Chapter 4

CHANGES IN ARCTIC MARITIME TRANSPORT

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Key Messages:
• Shipping in the Arctic is increasing, mostly due to destination traffic linked to extraction of resources. This is expected to be the major factor for future traffic growth.
• Trans-Arctic shipping is emerging slowly. There are major constraints to its rapid expansion.
• Harsh natural conditions and serious lack of adequate infrastructure pose substantial risks.
• Major environmental issues are accidental oil spills, introduction of alien species, emissions to air and disturbance to wildlife.
• The EU may gain access to new resources, growing trade and economic benefits to ship owners and maritime industries.
• Measures must be taken before traffic builds up and as a prerequisite for harvesting the gains.

Recommendations to the EU:
• Improve the governance of Arctic shipping by supporting a Polar Code with high safety and environmental standards and additional measures to supplement it.
• Support the development of critical maritime infrastructure.
• Improve the knowledge needed for safer and environmentally responsible maritime activities.
“The Polar Code has no provisions related to Heavy Fuel Oil use or carriage regulation, mandatory ballast water or hull fouling requirements (concerning invasive species introduction) or black carbon restrictions. These are three of the most pressing and important matters concerning Arctic shipping, and the Code is severely wanting in all three areas.”

*Environmental NGO, US*

“There is a lack of sufficient infrastructure on communication, navigation and search and rescue, among others.”

*Respondent from the shipping industry, Norway*

“The most significant policy issues are to develop uniform shipping regulation that will be applied equitably throughout the Arctic Ocean.”

*Academic, US*

“The Arctic is a common natural heritage area, not the property of an individual country. It is the responsibility of the EU to take an active role in ensuring its protection to secure the ecosystem services that the Arctic provides.”

*Environmental NGO, Russia*

The quotes come from respondents to the online questionnaire – an element of the consultation process within the ‘Strategic Assessment of Development of the Arctic’

4.1 Introduction

The recent melting of the sea-ice and several highly publicised ship voyages in the Arctic have sparked greater interest in Arctic maritime transport. This chapter provides an overview of current traffic development, its drivers, impacts and relevance to the European Union.

4.2 Where Are the Ships Going?

There are two main sea routes in the Arctic Ocean today. The Northeast Passage (NEP) follows the coasts of Norway, Russia and Alaska. The major part of its Russian section is called the Northern Sea Route (NSR). The other traditional route is the Northwest Passage (NWP), which runs along the northern coast of North America. The Central Arctic Ocean Route in international waters is sparking interest as a future trans-Arctic transport corridor (Figure 4.1).

Figure 4.1: Arctic Maritime Transport Routes. Source: G. Sander/A. Skoglund, Norwegian Polar Institute, 2014.
Maritime transport along these routes can be:

- **Internal** for shipping between ports in the Arctic region, or for transport activities in the ocean area such as cruise tourism, research and transport related to fisheries, offshore oil and gas, etc.
- **Destinational** for all types of ships sailing to and from the Arctic.
- **Trans-Arctic** for traffic that uses the Arctic as a transport corridor between the Pacific and Atlantic Oceans.

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

Today the Northeast Passage/Northern Sea Route is the most attractive option due to the more favourable ice conditions and infrastructure available, including nuclear-powered icebreakers. The Russian government has high ambitions for the NSR both as a means of developing its northern regions and as an international trade route. In the NWP, the narrow sounds are more frequently clogged by sea-ice, the infrastructure for shipping is scant and there is no clear political commitment to develop the route. This chapter therefore focuses on the NEP/NSR.

### 4.3 What Changes Are Observed?

#### 4.3.1 Growth in Both Destinational and Internal Traffic in the Arctic

The Northern Sea Route was developed as 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 was opened for non-Russian flagged ships in 1991.

In recent years, the volume of cargo transported along the route has risen, though traffic has not reached the levels seen in the Soviet era (Figure 4.2). An emerging pattern is that Russian raw materials such as gas condensate and iron ore from the northwest are being exported eastwards directly to Asia.

Activity in the Northwest Passage is mostly linked to services for remote communities and a few mining projects. Most of the growth in traffic is accounted for by non-commercial craft such as yachts and Canadian government ships, not freight vessels.

