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“State of the art review on Baltic Sea oil recovery practices and development of mechanical response in ice”

PAJ Oil Spill Symposium 2014; February 6 - 7, 2014; Tokyo, Japan

Jorma Rytkönen

Finnish Environment Institute

SYKE

Content

- Baltic Sea - dense traffic area
- Maritime traffic and risks
- Accident and incident types
- Risks of winter navigation
- Winter recovery
- Mechanical oil recovery in ice
- Conclusions

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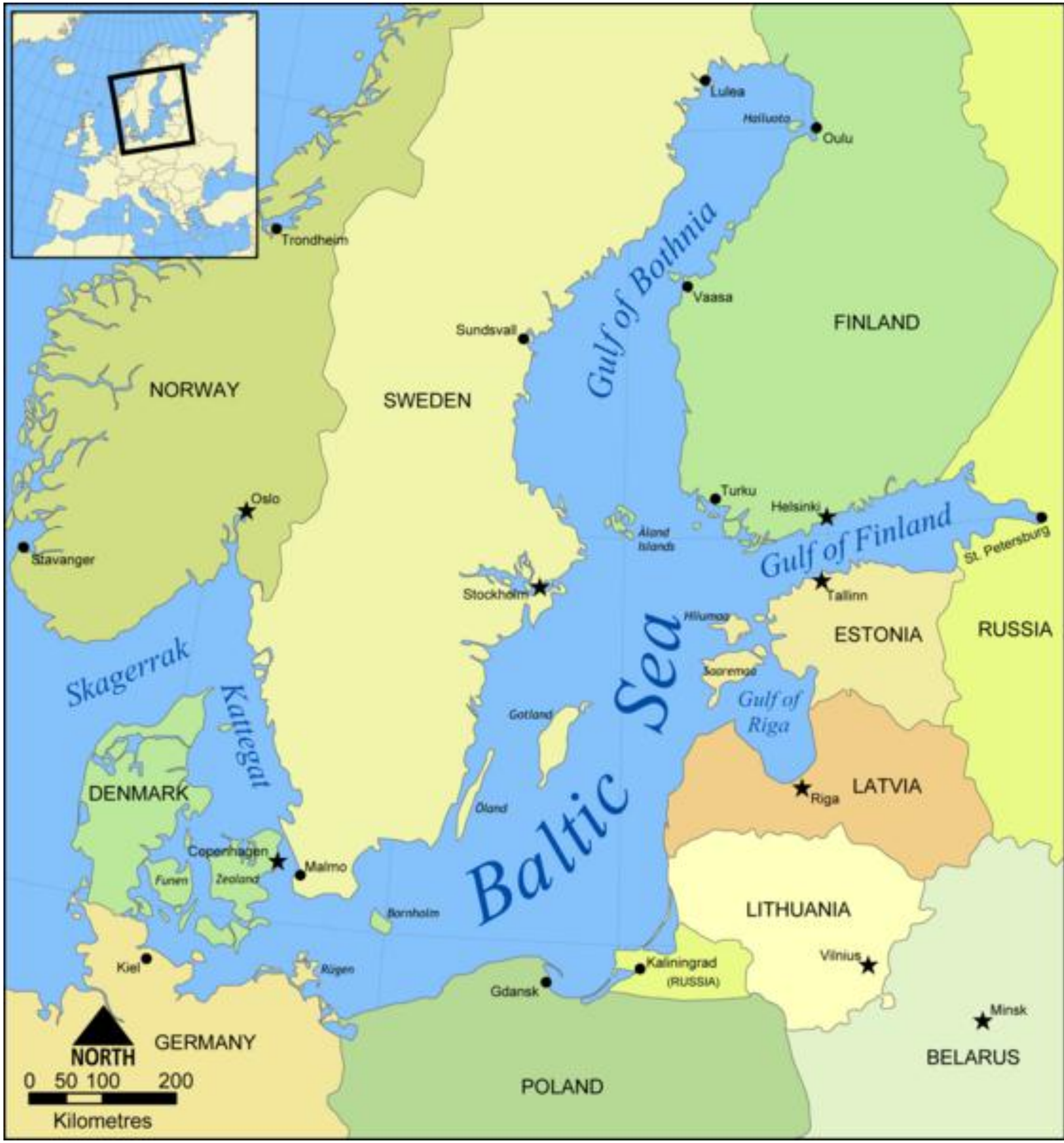
Baltic Sea

- **Nine countries, nine languages.**
- **Connected to North Sea/Atlantic Ocean through narrow Danish straits.**



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BRISK-risk analyses

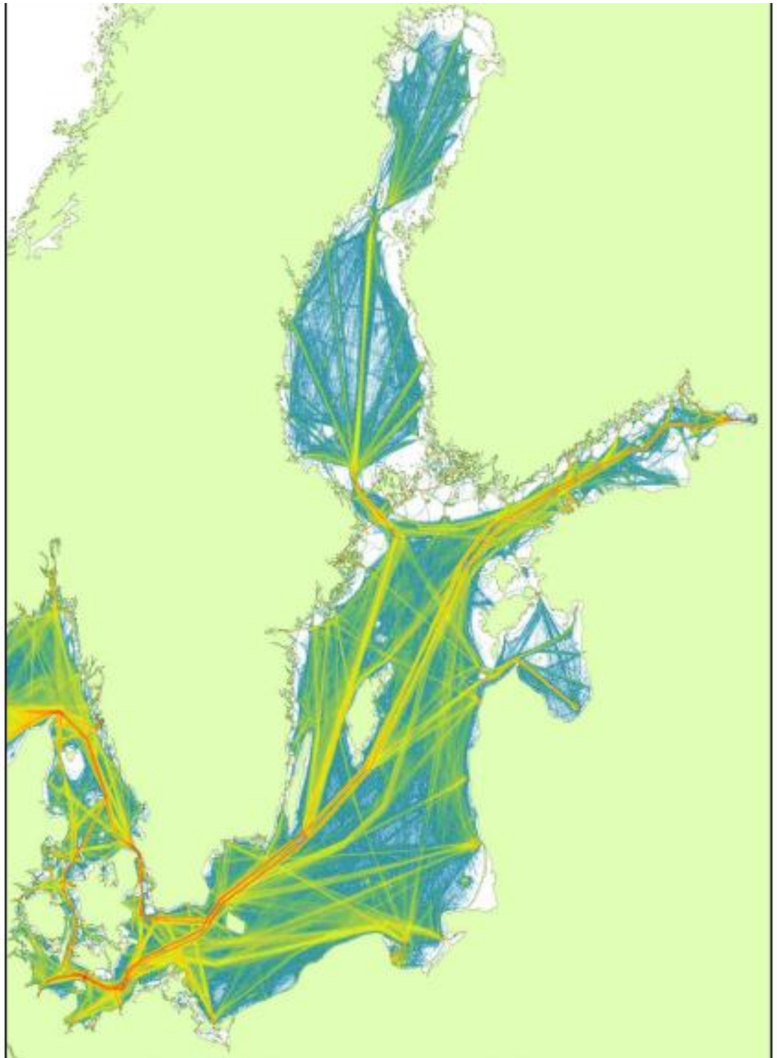
Ship Traffic

• Baltic Sea is one of the heavily trafficked seas in the world

• Around 2,000 ships at sea at any given time

•High traffic intensity in the Gulf of Finland and on the main route towards the North Sea

•AIS information 2008 - 2009



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Scenario Results

All spills

- **Existing Ship Traffic**
- **Existing Response Capacities**
- **Existing Navigational Aid**

ESTIMATES OF EXPECTED INTERVALS BETWEEN SPILL EVENTS

Sub-region	*Large accidents: 300–5.000 tonnes spilt*	*Exceptional accidents: 5.000< tonnes spilt*
1. Gulf of Bothnia	36 years	600 years
2. Gulf of Finland	39 years	255 years
3. Northern part of the Baltic Proper	30 years	175 years
4. South-eastern Baltic Proper	140 years	1,060 years
5. South-western Baltic Proper	17 years	97 years
6. Sound and Kattegat	11 years	65 years
Entire Baltic Sea	4 years	26 years

