

Baltic approach in oil spill recovery in ice, case studies and recent development in Baltic Sea States

**International Oil & Ice Workshop
Anchorage Alaska
October 10 – 11, 2007**

Kari Lampela
Finnish Environment Institute
Helsinki, Finland



Outline

- **Baltic Sea**
- **Traffic development**
- **Baltic approach in oil spill response**
- **R&D in oil & ice**
- **Mainly used methods in Baltic States**
- **Case studies**
- **Conclusions**



Picture: FIMR

Baltic Sea

- **Nine countries**
- **Nine different languages**

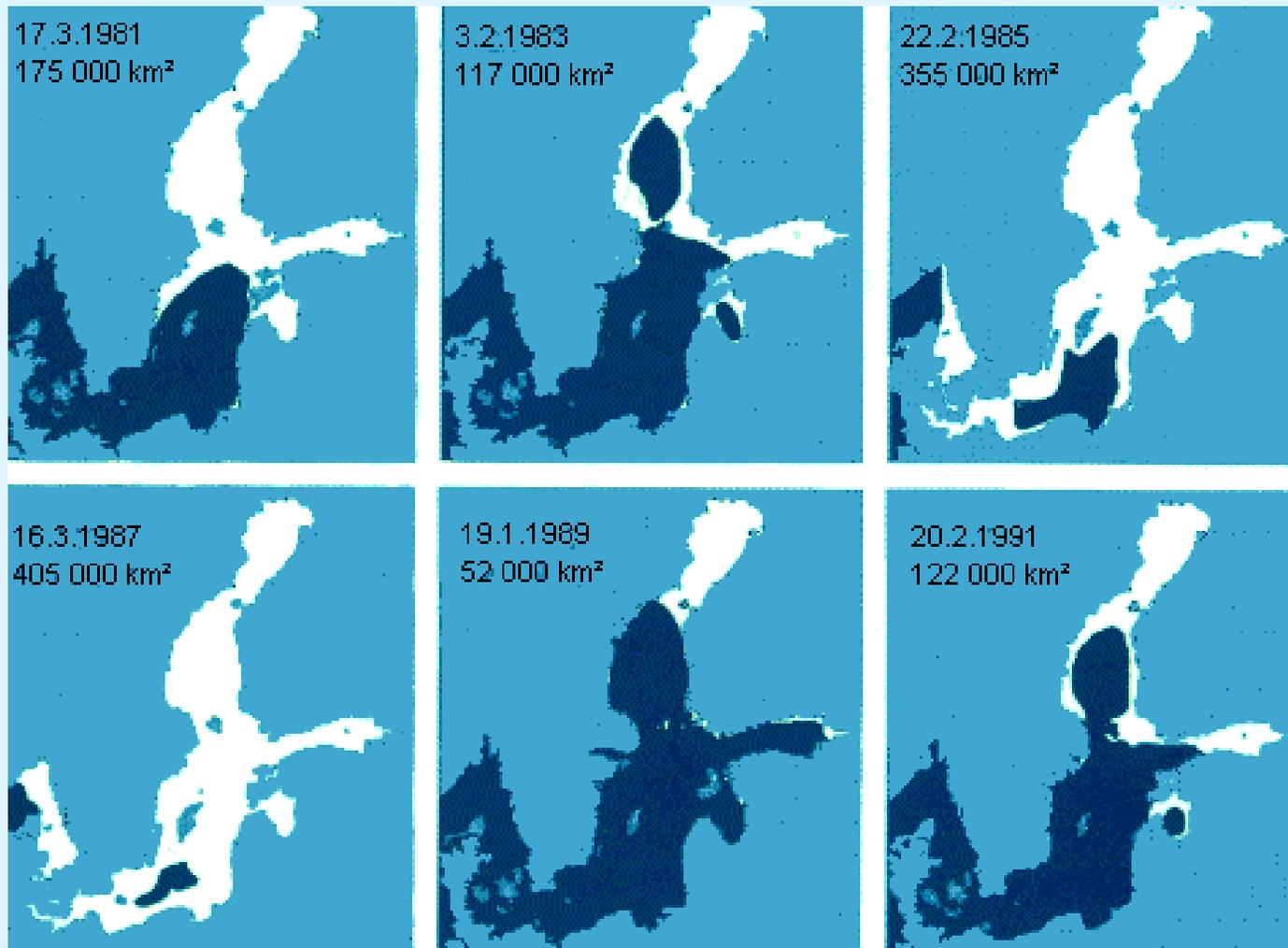


Baltic Sea

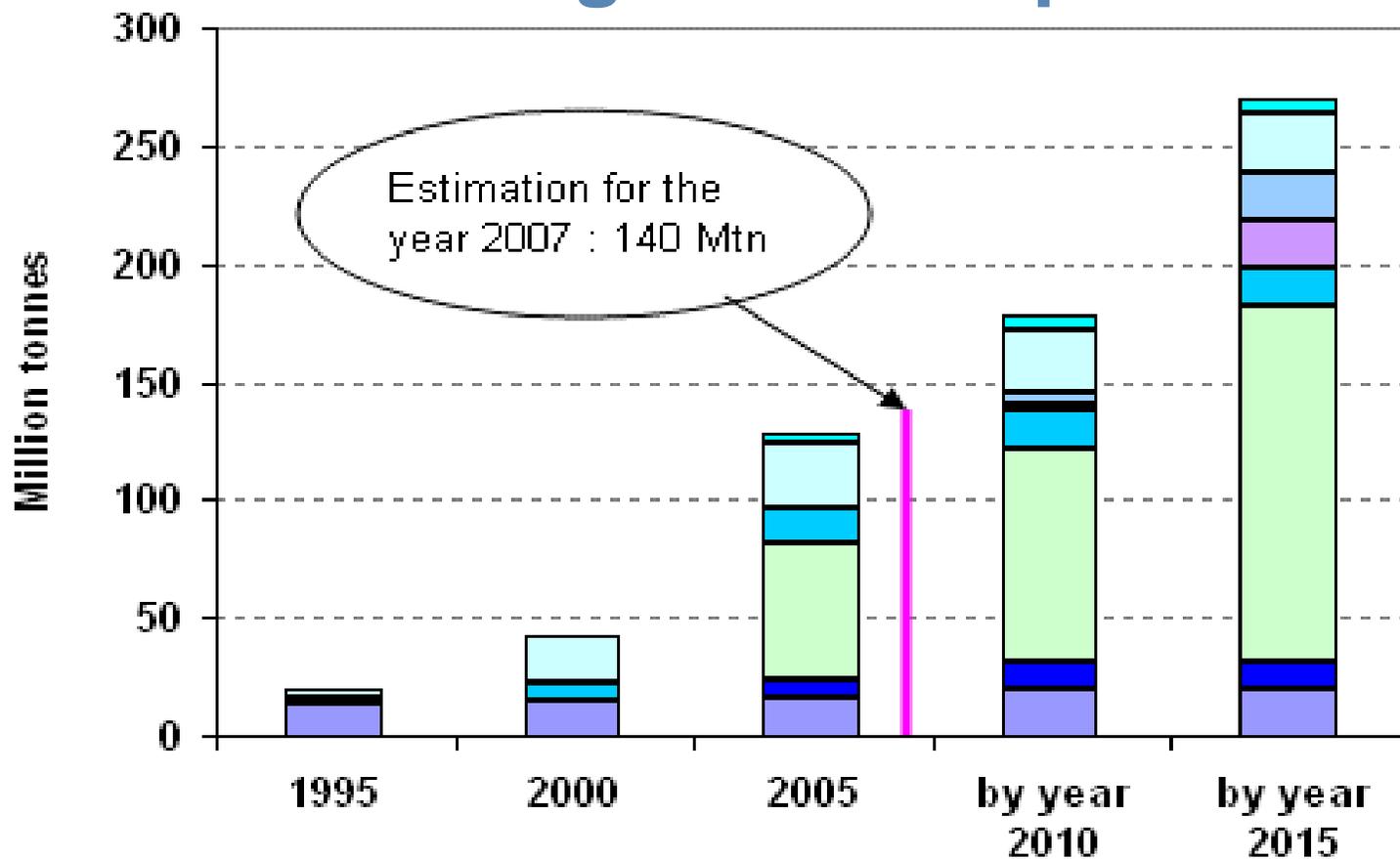
Baltic Sea

- **Largest brackish water area 400 000 km²**
- **Mean depth 53 metres**
- **Significant fresh water input**
- **Nearly non-tidal**
- **Heavily polluted**
- **25 to 30 years to change the water**
- **The most difficult ice conditions are in the northern part of the Gulf of Bothnia and the eastern parts of the Gulf of Finland**

