Danish Strait.

Thus it is more likely, that the sea-borne volume will roughly double. The general cargo and container traffic will even be three-fold. The increase in oil transportation will be 40%.

The maritime traffic of the Gulf of Finland is growing fast together with the general trend observed in logistics. The annual growth rate is 2–7% depending on the freight mode and the development trends of each country and port.

The passenger traffic of Baltic Sea is intensive, and will generally grow slightly in the future. The accurate forecast is difficult as it involves several desicion-makers compared to cargo transport. Ref (Ocean Shipping Consultants, 1999) estimates, that passenger volumes in the Baltic Sea will reach 75 million passenger limit in 2005.

The two main routes for passenger traffic have been the links between Finland and Sweden and Finland and Estonia. The amount of passengers from the ports of Turku and Helsinki to Stockholm and Kapellskär was nearly 10 million passengers in 2000. In the route Helsinki – Tallinn the figure has been around 6 million in 2000. These figures are not expected to grow anymore. By the year 2004 the allowed amount of alcohol imported by the passengers is lifted in Finland to the same level with other countries, and as a result the sale income of the passenger ships may be cut. Ref. (Venäläinen & Viitanen, 2001) suggest even 15 – 25 % decrease in shipping capacity, which may be realistic after Estonia joining EU will loose the tax free sales. The new taxation policy will probably encourage ferry companies to establish new routes between EU countries and other Baltic countries and Russia. Thus it is expected, that the passenger traffic volume in Finland will remain in its current level also in the future.

In Estonia, the EU membership and good relationships with Russia can increase the passenger traffic figure significantly in the future. All the scenarios presented in (Venäläinen & Viitanen, 2001) show all growth figures 120 % up to 300 % up to year 2010.

Other Baltic countries will have more moderate growth figures than Estonia. The most intensive growth will be taken place in Riga of Latvia where the 0.5 million passenger rate in 1998 is expected to rise to 1.4 million passengers in 2020. This might be underestimated, especially when Estonia will join EU, and the ferry companies will find out compensatory routes to keep their competitiveness as good as possible.

In the southern Baltic the most intensive growth rate of the passenger traffic is expected to take place in Poland, where the passenger traffic is forecast to more than double by the year 2020. Both Gdansk and Gdynia is expected to get more importance as passenger ports. The 1.6 million passenger level in 1998 is expected to exceed 2 million in 2010 and to reach 2.4 million passengers in 2020.

The main trends in logistics will be:

- restructuring the logistic system,
- realigning the supply chains,
- rescheduling product flow,
- changing management transport resources,
- changing transport policy trends,
- changing product configuration and design.

In order to improve maritime safety and to keep the risk of oil or ship accident as minimal as possible, new actions are required. The risk analyses as defined with the FSA method have been understood to be one of the most valuable tools to find out what is necessary for improving maritime safety. The new ship reporting system and traffic separation scheme for the Gulf of Finland will represent those required actions.

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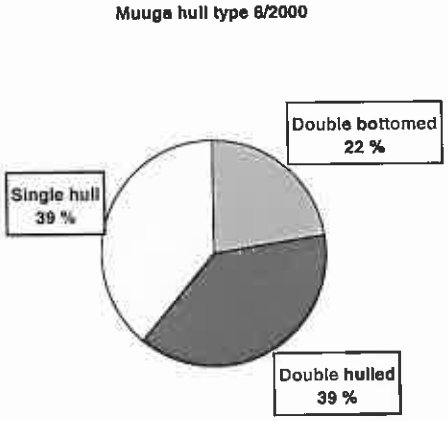
Appendices

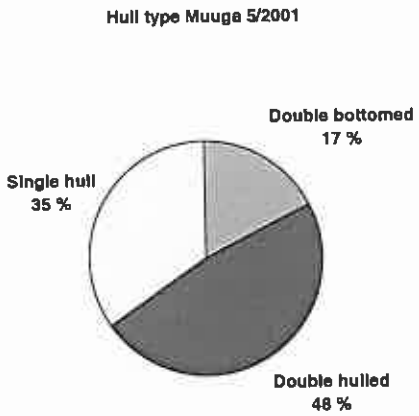
APPENDIX 1.
The analyses of tanker structure and age in Muuga (Estonia) in 2000 and 2001.

The Port of Muuga

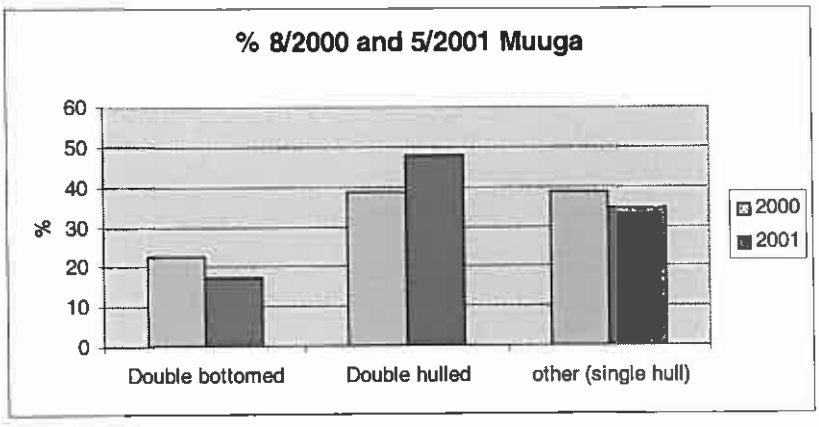
The statistical data of the Port of Muuga contained data of August 2001 (71 calls, 49 different ships)and May 2001 (23 ships). The number of double hull tankers is clearly increased from 39 % to 48 %. Another trend is the increasing size of the tankers. The oil tanker size of the Port of Muuga was about 19 000 tons in 1998, and 23 300 tons in 1999. Now, the average size in August was a 32 1010 dwt tanker and 41 898 dwt tanker in May 2001. The comparison of the hull and size of the 2000 and 2001 data is presented below. The increase of the size of tankers will continue in Muuga. The port authorities are considering a new jetty for 130 000 dwt tankers.



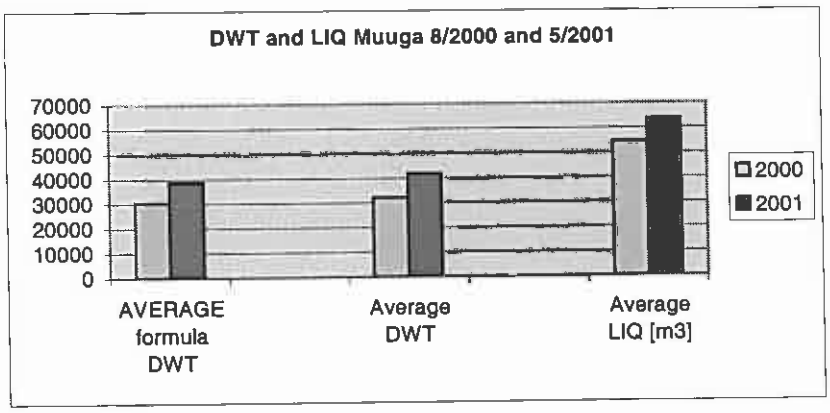
The distribution of the double hull, double bottom and single hull tankers in August 2000 in the Port of Muuga.



The distribution of the double hull, double bottom and single hull tankers in May 2001 in the Port of Muuga.

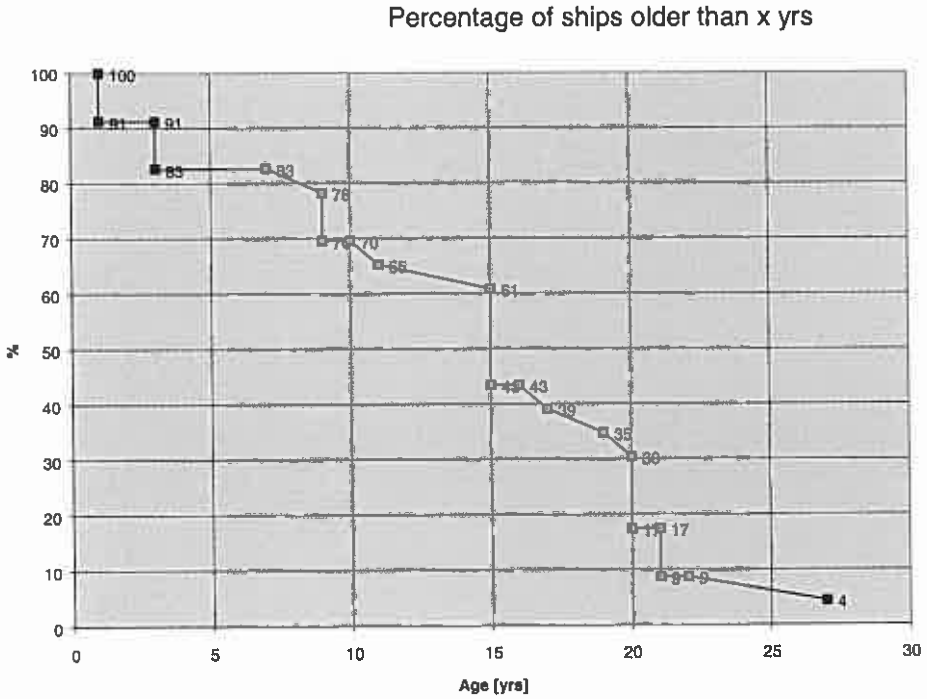


The short-term development of the tankers in the port of Muuga between August 2000 and the end of May 2001.



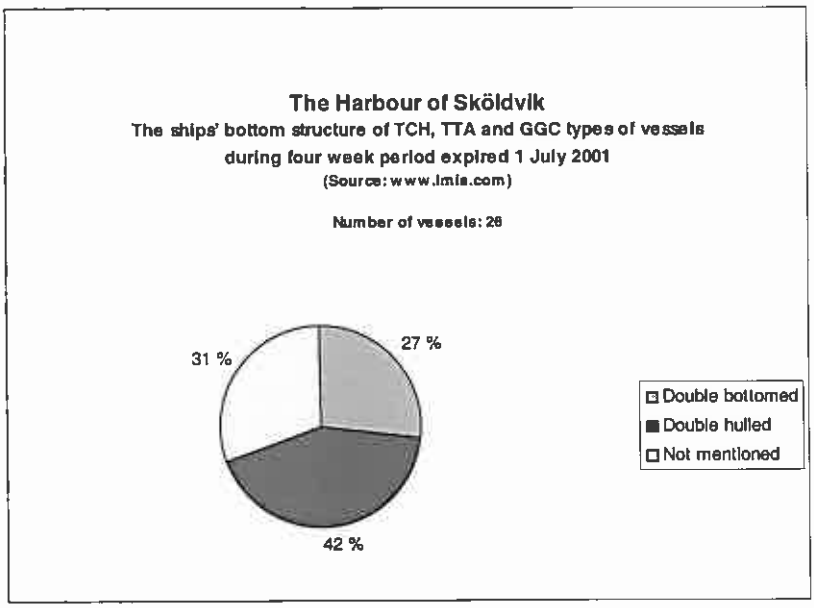
The increase of the tanker size in the port of Muuga. The average size of the oil tankers increased by 31 %.

When analyzing the age of the tankers it could be noted, that around half of the tankers are older than 15 years. The percentage of over 20 years old tankers was both in August 2000 and may 2001 near 17...18 %. The corresponding value for over 15 years old tankers was 43 %.

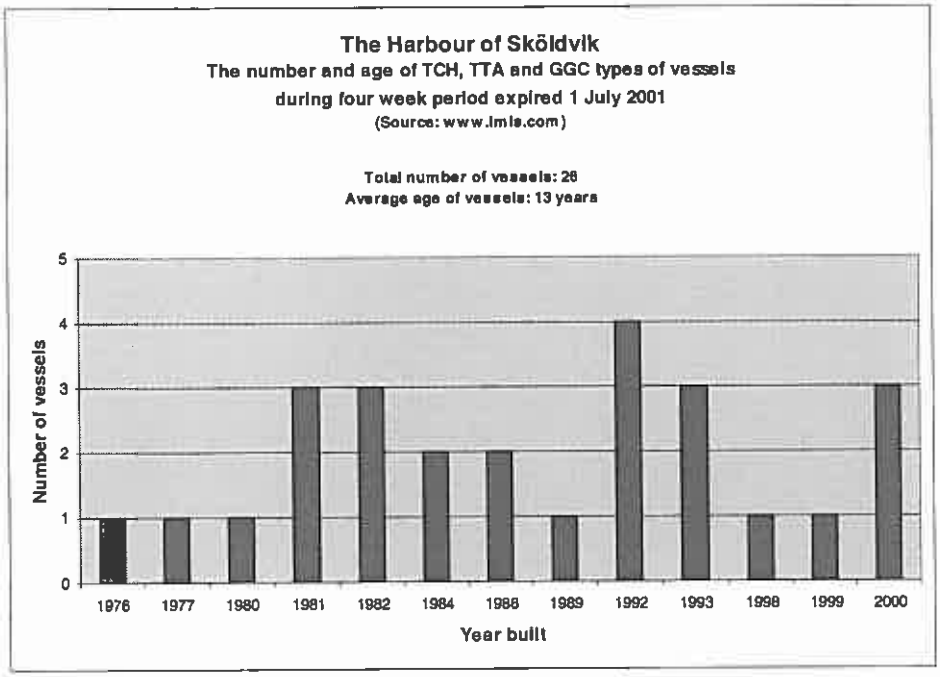


The distribution of the age of the tankers in Muuga (May, 2001).

APPENDIX 2.
The analyses of tanker structure and age in Sköldvik (Finland) in 2001.



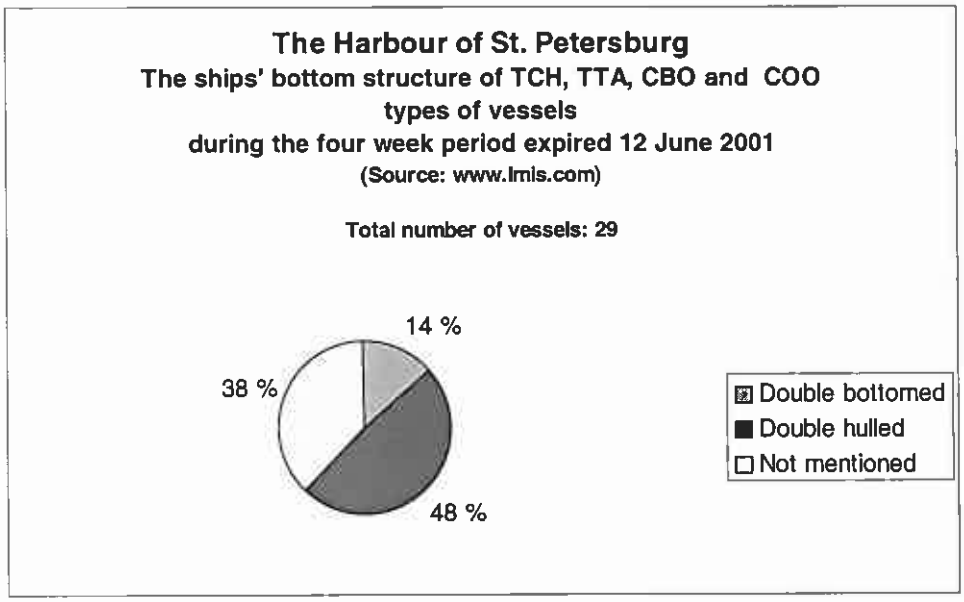
The distribution of TCH, TTA and GGC types of vessels in Sköldvik in 1 June - 1 July 2001 (source: www.lmis.com).



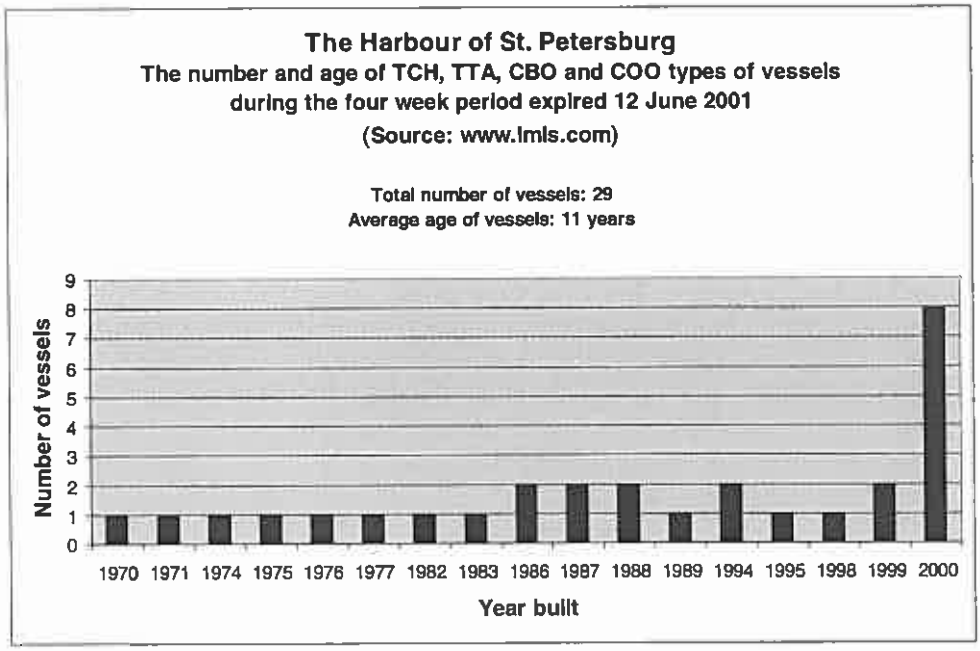
The age of TCH, TTA and GGC types of vessels in Sköldvik in 1 June - 1 July 2001 (source: www.lmis.com).

APPENDIX 3.
The analyses of tanker structure and age in St. Petersburg Sea Port (Russia) in 2001.

Altogether 29 tanker visited St. Petersburg Sea port in the four week period in May - June 2001. Most part of the vessels were TTA tank type-vessels (80 %). The amount of TCH-type chemical tankers was 14 %, and the rest were CBO-bulk/oil and COO- ore/oil bulkers. The age distribution of all analyzed tankers, shows the average age of the ship was 11 years. Only four of these vessels were Russian ships, all constructed between 1986 - 2000, and double hulled. The structural analyses shows that 48 % of all the vessels were double hulled, 14 % double bottomed, and the rest single hull vessels.



The distribution of oil tankers visiting St. Petersburg in 12 May -12 June 2001.