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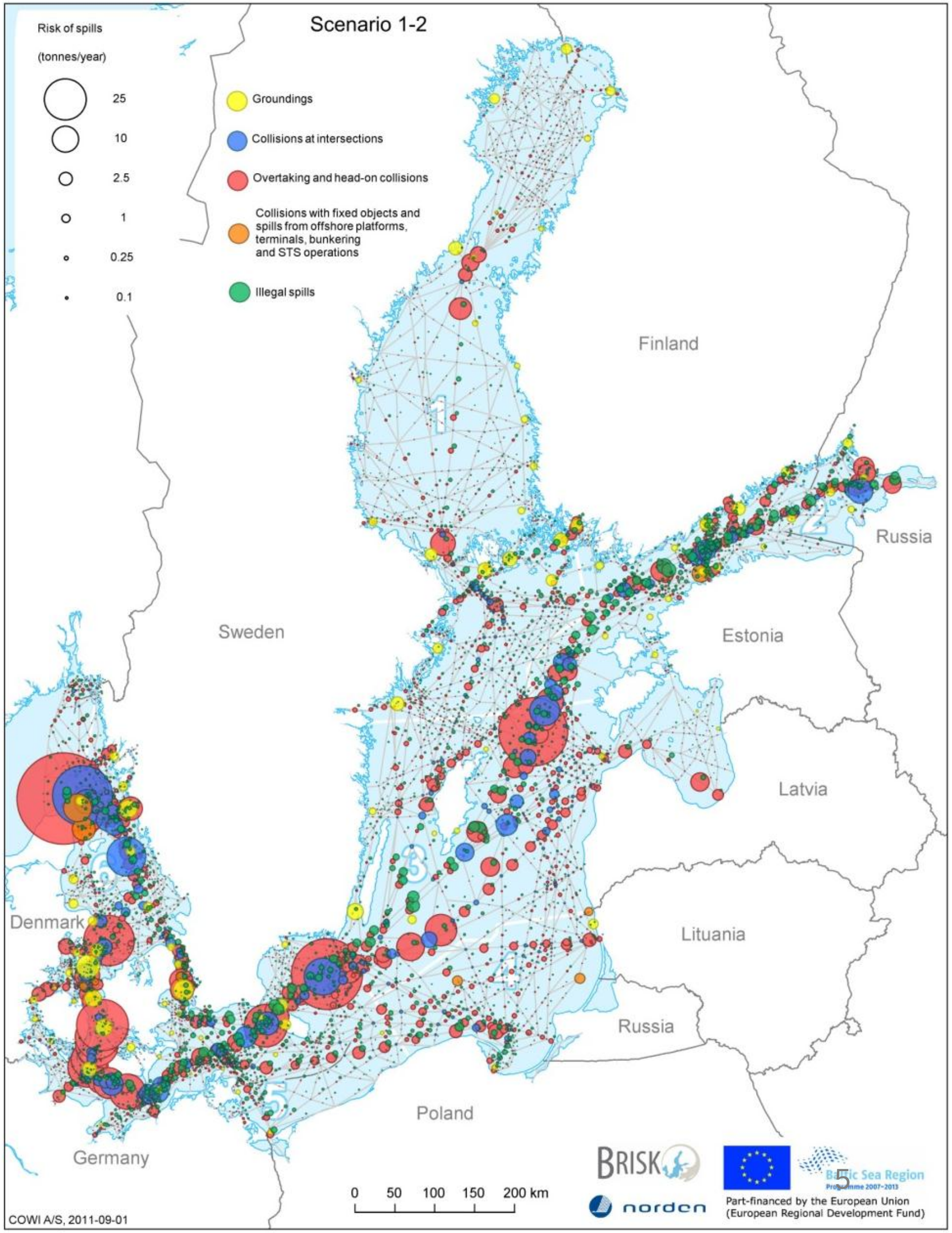

Largest Oil Accidents in the Baltic Sea Area 1980 - 2001

9/27/2012

Year	Name of ship	Quantity of Oil Spilled (tons)	Place of Incident
1980	Furenas	200	The Sound, Sweden
1980	Eva Oden	250	Gothenburg, Sweden
1980	Furenäs/Karnen	200	The Sound, Denmark
1980	Lloyd Bage	130	Helsinki, Finland
1981	Jose Marti	1000	Dalarö, Sweden
1981	Serif	375	Öland, Sweden
1981	Globe Asimi	16000	Klaipeda, Lithuania
1982	Sivona	800	The Sound, Sweden
1984	Eira	200	Vaasa, Finland
1984	Ibn Roch	300	Great Belt North, Denmark
1985	Sotka	350	Åland Sea, Sweden
1986	Thuntank 5	150-200	Gävle, Sweden
1986	Jan	320	Aalborg Bight, Denmark
1987	Antonio Gramsci	580	Porvoo, Finland
1987	Okba Bnou Nafia	120	Malmö, Sweden
1987	Tolmiros	250	West Coast, Sweden
1990	Volgoneft	1000	Karlskrona, Sweden
1995	Hual Trooper	180	The Sound, Sweden
1998	Nunki	$100\ m^3$	Kalundborg Fjord, Denmark
2001	Baltic Carrier	2700	Kadetrenden, Denmark

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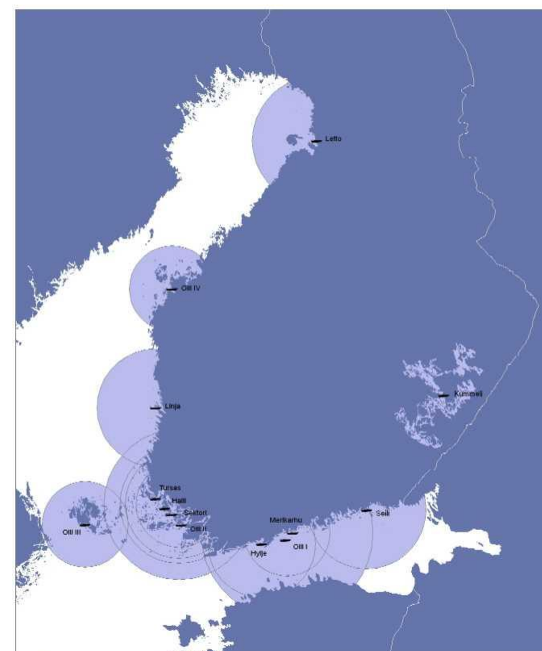
The Finnish governmental response fleet
16 multipurpose vessels operated by different authorities – Navy, Border Guard and Meritaito Ltd

- Normally the vessels are under the command – and in tasks – of the owner administration
- In case of a pollution incident the SYKE duty officer commands the vessels to operate under the appointed Response Commander
- 10 response vessels are ice class
- All are equipped with in-built oil recovery systems