The variation of ice coverage in the Baltic Sea

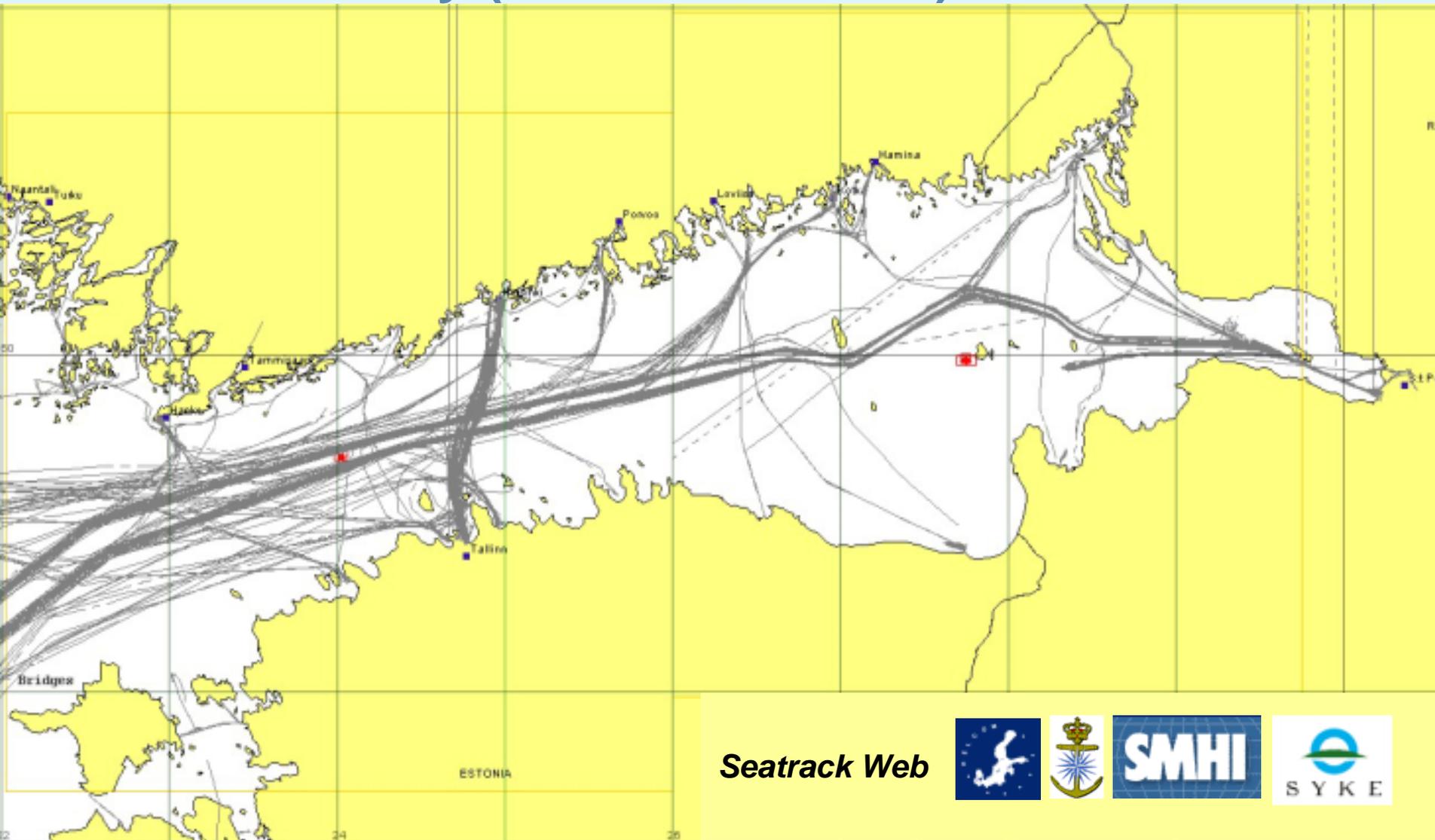


Oil transportation in the Gulf of Finland through main oil ports



■ Porvoo ■ Vysotsk ■ Primorsk ■ St.Petersburg ■ Ust-Luga ■ Sillamäe ■ Tallinn ■ Others (smaller oil ports)*

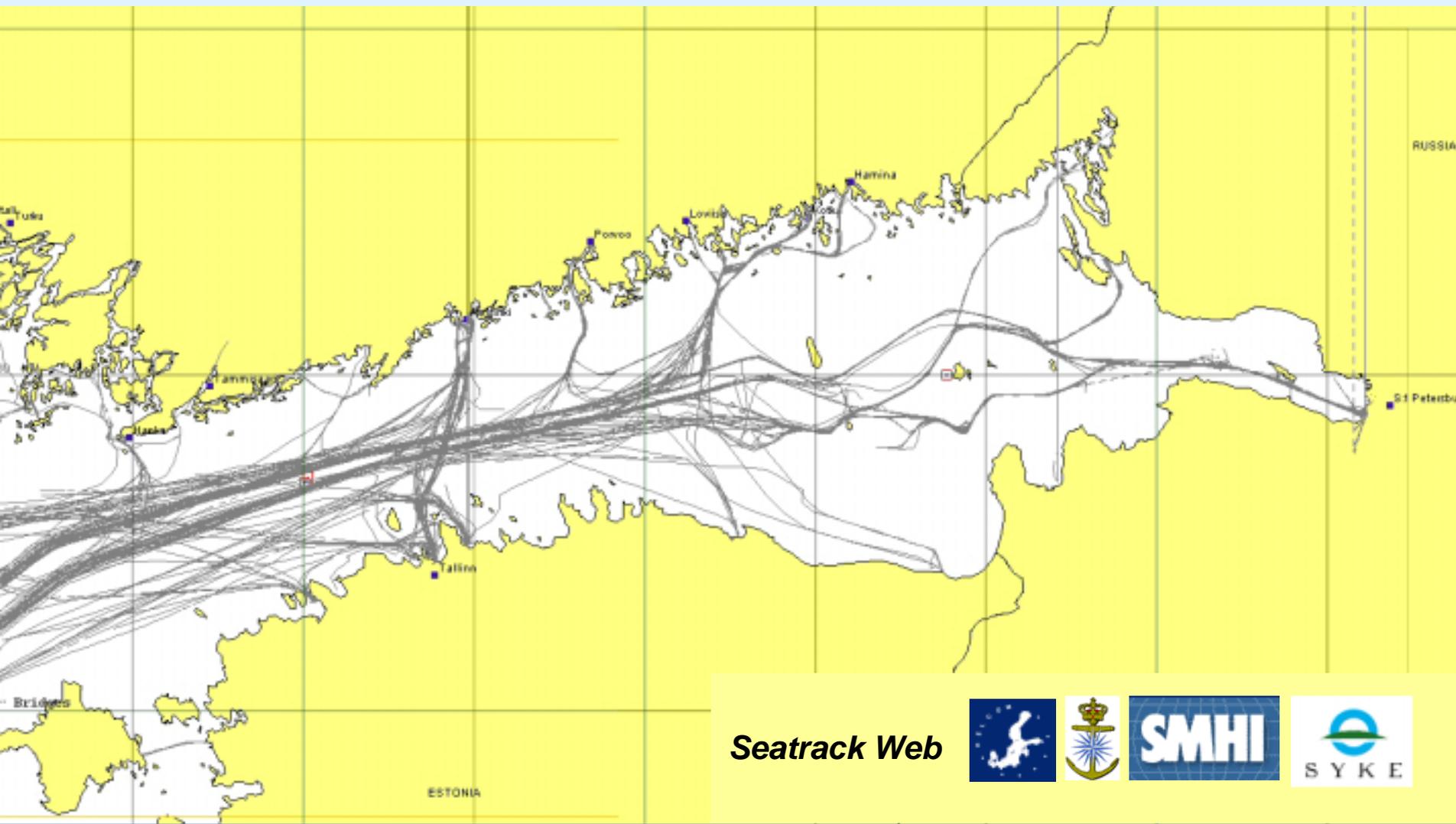
Traffic in the Gulf of Finland during one day (18th of Oct 2006)



