



The Increase of the Marine Oil Transportation in the Baltic a Developing Environmental Risk

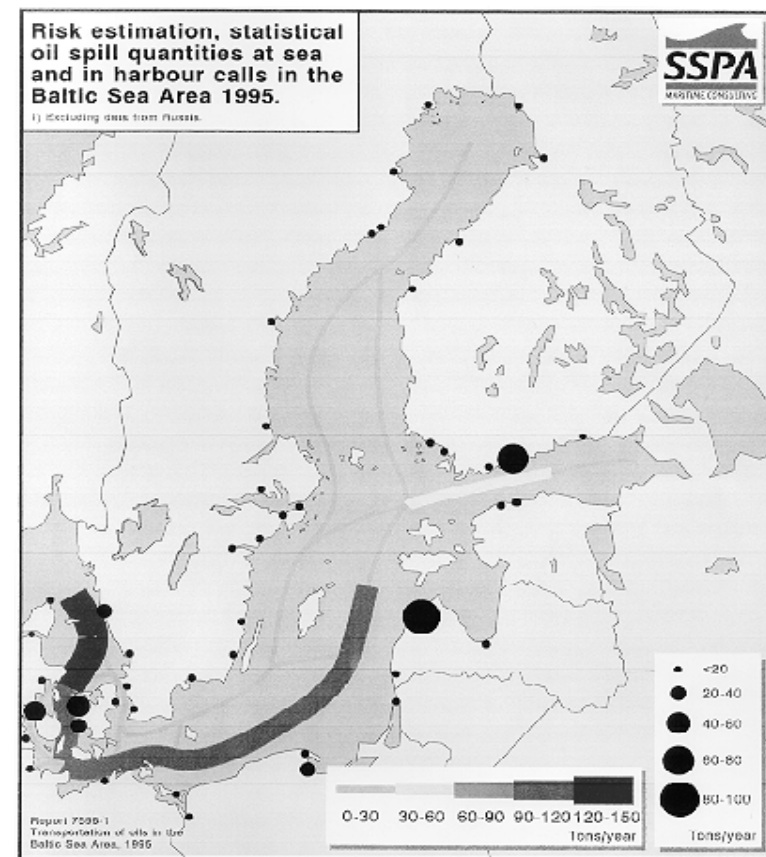
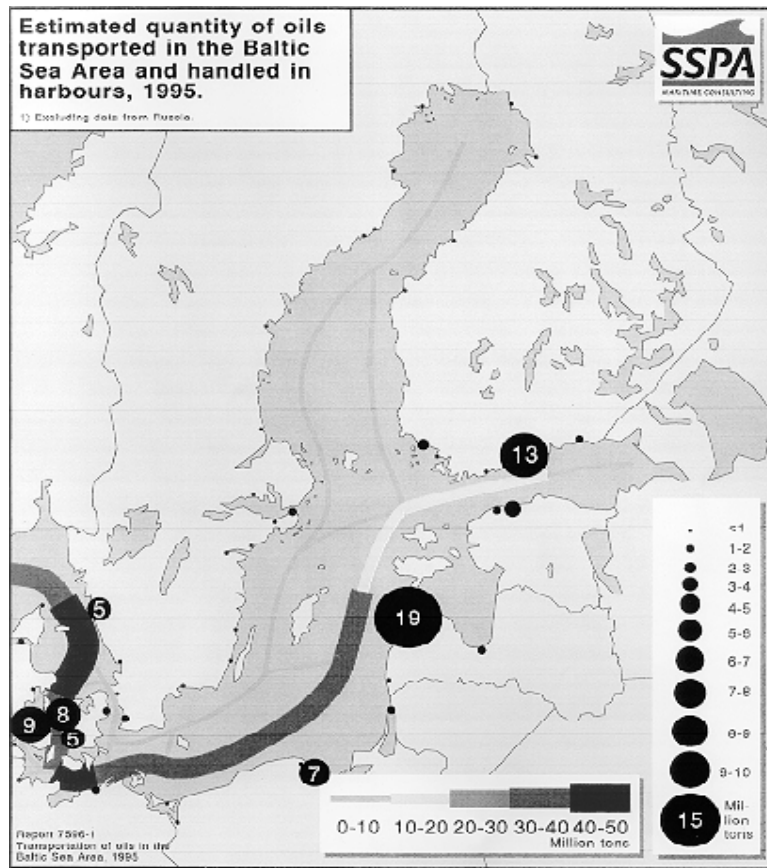
*Jorma Rytönen, VTT Industrial Systems
TFK's årskonferens, 12 November 2002
Ingenjörshuset City Konferensen, Stockholm*



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Old oil transport & spill scenarios



Sea borne traffic in the Baltic Sea in 1995(left) and expected growth from 1995 to 2017 (right)

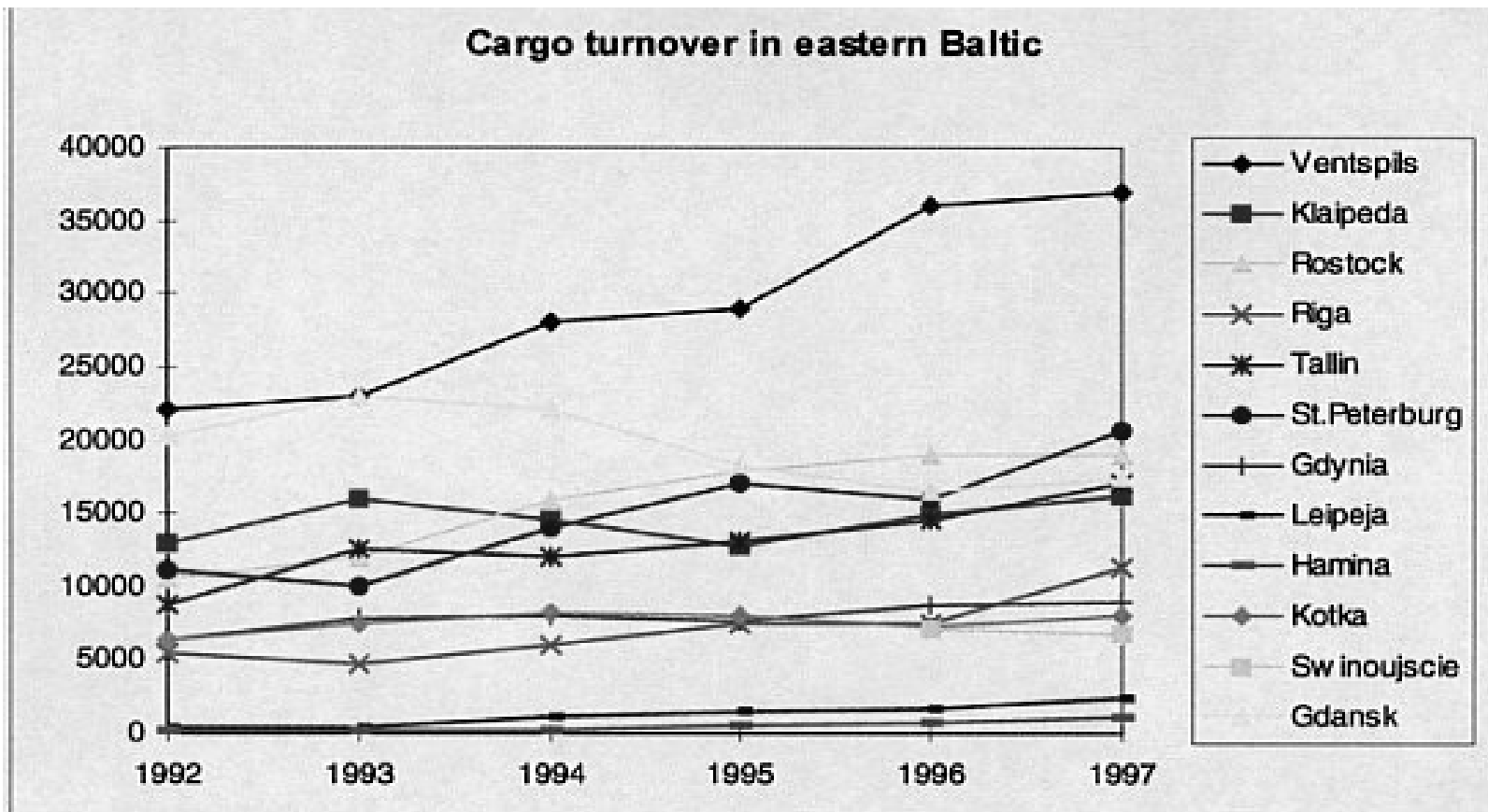
Source: Eurostat 1995 & COWI .