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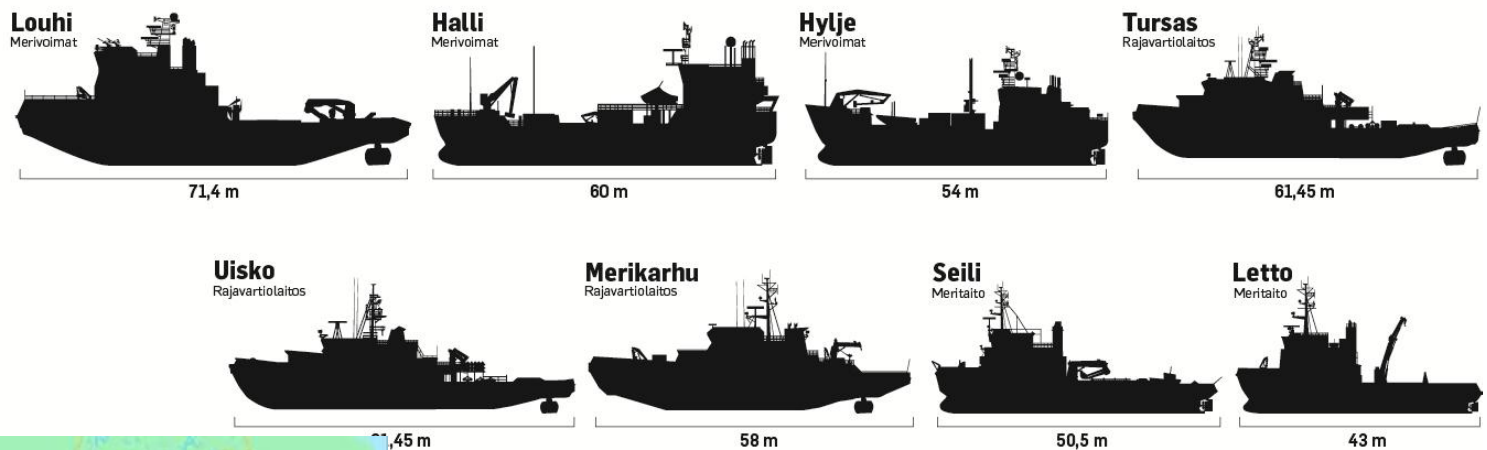
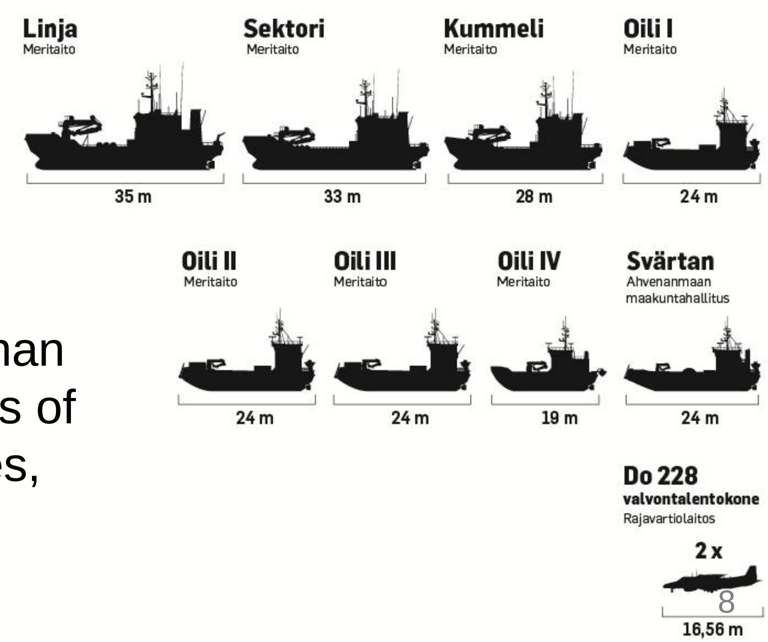
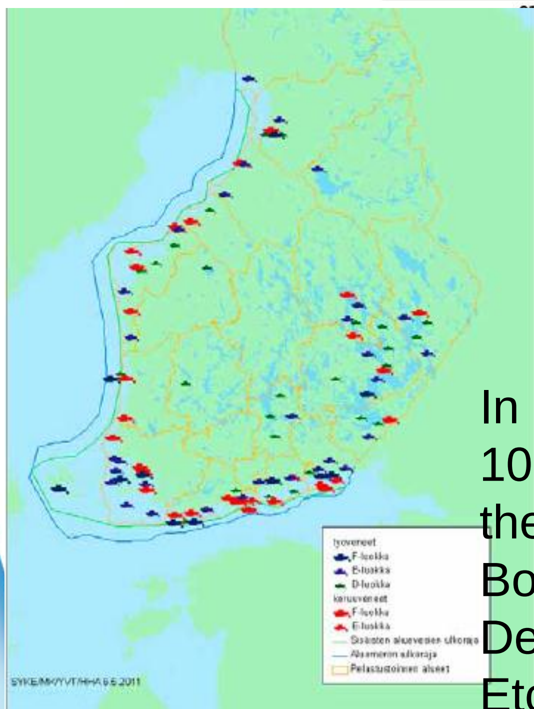
Pollution response preparedness – NOW > 800m3/hour and 4 456m3 storage capasity







In addition more than 100 recovery boats of the rescue services,

Booms

Depos

Etc…..

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New-Buildings in Progress and EMSA's contribution

TURVA of the Finnish Border Guard
- Lenght 95,9m
- Breadth 17,4 m
- Speed 18 knots
- Oil recovery system onboard
- Oil Recovery tank 1000m3
- Chemical recovery tank 200 m3


IB Kontio –chartered by EMSA

Kemin Karhu of the Arctia Shipping
- Length 35 m
- Breadth 12,8 m
- Draft 5 m
- Power 4 MW
- (Oil recovery system onboard)

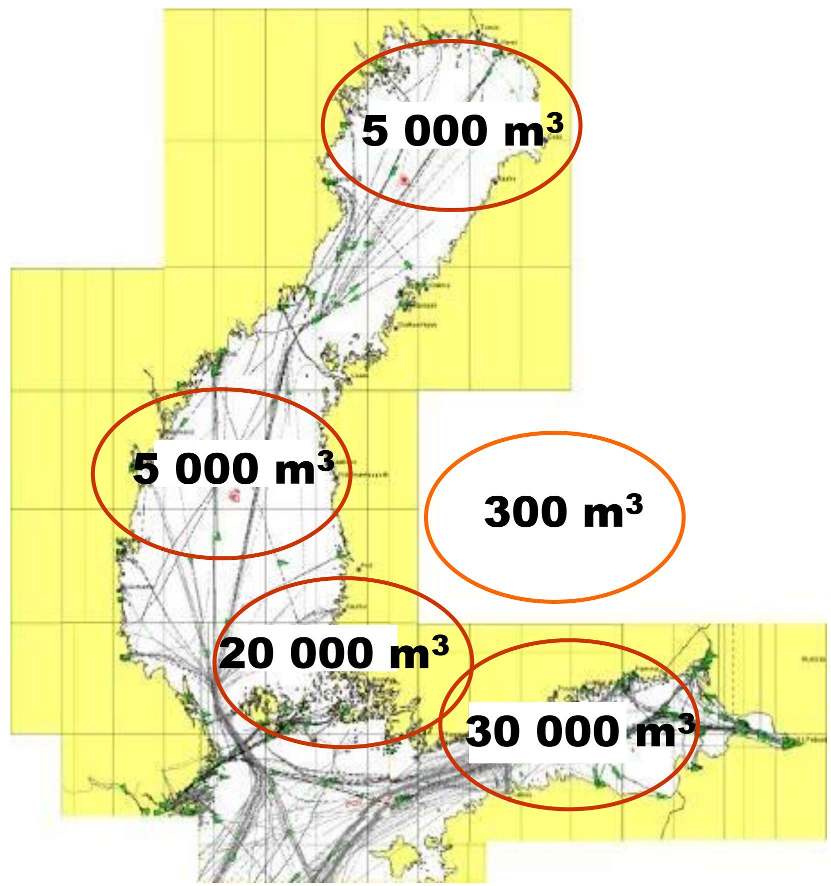
Additionally two 33 – 35 m long Archipelago passenger/car ferries with oil recovery equipments under design & construction

Target spills

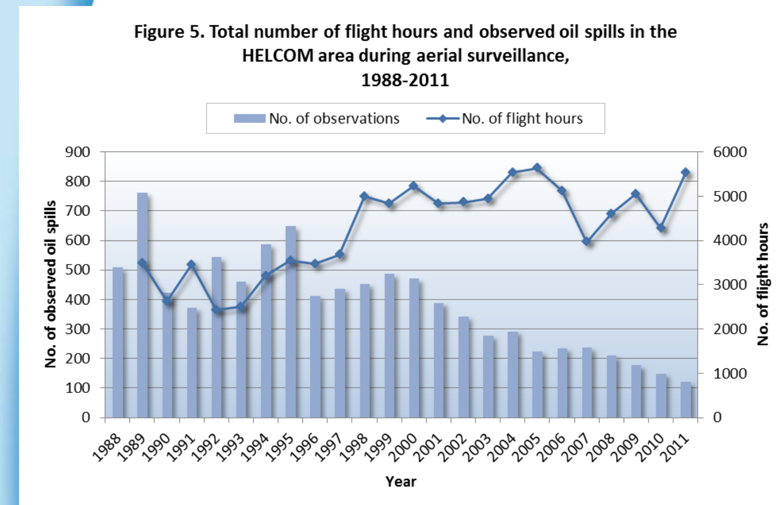
Total out-flow of two cargo tanks of the biggest tanker visiting the area

- In open water conditions the oil recovery capacity of the first 24 hours would be 50% of target spill: Aim for full recovery in 3 days. Target should be reached together with neighbouring states

- In ice conditions the oil recovery capacity of the first 72 hours would be 50% of the target spill: Aim for full recovery in 9-10 days