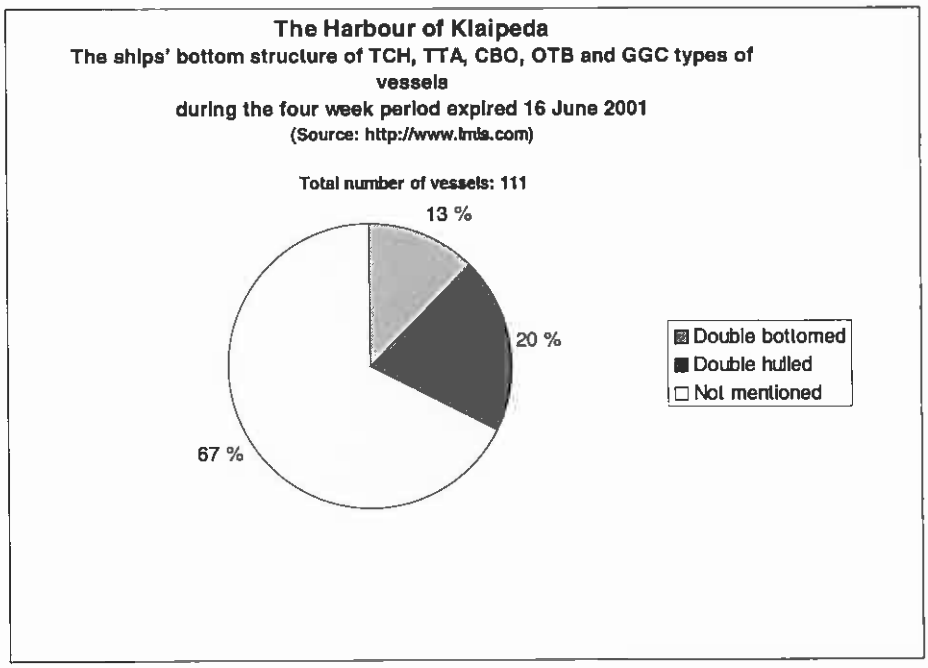


The age of tankers visiting St. Petersburg Sea Port in 12 May - 12 June 2001.

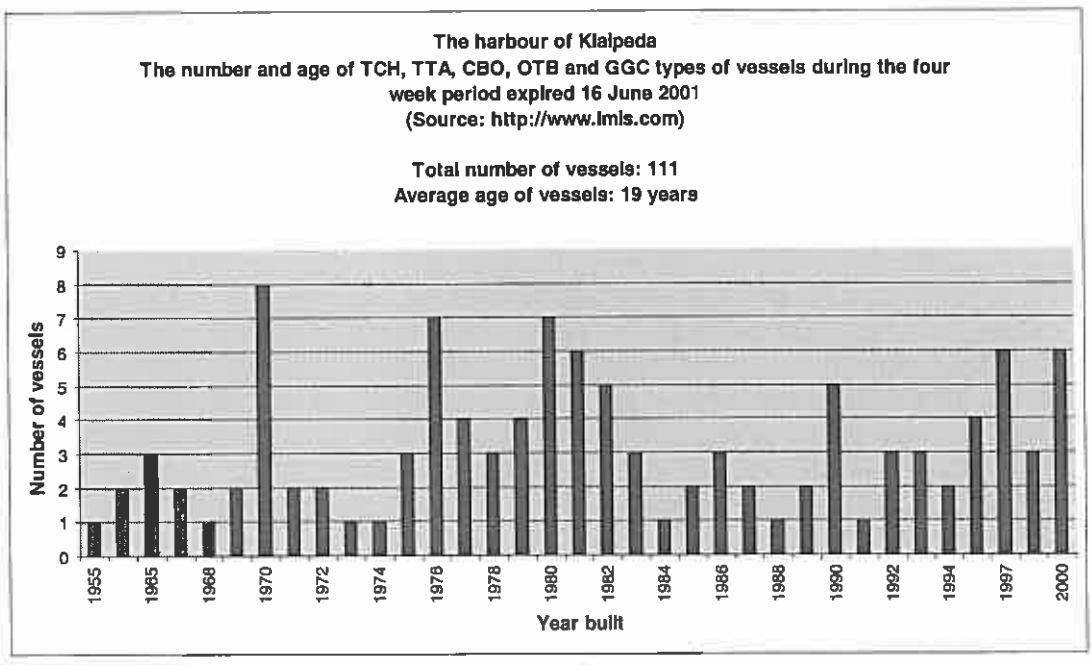
APPENDIX 4.
The analyses of tanker structure and age in Klaipeda (Lithuania) oil terminal in 2001.

The ships visiting Klaipeda oil terminal in May 2001 consisted 111 ships. The average age of the ships visiting Klaipeda in May 2001 was 19 years. Two third of the ships were single hull vessels. The percentage of double hull and double bottom vessels were 20 % and 13 %, respectively. The ships were classified into the following classes:

- TCH, chemical tanker
- TTA, tanker
- CBO, bulk/oil
- GGC, general cargo
- OTB, tank barge



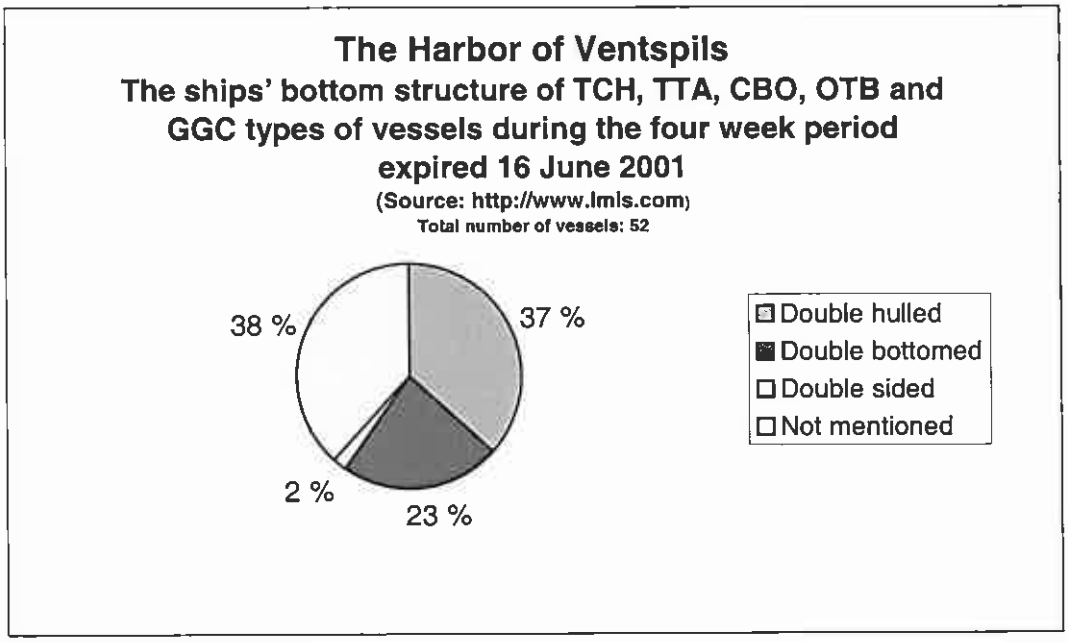
The distribution of tanker types in Klaipeda in May 2001.



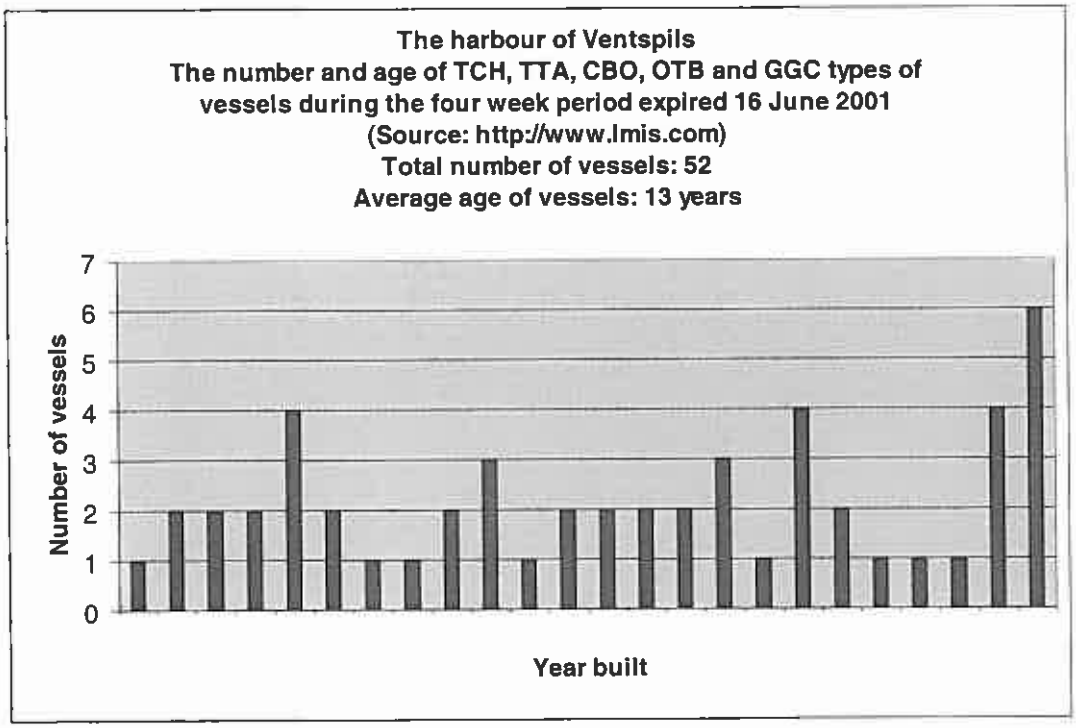
The age of the tankers visiting Klaipeda in May 2001.

APPENDIX 5.
The analyses of tanker structure and age in Ventspils (Latvia) oil terminal in 2001.

The amount of ships visiting Ventspils in May 2001 was 52. 38 % of the vessels were single hull ships, the rest of the ships being double bottom or double sided ships. The average age of the ships in May 2001 was 13 years. The oldest ships was constructed in 1971.



The distribution of ship types in Ventspils in May, 2001.



The age of the tankers visiting Ventspils in May 2001.

APPENDIX 6.
Port projects in the eastern Baltic Sea.

Port projects in the eastern Baltic Sea area.

Port project	Location	Project/ Estimated capacity per year
Primorsk	The bay of Viborg, 100 km from St. Petersburg	Oil, 29 to 45 million tons depending on the source.
Bolshaya Izora	South coast of the Gulf of Finland	Oil, 15 million tons.
Lomonosov Port	45 km from St. Petersburg	2.1 million tons; general cargo, cold transports, metals.
Petrolesport	old timber port near St. Petersburg	Estimated annual capacity 100,000 containers and 2 million tons of timber.
Ust Luga	120 km west of St. Petersburg	32 to 35 million tons of general cargo; first phase: coal port, later terminals for containers, dry bulk and timber; presently under construction; coal port will be finished in 12 to 18 months; 8 to 10 terminals planned.
Kaliningrad		1st phase: oil and liquid gas terminal (the annual capacity of 10 million tons); 2. phase: container terminal; construction will begin within two years.
The Bay of Batarvinaja	60 km from St.Petersburg	Oil, 15 to 17 million tons.
Expansion of the St. Petersburg port	Limited potential for expansion. The capacity can be increased from present 12 to 13 million tons to 18 million tons (maximum of 25 to 30 million tons); the container capacity will be increased from 160,000 to 220,000 TEU.	
Muuga	Estonia	Coal terminal, container terminal, storage capacity will be increased; problems: bottle necks and lack of capacity in the rail transports, the container capacity will be increased to 250,000 TEU.
Riga	Latvia	Development of equipment for handling cereals, increasing container capacity to 220,000 TEU.
Liepaja	Latvia	Specialising in timber and steel, no need for capacity increases.
Ventspils	Latvia	Oil 40 million tons, increasing volume for handling containers and bulk.
Klaipeda	Lithuania	Increasing capacity for handling volume, increasing container capacity to 200,000 TEU.
Kotka/Hamina	Finland	Increasing container capacity to 350,000 TEU and later even to 0.5 million TEU.
Kokkola	Finland	Deep-water wharf extension, new storage, acquisition of cargo handling equipment, etc.

Source: Salanne – Saario, 1999.

APPENDIX 7.
Baltic Sea Ports

Baltic Sea Ports, Denmark.

Name	Country	Area	Latitude	Longitude	Type
Denmark	**DNK**	**SCN**			
Bornholm	DNK	SCN			Land area
Ronne	DNK	SCN	55 6 N	14 42 E	Port
Nekso	DNK	SCN	55 4 N	15 9 E	Port
Svaneke	DNK	SCN	55 8 N	15 9 E	Port
Gudhjem	DNK	SCN	55 13 N	14 58 E	Port
Allinge	DNK	SCN	55 17 N	14 48 E	Port
Hammerhavn	DNK	SCN	55 16 N	14 45 E	Port
Hammeren	DNK	SCN	55 17 N	14 45 E	Port
Vang	DNK	SCN	55 16 N	14 45 E	Port
Hasle	DNK	SCN	55 11 N	14 42 E	Port
Stege	DNK	SCN	54 59 N	12 17 E	Port
Praesto	DNK	SCN	55 7 N	12 2 E	Port
Fakse Ladeplads	DNK	SCN	55 13 N	12 10 E	Port
Stevns Pier	DNK	SCN	55 19 N	12 27 E	Port
Koge	DNK	SCN	55 27 N	12 12 E	Port
Dragor	DNK	SCN	55 35 N	12 41 E	Port
Kastrup	DNK	SCN	55 38 N	12 39 E	Port
Copenhagen	DNK	SCN	55 42 N	12 37 E	Port
Tuborg Havn	DNK	SCN	55 43 N	12 35 E	Port
Elsinore	DNK	SCN	56 2 N	12 37 E	Port
Hundested	DNK	SCN	55 58 N	11 51 E	Port
Frederiksvaerk	DNK	SCN	55 58 N	12 1 E	Port
Frederikssund	DNK	SCN	55 50 N	12 3 E	Port
Ostby	DNK	SCN			Port
Kyndby	DNK	SCN	55 49 N	11 53 E	Port
Holbaek	DNK	SCN	55 43 N	11 43 E	Port
Nykobing	DNK	SCN	55 55 N	11 41 E	Port
Nykobing(Sjaelland)	DNK	SCN	55 55 N	11 41 E	Port
Odden	DNK	SCN	55 58 N	11 22 E	Port
Sjaellands Odde	DNK	SCN			Land area
Kalundborg	DNK	SCN	55 41 N	11 5 E	Port
Asnaesvaerkets Havn	DNK	SCN	55 40 N	11 5 E	Port
Halsskov	DNK	SCN	55 20 N	11 6 E	Port
Korsor Roads	DNK	SCN			Anchorage
Korsor	DNK	SCN	55 20 N	11 8 E	Port
Skaelskor	DNK	SCN	55 15 N	11 17 E	Port
Stigsnaesvaerkets Havn	DNK	SCN	55 13 N	11 15 E	Port
Gulfhavn	DNK	SCN	55 12 N	11 15 E	Port
Karrebaeksminde	DNK	SCN	55 10 N	11 38 E	Port
Naestved	DNK	SCN	55 14 N	11 45 E	Port

Masnedsund	DNK	SCN	55 0 N	11 54 E	Port
Masnedo	DNK	SCN	55 0 N	11 54 E	Port
Vordingborg	DNK	SCN	55 0 N	11 54 E	Port
Falster	DNK	SCN			Land area
Orehoved	DNK	SCN	54 57 N	11 51 E	Port
Stubbekobing	DNK	SCN	54 53 N	12 2 E	Port
Gedser	DNK	SCN	54 34 N	11 56 E	Port
Nykobing(Falster)	DNK	SCN	54 46 N	11 52 E	Port
Bandholm	DNK	SCN	54 50 N	11 30 E	Port
Nakskov	DNK	SCN	54 50 N	11 8 E	Port
Rodbyhavn	DNK	SCN	54 39 N	11 21 E	Port
Sakskobing	DNK	SCN	54 48 N	11 38 E	Port
Guldborg	DNK	SCN	54 52 N	11 45 E	Port
Rudkobing	DNK	SCN	54 56 N	10 43 E	Port
Bagenkop	DNK	SCN	54 45 N	10 40 E	Port
Marstal	DNK	SCN	54 51 N	10 31 E	Port
Aeroskobing	DNK	SCN	54 53 N	10 25 E	Port
Soby	DNK	SCN	54 57 N	10 16 E	Port
Svendborg	DNK	SCN	55 3 N	10 37 E	Port
Sprogo	DNK	SCN	55 20 N	10 58 E	Port
Nyborg	DNK	SCN	55 18 N	10 47 E	Port
Kerteminde	DNK	SCN	55 27 N	10 40 E	Port
Odense	DNK	SCN	55 25 N	10 23 E	Port
Lindo	DNK	SCN	55 28 N	10 32 E	Port
Bogense	DNK	SCN	55 34 N	10 5 E	Port
Strib	DNK	SCN	55 32 N	9 46 E	Port
Middelfart	DNK	SCN	55 30 N	9 44 E	Port
Assens	DNK	SCN	55 16 N	9 54 E	Port
Faaborg	DNK	SCN	55 6 N	10 14 E	Port
Kolby Kaas	DNK	SCN	55 48 N	10 32 E	Port
Ballen	DNK	SCN	55 49 N	10 39 E	Port
Jutland	DNK	SCN			Land area
Graasten	DNK	SCN	54 55 N	9 37 E	Port
Egernsund	DNK	SCN	54 54 N	9 36 E	Port
Sonderborg	DNK	SCN	54 55 N	9 47 E	Port
Katholm	DNK	SCN	54 56 N	9 50 E	Port
Augustenborg	DNK	SCN	54 57 N	9 52 E	Port
Enstedvaerkets Havn	DNK	SCN	55 1 N	9 26 E	Port
Aabenraa	DNK	SCN	55 2 N	9 26 E	Port
Aarosund	DNK	SCN	55 16 N	9 43 E	Port
Haderslev	DNK	SCN	55 15 N	9 30 E	Port
Kolding	DNK	SCN	55 30 N	9 30 E	Port
Skaerbaek	DNK	SCN	55 31 N	9 37 E	Port
Lyngs Odde	DNK	SCN	55 31 N	9 45 E	Port
Fredericia	DNK	SCN	55 34 N	9 45 E	Port
Vejle	DNK	SCN	55 43 N	9 33 E	Port
Juelsminde	DNK	SCN	55 43 N	10 1 E	Port
Horsens	DNK	SCN	55 51 N	9 52 E	Port