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%

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%

Eastern Baltic Port Development 1992 - 1997

Source: Tacis 1998: Existing and Future Shipping Through the Baltic Sea



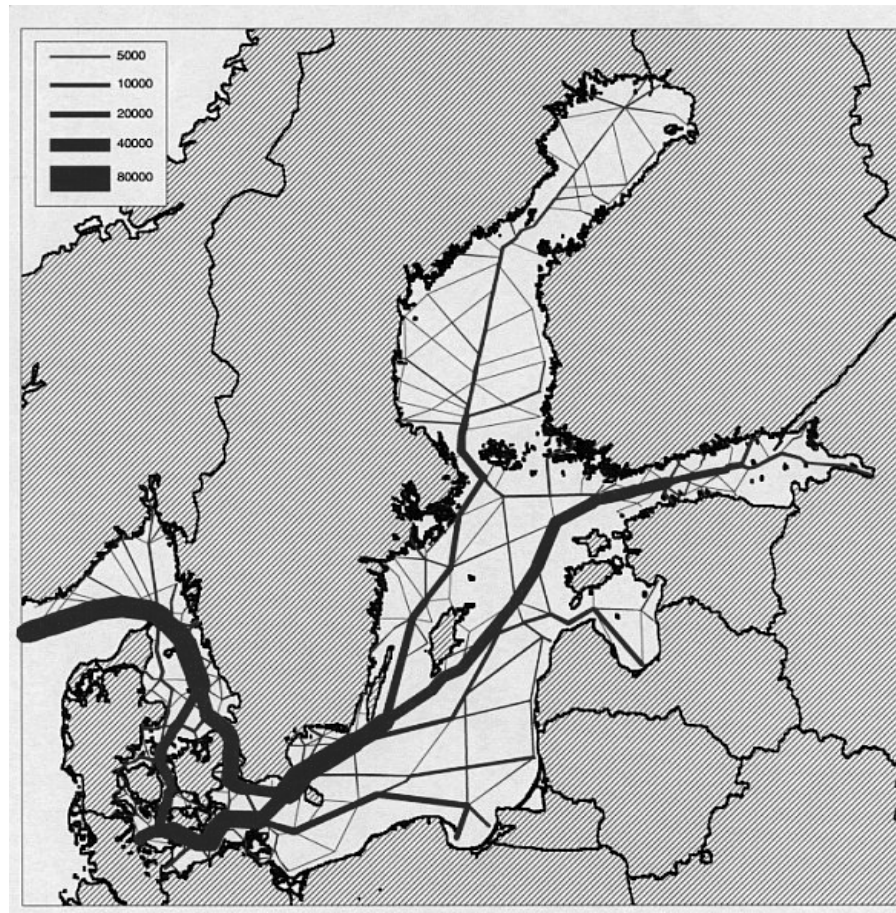
Statistics; Port Throughputs

Source: Outlook 2000 (level 1998)/ Swedish Maritime Administration

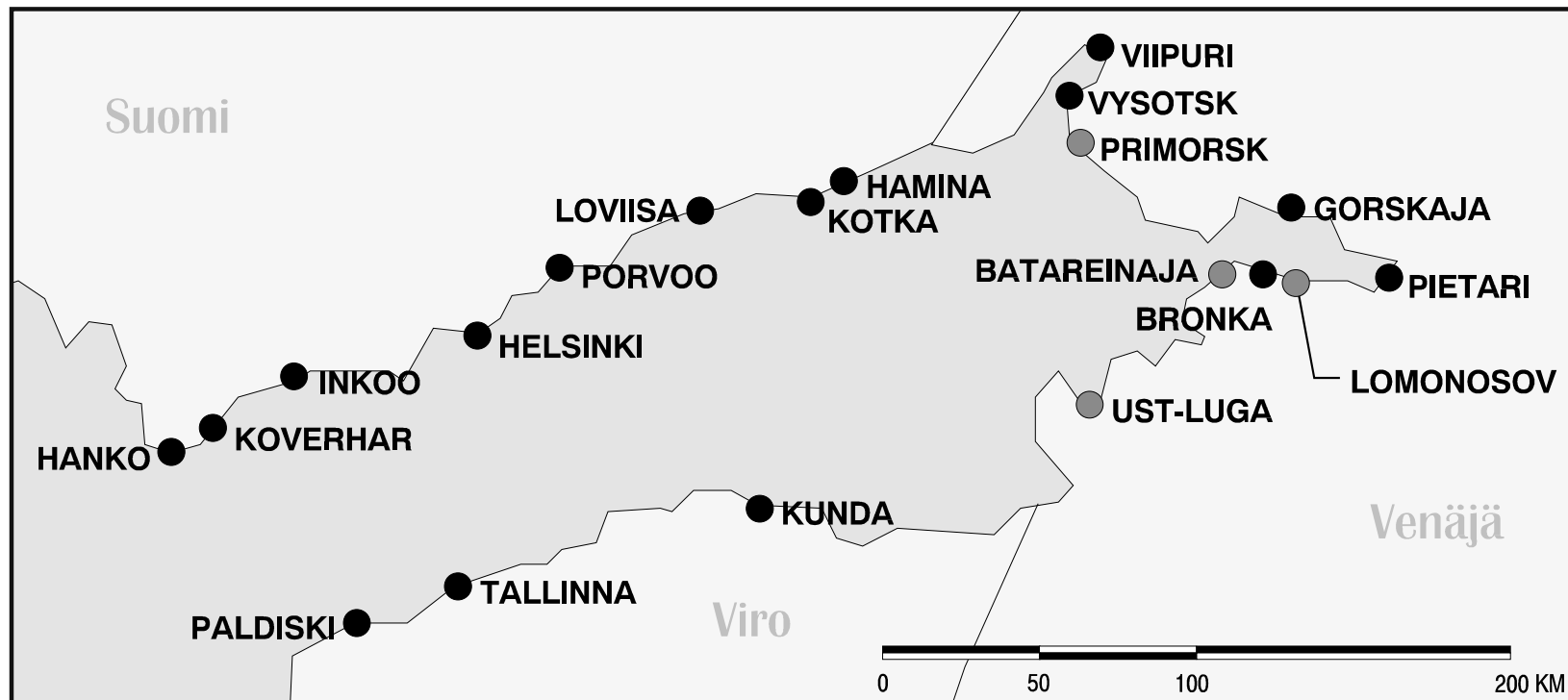
- Sweden 150 Mton;
Finland 93 Mton;
Russia 30 Mton;
Estonia 27 Mton;
Latvia 47 Mton;
Lithuania 15 Mton;
Poland 50 Mton;
- Germany 57 Mton;
Denmark 102 Mton;
- Norway 11Mton with
Germany&Sweden; 2 million
with Poland&Russia (St.
Petersburg alone > 24 Mton
in 2000).

Annual Ship Traffic (No. of movements) projected to year 2017, all ship categories

Source: Taxis, 1998: Existing and Future Shipping through the Baltic Sea.



SUOMENLAHDEN SATAMAT



● toimiva satama

● suunnitteilla tai rakenteilla oleva satama

9.10.1998



Development scenarios

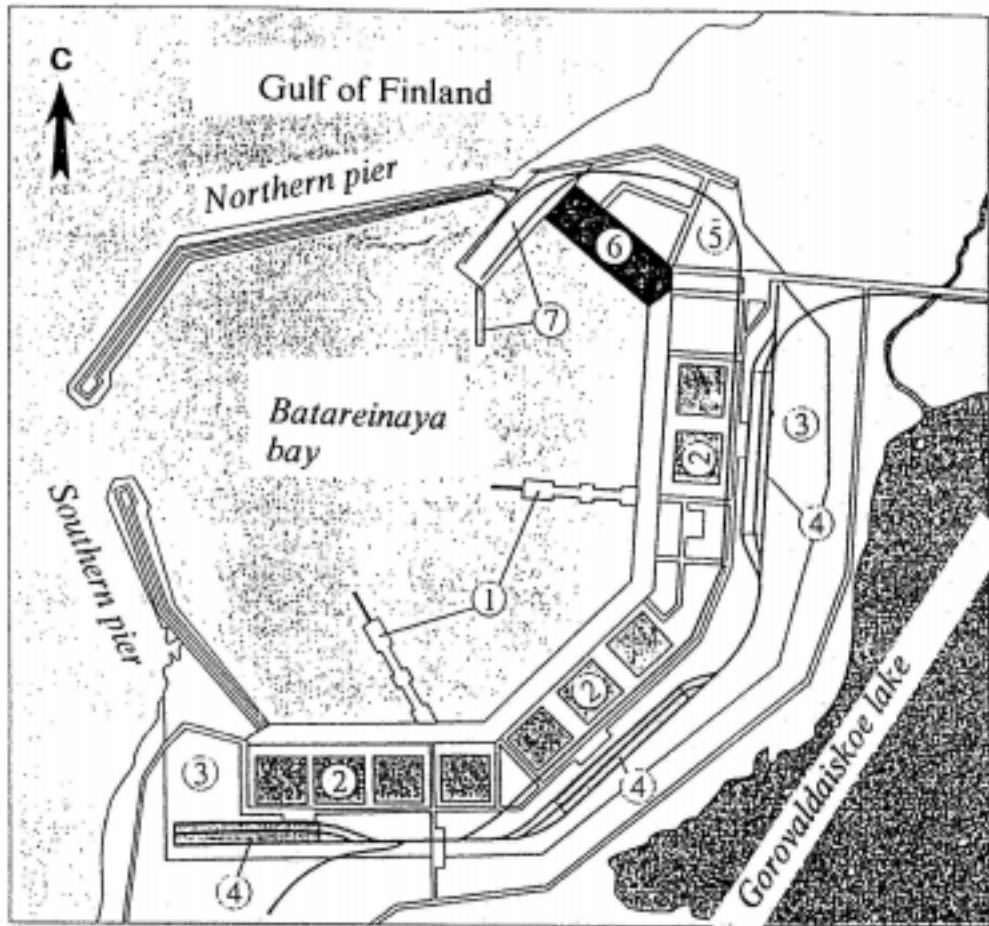
- St. Petersburg Sea Port 15.6 million tons in 1998;
- 20.5 million tons in 1999;
- over 30 million tons in 2001 ?
- oil over 9 million tons in 2001.
- Vyborg >2...2.5 million tons;
- several smaller terminals & port improvements,
- Vysotsk, oil terminal 10 million tons in 2003 ?
- Tallinn & Muga > oil 22..24 million tons; total volume over 35 million tons in 2000;
- Lomonosov, 2.1...4.5 million tons;
- Batareinya 15 million tons;
- Ust-Luga 35 million tons;
- Primorsk, first phase 12 million tons in 2001, second phase in construction -> 18 million tons, future up to...45 million tons;

