BALTIC ICEBREAKING MANAGEMENT

Baltic Sea Icebreaking Report 2010-2011

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FOREWORD

The winter of the last season has been again pretty cold. We can not tell so far whether this is a real global warming or a process of normal alternation of warm and cold winters. Within the limits of a separate historical period we will learn about it later.

Can anyone tell in the affirmative now «Global warming has come, and warm winters are established constantly for long times»? Can anyone assert there is a temporary period of alternation of warm and cold winters? The choice of an appropriate scenario as for a warm or a cold winter approach is certainly the right of every member State. The real problem is that there is no way to predict authentically the type of winters and ice conditions on long-term basis. We tend to consider that after the period of some warm winters there will come winters with really low temperatures.

It is essential to expect the approach of such a winter and be ready for it in advance. On the wake of some warm winters it might be easy to mistakenly cancel all the Baltic new ice-breaker building plans, send to scrape all outdated ice breakers and cut programs for navigators on sailing in ice conditions.

During the short and warm winters we actually get some additional time to get ready for approach of cold and severe winters and in advance to consider all possible forms of cooperation in our icebreaking efforts as well as to consider the possibility of installation on ice breakers some systems facilitating such a cooperation, which could be, in particular, a question of adoption IB-NET system which has been already tested for a long and has proved its own efficiency.

1. Short history of the Baltic Icebreaking Management

Baltic Icebreaking Management, BIM is an organisation with members from all Baltic Sea states. BIM is a development of the annual meeting between Baltic Sea States icebreaking authorities which have assembled for more than 20 years. The member countries of BIM are Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Russia and Sweden.

After the difficult winter navigation season of 2002/2003 a project was started up within the framework of HELCOM, aiming at improving the safety of winter navigation in the Baltic Sea. The Helcom – recommendation 25/7 on the safety of Winter Navigation in the Baltic Sea Area was adopted in March 2004.

Within the EU concept Motorways of the Sea, which is one priority project in the trans-European network, the Baltic Sea countries established a working group with the aim of creating more efficient winter navigation by cooperation between the Baltic Sea countries. The icebreaking authorities around the Baltic Sea decided in Helsinki meeting 2004 that this work shall continue within the framework of BIM, were also non EU-member states are taking part. BIM should function all year round and that its strategy should be to develop safe, reliable and efficient winter navigation between the Baltic Sea countries. The overall objective of BIM is to assure a well functioning maritime transport system in the Baltic Sea all year round by enhancing the strategic and operational cooperation between the Baltic Sea countries within the area of assistance to winter navigation.

January 10th 2007, the Joint Baltic web service on winter navigation www.baltice.org was launched, see appendix 1.

April 11th 2007, the DVD of training in ice navigation for seafarers was launched, see appendix 2.

15th November 2007, Helcom adopted a new recommendation 28/11 Further measures to improve the safety of navigation in ice conditions in the Baltic Sea, BIM was acting an “ice advisor” in this recommendation.

One important task of BIM is to inform stakeholders in the maritime sector and policy makers about winter navigation and icebreaking. There is a need for information about winter navigation and icebreaking that covers the whole Baltic Sea region. Several Baltic Sea countries prepare information about the winter navigation and icebreaking in their respective national waters. There has been a need to coordinate this country-specific information, improve the information and to distribute it to a wider target group by “Joint Annual Baltic Icebreaking Report” is the second of its kind.

This report gives an overview of the winter navigation season 2010/2011 for the Baltic Sea area. National reports can be found on www.baltice.org. The report will also describe organisational changes in the icebreaking authorities or changes in icebreaking resources and provide a progress report of the Baltic Sea Icebreaking cooperation and the development of BIM.

2. Overview of the icebreaking season (2010-2011) and its effect on the maritime transport system in the Baltic Sea region

According to the Finnish Ice Service of the Finnish Meteorological Institute the Baltic Sea ice season of 2010-2011 could be classified as a severe one. The peak of the ice winter was reached on February 25, when ice covered an area of 309,000 km².

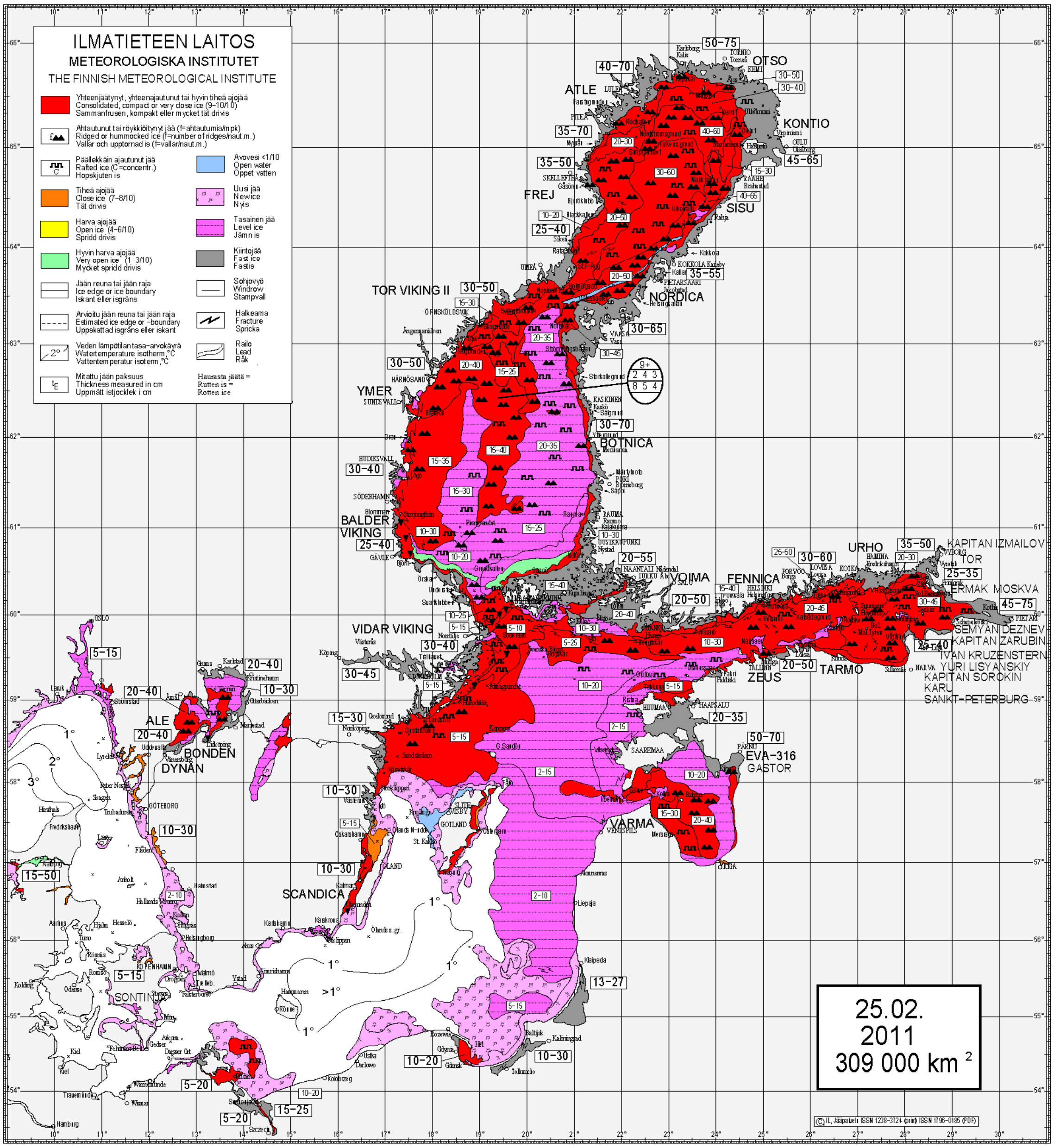

Figure 1. The maximum ice extent of the ice season 2010-2011.

Following a normal October, sea surface temperatures in the areas surrounding Finland were in line with long-term averages. At the beginning of November, the seawater actually warmed up a bit, but then began to cool down again after the first week of the month. A thin layer of ice formed in Kemi inner harbour and the innermost bays of Replot in mid-November. At that point sea surface temperatures were equivalent to long term averages.

The end of November was unusually, even exceptionally, cold. The cold period that began in November continued in December and the amount of sea ice began to increase. Immediately after mid-December, strong winds “cleaned out” the sea areas and reduced the ice-covered area. Freezing temperatures during the Christmas week caused the ice-covered area to expand rapidly again. December was exceptionally cold in the sea areas surrounding Finland.

Frosty weather continued at the beginning of the new year. The ice-covered area expanded to more than 165 000 km² on January 4. At that time, ice covered the entire Bay of Bothnia and the Quark as well as the Archipelago Sea. The thickness of the fast ice varied from about half a metre in the northern parts of the Bay of Bothnia to ten centimetres in the southern coastal areas.

After this, the frosty weather began to ease its grip and the southerly winds compressed the ice fields. On January 11, the ice-covered area had decreased to less than 100,000 km². The coldest period in January alternated with milder periods after this. The ice-covered area expanded and contracted according to the cold weather and strong winds. The ice-covered area was 150,000 km² on the last day of January. At this stage of the winter the ice situation corresponded quite closely to the average.

February was clearly divided into two parts in terms of temperature conditions. The weather at the beginning of the month was mild and windy, which caused the ice in the Gulf of Finland to drift into the sea areas east of the island of Gogland. While traffic to harbours in southern Finland continued with very little need for icebreaker assistance, Russian traffic had to cope with large problems – at one point more than 100 vessels were waiting for icebreaker assistance.

