Strategic Assessment of Development of the Arctic: Assessment Conducted for the EU

FACTSHEET

Changes in Arctic Maritime Transport

Overview

Maritime transport in the Arctic has increased in recent years. The growing traffic is closely linked to the development of economic activities within the Arctic and the export of raw materials such as petroleum and minerals. Arctic cruise tourism is also growing. A few ships have made transit voyages between Europe and Asia.

Destinational shipping in the Arctic is expected to expand, as is transit traffic later. However, there is considerable uncertainty regarding the timing and magnitude of future traffic levels. Operations must be safe, reliable and profitable to reach large volumes.

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The outlook for expanded maritime transport is determined by many factors and there is much inherent uncertainty. Melting summer sea-ice expands the area of navigable waters and extends the sailing season. Deficits in critical infrastructure ranging from ports to navigational maps, communication means, and search and rescue capabilities present significant challenges that must be overcome. Safety of navigation is a serious concern for ships operating in harsh conditions and remote areas far from salvage.

There is concern about environmental damage to areas that so far have been effectively protected from human influence by sea-ice. On the other hand, Arctic voyages may lead to lower costs, growing trade and economic benefits to ship owners, ports and maritime industries delivering ships and equipment.

This factsheet highlights changes in Arctic maritime transport, its drivers, conditions, possible impacts and relevance to the European Union. It provides an overview of relevant aspects for elaboration in the consultation process.

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Strategic Environmental Impact Assessment of Development of the Arctic

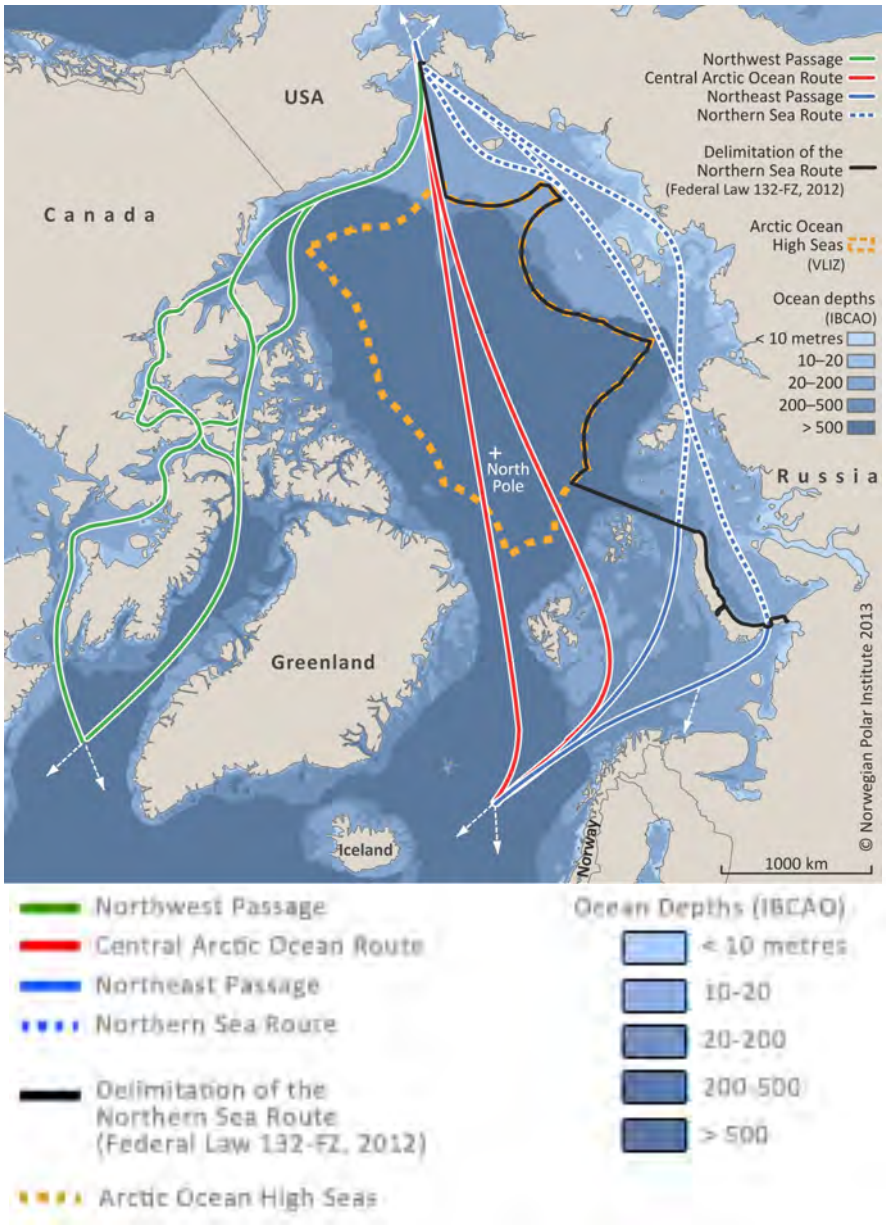
This factsheet is to stimulate dialogue between stakeholders, Arctic experts and EU policymakers. Stakeholder input informs the analysis of trends and the role of the European Union in shaping Arctic developments. It will lead to recommendations to EU policymakers and be published as the Strategic Assessment of Development of the Arctic Report in spring 2014. The European Commission-funded project is implemented by a network of 19 institutions lead by the Arctic Centre in Rovaniemi and is linked to the EU Arctic Information Centre initiative.

Where Are the Ships Going?