**Figure 4.2: Total Annual Cargo Volumes on the Northern Sea Route. Data include intra, destinational and transit traffic.**

*Source: NSR Information Centre, 2013.*
4.3.2 Trans-Arctic Shipping is Emerging

The number of ships using the Northeast Passage as a transport corridor between Europe and Asia is on the upswing, though the numbers are still small (Table 4.1). In the Northwest Passage, the first bulk carrier transited the whole route in September 2013. Compared with the 18 000-20 000 ships that pass through the Suez Canal each year, Arctic shipping today holds 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.

<table>
<thead>
<tr>
<th>Year</th>
<th>NSR Transits</th>
<th>NEP Transits</th>
<th>NWP Transits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>4</td>
<td>2</td>
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</tr>
<tr>
<td>2010</td>
<td>5</td>
<td>1</td>
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<td>10</td>
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</tr>
<tr>
<td>2012</td>
<td>44</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2013</td>
<td>40</td>
<td>18</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4.1: Number of Arctic Transit Voyages by Freight Carriers, 2009-2012. Note that the numbers for NEP transits are lower than for NSR since NEP is a longer voyage (Figure 2.1). Sources: Midgard M, et al. (2009 - 2011); NSR Information Centre (2012, 2013). Numbers of NSR transits are lower than in original source because destinational voyages have been excluded.

4.3.3 Uneven Regional Developments of Cruise Tourism

Worldwide, the number of passengers carried by cruise ships has grown about 7% per year since 1990, and continued growth is expected¹. However, the passenger volumes in the Arctic vary from region to region, with Svalbard and Greenland having the largest number of cruise tourists (Figure 4.3). Cruise ships have become larger; the biggest vessels in Svalbard can carry 3 300 passengers. At the other end of the spectrum, the region is frequented by smaller expedition cruises using vessels carrying anywhere from five to 300 passengers. In Svalbard, this segment accounts for approximately 20 – 25% of the total number of visitors. In Franz Josef Land and Canada, the cruise market is significantly smaller and dominated by the smaller vessels.

Figure 4.3: Cruise Tourism in Some Arctic Areas by Number of Passengers

Source: Association of Arctic Expedition Cruise Operators based on data from the Governor in Svalbard, Visit Greenland, National Park Russian Arctic and NORREG

¹ Cruise Market Watch website at www.cruisemarketwatch.com
4.4 What Is Shaping Change in Arctic Maritime Transport?

Commercial ship operations in the Arctic will expand if they are safe, reliable and profitable. This is influenced by a number of framing conditions and drivers, some of them general for all operations, some of them specific, as summarised in Figure 4.4.

4.4.1 Drivers for Destinational Shipping

The rich natural resources of the Arctic, particularly energy and minerals, are increasingly being seen as a new source for meeting growing global demand. Shipments are needed to deliver goods and equipment for exploration and production, and to export the products.

Turmoil in some resource-producing regions such as the Middle East increases the relative attractiveness of the Arctic as a secure source region. On the other hand, the costs of exploiting Arctic resources are often higher than elsewhere. At least in the near term, this may leave Arctic resources largely unexploited (see other chapters). Though quantitative estimates of resource exploitation and their timing are uncertain, increased activity is expected, thereby leading to growth in destinational traffic.

4.4.2 Shaping Elements Common for Destinational and Transit Shipping

Melting sea-ice

The extent of the summer sea-ice in the Arctic Ocean has decreased by about 40% on average since 1979, when satellite measurements started. The decrease in winter is only about 8% (Figure 4.5). Sea-ice has also become younger and thinner. There is large variation between years since the thinning makes the sea-ice more vulnerable to weather events.

In light of the current global warming trend, the Arctic Ocean is likely to become nearly ice-free in summer. It is uncertain when this will happen. The IPCC has estimated before mid-century for a scenario of comparatively high greenhouse gas concentrations (RCP 8.5), but states...
that it is not possible to make such projections with confidence for other scenarios.\(^2\)

The large variations in sea-ice conditions between summer and winter, and between years, and the uncertainty in predicting sea-ice on all time scales, complicate the planning of shipping operations.

