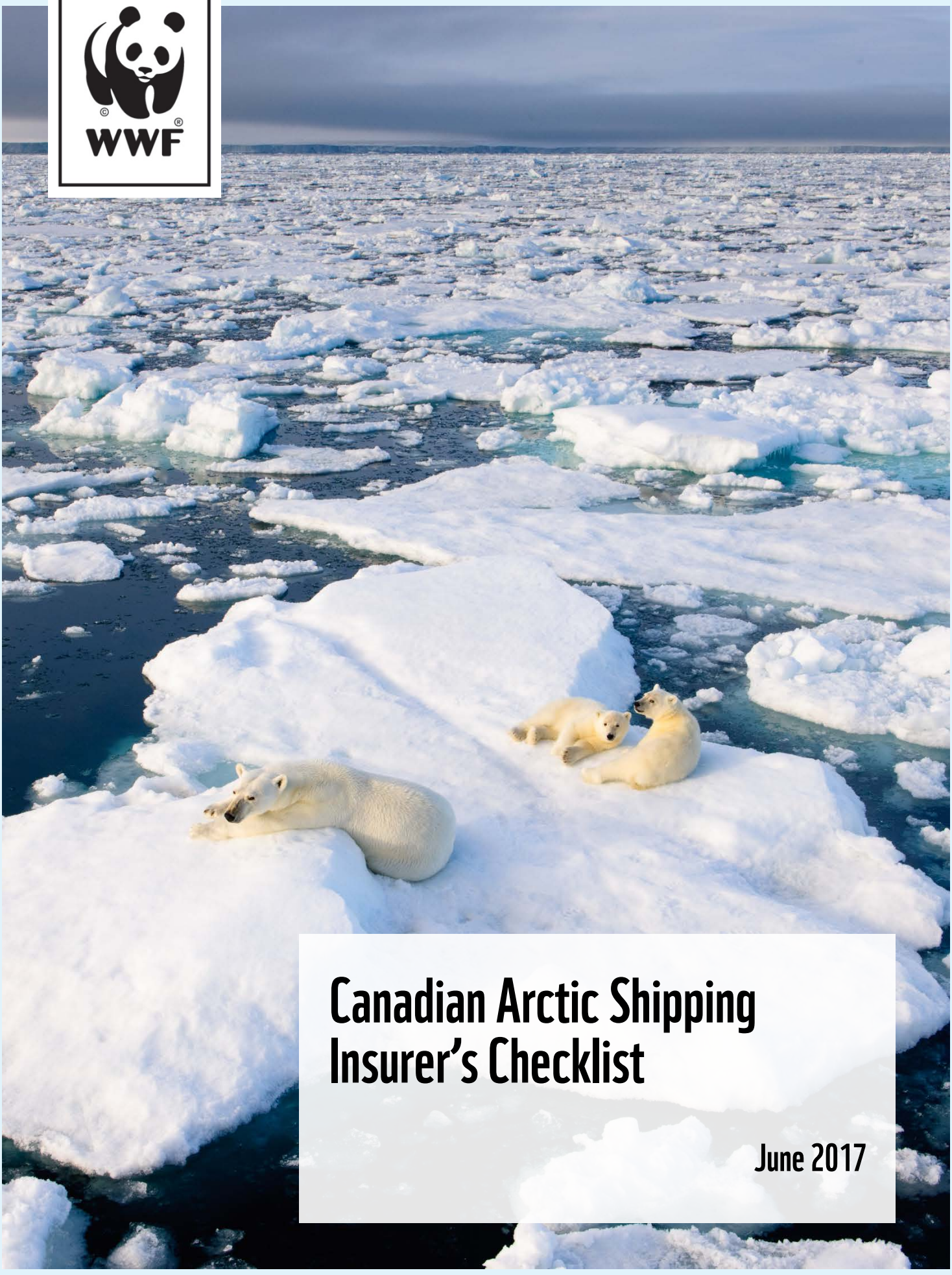

Canadian Arctic Shipping Insurer's Checklist

June 2017

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1 Introduction

A growing demand for raw materials and a changing Arctic environment, including a rapid decline in sea ice extent, thickness, and duration, have facilitated the increase of vessel traffic in Arctic waters, a trend that is expected to continue. Experts predict that shipping activities in the Canadian Arctic are expected to quadruple over the next 20 years. Vessel traffic in remote and challenging Arctic waters pose substantial safety and environmental risks, including possible impacts on cultural practices and the food security of Arctic Indigenous peoples. It is essential that the ecological integrity of this region is maintained while ensuring essential goods and development reach people in the north.

The insurance industry potentially holds a lot of leverage in regulating marine traffic in the Arctic due to their ability to deny coverage to shipping companies not abiding by high operating standards. Recent engagement with the insurance industry has revealed that they might not be aware of the full scope of risks and impacts associated with operating in the Arctic nor existing best practices. Having a more complete understanding of the Arctic environment will aid in voyage planning as well as determining appropriate premiums.

This Insurer's Checklist aims to close the perceived knowledge gap by providing the insurance industry with a list of available resources and best practices which will aid in navigation, route planning, and an overall reduction in key threats vessel traffic poses to Arctic people and the environment.

Contents

2 Physical Environmental Conditions

2.1 Sea Ice

Although summers in the Arctic are becoming increasingly ice-free, icebergs, bergy bits, and smaller chunks of ice will continue to create unpredictable hazards for shipping for much of the year. In some places, climate change may result in accelerated glacier calving events, which will in turn increase the number and size of icebergs in the Arctic. Contact with sea ice can result in propeller, rudder and associated machinery damage.