Aarhus	DNK	SCN	56 9 N	10 13 E	Port
Studstrup	DNK	SCN	56 15 N	10 21 E	Port
Ebeltoft	DNK	SCN	56 12 N	10 40 E	Port
Glatved	DNK	SCN	56 18 N	10 51 E	Port
Lyngsbaek Bridge	DNK	SCN	56 14 N	10 37 E	Port
Grenaa	DNK	SCN	56 25 N	10 56 E	Port
Kattegat	DNK	SCN			Water area
Anholt	DNK	SCN	56 43 N	11 31 E	Port
Randers	DNK	SCN	56 28 N	10 3 E	Port
Kongsdal	DNK	SCN	56 41 N	10 4 E	Port
Mariager	DNK	SCN	56 39 N	9 59 E	Port
Hobro	DNK	SCN	56 38 N	9 48 E	Port
Hadsund	DNK	SCN	56 43 N	10 7 E	Port
Aalborg	DNK	SCN	57 3 N	9 55 E	Port
Norresundby	DNK	SCN	57 4 N	9 55 E	Port
Hals	DNK	SCN	56 59 N	10 19 E	Port
Aggersund	DNK	SCN	57 1 N	9 17 E	Port
Laeso	DNK	SCN	57 13 N	10 42 E	Port
Saeby	DNK	SCN	57 20 N	10 31 E	Port
Understed	DNK	SCN	57 23 N	10 30 E	Port
Asa	DNK	SCN	57 9 N	10 25 E	Port
Frederikshavn	DNK	SCN	57 26 N	10 33 E	Port
Skagen	DNK	SCN	57 43 N	10 36 E	Port

Baltic Sea Ports, Sweden

Name	Country	Area	Latitude	Longitude	Type
Iddefjord+Kattegatt	*SWE*	*SCN*			*Water area*
Stromstad	SWE	SCN	58 56 N	11 10 E	Port
Grebbestad	SWE	SCN	58 41 N	11 15 E	Port
Fjallbacka	SWE	SCN	58 36 N	11 17 E	Port
Hunnebostrand	SWE	SCN	58 26 N	11 18 E	Port
Ramsvik	SWE	SCN	58 26 N	11 16 E	Port
Smogen	SWE	SCN	58 21 N	11 14 E	Port
Kungshamn	SWE	SCN	58 22 N	11 14 E	Port
Ryxo	SWE	SCN	58 22 N	11 26 E	Port
Brofjorden	SWE	SCN	58 20 N	11 23 E	Port
Stensjo	SWE	SCN	58 24 N	11 24 E	Port
Lysekil	SWE	SCN	58 16 N	11 26 E	Port
Munkedalhamn	SWE	SCN	58 26 N	11 40 E	Port
Skredsvik	SWE	SCN	58 23 N	11 39 E	Port
Uddevalla	SWE	SCN	58 21 N	11 55 E	Port
Gustavsberg	SWE	SCN	58 20 N	11 54 E	Port
Edshultshall	SWE	SCN			Port
Stenungsund	SWE	SCN	58 5 N	11 49 E	Port
Mossholmen	SWE	SCN	57 57 N	11 34 E	Port
Wallhamn	SWE	SCN	58 0 N	11 42 E	Port
Ronnang	SWE	SCN	58 5 N	11 40 E	Port
Skarhamn	SWE	SCN	57 59 N	11 33 E	Port
Marstrand	SWE	SCN	57 53 N	11 35 E	Port
Gothenburg	SWE	SCN	57 42 N	11 57 E	Port
Ockero	SWE	SCN	57 43 N	11 38 E	Port
Agnesberg	SWE	SCN	57 47 N	12 0 E	Port
Surte	SWE	SCN	57 50 N	12 1 E	Port
Bohus	SWE	SCN	57 51 N	12 2 E	Port
Nol	SWE	SCN	57 56 N	12 8 E	Port
Lodose	SWE	SCN	58 2 N	12 9 E	Port
Gota	SWE	SCN	58 6 N	12 9 E	Port
Trollhattan	SWE	SCN	58 17 N	12 17 E	Port
Lilla Edet	SWE	SCN			Port
Stallbacka	SWE	SCN	58 18 N	12 18 E	Port
Vargon	SWE	SCN	58 21 N	12 23 E	Port
Kungsbacka	SWE	SCN	57 29 N	12 5 E	Port
Ringhals	SWE	SCN			Port
Varberg	SWE	SCN	57 6 N	12 15 E	Port
Falkenberg	SWE	SCN	56 53 N	12 30 E	Port
Halmstad	SWE	SCN	56 40 N	12 51 E	Port
Angelholm	SWE	SCN	56 15 N	12 52 E	Port
Bastad	SWE	SCN	56 25 N	12 50 E	Port
Hoganas	SWE	SCN	56 12 N	12 33 E	Port
Helsingborg	SWE	SCN	56 3 N	12 41 E	Port
Kopparverkshamn	SWE	SCN	56 1 N	12 43 E	Port
Raa	SWE	SCN	55 59 N	12 45 E	Port

Backviken	SWE	SCN	55 54 N	12 43 E	Port
Landskrona	SWE	SCN	55 52 N	12 50 E	Port
Lomma	SWE	SCN	55 41 N	13 4 E	Port
Malmo	SWE	SCN	55 37 N	13 0 E	Port
Limhamn	SWE	SCN	55 35 N	12 56 E	Port
Klagshamn	SWE	SCN	55 31 N	12 53 E	Port
Trelleborg	SWE	SCN	55 22 N	13 9 E	Port
Ystad	SWE	SCN	55 26 N	13 50 E	Port
Simrishamn	SWE	SCN	55 33 N	14 22 E	Port
Ahus	SWE	SCN	55 56 N	14 19 E	Port
Solvesborg	SWE	SCN	56 3 N	14 35 E	Port
Elleholm	SWE	SCN	56 10 N	14 44 E	Port
Karlshamn	SWE	SCN	56 10 N	14 52 E	Port
Ronneby	SWE	SCN	56 10 N	15 18 E	Port
Torko	SWE	SCN	56 9 N	15 24 E	Port
Karlskrona	SWE	SCN	56 10 N	15 36 E	Port
Bergkvara	SWE	SCN	56 23 N	16 5 E	Port
Kalmar	SWE	SCN	56 40 N	16 22 E	Port
Oskarshamn	SWE	SCN	57 16 N	16 27 E	Port
Simpevarp	SWE	SCN	57 25 N	16 40 E	Port
Oland Is.	*SWE*	*SCN*			*Land area*
Borgholm	SWE	SCN	56 53 N	16 39 E	Port
Farjestaden	SWE	SCN	56 39 N	16 28 E	Port
Morbylanga	SWE	SCN	56 32 N	16 22 E	Port
Degerhamn	SWE	SCN	56 21 N	16 25 E	Port
Byxelkrok	SWE	SCN	57 18 N	17 2 E	Port
Gotland Is.	*SWE*	*SCN*			*Land area*
Visby	SWE	SCN	57 39 N	18 17 E	Port
Klintehamn	SWE	SCN	57 23 N	18 12 E	Port
Ronehamn	SWE	SCN	57 10 N	18 32 E	Port
Slite	SWE	SCN	57 42 N	18 49 E	Port
Furillen	SWE	SCN	57 46 N	19 0 E	Port
Bungenas	SWE	SCN	57 49 N	19 5 E	Port
Farosund	SWE	SCN	57 52 N	19 4 E	Port
Straa	SWE	SCN	57 54 N	19 2 E	Port
Ar	SWE	SCN	57 55 N	18 57 E	Port
Storugns	SWE	SCN	57 50 N	18 48 E	Port
Kappelshamn	SWE	SCN	57 51 N	18 47 E	Port
Vestervik	SWE	SCN	57 45 N	16 39 E	Port
Gamleby	SWE	SCN	57 54 N	16 25 E	Port
Kallvik	SWE	SCN	57 53 N	16 43 E	Port
Valdemarsvik	SWE	SCN	58 12 N	16 36 E	Port
Mem	SWE	SCN	58 29 N	16 25 E	Port
Braviken	*SWE*	*SCN*			*Water area*
Norrkoping	SWE	SCN	58 36 N	16 12 E	Port
Soderkoping	SWE	SCN	58 29 N	16 20 E	Port
Marsviken	SWE	SCN	58 40 N	16 57 E	Port
Oxelosund	SWE	SCN	58 40 N	17 7 E	Port
Nykoping	SWE	SCN	58 45 N	17 1 E	Port

Studsvik	SWE	SCN	58 45 N	17 17 E	Port
Sodertalje	SWE	SCN	59 12 N	17 38 E	Port
Stora Vika	SWE	SCN	58 56 N	17 47 E	Port
Landsort	SWE	SCN	58 44 N	17 52 E	Port
Nynashamn	SWE	SCN	58 54 N	17 57 E	Port
Dalaro	SWE	SCN	59 8 N	18 25 E	Port
Vesteras	SWE	SCN	59 36 N	16 26 E	Port
Enkoping	SWE	SCN	59 38 N	17 5 E	Port
Balsta	SWE	SCN	59 33 N	17 33 E	Port
Uppsala	SWE	SCN	59 52 N	17 39 E	Port
Stockholm	SWE	SCN	59 19 N	18 3 E	Port
Liljeholmsviken	SWE	SCN	59 19 N	18 0 E	Port
Loudden	SWE	SCN	59 20 N	18 8 E	Port
Stocksund	SWE	SCN	59 23 N	18 3 E	Port
Hogmarso	SWE	SCN	59 39 N	18 51 E	Port
Furusund	SWE	SCN	59 39 N	18 54 E	Port
Kapellskar	SWE	SCN	59 43 N	19 0 E	Port
Norrtalje	SWE	SCN	59 45 N	18 42 E	Port
Grisslehamn	SWE	SCN	60 6 N	18 49 E	Port
Hallstavik	SWE	SCN	60 3 N	18 36 E	Port
Hargshamn	SWE	SCN	60 10 N	18 29 E	Port
Oregrund	SWE	SCN	60 20 N	18 27 E	Port
Forsmark	SWE	SCN	60 25 N	18 12 E	Port
Skutskar	SWE	SCN	60 39 N	17 24 E	Port
Gefle	SWE	SCN	60 40 N	17 10 E	Port
Gulf of Bothnia	SWE	SCN			Water area
Norrsundet	SWE	SCN	60 57 N	17 10 E	Port
Soderhamn	SWE	SCN	61 19 N	17 6 E	Port
Aresund	SWE	SCN			Port
Iggesund	SWE	SCN	61 39 N	17 6 E	Port
Hudiksvall	SWE	SCN	61 43 N	17 7 E	Port
Sundsvall	SWE	SCN	62 25 N	17 20 E	Port
Hernosand	SWE	SCN	62 38 N	17 56 E	Port
Ornskoldsvik	SWE	SCN	63 16 N	18 43 E	Port
Rundvik	SWE	SCN	63 32 N	19 27 E	Port
Hornefors	SWE	SCN	63 34 N	19 29 E	Port
Umea	SWE	SCN	63 42 N	20 21 E	Port
Sikea	SWE	SCN	64 8 N	20 59 E	Port
Kallviken	SWE	SCN	64 20 N	21 22 E	Port
Backfors	SWE	SCN	64 30 N	21 25 E	Port
Burea	SWE	SCN	64 37 N	21 15 E	Port
Skelleftea	SWE	SCN	64 44 N	20 57 E	Port
Ronnskar	SWE	SCN	64 40 N	21 17 E	Port
Kagehamn	SWE	SCN	64 50 N	21 2 E	Port
Haraholmen	SWE	SCN	65 14 N	21 38 E	Port
Munksund	SWE	SCN	65 17 N	21 29 E	Port
Lulea	SWE	SCN	65 35 N	22 10 E	Port
Kalix	SWE	SCN	65 51 N	23 8 E	Port
Seskaro Is.	SWE	SCN	65 43 N	23 45 E	Port

Baltic Sea Ports, Germany

Name	Country	Area	Latitude	Longitude	Type
Ueckermunde	DEU	SCN	53 44 N	14 17 E	Port
Greifswald	DEU	SCN	54 6 N	13 23 E	Port
Wolgast	DEU	SCN	54 3 N	13 47 E	Port
Vierow	DEU	SCN			Port
Ladebow	DEU	SCN	54 6 N	13 27 E	Port
Sassnitz	DEU	SCN	54 31 N	13 38 E	Port
Kroslin	DEU	SCN	54 8 N	13 45 E	Port
Lauterbach	DEU	SCN	54 20 N	13 31 E	Port
Mukran	DEU	SCN	54 29 N	13 35 E	Port
Stralsund	DEU	SCN	54 19 N	13 6 E	Port
Barth	DEU	SCN	54 22 N	12 44 E	Port
Rostock	DEU	SCN	54 9 N	12 6 E	Port
Warnemunde	DEU	SCN	54 11 N	12 5 E	Port
Wismar	DEU	SCN	53 54 N	11 28 E	Port
Lubeck	DEU	SCN	53 52 N	10 40 E	Port
Travemunde	DEU	SCN	53 58 N	10 54 E	Port
Gromitz	DEU	SCN	54 9 N	10 59 E	Port
Neustadt	DEU	SCN	54 6 N	10 49 E	Port
Puttgarden	DEU	SCN	54 30 N	11 14 E	Port
Burgstaaken	DEU	SCN	54 25 N	11 12 E	Port
Fehmarn Is.	*DEU*	*SCN*			*Land area*
Orth	DEU	SCN	54 27 N	11 3 E	Port
Heiligenhafen	DEU	SCN	54 22 N	10 59 E	Port
Laboe	DEU	SCN	54 24 N	10 13 E	Port
Kieler Forde	*DEU*	*SCN*			*Water area*
Kiel	DEU	SCN	54 19 N	10 8 E	Port
Holtenau	DEU	SCN	54 22 N	10 9 E	Port
Rendsburg	DEU	SCN	54 19 N	9 40 E	Port
Eckernforde	DEU	SCN	54 29 N	9 51 E	Port
Schleswig	DEU	SCN	54 31 N	9 34 E	Port
Olpenitz	DEU	SCN			Port
Kappeln	DEU	SCN	54 40 N	9 56 E	Port
Gelting	DEU	SCN	54 44 N	9 54 E	Port
Gelting Bay	*DEU*	*SCN*			*Water area*
Flensburg	DEU	SCN	54 48 N	9 26 E	Port

Baltic Sea Ports, Finland

Name	Country	Area	Latitude	Longitude	Type
Finland	**FIN**	**SCN**			
Tornio	FIN	SCN	65 51 N	24 9 E	Port
Roytta	FIN	SCN	65 46 N	24 9 E	Port
Kemi	FIN	SCN	65 44 N	24 34 E	Port
Veitsiluoto	FIN	SCN	65 42 N	24 37 E	Port
Martinniemi	FIN	SCN	65 13 N	25 17 E	Port
Oulu	FIN	SCN	65 0 N	25 28 E	Port
Raahe	FIN	SCN	64 41 N	24 29 E	Port
Lapaluoto	FIN	SCN	64 40 N	24 25 E	Port
Kalajoki	FIN	SCN	64 15 N	23 56 E	Port
Rahja	FIN	SCN	64 12 N	23 44 E	Port
Kokkola	FIN	SCN	63 50 N	23 8 E	Port
Pietarsaari	FIN	SCN	63 41 N	22 42 E	Port
Vaasa	FIN	SCN	63 6 N	21 37 E	Port
Kronvik	FIN	SCN	63 3 N	21 31 E	Port
Kaskinen	FIN	SCN	62 23 N	21 13 E	Port
Kristinestad	FIN	SCN	62 16 N	21 19 E	Port
Nyhamn	FIN	SCN	56 15 N	12 34 E	Port
Merikarvia	FIN	SCN	61 51 N	21 28 E	Port
Pori	FIN	SCN	61 29 N	21 48 E	Port
Mantyluoto	FIN	SCN	61 35 N	21 30 E	Port
Olkiluoto	FIN	SCN	61 15 N	21 30 E	Port
Rauma	FIN	SCN	61 8 N	21 30 E	Port
Uusikaupunki	FIN	SCN	60 48 N	21 24 E	Port
Kustavi	FIN	SCN	60 34 N	21 20 E	Port
Naantali	FIN	SCN	60 28 N	22 1 E	Port
Tupavuori	FIN	SCN	60 27 N	22 4 E	Port
Turku	FIN	SCN	60 26 N	22 13 E	Port
Parainen	FIN	SCN	60 17 N	22 18 E	Port
Mjosund	FIN	SCN	60 13 N	22 28 E	Port
Perno	FIN	SCN			Port
Frojdbole	FIN	SCN	60 9 N	19 55 E	Port
Vartsala	FIN	SCN	60 20 N	23 1 E	Port
Salo	FIN	SCN	60 23 N	23 10 E	Port
Kokkila	FIN	SCN	60 20 N	22 52 E	Port
Stromma	FIN	SCN	60 11 N	22 54 E	Port
Dalsbruk	FIN	SCN	60 2 N	22 31 E	Port
Koverhar	FIN	SCN	59 53 N	23 13 E	Port
Lappohja	FIN	SCN	59 54 N	23 16 E	Port
Hanko	FIN	SCN	59 49 N	22 58 E	Port
Skogby	FIN	SCN	59 55 N	23 19 E	Port
Gulf of Finland	FIN	SCN			Water area
Lappvik	FIN	SCN	59 54 N	23 16 E	Port
Tammisaari	FIN	SCN	59 59 N	23 26 E	Port
Skuru	FIN	SCN	60 6 N	23 33 E	Port

Inkoo	FIN	SCN	60 3 N	24 1 E	Port
Kantvik	FIN	SCN	60 5 N	24 23 E	Port
Helsinki	FIN	SCN	60 10 N	24 57 E	Port
Svartback	FIN	SCN	60 17 N	25 32 E	Port
Skoldvik	FIN	SCN	60 18 N	25 33 E	Port
Tolkkinen	FIN	SCN	60 20 N	25 35 E	Port
Isnas	FIN	SCN	60 24 N	26 0 E	Port
Valkom	FIN	SCN	60 25 N	26 16 E	Port
Loviisa	FIN	SCN	60 27 N	26 14 E	Port
Kotka	FIN	SCN	60 28 N	26 57 E	Port
Hamina	FIN	SCN	60 34 N	27 11 E	Port
Saimaa Canal	FIN	SCN			Canal
Suikki	FIN	SCN			Port
Lauritsala	FIN	SCN	61 5 N	28 20 E	Port
Mustola	FIN	SCN	61 4 N	28 18 E	Port
Joutseno	FIN	SCN	61 8 N	28 29 E	Port
Lappeenranta	FIN	SCN	61 4 N	28 15 E	Port
Kaukas	FIN	SCN	61 4 N	28 13 E	Port
Imatra	FIN	SCN	61 10 N	28 50 E	Port
Kaukopaa	FIN	SCN	61 15 N	28 52 E	Port
Puhos	FIN	SCN	62 6 N	29 55 E	Port
Ristiina	FIN	SCN	61 32 N	27 25 E	Port
Savonlinna	FIN	SCN	61 54 N	28 55 E	Port
Varkaus	FIN	SCN	62 20 N	27 50 E	Port
Joensuu	FIN	SCN	62 36 N	29 45 E	Port
Kuopio	FIN	SCN	62 51 N	27 30 E	Port
Siilinjarvi	FIN	SCN	63 5 N	27 40 E	Port
Rapasaari	FIN	SCN			Port