Primorsk Oil Terminal





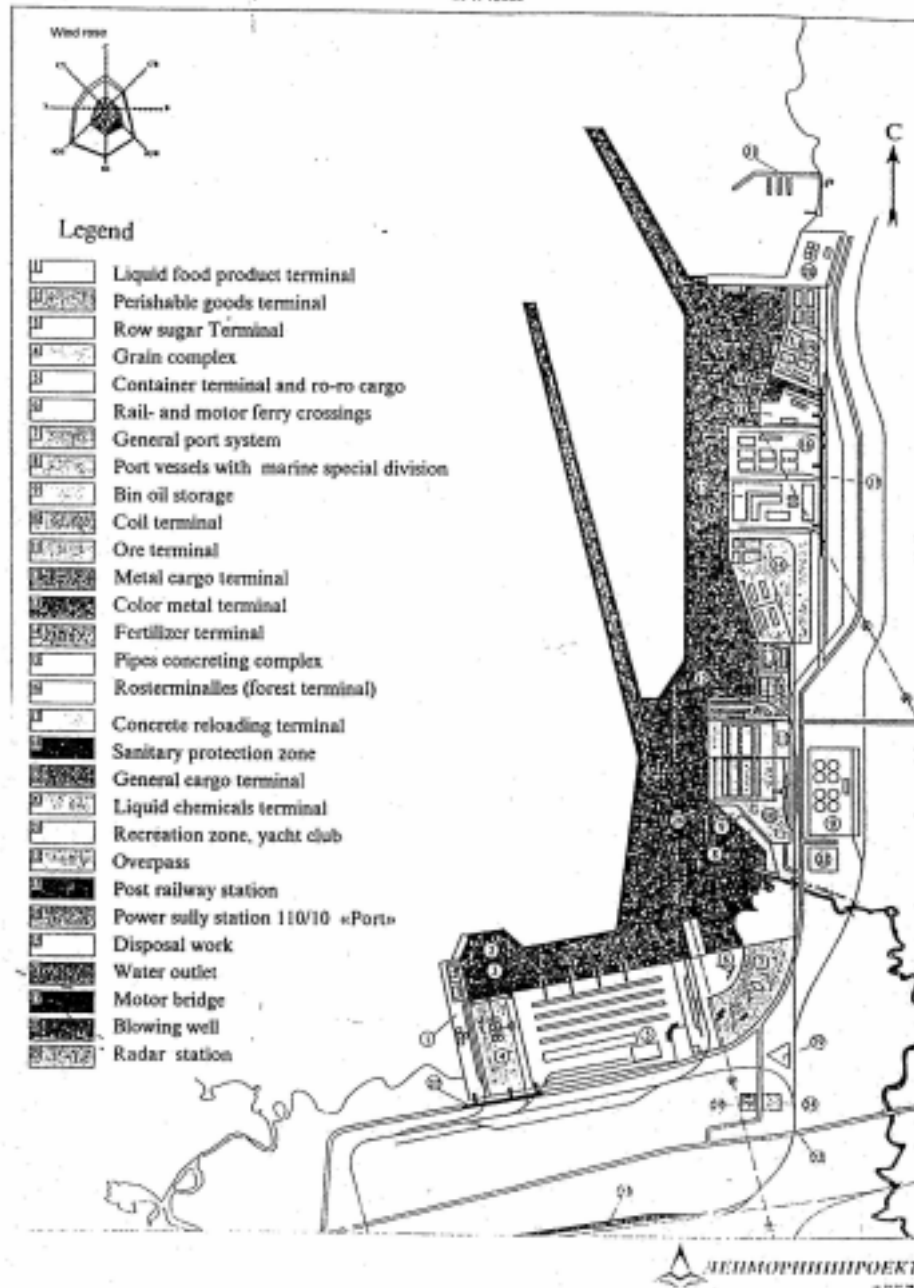
Batareinaya Bay



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



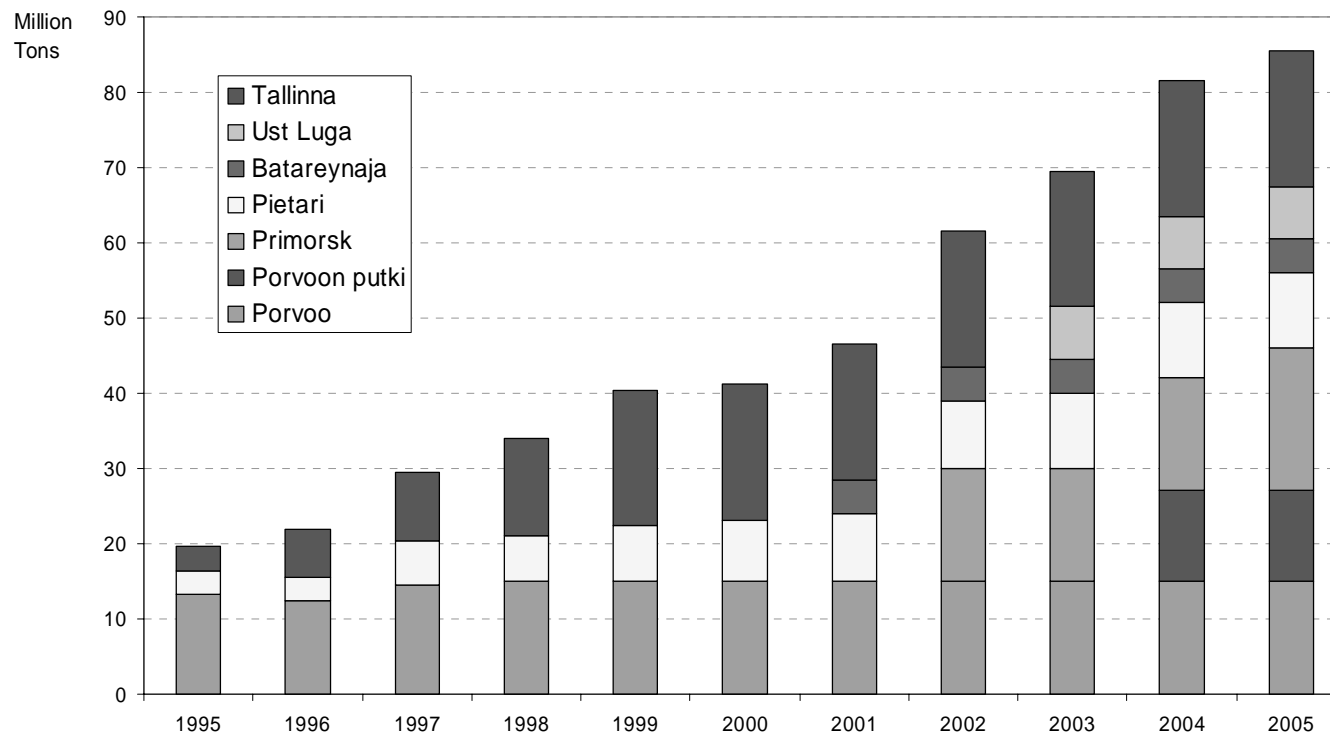
Cargo turnover and terminals

No	Terminal	Turnover th.ton/ year.	Vessels DWT, th/ flooring
1	Liquid food product terminal	250	9/1
2	Perishable goods terminal	300	10/1
3	Row sugar Terminal	500	40/1
4	Grain complex	3000	70/1
5	Container terminal and ro-ro cargo	4500	30-60/4
6	Rail- and motor ferry crossings	2700	Mukran type/2
7	Constructions of general port system		
8	Port vessels (base)		/4
9	Bin storage		/2
10	Coil terminal	8000	70/1
11	Ore terminal	2000	70/1
12	Ferrous metal and metal scrap reloading terminal	3200	16-50/4
13	Color metal terminal	1000	16-25/1
14	Fertilizer terminal	5700	16-70/3
15	Pipes concreting complex		20/1
16	Forest terminal	1000	10/3
17	Concrete and MCM reloading terminal	350	30/1
18	Sanitary protection terminal		/1
19	General cargo terminal	1500	10-20/3
20	Liquid chemicals terminal	1000	25/2
	Total	35000	