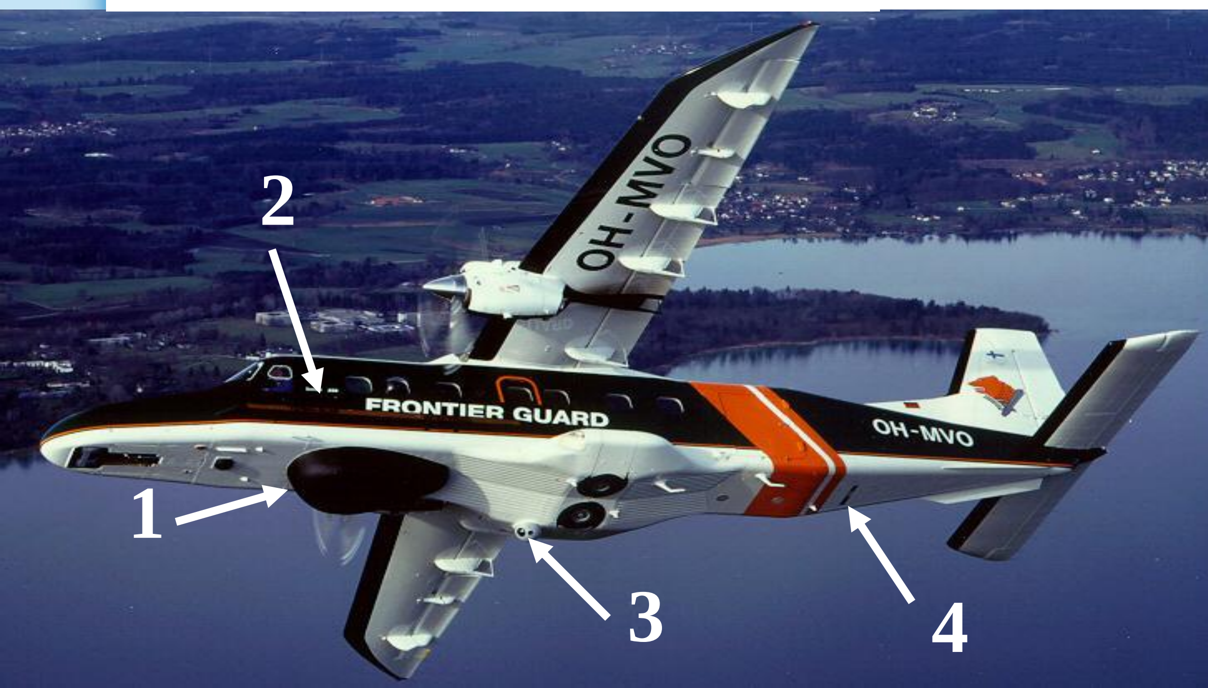


Aerial Surveillance in Finland



Finnish Environment Institute (SYKE) is the national competent pollution control authority

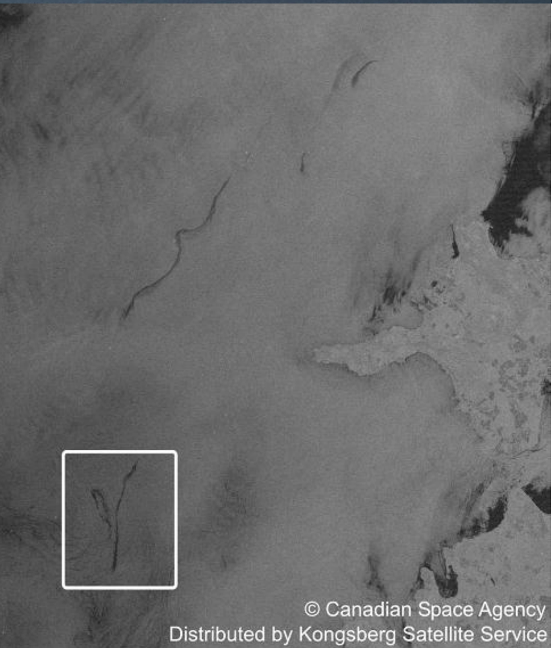
- Responsible for surveillance of illegal oil discharges
- Surveillance in close co-operation with Finnish Border Guard
- Two surveillance aircraft, Dornier 228-212
  - Aircraft equipped with Environmental monitoring equipment



1. Surveillance radar 360°
2. SLAR side looking radar
3. FLIR
4. IR/UV scanner

S Y K E

Rajavartiolaitos
Gränsbevakningsväsendet
The Finnish Border Guard

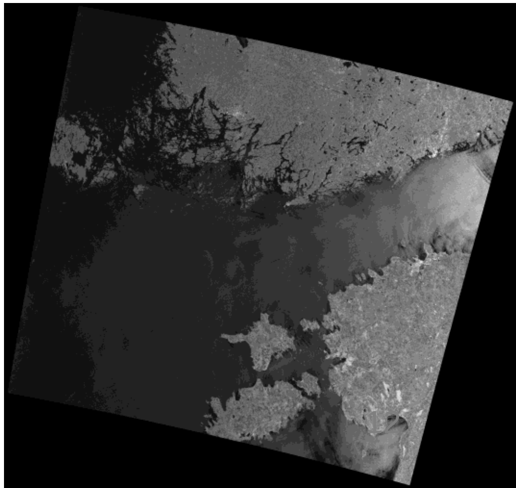


Use of Satellite Imagery in Oil Spill Monitoring

- First experiences of the use of satellite images 1996
- Benefits of using SAR (Synthetic Aperture Radar) images
  - One image can cover 400x400 km area at once
    - (can be 400x800 km)
  - Possibility to detect oil in the darkness and through clouds
  - Good supplementary tool for aerial surveillance

- All the indications has to be checked
  - A lot of false alarms ☹

- European Maritime Safety Agency (EMSA) CleanSeaNet Service
  - Between 600-1000 images annually for the Baltic Sea



Accident and incident types

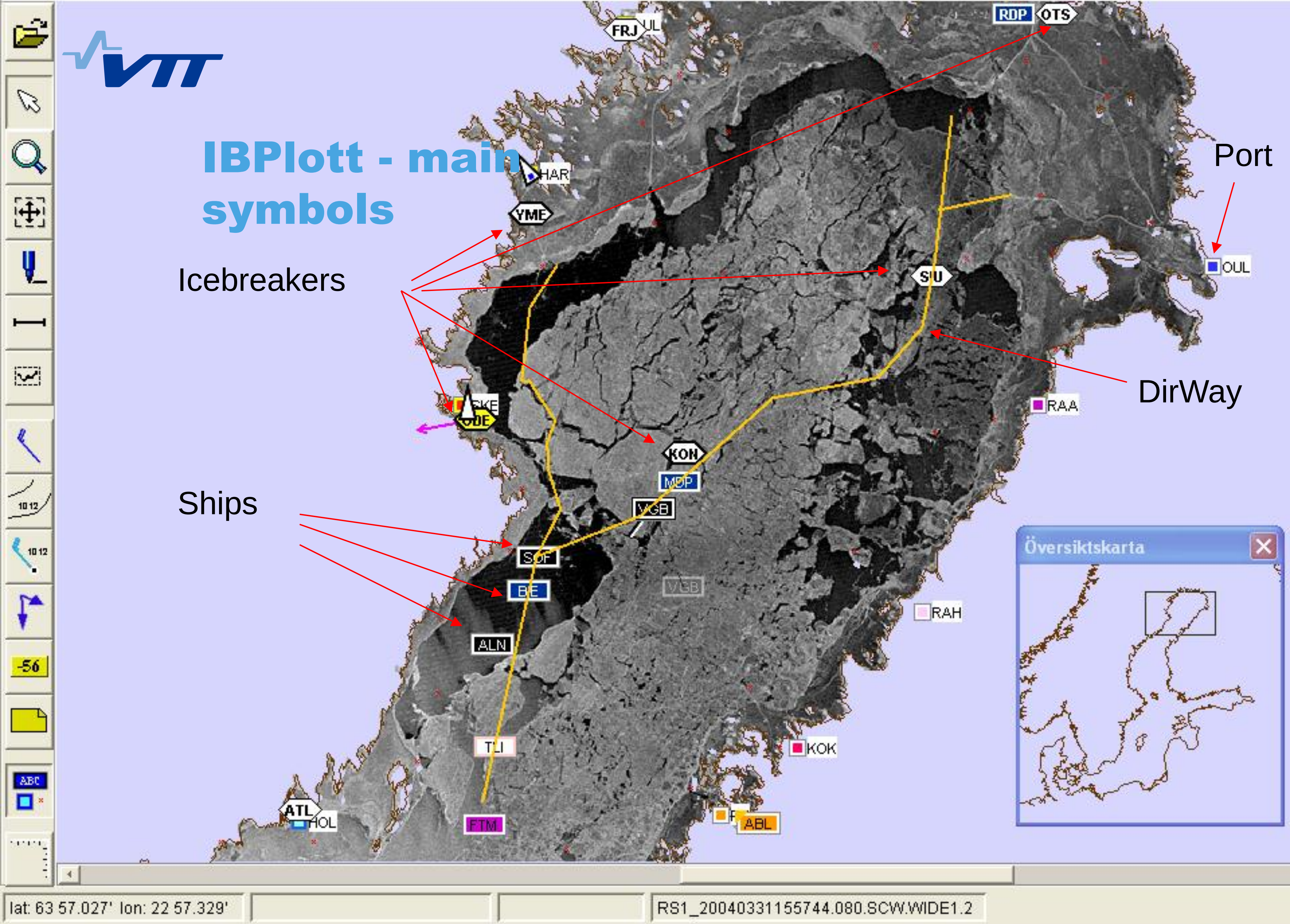
(www.iceadvisors.fi)