Baltic Sea Ports, Poland

Name	Country	Area	Latitude	Longitude	Type
Elblag	POL	SCN	54 10 N	19 24 E	Port
Tczew	POL	SCN	54 5 N	18 46 E	Port
Gdansk	POL	SCN	54 21 N	18 39 E	Port
Gdynia	POL	SCN	54 32 N	18 33 E	Port
Wladyslawowo	POL	SCN	54 48 N	18 25 E	Port
Puck	POL	SCN	54 43 N	18 21 E	Port
Ustka	POL	SCN	54 35 N	16 52 E	Port
Darlowo	POL	SCN	54 26 N	16 23 E	Port
Kolobrzeg	POL	SCN	54 11 N	15 34 E	Port
Niechorze	POL	SCN	54 6 N	15 4 E	Port
Swinoujscie	POL	SCN	53 56 N	14 17 E	Port
Stepnica	POL	SCN	53 39 N	14 38 E	Port
Szczecin	POL	SCN	53 25 N	14 33 E	Port
Police	POL	SCN	53 33 N	14 36 E	Port

Baltic Sea Ports, Russia

Name	Country	Area	Latitude	Longitude	Type
Vysotsk	RUS	SCN	60 38 N	28 34 E	Port
Vyborg	RUS	SCN	60 43 N	28 44 E	Port
Primorsk	RUS	SCN	60 22 N	28 38 E	Port
Lomonosov	RUS	SCN	59 50 N	29 48 E	Port
Kanonerskiy Is.	RUS	SCN	59 54 N	30 13 E	Port
Kronshtadt	RUS	SCN	60 0 N	29 46 E	Port
St. Petersburg	RUS	SCN	59 56 N	30 18 E	Port
Priozersk	RUS	SCN	61 1 N	30 8 E	Port
Novgorod	RUS	SCN	58 30 N	31 20 E	Port
Shlisselburg	RUS	SCN	59 56 N	31 8 E	Port
Petrodvorets	RUS	SCN	59 53 N	29 55 E	Port
Ust-Luga	RUS	SCN	59 40 N	28 18 E	Port
Kirovsk	RUS	SCN	59 52 N	30 59 E	Port
Baltiysk	RUS	SCN	54 39 N	19 54 E	Port
Svetlyy	RUS	SCN	54 38 N	20 9 E	Port
Kaliningrad	RUS	SCN	54 43 N	20 31 E	Port

Baltic Sea Ports, Estonia

Name	Country	Area	Latitude	Longitude	Type
Narva Joesuu	EST	SCN	59 28 N	28 3 E	Port
Prangli Is.	EST	SCN	59 38 N	25 0 E	Port
Muuga	EST	SCN	59 30 N	24 58 E	Port
Miiduranna	EST	SCN	59 30 N	24 49 E	Port
Tallinn	EST	SCN	59 27 N	24 45 E	Port
Paljassaare	EST	SCN	59 27 N	24 42 E	Port
Paldiski	EST	SCN	59 21 N	24 3 E	Port
Loksa	EST	SCN	59 35 N	25 43 E	Port
Dirhami	EST	SCN	59 13 N	23 30 E	Port
Forby	EST	SCN	59 0 N	23 10 E	Port
Lehtma	EST	SCN	59 3 N	22 42 E	Port
Kunda	EST	SCN	59 31 N	26 33 E	Port
Heltermaa	EST	SCN	58 52 N	23 4 E	Port
Kuivastu	EST	SCN	58 35 N	23 24 E	Port
Saaremaa Is.	EST	SCN			Land area
Roomassaar	EST	SCN	58 13 N	22 31 E	Port
Veere	EST	SCN	58 27 N	22 3 E	Port
Virtsu	EST	SCN	58 35 N	23 33 E	Port
Haapsalu	EST	SCN	58 57 N	23 32 E	Port
Rohukula	EST	SCN	58 54 N	23 25 E	Port
Parnu	EST	SCN	58 23 N	24 29 E	Port

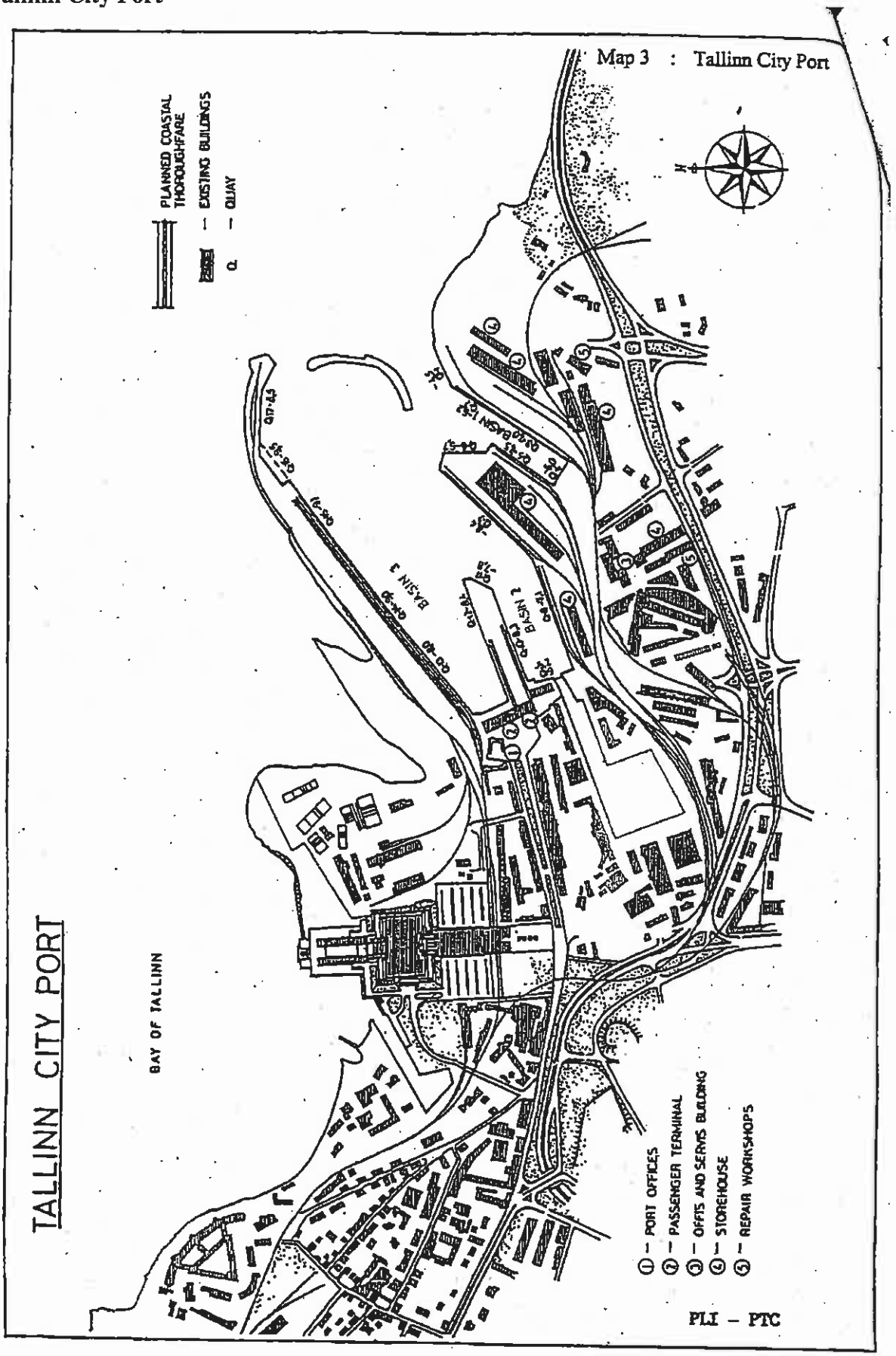
Baltic Sea Ports, Latvia

Name	Country	Area	Latitude	Longitude	Type
Salacgriva	LVA	SCN	57 45 N	24 22 E	Port
Skulte	LVA	SCN	57 18 N	24 21 E	Port
Riga	LVA	SCN	56 58 N	24 6 E	Port
Engure	LVA	SCN	57 10 N	23 14 E	Port
Mersrags	LVA	SCN	57 22 N	23 8 E	Port
Ventspils	LVA	SCN	57 24 N	21 33 E	Port
Labrags	LVA	SCN	56 59 N	21 22 E	Port
Liepaja	LVA	SCN	56 31 N	21 1 E	Port
Pavilosta	LVA	SCN	56 54 N	21 11 E	Port

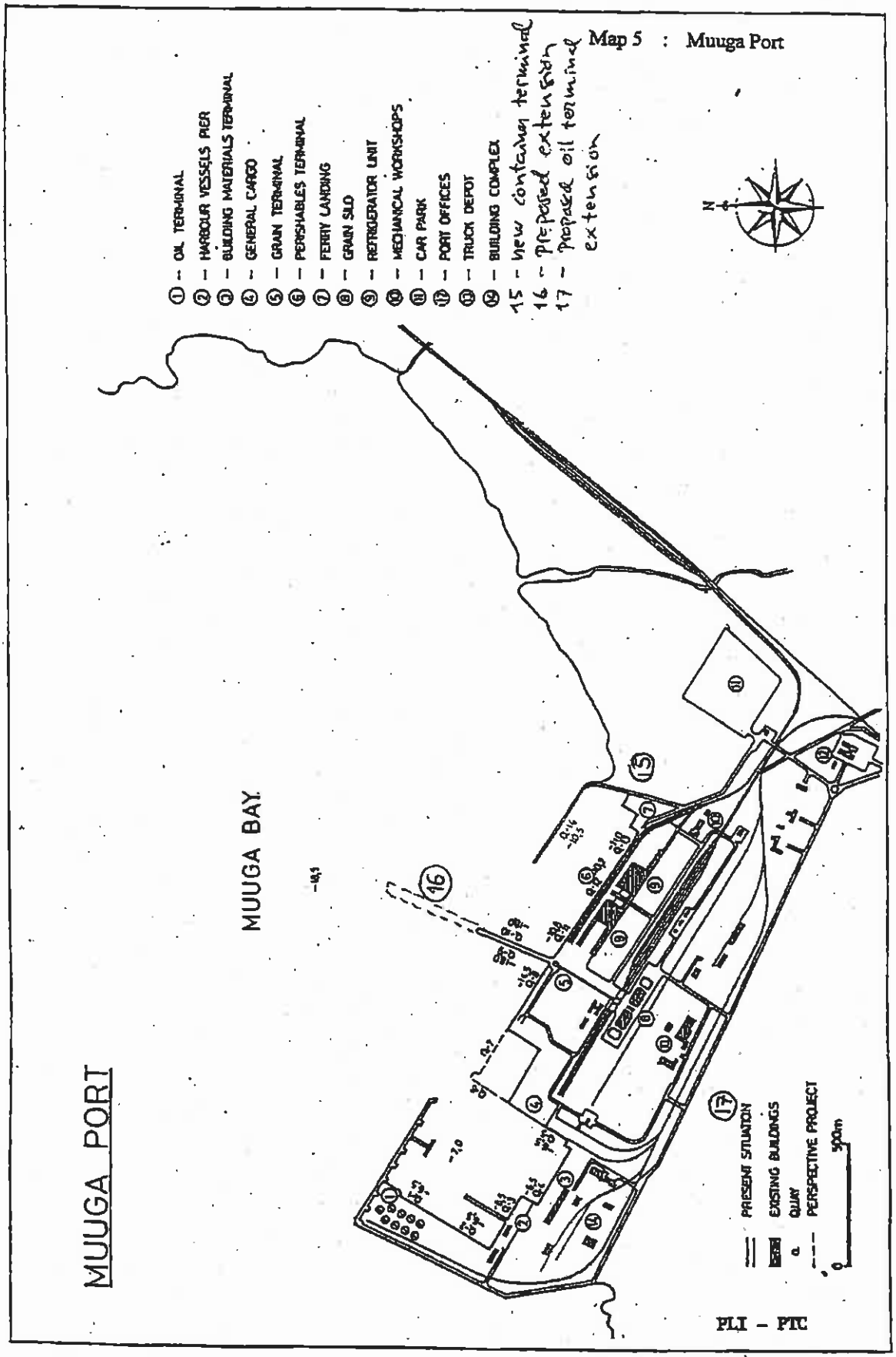
Baltic Sea Ports, Lithuania

Name	Country	Area	Latitude	Longitude	Type
Butinge Term.	LTU	SCN	55 58 N	20 43 E	Terminal
Klaipeda	LTU	SCN	55 43 N	21 8 E	Port

