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I&RS MECHANISMS TO REDUCE ARCTIC SHIPPING RISK

Marine Insurance and Arctic Risk

Gordon and Betty Moore Foundation

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Objective: The purpose of this study is to identify mechanisms that the marine insurance and reinsurance sectors (I&RS) use or could use to reduce risks to Arctic marine ecosystems and coastal communities from vessel traffic. It examines the hypothesis that the marine I&RS possess critical leverage in regulating Arctic vessel traffic. It examines the marine insurance sector's current perspectives, roles and actions on managing Arctic shipping risk, as well as evaluating new roles and actions they might adopt to further improve standards and reduce adverse impacts on the Arctic environment.

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EXECUTIVE SUMMARY

The Gordon and Betty Moore Foundation (USA) commissioned DNV GL to conduct a study to identify mechanisms that the marine insurance and reinsurance sectors (I&RS) currently use and could potentially use in the future to reduce risks to Arctic marine ecosystems and coastal communities from vessel traffic. The study examines the hypothesis that the marine I&RS possess critical leverage in regulating Arctic vessel traffic to reduce the risk of chronic and catastrophic impacts of vessel traffic in the Arctic. Our study looks at the marine insurance sector's current perspectives, roles and actions on managing Arctic shipping risk, as well as evaluating new roles and actions that the sector might adopt to further improve standards and reduce adverse impacts on the Arctic environment.

DNV GL organized the study around a literature review, an on-line questionnaire addressed to a broad sample of the marine insurance sector, a workshop with non-governmental organizations with interests in Arctic environmental protection, followed by in-depth interviews with a small, targeted set of marine insurance professionals.

These individuals and their companies have different levels of experience with polar shipping—some little, some considerable. Yet, we found their views on Arctic shipping risk quite uniform. **Insurers believe Arctic shipping is risky**. As shipping expands in what is a new frontier for many operators, insurers expect higher incident rates and higher loss rates, especially for third-party liabilities.

From our interviews with marine insurance executives, we understood their concern that shipowners may underestimate Arctic risks—particularly those without previous Arctic experience. They genuinely wish to support their clients' business pursuits, so they are searching for a middle ground between facilitating commercial activity and prudence in the face of uncertain risks.

Fortunately, **insurers believe they can take measures to improve safety and remain competitive**. In this regard, we believe insurers will support risk control measures that help both their customers and themselves, such as pre-activity risk assessments, operational measures, and due diligence surveys.

The cardinal finding of our study is that **insurers see themselves as part of the solution**. We find this conclusion fundamentally important, as it indicates the insurance sector is both able and willing to be a valuable partner in managing Arctic shipping risks. As professional risk managers, the marine insurance sector should be actively engaged to lend their counsel and influence to improving shipping safety in the Arctic. Their advice and assistance should not only be sought by their insured, but also by the International Maritime Organization (IMO), the Arctic Council, flag administrations, and classification societies.

Unfortunately, **insurers don't have sufficient information to adequately assess Arctic risks**, particularly on the potential cost of claims. Insuring new and emerging risks pose challenges to insurers, as they lack sufficient information to establish an actuarial relation between activity, incident, claims, safety measures, deductibles, premiums and settlement costs. Given the low number of ship incidents in the Arctic to date, the challenge is how to fulfil insurers' informational needs from other sources. Condition monitoring and big data analytics may promote operative risk management and enhance our understanding and management of shipping risk. DNV GL believes significant advances in risk analysis may be possible through collaboration between insurers and others with access to relevant big data sources, such as classification societies and equipment manufacturers.

Various stakeholders have called for controls to minimize both acute and chronic effects of shipping on the Arctic environment, particularly those associated with the use and carriage of heavy fuel oil (HFO)

and ship traffic through or near certain marine areas. This study examined how marine insurance does, or could, contribute to controlling these adverse effects.

Marine insurers already pay out liabilities associated with a spill of HFO caused by an insured's vessel. However, we concluded **insurance is not effective in regulating chronic impacts** of black carbon emissions from HFO use or the cumulative effects of ship traffic on marine areas. As neither loss, victim, source, obligation nor fault can be sufficiently established, it is not apparent a shipowner has a liability for which he needs indemnity insurance. Therefore, we do not see any role for marine insurance in regulating chronic impacts from air emissions or ship traffic; addressing these issues requires some other regulatory mechanism than insurance.

We also learned that **insurers do not currently advise on minimizing routing impacts** to marine areas, regardless of their type or designation. This position should change with the establishment of the Arctic Shipping Best Practices Information Forum, sponsored by the International Union of Marine Insurers (IUMI), which already includes minimizing routing impacts as a best practice.

Insurers believe common safety rules and regulations are an essential foundation for a healthy marine insurance market. Compliance with maritime safety regulations is a mandatory condition for cover, and non-compliance can affect insurance coverage. Yet **marine insurers do not want to be the primary enforcers**. Rather, insurers highly value classification society certification and oversight, port-state control, and charterer vetting for taking the lead as enforcers of international safety regulations, industry standards and best practice. We learned **insurers presume a ship's satisfactory condition** if it holds a valid certificate from an IACS-member class society or has been subject to charterer vetting, but do not necessarily scrutinize these as part of their underwriting.

With respect to Arctic regulation, **insurers believe the Polar Code will be effective** in managing Arctic shipping risk. Insurers will require shipowners operating in the Arctic to comply with it as a condition for coverage. Insurers expect a lot of the Polar Code, **but they appear rather passive in helping to implement it**. We find this the most disturbing conclusion of the project.

Granted, **determining compliance is more difficult with goal-based rules** such as the Polar Code. In our own efforts at helping shipowners understand the Polar Code, DNV GL has found great room for interpretation. To ensure the Polar Code is implemented as a truly common international safety regulation, it is essential all key stakeholders work together during the initial implementation phase. **We need the active participation of all parties—including insurers—to reach satisfactory consensus** vis-à-vis interpretation and application, rather than over-relying on class and flag to be solely responsible, not least because not all class societies or flags are equally prepared for or engaged with the Polar Code. If insurers see themselves as part of the solution, then they must take an active role to be a part of it.

The most promising development here is an initiative of the IUMI to establish an **Arctic Shipping Best Practices Information Forum**. Now formally adopted by the Arctic Council, the Forum is **the ideal place to bring together stakeholders** to discuss and facilitate consensus on Polar Code interpretation, implementation and compliance. The best practices developed in the Forum should include not only those of shipowners, but also those of insurers, class and flag in how *they* can best help shipowners operate safely and responsibly in this precious—and risky—environment.

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GLOSSARY

The following symbols, abbreviations and terms are used in this report.

$ – United States dollars

AIS – Automatic identification system

Arctic waters – As defined by SOLAS Ch. XIV Regulation 1, which may be summarized as the waters north of latitude 60°N, with deviations to include waters around the southern exposure of Greenland, but excluding those around Iceland, the Norwegian mainland, Russia's Kola Peninsula, the White Sea, the Sea of Okhotsk, and Alaska's Prince William Sound (see the fact box, *Polar Waters*, § 5.4.3).

Bunkers – Fuel oil used by ships

CDEM – Construction, design, equipment and manning

Class – Classification society

CSR – Corporate social responsibility

DNV – Det Norske Veritas

EEZ – Exclusive economic zone

ESG – Environmental, social and corporate governance

GAIRAS – Generally accepted international rules and standards

GBS – Goal-based standards

GNSS – Global navigation satellite system

H&M – Hull and machinery

HFO – Heavy fuel oil

I&RS – Insurance and reinsurance sector

IACS – International Association of Classification Societies

IGP&I – International Group of P&I Associations

IMO – International Maritime Organization

IOPP – International Oil Pollution Prevention Certificate

ITOPF – International Tanker Owners Pollution Federation

IUMI – International Union of Marine Insurance

LMA – Lloyd's Market Association

MARPOL – The International Convention for the Prevention of Pollution from Ships

NSR – Northern Sea Route

OCIMF – Oil Companies International Marine Forum

OPA 90 – Oil Pollution Act of 1990 (33 U.S. Code 2701 *et seq.*)

P&I – Protection and indemnity

PAME – Protection of the Arctic Marine Environment working group (of the Arctic Council)

Polar Code – The International Code for Ships Operating in Polar Waters

PSSA – Particularly sensitive sea area

PWOM – Polar water operational manual

RO – Recognized organization

SIRE – Ship Inspection Report program

SOLAS – The International Convention for the Safety of Life at Sea

STCW – The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers

TMSA – Tanker Management and Self-Assessment program

UNCLOS – United Nations Convention on the Law of the Sea

VTS – Vessel traffic service

1 PROBLEM AND HYPOTHESIS

As the Arctic heats up, the ice edge is retreating northwards, the ice is becoming thinner and weaker, and the occurrence of perennial ice along coastal areas is diminishing. These changes have opened new possibilities for tourism, resource exploration, development and marine transport.

The Arctic shipping market is growing. Cruise ship activity in Svalbard has doubled over the past ten years, at the same time oil shipments from the Russian Arctic jumped from insignificance to 10 million tons per year. Arctic shipping operations are also expanding in both time and place. Ships can reach previously inaccessible regions. They are also operating for longer and longer periods, beginning earlier in the spring and ending later in the autumn than the traditional Arctic navigation season has allowed. While commercial Arctic shipping is growing, the icebreaker support offered to commercial shipping by national administrations is declining. Commercial operators are taking matters into their own hands, developing their own icebreakers and ice-breaking cargo ships. Ice-breaking bulk carriers are already servicing base mineral mines in the Russian and Canadian Arctic on a year-round basis. Russia will soon begin exports of liquefied natural gas from the Yamal Peninsula in the Russian Arctic, using a fleet of fifteen ice-breaking gas carriers to ship the gas year-round to markets in Europe and Asia. This trend will only continue, as offshore oil and gas development will demand year-round operational capability.

Wherever there is industrial activity, there is risk – and nowhere more so than in the Arctic. In some parts, the harsh environment increases the likelihood of accidents and, given the relatively pristine state of many of the region's ecosystems, the consequences could be significant. There are also ethical dilemmas to consider. These include the need to mitigate climate change versus the need for energy, environmental risk versus business risk, and the needs of the Arctic's inhabitants versus those of the rest of the world.

Greater shipping activity in the region increases the risk of spills, with the Arctic's harsh weather, pervasive ice, limited hydrographical and bathymetrical charting, and the distance between emergency response centres, all contributory factors. In addition, more intensive shipping could introduce invasive species through ballast water or vessel hulls, disrupt the migratory patterns of marine mammals and release hazardous contaminants into the air and water.

Managing Arctic shipping risks is an endeavour that today crosses multiple layers of global society, engaging stakeholders at local, national, regional and international levels. One example is the International Maritime Organization's adoption of an international code for ships operating in polar waters, which went into effect on 1 January 2017. Other actions to improve shipping standards and reduce Arctic shipping risks involve the Arctic Council, individual regulatory actions of the Arctic coastal states, and improved technical standards and risk mitigation services offered by ship classification societies, such as DNV GL.

Other stakeholders – such as marine insurers – should also be able to contribute to improving shipping standards to reduce Arctic shipping risk. Marine insurers are private enterprises engaged in the business of assuming financial responsibility for the transfer of risk from ship owners, operators, charterers and cargo owners. Insurers manage their insurance risks through the techniques of risk pooling and risk transfer, and set risk controls through the terms of their insurance contracts. As Lord Donaldson (1994: 269) states in his parliamentary inquiry into the prevention of pollution from merchant shipping:

> At the outset of the Inquiry it was put to us that the marine insurance industry ought to be able to give clearer signals to shipowners to improve standards. To many it seems obvious that insurers are in a strong position to influence the shipping industry. They must be able to reward good operators by lowering premiums and penalise those with a poor or unproven record by increasing premiums – rather like a no claims bonus on car insurance. . . . This is all fine in theory but not so simple in practice.

The Gordon and Betty Moore Foundation (USA) commissioned DNV GL to conduct a study to identify mechanisms that the marine insurance and reinsurance sectors (I&RS) currently use and could potentially use in the future to reduce risks to marine ecosystems and coastal communities that are associated with vessel traffic in the Arctic. The study examines the hypothesis that the marine I&RS possess critical leverage in regulating Arctic vessel traffic via their ability to deny coverage to firms not abiding by public and private operating and spatial standards. The study aims to inform the Foundation's partners on the viability of using I&RS leverage to reduce the risk of chronic and catastrophic impacts of vessel traffic in the Arctic. Our study looks at the marine insurance sector's current perspectives, roles and actions on managing Arctic shipping risk, as well as evaluating new roles and actions that they might adopt to further improve standards and reduce adverse impacts on the Arctic environment. These key questions and their associated hypotheses and assumptions are outlined in the box below.

KEY STUDY QUESTIONS

Key questions	Hypothesis / assumption
What is the role of marine insurers in setting and enforcing risk controls?	**Insurers set their own private risk controls as well as enforce public risk controls** (such as those of the IMO).
How do marine insurers ensure their clients adhere to relevant shipping regulations?	Insurers can use **premiums and denial of coverage as leverage** to compel compliance with standards and regulations.
How does the marine insurance industry advocate for stronger shipping standards? – Within industry associations (IUMI, IGP&I, IACS, etc.) – Within international and regional regulatory fora (IMO, Arctic Council, EU, etc.)	**Insurers advocate stronger shipping standards** to reduce their own risk exposure.
What new risk control options could the marine insurance sector adopt to improve shipping standards in the Arctic? – Vessel specific requirements – IUMI best practices	Shipping standards in the Arctic are not stringent enough. The **marine insurers should develop new risk controls** to improve them.
How will the insurance sector apply Polar Code requirements to determine the nature and bounds of Arctic operations? – POLARIS ice navigation risk assessment system – Operational (risk) assessments and voyage planning	**Marine insurers take an active role** in operational risk management for shipping in the Arctic.
Will the insurance industry advocate for stronger risk controls in an amendment to the Polar Code or other IMO regulations? – More stringent ship certification requirements – More stringent crew training requirements	**Risk controls in the Polar Code are inadequate** and more stringent risk controls measures will better reduce their risk exposure.
How does or can the insurance sector support ocean management efforts? – Areas to be avoided – Potentially sensitive sea areas	Marine insurers will support ocean management efforts because they reduce marine insurance risks.
How do or can the insurance sector support measures to eliminate the use and carriage of heavy fuel oil in the Arctic? – Rewards through reduced premium – Higher liability limits	The use and carriage of **heavy fuel oil causes or compounds insurable risks**.

2 METHOD

DNV GL organized the study around a literature review, an on-line questionnaire addressed to a broad sample of the marine insurance sector, a workshop with non-governmental organizations with interests in Arctic environmental protection, followed by in-depth interviews with a small, targeted set of marine insurance professionals.

The literature review sought out and examined relevant academic, government, industry and other grey literature on insurance as a tool in public and private regulation. We particularly sought out works about insurance as a tool in environmental regulation or about marine insurance. The objectives of the literature review were:

- To orient ourselves on the types, use, applications, capabilities and limitations of insurance in general and marine insurance in particular;
- To identify and build on any previous research addressing the background questions, hypotheses, and assumptions posed in Chapter 1; and
- To provide insights relevant to designing the questionnaires and interviews to be conducted in Phase I and II of the study.

A brief primer on marine insurance is found in Chapter 3, and the literature review of previous research is contained in Chapter 4.

The study was conducted in two principal phases. Phase I was an on-line questionnaire addressed to a broad sample of the marine insurance sector. Phase II followed-up the results of Phase I through in-depth interviews with a small, targeted set of marine insurance professionals.

The study's geographic focus area is the Arctic, as defined by the IMO Polar Code (*see* the fact box *Polar Waters* in section 5.4.3), and its activity focus is shipping. This means that other activities, such as oil and gas exploration and production, are excluded, primarily because the regulation and insurance mechanisms associated with them are sufficiently different from the shipping industry to warrant separating them.

The Phase I study was a short and simple questionnaire designed for on-line/email administration, capable of being answered in less than five minutes. It sought opinions of marine insurance professionals on shipping safety in general and Arctic shipping risk in particular. The objective was to gauge the insurance sector's awareness, interest, opinion and concern regarding increased shipping in the Arctic. To encourage participation, it asked for only pre-formatted answers (for example, from strongly agree to strongly disagree) without asking for any substantiation of these opinions. A copy of the Phase I survey is contained in Appendix A; the results are tabulated and presented in Chapter 6.1. Given the relatively limited sample size of respondents, we did not attempt quantitative statistical analysis of the results.

In Phase II, DNV GL followed-up the Phase I survey by requesting a one-hour telephone interview with senior representatives of twenty selected marine insurance companies. The companies offered various types of marine insurance cover. The individuals we interviewed were primarily from their respective loss prevention units or senior management. The questions we asked explored in greater depth the questions we asked in the Phase I on-line survey and the answers we received from them. We also included questions developed during an Arctic shipping workshop held with several environmental non-governmental organizations in Seattle 9-10 August 2017. A summary of these questions is contained in Appendix B. The results are presented in Chapter 6, in which we both summarize, paraphrase and quote the responses from our interviews.

We developed a targeted list of potential I&RS respondents for the study by consulting automatic identification system (AIS) data to identify ships that have traded in the Arctic and the relevant insurers of these vessels to the extent possible. This helped to ensure the target set of I&RS respondents included those with experience of insuring vessels that operate in the Arctic.

However, the AIS database has use/privacy restrictions, therefore we not divulge identities of individual ships, owners, operators or insurers to third parties. Furthermore, to ensure candid responses from an industry known for its reticence, we have withheld the names of individual interviewees, their companies and their clients, and we do not substitute a pseudonym for attribution of their remarks.

3 PRIMER ON MARINE INSURANCE

3.1 A brief history of insurance

Modern insurance traces its genealogical roots back to the third millennium B.C. The first variant stems from the *bottomry contracts* used in Babylonian society, in which the financial risk for a trading venture was transferred from the trader to a merchant, in return for financial compensation. The second variant stems from *risk pooling* arrangements used by Chinese marine traders. Through reciprocal agreements, the traders subdivided their merchandise into small equal shares, each of which was carried on a different trader's ship. If a ship was lost, each trader would lose a small sum but no trader would suffer a complete loss. In risk pooling, each member of the group transfers a small share of risk to each of the other members, in return for assuming a similar share of risk from the other members. A third variant arose in the fourteenth century in Genoa with the issuance of what is considered the first modern insurance contract. Here, an insured paid a small sum (or premium) to an insurer, who in turn agreed to pay a larger sum if the insured's ship was lost. (Powers 2012: 94). The third, modern variant combines aspects of its ancient ancestors: the insured transfers his risk to the insurer, while the insurer pools his risk through many insurance contracts, and re-insurance offers a mechanism for the insurer to further transfer some of his acquired risk on to others.

Marine insurance falls into the category of *property–liability* insurance, which encompasses damage to property (including theft and loss) and injury to individuals. Payments are made on either a first-party basis to compensate the policyholder or on a third-party basis to compensate victims of a policyholder.

Insurance is a risk management mechanism appropriate for insurable financial risks. As this statement suggests, not all risks can be monetized, and not all financial risks are insurable. This may be visualized as in Figure 1, with the caveat that the boundaries between categories are not clearly demarcated.

Figure 1 – The realm of insurance risks

An insurance company is thus an enterprise engaged in the business of assuming financial responsibility for the transfer of risk in an economically efficient manner by operating subject to the forces of the marketplace for transferring such risks.

Insurers manage their insurance risks through the techniques of frequency mitigation, severity mitigation, and avoidance. Where a given risk exposure is expected to have a high frequency but only a

low severity, then frequency mitigation through risk pooling (diversification) is an appropriate strategy. Examples include insuring for damage to or loss of ship and cargo. Where a given risk is expected to have a low frequency but high severity, then severity mitigation through risk transfer (hedging) is the preferred strategy. An insurer would do this by purchasing reinsurance from another company. Examples include liability for damage to third parties and oil pollution. Finally, if an exposure has both a high frequency or likelihood of occurring and high severity, then avoidance is the norm. In such cases, insurers typically refuse cover or require owners to implement risk control actions to reduce the likelihood and/or severity to an acceptable level. These strategies may be conceptualized as in Figure 2.

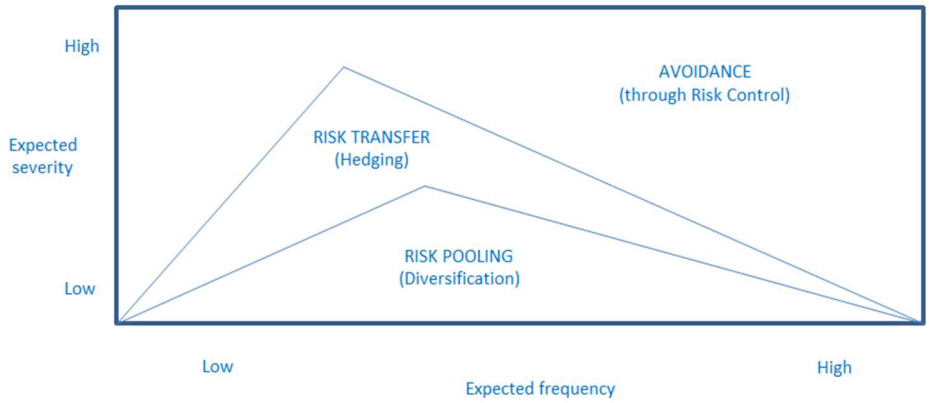


Figure 2 – Insurance risk finance model (Powers 2012: 117)

3.2 Underwriting risk

Insurers do not want to lose money by insuring bad risks. Underwriting thus involves a degree of risk assessment on behalf of the insurer. First is the vessel itself: its physical characteristics, age, condition, flag, classification and where it will be trading. Second are the owner's claims history, operational record, and reputation. Third is the human element, which encompasses crewing and operating policies aboard the vessel, as well as the owner's shore-side technical, operational and safety management.

Of particular importance to an underwriter is a vessel's claims history. "Obviously, there must be a correlation between future risk and the past level of claims because a high proportion of incidents giving rise to claims are avoidable" (Donaldson 1994: 271). One expects that vessels with high standards of management, operation and maintenance will be involved in fewer such incidents than those of lower standards.

Nevertheless, a vessel's or owner's claims history is not wholly indicative of future risk. Claims histories do not include near-misses, near-accidents or near-losses, where such do not give rise to a claim. A substandard vessel with a series of near-misses may be fortunate and trade for some time without serious incident. A spotless claims history is not a clean bill of health. The claims history is thus only one factor for an underwriter to consider when assessing risk. Underwriters may also order structural and condition surveys and issue questionnaires to brokers to learn more about owners with whom they are unfamiliar. The questionnaires typically address both technical details about the vessel as well as its crewing, training and operating practices.

An underwriter uses the risk assessment to determine the premium, deductibles and other conditions for a policy. By imposing higher premiums and deductibles, or refusing cover altogether, an underwriter can influence the industry and help eliminate substandard shipping.

This apparent influence, however, is tempered by market conditions. Marine insurance operates in a competitive market. Underwriters do not want to insure bad risks, but they also do not want to turn down business. In a competitive market, owners can shop around and find an underwriter willing to offer more favourable terms. Market conditions and an insurer's competitive position determine the extent to which the insurer can influence standards. Some insurers are in a better position to influence the decisions of shipowners and charterers, while others may more readily bend to misplaced optimism or competitive pressure and accept higher risk.

Marine insurance is subdivided into separate lines: hull and machinery, cargo, protection and indemnity, and defence. Hull and machinery (H&M) insurance covers damage to or loss of the insured's vessel. Cargo insurance covers damage to or loss of the cargo the ship is carrying. Protection and indemnity (P&I) insurance covers liabilities for loss or damage to others (personal injury, third-party property, environmental damage, economic use losses, etc.). Defence insurance provides members with cover for claims handling assistance and for legal costs in relation to a wide range of disputes outside the scope of H&M, cargo or P&I insurance.

3.3 Hull and machinery insurance

Hull and machinery (H&M) insurance covers the loss of or damage to the insured's vessel, including the costs related to salvage and repair. *Salvage* refers to the practice of rendering aid to a vessel in distress. H&M insurance does not cover cargo, but does typically cover some third-party liabilities, such as for collision and contact damage to third-party property.

The insured value of the vessel is agreed at the time of underwriting the policy and is fixed for an agreed period. This is the amount the insured will receive to compensate for a total loss. A ship's insured value is not necessarily the same as its market value. Naturally, a ship's market value fluctuates during the insurance period. Underwriters often agree a value more than current market value to reflect its mortgaged value, as well as to cover loss of trade in the event of the vessel's total loss.

Hull and machinery cover usually carry restrictions on navigation in polar waters. The standard International Navigating Limits of the Lloyd's Market Association (LMA) define the geographical limits within which ships may operate without incurring additional insurance premium from hull and machinery and other relevant underwriters. A vessel may not enter, navigate or remain in the restricted areas unless otherwise and to the extent agreed by the underwriters. For Arctic waters, the restricted areas of the International Navigating Limits are illustrated in Figure 3.

3.4 Cargo insurance

Cargo insurance covers the loss suffered by the cargo owner in the event of loss of or damage to the cargo during the course of a voyage. Should the insured cargo be lost or damaged, the cargo owner will receive the benefits of the insurance for their goods and the purchaser will be issued a refund. The standard cargo insurance clauses are found in the Institute Cargo Clauses of the Lloyd's Market Association (LMA 2009).

In the event of a claim, the cargo insurer may in turn seek to recover the loss from the shipowner, usually on the grounds that the loss resulted from a failure of the shipowner to exercise due diligence to make the ship seaworthy.

Cargo underwriters base their premium for a particular cargo on the cargo itself and the class, age, ownership and management of the carrying vessel. They attempt to ensure cargo is carried on vessels of suitably high standard by setting classification and age requirements through the Institute Classification Clause of the Lloyd's Market Association. These require cargo to be carried on a vessel classed with a

Area 1 - Arctic

a. North of 70°N

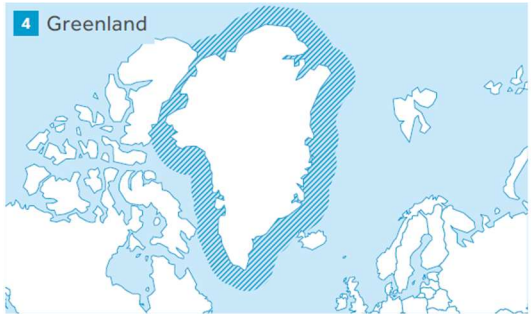
b. Barents Sea

except for calls at Kola Bay, Murmansk or any port or place in Norway, provided that the vessel does not enter, navigate or remain north of 72°30'N or east of 35°E

Area 2 – Northern Seas

a. White Sea

b. Chukchi Sea



Area 4 – Greenland

Greenland territorial waters

Area 5 – North America (East)

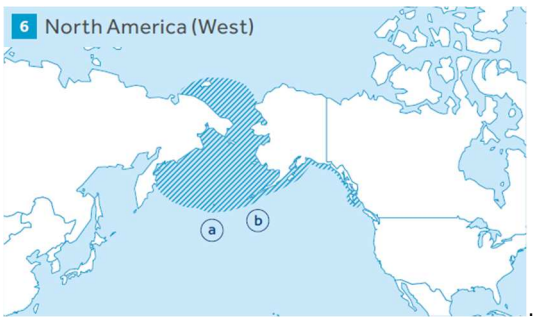
a. North of 52°10'N and between 50°W and 100°W

b. Gulf of St. Lawrence (21 Dec – 30 April)

c. St. Lawrence River (1 Dec – 30 April)

d. St. Lawrence Seaway

e. Great Lakes



Area 6 – North America (West)

a. North of 54°30'N and between 100°W and 170°W

b. Any port or place in the Queen Charlotte Islands or the Aleutian Islands

Maps courtesy of The Standard Club, Ltd

Figure 3 – International navigating limits in Arctic and sub-Arctic waters (LMA 2003)

member or associate member of the International Association of Classification Societies (IACS), or with a national flag society if the vessel is engaged exclusively in the coastal trading of that nation. Furthermore, the Classification Clause fixes an age limit of ten years for bulk and combination carriers and fifteen years for other vessels not operating on a liner service. Cargoes carried on vessels that do not conform to these requirements are subject to an additional premium (LMA 2001).

The extent to which cargo underwriters can influence the behaviour of the shipping industry is questionable. Their influence is limited by the nature of cargo insurance. First, the insurer has no direct contact with the shipowner. Second, a cargo owner may ask for coverage of goods already afloat or in transit, in which case the carrying vessel has already been decided. Third, the underwriter may be insuring a cargo owner who is not himself involved in making the carriage arrangements. Fourth, some cargo owners are not concerned whether the goods arrive in sound condition, so long as they are paid by the purchaser, the insurer, or a combination of the two. While the prospect of increased cargo premiums may provide a disincentive for hiring a substandard vessel, the pressure it brings to bear on shipowners is indirect and limited. (Donaldson 1994: 272)

Although the Institute Classification Clause attempts to reduce risk, vessel age and classification are weak proxies for discriminating among vessels and operators and setting premiums that more accurately reflect actual risk. The Donaldson Inquiry concluded,

> We would seek to encourage underwriters to achieve a more accurate assessment of risk, both in their own interests and to make it clear to those involved in buying and selling cargo that the selection of vessel will be reflected in the level of premium. . . . It must be in the interests of both insurers and those working to improve shipping quality that premiums are linked as closely as possible to actual risk. (Donaldson 1994: 272-273)

3.5 Protection and indemnity insurance

Protection and indemnity (P&I) insurance provides cover to shipowners, operators and charterers for third-party liabilities encountered in the commercial operation of a vessel. P&I insurance is designed to complement a vessel's hull and machinery insurance and related covers. It provides cover for the liabilities, expenses and costs for loss of life, injury, pollution, damage to other vessels and objects, etc. (see sidebar on the next page).

Marine P&I insurance is offered through two different mechanisms: one is through a mutual club of shipowners; the other is through a commercial fixed premium insurance policy. The mutual P&I club is the most common arrangement for large vessels and those engaged in international commerce, whereas the commercial fixed premium policy is usually reserved for smaller vessels engaged in the inland and coasting trades.

