



ARCTIA OY

Practical experiences and
changes in icebreaking over
last 20 – 35 years

Pasi Järvelin

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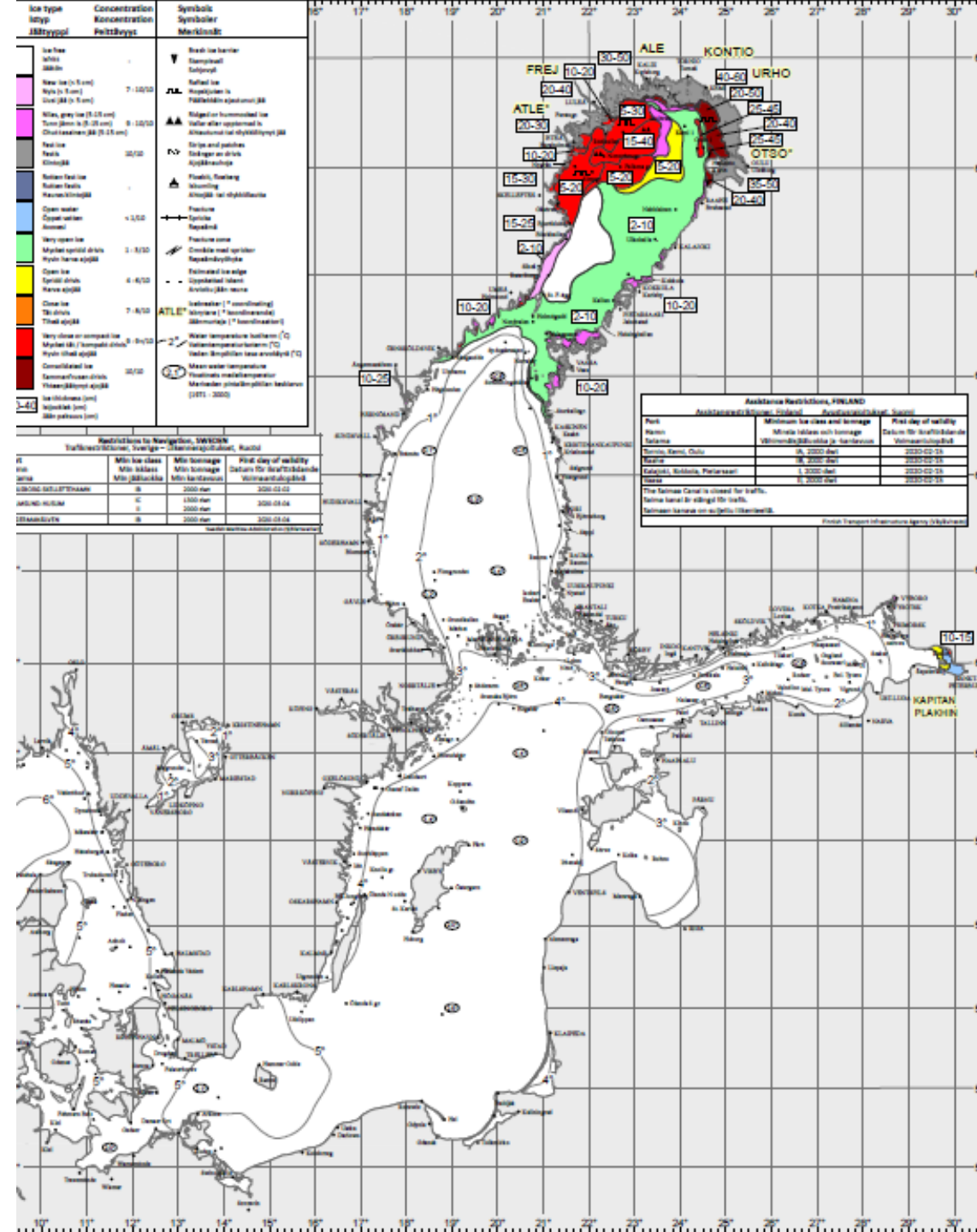
- Chapter 1)** Huge changes in the ice coverage
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1) HUGE CHANGES IN THE ICE COVERAGE

Following ice charts By Jouni Vainio (FMI)

5.3.2020 37'000 km²

- Year 2020 has been the mildest winter since the year 2000.
- Only three Finnish icebreakers operating in the Bay of Bothnia.
- Mildest winter does not mean, that it is easy for the icebreakers and other mariners in the merchant fleet. Normally it means lot of low pressure periods and lot of storms, heavy ridges etc.
- Even this winter 2023 (February), there is more ice compared to the season 2019/2020.
- **Less ice > more ice movement!**
- **Therefore in the future we need even bigger and stronger icebreakers.**

