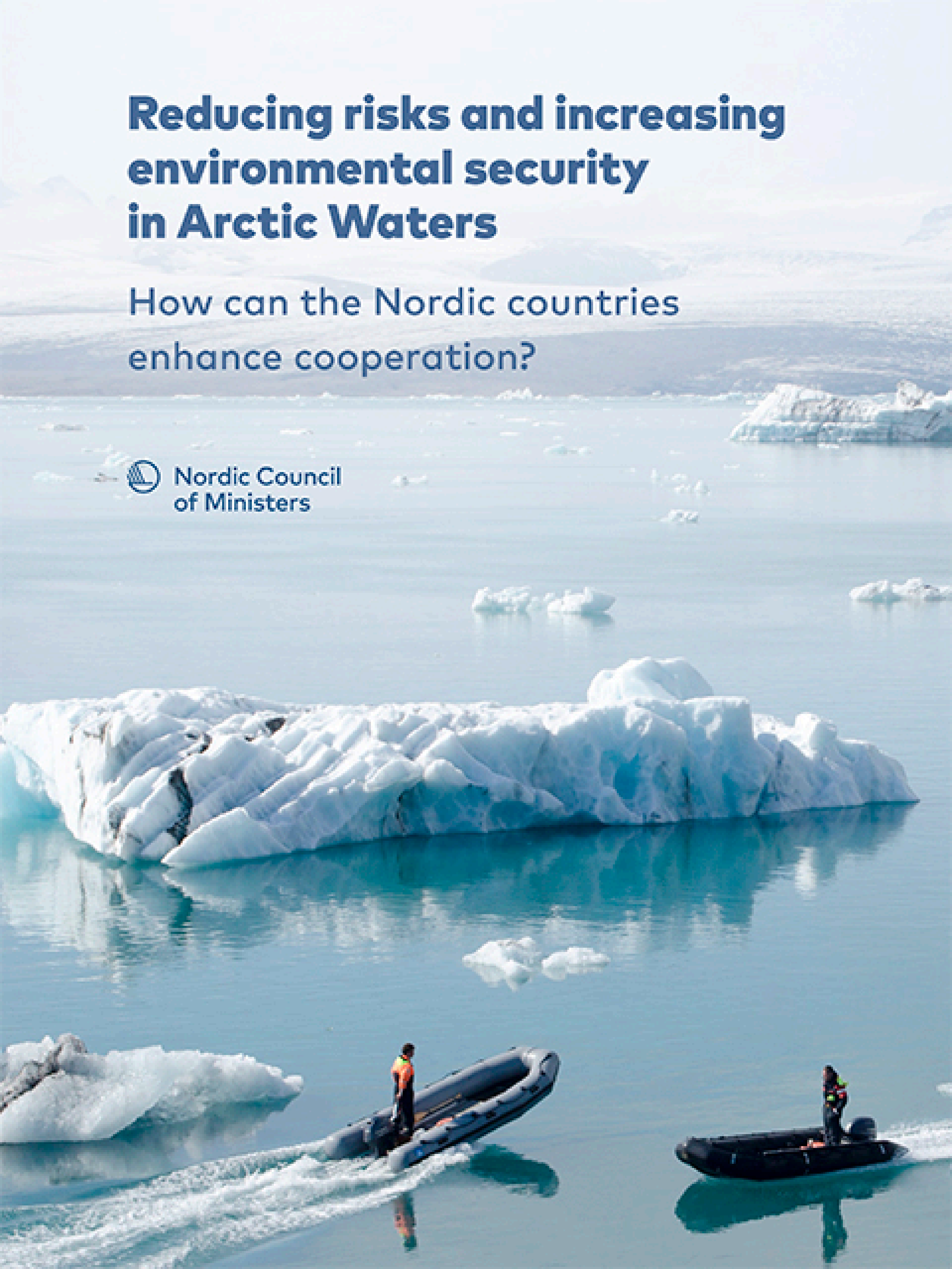
Reducing risks and increasing environmental security in Arctic Waters

How can the Nordic countries enhance cooperation?

Nordic Council of Ministers



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Executive Summary and recommendations

The Arctic is undergoing rapid climate change, and the shrinking sea ice opens up possibilities of exploring more of the Arctic Ocean for economic development, including new sea routes. Maritime activity and particularly commercial shipping, including cruise ship tourism, cargo transportation and fishing vessels, is projected to increase substantially. There are evident risks to human safety and environmental security related to an increase of shipping in the Arctic. The most evident risks associated with Arctic shipping include carriage and transport of Heavy Fuel Oil (HFO) and toxic hybrid fuel oils, use of HFO and atmospheric emissions, ecological impacts by invasive species and inadequate SAR capability and capacity. Failure to mitigate these risks in an adequate manner may result in accidents and natural disasters, with serious implications for human safety and environmental protection. Sustainable shipping is an integral part of the solution to counter climate change within and beyond the Arctic region. Mitigating the risks in relation to shipping is therefore fundamental in ensuring sustainable, economic development in the Arctic.

As Arctic states, the Nordics play a significant role in shaping the future of the Arctic. In order to do so, there is a need for enhanced Nordic cooperation to strengthen the work on Arctic affairs. Enhanced cooperation should take place within the frameworks of existing structures and forums to avoid unnecessary duplication of existing structures in the Arctic. Accordingly, the Nordics should enhance inter-Nordic cooperation through existing Nordic bodies as well as the AC and IMO. Proposed initiatives for enhanced Nordic cooperation within these structures include joint strategies with allocated budgets and increasing formal coordination (i.e. between Nordic AC and IMO representatives) in order to align national priorities, voting and statements into joint initiatives to enhance Nordic influence in Arctic affairs. It is recommended that these priorities focus on mitigating risks in Arctic shipping, as identified by this report. The most effective measure to mitigate these risks is by reinforcing the regulatory framework of the IMO, particularly the Polar Code, which is insufficient to accommodate the projected increase in Arctic shipping. According to the results of this research, a revised Polar Code, which enforces mandatory requirements on all vessels voyaging in the Arctic, including "non-SOLAS ships", is fundamental to accommodate the challenges and risks related to increasing shipping in Arctic waters. Besides these overall initiatives for enhanced Nordic cooperation within Arctic shipping, the various chapters consistently point to places and areas where the Nordics can push an agenda or create added value when it comes to reducing risks and increasing environmental security in the Arctic.

As a part of the 2018 budget negotiations for the Nordic Council of Ministers, the Nordic Council- the cooperation of Nordic Parliamentarians, instructed the Nordic of Ministers to commission a report looking at security and environmental aspects of shipping in Arctic waters. The report was written by Isuma Consulting with Mrs. Nauja Bianco and Mr. Nichlas Appelby Svendsen as lead authors of the report. The report is an independent study on how the Nordic Countries, individually and collectively, can reduce risks and increase environmental security in Arctic waters, a region that is faced with many challenges as the Arctic environment and climate changes and maritime traffic increases. The report and its recommendations are not endorsed by the Nordic Countries or the Nordic Council of Ministers but are meant to stimulate ideas, discussion and policy making on this subject that is of great importance to the Nordic Countries.

In its conclusion, the report outlines recommendations on how the Nordics might potentially deepen their cooperation to realize their common ambition of reducing risks and increasing environmental security in the Arctic. The recommendations are many and various, but may be listed in brief as follows:

Recommendation 1

Enforcement of stricter grade oil requirements

Nordic cooperation on enforcement of stricter grade oil requirements to mitigate risks related to oil spills from carriage and transport of Heavy Fuel Oil (HFO) and toxic hybrid fuel oils. Work should be undertaken to ban HFO in the Arctic, while simultaneously supporting development of new, less toxic and more energy-efficient and sustainable fuel types to replace HFO globally.

Recommendation 2

Minimize damaging emissions, incl. reduction of sulphur concentration and other accelerating ice-melting pollutants

Nordic promotion of regulations preventing environmentally harmful shipping emissions in order to minimize damaging emissions, incl. reduction of sulphur concentration and other accelerating ice-melting pollutants.

Recommendation 3

Stricter vessel and cargo control of ships voyaging in the Arctic with regards to invasive species

Nordic push for stricter vessel and cargo control of ships voyaging in the Arctic to mitigate risks from invasive species introduced via ballast water as ice cover recedes and seawater warms in polar areas.

Recommendation 4

Joint training sessions and new innovative training methods with remote SAR training

Nordic push for joint training sessions and new innovative training methods to provide Arctic SAR competencies to personnel on board commercial ships and respective coastguard authorities.

Recommendation 5

Joint work for improving nautical charts in the Arctic for navigation security

Nordic push for a renewal or production of navigation charts and hydrographic surveys aimed at providing chart coverage for coastal navigation and reliable information on depth and potential hazards.

Recommendation 6

Nordic cooperation work to stipulate mandatory requirements for so-called "pairing" sailing

Enhanced Nordic cooperation on mandatory requirements for so-called "pairing" between two operating vessels in remote polar waters (certain latitudes in the high Arctic), i.e. between cruise/passenger ships.

Recommendation 7

Nordic priority to enhance joint research cooperation, including (annual) resource and budget allocations to support research initiatives in the Arctic

Nordic priority to enhance joint research cooperation, including (annual) resource and budget allocations to support research initiatives in the Arctic.

Recommendation 8

Nordic efforts to push for a Polar Code that meets current demands

Coordinated joint Nordic efforts pushing for enhanced reformation of the Polar Code is strongly recommended.

Recommendation 9

Nordic effort to enhance emission regulation by assigning Emission Control Area status

Nordic cooperation on enhancing emission regulation by assigning Emission Control Area status to the Arctic, and progressively work towards a ban on use of Heavy

Fuel Oil in the Arctic.

Recommendation 10

Nordic cooperation on Particular Sensitive Sea Areas in the Arctic

Enhanced Nordic cooperation on implementation of Particular Sensitive Sea Areas to constitute internationally formalized legal measures, thus protecting sensitive marine areas in the Arctic.

Recommendation 11

Nordic push for ratification of ban on commercial fishing in the high Arctic and provide science on commercial fishing in the Artic

Deeper Nordic approach on the international agreement to ban commercial fishing in the high Arctic focusing on a push for speeding up the ratification process as well as providing science on the area.

Recommendation 12

Enhanced Nordic cooperation on infrastructure development in the Arctic

Enhanced Nordic cooperation on infrastructure development by strengthening specific joint infrastructure priorities, including joint budget allocations and strategizing. Nordics to produce a stronger mandate to involve and make demands on the part of industry stakeholders.

List of Acronyms

ACGF	Arctic Coast Guard Forum
AC	Arctic Council
AIS	Automatic Identification System
AMSA	Arctic Marine Shipping Assessment
AMVER	Automated Mutual-Assistance Vessel Rescue System
AtoN	Aids to Navigation
ASTD	Arctic Ship Traffic Data
A-5	"Arctic 5": Canada, the Kingdom of Denmark, Norway, Russia and USA
BC	Black Carbon
BWM	Ballast Water Management
CAFF	Conservation of Arctic Flora and Fauna
CBD	Convention on Biological Diversity
CTA	Cape Town Agreement
CISE	Common Information Sharing Environment
CO2	Carbon Dioxide
DNV	Det Norske Veritas
EBSA	Ecologically or Biologically Significant Marine Areas
ECA	Emission Control Area
EPIRBs	Emergency Position Indicating Radio Beacons
EUROSUR	European Border Surveillance System
FAL	Convention on Facilitation of International Maritime Traffic
FAO	Food and Agriculture Organization
GMDSS	Global Maritime Distress and Safety System
GHG	Greenhouse Gas

GT	Gross Tonnage
HFO	Heavy Fuel Oil
IHO	International Hydrographic Office
IMarEST	The Institute of Marine Engineering, Science & Technology
IMO	International Maritime Organization
IUCN	The International Union for the Conservation of Nature
LNG	Liquefied Natural Gas
MARPOL	International Convention for the Prevention of Pollution from Ships
MARSUNO	A specific integrated maritime surveillance pilot project
MARSUR	Maritime Surveillance (Military)
MEPC	Marine Environment Protection Committee
MOSPA	Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic
MPA	Marine Protected Area
MPLAP	Marine Plastic Litter Action Plan
MRO	Mass Rescue Operation
NACGF	North Atlantic Coast Guard Forum
NAMMCO	North Atlantic Marine Mammal Commission
NEBA	Net Environment Benefit Analysis
NC	Nordic Council
NCM	Nordic Council of Ministers
NGO	Non-governmental Organization
NM	Nautical Miles
NORA	The Nordic Atlantic Cooperation
NORDRED	Nordic Cooperation on Civil Protection
NOx	Nitrogen Oxides
NSR	Northern Sea Route
NWP	Northwest Passage
PAME	Protection of the Arctic Marine

	Environment
PC	Polar Code
PM	Particulate Matter
PSSA	Particular Sensitive Sea Area
RCC	Rescue Coordination Center
SAR	Search and Rescue
SARTs	Search and Rescue Transponders
SDGs	Sustainable Development Goals
SO2	Sulphur Dioxide
SOLAS	International Convention for the Safety of Life at Sea
SOx	Sulphur Oxides
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
SUCBAS	The Sea Surveillance Co-operation Baltic Sea
UNCLOS	The United Nations Convention on the Law of the Sea
VDRs	Voyage Data Records
WNC	The West Nordic Council

1. Introduction: What is at stake in the Arctic?

The 2009 AMSA (Arctic Marine Shipping Assessment) report, conducted by the Arctic Council's (AC) Protection of the Arctic Marine Environment (PAME) working group, found that the most significant drivers of Arctic maritime activity in the future relate to natural resource development and exploration of oil, gas and minerals. Estimates by the 2008 US Geological Survey reported that nearly one quarter of the world's undiscovered recoverable petroleum resources are to be found in the Arctic: 13% of the oil (estimated 90 billion barrels); 30% of the natural gas (estimated 47 trillion cubic meters); and 20% of the liquefied natural gas (LNG). Of these, 80% is projected to be offshore (PAME 2009, 97). Consequently, the level of shipping will increase as resource exploration increases. The shrinking sea ice and the possibilities to explore more of the Arctic Ocean will inevitably lead to a rise in commercial shipping in the Arctic, including cruise ship tourism, cargo transportation, fishing vessels etc. Combined with more passengers, the risks of accidents such as vessel collisions and oil spills, as well as marine litter and emission pollution, will increase the overall threat to human safety and the marine environment substantially in relation to shipping in the Arctic.

Melting sea ice and extended navigation periods allow for longer seasonal accessibility to, from, in and through the Arctic. Therefore, the shipping routes through the Arctic, the Northern Sea Route (NSR) and Northwest Passage (NWP), will be able to connect the Atlantic and Pacific Oceans and present alternatives to the Panama Canal and the Suez Canal. 90% of global goods is transported by ship, and prolonged accessibility through NSR and NWP represents huge potential savings in time and costs (Arctic WWF 2019). One study estimates that the comparative distances from East Asia to Western Europe are 21,000 kilometers via the Suez Canal versus 12,800 via the NSR, and 24,000 kilometers via the Panama Canal versus 13,600 via the NWP. It does depend on the port of embarkation, but in almost all cases involving ports in north China, Japan and Korea, savings in distance and time are significant (Stephens 2016, 3). Due to the current level of sea ice retreat, however, it may not just involve the NSR and the NWP. A Trans-Arctic/Central Arctic Passage, cutting straight across the North Pole, may be the reality in 2040, offering an alternative route to the NSR and NWP as well potentially making icebreakers obsolete (Maritime Executive 2019).

The activities in question present a tremendous opportunity for economic development to Arctic as well as non-Arctic stakeholders, including communities, corporations and states. However, the economic development potential and increasing shipping are associated with great risks to human safety and the marine environment if the stakeholders operating in the Arctic fail to take protective measures. Any increase in commercial activities or any political initiative in the Arctic region will inevitably lead to challenges in an already rapidly changing world, due to its strategic geopolitical location and its impact on global climate change.