Reduction of summer sea-ice will expand the navigable area and extend the season. Both the Northwest Passage and the Central Arctic Ocean route could become navigable under summer conditions by mid-century, or even earlier (Figure 4.6). Winter sea-ice will remain, but will gradually be replaced by first-year ice, which is thinner and easier to penetrate for a reinforced ship hull than multi-year ice. The occurrence of winter ice and drifting ice from glaciers in addition to icing from sea spray means that ships will need to always be prepared for ice, even in summer.

**Overcoming the infrastructure deficit**

There are severe shortcomings to the Arctic marine infrastructure. Hydrographic surveys are needed to improve nautical charts. Better navigational aids, communication systems, ship surveillance and reporting together with better meteorological and ice services are also needed to improve safety of navigation. Search and rescue services capable of serving huge areas must be developed. Protection of the environment requires oil-spill combating equipment that works in ice-infested waters, designation of “places of refuge” and port reception facilities for ship waste. There is also a need to improve services along the routes for bunkering, repair and maintenance. A significant dilemma is who should finance the necessary infrastructure.
The Russian government wants to upgrade the services along the NSR, which decayed after the dissolution of the Soviet Union. Investments are being made in ports, search and rescue centres have been designated and a programme for investments in new icebreakers has been approved. Changes have also been made to legislation, tariffs and application procedures for foreign ships.

**Ship technology**

Shipping technology for ice conditions has evolved, with advances in areas such as new propulsion systems, winterisation of equipment and workplaces, and concepts for oblique icebreakers. For example, the double-acting container vessel shown in picture 4.2 can traverse ice that is up to 1.5 m thick, 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 and increases the risks of fatigue, injuries and lower decision-making capacity. Today there is a shortage of qualified sailors. Special skills must be achieved through education and training and will be more formalised in new international standards.

**Interlinkages and competition with other modes of transport**

Maritime freight transport competes with – and interacts with – other modes of transport. For transporting Arctic oil and gas, ships or pipelines are the main alternatives. However, railways, waterways and trunk pipelines are used internally in Russia for transport to the coast, where oil is loaded onto ships for export. Similar chains of transport ending up in ships are common in Arctic mining, whereas fish may be exported via ship, train, trucks or planes.

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The Trans-Siberian Railway and a few other rail connections are alternatives to shipments between Asia and Europe, particularly from inland areas. Trains seem to offer faster connections for containers, but at higher costs, making railways an appealing alternative for high-value commodities.¹

4.4.3 Shaping Elements for Transit Shipping

**Volume and direction of global trade flows**

Macroeconomic factors will shape the size and direction of trade flows globally and hence the demand for transport.

**Reducing maritime transport costs**

Cutting transport costs is a primary driver. The competitiveness of the Arctic routes is assessed against other modes of transport 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 greater access to deep-water routes (ref. Figure 4.6).

- **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 compared to current shipping networks.

- **Predictability**: Container ships in particular are part of integrated logistical chains where goods must arrive "just-in-time". Variable sea-ice and weather conditions and navigational challenges pose risks of delays in the Arctic. This will limit the attractiveness of Arctic routes until more reliable services can be established.

- **Seasonality**: Thus far, the Arctic sailing season is limited to late summer. This makes the route less attractive for ships operating on fixed routes, as is the case with much of the container market, since they would have to change logistics twice a year as long as the Arctic winter is not navigable. Most ship owners so far have considered this an unattractive business proposition.² 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**: For transits between ports in northern Asia and northern Europe, the distances through the Arctic are shorter than via the Suez Canal; further south, the Suez route is shorter (Figure 4.7). 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 times for convoys or icebreakers.

- **Fuel consumption**: Sailing shorter distances saves fuel. Breaking ice, however, requires extra energy. So does moving a heavy, ice-reinforced vessel with a hull and propulsion system optimised for ice when sailing in open water. This is a disadvantage, particularly for Polar class vessels, whereas the design of ships with a lower ice class strikes a compromise between ice and open water requirements.

“Slow steaming” has become increasingly accepted as a way of reducing the energy costs of individual vessels, though not necessarily for a whole fleet. One implication is that delays in the Arctic may not pose the same disadvantage compared to the Suez route as under normal modes of sailing.