P&I clubs are non-profit mutual insurance associations of shipowners. Each of a club's members is both insured and insurer,

P&I COVERAGE

Protection and indemnity (P&I) insurance provides cover for the liabilities, expenses and costs for:

- Loss of life, injury and illness of crew, passengers and other persons
- Pollution
- Wreck removal
- Collision
- Damage to docks, buoys and other fixed and floating objects
- Crew repatriation and substitution
- Cargo loss, shortage or damage
- Damage to property on board the insured vessel
- Fines and penalties
- Mutiny and misconduct by crew
- Quarantine
- Vessel diversion expenses
- Vessel's proportion of General Average and unrecoverable General Average contributions*

* *General Average* is a principle of maritime law in which all parties in a sea venture share proportionally any losses resulting from a voluntary sacrifice of part of the ship or cargo to save the whole in an emergency (e.g., by jettisoning cargo to regain stability and prevent capsize).

paying in premium on their own behalf and paying out claims on behalf of other members. As such, the P&I club is a classic risk pooling arrangement. The club's underwriting principles are set by its board of directors or committee, which is elected from the club's member shipowners. These principles are applied by the club's managers in fixing the premium rating for each member's fleet. The rating reflects the managers' appreciation of the risk that each member brings to the club and determines the proportion of the club's liabilities for which the member is responsible. The premium rating is highly individualistic and is reviewed and revised annually.

A portion of the premium rating is paid in by each club member at the beginning of the year. The remainder is called in later, once the size of the club's total claims for the year is apparent. If the year's total claims exceed the premium ratings, the board will either pay the deficit from the club's accumulated reserves or impose a supplementary call on its members. If the year's claims are lower, the board will either hold the excess in reserve or return it to the members.

P&I clubs are in a unique position among insurers to influence shipping standards. As a mutual society of shipowners, each member has an interest in ensuring that the claims of fellow members are both infrequent and small. Prospective members are vetted to ensure that their fleet is of an acceptable standard before being admitted to the club. Once admitted, members are subjected to an annual reassessment. Members with a poor claims record or increase in their risk profile will see their premium rating increase, whereas members with better performance will receive a more favourable rating. The premium rating system directly ties a member's rating to the risk they bring to the club. Analogous to a no-claims bonus for car insurance, the P&I club rating system provides shipowners a direct incentive to maintain a high standard and to demand that their fellow club members do the same.

Today there are fifteen P&I mutual clubs, thirteen of which are members of the International Group of P&I Clubs. The International Group members provide liability cover for 90% of the world's ocean-going tonnage. Two P&I mutual clubs are outside the International Group. Finally, there are at least sixteen insurance companies offering commercial fixed-premium P&I insurance policies. Figure 4 provides a breakdown of P&I insurers and their share of the market as a percentage of gross registered tons insured.

Illustration: DNV GL

Figure 4 – Protection and indemnity insurers and their market share (Omni 2015)

The International Group arranges market reinsurance to help the Pool with claims in excess of $80 million. It is the largest single contract in the marine insurance market, currently affording shipowners upper liability coverage of $1 billion for oil pollution, $2 billion for passenger claims, and $3.1 billion for all other claims (Omni 2015: 11). To date, the *Costa Concordia* passenger ship incident resulted in the largest marine P&I claim in history, the wreck removal cost alone exceeding $1.5 billion (Hussain 2015).

The complex pooling and reinsurance arrangement is illustrated in Figure 5.

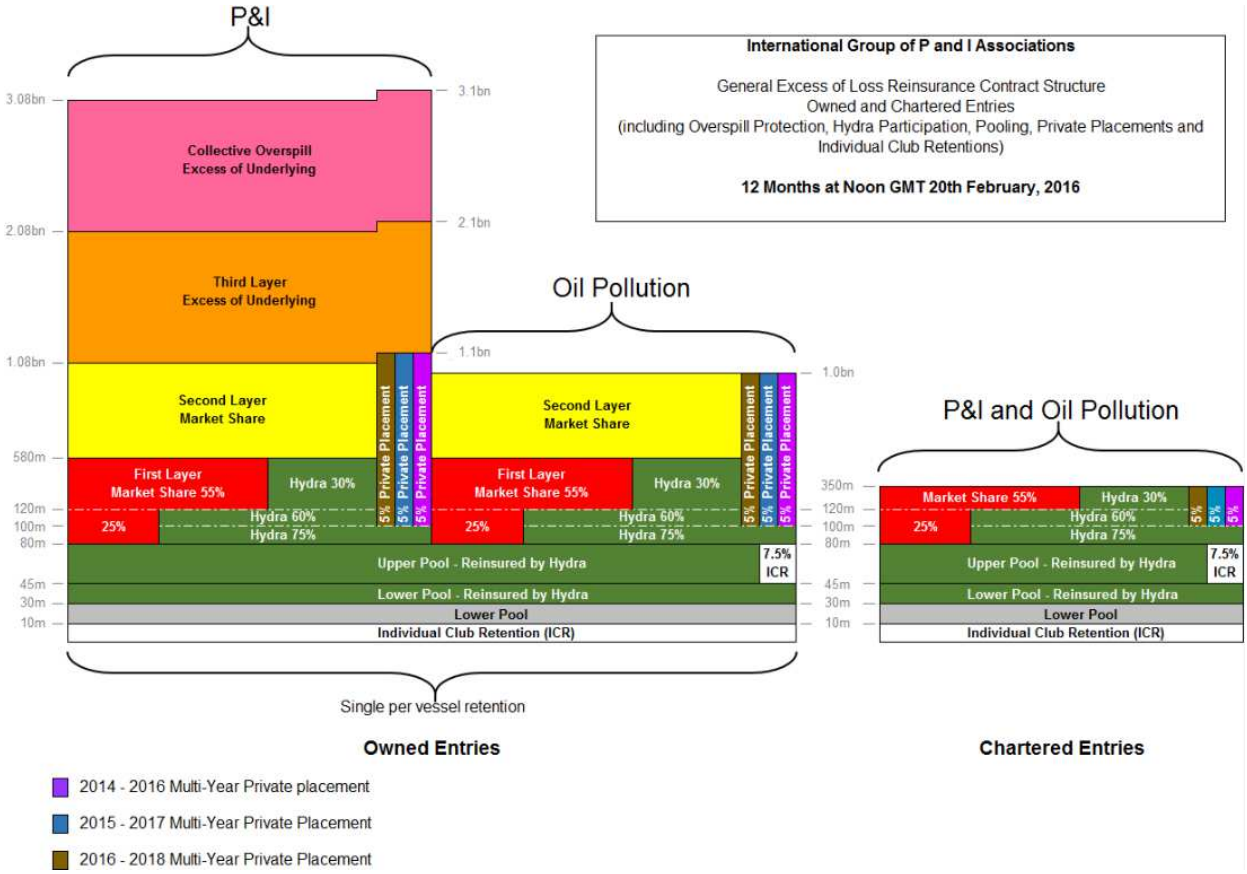


Illustration: IGP&I

Figure 5 – The International Group risk pooling and reinsurance arrangement (IGP&I)

In addition to the mutual clubs, P&I insurance is also offered to shipowners by commercial insurance companies (see the third column in Figure 4, above). These fixed premium policies have expanded significantly in the past five years, taking some business from the mutual clubs. In the current shipping market with depressed freight rates and declining profitability, fixed premium policies offer shipowners budget certainty that the mutual clubs cannot.

However, there are limitations associated with the commercial P&I policies. They often insure only smaller vessels and typically have lower liability limits, lacking the extensive pooling and reinsurance arrangements of the International Group. For example, Osprey Underwriting, the oldest fixed premium P&I insurer in London, limits liability cover to $1 million for ships operating in the USA market. Hanseatic P&I, established in 2005, offers liability cover for all types of vessels up to 30,000 gross tons for bulk carriers and 15,000 gross tons for tankers with a limit up to $500 million. Ingosstrakh Insurance, on the other hand, can provide liability cover up to $1 billion. The oldest insurance company in Russia, Ingosstrakh, holds 60% of the Russian P&I market and is reinsured with leading London and

international reinsurers. Another potential limitation to fixed premium P&I insurance policies is that they may not be accepted in some areas. Hanseatic P&I claims they are the only P&I insurer approved by China, outside of the mutual clubs (Omni 2015).

Because the International Group P&I clubs share claims through a risk pooling system, they have a common interest in loss prevention[1] and control, and in the maintenance of quality standards throughout their membership. This is not the case with commercial P&I insurance policies. Here, the insured shipowner does not pool his risk with other shipowners, but rather transfers it to the insurance company. This may give rise to *moral hazard*, which occurs when one party takes greater risks because someone else bears the cost of those risks. It is thus incumbent on the insurance company to conduct thorough risk due diligence and take other measures to reduce the potential reward of moral hazard.

3.6 Reinsurance

Insurers limit their risk exposure by reinsuring part or all of the risk they have undertaken. *Reinsurance* is a contract under which the reinsurer indemnifies an insurance company against all or part of the primary insurance risks it has underwritten under one or more insurance contracts. Reinsurers themselves may transfer some of the risks involved to other reinsurers.

Reinsurance allows insurers to increase the maximum amount they can insure for a given loss or category of losses, without their need to cover their solvency margin and, therefore, their shareholders' equity. This can make available substantial assets in the event of exceptionally large or multiple losses.

Reinsurance is often written in layers. A reinsurer or a group of reinsurers accepts the risk just above the direct insurer's retention up to a specified amount, at which point another reinsurer or a group of reinsurers accepts the excess liability up to a higher specified amount. The reinsurer taking on the risk just above the direct insurer's retention layer is said to write working layer or low layer excess of loss reinsurance. A loss that reaches just beyond the direct insurer's retention will create a loss for the lower layer reinsurer, but not for the reinsurers on the higher layers. Loss activity in lower layer reinsurance tends to be more predictable than that in higher layers due to a greater historical frequency, enabling underwriters and actuaries to more accurately price the underlying risks involved (SCOR 2016). The risk pooling and reinsurance arrangement arranged by the International Group of P&I Clubs, shown in Figure 5, is a good example of this layered approach.

Normally, reinsurers do not independently evaluate each of the individual risks assumed under a reinsurance contract (SCOR 2016). Rather, they base their decision on the coverage decisions made originally by the direct insurer's underwriters and on its underwriting practices. Such dependence subjects reinsurers to the possibility that the direct insurer has not adequately evaluated the risks to be reinsured and that the reinsurance premium may not adequately compensate the reinsurer for the risk assumed. Therefore the reinsurer's periodic evaluation of the direct insurer's underwriting, risk management and claims settlement practices—analogous to a quality system audit—is the determining factor in accepting and pricing a reinsurance risk.

Reinsurers are thus at least one step removed from the underlying insurance and have no direct contact with the ship or cargo owner, putting them in a weak position to influence shipping standards (Donaldson 1994: 275).

[1] Loss prevention refers to the measures used to prevent loss or damage to people, property, and the environment arising from an incident or accident. The aim of loss prevention is to prevent accidents and reduce the risks of hazards in the workplace. It helps by saving lives and physical properties, prevents workers from pain and suffering, and avoids unnecessary expenditure.

4 LITERATURE REVIEW

There is a relative dearth of literature on using insurance and reinsurance mechanisms to regulate international shipping safety and promote environmental governance. Nevertheless, DNV GL found several studies that helped shed light on the capabilities and limitations of managing environmental risk through insurance. None of these address shipping in the Arctic—not surprising given the emerging nature of this activity. They do address, however, issues of significance to understanding insurable risk, liability, risk transfer, moral hazard, loss prevention, risk management and the like, and how these intersect with the environmental risks caused by shipping.

Governments have delegated extensive regulatory authority to international private-sector organizations. This internationalization and privatization of rulemaking is motivated not only by the economic benefits of common rules for global markets, but also by the realization that government regulators often lack the resources to deal with increasingly complex and urgent regulatory tasks (Büthe and Mattli 2011).

Bennett (2000) reviews how governments facilitate, contract, conscript and even command the involvement of private actors such as insurance companies in international maritime regulation. Regulations such as Oil Pollution Act of 1990 (OPA 90) compel shipping companies to obtain financial guarantees to cover their environmental liabilities, with the objectives of ensuring compensation of victims, cleaning up after environmental damage, and deterring future risky behaviour. Bennet concludes, however, that environmental liabilities cannot be assumed to leverage an economic incentive to improve environmental performance, even if the source of pollution, victim and causal link between them are clear. In practice, the link between liability, deterrence and corporate behaviour is vague. "Especially where the risks are large, but rare and unpredictable, liability may have little meaning as a monetary value that can be worked into a cost-benefit equation" (Bennett 2000: 883). This is particularly so for new, emerging or development risks, where insurers do not have sufficient historical information to establish an actuarial relation between activity, incident, claims, safety measures, deductibles, premiums and settlement costs (Bennett 2000: 885). Given the nascent nature of Arctic shipping, this conclusion does not augur well for using liability to induce higher safety standards in the polar regions.

Enacted by the United States in the wake of the *Exxon Valdez* oil pollution incident, OPA 90 sought to place greater financial responsibility for oil spills on the polluter and thereby generate an incentive for sound risk management in the shipping sector. OPA 90 changed financial responsibility requirements for the transportation of oil in U.S. waters, increased liability limits for oil spills, and broadened the scope of damages, including natural resource damages, for which polluters are liable. Kim (2002) describes how in reality the potentially unlimited liability associated with vessel ownership under OPA 90 has led to avoidance behaviours from the shipping industry. Shipping companies have restructured, forming single-vessel corporations to limit their liability exposure. The P&I clubs, which have traditionally provided financial guaranties for oil pollution liabilities, have in turn refused to cover transportation of oil in U.S. waters to avoid liability under the Act. New commercial financial guarantors have superseded P&I clubs in providing the guaranties required by OPA 90. Whereas the risk pooling mechanism of P&I clubs internalizes risk and provides incentives for members to maintain higher standards of ship operation, maintenance and management, Kim (2002: 586-589) concludes that compulsory liability insurance systems such as financial responsibility guarantor schemes externalize oil pollution costs, undermining these incentives.

Proponents of enlisting insurers in a regulatory role oft point to the P&I clubs, whose mutual structure pools the risk among shipowners, thus giving the group an incentive to minimize risk and place a greater cost burden on those members responsible for the most claims. However, Bennett (2000:889) points to an inherent paradox: "the safest tankers in the world have the highest P&I insurance premiums." This

paradox is due to the fact that P&I clubs both insist on high safety standards for ships trading to the United States and charge them higher rates because of the financial risk that the unpredictable liability regimes there pose to other club members. Bennett (2000: 893) concludes that the drive for increased liability was principally designed to ensure adequate compensation after an incident rather than to improve safety standards. In any case, there is a limit to the clubs' willingness to take on a policing role. One must recognize, Bennett points out, that P&I clubs are comprised of shipowners who are both customer and owner, insured and insurer; there is almost automatic opposition from them to measures that will increase shipowners' costs (Bennett 2000: 892).

The viability of enlisting insurers in regulating environmental risks associated with or caused by shipping ultimately hinges on the nature of the risk and its insurability. Brown (1991: 20, as cited in Bennett 2000: 885) argues that five criteria must be met for a risk to be considered insurable:

1. The risk must create a loss that is definite in time, place and amount;
2. The loss must be accidental in nature;
3. The loss should not have catastrophic potential for the insurer;
4. There should be many similar but independent exposure units; and
5. The price of insurance should be economically feasible.

The first criterion points out a potential challenge in using insurance as a tool for redressing environmental damage caused by the cumulative or compounding effects of shipping, such as chronic disturbance of marine mammal habitat: how can responsibility be apportioned? One may also add that to be insurable, the risk must create a loss to a clearly identifiable victim who is both willing and able to seek financial redress for the loss. In remote areas of the Arctic that are far from communities, who will raise a claim?

In an examination of three global non-governmental regulators, Büthe and Mattli (2011) found that global rule-making by technical experts is also highly politicized and that domestic public institutions remain crucial. Influence in this form of global private governance is a function of the ability of domestic standard-setters to provide timely information and speak with a single voice. The marine insurance industry has some parallels here, in that the International Union of Marine Insurance (IUMI) and the International Group of P&I Associations (IGP&I) can and do set fundamental ground rules for assessing and insuring marine risks. However, the IUMI and IGP&I represent commercial actors rather than independent third-party standard setters, and their members are in commercial competition with each other. This makes it difficult for them to be either independent or to speak in a single voice.

Nevertheless, insurance contracts can promote risk management practices on behalf of insured parties. Among other things, insurance contracts may contain precautionary measures, preventive measures or promissory warranty clauses. As described by Habergham and others (2012), these are promises or representations by an insured to an insurer about future conduct, or that a particular state of affairs will continue after the contract is made. The insured must comply with the condition or the insurer may be discharged from its liability to pay for an otherwise insurable loss. Marine examples include requirements that a vessel have and maintain a valid classification certificate and that the vessel comply with certain regulatory requirements. For operating in the polar regions, one could envision that a marine insurance contract require the vessel to have and maintain a valid Polar Ship Certificate and that the insured exercise diligence in operating the vessel within the limitations stated on it.

Skorna and others (2011) describe how integrated risk management in the marine cargo insurance sector has traditionally focused on claims management and risk transfer through underwriting. They propose supplementing this with an active risk management framework using sensor-telematics and localization technologies to increase transparency in the transport chain. Technology-based continuous

condition monitoring has become a common practice for the transportation of frozen, fragile, hazardous or high-value goods. They posit that continuous monitoring of the transport allows operative risk management principles, including the identification of triggering events and vulnerabilities, and early intervention to avoid or minimize losses. In consequence, transport risks decrease. Furthermore, they claim condition monitoring will improve transparency in the pricing of insurance premiums, enabling more risk-based pricing. While Skorna and others limit their proposals to the cargo insurance sector, there may be potential for parallel benefits in the hull and liability insurance markets as well. Active use of automated identification system (AIS) ship tracking data by the marine insurance industry in correlating operations with casualties and claims could be a starting point.

Zvezdov and Rath (2016) further develop this theme, describing how advances in big data methodologies increase transparency and enhance the possibilities of socially responsible (re)insurance underwriting practices. A vast library of claims data has long been the prerequisite of good actuarial risk assessment. Zvezdov and Rath, however, point out that historical data sets of other relevant variables for insurance underwriting, when modelled in a multi-level, geo-spatial grid and processed with new algorithms, provide new opportunities for assessing (re)insurance risks. Such big data analytics may help detect significant gaps between insurance coverage, asset values, human preparedness and resources at risk in vulnerable areas. In the view of the authors this proposition enhances transparency in risk metrics definitions, and hence improves the overall decision-making and underwriting process for an insurance policy or a reinsurance contract, primarily but not limited to the (re)insurance of risks from natural catastrophes. In the context of Arctic shipping, the DNV GL Arctic Risk Map (DNV GL 2016) represents a multi-level, geo-spatial risk assessment model that could be supplemented with marine casualty and insurance claims information as a beginning point for the type of risk metrics Zvezdov and Rath propose.

Zelenika and others (2007) evaluate the risk management and loss reduction practices of marine P&I clubs. Describing a variety of internal and external factors (consisting of both threats and opportunities) that affect the clubs' risk profile, they propose a suite of measures to improve risk management and loss reduction. These are particularly remarkable in that they focus more on "soft" measures to improve the competence, judgment, health and well-being of their members' seafarers than they do on underwriting practices and ship-related technical factors. This focus reflects the findings of most marine incident investigations, where the cause can be traced to inadequacies in the performance of people in demanding situations. These loss reduction practices of the insurance industry bear serious support and encouragement, as good risk management ultimately relies on people.

Looking beyond the marine insurance sector, Prabhakar and others (2015) examine the evidence of insurance effectiveness in long-term disaster risk reduction and climate change adaptation. Traditional understanding of insurance effectiveness revolves around delivery of payoffs as agreed in the contract. Effectiveness is mainly assessed based on the number of people insured, avoidance of moral hazards, and minimisation of basic risk. They conclude, however, that these are not sufficient criteria to judge the effectiveness of insurance that must deliver disaster risk reduction and climate change adaptation benefits, where payoffs should result in long-term reduction of threat. They also conclude that the evidence of insurance effectiveness in long-term disaster risk reduction and climate change adaptation outcomes is largely speculative. Depending on how the insurance is designed, such as subsidised versus unsubsidised, the net quantified benefits of insurance could even be negative. As a result, Prabhakar et al. conclude that there is only a very limited scope left for insurance to result in long-term risk reduction without it being combined with other risk mitigation measures.

Stahel (2008), however, posits that insurance companies can influence global climate change directly through their investment and underwriting strategies as well as in their daily operations. The biggest

impact insurance might have in helping to speed up the adaptation to global climate change, according to Stahel, is by making available its pool of knowledge in prevention measures through risk engineering services. Ward and others (2008) come to a similar conclusion, pointing to examples of the insurance industry disseminating information to customers on how to reduce the vulnerability of their properties to weather hazards. Here, one can find a parallel with the marine insurance industry's loss prevention activities.

Mills (2009) describes that investors, regulators and even customers are increasingly eager to see insurers be proactive about the climate change threat and provide products that respond to the ''greening'' of the global economy. Insurers, however, have yet to catch up to science and even their customers, who, in response to climate change, are changing the way they produce energy, design and construct products, and transport people and goods. Some insurers are adapting their business model to the reality of climate change, recognizing environmental risk as a component of enterprise risk management. Mills (2009) concludes, however, that it has not yet been demonstrated how some insurance lines might respond to climate change and some market segments have not yet been served with a single green insurance product or service. Although Mills does not address it, the marine insurance sector does not appear to be a strong candidate for introducing insurance products or services aimed at reducing or mitigating the effects of climate change in the Arctic. One can argue climate change is responsible for increasing shipping activity in the Arctic, something the maritime sector considers a benefit rather than a liability.

To summarize some of the key conclusions and hypotheses found in the literature we reviewed, we have the following:

- The link between liability, deterrence and corporate behaviour is vague (Bennett 2000).
- Insurers may lack sufficient information on new and emerging risks to establish an actuarial relation between activity, incident, claims, safety measures, deductibles, premiums and settlement costs (Bennett 2000).
- Whereas risk pooling of P&I clubs internalizes risk and provides incentives reducing risk, compulsory liability insurance systems externalize liability, undermining these incentives (Kim 2002)
- There is a limit to insurers' willingness to take on a policing role (Bennett 2000).
- The viability of enlisting insurers in regulating environmental risks associated with or caused by shipping ultimately hinges on the nature of the risk and its insurability (Brown 1991).
- Global rule-making by technical experts is highly politicized; their influence is dependent on unified communication at both local and global levels (Büthe and Mattli 2011).
- Insurance contracts can promote risk management practices on behalf of insured parties by including precautionary measures, preventive measures or promissory warranty clauses (Habergham and others 2012).
- Condition monitoring and big data analytics may promote operative risk management and enhance our understanding and management of risk (Skorna and others 2011; Zvezdov and Rath 2016).
- Insurance is limited in its ability to deliver long-term risk reduction without it being combined with other risk mitigation measures (Prabhakar and others 2015).

- The biggest impact insurance might have in environmental risk management is sharing information on risk prevention measures (Stahel 2008; Ward and others 2008).

We recast these as questions to help guide the development and execution of our study into the potential leverage of I&RS mechanisms on shipping safety in the Arctic.

- How can and do insurers help shipowners identify and reduce their risks?
- Do insurers themselves have sufficient information on Arctic risks to advise their policyholders?
- How unified is the marine insurance industry in its approach to promoting high shipping standards, both with their customers and the maritime industry at large?
- What types of contractual clauses can and do insurers use that may promote good risk management in Arctic shipping? How does the use of these clauses benefit or harm the interests of third parties?
- Do insurers have sufficient information to adequately quantify the risks of Arctic shipping? What type of information is necessary, and how much is enough? If traditional actuarial information is not available, can other information be used as a proxy?
- Do insurers use automatic identification system (AIS) data from ships in analysing causes, circumstances and patterns that arise to incidents and claims? If not, are they amenable to exploring it and other big data analytics?
- Do insurers believe they can take cost-efficient actions that will improve shipping safety in the Arctic?
- Which environmental risks associated with or caused by Arctic shipping are insurable, and which are not?

5 SHIPPING IN THE ARCTIC

5.1 Who, what where and when

5.1.1 Automatic Identification System (AIS)

The Automatic Identification System (AIS) is an automatic tracking system used on ships and by vessel traffic services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships and AIS base stations. SOLAS Chapter V Regulation 19 requires AIS to be fitted aboard:

- all tankers and ships of 300 gross ton and greater, engaged in international voyages;
- cargo ships of 500 gross ton and greater, not engaged on international voyages; and
- all passenger ships irrespective of size.

Many other ships carry an AIS transponder, even though they are not required to do so. Hence, the traffic picture generated from AIS data is expected to be representative for most of the actual traffic in an area.

AIS transponders automatically broadcast information, such as their position, speed, and navigational status, at regular intervals via a VHF radio transmitter built into the transponder. The information originates from the ship's navigational sensors, typically its global navigation satellite system (GNSS) receiver and gyrocompass. Other information, such as the vessel name and radio call sign, are also transmitted regularly. These data are submitted at regular intervals to nearby vessels, land-based stations and lately to dedicated satellites.

The requirement for AIS transponders on-board ships has opened for a completely new way of ship traffic surveillance as well as safety and environmental risk calculations related to their operation. It has revolutionized our knowledge of ship traffic, its environmental footprint and the subsequent risks involved.

5.1.2 Inventory of ship traffic in the Arctic

Based on the AIS data from 1 January to 31 December 2013, DNV GL compiled a comprehensive illustration of shipping activities in the Arctic. We collected AIS transponder records for the full year originating within the boundaries of Arctic waters as defined by SOLAS Ch. XIV Regulation 1 (illustrated in the fact box *Polar Waters*, in § 5.4.3). This amounted to approximately 1.4 million records.

This data is then coupled with other proprietary databases for adding other relevant ship information, such as ship type, gross tonnage, flag, etc. Unfortunately, our databases do not currently include information on a vessel’s insurance. The data were then sorted using Lloyd’s thirteen standard ship types and seven size (gross tonnage) categories.

From the AIS data described above, we identified 1477 discrete vessels that operated in Arctic waters in 2013. As shown in the following tables, 70% of these are small vessels of less than 5,000 gross tons, and 34% are fishing vessels (which are exempt from compliance with the Polar Code). As for flag, 66% are flagged by one of the Arctic coastal states (Canada, Denmark/Greenland, Iceland, Norway, Russia and the United States), the majority of which are flagged by Russia (38%). This suggests the Arctic coastal states have a very important and influential role in both flag state and port state control for vessels operating in Arctic waters.