There are two main sea routes in the Arctic Ocean today: The **Northeast Passage** (NEP) which goes along the coasts of Norway, Russia and Alaska; its Russian section is called the **Northern Sea Route** (NSR). The **Northwest Passage** (NWP) which goes along the northern coast of North America.

The **Central Arctic Ocean Route** in international waters is sparking interest as a future transport corridor (Figure 1).

Figure 1: **Arctic Maritime Transport Routes**



Source: G. Sander/A.Skoglund, Norwegian Polar Institute, 2013.

Maritime transport along these routes can be:

- Internal for shipping between ports in the Arctic region, or for activities in the ocean area such as cruise tourism, leisure crafts and transport related to fisheries, offshore oil and gas, research, etc.;
- Destinational for shipping that goes to or comes from the Arctic;
- Trans-Arctic/transit for traffic that uses the Arctic as a transport corridor between the Pacific and Atlantic Oceans.

For simplicity, internal and destinational traffic are discussed jointly here, with an emphasis on freight transport.

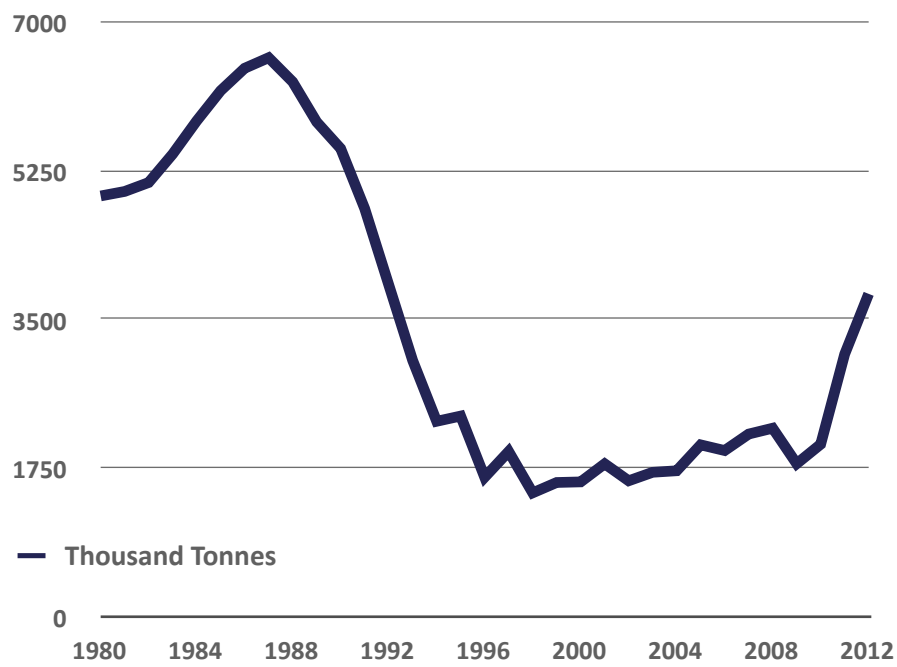
Today the Northeast Passage/Northern Sea Route is the most attractive due to more favourable ice conditions and residual infrastructure from the Soviet era, including nuclear-powered icebreakers. The Russian government has high ambitions for developing the NSR. In the Northwest Passage, the narrow sounds are more often clogged by sea-ice; there is scant infrastructure for commercial shipping and no clear political commitment to develop the route. Therefore this factsheet focuses on the NEP/NSR.

What Changes Are Observed?

Destinational and internal traffic in the Arctic are increasing.

The Northern Sea Route (NSR) was developed as a part of the Soviet industrialisation of Siberia and was closely linked to an internal transport system that included inland waterways and the Trans-Siberian railway. Shipping activity peaked in 1987 and declined sharply with the dissolution of the Soviet Union. The route is now open for non-Russian flagged ships.

Figure 2: **Total Annual Cargo Volumes on the Northern Sea Route**



Note: Data include intra, destinational and transit traffic.
Source: Northern Sea Route Information Office, *www.arctic-lio.com*

In recent years, the volume of cargo transported along the NSR has been growing, as illustrated in Figure 2, though traffic has not yet reached levels seen in the Soviet era. An emerging pattern is that Russian raw materials such as gas condensate and iron ore from the northwest are being exported directly to Asia.

Activity in the Northwest Passage is linked to services for remote communities and a few mining projects. Most of the increasing traffic is non-commercial crafts such as yachts and Canadian government ships including icebreakers, rather than freight vessels.

Trans-Arctic shipping is emerging

The number of ships that use the Northeast Passage as a transport corridor between Europe and Asia are on the upswing, though numbers are still small (Figure 3). In the Northwest Passage, the first bulk carrier transited the whole route in September 2013,

Figure 3: **Number of Vessels in Intercontinental Transits through the Northeast Passage, 2009-2012**

	2009	2010	2011	2012
No. of vessels	2	1	10	12

Note that the numbers are lower than for transits of NSR, which is only a part of NEP. Sources: Midgard (2012), Rosatomflot www.rosatomflot.ru.

transporting coal from the west coast of Canada to Finland. Compared with the 18 000-20 000 ships that pass through the Suez canal each year, Arctic shipping today holds only minor global significance. Yet, recent developments represent a major shift in the Arctic that signals future development and requires attention and action prior to the build up of activities.

What Is the Outlook?

Developments are in an early phase. Many of the voyages along the NEP-NSR are trial shipments to test the viability of new routes and destinations, types of ships and technology, and safety schemes. The Arctic Marine Shipping Assessment Report in 2009 projected the main increase in maritime transport in the near term to be destinational traffic rather than transit traffic. This still seems to be a sound outlook.