- **Costs of ice-classified vessels**: Ice-classified ships are more expensive to build, particularly Polar class vessels. The extra fuel consumption also adds to the operational costs. Since vessels that are specialised for operations in heavy ice will not be competitive in worldwide trade, the outcome might be that they would only be in seasonal use unless combinations are found, such as operating in the Baltic in winter and the Arctic in summer. Suspending operations for a season adds negatively to the costs.

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

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4.5 Outlook to 2030

Many Arctic voyages are still trial shipments to test the viability of new routes and destinations, types of ships and technology, and safety schemes. The Arctic Marine Shipping Assessment in 2009 projected that the main increase in maritime transport in the next decade would be destinational rather than trans-Arctic. This still seems to be a sound outlook. Within this broad picture, what types of shipping will grow and when, where and to what extent, will depend on the activities in different industries: mining, offshore oil and gas, tourism and scientific research, among others (see outlooks in other chapters).

Future Arctic transit traffic crucially depends on its attractiveness to container ships, which account for the largest share of global marine shipments. The few models used to project Arctic transits involve a high degree of uncertainty, but generally indicate that the number of ships will be rather modest. For example, DNV has estimated that the number of transit voyages with container ships will amount to 450 in 2030 and 850 in 2050.7

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7. Det Norske Veritas (DNV), 2010: Shipping across the Arctic Ocean. A feasi-
4.6 Impacts

4.6.1 Environment

**Ship emissions affecting the environment and human health**

Ship emissions contain many gases and particles with multiple effects caused by their original components and subsequent chemical and physical reactions (Figure 4.8). Both nitrogen and sulphur components cause acidification that damages 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 and soot (black carbon) have negative effects on health, too. Several estimates have demonstrated that ship emissions significantly contribute to diseases and increased mortality globally.8

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**Ship emissions and climate change**

Carbon dioxide (CO₂), nitrous oxides (NOx) and methane (CH₄) are greenhouse gases that result from ship emissions and contribute to global warming. Soot has a warming effect both in the atmosphere and when it is deposited onto white snow and ice surfaces. On the other hand, other shipping emissions have a cooling effect (e.g. sulphur dioxide that forms aerosols). The net global effect of shipping emissions has been shown to be an initial cooling on timescales of decades to centuries and thereafter a warming due to accumulation of long-lived greenhouse gases, mainly carbon dioxide.9 Calculating the net climate effect of growth in Arctic shipping is not easy and depends on the scenarios envisaged, the time horizon and location of emissions. However, emissions of short-lived climate pollutants in the Arctic have a stronger effect than at more southern latitudes, meaning that the warming effect of moving traffic may increase despite the shorter routes.10

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Operational discharges

The Convention on the Prevention of Pollution from Ships (MARPOL) restricts emissions from ships. Nevertheless, oil residues, garbage, sewage and cargo may be legally discharged when diluted and away from shore.

Pollution from accidents

Common pollution resulting from an accident is the discharge of bunker oil. Tankers loaded with petroleum products may cause much larger discharges, whereas other toxic goods on board may also pollute. Cleaning up oil spills in ice-covered waters is even less effective than in open waters.

Introduced alien species

Ships are the most common vector for introducing alien marine species to other ecosystems, not only from ballast water tanks and hulls, but also from 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 temperature gradients may pose a particular risk. Warming of the Arctic Ocean reduces the temperature barriers that have prevented species survival en route.12

Wildlife

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

4.6.2 Economic and Social Impacts in the Arctic

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

- Increased demand for supply services for ships like bunkering and repairs. This will favour service operators currently active in the region, 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 might see an improvement in their competitive position if transport costs were 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/tailoring skills to the new needs (long term) would be necessary.

- More economic and social opportunities in Arctic port communities could stimulate migration from rural areas, causing shifts in local economies. This may have negative impacts both on the rural side (reduced population, possibly below levels that allow sustainable maintenance of public services like schools and healthcare) and in urban areas (lack of housing facilities, pressures on local infrastructure).

- The fact that the Arctic sea routes will remain seasonal for some time may mean that impacts are seasonal. This poses issues about seasonal labour migration and off-season economic activities.