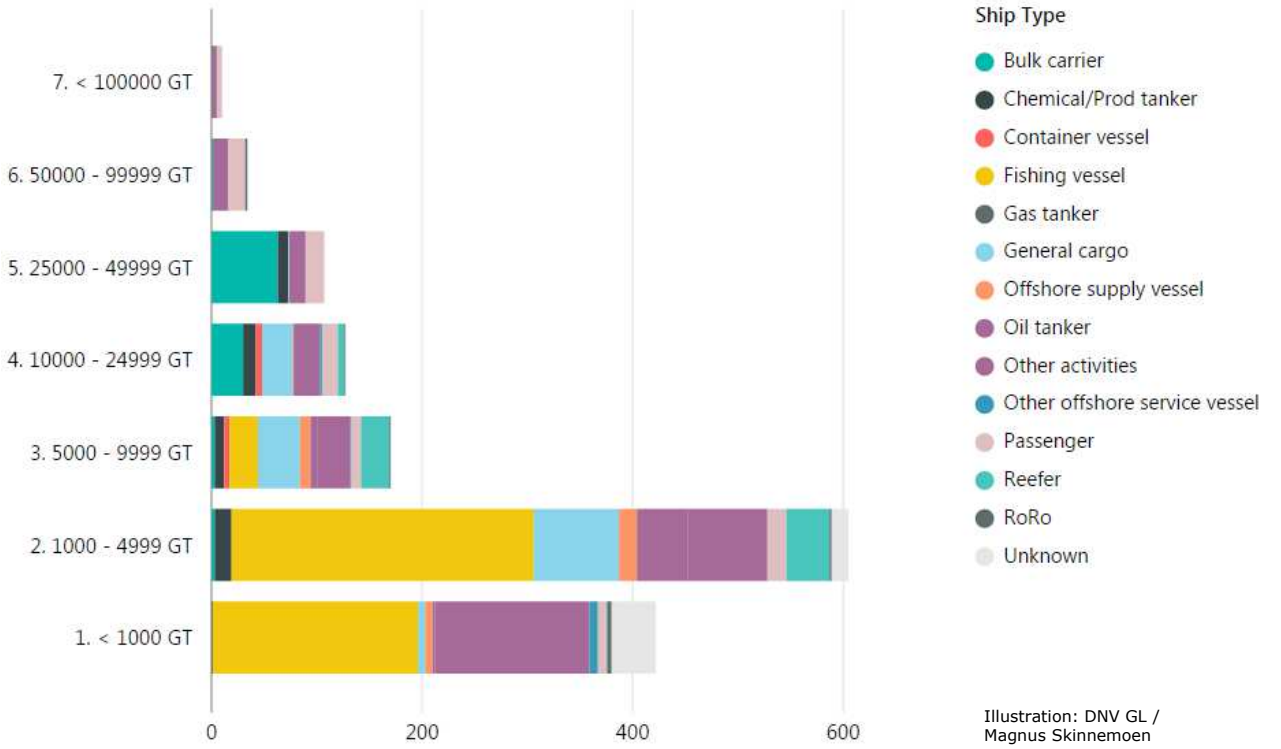


Figure 6 – Vessels in the Arctic by gross tonnage and ship type (2013)

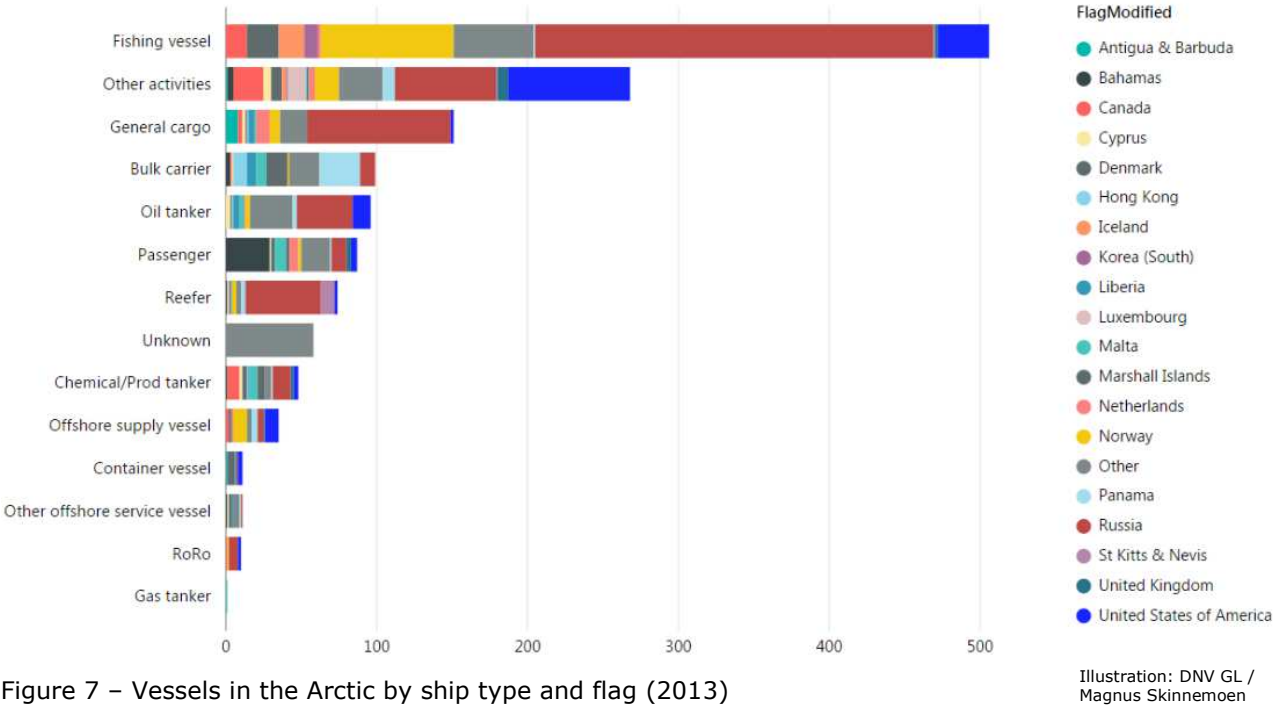


Figure 7 – Vessels in the Arctic by ship type and flag (2013)

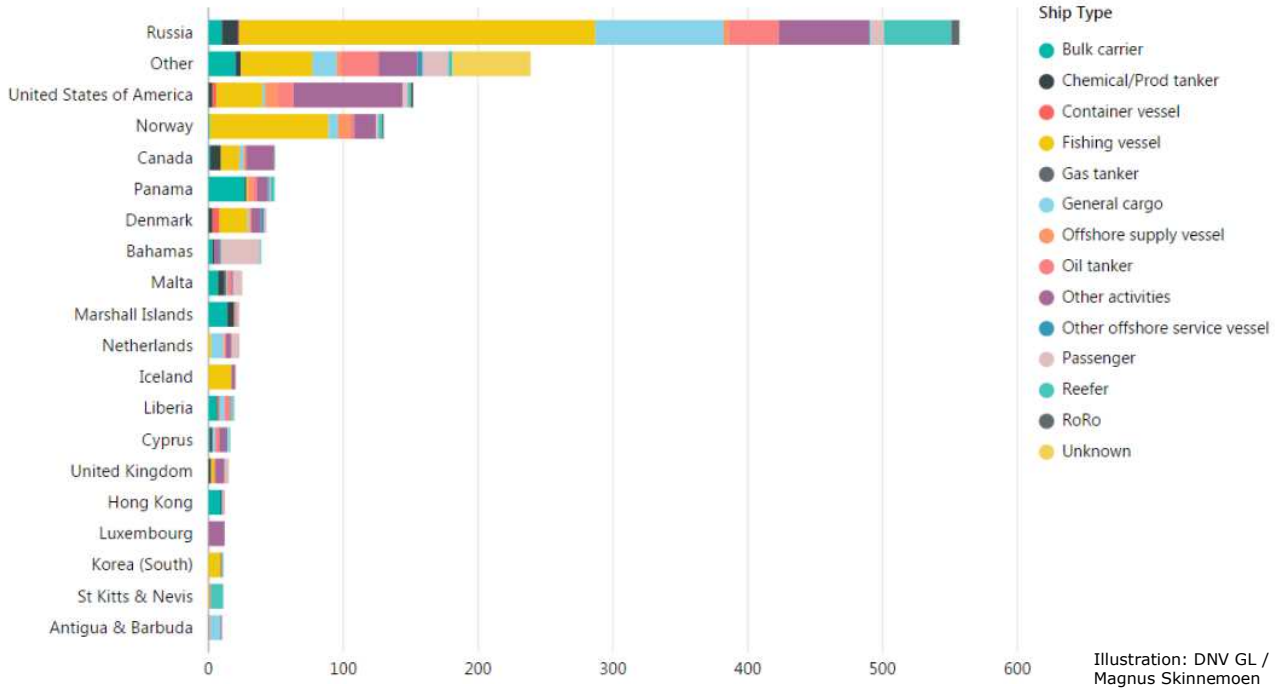
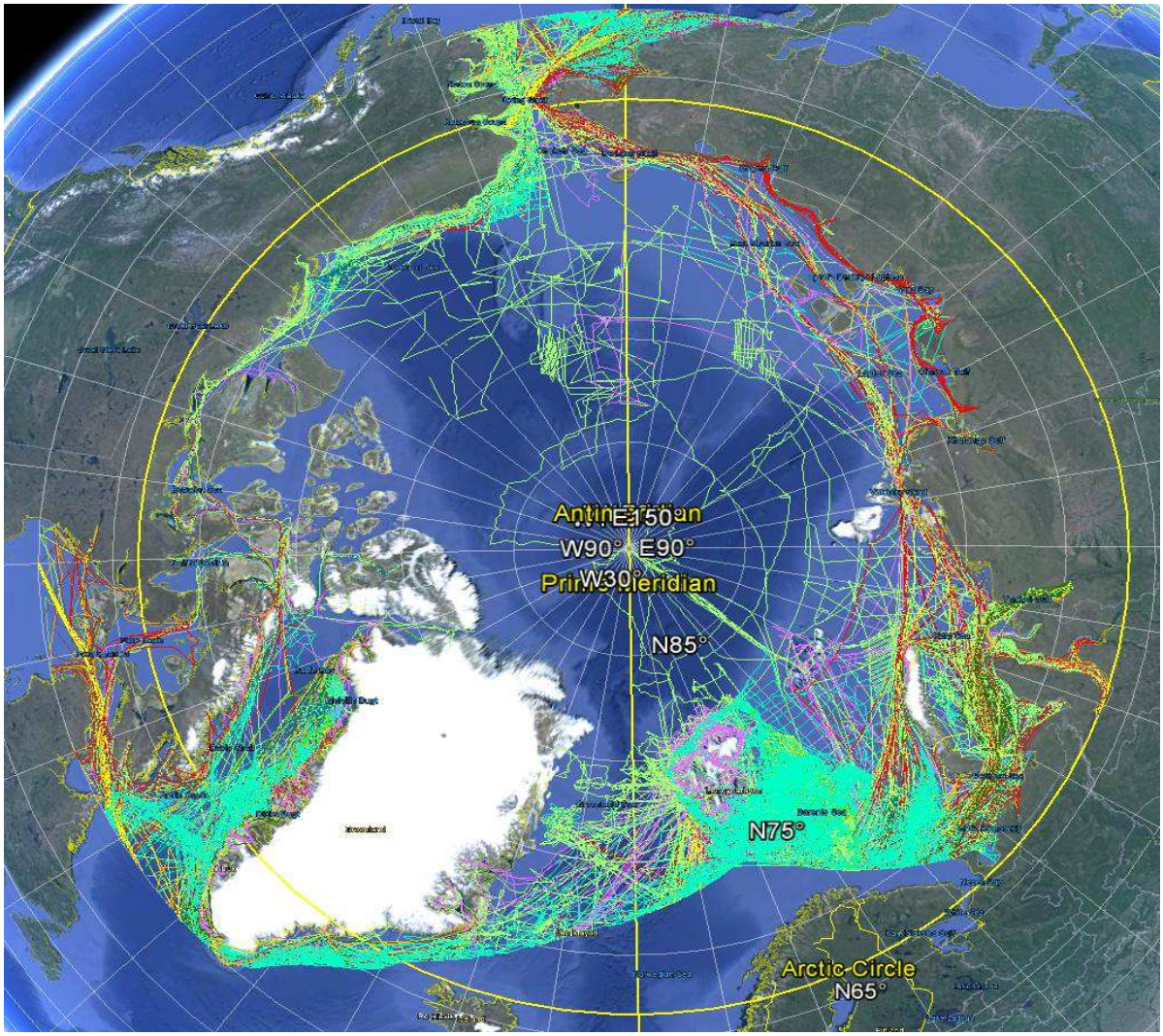


Figure 8 – Vessels in the Arctic by flag and ship type (2013)

Furthermore, we used the ArcGIS™ geographic information system tool to generate a plot illustrating the ship traffic in Arctic waters. Figure 9 shows a full year (2013) of ship tracks in Arctic waters superimposed on the map of the Arctic; ship tracks outside the Arctic as defined by SOLAS Ch. XIV Regulation 1 have been suppressed for clarity of the illustration. The ship track colors represent the different vessel categories shown in the legend below. Arctic ship traffic is generally skewed towards the Norwegian Sea, Barents Sea and the Russian coastline. The traffic is subject to large seasonal variations.



- Fishing vessel
- Other activities
- Other offshore service vessel
- Offshore supply vessel
- Passenger
- Reefer
- RoRo
- Container vessel
- General cargo
- Bulk carrier
- Gas tanker
- Chemical/Prod tanker
- Oil tanker

Figure 9 – Vessel tracks in the Arctic by vessel type (2013)

5.2 Shipping casualty figures

Figure 10 illustrates the global distribution of shipping casualties. It shows the number of total ship losses over the past decade for ten geographic areas. Losses in the Arctic are few in comparison to other areas, reflecting the much lower shipping activity and traffic density in the region. There were eighteen total ship losses in Arctic waters during the period, nearly half of which occurred in the winter months of January and February when one can expect the worst weather, ice and icing conditions—yet also when shipping activity in the Arctic is at its lowest level during the year. What this picture lacks, unfortunately, is an insight into the costs related to these total loss casualties, as well as a view of the number and magnitude of shipping casualties that did not involve a total loss.

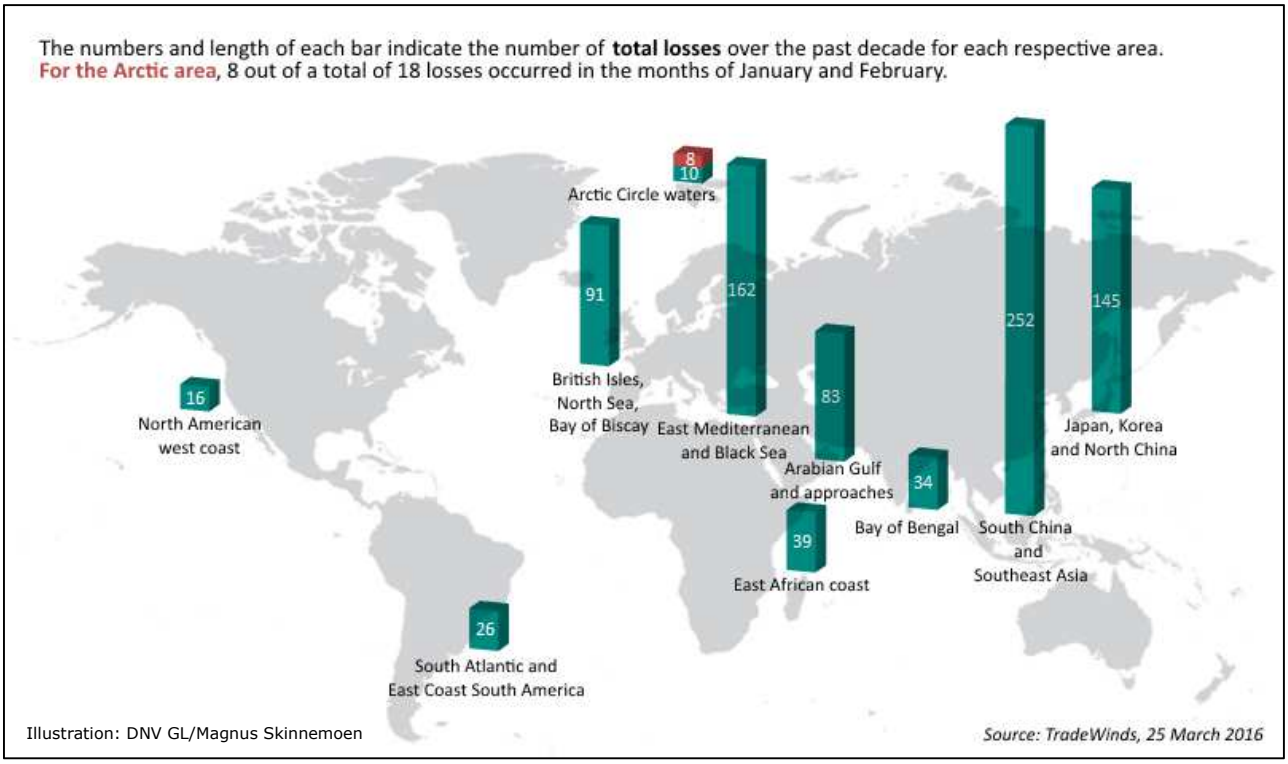


Figure 10 – Shipping casualties in Arctic waters vs. the rest of the world

5.3 Arctic shipping risk

This section is an abridged extract from the DNV GL report, *The Arctic: The Next Risk Frontier* (2014).

5.3.1 Mapping Arctic risk

Risk is inherently difficult to understand and explain, and the complexity of risk in the Arctic compounds the issue. However, DNV GL has developed a tool that makes forecasting potential hazards easier.

To assess the viability of an activity in the Arctic, it is necessary to know the risk factors and how they change depending on a variety of parameters, such as location and season. For this reason, DNV GL has used data from its Arctic projects and other sources to visualize risk in the Arctic, making it easier to understand. The result is the Arctic Risk Map (DNV GL 2016).

The map is an interactive, web-based application that displays the level of risk in specific areas for each month of the year. It considers seasonal distribution of ice and metocean (physical environment) conditions, biological assets, shipping traffic, oil and gas resources and accident history. It also contains indexes for risk levels that affect safety, operability and environmental vulnerability.

Risk in the Arctic is highly variable, greatly depending on the type of activity and the location and time of year it is performed in. The Arctic Risk Map presents this complex information in an accessible format.

It is a transparent resource that can be used in discussions between authorities, industry, the public and other stakeholders. DNV GL believes that, if used correctly, the Arctic Risk Map will improve communication between these groups by making risk more tangible and better understood.

The Arctic Risk Map can be found at http://dnvgl.com/arctic.

Safety and operability index

DNV GL has developed the Safety and Operability Index to provide a better view of the ever-changing levels of risk in the Arctic. The index shows, for example, that even in summer, the risk is higher off the north-west and north-east of Greenland than it is in the Barents Sea in winter.

The Safety and Operability Index gives a rating to risk factors relevant to Arctic operations and compares this rating to productive offshore fields in the Norwegian Sea. These fields were chosen as the benchmark because they lie in a harsh but well-known environment where there is nearly two decades of operational experience.

A high rating indicates extreme Arctic conditions that are likely to challenge the safety and operability of offshore and maritime activities. Sensitivity assessments can also be run to assess the risk drivers once a particular factor has been mitigated.

In Figure 11, the Arctic Risk Maps show variations in risks to safety and operability in the same location in different seasons. In July, large parts of the Barents Sea, Kara Sea, Laptev Sea, Chukchi Sea, Beaufort Sea and the seas south-west of Greenland experience similar operating conditions to the rating benchmark (the Norwegian Sea). The Barents Sea has the lowest safety and operability index (that is, lowest risk). As the January map shows, even in winter the southern part of the Barents Sea rates as the lowest overall risk area, with conditions comparable to the Norwegian Sea.

On the other hand, areas around the Central Arctic Ocean and north-west and north-east of Greenland present severe operational challenges, even in summer. These areas, as well as the northern part of Baffin Bay, have the highest risk rating.

The Kara, Chukchi and Beaufort seas are most likely to hold significant oil deposits; however, they also have a safety and operability index of "Severe Arctic Conditions" for several months of the year.

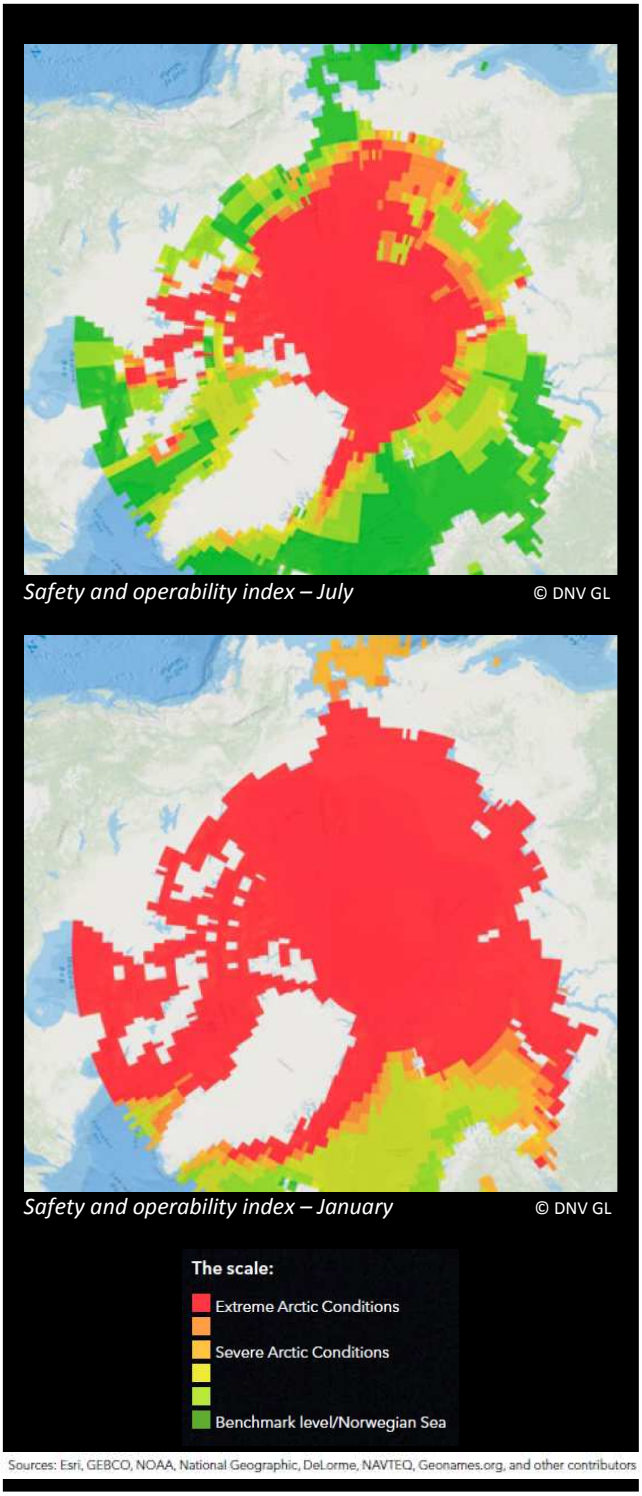


Figure 11 – Safety and operability index (DNV GL 2014)

Large variations in climate, species distribution, and human activity influence the environmental risk picture in the Arctic. DNV GL's analysis shows that the region is at its most vulnerable during summer—a time when industrial activity collides with important life stages for the Arctic's inhabitants.

DNV GL's Environmental Vulnerability Index required a careful assessment of Arctic species and their vulnerability to an oil spill. The index shows that the environment is generally at its most vulnerable during summer, due to the combination of species experiencing sensitive life stages at the same times as industrial activity. This risk tapers off during autumn and is at its lowest in winter. However, this differs greatly between regions.

Some areas, for example, are particularly vulnerable in winter, when they are used by birds for wintering or as spawning grounds for fish.

The methodology used to create the Environmental Vulnerability Index can be adapted to study the impact of other environmental stressors such as disturbance.

5.3.2 Case study: heavy fuel oil in vulnerable areas

The Arctic Risk Maps in Figure 12 show a high level of environmental vulnerability combined with the movement of shipping vessels that use heavy fuel oil (HFO). HFO spills are one of the main risks to the Arctic environment. Since ice coverage dictates both shipping lanes and biological activity, it has also been included in the maps.

Environmental vulnerability in January

Although January sees less shipping activity than the summer months, traffic at this time passes through environmentally vulnerable areas of the Davis Strait (south-west of Greenland), the Hudson Strait and part of the south-east Barents Sea (the Pechora Sea). Of these, the Davis Strait is the most vulnerable due to its winter bird population, however the eastern and western Hudson Strait are also concerns as they provide wintering areas for bowhead and beluga whales, walruses and feeding areas for ivory gulls in these months. Also vulnerable is the Pechora Sea, home to walruses and beluga whales in the winter.

Environmental vulnerability in July

The Northern Sea Route opens in July, bringing a drastic rise in shipping traffic between the Barents Sea and the Bering Strait, an ecologically significant Arctic region. The Bering Strait is of particular concern, as is the Great Siberian Polynya system, an important feeding ground for walruses and a breeding and staging area for seabirds and waterfowl.

The Barents Sea experiences increased traffic in sensitive areas at this time, as does Baffin Bay, where melting ice has allowed traffic into the northern parts. This is a highly vulnerable environment, particularly the North Water Polynya, where a great number of beluga, bowhead and narwhals feed in the summer. The North Water Polynya is inhabited year-round by walrus, polar bears and seals. In summer, the ivory gull, classified as a near-threatened species, also tends to congregate there.

The map also shows an increase in shipping traffic in the Hudson Bay during July, which has the potential to damage seabird breeding colonies and the feeding areas of marine mammals, including bowhead and beluga whales, narwhals and polar bears.

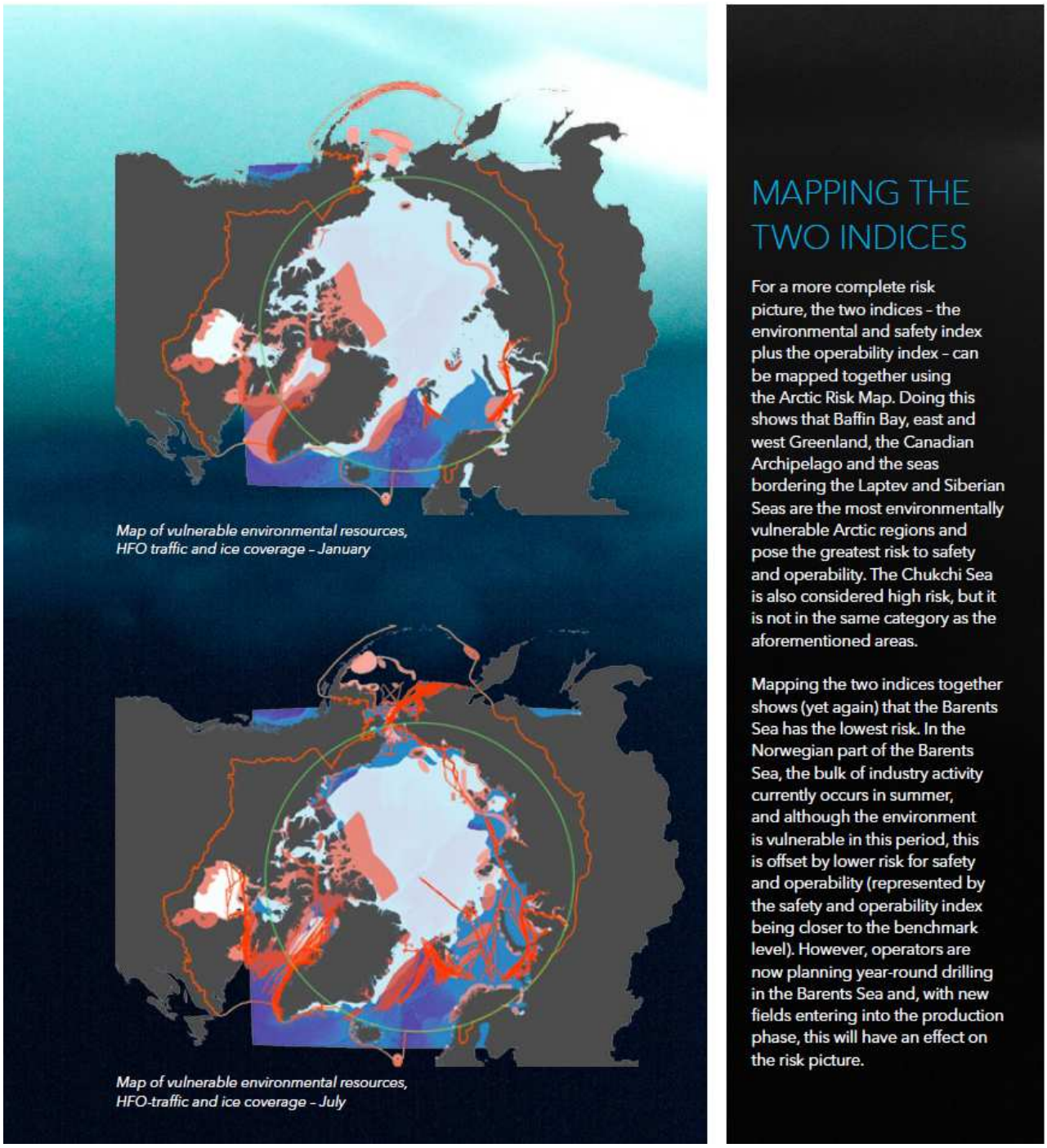


Figure 12 – Environmental vulnerability and HFO traffic in the Arctic (DNV GL 2014)

5.3.3 Mapping Arctic shipping risk

Navigating ships in cold climates and icy waters presents additional challenges to those generally encountered by the shipping industry. While centuries of experience have resulted in a good understanding of the risks involved in shipping around the world, knowledge of Arctic shipping is limited. Most of what is known about shipping in the Arctic comes from winter navigations of the Baltic, the Northern Sea Route and around North America, as well as operations in the Arctic with purpose-built vessels.

New challenges

The anticipated increase in Arctic shipping poses new risks and challenges according to the type of operation being embarked on, the size and make of the ship and the experience of its crew.

The most obvious threat is ice loads, which add to existing loads on the ship's hull and the machinery system. These additional forces make it necessary to modify the vessel. In addition, the low temperatures require that the hull be made of quality materials and that all components, systems and onboard equipment are suited to the freezing climes.

As well as the unique risks posed by the Arctic conditions, ships in the region face many of the same hazards encountered by ships all over the world. But there are some reprieves. The risk of collision, for example, is lower due to there being less traffic than in other parts of the world.

The changing risk picture

In the coming years, shipping traffic in the Arctic will increase, with most activity likely to occur in summer in areas with open water and limited ice. Relatively few vessels will operate in heavy ice in the far north during winter, however a reduction in ice coverage will change the risk picture as vessels with no ice class (or limited ice class) will be able to sail in areas where only ships with ice strengthening have to date been capable of operating. Some owners who choose to operate in these parts of the Arctic will not be sufficiently experienced in cold-climate shipping and will therefore require guidance to conduct safe operations.

Main hazards

Ships operating in cold conditions may encounter a variety of hazards, including the icing of systems and equipment, liquids in tanks and pipes freezing, large loads and impacts from heavy ice conditions and drifting icebergs and growlers (small, barely visible icebergs).

Correctly identifying prevailing ice conditions will help protect a vessel from significant ice damage. Appropriate dimensioning methods are also needed to ensure the vessel has the necessary structural integrity, as is winterization, which prepares the ship for extreme icing, freezing systems and wind chill.

Ships do, of course, have a natural advantage over offshore infrastructure in that they are able to move; with careful navigation and operation they can usually avoid ice.

The current risk picture

Arctic tourism and raw-material exports are set to rise in coming years. To understand the risks these expanding industries face, DNV GL examined two hypothetical cases: The first, a cruise ship travelling off the west coast of Greenland; the second a bulk carrier transiting through the Northern Sea Route.

Calculating Arctic risk

DNV GL's research aimed to identify the risk level for each of the vessels to create a recommendation of risk-control options, as outlined in the concept vessels, featuring later in this chapter.

Risk was gauged by first modelling the risk these vessels would encounter in typical trade conditions, then adding risks typically encountered by Arctic operations that travel through ice. The model was then implemented for selected routes with actual Arctic conditions and then compared to a benchmark with worldwide conditions. This methodology helped determine the difference between the risk of Arctic shipping compared with the risk of worldwide operations. Transit to and from the route was not included in the analysis.

The following scale indicates how Arctic shipping compares to the benchmark:

Higher risk:
Difference is larger than 5%

Equal risk:
Difference is within the range of -5% to 5%

Lower risk:
Difference is more than 5% below the benchmark

5.3.4 Case study: cruising the Arctic

Demand for Arctic cruises is increasing. Annual passenger numbers have grown steadily over the past decade and as a result operators have augmented their Arctic itineraries. The increasing choice of destinations, departures and journey times is transforming the industry's risk picture. It is worth remembering that a significant accident in the Arctic could have catastrophic consequences, including a major search and rescue challenge for coastal states.

The models

The route used for the study was a summer sailing trip off the west coast of Greenland, as shown in the map to the right. This is a typical route for Arctic cruise ships and is therefore well mapped. The most commonly visited harbors (Qaqortoq, Nuuk, Sisimiut and Ilulissat) were included in the journey.

DNV GL analyzed three trips along the Greenlandic coast: the benchmark case with a standard cruise ship; the same ship travelling in actual Arctic conditions in July; and a concept cruise ship equipped with several risk-control options created specifically for Arctic operations. The latter is discussed in detail in DNV GL (2014).

A standard vessel using standard practices

The dimensions of the study's fictional ship were based on the average size of cruise ships worldwide, therefore the results are applicable to all cruise vessels. Because the study focused on summer travel, researchers assumed the vessel was designed for temperatures above 0°C and was not ice-strengthened.