Therefore, political decisions, such as infrastructure development investments, aiming at accessing the Arctic's rich natural resource deposits and changing the social fabric of Arctic communities, have physical, ecological and economic consequences that are likely to spill over to other parts of the world. Sustainable shipping is an integral part of the solutions accommodating these consequences, within and beyond the Arctic region (IMarEST 2015, 2). Mitigating the risks associated with shipping is therefore fundamental to ensuring sustainable economic development in the Arctic. For the Nordics, "trapped" in the middle due to geographical proximity, judicial responsibilities and national interests, enhancing this development is a top priority. How can Nordic cooperation contribute to mitigating environmental and human risks in relation to shipping in the Arctic?

2. Environmental and human risks in relation to shipping in the Arctic

The impact of increased shipping and other marine operations in the Arctic region poses significant risks in relation to environmental and human safety, including diverse effects of a social and environmental nature. These take the shape of direct effects along routes and at the operations sites and indirect impacts in relation to supporting infrastructure. Within this context, Arctic development poses environmental and operational risks as well as risks for Arctic populations, particularly indigenous populations whose lives and livelihoods rely on traditional hunting of marine life and dependency on the marine environment. The Arctic is considered to contain some of the last physically undisturbed marine spaces on the planet, including unique ecosystems and distinctive species, and therefore needs special attention.

Due to its sensitive marine ecosystems, which are already under great pressure from climate change, the Arctic region is particularly vulnerable to exposure from these threats. In 2009, the AMSA found that *"the most significant threat from ships to the Arctic marine environment is the release of oil through accidental or illegal discharge"*, in other words oil spills (PAME 2009, 5). AMSA pointed to other environmental risks associated with shipping in the Arctic, such as ship strikes on marine mammals, the introduction of alien species, disruption of migratory patterns of marine mammals and anthropogenic noise produced from shipping. Moreover, besides providing longer navigation seasons, sea ice alterations may lead to increasing interaction between migrating species and ships. Finally, AMSA determined that BC emissions from marine vessels operating in the Arctic were a threat due to their accelerating impact on ice melt.

IMarEST states that the greatest threats to human safety, especially personnel, are:

- "Inadequate search and rescue (SAR) capability and capacity in the remote Arctic region;
- Lack of suitable personal protective equipment for often low-predictability conditions;
- Fatigue and physical strain of operating in extreme conditions" (IMarEST 2015, 7).

The lack of experience in operating under the shifting Arctic conditions, combined with a potential lack of suitable training of operators, can lead to an exacerbation of the risks.

The shifting conditions are an expression of the disruptive nature of the Arctic environment, which is unpredictable due to the rapid and continuous climate changes in the region. The distinctive Arctic conditions, including remoteness and marine environment, enhance the risks in relation to shipping and, as a result, exacerbate the consequences of accidents and natural disasters accordingly, making access and mitigation more difficult.

2.1. Carriage and transport of HFO

The consequences of HFO spills may be more serious than spills of other oils. Due to its viscosity, HFO breaks into small masses and spreads more slowly. HFO's tar-like consistency will cause it to stick to exposed substrates and make clean-up very difficult. Due to the different chemical compositions of HFO, the density of some HFO may cause them to sink in the water, rather than float on the surface like most petroleum fuels (PAME 2016, 5). A possible scenario in the Arctic is that an oil spill is trapped in snow or ice. Trapped in ice, HFO can be transported over longer distances, while simultaneously extending the pollution period of the area in question, and with a possible oil release upon melting. This can potentially reduce certain marine life populations, found beneath the sea ice during the Arctic Winter (PAME 2011, 38-41).

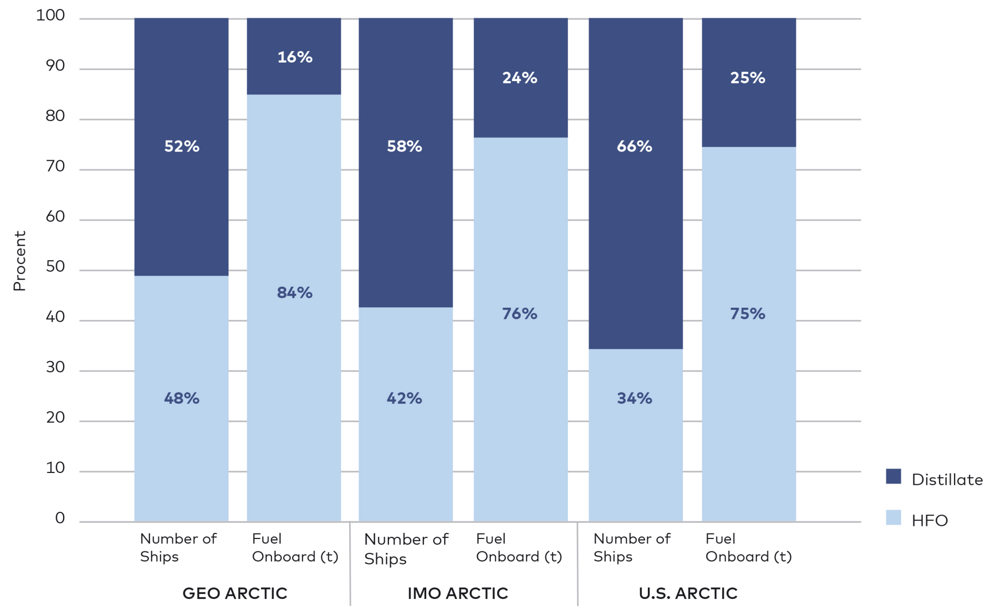
Carrying and transporting HFO in the Arctic is thus associated with great risks to the marine environment in the form of accidental oil spills, as species and organisms in Arctic waters as well as seabirds may be affected by spills. If marine life is damaged by a spill, this may in turn affect the livelihoods of indigenous populations, whose main sources of food are to be found in Arctic waters. Furthermore, HFO clean-up is complex due to the diverse chemical composition found in HFO and therefore requires situational approaches to carry out the clean-up most effectively.

Because of the melting sea ice and the extended navigation season, Arctic shipping is likely to increase drastically, especially in terms of commercial vessels, due to the opening up of timesaving sea routes and the prospects of cruise ship tourism. This entails an increasing number of vessels operating in Arctic waters. The melting sea ice will also facilitate new offshore or near-shore resource exploration operations. With an increase in vessels operating and the potential for new resource exploration operations, under current operating procedures, the amount of heavy fuel oil (HFO) present in the region will increase correspondingly. As a result, the risks of marine accidents and oil spills are higher. Oil spill prevention is the highest priority in the Arctic for environmental protection and therefore requires significant attention (Hildebrand, Brigham & Johansson 2018, 449).

HFO accounts for the main part of bunker fuel on board vessels operating in the Arctic. In the Geographic Arctic, HFO constitutes 85% of fuel onboard, whereas distillate is 15%, and LNG and nuclear fuel are less than 1%. In this area, bulk carriers[1] carry the most HFO (1,734,000 t), followed by oil tankers (1,120,000 t), and chemical tankers (494,000 t). In the IMO Arctic, HFO represents more than 76% of fuel onboard, followed by distillate (23%), with the remaining 1% of fuel carried as LNG or nuclear fuel. Bulk carriers carry the most HFO in this area (248,000 t), followed by container ships (113,000 t), and oil tankers (111,000 t) (Comer et. al. 2017, 23).

1. Ships carrying unpackaged cargo, usually consisting of a single dry commodity, such as coal or grain.

Figure 1: Number of ships and total fuel carriage type for the Geographic Arctic, IMO Arctic, and U.S. Arctic regions



Source: Comer et. al. 2017, 25.

Although only 42% of ships in the IMO Arctic operated on HFO in 2015, these ships accounted for 76% of fuel carried and 56% of fuel transported in this region. 75% of the HFO was carried and transported by bulk carriers, container ships, oil tankers, general cargo vessels and fishing vessels. Taking the fuel quantity carriage into account and the distances they each travel, these ships may pose a higher risk for HFO spills compared to other ships. The table below illustrates HFO carriage and transport as bunker fuel in the Arctic in 2015.

Table 1: Heavy fuel oil carriage and transport as bunker fuel in the Arctic[a], 2015

Ship Class	Geographic Arctic				IMO Arctic				US Arctic			
	Fuel onboard (t)	% of total fuel onboard	Fuel trans-ported (106 t-nm)	% of fuel trans-ported	Fuel onboard (t)	% of total fuel onboard	Fuel trans-ported (106 t-nm)	% of fuel trans-ported	Fuel onboard (t)	% of total fuel onboard	Fuel trans-ported (106 t-nm)	% of fuel trans-ported
HFO	**4,935,500**	**85%**	**18,180**	**69%**	**827,300**	**76%**	**2,070**	**56%**	**71,300**	**75%**	**76**	**54%**
Bulk carrier	1,733,900	29.7%	3,390	12.8%	247,500	22.8%	280	7.5%	41,900	43.8%	28	19.6%
Container	415,700	7.1%	1,590	6.0%	112,800	10.4%	100	2.7%	2,000	2.1%	0	0.1%
Oil tanker	1,120,200	19.2%	1,950	7.4%	110,700	10.2%	100	2.6%	7,700	8.1%	11	8.0%
General cargo	411,100	7.0%	1,090	4.1%	77,200	7.1%	110	3.1%	700	0.7%	0	0.1%
Fishing vessel	107,900	1.8%	10	0.0%	67,600	6.2%	10	0.2%	5,200	5.5%	0	0.3%
Chemical tanker	493,800	8.5%	2,390	9.0%	51,800	4.8%	0	0.1%	3,700	3.9%	8	5.7%
Refrige-rated bulk	130,700	2.2%	1,690	6.4%	49,700	4.6%	300	8.1%	0	0.0%	0	0.0%
Cruise	132,300	2.3%	230	0.9%	40,600	3.7%	550	14.8%	900	0.9%	2	1.1%
Service vessel	79,300	1.4%	800	3.0%	30,000	2.8%	0	0.0%	5,400	5.6%	18	12.7%
Vehicle	57,200	1.0%	1	0.0%	19,100	1.8%	0	0.0%	0	0.0%	0	0.0%
Tug	64,900	1.1%	80	0.3%	6,500	0.6%	0	0.1%	0	0.0%	0	0.0%
Ro-ro	17,100	0.3%	3,210	12.1%	5,800	0.5%	320	8.7%	3,300	3.5%	7	4.8%
Offshore	50,900	0.9%	440	1.7%	3,100	0.3%	120	3.2%	0	0.0%	0	0.0%
Ferry-ro-pax	25,800	0.4%	790	3.0%	2,200	0.2%	10	0.1%	300	0.3%	2	1.5%
Liquefied gas tankers	93,500	1.6%	360	1.3%	2,100	0.2%	160	4.4%	—	0.0%	—	—
Passenger ferry	900	0.0%	60	0.2%	500	0.0%	20	0.6%	—	0.0%	—	—
Other	200	0.0%	100	0.4%	200	0.0%	1	0.0%	—	—	—	—
Yacht	200	0.0%	1	0.0%	—	—	—	—	—	—	—	—
Distillate	**859,700**	**15%**	**7,650**	**29%**	**251,500**	**23%**	**1,490**	**41%**	**24,500**	**25%**	**65**	**46%**
LNG	**39,400**	**0.7%**	**530**	**2%**	**3,800**	**0.4%**	**3**	**0.1%**	—	—	—	—
Nuclear*	**4,800**	**0.1%**	**120**	**0.5%**	**2,800**	**0.3%**	**120**	**3%**	**—**	**—**	**—**	**—**
Total[b]	**5,839,400**	**100%**	**26,490**	**100%**	**1,085,400**	**100%**	**3,680**	**100%**	**95,700**	**100%**	**141**	**100%**

Note:
**Assumes nuclear fuel has a density of 1 t/m³ for ease of comparison with other fuel types.*
[a]Sorted largest to smallest percent share for the IMO Arctic.
[b]May not sum because of rounding.

Source: Comer et. al. 2017, 24.

The term HFO covers a broad range of marine residual fuels and some distillate fuels, and is also termed bunker oil, bunker fuel oil, residual fuel and heavy diesel oil. Common to them all is that they are used on board ships, which allows for a distinction between HFO and i.e. crude oils and other refined products. HFO mainly consists of residual products from crude oil refining processes, which are low-cost products compared to e.g. lighter marine fuels, and it is therefore often used as fuel in marine vessel engines. Due to the viscosity of the HFO, it cannot be transported through pipes and therefore must be distributed as cargo. There are no standards for the blend of residue and distillates used to produce HFO, and the chemical composition of HFO therefore varies depending on the origin and quality of the residual oil, the distillate and the refinery processes. Ultimately, these conditions determine the grade of the oil. Knowledge of the HFO grade, including quality and origin, is important in order to select the most effective protective countermeasures in the event of an oil spill situation and to conduct risk assessments of possible oil spills in cold waters and sea ice. In the event of spillage, this knowledge is also crucial when it comes to the protection of the marine environment and constitutes a fundamental point of reference when conducting oil spill response, the so-called Net Environment Benefit Analyses (NEBAs). NEBAs involve time-consuming scientific assessments to determine the most effective response measures for a specific oil spill, before an actual clean up can be commenced. In the meantime, the oil spill causes serious environmental and marine life damage as it floats in the water, especially in relation to surface-living species and organisms living in the upper part of the water column and along the coastline (Fritt-Rasmussen et. al. 2018, 9–13). Therefore, specific fuel grade requirements, including regulation on blend and composition, will help minimize the environmental impact and prepare oil spill contingency efforts to conduct NEBAs on oils with specific oil uptake properties.

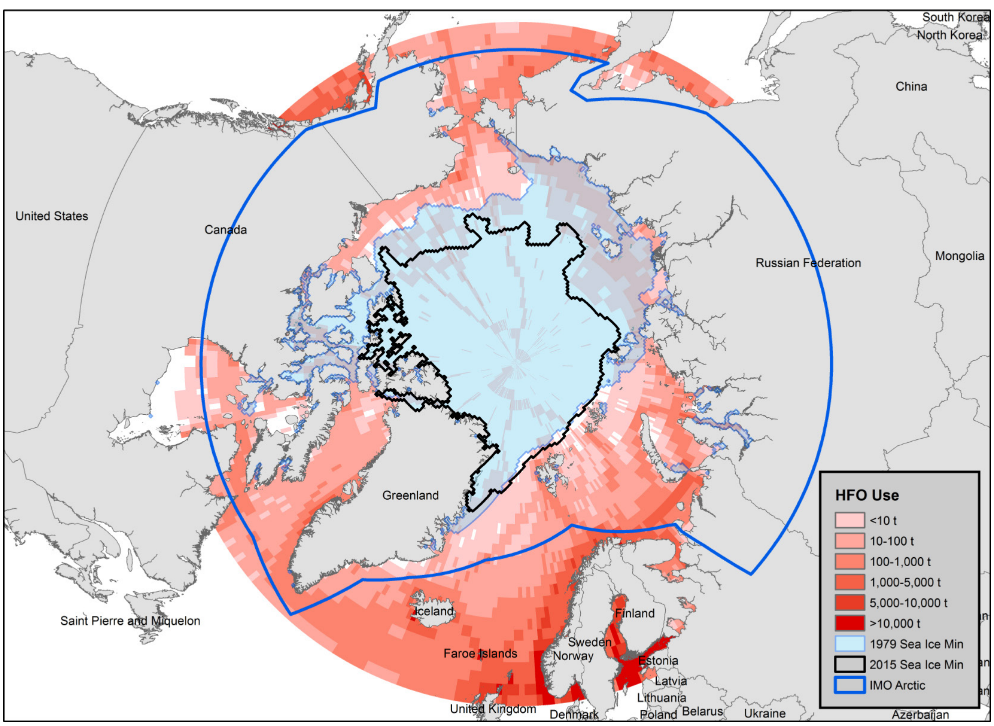
Accordingly, Nordic cooperation should work on enforcement of stricter grade oil requirements, as it will limit the amount of potential NEBAs and save valuable time in the event of an oil spill. Ultimately, it will mitigate risks associated with oil spills from carriage and transport of HFO and toxic hybrid fuel oils. Progressive steps should be undertaken to ban HFO in the Arctic, while simultaneously supporting development of new, less toxic, more energy-efficient and sustainable fuel types to replace HFO globally.