Resources:

Sea ice information (e.g. ice charts and ice forecasts) from the Canadian Ice Service: http://iceweb1.cis.ec.gc.ca/Prod/page1.xhtml?grp=Guest&mn=&lang=en

2.1.1 Navigation Through Sea Ice

There are two sea ice regulatory navigation systems presently working in parallel to enhance the safety and efficiency of shipping operations in the Canadian Arctic: The Zone/Date System and the Arctic Ice Regime Shipping System (AIRSS). The Zone/Date System divides the Arctic into 16 zones; a time of allowable entry into each zone is based on the ships' ice class as well as the historical data relating to the probable ice conditions at different times of the year. The Zone/Date System is meant for general voyage planning whereas AIRSS characterizes the real-time risk that different ice conditions pose to the structure of a ship.

Resources:

General description of the sea ice capabilities of the seven Polar Classes: http://www.ccg-gcc.gc.ca/e0010980

Additional information concerning sea ice navigation: http://www.ccg-gcc.gc.ca/Ice_home/Ice_Publications/Ice-Navigation-in-Canadian-Waters

2.1.2 Ice Operations and the Protection of Ice Habitat

Sea ice serves as an important habitat. Therefore, shipping through sea ice could lead to increased negative interactions with ice-bound marine mammals. For example, ships breaking ice through the breeding grounds of seals have resulted in direct mortality from collisions. Seal pups that are concealed in lairs are especially vulnerable. Operations through sea ice creates channels of brash ice, which may remain if the ice does not refreeze rapidly. Seals use these channels as leads into the ice and often create whelping sites along the edge of these open channels. This places them at risk of ship strikes from further shipping in the same channel.

It has been speculated that operations through sea ice are the cause of select cetacean ice entrapment occurrences. The passage of a ship creates a temporary opening in the sea ice, which can act as an artificial polynya. This can confuse cetaceans, causing them to become trapped too far from the ice edge as the channel eventually refreezes.

Lastly, acute and chronic oil spills from vessels operating in ice can be hard to detect and clean up and could also contaminate marine mammal prey or haul-out areas.

Resources:

The following is a list of best practices relating to species habitat, socioeconomics, and safety for ship owners and operators, which can be followed when operating in sea ice.

Species Habitat

- Follow a pre-existing ship track through sea ice as best as possible;
- Conduct landfast ice monitoring (including the number of ship transits that used the same track and the area of landfast ice disrupted annually);
- Reduce speeds to a maximum of 11 km/h (6 kts) in landfast ice and 13 km/h (7 kts) in pack ice to moderate the bow-wave and wake effects on the ice;
- Avoid operations through sea ice during ice formation (until ice is >20 cm thick) to avoid introducing cracks into the new ice sheet;
- Should large pieces of landfast ice prematurely break away as a result of ice breaking, ship routes (during spring only) should be modified to follow a zig-zag pattern;
- Re-rout or halt operations through sea ice during sensitive times of the year for wildlife, such as: over ice caribou migration routes and seal pupping areas;
- Support scientific research on the impacts of operations in sea ice (such as the number of marine mammals attracted to ship tracks) by providing access to ships for sampling by governmental and research groups; and
- Implement appropriate measures to mitigate disturbance to wildlife, including stoppage of movement until wildlife have moved away from the immediate area.

Socioeconomics

- Should operations in sea ice interfere with access to hunting grounds, ship owners should mark the ship tracks to make them visible to travelers, install ice bridging, such as pontoon bridges and keep the public informed on icebreaking activities by providing a minimum of 24 hour notice prior to icebreaking.

Safety

- Increased reporting; report into national vessel monitoring regime every four hours.

Additional information on Arctic shipping ice operations and their impacts as well as best operating practices:
http://awsassets.wwf.ca/downloads/170412___shippingthroughseaice.pdf?_ga=1.170365158.735604524.1468957492

Safety and environmental measures for ship transits in ice in Voisey's Bay: http://www.nunavut.ca/files/CD/TAB%2024%20Pages%20from%20140415-08MN053-App%20N.02%20-%20Shipping%20and%20Marine%20Wildlife%20Management%20Plan.pdf

2.1.3 Icebreaking and Shipping Support Services

When ice conditions prevent, or significantly impede a ship's operations, it may be desirable or necessary to work together with another vessel or be escorted. A limited number of Canadian Coast Guard (CCG) icebreakers are available for the escort and support of shipping in the Arctic. However, these icebreakers are heavily committed and cannot always be provided on short notice when requested.

Resources:

Icebreaker service availability and fees: http://www.ccg-gcc.gc.ca/eng/CCG/Ice_Service_Fees

2.2 Hydrography

With less than 10% (and some say as low as 1%) of the Canadian Arctic Ocean being charted to international navigational standards, there is relatively poor knowledge of seabed features and an associated risk of grounding on uncharted rocks and shoals.

Resources:

General shipping routes, the locations of northern communities as well as areas surveyed to modern, adequate and inadequate standards: http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_03_e_39850.html#ex1 (Exhibit 3.4)

2.3 Tides, Currents and Water Levels

To avoid grounding, ships navigating in shallow waterways require knowledge of the time and height of the water levels as well as the speed and direction of the tide currents.

Resources:

Predicted times and heights of high and low waters, and the hourly water levels for over seven hundred stations in Canada: http://www.tides.gc.ca/eng/find/region/2 and http://www.tides.gc.ca/eng/data/predictions/2016#vol4

2.4 Weather

Climate change is making weather in the Arctic more unpredictable, while inadequate weather monitoring and forecasting in this region exacerbate the problem. Rain and snow may be of concern to shipboard activities in spring and fall when rain, combined with low temperatures, can result in vessel icing, which can affect equipment and make vessels dangerously top-heavy. Superstructure icing is possible whenever air temperatures are - 2.2°C or less and winds are 17 knots or more.

Resources:

Marine forecasts and warnings for Canada: https://weather.gc.ca/marine/index_e.html

2.5 Visibility

Fog is a major cause of low visibility, particularly in Baffin Bay in the spring and summer. During the summer, fog often will develop over an ice pack or ice-covered waters. Blowing snow is an important contributor to reduced visibility during winter months.

The number of daylight hours available for navigation is of concern the further north one transits in the winter. In the Arctic, extended daylight conditions occur through the summer, whereas the converse is true during the winter months.