Seatrack Web



Traffic in the Gulf of Finland during one winter day (28th of Feb 2007)



Seatrack Web



Baltic approach

Based on:

- **HELCOM (Baltic Marine Environment Protection Commission) recommendations**
- **International cooperation**

Main principles:

- **Prefer mechanical recovery**
- **Chemical agents can be used only in limited situations**
- **In situ-burning also only when other means are not available.**
- **Regular airborne surveillance.**
- **Focus on high viscosity oils and cold conditions**
- **Reliable drift models.**

International cooperation



Baltic Marine Environment Protection Commission, Helsinki Commission, HELCOM.

- **Members: Nine Baltic Sea countries plus EU**
- **Main tools:**
 - **Recommendations and ministerial declarations**
 - **Working groups**
 - **Response manuals**
 - **Organize exercises**
 - **Areal cooperation**



Pictures from BALEX DELTA exercise
Gdynia, Poland September 6, 2006

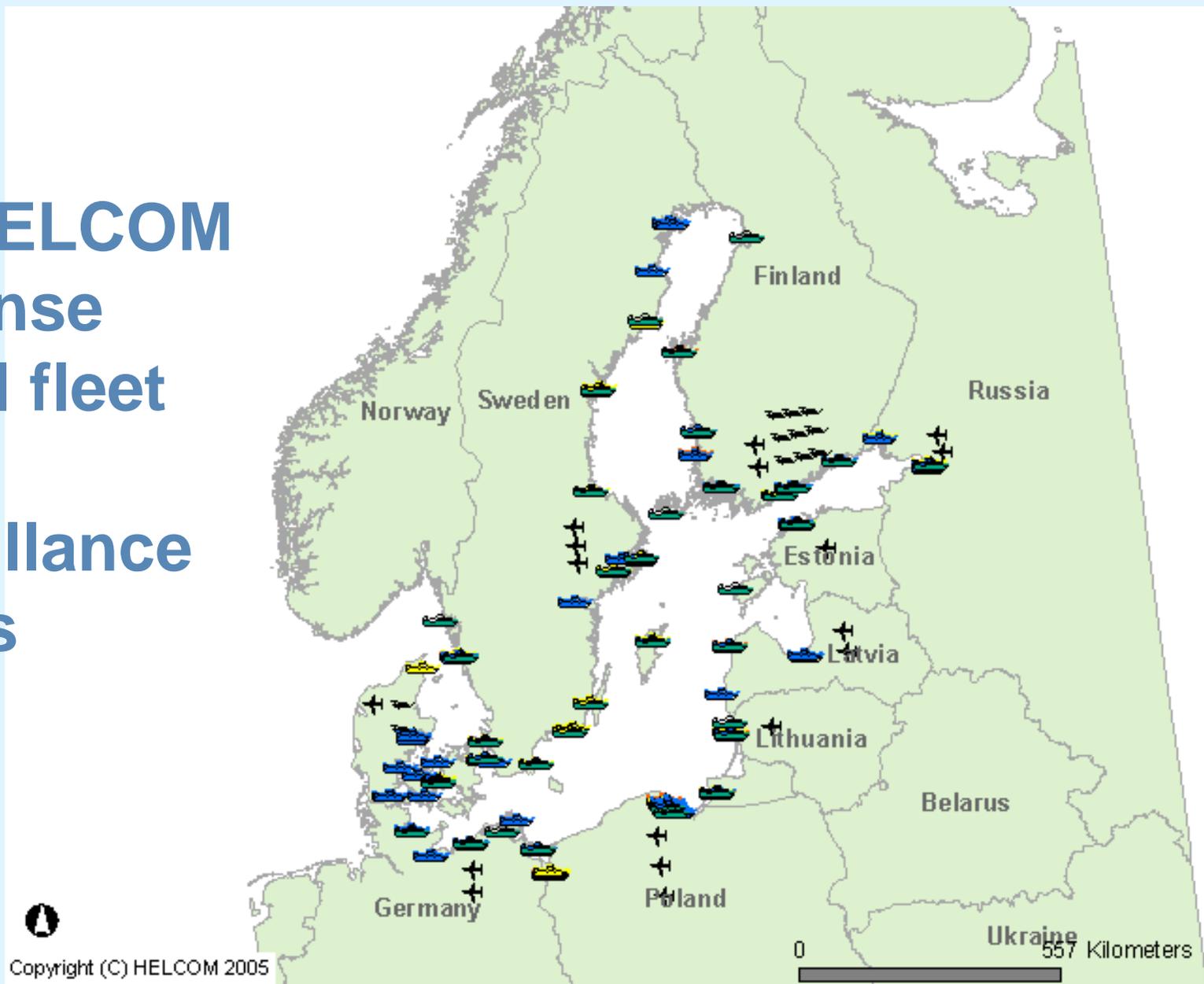
HELCOM recommendations

- **Application of no special fee system to ship-generated wastes in the Baltic Sea area, 26/1.**
- **Safety of winter navigation, 25/7.**
- **Assessment of the need for escort towing in tanker transport routes to prevent accidents in the Baltic Sea area, 25/5.**
- **Ensuring adequate emergency capacity, 24/9.**
- **Further development and use of Drift Forecasting for Oils and other Harmful Substances in the Baltic, 24/7.**

HELCOM recommendations, cont.