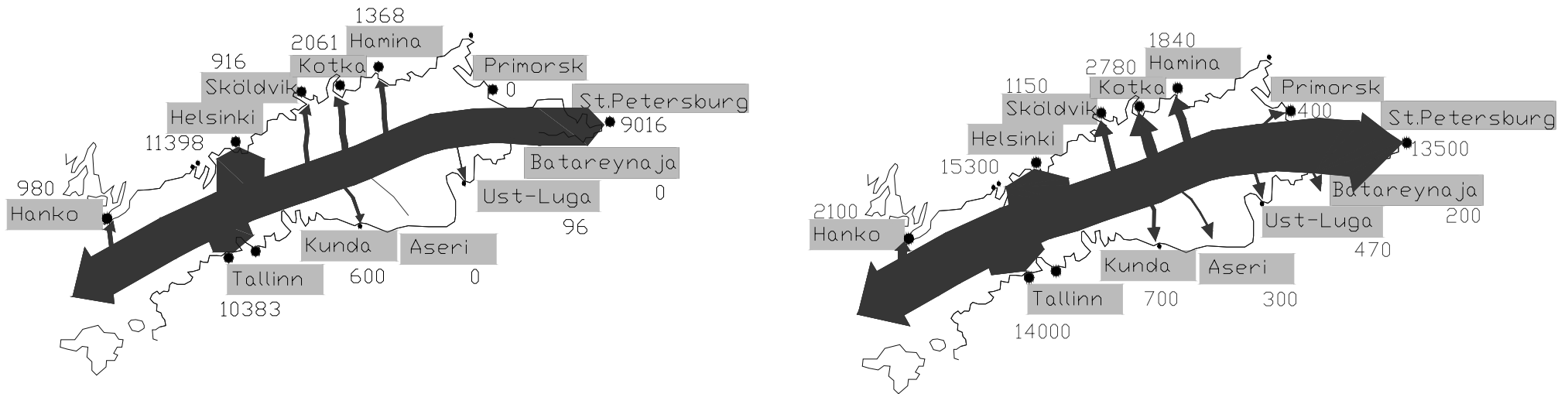
GoF Oil Transport 1995 - 2005 (Syke ,2001)

OIL TRANSPORTATION IN THE GULF OF FINLAND THROUGH MAIN OIL PORTS

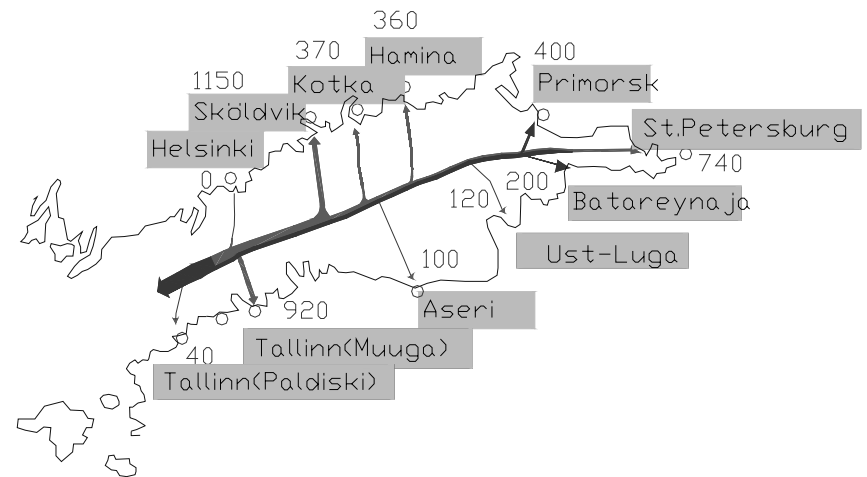
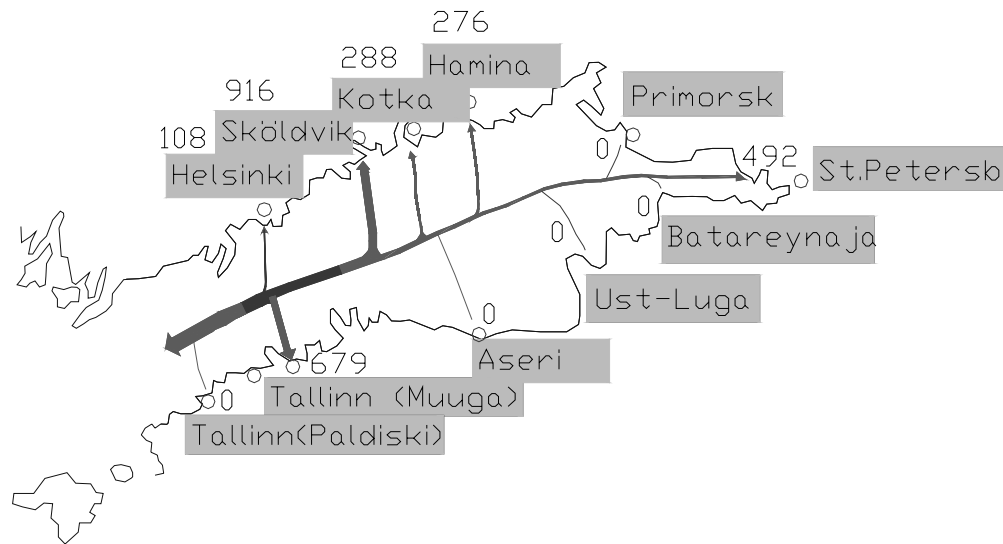
OIL TRANSPORTATION IN YEARS 1995-2000 AND ESTIMATED DEVELOPMENT 2001-2005



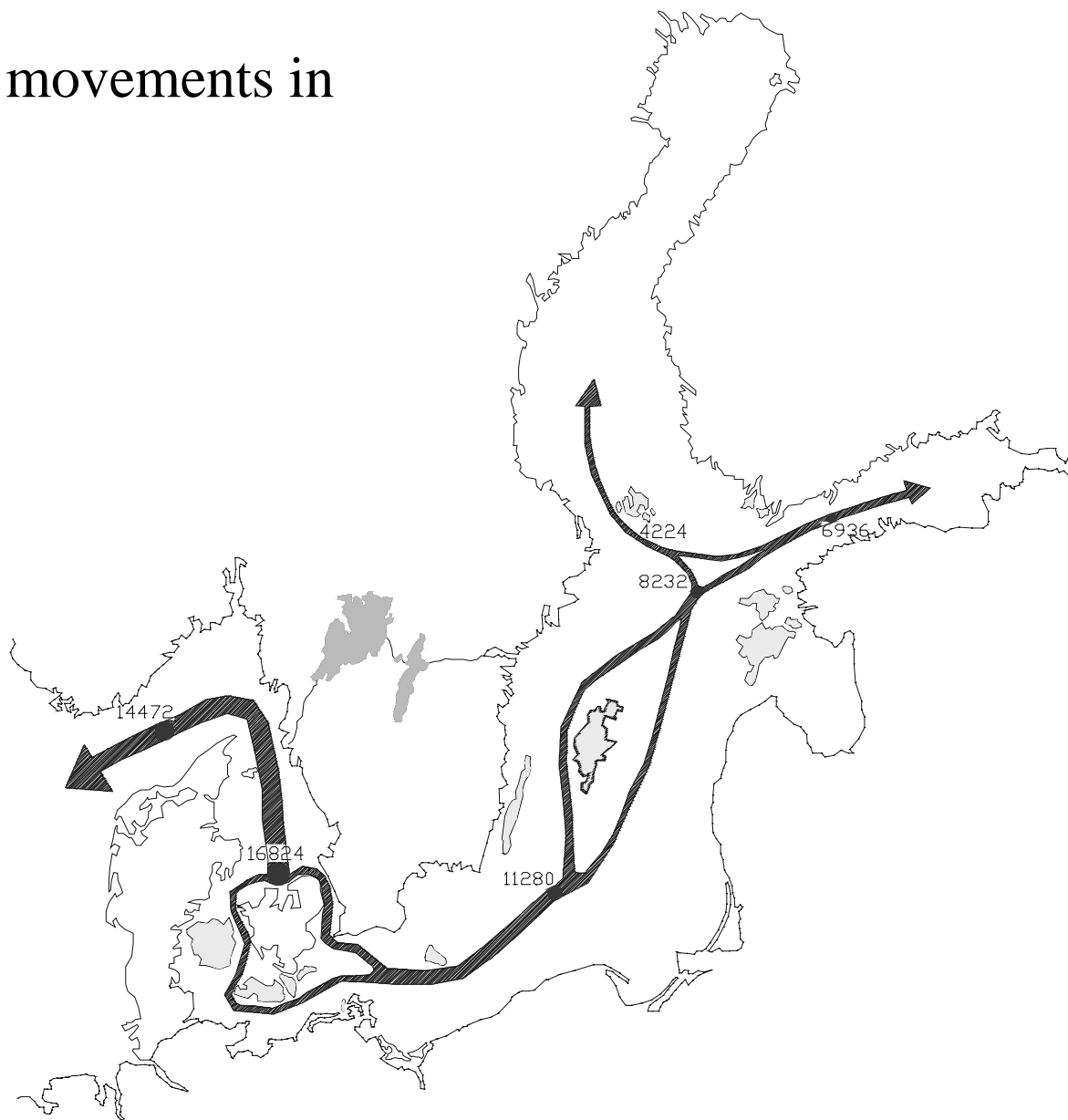
Maritime traffic in GOF in 2000 (left) and 2015 (right)