Resources:

The seasonal variability of daylight for different latitudes: http://www.ccg-gcc.gc.ca/Icebreaking/Ice-Navigation-Canadian-Waters/Ice-Climatology-and-Environmental-Conditions

3 Pollution Prevention

The Arctic Waters Pollution Prevention Act and the Arctic Waters Pollution Prevention Regulations are the primary pollution control mechanisms which govern shipping north of 60 degrees in Canada. Their aim is 'zero discharge', which states, "no person or ship shall deposit or permit the deposit of waste of any type in the Arctic waters." However, the ambition of zero discharge isn't realized in many cases. Outlined below are best practices which should be followed in order to meet the true intention of the Act/Regulations.

3.1 Discharge of Sewage and Grey Water

Discharges of sewage can lead to oxygen depletion, spread pathogenic bacteria and viruses, and increase nutrient levels in the surrounding ecosystem, possibly leading to toxic algal blooms and eutrophication that can cause harmful disturbances throughout food chains. The low light and temperature conditions in the Arctic amplify the environmental impacts since the decomposition is slowed and the Arctic is less tolerant to rapid changes in the nutrient status of the water column or seabed.

Grey water has pollutant levels comparable to untreated sewage and can have harmful environmental impacts such as: dead zones caused by excessive algal growth because of excess nutrients, oil and grease coating the gills of fish and preventing respiration, the suffocation of small benthic species due to increased particulate matter, and the introduction of invasive species.

Resources:

Best practices include zero discharge of untreated grey water and sewage under any circumstance within the Polar Code defined Arctic, and prohibiting discharge of treated sewage and grey water unless:

- Sewage and grey water contain no more than 14 fecal coliforms/100ml, and 30 mg/l of total suspended solids after treated by an approved water treatment system;
- The vessel is underway at a minimum of 6 knots;
- The vessel is at a distance of more than 3 nautical miles from the nearest land;
- The vessel is at a distance of more than 3 nautical miles from any ice-shelf or fast ice and shall be as far as practical from the areas of ice concentration exceeding 1/10.

It is also suggested that ship owners and operators conduct regular sampling and testing of sewage and grey water discharges to ensure compliance with the above requirements.

Information on grey water and its impacts:
http://assets.wwf.ca/downloads/grey_water_impacts___8_12_2016.pdf

Marine Discharge of Treated Sewage, Treated Grey water, and Other Treated Wastewater from Large Commercial Passenger Vessels Operating in Alaska Fact Sheet:
http://dec.alaska.gov/water/cruise_ships/gp/2014/2014GP_FactSheet_2013DB0004_Rev1.pdf

3.2 Underwater Noise Pollution

In most marine areas, low frequency noise from propellers and engines of commercial vessels are the dominant source of anthropogenic noise. Icebreakers generate higher and more variable noise levels from propeller cavitation due to the episodic nature of breaking ice, which often involves maneuvers such as backing-and-ramming into the ice. Some icebreaking vessels are equipped with bubbler systems that blow high pressure air into the water to push floating ice away from the ship, creating an additional noise source over short ranges.

Beluga whales have been shown to exhibit strong overt reactions to approaching icebreakers 35 to 50 km away and only return to the disturbed area nearly two days later. Similarly, bowhead whales have exhibited avoidance responses to icebreaking activity at ranges up to 25 km. The displacement of animals from preferred areas could result in negative consequences such as: changes in food and increased competition and predation.

Exposure to anthropogenic sound can also lead to a variety of behavioural reactions, increase stress hormones, decrease reproduction, cause temporary and permanent hearing loss, and change the ecosystems and result in a reduction of prey availability – all of which can negatively affect a population.

Resources:

Technical and maintenance best practices for owners and operators to reduce vessel noise described in detail by the Vancouver Fraser Port Authority ECHO Program include:

- Regular propeller polishing and repair;
- Regular hull cleaning;
- Hull coating (e.g. decoupling coating, coatings that reduce fouling);
- Propeller design modified to reduce cavitation and improve wake flow (e.g. high skew, air injection);
- Alternate propulsion (e.g. water or jet pump);
- Use of quieter engines (e.g. diesel-electric drive);
- Reduce on-board engine and machinery noise (location, mounting and insulation of components); and
- Changes to hull form.

Additionally, vessel operators should undertake the following best practices during navigation to reduce underwater noise:

- Speed Reduction: for ships equipped with fixed pitch propellers, reducing ship speed can be a very effective operational measure for reducing underwater noise, especially when it becomes lower than the cavitation inception speed; and
- Rerouting: to avoid sensitive marine areas including well-known habitats or migratory pathways when in transit will help to reduce adverse impacts on marine life and behavioral responses.

Best practices and options on how to reduce vessel noise from the Vancouver Fraser Port Authority Enhancing Cetacean Habitat and Observation (ECHO) Program: http://www.portvancouver.com/wp-content/uploads/2017/01/Vessel-Quieting.pdf

Information on Arctic shipping underwater noise and its impacts: http://awsassets.wwf.ca/downloads/170412___underwaternoiseduetoshipping.pdf?_ga=1.31906808.735604524.1468957492

3.3 Use of Heavy Fuel Oil

Most large seagoing vessels use HFO, also known as residual fuel or bunker fuel, due to its low cost. In the event of a spill, HFO breaks down extremely slowly, is virtually impossible to clean up, and will have long term, devastating effects on both livelihoods and ecosystems. HFO is also the source of harmful and significantly higher emissions of air pollutants, including sulphur oxides, nitrogen oxides, particulate matter, and black carbon.