They also assumed the ship met all relevant regulations and that its crew employed standard practices (that is, they had adequate training and experience in Arctic conditions, made reasonable navigation and operational decisions, a pilot was on board at all times and the ship only sailed within mapped areas).

The result: increased risk

Illustrated in Figure 13, the study found that the overall risk for the Arctic cruising case is nearly 30 percent higher than the benchmark, mainly due to the increased consequences for people on board in the case of an accident; their chance of survival is considerably lower due to the temperature of the air and water. In addition, the risk of a ship-to-iceberg collision does not exist in the benchmark scenario and therefore the overall likelihood of an accident is also increased.

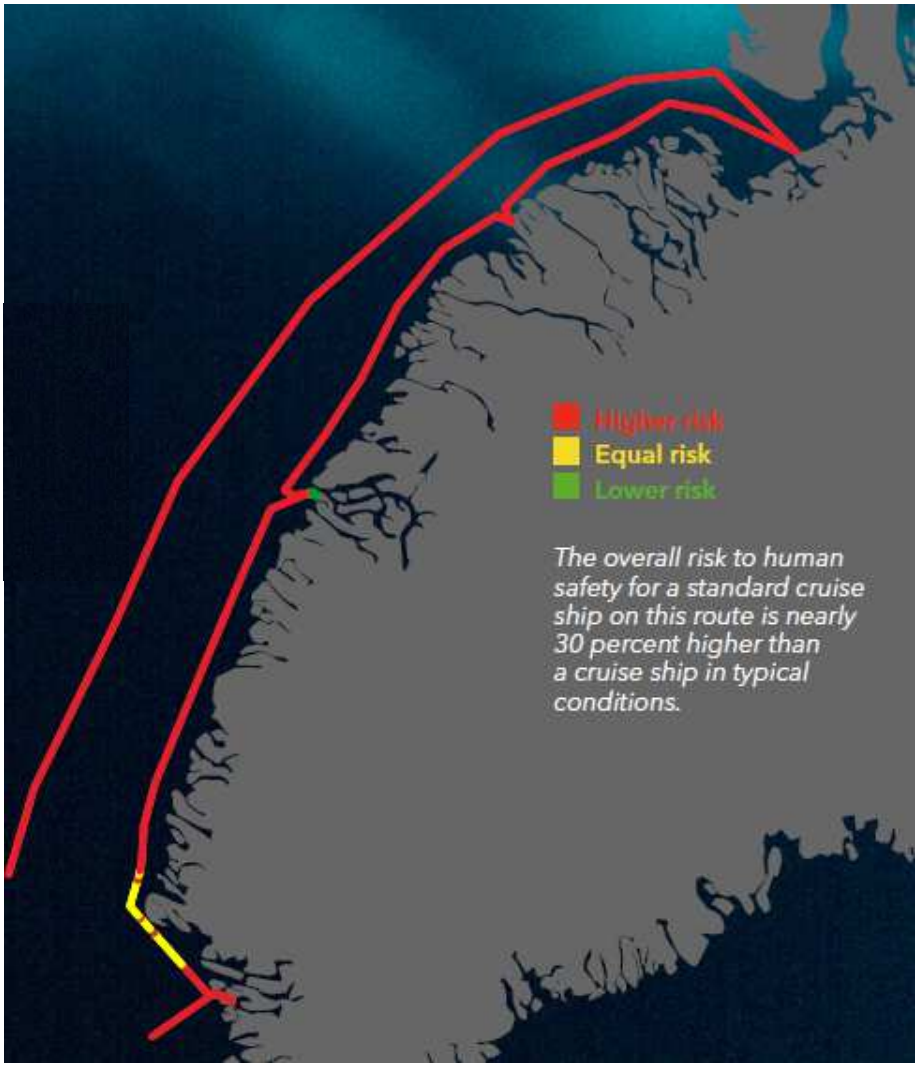


Figure 13 – Risk map for the Arctic cruising case study (DNV GL 2014)

5.3.5 Case study: bulk trade along the Northern Sea Route

By travelling along Russia's Northern Sea Route (NSR), a ship trading between Europe and Asia can cut its travel distance by between 20 and 50 percent (depending on its destination). The fuel savings are a strong commercial driver but the route's drawbacks—namely the challenging environmental conditions, the cost of using icebreakers, and the unpredictability of voyage duration—have led many industry experts to argue that it will be decades before the NSR sees significant shipping traffic.

In any case, traffic has increased markedly over the last five years and the trend is likely to continue. It is therefore essential to gain a better understanding of the risks it poses. The NSR stretches from Novaya Zemlya in the west to the Bering Strait in the east and covers some 2,200 to 2,900 nautical miles of icy waters. It consists of a series of sailing lanes with different draft limitations and ice conditions. Navigators choose which lane to take depending on factors such as land-fast ice, leads, wind direction, current, visibility, summer ice massifs and the depth of the water.

Commercial operations are generally restricted to the summer season, which has traditionally been defined as June to October, but melting ice and new technologies are gradually extending this window. Navigation along the NSR is challenging and it is important for operators to understand its unique risks and the measures they can take to mitigate them.

The models

The bulk carrier route used in the study was similar to that taken by actual bulk-carrier traffic in 2012. Three cases were tested: the benchmark worldwide case with a standard bulk carrier, the same ship travelling in July in actual Arctic conditions and a concept bulk carrier equipped with risk-control options specific to Arctic operations. The concept ship is discussed in DNV GL (2014).

A standard vessel using standard practices

The dimensions of the vessel were based on the average size of bulk carriers currently operating worldwide: between 60,000 and 80,000 deadweight tonnes. As with the cruise case, it was assumed the ship met all relevant requirements and that its crew employed standard practices (that is, they had adequate training and experience in Arctic conditions, made reasonable navigation and operational decisions, a pilot was on board at all times and the ship only sailed within mapped areas).

The result: increased risk

As the image shows, risk levels vary along the route; some parts are considered equal risk, others are lower risk and the largest portion is higher risk—that is, a level at least five percent greater than the benchmark. Overall, Arctic risk is about 14 percent higher than the average worldwide risk, mainly due to ice-related events, including collision in ice, impact on the hull and grounding by ice. For this reason, choosing a suitable ice class is extremely important.

On the other hand, as long as a vessel is operating in open water, its risk of ship-to-ship collision is significantly lower than the worldwide average (due to there being less traffic). Summer shipping along the NSR occurs during the open-water season, but it is important to note that in the Arctic, *open water* means that ice concentration (the relative ocean area covered by ice) is less than 10 percent—it does not mean waters are ice-free.

5.3.6 Reducing risk to an acceptable level

Operating in the Arctic does not have to be high risk. By combining effective risk management with research, continuous learning, cooperation and new technologies, a business can reduce the risk of its Arctic operations to an acceptable level.

The risks maritime and petroleum operators face in the Arctic are as diverse and dynamic as the ice sheets that sculpt the face of this unique region. In addition to wide variations in geography and seasonality, they must deal with extreme conditions and a lack of social infrastructure. But, as is the case elsewhere, operational risk can be mitigated through a structured approach. Defining that structure is the key to success.

Although there is no rule of thumb to ensure successful risk management in the Arctic, measures can be taken to help steer judicious decision-making. These can be grouped into four key areas (listed in order of preference):

- Measures that facilitate safe practices by removing a hazard or an unwanted effect (such as restricting operations in certain areas altogether);
- Preventive measures that reduce the likelihood of problems occurring;
- Consequence-reducing measures that control the effects of an accident; and
- Measures that require external assistance (these should be secondary to measures based on self-support and robust operations).

Technical measures should always be guided by clear operating principles. With good management, all petroleum and maritime operations should be able to attain a reasonable level of safety. However,

determining whether a risky operation should proceed is often a values-based judgement and decision-makers (such as authorities or members of the public) may decide that the benefits do not justify the risk, as has been the case with drilling in Norway's Lofoten islands and the moratorium on Arctic drilling after the Macondo accident in the United States.

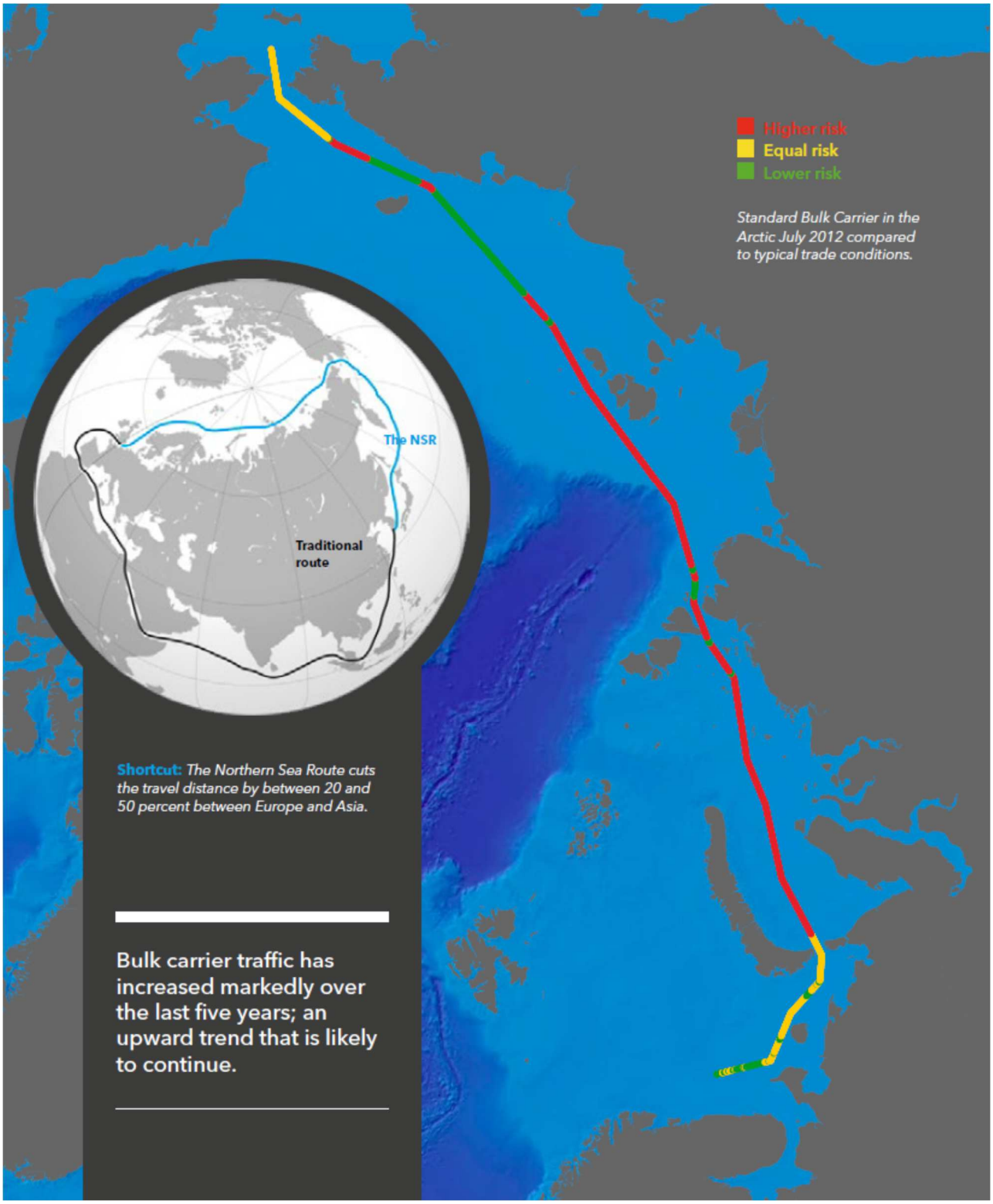


Figure 14 – Risk map for the NSR bulk carrier case (DNV GL 2014)

5.4 Arctic regulation

5.4.1 The international legal regime regulating shipping

The international regulation of maritime shipping is primarily undertaken by global bodies and instruments of global application. This is a direct consequence of the global nature of international shipping and the interest of the international community in globally uniform international regulation.

The UN Convention on the Law of the Sea (UNCLOS) safeguards this interest by only allowing unilateral coastal state prescription in a few situations. The regional bodies or groupings of states that nevertheless exercise prescriptive or enforcement jurisdiction over vessel-source pollution commonly do this in their capacities as flag states or port states.

Like UNCLOS, the international legal regime for the regulation of maritime shipping also balances the different interests of the international community with the interests of states that have rights, obligations or jurisdiction in their capacities as flag, coastal or port states.

The overarching objective of UNCLOS is to establish a universally accepted, just and equitable legal order for the oceans. It seeks to reconcile a range of competing interests including the rights of coastal States and flag States as well as the interests of the international community in terms of such matters as navigation and the protection and preservation of the marine environment.

In addition to UNCLOS, the international legal regime for the regulation of maritime shipping consists of a range of instruments adopted within the International Maritime Organization (IMO) and various regional organizations. These include conventions and codes adopted within the IMO (see the box, *Key IMO Instruments*), as well as non-binding instruments, such as the General Provisions on Ships' Routeing and the Particularly Sensitive Sea Area (PSSA) Guidelines. Apart from the Polar Code, these instruments have a global scope of application and therefore apply in principle to the entire Arctic marine area.

In terms of substantive standards, the international regime for the regulation of maritime shipping contains a wide number of categories, including:

- construction, design, equipment and manning (CDEM) standards, including fuel content specifications and ballast water treatment requirements;
- navigation standards, ship routing measures, ship reporting systems and vessel traffic services;
- discharge and emission standards, including standards relating to ballast water exchange;
- contingency planning and preparedness standards; and
- liability, compensation and insurance standards.

Prescriptive jurisdiction by flag states and coastal states is linked by means of rules of reference to the notion of *Generally Accepted International Rules and Standards* (GAIRAS). These refer to the technical rules and standards laid down in instruments adopted by international regulatory organizations. Rules and standards laid down in legally

KEY IMO INSTRUMENTS

Global IMO instruments

- International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended
- International Convention for the Prevention of Pollution from Ships (MARPOL), 1973, as amended
- International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, as amended

Regional IMO instruments

- International Code for Ships Operating in Polar Waters (Polar Code)

binding IMO instruments may be regarded as GAIRAS.

UNCLOS stipulates that flag state prescriptive jurisdiction over CDEM, navigation, discharge and emission standards, etc., is mandatory and must have at least the same level as GAIRAS. Flag states can therefore choose to require vessels of their own flag to comply with more stringent standards than GAIRAS.

Conversely, coastal state prescriptive jurisdiction over CDEM, navigation, discharge and emissions, etc., is restricted under UNCLOS. If exercised, it cannot be more stringent than the level of GAIRAS. This is the general rule even though it is subject to some exceptions, described below.

In ports and internal waters, UNCLOS and several IMO instruments explicitly confirm the port state's residual prescriptive jurisdiction. This means that port states within or beyond the Arctic marine area can, for example, deny access to certain types of ships or impose conditions for entry into port that are more stringent than GAIRAS.

Furthermore, Article 218 of UNCLOS grants port states enforcement jurisdiction over illegal discharges that have occurred beyond their own maritime zones, namely the high seas and the maritime zones of other states. Apart from rights, port states also have relevant international obligations with respect to foreign vessels in their ports and internal waters. One such obligation is contained in Article 219 of UNCLOS for 'unseaworthy' vessels. Moreover, regional arrangements on port state control contained in memorandum of understanding (MOU), such as the Paris MOU and the Tokyo MOU, contain non-legally binding commitments on inspection and follow-up to eliminate the operation of sub-standard ships.

In the territorial sea, the coastal state has full sovereignty, although ships of other states may sail through it if their passage is "innocent"; that is, it does not disturb the coastal state's peace, good order or security. The coastal state may adopt laws and regulations relating to innocent passage in respect to the safety of navigation and the regulation of maritime traffic; the preservation of the environment; the prevention, reduction and control of pollution; and other defined matters. Such laws and regulations, however, may not apply to the design, construction, manning or equipment of foreign ships unless they are giving effect to generally accepted international rules or standards (UNCLOS, Article 21). The rationale of this provision is to safeguard the objective of uniformity in the regulation of international shipping, which would be undermined if states unilaterally prescribe standards that have extraterritorial effects. For instance, unilateral fuel requirements affect this objective because compliance can require substantial and costly adjustments to vessels. Such requirements should therefore be treated analogous with CDEM standards.

In straits used for international navigation, coastal states may adopt laws and regulations relating to transit passage in respect of the safety of navigation and the regulation of maritime traffic; the prevention, reduction and control of pollution; and other tightly defined matters.

In the Exclusive Economic Zone (EEZ), coastal states have sovereign rights for exploring, exploiting, conserving and managing the natural resources of the waters, seabed and subsoil, and for the protection and preservation of the marine environment. However, coastal states are not entitled to adopt laws and regulations that restrict navigation or relate exclusively to maritime safety and security. For marine environmental protection, coastal states may enact prescriptive jurisdiction, but it cannot be more stringent than the level of GAIRAS.

5.4.2 Special provisions for ice-covered areas

Article 234 of UNCLOS provides a major exception to the normal limitations to coastal state jurisdiction. Entitled 'Ice-covered areas', the Article provides:

> Coastal States have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance. Such laws and regulations shall have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence.

Article 234 gives coastal states broad prescriptive and enforcement jurisdiction in ice-covered areas such as the Arctic, even though for a limited purpose and subject to several restrictions. One such restriction follows from the words "for most of the year." Decreasing ice-coverage may mean that states will be able to apply Article 234 in fewer areas.

The precise scope of the powers conferred on coastal states by Article 234 is a question of debate. Canada uses Article 234 in justifying its Arctic Waters Pollution Prevention Act and underlying regulations and orders, which assert special ship construction, design, equipment and manning requirements on both Canadian and foreign ships operating in Canadian Arctic waters. Russia does the same through its regulations governing navigation along the Northern Sea Route.

5.4.3 The Polar Code

Until recently, IMO instruments did not set mandatory requirements on ships to address the additional hazards, risks and challenges of operating in Arctic or Antarctic waters. The sinking of the expedition cruise vessel *Explorer* in Antarctica in 2007 prompted the IMO to address this lacuna in the international maritime regulatory regime, and in 2015, the IMO adopted the International Code for Ships Operating in Polar Waters (the Polar Code).

The Polar Code acknowledges that polar waters impose additional demands on ships beyond those normally encountered. It provides for safe ship operation and environmental protection in the polar regions by establishing mandatory requirements for the construction, design, equipment, manning and operation of ships; the carriage and discharge of pollutants, garbage and sewage; voyage planning and contingency preparedness; and the training and competence of seafarers. The Polar Code is implemented through amendments to SOLAS, MARPOL and the STCW.

Photo: Armada de Chile

MV *EXPLORER* INCIDENT

Explorer was an ice-strengthened, Liberian-registered cruise ship operated by the Toronto-based travel company G.A.P Adventures.

On 23 November 2007, *Explorer* was holed, took on water and sank while sailing in drift ice in Bransfield Strait, between the South Shetland Islands and the Antarctic Peninsula.

Explorer's entire complement of 154 crew and passengers were rescued by the Norwegian cruise ship *Nordnorge*.

The Polar Code applies to ships that operate in Arctic or Antarctic waters (see the fact box, *Polar Waters*), depending upon their international certification requirements, as follows:

- Part I safety requirements and Part I manning and training requirements apply to ships certified in accordance with SOLAS; that is, cargo ships of 500 gross tons or more and all passenger ships.
- Part II environmental protection requirements apply to ships certified under MARPOL Annexes I, II, IV and V.

For non-SOLAS ships that are required to hold a MARPOL certificate (such as fishing vessels), only the Part II environmental protection requirements of the Polar Code apply.

The Polar Code has several different implementation dates.

- The Part I safety requirements are phased in for new and existing SOLAS ships. *New ships* (that is, ships built on or after 1 January 2017) must comply upon delivery. *Existing ships* (that is, ships built before 1 January 2017) must comply by their first intermediate or renewal survey after 1 January 2018.
- The Part I manning and training requirements come into force for both new and existing SOLAS ships on 1 July 2018.
- The Part II environmental protection requirements came into force for all MARPOL ships on 1 January 2017.

The Polar code is a functional, goal-based code. The safety part of the Code has design, construction, equipment, operational, training, search and rescue requirements related to the potential hazards of operating in polar regions, including ice, remoteness and severe and rapidly changing weather conditions.

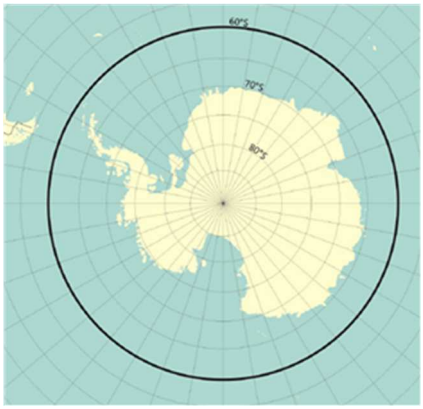
A key objective of the Polar Code is to ensure a ship is fit for its intended operation in polar waters. It applies to ships differently, based on how a ship is constructed and how it will be operated in polar waters. As such, the Code does not provide a one-size-fits-all solution. Rather, the Code's requirements flow from the suite of capabilities a ship will need to carry out its intended operations safely and responsibly. This is highly dependent on where, when and how it will operate in the polar regions and what environmental conditions it will likely encounter while there.

The first step in understanding how the Code applies to a ship is to define its polar operating profile and conduct the operational assessment required by Part I-A, § 1.5. This includes where the ship is intended to operate, what seasons it will operate there,

POLAR WATERS

The Polar Code applies to SOLAS and MARPOL certified ships operating on domestic or international voyages in polar waters. Polar waters are defined as the following areas:

Antarctic area – all waters south of latitude 60°S.



Arctic area – the waters north of latitude 60°N, with deviations to include waters around the southern exposure of Greenland, but excluding those around Iceland, the Norwegian mainland, Russia's Kola Peninsula, the White Sea, the Sea of Okhotsk, and Alaska's Prince William Sound.

Illustration: IMO

and what type of activities the ship will conduct. The operational assessment

- defines the anticipated range of operating and environmental conditions for the area and season of operations,
- identifies the relevant hazards associated with the ship's polar operating profile,
- identifies the capabilities the ship requires to perform satisfactorily under these conditions,
- assesses the ship's design and equipment arrangement against these capabilities, and
- identifies additional technical and operational measures needed to comply with the Polar Code.

Certain key choices in a ship's polar operating profile and key conclusions from the operational assessment will determine which parts of the Polar Code apply to the vessel. These are operation in ice, operation in low air temperature, operation in high latitude, and the maximum expected time of rescue.

The Polar Code assigns a ship to one of three categories—Category A, B or C—based on the type of ice for which it is designed to operate, if any. A ship's category determines the applicability of some requirements and regulations in the Code. That is, some requirements apply only to a Category A ship, others apply to Category A and B ships, and so on. A ship's ice class is used to determine its polar ship category (*see* the fact box, *Polar Ship Categories*).

The Polar Code does not associate a ship's category with geographic operating areas. Rather, a ship owner must ensure that the ship's ice class is appropriate for the anticipated ice conditions and operate it within those limits.

POLAR SHIP CATEGORIES

The Polar Code divides ships into three categories: Category A, B and C.

Category A ship means a ship designed for operation in polar waters in at least medium first-year ice, which may include old ice inclusions. This corresponds to vessels built to the IACS Polar ice classes PC1 to PC5.

Category B ship means a ship not included in category A, designed for operation in polar waters in at least thin first-year ice, which may include old ice inclusions. This corresponds to vessels built to the IACS Polar ice classes PC6 and PC7.

Category C ship means a ship designed to operate in open water or in ice conditions less severe than those included in categories A and B. This corresponds to ships of any Baltic ice class or with no ice strengthening at all.

Vessels with other ice class notations must be evaluated on a case-by-case basis to determine their equivalent IACS Polar ice class and their polar ship category.

Cat.	Ice class	Operating capability
A	PC1	Year-round operation in all polar waters
	PC2	Year-round operation in moderate multi-year ice
	PC3	Year-round operation in 2nd-year ice which may include multi-year inclusions
	PC4	Year-round operation in thick 1st-year ice which may include old ice inclusions
	PC5	Year-round operation in medium 1st-year ice which may include old ice inclusions
B	PC6	Summer/autumn operation in medium 1st-year ice which may include old ice inclusions
	PC7	Summer/autumn operation in thin 1st-year ice which may include old ice inclusions
C	ICE-1A* / E4	First-year ice to 1.0 m
	ICE-1A / E3	First-year ice to 0.8 m
	ICE-1B / E2	First-year ice to 0.6 m
	ICE-1C / E1	First-year ice to 0.4 m
	ICE-C / E	Light ice conditions
	none	Ice-free / open water conditions

Illustration: DNV GL

Some requirements must be met by design measures and some by operational procedures. For others, the owner may choose either design or operational measures, or a combination of both, to comply. For many functional requirements, there is no single prescribed solution for what is considered "acceptable". In this way, the Polar Code is very similar in approach to the International Safety Management (ISM) Code and the International Ship & Port Facility Security (ISPS) Code, which rely heavily on the owner/operator to develop processes that adequately address a ship and its operation.

Certificates – To comply with the Polar Code, a ship and its crew must be certified for operations in polar waters.

SOLAS ships intending to operate in polar waters will require a Polar Ship Certificate. This is a new statutory certificate issued by a vessel's Flag administration or an authorized classification society. The Certificate attests that the ship complies with the ship safety requirements in Part I-A of the Polar Code. To obtain a Polar Ship Certificate, the owner must:

- Conduct an operational (risk) assessment of the ship and its intended operations in polar waters,
- Prepare a Polar Water Operational Manual (PWOM) specific to the ship, its arrangement, and its intended operation in polar waters, and
- Have the ship surveyed by its Flag administration or an authorized classification society to verify its compliance with the relevant requirements Polar Code.

For SOLAS ships, Part I-A § 12 of the Polar Code also requires masters, chief mates and officers in charge of a navigational watch to have completed special training. These officers must obtain a certificate of competence from their respective licensing authority attesting that they fulfil the new polar navigation competence requirements in the STCW and are qualified for operating in polar waters.

For MARPOL ships, the International Oil Pollution Prevention (IOPP) Certificate must be endorsed for a new Category A or B ship to certify that it complies with the additional structural requirements in Part II-A § 1.2 to separate fuel oil and noxious liquid substance tanks from the outer hull plating. As no structural modifications are required of Category C ships or of existing Category A or B ships, these vessels do not require a supplementary endorsement of their IOPP Certificate. No other MARPOL certificates are affected by the Polar Code.

Operational compliance – The Polar Code includes certain acts and prohibitions for ships while operating in polar waters.

SOLAS ships must comply with all operational safety requirements in Part I-A of the Polar Code, including conducting a proper voyage plan and—most importantly—operating the vessel within the capabilities and limitations stated on its Polar Ship Certificate.

MARPOL ships must comply with operational environmental protection requirements in Part II-A of the Polar Code. All discharge of oil is prohibited in polar waters. Sewage discharge is restricted near ice: no closer than three nautical miles for treated sewage or twelve nautical miles for untreated sewage, and the discharge of untreated sewage from category A and B cargo ships and passenger ships of all categories is prohibited. Garbage may not be discharged within twelve nautical miles of ice.

The Polar Code does not currently contain requirements or prohibitions regarding emissions to the atmosphere or the carriage and use of heavy fuel oil (HFO). However, the carriage and use of HFO is prohibited in Antarctic waters by MARPOL and in certain areas around Svalbard by Norwegian legislation.

The Polar Code states that ships shall navigate with due regard for marine mammals, wildlife, areas of cultural heritage and significance, and national and international designated protected areas along their

route. The Code does not prohibit or restrict navigation through marine wildlife habitat or spawning/calving grounds, but does counsel ship operators to use available information on known areas, including seasonal migration areas, when developing and executing a voyage plan, and to consider existing best practices to minimize adverse effects when navigating in their vicinity (Polar Code, Part I-A § 11.3 and Part I-B § 12).

6 SURVEY OF MARINE INSURERS

6.1 Phase I survey results

DNV GL sent the Phase I survey to 1123 named individuals in eleven marine insurance companies offering P&I, H&M, cargo, defence, special and reinsurance cover. We invited them to give their personal opinions to the questions posed in the online questionnaire.

The complete Phase I survey as distributed may be found in Appendix A.

We administered the survey on 6 July 2016, following-up non-respondents with a second invitation on 13 July 2016. We received twenty-nine responses from individuals in eight companies, which represents a 3% response rate for individuals and 73% for companies. The response rate was lower than desired, though it is similar to our experience with other online surveys DNV GL has conducted.

The eight companies represented by the respondents provide a variety of marine insurance products:

95% provide protection and indemnity coverage;
50% provide hull and machinery coverage;
7% provide cargo coverage;
32% provide special and other covers; and
11% provide reinsurance.

The individuals who responded to the survey represent a broad range of positions and seniority from leading marine insurers around the world (see the sidebar, which lists their position titles). All the key insurance company functions we wished to hear from are represented among the group of respondents: management, underwriting, claims, and loss prevention (the marine surveyors and technical managers are associated with the loss prevention discipline). Moreover, the number of senior level respondents gives us confidence that their responses are well-founded and considered, based on their many years of experience in the marine insurance industry. As for gender, six women and twenty-three men responded to the survey.