Container ships account for the largest share of global shipments, and the attractiveness for this segment will be crucial for future activity levels in the Arctic. Few quantitative predictions have been made, but those that have generally indicate a rather modest number of Arctic transits. For example, Det Norske Veritas (DNV) has estimated 450 transit voyages with container ships in 2030 and 850 in 2050. However, all such quantitative estimates have high uncertainty assigned to any output.

What Is Shaping Change in Arctic Maritime Transport?

Commercial ship operations in the Arctic must be safe, reliable and profitable. These elements are influenced by a number of framing conditions and drivers; some of them general for all operations, some of them specific, as summarised in Figure 4 and briefly set out below.

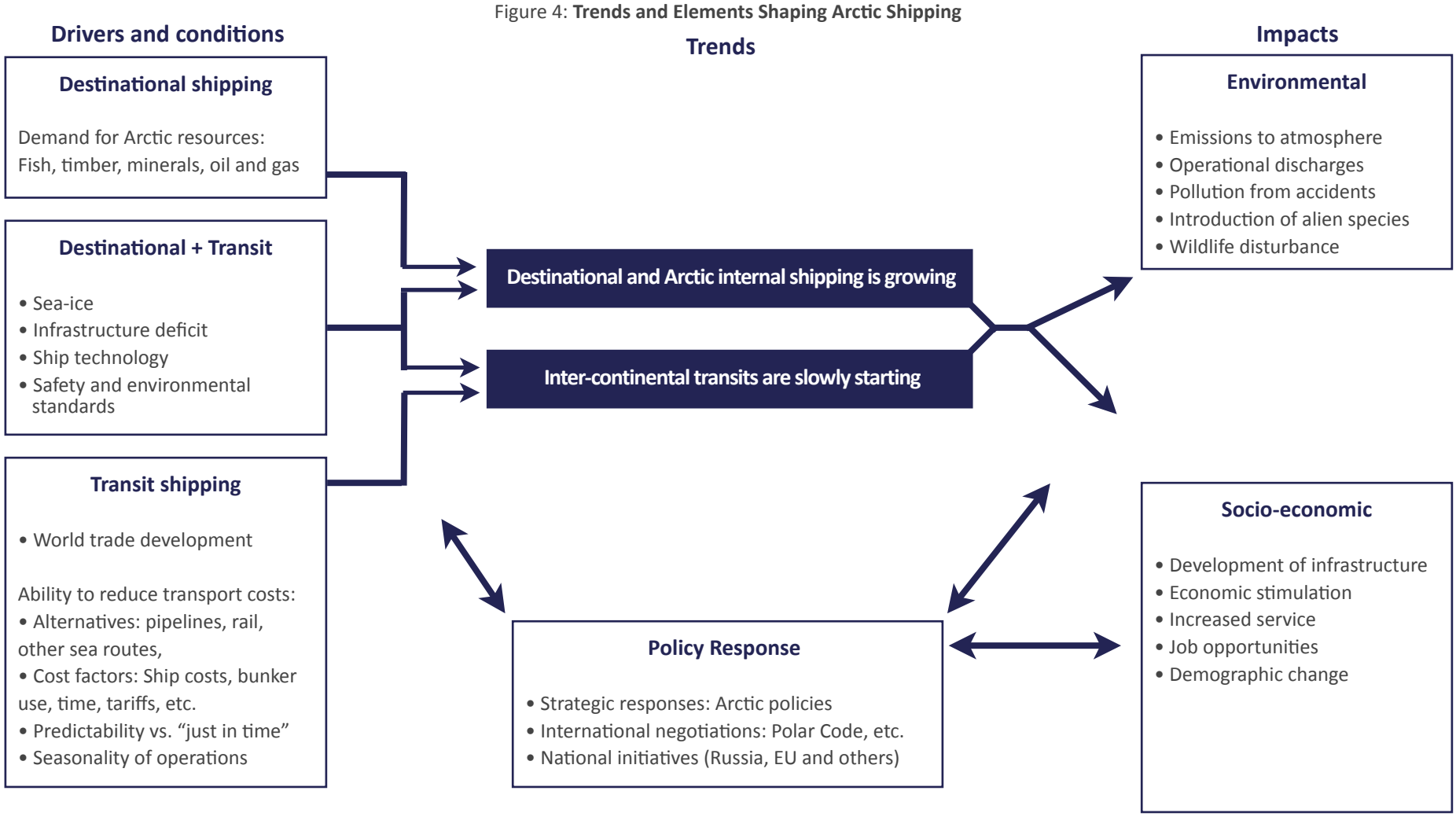
Drivers for destinational shipping

Rich natural resources in the Arctic, particularly energy and minerals, are increasingly being seen as a new source to contribute to growing global demand. Shipments to deliver goods and equipment needed for exploration and production, as well as the export of the raw materials, are important drivers for Arctic shipping.

Turmoil in some producing regions such as the Middle East increases the attractiveness of the Arctic as a potential secure source. On the other hand, costs to exploit Arctic resources are generally higher than available alternatives.

At least in the near term, this may leave Arctic resources largely unexploited. While quantitative estimates of resource exploitation and their timing are uncertain, increased activity is expected, and hence, growing levels of destinational traffic. (See the *Mining in the European Arctic* and *Developing Oil and Gas in Arctic Waters* factsheets.)