HFO is banned throughout the Antarctic (south of 60°S), and in protected areas off the coast of Svalbard, Norway, because of its potential spill impact on wildlife. The U.S. and Canada announced a "phase down" of HFO from ships operating in the Arctic. The two governments had already acknowledged that a "heavy fuel oil spill in the Arctic could cause long-term damage to the environment" in a document submitted to the 70th session of the IMO Marine Environment Protection Committee (MEPC). Recently, the U.S. and Canada, with co-sponsorship from Finland, Iceland, Norway, Germany and the Netherlands, submitted a proposal for a new output in the IMO MEPC work programme to develop measures to reduce risks of use and carriage of HFO as fuel by ships in Arctic waters. This proposal will be considered at the 71st session of MEPC in July 2017.

Resources:

Svalbard's HFO ban: http://www.sysselmannen.no/en/Shortcuts/Ban-on-heavy-fuel-oil/

Heavy fuel oil use in Arctic shipping in 2015: http://www.theicct.org/heavy-fuel-oil-use-arctic-shipping-2015

Economic impact and Environmental risks of HFO use: http://awsassets.wwf.ca/downloads/vard_313_000_01_fuel_alternatives_letter_final.pdf?_ga=2.71619027.153461067.1496173305-1558178095.1469629046

Alternatives to heavy fuel oil use in the Arctic: Economic and environmental tradeoffs: http://www.theicct.org/alternatives-to-Arctic-HFO-use-economic-and-environmental-tradeoffs

An analysis of heavy fuel oil use and carriage and black carbon emissions from ships in the Arctic in 2015, with projections to 2020 and 2025: http://www.theicct.org/2015-heavy-fuel-oil-use-and-black-carbon-emissions-from-ships-in-arctic-projections-2020-2025

3.4 Air Emissions

The great majority of commercial vessels are powered by diesel engines that run on HFO, distillates, or fuel blends. These engines generate combustion exhaust, releasing long and short lived pollutants into the atmosphere. Many of these pollutants contribute to global warming, and all negatively impact human and environmental health.

Carbon dioxide (CO_2) makes up the bulk of emissions from any diesel engine. As a long-lived GHG, CO_2 becomes well-mixed in the atmosphere and causes global warming. In 2012, vessel traffic accounted for approximately 2.2 percent of total greenhouse gas emissions worldwide. CO_2, SO_x, NO_x and PM diesel engine emissions are short lived and localized pollutants, yet can be extremely potent. Recently, there has been an increased focus on the effects of black carbon (BC), a form of PM, due to its significant climate forcing impact. BC is the most effective form of PM, by mass, at absorbing solar energy. While CO_2 persists longer, BC, which only remains in the atmosphere for days or weeks, has hundreds to thousands of times greater warming potential than CO_2. After CO_2, BC is the second greatest contributor to human induced climate warming. BC is of particular concern in the Arctic due to the fact that, when depositing on snow and ice surfaces, it reduces albedo and increases warming. The warming impact of BC is increased by at least a factor of three in the Arctic region.

Other pollutant emissions that cause adverse localized air quality, acidification or human health impacts –like SO_x and NO_x—may also be prioritized for reduction/mitigation efforts. In 2012, the World Health Organization classified diesel engine exhaust as carcinogenic to humans. Airborne particles in SO_x, NO_x and PM emissions enter the lungs and can trigger inflammation that can lead to lung and heart failure. In addition, emissions of SO_x and NO_x cause acidification of soil and water. NO_x also contributes to the formation of ground level ozone, which is detrimental to vegetation and human health.

Individual vessels can use a variety of techniques to reduce emissions from ships by:

- Switching from HFO to distillates, LNG, or other cleaner fuels;

- Slow steaming/derating;
- Using exhaust gas scrubbers, exhaust gas recirculation, and filters;
- Using shore power in ports;
- Improving engine efficiency;
- Improving thrust efficiency (e.g., propeller polishing, propeller upgrade);
- Weather routing;
- Improving hydrodynamics (e.g., hull cleaning, hull coating);
- Incorporating zero or low emission auxiliary propulsion (e.g., wind assist; battery electric power)

Resources:

Black carbon measurement methods and emission factors from ships: http://www.theicct.org/black-carbon-measurement-methods-and-emission-factors-from-ships

Long-term potential for increased shipping efficiency: http://www.theicct.org/long-term-potential-increased-shipping-efficiency

The impacts of Arctic shipping operations on Black Carbon emissions: http://www.hfofreearctic.org/wp-content/uploads/2016/10/The-impacts-of-Arctic-shipping-operations-on-Black-Carbon-emissions.pdf

The Impacts of an Arctic Shipping HFO Ban on Emissions of Black Carbon: http://www.hfofreearctic.org/wp-content/uploads/2016/10/The-Impacts-of-an-Arctic-Shipping-HFO-Ban-on-Emissions-of-Black-Carbon.pdf

3.5 Invasive Species – Hull Fouling and Ballast Water

Invasive species prey on and/or compete with native species, resulting in alterations of habitats, biodiversity, food webs and ecological stability. Aquatic invasive species have led to incidents as diverse as the collapse of commercially important fisheries to cholera outbreaks affecting human populations. Shipping is a significant vector in the spread of aquatic invasive species, mostly via ballast water and hull fouling.

Increasing surface water temperature and changing salinity levels will reduce the environmental barriers currently limiting the establishment of more temperate species. These factors, in combination with the potential increase of ballast water discharges and transport of organisms via hull fouling as shipping increases in the region, will increase the risk of non-indigenous invasive species introductions. Thus, in the future, invasive species could threaten the ecological and economic viability of the region.

Resources:

Conservation of Arctic Flora and Fauna's Arctic Invasive Alien Species Strategy and Action Plan: https://www.caff.is/strategies-series/415-arctic-invasive-alien-species-strategy-and-action-plan

3.5.1 Hull Fouling

The 2011, IMO Guidelines for the Control and Management of Ships' Anti-fouling to Minimize the Transfer of Invasive Aquatic Species (IMO Anti-fouling Guidelines) voluntary guidelines recommend installation and maintenance of an anti-fouling coating, the development of a plan to manage hull fouling, and provides inspection, cleaning and record keeping suggestions. The Polar Code recommends ships follow the IMO Anti-fouling Guidelines, and specifically recommends "measures should be considered to minimize the risk of more rapid degradation of anti-fouling coatings associated with polar ice conditions".