Accident/incident type	Typical ice related situation
Collision	▪ In icebreaker assistance ▪ Between unassisted vessels in narrow ice channel
Drift groundings	▪ Vessel gets stuck in ice and drifts with the ice on a shoal
Powered grounding	▪ Ice prevents from making needed manoeuvre to keep ship on safe route ▪ Vessel is seeking for an easier route in difficult ice conditions and thus deviates from the normal route
Icing	▪ Cold and windy open sea conditions

Risks of winter navigation in the northern Baltic Sea (Jalonen et al, 2005)

Winter classification	Fatalities	Pollution	Total loss
mild winter	once in 40–75 years	once in 8–17 years	once in 12–20 years
normal winter	once in 10–20 years	once in 2–5 years	once in 2–5 years
severe winter	once in 3–6 years	yearly	once in 1–2 years

IBPlott - main symbols



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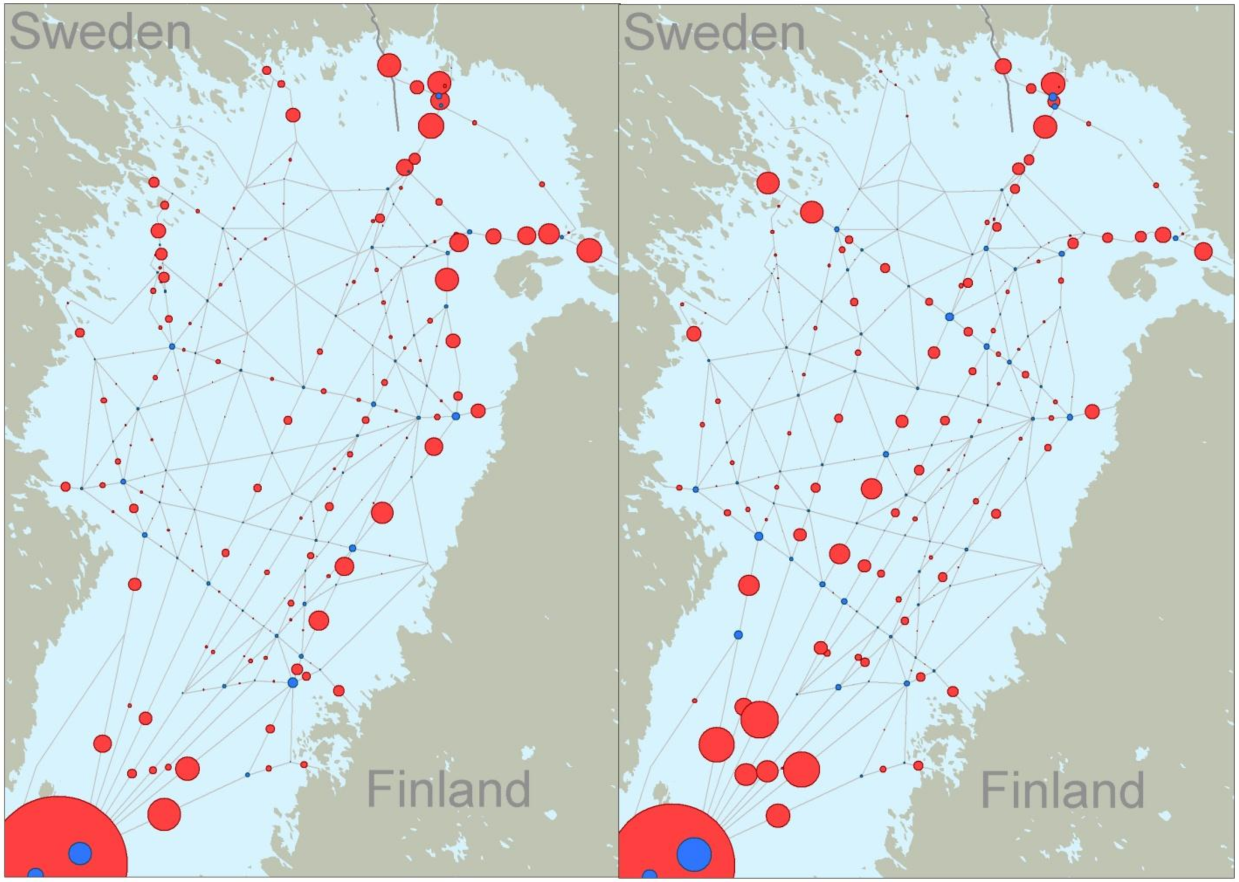
Risk evaluation /BRISK