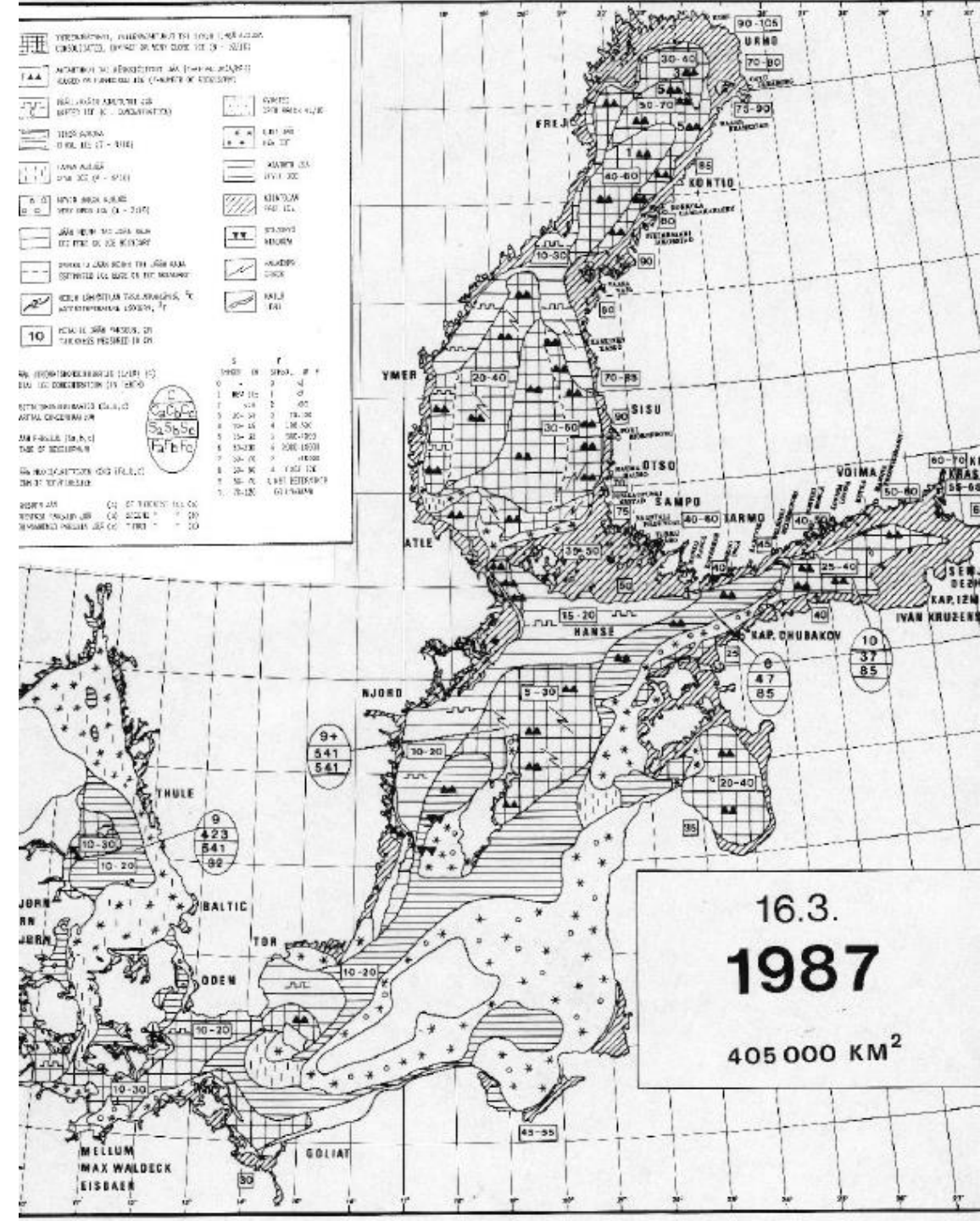
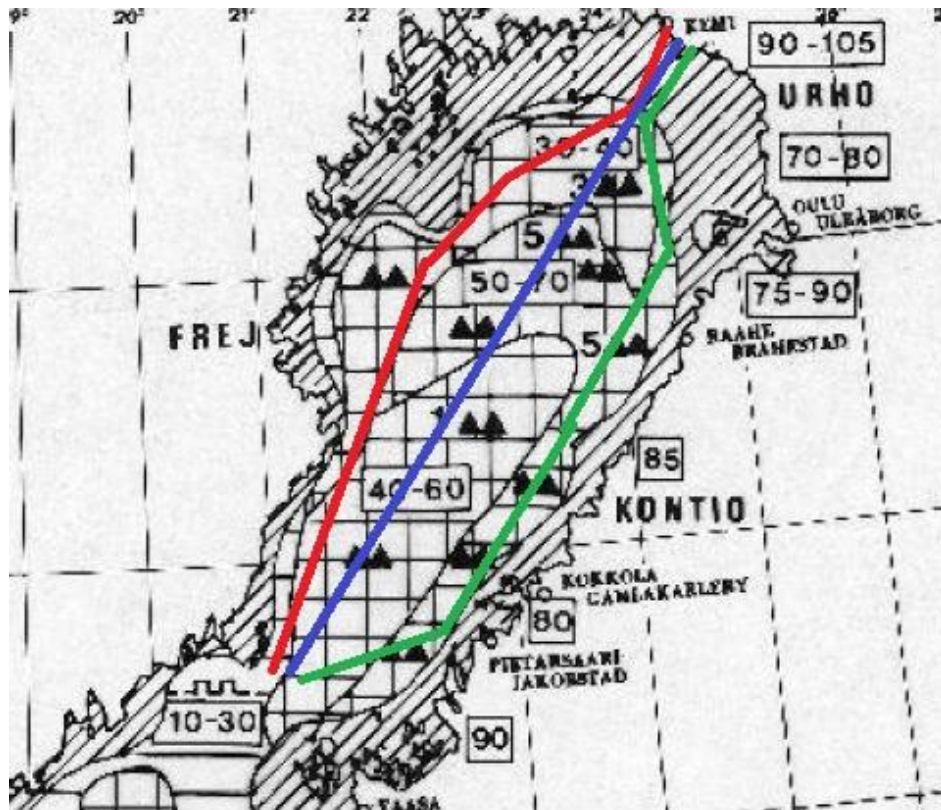