4.7 Governance

The United Nations Law of the Sea (LOS) Convention provides a fundamental framework for the governance of navigation, also in the Arctic.13 A coastal state has full rights to set the conditions for ships in its ports and internal waters, but has less authority in its territorial sea where ships enjoy the right to innocent passage (Figure 4.9). In the exclusive economic zones (EEZ), navigation can mostly take place under the principle of freedom of navigation, as on the high seas. Under this sailing regime, the main rule is that only the flag state has authority over a vessel, with the duty to enforce customary laws and all international conventions to which it is a party.

When the EEZ is ice-covered, Article 234 of the LOS Convention 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 and their drawing of baselines whereby parts of their maritime areas are designated as internal waters.14 Until ships can sail on the high seas along the Central Arctic Route (Figure 4.7), Canadian and Russian rules to a large degree set the standards for ships operating in the high Arctic.

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The International Maritime Organization (IMO) is the specialised United Nations agency responsible for important regulations related to maritime safety and environmentally sound and efficient shipping. The MARPOL Convention and the Convention on the Safety of Life at Sea (SOLAS) are prominent results of its work. The IMO has been proactive in developing voluntary guidelines, initially for ships operating in Arctic waters, later adjusted for ships in polar waters (Arctic and Antarctica). These will be replaced by a mandatory Polar Code that is being negotiated in the IMO and is expected to enter into force in 2016. The goal is to provide for safe ship operation and prevention of pollution from ships by addressing risks in polar waters that are not adequately mitigated by other IMO instruments.

For the global shipping industry, the preferred option is to have uniform Arctic standards. This could be achieved through the Polar Code, but also by means of a harmonised set of national standards from the Arctic coastal states. Uniform regulations can also be strengthened by adding to current relevant port state agreements – the Paris and Tokyo Memoranda of Understanding (MoU) – or creating a new one for the Arctic region.\(^\text{15}\)

The Arctic Council influences Arctic shipping through assessments such as the Arctic Marine Shipping Assessment with follow-up activities and non-binding guidance for its member states.\(^\text{16}\) 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.

### 4.8 How Changes in Arctic Maritime Transport May Affect the European Union

Changes in Arctic maritime transport may affect the economic, political and environmental interests of the European Union (EU). Their implications and magnitude will depend on the pace and extent of the changes and may differ for destinational and transit shipping. Some potential effects are:

- Access to trade routes.
- Access to new sources of energy and other natural resources at relatively close distances from politically stable countries, serving to enhance security of supply in line with EU policies regarding raw materials and energy security.
- Potential cost savings related to shorter shipping routes, contributing to lower logistics costs for the European economy.
- Greater demand for ice-class ships, icebreakers and related technology. This is a market in which the EU already has a significant position, primarily companies and shipyards in Finland. Estimates of the


annual potential for this market amount to EUR 500 million.\(^\text{17}\)

- European ship owners who want to operate in the Arctic may be expected to have a share of the market to be served as well as substantial shares of the required investments in ice-strengthened vessels.

- Within Europe, the availability of a trans-Arctic shipping route may affect competition between ports.

### 4.9 How the European Union Influences Arctic Maritime Transport

#### 4.9.1 European Union International Activities

Competence in maritime transport is shared by the EU and its member states. Member states cannot act in a manner that is detrimental to EU competence or interests, or adversely affect the effective implementation of EU policies. In areas where the EU internally regulates maritime transport, the EU also acquires external competence. This means that member states cannot act internationally without taking into account established EU policies and common positions.

This is relevant for instance in the IMO, where the EU is not a member, but its member states are. Due to extensive EU regulations on shipping-related issues, the European Commission and the European Maritime Safety Agency co-ordinate with the member states in the IMO committees, for example with regard to the Polar Code. As the co-ordination involves 28 out of 170 members of the IMO and represents considerable tonnage, the EU has significant influence. It is thus a potentially strong mechanism for EU influence to co-ordinate positions in the IMO and other international organisations that can set conditions relevant for Arctic shipping. The EU clearly supports the development of a strong mandatory code, but attempts to balance the interests of ship operators with concerns for the environment and safety.\(^\text{18}\)

Within the Arctic Council, the EU has been active in the Protection of the Arctic Marine Environment (PAME) Working Group, contributing substantial input to a number of topics particularly from the European Commission’s DG Mobility and Transport. The European Maritime Safety Agency and PAME are currently exploring possible areas of co-operation.