The weather got colder in the middle of February, and the latter half of the month turned out to be exceptionally cold in the majority of the country. This cold period also caused the amount of sea ice to increase rapidly, and **the peak of the ice winter was reached on February 25, when ice covered an area of 309,000 km².** This event occurred at nearly the average time. At that point, both the Gulf of Bothnia and the Gulf of Finland were completely covered by ice. The Gulf of Riga and the northern Baltic Sea were also completely ice-covered. The ice edge ran from Öland to Gotland and from the northern tip of Gotland south to Rozewie on the coast of Poland. In the southern Baltic Sea, there was new ice off the coasts of Poland and the former East Germany, as well as in Oresund and on the Swedish west coast (Fig. 1).

At the end of February, the winds began to blow from the south and became stronger. Pressure in the ice fields was detected in all Finnish sea areas, and at times it reached dangerously intense levels. When the situation was at its worst, dozens of commercial vessels were waiting for icebreaker assistance on both sides of the Quark and ships were assisted one at a time.

The situation eased temporarily at the beginning of March as the winds calmed. However, this did not last long, as south-westerly winds strengthened on March 3 and the ice began to drift east. Pressure developed once again in the ice fields, causing severe compression and a rapid decrease in the size of the ice-covered area.

On March 10, the extent of the ice-covered area was 165,000 km² (Fig. 2.). The winds blew from the Swedish side for another week and the ice in the Gulf of Bothnia was pushed against the Finnish coast. This caused great difficulties for winter navigation, as icebreakers had to assist the vessels one by one. Russian traffic in the eastern Gulf of Finland experienced so much difficulty that a nuclear-powered icebreaker had to be called in from the Arctic Ocean.

In mid-March, the winds calmed briefly and the frosty weather caused new ice to form in open places and cracks in the ice fields. Signs of spring appeared at the end of March and the ice-covered area decreased steadily. Even gentle winds caused pressure in the heavily ridged ice fields.

The average temperature in April was unusually high in nearly all parts of the Finland. Rainfall at the beginning of April darkened the ice and the coastal ice began to rot. Very warm weather at Easter (21-25 April) melted the ice on the southern coast of Finland. The coastal areas of the Gulf of Finland were almost completely free of ice, and the ice that remained was dangerously rotten. In contrast, ice in the pelagic areas of the eastern parts of the Gulf of Finland continued to disturb Russian sea traffic. The coastal ice in the Sea of Bothnia north of Uusikaupunki rotted, but farther off the shore a heavily ridged 20-30 kilometre wide ice field interfered with shipping traffic. The ice winter also continued in the Bay of Bothnia although the coastal ice slowly began to darken and subsequently rot. The ice in the pelagic areas was still strong.

The beginning of May was warm in many places, causing the ice to rot and melt. On May 14, the Gulf of Finland was ice-free and the last pieces of ice in the Sea of Bothnia also melted at the end of the following week. In mid-May, the ice in the Bay of Bothnia was mainly on the Finnish side of the fishery zone limit. Although the ice in the archipelago areas had rotted and, in many areas, also melted, ice in the pelagic area still interfered with shipping in many places. The winter finally ended and summer began when the Bay of Bothnia was ice-free on May 25.

The time of the final melting of the ice varied greatly in comparison to average values. In the coastal waters of the northern Bay of Bothnia, the date of the final disappearance of ice took place from a few days earlier to about one week later than average. Melting in the Sea of Bothnia took place from approximately one week to nearly three weeks later than on average, and in the Gulf of Finland from average times to some two weeks later than normal.

The ice disappeared more than one week later than average in the northern Baltic Sea; however, ice formation also began nearly one month earlier than usual.

The duration of the ice winter in the northern Bay of Bothnia was nearly two weeks shorter than average. The ice winter in the southern Bay of Bothnia and Vaasa Archipelago was from one and a half weeks to nearly a month longer than average. The ice winter in the Sea of Bothnia, northern Baltic Sea and Gulf of Finland was from two weeks (in the capital region) to more than six weeks (in the Rauma region) longer than average.

The maximum thickness of the fast ice was 40-80 cm in the Bay of Bothnia, 35-75 cm in the Sea of Bothnia, 25-55 cm in the Archipelago Sea and 25-65 cm in the Gulf of Finland. The thickness of the pelagic ice was 35-85 cm in the Bay of Bothnia, 20-50 cm in the Sea of Bothnia, 25-60 cm in the Gulf of Finland, 10-25 cm in the Sea of Åland and 5-30 cm in the northern Baltic Sea.

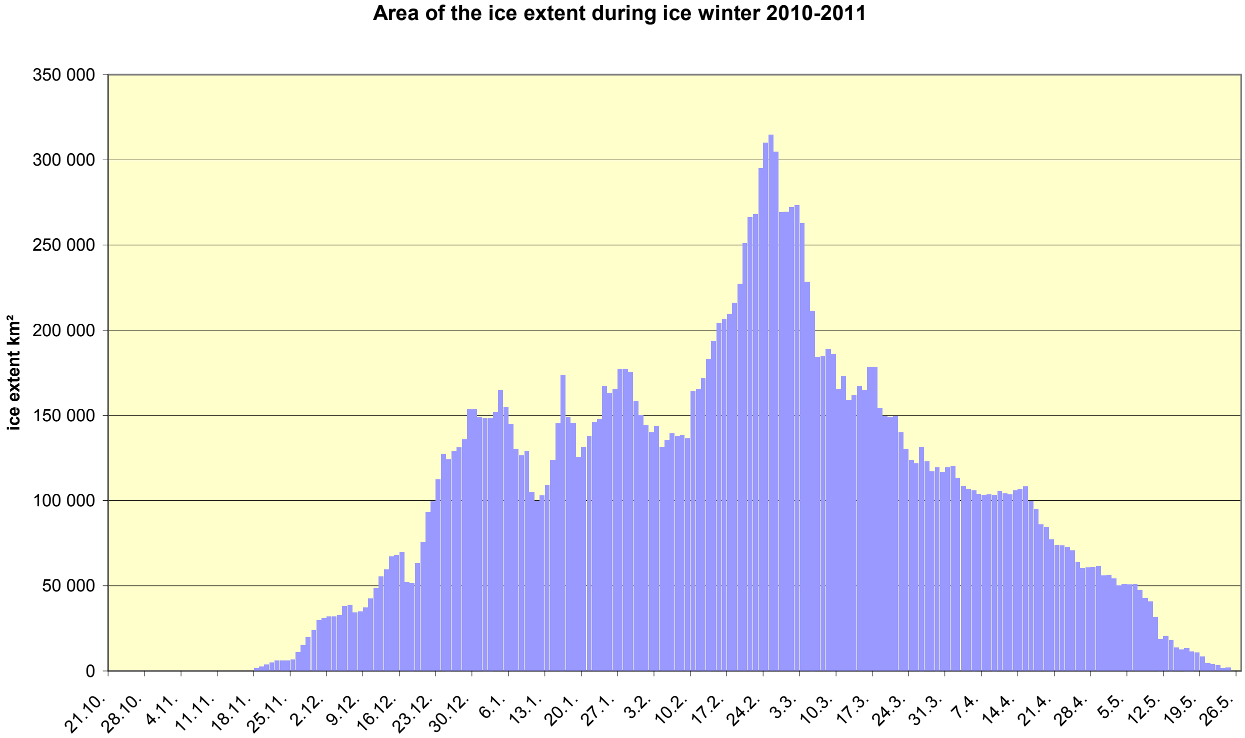

Figure 2. The area of the ice extent during the ice season 2010-2011.

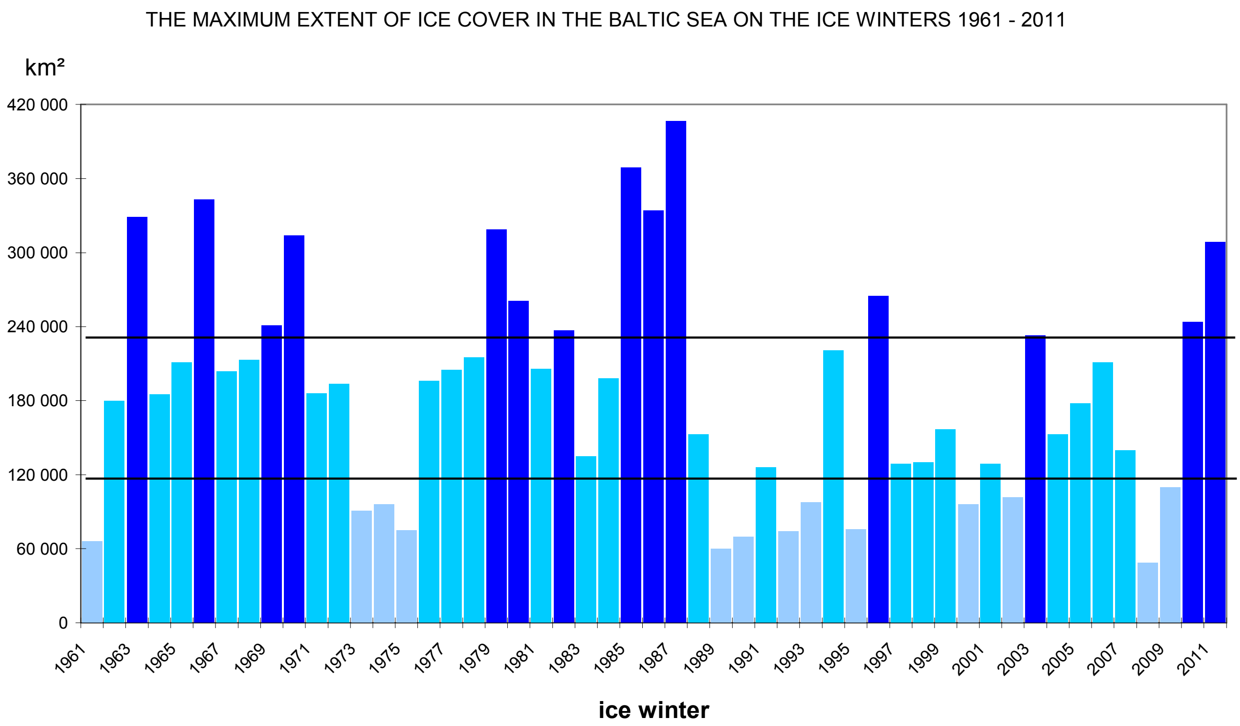

Figure 3. The maximum ice coverage in ice winters 1961-2011. The median of 1961-2011 (51 years) is 186 000 km². Severities of the season are indicated using colours from mild to severe (lightest blue to darkest blue respectively).