Figure 4: **Trends and Elements Shaping Arctic Shipping**



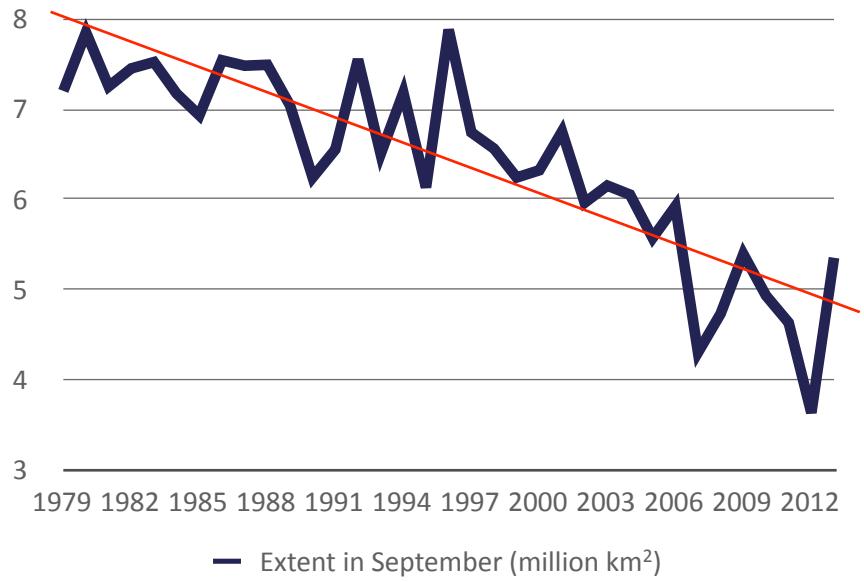
Shaping elements for destinational and transit shipping

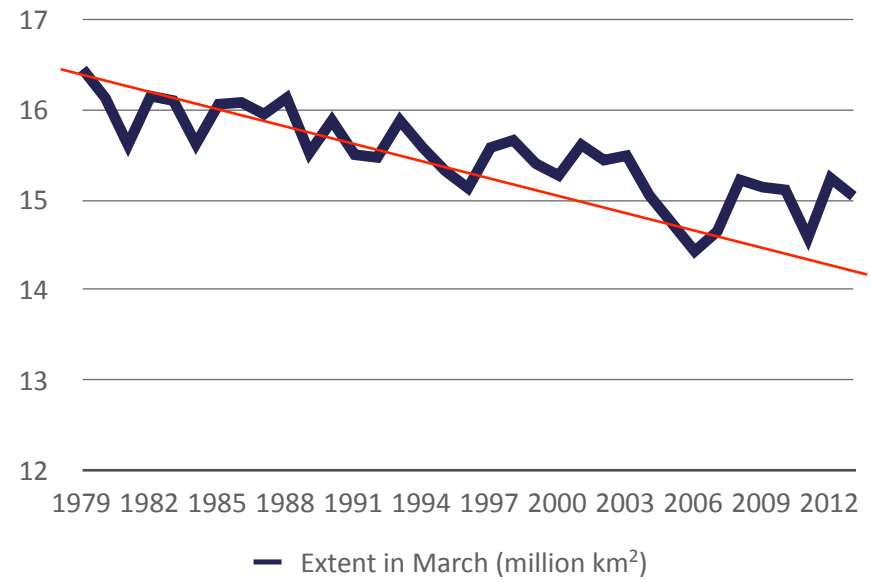
Melting sea-ice

Summer sea-ice extent in the Arctic Ocean has been reduced by about 40% on average since 1979, when satellite measurements started (Figure 5, left graph). Sea-ice has also become younger and thinner. The decrease in maximum extent in winter is only about 8% (Figure 5, right graph. See factsheet on *Climate Change in the Arctic* for details).

There is large annual variability since the thinning of the sea-ice makes it more vulnerable to annual weather events. With current trends of global warming, the Arctic Ocean will become ice free in mid-summer. When that might unfold is uncertain. The Inter-governmental Panel on Climate Change (IPCC) estimates around mid-century, but single models and outlooks show large variations in projected timing. This is an obstacle to long-term planning for shipping.

Figure 5: **Average Monthly Arctic Sea-Ice Extent in September and March 1979 - 2013**