The EU has also developed an Integrated Maritime Policy that includes the Arctic Ocean. It is one of the sea basins for which a separate policy is to be developed.

#### 4.9.2 EU Regulations Affecting Flag State and Port State Measures

Many ships traversing Arctic sea lanes are either owned by companies based in Europe or have European ports of departure or destination. The EU member states therefore can influence Arctic shipping via requirements on vessels flying their flags and through port state control. The European Union affects this when setting common standards that the member states must follow.

The EU has developed a comprehensive regulatory framework regarding shipping safety and environmental standards, in particular in the aftermath of major accidents.\(^\text{19}\) Relevant EU regulations include maritime safety and pollution prevention, ship inspection, improved flag state performance, liability of carriers and training of seafarers. Selected examples that may be relevant for the Arctic are:

- The directive on vessel traffic monitoring and information system\(^\text{20}\) is one of few EU regulations referring directly to sea-ice. Member states are required to provide information on ice conditions, recommend routes and icebreaking services, and request certification documents commensurate with the ice conditions.

- The directive on sulphur in marine fuels limits the maximum content according to MARPOL requirements.\(^\text{21}\) Additional legislation affects maritime emissions that contribute to acidification, eutrophication and the formation of ground-level ozone.\(^\text{22}\)

- The EU framework for port state control is mainly the 2009 directive, which builds on the Paris MoU.\(^\text{23}\) The Paris MoU includes a new inspection regime for all ships calling at MoU ports seen as a whole instead of the previous goal of controlling 25% of ships calling at the ports of an individual state. The European Maritime Safety Agency hosts an information system for selecting which ships should be inspected in Europe.\(^\text{24}\)

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4.9.3 Supporting Improved Infrastructure and Services for Arctic Maritime Transport

EU policy documents express interest in supporting Arctic-relevant maritime infrastructure. For instance, the Galileo satellite system, whose first services are expected to be introduced in 2014, will increase the accuracy of satellite-based positioning in the Arctic, thereby making Arctic navigation safer. Galileo also has a dedicated search and rescue function that will locate ships in distress more efficiently.

The Copernicus earth observation programme is soon to enter the operational phase. This will increase observation capabilities in the Arctic and could provide a wide array of improved services like more accurate meteorological data, better ice forecasts, detection of oil spills and increased understanding of many climatic and environmental issues.

Surveillance is useful in tracking ships and has multiple applications in preventing collisions and monitoring whether ships discharge oil or engage in illegal fishing, for example. The EU has developed SafeSeaNet and CleanSeaNet and given practical support to IMO initiatives such as Automatic Identification System (AIS) and Long-Range Identification and Tracking. Satellite-based AIS is necessary for the Arctic marine areas where terrestrial AIS cannot cover vast ocean areas.25

4.9.4 Research

EU-funded research projects inter alia help to support the safety and environmental performance of Arctic shipping and improve the understanding of its driving forces and implications. Annex 2 contains several relevant examples of projects.

4.9.5 Indirect Effects of EU Regulations and Policies

The EU can have indirect effects on the volume and pattern of maritime transport in Arctic waters via other policies and actions. Examples include general transport policies, engagement in Arctic resource development and trade or consumer-related actions that affect the demand for Arctic resources.
4.10 Critical Factors for EU Decision-making

Stakeholders were asked during consultations about the most important factors for EU policy-making related to Arctic maritime transport. The responses show strong interest in issues that can be clustered into three areas that constitute key challenges.

4.10.1 Minimising Risks in Arctic Shipping

The Arctic is a frontier region for shipping. Sea-ice and environmental conditions such as polar lows, temperatures and darkness are challenging. There is scant infrastructure to service maritime transport. Vast areas must be covered by search and rescue capacities and preparedness to cope with accidents and incidents. Seafarers with sufficient training are scarce. Discharges of oil and the introduction of alien species are environmental risks of particular concern. These additional risks must be overcome for Arctic shipping to become safe and secure.

4.10.2 Insufficient Governance System

The governance of Arctic shipping should be improved. There is a clear recommendation from stakeholders to focus on international regulations, highlighting the Polar Code in particular. Concerns have been expressed about whether its standards will be sufficient to safeguard the Arctic and whether the full suite of environmental issues will be addressed. Another concern was the need to ensure uniform regulations and harmonised standards (“level playing field”).