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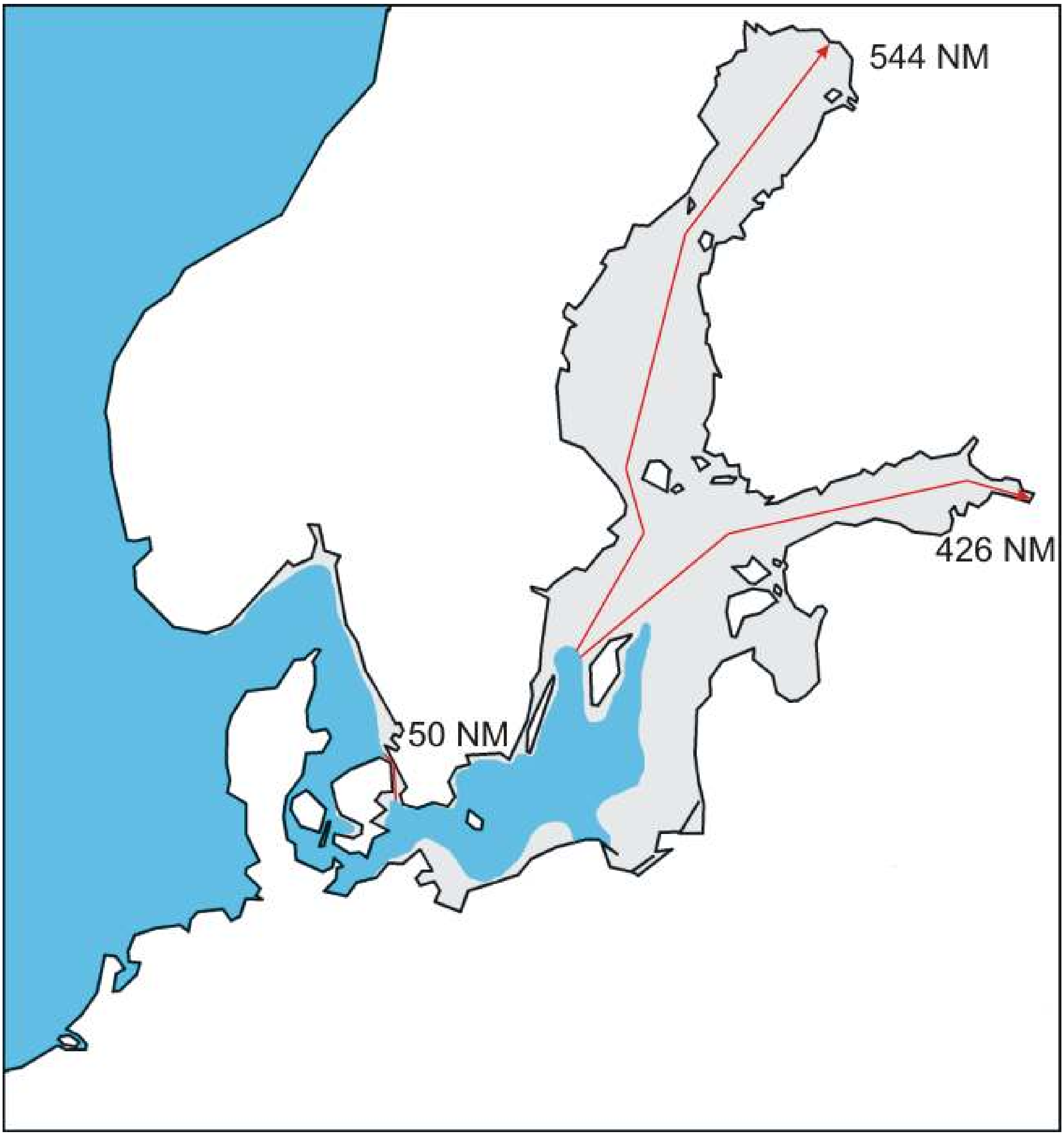


Figure xx. Sailing distance from ice edge during maximum ice extension, 25 February 2011: to Kemi 544 nautical miles and to St.Petersburg 426 nautical miles. In addition there was 50 nautical miles ice in Öresund.

Traffic restrictions 2010-2011

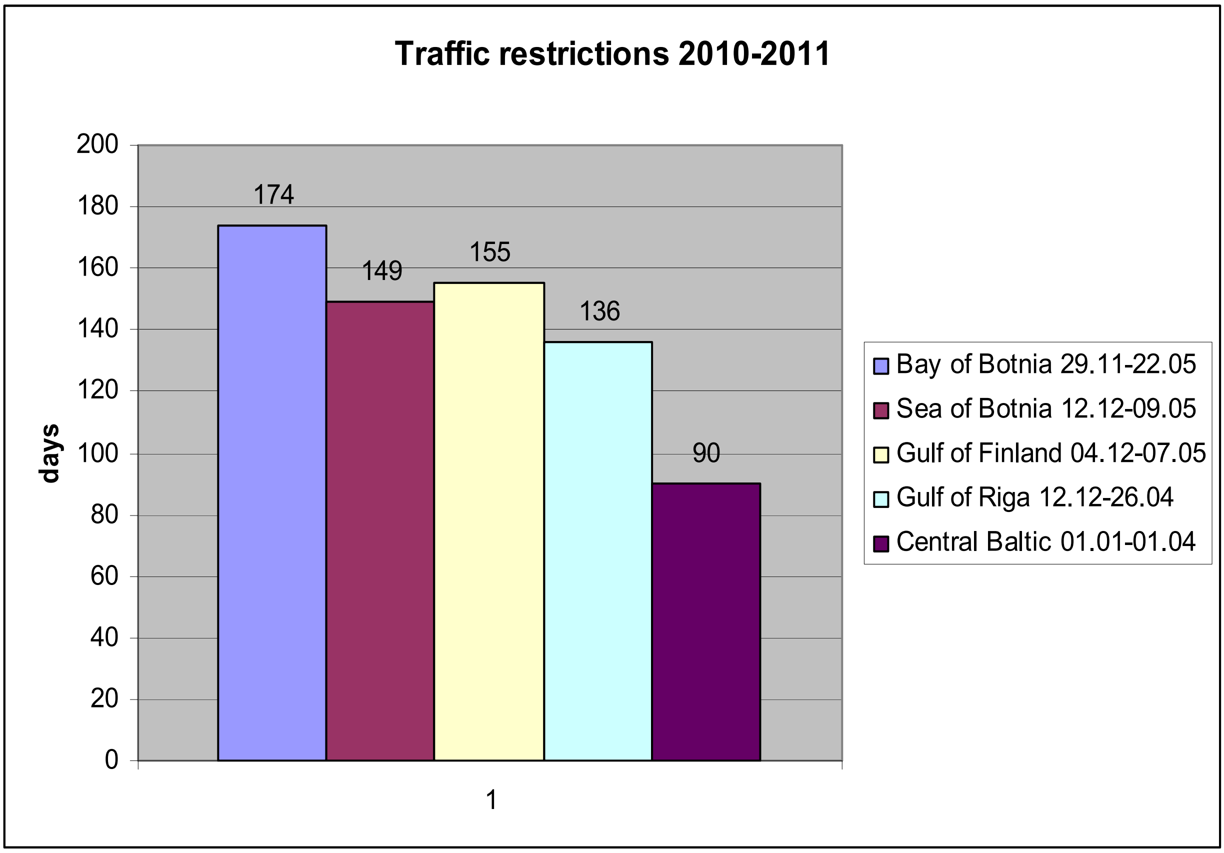


Figure 5. Dates when traffic restrictions were in force in the different areas.

For safety reasons, the Baltic Sea countries have within HELCOM agreed on a joint policy when traffic restrictions shall be issued. For efficiency reasons, the icebreaking authorities can demand a lowest limit on vessels' engine power as well.

> The traffic restrictions should be set as follows:
>
> When the thickness of level ice is in the range of 10-15 cm, and the weather forecast predicts continuing low temperature, a minimum ice class LU1 or equivalent should be required for ships entering the ports of a Contracting Party.
>
> When the thickness of level ice is in the range of 15-30 cm, and the weather forecast predicts continuing low temperature, a minimum ice class IC or LU2 or equivalent should be required for ships entering the ports of a Contracting Party.
>
> When the thickness of level ice is in the range of 30-50 cm, a minimum ice class IB or LU3 or equivalent should be required for ships entering the ports of a Contracting Party.
>
> When the thickness of level ice exceeds 50 cm, a minimum ice class IA or LU4 or equivalent should be required for ships entering the ports of a Contracting Party.

Figure 6. HELCOM recommendations for traffic restrictions.