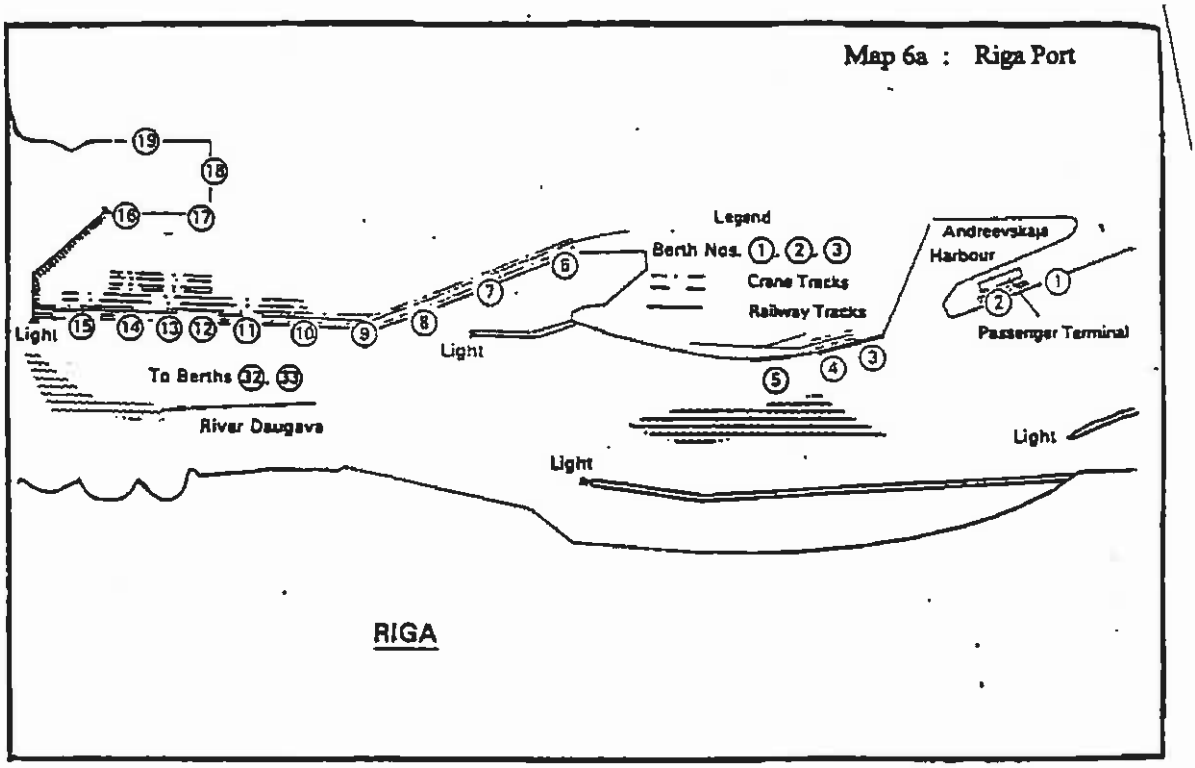
APPENDIX 8.
Tallinn City Port



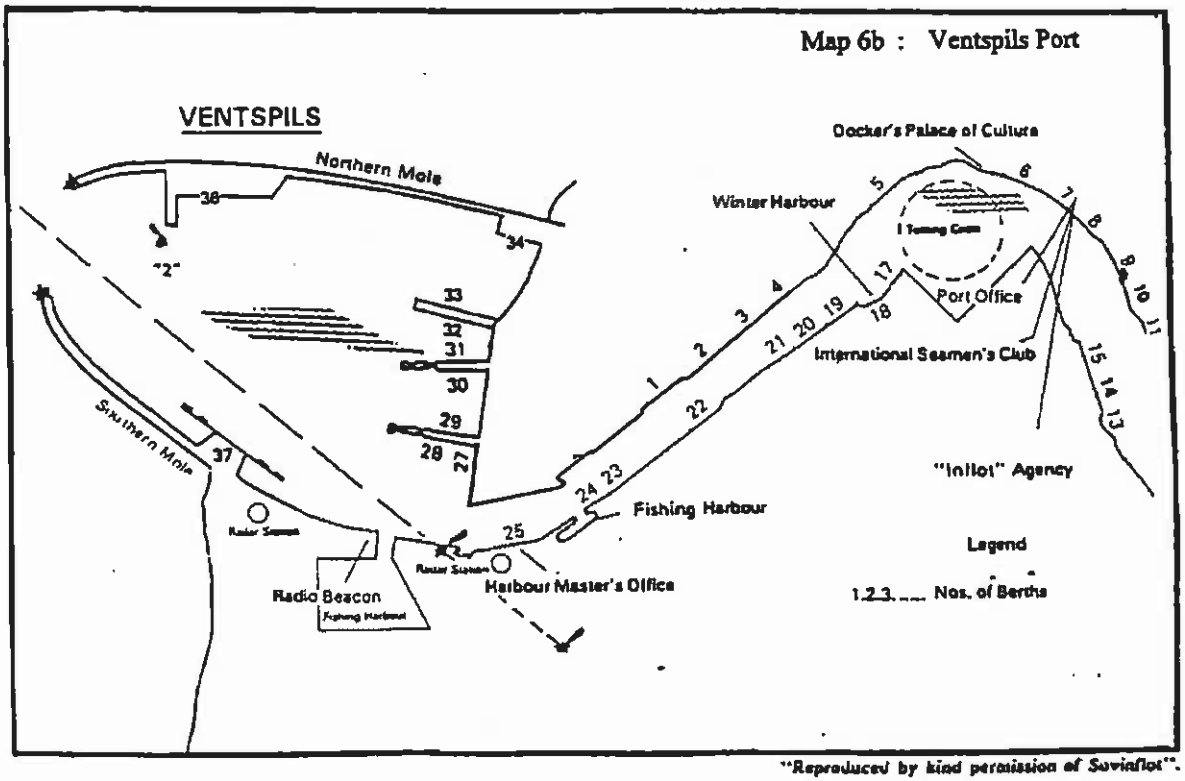
APPENDIX 9.
Port of Muuga



APPENDIX 10.
Port of Riga



APPENDIX 11.
Port of Venspils



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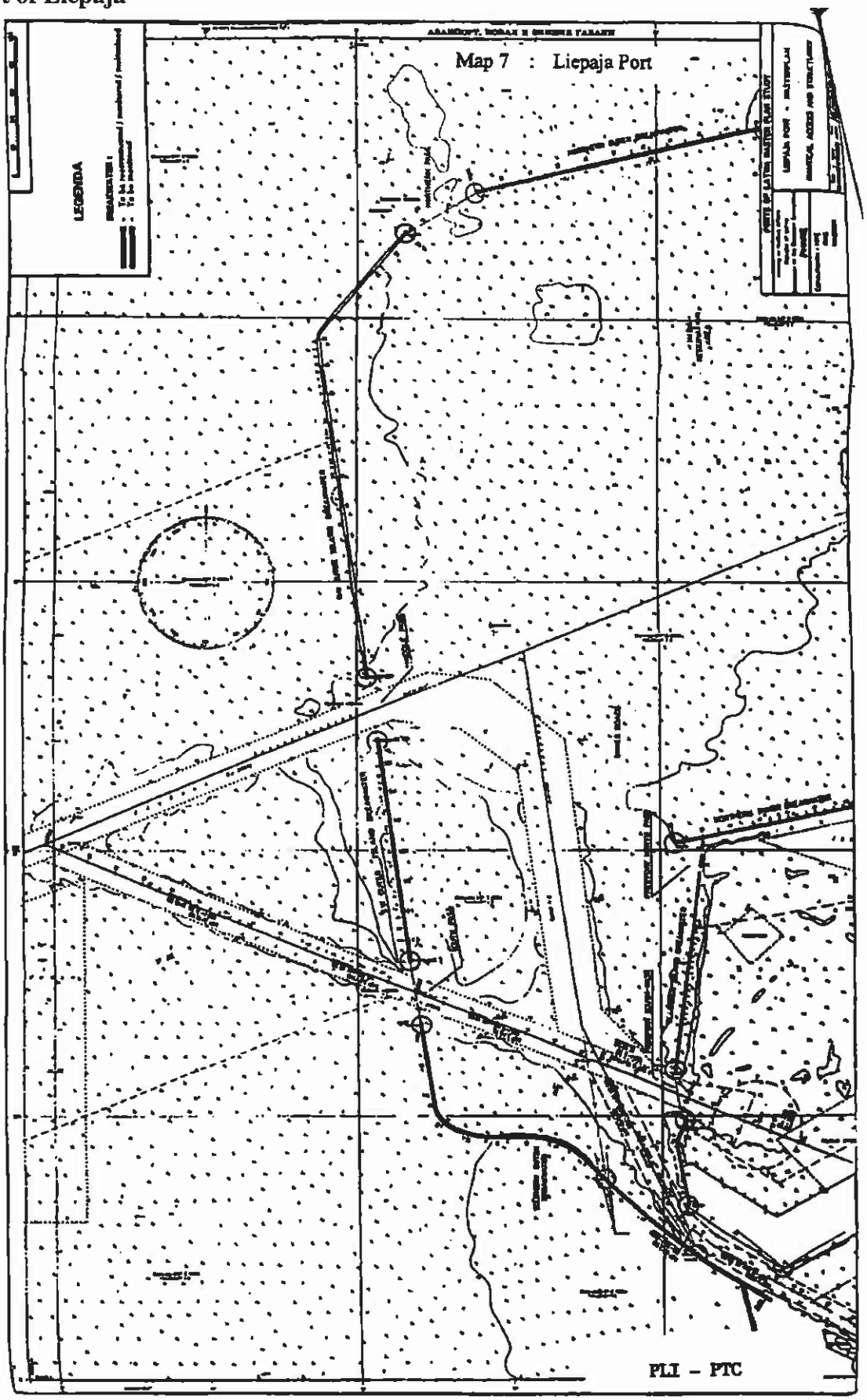
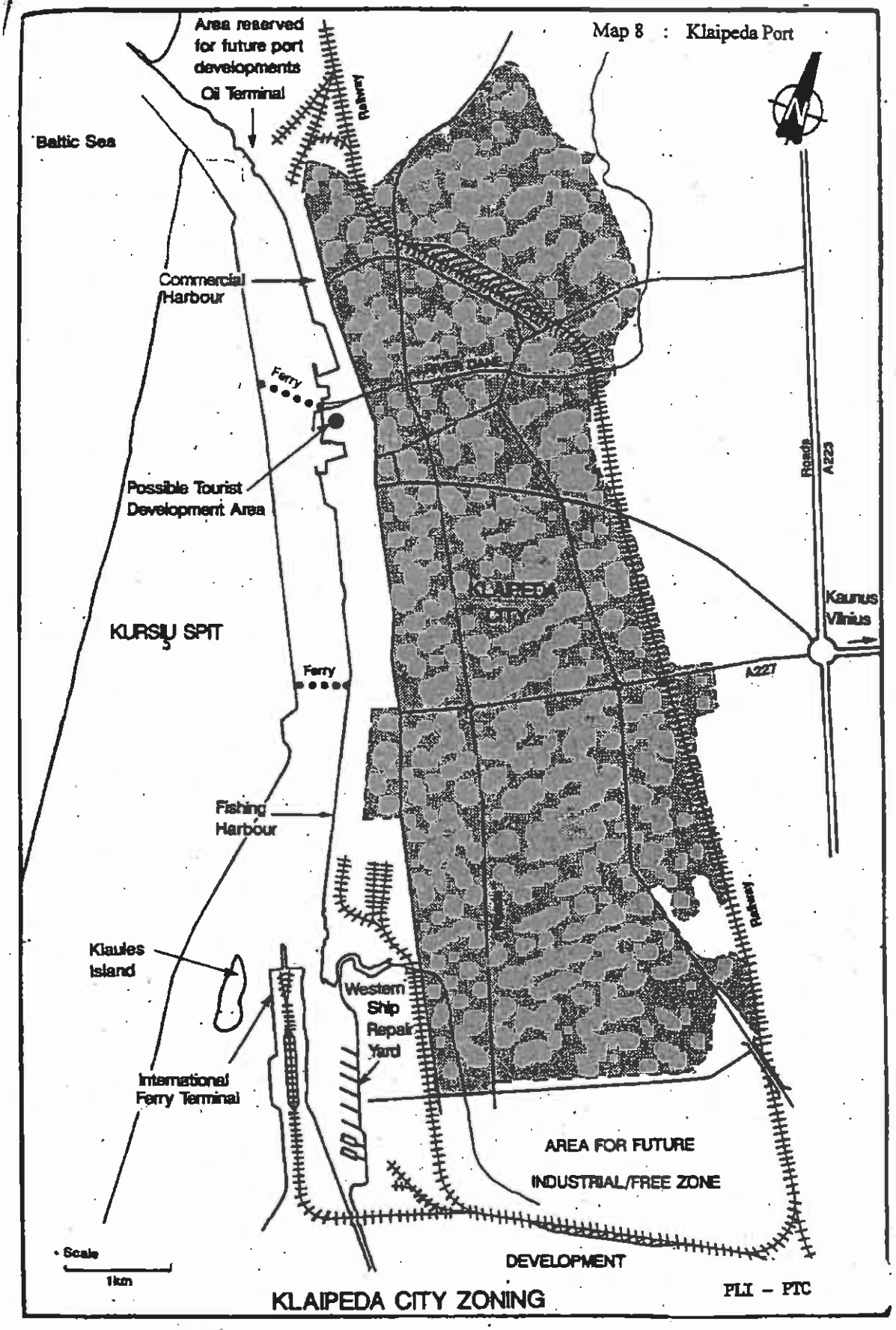
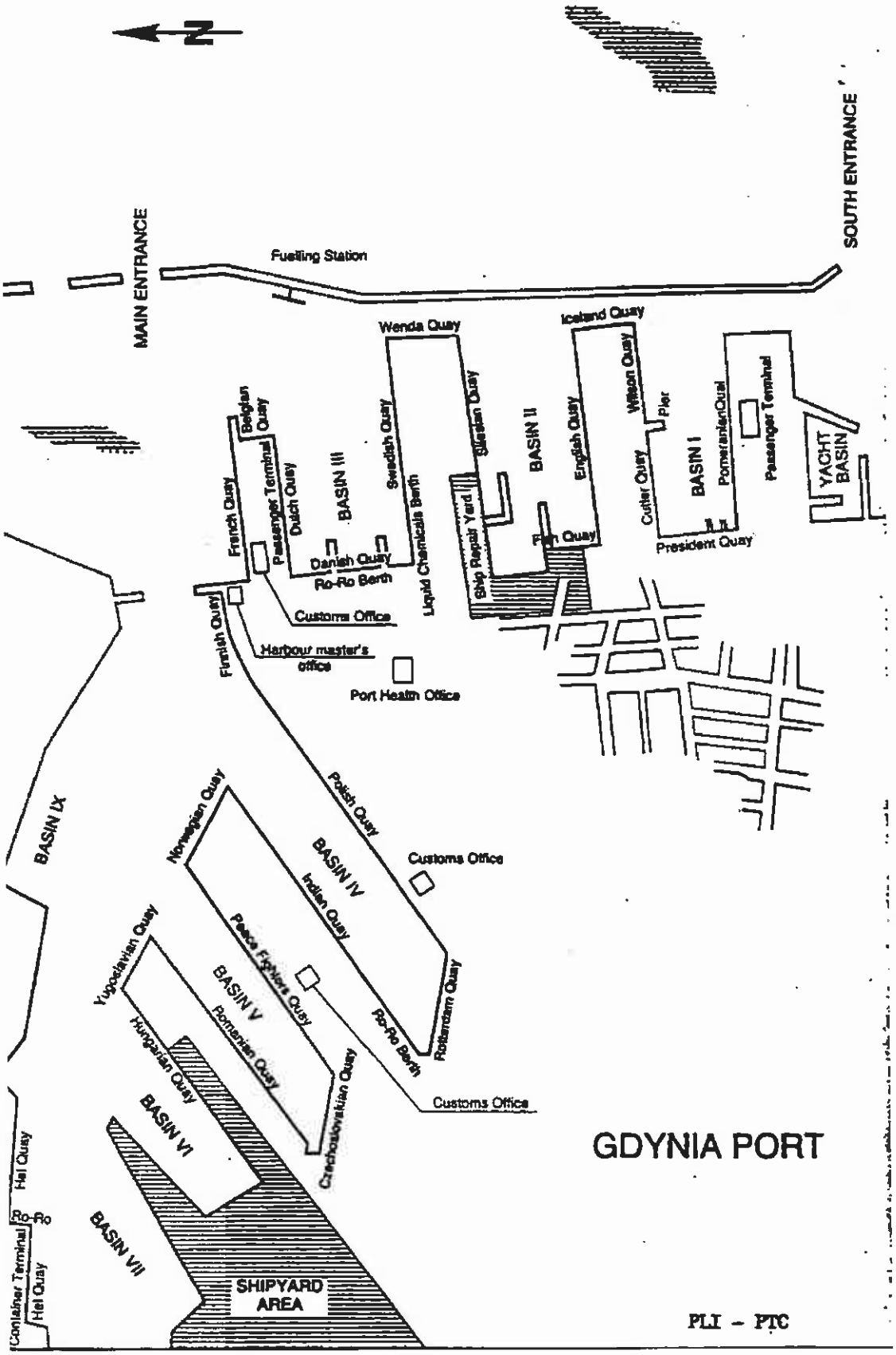
APPENDIX 12.
Port of Liepaja



