



**ACCESS**  
Arctic Climate Change  
Economy and Society



**Project no. 265863**

**ACCESS**

**Arctic Climate Change, Economy and Society**

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## **D2.53 – Treat by icebergs and ice massifs to Arctic Shipping**

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<b>PU</b>	Public	X
<b>PP</b>	Restricted to other programme participants (including the Commission Services)	
<b>RE</b>	Restricted to a group specified by the consortium (including the Commission Services)	
<b>CO</b>	Confidential, only for members of the consortium (including the Commission Services)	

# ACCESS Project

## ACCESS WP2 Tasks 2.5.3

### by Nordic Bulk Carriers A/S

## April 2014

*The danger from icebergs, growlers and ice massifs (large ice accumulation of very close pack ice) will be investigated by NBC in cooperation with AARI and Met.no especially for the Northern Sea Route (the Barents Sea is covered by WP4). Special areas of high potential iceberg occurrence along the Northern Sea Route will be defined. Countermeasures such as satellite observing systems with high resolution and ice monitoring and forecasting systems will be evaluated with respect of reducing the danger of iceberg/ ship collision.*

NBC have so far performed 12 transits in the Northern Sea route (NSR) and one (1) in the North West Passage (NWP).

This makes NBC the most active user of these new Arctic shipping routes, and has collected lot of raw data from these shipments about the risks and threats. We have put them in following categories.

1. Risks from icebergs
2. Risks from growlers
3. Risks from ice pushing
4. Available assistance
5. Comments to rules and regulation in the future.

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## Risks from Icebergs

*Only once in more than a century have icebergs calved off one of the largest glaciers in Greenland as quickly as they are today due to warming waters, scientists find. Any further warming of the ocean around Greenland is likely to increase ice loss there, researchers said. **Source Charles Q. Choi, OurAmazingPlanet Contributor***

*One hundred years after the RMS Titanic foundered in icy waters 375 miles south of Newfoundland, the dangers of vessels striking an iceberg continue.*

*Shipboard radar, satellite photos, global positioning systems (GPS) and aircraft patrols have made the North Atlantic safer now than it was during the early 1900s.*

*However, despite improvements in detection methods and more accurate ship positions, as well as trending warmer seas melting the icebergs faster, ships continue to have close encounters with these frozen, floating objects.*

*According to the BBC, between 1980 and 2005 there have been 57 incidents with vessels involving icebergs. **Source lex Sosnowski, Expert Senior Meteorologist***

These are just few of many quotes and opinions from experts on this issue, but how does a ship owners see this? We have now traded in Arctic during the last four (4) years and have not had any major incidents, but small damages to the vessels has accoutred.

In all of our transits, we have followed an icebreaker, which has escorted our vessels through the iciest areas, areas defined solely by the icebreaker service, in other words, the Russian and Canadian authorities decide where, and when we need the escort.

We follow these icebreakers alone or in convoy, depending on the traffic volume. Our experience is that it is very safe to behind the icebreaker, both alone and in convoy. The biggest risk islack of experience, it is extremely important to have high educated and experienced crew when you sail in the arctic. Sailing in convoy creates a risk from other vessels too - do they have experienced crew, if not, we can be at risk.

We see icebergs when we transit. The icebreaker avoids them and we follow. Speed is reduced at night to limit risks, but speed is a risk, because icebreakers have a shorter manoeuvre time than a 225m long bulk carrier, or other vessels in a convoy – this can be and has been an issue.

The icebergs are relatively easy to spot and they can be avoided during transits - again the icebreaker is leading to direction.

## Risks from growlers

Growlers represent a bigger threat to shipping in Arctic. They are normally about 20 m<sup>2</sup> and are floating less than 1 m below the sea surface. This makes them difficult to see from both the icebreaker and from the Bulk Carriers.

Their size is similar to a car, wherefore they can make big damages to the vessel's hull and even make hole in vessel's hull.

We have not had any collision with growlers (that we know of) but we have seen small damages to vessel hulls, which could have been caused by growlers – but never anything critical.