Approximate correspondence between ice classes of Finnish-Swedish ice Classes Rules (Baltic classes) and ice Classes of other Classification Societies

Classification Society	Ice Class				
Finnish-Swedish Ice Class Rules	**IA Super**	**IA**	**IB**	**IC**	**Category II**
Russian Maritime Register of Shipping (Rules 2007)	**Arc 5**	**Arc 4**	**Ice 3**	**Ice 2**	**Ice 1**
Russian Maritime Register of Shipping (Rules 1995)	UL	L1	L2	L3	L4
Russian Maritime Register of Shipping (Rules 1999)	LU5	LU4	LU3	LU2	LU1
American Bureau of Shipping	IAA A1	IA A0	IB	IC	D0
Bureau Veritas	IA SUPER	IA	IB	IC	ID
CASPPR, 1972	A	B	C	D	E
China Classification Society	Ice Class B1*	Ice Class B1	Ice Class B2	Ice Class B3	Ice Class B
Det Norske Veritas	ICE-1A* ICE-10	ICE-1A ICE-05	ICE-1B	ICE-1C	ICE-C
Germanischer Lloyd	E4	E3	E2	E1	E
Korean Register of Shipping	ISS	IS1	IS2	IS3	IS4
Lloyd's Register of Shipping	1AS	1A	1B	1C	1D
Nippon Kaiji Kyokai	*IA Super*	*IA*	*IB*	*IC*	*ID*
Registro Italiano Navale	IAS	IA	IB	IC	ID

Figure 7. Table for corresponding ice classes.

Smaller vessels like buoy tenders and tugs with strong engines and hull are used as port icebreakers and for icebreaking mission in waters protected from drifting sea ice. In open sea areas that are affected by drifting sea ice with ridges and ice pressure, big sea icebreaker are required.

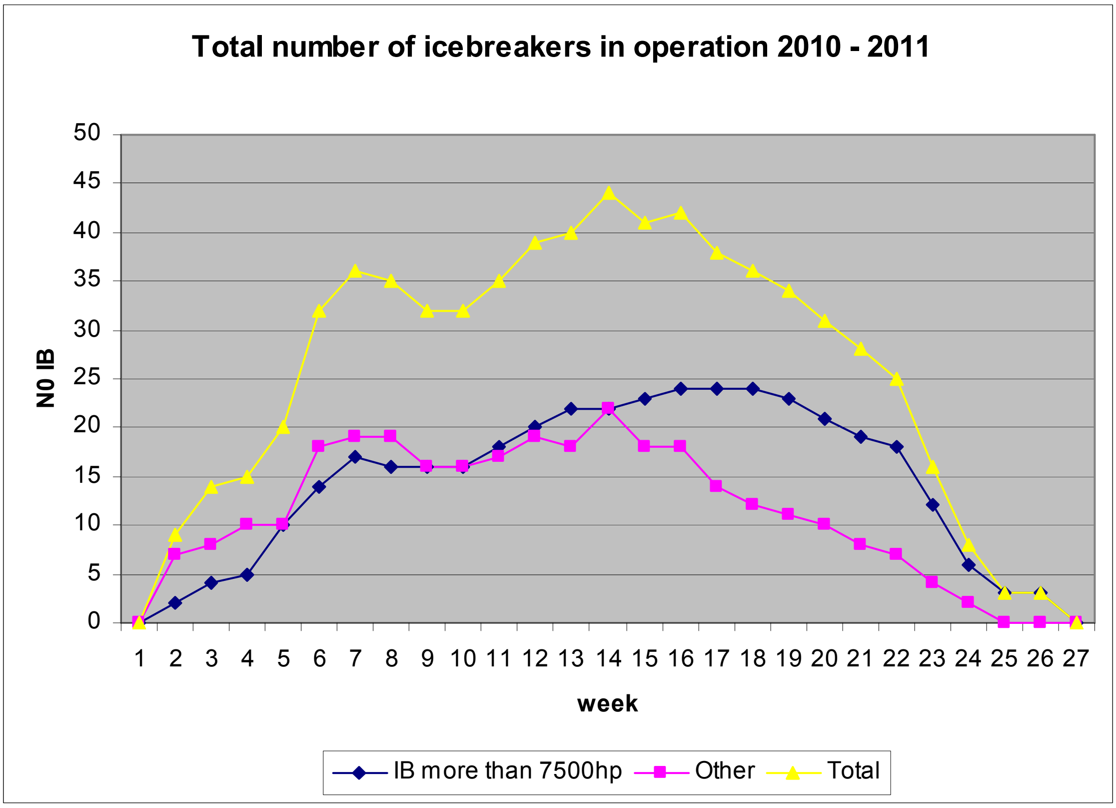


Figure 8 The total number of icebreakers in operation each week in Baltic Sea during the season 2010/2011

According to statistics from the Baltic Sea icebreaking authorities, 10750 vessels received assistance from icebreakers this season.

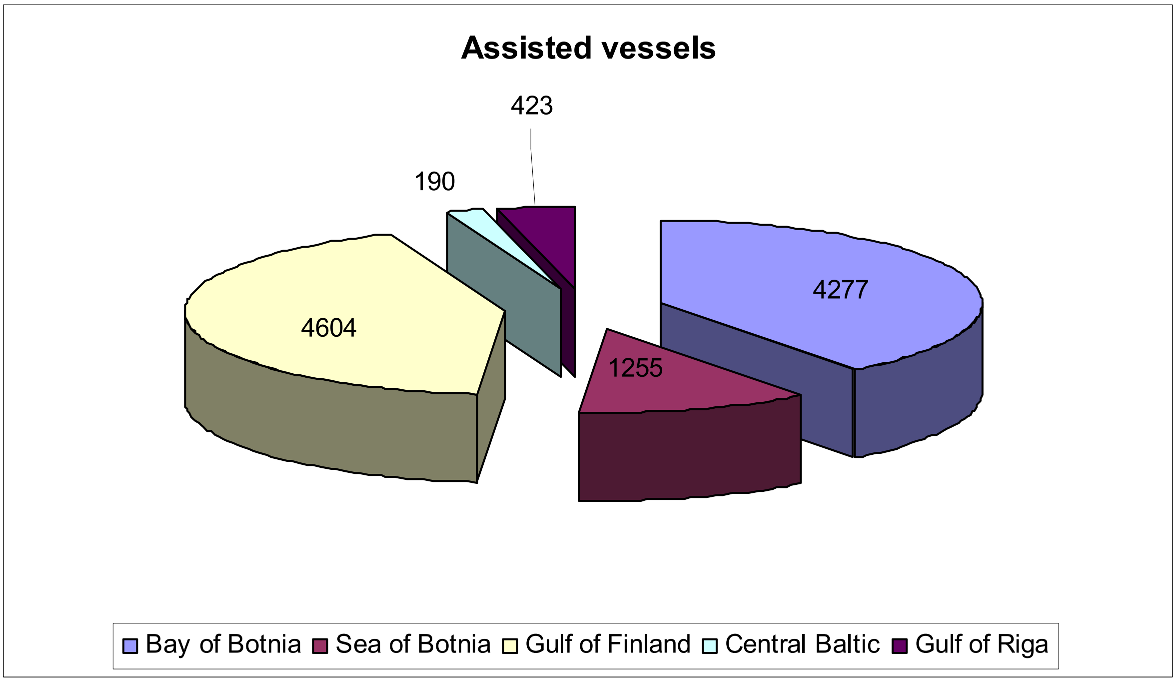


Figure 9. A total of 2432 vessels where assisted by icebreakers during the icebreaking season in the Baltic Sea.

The longest sailing distance in sea ice is to the northernmost ports in the Bay of Bothnia. But due to the big number of vessels in the shorter fairway to the easternmost ports in the Gulf of Finland, the traffic is more affected by sea ice in this area, especially during periods with strong westerly winds when the icebreakers must tow many vessels one by one.

Maximum sailing distance in sea-ice 2010-2011

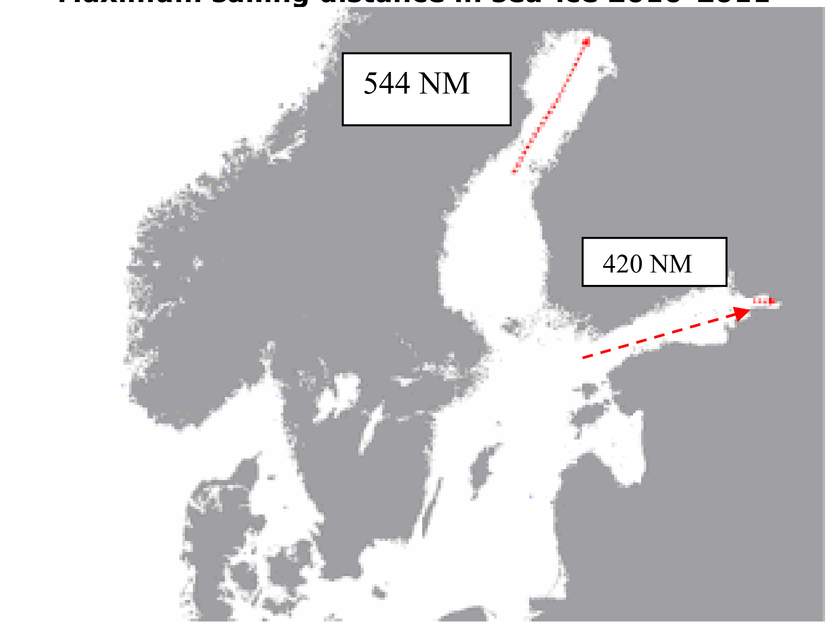


Figure 10. Sailing distance from ice edge during maximum ice extension, in March 2011. Kemi 400 nautical miles and St. Petersburg 240 nautical miles.