Some nations have created mandatory measures to address hull-fouling. Beginning May 15, 2018, all vessels traveling to New Zealand that will anchor, berth or be brought ashore after a voyage outside of its waters must comply with specific "clean hull" regulations, which essential means no biofouling other than a slime layer, with the exception of fast turnaround vessels that can have a small amount of biofouling. The regulations also "provide three options for the proper management of biofouling: a) cleaning before entry (carried out less than 30 days before arrival in New Zealand or within 24 hours after arrival); b) continuous maintenance using best practice, e.g. the IMO's guidelines for management of ships' biofouling in Res.MEPC.207(62); or c) application of approved treatments".

The IMO biofouling guidelines should not only be mandatory but have polar specific measures including enhanced levels of hull cleaning, which should match precaution regarding the translocation of alien species on ships hull niche area in such sensitive areas.

In addition, an assessment of the effectiveness of the most appropriate antifouling coatings for Arctic operations would be timely as the Polar Code begins to take effect. The Polar Code or other appropriate mechanisms should specify fit for purpose polar anti fouling systems which have no biocide content, be suitable for ice operations, and linked to the IMO biofouling guidelines.

Resources:

IMO Guidelines for Inspection of Anti-fouling System on Ships: http://www.mardep.gov.hk/en/msnote/pdf/msin1139anx1.pdf

3.5.2 Ballast

The International Convention for the Control and Management of Ships' Ballast Water and Sediments enters into force September 2017 and applies to all waters, including the Arctic. Whether the Convention's measures are sufficient to protect the unique Arctic region from species invasions is yet to be seen. Some regions have already elected to have more stringent requirements than those of the convention. The state of California established (and is soon to implement) limits on total bacteria and virus concentrations that do not exist in US or IMO standards.

It is recommended that ballast water is monitored for the effectiveness of the ballast water convention treatment requirements in the Arctic, and consider more stringent requirements (e.g. higher treatment standards, strengthening of enforcement, etc.) in the future if needed.

4 Reducing Disturbance on Marine Mammals

4.1 Polar Code

The Polar Code provisions call upon mariners to take into account when considering a route through polar waters "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," (paragraph 11.3.6) and "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" (paragraph 11.3.7).

Information relevant to the implementation of the marine mammal avoidance provision includes population trends, spatial densities, and seasonal migrations of Arctic and Antarctic marine mammals. In the Arctic, this information is generally uncoordinated and fragmented across species, populations and geographic regions.

There are multiple ways of communicating marine mammal information to masters now and in the future. These include the incorporation of information into:

- Electronic navigation charts;
- Voyage planning documents;
- Notices to Mariners and Notices to Shipping;
- Mariner's Guides, graphics, and apps;
- Risk assessment/decision support tools; and
- Real-time, satellite-based electronic notification systems.

For the time being, whilst data is collected, made accessible, and communicated to mariners, the following actions can be taken:

- Implement appropriate routing measures (e.g. seasonal ATBAs) in areas of known marine mammal concentrations; and
- Implement speed restrictions in areas where slowing a vessel would protect vulnerable marine mammal species.

Resources:

Below is a list of examples of information published by academic researchers, governments, and NGOs on Arctic marine mammal densities and migrations that could supplement current government information made available to mariners.

Arctic Marine Synthesis: Atlas of the Chukchi and Beaufort Seas (see update in July 2017): http://ak.audubon.org/conservation/arctic-marine-synthesis-atlas-chukchi-and-beaufort-seas

WWF's Hudson Strait Mariner's Guide: http://awsassets.wwf.ca/downloads/hudsonstraitmarinersguide_2.pdf?_ga=1.39622627.1558178095.1469629046

ENGO submission to MEPC 71: Application of the Polar Code marine mammal avoidance provisions: http://www.usmsa.org/wp-content/uploads/2017/04/MSC-98-17-2.pdf

4.2 Vessel Traffic and Monitoring

The maritime industry is embracing the use of AIS technology and other e-Navigation technologies to aid the efficiency of maritime operations. By allowing vessels and on-shore observers to track ships, AIS helps avoid collisions, maintain safe distance from maritime hazards, locate vessels in distress, and assist in search and rescue efforts. Moreover, it makes possible vessel traffic and monitoring systems that may encourage safer maritime practices and compliance with both mandatory and voluntary regulatory measures.

Establishing vessel traffic and monitoring systems has been a priority of Arctic vessel operations for several years. A recommendation of the 2009 Arctic Marine Shipping Assessment says, "Arctic states should support continued development of a comprehensive Arctic marine traffic awareness system to improve monitoring and tracking of marine activity, to enhance data sharing in near real-time, and to augment vessel management service in order to reduce the risk of incidents, facilitate response and provide awareness of potential user conflict. The Arctic states should encourage shipping companies to cooperate in the improvement and development of national monitoring systems."

The US Coast Guard requires vessels that have called on a US port to adopt and adhere to enhanced prevention measures to reduce the risk of environmental damage from a vessel casualty, as national oil spill prevention and standards cannot be met in Alaska due to limited infrastructure. The Marine Exchange of Alaska, a non-profit organization based in Juneau, Alaska, is monitoring vessel traffic in Alaska 24/7 as an incident prevention measure. By on-shore tracking of ships via AIS, the MXA operations assist vessels in maintaining a safe distance from shore and maritime hazards, can locate and aid vessels in distress, and can monitor vessels that are not compliant with mandatory (and non-regulatory) navigation safety measures.