16.3.1987 405'000 km², Extremely severe

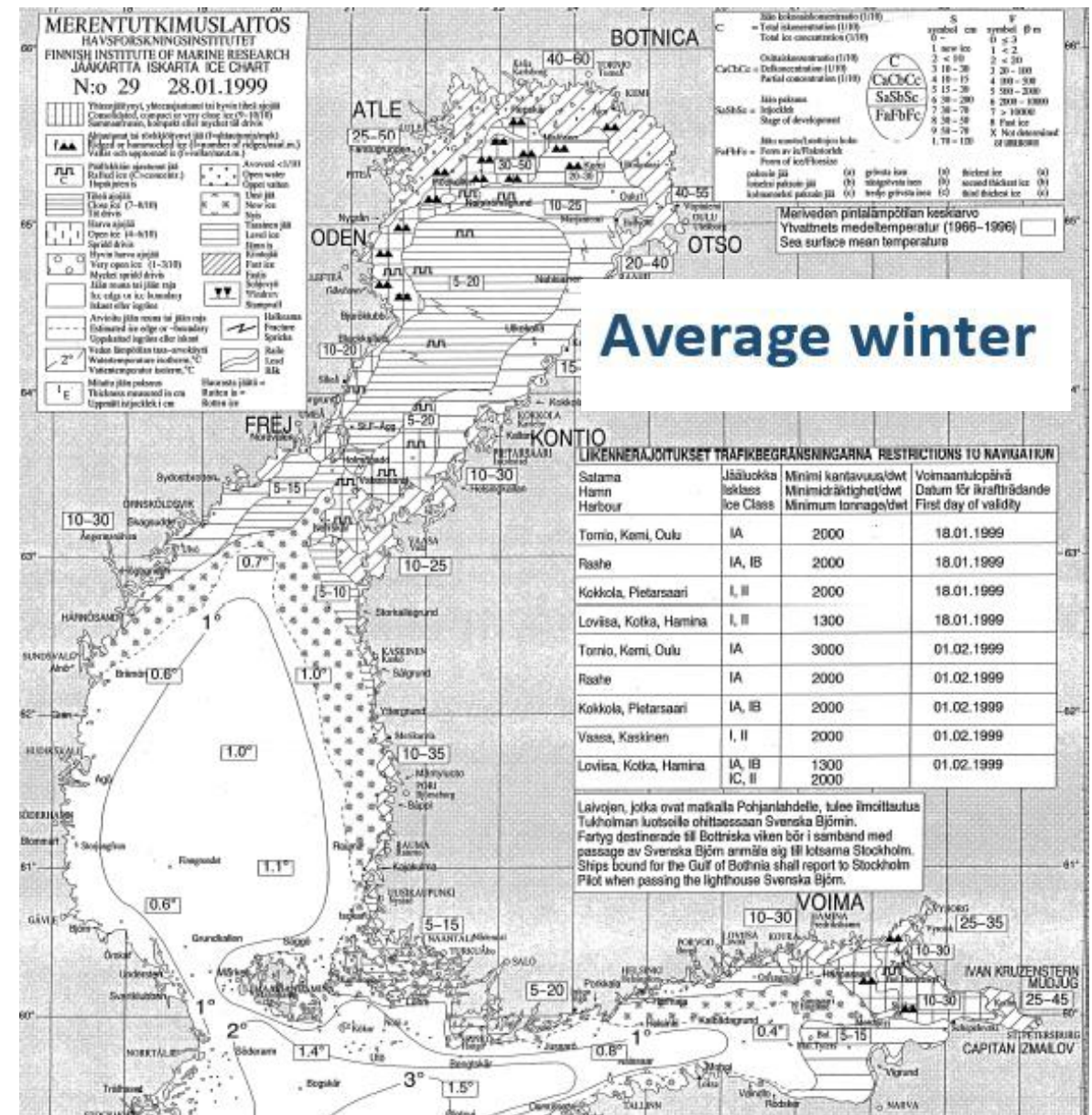
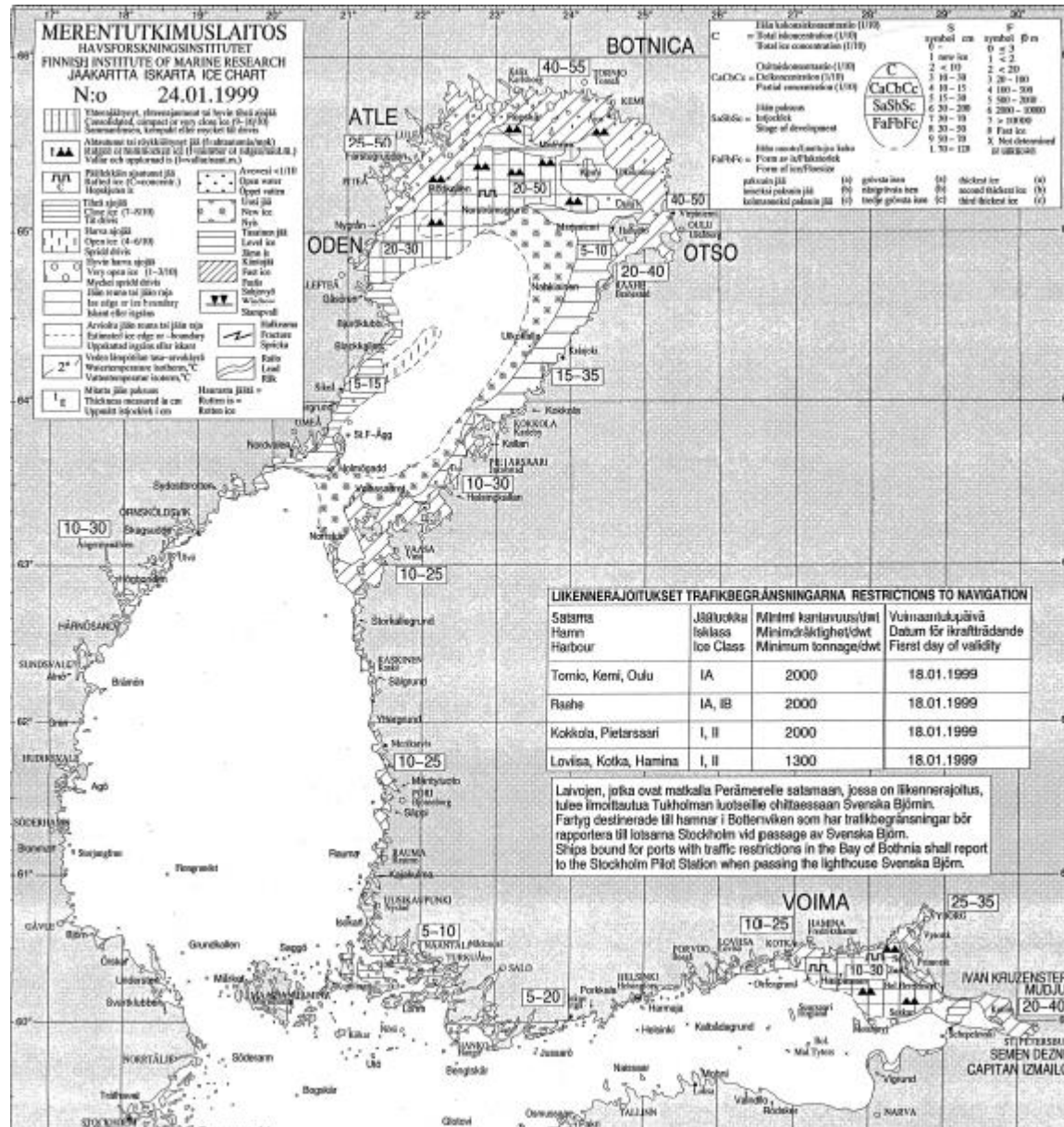
Late 80's there were no onboard GPS-navigators, only hyperbolic Decca & Loran C or Omega.