6.1.1 General marine safety questions

We present the results of the general marine safety questions first. These questions (numbers 3 to 8) ask respondents to rate their answers on a scale from 1 to 5, where 1 is "very limited" and 5 is "very strong". The results are presented in stacked bar charts, where the total bar length corresponds to

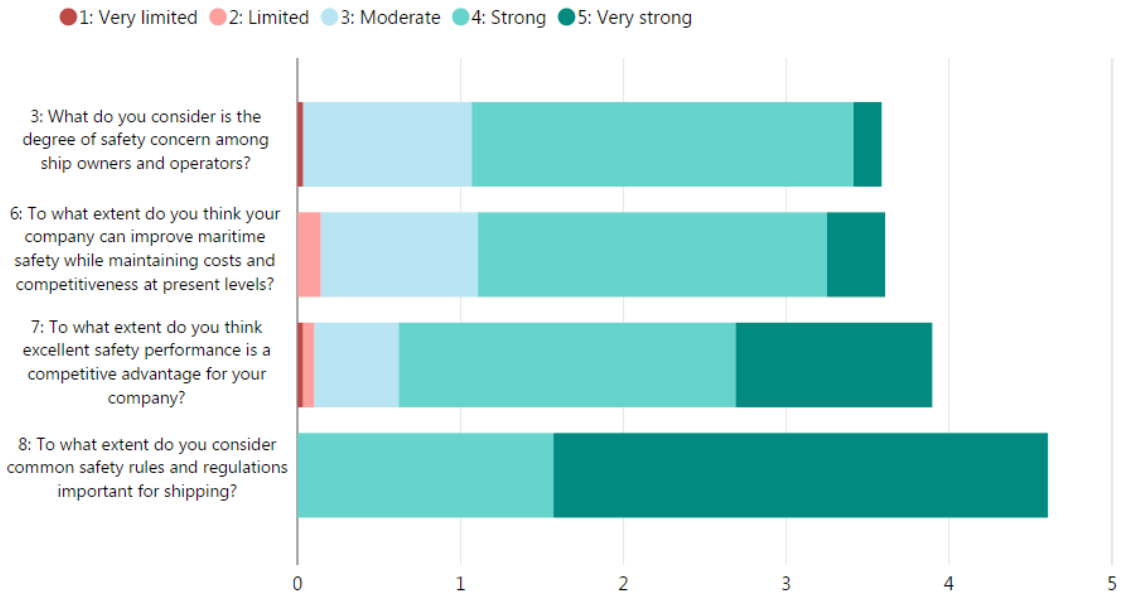
PHASE I RESPONDENTS

The individuals responding to the Phase I survey represent a broad range of positions and seniority from leading marine insurers around the world:

- Managing Director, Claims Manager
- Senior VP, Regional Deputy Manager
- Senior VP, Head of Loss Prevention
- Vice President, Head of Claims
- Assistant Vice President
- Assistant Vice President
- Area Manager
- Syndicate Claims Executive
- Syndicate Claims Executive
- Senior Claims Director
- Senior Claims Executive
- Senior Claims Executive
- Senior Claims Adviser
- Claims Executive
- Claims Executive
- Claims Executive
- Claims Executive
- Claims Executive
- Loss Prevention Executive
- Senior Loss Prevention Consultant
- Senior Marine Surveyor
- Marine Surveyor
- Marine Surveyor
- Marine Surveyor
- Senior Technical Manager
- Technical Manager
- Underwriter
- Underwriter
- Underwriting Assistant

the mean value of all responses to a question, and the different colours within each bar indicate the proportion of respondents that chose each answer category.

In Questions 3, 6, 7 and 8, we asked insurers to tell us about the importance of safety and common safety rules to their clients and their own business. Safety performance is often a good proxy for environmental performance, as many environmental incidents stem from ship accidents (such as an oil spill caused by a grounding). Answers to these questions indicate that safety is a major concern. Most respondents believe shipowners and operators take safety seriously (Q.3). A similar proportion also believe that their insurance company can further improve maritime safety in a cost-efficient manner (Q.6). Respondents even more strongly believe that safety excellence is a competitive differentiator in their insurance business (Q.7). All respondents view common rules and regulations as an essential foundation for shipping safety (Q.8).

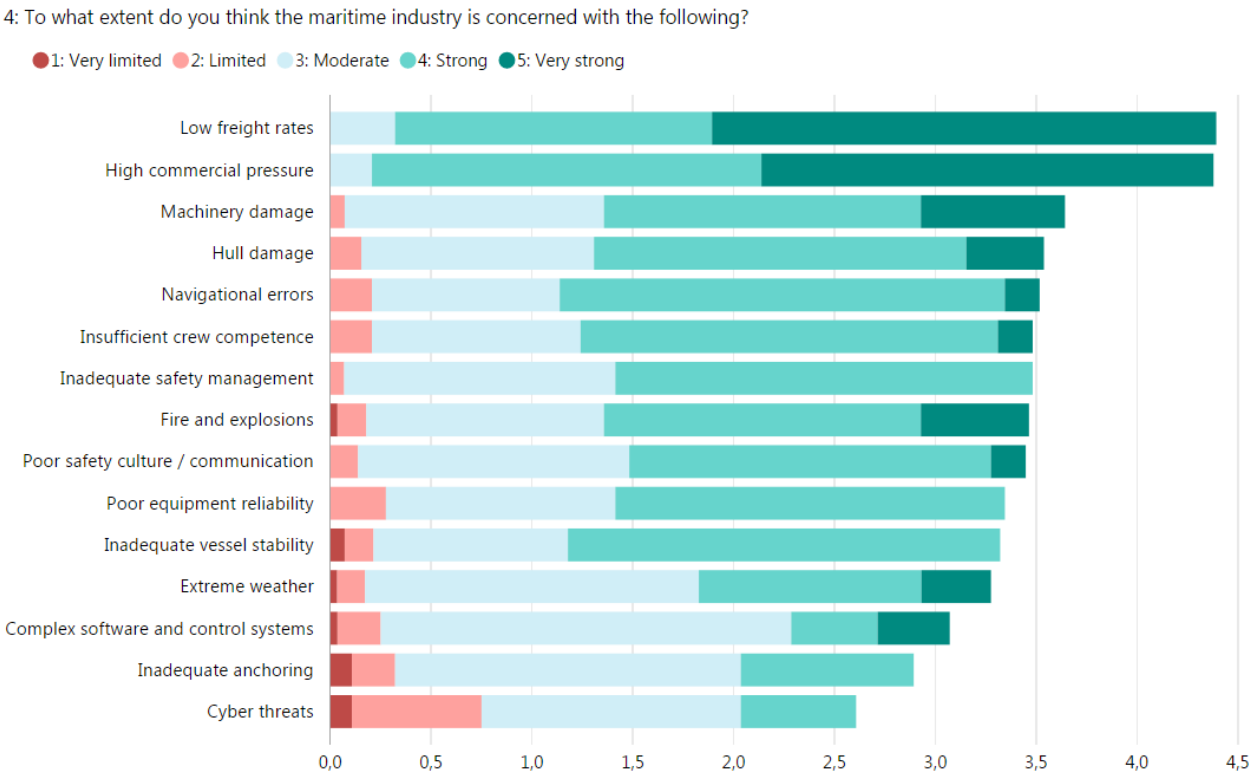


It is not surprising that insurers consider excellent safety performance important to their business, as higher safety should translate into fewer incidents, fewer claims, and thus greater profitability. It is notable that insurers see safety excellence as a competitive differentiator and that they can take *individual* measures to improve safety and thus competitiveness, while at the same time they strongly believe *common* measures are an essential foundation. Is this a contradiction? We flagged this as an important issue to follow-up: what types of individual measures do insurers believe they can take? If common rules and regulations are important to ensure a level playing field among insurers, what incentives can they offer shipowners to rise above the minimum standard without directly or indirectly increasing shipowner costs? How much room have they to push for higher safety practices without being undercut by their competitors?

In Question 4, we asked insurers to tell us how concerned they felt the maritime industry was with a variety of issues, including:

- external environmental factors (weather)
- technical ship factors (stability, equipment reliability, software and control systems, anchoring)
- types of marine casualties (fire and explosion, hull damage, machinery damage)
- human behaviour (navigational errors, competence, communication, safety culture and safety management)

- business factors (commercial pressures, freight rates)
- emerging issues (cyber threats)



Respondents' answers to Question 4 indicate that commercial concerns overshadow safety concerns within the maritime industry today. High commercial pressure and low freight rates were considered by far the main concern of the maritime industry, with nearly half of the respondent's rating industry's concern with them "very strong"—a very understandable response given the financial crisis the maritime industry is currently experiencing.

Marine casualties also rate highly. This was to be expected, given that a marine insurer's day-to-day business is dealing with the consequences of such casualties.

Closer examination of the answers suggests that human behaviour leads technical safety concerns. This is consistent with the findings of most marine incident investigations, where the cause can be traced to inadequacies in the performance of people, and it lends support to the focus of Zelenika and others (2007) on human factors for overall safety performance (see chapter 4, literature review). Given the commercial pressure on shipowners and operators today, we were concerned about how such pressure affects the safety culture and human behaviour within these organizations. We flagged this issue for further exploration in Phase II.

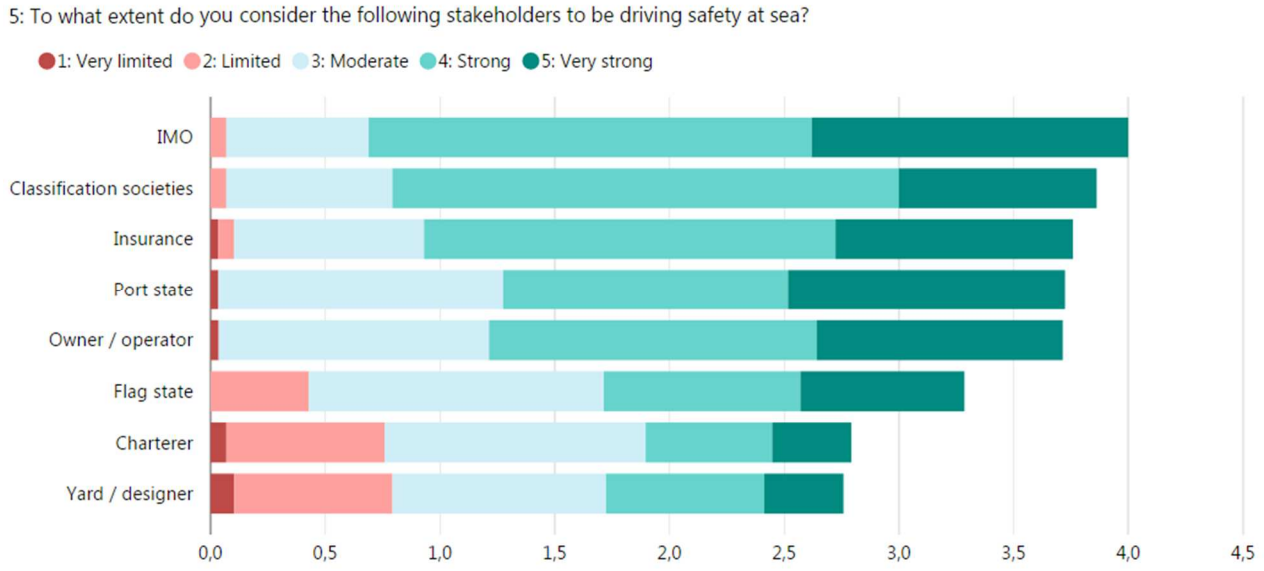
Extreme weather rated lower than many other factors. This may be that weather-related marine casualties are well understood and accounted for by marine actuaries.

Finally, we find the emerging issue of cyber threats at the bottom end of the scale. Perhaps the current focus of government, classification societies and maritime trade journals on industrial cyber security is overrated? Or, like the Arctic, is it a risk environment that is simply not well enough understood or

appreciated by insurers for them to rate with confidence? We do not further address cyber security in this study, but we do address the emerging nature of the Arctic risk environment.

Question 5 examines insurers' perceptions on the influence of various stakeholders on marine safety. Respondents pointed to the International Maritime Organization (IMO) and classification societies as the strongest drivers of safety at sea, closely followed by the insurance industry, port states and operators. Respondents considered flag states less favorably, which is somewhat worrying in that flag administrations have the formal legal responsibility for implementing international safety conventions such as SOLAS and the Polar Code for vessels flying their flag. Respondents rated charterers and yards/designers as the least important stakeholders when it comes to driving safety at sea.

By arranging the stakeholders in order of their perceived influential strength, we see that the regulators rank highest. This is consistent with the respondents' opinion in Question 8 that common rules and regulations are very important for marine safety. It is not clear from this question whether insurers consider themselves regulators in their own right, enforcers of others' regulations, or merely financial risk managers for their customers. Recalling Bennett's conclusion that there may be a limit to insurers' willingness to take on a policing role (see chapter 4, literature review), we flagged this as an issue to follow-up in Phase II.

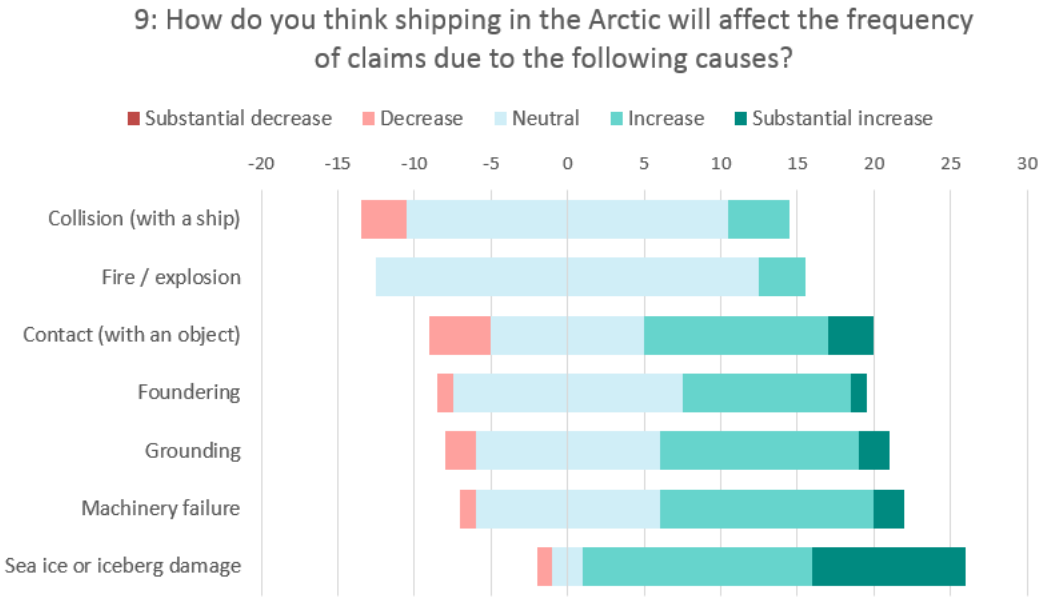


6.1.2 Arctic-specific questions

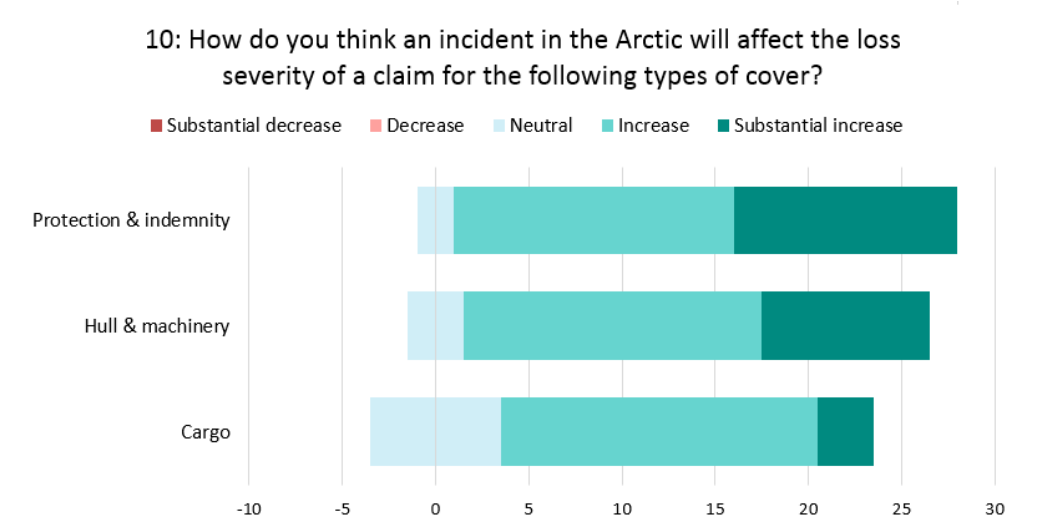
In the Phase I survey, we asked five Arctic-specific questions (questions 9 to 13). Unlike the general marine safety questions, the Arctic questions are posed in a manner that there is a negative–positive split to the answer choices: from "substantial decrease" to "substantial increase" for questions 9 and 10, and from "strongly disagree" to "strongly agree" for questions 11 to 13. The results are presented in floating stacked bar charts centred around the neutral value. The bar length corresponds to the number of respondents, and the different colours indicate the proportion of respondents that chose each answer category.

Question 9 explores insurers' perception on how Arctic shipping will affect the frequency of claims due to different causes. We used the list of major incident causes the marine insurance industry uses in

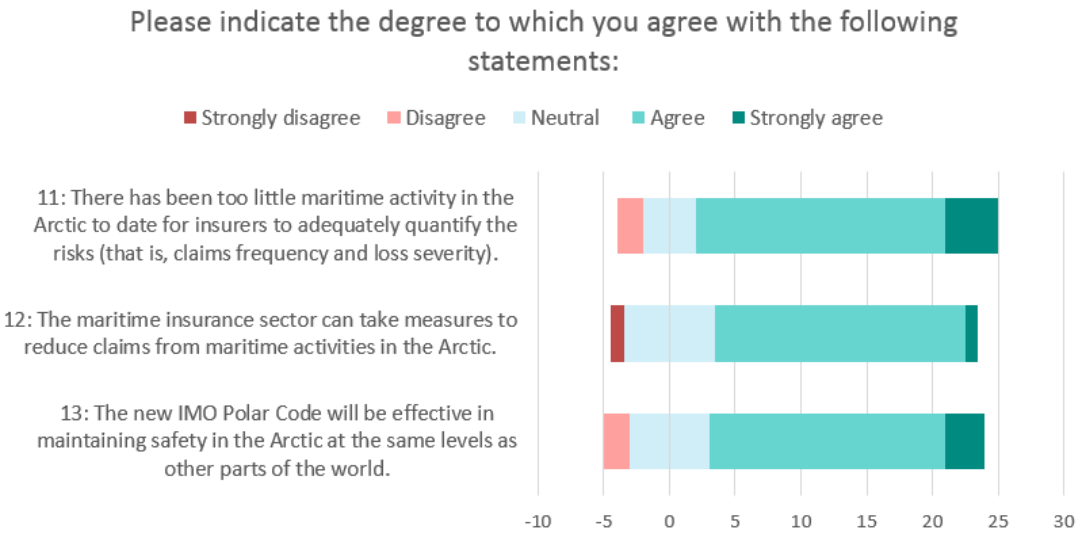
reporting claim statistics, and added sea ice and iceberg damage as a new, separate incident cause. The respondents' answers indicate insurers expect the relative frequency of claims will increase due to increased shipping in the Arctic. Not surprisingly, the frequency of claims due to sea ice and iceberg damages are considered to substantially increase. Contact with an object, foundering, grounding and machinery failure were all thought to moderately increase. Most respondents consider the frequency of fire/explosion will remain unchanged, while the frequency of collisions with other ships will either decrease or remain unchanged. The latter is understandable given the lower traffic density in the Arctic, thus decreasing the likelihood of encountering and colliding with another ship.



Question 10 explores how insurers think an incident in the Arctic will affect the loss severity of a claim for different types of insurance cover. The respondents overwhelming expect Arctic incidents will cause higher losses in all insurance categories, with substantially higher losses for liability pay-outs to third parties.



The last three questions of the Phase I survey asked the degree to which an individual agreed with three different statements on information availability, loss control measures, and regulation. The respondents' answers indicate a consensus in the marine insurance industry that the data foundation of Arctic shipping is insufficient to accurately quantify the insurance risks. Additionally, respondents largely agreed that the insurance sector can take measures to reduce claims and that the new IMO Polar Code will be effective in maintaining a similar level of safety in the Arctic as in other parts of the world.



SUMMARY – PHASE I RESULTS

Findings	Implications
Safety is a major concern in the maritime industry. – But commercial concerns overshadow safety concerns. – Human behaviour leads technical safety concerns.	Today's depressed maritime market may lead to cost-cutting. Shipowners' training budgets are often cut first, which may hurt safety and increase marine incidents and claims.
Insurers see **safety excellence as a competitive differentiator** among their companies.	Insurers will support loss prevention measures that help both their customers and themselves maintain a competitive edge.
Insurers believe **they can take measures to improve safety** and remain commercially competitive.	**Insurers see themselves as part of the solution** to improve safety.
Insurers see **safety excellence as a proxy for environmental performance**.	Insurers are not focused on environmental excellence per se.
Insurers believe common safety rules and regulations are an essential foundation.	Common rules are necessary to maintain a level playing field in a competitive environment.
Insurers view rule makers and enforcers as the driving forces behind maritime safety.	Insurers may prefer to use standards from other recognized authorities rather than developing or enforcing their own.
Insurers don't have enough information to adequately assess Arctic risks.	Insurers may be conservative in writing policies for the Arctic. Insurers will welcome better information on Arctic shipping.
Insurers believe Arctic shipping is risky. – They expect higher incident rates and higher loss rates, especially for third-party liabilities.	Insurers will be receptive to additional risk control measures they and their customers can use.
Insurers believe the **Polar Code will be effective** in managing Arctic shipping risk.	Insurers may want to "wait and see" how the Polar Code performs before taking any initiatives themselves.

6.2 Phase II survey results

DNV GL followed-up the Phase I survey by requesting a one-hour telephone interview with senior representatives of twenty selected marine insurance companies. The companies offered P&I, H&M, cargo, defence, special and reinsurance cover. Seven companies accepted our interview request, which represents a 35% response rate.

The individuals we interviewed were primarily from their respective loss prevention units or senior management. Claims and underwriting executives were under-represented among the interviewees, though the senior managers did have this experience as part of their professional background. As for gender, we interviewed two women and five men in Phase II.

In the following sections, we both summarize, paraphrase and quote the responses from our interviews. To ensure candid responses from an industry known for its reticence, we neither use the names of individual interviewees, their companies or their clients, nor do we substitute a pseudonym for attribution of their remarks.

6.2.1 What type of experience does your company have in the Arctic?

Experience with Arctic shipping varies widely among the insurers we interviewed. For one P&I club, the number of its members operating in the Arctic is "minimal". Other insurers reported that although they do not see considerable trade in the Arctic, with perhaps only 15 to 18 of their ships having traversed the Northeast Passage, they do have some clients with considerable Arctic experience in Canadian, Norwegian and Russian Arctic waters. One insurer reported having many clients that operate in the Arctic, including large passenger vessels that tour these waters during the summer navigation season.

6.2.2 What did you think of the results from the Phase I survey?

Results of the Phase I survey were distributed to all who answered it, as well as to those individuals we contacted for interviews during Phase II. We asked the interviewees what they learned from the Phase I survey. They answered across the board that the survey had identified their major concerns regarding Arctic shipping activity and that the results confirmed their expectations. None pointed to any surprising revelations from the results, but the confirmation of expectations itself was considered by all to be valuable.

6.2.3 Has Arctic shipping and risk changed from what it was?

The interviewees were rather circumspect when asked if Arctic shipping risk has changed over the years. Accurately judging risk is itself an issue of experience, and here most insurers readily admit that polar waters are a new frontier for them. "Our members do all sorts of dangerous things around the world. I'm not certain that trading in the Arctic is necessarily riskier than these other types of trade. Yet, we don't have a lot of experience in this region."

One notable change in the Arctic risk picture is in who the players are. "We see differences with new entrants in the polar regions," one answered. Shipping companies new to the Arctic lack the benefit of experience in dealing with the vagaries and capriciousness of the polar environment, the general reduction in Arctic sea ice notwithstanding. New entrants also appear more willing to push the boundaries at each end of the traditional navigation season, seeking to enter Arctic seas earlier and leave later than has been the norm.

The industry appears to be searching for a middle ground between being accommodating to their clients' new commercial initiatives and prudence in the face of uncertain risks. As one interviewee said, "We don't want to be unprepared. We do not want to spook our members by being too reactionary, but neither do we want to give them a false sense of security."

6.2.4 How do you advise your insured on emerging issues, guidelines and best practice?

All the insurers we talked to take pains to advise their insured on emerging issues, guidelines and best practice. Most use their website, annual report and special information circulars for this purpose. Besides this pooled advice, usually organized through their Loss Prevention units, they also engage with their insured individually when underwriting new policies and processing claims.

The initiative for risk management and loss prevention advice is not solely that of the insurer. Shipowners are neither passive actors in this process nor infrequently seek the counsel of their insurers on such matters. As one respondent noted, "We are getting calls regularly from our members." This is important to encourage, particularly for shipowners considering a voyage in Arctic waters for the first time. While setting the premium to accurately reflect risk is important, it is even more important that shipowners can obtain expert help in risk assessment and loss prevention, which is a win–win proposition. "We want to be a discussion partner for any member who wants to trade in the Arctic," emphasized another respondent.

In addition to passing along relevant guidance and best practice, some insurers are taking a more active role in *creating* them. One insurer is developing Arctic emergency preparedness guidelines, working together with a leading ship classification society to gather essential input from shipowners and operators. The most important insurance-based initiative is the Arctic Shipping Best Practice Information Forum, sponsored by the Lloyd's Market Association to support best practice for marine operations in the polar regions (cf. Kingston 2016).[2]

6.2.5 How do you use rules and regulations in your work?

In Phase I, we learned that insurers see safety excellence as a competitive differentiator and that they can take individual measures to improve safety and thus competitiveness, while at the same time they strongly believe common rules and regulations are an essential foundation. Is this a contradiction? In Phase II, we asked how insurers used rules and regulations in their work.

The insurers we interviewed all consider compliance with safety regulations as a mandatory condition for cover. This applies to ship safety rules issued by the vessel's classification society (known as "class rules") and other international, national and local safety regulations, including coastal state regulations. Violation of regulations or non-compliance with class rules can affect insurance coverage.

For an H&M policy, non-compliance can mean the policy is invalidated and the insured loses cover for damage to his vessel. This relates to warranty in the UK system.

For P&I coverage, non-compliance does not invalidate a policy, and the insurer will still pay pollution damages and other third party claims. However, P&I policies typically have clauses to reduce coverage or reclaim amounts paid out if the incident is the result of unsafe or imprudent actions. "If we consider a member was not prudent, the member may be required to reimburse what was paid out to third parties, and fines are not normally covered."

One insurer underscored that determining whether an insured is in compliance is not necessarily straightforward and may be more difficult now than in the past. The new challenge for insurers is evaluating goal-based rules and regulations, as they are open to more interpretation than prescriptive regulations. The line between compliance and non-compliance may not be clear. This will likely be the case with the IMO Polar Code, which is one of the IMO's first goal-based codes. (See the fact box, *Goal-based standards)*

[2] We did not ask about the Best Practices Information Forum during our Phase I and II surveys as it was still under development at the time.

6.2.6 How has high commercial pressure affected claims?

In Phase I, respondents' answers indicated that commercial concerns overshadow safety concerns within the maritime industry today. High commercial pressure and low freight rates were considered by far the main concern of the maritime industry, with nearly half of the respondents rating industry's concern with them "very strong".

In Phase II, we asked the insurers if they had noted any effect of the industry's heightened commercial concerns upon incident types, rates or loss severity. In general, they replied that they see a moderation of shipowners' risk aversion, but they do not yet see adverse effects in their claims figures.

"Shipowners are more willing to take riskier trades," one insurer remarked. "For example, some who previously avoided taking cargoes at risk of liquefaction[3], such as nickel from the Philippines, are now willing to take them, given the higher freight rates for these cargoes and the otherwise poor rates for safer cargoes. They are not as picky as they used to be. But I can't say that this is showing in our claims figures yet."

This view was corroborated by another insurer, describing today's situation as a charterer's market. "Owners are committing to more onerous charter-party agreements and taking greater risks, agreeing to worse contracts."

All the insurers we interviewed denied commercial pressures were showing through an increase in claims or loss rates. Indeed, one insurer pointed out that the tough market has even contributed to reducing incident rates. "We see a lot of slow-steaming by owners to save fuel costs, which in turn reduces the frequency and severity of incidents. Incident frequency is down due to the general decrease in shipping activity, and loss severity is down due to the decreased value of vessels. But these parameters can reverse when the market begins to recover, so we are watching this closely."

Ship maintenance and crew training are often early casualties of a market downturn. The insurers we questioned responded with surprise that this was not the case, at least yet. One remarked, "We are pleasantly surprised that our members are maintaining their ships and keeping competent crew despite the tough financial conditions at present." Another noted that there is pressure on maintenance, but

[3] Liquefaction is when a solid cargo becomes liquid, which can cause vessel instability and capsize.

Goal-based standards

In the 1990s, the IMO recognized prescriptive regulations were unable to keep up with new ship designs and decided to incorporate a goal-based philosophy into the technical regulations of SOLAS.

Goal-based standards (GBS) are high-level standards and procedures that are to be met through regulations, rules and standards for ships.

Prescriptive regulations tend to represent past experience and become less relevant over time. Thus, safety regulations need to be frequently updated to keep pace with lessons learned and the latest technology.

An example demonstrates the difference between goal-based and prescriptive rules:

- **Goal-based**: "People shall be prevented from falling over the edge of the cliff."
- **Prescriptive**: "You shall install a 1-meter high rail at the edge of the cliff."

GBS are comprised of at least one goal, functional requirement(s) associated with that goal, and verification of conformity that rules/regulations meet the functional requirements and goals.

Classification societies and national Administrations will develop rules and regulations accordingly. These detailed requirements become a part of a GBS framework when they have been verified, by independent auditors or appropriate IMO organs, as conforming to the GBS.

The basic principles of IMO goal-based standards/regulations are:

- Broad, over-arching safety, environmental or security standards that ships are required to meet.
- The required level to be achieved by the requirements applied by class societies, Administrations and IMO.
- Clear, demonstrable, verifiable, long standing, implementable and achievable irrespective of ship design and technology.
- Specific enough to avoid being open to interpretation.

The Polar Code is one of the latest IMO instruments using the GBS approach.

Abridged from IMO (2016)

that they do not see it reflected in the vessel or in their claims figures. Nevertheless, he reminded us that "bad things happen to good ships," underscoring that excellence in maintenance and training have never guaranteed incident-free sailing.

6.2.7 Who is driving the marine safety agenda?

Question 5 in Phase I examined insurers' perceptions on the influence of various stakeholders on marine safety. Respondents ranked regulators highest, with the IMO, classification societies and insurance as the strongest drivers of safety at sea. Flag states were ranked less favorably (sixth of eight stakeholder groups). This should give cause for concern in that flag administrations have the formal legal responsibility for implementing international safety conventions such as SOLAS and the Polar Code for vessels flying their flag. In Phase II, we asked why this might be.