Why have this never been critical? We believe it is due to the high ice class we have on our fleet. A vessel with less/lower ice class could have experienced bigger damages, which could have been critical.

## Risks from ice pushing

Another risk is ice pushing. This is mainly an issue when vessels are idle in the ice. For commercial transits, idle time is very unusual and only occurs when waiting for an icebreaker, or if the icebreaker gets stock in the ice.

We experienced this on our first voyage in 2013. We started the transit two (2) weeks earlier than the previous years – we experienced lots of ice in the western part of the NSR – and after two (2) days, the Russian Icebreaker had to call for assistance from their biggest icebreaker. This caused a delay of three (3) days where our Nordic Orion sat idle in very though ice. The ice pushing on the vessel's side was very easy to see afterwards – vessel hulls had been pushed on both sides and the steel plate had been bended – nothing critical and a class surveyor approved the vessel's seaworthiness, but with the remark that the damages on the vessel should be repaired within 6 months.

We are very certain that this could have been very critical if our vessels have had a lower ice class.

## Available assistance

We have, on all our transits, been escorted by an icebreaker and we feel that the assistance is very close to us, much closer than when we cross big oceans. However, we think that the general icebreaker fleet is very old and need a major upgrade. There has been a lot of talking the last couple of years by all the active

countries in the Arctic, but so far only the Russians have placed a firm order for newer and bigger icebreaker(s).

## **Comments to rules and regulations in the future**

*The global shipping regime is globally controlled by IMO*

Within this organization, states have negotiated some 50 legally binding treaties and protocols on matters ranging from maritime safety, seafarer competency and training to marine pollution and biodiversity instruments like ballast-water rules aimed at preventing the introduction of invasive species.

Despite the universal character of the shipping regime, certain features reflect sensitivity to the special risks associated with operation in some regions, like the Arctic.

The Arctic will be covered under the Polar Code, negotiations on a Polar Code that would specify and harmonize construction, design, equipment, and other requirements concerning vessel operations in partly ice-covered waters began in the early 1990s. The first output was a set of non-mandatory Guidelines for Ships Operating in Arctic Ice covered Waters, approved in 2002. – The final version is expected to be ready and in force in 2016-2018.

We believe that the Polar Code should focus a lot on the right ice class. As a shipping company we have decided to upgrade our New Buildings, they will be ice classed 1A as the present, but they have more steel and a bigger ice belt – this is only because of our increased activity in Arctic.

## Abridged Ice Glossary

**Bergy Bit** - A large piece of floating glacier ice, generally showing less than 5 m above sea level, but more than 1 m and normally about 100-300m<sup>2</sup> in area.

**Bergy Water** - An area of freely navigable water in which ice of land origin is present in concentration less than 1/10. There may be sea ice present, although the total concentration of all ice shall not exceed 1/10.

**Bight** - An extensive crescent-shaped indentation in the ice edge, formed by either wind or current.

**Brash Ice** - Accumulations of floating ice made up of fragments not more than 2 m across, the wreckage of other forms of ice.

**Close Ice** - Floating ice in which the concentration is 7/10 to 8/10, composed of floes mostly in contact.

**Compacted Ice Edge** - Close, clear-cut ice edge compacted by wind or current, usually on the windward side of an area of drift ice.

**Concentration** - The ratio expressed in tenths describing the amount of the sea surface covered by ice as a fraction of the whole area being considered. Total concentration includes all stages of development that are present, whereas partial concentration may refer to the amount of a particular stage or a particular form of ice and represents only a part of the total.

**Consolidated Ice** - Floating ice in which the concentration is 10/10 and the floes are frozen together.

**Crack** - Any fracture which has not parted.

**Drift Ice\*/Pack Ice** - Term used in a wide sense to include any area of sea ice other than fast ice no matter what form it takes or how it is dispersed. When concentrations are high, i.e. 7/10 or more, drift ice may be replaced by the term Pack Ice. (\*Previously the term pack ice was used for all ranges of concentration.)