Also given waypoints had to be very simplified, for example:

- WP's close to Swedish coast (during westerly wind)**
- WP's via the fishing border (during high pressure)**
Quite often command: "Follow Decca Echo-0"
- WP's close to Finnish coast (during easterly wind)**

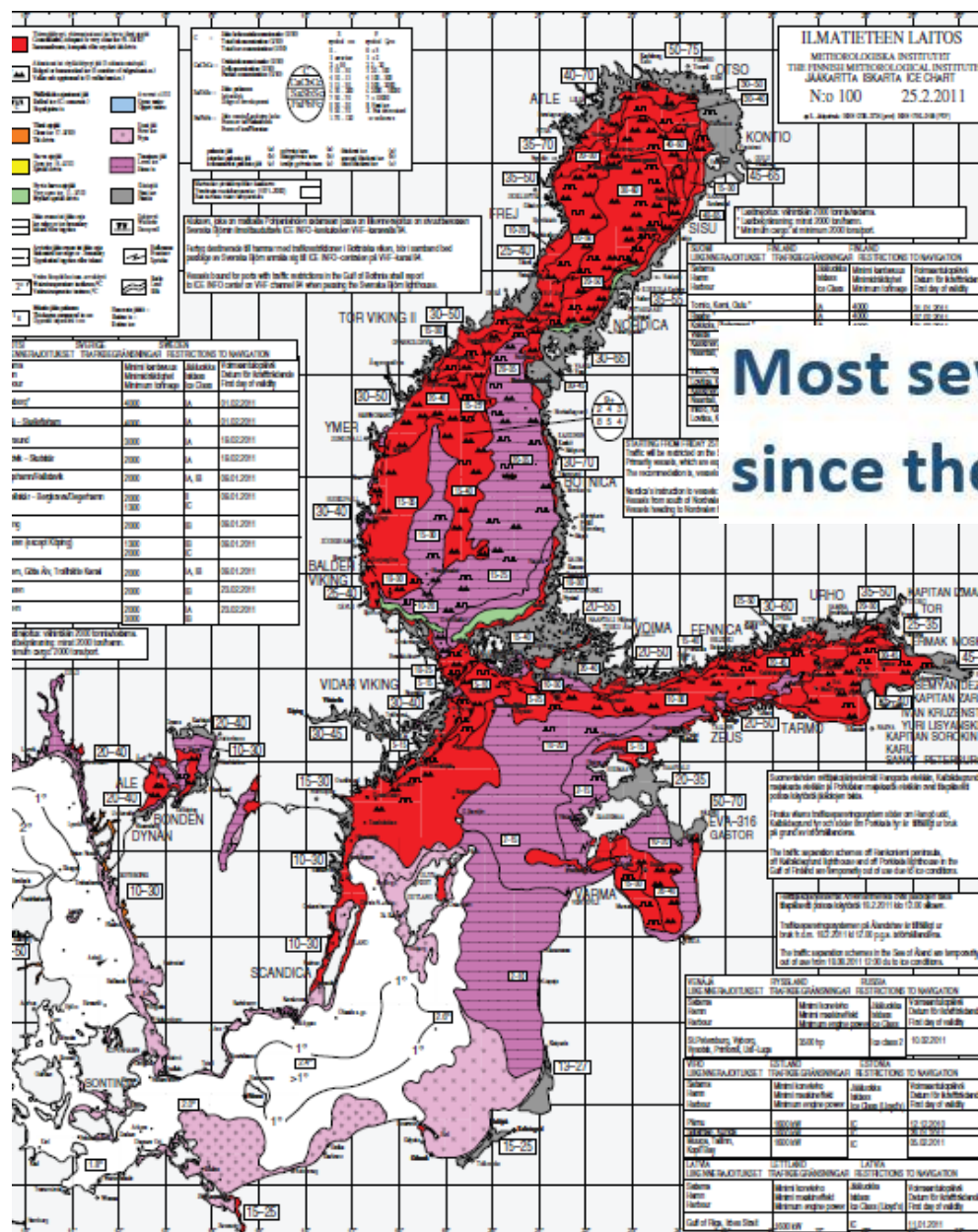


24.1.1999 > ice formation 4 days after > 28.1.1999 Kittilä (Pokka) -51,5° C

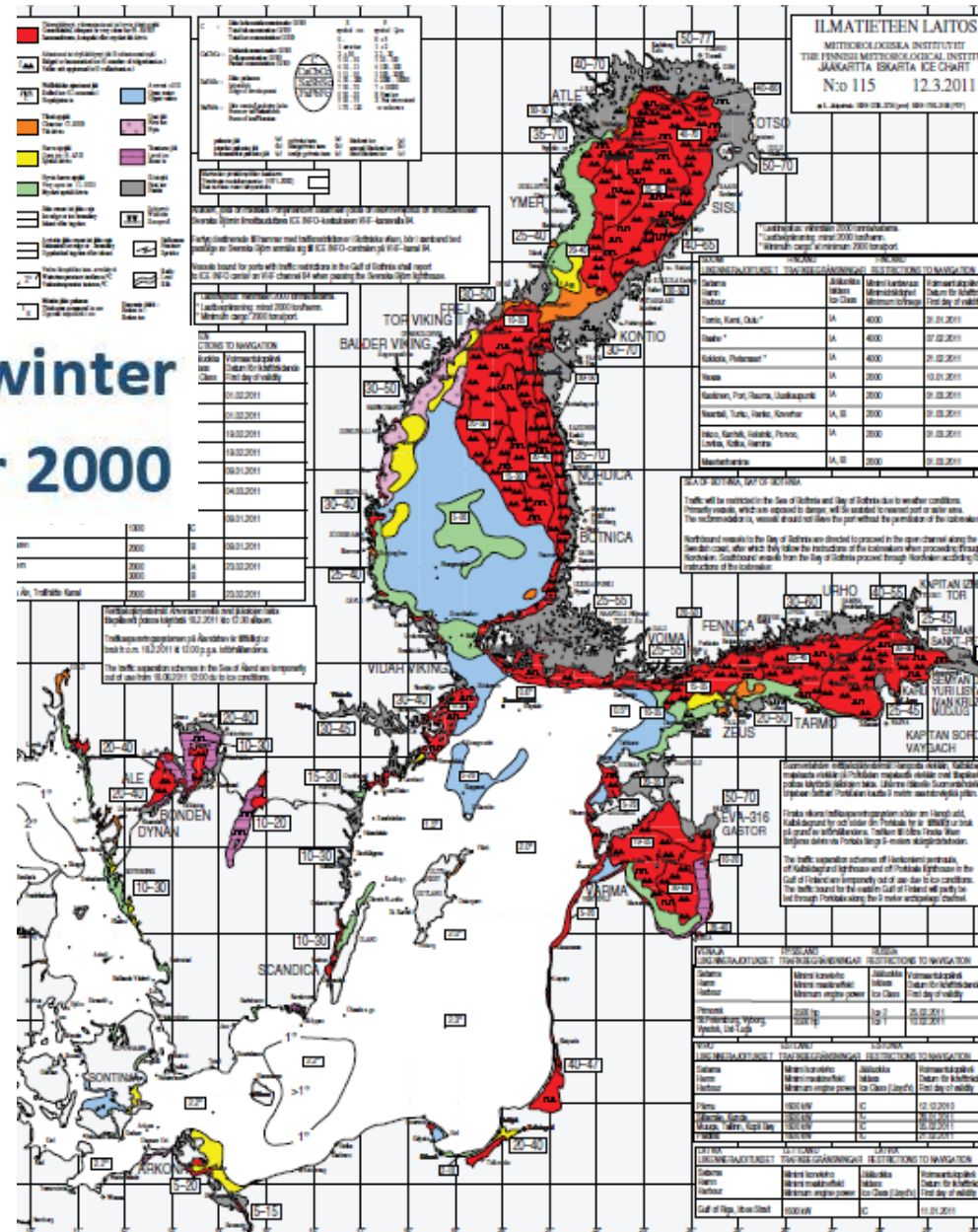


Average winter

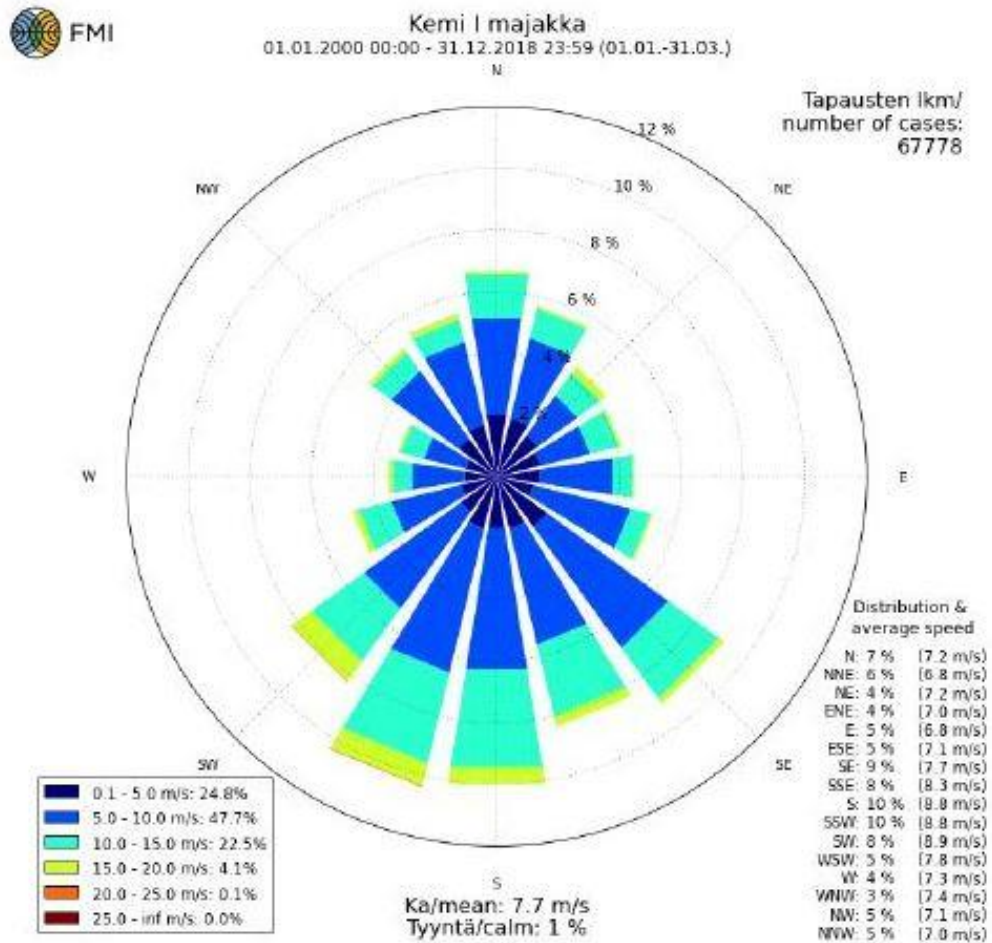
25.2.2011 309'000 km² > 2 weeks > 12.3.2011