"The flag state position doesn't surprise us," replied one insurer. "For us, classification societies are more important, since flag state enforcement is largely carried out by class. Flag administrations are not actively involved. We rarely see a flag authority attending a vessel themselves."

Mere lack of engagement in day-to-day enforcement is not the only reason why flag states lag behind. Another insurer explained that it is their lack of interest in regulation itself that concerns insurers. "The position of IMO, class and insurance is natural, as these push for regulations, which we find helpful. Flag states, on the other hand, are not pressing for regulation."

6.2.8 What kind of information do you use in writing policies and preventing loss?

A key question revolves around the type of information insurers use when writing policies for an individual client and when analyzing trends to support their broader-based loss prevention efforts. In our interviews, we asked insurers to describe what they used and what priority they gave to it, including information on port state detentions; class surveys, conditions of class and optional class notations; and charterer vetting reports.

Insurers focus first and foremost on an operator's claims history and reputation, followed by information on the individual ship and its crew. As one insurer described, "We use claims history, together with an evaluation of the physical ship and its maintenance, operating profile and crew experience. We also ask for current class status, and sometimes for a hull integrity status" [steel thickness reports, used to evaluate hull condition, deterioration and life expectancy]. Insurers also review previous enforcement actions against the vessel and the owner. "Port state detentions are an issue we monitor closely and discuss with our members when they occur," explained one insurer. "We believe Port State Control is helping keep maintenance and manning up to proper levels."

A classification society assigns class notations to a vessel to indicate the various rule requirements applicable to it. Class notations cover mandatory and optional requirements. Mandatory notations describe the ship type and service area restrictions. Optional notations describe special design features, equipment and capabilities, such as ice strengthening, winterization, and enhanced navigation and pollution prevention technologies.

When we asked insurers how they looked at a vessel's class notations and used them in their underwriting, we received a mixed set of responses. Some considered them important, some less so, and one even questioned their relevance. "Class notations are indeed important, and are looked at first together with class status," replied one insurer. "We give credit for having optional class notations; besides compliance with regulations, class is the most important issue for us," explained another. Not all shared this view, however: "We do not look much into special class notations. I've not seen any arguments for this. For the Arctic, ice class and winterization are interesting as part of evaluating a vessel's preparation. But this is a hypothetical question for the time being."

Even where considered important, however, a vessel's class notations will not necessarily translate into a financial discount for the owner. One insurer explained that class notations—albeit important—don't normally affect premiums, but may influence whether the insurer orders a survey or not. "Premiums are more related to trading area," he said. "Trading to the United States would certainly affect rates, but not necessarily to the polar regions, depending upon the specific area and operator." Another insurer recounted that only one of their members asked for cover to sail the Northeast Passage, and it did not result in a higher premium. "This is because we could expect them to do the right thing. Though generally speaking, we would ask for extra documentation for a member trading outside the normal trading area."

Some charterers use vetting agents to conduct an independent due diligence process before hiring a vessel, particularly oil majors via the Oil Companies International Marine Forum (OCIMF). This process usually involves both an inspection of the vessel and a review of the operator's safety management processes. We asked insurers how they used information from vetting agents in making underwriting decisions. One insurer held OCIMF's vetting processes in high regard. "The reason the oil and gas sector has such a good safety record is that it sets the right commercial premises on its carriers. The OCIMF TMSA [Tanker Management and Self-Assessment] and SIRE [Ship Inspection Report] programs are not really voluntary—and that is very important. Although the oil and gas industry has the greatest loss potential, it also experiences the lowest risk within marine shipping."

Other insurers recognize the value of independent charterer vetting, but do not use it directly in their underwriting. "We don't use vetting reports directly," explained one insurer, "but if a vessel is subject to vetting, we presume this is an added assurance to its acceptable condition, manning and operation. We don't see the results, and we don't normally hear them, either."

This presumption of satisfactory condition extends also to class surveys and certificates. All insurers interviewed mentioned the singular importance of class scrutiny. "Class is the most important to us," summed up one insurer. Nevertheless, it does not appear that all insurers are reviewing key class documents, such as survey reports, or scrutinizing the quality of their work. "We assume that a vessel in class is in good order. We don't require our members to send class surveys or certificates to prove this status. But having class in order is a prerequisite for coverage. If something goes wrong and they aren't in compliance with class, then we may not cover for them." When questioned about the prudence of not reviewing class or vetting agent reports themselves, the insurer admitted "this is a sort of back-end approach rather than a front-end approach."

We also asked about the relevance of a shipowner's corporate social responsibility (CSR) and environmental, social and corporate governance (ESG) policies and practices to the underwriting process. "We use the insured's CSR and ESG criteria to know the company, if they are new customers. But reputation is most important for us," one insurer answered. In this regard, a good safety reputation is seen as relevant to avoiding environmental liabilities: "There is a direct correlation between safety and environment."

6.2.9 What are your expectations for incident type, frequency and loss severity in Arctic waters?

In Question 9 and 10, we asked about the frequency and loss severity of claims from Arctic shipping. In Phase II, we asked our interviewees to expand on the answers, including if there were other incident types that were not mentioned in our first survey, which incident types lead to the most expensive losses, and what they viewed as the major drivers affecting loss severity, particularly in the Arctic.

Question 9 lists seven casualty types, from ship collision to ice damage. The casualty type list was developed to reflect the same categories marine insurers typically use to report casualty statistics. Most

respondents had no comments on it; one mentioned that human injury could be added as a casualty type, and three mentioned reflecting human causes. The injury issue is a useful one, though human causes of marine casualties are not a casualty type itself; humans are often a critical causal or contributory component of all the casualty types listed in the question.

In Phase I, sea ice and iceberg damage was expected by most all respondents to either increase or strongly increase in frequency with an expansion of Arctic shipping. In our Phase II interviews, one insurer expanded on this issue, explaining "Ice damage is minimal today, about 0.3% of claims. We don't expect frequency to go up so much, but loss severity will certainly increase."

Machinery failure was the second casualty type most Phase I respondents expected to increase with an expansion in Arctic shipping. One insurer explained, "Machinery failure is expected to increase due to our expectation [that] machinery is not suited to the temperature." Low temperature effects on non-winterized machinery include loss of hydraulics, malfunction of compressed air control systems, and loss of lubrication with subsequent damage to critical machinery. "The loss severity will also increase, given our expectation that ports and repair facilities in the region are inadequate to resolve issues effectively and expeditiously."

For those outside the insurance industry, the incidence and cost of marine machinery failure is probably not appreciated. Simon Stonehouse, head of marine at Asia Capital Reinsurance Group helps put this in perspective: "The top four causes of casualty are always machinery, grounding, fire and collision, in that order. Machinery is the biggest cost in terms of overall claims amount that insurers pay. Machinery incidents amount to over 40% of the overall claims paid by underwriters . . . [and] insurers are paying out $2.6 billion a year for machinery damage claims" (Stonehouse 2016). Machinery failure is a common contributory cause to grounding, the second most common marine incident type.

For hull and machinery (H&M) policies, the insurers we interviewed were in relative agreement that the major driver affecting loss severity in the Arctic would likely be salvage to aid a stricken vessel. Given the general lack of salvage resources in or near Arctic waters, the severity of a casualty is more likely to escalate before salvage assistance arrives on scene. "We can expect higher costs due to the distance and location, and it will be more difficult to find suitable tugs to help," remarked one insurer. Another pointed out that it may take so long for a salvor to arrive on scene that there is little opportunity to mitigate the losses. This is particularly so if the incident occurs in ice-infested waters and the assisting vessels need ice-going capabilities themselves. For example, a grounded vessel's hull integrity may fail as weather and ice conditions change, leading to a loss of bunker fuel and pollutants before salvors can safely stabilize the vessel and remove them [n.b., H&M coverage pays for salvage assistance, while P&I coverage normally pays for removal of bunkers and pollutants].

The lack of infrastructure in the region also adds to repair delays. "Delivering parts to the region could be difficult, not least because of the bureaucracy of customs," explained one insurer. "Repair facilities are likely far away, so the vessel would need to be towed a long distance," remarked another. Delay increases the eventual scope and cost of repair, and salvage terms are likely to be higher given the lack of competition.

Although the insurers we interviewed all expect H&M claims in the Arctic to be more expensive than in other parts of the world, they also expect third-party liabilities to be even more variable in comparison. "H&M claims are more or less fixed," explained one insurer, "whereas P&I claims are more variable and more expensive."

For P&I insurance, wreck removal and pollution clean-up account for the greatest payouts. All insurers interviewed expect these operations to be more difficult, time-consuming and costly than in other parts of the world. One insurer eloquently summarized the situation:

> We could expect for the Arctic that the type and availability of equipment is poorer, that the weather window for operations is shorter, the time delay is longer, and that the clean-up process in cold weather is more difficult. In normal waters, compensation costs are high (given the high density of other interests damaged by a spill), whereas the clean-up costs are lower. In Arctic waters, we may have lower compensation costs (given lower density of other interests damaged by a spill), whereas the clean-up costs are higher. Whether the combination of the one is higher than the combination of the other, we can't yet say, since we thankfully have so few incidents to draw upon for pay-out data.

Of the Arctic coastal states, only Norway and Greenland are members of the Nairobi International Convention on the Removal of Wrecks, 2007. The Convention contains measures to facilitate the removal of wrecks, including when the shipowner is responsible for removing the wreck, when a State may intervene, and the owner's liability for the removal costs. Liability pay-outs could be greater to remove wrecks from the waters of non-signatories, which constitute a majority of the Arctic.

P&I also covers personal injury and casualty evacuation. This includes the rescue, evacuation, treatment and repatriation of crew and passengers. As the cost is not insignificant for evacuating even a single person from a remote location, the implications of attending to hundreds of people from a stricken cruise vessel in the Arctic are staggering. One insurer opined that more oil and gas activity in the Arctic might help shipping here, as this provides infrastructure and other valuable resources (such as helicopters, field medical facilities and logistics hubs) that can assist others in an emergency.

Moreover, on top of the practical difficulties and financial implications of handling a major incident in the Arctic, insurers recognize that public attention—and criticism—are certain to be high. As one insurer pointed out, this not only adds reputational liabilities to shipowners and others involved, it is also likely to complicate political decisions on granting access to a place of refuge. When a ship has suffered an incident, the best way of preventing damage or pollution from its progressive deterioration is to transfer its cargo and fuel, and to repair the casualty. As the IMO (2003) explains, such an operation is best carried out in a place of refuge. However, to bring a damaged ship into a place of refuge near a coast may endanger the coastal state environmentally and economically, and communities and local authorities may strongly object. Granting access involves a political decision taken on a case-by-case basis. When such a decision-making process involves the Arctic environment, insurers worry that access will either be denied or it will not be granted in time for it to be beneficial. This further factors into their expectations for increased costs in handling Arctic maritime incidents. One insurer felt that Arctic states should develop guidance on places of refuge in the Arctic and make this available.

6.2.10 Do you advise your insured on minimizing routing impacts?

Another key question regards what type of requirements, standards, advice or measures insurers had to shipowners on shipping near essential marine habitat, spawning grounds, designated areas to be avoided, and the like.

The singular answer from all the insurers we interviewed is that they do not have any such requirements or guidance at present. "We do not instruct, ask or advise our insured on minimizing routing impacts directly," explained one insurer. "We do not have any measures or instructions on avoiding essential marine habitat or designated areas," answered another. "No, we don't do this. This is very operational-related and is not a mandatory requirement."

Even where avoiding an area is mandated by law, violation of that requirement does not invalidate liability insurance coverage. One P&I insurer pointed out that doing so would not be in the best interests of society, since without sufficient coverage, who would redress the losses of injured third parties?

However, the insurers we interviewed agreed that if good information on such areas and best practice is readily available, then it can be incorporated in the underwriting process and loss prevention process. Here, the Arctic Shipping Best Practices Information Forum, established by the Arctic Council in early 2017, will be instrumental. This is particularly because it is an initiative of the Lloyd's Market Association to support best practice for marine operations in the polar regions and harness the best standards available for operators to include in their Polar Water Operational Manual. The aim of the Forum is

> to raise awareness of its provisions amongst all those involved in or potentially affected by Arctic marine operations and to facilitate the exchange of information and best practices between the Forum members on specific shipping topics, including but not limited to; hydrography, search and rescue logistics, industry guidelines and ship equipment, systems and structure. A publicly accessible web-portal will be created with information specific to each topic. (PAME website, 2017)

One of the objectives of the Forum is to collect and disseminate information on essential habitat, spawning grounds, indigenous communities' hunting areas, and operational measures that shipowners can take to avoid them or reduce their impacts on them. Therefore, we can expect underwriters to soon be better informed themselves and see supportive action from them towards their clients.

The Forum membership is open to Arctic States, Permanent Participants and Arctic Council Observers as well as any widely recognized professional organization dedicated to improving safe and environmentally sound marine operations in the Arctic as demonstrated by expertise and experience in Arctic shipping and/or related issues. The Senior Arctic Officials approved the Forum's Terms of Reference in March 2017 (reproduced in Appendix C).

6.2.11 What information do you need to better quantify Arctic shipping risk?

In Phase I, we learned that most insurers believe the data foundation of Arctic shipping is insufficient to accurately quantify the insurance risks. We explored this question in Phase II, asking our interviewees what type of information they need, and whether using ship tracking information, classification society databases, "big data", and even non-conventional analytical approaches could fill the gaps.

All the insurers interviewed underscored the singular importance of historical claims information. Our initial impression was of their interest in accurately predicting claims *frequency*, however, they corrected this misunderstanding: there were too few claims to accurately predict *costs*. "The most important to us are statistics on claim events. It isn't just the number of claims for predicting frequency, but the payout that is important. The amount of trade in the Arctic and the number of incidents is too low for us to get a handle on the loss severity side of the equation. We have too little experience on the cost of dealing with an incident in these waters."

We then explored the efficacy of using ship tracking data and combining it with the insurers' claims databases, class societies' data from fleets in service, and other information sources. Correlating a claim with the ship's location, traffic situation, hydrography and weather could reveal useful information on causal, contributory, compounding and mitigating factors of different incident types. These correlations could prove useful in assessing the potential for and likely scope of an incident in other waters where there is currently little information, such as the Arctic.

None of the insurers we interviewed were currently using AIS ship tracking data today. Nevertheless, they found the suggestion intriguing. "We are not using AIS data today," replied one insurer, "but it could be useful. We will consider this, especially in looking deeper at root-cause analysis." Another lamented the lack of operational details for use in post-incident analysis: "Sadly, we don't get

information on geographic location for many claims, thus claims reports can be hard to correlate with other data at present."

We also asked about the usefulness of broadening the actuarial analysis to include ship movements that did not lead to an incident. What makes them different from those that did? The tenor of our interviewees' responses suggested some skepticism. "As for information about ship activity without incidents, this is a 'reverse' review," answered one. Nevertheless, some admitted that information about activity without incidents might indeed help for determining frequency, by setting the rate of claims per ship sailing hour or mile, though they have not experimented with this to date.

6.2.12 What measures can the insurance industry take to reduce Arctic shipping risks?

We asked in question 12 if the marine insurance industry could take measures to reduce claims from maritime activities in the Arctic. The overwhelming majority agreed that they could. In the Phase II interviews, we asked the insurers what kind of measures these might be, and if increasing incentives to shipowners would help.

Their responses fell into three categories: pre-activity risk assessments by both insurer and insured; operational measures to both reduce incidence likelihood and reduce the consequences should one occur; and due-diligence surveys.

"We think about the prudence requirement, proper risk assessment requirements, expert advisor requirements, and perhaps spare parts requirements," answered one insurer. Some of these requirements are provided by the Polar Code, while others are likely to emerge through the Arctic Shipping Best Practice Information Forum launched by the insurance industry itself.

Another insurer pointed to improving the breadth, depth and quality of risk assessments. "Risk assessment could be a measure to reduce risk, but there is a difference between a basic risk assessment and an in-depth assessment. I take a bit of a cynical view, knowing that there is a difference between the approach of the offshore sector versus the maritime sector regarding risk assessment." Although not named by any of our interviewees, a common shortcoming in effective risk management is the lack of action in following-up an otherwise comprehensive and insightful risk assessment. We believe this is an area where the insurer can assist their insured to develop and implement risk control measures that will effectively eliminate or substantially reduce risks in their operations—not just for the Arctic, but for shipping in general.

Lastly, insurer-directed ship inspections can help to identify issues before they become casualties. One loss-prevention executive described the importance of the routine due-diligence surveys they conduct each year, both on new and longstanding members of the club. "These are one-day, fairly detailed third-party liability risk surveys. Post-survey, we liaise with individual members on the results. There are hundreds of surveys every year. We do ten percent of the club's ships each year at no cost to the shipowner. We will probably not develop a bespoke survey for Arctic trading, but we can broaden the scope to add relevant elements to our questionnaires, such as Arctic ice navigation questions."

6.2.13 How will insurers participate in the Polar Code certification and compliance process?

Flag administrations and classification societies authorized to act on their behalf (so-called Recognized Organizations) will certify a ship's compliance with the Polar Code. This process involves reviewing the ship's operational (risk) assessment and the Polar Water Operational Manual (PWOM), and then surveying the ship for compliance with the Code's technical requirements. During our Phase II survey, we asked insurers what level of validation or verification they planned to conduct themselves, beyond

merely verifying the vessel had a Polar Ship Certificate. Did they intend to review the assessment and operating manual as part of their underwriting process for a ship planning to trade in polar waters? We also asked several insurers a follow-up question about their interest in participating in operational (risk) assessment and ship review workshops that DNV GL conducts with shipowners as part of its Polar Code certification process.

None of the insurers we interviewed expressed an intention to review the operational (risk) assessment or Polar Water Operating Manual, but most were interested in seeing the Polar Ship Certificate issued by the Flag administration or Recognized Organization (RO). One stated,

> We would probably view the Polar Ship Certificate as evidence of compliance. We would look at it for insuring a ship for operations in polar waters. The Polar Code will prevent ships without any planning or risk assessment from going to the Arctic, however, the operational assessment and PWOM will not necessarily mean they are safe. We will not ask to see their operational assessment.

A second insurer responded similarly:

> We haven't made seeing the Polar Code assessment a requirement yet. We probably would not review it, but rather expect that if a ship is issued a Polar Ship Certificate, then the RO / Flag have done their job. As for setting some expectations for what should be in the assessment, or how it should be conducted, we could be interested in attending some Polar Code workshops with our clients. So yes, please invite us.

A third dismissed the need to review the documents, but was open to participating in an assessment workshop:

> No, we would not normally review them. We just require that it is done. We would expect to see a Polar Ship Certificate taken at face value, with no expectation for follow-up due diligence. We may do a random check as part of our survey program. We might be interested in joining an operational assessment.

A fourth put the burden for proper action on the shipowner's shoulders, and was concerned about insurance duplicating the compliance review activities of other parties, such as class.

> We are not reviewing them yet. There is a balance on reviewing versus an expectation of the shipowner doing the right thing. We conduct a member risk review to see the member's safety management procedures and to understand the member's risk profile. This gives us a list of what to improve. The Polar Code could be addressed in that meeting, but probably not each time it is conducted. However, failure to conduct the assessment is another thing. From the loss prevention perspective, our objective is to drive awareness. We could be interested in working with Class on the operational assessment, but I am a bit worried about overlap between Class and insurance.

And finally, a fifth underscored their faith that class and flag would take all of the proper measures, minimizing the need for insurers to get too involved:

> Insurers will still ask hard questions, but the level of detail is dependent on the customer and trading area, and any special individual risks. We don't feel comfortable in specifying too much, and will rather rely on Class and Flag. Other issues of importance to us are contingencies for repairs, salvage and repair parts. We are happy to know that Class is involved in the Polar Code compliance process.

These answers suggest insurers will take a rather passive approach to the suitability of a ship for polar operations, as long as it has a Polar Ship Certificate from the Flag administration or RO. If none of the underlying documents—assessment, operating manual, or survey—are reviewed by the insurer, then one

might ask whether insurers are abdicating their role as professional risk managers. The lack of even a cursory review means the insurer will forego the benefit of important insights into the ship's suitability and preparedness for operations in potentially risky waters. As the first insurer said, "The Polar Code will prevent ships without any planning or risk assessment from going to the Arctic, however, the operational assessment and PWOM will not necessarily mean they are safe." We would agree with this; the question is, however, what should insurers do to help make sure that they are?

The insurers' responses underscore Bennett's conclusion that there is a limit to insurers' willingness to take on a policing role (Bennett 2000).

6.2.14 Are you receptive to working with non-governmental organizations?

"We might be receptive to working with NGOs. We do work with scientists in the ITOPF [International Tanker Owners Pollution Federation], and with NGOs via the ITOPF when this makes sense." Another was open to the prospect, depending on what material contribution environmental and other NGOs could bring to the table: "We would first like to know about what they can do."

6.2.15 Does an HFO spill represent a greater claims risk?

Another issue we wished to explore was how marine insurers viewed the carriage and use of heavy fuel oil (HFO). The use and carriage of HFO is prohibited in Antarctic waters by MARPOL Annex I, Chapter 9, Regulation 43. It is not similarly prohibited in Arctic waters, but the issue is being taken up by the IMO. In Phase II, we raised this issue with the insurers we interviewed, asking them if they considered the use and carriage of HFO a higher risk in their underwriting, and if there is a difference in loss severity between incidents involving a spill of HFO versus those of marine distillates.

Although one insurer was aware of IMO discussions on HFO use in Arctic waters, none of the insurers had a definitive answer regarding the comparative loss severity of cleaning up an HFO spill vs. a marine distillate spill. Three of the insurers suggested contacting the ITOPF for information on comparative clean-up costs. One respondent, a loss prevention executive, thought the carriage and use of HFO was "probably used by underwriters in allocating premiums," but could not elaborate on what material difference that might give in policy terms or premiums.

6.2.16 What are the consequences of loss of H&M cover for P&I insurance?

Generally speaking, H&M policies are written for the so-called "worldwide" trade. The Arctic, however, is not considered "worldwide", as reflected in the international navigating limits of the Lloyd's Market Association (LMA). When trading in Arctic waters, an owner must first notify its H&M insurer to arrange adequate cover. Failure to do so may invalidate the H&M policy.

Our interviewees explained that P&I coverage is also written for "worldwide" trade, yet P&I policies do not normally specify geographic limits and do not use the LMA international navigating limits clauses. Neither do P&I clubs require owners to notify them when trading in the Arctic. Failure to notify does not invalidate the P&I policy.

We also asked if invalidation of H&M cover had consequences for P&I coverage. As one P&I manager explained, "non-compliance with the H&M cover isn't necessarily a problem for P&I. Our rules only require that the ship must be in compliance with Class and with international, national and local regulations. A lack of H&M cover doesn't change the P&I risk exposure. One can think of an owner who has no H&M cover, accepting to take this as a self-insurance risk."

SUMMARY – PHASE II RESULTS

Findings	Implications
Polar waters are a new frontier for most insurers. – They are **searching for middle ground between facilitating commercial activity and prudence** in the face of uncertain risks.	Insurers will support risk control measures that help both their customers and themselves maintain a competitive edge.
Insurers have channels for effectively communicating risk management advice to shipowners.	Insurers will be receptive to communicating Arctic risk control measures their customers can use.
Compliance with safety regulations is a mandatory condition for cover, and non-compliance can affect insurance coverage. – **Determining compliance is more difficult with goal-based rules** such as the Polar Code.	**Insurers may over-rely on class** and flag to police compliance rather than take an effective stance themselves.
High commercial pressure is moderating shipowners' risk aversion, but has not yet adversely affected claims.	Shipowners may underestimate Arctic risks, particularly those without Arctic experience.
Insurers believe flag states are not pressing for regulation and are not as actively involved in safety as they should be.	Class takes the key role for effectively implementing the Polar Code, but not all class societies are equally prepared for it.
Insurers value class oversight and charterer vetting, but do not scrutinize it as part of their underwriting. – There is a presumption of satisfactory condition.	Without outside scrutiny, class oversight and Polar Code implementation may lack uniformity, quality and effectiveness, while giving others a **false sense of security**.
Premiums are primarily related to trading areas with high claim settlement costs, such as the USA.	Arctic trading will not necessarily affect insurance rates, and thus rates may not accurately reflect risk.
Salvage will be the major driver affecting H&M loss severity in the Arctic, due to the lack of available resources. – Insurers worry Arctic coastal states will not grant access to places of refuge in time to mitigate damage effects.	It may take so long for a salvor to arrive that there is little opportunity to mitigate damage to the ship and environment.
Wreck removal, pollution clean-up and personal injury will be the major drivers affecting P&I loss severity in the Arctic due to remoteness and environmental complicating factors.	Compensation costs may be low, but clean-up costs expected to be high.
Insurers do not currently advise on minimizing routing impacts.	This position should change with the establishment of the Arctic Shipping Best Practices Information Forum.
Insurers lack sufficient information to accurately predict the costs of dealing with an incident in Arctic waters.	Insurers may be conservative in writing policies for the Arctic. Insurers will welcome better information on Arctic shipping.
Insurers are not using ship tracking data, but are open to doing so in conducting deeper root-cause and consequence analysis.	Significant advances in risk analysis may be possible through collaboration with insurers and use of "big data" sources.
Insurers can reduce Arctic shipping risk through improving pre-activity risk assessments, operational measures, and due diligence surveys. – But **insurers do not show interest in actively reviewing Polar Code compliance documentation**.	Insurers are professional risk managers with an important role in reducing Arctic shipping risk. – But **a passive role in Polar Code compliance will diminish insurers' contribution**.
Insurers may be receptive to working with NGOs if they know what material contributions they can make.	NGOs need to communicate how they can add value to insurance risk management activity.
Insurers do not readily know the comparative costs of HFO vs. other types of marine fuel spills in the Arctic.	Insurers will not adjust their underwriting policies for ships carrying HFO until they know there is a cost differential.

7 DISCUSSION

7.1 Current role of marine insurance in regulating Arctic shipping risks

This study was commissioned to assess the current role of the marine insurance and reinsurance sector (I&RS) in regulating risks associated with vessel traffic in the Arctic. It seeks answers to the following questions:

- What is the current role of the marine I&RS in setting and enforcing private risk controls?
- What is the current role of the marine I&RS in advocating for stronger public (i.e., IMO and national) standards?
- How do marine insurers ensure that their customers adhere to international and domestic shipping regulations? Is there any pro-active monitoring?

7.1.1 Private risk controls

Marine insurers are private enterprises engaged in the business of assuming financial responsibility for the transfer of risk from ship owners, operators, charterers and cargo owners. Insurers manage their insurance risks through the techniques of risk pooling and risk transfer. They set comprehensive risk controls through the terms of their insurance contracts.

The London marine insurance market sets standard policy conditions in its MAR 91 Form (a generalized statement of insurance cover), and uses standardized "Institute Clauses" to set out the details of the insurance cover for hull and machinery (H&M) policies and for cargo insurance policies. For protection and indemnity (P&I) coverage, a similar approach is taken through the rules of the various P&I mutual clubs or commercial P&I insurers. These insurance contracts, clauses and rules set specific requirements of shipowners regarding compliance with conventions, laws, regulations, standards, codes, and practices of prudent seamanship.

There are many requirements a shipowner must satisfy to insure a ship operating in Arctic waters. For example, one P&I mutual club answered that besides the standard conditions of cover, the club also requires the following:

- Ships have an appropriate ice class per classification society requirements, and operate within the its capabilities when in ice,
- Compliance with the Polar Code,
- Compliance with local regulations, such as the Canadian Arctic Waters Pollution Prevention Regulations,
- Suitable escorts by icebreakers where appropriate,
- Use of local ice information services,
- Appropriate crew training and experience, and
- A full risk assessment which will include the ship's preparation, operation plan and emergency procedures specific to polar navigation.

Compliance with safety regulations is a mandatory condition for cover, and non-compliance can affect insurance coverage.

The LMA clauses and P&I club rules are well-established; they are revised from time-to-time, but not frequently. Regarding Arctic shipping risk management, the most recent initiative of the marine insurance industry is the establishment of an Arctic Shipping Best Practices Information Forum. The best practice guidelines include expectations of insurance underwriters when writing policies for ships operating in Arctic waters.

7.1.2 Public risk controls

Marine insurers are strong advocates of public regulation. As we learned in the Phase I survey, insurers consider excellent safety performance important to their business, as higher safety should translate into fewer incidents, fewer claims, and thus greater profitability. Good safety regulations improve safety performance and thus decrease the insurer's losses. Although insurers can take individual measures to improve safety of their clients, they also operate in a very competitive market. They feel constrained in how far they can push themselves for higher safety practices without being undercut by their competitors. Thus, they prefer public risk controls to private, as common rules and regulations both increase safety and ensure a level playing field among insurers.

Insurers ranked regulators such as the IMO and classification societies as the strongest drivers of safety at sea. They ranked flag state authorities less favourably (sixth of eight stakeholder groups), primarily because they did not perceive flag authorities as being strong advocates of regulation or sufficiently active in its enforcement.

Marine insurers' advocacy of stronger regulation is generally voiced through their key industry association, the International Union of Marine Insurance (IUMI). The IUMI has consultative status in the IMO.

7.1.3 Ensuring compliance with regulation

In our Phase II survey, we asked marine insurers how they used rules and regulations in their work. We learned that marine insurers consider compliance with safety regulations as a mandatory condition for cover. This applies to ship safety rules issued by the vessel's classification society and other international, national and local safety regulations, including coastal state regulations. Violation of regulations or non-compliance with class rules can affect insurance coverage. For some policies, such as hull and machinery insurance, non-compliance can mean the policy is invalidated; for P&I coverage, a non-compliant member may be required to reimburse what was paid out to third parties. See § 6.2.5.

Insurers review regulatory compliance of their policyholders both when underwriting a new policy and during the term of the policy. Insurers review an operator's claims history, reputation, class status and previous enforcement actions against the vessel, followed by information on the individual ship and its crew. This can include insurer-ordered surveys of the vessel. However, we noted during our interviews that insurers do not independently review key evaluations and determinations of class societies and vetting agents. They place great weight on determinations from class, but assume that a vessel in class is in good order. A similar presumption may extend to Polar Code compliance for vessels that have a Polar Ship Certificate. (See § 6.2.8, 6.2.12 and 6.2.13).