3. Accidents and incidents in sea ice

The Technical University of Helsinki collects information on accidents related to navigation in ice. Ship owners and others within winter navigation are requested to report accidents, incidents and damages that are ice-related to icedamage@tkk.fi or to:

Ice Damage Database
Helsinki University of Technology
Ship Laboratory
PL 5300
02151 TKK
FINLAND

Only some minor damages occurred to merchant vessels during assistance of the icebreakers. In comparison, about 100 vessels reported damages due to the severe ice conditions in the year 2011. Reports of accidents are difficult to get because often damages won't appear until during the next dry docking.

4. Costs of icebreaking services in the Baltic Sea

Winter conditions cause various costs for vessel traffic in the Baltic Sea. The vessels' fuel costs increase since speed is reduced by even half on average due to ice barriers when proceeding in ice at full effect, and approaching the quay can take hours. The harbour costs also increase, since the basin must be kept open by a harbour tug in order for the vessels to reach the quay.

Moreover, heating to keep equipment in working order despite outdoor temperatures below -20 ºC adds to the costs. Since it is difficult to estimate other costs, this report comprises only those related to icebreakers.

4.1 Finland

The cost of icebreakers stand-by period in 2010-2011 were about 45 million euros. This winter the season was harsh in total amount of operating days were 1030. Operational costs were 32.5 million euros and the fuel costs were 12, 5 million euros. The Finnish Transport agency had also contracts with private tugboat companies for minor operations. The costs of the Finnish icebreaking services vary from 30 to 50 million euros depending on winter.

4.2 Sweden

In Sweden the costs for the stand-by period amount to approximately 10 million EUR, additional operational costs to approximately 4 million EUR, and fuel costs to 2.5-9 million EUR. The cost of the Swedish icebreaking services varies from 15 to 34 million euros depending on the winters' degree. The costs this winter are estimated to be 30,5 million euros. This is the Governmental costs the cost for merchant vessels, harbours, local tugs and industries are not included.

4.3 Russia

Since January, 01st, 2008 according to the act of Federal Service on Tariffs dd 20.12.07 №552-t/1 rates of icebreaking dues in the Russian ports of the Gulf of Finland are established as follows:

Icebreaking dues:

Icebreaking dues are applied for incoming, outcoming or transiting the port area.

For the cargo ships engaged in liner services, which are officially declared, to the rates of the icebreaking dues the factor of 0.8 is applied.

From icebreaking dues are released:

vessels of ice class LU7 (according to classification of the Russian Maritime Register of Shipping or classes of other classification societies corresponding to it)
passenger vessels

Upon the announcement by the Harbour Master of winter (summer) navigation before the target date, and also after the prolongation of its duration, icebreaking dues are paid as per corresponding rates from the date of announcement to a date of completion (inclusive), corresponding to the period of winter navigation.

Rates for ships engaged in an international trade rub/1 GT

	All vessels except Ro-Ro, Ro-Flow, container ships and bulk carriers	Ro-Ro, Ro-Flow and container ships	Tankers
The summer rate from May, 1st till November, 30th	5.5	3.85	6.03
The winter rate from December, 1st till April, 30th	13,70	9,59	15,02

During the period from May, 1st till November, 30th the following vessels are released from payment of icebreaking dues:

arriving to the port from inland waterways of Russia or from the Saimaa canal and sailing back within current year;

arriving to the port from other Russian ports situated in the eastern part of the Gulf of Finland.

During the period from December, 1st till April, 30th the vessels with ice class LU5 and LU6 (according to classification of the Russian Maritime Register of Shipping or classes of other classification societies corresponding to it) are subject to icebreaking dues multiplied by factor 0.75.

4.4 Estonia

In Estonia, the total cost of icebreaking in the 2010-2011 season amounted to approximately 5,9 million EUR, with about 1,6 million EUR accounting for the costs in the Pärnu Bay and 4,3 million EUR for the Gulf of Finland. This is the Governmental costs

4.5. Denmark

In 2010/2011 the cost of the Danish ice service was approximately € 3,54 mill. This is a little more than the cost the previous year (€ 3,0 mill.). The cost covers charter of ice breaking tugs. The tugs operates from the ice edge to the breakwaters.

4.6 Norway

During the winter 2010 – 2011, the total costs of ice breaking service in Norwegian waters were approximately EUR 2.6 million. The tug Bamse Tug was hired for ice breaking and vessel assistance at a cost of slightly above EUR 1.0 million. Local vessels were hired at a cost of approximately EUR 1.6 million.

4.7. Latvia, Lithuania, Poland, Germany,

There was no cost info for icebreaking operation in this season 2010-2011.

5. Winter navigation in the different parts of the Baltic Sea

5.1. Bay of Bothnia

The first traffic restrictions were initiated on the 29th of November and reached their highest level IA and 4000 dwt, on the 10th of January.
On the 31st of January minimum load and discharge of 2000 tons were initiated.

The first icebreaker Kontio left Helsinki to start the icebreaking operations on November the 26th.

The ice growth started in the beginning of December and in the middle of February the maximum ice extension appeared.

At that time there were 4 icebreakers (3 Finnish and 1 Swedish) engaged in accordance with the joint icebreaking plan.

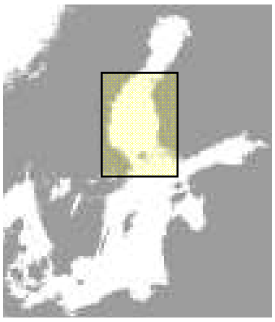
Assistance has been conducted to following ports:

Karlsborg	Tornio
Luleå	Kemi
Haraholmen	Oulu
Skelleftehamn	Raahe
Kokkola	Pietarsaari

The icebreakers in the Bay of Bothnia assisted 4 277 merchant vessels and 590 towing operations were conducted. The average waiting time was 9 hours and 7 minutes.

59,6% of all port calls did not have to wait for icebreaker assistance at all, but 32,4% of the port calls had to wait more than 4 hours for icebreaker assistance (so-called long waiting).
The icebreaking season in the Bay of Bothnia ended on the 22nd of May.

5.2. Sea of Bothnia



The first traffic restrictions in the northern part of Sea of Bothnia were initiated on the 12th of December and in the southern part the restrictions were initiated on 18th of December. The highest level IA and 3000 dwt in the North and IA and 2000 dwt in the South was in force from the middle of February until the middle of April.

6 icebreakers were engaged in the Sea of Bothnia when the maximum ice extension appeared.
The icebreaker Frej has jointly been used by the Finnish and Swedish Administrations in the Northern Quark.

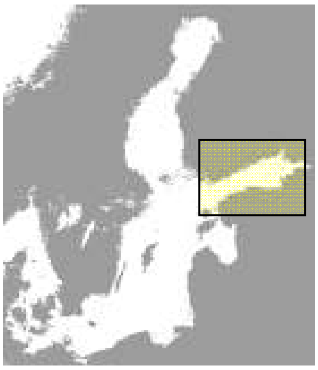
Assistance has been conducted to following ports:

Holmsund	Vaasa
Rundvik	Kaskinen
Husum	Mäntyluoto
Örnsköldsvik	Rauma
Ångermanälven	Uusikaupunki
Härnösand	Naantali
Söråker	Turku
Sundsvall	
Iggesund	
Söderhamn	
Orrskär	
Norrsundet	
Gävle	
Skutskär	
Hallstavik/Hargshamn	
Kappelskär	

The icebreakers in the Sea of Bothnia assisted 1 255 merchant vessels and 131 towing operations were performed. The average waiting time was 14 hours and 40 minutes. 66,53% of all port calls did not have to wait for icebreaker assistance at all, but 20,64% of the port calls had to wait more than 4 hours for icebreaker assistance (so-called long waiting).

The icebreaking activities in the Sea of Bothnia ended in the beginning of May and the traffic restrictions was lifted on the 9th of May.

5.3 Gulf of Finland



The first traffic restrictions were initiated 04 December in St. Petersburg. The restrictions were cancelled 07 May.

All vessels, which needed icebreaker assistance, were bound for Russian ports. During the largest ice cover, the Russians had 6 sea icebreakers and 8 minor icebreakers in use. The icebreaking season lasted from 01 December to 07 May in the Russian territorial water.

Ice conditions in the eastern part of the Gulf of Finland in 2010-2011

The ice formation processes in the winter of 2010/2011 were those of an extremely severe winter.

The average monthly air temperatures in the winter season were below normal, namely, by 3.70 in December, by 4.10 in February, while in January and in April the temperature was 2.00 and 1.7 o above normal and near the normal in November and March. The sum of degree days of cold amounted to 883^{0}C, (normal 775 ^{o}C) which describes the winter as a harsh one. In the winter of 2010-2011, snowfalls were abundant, and in three winter months the monthly precipitation was above normal, namely, 159 % in December, 217 % in January, 155 % in February.

The first ice in the water areas of the Neva Bay and the Gulf of Vyborg was noticed on November 25-26, which is in average one week later than the mean annual time.

Very cold weather in the December contributed to continuous and quite intensive ice formation, with a stable ice cover established at once. Fast ice in the water areas of the Neva Bay and the Gulf of Vyborg formed on December 1, which is just one week prior than the average annual time. Ice formation in the bays of Luga and Koporye began on December 2, in the Bjerkesund strait on December 6.

The ice edge quickly proceeded to the west and was on the longitude of the Shepelevskiy lighthouse on December 10, and then it was on the longitude of the Moshchny island on December 22 and then it was on longitude of the Hogland island on December 27. The ice situation at the end of the December was as follows. In the Neva Bay, there was fast ice, and the ice thickness was 23-37 cm. In the Gulf of Vyborg until the latitude of the Rondo island there was fast ice, and the ice thickness was 15-27 cm, and in the Bjerkesund strait, there was fast ice 10-25 cm thick.