It is recommended that coastal States should ensure a (public or private) vessel information, compliance monitoring and response system that establishes a relationship with each vessel that sails through their waters. This would entail the following:

- Communications protocols - How they can contact the vessel and the owner/operator via e-mail and phone (owner/operator) and the vessel master via satellite phone and e-mail to ensure safety and environmental information can been transmitted to the vessel;

- Establishing and disseminating preferred routing measures;
- Developing capabilities to transmit safety and environmental information to vessels via AIS transmitters and other means;
- Establishing processes for transmitting real time information on sea ice concentrations and other relevant information such as walrus haul outs;
- Ensuring the capability to immediately locate and communicate with response resources; and
- Request vessels engage with Coastal States upon approaching their waters to inform of their communications capabilities and voyage plan, and should ensure they have the technology to communicate with Coastal States or their representative organization as well as be able to receive, process and display AIS transmitted information.

Resources:

Marine Exchange of Alaska: http://www.mxak.org/

4.3 Biological and Cultural Important Areas

The amount of overlap between shipping routes and important biological and cultural areas should be reduced as much as possible. This is particularly important during certain times of the year near known marine mammal feeding and calving areas, migration routes and other vulnerable wildlife concentration areas. In these areas, seasonal shipping restrictions should be established. When a biological and cultural important area cannot be avoided, guidance should be put into place on speed limits and approach distances to avoid disturbance to marine mammals including approach distances.

The following sections review numerous biological and cultural important areas where appropriate measures should be undertaken.

4.3.1 Marine Protected Areas (MPAs)

According to the International Union for Conservation of Nature (IUCN), a MPA is: "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values."

Resources:

Information and map of MPA locations in the Canadian Arctic:
http://www.wwf.ca/conservation/oceans/marine_protected_areas/

4.3.2 National Marine Conservation Areas (NMCAs)

NMCAs are managed to protect and conserve representative marine ecosystems and key features, while ensuring the ecologically sustainable use of marine resources. The eventual designation of Lancaster Sound as an NMCA will make it the first of its kind in the Canadian Arctic.

Resources:

Information on NMCAs: https://www.pc.gc.ca/en/amnc-nmca/plan, and Lancaster Sound https://www.pc.gc.ca/en/amnc-nmca/cnamnc-cnnmca/lancaster

4.3.3 Ecologically and Biologically Significant Areas (EBSAs)

In 2008, the Parties to the Convention on Biological Diversity (CBD) adopted scientific criteria for identifying ecologically or biologically significant marine areas. The definition of an EBSA from the CBD is: "geographically or oceanographically discrete areas that provide important services to one or more species/populations of an ecosystem or to the ecosystem as a whole, compared to other surrounding areas or areas of similar ecological characteristics, or otherwise meet the [EBSA] criteria".

Resources:

Information on EBSAs: http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2011/2011_055-eng.pdf

EBSAs specific to the Beaufort region: http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2014/2014_052-eng.pdf

EBSAs specific to the Canadian Eastern Arctic: http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2015/2015_049-eng.pdf

4.3.4 Particularly Sensitive Sea Areas (PSSAs)

PSSA require special protection through action by IMO because their significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities. Currently, there are no PSSAs in the Canadian Arctic.

Resources:

Additional information on PSSA and a list of adopted PSSAs: http://www.imo.org/en/OurWork/Environment/PSSAs/Pages/Default.aspx and http://www.gc.noaa.gov/gcil_mpa-pssa.html

4.3.5 Area to be Avoided (ATBA)

An ATBA comprises of defined areas in which either navigation is particularly hazardous or it is exceptionally important to avoid casualties and should be avoided by all ships or certain classes of ships. Currently, there are no ATBAs in the Canadian Arctic.

Resources:

Information on ATBA: http://www.gc.noaa.gov/gcil_mpa-aa.html

4.3.6 Inuit-Identified Areas of Importance

Community Conservation Plans include information on species habitat range and harvest seasons.

Resources:

Community Conservation Plan for Western Canadian Arctic communities (Inuvik, Aklavik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok): http://jointsecretariat.ca/resources/

4.3.7 Land Use Plan - Nunavut

The Nunavut Planning Commission has developed a draft land use plan which includes all the region's marine territory. Land and sea zoning is in place with various designations from general use to protected area.

Resources:

Interactive map of all zones and restrictions: http://nunavut.maps.arcgis.com/apps/Viewer/index.html?appid=8fd1be3d63ad46eeaede003c85ec1d34

General overview of the Land Use Planning process and updates to designated zones: http://www.nunavut.ca/en/downloads

4.3.8 Areas of High Biological Importance

In 2010, the department of Fisheries and Ocean Canada convened a workshop to identify areas of higher biological importance to wildlife in the Canadian Arctic. Additionally, The Arctic Council's 2009 Arctic Marine Shipping Assessment (AMSA) identified a number of recommendations to guide future action by the Arctic Council, Arctic States and others on current and future Arctic marine activity.

Resources:

Map of Canadian areas of high biological importance: http://www.dfo-mpo.gc.ca/Library/341178.pdf (p. 65)

Identification of Arctic marine areas of heightened ecological and cultural significance: Arctic Marine Shipping Assessment (AMSA) IIc: https://www.caff.is/assessment-series/251-arctic-marine-areas-of-heightened-ecological-and-cultural-significance-arctic-ma

4.3.9 Polynyas

Polynyas are geographically fixed regions of open water (or low average sea-ice thickness) that are isolated within thicker pack ice. Polynyas play important ecological roles and are associated with higher biological activity, including higher than usual concentrations of marine mammals.

Resources:

Polynya locations in the Canadian Arctic: http://arctic.journalhosting.ucalgary.ca/arctic/index.php/arctic/article/view/115/149 (Figure 1)

4.3.10 Coastal and Marine Important Bird Areas (IBA)

Accidental oil spills can destroy the thermal protection and natural water resistance of seabird feathers, making them unable to fly, and causes them intestinal problems possibly leading to starvation, liver failure, and other disease. Additionally, debris discharged from ships can be hazardous to birds that eat it or become entangled and often die.