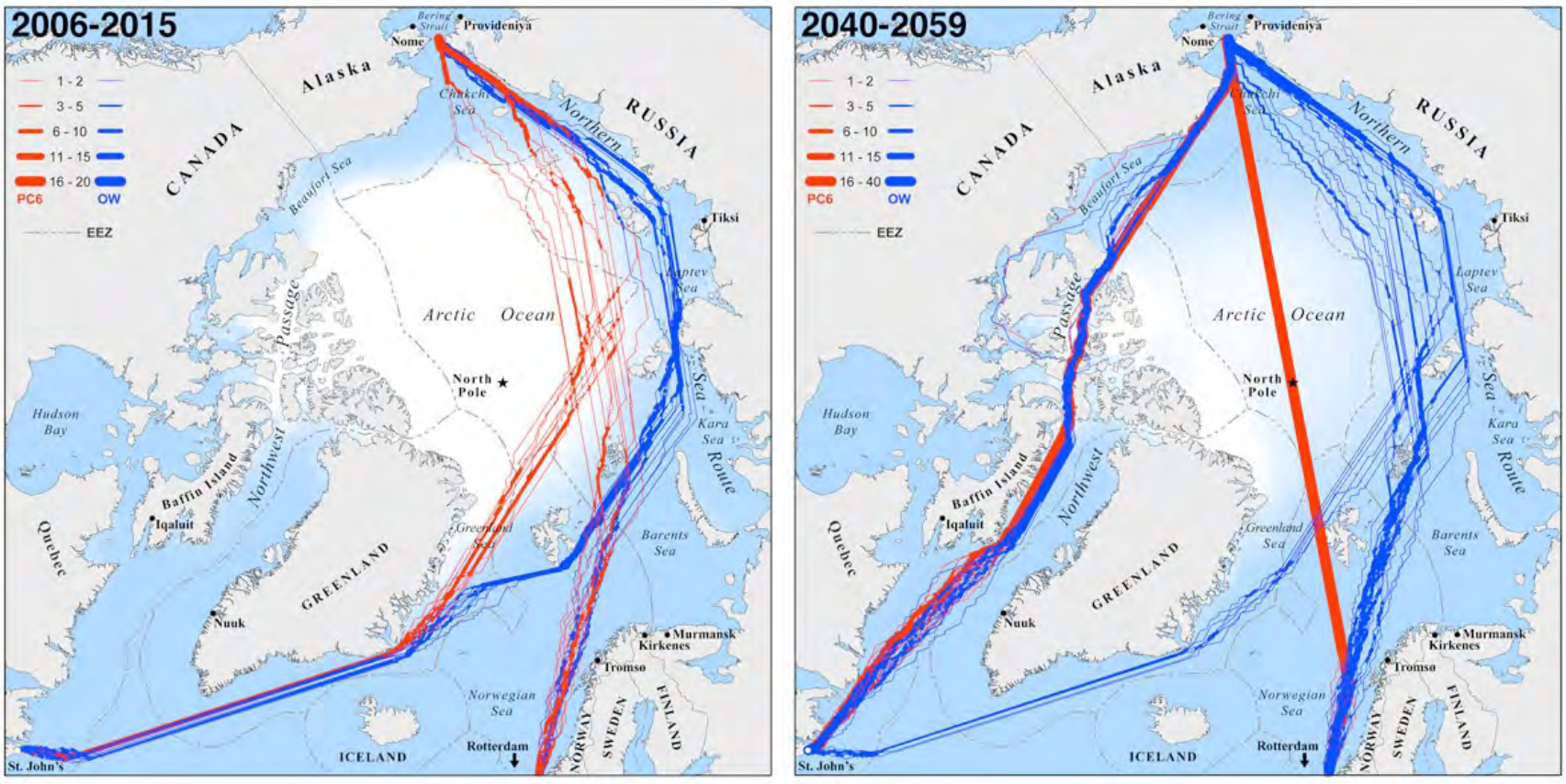


Source: National Snow and Ice Data Centre (NSIDC).

Reduction of summer sea-ice will extend the navigable spatial area and the season. Both the Northwest Passage and the Central Arctic Ocean route could become navigable under summer conditions by mid-century – or before (Figure 6).

Winter sea-ice will remain, but gradually be changed into first-year ice, which is thinner and easier to penetrate for a reinforced hull than multi-year ice. The occurrence of winter ice and drifting ice from glaciers means that ships will need to always be prepared to meet ice, even in summer.

Figure 6: **Modelled routes accessible for ships sailing in September between the Bering Strait and St. Croix, Canada and Rotterdam, Netherlands**



Note: The current period is on the left. The mid-century conditions under a modest climate scenario are shown on the right. Red routes are moderately ice-strengthened ships (Polar Class 6 - PC6 - International Association of Classification Societies); blue are ordinary (open water - OW) vessels. Source: Smith and Stephenson, 2013.

Overcoming the infrastructure deficit

Ports along the Northern Sea Route were closed and infrastructure deteriorated after the dissolution of the Soviet Union. Today the Russian Government wants to upgrade the services along the route, both for getting access to the resources of northern Russia and to facilitate an international sea route.Investments are being made in ports, search and rescue centres have been designated and a programme for investment in new icebreakers has been approved. Changes have also been made to legislation, tariffs and application procedures for foreign ships.

Much of the needed infrastructure that is related to accessibility, safety and environmental protection: hydrographic mapping; charts; meteorological service; ice services; communications; ship surveillance and reporting. Search and rescue services capable of serving huge areas must be developed. So must oil spill response capabilities and equipment. There is also a need to improve services along the routes for re-supply, repair and maintenance. A significant dilemma is who will finance the necessary upgrading of infrastructure.

Ship technology

Shipping technology for ice conditions has evolved, such as new propulsion systems, winterisation of equipment and work places, and concepts for oblique icebreakers. For example, the double-acting container vessel shown below can traverse up to 1.5 m thick ice and moves stern-first in ice and bow-first in open waters. Further technology advances are expected and may increase Arctic accessibility and safety margins. Investments in new ice-class vessels with modern technology are necessary to accommodate more Arctic maritime transport.

Availability of competent crew

Sailing in harsh Arctic waters puts the competence and endurance of marine crews to the test. Today there is a shortage of qualified sailors. Special skills must be achieved through education and training and will be more formalised in new standards (classification societies and IMO conventions).

Double-acting cargo vessel used for shuttle transport between Murmansk and Dudinka

Photo: Aker Arctic, *www.akerarctic.fi*.

Competition with other modes of transport

Maritime transport competes with – and interacts with – other modes such as pipelines, railways and river transport. Ships have an advantage for big volume bulk cargo while rail may be more interesting for high-value commodities.

Factors shaping transit shipping

Volume and direction of global trade flows

Macro-economic factors will shape the size and direction of trade flows globally and hence the tasks to be provided by the transport sector.