In January, ice formation in the gulf was moderate, and the ice edge moved to the west. The ice thickness was within normal due to a stable snow cover on the ice, which was 20-25 cm. In the Neva Bay and the Gulf of Vyborg there was fast ice, and by the end of the month the ice thickness reached 35-47 cm and 25-35 cm respectively. In the Bjerkesund strait by the end of the month the ice thickness reached 20-35 cm. In the bays of Luga and Koporye, fast ice along the coast by the end of the month the ice thickness reached 20-35 cm. The drifting ice edge reached the borders of the Osmussar-Marianxamina island, while ice thickness till the Hogland island was 15-40 cm.

In the first ten days of February ice formation on the Gulf was weak, but during the second and third ten-day periods ice formation was intensive. In the gulf there was fast ice till Gogland island, the edge of nilas ice proceeded off the Gulf on 14 February and reach latitude of Gotland island on 24 February.   The By the end of the month, the ice thickness reached 45-65 cm, which is the above annual value for this period. The ice thickness on the fairway can reached 80-90 cm due to hummocking, rafting and ridged ice.

On February 26 to 27, the ice conditions were maximum hard. The thickness of fast ice reached 45-65 cm till Shepelevskiy lighthouse, 30-50 cm till the Hogland Island.

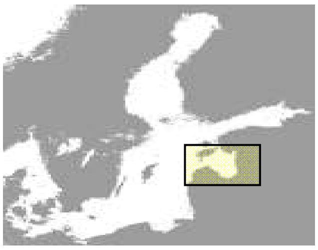
In March, weak ice situation was the same as winter 2002 /2003 due to winds of western directions. By the end of the month, the ice thickness in the Neva Bay was 50-65 cm (maximum ice thickness was observed on the Sestroretsk shallows at 70–80 cm), in the Gulf of Vyborg 45-55 cm, in the Bjerkesund strait and in the bays of Luga and Koporye 30-50 cm.

During April, warm weather was observed, with the average monthly temperature within the standard values. The ice cover in the Gulf of Finland was slowly destructing. The thickness of fast and drift ice was gradually decreasing. The destruction of ice was increasing. The fast ice in the northern part of the Nevskaya Guba was broken on first half of the month, the destruction of the ice cover accelerated. The Nevskaya Guba, as well as all the main navigable fairways, became completely free of ice on April 26, the Lushskaya and the Koporskaya Guba on April 30.

The Bjorkesund passage on May 2, the Koporskaya Guba on May 9 were fully cleared of ice. The main fairway to St. Petersburg was cleared of ice on May 14.

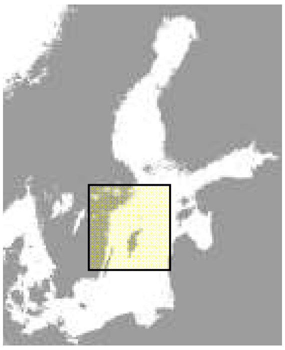
Full clearance of the gulf from ice was registered on May 16. The date of clearance of the Gulf of Finland are two weeks later then the mean annual dates.

5.4 Gulf of Riga



The Estonian Meteorological and Hydrological Institute assessed the winter of 2010/2011 as severe. The traffic restrictions were initiated 12 December being IC-1600 kW in Pärnu and were cancelled 26 April. The icebreaking season lasted from 7 Detsember to 26 April and 423 ships were assisted

5.5. Central Baltic



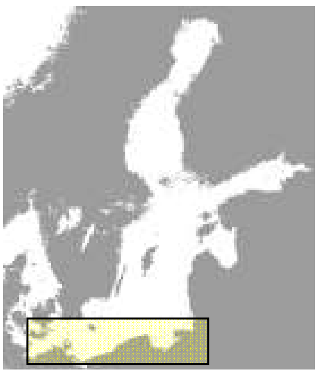
The first traffic restrictions in the Central Baltic were initiated on the 1st of January. The highest level was ice class IC and 2000 dwt.

The assistance activities were conducted by 1 large icebreaker, two buoy tenders and hired tugboats. Totally 190 merchant vessels were assisted by the icebreaking service.
The traffic restrictions were lifted on the 1st of April.

Assistance has been conducted to following ports:

Stockholm	Södertälje
Oxelösund	Oskarshamn
Mönsterås	Kalmar
Degerhamn	

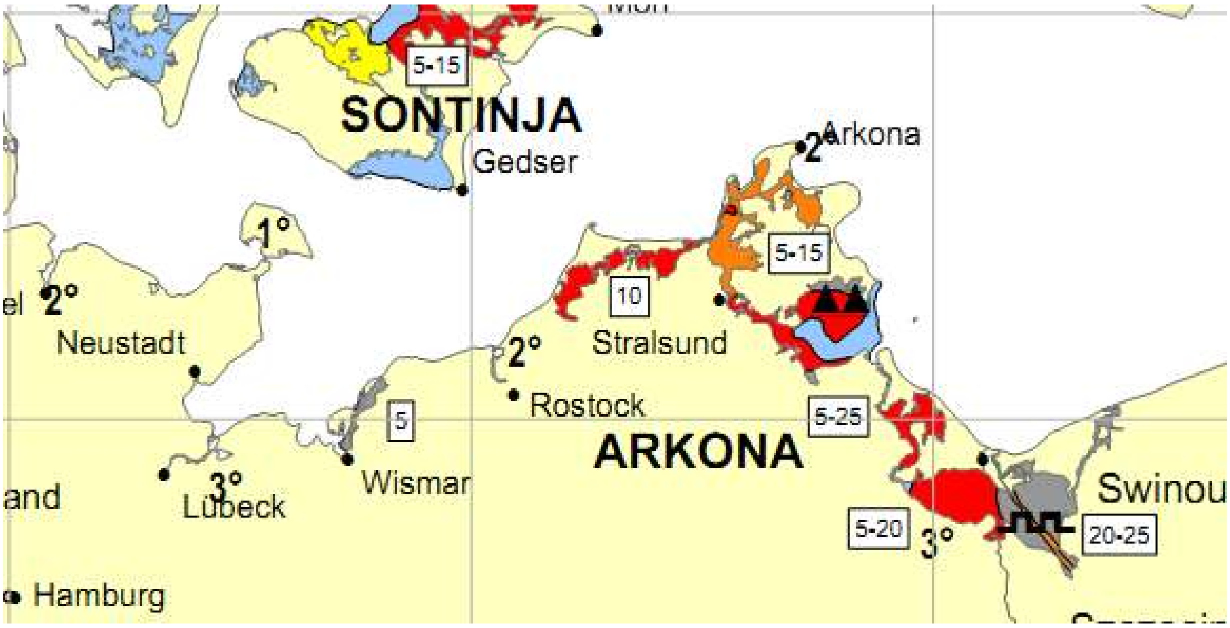
5.6 South Baltic Coastline



The ice situation in German waters was similar to the situation during the last winter season.

During the ongoing period of frost at first the sheltered waters of Greifswalder Bodden and Oderhaff were coffered by ice in December and January, followed by Schlei, Eckerförder Bucht und Flensburger Förde.

All floating aids to navigation were removed ore changed to ice buoys.
Partly the



Ice map of 19.01.2011

The Multi Purpose Vessel "Arkona" and two smaller icebreakers (Grömitz" and "Ranzow" were nearly in service during the whole period.

The Waterways and Shipping Directorate North (WSDN) coordinated according an overall plan the icebreaking service for the harbour entrances, coastal- and sea regions in the German part of the Baltic Sea.

On the beginning of February also the open sea was partly affected by ice. The thickness was not so large and the period was, due to changing wind directions, not so long, so that no icebreaking service was needed away from the coast line.

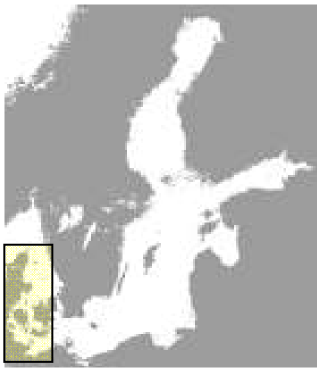
Ice map 27.02.2011

Depends on the wind drift the sea ice was more concentrated on the east coast of Rügen (see map of 27.02.2011), where it forms to a compact area on the end of February.
The inner waters were complete coffered by ice and the supply of the island of Hiddensee (close to Rügen) could only maintain with utmost efforts.
During this time the Icebreaker ARKONA was assisting in the approach to Stralsund, Landtief and in the Greifswalder Bodden.
GÖRMITZ was assisting in the northern Peenestrom, southern Greifswalder Bodden and Osttief. RANZOW was
assisting in the Strelasund and in the Greifswalder Bodden.

The northern approach to Stralsund, the southern Peenestrom and Kleines Haff were closed for navigation. Only daytime navigation was allowed to Stralsund.
Other connected waters with minor importance for winter traffic, like the Schlei in the western part of the area, were closed for shipping with beginning of ice development.

The main entrances to the large ports could be maintained ice free with help of larger tugs.
Overall, there were no extraordinary disabilities for the ships traffic in the last winter. Other large icebreakers than the governmental Multi Purpose Vessel ARKONA were not needed for maintaining the service.

5.7 Western Baltic, Danish waters



The winter 2010 – 2011 began already in the last half of November Parts of the inshore waters were covered by ice around December 1st. Assistance to shipping began at the same date. The cold weather continued until shortly before the New Year where the weather changed into being mostly mild. Inshore waters such as Limfjorden, the waters between Zeeland and Lolland Falster and Isefjorden were ice covered and required ice breaking assistance to shipping in the area.