7.2 New risk control options

When developing the study plan, the study sponsor asked whether various new risk control options might be viable. In the sub-sections below, we set out each premise as a question and then outline our opinions and conclusions.

7.2.1 Vessel-specific standards

Is it worth pursuing rules and insurance requirements specific to vessel type (such as tankers, cruise ships, etc.)?

Type-specific vessel rules are already common in the maritime industry today at all regulatory levels from the IMO to class. The Polar Code, for example, includes special provisions for tankers and for passenger vessels. It also provides special provisions for vessels based on their intended operating capabilities, such as operations in ice, low air temperature, and high latitude (above 80°).

Classification rules are typically organized by ship type. For example, DNV GL ship classification rules have thirteen different principal ship types, with sub-divisions within these types (DNV GL 2017: Pt.1 Ch.2). A vessel may be assigned more than one ship type notation provided the respective requirements are met. Certain ship type notations are mandatory based on type of cargo, number of passengers, or the ability to execute special operations. The principal ship types are shown in the info box, *DNV GL Ship Type Notations*.

Insurers also have different requirements based on ship type. These requirements reflect the differences in type, frequency and loss potential of incidents for each ship type.

The survey of marine insurers did not elicit any comment on or recommendations about the need for new ship type requirements for vessels operating in the Arctic. Nevertheless, one may point out that the Polar Code does not address all ship types. Since Part I of the Polar Code only applies to ships certified under SOLAS, its safety provisions do not apply to fishing vessels, mobile offshore units, warships or government vessels operating on non-commercial service. As fishing vessels and mobile offshore units typically carry marine insurance, insurers could potentially play a role in ensuring their suitability for Arctic operations by applying the Polar Code as a best practice guideline rather than as a regulation.

DNV GL SHIP TYPE NOTATIONS

- Dry cargo ships
- Container ships
- Roll-on/roll-off sips
- Passenger ships
- Oil tankers
- Chemical tankers
- Liquefied gas tankers
- Compressed gas tankers
- Offshore service vessels
- Vessels for special operations (e.g., cable-laying, icebreaker, seismic vessel, semi-submersible heavy transport vessel)
- Non-self-propelled vessels
- Fishing vessels
- Naval vessels

7.2.2 IUMI best practices

Can best practices adopted by the IUMI or another industry association for Arctic operations be applied to harmonize and strengthen insurers' practices in the region?

The IUMI-sponsored Arctic Shipping Best Practice Information Forum is a very important, valuable and exciting initiative for improving shipping safety in Arctic waters. The intention is that it will not only provide best practices for shipowners and operators contemplating operations in the region, but also for underwriters who insure them.

One example of how the Forum can contribute is in minimizing routing impacts of ships on marine mammals, sensitive or important habitats, etc. As described in § 6.2.10, marine insurers do not currently advise shipowners on minimizing routing impacts, but the Forum does include this issue; we are hopeful, therefore, that the Forum will strengthen insurer's role in giving such advice to their clients.

7.2.3 Strengthening ship classification systems

What can NGOs do to encourage the private sector to adopt stringent ship classification systems (regarding the types of vessels that can operate in various ice conditions), as well as advocate for the IMO to give these systems teeth?

Ice-strengthening rules of the ship classification societies are relatively well-established in the marine industry. In August 2006, the International Association of Classification Societies (IACS) established seven different Polar ice classes (PC1 to PC7), with each level representing changes with respect to the operational capability and strength of steel ships. The specifications are standardized in the IACS Unified Requirements for Polar Ships (IACS 2016). IACS member societies are required to implement these standard specifications in their own ship classification rules. The Unified Requirements are minimum requirements. Each IACS member remains free to set more stringent requirements.

The Polar Code refers to these capabilities and ice classes when assigning a polar ship category to a ship. A ship's category determines the applicability of some requirements and regulations in the Code. The Polar Code does not, however, associate a ship's category with geographic operating areas. Rather, a ship owner must ensure that the ship's ice class is appropriate for the anticipated ice conditions and operate it within those limits. (See § 5.4.3).

The vessel's polar ship category, ice class, and ice-going capabilities/limitations will be described on its Polar Ship Certificate. Since these are meant to clearly describe the type of ice in which the vessel can safely operate, one would expect that marine insurers will require their insured to operate within these capabilities/limitations as a condition of cover.

As the Polar Code has only just come into force January of this year, we would expect a period of learning, adjustment and consensus-forming as the various parties implement the Polar Code (e.g., IMO, flag administrations, class societies, shipowners, port states, and insurers). Once this initial implementation is over, it will be easier to determine what aspects of the regime—from class rules to the Polar Code itself—require improvement. We do not see that existing ship classification rules for ice navigation are inadequate. Most important is that ship officers understand the capabilities and limitations of their vessel and operate it within them. POLARIS, described below, is designed to help them do this.

7.2.4 POLARIS and polar shipping risk management systems

How will the marine insurance sector likely use POLARIS or other similar risk-based systems to determine the bounds of operations in the Arctic?

In our Phase II survey, we asked insurers how they would implement the Polar Code in their underwriting and loss prevention practices (see § 6.2.13). Given their answers, it does not appear insurers plan on taking an active role in conducting or reviewing the operational (risk) assessment required by Part I § 1.5 of the Polar Code. POLARIS is a risk management tool used for making operational decisions at the voyage planning and voyage execution level—that is, at a "tactical" level of ship operations. Marine insurers are rarely involved in such operational decision-making. We would expect merely that insurers require their clients to use POLARIS or another appropriate ice navigation risk management tool in their ship operations, that this tool is described in the ship's Polar Water Operational Manual, and that the ship's officers are adequately trained in its effective use.

It is worth pointing out that marine cargo insurance does not cover loss or damage arising from unseaworthiness or unfitness of a vessel for the safe carriage of the cargo (LMA 2009: Clause 5). For operating in Arctic waters, a vessel's seaworthiness and fitness will naturally include its suitability for the ice conditions along the intended route. Using POLARIS or another appropriate ice navigation risk management tool to assess a vessel's suitability is expected as part of proper voyage planning in fulfilment of Part I § 11 of the Polar Code. Given DNV GL experience in conducing independent third-party review of ice damage to cargo ships, we strongly expect cargo insurers will review the shipowner's use of ice navigation risk management tools when considering claims arising from ice damage in the Arctic.

7.2.5 Improving crew training and certification

Should the marine insurance sector advocate for more stringent crew training and certification requirements than the Polar Code currently requires?

Part I § 12 of the Polar Code sets mandatory requirements for manning and training. Ships subject to Part I of the Polar Code must be in compliance with these requirements when operating in polar waters. The training requirements are based on the type of ship and the type of ice conditions in which that ship operates.

The IMO intends to implement the requirements by forthcoming amendments to the STCW Convention and the STCW Code (IMO 2015). Where the Polar Code requires basic or advanced training, the proposed amendment to the STCW Convention will require the officer to hold a Certificate in basic or advanced polar ship training. This must be renewed at least every five years for continued service. The amendments to the STCW enter into force on 1 July 2018. Implementation of them includes a two-year transition period.

Flag Administrations are responsible for approving training courses, defining approved or equivalent seagoing service, determining that a seafarer meets the required standard of competence, and issuing a Certificate of Proficiency to seafarers. Port State Administrations may inspect ships to verify compliance (port state control).

In 2008, DNV GL published its own, independent competence standard for ship officers navigating in ice (see DNV GL 2015 for the current edition) to provide guidance to the maritime industry until the IMO could establish formal requirements via the STCW. The IMO's proposed STCW competence requirements for officers navigating in polar waters appear quite similar to the DNV GL standard, thus we believe they present a sound basis for crew training and certification.

The true test of their effectiveness will be the quality of training programs that are developed and offered by the maritime training industry to respond to the new requirements. An IMO working group completed in December 2016 a draft model course for basic and advance training for ships in polar waters. This model course provides a framework for the maritime training industry to use in developing courses for industry. Since there is still some time before this work is completed and the STCW amendments come into force, it is too soon to judge how effective the training will be. We would certainly hope the marine insurance industry will monitor the developments here closely, as will DNV GL.

7.2.6 The case of heavy fuel oil

What is the viability of using the marine insurance sector's leverage in eliminating the carriage and use of heavy fuel oil (HFO) in the Arctic?

DNV (2013) is a detailed report to the Arctic Council's Protection of the Arctic Marine Environment Working Group (PAME) on the use and carriage of HFO in the Arctic. It describes a full year (2012) of maritime traffic based on satellite AIS recordings in the Arctic region, including vessel composition (type and size), geographical distribution, sailed distances and operating hours throughout the year. The report includes modelling of air emissions from use of HFO and a high-level risk analysis of frequencies of an HFO oil spill, risk control options, expected shipping traffic development in the Arctic and a gap analysis of the regulatory regime for the use and carriage of HFO in the Arctic.

As posited by Brown (1991), the viability of enlisting insurers in regulating environmental risks associated with or caused by shipping ultimately hinges on the nature of the risk and its insurability. The principal adverse environmental risks associated with HFO use are the emission of black carbon, sulphur and nitrogen to the atmosphere during its combustion as a fuel, and pollution to the water caused by intentional, unintentional and accidental releases of HFO to the sea. To assess the viability of using

insurance to regulate HFO use, we divide this into two sub-cases: one regarding air emissions, and one regarding water pollution.

Air emissions of black carbon caused by burning HFO appears a poor candidate for regulation through insurance. The risk that parties wish to control is the compound, cumulative effects of black carbon on the environment from many sources, including—but not limited to—the burning of HFO by ships, likely dispersed over a vast geographic area. This case has the following problems:

- The loss is not definite in time, place or amount.
- The loss is not accidental in nature (assuming the emission of black carbon is not regulated).
- The victim is not clearly identifiable, particularly where the damage occurs in remote areas with low populations. Who will raise a claim: discrete individuals, society at large, the biosphere?
- The source is either not clearly identifiable, or apportioning responsibility among multiple sources presents an insurmountable challenge.
- Where black carbon emissions are unregulated, it does not appear that a shipowner has a legal obligation to control them. Even government is probably unable to seek compensatory or punitive damages on behalf of society at large.

If neither loss, victim, source, obligation nor fault can be established, then it is not apparent a shipowner has a liability for which he needs indemnity insurance. Therefore, we do not see any role for marine insurance with respect to unregulated emissions to the air by ships.

Pollution from the release of HFO from a ship to the sea is a better candidate for regulation through insurance. Oil pollution is already a standard liability covered by P&I insurance. In this case, the objective is to reduce the environmental risk from a fuel oil spill by providing incentives to shipowners to switch from HFO to marine distillates. For insurers to weigh in on this issue, it is important to demonstrate that the liabilities (loss) from a spill of HFO are greater than a spill of marine distillate fuel. If the likely liability exposure is significantly greater, then there is reason for the insurer to try to limit it.

We asked insurers about this during our Phase II interviews. Although one insurer was aware of IMO discussions on HFO use in polar waters, none of the insurers had a definitive answer regarding the comparative loss severity of cleaning up an HFO spill vs. a marine distillate spill, particularly in Arctic waters. Three of the insurers suggested contacting the International Tanker Owners Pollution Federation for (ITOPF) for information on comparative clean-up costs. One respondent, a loss prevention executive, thought the carriage and use of HFO was "probably used by underwriters in allocating premiums," but could not elaborate on what material difference that might give in policy terms or premiums.

Insurers are unlikely to adjust their underwriting policies for ships carrying HFO unless they know there is a significant cost differential in their spill liability. This could be an area for additional study by NGOs.

7.2.7 The case of minimizing routing impacts

How does or could the marine insurance sector support ocean management efforts such as internationally or nationally designated Particularly Sensitive Sea Areas (PSSA), areas to be avoided (ATBA), marine sanctuaries, conservation areas, etc.? More specifically:

- How does the marine insurance sector view internationally or nationally designated PSSAs, ATBAs and the like? Does a designation itself help drive a higher standard of care?
- If abiding by designated areas would reduce the risk of damaging ecologically important areas in the Arctic, would it reduce risks for insurers?

- Does or could the marine insurance sector take any actions towards their insured to require or encourage them to support spatial or operating ocean management measures?

We explored these questions during our Phase II survey (see § 6.2.10). None of the insurers we interviewed have requirements or guidance on minimizing routing impacts at present. "We do not instruct, ask or advise our insured on minimizing routing impacts directly," explained one insurer. "We do not have any measures or instructions on avoiding essential marine habitat or designated areas," answered another.

The Polar Code includes requirements on voyage planning (see the fact box, *Polar Code Voyage Planning*). Part I § 11.3 of the Code requires that the master of a ship shall "consider" a route through polar waters that "takes into account . . . areas with known densities of marine mammals, including seasonal migration areas . . . [and] international and national designated protected areas along the route." Although phrased as a requirement, the Code does not compel a particular action or duty other than to "consider" these areas. Insurers do not see a legal duty for their insured, either: "This is very operational-related and is not a mandatory requirement," commented one of our respondents.

Vessel impacts on marine areas can be divided into two cases: damage caused by a ship incident in or near the area, and chronic impacts of shipping traffic through an area.

Damage caused to an area by a single, identifiable ship incident, such as oil pollution or grounding damage to a coral reef, can be addressed through marine insurance liabilities. Oil pollution and striking damages to third-party property are already a standard liability covered by P&I insurance.

Preventing chronic, cumulative aspects of shipping traffic on an area and the marine life living there is a poor case for marine insurance. Like the HFO air pollution case, the damage is not definite in time or amount, the loss is not accidental in nature, apportioning responsibility among multiple sources presents an insurmountable challenge, and it does not appear that a shipowner has a legal obligation to avoid many of these areas.

There are some marine protected areas where ships may be prohibited to enter. Where unauthorized entry does not cause demonstrable damage for which a liability claim can be lodged against the shipowner, we do not see any role that insurers can play. Enforcement responsibility more properly falls to the relevant coastal state authorities.

The insurers we interviewed agreed that if good information on such areas and best practice is readily available, then it can be

POLAR CODE VOYAGE PLANNING

The following requirements for voyage planning are stated in Part I, § 11.3 of the Polar Code.

The master shall consider a route through polar waters, taking into account the following:

.1 the procedures required by the Polar Water Operating Manual;

.2 any limitations of the hydrographic information and aids to navigation available;

.3 current information on the extent and type of ice and icebergs in the vicinity of the intended route;

.4 statistical information on ice and temperatures from former years;

.5 places of refuge;

.6 current information and measures to be taken when marine mammals are encountered relating to known areas with densities of marine mammals, including seasonal migration areas; *

.7 current information on relevant ships' routing systems, speed recommendations and vessel traffic services relating to known areas with densities of marine mammals, including seasonal migration areas; *

.8 national and international designated protected areas along the route; and

.9 operation in areas remote from search and rescue capabilities.

* Refer to MEPC/Circ.674, *Guidance document for minimizing the risk of ship strikes with cetaceans*.

incorporated in the underwriting process and loss prevention process. Here, the Arctic Shipping Best Practices Information Forum, which was established by the Arctic Council in 2017, will be instrumental. This is particularly because it is an initiative of the Lloyd's Market Association to support best practice for marine operations in the polar regions and harness the best standards available for operators to include in their Polar Water Operational Manual. Since one of the objectives of the Forum is to collect and disseminate information on essential habitat, spawning grounds, indigenous communities' hunting areas, and operational measures that shipowners can take to avoid them or reduce their impacts on them, we can also expect underwriters to soon be better informed and to take supportive actions.

7.2.8 Polar Code II

Can and will the marine insurance and reinsurance sector play a role in advocating for stronger measures in subsequent amendments to the Polar Code or other IMO regulations to reduce their exposure to catastrophic incidents?

In conducting this study, we found that the marine insurance sector is not a single, homogenous entity. Rather, one might consider it a confederation of three sub-sectors: commercial marine insurers; commercial re-insurers, and mutual associations of shipowners. The first two are more amenable to maritime shipping regulations than the latter.

In our Phase I survey, we asked insurers whether common safety rules and regulations were important. Their answer scored 4.6 on a scale of 5, indicating they strongly agreed regulations form an essential foundation for maritime safety (see § 6.1.1). In Phase II, we explored this further. One insurer we interviewed underscored the importance of IMO, class and insurers, "as these push for regulations, which we find helpful. Flag states, on the other hand, are not pressing for regulation" (see § 6.2.7). These answers suggest that some insurers may support further regulation that can better reduce incident frequency and loss severity, but this position should not be assumed to be held by all insurers.

Marine regulation often comes with a cost, particularly to shipowners. As Bennett (2000: 892) points out, P&I clubs are comprised of shipowners who are both customer and owner, insured and insurer; there is almost automatic opposition from them to measures that will increase shipowners' costs. Commercial marine insurers and re-insurers, on the other hand, may be more supportive, since they will directly benefit from any risk reduction, while they are not directly responsible for the costs of regulatory compliance as are the P&I club members.

SUMMARY – DISCUSSION

Findings	Implications
Insurers prefer public risk controls to private, as common rules both increase safety and ensures a level playing field.	Don't expect insurers to establish their own, internal rules as an alternative to public regulations.
The IUMI is the voice of marine insurers in the IMO.	
Not all ship types are covered by the Polar Code, such as fishing vessels and mobile offshore units.	Insurers could apply the Polar Code to these vessels as a best practice rather than a regulation.
Using POLARIS or other ice navigation risk tool is required by the Polar Code.	Insurers will likely review a shipowner's use of ice navigation risk management tools when considering ice damage claims.
The IMO has adopted new polar ship training requirements, but they do not go into effect until July 2018.	It is too soon to conclude that more stringent requirements are needed, but insurers might push for early adoption.
Insurance could be effective in regulating HFO spills, but not black carbon emissions. – Insurers don't know the cost of an HFO spill vs. one of marine distillates.	Insurers are unlikely to adjust their underwriting policies unless they know there is a significant cost differential. – This could be an area for NGO study.
Insurance is not effective in regulating chronic impacts on marine areas from ship traffic. – But the IUMI-sponsored Arctic Shipping Best Practices Information Forum supports minimizing routing impacts.	Black carbon from HFO use needs some other regulatory mechanism than insurance. – NGOs could work with the IUMI to ensure the best information is made readily available through the Forum.
Commercial (re)insurers may be more amenable to stronger regulation than P&I mutual clubs.	

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 How marine insurers view Arctic risk

This study sought to learn how the marine insurance and reinsurance sector views Arctic shipping risk and their ability and willingness to contribute to making it safer. During the course of the study, we both polled and interviewed a diverse range of marine insurance professionals. These individuals and their companies have different levels of experience with polar shipping—some little, some considerable. Yet, we found their views on Arctic shipping risk quite uniform. **Insurers believe Arctic shipping is risky**. As shipping expands in what is a new frontier for many operators, insurers expect higher incident rates and higher loss rates, especially for third-party liabilities.

This and other studies conducted by DNV GL indicate that safety is a major concern of the maritime industry. Although insurers strongly believe safety is important to their clients, they also believe that commercial concerns overshadow safety in today's depressed maritime market. High commercial pressure is moderating shipowners' risk aversion; they worry that this and cost-cutting in maintenance and training will hurt safety and increase marine incidents and claims, though claims figures are not yet showing these adverse effects. Insurers are not immune from the market downturn. They, too, are under financial pressure, driving rates down as insurers compete for business.

The cardinal finding is that insurers see themselves as part of the solution.

Insurers consider safety excellence is a competitive differentiator among their companies. Although bad things can happen to good ships, high safety standards correlate to lower incident and loss ratios, which is good for both insurer and insured. From our interviews with marine insurance executives, we could feel their concern that shipowners may underestimate Arctic risks—particularly those without previous Arctic experience. They genuinely wish to support their clients' business pursuits, so they are searching for a middle ground between facilitating commercial activity and prudence in the face of uncertain risks.

Fortunately, **insurers believe they can take measures to improve safety and remain competitive**. In this regard, we believe insurers will support risk control measures that help both their customers and themselves, such as pre-activity risk assessments, operational measures, and due diligence surveys.

The cardinal finding of our study is that **insurers see themselves as part of the solution**. We find this conclusion fundamentally important, as it indicates the insurance sector is both able and willing to be a valuable partner in managing Arctic shipping risks. As professional risk managers, the marine insurance sector should be actively engaged to lend their counsel and influence to improving shipping safety in the Arctic. Their advice and assistance should not only be sought by their insured, but also by the IMO, the Arctic Council, flag administrations, and classification societies.

8.2 Improving information on Arctic risks

Insurers manage their insurance risks through risk pooling (diversification), risk transfer (hedging), and risk avoidance, depending upon expected incident frequency and loss severity. Insuring new and emerging risks pose challenges to insurers, as they lack sufficient information to establish an actuarial relation between activity, incident, claims, safety measures, deductibles, premiums and settlement costs (Bennett 2000).

Insurers don't have sufficient information to adequately assess Arctic risks, particularly on the potential cost of claims. This is understandable, given the low traffic density in Arctic waters

(approximately 1500 vessels operating in Arctic waters annually). Although the lack of information might lead some insurers to be conservative in writing policies for Arctic trade, we learned from our interviews that Arctic trading has not led to higher premiums. Today, high premiums are primarily related to trading areas with high *known* claim settlement costs, such as the United States. Arctic trading may not necessarily affect insurance rates until experience proves the magnitude of claim settlement costs there, thus current rates may understate risk. This could undermine the general principle that premiums are linked as closely as possible to actual risk.

Insurers welcome better information on Arctic shipping. Given the (thankfully) low number of ship incidents in the Arctic to date, the challenge is how to fulfil insurers' informational needs from other sources. Condition monitoring and big data analytics may promote operative risk management and enhance our understanding and management of shipping risk (Skorna and others 2011; Zvezdov and Rath 2016). Big data analytics is the process of examining vast information stores to uncover hidden patterns, unknown correlations and other useful information that can be used to make better decisions. From our interviews, we learned insurers are not currently using ship tracking or other big data analytics, but are open to doing so if it could assist them conduct deeper root-cause and consequence analysis.

DNV GL believes significant advances in risk analysis may be possible through collaboration between insurers and others with access to relevant big data sources, such as classification societies and equipment manufacturers. Digitalization and big data analytics are major strategic corporate initiatives at DNV GL, both in its Analytic Innovation Center and across all its business areas. DNV GL will explore opportunities for collaboration with the marine insurance sector, perhaps through a pilot project with an appropriate insurer or group of insurers.

NGOs have long experience in the Arctic and a wealth of knowledge on its physical, biological, cultural, socio-economic and political environment. As we learned at the Seattle project workshop, NGOs want to contribute to reducing risks from shipping in the Arctic. From our interviews with the insurance sector, we learned that **insurers are receptive to working with NGOs** if they know what material contributions NGOs can make – particularly information that helps to assess financial loss severity exposure for incidents in the Arctic. **NGOs need to communicate how they can add value** to insurance risk management activity. The Arctic Shipping Best Practice Information Forum may be the best mechanism for working together on this.

8.3 HFO and ship routing impacts

Various stakeholders have called for controls to minimize both acute and chronic effects of shipping on the Arctic environment, particularly those associated with the use and carriage of heavy fuel oil (HFO) and ship traffic through or near certain marine areas. This study examined how marine insurance does, or could, contribute to controlling these adverse effects.

Marine insurers already pay out liabilities associated with a spill of HFO caused by an insured's vessel. However, insurers treat HFO spills as any other pollutant spill; they do not currently discriminate between type of fuel when underwriting a policy or advising their customers on loss prevention. They also pay out for other third party liabilities from acute damage caused by an insured's vessel in a discrete incident. For a marine area, this might include habitat restoration for physical damage to a coral reef caused by a vessel grounding, restitution for damaged aquaculture sites, and the like.

Insurance is not effective in regulating chronic impacts of black carbon emissions from HFO use or the cumulative effects of ship traffic on marine areas. As neither loss, victim, source, obligation nor fault can be sufficiently established, it is not apparent a shipowner has a liability for which he needs indemnity insurance. Therefore, we do not see any role for marine insurance in regulating chronic impacts from air

emissions or ship traffic; addressing these issues requires some other regulatory mechanism than insurance.

Insurers are not engaged on HFO use. We learned that insurers do not know the comparative cost of an HFO spill vs. one of marine distillates in the Arctic. Insurers will not adjust their underwriting policies for ships carrying HFO until they know there is a significant cost differential in cleaning up an HFO spill. This could be an area for NGO study, and insurers recommend contacting the ITOPF for information on comparative oil spill clean-up costs. As P&I policies are the primary insurance vehicle for addressing spill clean-up and compensation liabilities, NGOs should consider approaching the IGP&I and its member associations on this matter.

We also learned that **insurers do not currently advise on minimizing routing impacts** to marine areas, regardless of their type or designation. This position should change with the establishment of the IUMI-sponsored Arctic Shipping Best Practices Information Forum, which already includes minimizing routing impacts as a best practice. NGOs should work with the IUMI to ensure the best information is made readily available through the Forum. NGOs are planning actions here, including methods for formalizing information availability to shipowners for voyage planning and execution. We recommend AIS data be used to track actual ship routing through Arctic marine areas as a means of monitoring implementation, whether voluntary or obligatory, and to support further policymaking efforts. Government studies on potential recommended routes in Arctic waters are also under consideration, such as in the Chukchi Sea, Bering Strait and Bering Sea (U.S. Coast Guard 2014). The IUMI and IGP&I should be invited to comment on these proposals when under development and to encourage their insured to abide by them where established. Again, the Arctic Shipping Best Practices Information Forum provides a convenient avenue for coordinating this type of dialogue among the Arctic Council member states, observers, NGOs and the maritime industry, including the marine insurance sector.

8.4 Supporting rules and regulations

Insurers believe common safety rules and regulations are an essential foundation for a healthy marine insurance market. A strong regulatory regime promotes safer ships and ship operations, which reduces insurance risks. Insurers prefer regulations and standards issued by recognized authorities and common to all shipowners rather than developing and enforcing their own, as common rules both increase safety and ensure a level playing field in a highly competitive insurance market.

Compliance with maritime safety regulations is a mandatory condition for cover, and non-compliance can affect insurance coverage. Some insurers commission due-diligence ship surveys during the underwriting process for an individual client or as part of their general loss prevention efforts to benefit all their policyholders. Yet Bennett (2000) posited that there is a limit to insurers' willingness to take on a policing role. Our interviews confirmed Bennett: **marine insurers do not want to be the primary enforcers**. Rather, insurers highly value classification society certification and oversight, port-state control, and charterer vetting for taking the lead as enforcers of international safety regulations, industry standards and best practice. Insurers do not see flag states as actively involved in safety as they should be, which is alarming given that flag administrations have the primary formal responsibility to implement international maritime safety regulations by ships flying their flags.

Insurers place great trust and confidence in classification societies. They value class oversight in ensuring ships are properly designed, built and maintained to high industry standards, and in verifying compliance with statutory regulations on the behalf of flag administrations. From our interviews, however, we learned **insurers presume a ship's satisfactory condition** if it holds a valid certificate from an IACS-member class society or has been subject to charterer vetting, but insurers do not scrutinize these as part of their underwriting. As a classification society ourselves, it is flattering to know

our work is held with such high regard by marine insurers, yet without outside scrutiny, class oversight may lack uniformity, quality and effectiveness, while giving others a **false sense of security**. We recommend insurers take a more active role in using information from class societies, vetting agents, port state control actions, and others in verifying a ship's standard of safety and regulatory compliance.

8.5 Implementing the Polar Code

From the responses we received to this study, **insurers believe the Polar Code will be effective** in managing Arctic shipping risk. Insurers will require shipowners operating in the Arctic to comply with it as a condition for coverage, and most want to see the Polar Ship Certificate as evidence of compliance.

Insurers expect a lot of the Polar Code, **but they appear rather passive in helping to implement it**. The insurers we interviewed did not show interest in actively reviewing Polar Code compliance documentation, such as the operational (risk) assessment required by Part I §1.5 of the Code, or the Polar Water Operational Manual required by Part I § 2. We find this the most disturbing conclusion of the project. A passive role will diminish insurers' interests in the Polar Code's development, and the effectiveness of that implementation will be the poorer without it. If insurers see themselves as part of the solution, then they must take an active role to be a part of it. A marine insurance contract should not only require the vessel to have and maintain a valid Polar Ship Certificate, but that the insured exercise diligence in operating the vessel within the limitations stated on it.

Determining compliance is more difficult with goal-based rules such as the Polar Code. In our own efforts at helping shipowners understand the Polar Code, DNV GL has found great room for interpretation. To ensure the Polar Code is implemented as a truly common international safety regulation, it is essential all key stakeholders work together during the initial implementation phase. **We need the active participation of all parties—including insurers—to reach satisfactory consensus** vis-à-vis interpretation and application, rather than over-relying on class and flag to be solely responsible, not least because not all class societies or flags are equally prepared for or engaged with the Polar Code.

If insurers see themselves as part of the solution, then they must take an active role to be a part of it.

DNV GL Maritime Advisory assists shipowners to define a polar operating profile, conduct the operational (risk) assessment, determine which parts of the Polar Code apply to their ship, and evaluate alternative design and operational measures to comply with them. This process is typically conducted in a workshop setting. DNV GL recommends to shipowners that they invite the vessel's insurer and flag administration to participate in these workshops. This is an ideal setting for the key actors—class, flag, insurer and shipowner—to jointly review a ship's intended operation in polar waters and ensure that any attendant risks are mitigated as best as possible. We strongly recommend insurers accept these invitations when offered.

At a higher level, **the Arctic Shipping Best Practices Information Forum is the ideal place** to bring together stakeholders to discuss and facilitate consensus on Polar Code interpretation, implementation and compliance. We recommend the organizers invite marine insurers, class societies, NGOs, flag administrations, and the Arctic coastal state authorities to participate. The best practices developed in the Forum should include not only those of shipowners, but also those of insurers, class and flag in how *they* can best help shipowners operate safely and responsibly in this precious—and risky—environment.

9 REFERENCES

Bennett, Paul. (2000). Environmental governance and private actors: enrolling insurers in international maritime regulation. *Political Geography* 19: 875-899.

Bennett, Paul. (2001). Mutual risk: P&I insurance clubs and maritime safety and environmental performance. *Marine Policy* 25: 13-21.