Reducing maritime transport costs

A primary driver is to cut transport costs as the competitiveness of the Arctic routes is assessed against other modes of transport (rail and pipeline) and other shipping routes, primarily the Suez Canal. Important factors include:

- **Size and draft restrictions:** Larger ships reduce costs per unit of cargo transported. Today's Arctic sea routes accommodate only limited ship sizes as they follow the shallow continental shelf and must pass through narrow straits. Reduced sea-ice will gradually allow more access to deep-water routes, as illustrated by possible future routes in Figure 6.

- **Combining multiple hubs and destinations en route:** Operational patterns, particularly for container shipping, use hub ports and intermediate stops to load/unload and redistribute cargo. These are dispersed along the traditional sea routes. Since there are no such services in the Arctic, even a full-year accessible Arctic route would face disadvantages to current shipping networks.

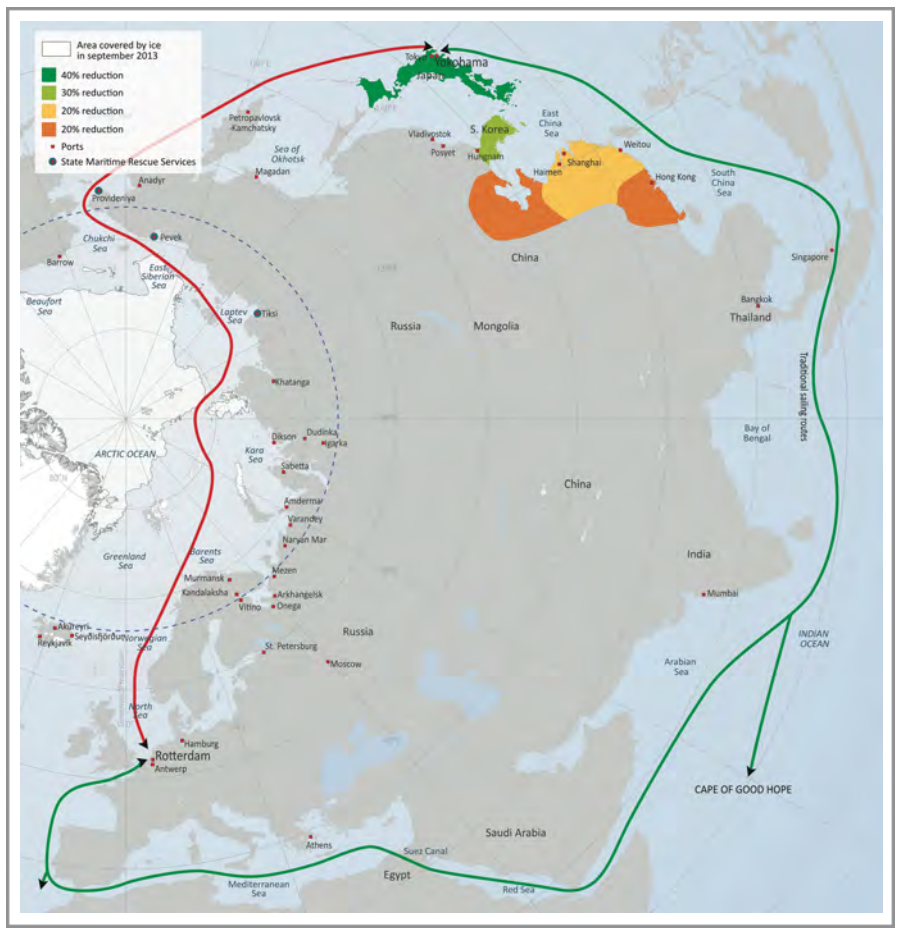
- **Predictability:** Container ships in particular are part of integrated logistical chains where arrivals must be "just-in-time". Sea-ice, weather conditions and navigational problems pose risks of delay in the Arctic. This will limit the viability of Arctic routes until more reliable services could be obtained.

- **Seasonality:** So far, the Arctic sailing season is limited to late summer. This makes the route less attractive for ships operating on fixed routes, such as much of the container shipping market, since they would have to change logistics twice a year as long as winters in the Arctic are not navigable. Most ship owners consider this an unattractive business condition. Operations where route flexibility is an option, for example spot market transports, may be able to take advantage of the late summer Arctic routes.

- **Distance and time:** Compared with transit via the Suez Canal, there are shorter distances for Arctic routes between ports in

northern Asia and Northern Europe (Figure 7). Nonetheless, speed is reduced when sailing in ice, so savings in distance may not deliver the same time savings. Sailing times in the Arctic also depend on weather conditions, regulatory approvals and waiting time for convoys or icebreakers.

Figure 7: **Distance Saving for Northeast Passage Compared with Suez Canal**



Source:DNV GL, Arctic Portal

- **Fuel costs:** Sailing shorter distances will save fuel. But breaking ice requires extra energy, as does moving a heavy, ice-reinforced ship that is not fit for plying open waters. On any route, fuel consumption can be decreased by slower speed.

- **Tariffs:** Ships using the Northern Sea Route pay tariffs based on the use of services such as ice pilotage and icebreakers. Ship owners also must pay tariffs in the Suez and Panama Canals.

- **Cost of ice-classified vessels:** Ice-classified ships are more expensive to build and to operate in open waters. Seasonal use of such vessels would add costs.

Impacts

Environment

- **Ship emissions affecting the environment and human health:** Ship emissions contain many gasses and particles with multiple effects caused by the original components and their further chemical reactions. Both nitrogen and sulphur components cause acidification that damage vegetation, freshwater fish and materials. Nitrogen also adds to the problem of excessive enrichment of nutrients in ecosystems, whereas surface ozone affects crop yields. These gases as well as black carbon (soot) have negative effects on health too. Several estimates have demonstrated that ship emissions significantly contribute to diseases and increased mortality globally.