**Fast Ice** - Sea ice which forms and remains fast along the coast where it is attached to the shore, to an ice wall, or to an ice front, or between shoals or grounded icebergs. Vertical fluctuations may be observed during changes of sea level. Fast ice may be formed in situ from sea water or by freezing of floating ice of any age to the shore, and it may extend a few metres or several hundred kilometres from the coast. Fast ice more than one year old may be prefixed with the appropriate age category: old, second-year, or multi-year. If it is thicker than about 2 m above sea level, it is called an ice shelf.

**Fast Ice Edge** - The demarcation at any given time between fast ice and open water.

**First-year Ice** - Sea ice of not more than one winter's growth, developing from young ice; thickness from 30 cm to 2 m may be subdivided into thin first-year ice/white ice, medium first-year ice, and thick first-year ice.

**Flaw** - A narrow separation zone between pack ice and fast ice where the pieces of ice are in a chaotic state; it forms when pack ice shears under the effect of a strong wind or current along the fast ice boundary (cf. shearing)

**Flaw Lead** - A passageway between drift ice and fast ice which is navigable by surface vessels.

**Floating Ice** - Any form of ice found floating in water. The principal kinds of floating ice are lake ice, river ice, and sea ice, which form by the freezing of water at the surface, and glacier ice (ice of land origin) formed on land or in an ice shelf. The concept includes ice that is stranded or grounded.

**Floe** - Any relatively flat piece of sea ice 20 m or more across. Floes are subdivided according to horizontal extent as follows: Giant - over 10 km across; Vast - 2-10 km across; Big - 500-2,000 m across; Medium - 100-500 m across; Small - 20-100 m across.

**Floeberg** - A massive piece of sea ice composed of a hummock or a group of hummocks, frozen together and separated from ice surroundings. It may typically protrude up to 50 m above the sea level.

**Frazil Ice** - Fine spicules or plates of ice suspended in water.

**Glacier Ice** - Ice in or originating from a glacier, whether on land or floating on the sea as icebergs, bergy bits, or growlers.

**Grease Ice** - A later stage of freezing than frazil ice when the crystals have coagulated to form a soupy layer on the surface. Grease ice reflects little light, giving the sea a matte appearance.

**Grey Ice** - Young ice 10-15 cm thick. Less elastic than nilas and breaks on swell. Usually rafts under pressure.

**Grounded Ice** - Floating ice aground in shoal water (cf. Stranded ice).

**Growler** - Smaller piece of ice than a bergy bit or floeberg, often transparent but appearing green or almost black in colour, extending less than 1 m above the sea surface and normally occupying an area of about 20 sq. m.

**Hummocked Ice** - Sea ice piled haphazardly, one piece over another, to form an uneven surface. When weathered it has the appearance of smooth hillocks.

**Iceberg** - A massive piece of ice of greatly varying shape, more than 5 m above sea level, which has broken away from a glacier, and which may be afloat or aground. Icebergs may be described as tabular, domeshaped, sloping, pinnacled, weathered, or glacierbergs.

**Icebound** - A harbour, inlet, etc., is said to be icebound when navigation by ships is prevented by ice, except possibly with the assistance of an icebreaker.

**Ice Boundary** - The demarcation at any given time between fast ice and drift ice or between areas of drift ice of different concentrations (cf. ice edge).

**Ice Cake** - Any relatively flat piece of ice less than 20 m across.

**Ice Edge** - The demarcation at any given time between the open sea and sea ice of any kind, whether fast or drifting. It may be termed compacted or diffuse (cf. ice boundary).

**Ice Field** - Area of floating ice consisting of floes of any size, which is greater than 10 km across (cf. ice patch).

**Ice Free** - No ice present. If ice of any kind is present, this term should not be used.

**Ice Jam** - An accumulation of broken river ice or sea ice caught in a narrow channel.

**Ice Patch** - An area of floating ice less than 10 km across.

**Ice Under Pressure** - Ice in which deformation processes are actively occurring, hence a potential impediment or danger to shipping.