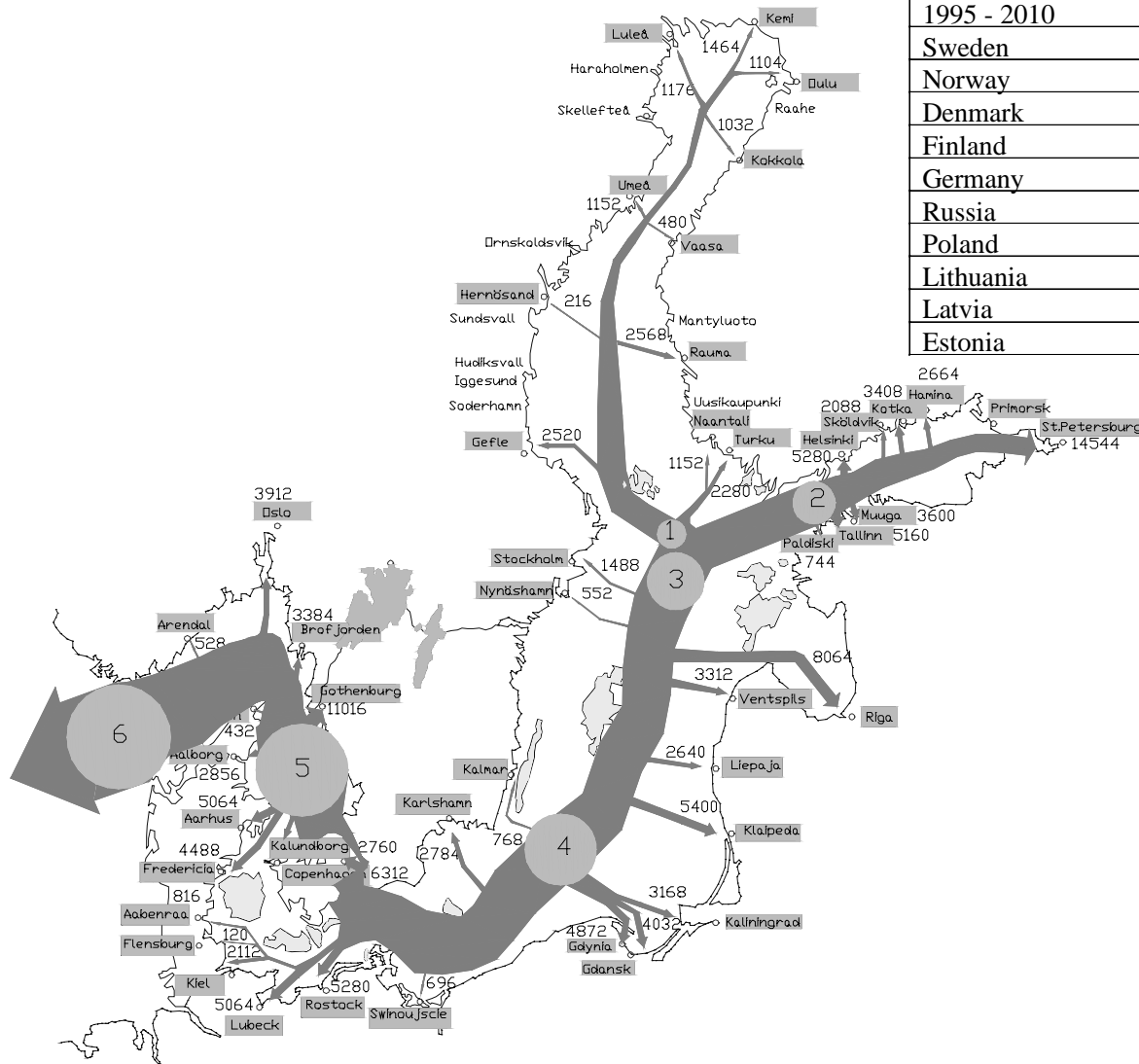
Oil transportation in GOF in 2000 (left) and 2015 (right)



Oil tanker movements in 2015



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



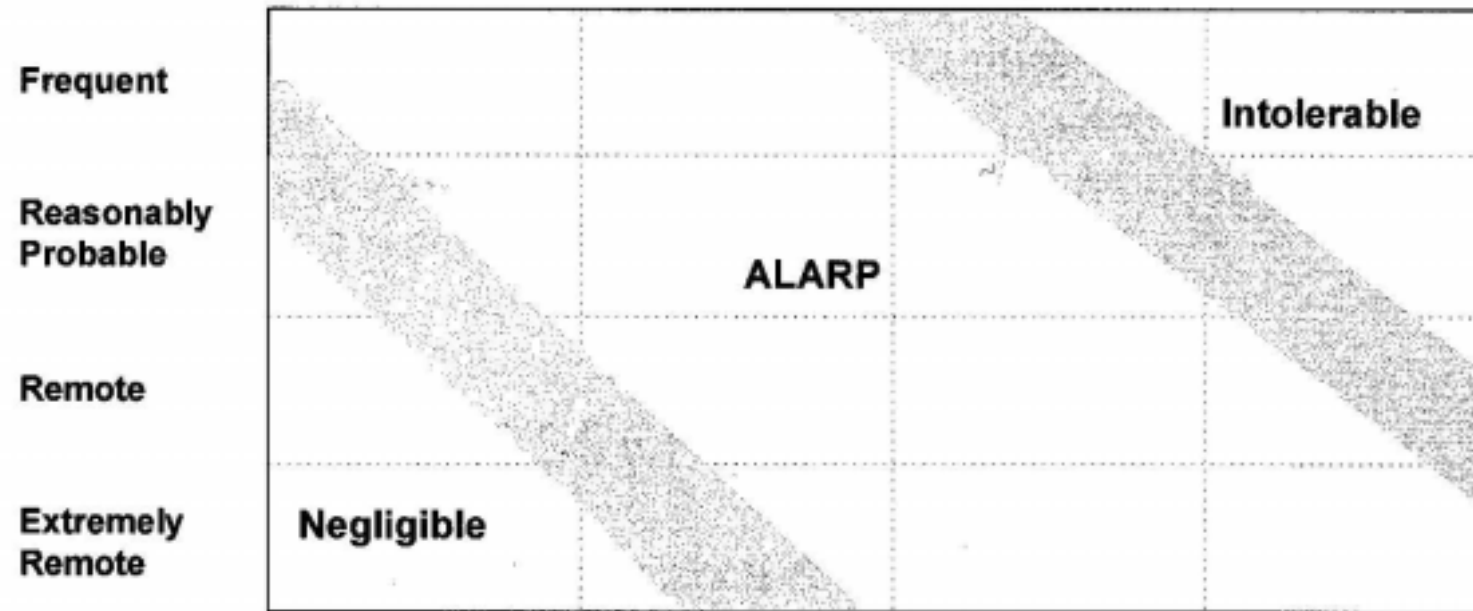
Point	v.2000
1	23388
2	34692
3	46476
4	58500
5	75696
6	85296

Definition of Risk

- *Risk can be defined as a combination of probability and consequences.*
- *Risk may be determined by its attributes either qualitatively or quantitatively*