- **Ship emissions and climate change:** Carbon dioxide, nitrous oxide and methane are long-lived greenhouse gasses emitted by ships that contribute to climate change. Black carbon has a warming effect in the atmosphere and when deposited onto white snow and ice surfaces by increasing the uptake of solar radiation and hence the melting. On the other hand, sulphur dioxide and probably also nitrogen oxides “to a lesser extent” have a cooling effect. The net global effect of current shipping emissions due to all gases has been shown to be an initial cooling on timescales of decades to centuries and thereafter a warming due to accumulation of the long-lived greenhouse gases, mainly carbon dioxide. Calculating the net climate effect of increasing Arctic shipping is not straightforward and depends on the scenarios envisaged and the time horizon.

- **Operational discharges:** The MARPOL convention bans or restricts emissions from ships. Still, oil residues, garbage, sewage and cargo to a limited degree may be legally discharged when diluted and away from shore.

- **Pollution from accidents:** Common pollution from an accident is the discharge of bunker oil. Tankers loaded with petroleum products may enhance the risk of oil pollution. Other toxic goods also may be problematic. Cleaning up oil spills in ice-covered waters is complicated. Little contingency equipment is deployed along the Arctic routes.

- **Introduced alien species:** Ships are the most common vector for introduced alien species from their ballast water tanks and hulls, and also in the cargo. Alien species may alter marine ecosystems and cause economic losses. Transports from the relatively species rich Pacific to the Atlantic along the same latitudes and hence temperatures may pose a particular risk.

- **Wildlife:** Noise, collisions and the mere presence of humans may disturb Arctic wildlife, *e.g*. birds and whales at chokepoints and in sensitive areas.

Economic and social impacts in the Arctic

- Upgrading of existing ports and construction of new ones entail substantial costs. Public investments in ports, maritime transport infrastructure, and search and rescue will require long-term government commitments even if done in partnership with the private sector.

- Increased demand for supply services for ships: bunkering, food supplies and repairs. Service operators currently active in the region may expand, whereas others may enter the Arctic market.

- Increased accessibility and lower transport costs could increase goods availability and decrease prices in remote settlements. This would directly benefit local communities and raise welfare levels.
- Improved transport could also lower the costs of export and import, thereby facilitating more trade with other (non-Arctic) partners. Manufacturing centres in the region may see an improvement in their competitive position if transport costs are lower.
- Whether or not Arctic regions will benefit from employment growth depends on the type of demand/skills needed and the available skill base. As the current Arctic population is small, the specific skills needed may not be present. Importing skilled labour from elsewhere (short term) or raising education levels/ tailor to the new needs (long term) would be necessary.
- More economic and social opportunities in Arctic port communities could stimulate migration from rural areas in the region, shifting local economies. This may create negative impacts both on the rural side (reduced population, eventually below levels that allow sustainable maintenance of public services like schools and healthcare) as well as in urban areas (lack of housing facilities, pressure on local infrastructure).
- The fact that the Arctic sea routes will remain seasonal for some time may mean that impacts are seasonal and poses issues about seasonal labour migration and off-season economic activities.

Governance and Stakeholders

The United Nations Convention on the Law of the Sea (UNCLOS) provides a fundamental framework for the governance of navigation. A coastal state has full rights to set the conditions for ships in its ports and internal waters, but less so in its territorial sea where ships enjoy the right to innocent passage and competent global organisations must be consulted. In exclusive economic zones (EEZ), navigation can mostly take place as it does in the high seas, under the principle of freedom of navigation. Then only the flag state has authority over a vessel, with the duty to enforce all customary laws and international conventions to which it is a party.

When the EEZ is ice-covered, article 234 of UNCLOS makes an exception to this general division of responsibilities. Then coastal states have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution. Canada and Russia have developed the most comprehensive regulations based on this article. Until ships can sail in the high seas along the Central Arctic Route (see Figure 1), Canadian and Russian rules to a large degree set the standards for ships operating in the high Arctic.

The International Maritime Organization (IMO) is the competent United Nations agency with responsibility for important regulations related to shipping globally. The Convention on the Prevention of Pollution from Ships (MARPOL) and the Convention on the Safety of Life at Sea (SOLAS) are prominent. IMO has been proactive in developing voluntary guidelines initially for ships in ice-covered waters and later adjusted for ships in polar waters (Arctic and Antarctic). These will be replaced by a mandatory Polar Code that is being negotiated in the IMO and is expected to be completed in 2014 and to come into force in 2016. The Polar Code will address issues such as ship design, equipment, manning and protection of the environment.

For the global shipping industry, the preferred option is to have uniform standards. This could be achieved both through the Polar Code and a harmonised set of national standards from the Arctic coastal states. Such regulations can also be strengthened by adding to existing port state agreements or creating new ones for the Arctic.

The Arctic Council influences Arctic shipping through assessments such as the Arctic Marine Shipping Assessment (2009) with follow-up activities and non-binding guidance for its member states. Moreover, under the auspices of the Arctic Council, eight Arctic states negotiated the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic and the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic.