- **Restricted use of Chemical agents and other Non-chemical means in Oil Combatting Operations on the Baltic Sea Area 22/2.**
- **Development of national ability to respond to spillages of oil and other harmful substances 20/5.**
- **Guidelines for the Establishment of Adequate Reception Facilities in Ports 10/5.**
- **Co-operation and assistance to Estonia, Latvia, Lithuania and Russia in the field of Combatting Marine Pollution Incidents 23/2.**
- **Recommendation Concerning Establishing of a Pollution Reporting System for Pollution Incidents 6/14.**

The HELCOM response vessel fleet and surveillance planes



International cooperation, cont.

- **Cooperation within Nordic Countries, Copenhagen Agreement**
 - Agreement covers Denmark, Sweden, Finland Norway and Island
 - Organize exercises between neighbouring countries
 - Supports also R&D
- **Specially in the Gulf of Finland**
 - Trilateral cooperation between the GoF States
 - Bilateral agreements
 - Russia – Finland
 - Estonia – Finland
 - Estonia – Russia

EU

EMSA, European Maritime Safety Agency

- Based in Lissabon
- Hired five response vessels for the Baltic Sea
- Satellite imagery service
- Organize training



Older tests made by Wärtsilä Marine

- **Oil behaviour in and response options in ice. Model test D 30/Yrjö Kalaja. July 1983. 66 p. (in Finnish)**
- **Full scale test of an oil recovery skimmer on the front of a fairway service vessel. Report D 54, December 1985. 18 p. (in Finnish)**

Older tests made by VTT, Technical Research Centre of Finland

- Full scale oil recovery trials of LORI Ice Cleaner. LAI 1583/91, June 1991. 44 p. (in English)
- Laboratory oil recovery tests of LORI Ice Cleaner brush pack in cold conditions. LAI 1209/92. March 1992. 33 p. (in English)
- Adhesion of oil on some skimmer materials and ice. VAL 3230/94/LAI. February 1994. 72 p. (in English)
- Adhesion between oil and ice. Seppo Liukkonen. VALB160 November 1996. 120 p. (in English)
- Laboratory study on spreading and drifting of oil under ice. Seppo Liukkonen et al. November 1996. 53 p. (in English)

Technical development, some Finnish and Nordic studies since 1987

- **Oil and ice interaction in brackish Baltic Sea water**
- **How commercial dispersant behaviour in Baltic Sea circumstances**
- **Use of brush skimmers in icy conditions**
- **The performance of different kind of skimmers with high viscosity oils**
- **Pumping of high viscosity oils**
- **Test reports of several new constructions**

Winter recovery

Difficulties:

- Location of the oil under ice
- Freezing ambient
- Ice going specialized vessels needed
- High viscosity, difficult skimming and pumping

Advantages:

- Limited spreading
- Normally no waves



Mechanical methods used and tested for collecting oil in ice in Finland

- **Brush technology:**
 - Ice bow
 - Brush bucket
 - Vibrating grid
- **Excavator shovels**
- **Vacuum pumps**
- **Skimmers operating under ice**
- **Using of air or propeller flow to steer oil under ice**
- **Using of ice barriers and ice dwells**



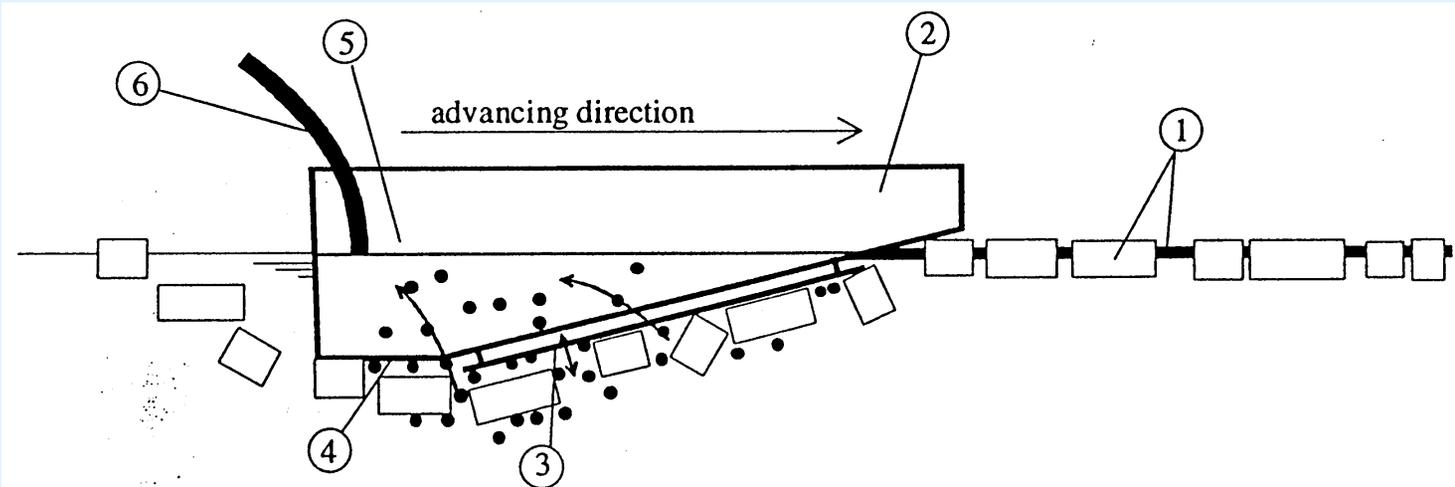
**Ice bow, LORI
Ice Cleaner
mounted to the
fairway service
vessel Letto.
Sea trials 1994**