As Low As Reasonable Practicable

FREQUENCY



Insignificant

Minor

Major

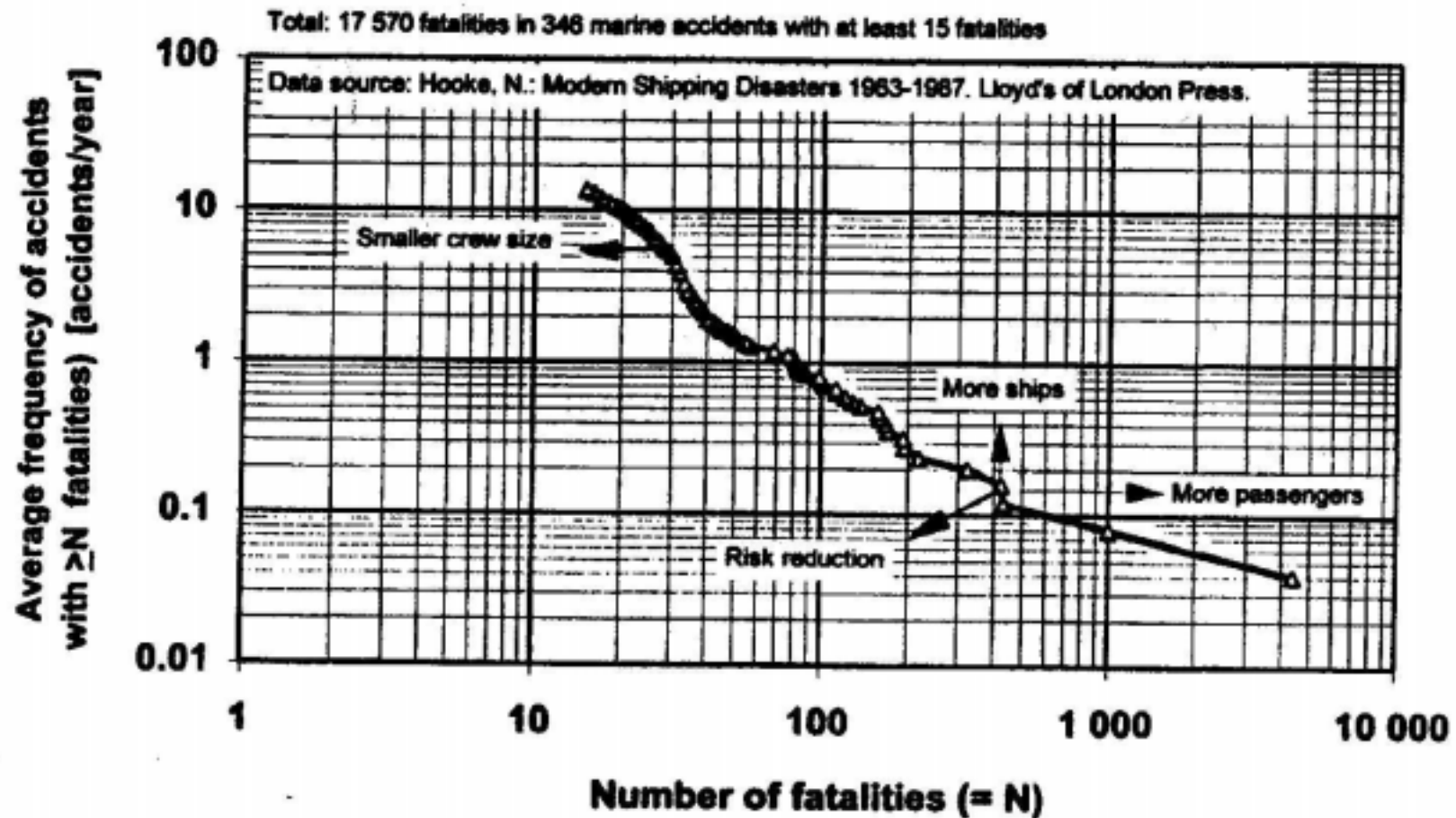
Catastrophic

CONSEQUENCE



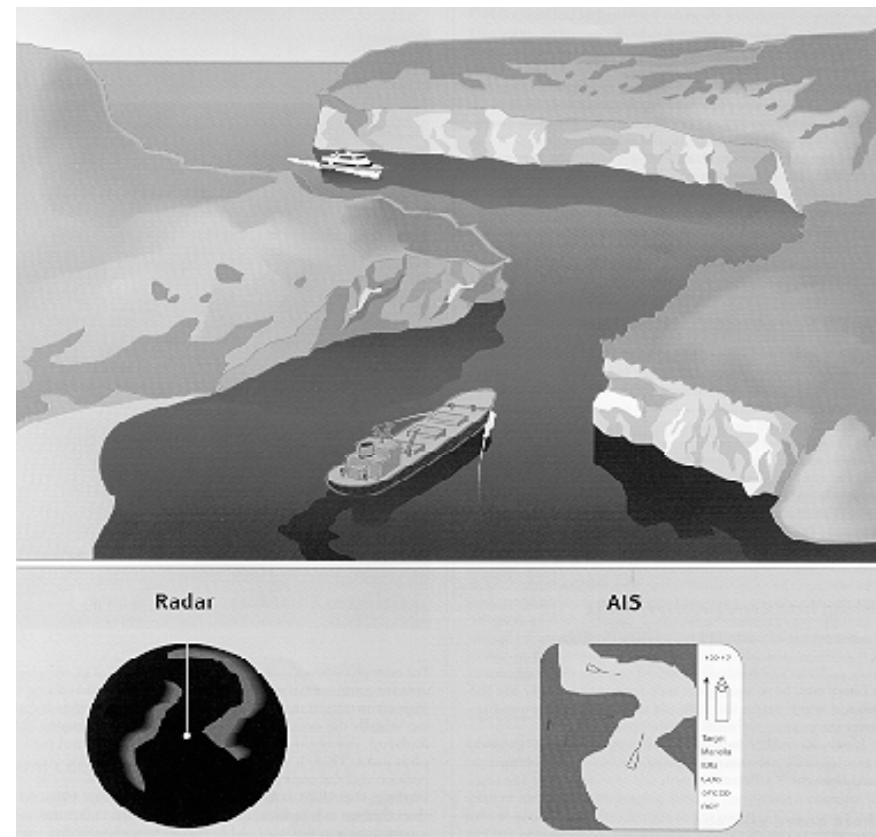
Frequency-Number of Fatalities

(source: Hooke: Modern shipping disasters 1963 - 1987.)



Maritime Safety Issues

- External safety(fairways, ports, other ships),
- Internal safety(hull, stability, fire protection),
- Human impact,
- Risks to Environment.



Human influence on risks 1

- The increase of foreign flags:
 - poor knowledge on local conditions,
 - competence differences,
 - insufficient training ,
 - COLREG-codes - misunderstanding:
 - traffic separation, routing - no actions to follow,
 - bypassing rules unknown.

Human influence on risks 2

- Risks due to the pleasure crafting:
 - rely on electronics - traffic watching secondary, if any,
 - navigation skills insufficient,
 - understanding of the navigability of large vessel ??
- Loss of fairway,
- Long shifts
 - fall asleep & fits,
- Trouble making ships - not following regulations.

External risk factors

- Increase of the maritime transport
 - fast ferries between Helsinki - Tallinn
 - oil & chemical transportation
 - passenger traffic, new lines
 - small crafts
- Difficult weather and seakeeping conditions,
- Loss of deck cargo, especially timber,

Technical risk factors

- The increase of oil transportation - poor & old ships ?
- Single hull tankers,
- Shipping companies with one poor ship,
- Danger of explosion or fire onboard,
- Electronic failures,
- Dangerous and poisonous cargoes,
- Spills due to the technical malfunctions
- Failures in valves or in pipings, structural failures.

Some risk factors

- Collisions, all ships - probability of a bunker oil spill 0,128 [*Mehra*],
- Collisions of tankers, oil spill probability 0,39 [*Mehra*],
- Gof statistics [*Helcom-95*] 28 accidents per year:
- 1995 0,22 average spill 234 ton (tanker and cargoship collision),
- 1996 0,40,
- 1997 0,46.
- Collision of cargo ships - bunker spill up to 700 tons.

FSA procedure - basic steps

1 Identification of dangers

2 Risk assessment

Probability and consequences ?

3 Definition of risk-based approaches

What can be done to avoid the unwanted event ?

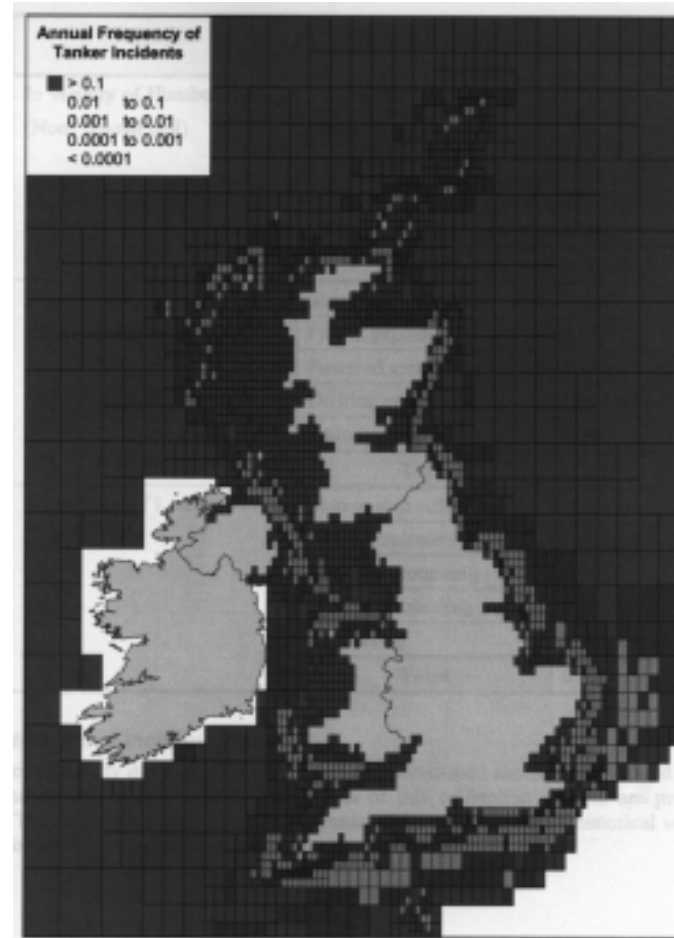
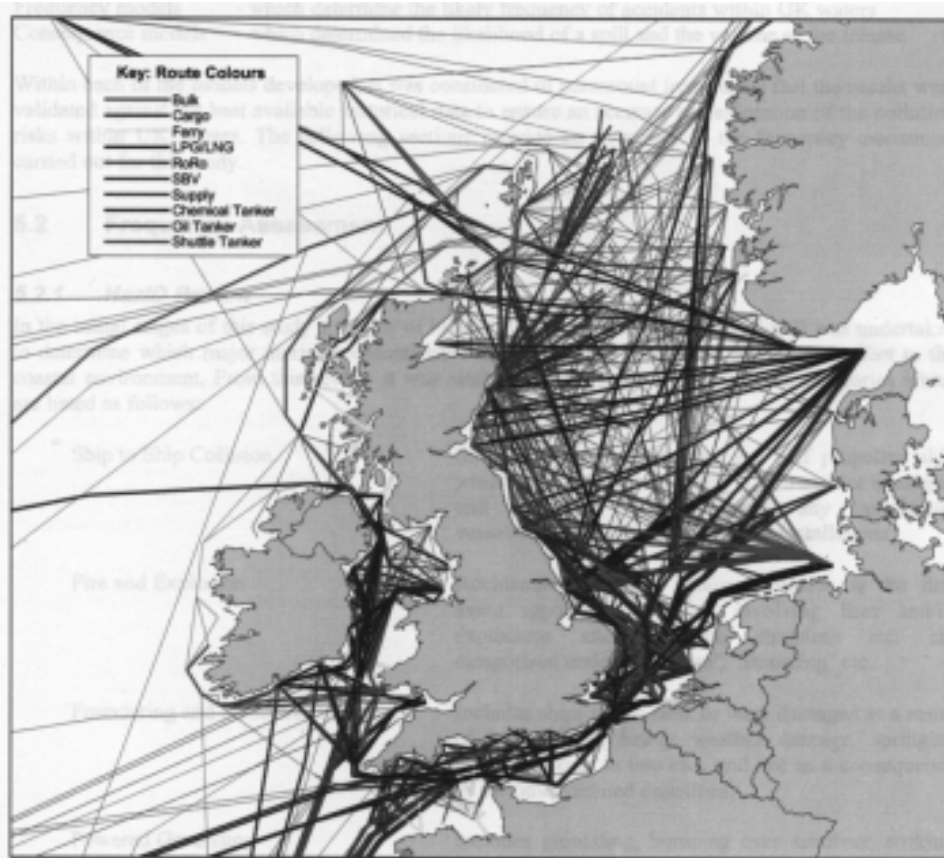
4 Cost-benefit analyses