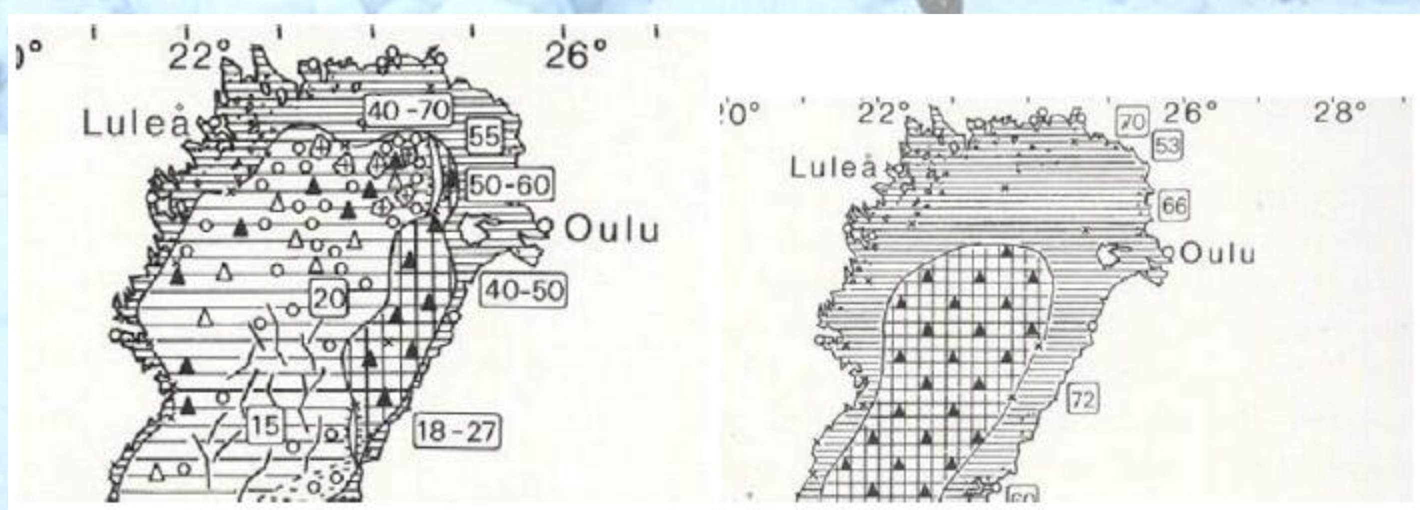


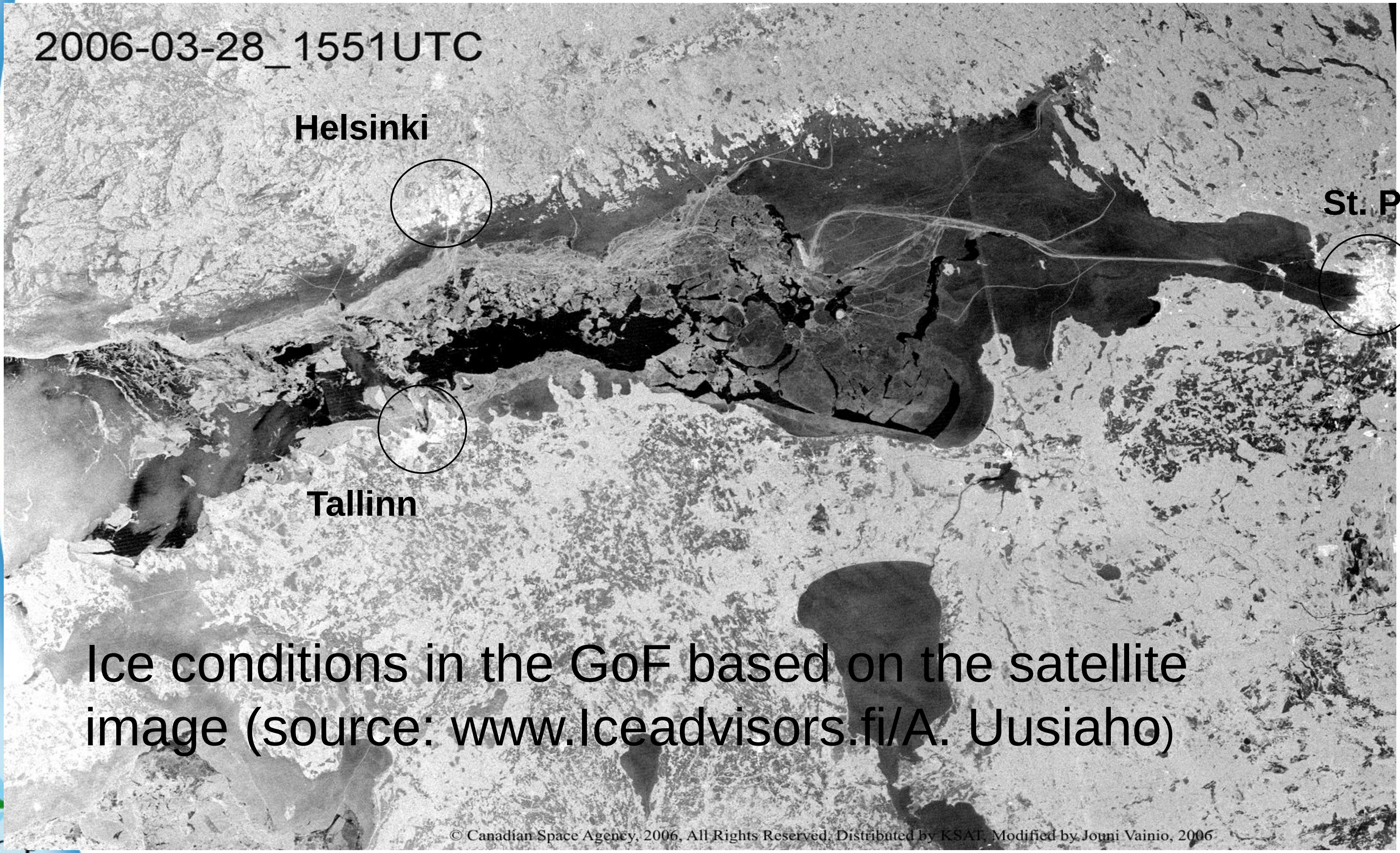
Risk of collisions during winter season (left) and remaining seasons (right), Bothnian Bay:

Part-financed by the European Union

Ice conditions in mild(left) and severe(right) winter

source: Leppäranta, M. 2011. Siikajoen Tuulivoimapuiston vaikutukset jääeroosioon

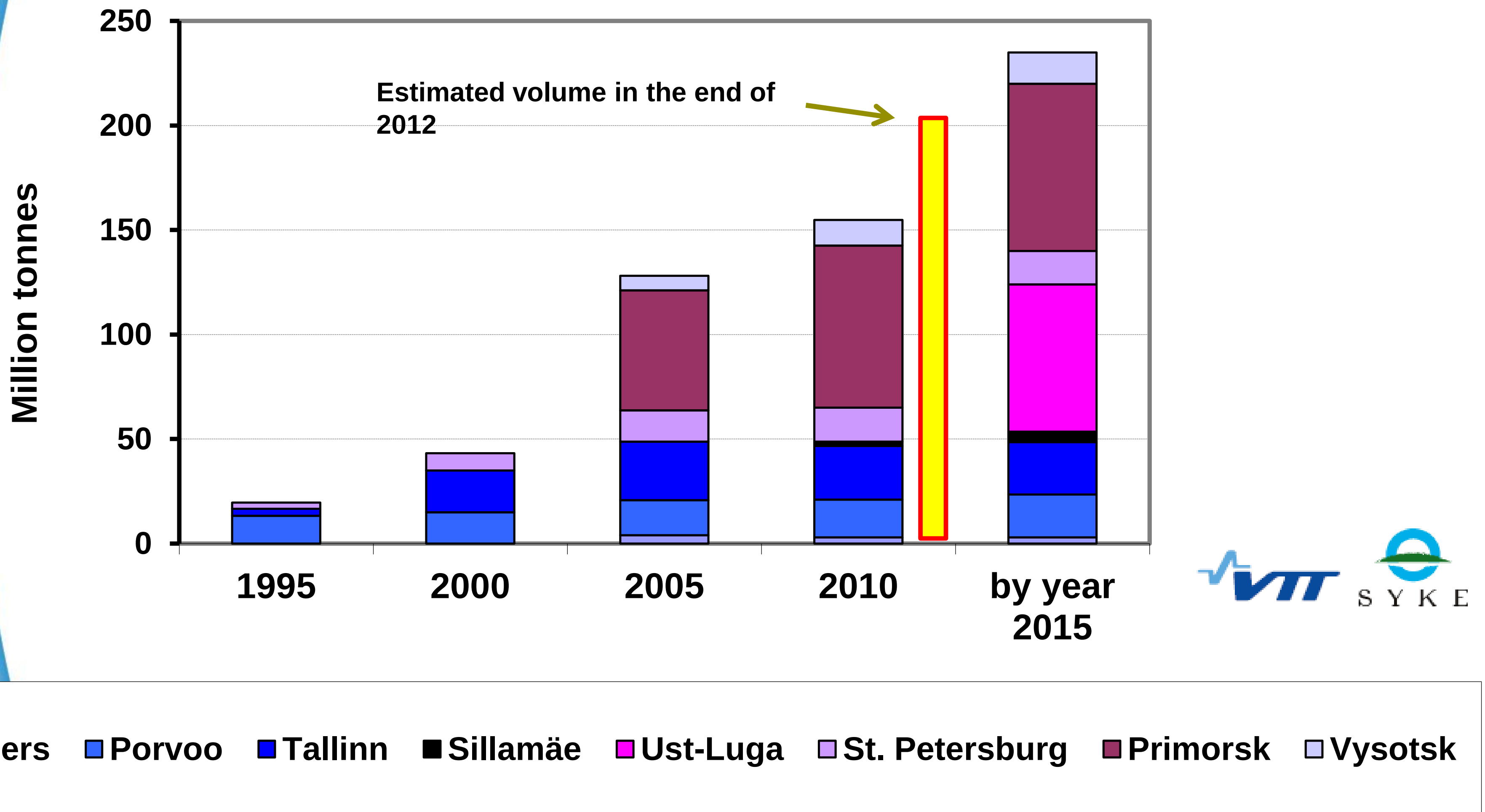




Ice conditions in the GoF based on the satellite image (source: www.Iceadvisors.fi/A. Uusiaho)

18th March 2011

OIL TRANSPORTATION IN THE GULF OF FINLAND THROUGH MAIN OIL PORTS
Oil transportation in years 1995-2009 and estimated development by year 2015



Winter recovery

Difficulties:

- **Location of the oil.**
- **Freesing ambient.**
- **Darkness.**
- **Specialized skimmers and ice going vessels needed.**
- **High viscosity, difficult skimming and pumping.**

Advantages:

- **The window of opportunity may be larger than in open waters –there is more time for response before oil reaches the shore.**
- **Ice prevents the oil from spreading over large distances; it acts as a physical barrier.**
- **Normally no waves.**