The remoteness factor, including the lack of appropriate response infrastructure, combined with the shifting – and at times hazardous – Arctic weather and environmental conditions make the prospects for protective response efforts even more difficult. Long response times for oil spill recovery start-up potentially allow a spill to spread and impact on a larger area. Therefore, preventive measures mitigating the environmental damage caused by HFO spills must be taken to protect the Arctic environment, marine life and peoples.

2.2. Use of HFO and atmospheric emissions

The dominant marine fuel used in Arctic shipping is HFO because it is relatively inexpensive, typically around 30% less than distillate fuels. In the Geographic Arctic, almost 60% of the fuel consumed is estimated to be HFO, whereas distillate accounts for 38% and LNG for 4%. Ro-ro ferries[2] consume the most HFO in this area (427,000 t), followed by oil tankers (386,000 t) and cruise ships (361,000 t). In the IMO Arctic, HFO represents 57% of fuel consumed, followed by distillate (43%), but almost no LNG (0.1%) is consumed. General cargo vessels consume the most HFO in this area (66,000 t), followed by oil tankers (43,000 t), and cruise ships (25,000 t). As illustrated by the map below, the HFO consumption is concentrated in certain parts of the Arctic. Excluding these portions of the Geographic Arctic from the IMO definition results in a 90% decrease (Comer et. al. 2017, 22). The figures for HFO use in the Arctic, constituting the data for the map, are to be found in the table below the map, sub-divided by ship class.

Figure 2: Heavy fuel oil use in the Arctic, 2015, with minimum sea extents displayed



Source: Comer et. al. 2017, 23.

2. Vessels designed to carry wheeled cargo, such as cars, trucks, semi-trailer trucks, trailers, and railroad cars, that are driven on and off the ship on their own wheels or using a platform vehicle.

Table 2: Heavy fuel oil use in the Arctic[a], 2015

Ship Class	Geographic Arctic		IMO Arctic		US Arctic	
	Fuel consumed (t)	% of all fuel consumed	Fuel consumed (t)	% of all fuel consumed	Fuel consumed (t)	% of all fuel consumed
HFO	**2,568,000**	**59%**	**249,800**	**57%**	**11,300**	**53%**
General cargo	242,300	5.5%	66,000	15.1%	20	0.1%
Oil tanker	385,700	8.8%	43,100	9.9%	2,300	10.7%
Cruise	360,600	8.2%	24,500	5.6%	800	3.6%
Bulk carrier	248,100	5.7%	23,500	5.4%	2,100	9.8%
Fishing vessel	68,000	1.5%	23,400	5.4%	20	0.1%
Refrigerated bulk	81,600	1.9%	17,600	4.0%	—	—
Chemical tanker	269,400	6.1%	17,200	3.9%	1,500	7.1%
Service – other	40,100	0.9%	15,400	3.5%	4,000	18.5%
Container	207,300	4.7%	12,700	2.9%	10	0.0%
Ferry-ro-pax	426,900	9.7%	1,500	0.3%	—	—
Roro	161,200	3.7%	1,500	0.3%	—	—
Ferry-pax only	2,700	0.1%	1,400	0.3%	—	—
Service-tug	7,100	0.2%	1,200	0.3%	300	1.4%
Offshore	15,300	0.4%	700	0.2%	300	1.4%
Other	200	0.0%	100	0.0%	—	—
Vehicle	12,000	0.3%	30	0.0%	—	—
Liquefied gas tanker	39,400	0.9%	0	0.0%	—	—
Yacht	100	0.0%	—	—	—	—
Distillate	**1,655,200**	**38%**	**186,300**	**43%**	**10,100**	**47%**
LNG	**149,700**	**3%**	**400**	**0.1%**	**—**	**—**
Total[b]	**4,372,900**	**100%**	**436,400**	**100%**	**21,400**	**100%**

Notes:

[a]Sorted largest to smallest percent share for the IMO Arctic.

[b]May not sum because of rounding.

Source: Comer et. al. 2017, 22.

HFO is the end-stage product of a petroleum refining process and contains much higher concentrations of sulphur, ash and hydrocarbons than do refined fuels, such as marine distillates and road diesel. Consequently, HFO is burned to black particles during combustion processes and is therefore referred to as black carbon (BC) in emission terminology. It is the second-largest human-induced contributor to climate change, surpassed only by CO2. BC emissions from shipping account for about 2% of global BC emissions (Lack 2016, 7). Several studies in different environments suggest that sulphur concentration levels are directly linked to the actual BC emission footprint of a ship engine. Ultimately, reduced sulphur concentrations (meaning less complicated hydrocarbons and less ash content) result in decreasing BC emissions and thus decreasing environmental impact. So, measures to minimize damaging emissions, including reduction of sulphur concentration and other accelerating ice-melting pollutants, should be jointly promoted by the Nordics and ultimately lead to actual regulation that prevents environmentally harmful shipping emissions. The key to preserving the pristine Arctic environment, including distinctive species, flora and fauna, which constitute fundamental elements of the livelihoods of Arctic communities, is to employ protective measures in order to mitigate risks from increasing shipping in the Arctic and global emissions. Therefore, progressive work towards carbon-neutrality, including a ban on the use of HFO and development of new sustainable fuel types must be prioritized to secure the future of Arctic environments and peoples.

Its black color means that BC contributes to warming the climate by absorbing solar radiation in the atmosphere. When emitted, BC absorbs solar radiation and warms the atmosphere directly. BC typically falls out of the atmosphere and is deposited on the Earth's surface within a few days or weeks. When forming deposits on light covered surfaces, such as snow and ice, BC reduces the albedo of the surface and continues to have a warming effect. Therefore, it is of concern in the Arctic, as marine vessels operating in the Arctic emit BC that can be directly deposited on snow and ice, thereby amplifying the pollutant's warming effect and ultimately leading to accelerating ice melt (Comer et. al. 2017, 3). The warming impact of BC is increased by (at least) a factor of 3 in the Arctic compared to the open ocean because of two significant physical effects of the reflective surface. The short lifetime of BC in the atmosphere means that failure to control BC emissions will have immediate impacts on the climate. Therefore, a larger volume of shipping in the Arctic will increase the atmospheric pollution from ships, particularly BC emissions. Current estimates suggest that shipping north of 60 degrees accounts for 5% of global shipping's BC emission. By 2030, BC emission is estimated to triple in the Arctic (Lack 2016, 9). The table below illustrates the BC emissions in the Arctic in 2015, based on ship class.

Table 3: Black carbon emissions in the Arctic, 2015

Ship Class	Geographic Arctic		IMO Arctic		U.S. Arctic	
	BC (t)	% of total BC	BC (t)	% of total BC	BC (t)	% of total BC
HFO	**966**	**66%**	**131**	**68%**	**6**	**64%**
General cargo	104	7.2%	34	17.7%	0.1	0.1%
Oil tanker	135	9.3%	22	11.6%	1	11.2%
Fishing vessel	42	2.9%	16	8.0%	0.1	0.1%
Cruise	143	9.9%	13	6.9%	0.4	4.6%
Bulk carrier	97	6.7%	10	5.3%	1	10.0%
Service vessel	21	1.4%	9	4.8%	2	26.0%
Refrigerated bulk	34	2.3%	8	4.2%	—	—
Chemical tanker	95	6.5%	8	4.1%	1	7.2%
Container	75	5.2%	7	3.4%	0.1	0.1%
Ferry-ro-pax	142	9.8%	1	0.4%	—	—
Tug	3	0.2%	1	0.4%	0.2	2.6%
Passenger ferry	1	0.1%	1	0.4%	—	—
Ro-ro	53	3.7%	1	0.4%	—	—
Offshore	6	0.4%	0.4	0.2%	0.2	1.9%
Other	0	0.0%	0.1	0.0%	—	—
Vehicle	4	0.3%	—	0.0%	—	—
Liquefied gas tankers	11	0.8%	—	0.0%	—	—
Yacht	0	0.0%	—	—	—	—
Distillate	**485**	**33%**	**62**	**32%**	**3**	**36%**
LNG	**2**	**0%**	**<<1**	**0%**	**—**	**—**
Nuclear	**—**	**—**	**—**	**—**	**—**	**—**
Total	**1,453**	**100%**	**193**	**100%**	**9**	**100%**

Source: Comer et. al. 2017, 26.

International shipping accounts for 2.2% of global CO2 emissions and 2.8% of GHG warming, which contribute to up to 60,000 premature deaths annually (Lack 2016, 5–9). Consequently, MARPOL Annex VI was revised and strengthened to reduce the global emissions by introducing the Emission Control Areas (ECA) control measure to further reduce air pollution in designated areas (Fritt-Rasmussen et. al. 2018, 17). When it comes to actual engine operation, PAME conducted research to determine if HFO operations are more likely to experience engine failure in Arctic conditions than engines operating on other fuels. According to PAME, there are no indications of increased hazards for engines and fuel systems using HFO in cold climate. However, HFO operations need careful attention by skilled personnel and good procedures to achieve safe operation. Utilizing HFO requires that the fuel is pre-heated to ensure that it is sufficiently fluid for pumping, separation etc. Hence, the need for heating may typically be higher operating in the Arctic. Furthermore, in cold climates such as the Arctic, available restart time is expected to be shorter in the event of machinery blackout due to the rapid cooling (PAME II 2016, 5). As a proven contributor to climate change and melting sea ice, the use of HFO and atmospheric emissions, especially BC, is of environmental concern in the Arctic. The environmental impact will spill over to affect the living conditions of marine life and livelihoods of Arctic communities. The tables below illustrate the trends in number of vessels, activity and fuel consumption for different ship classes in IMO Arctic from 2012 to 2017. The figures reveal an increasing presence of ships, and thus of HFO and BC in the Arctic, which reinforces human and environmental risks associated with shipping in the region.

Table 4: Findings compared to DNV (2013) results for the IMO Arctic region

Metric	DNV results (2012 activity)	This study (2015 activity)
BC (t)	52	193
Sailed distance (nm)	5,694,450	10,322,500
Number of ships	1,347	2,086
Operating hours	1,859,382	2,582,400
HFO fuel carried (t)	396,554	827,300
Distillate fuel carried (t)	132,464	251,500
Total fuel consumption (t)	290,624	436,400
BC EF (g BC/kg fuel)	0.18	0.30–0.56 (0.44 avg. in the IMO Arctic)

Source: Comer et. al. 2017, 36.

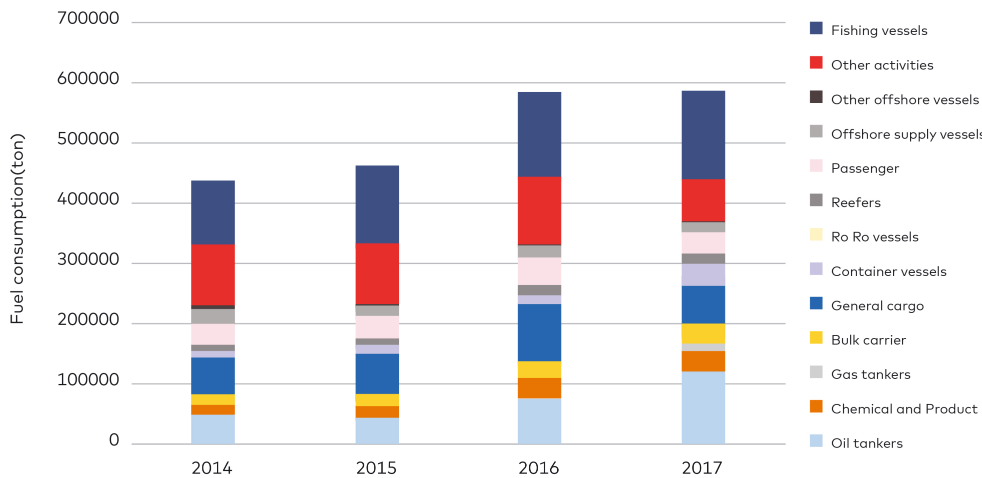
Table 5: Number of vessels, activity and fuel consumption in 2017 for the IMO Arc5tic polar code area

Ship type	# vessels	Sailed distance [NM]	Time in area [hours]	Fuel consumption [ton]
Oil tankers	108	826 200	160 300	132 300
Chemical and Product tankers	66	344 100	73 300	26 200
Gas tankers	6	27 100	4 800	8 200
Bulk carrier	113	263 300	56 900	29 000
General cargo	209	1 143 700	267 600	87 300
Container vessels	11	146 900	21 300	14 300
Ro Ro vessels	8	25 200	8 000	1 000
Reefers	98	177 400	87 200	15 000
Passenger	101	578 200	122 000	34 300
Offshore supply vessels	39	161 400	63 700	15 300
Other offshore vessels	15	41 500	10 600	2 200
Other activities	329	1 382 300	584 800	70 100
Fishing vessels	765	5 305 500	1 524 400	145 900
Total	**1 868**	**10 422 800**	**2 984 900**	**581 100**

Source: DNV 2019, 12.

According to the figures below, annual fuel consumption continues to increase in the IMO Arctic area. Det Norske Veritas (DNV) Maritime Environment Advisory has observed an overall increase of 45% in fuel consumption from 2014 to 2017. Accordingly, the overall number of vessels and shipping activities in the form of operational hours and sailed distance have increased. The number of vessels is up by 7%, while the operational hours and sailed distance within the IMO Arctic area increase by 12% and 21% respectively. Note that only vessels with an IMO number are included in the count. There are also hundreds of unregistered small vessels operating within the region (DNV 2019, 14).

Figure 3: Annual fuel consumption in the Arctic Polar code area for 2014 to 2017



Source: DNV 2019, 14.

Due to the increase in these figures, there are general concerns that profitable economic development incentives will lead to a race for Arctic opportunity maximization, associated with risks relating to human safety and environmental protection. Dangerous and unpredictable operational conditions, environmental impacts, little contingency for equipment failures and public campaigns against development in the region may further enhance both risks and costs. Factors such as global commodity prices and innovation of exploration and production technologies may reinforce the urge to explore the Arctic, and thus further enhance shipping and emission levels.

2.3. Ecological impacts by invasive species

Another significant risk identified by the AMSA report, PAME, IMarEST and a wide range of NGOs, is the introduction of invasive species into the Arctic marine environment. As global temperatures rise, Arctic sea ice melts and the shipping volume is set to increase, the risk of introducing invasive species will increase accordingly. Invasive species pose a severe threat to the native biodiversity in the Arctic, including aquatic organisms and marine life. Many species and habitats are found only in the Arctic and nowhere else on Earth. Some of these species and Arctic flora and fauna constitute a fundamental part of food supplies, cultural practices and commercial industries for Arctic inhabitants, especially indigenous peoples, and essential parts of Arctic ecosystems and environmental preservation. More than 21,000 species of mammals, birds, fish, amphibians, reptiles, invertebrates, plants, and fungi are native and uniquely adapted to the region. These include species such as polar bear, narwhal, caribou/reindeer, and snowy owl. The Arctic is also characterized by extreme seasonality; many species migrate long distances, some by the millions, in order to track resource productivity.

Approximately four million people live in the Arctic today, including around 400,000 indigenous peoples, who depend upon subsistence gathering and harvesting of native species from the land and sea as a major source of their daily food intake and as a vital element of their culture. Commercial fisheries annually harvest millions of tons of marine organisms valued in billions of US dollars (CAFF & PAME 2017, 9). Therefore, invasive species are a matter of both environmental and human safety. In time, some invasive species may migrate naturally due to the changing global climate, most notably rising temperatures.