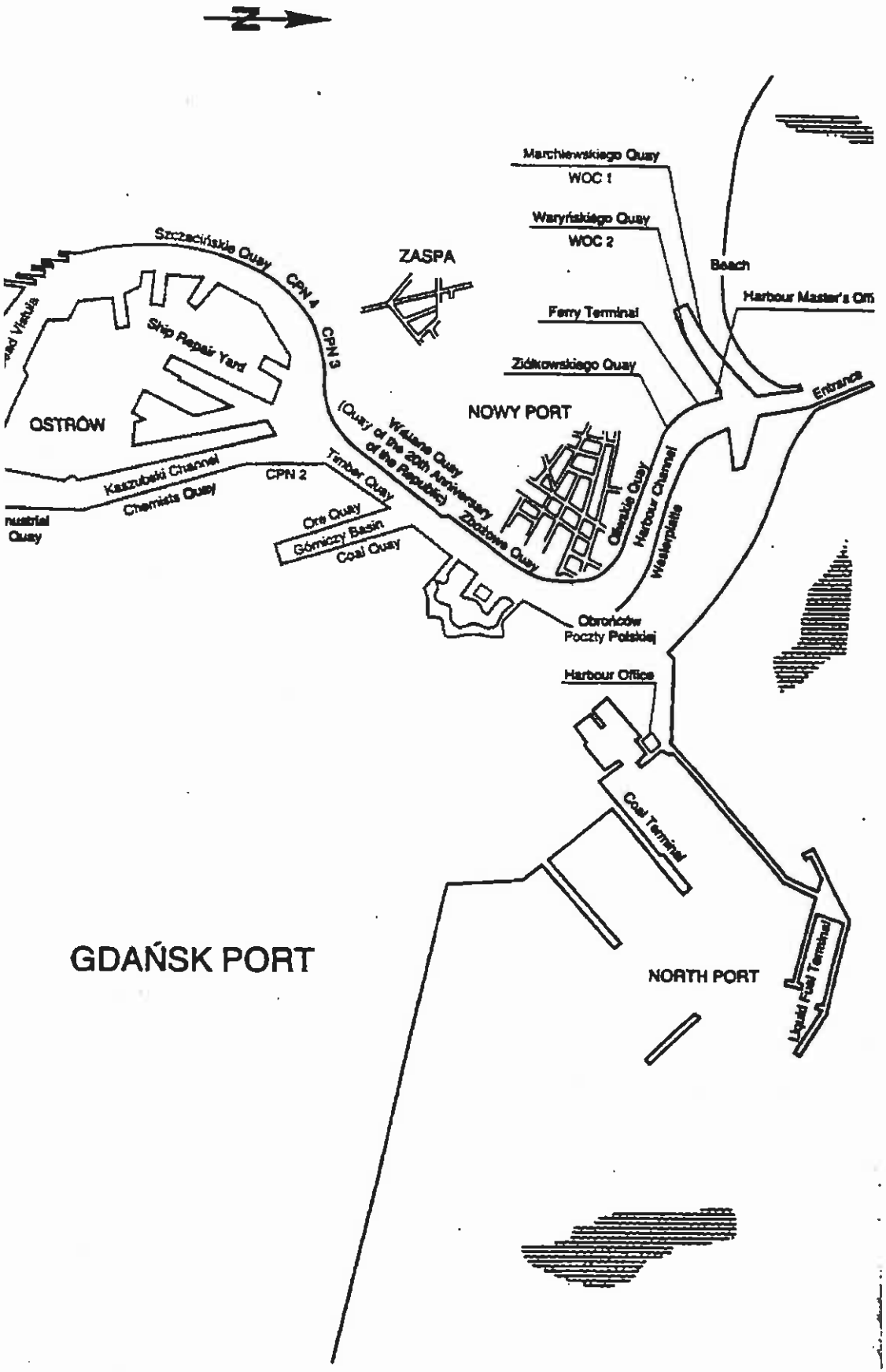
APPENDIX 13.
Port of Klaipeda



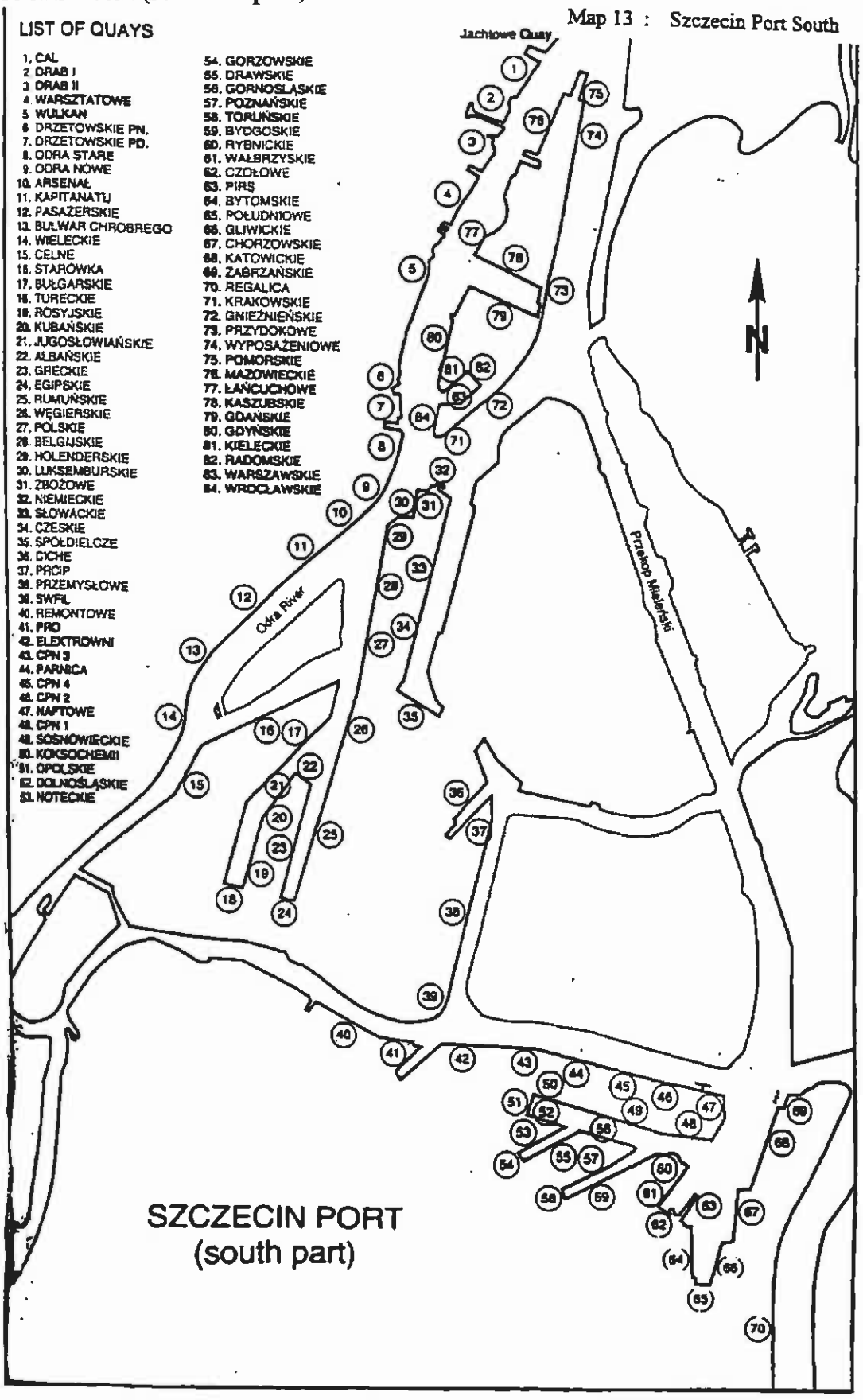
APPENDIX 14.
Port of Gnydia



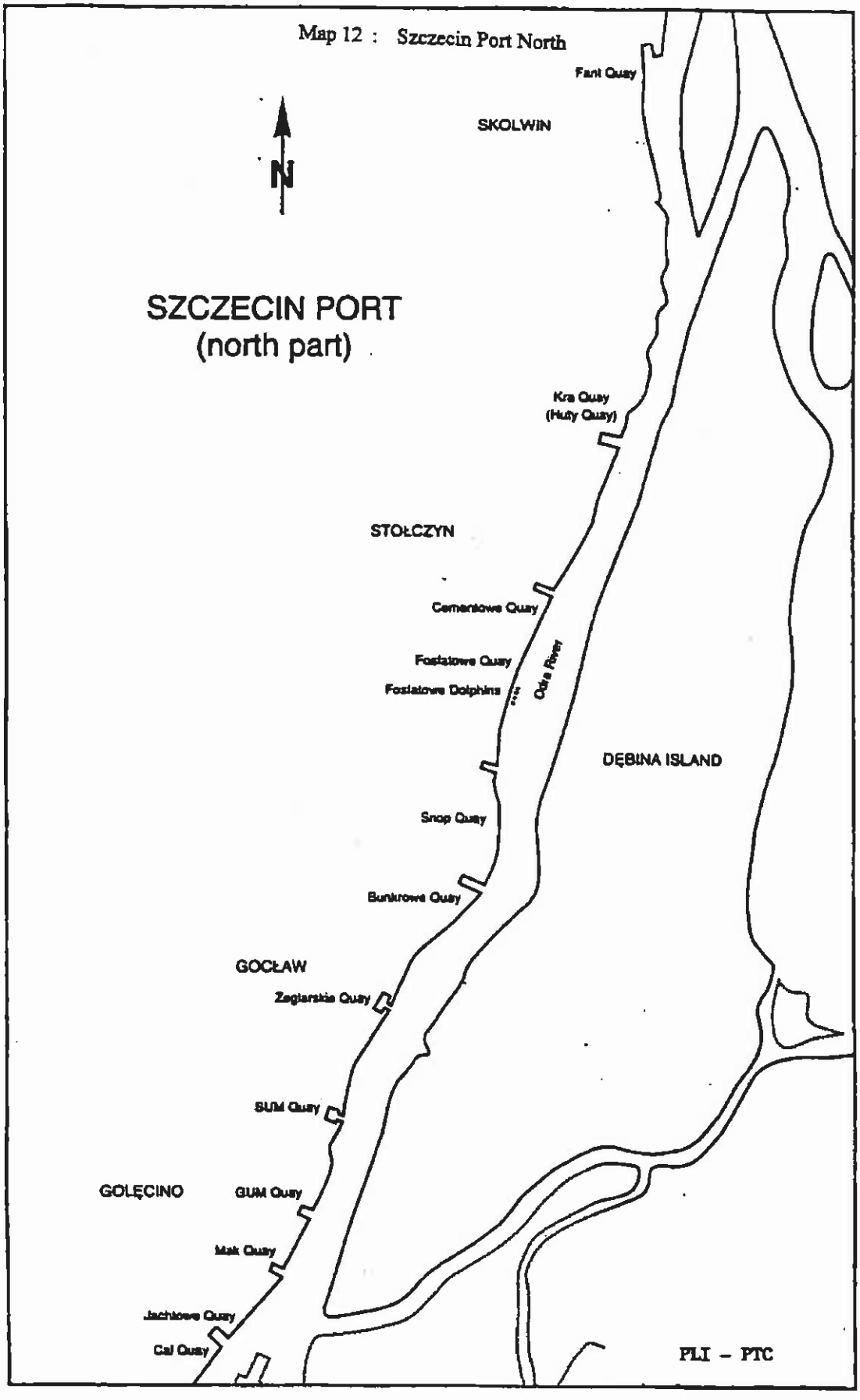
APPENDIX 15.
Port of Gdansk



APPENDIX 16.
Port of Szczecin (southern part)

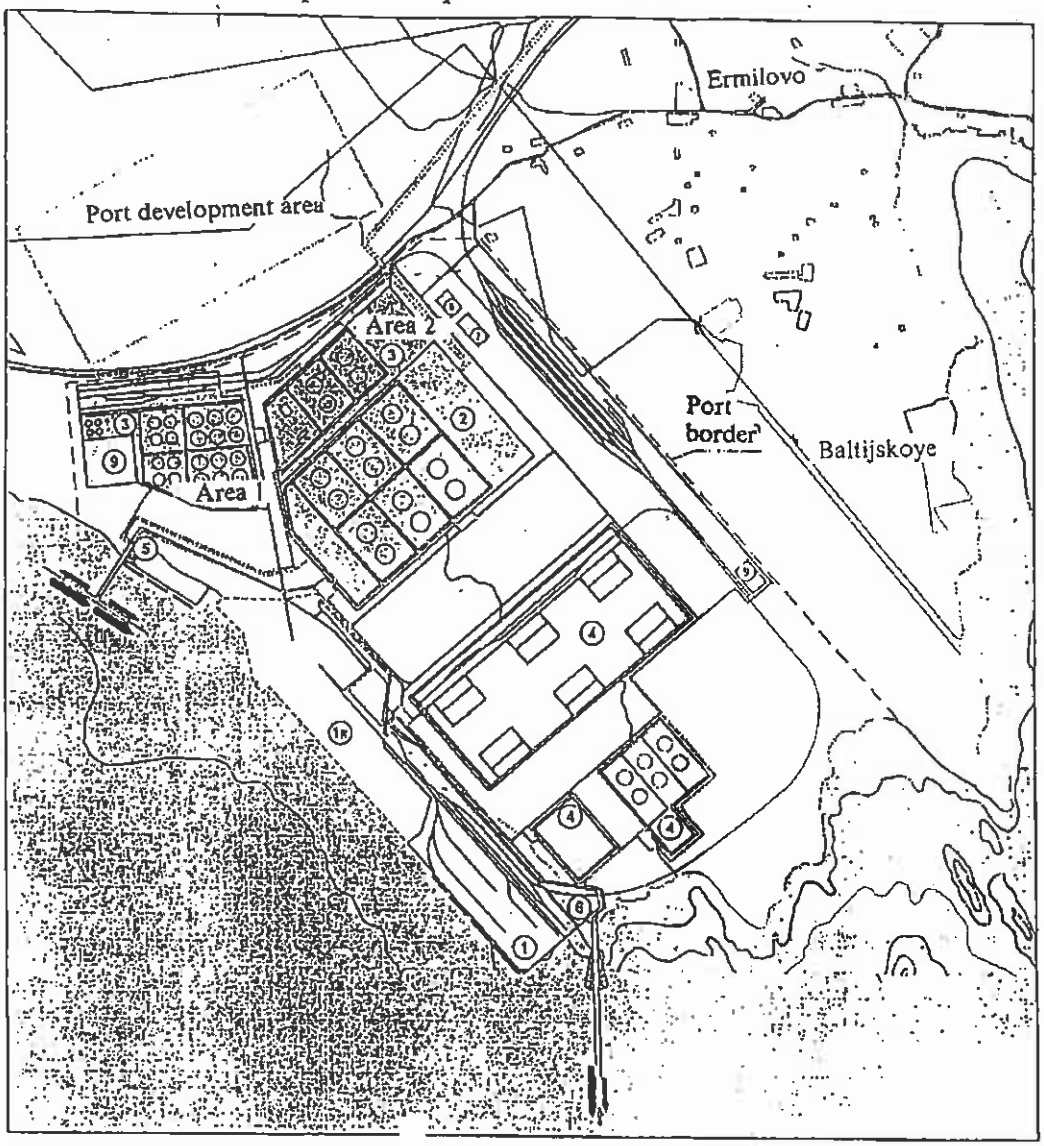


APPENDIX 17.
Port of Szcecin (northern harbours)



APPENDIX 18.
Port of Primorsk

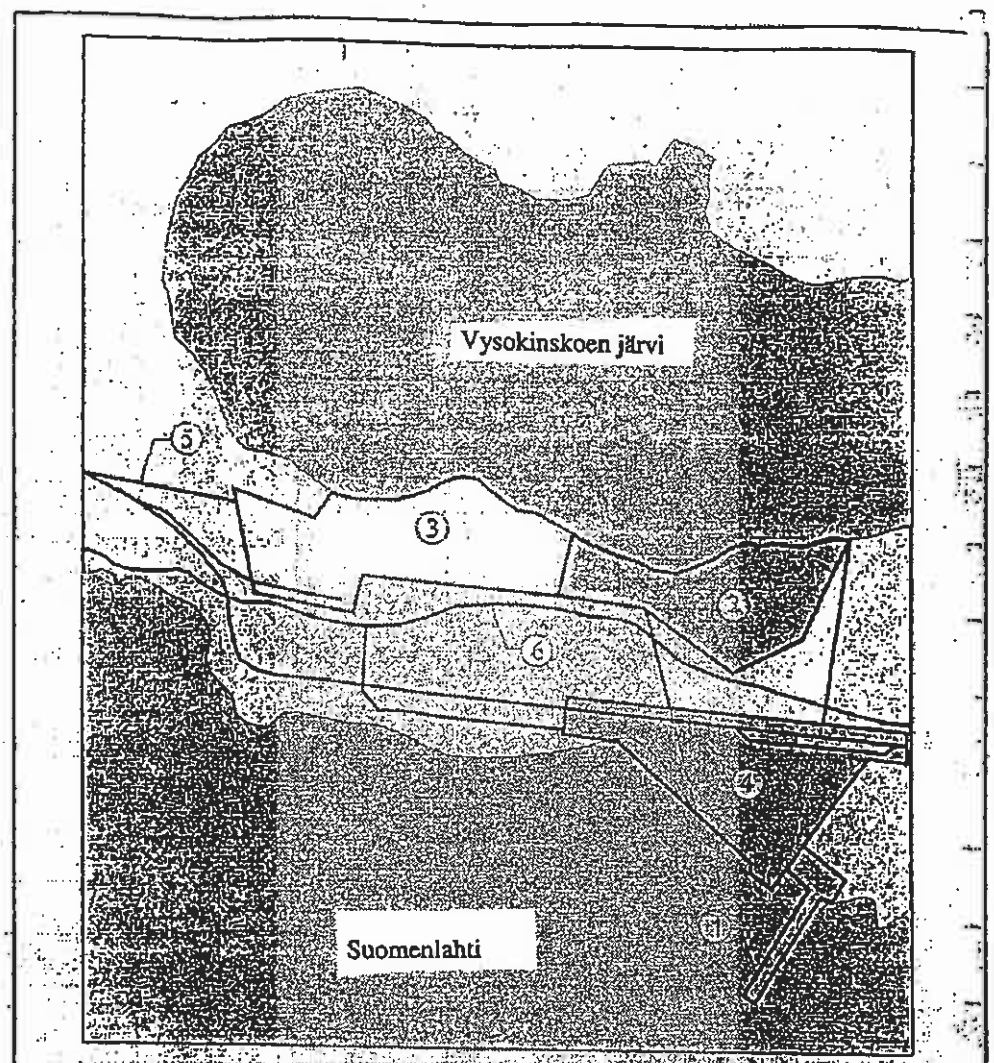
Scheme
of general plan of transport-technological
port complex in Primorsk



LEGEND

- ① General cargo terminal
- ①к Container terminal
- ② Oil terminal
- ③ Oil products terminal
- ④ Liquified gas terminal
- ⑤ Base of marine special division
- ⑥ General objects of port system
- ⑦ Water supply systems
- ⑧ Energy supply systems
- ⑨ Waste water systems
- Motorway
- Railways
- Pipeline
- Boundary of dredged soil
- Sanitary zone boundary

ЛЕНМОРНИИПРОЕКТ

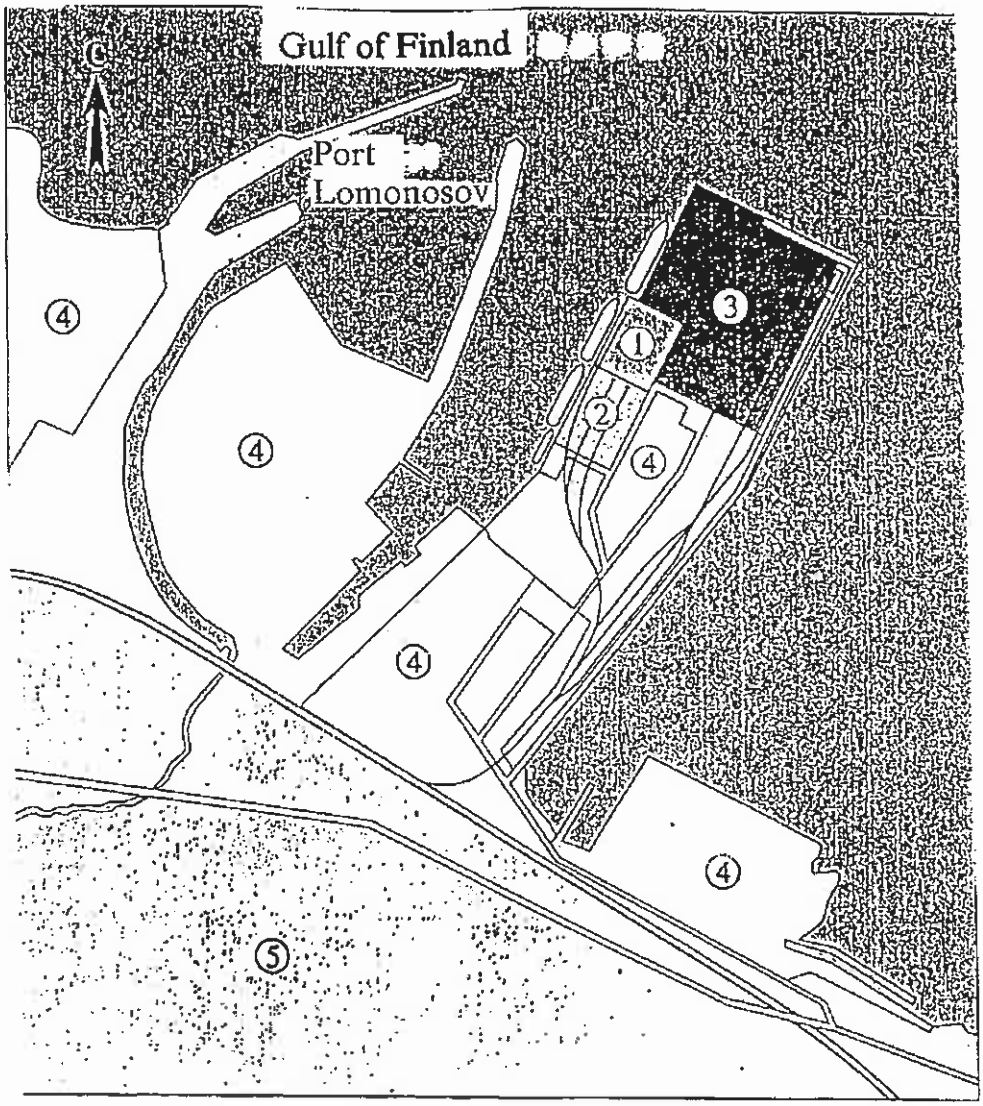


УСЛОВНЫЕ ОБОЗНАЧЕНИЯ

1. kaasuterminaalin laituri
2. Nestekaasuterminaali
3. Primorskin keskusalue NTC
4. Suunniteltu erityisrahdin terminaalialue
5. Olemassaoleva rautatie
6. Olemassaoleva moottoritie

КУСТОВАЯ БАЗА СЖИЖЕННОГО ГАЗА
С МОРСКИМ ГАЗОВЫМ ТЕРМИНАЛОМ
в районе п.Приморск (Выборгский р-н)