Oil recovery bucket



The principle of vibrating grid as an oil in ice skimmer

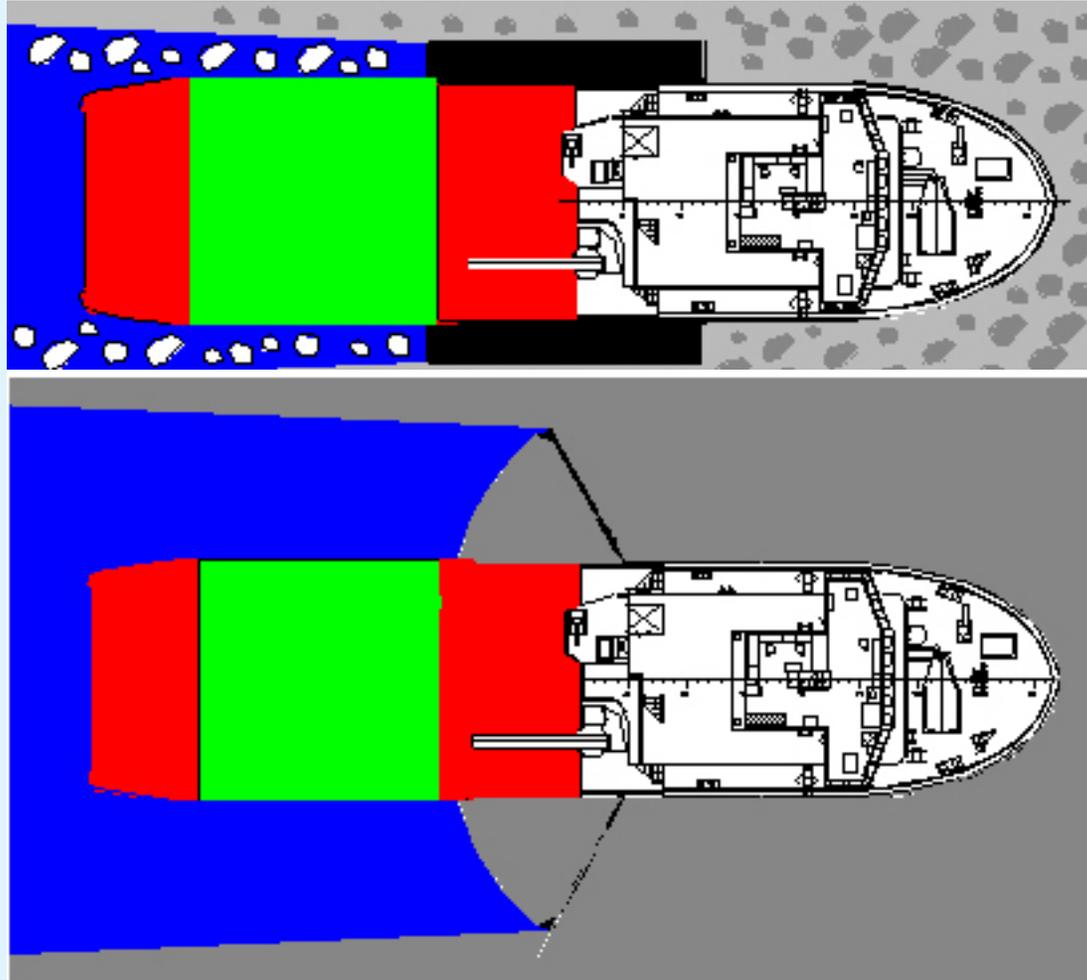


- 1: oil between ice blocks
- 2: recovery unit
- 3: vibrating perforated plate or grid to make the ice blocks vibrate and rotate

- 4: perforated outer shell of the recovery unit
- 5: space inside the recovery unit where the oil enriches on the water surface
- 6: skimming the oil off the water surface inside the recovery unit

Use of vibrations to separate oil from ice

The principle of ice and open water collecting skimmers on fairway service vessel Seili