As global – and Arctic – shipping is a contributor to rising temperatures, due to polluting and warming fuel emissions, there is a link between natural migration and increasing shipping. Thus, polluting atmospheric emissions may lead to increased migration of invasive species, posing severe threats to the natural lifecycle of Arctic ecosystems, and disappearance of Arctic species. Ultimately, this may lead to disruptions of food chains and behavioral patterns among Arctic species, which potentially could lead to reduced populations and, in the worst-case scenario, extinction of certain species. This constitutes another incentive to enforce regulation on emission levels and/or particle contents of emissions and ultimately a ban on the use of HFO, which is a proven contributor to climate change, including rising temperatures and melting ice. Global demand and increasing shipping may enhance (illegal) commercial fishing, constituting another ecological risk to the Arctic, as it challenges the natural evolution of Arctic marine ecosystems. Therefore, as levels of marine activity and marine litter are on the rise, enforced regulatory control measures (currently non-existent) on fishing vessels are vital to sustaining and preserving Arctic marine life.

In its current form, however, shipping in the Arctic is associated with several risks. One comes from ballast water and waste during ship discharging, while another is hull fouling that may transfer invasive species from operating vessels entering the Arctic region. In addition, cargo transportation and distribution may introduce invasive species through palletized sealift and re-supply movements. Another risk comes from accidents involving marine vessels, such as sinkings and shipwrecks, unwanted grounding and leaks from collisions with hazardous icebergs or fellow ship operations (PAME 2009, 150–151). With global shipping on the rise through the NSR and the NWP, the threat from invasive species becomes even more evident, as the volume of ships and cargo transported will increase substantially. Therefore, enhanced Nordic cooperation should stress the importance of stricter vessel and cargo control of ships voyaging in the Arctic (to be performed by port authorities), as it will mitigate risks from invasive species introduced via ballast water as ice cover recedes and seawater warms in polar areas. Such control regulation should include additional restrictions on ballast water, grey water[3] discharges, as well as enhanced protective measures on sewage treatment plants for waste management.

3. wastewater from galleys, showers, laundries and food pulp

2.4. Inadequate SAR capability and capacity in Arctic conditions

Search and Rescue (SAR) is another important component of mitigating human and environmental risks associated with shipping in the Arctic. SAR resources will be pulled together when accidents related to both human safety and environmental protection occur. In many cases, accidents are twofold risks, in the sense that vessel collisions, unwanted groundings or sinkings put human lives at risk as well as causing environmental damage. In terms of SAR, environmental damage, usually related to oil spills, will cause pollution and marine degradation, which will impact the lives of human beings and local communities. Thus, SAR operations involve preservation of lives as the highest priority, and environmental protection and protection of property if it poses a risk to the safety, health, and welfare of people. The projected increase in Arctic marine activities requires more and improved SAR facilities to service the increasing volume of vessels operating in (remote) Arctic conditions. Due to the operational diversity of Arctic shipping, ranging from cargo transportation, fishing and tourism to research and offshore resource exploration, with varying numbers of passengers and crew on board, Arctic SAR operations vary in scale, scope and complexity. Strict onboard safety requirements mean that the probability of accidents is low, but the consequences may be severe. However, increasing and unprecedented marine traffic may make accidents more probable, considering the Arctic marine conditions, such as low visibility, low temperatures and long distances between the emergency sites and the support bases. Floating ice also poses challenges for navigation. Small icebergs like growlers and bergy bits are difficult to detect with satellites and radar, especially during rough weather, as they are mainly submerged. Ice formation on deck and hatch covers can create problems for ship stability and deck equipment, which needs to be removed regularly. Entering an icy ship deck in darkness and harsh weather places the crew members at risk. Harsh conditions can also increase fatigue among crew members and affect daily work. Extreme cold can cause problems to the engine, fuel transfer and pumps needed for firefighting, which could freeze from excess water inside. In certain Arctic cases, crews must be prepared to react without a "best practice" to follow, due to the unpredictable and shifting conditions (Hildebrand, Brigham & Johansson 2018, 39). Due to the lack of remote Arctic SAR experience, relevant personnel onboard commercial ships and the respective coastguard authorities require the best possible preparation, i.e. joint training sessions and new innovative training methods. [Anchor] Access restrictions may be another way to accommodate these conditions and avoid putting crews in unprecedented situations. Alternatively, regulation of the type or number of ships and/or passengers would mitigate risks and allow for better crew preparation.

As cruise tourism is projected to increase, this may lead to a growth in the number of passengers in the region, which will require more SAR resources, including medical and response facilities, in the event of an accident. Arctic weather conditions, including the cold and dark, underscore the need for such facilities, a timely response and properly trained crews on board marine operations. Combined with the remoteness factor, these conditions pose a challenging environment in which to undertake SAR operations. As with other Arctic infrastructure, there is a SAR infrastructure deficit, which requires development and funds at a national and international level in order to be able to intervene in emergencies, in a timely and adequate manner (Hildebrand, Brigham & Johansson 2018, 360–362). It does vary, however, as e.g. Norway possesses a robust set of response assets, whereas Greenland has very limited infrastructure to respond to emergency calls. Generally, communications and connection demands are higher in the Arctic, and there is a need for proper satellite broadband, satellite automatic identification system (AIS), radio towers, and other communications infrastructure to support SAR operations, as current satellite positioning systems and communications can be unreliable. In many cases, navigation charts are blank or inaccurate (Ikonen 2017 II). It is, therefore, advisable to further develop and strengthen Arctic maritime infrastructure, particularly concerning the availability of port reception facilities, which will improve communications between ports and operations. There is also a lack of reliable navigation safety information to help mariners identify, assess, and mitigate risks in the Arctic region, due to minimal maritime safety information infrastructure in the region. Hydrographic surveys rarely exist and, if they do, are likely to be decades old and performed using obsolete technology. In addition, physical aids to navigation (AtoN) cannot be sited throughout much of the Arctic due to ice movement, and AIS-based AtoN lack infrastructure required for their use. Virtual AtoN technology requires that hydrographic surveys have been performed and thorough knowledge of the seabed is available. Many remote areas in the Arctic are poorly surveyed if at all, which means it is still early days for virtual AtoN in an Arctic context (Hildebrand, Brigham & Johansson 2018, 77; 84; 95). There is a need for improved nautical charts in the Arctic, as chart coverage for coastal navigation is inadequate and lacks reliable information on depth and potential hazards. Nordic resource support for conducting hydrographic surveys is therefore necessary to enhance navigation security.

According to Hildebrand, Brigham & Johansson, SAR challenges across the Arctic include the following:

- *shortage of duly equipped support vessels that may be called on for assistance with regards to their maneuvering and station-keeping abilities in ice;*
- *the effect of cold temperatures on human physiology and psychology, equipment, materials and supplies;*
- *the possible flight limits of the rescue helicopters due to technical limitations or military regulations;*
- *lack of experienced personnel and training facilities for the specific evacuation systems that have been proposed for the Arctic areas;*
- *the effect of the polar night with extended periods of darkness;*
- *the possible lack of qualified medical help, the recovery and transportation of large numbers of survivors (and bodies, if necessary), accounting for survivors potentially having injuries and lack of training, age limitation, hypothermia, etc. This issue can be addressed by coordinating with hospitals in neighboring regions/countries* (Hildebrand, Brigham & Johansson 2018, 362).

In emergencies, IMO distinguishes between rescue as the *"operation to retrieve persons in distress, provide for their initial medical or other needs and deliver them to a place of safety,"* and a *mass rescue operation* (MRO) as *"characterized by the need for immediate response to large numbers of persons in distress such that the capabilities normally available to (SAR) authorities are inadequate"* (Hildebrand, Brigham & Johansson 2018, 361). Whether an emergency is a rescue or an MRO is determined by scale, scope and complexity. In the case of an emergency, it is the responsibility of the jurisdictional and national authority of the waters in which the emergency occurred to respond via its closest Rescue Coordination Center (RCC) if requested and of the flag State of the operating vessel(s) to intervene and take the necessary SAR actions. If deemed necessary, the relevant authorities may upgrade it to an MRO and ask for international support. In the case of an MRO, joint coordination is evidently required to ensure effective cooperation, as it may involve a range of different national private and public stakeholders. Working across different coordination levels is associated with difficulties in terms of contingency planning, as local communities, voluntary organizations, industry stakeholders and SAR authorities work across different platforms and systems, which reduces SAR coordination and efficiency (Ikonen 2017, 24). Promoting the development and integration of increased information exchange systems and the use of mutual vessel assistance systems such as Automated Mutual-Assistance Vessel Rescue System (AMVER) or VMS Victoria would serve to complement the extremely limited SAR resources and improve SAR capacity in the Arctic. These would be valuable assets to counter the risks associated with the limited experience in SAR operations and MROs in Arctic conditions. Nordic integration and coordination initiatives could be suitably enhanced through the Arctic Coast Guard Forum (ACGF), thereby utilizing all available resources and covering a larger area of the immense Arctic.

Despite formalized principles of Arctic cooperation both bilaterally and multilaterally, there is still work to do if the Arctic nations are to enhance SAR capabilities and mitigate human and environmental risks. There is a general need for infrastructure development, especially in terms of satellite imaging, communication, medical facilities and staff. Ikonen points to improved communication between coastguards and SAR authorities during emergencies, including information exchange and joint monitoring on vessel traffic, SAR assets and development of logs or platforms to share information between authorities. This entails development of cross-border communication infrastructure and navigation equipment, comprising route plans, emergency plans and vessel information of shipping companies and cruise operators. It is therefore recommended that enhanced Nordic cooperation work aims at specifying mandatory requirements for so-called "pairing" between two operating vessels in remote polar waters (certain latitudes in the high Arctic), i.e. between cruise/passenger ships. These must require shipping companies and cruise ship operators to share route plans, emergency plans as well as vessel and AIS information in order to maximize marine safety and assistance in the event of an emergency.

3. Overview: Regulations and measures for reducing and mitigating risks and preventing environmental damage in Arctic waters

Regulations and measures taken with the aim of reducing and mitigating risks and preventing environmental damage in Arctic waters are only binding within the IMO framework, whereas the AC is a rule-shaping body that works to promote consensus among the Arctic states on international regulatory frameworks, including on the Arctic. The table below presents important agreements for regulation on both international and Arctic shipping (IMO Status of Conventions 2019).

Table 6: Agreements for regulation on both international and Arctic shipping

Agreements	AC signatories	Total number of contracting states
The SAR Agreement 2011	Canada, Kingdom of Denmark, Finland Iceland, Norway, Russia, Sweden & USA (all AC member states)	8
MOSPA 2013	Canada, Kingdom of Denmark, Finland Iceland, Norway, Russia, Sweden & USA (all AC member states)	8
Agreement on Scientific Cooperation 2017	Canada, Kingdom of Denmark, Finland Iceland, Norway, Russia, Sweden & USA (all AC member states)	8
UNCLOS	Canada, Kingdom of Denmark, Finland, Iceland, Norway, Russia & Sweden (USA signed agreement but not Convention)	168
MARPOL Convention 1983	Canada, Kingdom of Denmark, Finland Iceland, Norway, Russia, Sweden & USA (all AC member states)	156
SOLAS Convention 1974	Canada, Kingdom of Denmark, Finland Iceland, Norway, Russia, Sweden & USA (all AC member states)	162
Polar Code (PC)	Mandatory under SOLAS	
IMO 2020 Sulphur Limit	Canada, Kingdom of Denmark,	97

(MARPOL Annex VI)	Finland Iceland, Norway, Russia, Sweden & USA (all AC member states)	
BWM Convention	Canada, Kingdom of Denmark, Finland Iceland, Norway, Russia, Sweden & USA (all AC member states)	81
FAL Convention	Canada, Kingdom of Denmark, Finland Iceland, Norway, Russia, Sweden & USA (all AC member states)	121
Ban on Commercial Fishing in the Arctic High Seas	Canada, China, Iceland, Japan, the Republic of Korea, Norway, Russia and the USA in addition to the EU, including Denmark (all AC member states)	36

Source: (IMO Status of Conventions 2019).

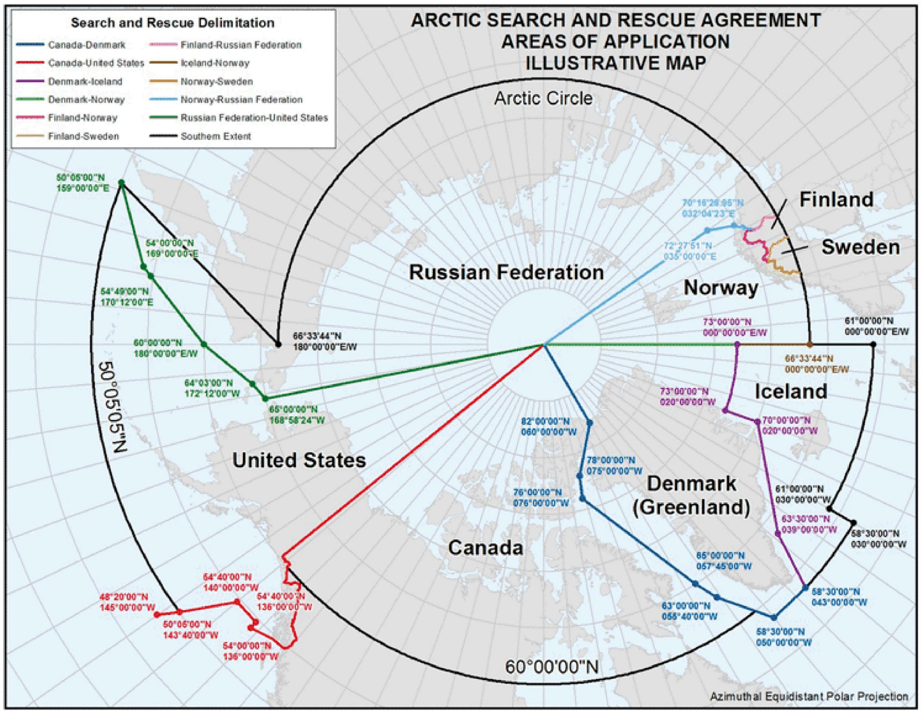
Whether the AC should be a rule-shaping or rule-making body is subject to ongoing discussion, and reform of its procedures is often debated. A proposal forwarded by the Standing committee of Parliamentarians of the Arctic Region is that the AC should become a fully-fledged international organization and, in such an event, the agreements and cooperation between and among the Arctic states could be made legally binding (Hildebrand, Brigham & Johansson 2018, 268). So far, three agreements have been negotiated under the auspices of the AC before being legally ratified through the IMO. They aim to accommodate the aforementioned drivers of maritime activity and thereby mitigate environmental and human safety risks in the maritime Arctic. The agreements are:

- Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic
- Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic (MOSPA)
- Agreement on Enhancing International Arctic Scientific Research (Arctic Council Agreements, 2018).

3.1. The SAR Agreement

The Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (SAR Agreement), signed in 2011, came into force in January 2013, constituting the first ever legally binding agreement negotiated under the auspices of the AC. The objective of the agreement is to strengthen Arctic aeronautical and maritime SAR cooperation and coordination. The agreement stipulates bordering coordinates, specifying the areas the respective Arctic countries are responsible for and may potentially work together, in the case of SAR situations, as displayed by below map.

Figure 4: Arctic search and rescue agreement areas of application illustrative map



Source: Arctic Deeply n.d.

In line with the agreement, bilateral and multilateral agreements have been enacted between neighboring countries to strengthen cross-country SAR cooperation. Thus, the neighboring countries with bordering nautical coordinates exchange information on their respective national SAR capabilities. In the event of an accident that requires additional deployment of resources, it is vital that the position of the closest available SAR capabilities be known.