APPENDIX 19.
Port of Lomonosov

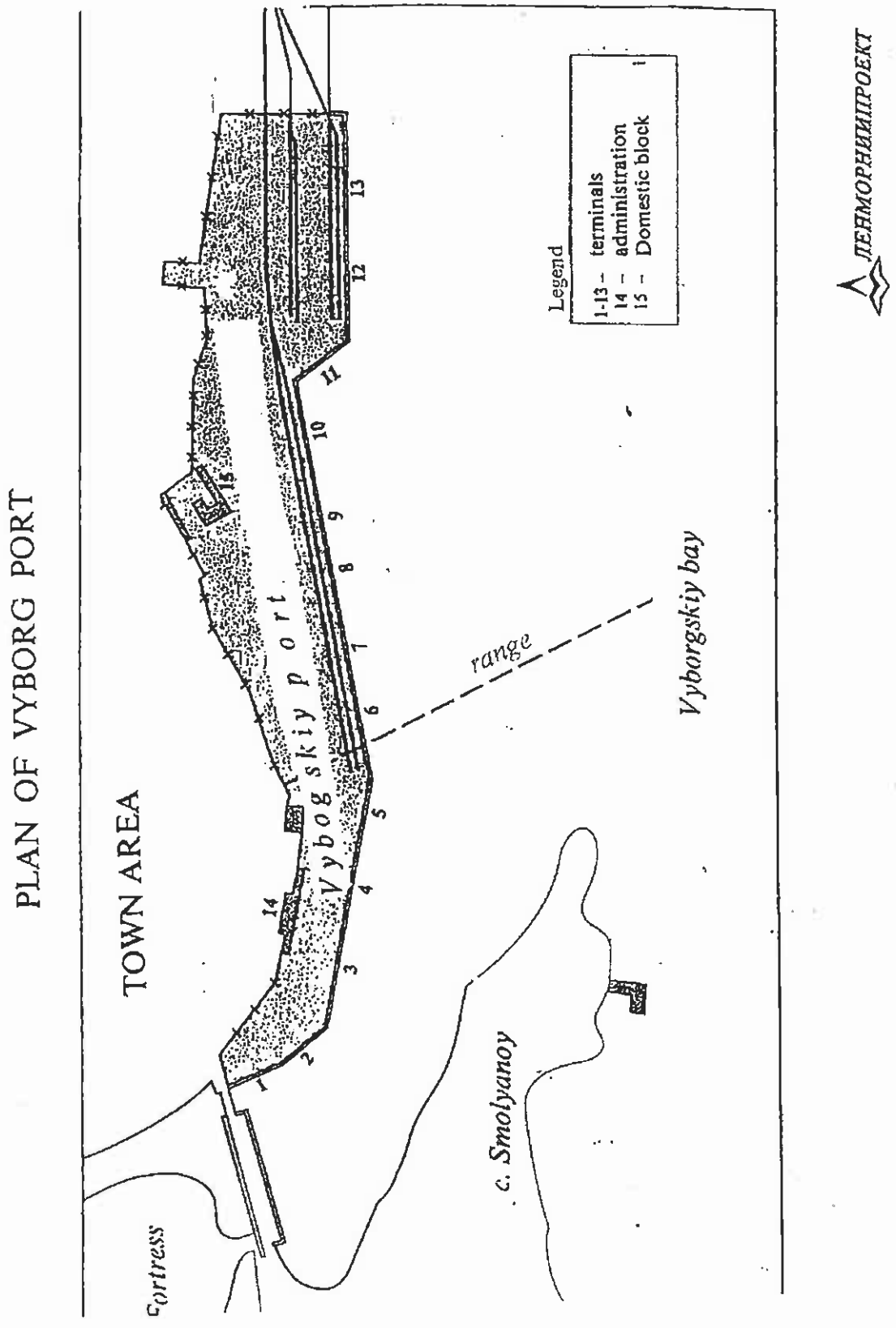


Legend

- Perishable goods terminal
- Metal cargo terminal
- Container terminal
- General objects of port system
- Town area
- Motor way
- Railways

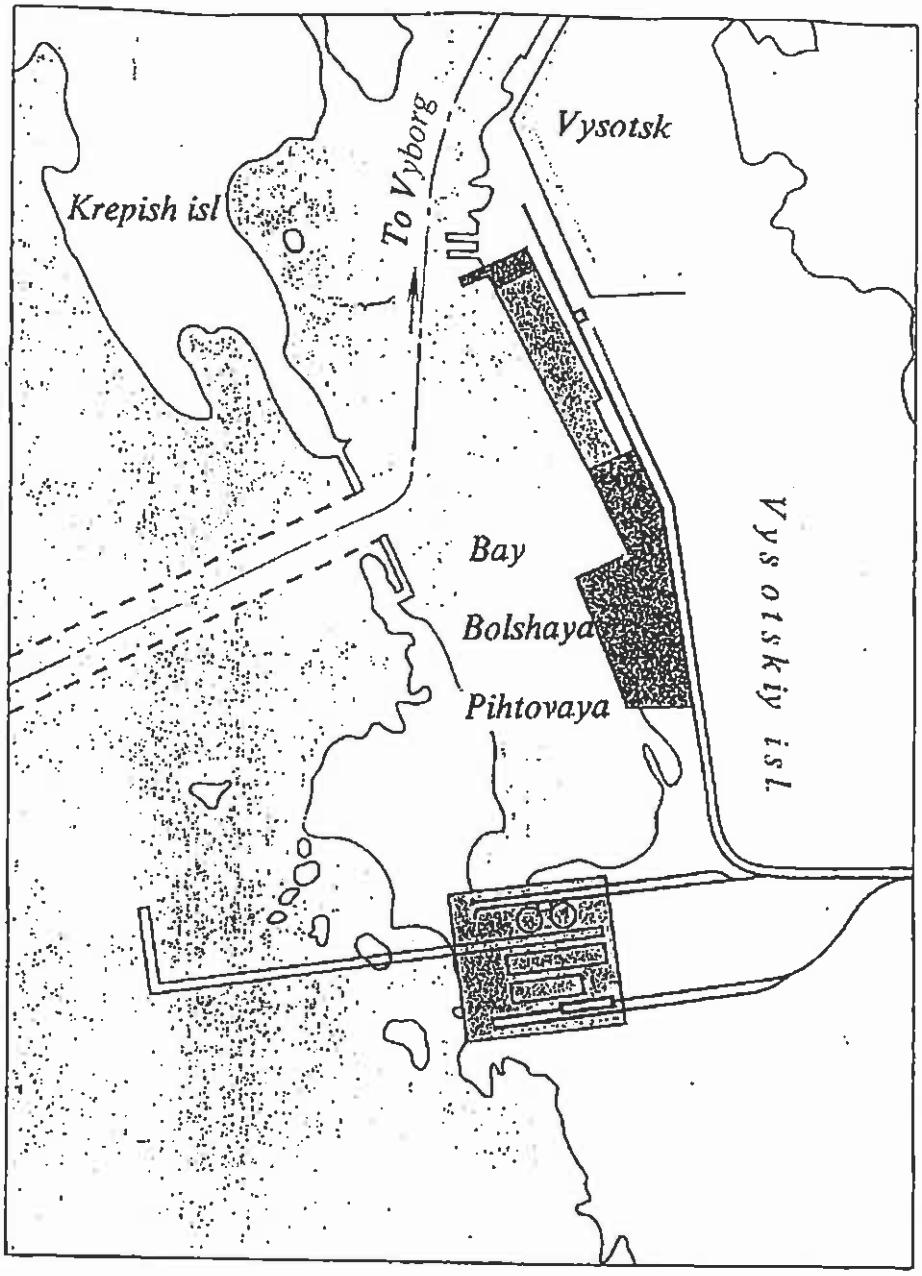
PORT COMPLEX IN LOMONOSOV

APPENDIX 20.
Port of Vyborg



APPENDIX 21.
Port of Vysotsk

PLAN OF PORT DEVELOPMENT IN VYSOTSK

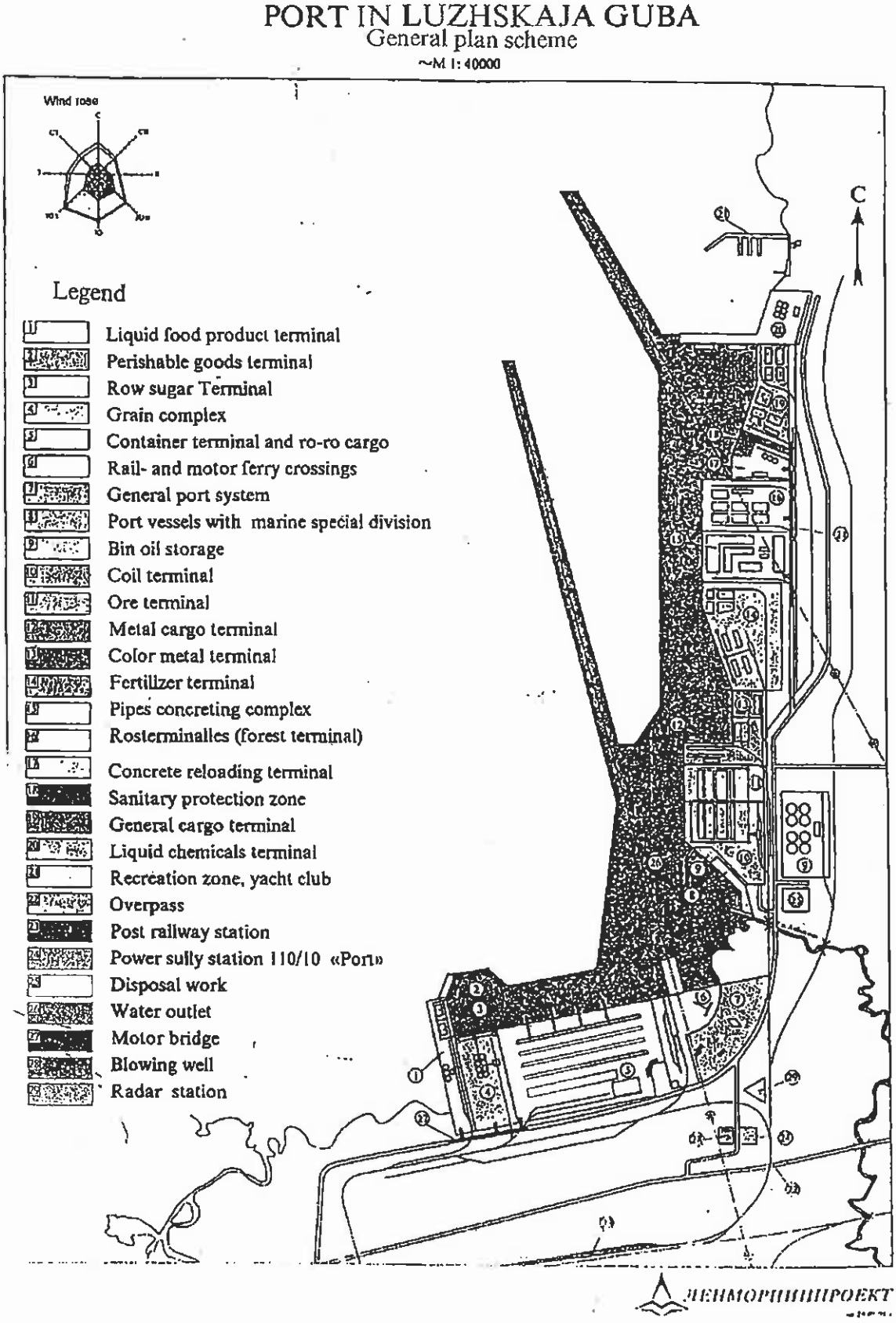


LEGEND

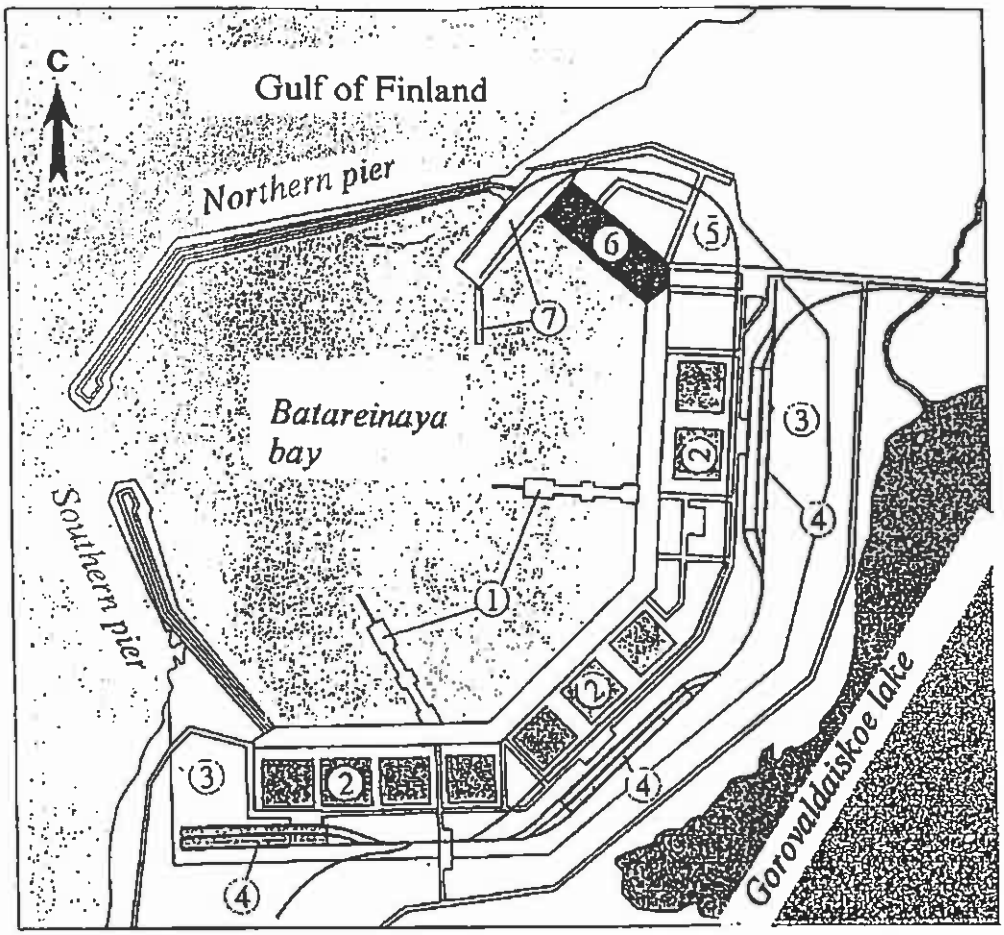
Existing port area
Area of post development
Designed complex for mineral fertilazers and alumina reloading.

ЛЕНМОРНИИПРОЕКТ

APPENDIX 22.
Port of Luzhskaja Guba



APPENDIX 23.
Port of Batareinya

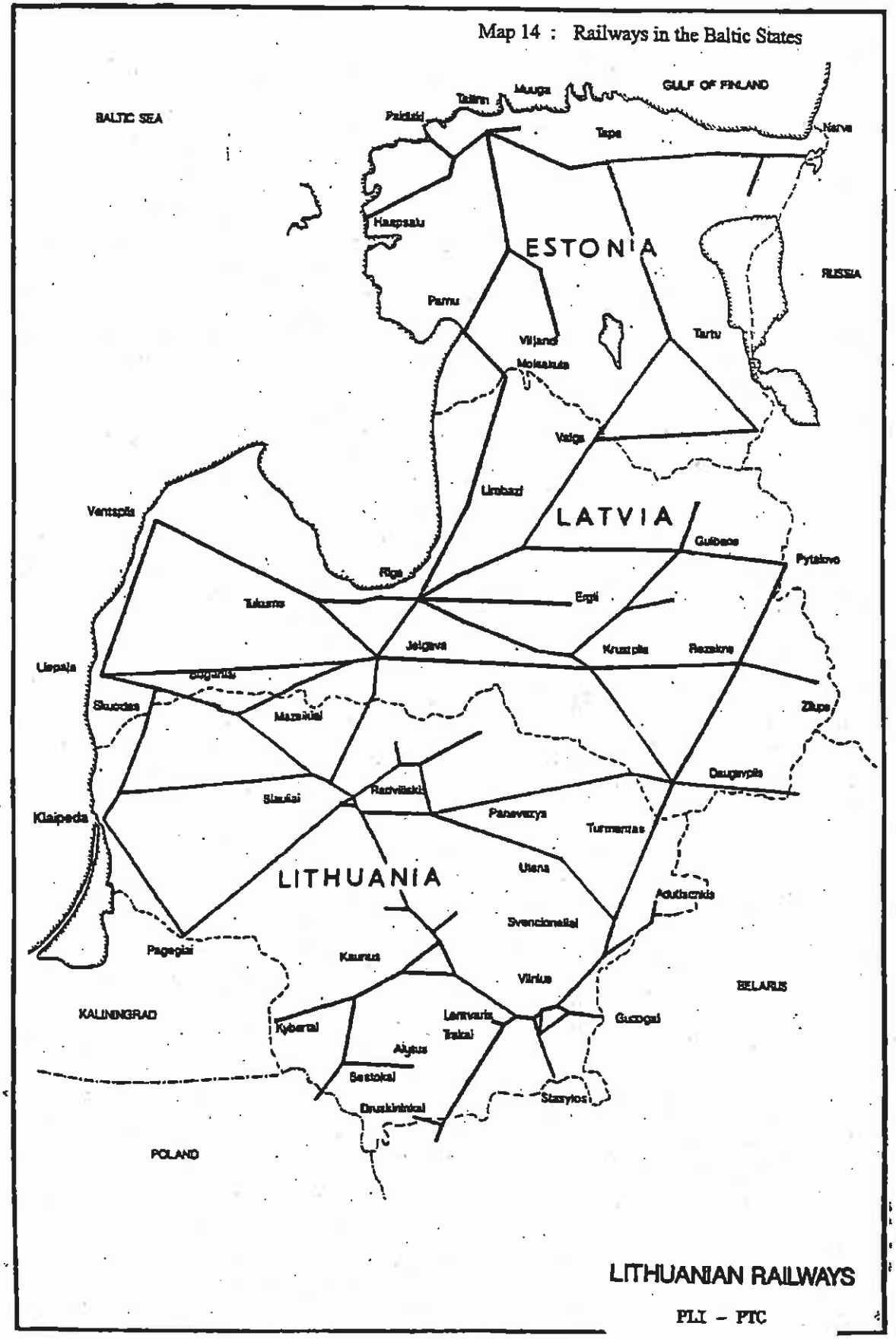


LEGEND

- Port area border
- Oil terminals
- Reservoir area
- Production zone
- Rundown fronts
- Disposal works area
- Port fleet Technical service
- Complex of general cargo reloading
- Motorway
- Railway

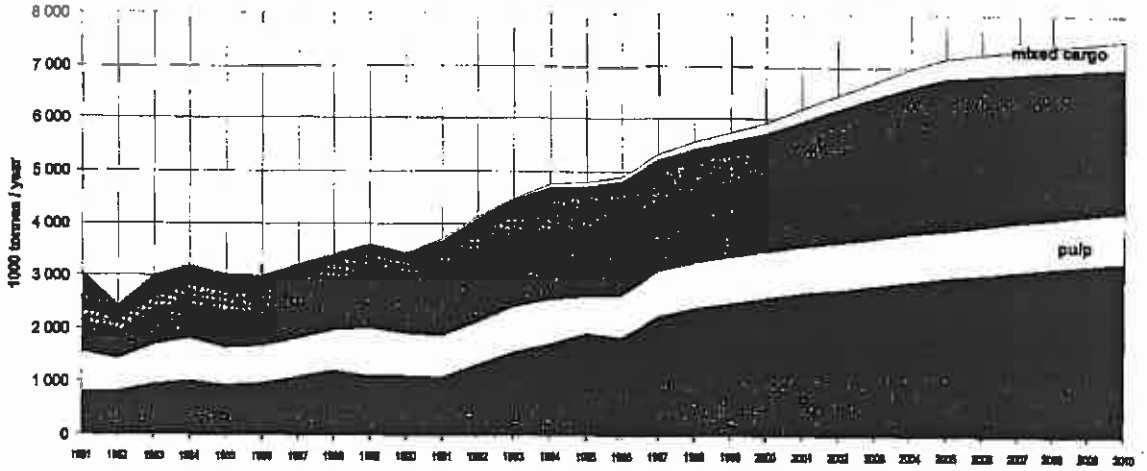
PORT IN BATAREINAYA BAY

APPENDIX 24.
Baltic railways network

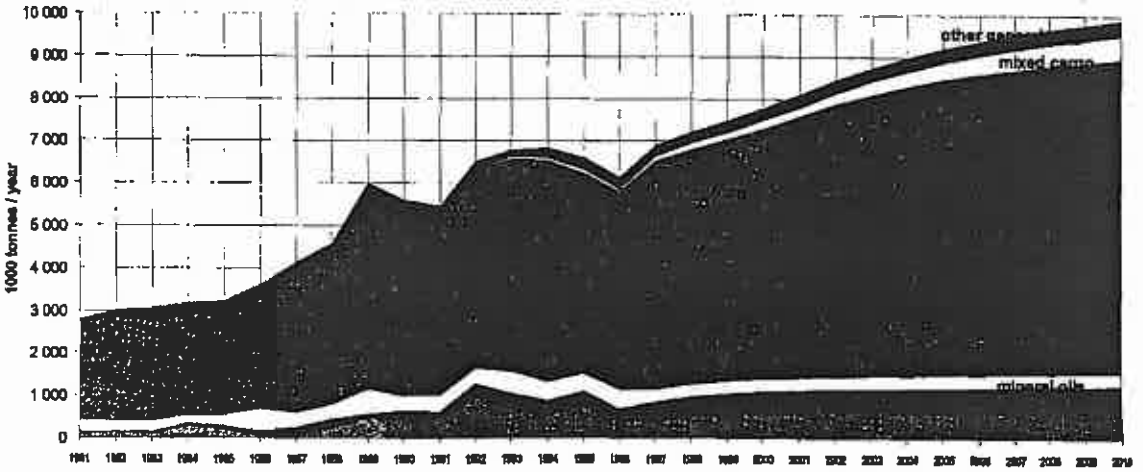


APPENDIX 25.
Exports and imports through the Finnish ports in Gulf of Bothnia in 1981-2010.