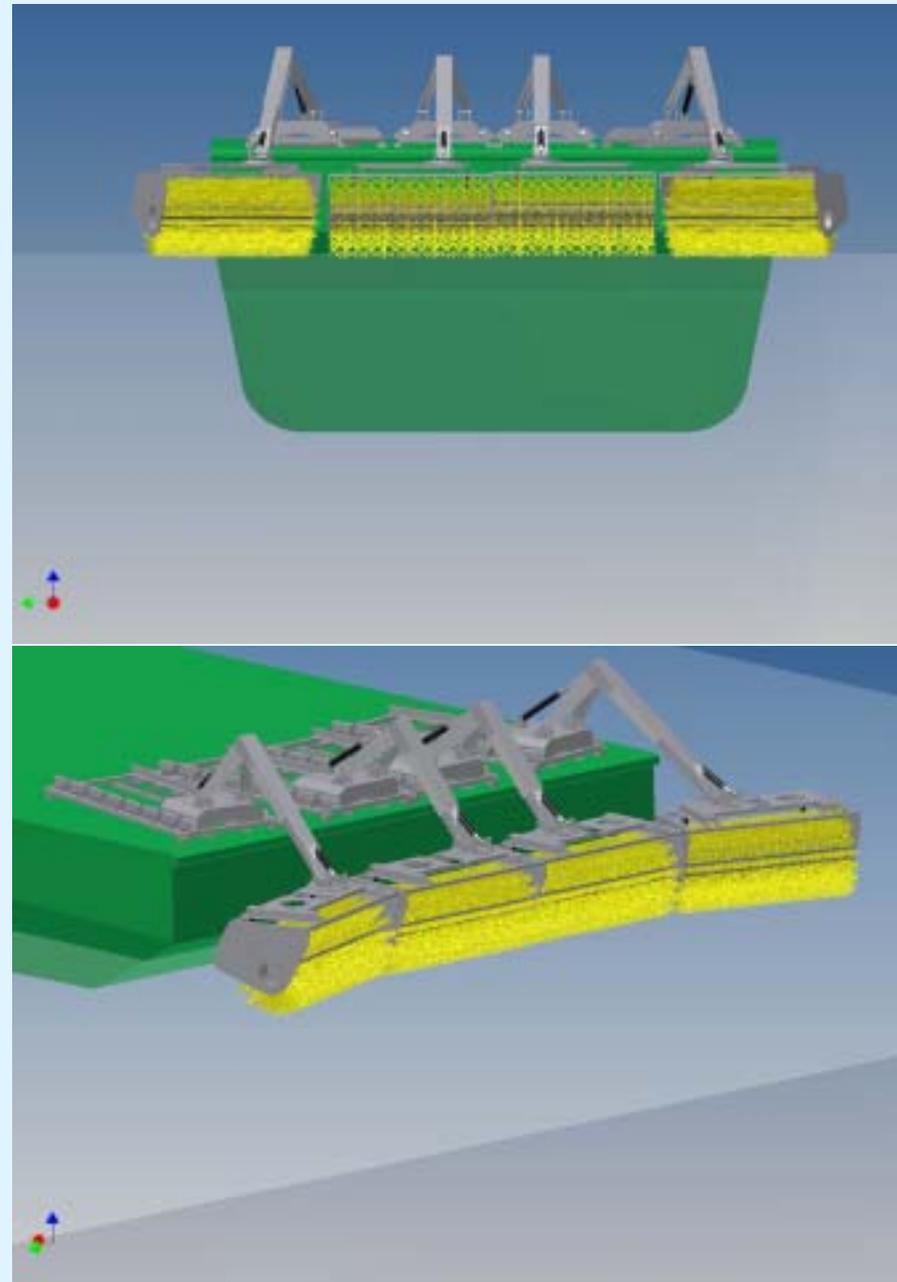
Seili with her LOIS collectors in collecting mode



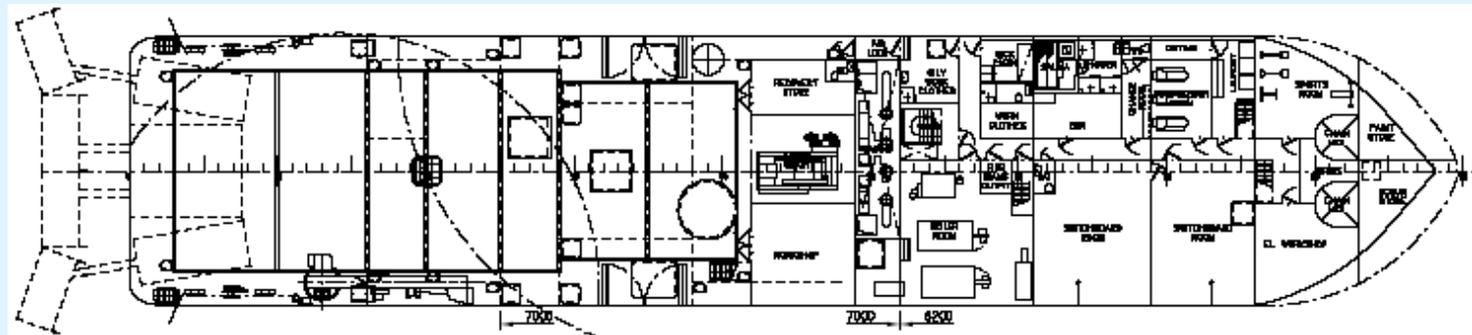