The SAR Agreement further sets out the jurisdictional coordinates of each country and of the national SAR authorities, SAR agencies and RCCs. Article 7 specifies how the parties must conduct SAR operations. Articles 8 and 9 of the agreement acknowledge that the parties commit to transparent communication with regard to SAR facilities, relevant emergency infrastructure and territory entry requests in relation to SAR incidents. The agreement also encourages the AC member states to conduct joint training sessions (Arctic Council SAR Agreement 2013).

3.2. MOSPA

MOSPA was signed in May 2013. The objective of the agreement is to strengthen Arctic cooperation, coordination and mutual assistance among the parties on oil pollution preparedness and response in order to protect the marine environment from pollution by oil. By signing the agreement, the parties undertake to prepare national contingency plans on oil spills, including the relevant personnel and stakeholders to counter such incidents within the individual jurisdiction of any state.

It also lays down operational guidelines, including which measures and interventions the states are to take, as well as how to involve affected parties and request assistance from other AC member states. The agreement also encourages the AC member states to conduct joint training sessions (Arctic Council Agreement on Oil Pollution Preparedness and Response 2013).

3.3. Agreement on Scientific Cooperation

The Agreement on Enhancing International Arctic Scientific Research was signed in May 2017 and is thereby the third legally binding agreement negotiated under the auspices of the AC. The objective of the agreement is to strengthen AC ties, effectiveness and efficiency within the scientific realm of the Arctic. The agreement features specified areas, in which the respective states have undertaken to allow full access for researchers. By signing the agreement, the states have also committed to facilitate access to facilities, infrastructure and data needed to carry out scientific research within the Arctic. The agreement encourages joint research and studies among AC members. Increased cooperation on research is an evident feature, as research is key to introducing new methods and solutions to mitigate risks in Arctic shipping, especially on the environmental side, i.e. on fuel, invasive species and the impact of climate change on the Arctic and its inhabitants. Therefore, it should be a Nordic priority to enhance joint research cooperation, in line with recommendation number seven, including (annual) resource and budget allocations to support research initiatives in the Arctic. This may best be achieved through PAME and may be supplemented with national experts from various research institutions.

3.4. UNCLOS

The United Nations Convention on the Law of the Sea (UNCLOS) was adopted in 1982. It lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources. It embodies in one instrument traditional rules for the uses of the oceans, at the same time as introducing new legal concepts and regimes and addressing new concerns. The Convention also provides the framework for further development of specific areas of the law of the sea (IMO UNCLOS 2019).

3.5. MARPOL Convention

MARPOL is the International Convention for the Prevention of Pollution from Ships, enforced by IMO and covers pollution prevention of marine environments by ships from operational and accidental causes. MARPOL includes regulations aimed at preventing and minimizing pollution from ships – both accidental pollution and that of routine operations. Currently, it includes six technical Annexes, which encompass special areas with strict controls on operational discharge. The six technical Annexes concern regulations for the prevention of pollution from oil, noxious liquid substances in bulk, harmful substances carried by sea in packaged form, as well as sewage, garbage and air pollution from ships (IMO MARPOL 2019).

3.6. SOLAS Convention

SOLAS is the International Convention for the Safety of Life at Sea and is under the jurisdiction of IMO. The main objective of SOLAS is to ensure the safety of life at sea, intended for the protection of human life. The SOLAS Convention specifies minimum standards for the construction, equipment and operation of ships, compatible with their safety. According to IMO, flag states are responsible for ensuring that ships under their flag comply with its requirements, and several certificates are prescribed in the Convention to provide proof of this. If there are clear grounds to question the compliance of a given ship and its equipment with these requirements, contracting states are allowed to inspect the ship in question, through the port state control procedure. SOLAS outlines general provisions regarding documentation to indicate whether a given ship meets the requirements of the Convention. The Convention runs to 14 chapters, specifying the safety standards and requirements for vessels in regard to operational crew protection, electronic installations, safety equipment, navigational and fire safety equipment, radio communications, and carriage of cargoes and dangerous goods.

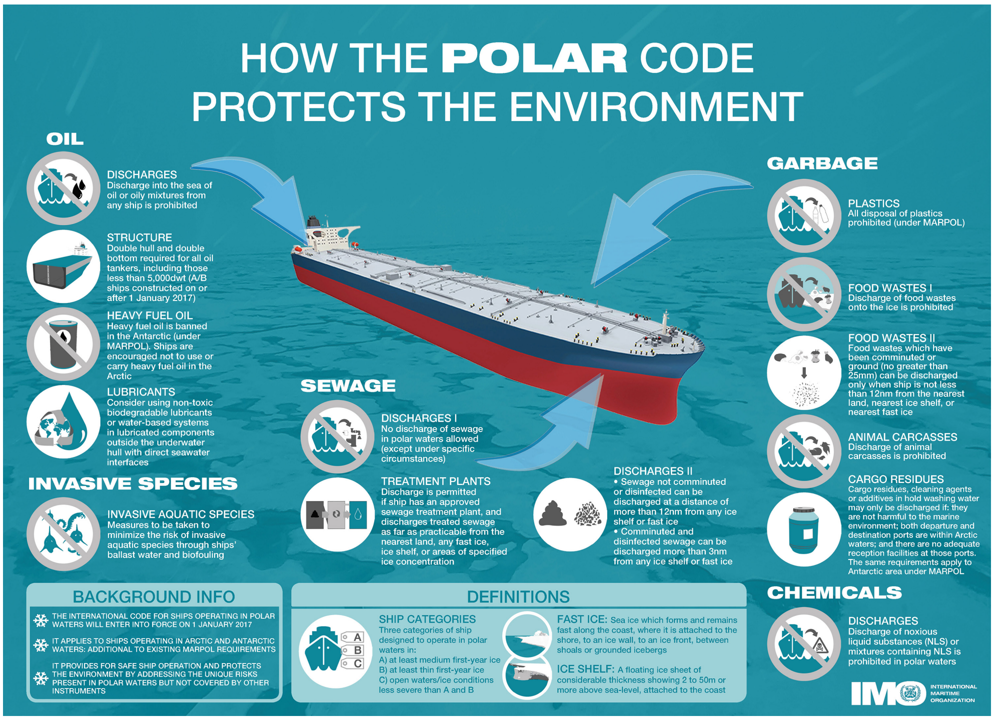
3.7. Polar Code (PC)

In 2017, IMO enacted the International Code for Ships Operating in Polar Waters (Polar Code) as a protective measure due to the fact that ships operating in polar environments are exposed to several unique risks. Harsh and unpredictable weather conditions and the relative lack of good charts, communication systems and other navigational aids pose challenges for marine operations. The remoteness of the areas makes rescue and clean-up operations difficult and costly. Cold temperatures may reduce the effectiveness of several ship components, ranging from deck machinery and emergency equipment to sea suctions. When ice is present, it can impose additional loads on the hull, propulsion system and appendages. The PC is mandatory under the existing legal framework of SOLAS and MARPOL and incorporates the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention). The PC includes mandatory measures covering safety (part I-A) and pollution prevention (part II-A) and recommendatory provisions for both (parts I-B and II-B). Thus, the PC incorporates requirements on design, construction, equipment, operational training, SAR, and environmental protection matters relevant to ships operating in the inhospitable waters surrounding the two poles (IMO Polar Code 2019).

The Polar Code is mandatory for certain ships under SOLAS and MARPOL. While SOLAS Chapter 5 (Safety of navigation) applies to all ships on all voyages (with some specific exceptions), the other chapters of the Convention do not apply to some categories of ships, including cargo ships of less than 500 GT, pleasure yachts not engaged in trade (cruise/passenger ships) and fishing vessels (also termed "non-SOLAS ships"). This exemplifies the clear need for a PC version II which incorporates mandatory requirements for all ships voyaging in polar waters, as it is fundamental to the improvement of human and environmental safety in the Arctic. Coordinated joint Nordic efforts pushing for enhanced reform of the PC are therefore strongly recommended.

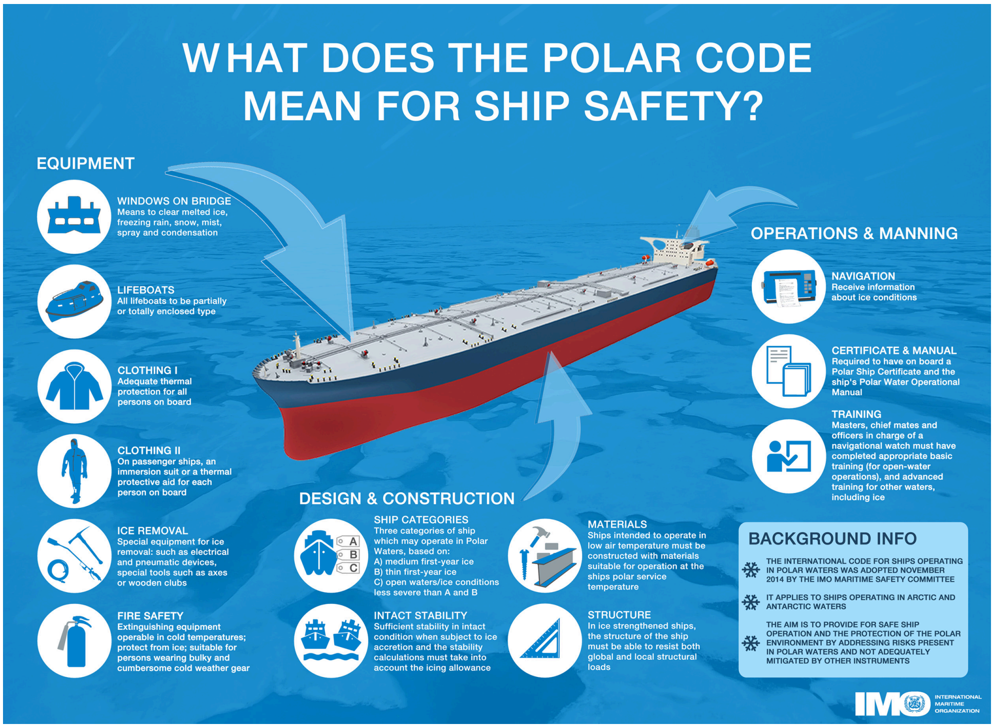
The infographics below issued by IMO illustrate how the PC is intended to contribute to mitigating environmental and human safety risks in Arctic shipping

Figure 5: How the polar code protects the environment



Source: IMO Polar Code 2019.

Figure 6: What does the polar code mean for ship safety?



Source: IMO Polar Code 2019.

3.8. IMO 2020 Sulphur Limit

As a response to one of the major threats identified not only to the Arctic environment and to the human health of Arctic inhabitants, but also from a global perspective, the IMO enacted a 0.50% sulphur limit (as opposed to the current cap of 3.5%) in fuel for marine operations to take effect from January 1, 2020 (IMO PPR 6th Session 2019). This will significantly reduce the risks of SOx in connection with acid rain (which causes environmental damage to crops, forests and aquatic species and contributes to acidification of the ocean), while decreasing the harmful effect on human health and related diseases. It is adopted under MARPOL Annex VI regulation 14 and applies to all ships on international voyages (IMO Sulphur 2020 2019).

The projected effect of the 0.50% sulphur limit will result in a 10% reduction of BC emission in the Arctic, whereas assigning Emission Control Area (ECA) status to the Arctic, and thereby a 0.1% sulphur emission limit, will result in a 50% BC emission reduction (Lack 2016, 12). Nordic cooperation should therefore seek to enhance emission regulation by assigning ECA status to the Arctic and progressively work towards a ban on the use of HFO in the Arctic.

To speed up the mitigation of risks in the Arctic associated with the use and carriage of HFO, the Clean Arctic Alliance (a coalition of 18 NGOs) has called for a complete ban on HFO use and carriage in the Arctic, to be developed and adopted by 2021 and phased in by 2023. The work towards making the Arctic HFO-free was supported by IMO's Marine Environment Protection Committee (MEPC) at the 72nd session of the committee, and jointly suggested by Finland, Germany, Iceland, Netherlands, New

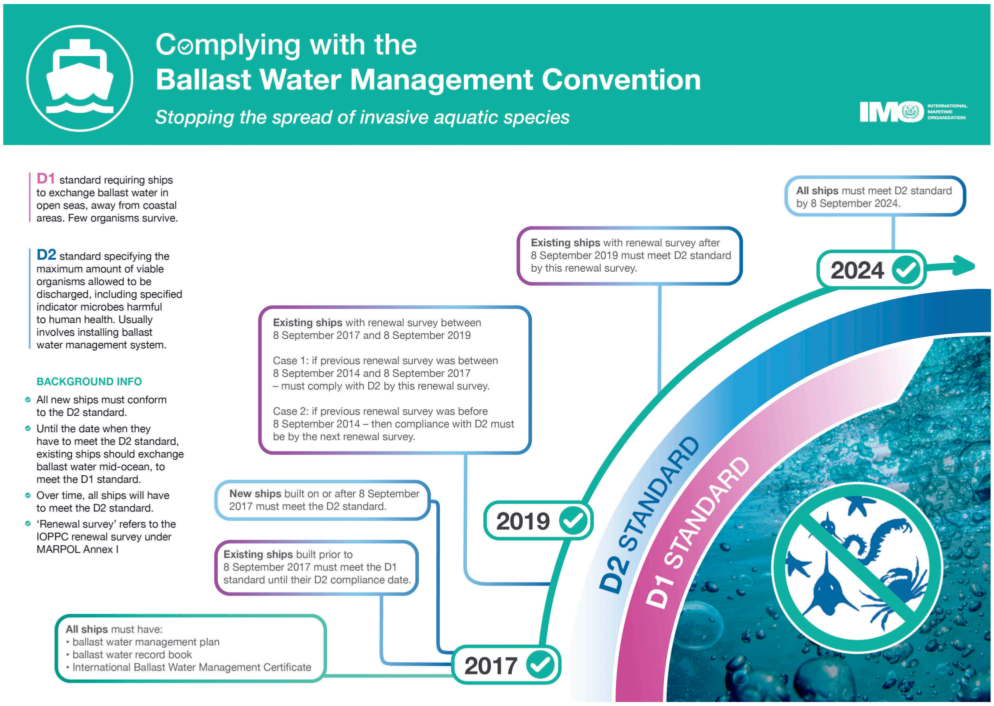
Zealand, Norway, Sweden and the USA. The ban proposal and a proposal for an assessment of the impact of such a ban on Arctic communities set forward by Canada were supported by Australia, Belgium, Czech Republic, Denmark, Estonia, France, Ireland, Japan, the League of Arab States, Poland, Portugal, Spain, Switzerland and the UK (World Maritime News 2018). In other words, there is widespread support within IMO to pursue an HFO-free Arctic. An HFO ban will result in reduction of emissions. Accordingly, a switch from low quality fuel to high quality fuel will result in a 5–8% decrease in CO2 emissions, whereas SO2 emissions will decrease by 95%. Sulphate emissions will decrease by 93% and organic matter by 75% if fuels are switched from low to high quality (Lack 2016, 13). In Antarctica, the other area covered by the PC, an HFO ban is already present and has been in effect since 1 August 2011. This has led various NGOs to call for a similar ban in the Arctic. However, according to IMO there are significant differences between the two, despite the many similarities with regard to marine environment. The Arctic is an ocean surrounded by continents with a significant amount of multi-year ice, while the Antarctic is a continent surrounded by an ocean with relatively little multi-year ice. Moreover, there is a different legal and (geo)-political climate present in the two marine spaces, which may complicate certain international initiatives in the Arctic (IMO Polar Code 2019).

Furthermore, it is the ambition of IMO to reduce the total annual global GHG emission in shipping by 50% in 2050 compared to the emission levels of 2008, while simultaneously working to phase out GHG emissions entirely. This overall goal is complemented by objectives to strengthen the requirements for each ship type and reach 40% by 2030. These objectives call for full commitment on the part of all the relevant marine stakeholders at national, regional and international level and substantial R&D investments to introduce new fuel types, such as hybrid fuel oils, and propulsion technologies (World Maritime News 2018 II).