Costs of the risk handling procedures?

5 Recommendation phase

Legislative actions?

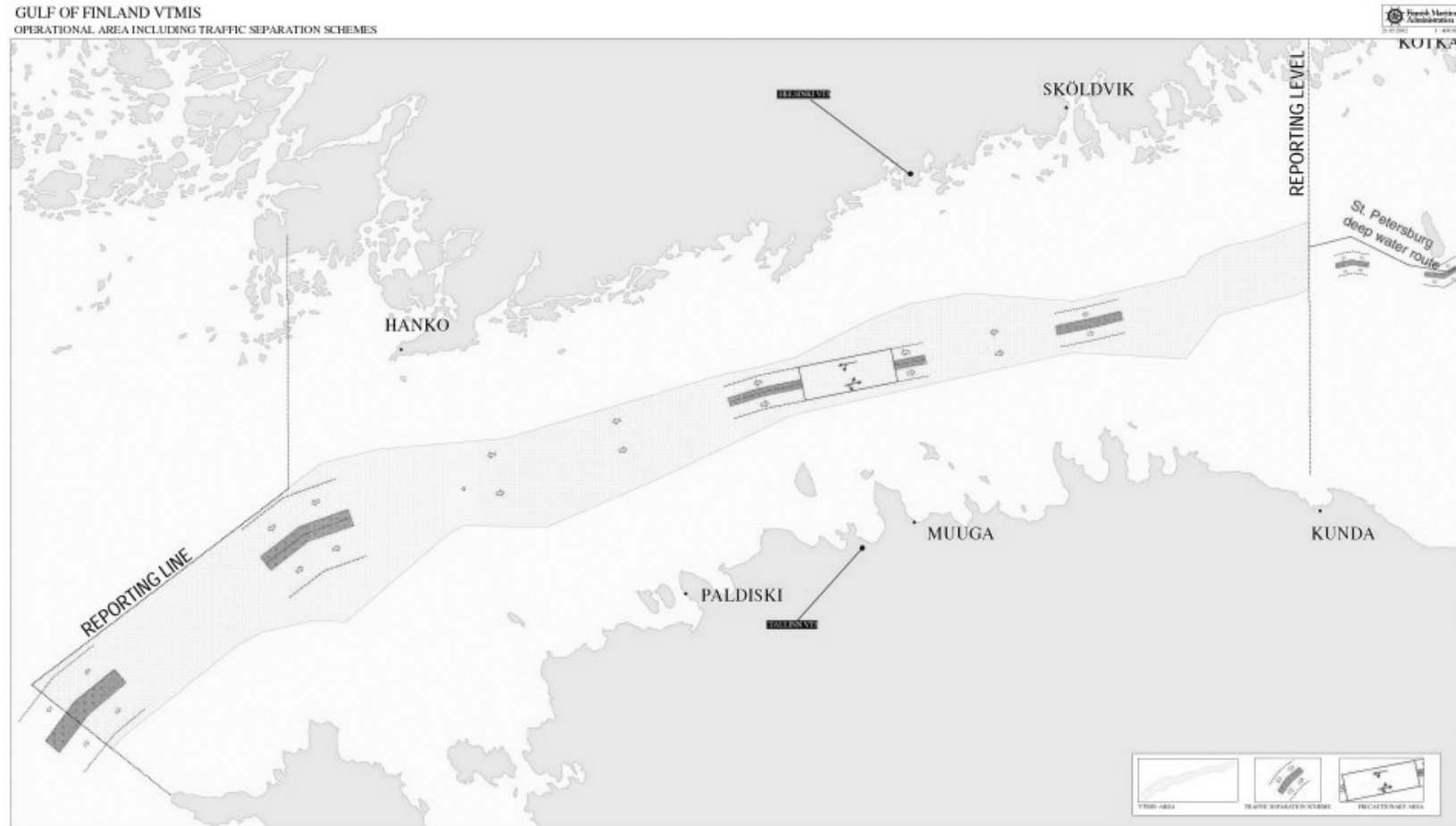
Case: UK, shipping routes & tanker accidents.



Case: FSA for the Gulf of Finland

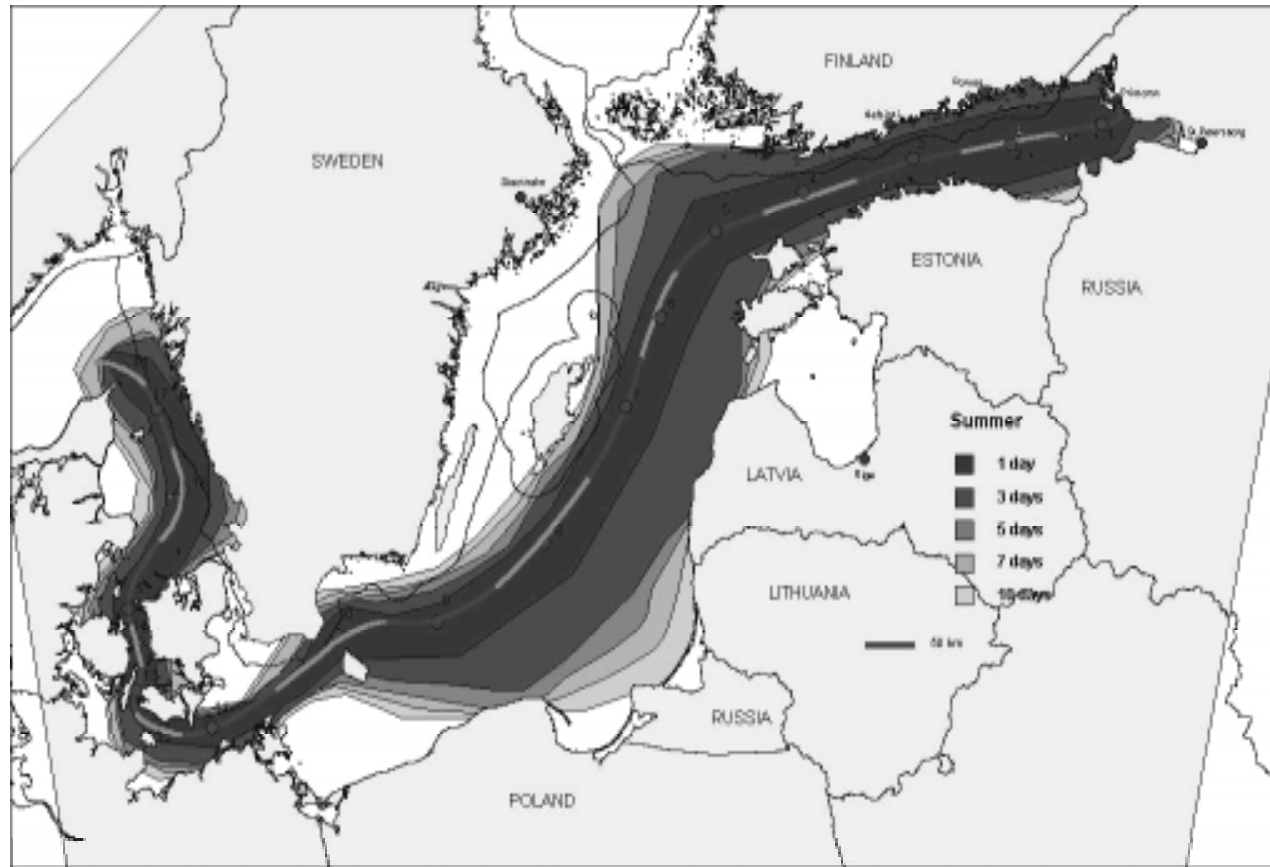
- Statistical analyses,
- Fairways, hot spots,
- Accident statistics of the Baltic Sea,
- Oil spills in the Baltic Sea,
- Definition of sensitive areas,
- Environmental conditions,
- Ice problems, winter traffic...