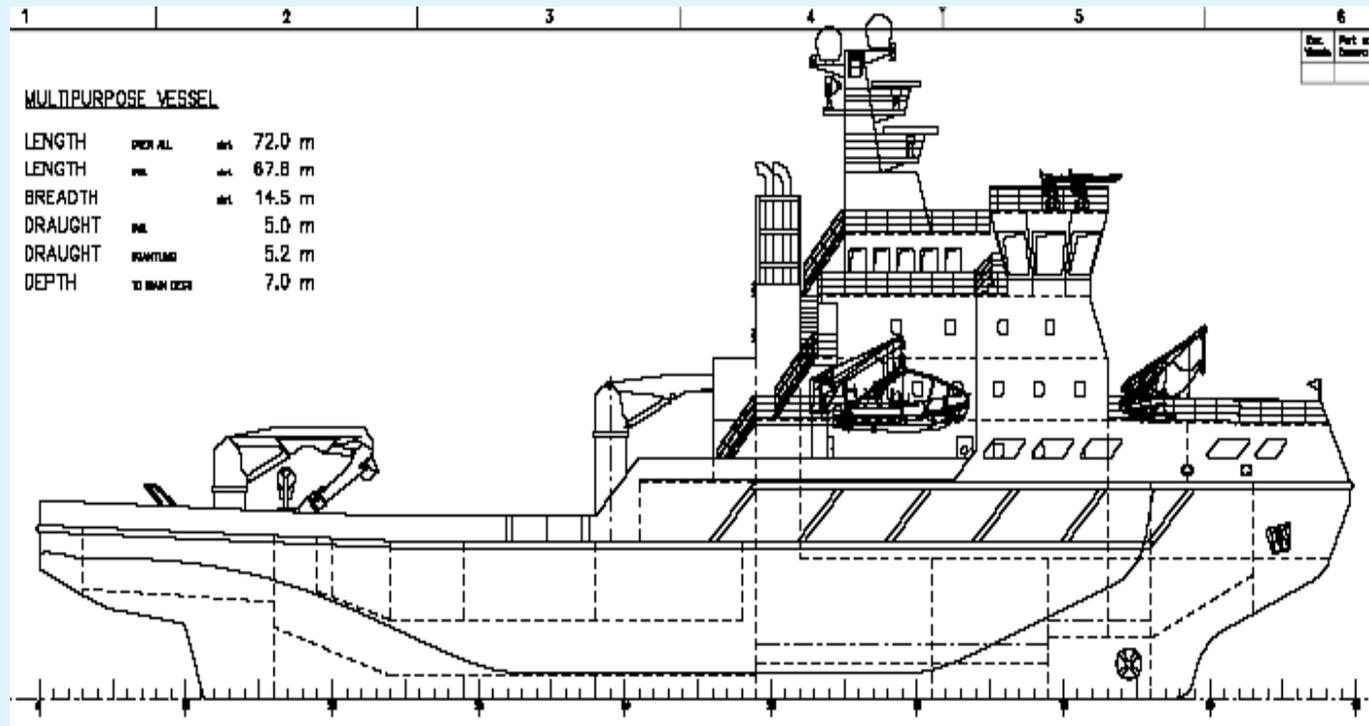
**New oil
Finnish
skimmer
construction
for ice
conditions
during trials in
spring 2007**