3.9. BWM Convention

As authorized by the MEPC under the IMO, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted in September 2017. To date, it has been ratified by 81 countries, representing 80.76% of the world's merchant shipping tonnage. Amendments to the treaty, relating to implementation timelines, will enter into force on 13 October 2019. The convention applies to ships registered under contracting parties to the BWM Convention which take up and use ballast water during international voyages. The purpose of the treaty is to help prevent the spread of potentially harmful aquatic organisms and pathogens in ships' ballast water. Considering the vulnerable Arctic marine environment combined with rapid climate change, ballast water management is an important factor in preserving the unique Arctic biodiversity and sustaining vital ecosystems. Under the BWM Convention, ships must manage their ballast water so that aquatic organisms and pathogens are removed or rendered harmless before releasing their ballast water into a new location. This will help mitigate the risks associated with the spread of invasive species. The timeline implementation amendments concern the two ballast water management standards D1 and D2, as illustrated by the infographics below (IMO BWM Convention 2019).

Figure 7: Two ballast water management standards D1 and D2



Source: IMO BWM Convention 2019.

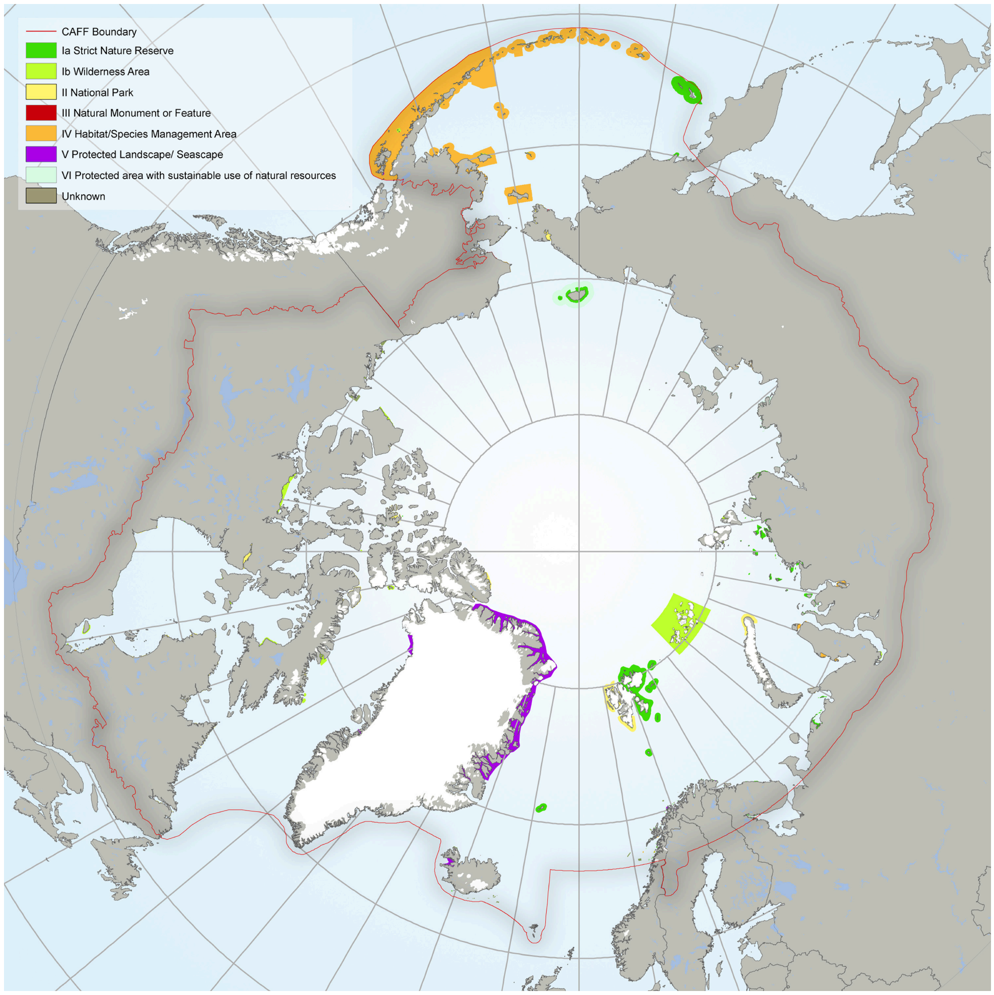
3.10. Enhanced marine protection: Special Areas, MPAs and PSSAs

MARPOL Annex V recognizes that certain sea areas require higher degrees of protection and can be designated as Special Areas under MARPOL. There are currently eight Special Areas designated under Annex V: the Mediterranean Sea, the Baltic Sea, the Black Sea, the Red Sea, the "Gulfs" areas, the North Sea, the Wider Caribbean region including the Gulf of Mexico and the Caribbean Sea, and the Antarctic area. Similar to Antarctica there is *"a clear need to designate areas within national jurisdiction as 'Special Areas' or 'SOx emission control areas' in order to obtain special protection under MARPOL73/78. A designation as such would certainly add weight to the protection of the marine environment in Arctic ice-covered areas and could even be extended to 'areas beyond national jurisdiction' where increased trans-Arctic shipping could increase the possibility of harmful discharge from commercial vessels"* (Hildebrand, Brigham & Johansson 2018, 259).

However, neither the Arctic Ocean nor parts of it are currently designated Special Area(s). This may be due to the Special Area Guidelines, which, in accordance with the provisions of MARPOL, require adequate reception facilities to be provided for ships, in order for a Special Area designation to become effective. Considering the current lack of port infrastructure, including reception facilities, this presents a challenge in the Arctic context (Hildebrand, Brigham & Johansson 2018, 313). A report conducted by DNV in 2014 concluded however that *"designation as a Special Area under MARPOL would not lead to a discernible increase in protection, but that* *all or part of the Arctic high seas should be designated as a [Particular Sensitive Sea Area] (PSSA). A preferred option was to designate the entire Arctic high seas as a PSSA with a ship reporting system to monitor traffic and dynamic areas to be avoided to reflect the moving sea ice edge"* (Hildebrand, Brigham & Johansson 2018, 306). Alternatively, one or more so-called "core sea ice areas" could be designated as PSSAs or areas to be avoided. So far however there is no PSSA to protect sensitive marine areas in the Arctic. According to IMO's definition, a PSSA *"is an area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities. The criteria for the identification of particularly sensitive sea areas and the criteria for the designation of special areas are not mutually exclusive. In many cases a Particularly Sensitive Sea Area may be identified within a Special Area and vice versa"* (IMO PSSA, 2019).

A PSSA proposal is initiated by a member state or a group of states which have a common interest in the proposed PSSA. A PPSA application must contain evidence to satisfy the three primary requirements for PSSA designation. First, the area must meet at least one of the specified ecological, socio-economic or scientific criteria; secondly, the area must be at risk from international shipping; and thirdly, the proposed associated measures must have a clear legal basis and be within the competence of the IMO (Hildebrand, Brigham & Johansson 2018, 314). Another similar term, "marine protected area" (MPA), as operationalized by PAME under the auspices of the AC to enhance protection of Arctic peoples and the marine environment, is defined as: *"A clearly defined geographical space recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values"* (PAME Marine Protected Areas 2019). PAME adopted this definition from the International Union for the Conservation of Nature (IUCN), which specifies seven management categories of MPAs: (I) Strict Nature Reserve, (II) Wilderness Area, (III) National Park, (IV) Natural Monument or Feature, (V) Habitat/Species Management Area, (VI) Protected Landscape/Seascape and (VII) Protected area with sustainable use of natural resources. The map from 2016 below illustrates MPAs in the Arctic classified in accordance with their IUCN Management Category.

Figure 8: Illustration of MPAs in the Arctic classified in accordance with their IUCN Management Category



Source: PAME Marine Protected Areas 2019.

As of 2016, the MPAs on the map account for 4.7% of the 860,000 km^2 Arctic marine area, and Category V Habitat/Species Management Areas account for approximately 60% out of the 4.7%. Infrastructure plays a significant role in the establishment and functioning of MPAs (for shipping), and includes: *"hydrography and charting; monitoring and surveillance of marine traffic; aids to navigation; search and rescue capacity; environmental response capacity; salvage; environmental observing (sea ice, oceans, atmosphere and terrestrial (permafrost); communications; port services, and, more. Without these fundamental elements of infrastructure MPAs cannot become effective marine management tools that can enhance safety and protection"* (Hildebrand, Brigham & Johansson 2018, 318). Therefore, the current Arctic (marine) infrastructure deficit represents an obstacle to further adoption of MPAs. The Arctic marine environment includes areas under national jurisdiction and areas of high seas beyond national jurisdiction. To date, only MPAs have been established in the Arctic (and therefore under national jurisdiction), which entails that no MPAs affect international rights of navigation (Hildebrand, Brigham & Johansson 2018, 298–302). On the other hand, implementation of PSSAs would constitute internationally formalized legal measures and thus protect sensitive marine areas in the Arctic. They should therefore be a main priority for enhanced Nordic cooperation.

3.11. Ban on Commercial Fishing in the Arctic High Seas

In 2015, by signing the Declaration Concerning the Prevention of Unregulated High Seas Fishing in the Central Arctic Ocean, the five coastal Arctic nations (the A-5) agreed to keep fishing fleets out of the central Arctic Ocean to give scientists the chance to learn more about the fish that migrate to the high Arctic. No commercial fishing occurs there now, but that could change as climate change opens the seas and if warmer temperatures draw fish such as cod further north (Arctic Deeply n.d.). On 14 February 2019, the A-5 signed an international agreement to ban commercial fishing in the high Arctic for 16 years in order to reduce the impact of unregulated commercial fishing and preserve the region's fragile ecosystem. The treaty has an automatic renewal clause every five years and was signed by Canada, China, Iceland, Japan, the Republic of Korea, Norway, Russia and the USA, in addition to the EU, including Denmark. It will enter into force once ratified by all ten parties. The agreement covers an area of about 2.8 million km^2 of the central high Arctic. It is the first time that the international community has refrained from commercial fishing in an area before more is known about its ecosystem (Lee 2019). Since the agreement has not yet come into force, Nordic efforts should push for speeding up the ratification process.

4. Mapping: Nordic cooperation regionally and internationally on shipping in the Arctic

Nordic cooperation comes in many forms, both formally via established bodies and informally via existing bilateral and multilateral structures. The degree of Nordic cooperation also depends on various factors, including regional and international forums, such as the Nordic Council (NC)/Nordic Council of Ministers (NCM), the AC, NATO and the EU. When discussing Nordic cooperation, however, one cannot avoid mentioning the 2009 Stoltenberg report. The scope of the report is Nordic cooperation on foreign and security policy in relation to the changing Arctic, comprising various elements relating to shipping. In the report, Thorvald Stoltenberg provided an account of 13 recommendations for increasing Nordic cooperation. The 13 recommendations are as follows:

1. Nordic stabilization task force
2. Nordic cooperation on surveillance of Icelandic airspace
3. Nordic maritime monitoring system
4. Maritime response force
5. Satellite system for surveillance and communications
6. Nordic cooperation on Arctic issues
7. Nordic resource network to protect against cyber attacks
8. Disaster response unit
9. War crimes investigation unit
10. Cooperation between foreign services
11. Military cooperation on transport, medical services, education, materiel and exercise ranges
12. Amphibious unit
13. Nordic declaration of solidarity

Now, 10 years later, various representatives from the Nordic countries are opting for a new Stoltenberg report, including an implementation assessment of the 2009 recommendations. According to a recent scoreboard reassessment of Stoltenberg's report conducted by the respective Nordic Institutes of International Studies/Affairs, the degree of implementation of the 13 2009 recommendations is indicated in the table below.

Table 7: The degree of implementation of the 13 2009 recommendations

1	Nordic stabilization task force	
2	Nordic cooperation on surveillance of Icelandic airspace	
3	Nordic maritime monitoring system	
4	Maritime response force	
5	Satelite system for surveillance and communications	
6	Nordic cooperation on Arctic issuses	
7	Nordic ressource network to protect against cyper attacks	
8	Disaster response unit	
9	War crimes investigation unit	
10	Cooperation between foreign services	
11	Military cooperation on transport, medical services, education, materiel and exercise ranges	
12	Amphiblous unit	
13	Nordic declaration of solidarity	

Coding

Green	Significant process	
Shaded green	Significant process, but the Nordic effort has been supplemented by an external body	
Yellow	Some progress	
Shaded yellow	Nordic planning/small steps have been made towards solving the task, but an external body is also involved	
Red	Little or no progress	

Source: Fägersten et. al. 2019, 7.

Due to the specific scope of the 2009 Stoltenberg report, the proposals reflect a focus on foreign and security policies. However, proposals 3, 4, 5, 6 and 8 are of significant interest in terms of Nordic cooperation on shipping in the Arctic. According to the report, a Nordic maritime monitoring system should be established for monitoring and early warning in the Nordic sea areas. Such a system should be civilian in nature and designed for monitoring the marine environment as well as pollution and monitoring of civilian traffic. The existing military surveillance systems are not able to carry out these tasks in their present formats. The report suggested a two-pillar system, one covering the Baltic Sea ("BalticWatch") and one covering the North Atlantic, parts of the Arctic Ocean and the Barents Sea ("BarentsWatch"), under a common overall system. It points to a need for a comprehensive Nordic system, as the Nordics cover immense sea areas which are rapidly changing and therefore should be covered by an integrated Nordic monitoring system to enhance (the lack of) information exchange between different national and multilateral authorities (Stoltenberg 12–14, 2009).

Currently, Nordic cooperation is bilateral in form or part of different structures which do not solely rely on a Nordic framework. Despite the existing building-blocks, developments in the direction envisaged by Stoltenberg have been limited. The Sea Surveillance Co-operation Baltic Sea (SUCBAS) is an example of multilateral cooperation between all the littoral states in the Baltic Sea except for Russia It aims to improve maritime situational awareness through the exchange of relevant data, information and knowledge across national and organizational borders. Norway and Iceland are currently not members – maybe due to the geographical scope of the system, which may not be as relevant for Norwegian and Icelandic stakeholders. For the purposes of Nordic maritime surveillance, Norwegian and Icelandic membership of SUCBAS would enhance the existing Nordic cooperation and may lead to an expansion of the geographical scope to the North Atlantic and Arctic regions. On the other hand, Norway has developed the "BarentsWatch", but it is still a national surveillance system, as none of the other Nordic countries has joined. This sub-regional division illustrates how geography, which in many respects unites the Nordic states, can also divide them. Also, the current actions taken by the EU (*European Border Surveillance System [EUROSUR]*) in the maritime sphere may endorse a reluctance towards a Nordic system. (Fägersten et. al. 2019, 10).

Multilateral forums such as the North Atlantic Coast Guard Form (NACGF), involving all five Nordic countries among others, and the ACGF, involving all the member states of the AC, also challenge the Nordic scope of a maritime surveillance system, as these would encompass greater capacity and cover larger geographical areas. In addition, PAME's Arctic Ship Traffic Data (ASTD), which provides data about all shipping activities in the Arctic, including the type of ships and vessels, their routes and destinations, and detailed data on fuel consumption and emissions, provides this information within an AC scope (NCM 2019, 11).

Following on from the above, Stoltenberg's 4th proposal is a Nordic maritime response unit which can be implemented once a Nordic maritime surveillance system is developed and enforced. The primary motivation behind the proposal is the combination of increasing maritime traffic in Arctic waters and the limited ability of the relevant Nordic states, particularly Denmark, Iceland and Norway, to respond to the related challenges in terms of surveillance as well as SAR. The report also urges the Nordic states to develop a joint icebreaker capacity for Arctic conditions (Stoltenberg 2009, 15–16). Although Nordic cooperation in these areas has not advanced as suggested by the Stoltenberg report, these issues have been addressed within the framework of the AC. As mentioned earlier, the eight Arctic states in the AC signed agreements on aeronautical and maritime SAR and on cooperation on marine oil pollution preparedness and response in 2011 and 2013 respectively. In 2015, the AC agreed to set up the ACGF, which aims at enhancing practical cooperation among their coastguards, especially regarding SAR, emergency response and icebreaking. Furthermore, there are various forms and formats of informal cooperation involving the Nordic coastguards. Nordic cooperation is present but unlike the outcome envisaged by Stoltenberg, it is taking place under the auspices of the AC, and above all the ACGF (Fägersten et. al. 2019, 11).