6. Description of organisations and icebreakers engaged during the season 2010/2011

6.1 Finland

The Finnish Transport Agency (FTA) is the national authority responsible for the assistance of winter navigation, its coordination, development and management nation-wide. The actual icebreaking services have been contracted out.
The FTA develops Finland’s icebreaking policy, taking into account the requirements of its clients (mainly the Finnish industry). Essential for the industry are as short

waiting times as possible for traffic. The FTA decides on the length of the assistance period, exemptions and traffic restrictions.

The traffic restrictions are normally made more stringent at a faster pace than the minimum HELCOM safety recommendations, as the objective is to assure an efficient maritime traffic flow. Only vessels fulfilling the criteria of daily traffic restrictions are given assistance.

The icebreaking services were purchased from the Arctia Icebreaking during last season, and also from the private companies (mainly tugboat services in ice breaking)

Arctia Icebreaking was responsible for the management and daily operation of the icebreaking services to all 23 winter ports. The demands as to the standard of service are included in the freight contract. The main requirement is that vessels should not have to wait for an icebreaker for more than 4 hours on an average. Another goal for the Finnish icebreaker service standard is that 90 % to 95 % of vessels navigating in the ice field could get through without delay.

In Finland no special fee is collected for the icebreaker service. All ships pay fairway fees based on ship size and ice class. The fairway dues are used to cover the costs of fairway maintenance and icebreaking services.

Icebreakers engaged by the Finnish Transport Agency 2010/2011:

Name	Type	Engine power
FENNICA	Multi-Purpose Icebreaker	21 000 KW
NORDICA	Multi-Purpose Icebreaker	21 000 KW
BOTNICA	Multi-purpose Icebreaker	
FREJ	Icebreaker	18 400 KW
KONTIO	Icebreaker	21 800 KW
OTSO	Icebreaker	21 800 KW
SISU	Icebreaker	18 400 KW
URHO	Icebreaker	18 400 KW
VOIMA	Icebreaker	12 800 KW

Icebreaker Frej was a short period of 27 days in joint chartering with SMA and FTA

6.2 Sweden

Icebreaking operations are managed by the Icebreaking Management of the Swedish Maritime Administration in Norrköping and are based on the Swedish icebreaking regulation (2000:1149). It allocates icebreakers to work areas, issues traffic restrictions, monitors the operational situation and informs the shipping stakeholders of ice conditions and the traffic situation. Sweden controls eight icebreakers, of which the Swedish Maritime Administration owns five and has three on long-term charter from a private ship owner. All icebreakers are manned by a private shipping management company.

Sweden and Finland use a jointly developed IT based on-line system, IB-Net (IceBreaker Net) for coordination of the joint icebreaking operations. IBNet contains information about the weather, ice conditions and traffic situation, and transmits the information between the different connected units (icebreakers, coordination centres, VTS etc.)

In addition to the icebreakers, ice strengthened buoy tenders of the Swedish Maritime Administration and private tugboats are also engaged in the icebreaking service. Helicopters are chartered and used for ice reconnaissance and personnel transport in order to reduce time expenditure for icebreakers. Cooperation with the tugboats in ports is common around the coastline.

The governmental fairway dues cover the costs for the icebreaking operations and no vessel that receives assistance from icebreaker is charged.

Icebreakers engaged by the Swedish icebreaking service 2010/2011:

Name	Type	Engine power
ALE	Icebreaker	3500 KW
ATLE	Icebreaker	18400 KW
FREJ	Icebreaker	18400 KW
YMER	Icebreaker	18400 KW
ODEN	Icebreaker	18000 KW
TOR VIKING II	Icebreaker	16000 KW
BALDER VIKING	Icebreaker	16000 KW
VIDAR VIKING	Icebreaker	16000 KW
SCANDICA	Buoy tender	2610 KW
FYRBYGGAREN	Buoy tender	1140 KW

During the winter the Administration also has engaged 19 different tugboats for icebreaking operations.

6.3 Russia

The Harbour Master of Sea Port “Bolshoy port of St. Petersburg” (according to Direction of Ministry of Transport BP-113-p, 30.11.2001) regulates the icebreaker assistance in the eastern part of the Gulf of Finland. The Harbour Master of Sea Port “Bolshoy port of St. Petersburg” has the power to impose any shipping restrictions in the area for the traffic bound to or from Russian ports, based on actual ice conditions (according to article Nos. 74 & 76, Russian Federal Law No. 81-FZ, Russian Merchant Marine Code, 30.04.1999).

The ice navigation assistance is conducted by the state-owned or state-chartered icebreakers and covers the ports of St. Petersburg (including merchant cargo-handling areas in Kronstadt, Lomonosov and Vasileostrovsky cargo area), Primorsk, Vyborg, Vysotsk and Ust-Luga. The state-owned icebreakers assist the inland transit navigation via Symens canal both ways.

The ice-breaker fleet consists of the following ice-breakers:

Name	Type	Engine power
VAIGACH	Icebreaker	32 500 kW
ERMAK	Icebreaker	30 400 KW
CAPTAIN SOROKIN	Icebreaker	18 300 KW
CAPTAIN DRANICHIN	Icebreaker	18 000 kW
MOSKVA	Icebreaker	16 000 KW
SAINT-PETERSBURG	Icebreaker	16 000 KW
SEMION DEZHNEV	Icebreaker	4 000 KW
IVAN KRUZENSTERN	Icebreaker	4 000 KW
CAPITAN M. IZMAILOV	Icebreaker	3 940 KW
CAPTAIN ZARUBIN	Icebreaker	4 650 KW
MUDYUG	Icebreaker	9 100 KW
KARU	Icebreaker	6 450KW
TOR	Icebreaker	10 000KW
YURI LISYANSKY	Icebreaker	4 000 KW

The icebreaker assistance, as a rule, is conducted as follows:

1. Independent ice navigation following icebreaker recommendations and strictly under her supervision.
2. Icebreaker assistance in a convoy.
3. Individual icebreaker assistance behind an icebreaker.

Icebreaker assistance is given to the ships which do not fall under the acting restrictions in the ports of their destination. Icebreaker assistance for the traffic coming from the sea is conducted from the point where the convoy is formed to the inner road of the port, and the ships leaving the port are assisted from the inner road to the area next to the convoy forming point (CFP).

All the ships coming from the sea are prohibited from entering the ice east of the convoy forming point (CFP) without permission of the icebreaker. The Masters of the ships sailing independently upon receiving the permission of the icebreaker are to report to the icebreaker while passing the established control points of the recommended route and inform of the ice situation in the area. If such a ship gets stuck, the icebreakers are to release them and correct their recommended route or get them in the convoy for further motion. The Masters of the ships are not recommended to rely on data regarding recommended routes received from other ships and not confirmed by the Master of the icebreaker.

When the ice thickness over the approach fairways leading to Russian ports in the eastern part of the Gulf of Finland becomes considerable, the Harbour Master of St. Petersburg imposes restrictions on ships the ice class and the main engine capacity of which are not sufficient for navigation under prevailing circumstances.

The permission to enter the port or the icebreaker assistance to ships under restrictions due to their ice class is granted in exceptional cases, after detailed study of their ice certificates ("Ice passport" or "Provisional recommendations on ice safety") issued by a recognized institution. The permission to enter the port or icebreaker assistance to a ship under restrictions due to her main engine capacity may be granted in case her ice class meets the requirements. The ships whose age exceeds 20 years, as a rule, are not permitted entry in case they are under restrictions.

In case such permission is granted to a ship falling under one of the restrictions established, a particular icebreaker is allocated for her assistance and the Master of that icebreaker has the authority to determine the best way to render such assistance.

6.4 Estonia

The responsible organization for icebreaking in Estonia is the Estonian Maritime Administration. The Director-General of the Estonian Maritime Administration decides on traffic restrictions and directives on winter navigation. The icebreaking coordination center consisted of 11 members in 2010, chaired by the Head of the Maritime Safety Division of the Maritime Administration, and acts as an advisory board for the Director-General in icebreaking issues.

Ports that are serviced by state ice-breakers are Muuga Harbour, harbours of Tallinn and Kopli Bay, Paldiski North Harbour, Paldiski South Harbour, Kunda Harbour, Sillamäe Harbour and Pärnu Harbour.

Currently, Estonia has one icebreaker, TARMO, to operate in the Gulf of Finland area, and the multi-purpose vessel EVA-316 to operate in the Pärnu Bay. Icebreaking to the port of Pärnu was carried out by multi-purpose vessel EVA 316 and tug CASTOR. Icebreaking for Gulf of Finland was carried out by IB TARMO and tug ZEUS

Icebreakers engaged by the Estonian Maritime Administration 2010/2011:

Name	Type	Engine power
TARMO	Icebreaker	10 000KW
EVA 316	Multi-Purpose Vessel	3 x 1 717 KW
ZEUS	Tug	5416 kW
CASTOR	Tug	3728 kW

6.5 Latvia

Latvia has three international sea ports: Riga, Ventspils and Liepaja. There is one icebreaker, the VARMA, which is owned and operated by the Port of Riga, for approximately 10 years. VARMA mainly operates in the Irbe Strait. The icebreaking in Ventspils and Liepaja is carried out by tugboats. There are plans to replace the VARMA with a new icebreaker.

The estuary to the Port of Riga is affected by silting and maintenance dredging is essential to keep the depth in the fairway. A combined icebreaker/dredger should be a good solution when such investment is useful every year.