How Changes in Arctic Maritime Transport May Affect the European Union

Changes in Arctic maritime transport may affect the European Union (EU) including in areas of economic significance for trade and consumption; ports and shipping companies; security and safety of transport opportunities; and environmental interests. The implications and their magnitude will depend on the pace and breathe of the changes and may differ for destinational and transit shipping. Selected potential effects are:

- Access to new trade routes.
- Access to new sources of natural resources at relatively close distance and from politically stable countries to enhance security of supply.
- Potential cost savings related to shorter shipping routes.
- Greater demand for ice-classified ships, icebreakers and related technology. This is a market in which the EU already has a significant position (primary due to Finnish companies and shipyards). Estimates of the annual potential for this market are EUR 500 million (Ecorys, 2012).
- European ship owners who want to operate in the Arctic may be expected to have a substantial part of future investments in ice-strengthened vessels, but also a share of the market to be served.
- Within Europe, the availability of a trans-Arctic shipping route may affect competition between ports.

European Union's Role in and Influence on Arctic Maritime Transport

Competence

Competence in the field of maritime transport is shared by the EU and its members. Member States cannot act in a manner detrimental to EU competence and interests. The EU has developed an Integrated Maritime Policy that includes the Arctic Ocean as a neighbouring basin. The European Commission and the European Maritime Safety Agency co-ordinate with the EU Member States within various IMO committees, where exclusively states can be members, on issues such as the Polar Code.

EU regulations on safety and environmental performance

EU regulations can influence Arctic shipping via requirements on vessels flying EU Member States' flags and through port state control. Relevant EU regulations include maritime safety and pollution prevention, ship inspection, traffic monitoring and surveillance and training for seafarers. Selected examples of EU maritime regulations that may be relevant for Arctic maritime transport include:

- Directive on vessel traffic monitoring and information making the Member States responsible for providing information on ice conditions, recommending routes and icebreaking services, and empowering them to request certification documents for ship's strength and power requirements commensurate with the ice conditions.

- Sulphur Directive, following MARPOL convention amendments, limits the sulphur content in marine fuels and would be relevant if emission control areas are established in Arctic waters (for example, as is the case in the Baltic Sea).

- Regulating the extent to which emissions from maritime traffic contribute to acidification, eutrophication and the formation of ground-level ozone.

Support improved infrastructure and services for Arctic maritime transport

EU policy documents express interest in supporting Arctic relevant maritime infrastructure. European institutions and companies have capabilities and knowledge relevant for Arctic navigation, exploration, meteorological services, satellite communication, and search and rescue. The Galileo satellite system can play an important role in improving navigation and developing search and rescue capacities. Surveillance is useful in tracking ships and oil spills. Systems that are supported by the EU include SafeSeaNet, CleanSeaNet, as well as Automated Identification System, and Long-Range Identification and Tracking.

Research

EU-funded research projects may support safety and environmental performance and understanding of the implications of changes in Arctic maritime transport. The EU also sponsors research on weather forecasting and improved ice condition predictions, Arctic marine ecosystems and impacts of shipping on Arctic ecosystems and livelihoods.

Icing of vessels due to sea spray is a serious challenge

Photo: LT William Mowitt, NOAA Ship OSCAR DYSON, National Oceanic and Atmospheric Administration / US Department of Commerce.

What is the Role of the European Union in the Arctic?

The European Union is a complex international actor. It has acquired a number of decision-making powers from its Member States and hence influences the content of their national legislation. Based on the European Economic Area Agreement, the EU also influences relevant legislation in Iceland and Norway. The EU also influences outcomes of international negotiations – including those of importance for the Arctic.

Only a small part of the territory of EU Member States - in northern Sweden and Finland – is located in the Arctic and the EU has no Arctic coastline. Nevertheless, EU regulations and actions, including research funding and regional policies, influence Arctic developments. Moreover, the EU is a major environmental and economic actor in the Arctic and has established a special relationship with Greenland.

Since 2008, relevant EU activities have been brought under a common umbrella of "Arctic policy". A communication in 2012 stresses three key aspects: knowledge – support for scientific research; responsibility – promoting the sustainable use of natural resources; and engagement – enhancing co-operation with Arctic partners.

Key Questions to Stakeholders Regarding Maritime Transport in the Arctic

1. **What are the main opportunities and challenges for maritime transport in the European Arctic?**
2. **In what ways will the European Union and its Member States be affected by changes in shipping in the Arctic?**
3. **What are the most important ways that the EU influences Arctic maritime transport and what actions should the EU take?**

Specifically:

- **In what ways could the EU participate in the implementation of the IMO Polar Code?**
- **How could the EU influence risk and contingency planning and implementation for maritime transport?**
- **What are the avenues by which the EU could contribute to strengthen and expand search and rescue services?**
- **How can the EU contribute to Arctic marine spatial planning in accordance with its own marine policy and strategy?**
- **Does the EU have a role or influence in the designation and establishment of marine protected areas in the Arctic?**

Selected References

Arctic Climate Change Economy and Society (ACCESS), Annual Report; Arctic Council (2009): *Arctic Marine Shipping Assessment*; Ecorys (2012), *Green Growth Opportunities in the EU Shipbuilding Sector*; Midgard, et al., (2012), *Shipping in the Arctic – data needs and available data*, Northern Research Institute; Smith, L. and S. Stephenson (2013), *New Trans-Arctic Shipping Routes Navigable by Mid-Century, Proceedings of the National Academy of Sciences.*

The chapter "Changes in Arctic Maritime Transport" in the final assessment report (see www.arcticinfo.eu) builds on this factsheet and on the stakeholder consultations conducted between October 2013 and February 2014.

Published in December 2013, Revised in May 2014.

Recommended citation: Strategic Assessment of Development of the Arctic (2014), 'Changes in Arctic Maritime Transport' [factsheet], - URL: www.arcticinfo.eu.

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