Connected to proposals 3 (Nordic maritime monitoring system) and 4 (Maritime response force), Stoltenberg puts forward proposal 5 (Satellite system for surveillance and communication), which states that a Nordic polar orbit satellite system should be established by 2020, either jointly developed or purchased by the Nordics. Such a satellite system could provide frequently updated real-time images of the situation at sea, which is essential for effective maritime monitoring and emergency management, especially given the prospects of increased shipping in the Arctic. In addition, a functioning satellite system would be capable of providing information from the sea surface irrespective of weather and light conditions, as well as tools for communication between various actors and components of a maritime monitoring system (Stoltenberg 2009, 17–18). Around the same time as the publication of Stoltenberg's report, the EU emerged as a new and operative space actor in Europe, with the launch of the EU Copernicus program (2014–2020), which Norway and Iceland also joined. This is most likely the reason why no substantial progress has been made on a Nordic satellite system (Fägersten et. al. 2019, 12).

Moving on to proposal 6 (Nordic cooperation on Arctic issues), Stoltenberg suggests that the Nordic countries should develop deeper cooperation on Arctic issues focusing on the environment, climate change, maritime safety and SAR services. According to Fägersten et. al., *"Nordic cooperation on Arctic issues has strengthened since Stoltenberg's report, it is largely under the auspices of the AC, which has taken up a greater and more significant role, as climate change is accelerating in the Arctic. Hence, the significant accomplishments in Nordic Arctic cooperation should be credited to the AC, plus the ACGF, rather than the Nordics as such. It is only in the unfortunate event that the AC should cease functioning that there would be an opening for a purely Nordic effort"* (Fägersten et. al. 2019, 13). Increased Arctic regionalization, through the AC and Nordic cooperation, are dependent on the nature of the cooperation and to what extent it potentially plays into the forum of the A-5

Finally, as regards proposal 8 (Disaster response unit), which relates to or elaborates on proposal 4 regarding the development of a marine response force, the report states: "*A Nordic disaster response unit should be established for dealing with large-scale disasters and accidents in the Nordic region and in other countries. The unit's main task would be to coordinate Nordic efforts as needed. It would maintain an overview of available equipment and personnel and establish a network made up of the many public and private organizations working in this field. The unit would set up Nordic groups/teams to meet specific needs, for example in the field of advanced search and rescue"* (Fägersten et. al. 2019, 15). The development of a Nordic disaster response unit is particularly interesting in the case of the Arctic, and the projected increase in maritime activity that will take place in Arctic waters. With the two Haga Declarations from 2009 and 2013, the civil protection and emergency management agenda was raised to the highest political level. The declarations emphasize joint capacity building and joint interventions as instrumental in pre-empting and limiting the consequences of natural disasters and accidents. Although no formal unit has been established, units such as the Nordic Cooperation on Civil Protection (NORDRED) and Nordic Cooperation Forum, where officials representing the EU and NATO delegations and the European Commission meet four times a year to discuss current issues, have been established. Structures supported by the Nordics at EU and/or NATO level(s) may also handle disaster responses (Fägersten et. al. 2019, 15).

4.1. The Nordic Council of Ministers (NCM) and the Nordic Council (NC)

The NCM is the formalized institution of Nordic cooperation, and cooperation on the Arctic is a significant priority, as demonstrated by the development of Arctic Cooperation Programs. The pro-regional cooperation approach of the NCM means it is well-placed to act as an intermediary between institutions such as the AC and the EU and to promote Arctic integration on different levels of governance (Rosamond 2011, 26). In terms of the current Arctic Cooperation Program 2018–2021, the purpose is to create sustainable and constructive development in the Arctic and for its people based on the five Ps: planet, peoples, prosperity, peace and partnerships. This agenda is strongly influenced by the UN Sustainable Development Goals (SDGs), and involves the following shipping-related areas, amongst others:

- Indigenous peoples in the Arctic
- Health and social conditions in the Arctic
- Research, education, training and skills enhancement in the Arctic
- Innovative solutions for sustainable energy in the Arctic
- Sustainable exploitation and use of marine resources
- Recognition of the importance of biodiversity and change in the Arctic
- Reduction of greenhouse gas emissions, adaptation to climate challenges and resilient communities in the Arctic
- The importance of culture for a sustainable future in the Arctic
- Relevant businesses in the Arctic, including tourism, food culture and food exports (NCM 2017, 7–12).

The Nordic Council (NC) is a formalized, institutional body functioning as inter-parliamentary cooperation between its members from Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland. The NC is a forum for the Nordic countries to work jointly on integrating priorities within the Nordic region, as well as to promote Nordic solutions globally. Due to their territorial location, the Nordics share an immense interest in the Arctic region. Through the NC, the Nordic countries work together to improve the quality of life of the indigenous peoples in the Arctic, to promote social and cultural development, to protect the sensitive and unique Arctic nature, to ensure sustainable use of natural resources and to protect biological diversity (Nordic Council 2019).

4.2. Sub-regionalized Nordic cooperation

Nordic cooperation in the Arctic is further sub-regionalized into different types of cooperation, involving fewer countries than the NC/NCM. The Nordic Atlantic Cooperation (NORA) is an intergovernmental body, under the NCM's regional cooperation program, consisting of Greenland, Iceland, the Faroe Islands and coastal Norway. The NORA countries are united by geography, common characteristics and challenges as well as historical, institutional and cultural ties. NORA contributes to strengthening the region by emphasizing sustainable economic development, e.g. through cross-border collaborations with businesses, development and research institutions. NORA is financed by the respective governments and NCM and provides funding for projects and initiatives aimed at strengthening the region and involving partners from at least two different NORA countries (NORA n.d.). Another cooperation, consisting of the same members as NORA, is the North Atlantic Marine Mammal Commission (NAMMCO). Unlike NORA, the scope of NAMMCO is more closely defined and relates to the conservation management and study of cetaceans (whales, dolphins and porpoises) and pinnipeds (seals and walruses) in the North Atlantic. NAMMCO is committed to sustainable and responsible use of all living marine resources, including marine mammals. NAMMCO therefore aims to strengthen and further develop effective conservation and management measures for marine mammals, based on research and local user knowledge. These measures are fundamental to sustaining coastal communities, which depend on sustainable Arctic marine life.

Another sub-regional inter-parliamentarian cooperation is the West Nordic Council (WNC), with a constellation of the most sparsely populated countries, namely Greenland, the Faroe Islands and Iceland. According to the WNC website, the focus areas of the organization include: *"sustainable development, environmental affairs, natural resources, transport, infrastructure, SAR, climate change, free trade, security and defense, public health, culture, education, youth and Arctic affairs"*. The WNC is a forum that offers the three small countries a worthwhile platform where they can engage further in economic cooperation and conduct foreign affairs, especially in relation to the Arctic. For Greenland (and to some extent the Faroe Islands), it is one of the few venues where it pursues cooperation without Denmark's supervision, with the only other notable exception for such cooperation forums being NAMMCO. The WNC's closest collaborator is the NC, and they work together on key issues of the West Nordic region, giving the WNC the right to speak at the NC's sessions. The NCM has observer status in the AC, while the WNC and NC are members of a complementary forum to the AC, called the Conference of Parliamentarians of the Arctic Region. Based on the WNC countries' emphasis on further development and cooperation through the Council, it is likely that it will go from strength to strength, especially in terms of Arctic issues (Nielsson 2013).

In terms of Arctic governance, one may argue that there are too many regional institutions in the Arctic, creating an overlapping effect and leading to inefficiency. Institutional sedimentation therefore works to preserve good inter-state relations, thereby enhancing stability in economic and security matters within the Arctic.

5. Analysis: What needs to be done and what can Nordic cooperation bring of value?

As illustrated in Chapter 3 of this report, the Arctic, including the geographic and IMO Arctic, faces increasing maritime activity, particularly shipping, which entails an increased risk of accidents and natural disasters posing threats to human lives and environmental protection. Based on the research of this report, including desktop studies, survey responses and interviews with relevant Nordic representatives, these risks have a twofold nature in the Arctic region. There is work to be done in mitigating risks in relation to Arctic shipping, and enhanced Nordic cooperation can drive this development forward.

5.1. Infrastructure development

Due to remoteness, weather conditions and lack of adequate infrastructure, the distances in the Arctic serve to reinforce challenges for available SAR capabilities to reach accidents and mitigate them within a reasonable response timeframe. Combined with the increase in shipping, which is projected to increase year-on-year (especially due to the development of the cruise ship tourism industry), these risks will be even more evident. Due to the idiosyncratic environment and conditions of the Arctic, shipping is associated with greater risks to human lives and environmental protection and sustainability than in many other places on the planet. Therefore, infrastructure development of e.g. accurate hydrographic surveys, charts and AtoN, local response capacity, medical and port facilities, including rescue helicopters, and places of refuge will constitute relevant resources to mitigate risks in relation to shipping in the Arctic. However, it will not reduce the immense distances in the Arctic region, and the critical question is therefore how big a difference improved infrastructure will make if a cruise ship of 3,000 passengers finds itself isolated, distressed and in immediate need of emergency assistance in the Arctic. The current SAR facilities are not capable of responding effectively to worst-case scenarios. It is simply not possible to prepare for worst-case scenarios in Arctic areas, due to the distances, infrastructure deficit and Arctic weather and environmental conditions, but there is room for improvement of SAR capabilities.

Arctic infrastructure development is dichotomous however, as it serves commercial interests as well as SAR and environmental protection interests. It plays a significant role in regulation enforcement. Without having adequate infrastructure, including port services, SAR and environmental response capacities, accurate hydrographic surveys and AtoN, proper control and observation measures and well-functioning monitoring and surveillance capacities, in place, protective measures and regulations, such as ECAs, will not be effective marine management tools. Regardless of its nature, there is also a financial dimension to infrastructure development, as the actual development of it, as well as the operation and maintenance of such infrastructure, is very expensive. According to contributors to the research of this report, it is something that requires more than individual state budget allocations if it is to be realistic. As state budget allocations for this are already scarce, it may therefore be an option for Nordic or Arctic states to provide joint budget allocations to support the work on common infrastructure priorities to mitigate risks. From a cost-benefit perspective, costs are expected to be greater than benefits in such investments, in particular due to the current probability of accidents. Therefore, uniting industry's commercial interests and states' risk mitigation interests in the form of joint budget allocations may enhance the prospects of sustainable business cases for certain infrastructure developments that serve these interests.

Enhanced Nordic cooperation on infrastructure development would accommodate national resource scarcity by strengthening specific joint infrastructure priorities. This requires greater in-depth inter-Nordic cooperation, including joint budget allocations and strategic alignment. If successful, it would be a valuable asset for the Nordics (and potentially for all Arctic states), as sharing the operational responsibility and costs would enable long-term establishment and thereby contribute to mitigating the aforementioned risks in relation to (increased) shipping in the Arctic. As a unit, the Nordics also constitute a stronger mandate to involve and make demands on the part of industry stakeholders. Given the current regulatory framework, this is especially evident in the case of cargo ships and cruise/passenger ships, as enhanced cooperation with these operators will be an evident feature to mitigate shipping risks, as maritime activities increase.

As envisaged by Stoltenberg, Nordic Arctic priorities should focus on the environment, climate change, and maritime safety and SAR services. A united Nordic approach and effort enables coverage of a larger area, enhancement and improvement of existing resources and thus improved risk mitigation and protection of human lives and marine environments. In the best case scenario, this will expand to incorporate all the Arctic states, as enhanced pan-Arctic cooperation is key to facing the challenges associated with the increase in maritime activity in the immense Arctic area. Current maritime infrastructure development priorities include further development and strengthening of SAR facilities under the GMDSS in polar areas, including port reception facilities, icebreaker support and improvement of hydrographic surveys and nautical charts in order to enhance navigation safety in coastal and polar areas of the Arctic (Hildebrand, Brigham & Johansson 2018, 33–34). These priorities will strengthen maritime monitoring as well as satellite surveillance and communication, as proposed by Stoltenberg. Instead of an exclusive Nordic platform, this effort should involve the entire AC and PAME's ASTD, which constitute a valuable monitoring management tool. It will provide data about all shipping activities in the Arctic, including the type of ships and vessels, their routes and destinations, and detailed data on fuel consumption and emissions. Thus, it allows pollution from shipping to be calculated, which will help regulate and protect the Arctic environment (NCM 2019, 11). Enhancing data integration between ASTD, GMDSS and the relevant Arctic coastguards will provide valuable insights into ship traffic for voyaging vessels and increase the use of a common monitoring system. Development of a joint disaster/maritime response unit as proposed by Stoltenberg is a good fit with the framework of enhanced Nordic cooperation, including strategizing and budget allocations, as it is a Nordic priority to be able to respond to accidents and natural disasters in the best possible way. Preventive measures to strengthen maritime safety and protect human lives and environments, however, constitute a priority of all the Arctic states, and these initiatives should therefore take place within the existing structure of the ACGF. This would enable greater coverage of the Arctic, as inclusion of all the Arctic states will provide greater budget and resource allocation and thus a comprehensive Arctic framework and approach to mitigate risks.

Due to the combination of Arctic conditions, immense distances, hazardous environment, (unpredictable) polar weather conditions, the lack of adequate response resources, the costs associated with infrastructure development and the limited possibilities to respond to accidents and emergencies in a timely manner, regulation is the most effective preventive measure to mitigate human and environmental risks in relation to increasing Arctic shipping. Physical infrastructure development therefore takes second place in the hierarchy of priorities.

5.2. Enhancement of the international regulatory framework

The current level of regulation for shipping in the Arctic is limited and, except for the Polar Code (PC), there is no international regulatory framework encompassing the Arctic as a whole. The research of this report also suggests that legislation at an international level could be enhanced. By signing the regional MOSPA and SAR agreements, negotiated under the auspices of the AC, the Arctic states undertake to prepare national SAR emergency plans and contingency plans on oil spills, including the relevant personnel and stakeholders to counter such incidents within the individual jurisdiction of any state. Although the agreements seek to enhance pan-Arctic cooperation on SAR and oil spill preparedness and prevention, the Arctic states are only bound to meet the necessary requirements to fulfil their obligations within waters of national jurisdiction. In waters outside national jurisdiction, the states are obliged to assist to "the best of their abilities", meaning that they are not under any obligation to provide assistance of a certain type in foreign territorial waters.

The Arctic states each have national legislation that complies with the international regulations set out in IMO's legal framework, such as UNCLOS, SOLAS and MARPOL. Within national territorial jurisdictions and thus the respective maritime spheres however, the Arctic states are free to enforce any national legislation as long as it complies with the international laws and standards of the IMO. The Arctic high seas are international waters and therefore governed solely by the international legal regime of the IMO, including the PC, which is mandatory under SOLAS and MARPOL. Therefore, regulatory discrepancies between national territorial waters and international waters exist, due to national priorities, flag state regulations and the international level of legislation on shipping. Hence, vessels on Arctic voyages potentially face different legislation and regulation, which they are obliged to abide by. The Nordic representatives contributing to the research of this report also find the current level of national legislation to be sufficient but would like to see greater strategy development and budget allocation for shipping in the Arctic.

However, based on the research of this report, there is general agreement that the PC regulations covering the Arctic high seas are a good start, but insufficient to mitigate human safety and environmental risks in Arctic shipping. According to this report, which, among other things, relies on views from official Nordic maritime representatives, there is a need for reform of the regulatory framework of the PC.