Exports through the Bay of Bothnia ports 1981-1997 and forecast of exports 1998-2010



Imports through the Bay of Bothnia ports 1981-1997 and forecast of imports 1998-2010



APPENDIX 26.

Forecast of the throughput development in Baltic up to 2015. The prognoses has been made in 1993, and is underestimating the Russian and Estonian developments.

Table 3: Ports in the Baltic Region: Tonnage forecasts														
Tonnage Forecasts in the years -Total														
	1991	1992	1995	2000	2005	2010	2015	% growth						
Ports								91-95	95-20	20-2005	2005-10	2010-15		
Tallinn-all	9.160	9.000												
Muuga			13.500	19.800	20.000	20.000	20.000	47,4	46,7					
Riga CP	5.209	4.735	3.278	2.975	3.784	4.440	5.224	-30,3	-9,2	27,2	17,3	17,7		
Riga Fish.P.	300	283	198	178	226	265	311	-30,7	-9,2	27	17,3	17,4		
Volerl Port		550	48	55	75	94	118	-91,3	14,8	36,4	25,3	23,4		
Ventspills	24.758	21.375	16.071	12.356	14.104	16.313	18.877	-24,8	-23,1	14,1	15,7	15,7		
Liepaja		100	82	104	144	184	234	-8	13	36,5	27,8	27,2		
Klaipeda	12.407	12.000	9.676	12.530	13.240	13.684	14.248	-22	29,5	5,7	3,4	4,1		
St Petersburg	15.000	15.300	17.000	17.000	24.000	25.000	26.000							
TOTAL	66.924	63.343	59.861	64.998	75.573	79.980	85.010							
Gdansk	24.700	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.							
Gdynia	11.900	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.							
Szczecin	23.900	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.							

APPENDIX 27.
Largest crude oil terminals in the Baltic Sea area (Arentz, 2002b).

Country/location	Terminal	Discharge / loading	Max. length	Max. DWT	Loading rate m^3/hour
Germany					
Rostock	oil harbour berth 3	disc/load		85 000	350 / 1 400
Brunsbuttel	Elbehafen oil section	discharge	400 m	130 000	
Hamburg	Kattwykhafen	discharge		70 000	
Wilhemshaven	North-West oelleitung, berth 4	discharge		260 000	
Standerstand	St Catalina Island oil terminal	discharge	230 m	60 000	1 200
Poland					
Gdansk	North Port liq. terminal	disc/load	300 m	150 000	4 150/4 150
Denmark					
Kalundborg	Statoil Oil terminal	discharge	262 m	130 000	6 400
Aabenraa	Oil terminal, berth1	disc/load	350 m	90 000	
Stignäsvärkets	Oil jetty	discharge		110 000	
Fredericia	Fredericia	disc/load	275 m	130 000	
Gulfhavn	Kuwait refinery	discharge	280 m	120 000	
Sweden					
Brofjorden	Brofjorden	discharge		500 000	
Nynäshamn	Nynäshamn	discharge	300 m	130 000	
Gothenburg	Torshamnen berth 801	discharge	300 m	225 000	
Finland					
Porvoo/Sköldvik	Fortum Oil Harbour	discharge	330 m	150 000	12 800
Naantali	Fortum Oil harbour	discharge	250 m	70 000	
Estonia					
Muuga	Crude oil loading berth	load		95 000 – (120 000)	
Latvia					
Ventspils	Ventspils	load	225 m	120 000	2 570
Lithuania					
Klaipeda	Butinge marine terminal	disc/load		80 000	4 300
Russia					
Primorsk	load			120 000	

APPENDIX 28.
North European crude oil terminals

North European Crude Oil Terminals

Country/ location	Terminal	Discharge/ Loading	Max length	Max DWT	Dis/load rate mt/h	Refinery	Operator
United Kingdom							
Tranmere	Tranmere Oil Terminal North Stage	Discharge		95,000		Shell UK Ltd. Stanlow	Shell UK Ltd.
Pembroke	Texaco Terminal Berth 6	Discharge		275,000		Texaco Ltd.	Texaco Ltd
Shell Haven	Shell Haven	Discharge	355.0 m	270,000		Shell UK Ltd., Haven	Shell UK Ltd
Milford Haven	Milford Haven	Discharge		275,000		Elf Oil (UK) Ltd., Milford Haven Ref.	Elf Oil (UK) Ltd.
Immingham	Immingham Oil Terminal	Discharge	335.3 m	140,000		Lindsey Oil Refinery Ltd.	Humber Oil Terminals Trustee Ltd.
Finnart	Finnart Terminal	Discharge		300,000		BP Oil Grangemouth Refinery Ltd.	BP Oil (UK) Ltd.
Fawley	Esso Marine Terminal	Discharge		110,000	10,000	Esso Petroleum Co. Ltd.	Esso Petroleum Co. Ltd
Coryton	Coryton	Discharge		90,000	14,000	BP Oil (UK), Coryton	BP Oil (UK) Ltd.
Sullom Voe	Sullom Voe	Load	365.0 m	350,000	13,750	None	BP Oil (UK) Ltd.
Flotta	SPM Nos 1 & 2	Load		200,000	10,900	None	Elf Exploration (UK)
Tessport	Seal Sands Oil Terminal (No 2 Jetty)	Load	295.0 m	150,000		Phillips Imperial Petroleum	Phillips Petroleum UK
Nigg	Nigg Oil Terminal	Load	290.0 m	155,000	6,800	None	BP Oil (UK) Ltd.
Hamble	BP Terminal Hamble	Load	260.0 m	110,000	6,000	None	BP Oil (UK) Ltd.
The Netherlands							
Vlissingen	Total Refinery Jetty	Discharge	280.0 m	100,000	3,000	Total Fina	None
Amsterdam	Oiltanking B.V.	Discharge	310.0 m	100,000	2,000	Amsterdam Refinery (Smid & Hollander)	None
Terneuzen	Ocean Dock	Discharge	280.0 m	100,000		None	None
Borssele	Borssele	Discharge		80,000		None	None
Europoort	Nerefco 6th Petroleumhaven	Disc/Load		260,000		Nerefco	None
Europoort	Maasvlakte Oil Terminal 8th Petrolhaven	Disc/Load	364.0 m	350,000		None	None
Germany							
Rostock	Oil Harbour Berth No. 3	Disc/Load		85,000	350/1,400	None	Seehafen Rostock
Brunsbuttel	Elbehafen Oil Section	Discharge	400.0 m	130,000		None	None
Hamburg	Kattwykhafen	Discharge		70,000		None	None
Wilhelmshaven	Nord-West Oelleitung Berth No 4	Discharge		260,000		None	Nord-West Oelleitung
Stondersand	Santa Catalina Island Oil Terminal	Discharge	230.0 m	60,000	1,200	None	Pinnavm Elektra
Poland							
Gdansk	North Port Liquid Fuel Terminal	Disc/Load	300.0 m	150,000	4,150/4,150	Gdansk Refinery	Port Polnocny
Norway							
Slagen	Slagen Marine Terminal	Discharge	350.0 m	190,000	10,000	Esso Refinery	Esso
Mongstad	Mongstad Crude Oil Jetty	Discharge	270.0 m	180,000		Statoil	Statoil
Mongstad	Mongstad	Load	350.0 m	300,000			Statoil
Kaarsta	Statfjord Terminal	Load		150,000		None	Statoil
Denmark							
Kalundborg	Statoil A/S Oil Terminal	Discharge	262.0 m	130,000	6,400	Kalundborg Refinery	Statoil
Aabenraa	Oil Terminal Berth 1	Disc/Load	350.0 m	90,000		None	None
Stignaesvaerket	Oil Jetty	Discharge		110,000		None	None
Fredericia	Fredericia	Disc/Loafd	275.0 m	130,000		Fredericia Refinery (Shell)	Dansk Shell
Gulfhavn	Kuwait Refinery	Discharge	280.0 m	120,000		None	Kuwait Petroleum DK
Sweden							
Brofjorden	Brofjorden	Discharge		500,000		Skandinaviska Raffinaden AB	None
Nynashamn	Nynashamn	Discharge	300.0 m	130,000		Nynäs Petroleum	Nynäs Petroleum
Gothenburg	Torshamnen Berth 801	Discharge	300.0 m	225,000		None	Port of Gothenburg
Finland							
Porvoo	Porvoo	Discharge	330.0 m	150,000	12,800	None	Fortum Oil & Gas Oy
Naantali	Fortum Oil Harbour	Discharge	250.0 m	70,000		None	Fortum Oil & Gas Oy
Estonia							
Muuga	Crude Oil Loading Berth	Load		95,000		None	None
Latvia							
Ventspils	Ventspils	Load	225.0 m	120,000	2,570	None	Ventbunkers
Lithuania							
Klaipeda	Butinge Marine Terminal	Disc/Load		80,000	4,300	Mazheikiai Refinery (Nafta)	Mazheikiai Nafta
Russia							
Primorsk	Primorsk	Load		120,000		(See text)	(See text)

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Source: Scandinavian Shipping Gazette; June 14, 2002.

Country/ location	Terminal	Discharge/ Loading	Max length	Max DWT	Dis/load rate mt/h	Refinery	Operator
OFFSHORE LOADING							
Norway							
Yme Field	Polysaga	Load		100,000		None	None
Varg	Petrojarl Varg	Load		80,000		None	Golar Nor Offshore
Norne	Norne FPSO	Load		60,000		None	Statoil
Njord	Njord B	Load		90,000		None	Norsk Hydro
Gullfaks	Loading Buoys	Load		140,000		None	Statoil
Heidrun	Shuttle loading	Load		130,000		None	Statoil
Draugen	Draugen	Load		150,000		None	Norske Shell
Aasgaard	Aasgaard A	Load		80,000		None	None
United Kingdom							
Brenheim Field	Petrojarl 1	Load		67,000		None	Petroleum Geo-Services UK Ltd.
Banff Field	Ramform Banff	Load		100,000		None	Petroleum Geo-Services UK Ltd.
Alba Terminal	Alba	Load		130,000		None	Chevron UK Ltd.
Ross Field	Bleo Holm	Load		150,000	4,300	None	Talisman Energy Inc.
Kittiwake	Kittiwake Loading Buoy	Load		110,000		None	Shell UK Exploration and Production
Gryphon Field	Gryphon A	Load		100,000		None	Kerr-McGee
Fonhaven Field	Petrojarl Fonhaven	Load		100,000		None	Petroleum Geo-Services UK Ltd.
Fife Field	Ulsge Gorm	Load		100,000		None	Amerada Hess
Curlew Field	Maersk Curlew	Load		100,000		None	MAS Production Company (Maersk)
Captain	Captain	Load		100,000		None	Texaco North Sea UK Co.
Teal/W. Guillemot	Teal/West Guillemot	Load		100,000		None	Shell UK Exploration and Production
Schiehallion	Schiehallion	Load		130,000		None	BP Oil (UK) Ltd.
Harding	Harding Offshore Loading Terminal	Load		120,000		None	BP Oil (UK) Ltd.
Denmark							
Siri	Siri Offshore Loading	Load		80,000		None	None

Source: Scandinavian Shipping Gazette; June 14, 2002.

APPENDIX 29.

Cargo throughput in Swedish ports in 2000 and 2001 (Svensk Sjäfarts Tidning, 2002).

Port	*Throughput 2001 (Mt)*					*Throughput 2000 (Mt)*				
	In		Out		Total	In		Out		Total
	Oil	total	Oil	Total		Oil	total	Oil	Total	
Brofjorden	9,36	9,36	8,97	7,97	18,30	10,17	10,20	10,04	10,08	19,85
Falkenberg	0	0,24	0,03	0,17	0,40	0,03	0,35	0	0,06	0,41
Gotland	0,08	0,62	0	0,72	1,34	0,09	0,66	0	0,74	1,40
Gävle	0,89	2,29	0,04	1,23	3,52	0,69	2,38	0,01	0,89	3,27
Göteborg	11,70	17,24	7,60	16,26	33,50	11,49	17,17	7,80	15,96	33,13
Hallstavik	0,02	0,11	0	0,38	0,50	0,02	0,28	0	0,42	0,70
Halmstad	0,39	1,20	0,07	0,76	1,96	0,32	1,14	0,06	0,77	1,94
Hargshamn	0	0,25	0	0,17	0,42	0	0,38	0	0,09	0,47
Helsingborg	-	?	0	?	7,40					9,90
Härnösand	-	-	-	-	0.00	0,02	0,41	-	0,54	0,95
Iggesund	-	0,38	0	0,53	0,91	-	0,51	-	0,64	1,15
Kalmar	0,24	0,57	-	0,32	0,81??	0,25	0,58	0	0,21	0,79
Kapellskär	-	1,04	-	1,10	2,14	-	0,99	-	1,04	2,03
Karlshamn	0,45	1,45	0,03	2,16	4,19?	0,52	1,72	0,21	2,55	4,55?
Karlskrona	0,01	0,24	-	0,09	0,33	0,02	0,11	-	0,14	0,25
Köping/ Västräs	0,51	2,44	0,01	0,80	3,24	0,45	2,69	-	0,70	3,39
Landskrona	-	0,51	-	0,08	0,59	-	0,46	-	0,22	0,68
Luleä	0,35	2,54	-	4,27	6,81	0,33	2,37	-	4,66	7,01
Lysekil	-	0,15	-	0,31	0,46	-	0,16	-	0,27	0,43
Malmö	5,15	13,26	?	?	13,26		?	?		13,21
Norrköping	0,88	2,36	0,05	1,65	4,01	0,83	2,53	0,06	1,54	4,07
Nynäshamn	-	0,14	-	0,18	0,33	-	0,12	-	0,18	0,30
Nynäs AB	1,03	1,03	0,96	0,96	1,99	1,10	1,10	1,02	1,02	2,18?
Oskarshamn Västervik	0,12	0,51	-	0,35	0,86	0,23	0,82	-	0,43	1,25
Oxelösund	0,01	3,65	0,05	1,42	5,07	0,13	3,66	0,07	1,32	4,98
Piteä	0,17	0,73	0,03	0,71	1,44	0,17	0,65	0,03	0,67	1,32
Ronneby	-	0,01	-	0	0,01	-	0,01	-	0,01	0,02
Simrishamn	-	0,01	-	0,02	0,02	-	0	-	0,02	0,02
Skellefteä	0,04	0,73	-	1,00	1,73	0,03	0,47	-	0,83	1,30
Slite	-	0,60	-	2,02	2,62	-	0,57	-	2,03	2,60
Stenungsund	1,20	1,81	0,1	1,02	2,83	0,03	1,77	0,44	1,37	3,14
Stockholm	1,14	3,89	0,03	1,55	5,44	1,04	3,80	0,02	1,57	5,37
Storungs	0,01	0,01	-	2,40	2,41	0,01	0,01	-	2,27	2,28
Strömstad	0,07	0,16	-	0,13	0,29	0,01	0,20	-	-	-
Sundsvall	-	1,52	-	1,51	4,2?	-	1,47	-	1,61	4,28
Söderhanm	0,08	0,33	0,02	0,24	0,57	0,09	0,46	0,02	0,24	0,70
Södertälje	0,31	0,68	-	0,08	0,76	0,29	0,67	-	0,10	0,77
Sölvesborg	-	0,62	-	0,05	0,67	-	0,60	-	0,04	0,64
Trelleborg	0,07	4,68	-	5,16	9,84	0,06	4,59	-	5,74	10,33
Uddevalla	0,03				0,97?	0,04				1,29
Umeå	0,31	0,63	0,01	1,14	1,77	0,31	0,68	-	1,15	1,83
Varberg	0,01	0,57	-	0,78	1,35	0,01	0,67	0,01	0,76	1,43
Vänerhamn	0,51	0,79	-	1,31	2,10	0,52	0,95	-	1,52	2,47
Wallhamn	-	-	-	-	0,29	-	0,12	-	0,16	0,28
Ystad	-	0,95	-	1,14	2,09	-	0,91	-	1,14	2,05
Ähus	0,01	0,47	-	0,21	0,68	0,01	0,54	-	0,22	0,76
Örnskölsvik	0,03	0,29	-	0,16	0,45	0,02	0,46	0,01	0,21	0,67