Novel oil brush collector for ice conditions installed to the new Finnish multipurpose response vessel

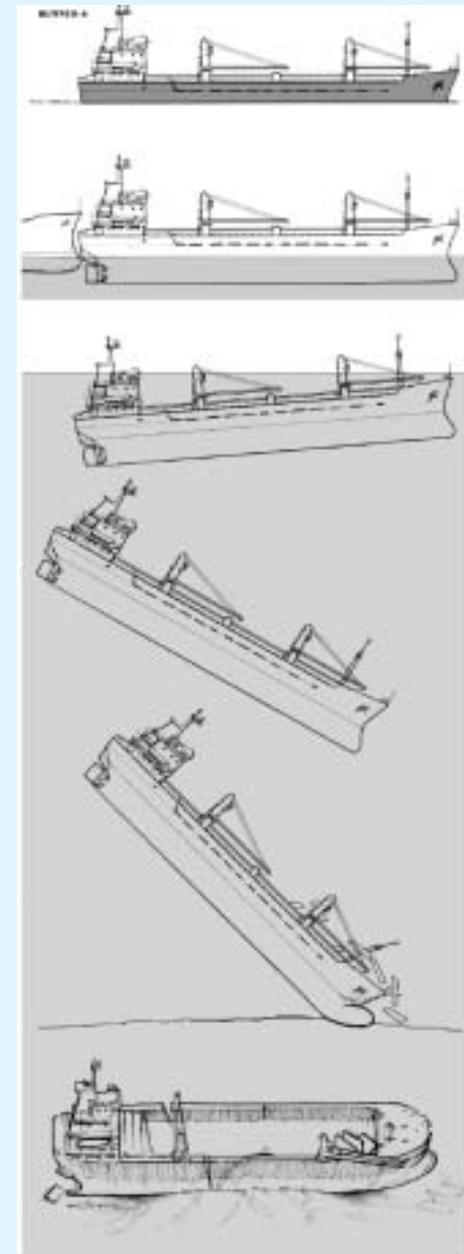


New multipurpose response vessel for Finnish Environment Institute/ Finnish Navy



Runner 4 case

- Sank 5.3.2006 due collision in Estonian waters in convoy in ice channel on the way from St. Petersburg.
- Amount of different type of oils 160 t.
- Spilled oil between 30 – 50 t.
- Joint Estonian – Finnish operation.
- Collected in March about 15 t. with several bucket brush skimmers.
- The wreck was emptied autumn 2006, about 110 t.
- The lifting of the aluminum cargo in now going on.



The accident place



Merikarhu was the first Finnish vessel on the spot surveilling the wreck by ROV



Hylje in work



Estonian Valvas and Finnish Halli and Hylje



Finnish Seili



Hylje in almost open water



February 2006 about 12 m³ of heavy fuel oil escaped from a tank of a power plant in the Lake Saimaa area.

Temperature was between -35 C to 0 C.

Used methods were trawls and vacuum pumps. 13 m³ of oil and debris was collected. The operation lasted 4 months.

Recovery of sunken oil



Recovery of sunken oil, cont.



Finnish vessels collecting illegal releases during spring 2003

About 50 vessels were waiting icebreaker assistance several weeks in March 2003 in the Gulf of Finland on the way to St. Petersburg. During that time they washed tanks, emptied bilge water tanks etc. to the GoF. Finnish oil recovery vessels cleaned the oiled ice in Finnish waters.



Conclusions

- **Possible to response small spills in ice**
- **To succeed you must have many alternative methods**
- **Much work is needed to develop real operative response methods for large spills in ice**
- **Locating of oil under (snow covered) ice is a problem**
- **If the oil sinks, it is very difficult to find and collect**
- **Reliable oil/ice drift models don't exist**

**Thank you for attention
Questions?**