The current PC consists of a dual framework encompassing mandatory provisions (parts I- and II-A) as well as recommendatory guidelines (parts I- and II-B). The current mandatory provisions constituting parts I- and II-A of the PC, however, only apply to certain types of ships – the larger ones. Hence, vessels of less than 500 GT, non-SOLAS ships, operating in polar waters are not obliged to comply with any PC regulations. The non-SOLAS ships category consists mainly of pleasure yachts, cruise/passenger ships and fishing vessels.

With the accelerating ice melt and the opportunities that come with it, the presence of ships within this category is projected to increase in the Arctic. DNV's figures from 2017 reveal that passenger ships (101) and fishing vessels (765) constitute almost half of the total amount of vessels operating (1,868) in the IMO Arctic. In addition, these vessels take up more than half of the total amount of sailed distance (10,422,800 NM) and the total amount of hours spent in the IMO Arctic (2,984, 900). Thus, they are a significant contributor to the total amount of fuel consumption in the area and constitute close to 50% of the vessels potentially involved in accidents (DNV 2019, 12). In other words, almost half of the vessels operating in the IMO Arctic are not obliged to abide by the existing PC framework covering the international waters of the Arctic high seas.

In order to efficiently mitigate human safety and environmental risks in relation to shipping, as covered by this report, it is therefore evident that the PC and reforms of or any mandatory amendments to the PC should make no exceptions and apply to all vessels voyaging in the Arctic. The first step may be to invoke parts I- and II-A on "non-SOLAS ships" and thus have them apply to all ships voyaging in the Arctic high seas. Then, parts I- and II-B may be made mandatory requirements, as opposed to recommendatory provisions, in order to strengthen the mitigation of risks in Arctic shipping. Ratifying the IMO Cape Town Agreement (CTA) of 2012 is another option to accommodate the legislative gap of the PC. It relates to fishing vessels in international high seas and specifies standards and regulations designed to protect the safety of crews and observers and provide a level playing field for industry. Once in force, the CTA will set minimum requirements on the design, construction, equipment and inspection of fishing vessels 24 meters or more in length that operate on the high seas (international waters). The treaty would be mandatory under SOLAS and empower port states to carry out safety inspections that could be aligned with fisheries and labor agencies, to ensure transparency of fishing and crew activities. The CTA takes effect once 22 states with a combined 3,600 eligible fishing vessels ratify or accede. Until the CTA enters into force, there are no mandatory global safety regulations for fishing vessels (The PEW Charitable Trusts 2019).

Once the legal framework of the new international treaty that bans commercial fishing for 16 years is ratified by all the signatories and takes effect, the number of commercial fishing vessels in the Arctic is expected to decrease significantly and may thus advance potential IMO regulations on non-SOLAS ships. As demonstrated by the current failure to ratify the CTA however, it is not a given that it will happen shortly. Furthermore, this agreement excludes cruise/passenger ships, which emphasizes the need for further regulation. A way to circumvent this is to make an amendment to the CTA that incorporates mandatory safety requirements and ship standards for cruise/passenger ships and thus ensures a level playing field for cruise ship operators. Considering the figures on ship type operations in the IMO Arctic, regulation of non-SOLAS ships is a major step in mitigating risks in relation to shipping in Arctic waters. Another regulatory measure to enhance human safety is to place restrictions on the number of passengers per cruise ship and on the types and volume of cruise ships operating in the Arctic. Such restrictions would reduce the number of lives at risk in the event of accidents. Restrictions on cruise ship type will enable SAR authorities to prepare and train for specific types of ships and a maximum number of passengers when undertaking SAR operations. In addition, mandatory requirements for so-called "pairing" between two operating vessels in remote polar waters (certain latitudes in the high Arctic), i.e. between cruise/passenger ships, will force shipping companies and cruise ship operators to share route plans, emergency plans as well as vessel and AIS information to maximize marine safety and assistance in case of an emergency. This will mitigate risks to human lives if the distance between the SAR response unit(s) and the cruise ship requesting emergency assistance is too great to deliver a timely response measure. Additionally, enhanced regulation on vessel discharging, including stricter requirements for and control mechanisms of sewage discharge and BWM systems for all vessels is an appropriate step to mitigate risks in relation to invasive species and damaging substances from discharging.

As it is in the interest of all Nordic countries to take the necessary measures to protect human lives and preserve fragile ecosystems in the Arctic, reform of international regulatory framework, including the PC, should be a common Nordic priority. International regulation of shipping which is not centered on the Arctic is an important feature as well, due to the impacts of global climate change on the Arctic. With enhanced cooperation and united strategic thinking on regulatory priorities, the Nordics constitute a significant voice and can influence Arctic development in a direction that serves Nordic interests, through international regulation such as the CTA and PSSAs. Reduction of damaging atmospheric emissions is another Nordic priority, and the Nordics should therefore work jointly on assigning the Arctic high seas or parts of them ECA status, thereby reducing the sulphur cap to 0.1% in fuel, at the same time as progressively working towards a ban on use of HFO. This will encourage the development of more energy-efficient solutions and the use of alternative and more sustainable fuel types. Similarly, a ban on the carriage and transport of HFO and toxic hybrid fuel oils will help protect the fragile marine environment from risks associated with oil spills in the icy conditions present in the Arctic and further encourage the use of more sustainable alternatives.

As mentioned earlier, it is important that efforts on Arctic affairs, including regulation, take place through existing structures, most notably IMO and AC (and its working groups), to ensure legally binding measures and that parallel work does not occur. According to the survey responses, the remote nature of Arctic distances reinforces the implications of accidents and natural disasters in shipping. Due to the interrelation between risk mitigation in relation to human safety and the environment in Arctic shipping, i.e. between protection of Arctic ecosystems and Arctic and indigenous communities and their cultural practices, there is a need for a holistic approach to regulation. Enhanced Nordic cooperation can ensure such a holistic approach to regulation, so that ratified regulation considers every aspect of a given issue area, including existing regulation. It is important that any regulation takes the necessary steps to enhance sustainability and mitigate risks in the Arctic, while not hampering the region's potential for economic development – and *vice versa.*

5.3. Sustainable economic development

With ambitions of becoming the most sustainable and integrated region in the world by 2030, the Nordics should join forces and take the lead on enhancing a safe and sustainable Arctic, without impeding the need for human and economic development of the Arctic region and its peoples.

As one of (if not the) most SDG-oriented region(s) on the planet, combined with their focus on facilitating entrepreneurship and innovation centered on delivering sustainable solutions to combat climate change and enhance economic development, the Nordics have positioned themselves in the vanguard of sustainable, green transformation. The Nordics should take advantage of their position and utilize this momentum to scale up their activities on the green agenda by establishing strategic partnerships with relevant industry stakeholders to work jointly on developing sustainable shipping solutions for Arctic conditions. This approach is currently employed under the auspices of Nordic Innovation, which supports a more sustainable, digitalized and connected maritime industry with its project "The Connected Ship". This project aims to utilize Nordic strong points, such as IT, digitalization, Clean Tech and the maritime industry, to find innovative solutions to maximizing energy efficiency in shipping operation, thereby working to reduce emission levels as well as fuel costs for shipping companies. The project aims to build knowledge and enterprises that can make the Nordic shipping industry more sustainable and create new Nordic export business models based on maritime digitalization. According to Nordic Innovation, *"the goal of the project is to demonstrate a digitalization platform on board a ship by utilizing technology, platforms and experiences from smart city projects combined with maritime industry control systems, communication protocols and environmental prerequisites. This will also prepare the ships for future interaction with the smart society - harbors, trucks, cargo, passengers and other smart micro-systems"* (Nordic Innovation n.d.).

Nordic Innovation and the Nordic Arctic Cooperation Program constitute two examples of platforms, under the umbrella of the NCM, that are suited to innovative and research initiatives. However, AC working groups, in particular PAME, are the most appropriate platform to advance activities aimed at enhancing sustainable economic development in the Arctic, as they involve all Arctic states and IMO representatives. The Nordic countries can contribute by allocating funds and experts to the work on protecting the Arctic marine environment. An important element in monitoring developments of and mitigating risks to Arctic ecosystems is the inclusion of local communities and indigenous peoples. Preserving and sustaining these ecosystems is fundamental to the livelihoods of these communities, as they constitute an essential source of food supply and of cultural elements idiosyncratic to these communities. As these communities have been living off and from the Arctic marine environment and its distinctive species for generations, environmental changes and potential population reductions pose great risks to them. A priority of enhanced Nordic cooperation should be to ensure that remote Arctic communities, indigenous populations and their livelihoods are protected from the risks associated with increasing shipping, i.e. from cruise ship tourism. In this regard, it is also vital to build on existing capacities and equip these communities with abilities to counter climate change and take advantage of the potential for economic development in a sustainable manner. Traditional knowledge exchange between different local communities, such as observations of the marine ecosystems, including changes in marine species, marine pollution and snow and ice conditions, is an important factor in enhancing the sustainability of Arctic communities (NCM 2019, 12).

Other focus areas should include support for further research of the impact on the climate from different fuel types, including emissions and oil spill clean-up in Arctic conditions. The research should also include tests of new fuel types, as there is a need for developing sustainable fuel, in particular due to the projected increase in global and Arctic shipping. These initiatives are necessary to ensure environmental protection by mitigating, and ultimately removing, the risks associated with transport, carriage and use of HFO and toxic hybrid fuel oils in the Arctic. The increase in shipping poses a severe threat to pristine Arctic ecosystems if marine use of such fuels is not made more sustainable. Moreover, the development of new, sustainable fuel types is an important step to reducing damaging global and Arctic emission levels and ultimately meeting the 2050 GHG emission target.

6. Conclusion and recommendations

In conclusion, the research undertaken during the course of this report, including surveys, interviews and desktop studies, suggests that there is room and potential for enhanced Nordic cooperation in risk mitigation in Arctic shipping, including joint strategies with allocated budgets.

It is vital that future enhanced Nordic cooperation be undertaken through existing structures and forums. New exclusive Nordic bodies or institutional frameworks will constitute unnecessary parallels to existing structures and lead to confusion, inefficiency and quality reduction of current work carried out in the Arctic. The Nordic countries are therefore advised to enhance inter-Nordic cooperation through existing Nordic bodies as well as the AC and IMO, focusing on increased formal coordination, strategic thinking and increasing the number of meetings between Nordic IMO and AC representatives. The aim is to align national priorities, voting and statements in order to create joint initiatives to enhance Nordic priorities in Arctic affairs within existing frameworks. One of these is the regulatory framework of the IMO Polar Code (PC), which, according to this research, is a necessary first step (though not sufficient in itself) in order to accommodate the projected increase in Arctic shipping, including mitigation of enhanced shipping-related risks in relation to human safety and environmental protection. Accordingly, there is a need for a revised version of the PC which enacts and enforces stricter regulations on requirements and standards for operating vessels in polar waters, thereby enhancing preventive measures to effectively mitigate risks in relation to human safety and environmental protection in Arctic shipping. A revised version of the PC will strengthen the international regulatory framework and streamline the diverse national regulations currently in place for territorial waters with the internationally regulated Arctic high seas. A revised PC is fundamental to mitigating risks in relation to human safety and environmental protection in Arctic shipping.

This report recommends that Nordic cooperation should enhance inter-Nordic cooperation by prioritizing work on the following regulatory and developmental measures to improve human safety and environmental protection in relation to shipping in the Arctic, under the umbrella of the existing structures of Nordic cooperation, AC and the IMO:

- Polar Code regulations must be mandatory for all operating vessels in polar waters and should thus also apply to non-SOLAS ships which are currently not obliged to apply Polar Code regulations.
- Ratification of the Cape Town Agreement with amendment(s) on similar requirements for cruise/passenger ships would accommodate the regulatory gap currently existing for non-SOLAS ships globally.
- Mandatory requirements for so-called "pairing" between two operating vessels in remote polar waters (certain latitudes in the high Arctic), i.e. between cruise/passenger ships, which will force shipping companies and cruise ship operators to share route plans, emergency plans as well as vessel and AIS information to maximize marine safety and assistance in case of an emergency. This will mitigate risks to human lives if the distance between the SAR response unit(s) and the cruise ship requesting emergency assistance is

too great to deliver a timely response measure.

- Designation of all or parts of the Arctic high seas as PSSA(s) or Special Area(s) cf. MARPOL Annexes I and V in line with the Antarctic. This would enforce stricter requirements for vessels operating in polar waters and thus a higher level of sea area protection by adopting special mandatory requirements for the prevention of pollution from ships through oil and garbage. One option is to designate the entire Arctic high seas as a PSSA. Alternatively, one or more so-called "core sea ice areas" could be designated as PSSAs or areas to be avoided.
- Regulation on atmospheric emission reductions of HFO and other damaging pollutants by assigning ECA status to the Arctic, under MARPOL Annex VI. This would further reduce emissions of NOx, SOx and particulate matter (PM) and reduce the fuel sulphur limit to 0.1%, at the same time as progressively working on a complete ban on the use of HFO.
- Stricter regulation of grade oil requirements, including blend and composition, which will mitigate the risks associated with oil spills from carriage and transport of HFO. This will limit the amount of potential NEBAs and oil spill responses, ultimately saving valuable time in the event of an oil spill.
- Work towards a ban on carriage and transport of HFO and toxic hybrid fuel oils (with damaging oil uptake properties) to protect the fragile marine environment from risks associated with oil spills in the icy conditions present in the Arctic.
- Development of HFO-free and more energy-efficient and sustainable fuel types in collaboration with industry stakeholders.
- Restrictions on the number of passengers per cruise ship and on the types and volume of cruise ships operating in the Arctic. Such limitations would reduce the number of lives at risk in the event of accidents. Restrictions on cruise ship types will enable SAR authorities to prepare and train for specific types of ships and a maximum number of passengers when undertaking SAR operations. Restrictions on the volume of cruise ship operations will also reduce atmospheric emissions and the risks of oil spills.
- Enhancement of research in the Arctic, under the Agreement on Scientific Cooperation, to introduce new methods and solutions to mitigate risks in Arctic shipping, especially on the environmental side, i.e. on fuel, invasive species and the impact of climate change on the Arctic and its inhabitants. A priority should be the promotion of joint research cooperation, including (annual) resource and budget allocations to support research initiatives in the Arctic.
- Improvement of nautical charts in polar areas. According to information from the International Hydrographic Office (IHO), the chart coverage for Arctic and Antarctic areas at an appropriate scale is generally inadequate for coastal navigation and, where charts do exist, their usefulness is limited because of the lack of any reliable depth or hazard information.
- Further development and strengthening of the maritime infrastructure, especially concerning availability of port reception facilities and icebreaker support.
- Strengthening of SAR facilities under the GMDSS in polar areas.
- Reduction and additional restrictions on ballast water discharges due to the great potential for major ecological impacts from invasive species introduced via ballast water as ice cover recedes and seawater warms in polar areas.

- Discharge control of grey water, i.e. the wastewater from galleys, showers, laundries, as well as food pulp, which could potentially cause harm to the environment due to concentrations of nutrients and other oxygen-demanding materials.
- Discharge of sewage through approved sewage treatment plants.
- Measures to reduce underwater ship noise to minimize disturbance to marine life.

Common to all initiatives is that they should be undertaken in enhanced dialogue with stakeholders in the Arctic in the aforementioned areas in order to facilitate co-creative solutions that are long-term. In that light, the study recommends the following in terms of cooperation:

- Facilitating dialogue between Arctic states and IMO;
- Enhancing stakeholders' knowledge of the subject area.

This could be done through extensive strategic partnerships and cascading knowledge through existing forums and conferences (meetings, workshops, seminars etc.), but also by convening new *ad hoc* forums for dialogue and conferences. Nordic cooperation has extensive muscle not only in terms of financial support, but also as a network to perform a stewardship role in ensuring that our knowledge basis for mitigating risks and improving the environmental security of the Arctic is up to date.

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