4.10.3 Need for Supporting Research, Data Collection and Technology Improvements

Stakeholders emphasised many outstanding science questions that need to be addressed to underpin safe and efficient shipping and better governance. The key topics they identified are better mapping and understanding of environmental conditions, better predictions of ice and weather conditions, better knowledge about the impacts of Arctic shipping and how to address them, and technological developments to boost safety and reduce the environmental footprint of ships.

4.11 Recommendations

The following recommendations are built on analyses carried out by the report authors, taking input from stakeholders as a starting point. Though structured under three headings, there are overlaps and inter-linkages. It is emphasised that measures to improve the regulation of Arctic shipping and develop maritime infrastructure must be taken before the traffic increases to levels that may pose unacceptable risks to safety and the environment. That is also a prerequisite for taking advantage of the economic gains that Arctic shipping may bring.

4.11.1 EU Contribution to Good Maritime Governance

The EU could use its influence in the IMO to show leadership in Arctic maritime transport. The Polar Code is by far the most important current process. The EU should develop unified positions to support high safety standards and effective measures against pollution.

The EU should also address issues that are not taken care of adequately in the Polar Code:

- Invasive species are an increasing risk to Arctic ecosystems as traffic grows and the Arctic Ocean becomes warmer. The global Ballast Water Convention needs additional ratifications to enter into force. The EU should urge all its member states to become parties and to implement it.²⁸ Urgent

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²⁸. See IMO status of ratifications, [http://www.imo.org/About/Conventions/](http://www.imo.org/About/Conventions/)
action is also needed on measures to prevent the introduction of invasive species via ship hulls. Another option is to support regional measures in the Arctic, by means of either the early implementation of the convention in a similar way as for European seas or co-ordinated measures based on port and coastal state jurisdiction.

- The IMO addresses emissions from ships to air as a global issue through MARPOL annex VI, partly motivated by its Arctic impacts. However, the Arctic states and the EU should also consider a regional approach by establishing an IMO Emission Control Area within the Arctic Ocean. Research so far indicates that short-lived climate forcers emitted in the Arctic atmosphere have a stronger impact than elsewhere, which could justify a regional approach.

- Measures pertaining to heavy fuel oil are currently discussed in PAME in the Arctic Council. The EU should follow these discussions and be active in finding solutions that could reduce this risk to the marine environment.

The Polar Code and other IMO instruments will be important for ensuring a level playing field for all operators. The EU should also support recommendations from the Arctic Council with a view to harmonising Arctic coastal state regulations. This will be an emerging issue when the Polar Code is adopted and its standards can be compared to the existing coastal state regulations. The EU could also strengthen joint Arctic regulations, both by IMO and the Arctic coastal states, by supporting their inclusion in the Paris MoU.

The EU and the Arctic Council share the goal of basing their ocean policies on ecosystem-based management. Themes for collaboration could include exchange of experience in this field and marine spatial planning including marine protected areas. Designation of ecologically sensitive sea areas and marine protected areas for the Arctic are also brought up in OSPAR and the Convention on Biological Diversity, where the EU could support relevant developments.

Stakeholders also highlighted the need for fostering effective cross-border co-operation on Arctic maritime transport, particularly stepping up collaboration with Russia and Nordic countries.

### 4.11.2 Minimising Risks by Developing Improved Maritime Infrastructure

Ship accidents in the Arctic may have severe consequences for humans, ships and the fragile environment. Prevention of accidents and incidents therefore should have the highest priority. At the same time, response capabilities for search and rescue and oil spills must be improved. However, such systems cannot be realistically expected to deliver the same level of protection as in more densely trafficked seas. A ship’s readiness in the Arctic will therefore depend largely on its own resources; ship operators must carefully assess the risks of operations and select the equipment and procedures necessary for avoiding problems and handling them on their own if they should occur. Large cruise ships are probably the most prominent example.

Reducing risks will require better maritime infrastructure. The Arctic coastal states are responsible for improvements in their ports and many services in their waters. They have also taken on major responsibilities for search and rescue operations in the whole Arctic marine area, including the high seas. This responsibility entails a high financial burden. The European Commission has signalled its willingness to collaborate with the Arctic countries in this respect. Possible mechanisms include bilateral collaboration, partnership agreements with Greenland and the Northern Dimension. Such EU contributions to improved infrastructure and services gained strong support from stakeholders involved in the SADA dialogue.