Environment and Climate Change Canada recommends that, during the breeding season, people stay off seabird and waterbird colonies, maintain appropriate buffer zones around colonies, and avoid any disturbance of migratory birds. The Canadian Wildlife Service has a set of Guidelines to avoid disturbance to seabird and waterbird colonies in Canada:

- In general, maintain a minimum distance of at least 300 m from all areas of the island or colony occupied by seabirds and waterbirds.
- Always travel at steady speeds when close to seabird and waterbird colonies, moving parallel to the shore, rather than approaching the colony directly.
- Avoid any sharp or loud noises, do not blow horns or whistles, and maintain constant engine noise levels.

- Do not pursue seabirds or waterbirds swimming on the water surface, and avoid concentrations of these birds on the water.
- Where possible, only use certified tour boats or accredited guides.
- Anchor large vessels, such as cruise ships, at least 500 m from the breeding islands and only approach as close as 300 m in smaller vessels.
- Never dump waste or garbage overboard, because:
    - even small amounts of oil can kill birds and other marine life, and habitats may take years to recover; and
    - fishing line, cans, plastic bottles and other plastic waste can injure or kill birds.

Resources:

Canada's IBA online directory: http://www.ibacanada.ca/explore_how.jsp?lang=EN

The population status of migratory game birds in Canada: http://www.ec.gc.ca/rcom-mbhr/B2A654BC-6B73-4D14-86CB-8D2FB3A70143/2013-November-report---EN---FINAL.pdf

5 Emergency Preparedness

5.1 Ports of Refuge

The availability of port infrastructure and support directly influences the level of risk associated with transiting a particular waterway. There are few deepwater ports in U.S. or Russian waters near the Bering Strait. The closest U.S. harbor with deep water is Dutch Harbor in the southern Bering Sea. On the Russian Federation side, the nearest deepwater port is Provideniya. Other Russian ports near the Bering Strait that are closed to foreign ships are Egvekinot, Anadyr and Beringovsky. In contrast, there are many Norwegian, Icelandic and Russian deepwater ports between the Atlantic and Arctic oceans. There are also several deepwater ports along the west coast of Greenland. There are essentially no deepwater ports along the North Slope of Alaska or throughout the Canadian Archipelago, except for that of Tuktoyaktuk.

Resources:

Additional information on Arctic deepwater port locations: http://www.arctis-search.com/Arctic+Ports and places of refuge: https://www.tc.gc.ca/eng/marinesafety/tp-tp14707-menu-1683.htm

5.2 Notice to Mariners

Notice to Mariners provide corrections to navigational publications and nautical charts and advises mariners of important matters affecting navigational safety, including new hydrographic information, changes in channels and aids to navigation, and other important data.

Resources:

Notice to Mariner's publications and chart corrections: https://www.notmar.gc.ca/index-en.php

5.3 Notice to Shipping (NOTSHIPs)

NOTSHIPs are notices concerning Navigational Aid changes or defects, fishing zones, military exercises, dredging, or other marine hazards. The information is intended to inform the marine community of hazards, current activities and other pertinent information.

Resources:

NOTSHIPs for the Canadian Arctic: http://www.ccg-gcc.gc.ca/eng/CCG/Notship

5.4 Emergency Contact Information

5.4.1 Government Contacts

Ice information	Environment Canada Canadian Ice Service	373 Sussex Drive Lasalle Academy, Block "E" Ottawa, Ontario K1A 0H3 **Telephone:** 1-877-789-7733 **Fax:** (613) 947-9160 http://ice-glaces.ec.gc.ca/
Navigational charts, notices to mariners, radio aids, lists of lights, and sailing directions	Canadian Hydrographic Service	615 Booth Street Ottawa, Ontario Canada K1A 0E6 Attention: Client Services **E-mail:** CHSInfo@dfo-mpo.gc.ca **Phone:** 1-866-546-3613 www.charts.gc.ca
Marine safety and hazards	Marine Communications and Traffic Services (MCTS) Canadian Coast Guard	Iqaluit MCTS Iqaluit, NU X0A 0H0 **Telephone:** (867) 979-5269 **Fax:** (867) 979-4264 http://www.ccg-gcc.gc.ca/Marine-Communications/Home
Vessel Traffic Reporting Arctic Canada Traffic Zone	Northern Canada Vessel Traffic Services Zone (NORDREG) Canadian Coast Guard	Iqaluit MCTS P.O. Box 189 Iqaluit, NU X0A 0H0 **Telephone:** (867) 979-5724 **Fax:** (867) 979-4264 **Email:** iqaNordreg@innav.gc.ca **Telex (telefax):** 063-15529 **Telegraphic Identifier:** NORDREG CANADA
Ice breaking service fee	Canadian Coast Guard	1-800-563-6295 http://www.ccg-gcc.gc.ca/eng/CCG/Ice_Service_Fees
Reporting oil spills	Northern Canada Vessel Traffic Services Zone (NORDREG)	**Spill Report Centres:** Nunavut and NWT: (867) 920-8130 Yukon: (867) 667-7444

	Canadian Coast Guard	**Canadian Coast Guard toll-free:** 1-800-265-0237 (24 hours)
Ice operations centres	Eastern Canada Vessel Traffic Services Zone Regulations (ECAREG) Northern Canada Vessel Traffic Services Zone (NORDREG) Canadian Coast Guard	**Ice Atlantic** Telephone: (709) 772-2078 Fax: (709) 772-5369 **Ice Quebec** Icebreaker Support: (418) 648-7290 Fax: (418) 648-3614 Ice Information: (418) 648-2214 Fax: (418) 648-7305 **Ice Sarnia** Icebreaker Support: 1-800 265-0237 or 519-383-1814 Ice Information: (519) 383-1855 Fax: (519) 337-2498 MARINFO http://www.marinfo.gc.ca/en/glaces/index.asp ICEBREAKING http://www.ccg-gcc.gc.ca/Icebreaking/home GENERAL INFORMATION ice-glace@dfo-mpo.gc.ca
Incidental take of migratory birds, their nests and eggs	Prairie and Northern Region Canadian Wildlife Service Environment and Climate Change Canada	Eastgate Offices 9250 - 49th Street Edmonton, Alberta T6B 1K5 ec.priseaccessoire-incidentaltake.ec@canada.ca

5.4.2 Canadian Arctic Community Contacts[1]

Mariner's should have the contact information of northern Hunter and Trapper Organizations so they can call and obtain local and traditional knowledge.