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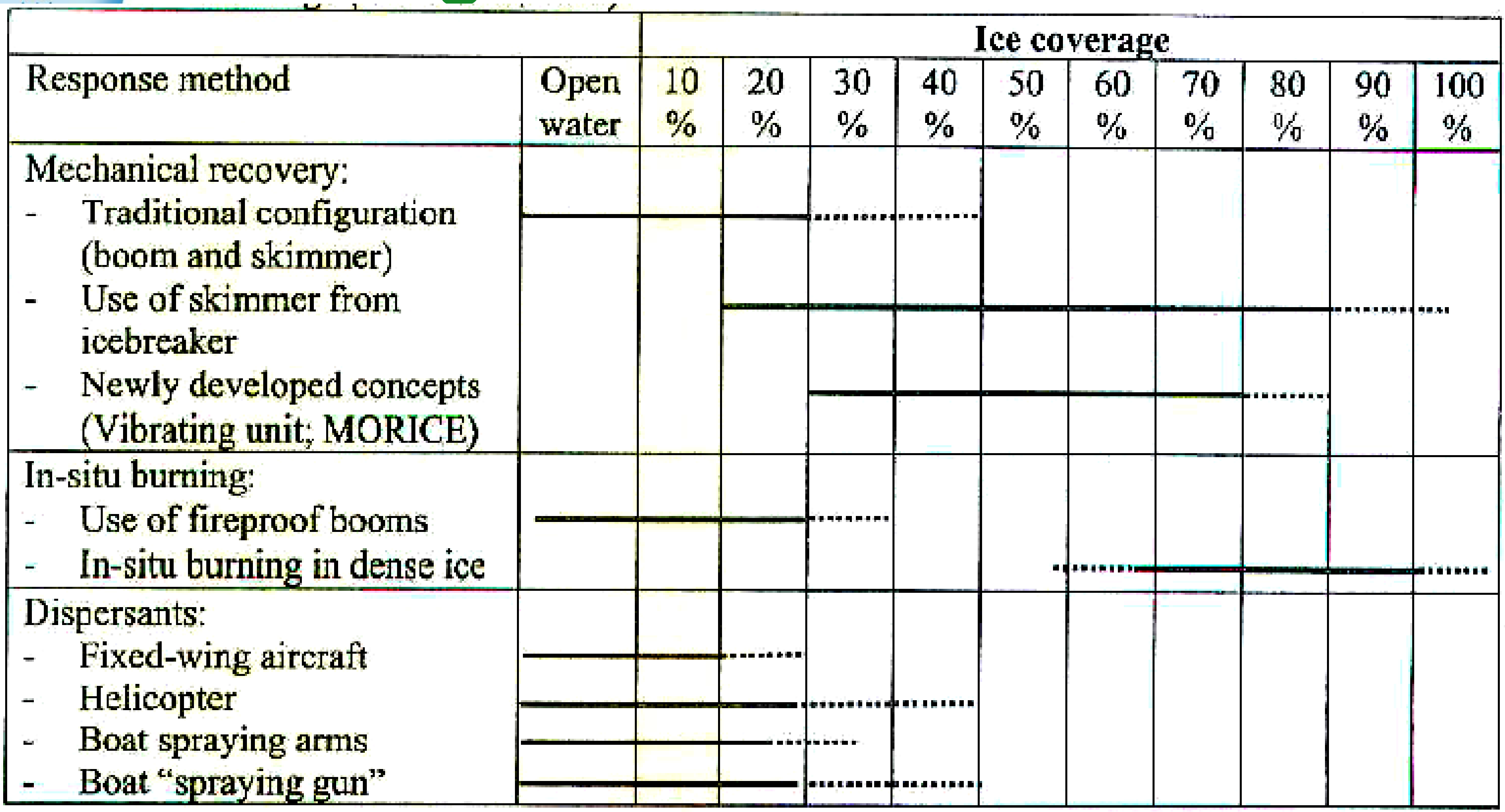
Baltic Sea approach

The Baltic Marine Environment Protection Convention (**HELCOM**).

Based on **HELCOM recommendations** and the fact that Baltic Sea is already heavily polluted, main response principles in case of marine oil releases are:

- **Prefer mechanical recovery.**
- **Minimization of the use of sinking agents and absorbents. Dispersants not used in Finland.**
- **In situ-burning also only when other means are not available and when greater damages can then be avoided.**

Different response methods versus ice coverage



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Main mechanical methods used and/or tested in Baltic States, mainly in Finland

- Ice bow.
- Oil recovery bucket.
- Vibrating grid.
- Big brush wheel.
- Using of air or propeller flow to steer oil under ice.
- Using of ice barriers and ice dwells.
- Ice saw.
- Vacuum pumps.
- Skimmers operating under ice.

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LORI Ice Cleaner, ice bow

Ice bow, LORI Ice Cleaner mounted to the fairway service vessel Letto.

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LOIS unit installed to fairway service vessel Seili

Oil recovery bucket

Originally constructed for shoreline cleaning.

Photo: J. Pirttijärvi

Oil recovery bucket, cont.

Now the mostly used equipment to collect oil in ice.

Brush wheel diameter 800 mm.

Three wheel length, 0.6, 1.6 and 3.0 m.

Oil recovery bucket installed on a new Swedish response vessel

Hylje in work

Photo: J. Pirttijärvi

Estonian Valvas and Finnish Halli and Hylje

Photo: J. Pirttijärvi

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Finnish Seili

Photo: J. Pirttijärvi

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Ship mounted ice cleaning brush wheels

- Four collectors installed on the aft deck with container fastenings.
- In collecting mode vessel moves backward.
- Wheel diameter 1.8 m.
- Sweeping width 4x4 m.
- First units to a new Finnish multipurpose vessel.

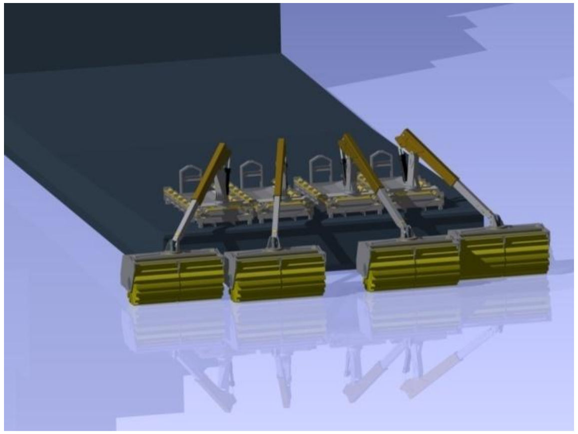

Photo: J. Pirttijärvi

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Novel ice brush for ice breakers and supply vessels – tests in 10 April 2013

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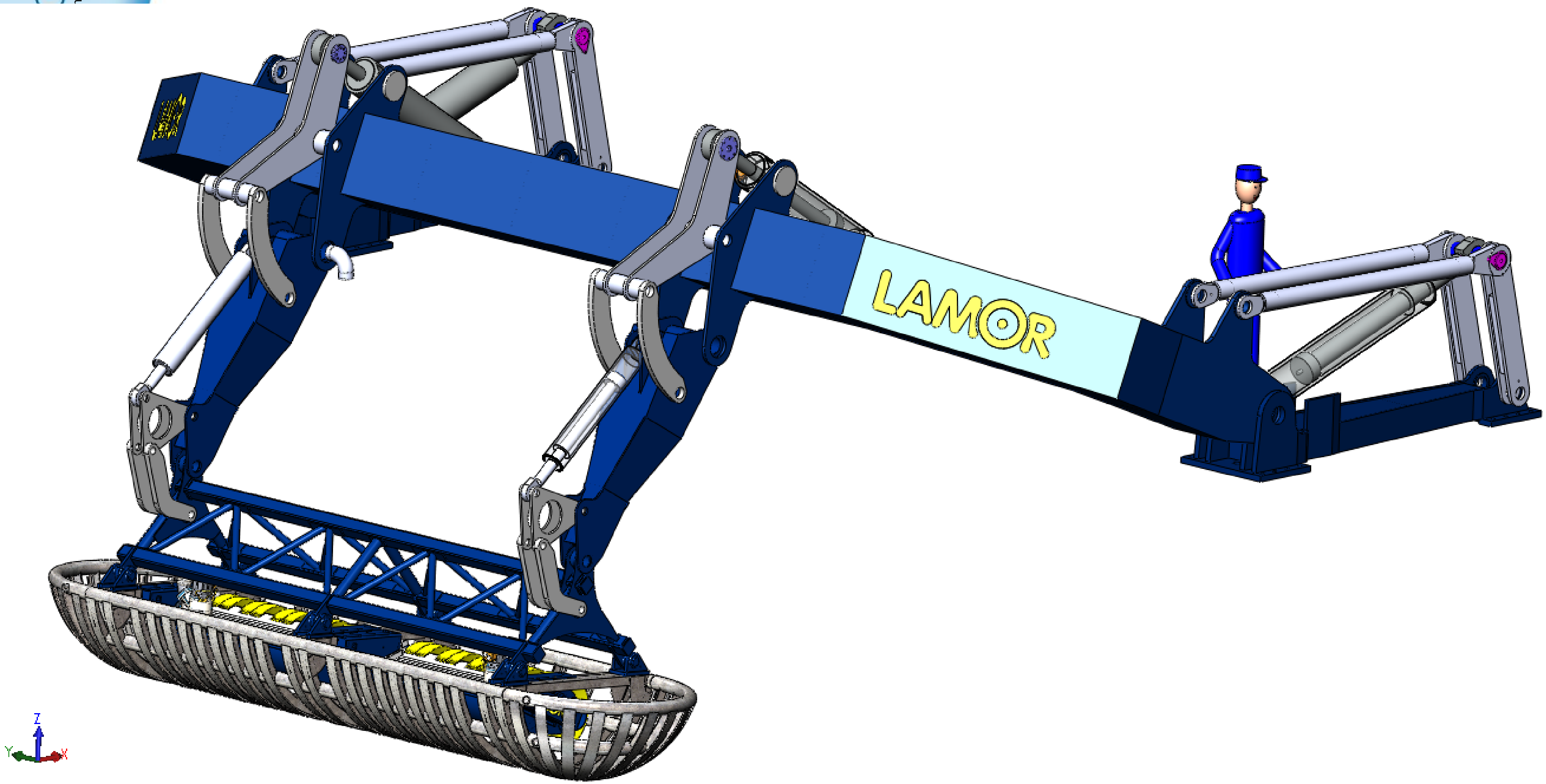
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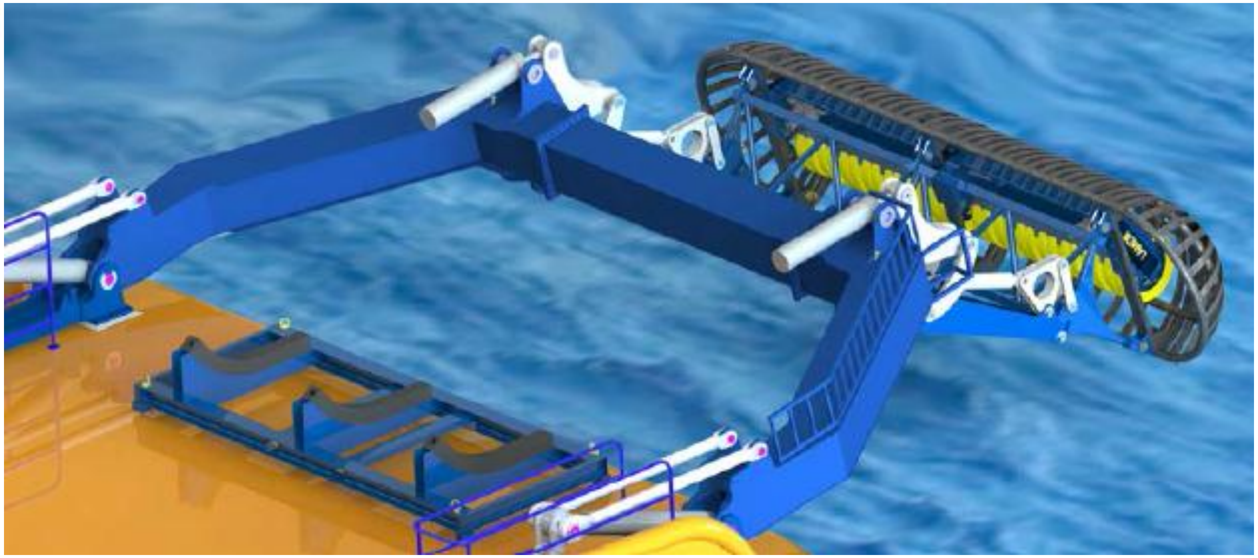