Most severe winter since the year 2000



Wind at Kemi 1: 1.1.2000 – 31.12.2018



2) INFRASTRUCTURE – PROFOUND CHANGES

Communication methods, IBNet, AIS,
GSM, GPS, VTS, Satellite pictures,
Helicopters, Ice buoys, Pilotage

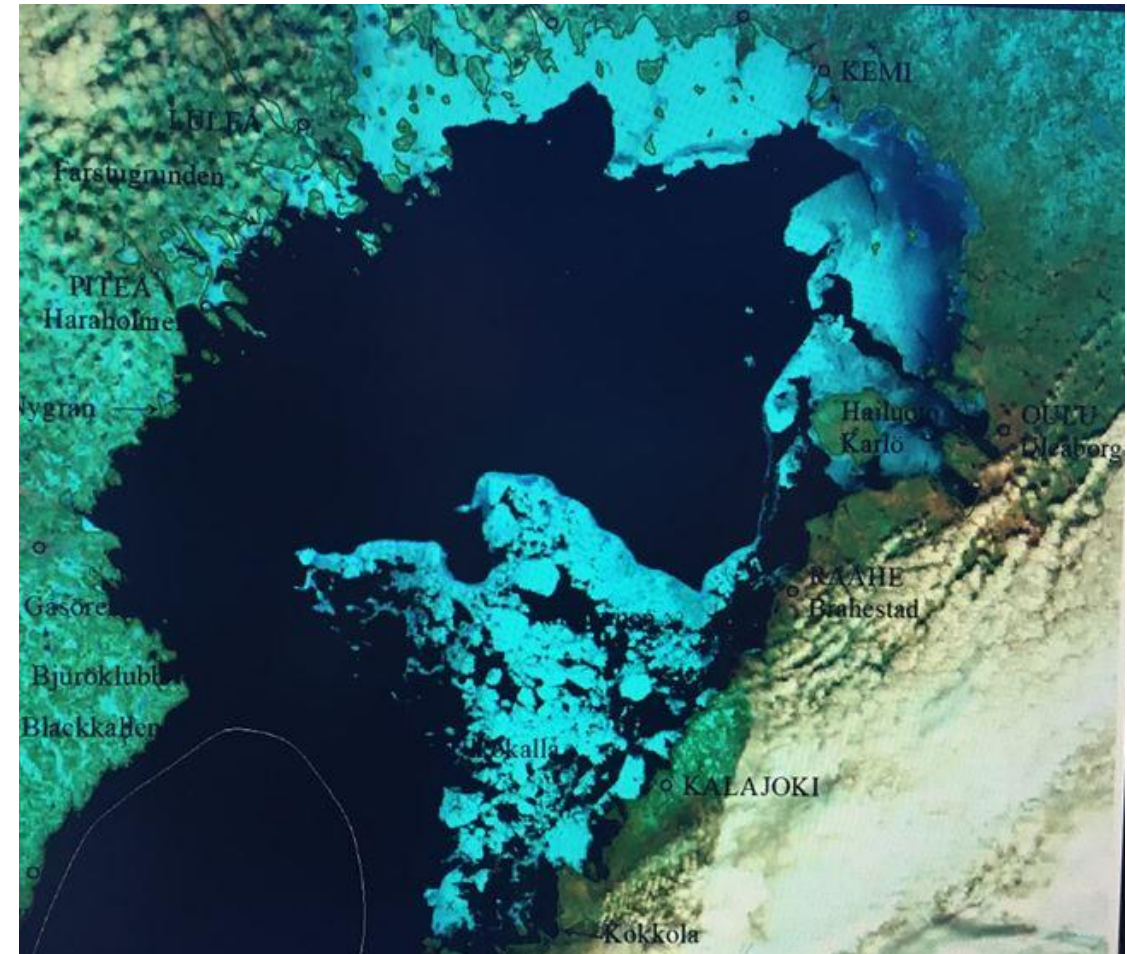
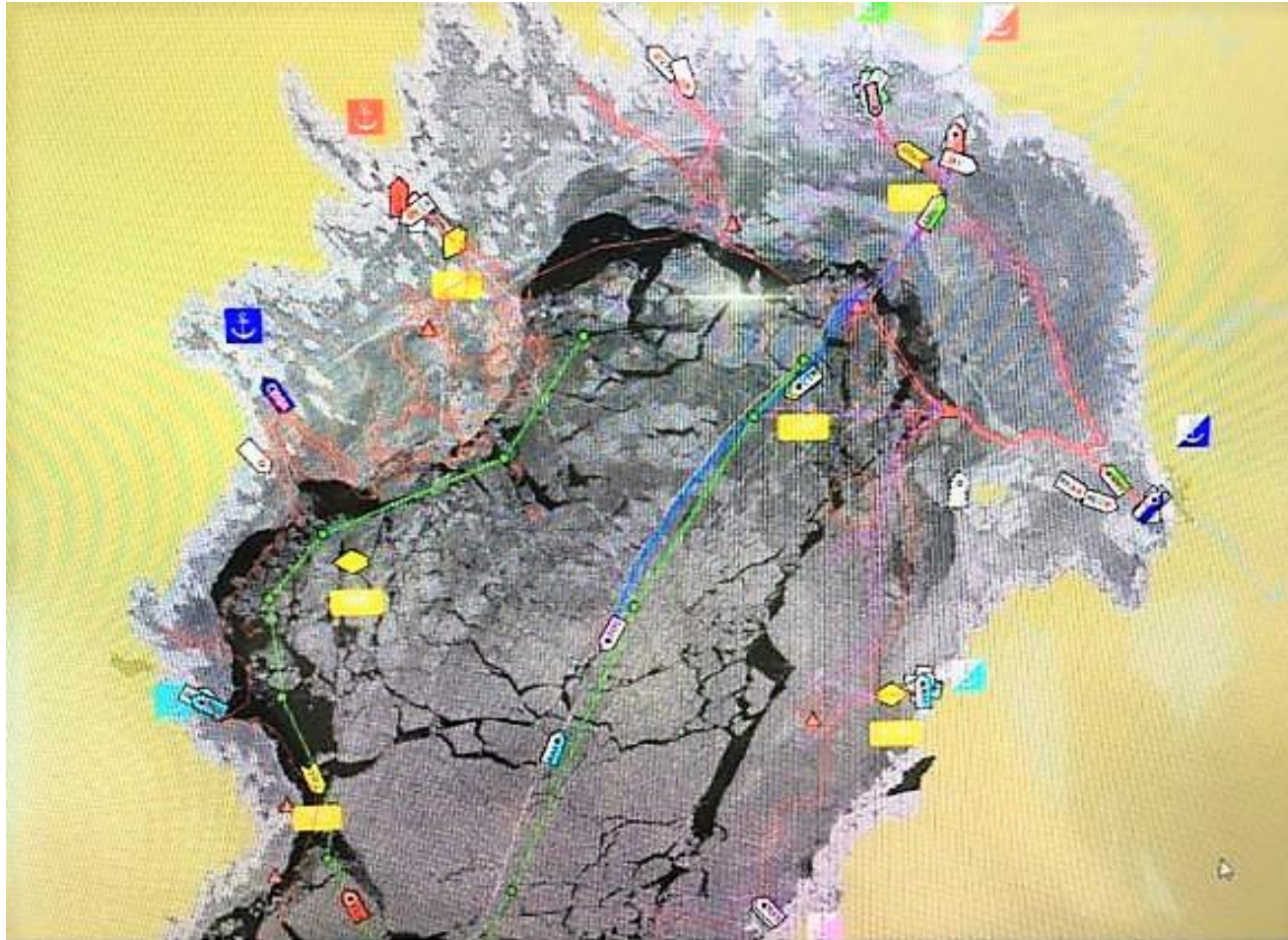
Infrastructure