There will be a need for international collaboration on much of the maritime infrastructure. It is suggested that the EU and its member states may contribute with:

- The Galileo and Copernicus programmes: The challenge for the EU is to develop better services for

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30. See: “Joint Notice to Shipping from the Contracting Parties of the Barcelona Convention, OSPAR and HELCOM on: General Guidance on the Voluntary Interim Application of the D1 Ballast Water Exchange Standard by Vessels Operating between the Mediterranean Sea and the North-East Atlantic and/or the Baltic Sea. (Agreement 2012-04)”. Such regional arrangements are encouraged by the Ballast Water Convention. However, these guidelines are voluntary, which seems to have limited their application.

31. Recommendation I C in Arctic Marine Shipping Assessment (ibid).

32. The Arctic Search and Rescue Agreement divides the responsibility between six coastal states.

33. EU (2012). Developing a European Union Policy towards the Arctic Region.
the maritime community based on these satellite platforms and find ways of sharing the information with other systems.

- A common monitoring system for ships in the Arctic providing an overview of ships and cargo transport en route would improve safety. SafeSeaNet could be one model for such collaboration.

- Supporting wider operational networks of meteorological and oceanographic observations and communication of weather, ice and wave forecasts.

- Supporting the coastal states in their hydrographic mapping by using merchant vessels as observational platforms. Ships can also collect and share data on meteorology and ice, for instance.

- Supporting targeted technology innovation to advance ship design and operation to improve efficiency and safety, and to reduce emissions.

- Supporting training on Arctic conditions for seafarers within the EU.

- Working with industry to disseminate best practices in Arctic marine shipping and transport.

- Pooling of resources for search and rescue and oil spill prevention with European states and agreements in areas bordering the Arctic. CleanSeaNet is an example of a European system that could be used as a model.

### 4.11.3 Better Knowledge through Research, Monitoring and Assessment

The EU and its member states have long-standing engagement in Arctic research. There is a need for a better understanding of the region’s environmental conditions:

- Observational data should be shared in the scientific community and be made easily available for ships. The EU countries have practical solutions that could be useful for Arctic collaboration.\(^34\) Research is needed to advance predictive capabilities and develop forecasting services.

- EU mapping and research could also contribute to identifying valuable and vulnerable areas as a basis for establishing marine protected areas.

- Improve knowledge about the Arctic-specific environmental impacts of shipping and what may be done to address them efficiently. Steps should be taken to determine which species are actually being carried by ships and how they survive en route. This information should then be used in risk assessments, supplemented by targeted baseline inventorying. Better technologies for cleaning hulls and ballast water under low temperatures are also needed. Impacts of ship emissions on the Arctic atmosphere need more attention. There is also a need to improve knowledge of the Arctic-specific impacts of discharges of oil and other harmful substances, and improvements in abatement technologies.

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\(^34\) One example is the European Environment Information and Observation Network (EIONET) of the European Environment Agency, [https://www.eionet.europa.eu/](https://www.eionet.europa.eu/)

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**Maksim Gorkij Accident in 1989**

The cruise ship Maksim Gorkij hit an ice floe SW of Svalbard in perfect weather 19 June 1989 and sprang a leak. A Norwegian coast guard vessel happened to be just 4 hours away. When arriving, almost 400 passengers had been evacuated, some of them waiting for rescue on ice floes. Due to a series of fortunate circumstances, all 954 passengers, the crew and the ship were salvaged.
There are also needs for many technological developments. Stakeholders have suggested working with states and the maritime industry towards achieving zero-waste and zero-emissions targets. Shipping technologies could be improved on issues like hull design, energy efficiency, new fuels and winterisation. Ships should be supported with better systems for communication under high Arctic conditions, tracking and assistance in voyage planning.

Stakeholders agreed that there is a need to follow the drivers behind Arctic shipping, such as developments in extractive industries and competition with other sea routes. While this could be a task for strategic collection of information, it also involves research questions of understanding the importance of different drivers and using this information to predict future developments in Arctic marine transport.