Brown, R. L. (1991). Environmental liability insurance: an economic incentive for responsible corporate action. *Alternatives* (Canada) 18: 18-25.

Büthe, Tim, and Walter Mattli (2011). *The new global rulers: the privatization of regulation in the world economy*. Princeton University Press.

DNV (2013). *HFO in the Arctic – phase 2*. Report No. 2013-1542-16G8ZQC-5/1. Det Norske Veritas.

DNV GL (2014). *The Arctic: the next risk frontier*. DNV GL.

DNV GL (2015). *Competence of officers for navigation in ice*. Standard DNVGL-ST-0017. DNV GL.

DNV GL (2016). *The Arctic risk map*. DNV GL. https://maps.dnvgl.com/arcticriskmap/

DNV GL (2017). *Rules for classification of ships*. DNVGL-RU-SHIP. DNV GL.

Donaldson, John F. of Lymington (1994). *Safer ships, cleaner seas: report of Lord Donaldson's inquiry into the prevention of pollution from merchant shipping.* HMSO.

Equasis (2015). *The world merchant fleet in 2015*. Equasis.

Habergham, John, Greg Pynt, Anne Pélissier, David Hirzel, Kyriaki Noussia, Stella Sakellaridou, and Samim Unan (2012). Precautionary measures: clauses requiring the policyholder or the insured, before the insured event occurs, to perform or not to perform certain acts (PEICL 4:101). Papers submitted to the AIDA Consumer Protection & Dispute Resolution Working Party meeting held on 13 September 2012. Sigorta Hukuku Türk Derneği.

Hussain, Enam (2015). What are the biggest claims? *Maritime Risk International*, July/August: 14-15.

IACS (2016). Unified requirements concerning polar ships. IACS UR-I. International Association of Classification Societies.

IMO (2003). Guidelines on places of refuge for ships in need of assistance. Resolution A.949(23). International Maritime Organization.

IMO (2015). Amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, as amended. Draft MSC Resolution MSC95/22/Add.2 Annex 8. International Maritime Organization.

IMO (2016). IMO Goal-based standards. International Maritime Organization.

Kim, Inho (2002). Financial responsibility rules under the Oil Pollution Act of 1990. *Natural Resources Journal* 42: 565–598.

Kingston, Michael (2016). The Polar Code. *The Circle*, No. 3: 22–23. WWF Arctic Programme.

LMA (2001). Institute classification clause. Lloyd's Market Association.

LMA (2003). International navigating limits. Lloyd's Market Association.

LMA (2009). Institute cargo clauses. Lloyd's Market Association.

Mills, Evan (2009). A global review of insurance industry responses to climate change. *The Geneva Papers on Risk and Insurance* 34: 323–359.

Molenaar, Erik, Stephen Hodgson, David VanderZwaag, Huni Heidar Hallsson, Tore Henriksen, Lena Holm-Peterson, Maxim Vladimirovich Korel'skiy, James Kraska, Bjarni Már Magnússon, Susan Rolston and Andrew Serdy (2010). *Legal Aspects of Arctic Shipping*. European Commission, Directorate-General for Maritime Affairs and Fisheries.

Omni (2015). *P&I report*. Omni, Limited.

PAME (2017). Arctic Shipping Best Practices Information Forum Terms of Reference. Arctic Council, Protection of the Arctic Marine Environment Working Group.

Powers, Michael R. (2012). *Acts of god and man: ruminations on risk and insurance*. Columbia University Press.

Prabhakar, S.V.R.K., J. Pereira, J. Pulhin, G. Srinivasa Rao and J. Cummins (2015). Assessing the climate change adaptation and disaster risk reduction effectiveness of risk insurance approaches. *APN Science Bulletin*, Issue 5.

SCOR (2016). About reinsurance. SCOR Global Property & Casualty Insurance.

Skorna, Alexander C. H., Christoph Bode and Markus Weiss (2011). Risk and loss prevention within the transport chain. International Conference on Management of Technology, 10-14 April 2011, Miami Beach, Florida.

Stahel, Walter R. (2008). Global climate change in the wider context of sustainability. *The Geneva Papers on Risk and Insurance* 33: 507-529.

Stonehouse, Simon (2016). Machinery, what is the underwriter's problem? International Institute of Marine Surveying.

U.S. Coast Guard (2014). Port access route study: in the Chukchi Sea, Bering Strait and Bering Sea. 79 *Federal Register* 72157.

Ward, Robert E. T., Celine Herweijer, Nicola Patmore and Robert Muir-Wood (2008). The role of insurers in promoting adaptation to the impacts of climate change. *The Geneva Papers on Risk and Insurance* 33: 133–139.

Zelenika, Ratko, Ingrid Knapić and Ratko Likić (2007). Upravljanje rizicima u klupskom osiguranju [Risk management in the insurance clubs]. *Naše More: znanstveno-stručni časopis za more i pomorstvo*, [*Our Sea: the scientific journal of the sea and maritime activities*] 54(1-2): 49-61.

Zvezdov, Ivelin, and Sebastian Rath (2016). Towards socially responsible (re)insurance underwriting practices: readily available 'big data' contributions to optimize catastrophe risk management. Working Paper. ResearchGate.

APPENDIX A
Phase I Survey

SURVEY OF MARINE INSURERS ON MARITIME SAFETY AND ARCTIC RISK

Arctic shipping is changing. Is it safe?

Shipping in the Arctic is changing. Our data show more ships, longer navigation seasons, and new entrants among ship operators in the region. DNV GL wants to ensure shipping in the Arctic is safe. Is the industry prepared to ensure safety of people, property and the Arctic environment? A first step is to take a temperature check on safety and Arctic risk from key stakeholders in the maritime community, including **you**, the community's insurers. We ask you to take 4 minutes to give us your opinion by answering the following questions. Thank you!

Payback

1. Would you like to receive a copy of the results from this survey?

Yes	
No	

Demographics

2. What type of insurer is your company? Please check all that apply.

Protection & Indemnity	
Hull & Machinery	
Cargo	
Reinsurance	
Special covers	
Other	

Safety concern

3. What do you consider is the degree of safety concern among ship owners and operators?

Very limited	Limited	Moderate	Strong	Very strong

4. To what extent do you think the maritime industry is concerned with the following?

	Very limited	Limited	Moderate	Strong	Very strong
Low freight rates					
High commercial pressure					
Inadequate safety management					
Poor safety culture / communication					
Insufficient crew competence					
Complex software and control systems					
Navigational errors					
Poor equipment reliability					

	Very limited	Limited	Moderate	Strong	Very strong
Machinery damage					
Hull damage					
Inadequate vessel stability					
Fire and explosions					
Inadequate anchoring					
Cyber threats					
Extreme weather					

Stakeholder influence on safety

5. To what extent do you consider the following stakeholders to be driving safety at sea?

	Very limited	Limited	Moderate	Strong	Very strong
IMO					
Flag state					
Port state					
Classification societies					
Insurance					
Owner / operator					
Charterer					
Yard / designer					

6. To what extent do you think your company can improve maritime safety while maintaining costs and competitiveness at present levels?

Very limited	Limited	Moderate	Strong	Very strong

Safety as a competitive differentiator

7. To what extent do you think excellent safety performance is a competitive advantage for your company?

Very limited	Limited	Moderate	Strong	Very strong

Importance of rules and regulations

8. To what extent do you consider common safety rules and regulations important for shipping?

Very limited	Limited	Moderate	Strong	Very strong

Arctic risk

9. How do you think shipping in the Arctic will affect the **frequency** of claims due to the following causes?

	Substantial decrease	Decrease	Neutral	Increase	Substantial increase
Collision (with a ship)					

Contact (with an object)					
Sea ice or iceberg damage					
Fire / explosion					
Foundering					
Grounding					
Machinery failure					
Other					

10. How do you think an incident in the Arctic will affect the **loss severity** of a claim for the following types of cover?

	Substantial decrease	Decrease	Neutral	Increase	Substantial increase
Hull & machinery					
Protection & indemnity					
Cargo					

Please indicate the degree to which you agree with the following statements:

11. There has been too little maritime activity in the Arctic to date for insurers to adequately quantify the risks (that is, claims frequency and loss severity).

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

12. The maritime insurance sector can take measures to reduce claims from maritime activities in the Arctic.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

13. The new IMO Polar Code will be effective in maintaining safety in the Arctic at the same levels as other parts of the world.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

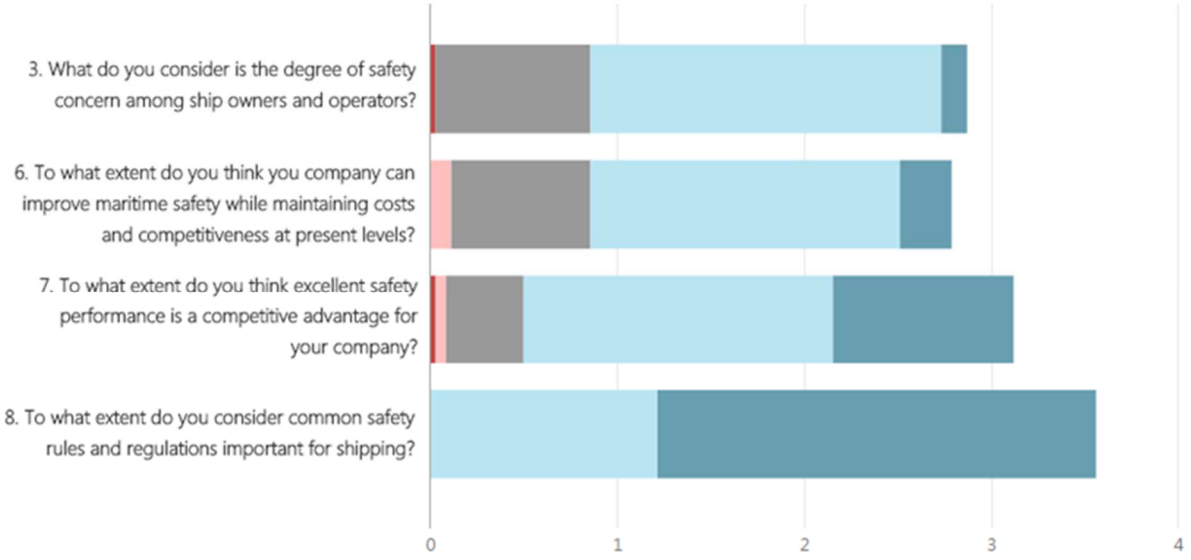
APPENDIX B
Phase II Survey

MARITIME SAFETY AND ARCTIC RISK
SURVEY OF MARINE INSURERS, PHASE II

Phase II survey design

The following pages contain the question guide sheets used in telephone interviews of selected individuals from the marine insurance sector. At the top of each page are questions and results from the Phase I survey for the interviewer to use as a point of reference for the discussion, and below them are the questions used in the Phase II phone interviews.

Phase II survey



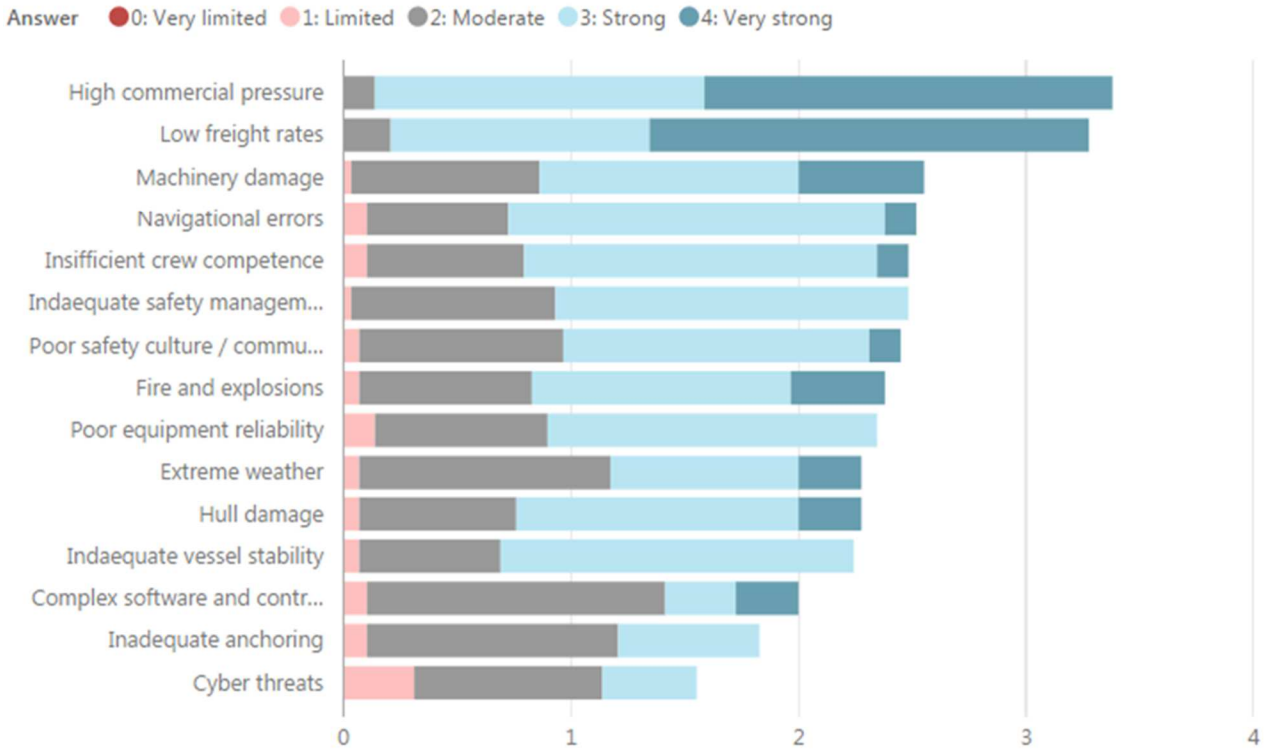
6.1 What kinds of measures do you think these might be?

- How do you advise your insured on emerging issues, guidelines, best practices, etc.?

8.1 How do you use rules and regulations in your work?

- In evaluating new customers and contracts?
- In underwriting a particular voyage, such as one to the polar regions?
- In claims handling?

4. To what extent do you think the maritime industry is concerned with the following?

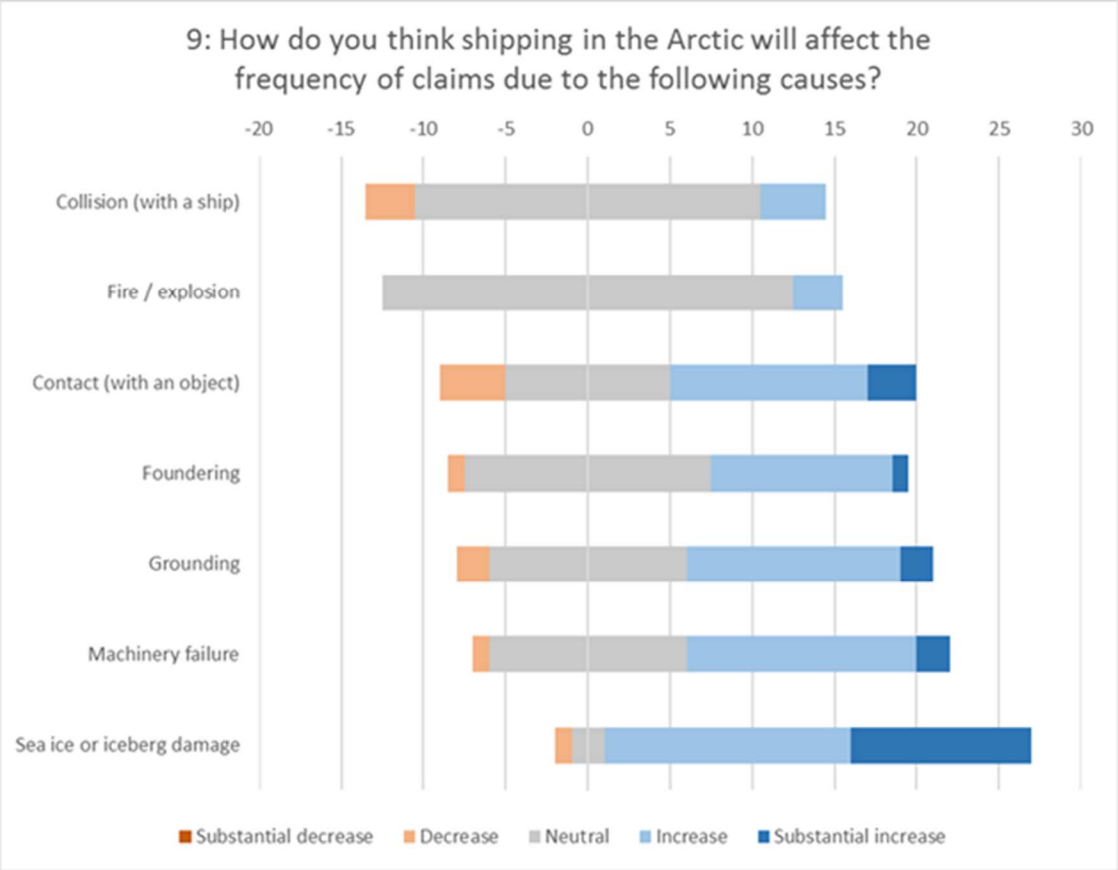


4.1 What kinds of effects do you see from high commercial pressure and low freight rates on incident types, rates and loss severity?

- How does that affect your loss prevention efforts?

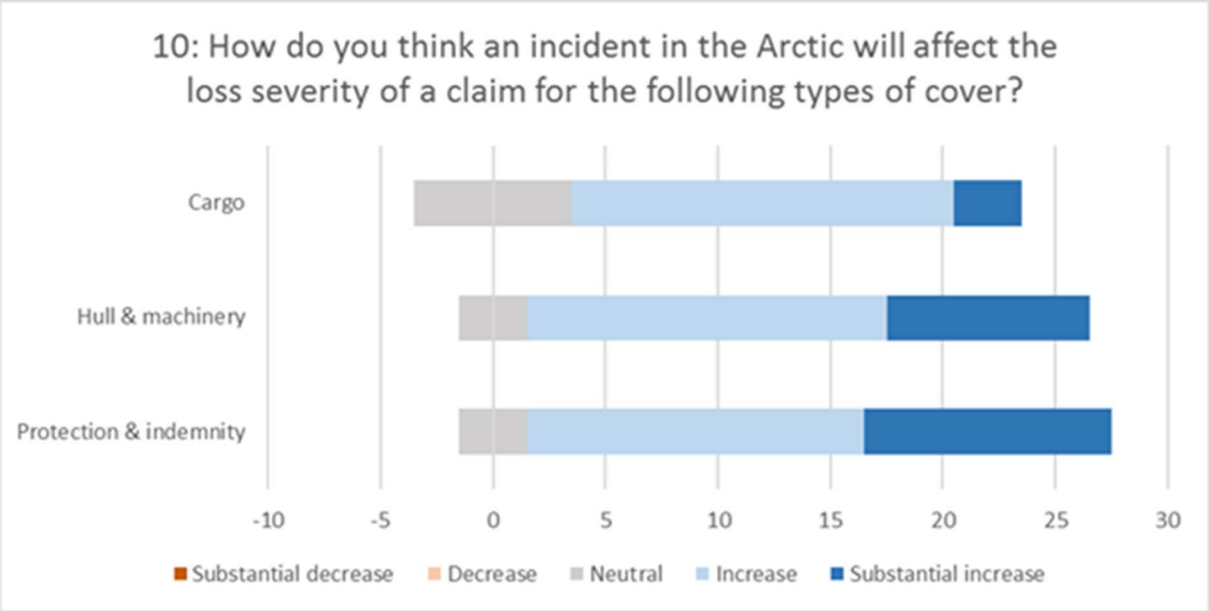
5.1 What kind of information do you use from these sources in writing policies and managing/preventing loss?

- Port state detentions (negatives)
- Class surveys and Conditions of Class (negatives)
- Class notations (positives)



9.1 Are there other causes we haven't addressed here?

9.2 Which of these types of causes lead to the most expensive losses?



10.1 What are the major drivers affecting loss severity

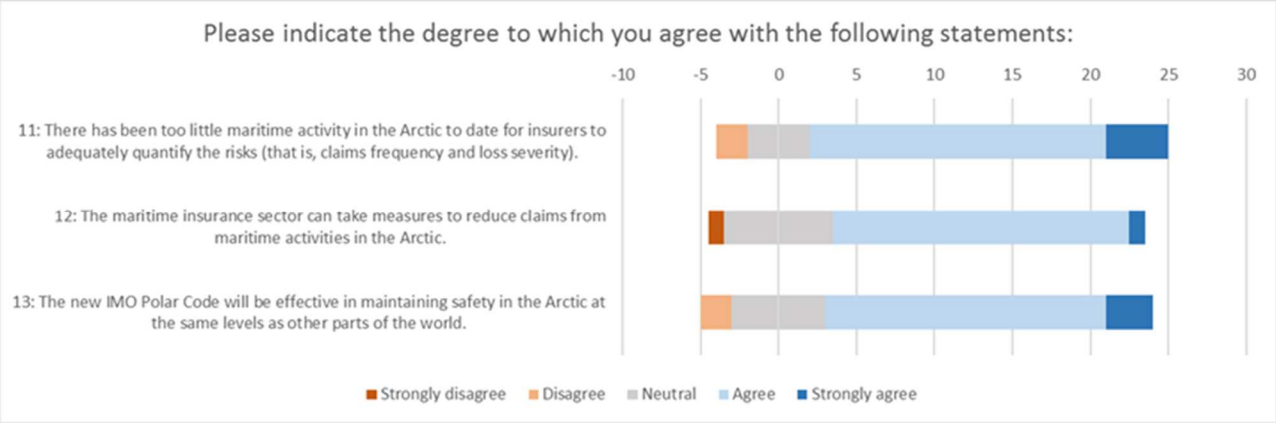
- For H & M ?
- For P & I ?

10.2 What are the greatest concerns here?

- Costs of response to a remote area?
- Liability payments?

10.3 How do you see environmental liabilities from an incident in the Arctic vs. the rest of the world?

- How are safety and environment linked?
- How do you use an insured's Corporate Social Responsibility and Environment, Social and Government criteria in your work?
- Do you have any measures, instructions, or guidelines to your insured on avoiding essential marine mammal habitats or designated Areas to be Avoided?
- Do you instruct, ask or advice your insured to minimize routing impacts by taking particular routes (or not taking particular routes)?
- When vessels transit through essential marine habitats is unavoidable, do you have any guidelines or instructions to insured on how to minimize potential impacts (e.g., slow steaming, etc.?)



11.1 What data are needed to adequately quantify the risks (type and quantity)?

- How could AIS and class databases help?
- What about information on ship activity without incidents?

12.1 What kind of measures do you think of here?

- Are there any opportunities to incentivize?

13.1 Class will act as RO for assessing Polar Code compliance. This involves reviewing the ship's operational (risk) assessment and Polar Water Operation Manual, among other things.

- What level of validation/verification (if any) is expected by the insurance industry, beyond the issuance of the Polar Ship Certificate?
- Would you review that in insuring a ship for operations in polar waters?

APPENDIX C
Arctic Shipping Best Practices Information Forum

Reproduced from PAME (2017)

SAO meeting 8-9 March 2017
For information

Arctic Shipping Best Practice Information Forum (the FORUM)
Terms of Reference

Preamble

1. The Arctic region is unique. A home to indigenous communities for many generations, the Arctic is environmentally and ecologically sensitive, experiences extreme weather and climatic events, and is rich in both flora and fauna and in living and non-living natural resources. With advances in technology and changing environmental conditions, there is a growing focus on the development of these resources (*e.g.*, oil and gas, mineral deposits, fish stocks) and the expansion of maritime activity. The Arctic is also a region of timeless and diverse indigenous practices and customs which must be included in any critical assessment of contemplated maritime activity.

2. As the Arctic changes, maritime activity must be carried out in an environmentally sustainable manner to prevent or mitigate any negative social and ecological consequences.

3. In order to increase the safety of ships' operation and mitigate the impact on the people and environment in the remote, vulnerable and potentially harsh polar waters, the International Maritime Organization (IMO) in 2015 adopted the *International Code for Ships Operating in Polar Waters* (the Polar Code) which sets out international safety and pollution prevention requirements for ships operating in Arctic and Antarctic waters.

4. IMO Contracting Parties developed the Polar Code to supplement existing IMO instruments with the objective of increasing the safety of ships as well as reducing possible negative impacts of international shipping activities on the peoples and environment in the Polar Regions.

5. The Polar Code imposes additional requirements on ships and their operations beyond the existing ones set forth in the *International Convention for the Safety of Life at Sea (SOLAS), 1974*, the *International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto as amended by the 1997 Protocol (MARPOL)*, the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978*, and other relevant IMO instruments.

6. The Polar Code acknowledges that operations in Polar Regions impose navigational demands on ships beyond those normally encountered in other latitudes. For example, in many Arctic areas, nautical charts may lack adequate specificity or may not be sufficiently up-to-date for safe navigation of the intended operations. Despite annual fluctuations in sea ice cover, sea ice hazards are also pervasive. Coverage of the region by communications satellites is limited.

7. Complementing the role of the IMO as the international organization globally responsible for addressing safe, secure, and environmentally sound maritime navigation, the Arctic Council's Working Group on the Protection of the Arctic Marine Environment (PAME) has a mandate to address policy and non-emergency pollution prevention and control measures related to the protection of the Arctic marine environment from sea-based activities.

8. PAME is fully cognizant of the relationship between safety measures and protection of the marine environment and recognizes that safety measures taken to reduce the probability of a maritime accident are likely to lower the risk of damage to the environment.

PAME Objectives for the Polar Code

9. The Polar Code entered into force on 1 January 2017. As a set of fundamental obligations concerning international shipping activity in the Arctic, its terms must be fully understood, consistently implemented, and faithfully adhered to.

10. To promote effective implementation of and compliance with the Polar Code, PAME recognizes the need to raise awareness of its provisions amongst all those involved in or potentially affected by Arctic marine operations, including ship owners and operators, Flag, Port and Coastal States, classification societies, marine insurers, financial institutions funding Arctic activity, and indigenous and local communities.

11. In particular, a forum open to those decision makers and stakeholders engaged with Arctic marine operations as identified in paragraph 18 will support broad understanding of the inputs for best navigational practices and operational limitations as listed, but not limited to those enumerated in paragraph 14.

12. To obtain a Polar Ship Certificate under the Polar Code, a ship operating in Polar Waters is required to carry on board a Polar Waters Operational Manual (PWOM) that provides the owner, operator, master and crew with sufficient information regarding the ship's operational capabilities and limitations in order to support their decision making process.

13. Issuance of a Polar Ship Certificate (PSC) requires the preparation of an Operational Assessment. This Operational Assessment involves taking into consideration the anticipated range of operating and environmental conditions and various hazards that may lead to elevated levels of risk. The outcome of the Operational Assessment informs the PWOM that must be carried on board the ship.

14. Voyage planning and Operational Assessments require knowledge and consideration of environmental and other conditions as they relate to the operation of the ship and the ship's limitations. Essential components of the Operational Assessment are voyage planning (as described in IMO *Guidelines for Voyage Planning,* Resolution

A.893(21) adopted on 25 November 1999) and any defined ship operational limitations require numerous important inputs, which include but are not limited to the following:

a) Hydrography;
b) Meteorology;
c) Ice data;
d) Crew training;
e) Search and rescue logistics;
f) Communication;
g) Industry guidelines;
h) Traditional and local knowledge;
i) Ecological knowledge;
j) Operational understanding; and
k) Ship equipment, systems and structure.

The Forum

15. PAME has decided to establish a Forum to increase awareness of the Polar Code. The Forum will facilitate the compilation, exchange and public sharing of associated information and best practices, including with respect to the inputs identified in paragraph 14. This compilation, exchange and public sharing of information will assist all those involved in the decision-making processes in relation to Arctic marine operations under the Polar Code.

16. To achieve this objective, PAME will establish and maintain a publicly accessible web portal that will link to and make this information available in one place.

Forum Organization and Membership

17. Arctic States[1] intend the Forum to meet annually under PAME's auspices, with the oversight and guidance of the Co-Chairs of PAME's Shipping Expert Group, and with a representative of the Arctic State that holds the Chairmanship of the Arctic Council at the time the Forum meets serving as Chair of the Forum. This may be a virtual meeting facilitated by, where practicable, teleconference or videoconference.

18. Arctic States intend Forum membership to be open to Arctic States, Permanent Participants and Arctic Council Observers as well as any widely-recognized professional organization dedicated to improving safe and environmentally sound marine operations in the Arctic as demonstrated by expertise and experience in Arctic shipping and/or related issues (*e.g.,* hydrography, meteorology, nautical charting, ice data, high-latitude communications, ecological information, search and rescue, marine insurance, naval architecture, pilotage, traditional and local marine knowledge).

[1] The Arctic States are Canada, the Kingdom of Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States of America.

19. Arctic States intend that any decisions taken by the Forum under paragraphs 15 and 16 are to be by consensus of its Members. Any disagreements may be referred by the Shipping Expert Group Co-Chairs to PAME for resolution at its next scheduled meeting.

20. The PAME Secretariat, in consultation with the Shipping Expert Group Co-Chairs, will invite participants by letter to each annual meeting.

21. The Forum intends to review and update the web portal content at each Forum meeting.

22. Forum Members also intend to communicate intersessionally to identify web portal updates and address other Forum matters as necessary.

23. Forum Members intend that they may, by consensus, invite one or more experts to attend a Forum meeting and, if appropriate, to submit information to and/or make a presentation at such meeting.

24. When appropriate, Forum Members intend to take notice of and post to the web portal relevant information related to maritime operations in the Antarctic.

25. Forum Members may decide by consensus upon rules of procedure to guide Forum meetings and eligibility criteria for information proposed to be posted to the web portal. Such rules of procedure may be updated from time-to-time (refer to paragraph 17).

26. Each Forum Member is to provide a single point of contact to the PAME Secretariat. The PAME Secretariat is to maintain a current list of Forum Member points of contact. Such points of contact are to be posted on the web portal.

27. These Terms of Reference are not binding under international law. Activities by Forum Members under these Terms of Reference are undertaken voluntarily and are subject to the availability of funds. The Forum has no authority over Members.

About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil & gas and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our professionals are dedicated to helping our customers make the world safer, smarter and greener.