- Communication improvements: IRIS late 80's, after which IBNet & GSM.
- Decca and Loran C hyperbolic navigators & Omega were replaced by GPS's.
- Due to both VTS (Vessel Traffic Services) and improved ice information of satellites, icebreakers are now aware of each vessel before they proceed to the ice covered sea areas. VTS has increased its role and works fine.
> Nowadays no unknown "lost vessels" in the middle of the Bay of Bothnia.
- In Finland helicopters were replaced by satellite pictures, which are better and better each year (although ice thickness still unknown).
- Ice buoys in use > ice movement could better be seen in a big scale.
- Improved Pilot boats; Pilots only occasionally need to be assisted by IB's.



Satellite pictures incl. vessel information

The Best tool in icebreaking – Easy to co-operate with the Swedish IB's



IBNet & AIS: visible vessels + fresh photos of ports





Photo: Trad.

Hummock of ice



Photo: Atso Uusiaho



Photo: Pekka Väisänen



Anni Montonen (FMI)





< Pilots only occasionally
need to be lifted on/off



Improved pilot boats >

In the 80's pilots had to practice in icebreakers
in order to learn better winter navigation

3) GENERAL CHANGES

Towing and towing fees, Ownership of icebreakers,
Tugs, Safety management, Safety zones,
IB Maintenance, Emissions, Environmental aspects,
Documentation, Internet, e-mails

Strategy

- Towing was not free of charge in the 80's. It was very expensive and icebreakers therefore tried to avoid towing, even though speed of the Clients would have been very slow. Decision to tow was made by the IB captain only.
- Average assistance speed improved a lot after idea of paid towing was rejected. Towing is often much faster than assistance without towing.
- During the last millennium Maritime Administration took care of icebreaking and pilotage. Nowadays Finnish icebreakers are owned by Arctia or Håkans, and Finnish Transport Infrastructure Agency charters IB's (also MGO paid by FTIA). Finnpilot is taking care of pilotage.
- Last millennium icebreakers were sent out as soon as there was ice formation. Nowadays there are stronger tugs and more used, especially early winter days.

Improved Safety

- Safety has improved with huge steps – mainly due to "lessons learned" during offshore work 1992-2015, performed by Fennica, Nordica & Botnica.
- Safety Management-system, safety permits etc.
- Watch hours have been modified to 12 hour shifts (earlier 6h/6h > now 12h/12h) in most of the icebreakers in order to avoid fatigue.
- Company guidelines & documentation
- "Safety First"-thinking > Last year 2022 Arctia Icebreaking Ltd > LTI's: Deck & Engine departments = 0 LTI's / Catering department = 6 LTI's
- 30 years earlier crew's protective clothing = fur hat & work gloves > today everybody must wear full protective equipment of best quality.