**Large Fracture** - More than 500 m wide.

**Lead** - Any fracture or passageway through sea ice which is navigable by surface vessels.

**Multi-Year Ice** - Old ice up to 3 m or more thick which has survived at least two summers' melt. Hummocks are smoother than in second-year ice, and the ice is almost salt-free. Color, where bare, is usually blue. Melt pattern consists of large interconnecting irregular puddles and a well-developed drainage system.

**New Ice** - A general term for recently formed ice, which includes frazil ice, grease ice, slush, and shuga. These types of ice are composed of ice crystals which are only weakly frozen together (if at all) and have a definite form only while they are afloat.

**Nilas** - A thin elastic crust of ice, easily bending on waves and swell under pressure, thrusting in a pattern of interlocking "fingers" (finger rafting). Has a matte surface and is up to 10 cm in thickness. May be subdivided into dark nilas and light nilas.

**Nip** - Ice is said to nip when it forcibly presses against a ship. A vessel so caught, though undamaged, is said to have been nipped.

**Old Ice** - Sea ice which has survived at least one summer's melt. Most topographic features are smoother than on first year ice. May be subdivided into second-year and multi-year ice.

**Open Ice** - Floating ice in which the ice concentration is 4/10 to 6/10, with many leads and polynyas, and the floes are generally not in contact with one another.

**Open Water** - A large area of freely navigable water in which sea ice is present in concentrations less than 1/10. No ice of land origin is present, although the total concentration of all ice shall not exceed 1/10.

**Pack Ice** - See Drift Ice

**Pancake Ice** - Predominantly circular pieces of ice 30 m in diameter, up to 10 cm in thickness, with raised rims due to the pieces striking against one another. May form on a slight swell from the grease ice, shuga or slush, or as a result of the breaking of ice rind, nilas or, under severe conditions of swell or waves, of grey ice. Sometimes forms at some depth at an interface between water bodies of different physical characteristics, then floats to the surface. Its appearance may rapidly cover wide areas of water.

**Polynya** - Any non-linear shaped opening enclosed in ice. Polynyas may contain brash ice and/or be covered with new ice, nilas or young ice. Sometimes the polynya is limited on one side by the coast and is then called a shore polynya or by fast ice and is called a flaw polynya.

**Rafting** - Pressure processes whereby one piece of ice overrides another. Most common in new and young ice (cf. finger rafting).

**Ram** - An underwater ice projection from an ice wall, ice front, iceberg, or a floe. its formation is usually due to more intensive melting and erosion of the unsubmerged part.

**Ridge** - A line or wall of broken ice forced up by pressure. May be fresh or weathered. The submerged volume of broken ice under a ridge forced downwards by pressure is termed an ice keel.

**Rotten Ice** - Sea ice which has become honeycombed and which is in an advanced state of disintegration.

**Sea Ice** - Any form of ice found at sea which has originated from the freezing of sea water.

**Second-Year Ice** - Old ice which has survived only one summer's melt. Because it is thicker and less dense than first-year ice, it stands higher out of the water. In contrast to multi-year ice, summer melting produces a regular pattern of numerous small puddles. Bare patches and puddles are usually greenish-blue.

**Shore Lead** - A lead between drift ice and the shore or between drift ice and an ice front.

**Shuga** - An accumulation of spongy white ice lumps, a few centimetres across; formed from grease ice or slush and sometimes from anchor ice rising to the surface.

**Slush** - Snow which is saturated and mixed with water on land or ice surfaces, or as a viscous floating mass in water after a heavy snowfall.

**Strip** - Long narrow area of floating ice, about 1 km or less in width, usually composed of small fragments detached from the main mass of ice, and run together under the influence of wind, swell or current.

**Tongue** - A projection of the ice edge up to several kilometres in length caused by wind or current.

**Very Close Ice** - Floating ice in which the concentration is 9/10 to less than 10/10.

**Very Open Ice** - Floating ice in which the concentration is 1/10 to 3/10 and where water preponderates over ice.

**Young Ice** - Ice in the transition stage between nilas and first-year ice, 10-30 cm in thickness. May be subdivided into grey ice and grey-white ice.

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Christian Bonfils, Managing Director  
Nordic Bulk Carriers A/S