Traffic Separation Schema,

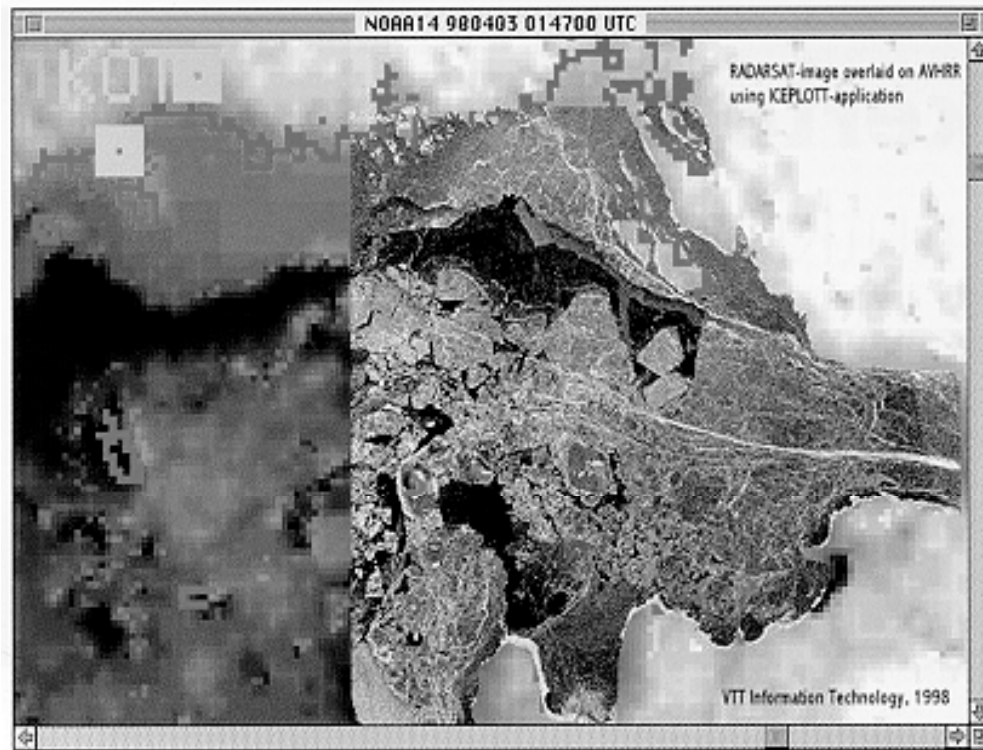


Risk zones for summer period

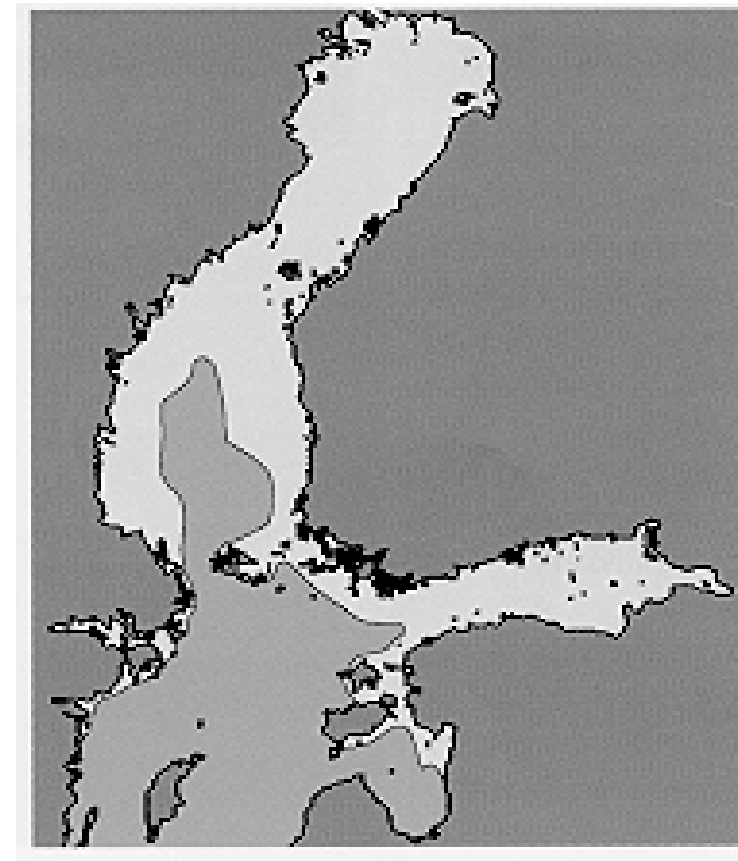
Source: Tacis, Baltic Pipeline System; Oil Spill Analysis, March 2000.



Winter problems



Ice conditions of the Eastern GOF. Shipping channel leading to St. Petersburg is clearly visible.



The maximum ice coverage in 1997

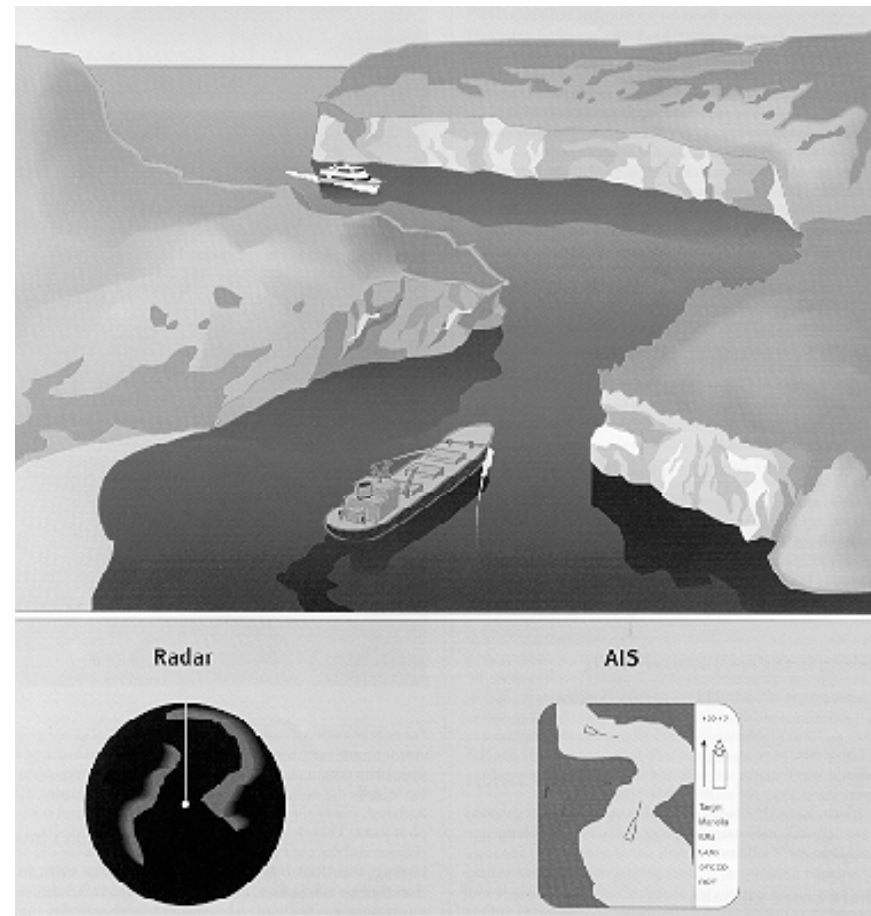
•Risk Control Options

"Safety of Shipping in Coastal Waters" (SAFECO)1995 - 1998:

Establishment of VTS Systems,
Simulator Training, Refreshment Training,
Bridge Management Tools (International Safety
Management Code),
Reliability of Propulsion Systems,
Structure Design and Maintenance ,
Improvement of Navigation Ability and
Bridge Control Systems (ECDIS, Integrated Control
Systems, Nacos etc..)

Risk Control Options

- Structural means,
- traffic control:
- pilotage,
- escort towing,
- speed restrictions,
- remote control,
- basic registers,
- AIS,
- VTS & VTMIS,
- distribution of information,
- traffic separation,
- weather limits,
- wind limits....etc



Conclusions and Recommendations

- Risk Identification:

- FSA analyses for the EU scale & Baltic scale,
- Establishment of INCIDENT System,
- Defining electronic failures and developing protocols and redundant systems.

- Operative Risk Control:

- Escort and emergency towing,
- VTS and traffic control,
- Oil combating,
- Traffic restrictions,
- On-line load monitoring systems.

Conclusions and Recommendations

- Structural means to minimize risks:
 - grounding analyses,
 - collision analyses,
 - stability, leakage,
 - winter navigation.

- [Http://www.vtt.fi/val/val3/val34/seastat/seastatkotisivu.htm](http://www.vtt.fi/val/val3/val34/seastat/seastatkotisivu.htm)