Name	Type	Engine power
VARMA	Icebreaker	10 165 KW

6.6 Lithuania

The port of Klaipeda is the northernmost ice-free port in the eastern Baltic coast. Klaipeda State Seaport Authority (KSSA) is the responsible organisation for icebreaking in Klaipeda harbour waters. The Lithuanian fairways are open all year round.

There are no demand and necessity for icebreaking service in the Lithuanian coastal waters, to the border to the port area or in Butinge Terminal. During severe winters, private tugboats carry out icebreaking. In total, 11 tugboats operate in the port of Klaipeda.

6.7 Poland

EAST COAST AREA OF POLAND (GDANSK and GDYNIA).

The ice-breaking agreement with WUZ - Gdansk, and with WUZ – Gdynia, Towing Companies was still in force In the 2010/2011 season .

A list of contacts and a list of tugs available for ice breaking action was announced in November.
Prolonged low temperatures at the end of the month of November and early December 2010 caused the first ice formation which appeared about 14th of December 2010. It covered a small percentage of the ports and roads area and remained to the beginning of February 2011, without creating any serious difficulties in shipping.

Another wave of low temperatures in the mid-month in February 2011 resulted in systematic growth of ice formation on roads areas and harbors and caused finally complete water freezing of the Gulf of Gdansk including the port of Wladyslawowo. The thickness of sea ice was estimated from 10 to 30 centimeters.

The ice breaking action began in Gdynia on 21.02.2011r. In Gdansk on 22.02.2011r. On 25.02.2011r. action was extended to the approach channels and roads of the both ports.

Freezing the Gulf of Gdansk waters did not constitute a greater obstacle to large ships, which fared well in the existing ice conditions. Smaller ships often used grated (mainly by ferries), waterways, or were forced to call upon occasionally tugs assistance. The costs of such services as long as it concerned the waters off the roads and approach channel were covered by the shipowner. Crushing ice inside the port lays in the responsibility of the owners of the port.

In the Gulf of Gdansk the drifting ice fields caused frequent drifting of the buoys, or shifts of position.

In Gdansk, the ice braking action was suspended on the 02.03.2011r , in Gdynia on the 05.03.2011r. The ice braking action was cancelled on the 21.03.2011r.

The action revealed the lack of ice breaker capability of crushing ice in shallow waters (Dead Vistula River from the Siennicki bridge to the mouth of the Vistula Smiala, ports of Wladyslawowo and Hel).

During whole ice breaking action tugs for ice breaking on the roads and approach channel were used for only 13 hrs. This does not include commercial use of the tugs for ice breaking inside the ports.

<u>WEST COAST AREA OF POLAND (SZCZECIN and SWINOUJSCIE)</u>

I Preparatory action taken before winter season 2010/2011

1. On October 2010 Harbour Master of the port of Szczecin began the procedure for public procurement for Ice Breaking. The Ice Breaking Contract for winter season 2010/2011. was signed on 10 December 2010 by Director of Maritime Office in Szczecin and Director of Ice Breaking Company "Zakład Usług Żeglugowych"
2. Maintaining the list of phone/mobile numbers and VHF channels and distributing it among involved parties.

3. The Rules of co-operation with The Institute of Meteorology and Water Administration was established.
4. The buoyage was partly removed and partly replaced by special winter buoys on the approach to Świnoujście and on the main fairway Świnoujście -Szczecin shortly before winter season.

II. Winter season 2010/2011

The winter began rather early and the first ice formation appeared on 03 December 2010 and on 10 December 2010 it was 100% coverage of ice in the area within ports of Świnoujście and Szczecin. The ice thickness was abt 10 cm in the beginning, and 50-60 cm later on.

The situation remained unchanged up to 02 February 2011, then due to the warmer weather the ice started to melt and on 17 March 2011 disappeared.

III. Actions taken

1. As the first ice formation appeared on 03 December 2010, VTS Szczecin started publishing in internet the ice statements for regions: Zatoka Pomorska, Świnoujście, Dziwnów, Zalew Szczeciński and small ports of Zalew Szceciński and port of Szczecin. These "ice news" included :
   - percentage of ice covering
   - thickness / rafting of ice
   - ice restriction, if were any, put into force by Harbour Master of port of Świnoujście/ Szczecin in their area of responsibility.

   The publishing ice news ended on 17 March 2011.

2. Putting into force the ice restrictions by Harbour Master of Świnoujście / Szczecin, in their area of responsibility.
   - The first restriction was put into force on 05 December 2010 and it stated that the main fairway Świnoujście - Szczecin and port of Świnoujście and Szczecin were available for vessels with ice class L-4 PRS (or equivalent class of other Classification Society)
   - 11 December 2010 the fairway Świnoujście – Szczecin and Port of Szczecin was available for vessels with ice class L-3 PRS (or equivalent class of other Classification Society) and main engine with power above 1700 KW
   - 30 December 2010 port of Świnoujście was available for vessels with ice class L-3 PRS (or equivalent class of other Classification Society) and main engine with power above 1700 KW
   - 11 March 2010 all restrictions were cancelled

3. Special statements of Harbour Master of Świnoujście/Szczecin.

   Statements issued by Harbour Master of Szczecin:
   - 10 December 2010 one way traffic was established on water fairway between Gate No I and Mankow. This was cancelled on 11 March 2011
   - 10 December 2010 to 11 March 2011 tug exemption was suspended
   - 05 December 2010 to 11 March 2011 pilot exemption was suspended

4. Ice breaking actions

   Generally the traffic was organized in convoys as one way traffic was established. The convoys were leaded by strong tugs as ice breakers.
   The first ice breaking action was on 10 December 2010 the last on 05 February 2011.
   Total working time of ice breakers has reached 163 hours

IV. The summary

1. In the thermal aspect - winter season 2010/2011 can be defined as severe and difficult.
2. In the ice condition aspect - winter season was difficult, ice formation was serious obstacle to navigation.
3. "Ice news" containing information about weather condition, ice formation, vessels
   traffic were available everyday in internet and any time on request on VHF from VTS.

6.8 Germany

In Germany the Ice Service is under the responsibility of the Waterways and Shipping Administration on behalf of the Ministry of Traffic, Building and Housing. The German Ice Service is divided into two parts, ice information and icebreaking.

The German hydrographical office BSH deals with ice observation and information service, and the Waterways and Shipping Directorate North organises the icebreaking service for the harbours, coastal and sea regions in the German part of the Baltic Sea.

The German ice service plan is set up annually by the responsible authority, listing all available vessels which are able to break ice, giving information on the respective areas of icebreaking service, the expected ice situation, etc.

For missions of icebreaking on the coastal and sea area different vessels are available:

Name	Type	Engine power
NEUWERK	Multi-Purpose Vessel	8 400 KW
MELLUM	Multi-Purpose Vessel	6 620 KW
ARKONA	Multi-Purpose Vessel	3 700 KW
BÜLK	Emergency Tug	2 320 KW

In addition to that, a number of smaller tugboats and river-icebreakers are available for the inner coastal waters and harbours.

Because the ice situation in Germany does not call for icebreaker assistance every year, the operation of multifunction vessels capable of icebreaking is most useful.

With “Neuwerk”, “Mellum” and the new multifunction vessel “Arkona”, Germany has a good combination between effective environmental protection and icebreaking during the wintertime along the coast and the affected international waterways.

6.9 Denmark

Due to a wish from the industry the Ice service is to be reorganised. How the Danish Ice service will be arranged is still undecided, until a decision is reached Admiral Danish Fleet will operate a temporary Ice Service.

As of the Defence agreement covering 2010 – 2015 The Danish Navy no longer operates icebreakers hitherto referred to as navy icebreakers:

Name	Built	Engine Power
DANBJØRN	1965	8 700 KW
ISBJØRN	1966	8 700 KW
THORBJØRN	1980	4 700 KW

The future Danish Ice service is at present undecided. Until a new Ice service are in place The Danish Navy will continue operate 2 navy icebreakers although in a reduced form. DANBJØRN and ISBJØRN will for the coming winter be kept on 5 days notice. For assistance to shipping in inshore waters the Danish will make use of tug boats which are hired on a case to case basis

7.0 Norway

Around Christmas, the ice conditions along the Norwegian coastline in Skagerrak appeared to become even stronger than the previous winter. However, the winter altogether turned out to be a little easier.

The tug Bamse Tug was hired for ice breaking from medio January to medio March, mainly in the approach to Drammen.
Several local vessels were hired for ice breaking in the same period, mainly in the ports of Arendal, Kragerø, Toensberg, Moss and Halden.
The buoy tenders Villa and Hekkingen were not used for ice breaking at all.
The Norwegian Coast Guard did not conduct any ice breaking or assistance.

Due to revised legislation regarding the administration of ports and fairways in Norwegian waters, the Norwegian Coastal Administration now is responsible of all ice breaking in the main fairways. This includes the approaches to ports, which used to be the respective port authority’s responsibility. As a result, the Norwegian Coastal Administration’s costs connected to ice breaking have been higher than for the winter 2009-2010, even though the ice conditions have been easier.

Governmental vessels with ice breaking capacity in Norway

Name	Type	Engine capacity	Owner
Villa	Buoy tender	1.250 bhp	Norwegian Coastal Administration
Hekkingen	Buoy tender	1.250 bhp	Norwegian Coastal Administration
Svalbard	Coast Guard vessel	18.000 bhp	Norwegian Coast Guard

Some port authorities still operate tugs that are used for ice breaking in the harbour area and their approaches. This is mainly old tonnage which has undergone only minor renewals during the last years. As a consequence of the above mentioned revised legislation, it is likely that this trend will continue, hence that the fleet of harbour ice breaking tugs will grow older.