Nunavut

Aklavik
Hunters and Trappers Committee
P.O. Box 133
Aklavik, NT X0E 0A0
Phone: (867) 978-2723
Fax: (867) 978-2815
ahtc@northwestel.net
President: Dean (Manny) Arey
Resource Person: Michelle Gruben

Arctic Bay
Ikajutit Hunters & Trappers Organization
Contact: Vera Pauloosie
Phone: (867) 439-9949
Fax: (867) 439-8341

Arviat
Hunters & Trappers Organization
Contact: Judy Issakiark
P.O. Box 529
Phone: (867) 857-2636
Fax: (867) 857-2488

Baker Lake
Hunters and Trappers Association
Harold Etegoyok, President
Phone: (867) 793-2520
Fax: (867) 793-2034
P.O. Box 255
Baker Lake, NU
X0C 0A0

Cambridge Bay
Ekaluktutiak Hunters & Trappers Organization
Phone: (867) 983-2426
Fax: (867) 983-2427

Cape Dorset
Aiviq Hunters and Trappers Association
Phone: (867) 897-8978
Fax: (867) 897-8214

Chesterfield Inlet
Aqigiq Hunters and Trappers Organization
Phone: (867) 898-9063
Fax: (867) 898-9079
Contact: Secretary-Manager

Clyde River
Hunters and Trappers Association
Contact: Lisa Qaqqasiq
Phone: (867) 924-6202
Fax: (867) 924-6197

Coral Harbour
Aiviit Hunters and Trappers Association
Phone: (867) 925-8622
Fax: (867) 925-8300

Gjoa Haven
Gjoa Haven Hunters and Trappers Association
Phone: (867) 360-6028
Fax: (867) 360-6913

Grise Fjord
Iviq Hunters & Trappers Organization
Phone: (867) 980-9063
Fax: (867) 980-4311

Hall Beach
Hunters and Trappers Organization
Phone: (867) 928-8994
Fax: (867) 928-8765

[1] http://www.explorenunavut.com/whalecove-tourism.php

Igloolik
Hunters and Trappers Association
Contact: Silas Attagutsiaq
Phone: (867) 934-8807
Fax: (867) 934-8067

Iqaluit
Amarok Hunters and Trappers Association
Phone: (867) 979-6848
Fax: (867) 979-3390

Kimmirut
Mayukalik Hunters & Trappers Organization
Contact: Martha Padluq
Phone: (867) 939-2355
Fax: (867) 939-2112

Kugluktuk
Hunters' & Trappers' Association
Phone: (867) 982-3903
Fax: (867) 982-4047

Kurtairujuark
Hunters and Trappers Association
Contact: Ema Qaggutaq
Phone: (867) 769-7002
Fax: (867) 769-6713

Pangnirtung
Hunter's & Trappers Association
Contact: Mosesie Keenainak
Phone: (867) 473-8751
Fax: (867) 473-8741

Pond Inlet
Mittimatalik Hunters & Trappers Organization
Phone: (867) 899-8856
Fax: (867) 899-8095

Qikiqtarjuaq
Nattivak Hunters and Trappers Organization and Papiruq Fisheries
Contact: Olasie Kooneeliusie
Phone: (867) 927-8836
Fax: (867) 927-8525

Rankin Inlet
Aqiggiaq Hunters and Trappers
Contact: Manager
P.O. Box 194
Phone: (867) 645-2350
Fax: (867) 645-3257

Repulse Bay
Arviq Hunters & Trappers Association
Contact: Louise Siusangark, Manager
Phone: (867) 462-4334
Fax: (867) 462-4335

Resolute Bay
Phone: (867) 252-3170
Fax: (867) 439-8341

Taloyoak
Hunters and Trappers Association
Contact: David Irqiut
Phone: (867) 561-5066
Fax: (867) 561-5232

Whale Cove
Isatik Hunters and Trappers Organization
Phone: (867) 896-9944

Northwest Territories

Inuvik
Hunters and Trappers Committee
P.O. Box 1720
Inuvik, NT X0E 0T0
Phone: (867) 777-3671
Fax: (867) 777-2478
inuvikhtc@hotmail.com
President: John Day
Resource Person: Lorna Elias

Olokhaktomiut
Hunters and Trappers Committee
Box 161
Ulukhaktok, NT X0E 0S0
Phone: (867) 396-4808
Fax: (867) 396-3025
ohtc_2015@outlook.com
President: Joshua Oliktoak
Resource Person: Bessie Inuktalik

Paulatuk
Hunters and Trappers Committee
Box 39
Paulatuk, NT X0E 1N0
Phone: (867) 580-3004
Fax: (867) 580-3404
paulatukhtc@gmail.com
President: Tony Green
Resource Person: Diane Ruben

Sachs Harbour
Hunters and Trappers Committee
Box 79
Sachs Harbour, NT X0E 0Z0
Phone: (867) 690-3028
Fax: (867) 690-3616
shtcresperson@yahoo.ca
President: Manny Kudlak
Resource Person: Betty Hoagak

Tuktoyaktuk
Hunters and Trappers Committee
P.O. Box 286
Tuktoyaktuk, NT X0E 1C0
Phone: (867) 977-2457
Fax: (867) 977-2433
tuk.htc@gmail.com
President: Chucky Gruben
Resource Person: Jocelyn Noksana

FOR MORE INFORMATION:

Andrew Dumbrille
Senior specialist, sustainable shipping, WWF-Canada
(613) 232-2506
adumbrille@wwfcanada.org