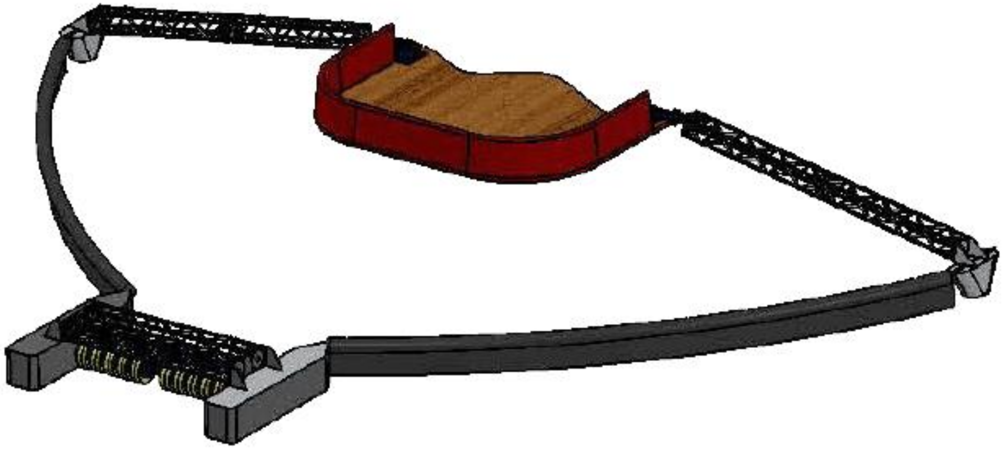

www.lamor.com

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Nordic skimmers for ice conditions

Arctic skimmer skimmer

Lamor

Rope mop

Desmi

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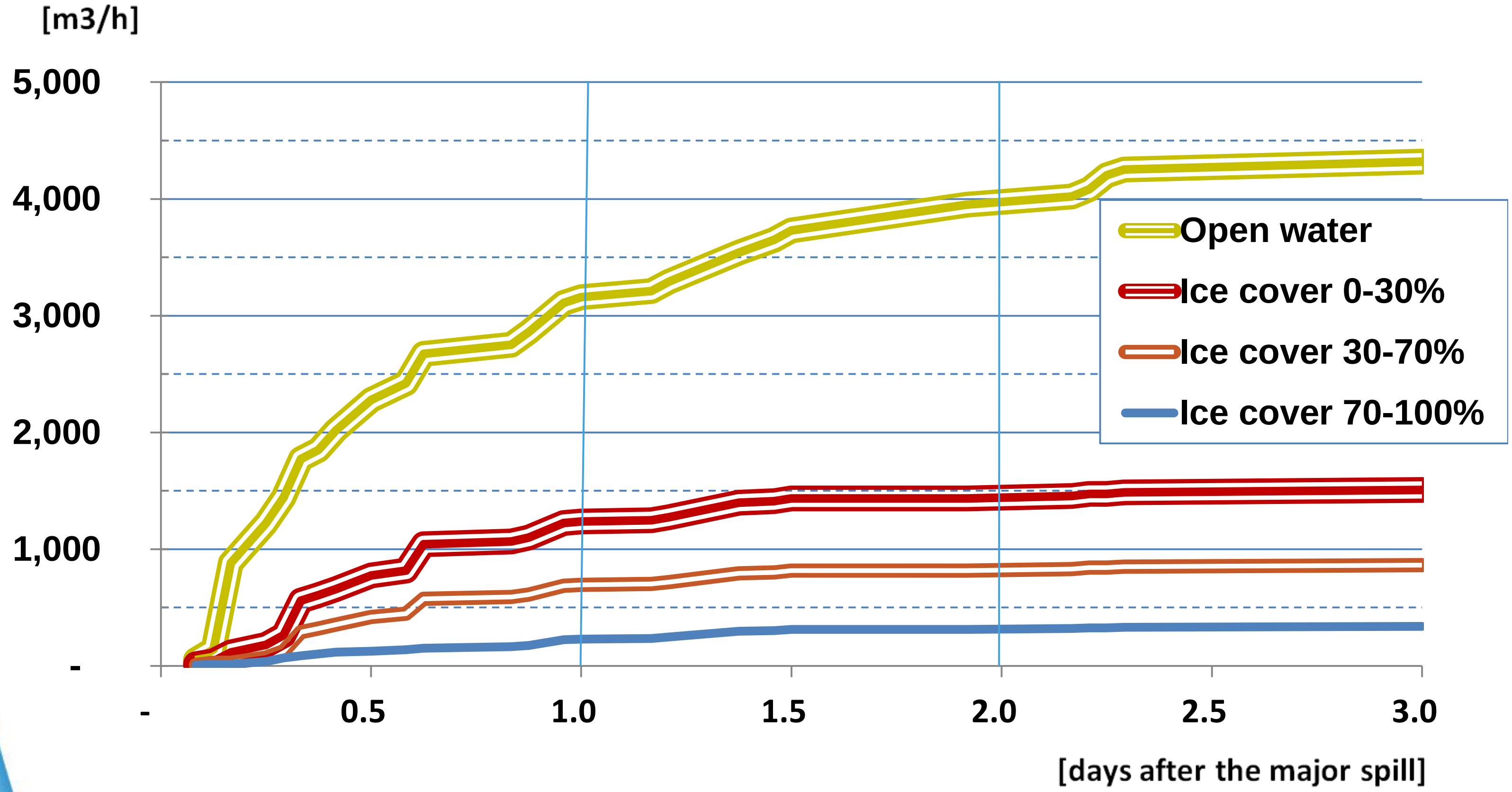
Theoretical development of the HELCOM fleet oil recovery rate (m3/h) in Gulf of Finland after a major oil spill

(preliminary results from the HELCOM BRISK-project)



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Conclusions – Arctic Challenges

- Possible to response small spills in ice.
- Promising new methods are being developed.
- To succeed you must have many alternative methods.
- Much work is still needed to develop real operational 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.
- New sensors for satellites to show oil in ice /snow

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Conclusions……

- We must also consider other than mechanical methods for Arctic Sea areas, like
  - In situ burning
  - Enhanced bioremediation
  - Chemical methods (dispersants, etc.).

More Information:
jorma.rytkonen@ymparisto.fi

Recovery Vessel LOUHI

SYKE