Less emissions & Environmental aspects

- Last millennium sulphur content of heavy fuel oil might have been even 4 %.
- All Arctia Icebreakers use either.
 - ultralow sulphur diesel (sulphur emissions 0,000010 %) or
 - light fuel oil (sulphur emissions 0,00030 %)
- Grey water and sewage will be discharged ashore.
- Safety zones (Sea of Bothnia & Gulf of Finland) made navigation easier and improved safety at sea > neither shipwrecks nor oil spills.
- Unfortunately due to mild winter, the most environmental and fuel efficient icebreaker, Polaris, is still waiting for icebreaking duties in Helsinki

Increased documentation & paper work

- From each icebreaker Finnish Maritime Administration received only one report, which R/O's sent to FMA early in the morning (to only one receiver). Now hundreds of people are On-line via the IBNet & several daily reports.
- IBNet & AIS made it possible to send exact waypoint details and info to merchant vessels via VTS. In addition Internet & e-mail made individual info to only certain vessels possible.
- IB Maintenance (everything documented to Sertica planned maintenance)



4) TECHNICAL IMPROVEMENTS FOR THE ICEBREAKERS

Reduced marine crews & R/O's, IBNet + AIS,
Propulsion innovations, Agility,
More expensive technology

Technical improvements - icebreakers

- Amount of marine crew has been reduced a lot due to automation etc.
- Radio operators were replaced late 80's by new technology. Earlier R/O's used Morse codes in order to receive positions, ETA's and ETD's of the merchant fleet vessels > nowadays communication done by deck officers.
- Deck officers use towing winches from the bridge.
- Helmsmen only occasionally are used in the oldest icebreakers > deck officers are taking care of rudder or Azimuth propellers.
- FIX-point navigation was used until early 90's. GPS more safe and reliable.
- First innovation was IRIS, after which IBNet & AIS.

Azimuth propellers > adjustable track breadth

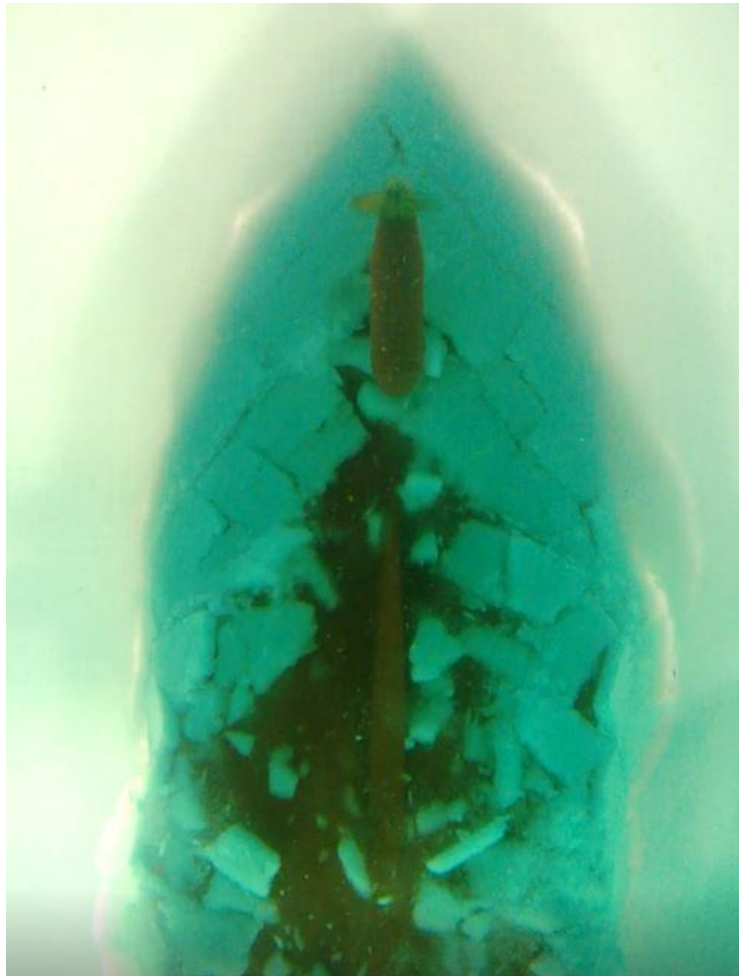
(average assistance speed abt. 10 knots)



Three Azimuth propellers – The future?

Easy to control; either ahead or astern / on the other hand expensive maintenance

Left > going ahead, level ice



Right > going astern, 10 m packed ice



Agility – turning 360° in same spot

Photo: Aker Arctic Oy



5) ASSISTED VESSELS NOW AND BEFORE

Vessel size, Ice experience of captains & navigators,
Marine traffic, Less convoys, Bow constructions

Vessel size, experienced captains

- Late 80's vessels were much smaller and same ice strengthened ships visited Bothnia Bay continuously. Most vessels were known by icebreaker officers. Nowadays various vessels and "one timers".
- Captains and navigators were more experienced in ice. Assisted also other vessels in dire straits.
- Now due to expensive fuel, AIS & "marine traffic" > shipping companies are spying vessel tracks.



Now less convoys & bigger vessels

- Less amount of convoys due to more heavily compacted and consolidated ice with ridges and pressure forced broken ice. Mostly one at the time.
- Size of vessels enlarged, ice knives (= bad for IB's towing notch), strange bow constructions.



The background of the slide is a solid dark blue color. It is decorated with several thin, light blue wavy lines that flow across the frame, creating a sense of movement and depth. These lines are more concentrated on the left and right sides, leaving the center where the text is located relatively clear.

6) BIGGEST IMPROVEMENT WITHIN LAST 35 YEARS OF FINNISH ICEBREAKERS

**Smoking
is not any more allowed
on the bridge
and in the accomodation!**



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